Energy Zone®

Engineering Manual

BAS Building Automation Systems

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6. WARRANTY RETURN. Products sent in under warranty should be routed through the authorized **BAS** distributor from which they were purchased. Warranty returns should be sent in freight prepaid. The products must be accompanied by a copy of the original invoice and a written statement by the installing dealer including the following information:

   a. Dealer name and address
   b. Installation address
   c. Installation date
   d. Brief description of application
   e. Brief description of problem

7. **BAS** will ship, at its discretion if requested, warranty replacements prior to receiving the damaged equipment back. A standard invoice will be issued which will be credited when the returned equipment is received at **BAS**. If a product, sent in under warranty, is found to be in good working order, it will be shipped back to the customer and the invoice for the replacement item will not be credited. Products must be returned intact to be considered for warranty or credit.

8. WARRANTY REGISTRATION. It is the responsibility of the installing dealer to fill out and return the warranty registration card.

9. CUSTOMER COPY. It shall be the responsibility of the installing Dealer to provide the end User with a copy of the End User License and Warranty.

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Introduction

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Chapter 1

The Energy Zone® System

Overview

Energy Zone® (EZ) is a Direct Digital Control (DDC) Building Energy Management and HVAC Control System. The **EZ** system was developed with several goals in mind. In addition to all features expected in a modern DDC system such as remote communication, trend logging, load shedding, smart recovery, outside air reset control, alarm functions, password security, and a dynamic graphical User interface, several unique features were added. Among those features are:

1. **Easy set-up.** The system can be configured for any HVAC system with no prior programming experience. This allows the installer to set up the software in a very short time.
2. **Pre-Engineered.** The Dealers of the **Energy Zone®** system are provided with CADD generated schematics for all Equipment Schedules and allowed unlimited royalty free use the files. The files are available in both AutoCAD and GenericCADD formats. This reduces engineering time by at least half, compared to other DDC systems.
3. **Versatile default control.** Positioning a dip switch is all that is necessary to set up the Remote System Controller (RSC) for sophisticated default control.
4. **Single Universal Controller.** A single universal controller design, the Remote System Controller (RSC), handles all necessary control and data acquisition. The Command Center communicates directly with each RSC through a single twisted pair cable.
5. **Unnecessary Hardware Components Eliminated.** The BAS System architecture includes no external field interface device or network managers. By reducing the number and complexity of System hardware components, reliability is increased and installation costs are lowered.
6. **Alarm Callout.** System alarms can be configured to callout to both digital pagers and/or fax machines
7. **Multitasking.** The **EZ** software was designed to operate in the Microsoft Windows environment. The **EZ** software will operate in the background concurrently with any other Windows compatible software. This includes such software as Microsoft Excel and Microsoft Word.
8. **Microsoft Windows Operating System**. The **EZ** system is fully integrated into the Microsoft Windows environment and all Systems are delivered with an IBM PC compatible computer and a retail version of Windows. This feature is unique to the control industry. BAS uses no obscure operating systems or computer platforms.
9. **Microsoft technical support.** Microsoft sets the industry standard for software technical support.. Because of the integration with Windows, Microsoft can answer many of the common User questions.
10. **Local testing.** An optional Handheld Tester, powered by the RSC, is used to test all RSC outputs and monitor all RSC inputs. All test functions are accessed by function keys.
11. **Warranty.** All components in the **EZ** system are provided with a full 2-year warranty.

All of these features result in an overall lower installation and maintenance cost compared to competitive DDC systems.

System Highlights

When the BAS System architecture was first planned, the conventional structure of a DDC system was ignored. The resulting BAS System architecture is unique in that no external field interface device or network managers are needed. This is accomplished by using innovative software to take on tasks commonly performed by hardware components. The potential for System software failure has been nearly eliminated as a direct result of the years of field tests and refinements implemented after initial development and de-bugging was completed in 1986. Countless years of System operation have been accumulated since that time with no significant impact on System operation as a result of software failure. By using fewer, less complex, and more readily available hardware components, reliability is greater and installation costs are lower for BAS than every other system available on the market. Both the potential for System failures and the cost of operation and maintenance is significantly lower with BAS. This is a result of other systems long term reliability and costs tied directly on the longevity of expensive custom-built hardware components. By investing significant research and development effort in structure and programming of the software component of the BAS System, features and functionality did not have to be compromised. The BAS System can meet or exceed any available product in terms of functions, feature list, reliability, and capabilities.

The heart of the **Energy Zone® (EZ)** system is the Remote System Controller (RSC). The RSC is an 8 bit microcontroller, with full stand alone capability. The **EZ** system networks RSCs to the Command Center over an RS-485 communication trunk line. Each RSC has a capacity of thirty control points and can control up to four Heating, Ventilating, and Air Conditioning (HVAC) zones. The Command Center host computer can network up to 256 RSCs on a single network card, providing a system capacity of 1024 HVAC control zones with 7168 points. Larger numbers of RSCs can be controlled by networking Command Centers together.

The RSC is field configurable for control of most types of commercially available HVAC equipment. The RSC contains built-in control algorithms referred to as Equipment Schedules. An Erasable Programmable Read Only Memory (EPROM) or optional battery backed SRAM located on the RSC contains all Equipment Schedule control algorithms. Dip switches located on the RSC select which Equipment Schedule is used for RSC default control. On initial startup, or any time that communication with the Command Center is lost, the RSC takes over equipment control using pre-programmed heating and cooling setpoints. Additional versions of the EPROM and SRAM chips are available for custom applications.

The Command Center contains the control algorithms for each RSC connected to the trunk line. Because the **EZ** User interface operates in the Microsoft Windows environment, the system can be installed and operated with no computer programming experience. The System has the capacity for 128 separate Equipment Schedules, with the appropriate control algorithms for that equipment. During system configuration, an Equipment Schedule is chosen for each RSC. When an Equipment Schedule is chosen, the **EZ** software will prompt the User to input those parameters necessary for proper equipment control.

Software Features

Command Center - The Command Center includes all software and algorithms for normal system control. A communication link is established between an RSC and the Command Center within 8 seconds of power-up. The Command Center retrieves a data packet the RSC once every 8 seconds and uses the data provided by the RSC to determine the correct state for all outputs. All decisions are controlled by the configuration file for that RSC. Each RSC in the System is monitored and the proper output state determined once every eight seconds. When the communication link is lost for any reason, both the RSC and the Command Center will attempt to reestablish the link for three minutes. After three minutes, the Command Center reports the RSC as off-line and the RSC will control its outputs based on factory default control algorithms and setpoints stored in the EPROM.

Microsoft Windows - **EZ** software operates in the Microsoft Windows environment and provides a very fast, easy to use, menu driven graphical User interface. Most System operations can be performed entirely with a mouse, without requiring the use of a keyboard. In addition to a copy of Microsoft Windows, **BAS** also includes several useful Windows applications with the **EZ** system. **EZ** is compatible with any other Microsoft Windows based application and can operate simultaneously with those applications in true multitasking fashion. No previous programming experience is needed to configure or operate any aspect of the system. All system configuration is User-prompted, fill-in-the-blank. The System monitors all User input and alerts the User to any invalid entries.

Data Exchange - Access to all System RSC’s inputs, outputs, and configuration data is made available to any Windows application that conforms to the Dynamic Data Exchange specification.

Dynamic Graphics - With the Graphics Builder, graphics display screens can be easily and quickly setup. Floor plans can be imported from CADD or paint programs. Dynamic graphic icons for standard HVAC components such as fans, dx coils, pumps, economizers, boilers, chillers, etc. are all built into the System and menu selectable. These icons are all dynamic, and can be linked to any data in the system. With the Graphics Viewer, the User can quickly view the status of any site, building, floor, zone, or HVAC unit. All Graphics Viewer inputs are performed with a mouse, requiring no keyboard input.

Remote Communication - An identical User interface to that on the Host system (the building being controlled) is available from a Remote Client site (any location remote to the Host site). The only real difference between the Remote and the Local interface is the source of the System data. When accessing the System locally at a BAS Site, all information is provided to the User interface (Building.exe) by the control program that manages System operation in the background (RSCPC.exe) after the data is retrieved directly from the EnerNet. When a Remote connection to a Host Site is made through a modem, the Remote Server application (RemSvr.exe) provides the link between RSCPC.exe and a modem. Remote Server responds to requests for data and processes new configuration information delivered by the Remote Monitoring version of Building.exe. RSCPC.exe is notified of and is responsible for implementing any changes delivered by modem that would impact System operation. The System communicates over standard phone lines at 14400 baud, which provides for rapid data transfers and nearly transparent screen updates.

Password Security - Seven levels of security built into the System. All software features and menu items are pre-set to a security level. A security log is maintained to keep a record of the date, time, and name of all Users logged onto the system.

Equipment Schedules (ES) - Control of all equipment is based on pre-programmed control algorithms referred to as Equipment Schedules. Extensive research and development efforts were invested in developing individual control algorithms that optimize the operation of each equipment type in all known applications. The Equipment Schedules provided with each System covers virtually all commercially available HVAC equipment. Once perfected, the control strategy for each ES is integrated into in each new System. This strategy has eliminated the need for BAS and our Dealers to develop custom control strategies at each new installation. BAS has established standards that are used as the basis for control at each Site. The structure of the software used as the foundation of the BAS System eliminates the variables in reliability, maintainability, quality and equipment operating efficiency that is all too common to the control industry. These problems are nearly impossible to avoid when the programming for each new Installation is done by different individuals with different backgrounds, levels of experience and knowledge of mechanical systems.

The Command Center contains advanced control algorithms used by all RSCs when connected to a trunk line. A simplified version of each control algorithm is stored at the RSC in an EPROM. The software in the EPROM is used for equipment operation when the Command Center can not communicate with the RSC for any reason. An Equipment Schedule for each equipment type supported by BAS is provided both in every Command Center and in the EPROM of every RSC delivered by BAS. The RSCs are fully interchangeable without modification between all equipment that uses a supported Equipment Schedule. Equipment Schedules, with each control algorithm delivering optimum equipment operation, are available for up to 128 different types of HVAC equipment. When a type of equipment is found that is not supported, an Equipment Schedule is developed and the System upgrade is distributed to all installed Sites free of charge.

During system configuration, an Equipment Schedule is chosen for each RSC. When the correct Equipment Schedule is selected, a configuration file will be created using factory defaults for the RSC at that address. The User can then choose to accept factory defaults or customize the Zone configuration. The System will use the configuration file to customize the control algorithm for that Zone. All System configuration information is stored in configuration files on the System hard disk. This makes the System virtually immune to data loss resulting from power outages. The System will automatically return to full operation within 1 minute after power is restored. The configuration files can be changed at any time and the changes will take effect immediately without requiring the software to be compiled or the full System to be re-started.

All Equipment Schedule control algorithms are also contained in an EPROM located on the RSC. Dip switches located on the RSC are used to select which Equipment Schedule is used for RSC default control. On initial startup, or any time that communication with the Command Center is lost, the RSC takes over unit control using preprogrammed heating and cooling setpoints.

Equipment Schedule Editor - The Equipment Schedule editor can be used to change the factory default control algorithm of any Equipment Schedule, or a new Equipment Schedule can be created. Changing the control sequence for any piece of equipment is as easy as a point and click with the mouse. Any custom Equipment Schedules developed by Dealers can be easily copied and used at a new site. Because this tool is so simple to use, and the results can have a major impact on the operation of the equipment, this feature should be limited to use by the Installer only.

Auto Configuration on Startup - The quickest building configuration can be performed by simply setting an address and equipment schedule at each RSC, connecting them to a trunk line, and energizing the system. If the Command Center finds an RSC on-line with no existing configuration file, a configuration file is created using a field defined default or, if none exists, system defaults. The System and all Zones are fully functional at this point and additional effort by the user is only necessary if changes are to be made to the automatic settings (such as a unique description for each Zone).

Sophisticated Alarm Configuration - Each Control Zone in the system can have up to 16 alarm or special control functions configured, in addition to 64 Global Alarms, for a total of 16,400 total System alarm or control functions. All inputs and outputs at each RSC can be configured to take any combination of alarm actions. The factors that determine activation of an alarm or control function include:

1. The input or output point and the desired trigger level. For digital I/O points this can be either On or Off. For analog points, the selected reading is compared to either a fixed value or set to be some amount above or below the configured Zone setpoint.
2. The time-of-day mode during which the alarm can be activated.
3. The number of seconds that the monitored value must exceed the alarm setpoint before an action is taken.

Once all conditions for an alarm or control function are met, the available actions are

1. Screen display of message
2. Printer output
3. Log to hard disk
4. Callout to fax machine terminal
5. Callout to a digital pager
6. Take a specific action.

The specific action feature can act on output in the System and is not limited to the originating Zone. The specific action can turn on or off any digital output or Master Alarm and position any analog output to either a specific percentage open or a relative +/- change from the current position. Specific actions can also be used to shutdown or re-initialize a Zone, place an individual Zone or the entire building into Setback Override, and start the lag pump in a Lead/Lag pump configuration. Master Alarms also can be configured selectively throughout the system, with all regular alarm features available. This feature provides the User with a simple-to-use yet powerful scripting language that can be used for those unique control situations not covered by an Equipment Schedule.

Alarm Callout to Fax and Digital Pager - Any system alarm can be configured to be sent to a remote fax machine and/or sent to a digital pager. The fax machine will display detailed information about the alarm condition and the status of the all inputs and outputs at that RSC at the time of the alarm. The pager will display a four digit number corresponding the Host Site Number set up at configuration.

Global Alarms - The System allows configuration of up to 64 Global Alarms. These Alarms are configured identically to Zone alarms, except that they may only be triggered by global values such as outside air temperature or enthalpy and Master Alarms. Even though Alarm or Control Functions that have an effect on System-wide operation can be configured at any Zone, they should be configured as a Global Alarm. This will allow for easier troubleshooting of System operation.

Master Alarms - A System total 32 Master Alarms are available to all Zones. Each Master Alarm can have an accumulated value anywhere from 0-255. Each of the 16 specific actions at any Zone and any Global Alarm can be configured with a specific action to raise or lower the value of any Master Alarm by 1. Any Zone or Global Alarm can also monitor any Master Alarm as a test point and take actions based on the accumulated value of a Master Alarm. This feature allows for fast and easily configured communication of System or Zone status to all System RSCs simultaneously.

The Trend/Alarm Logging - All RSC inputs and outputs at any zone can be stored on the hard disk for later retrieval and review. All parameters flagged in the initial system setup are logged to the hard disk once every ten minutes. A new trend log is started each month. The Trend Log Viewer utility allows for screen display or printer hard copy of any User selected parameters. The Trend Log also monitors and stores all setback override conditions, which can be useful in billing tenants for off hours HVAC operation.

Any alarm condition that has been configured for logging will be stored in the Alarm Log. The Alarm Log is in a text format and can be viewed by the text editor provided with the System, or any other standard text editor. .The Alarm Log can also be printed by any standard text editor with printing capabilities, such as Notepad.

Weekly Schedules - Up to 32 weekly schedules can be configured, each with two occupied and two unoccupied times per day. Each weekly schedule can be configured for eight days, including seven weekdays and a holiday. Any HVAC equipment or miscellaneous equipment can use any weekly schedule.

Pre-Configured Holidays - All 10 US federal holidays through the year 2010 are pre-configured and provided with the system. Any of these holidays may be modified or any new holidays easily added.

Time Schedule Override Capabilities - The standard time of day schedules for all HVAC equipment and miscellaneous equipment can be overridden in one of three ways. All System overrides are logged to the Trend Log for review and reporting. The three overrides types are listed in order of least to greatest priority:

1. All Zones Override, a pre-programmed one time override event to either the occupied or unoccupied mode
2. Single Zone Override, a pre-programmed one time override event to either the occupied or unoccupied mode available for each Zone
3. Setback Override, an input activated from the zone that will override the zone to occupied for a preset amount of time.

Override Reports - Override reports can be printed for any single Zone or the entire building. This report will show start and stop times, length of override, and total override hours for the entire month. This report is useful for property managers to bill tenants for off-hours HVAC operation.

Zone Setpoint Override - Each Zone can be equipped with an optional Setpoint Override control for use by the Tenant in modifying the temperature of the space. The control is mounted to the face of the wall sensor. This control will change the setpoints used for temperature control of the Zone when in the Occupied mode. The configured base setpoints are not affected. The range of the allow setpoint modification is from +/- 0° to +/- 10° F. Each Zone can be individually configured for the amount of override allowed.

Smart Recovery (Warmup/Cooldown) - All Equipment Schedules that use different setpoints for the unoccupied mode can use Smart Recovery. If the space is in unoccupied mode and below the occupied setpoint, the system will calculate a time to enter warmup mode. This time will be based on actual space temperature, desired occupied setpoint, outside air temperature, and recovery history for the zone. If the space is in unoccupied mode, above the occupied setpoint, and has an economizer the system will enter Cooldown mode. The software tracks actual setback recovery conditions and adjusts startup times for subsequent recoveries.

Dual Enthalpy Economizer Control - All systems with economizers installed use dual enthalpy to determine the economizer mode. One outside air enthalpy sensor is used for all economizers in the system. Each HVAC unit with an economizer has an enthalpy sensor installed in the return air duct.

Pressure Independent Damper Control - All VAV and VariZone Equipment Schedules can be selected to use either pressure dependent or pressure independent damper control.

Terminal Regulated VAV Control - The latest development in VAV server control is known as TRAV (Terminal Regulated Variable Air Volume). This concept uses input from all of the clients (zone dampers) to reset a variable frequency drive on the VAV server (rooftop air handler). The duct static pressure is allowed to vary, within preset limits, to the minimum necessary to satisfy the clients. This control strategy provides for a significant energy reduction with a corresponding increase in comfort and air quality.

Outdoor Air Reset Control - Reset of controlled temperature, based on outside air temperature, is available for several schedules. All parameters are User defined. These include outside air shutoff temperature, maximum outside air temperature, minimum controlled temperature, maximum controlled temperature, reset ratio, and unoccupied degrees offset.

KW Load Shedding - Any piece of HVAC equipment and any piece of miscellaneous equipment can be configured for KW load shedding. All equipment configured for load shed are assigned a priority from 1-32 by the User. Any number of pieces of equipment can be given the same load shed priority. If building KW exceeds the preset level, the system will begin to shed equipment belonging to successively higher priority levels until KW falls below the preset demand level. Up to 16 KW meter input locations are available and any Zone may be assigned to any meter. Load Shed temperature setpoints will maintain reasonable comfort at each Zone that has been Shed.

Temperature Control - Proportional, integral, and derivative control modes are standard. Each of these three factors may be modified by the User at each Zone.

PID Loop Tuning - Proportional, integral, and derivative gains can all be changed for each control zone. The User can also change the cycle rate (cycles per hour) and derivative look back time. Default PID control parameters are provided for all Equipment Schedules and should rarely require adjustment. A Zone History graph is available for all zones. The Zone History will show a graph of the temperature over the most recent PID cycle time to aid the User in PID loop tuning.

Outside Air Temperature and Enthalpy - Both sensors can be input at any convenient RSC location. These are global values and can be used by any RSC in the System through the EnerNet.

Miscellaneous Equipment Control - Any digital output not used by an Equipment Schedule can be configured to be used for miscellaneous equipment such as exhaust fans, lighting control, hot water tanks, etc. Each piece of equipment can be configured for weekly schedule, load shedding, and any System digital input to be used for setback override.

Completely Configurable Main System Screen - The main system screen can be easily modified to select the configuration and data items displayed in the Main List Box. Any I/O point or configuration item selected is displayed for all Zones in the System.

Troubleshooting Screen - Any RSC can be placed in Troubleshooting mode from the Command Center. A detailed display of all RSC inputs, outputs, and communication status is displayed. Any input or output can be overridden by the User to any desired state or value. The Troubleshooting screen will override all other software control functions. A custom label can be assigned to each of the inputs and outputs for clarity.

Optional Fahrenheit/Celsius Display - The temperature display mode can be selected from the system settings screen. All system displays including the main system screen, troubleshooting screen, trend log, alarm log, and configuration files will be automatically scaled to the selected format.

System Troubleshooting - The software is capable of convenient monitoring and temporary override of all system parameters from the Command Center. A custom label can be assigned to each of the inputs and outputs for clarity.

Data Backup/Restore Tools - The standard User interface program, Building, offers a menu selectable automatic backup of all System configuration files. The backup will be saved to both an alternate directory on the Command Centers hard drive and to a floppy disk for safekeeping at an off-site location. All but the largest installations can be backed up to a single floppy disk. The data can be restored from either location. The User is prompted for a confirmation before any existing configuration files are overwritten by the backup.

Hardware Features

These descriptions are applicable to Version 3 hardware only. There are several significant differences and improvements over Version 1 hardware. Version 2 hardware was produced in prototype quantities only and not distributed. All versions are software compatible. They can all be connected on the same trunk line and communicate with any software version at the Command Center. The hardware version can be identified at the Command Center by viewing the ROM version. Version 1 hardware will use ROM Version 3.x. Version 3 hardware will use ROM Version 4.x or greater.

Command Center - The EZ system Command Center is an IBM PC-AT compatible computer. The minimum configuration comes with a 33 MHz 80486SX microprocessor, 4 MB RAM, 1.44MB floppy drive, 250MB hard drive, VGA color monitor, mouse, and a 14,400 baud fax modem.

Advanced Communication Link (ACL) - The ACL is the link between the RSC and the Command Center. Each ACL can control 256 RSCs and resides in the Command Center using one full length standard ISA expansion slot. The ACL is actually a microcomputer using an 8088 microprocessor. On initial boot up, the operating system is loaded onto the ACL. The ACL then directs communication traffic to all RSCs connected to it. This reduces overhead on the Command Center and allows for very fast cycle times.

Remote System Controller (RSC) - The BAS System revolves around the RSC. The design of the RSC circuit board is based on the NEC 78C10 microcomputer. Each RSC has a total capacity of thirty I/O points including eight digital outputs, eight digital inputs, eight analog inputs, four analog outputs, and two remote LCD display modules. The Analog Outputs(AO) are controlled by the RSC but require the use of a separate AO board.

The RSC meets all onboard power requirements with a standard 24 VAC power supply. When power reaches the RSC it is first passed through a pair of automatic resetting solid state fuses and an isolation transformer. This combination provides the RSC with almost complete immunity to fluctuations and noise in the 24 VAC power supply. It also protects vital components against faults that could affect RSC operation and reliability. All DC voltages necessary for system operation are generated by two onboard regulated power supplies, 18 Vdc for external components and 5 Vdc for onboard digital logic circuits. All field wiring connects to the RSC with de-pluggable compression type screw terminal strips. These de-pluggable terminals allow for rapid change-out of damaged RSCs.

RSCs can be mounted in a central location, but are usually distributed throughout the facility and mounted near the equipment they serve. The RSC is 5 1/2”w x 7”h and is mounted in a 7 1/2”w x 9”h NEMA 1 metal enclosure. Electrical conduit knockouts are provided in both 1/2” and 3/4” sizes. The RSC must be either mounted in a dry location or a field supplied enclosure used. RSCs are available from BAS without an enclosure and can be mounted directly to any flat surface using plastic standoffs. The RSC and all devices supplied by BAS, except the Command Center, are rated as Class 2 limited energy electrical devices. UL does not require UL certification of any component manufactured and sold by BAS as long as the installation conforms to the NEC for a Class 2 circuit installation.

One RSC can control up to 4 HVAC control zones. Equipment Schedules are the control sequences for a given type of HVAC equipment. Equipment Schedules are stored on an EPROM that resides on the RSC. Positioning a dip switch on the RSC will determine which Equipment Schedule is used for RSC default control. Two banks of dip switches are located on the RSC. One switch bank determines the Equipment Schedule and the other set is used for the RSC address and troubleshooting.

Two forms of communication interface are available at each RSC. Communication between each RSC and the Command Center follows the RS-485 specification. Up to 32 RSCs can be placed on each of eight trunk lines. Communication is on a standard 2-conductor, 18 AWG, twisted shielded pair (tsp), with all RSCs on a trunk line wired in parallel. An RS-232 interface is also available at each RSC and is the communication standard used to communicate with the Handheld Tester.

Several status LEDs are provided on the RSC. A great deal of troubleshooting can be performed by simply checking the status of these LEDs. A heartbeat LED monitor is located on the RSC and will indicate the operational status and mode of the RSC. Two LEDs indicate the status of all incoming and outgoing communication from the RSC to the trunk line. One additional LED is provided at each digital output to indicate the commanded state of the output.

Digital Inputs - Digital Inputs are activated by routing 18 Vdc from the RSC power supply to the appropriate RSC input terminal through a field device. This field device could be anything with a set of dry contacts.

Digital Outputs (DO)- Control of loads connected to Digital Outputs is provided by triacs mounted on the RSC. Each output can directly switch loads up to 1 A @ 24 Vac. Loads that exceed these ratings should be provided with a pilot duty relay for interface to the RSC. Each DO is accompanied by an LED that indicates the state of the DO. The 8 DOs are divided into two banks of 4 DOs each (Bank A (DO1-4) and Bank B (DO5-8)). The power supply common to each bank can be shared with the RSC or each bank can use an individual common, isolated from the rest of the RSC. This allows for control of up to two different pieces of HVAC equipment having a factory transformer from one RSC without the use of field installed isolation relays.

Analog Inputs (AI)- All analog inputs are jumper selectable as 0-5 Vdc or 4-20 mA. All 8 AI locations are provided with a separate 18 Vdc power supply terminal and a dc common terminal.

Analog Output Conversion Cards (AO) - All modulating analog outputs are provided by an AO card. AO cards receive digital control data from the RSC and use the data to generate 4 individual modulating current or voltage outputs. Each output is jumper selectable as either 4-20 mA or 0-10 Vdc. The AO card connects to the RSC by means of a factory provided 16 pin ribbon cable and connector.

Standard Wall Sensor - The standard Zone temperature sensor is housed in a wall mounted enclosure and senses temperature using an LM-34 solid state device. These sensors have a guaranteed minimum error not to exceed +/-1° F. The sensor’s output is offset and amplified to a provide a total range seen by the System of 32-96° F. The comparatively small range of the wall sensor (64° F) was chosen to provide maximum temperature resolution at normal comfort temperatures. This sensor also allows much more accurate PID load calculations. The accurate load determination will provide more accurate temperature control than sensors which span large temperature ranges.

The sensor uses an 18 Vdc power supply from the RSC and generates a linear output of 0-5 Vdc output. An amplifier, noise filter and calibration pot are included on the LM-34 circuit card. A Class 2 three conductor cable connects the sensor to the RSC. A twisted shielded cable should be used to connect the RSC to sensors that are located in electrically noisy environments. A push button extends from the cover for setback override. The sensor is 2 1/2”h x 2” w designed for direct mounting to drywall.

Wall Sensor Options - Wall sensors can be provided with an attractive backplate designed for horizontal mounting to standard 2” x 4” electrical enclosures. Vandal-proof wall sensors are also available. These are mounted to the back of a 2” x 4” stainless steel plate for flush mount applications. All wall sensor styles can be provided with a front mounted setpoint offset control. This option requires the use of a four conductor cable between the RSC and the sensor rather than the standard three conductor cable.

Duct, Well, and Outside Sensors - The LM-34 solid state device is available from BAS in three additional temperature ranges, 30-157° F in both duct and well mounted configurations, 0-255° F in both duct and well mounted configurations, and (-12)-115° F in a weatherproof enclosure for input of outside air temperature. These ranges will provide the necessary input for nearly all standard HVAC applications. Range adjustment, calibration, and screw terminals are provided on a circuit card mounted to the back of the box cover of each sensor type. These cards are manufactured and calibrated to a specific temperature range and are not interchangeable with other sensor types.

Third Party Analog Input Devices - BAS welcomes the use of sensing devices provided by third party suppliers. Industry standard voltage and current devices are supported without modification. The requirements for an Analog Device to be fully compatible with an RSC are:

1. The device must be able to operate on an 18 Vdc supply
2. The device consumes no more than 0.7 VA
3. The signal delivered to the RSC does not fall outside the limits of 0-5 Vdc for a voltage device or 4-20 mAdc for a current device.

HandHeld Test Device (HTD) - The HTD communicates with the RSC through a 6 pin RJ-11 connector by means of a 9600 baud standard RS-232 serial data port. The HTD is a menu driven RS-232 “dumb” terminal that gives instantaneous access to all RSC data and allows manual override of all RSC outputs. The RSC delivers 5 Vdc regulated power to the HTD, eliminating the need for an external HTD power supply. When the HTD is connected to an RSC, the presence of the HTD detected by the RSC. The RSC will sever its connection to the EnerNet and accept commands from the HTD after it first notifies the Command Center that it is entering local HTD mode. The RS-485 driver is disabled while in HTD mode and no communications will take place between that RSC and the EnerNet.

An optional cable is available that allows the RSC to communicate with any standard RS-232 terminal through a standard serial cable using either a nine pin or a twenty-five pin serial connector. It is possible to connect the HTD to an RSC from a remote location up to 250’ away. A six conductor wire must be run from the RJ-11 HTD connector on the RSC to a remotely mounted RJ-11 jack.

Chapter 2

Energy Zone®
Software Features

Overview

The **Energy Zone®** (**EZ)** System was designed to be **EZ** without sacrificing any of the advanced features and capabilities found in a modern control system. By using the System defaults, a new installation can be up and running in seconds. For more advanced Users, the System can be customized to meet a building owner's special needs for control, comfort, and energy savings.

Features Described In This Chapter

- Microsoft Windows Compatibility
- Equipment Schedules
- Smart Recovery (Warmup/Cooldown)
- Dual Enthalpy Economizer Control
- Outside Air Reset Control
- Optional Fahrenheit/Celsius Display

Features Described In More Detail Elsewhere

- Password Security
- Pre-Configured Equipment Schedules
- Dynamic Graphics
- Auto Configuration on Startup
- Equipment Schedule Editor
- Remote Communication
- Trend/Alarm Logging
- Sophisticated Alarm Configuration
- Alarm Callout to Fax and Digital Pager
- KW Load Shedding
- Miscellaneous Equipment Control
- Weekly Schedules
- Pre-Configured Holidays
- Completely Configurable Main System Screen
- Troubleshooting Screen
- Dynamic Data Exchange
- Convenient Override Capabilities
- PID Loop Tuning

Microsoft Windows Compatibility

Any software designed to operate in the Microsoft Windows environment will operate on the Command Center at the same time as **EZ**. Any alarm conditions which occur and are configured for screen display will be displayed on top of the active window.

Precautions for Multitasking with EZ

1. The amount of available RAM is one of the most important criteria when operating in Windows. This can be determined by selecting About Program Manager...from the Help menu in Program Manager. The amount of memory should not be allowed to fall below about 250KB free. Memory can be made available by closing applications not actually in use.
2. It is also important to use caution with applications that make extensive use of the processor. Some processes such as file copying, database sorting, printing large documents, or calculating large spreadsheets can take a long time to complete. **EZ** will not be communicating with the RSCs during this time. If these processes take more than 30 seconds of continuous operation to complete, building control may begin to be adversely affected. If any operation takes longer than 3 minutes to complete, the RSCs will enter default mode.
3. Do not run any DOS application while running Windows in Standard Mode. This will cause all Windows applications to be temporarily suspended. This is not a problem if Windows is run in Enhanced Mode. All Systems are shipped from **BAS** setup to operate in Enhanced Mode.
4. Use caution when using any DOS application from Windows. It is always safest to test the application for a short time to verify that **EZ** is not affected by the DOS application.

Equipment Schedules

An Equipment Schedule is the combination of all control functions necessary for a given type of HVAC equipment. Equipment Schedules are provided for all commonly available commercial HVAC equipment. Equipment Schedules are set by adjusting a dip switch on the RSC and through the configuration screen at the Command Center. The RSC is then controlled by that Equipment Schedule locally when in default and by the Command Center when on-line.

Command Center Based Equipment Schedules - The following is an example of an Equipment Schedule under Command Center control:

EQUIPMENT SCHEDULE #7

Heat Pump, 2 Stage, Backup Heat, Economizer, Reversing Valve Cooling

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan	DI1 - Setback Override
DO2 - Compressor #1	
DO3 - Reversing Valve	**ANALOG INPUTS**
DO4 - Backup Heat	AI1 - Space Temperature
DO5 - Economizer Min Pos/Pwr Supply	AI2 - Return Air Enthalpy
DO6 - Economizer Cooling	
DO7 - Compressor #2	

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cmp 1	RV	B/U Ht	M Pos	Econo	Cmp 2	DO8	AO1	AO2	AO3	AO4
Econo 3	ON	ON	ON		ON	ON	ON					
Econo 2	ON	ON	ON		ON	ON						
Econo 1	ON				ON	ON						
At Set	ON				ON							
Heat 1	ON	ON			ON							
Heat 2	ON	ON			ON		ON					
Heat 3	ON	ON		ON			ON					

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cmp 1	RV	B/U Ht	M Pos	Econo	Cmp 2	DO8	AO1	AO2	AO3	AO4
Econo 3	ON	ON	ON		ON	ON	ON					
Econo 2	ON	ON	ON		ON	ON						
Econo 1	ON				ON	ON						
At Set												
Heat 1	ON	ON										
Heat 2	ON	ON					ON					
Heat 3	ON	ON		ON			ON					

Those inputs and outputs listed above are dedicated to the use of this Equipment Schedule. All inputs and outputs not listed can be programmed at the Command Center for auxiliary functions such as exhaust fan control, air flow switch input for alarm, outside air temperature input, etc.

Default Control Equipment Schedules -The default control algorithms are located in the EEPROM onboard the RSC. Because the EEPROM is non-volatile memory, the control algorithms are not lost when power is cycled to the RSC and battery backup is unnecessary. The desired algorithm to use is selected by the dip switch position on the RSC.

The following is an example of an Equipment Schedule default control:

EQUIPMENT SCHEDULE #7

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan	DI1 - Setback Override
DO2 - Compressor #1	
DO3 - Reversing Valve	**ANALOG INPUTS**
DO4 - Backup Heat	AI1 - Space Temperature
DO5 - Economizer Min Pos/Pwr Supply	AI2 - Return Air Enthalpy
DO6 - Economizer Cooling	
DO7 - Compressor #2	

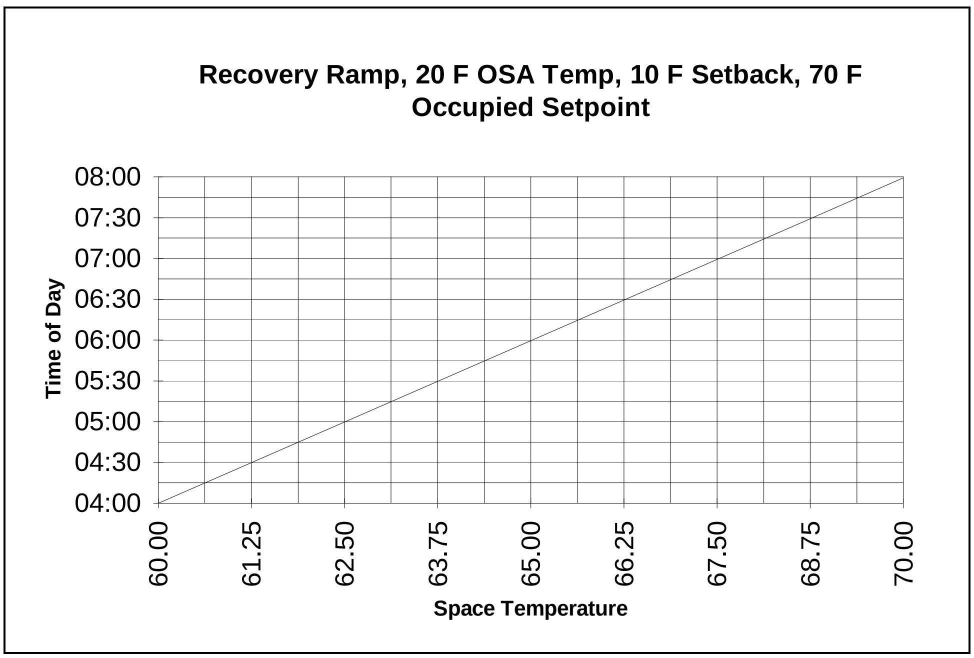
DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Cmp 1	RV	B/U Ht	M Pos	Econo	Cmp 2	DO8	AO1	AO2	AO3	AO4
>76	ON	ON	ON				ON					
>75 <=76	ON	ON	ON		ON		ON					
>74 <=75	ON	ON	ON		ON							
>=71 <=74	ON				ON							
<71 >=70	ON	ON			ON							
<70 >=69	ON	ON			ON		ON					
<69	ON	ON		ON			ON					

Smart Recovery

Warmup Mode Sequence of Operation

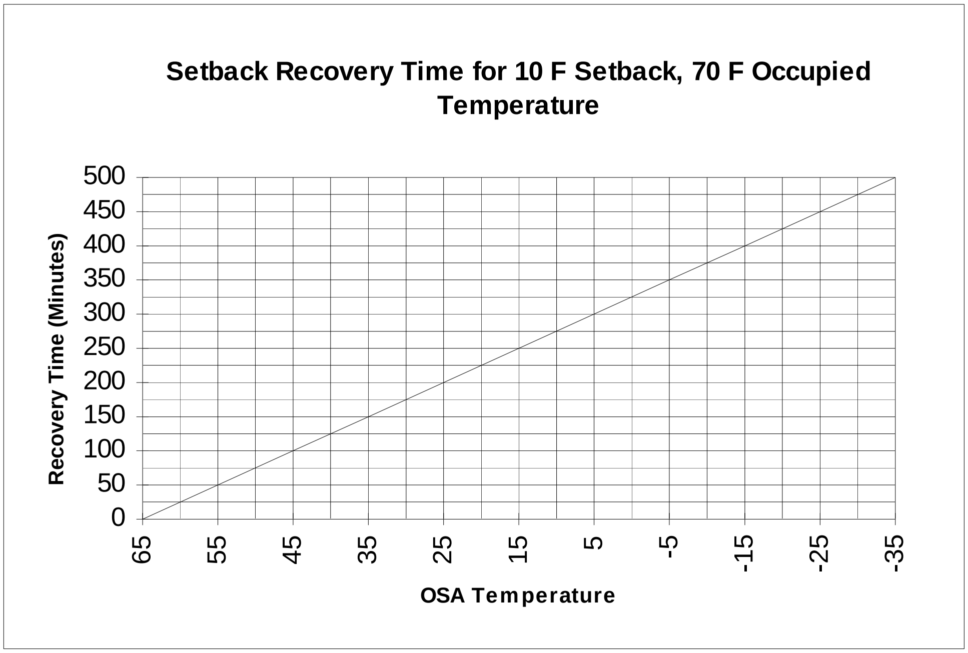
1. The first time an RSC needs to calculate a start time for recovery from night setback, the start time is based only on outside air temperature, occupied setpoint, and degrees of setback. Higher occupied setpoint temperatures, greater amounts of setback and lower outside air temperature will all require longer recovery times.
2. The System is configured to start all available heat stages on Warmup stage 1, except for heat pumps. Only compressor heat will be used for stage 1, and backup heat will be used for stage 2. The System will be maintained in Warmup stage 1 or 2 until the space has reached occupied setpoint. At this time, the space will be controlled using normal occupied control sequences.
3. On the basis of the calculated startup time, the System will generate a ramp of time versus temperature. This ramp is used in determining the number of Warmup stages to be used at any point in the recovery. If the Warmup is progressing normally, only Warmup stage 1 is energized. If the space temperature falls more than 2° F below the ramp, the System will activate Warmup stage 2 and maintain this stage until the temperature comes within 1° F of the ramp.



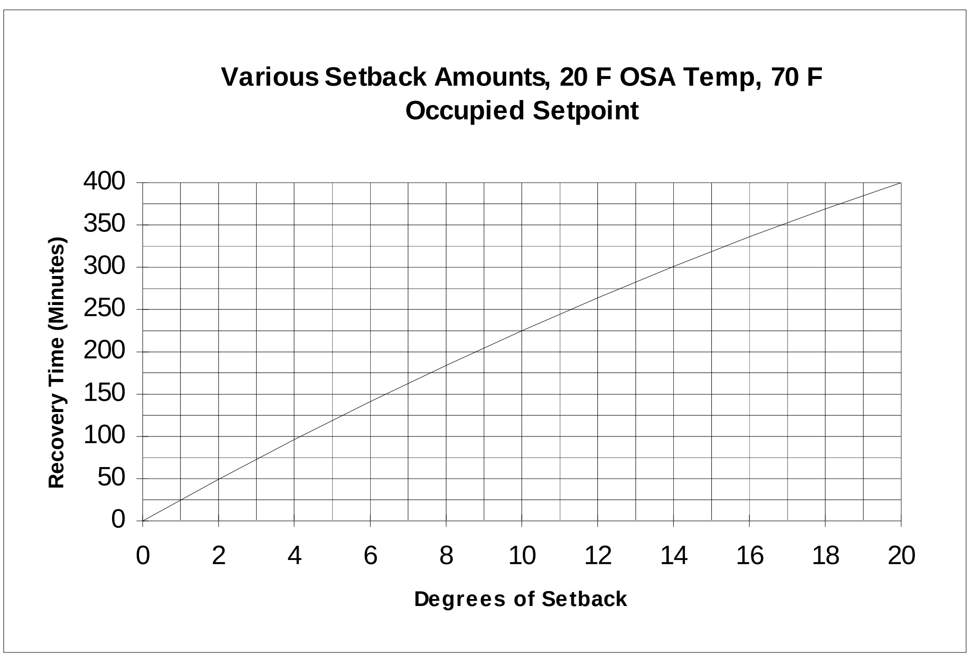
4. The System will track the actual setback recovery conditions and adjust startup times for subsequent recoveries. The following will cause the startup times to be modified:
   a. Setpoint not achieved at occupied time, subsequent startups increased by 2% for every ° F below setpoint.
   b. Occupied setpoint achieved early, subsequent startups decreased by 1% for every 5 minutes early.
   c. Warmup stage 2 required to be activated, subsequent startups increased by 1% for every minute stage 2 was activated.

Graphs of Various Warmup Recovery Conditions

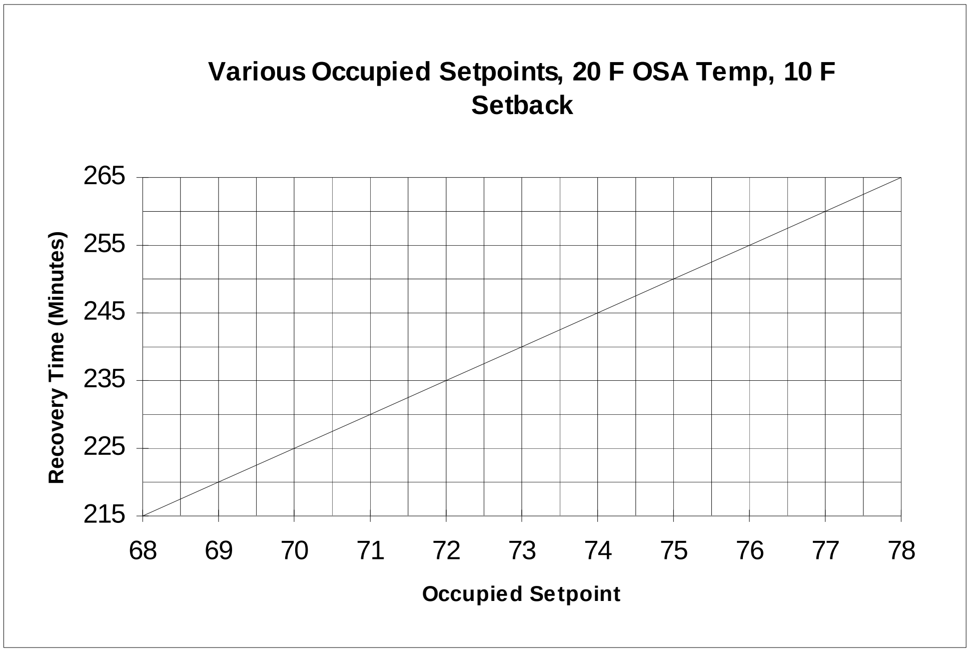
The first graph will show the amount of recovery time calculated for various outside air temperatures with a 60° F space temperature and a 70° F occupied setpoint.



The next graph shows the amount of recovery time calculated for an outside air temperature of 20° F, a 70° F occupied setpoint and varying degrees of setback.



The last graph shows the amount of recovery time calculated for an outside air temperature of 20° F, a space temperature 10° F below occupied setpoint and increasing high occupied temperatures setpoints.



Cooldown Mode Sequence of Operation

1. Cooldown is a mode in which an economizer is used to cool a building during the night prior to Occupied start time.
2. In order for any zone to enter and remain in Cooldown mode, all of the following conditions must be met:
   a. The temperature in the zone is greater than the Occupied cooling setpoint, but less than the Unoccupied cooling setpoint.
   b. The zone has economizer capability.
   c. Time of day is within 4 hours of Occupied start time.
   d. Outside air temperature is greater than 50 F.
   e. Outside air enthalpy is less than return air enthalpy.
3. When in Cooldown mode, the System will remain in full Economizer mode. No other cooling stages are allowed to operate.
4. If the Occupied cooling setpoint is achieved prior to Occupied start time, the zone will re-enter Unoccupied mode.

Software Setup

1. The only setup necessary is to check the Smart Recovery checkbox on the RSC configuration screen for that zone. All other operation is automatic.

Dual Enthalpy Economizer Control

General

1. Description - An economizer is a combination of outside air, return air, and sometimes relief air dampers. The outside and relief dampers work in the same direction and the return damper operates in the opposite direction. These dampers are generally connected through a common linkage to a single actuator. The outside air dampers are capable of providing 100% outside air to the system air handler. If no motorized relief damper exists, relief is generally provided through a barometric relief damper.
2. Factory economizer packages generally perform very well. It is often best to use the factory economizer package, rather than building an economizer in the field. The actuator would be 24 Vac powered, spring return to closed, and include both a minimum position pot and a discharge air temperature sensor. One digital output is used to make or break the 24 Vac power to the actuator. The second digital output is used to either make the circuit to the discharge air sensor allowing the actuator to operate or break the circuit to the discharge air sensor forcing the actuator to drive to minimum position.
3. **EZ** will also allow for use of built up economizer packages, using either an analog actuator or 3 point floating actuators. With this setup, the System will directly control the actuator position and minimum position is set in software. A discharge sensor must be installed by the Dealer and wired to Analog Input 4.

Sequence of Operation

1. If the zone needs cooling and the outside air enthalpy is lower than the return air enthalpy, the economizer will be activated on first stage cooling.
2. The action taken in Economizer Mode will be dependent on the type of economizer being used:
   a. If override of a factory economizer package is used, the economizer output is activated.
   b. If either an analog actuator or a 3 point floating built up economizer is used, the actuator will be opened 100% and be maintained open unless discharge air temperature falls below 55° F. The damper will close 5% per minute until the temperature returns to above 55° F.
3. The economizer will be maintained at minimum position when not active and in the Occupied mode.
4. The economizer will be closed when not active and in the Unoccupied mode.

Software Setup

1. No setup is necessary. Any schedule with economizer capability will control automatically.

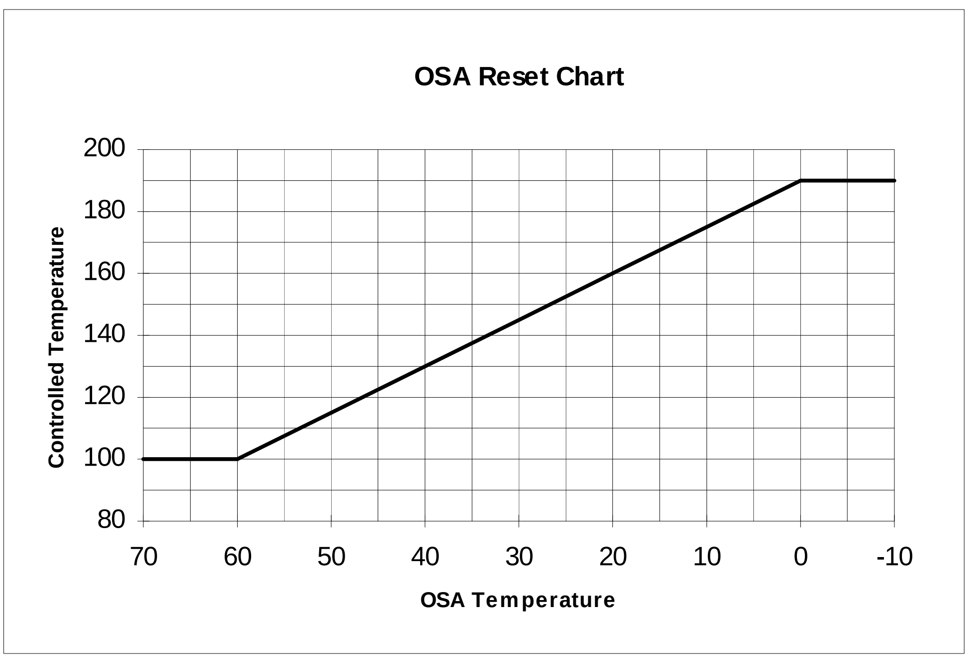
Outside Air Reset Control

Description

1. Outside Air (OSA) Reset Control is available for heating equipment only and only when the RSC is on-line.
2. When using OSA Reset, the setpoint used for RSC control is adjusted based on the outside air temperature. The parameters used for setup are:
   a. Shutoff Temperature is the outside air temperature at which heat is no longer needed and all stages of heat are shut off. When this setpoint is reached, the Zone is forced to AtSet. If an actuator is configured for the Zone, the actuator will close when the OSA cutoff temp is reached
   b. Maximum Outside Air Temperature is one of the points used for calculation of the reset ramp.
   c. Reset Ratio is the number of degrees by which the Controlled Setpoint will increase above the Minimum Controlled Temperature for each degree of OSA temperature decreases below the Maximum OSA Temperature. This number can be anywhere from 0.05 to 12.75 in increments of 0.05.
   d. Unoccupied Offset is the degrees offset below the calculated daytime control ramp to be used in the Unoccupied mode.
   e. Minimum Controlled Temperature is used for calculation of the reset ramp and corresponds to maximum outside air temperature on the ramp.
   f. Maximum Controlled Temperature is the highest allowed temperature of the controlled device, regardless of calculated reset temperature.

Outside Air Reset Example

Shutoff Temperature - 70° F
Maximum OSA Temperature - 60° F
Reset Ratio - 1.50
Minimum Controlled Temperature - 100° F
Maximum Controlled Temperature - 190° F



Optional Fahrenheit/Celsius Display

Description

All temperature display ranges can be optionally selected for Fahrenheit or Celsius display. The desired display range can be selected at any time. Once selected, all temperature displays will be in the correct range. The System default is Fahrenheit. Manual conversion can be done using the following formulas:

° F = (1.8*° C) + 32
° C = (° F - 32) / 1.8

Part II

Software

1. Main Window
2. Miscellaneous Equipment Configuration
3. Time of Day Scheduling
4. Trend Log Viewer
5. Remote Communication
6. Graphics Viewer
7. Graphics Builder
8. Zone Configuration
9. Alarms and Control Functions
10. Configuration Options

Chapter 1

Main Window

Overview

All actions that configure, monitor or modify the operation of an **Energy Zone®** (**EZ**) Site are accessed from the Main Window of the Building program. This chapter provides a description of the Main Window components and instructions for configuration functions available to Access Level 1.

Features

- Graphical Representation of Zone Status
- Simple Point-and-Click Mouse Interface

Specifications

Password Security - **EZ** allows for six levels of Password Security. See the Main Window chapter for a detailed description of the menu items available at each access level.

Passwords can only be edited for those Users at the same or lower levels as the current User. Dealers are given a Level 4 password with every System and are responsible for setting up a password file for each installation. It is important that the password level matches the ability of the User. Damage to controlled equipment can occur if the User is not qualified to be making the changes allowed by the password level.

The current User level is displayed on the status bar at the bottom of the Main List box. The Access menu has a Log Off option, allowing for return to Level 0. The System will automatically return to Level 0 after a period of no keyboard of mouse activity. This time is configurable, and would typically be 15 minutes. The Access Timeout is configured under the Options / Settings menu.

The levels and their intended use are:

0 No System parameters can be changed at this level. This is designed to be used for System monitoring only. The Main List box, Miscellaneous Equipment status, and the Trend Log can all be monitored.

1 The ability to change Setpoints, program Overrides, and view both Active Alarms and the Alarm Log is added at this level. This level is designed to be used by building managers with minimum qualifications.

2 This level adds editing of Weekly Schedules, Holiday Schedules, Phone book, and Zone List options. This level is designed to be used by building managers with moderate qualifications.

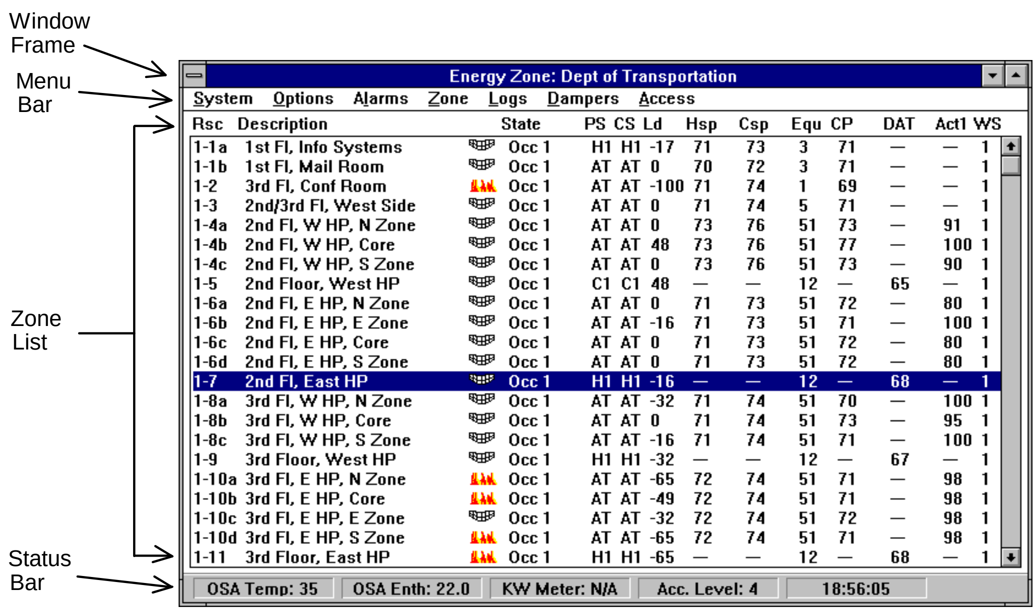
3 This level allows for complete System configuration and troubleshooting. This level is designed to be used by design engineers, technicians, and building managers with significant qualifications.

4 This level allows access to the Equipment Schedule Editor. This level is designed to be only used by design engineers or technicians with extensive background in control theory and mechanical equipment.

Note: A Level 5 and Level 6 Access are used for **BAS** internal testing and configuration only.

Main Window

The Main Window of the Building program is automatically displayed when the program is activated. This is done by clicking on the Building icon in the **Energy Zone®** group. This window is used as the primary User interface.



Energy Zone Main Window

Main Window Components

Window Frame - This component is the same for most Microsoft Windows applications. The frame includes items such as the caption (which names the site), minimize and maximize buttons. The window frame allows the Energy Zone window to be sized as desired.

Menu Bar - Just below the caption resides the menu bar. All System operation and configuration can be accessed through the menus found here. The menu items included on the menu bar are determined by the System mode (on-site or Remote Monitoring) and the Access Level of the User.

Zone List - At the center of the **EZ** window is the Zone List Box. This List Box contains an entry for every Zone in the System. The data columns displayed in the Zone List Box are User selectable and can be modified at any time. The Zone List Options include configuration data, Zone input and output values, and operational status. Startup, monitoring, and troubleshooting operations can be completed on any Zone from within the List Box. All individual Zone operations require that the Zone first be selected in the Zone List Box by pointing and clicking at the Zone with the mouse.

Status Bar - The status bar is located at the bottom of the Main Window. The status bar displays the current outside air temperature, outside air enthalpy, KW demand level (from the meter that is configured for the currently highlighted Zone), User Access Level, and time of day. If connected remotely, the System can also be configured to display communication errors. This number is the total of all errors that have occurred since connecting to the Host Site.

Using the System Interface

These rules apply to all operations in the **Energy Zone®** System.

Menu Selections - All Menu selections can be made by both the mouse and the keyboard. Mouse selections are made by pointing and clicking on the desired selection. The keyboard can be used by pressing both the Alt key and the letter that is underlined in the Menu.

Pop-Up Menu - A Pop-Up menu is also provided for the most frequently used System actions. This menu is accessed by pointing anywhere inside the Zone List and holding down the right mouse button.

Selecting a Zone - The System will direct all individual Zone actions to the Zone that is currently selected in the Zone List Box. To select a Zone, use the mouse to point and click anywhere on the that Zone's line in the Zone List. The current selection is indicated by highlighting the entire line for that Zone in the Zone List.

Selecting Multiple Zones - Several System operations can be performed simultaneously on multiple Zones. To select multiple Zones that are listed consecutively in the Zone List, click on the first Zone, hold down the Shift key, and then click on the last Zone. All Zones between and including the two selected are then highlighted. To select multiple Zones that are not listed consecutively in the Zone List, click on the first Zone, hold down the Control key, and then click additional Zones one at a time.

Selecting a List Item - Item displayed in List Boxes must be selected in order to performing an edit action. Use the mouse to point and click on the item in the List. The selection is indicated by highlighting the item in the List Box.

Dialog Box Buttons - The following buttons will provide the same action in all Dialog Boxes.

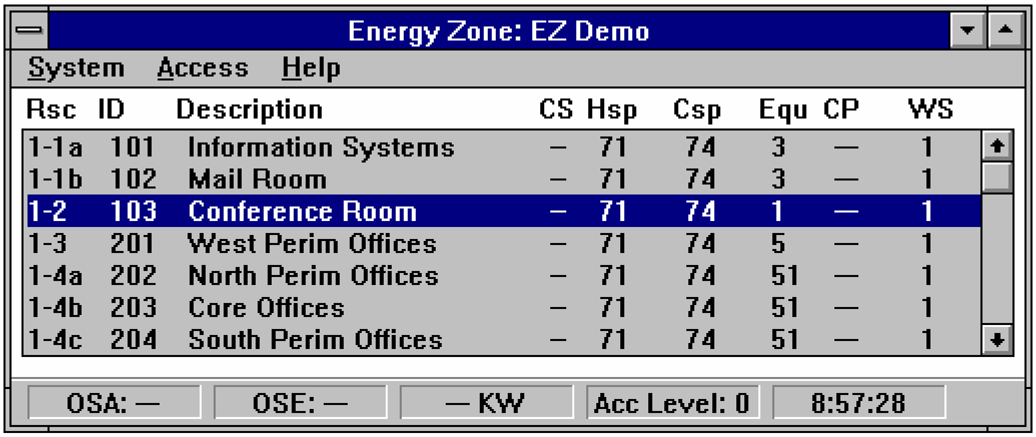
- Ok - This will accept all entries. When necessary, this will update the stored configuration files. There is no provision to undo any entry that has been accepted by selecting Ok.
- Reset - This will undo any current entries and restore all items in the Dialog Box to their original values. This feature will not work after the entries have been accepted by selecting Ok.
- Cancel - This will allow User to exit the Dialog Box without making any changes.
- Add - This is used to add a new item to the group in the currently displayed List Box.
- Delete - This is used to delete the currently selected List Box item.
- Edit - This is used to edit the currently selected List Box item. Most Dialog Boxes will also enter the edit screen when the item is double-clicked in the List Box.
- Close - This will exit the Dialog Box.
- Defaults - This will set all Dialog Box entries to factory defaults.

Edit Shortcut - Most List Boxes will enter edit mode for any item that is double-clicked from inside the List Box.

Change Setpoints Shortcut - When a Zone is double-clicked in the Zone List Box from Access Level 1 or higher, the Change Setpoints Dialog is activated for that Zone.

System Log In

To Log In to the System, select Access from the Menu Bar.



Access Menu

Enter a valid password. The screen will display an * for all keyboard entries.

System Access Screen

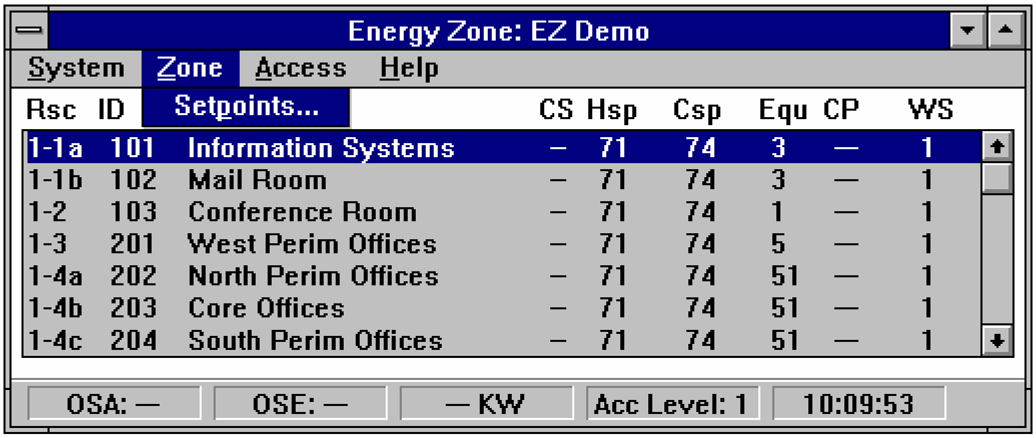
System Log Out

At the completion of an **EZ** session, it is important for the User to Log Out of the System. This will prevent unauthorized changes being made to the System. The Log Out menu item will return the System access to Level 0. To Log Out of the System, select Access and then Log Out from the Menu Bar.

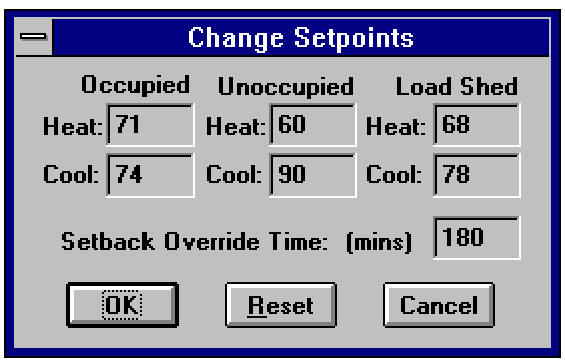
Automatic Log Off: If there is no mouse or keyboard activity for a pre-set number of minutes, the System will automatically Log Out the current User and set Access to Level 0. The default time delay setting is 30 minutes. This can be modified using System / Site Configure / General Settings... from Access Level 3.

Changing Zone Setpoints & Setback Override Time

To display the Change Setpoints dialog, first select the Zone in the Zone List Box. Then select Setpoints ... from the Zone menu. Access Level 1 is required to change Setpoints.



Zone Menu



Change Setpoints Screen

Occupied Heat: and Cool: Enter the desired temperature control setpoints for the Occupied time-of-day mode.

Unoccupied Heat: and Cool: Enter the desired temperature control setpoints for the Unoccupied time-of-day mode.

Load Shed Heat: and Cool: Enter the desired temperature control setpoints to be used when this Zone is in KW Load Shed mode. Load Shed setpoints are grayed out unless the Zone has been configured to allow KW Load Shedding.

Setback Override Time (mins): This is the length of time that the Zone will be placed in Occupied mode if the setback override button on the wall sensor is pushed while Unoccupied. This time can be set from 0 to 65,535 minutes.

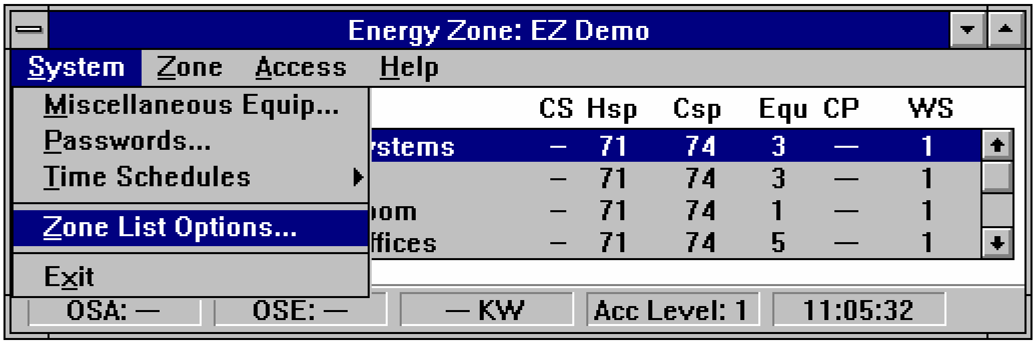
Setpoint Entry Limits - The System will verify that the setpoints entered do not exceed the following limitations. An error message will be displayed if an invalid entry is made.

1. The setpoint must be within the range of the sensor being used for Zone control. The standard wall sensor is scaled to a range of 32-96° F.
2. The heating setpoint must always be lower than the cooling setpoint for each mode. The required separation is set by the DeadBand value configured for the site. The default DeadBand is 2° F. This can be modified using System / Site Configure / General Settings... from Access Level 3.
3. The Load Shed Heat setpoint can not be higher than the Occupied Heat setpoint.
4. The Load Shed Cool setpoint can not be lower than the Occupied Cool setpoint.

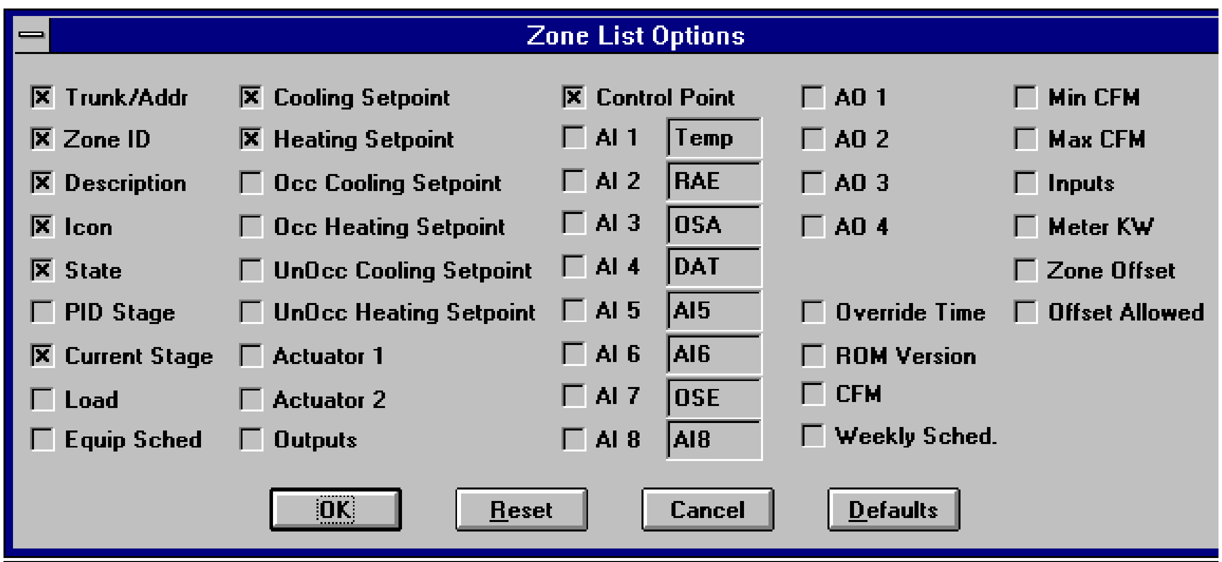
Note: To change Setpoints in multiple Zones, all selected Zones must use the same Equipment Schedule.

Zone List Options

Zone List Options... are accessible from the System menu.



System Menu



Zone List Options Screen

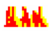
The options shown are the default Zone List Options. To select information for display, simply click on the desired information box with the mouse.

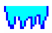
Note: The User must be logged onto the System at Access Level 1 to modify the Zone List Options.

Description of Zone List Options

- **Trunk/Addr** - Trunk (1-8), Address (1-32), and if applicable SubZone (a-d).
- **Zone ID** - Usually is the room number, but will display information entered as the ID: item of Zone Configuration.
- **Description** - This is a text description and comes from the Description: entry in Zone Configuration.
- **Icon -** This is a graphical representation of the status of the Zone. The possible Icons and their meanings are:

 **Cheshire Cat Grin** - Zone is on-line and at setpoint.

 **Flames -** Zone is in heating. (PID Load is <= -48). This Icon will only display if the Zone has heating capability, as configured in the Equipment Schedule Editor.

 **Icicles -** Zone is in cooling. (PID Load is >= +48). This Icon will only display if the Zone has cooling capability, as configured in the Equipment Schedule Editor.

 **Fireman's Hat -** Zone is in alarm.

 **Circuit Board -** Zone is off-line.

 **Handheld Tester -** Zone is in local Test mode with a Handheld Tester.

- **State** - This is the current state of the zone. The valid states are:

AlmDis	Display of Alarm messages configured for screen or printer output is disabled.
Az Occ	All Zones Override into Occupied mode.
Az UnOcc	All Zones Override into Unoccupied mode.
Calibrate	System is calibrating the Zone CFM airflow sensor zero offset.
CoolDwn	Smart Recovery Cool Down mode.
DmprMax	All dampers are forced to the maximum position as configured for that Zone.
DmprMin	All dampers are forced to the minimum position as configured for that Zone.
EarlyOcc	Completion of Smart Recovery prior to Occ 1.
Init...	Zone has just come on-line with the Command Center and is being initialized.
SetbkOvr	Local Setback Override to Occupied mode.
ShedOvr	Zone has been placed in KW Load Shed mode.
Sz Occ	Single Zone Override into Occupied mode.
Sz UnOcc	Single Zone Override into Unoccupied mode.
Occ 1	First programmed occupied time of the day.
Occ 2	Second programmed occupied time of the day.
offline	Zone is not communicating with the Command Center.
UnOcc 1	First programmed unoccupied time of day, from midnight to Occ 1.
UnOcc 2	Second programmed unoccupied time of day, between Occ 1 and Occ 2.
UnOcc 3	Last programmed unoccupied time of day, from Occ 2 to midnight.
WarmUp	Smart Recovery Warm Up mode.

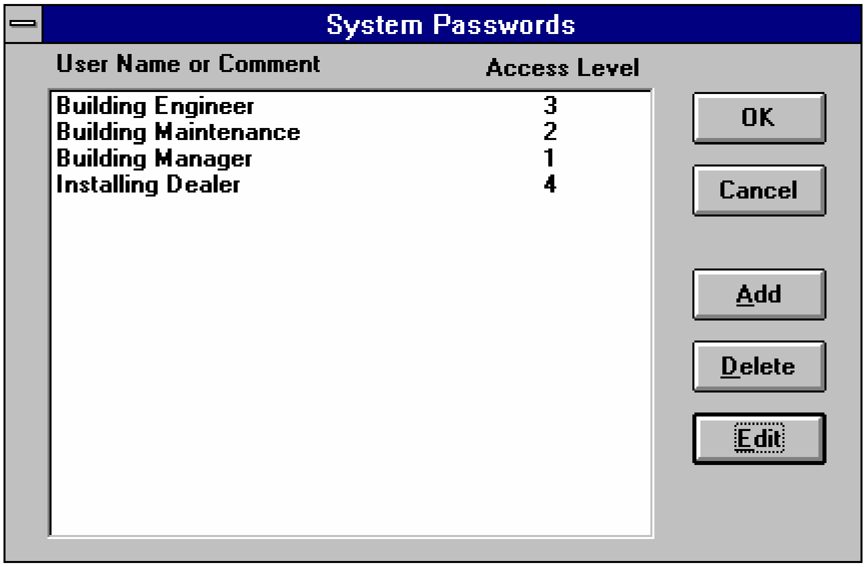
- **PID Stage** - The calculated PID stage. The valid stages are:

C1 - C4	Cooling stage 1 through cooling stage 4.
H1 - H4	Heating stage 1 through heating stage 4.
AT	Zone is at setpoint.
FA	Zone is forced at setpoint. This occurs when the Zone reaches setpoint prior to the end of the stage time calculated by the System.

- **Current Stage** - The present operating stage. The valid stages are the same as the valid PID stages.
- **Load** - The PID load. This will be a number from -255 (maximum heating need) to +255 (maximum cooling need). If the Zone is configured as a Server and the source of the Load is its Clients, a ‘c’ will be displayed after the number.
- **Equip Sched** - The number of the Equipment Schedule.
- **Cooling Setpoint** - The cooling temperature setpoint for the current time-of-day mode for the Zone. The displayed value will automatically change as the time-of-day modes change.
- **Heating Setpoint** - The heating temperature setpoint for the current time-of-day mode for the Zone. The displayed value will automatically change as the time-of-day modes change.
- **Occ Cooling Setpoint** - The cooling temperature setpoint for the Occupied mode.
- **Occ Heating Setpoint** - The heating temperature setpoint for the Occupied mode.
- **UnOcc Cooling Setpoint** - The cooling temperature setpoint for the Unoccupied mode.
- **UnOcc Heating Setpoint** - The heating temperature setpoint for the Unoccupied mode.
- **Actuator 1** - The percentage open position of the first 3 point floating actuator.
- **Actuator 2** - The percentage open position of the second 3 point floating actuator.
- **Outputs** - The current state of all outputs for the Zone. A display of 0 indicates the output is off, and 1 indicates the output is on. All 8 outputs are listed in order from 1 to 8.
- **Control Point** - The scaled value of the Control Point. This is normally the same as AI1, but could be a calculated value as configured for that Zone.
- **AI1** thru **AI8** - The value of the Analog Input, scaled correctly based on the Zone configuration. The edit box on the right is used to enter a label to be used at the top of the Zone List.
- **AO1** thru **AO4** - The percentage open position of the Analog Output.
- **Override Time** - The time remaining for a User activated local Setback Override.
- **ROM Version** - The version number of the EPROM located at the Zone.
- **CFM** - The calculated Cubic Feet per Minute (CFM) airflow rate for pressure independent Zones.
- **Weekly Sched.** - The Weekly Schedule number being used at that Zone. If the Zone is a Parent, the Weekly Schedule ## will be followed by a 'p' (i.e. 13p). If a Child, the Weekly Schedule ## will be followed by a 'c' (i.e. 13c).
- **Min CFM** - The Minimum CFM configured for that Zone.
- **Max CFM** - The Maximum CFM configured for that Zone.
- **Inputs** - The current state of all inputs for the Zone. A display of 0 indicates the input is off, and 1 indicates the input is on. All 8 inputs are listed in order from 1 to 8.
- **Meter KW** - The KW level reported by the meter configured for Load Shedding at this Zone
- **Zone Offset** - The amount of offset being applied to the configured Occupied setpoints.
- **Offset Allowed** - The maximum amount of offset to the configured setpoints allowed to be input from the Zone.

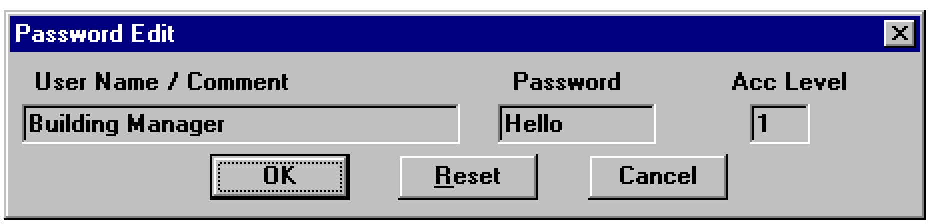
Passwords

The System will only allow Passwords to be Added or modified at the same or lower Access Level as the current User. To add, delete, or edit any password, first select System and then Passwords... from the Menu Bar. This will bring up the System Passwords list box.



System Passwords List Box

To Delete or Edit any password, select that password from the list and then select the Delete or Edit button. To add a new password, select the Add button.



Password Edit Screen

User Name/Comment - The User Name/Comment is used both for display in the System Password list box and for entries made in the Security Log.
Password - The Password can be any combination of numbers, letters, or symbols from the keyboard.
Acc Level - The Access Level can be 1-4.

Menu Configurations

The available selections in the Menu Bar of the Main Window are determined by the Access Level of the User and the operating mode of Building. The menus shown here apply to standard operation with Building running at the Site. When connected to a Host Site using Remote Building, a Communication menu item is added and a couple of items that are not supported Remotely are deleted.

Access Level 0

```
System                          Access       Help
----------------------------    -----------  ----------------------------
Miscellaneous Equip...                       About Energy Zone...
----------------------------                 ----------------------------
Exit
---------------------------
```

Access Level 1

```
System                          Zone            Access        Help
------------------------------  --------------- ------------  ----------------------------
Miscellaneous Equip...          Setpoints...    Log Out       About Energy Zone...
Passwords...                    --------------- ------------  ----------------------------
Time Schedules         ->
    ---------------------------
    Weekly Schedules...
    Holiday Schedules...
    ---------------------------
    Building Override...
    Zone Override...
    ---------------------------
------------------------------
Zone List Options...
------------------------------
Exit
------------------------------
```

Access Level 2

```
System                          Zone            Logs               Alarms                              Access        Help
------------------------------  --------------- ------------------ ---------------------------------   ------------  ----------------------------
Miscellaneous Equip...          Setpoints...    Trend Logs...      Active Alarms...                    Log Out       About Energy Zone...
Passwords...                    --------------- Alarm Logs...      Active Control Functions...         ------------  ----------------------------
Phone Book...                                   ------------------ ----------------------------------
Time Schedules         ->
    ---------------------------
    Weekly Schedules...
    Holiday Schedules...
    ---------------------------
    Building Override...
    Zone Override...
    ---------------------------
------------------------------
Zone List Options...
------------------------------
Exit
------------------------------
```

Access Level 3

```
System
------------------------------
Miscellaneous Equip...
Passwords...
Phone Book...
Time Schedules        ->
    ---------------------------
    Weekly Schedules...
    Holiday Schedules...
    ---------------------------
    Building Override...
    Zone Override...
    ---------------------------
    Set Parent...
.....Undo Parent...
    ---------------------------
------------------------------
Zone List Options...
------------------------------
Site Configure        ->
    ----------------------------------
    Comm Settings...
    General Settings...
    VAV/VariZone Settings...
    Outside Air RSC...
    ----------------------------------
KW Load Shed...
------------------------------
Exit
------------------------------

Zone
--------------------
Setpoints...
Configure...
--------------------
Troubleshoot...
History
Status
--------------------
New...
Copy...
Delete...
--------------------
Set Server...
--------------------

Logs
-----------------------
Trend Logs...
Alarm Logs...
Security Log...
Comm Error Log...
------------------------

Alarms
---------------------------------
Active Alarms...
Active Control Functions...
Global Alarms...
----------------------------------
Master Alarm Status...
----------------------------------
Enable Alarm Messages...
Disable Alarm Messages...
---------------------------------

Tools
--------------------
Site Database...
Edit EZ.INI...
----------------------------
Backup Data to A&C
Restore Data from A
Restore Data from C
----------------------------
Damper Override       ->
    ---------------------------
        Normal
        Minimum
        Maximum
        ---------------------------
    ----------------------------

Access
-----------
Log Out
-----------

Help
----------------------------
About Energy Zone...
----------------------------
```

Access Level 4

```
System
------------------------------
Miscellaneous Equip...
Passwords...
Phone Book...
Time Schedules        ->
    ---------------------------
    Weekly Schedules...
    Holiday Schedules...
    ---------------------------
    Building Override...
    Zone Override...
    ---------------------------
    Set Parent...
.....Undo Parent...
    ---------------------------
------------------------------
Zone List Options...
------------------------------
Site Configure        ->
    ----------------------------------
    Comm Settings...
    General Settings...
    VAV/VariZone Settings...
    Outside Air RSC...
    ----------------------------------
KW Load Shed...
Equipment Schedules...
------------------------------
Exit
------------------------------

Zone
--------------------
Setpoints...
Configure...
--------------------
Troubleshoot...
History
Status
--------------------
New...
Copy...
Delete...
--------------------
Set Server...
--------------------

Logs
-----------------------
Trend Logs...
Alarm Logs...
Security Log...
Comm Error Log...
------------------------

Alarms
---------------------------------
Active Alarms...
Active Control Functions...
Global Alarms...
----------------------------------
Master Alarm Status...
----------------------------------
Enable Alarm Messages...
Disable Alarm Messages...
---------------------------------

Tools
--------------------
Site Database...
Edit EZ.INI...
----------------------------
Backup Data to A&C
Restore Data from A
Restore Data from C
----------------------------
Damper Override       ->
    ---------------------------
        Normal
        Minimum
        Maximum
        ---------------------------
    ----------------------------

Access
-----------
Log Out
-----------

Help
----------------------------
About Energy Zone...
----------------------------
```

Pop-up Menus - Pop-up Menus are available to all Access Levels. They can be accessed by clicking the right mouse button from anywhere within the Zone List Box.

Access Level 0

Access

Access Level 1

Setpoints...
Override...

List Options...

Log Out

Access Level 2

Setpoints...
Override...

Trend Logs...
Alarm Logs...
List Options...

Log Out

Access Levels 3 & 4

Troubleshoot...
History...
Status...

Setpoints...
Configure...
Override...

Trend Logs...
Alarm Logs...
List Options...

Log Out

Setpoints Dialog - Using the left mouse button to double click on any Zone while at Access Level 1 or higher will bring up the Setpoints Dialog box.

In Case of Failure at the Command Center

The integrity of the Windows operating system can be affected by a poorly designed Windows application. These events can hinder and possibly even disable the Command Center. These failures can generally be eliminated by using only applications that are provided by **BAS** with the Command Center (Windows standard components and all **Energy Zone®** applications) and those developed by major software vendors. It is also possible for an inexperienced User to inadvertently close Windows or one of the necessary **Energy Zone®** software components.

The System will continue to provide control of the Zones if a problem occurs at the Command Center. If three minutes has passed since the last communication between any RSC and the Command Center, that RSC will assume control of the attached equipment using default control sequences and setpoints.

The following procedure should be used to restore the System to normal operation following any event that is known or suspected to have had an affect on either the Windows operating system or **Energy Zone®**. The steps should be performed in order until the System is restored to normal operation or the Command Center is disabled.

1. Close the problem application or otherwise take steps to correct or eliminate the source of the error. This does not always restore Windows to full normal operation and should only be attempted by Users with experience using the Windows environment.
2. Use the Ctrl-Alt-Del key sequence to re-boot the Command Center.
3. Use the Reset button on the face of the Command Center case to re-boot.
4. Turn off power to all Command Center components (CPU, monitor, modem, etc.). Wait for 10 seconds and re-energize.
5. Turn off and leave off power to all Command Center components (CPU, monitor, modem, etc.). After three minutes all RSCs will enter default mode. Contact your Dealer or **BAS** for additional assistance.

Note: The Command Center and other System components can not be hurt by following these steps. All configuration information is stored on the System hard disk. Upon re-starting, Windows will automatically load all necessary **Energy Zone®**. applications. The System will then load all configuration data and resume normal operation.

Chapter 2

Miscellaneous Equipment

Overview

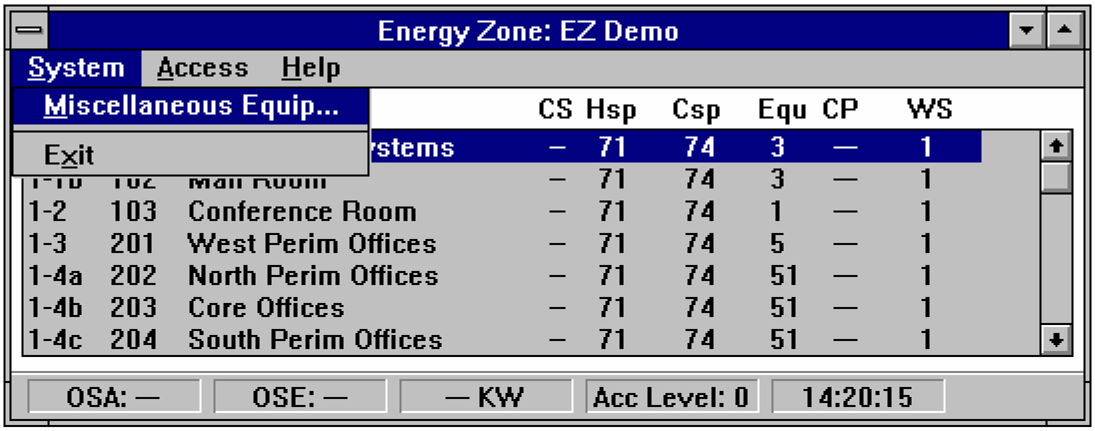
Energy Zone® (**EZ**) has the ability to control Miscellaneous Equipment at any RSC address, independent from any control functions based on the Equipment Schedule. This feature can be used for anything requiring simple on/off control such as lighting, exhaust fans and hot water tanks. An output programmed for Miscellaneous Equipment control will override any Equipment Schedule function attempting to set the state of the output. Miscellaneous Equipment control will not override an Alarm or Control Function.

Features

- Occupied State - On or Off
- Can be Assigned to any Weekly Time Schedule
- Location of Equipment can be any Digital Output on any RSC
- Configurable KW Load Shed Priority Levels
- Setback Override Input Location and Override Time

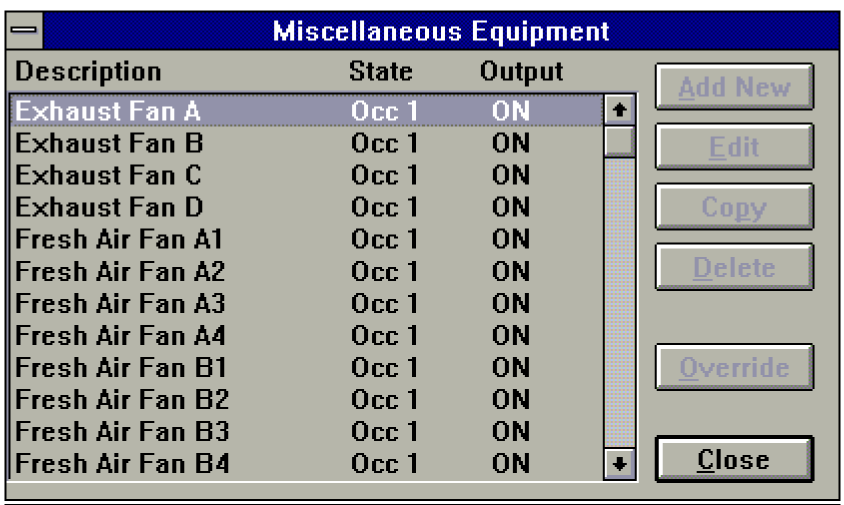
Miscellaneous Equipment Status

The Miscellaneous Equipment Status Screen is accessible from the Main List Box System Menu.



System Menu

This screen is used for display of Miscellaneous Equipment status. The valid States are Occ, Unocc, SZ Occ, SZ Unocc, AZ Occ, AZ Unocc, Setbck Ovr, or Offline. The valid Outputs are either ON, OFF, or -- (Offline).

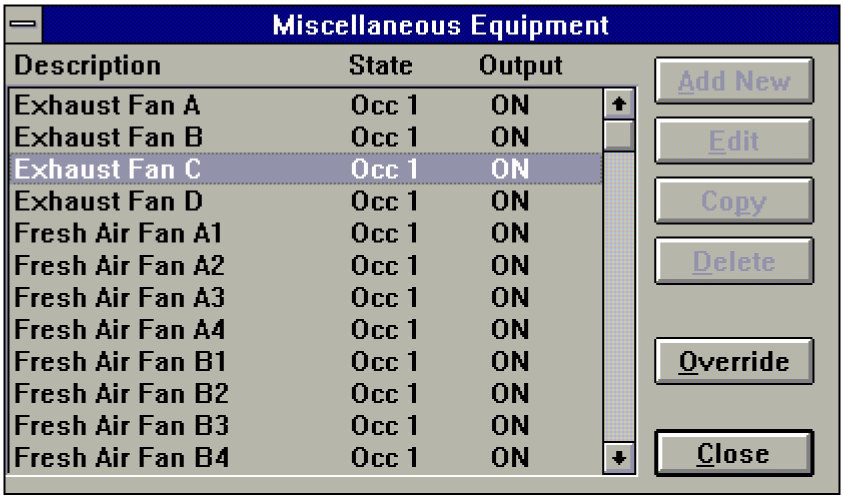


Miscellaneous Equipment Status Screen

Note: The Miscellaneous Equipment Status Screen can be viewed at Access Level 0.

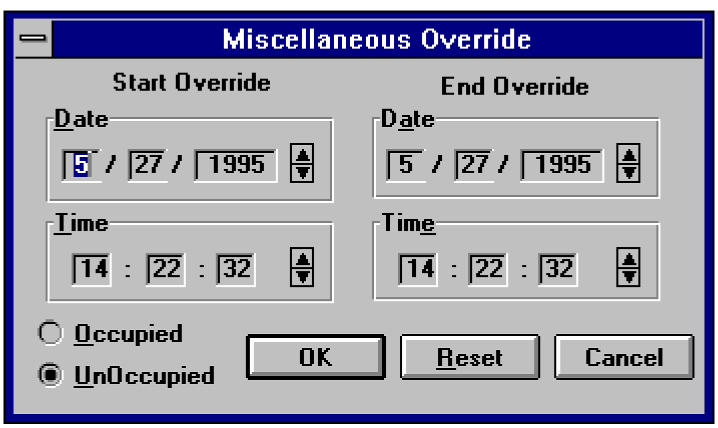
Miscellaneous Equipment Override

To program a one time Setback Override for a single piece of Miscellaneous Equipment, first select the Equipment from the Miscellaneous Equipment list box using the left mouse button. Then select the Override button.



Miscellaneous Equipment List Box

Enter a desired Start time and End time and the mode to be used during the Override period.

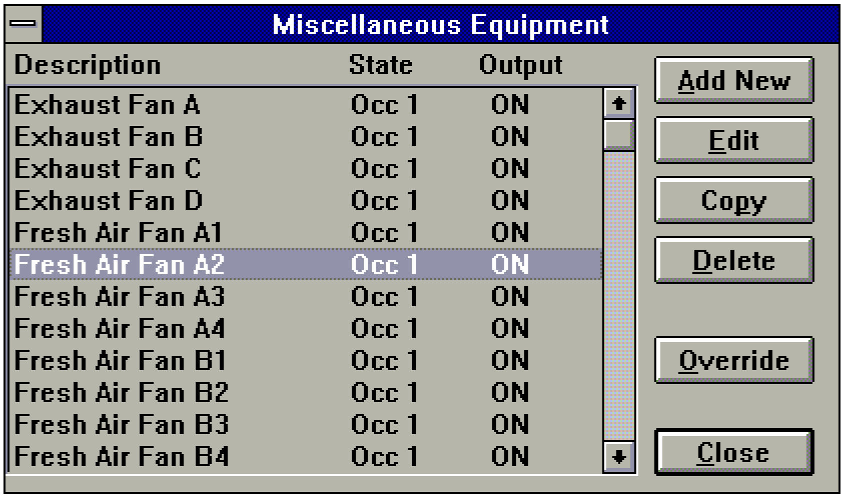


Miscellaneous Equipment Override Screen

Note: The User must be logged onto the System at Access Level 1 to program a Miscellaneous Equipment Override.

Miscellaneous Equipment Configuration

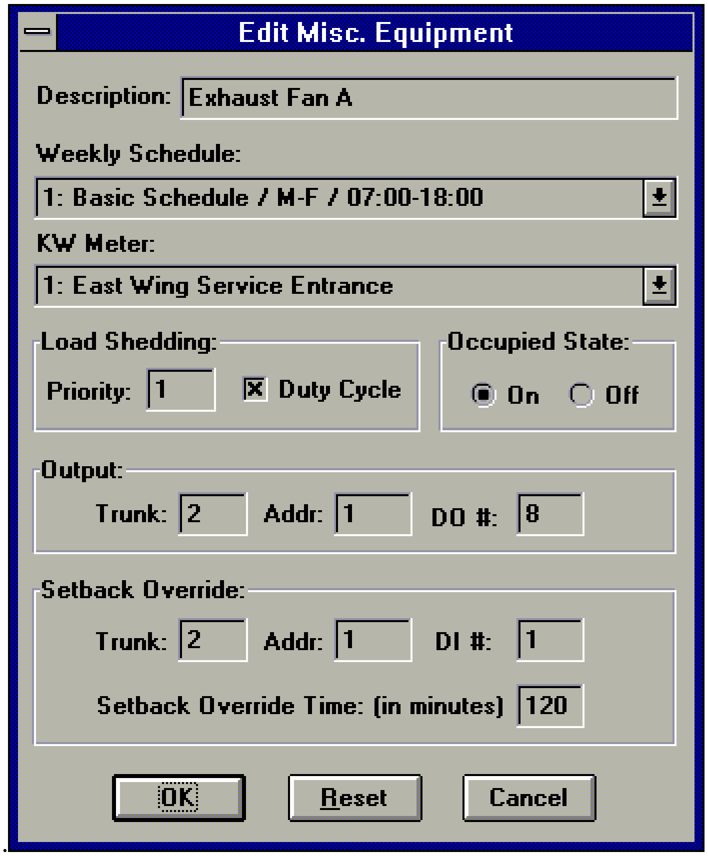
To modify an existing configuration, select the Equipment from the Miscellaneous Equipment list box using the left mouse button. To add a new item, it is not necessary to first make a selection.



Miscellaneous Equipment List Box

Add New - Select the Add New button to configure a new Miscellaneous Equipment item.
Edit - Select the Edit button to modify an existing item.
Copy - Select the Copy button to create a new item and copy all configuration information from the selected Equipment to the new item. The system will create a new item and enter the Edit screen for the new item. Modify configuration as necessary for the new Equipment.
Delete - Select the Delete button in order to remove an item from the System. The Delete function will ask the User for confirmation and then delete the configuration information.

Note: The User must be logged onto the System at Access Level 3 to edit Miscellaneous Equipment configuration.



Edit Miscellaneous Equipment Screen

Description - The description of the Equipment being controlled.

Weekly Schedule - The Weekly Time Schedule used for this equipment. The list box may be dropped down for a complete list of all available weekly schedules.

KW Meter - The KW Meter to be used for KW load shedding of this equipment. The list box may be dropped down for a complete list of all available KW Meters.

Load Shedding - The priority level determines which equipment is Load Shed first. Set a priority level from 1-32. Lower numbers are shed first. Any number of different pieces of equipment may be set to the same priority level. Check the Duty Cycle check box to duty cycle the equipment at the same priority level as this item.

Occupied State - The State of the output in the Occupied mode. In order to ensure fail-safe operation of critical equipment, use a relay to interface the digital output of the RSC to the miscellaneous equipment. Connect the control circuit of the miscellaneous equipment to the normally closed contacts of the interface relay. Configure the miscellaneous equipment to be Off in the Occupied State. A failure in the System will de-energize the interface relay that will then activate the miscellaneous equipment.

Output - The RSC address and output location of the equipment being controlled. This can be any Digital Output (1-8) at any RSC address. Miscellaneous Equipment output locations must be identified by the physical RSC address and Digital Output, not the logical Zone address and output. If an RSC is used for a dual Equipment Schedule, then the physical outputs DO1-8 are setup as logical outputs DO1-4 on Zone A and DO1-4 on Zone B.

Example

RSC 1-1 Physical Output	Zone 1-1a Logical Output	Zone 1-1b Logical Output
DO1	DO1	N/A
DO2	DO2	N/A
DO3	DO3	N/A
DO4	DO4	N/A
DO5	N/A	DO1
DO6	N/A	DO2
DO7	N/A	DO3
DO8	N/A	DO4

In order to use DO2 at Zone 1-1b for Miscellaneous Equipment, the output should be configured for RSC Trunk 1, Address 1, DO# 6.

Note: - Any output assigned to an Equipment Schedule should not be used for Miscellaneous Equipment even if it is not actually needed in that Zone. Miscellaneous Equipment will override the output to the correct state when on-line, but the RSC will cycle the output based on the default sequence of operation. It is also not possible to use any output configured for a 3 point floating actuator to control Miscellaneous Equipment. The RSC controls these outputs based strictly on timing and ignores any commands to turn the output on or off.

Setback Override - This configuration will Override the Weekly Time Schedule when the equipment is in the Unoccupied mode. Any Digital Input at any RSC address can be used as an Override input. It is not necessary to use an input at the same RSC as that being used to control the output. The same rules that apply to identification of the output location also apply to input location.

Chapter 3

Time-of-Day Scheduling

Overview

Energy Zone® scheduling provides the User with all of the tools necessary to meet even the most demanding scheduling needs of tenants.

Features

- Standard 7 Day Schedule with 2 Occupied and 2 Unoccupied Periods per Day
- Separate Holiday Schedule with 2 Occupied and 2 Unoccupied Periods per Day
- Monthly Calendars with Programmable Holidays
- Pre-programmed Overrides for Each Individual Zone
- Pre-programmed Override for All Zones in the System
- Occupant Initiated Setback Override Control for Each Individual Zone
- Parent/Child - Links Many Child Zones to the Time-of-Day Mode of one Parent Zone
- Time-of-Day Overrides Available from Alarm or Control Functions
- All Override Events Automatically Stored in the Trend Log

Specifications

Scheduling Priority - The System sets the time-of-day mode of the Zone based on the following order of priority. The priorities are listed in order of least to most important.

1. Standard weekly schedule
2. Holiday Schedule
3. Programmed Building override
4. Programmed Zone override
5. Zone Setback Override
6. Parent/Child Control

Standard Weekly Schedule - The System has the capacity for 32 different time-of-day schedules. Any Zone or piece of Miscellaneous Equipment can be assigned to any one of the 32 schedules. Each schedule has two Occupied and two Unoccupied times per day. Weekly Schedule 32 is dedicated to Zones or Miscellaneous Equipment requiring 24 hour operation and can not be changed by the User.

Holiday Schedule - Each weekly schedule has an eighth day that is used for the time-of-day schedule during holidays. Each holiday has two Occupied and two Unoccupied times per day.

Programmable Holidays - Ten standard holidays through the year 2010 are programmed in the System. Anytime the holiday falls on a Saturday, it is observed on the Friday before. If the holiday falls on a Sunday, it is observed on the following Monday. Any holiday can be easily added or deleted from the System. The programmed holidays are:

1. New Years Day (January 1)
2. Martin Luther King's Birthday (3rd Monday in January)
3. Presidents Day (3rd Monday in February)
4. Memorial Day (Last Monday in May)
5. 4th of July (July 4)
6. Labor Day (First Monday in September)
7. Veteran's Day (November 11)
8. Thanksgiving Day (4th Thursday in November)
9. Friday after Thanksgiving Day
10. Christmas Day (December 25)

Programmable Building Override - The System can have one System-wide, pre-programmed time-of-day schedule override. The override will place all Zones into either Occupied or Unoccupied mode. The override is programmed with a starting date, hour, and minute and an ending date, hour, and minute. The override can be initiated from the System/Building Override menu item or from a programmed Alarm/Control Function.

Programmable Zone Overrides - Each Zone can have one pre-programmed time-of-day schedule override. The override can place the Zone into either Occupied or Unoccupied mode. The override is programmed with a starting date, hour, and minute and an ending date, hour, and minute. The override can be initiated from the Zone/Override menu item or from a programmed Alarm/Control Function.

Setback Override - Each Zone can enter Occupied mode for a pre-programmed length of time. The tenant enters setback override by pressing the button on the top of the wall sensor in the Zone. The button must be pressed for about 2 seconds to initiate an override. Each Zone can be individually programmed for the length of override time allowed, from 0-32,768 minutes. The Zone will return to the standard weekly schedule time-of-day mode at the completion of the setback override. Setback Overrides can also be initiated from a programmed Alarm/Control Function.

Parent/Child - The Parent/Child feature is used to link the time-of-day mode (State) of one Zone (Parent) to the time-of-day mode of one or more other Zones (Child). The Child zones will always use the State of the Parent. There is no limit to the number of Parents, or the number of Children at each Parent. The valid States that will be passed from Parent to Child are:

Az Occ	All Zones Override into Occupied mode.
Az UnOcc	All Zones Override into Unoccupied mode.
CoolDwn	Smart Recovery Cool Down mode.
EarlyOcc	Completion of Smart Recovery prior to Occ 1.
SetbkOvr	Local Setback Override to Occupied mode.
ShedOvr	Zone has been placed in KW Load Shed mode.
Sz Occ	Single Zone Override into Occupied mode.
Sz UnOcc	Single Zone Override into Unoccupied mode.
Occ 1	First programmed occupied time of the day.
Occ 2	Second programmed occupied time of the day.
UnOcc 1	First programmed unoccupied time of day, from midnight to Occ 1.
UnOcc 2	Second programmed unoccupied time of day, between Occ 1 and Occ 2.
UnOcc 3	Last programmed unoccupied time of day, from Occ 2 to midnight.
WarmUp	Smart Recovery Warm Up mode.

The Zone List Box will indicate the Parent and Children under the Weekly Schedule column. If a Parent, the Weekly Schedule ## will be followed by a 'p' (i.e. 13p). If a Child, the Weekly Schedule ## will be followed by a 'c' (i.e. 13c). The Weekly Schedule ## of the Children will match that of the Parent.

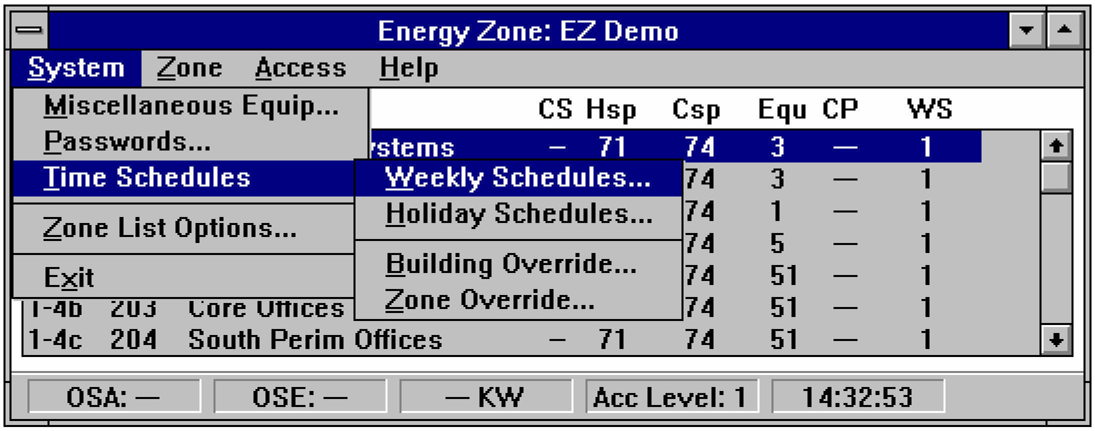
Any Zone configured as a VAV or a VariZone Server can not be configured as a Child Zone.

Overrides Logged - All overrides to the standard weekly schedule are logged to the Trend Log, storing both the begin and end times. This feature allows landlords to bill individual tenants for off-hours usage. See the chapter on Trend Log Viewing for details on this feature. Setback Overrides to a VAV Server are not logged. This would be a duplication of entries, since the override must be initiated from one or more Client zones and are logged at that time.

Alarm/Control Functions - Two time-of-day override conditions can be initiated by either an Alarm or a Control Function. A Building Override can be activated for a period from 1-999 hours. When the Alarm or Control Function is activated, the system will program a Building Override to the Occupied mode for the number of hours specified. This is identical to manually programming a Building Override. When an Alarm or Control Function has been configured for a Setback Override, the system will initiate a Setback Override at that Zone the same as if a Setback Override had been initiated from the Wall Sensor. See the chapter on Alarms and Control Functions for details on configuration.

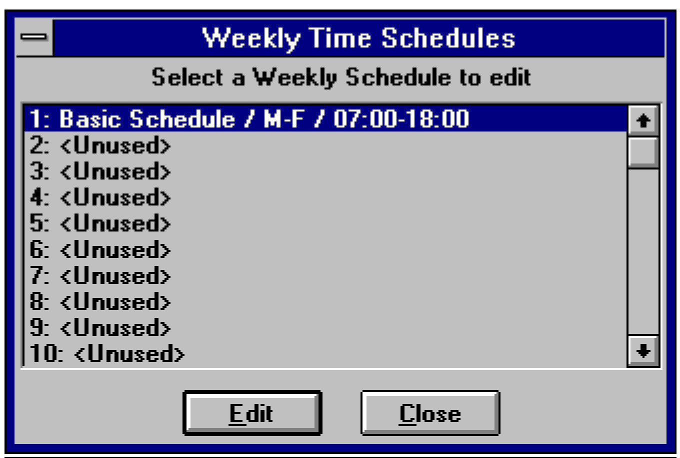
Weekly Schedule Configuration

Weekly Schedule configuration is accessible from the Time Schedules sub-menu of the System menu.



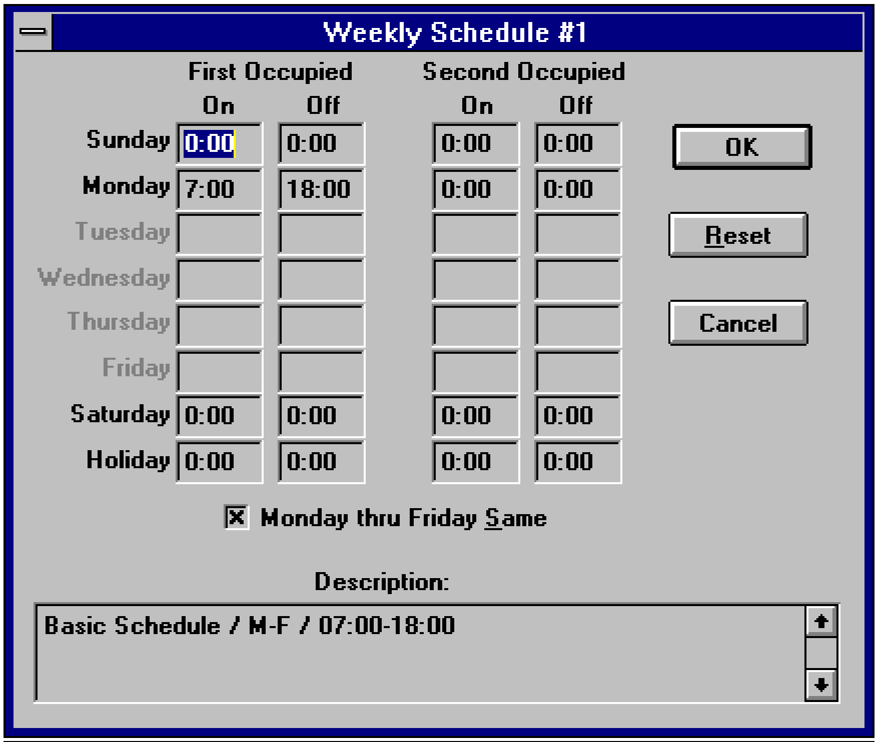
System Menu

The User is then asked to select the Weekly Schedule to edit.



Weekly Schedule Selection Screen

Note: The User must be logged onto the System at Access Level 2 to edit Weekly Schedules.



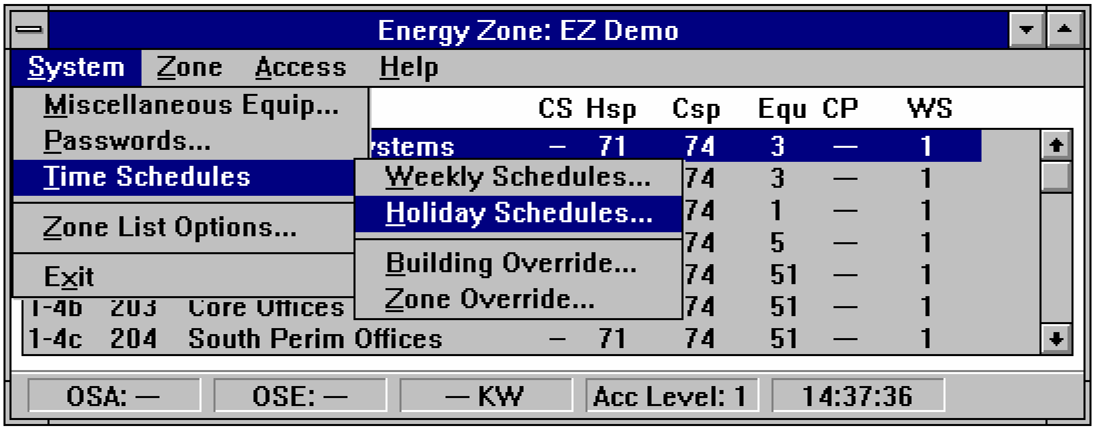
Weekly Schedule Edit Screen

Note: - All time entries must be in 24 hour format.

First Occupied On - Must be between 00:00 and First Occupied Off time.
First Occupied Off - Must be later than First Occupied On time and before 24:00.
Second Occupied On - Must be later than First Occupied Off time and before 24:00.
Second Occupied Off - Must be later than Second Occupied On time and before 24:00.
Monday thru Friday Same - This box should be checked if the same schedule is used for all days of the workweek. If Monday thru Friday Same is checked, then time entries need only be made for Monday.
Description - The first line of the description is used to describe the schedule in the list box. The remainder of the description is a reminder to the User as to the use of this schedule. Entry is optional. For Weekly Schedules assigned to Parent Zones, the description is set by the System and can not be edited.

Holiday Configuration

Holiday dates are accessible from the Time Schedules sub-menu of the System menu.

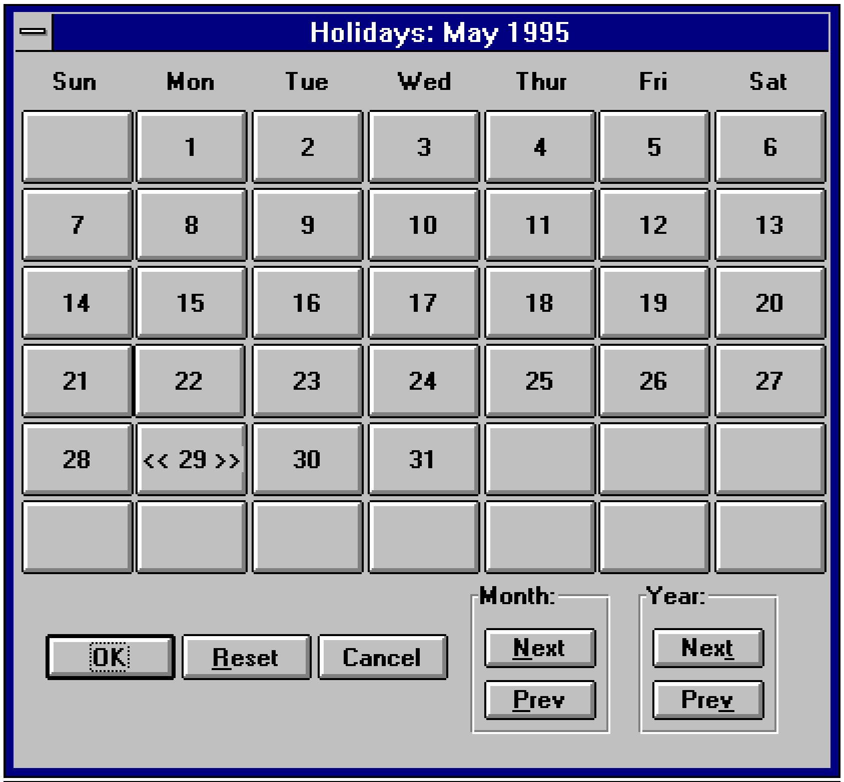


System Menu

The User is then asked to enter the Year and Month to edit.

Holiday Selection Screen

Note: The User must be logged onto the System at Access Level 2 to edit Holidays.

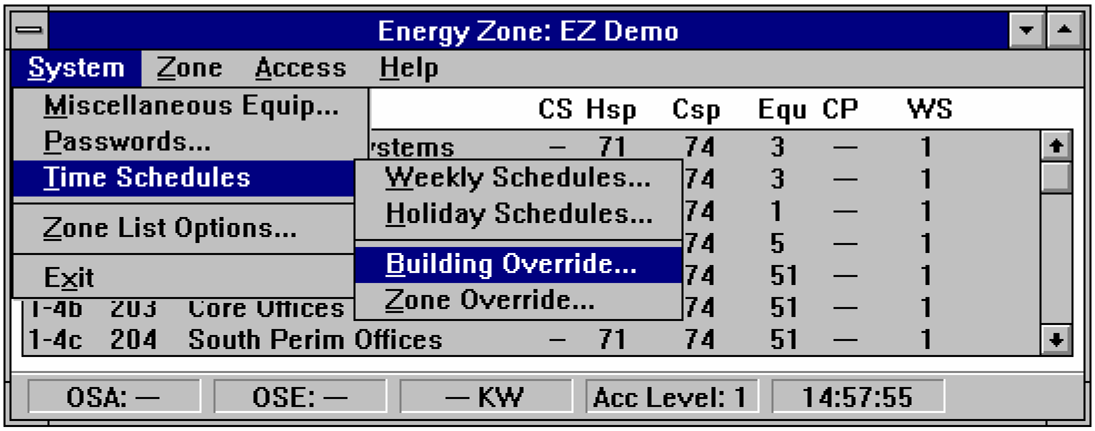


Holiday Edit Screen

Edit Holidays - Any date surrounded by <<   >> will be treated as a holiday by the System. To either create or delete any holiday, point and click with the mouse on the desired date. The holiday designation will toggle on and off.

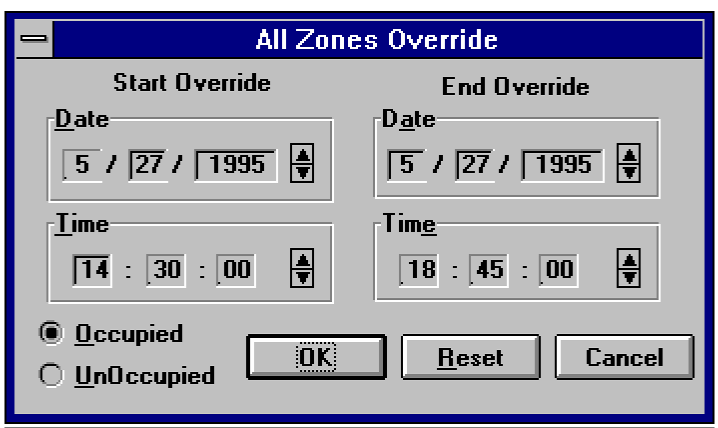
All Zones Pre-programmed Override

Select Building Override... from the Time Schedules sub-menu of the System menu.



Main List Box

Next enter the desired Start and End times and the desired mode for the Override. All times must be entered in a 24 hour format.

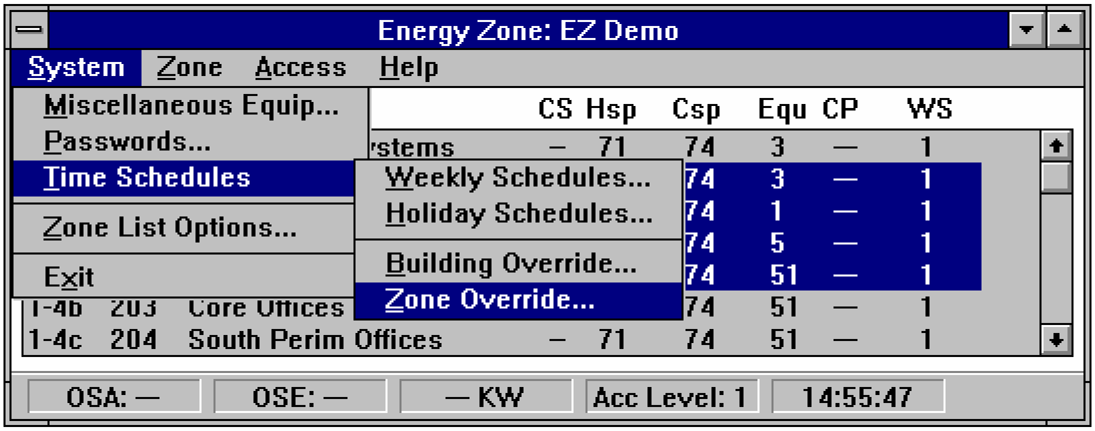


All Zones Override Screen

Note: The User must be logged onto the System at Access Level 1 to enter an All Zones Override.

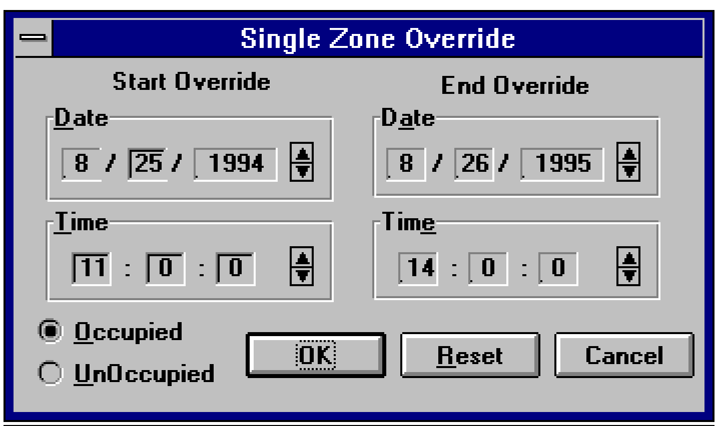
Single Zone Pre-programmed Override

First select a single Zone or multiple Zones from the Zone List Box. Then select Zone Override... from the Time Schedules sub-menu of the System menu.



Zone List Box

Next enter the desired Start and End times and the desired mode for the Override. All times must be entered in a 24 hour format.

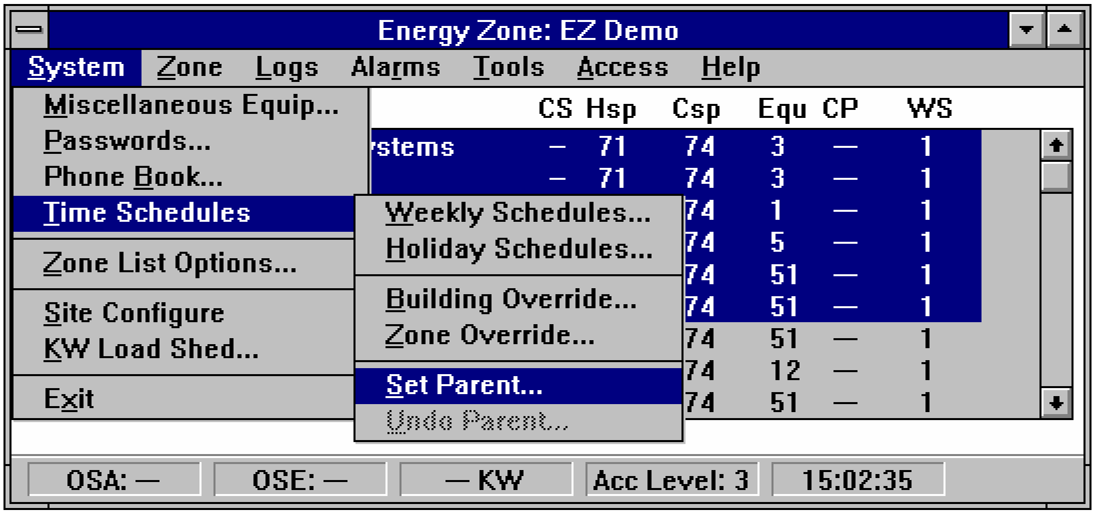


Single Zone Override Screen

Note: The User must be logged onto the System at Access Level 1 to enter a Single Zone Override.

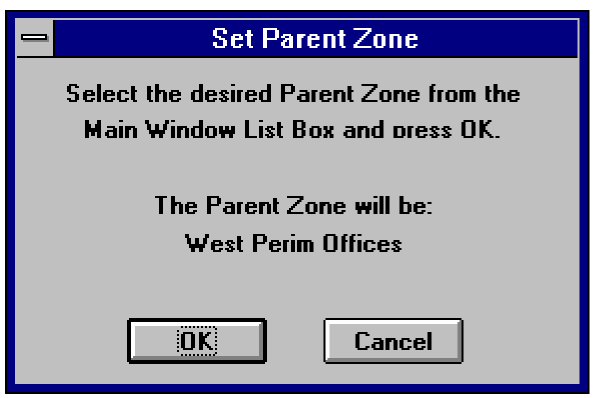
Parent/Child Configuration

Creating a Parent/Child - To setup a Parent/Child relationship, first select one or more Zones that will be the Children. Then select Set Parent... from the Time Schedules sub-menu of the System menu.



Zone List Box

Next select the desired Parent Zone and OK.



Set Parent Message Box

Note: The User must be logged onto the System at Access Level 3 to configure Parent/Child.

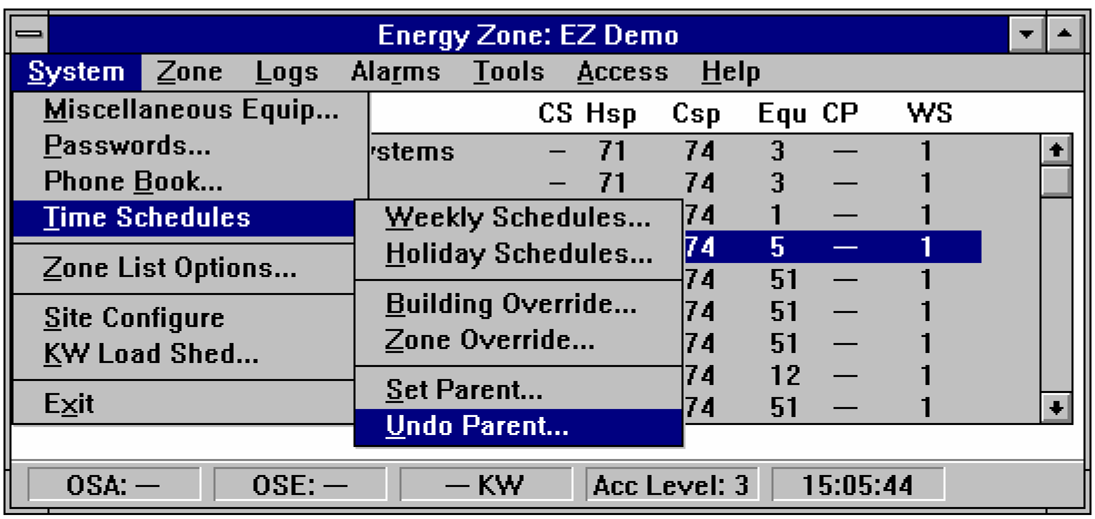
This will create a new Weekly Schedule. This Schedule uses the first unused Weekly Schedule number. The description of the Weekly Schedule will read [Parent {*Trunk-Address*}] {*Zone Description*}. The description from the example would read [Parent 1-3] West Perim Offices. The programmed times used in this new Weekly Schedule are the times from the previous Weekly Schedule of the Parent Zone.

The new Weekly Schedule times can be edited but not the description. The description is what identifies this Schedule as a Parent. The Weekly Schedule number used by the Parent can also not be changed. It must first be Unlocked.

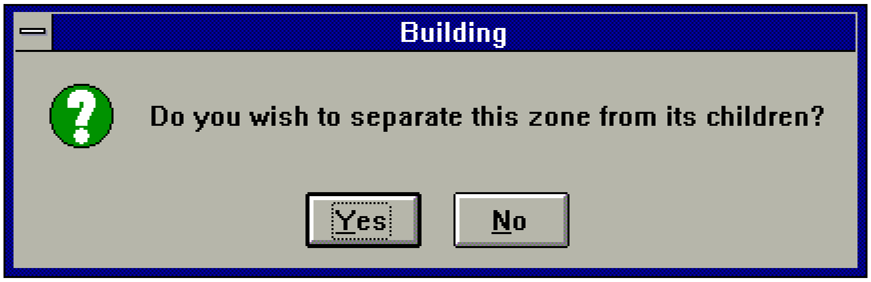
Adding a Child - To add a new Zone to an existing Parent, select the new Child and use the procedure as described above (Set Parent). Any previously configured Children will not be affected. It is not possible to add a Child by simply selecting a Weekly Schedule identified as a Parent. The only way to create the Link is by using the Set Parent function.

Removing a Child - To remove a Child, change the Weekly Schedule used by that Child in the RSC Configuration by using Zone / Configuration.

Removing a Parent - The only way to remove a Parent is to select Undo Parent... from the Time Schedules sub-menu of the System menu after selecting the Parent from the Zone List Box.



Zone List Box



Undo Parent Dialog Box

Answer yes to this dialog and the Parent and Child Zones will separate. The Weekly Schedule used by the Parent will change the description to Schedule ##. The Schedule description can now be edited. All Children will still be assigned to the same Weekly Schedule # but will no longer be locked to the other time-of-day modes of the Parent.

Trend Log Viewer

Overview

Energy Zone® provides automated Trend Logging services. The Trend Log can be used for troubleshooting, System fine tuning, and investigation of tenant temperature complaints. In addition, the data can be copied via the Windows Clipboard to any other Windows application for documentation or analysis.

Features

- Logging for all 1024 Zones
- Log Files are Organized by Calendar Month
- Automatic Logging of All Time-of-Day Overrides
- Monthly Setback Override Report Included to Track Off-Hours Usage
- Convenient Printing and Data Copying Services

Specifications

Simple selection - Any Zone can be configured for Trend Logging by selecting the Data Log checkbox from the Zone Configuration screen. Data Log is checked on the Zone Configuration screen as the default setting. See the chapter on Zone Configuration to change the Data Log option. Once selected, all input data, output status, and operating conditions from that Zone are automatically logged to the Trend Log once every 10 minutes.

File Size - One hour of Trend Logging for one Zone is equal to about 170 bytes of data. If the System logs all possible 1024 Zones for a full month, the Trend Log will use about 121M bytes of hard disk space. This is a great deal of data and may fill the hard disk on Systems with standard disk capacity. On Systems with more than 500 Zones consideration should be given to either not Trend Logging all Zones or installing a hard disk with more capacity.

Automatic Deletion - The System organizes data in the Trend Log by calendar month. The Trend Logs for the current and the previous month are always available. The Trend Logs for prior months are automatically deleted at the beginning of a new month. For example, the month of February will be available until midnight on the last day of the following month, March 31. February Trend Logs will be deleted automatically at midnight on March 31. The User may backup the pervious months Trend Log prior to the automatic deletion time for long term storage if desired.

Alernate Trend Log - An alternate data storage location can be configurrd for the Site. If configured, the System will maintain a full copy of the Trend Log at the alternate location. This copy will not be automatically deleted.

Automatic Logging of System Parameters - Outside Air Temperature, Outside Air Enthalpy, and Building KW are automatically logged with each time stamp in the Trend Log.

Override Logging - All time-of-day override conditions are automatically logged for all Zones.

Monthly Override Report - An Override Summary Report is available for all Zones in any selected month. The System will print the start, end, and net time for each override as well as an accumulated override time. The reports are organized and printed by Zone.

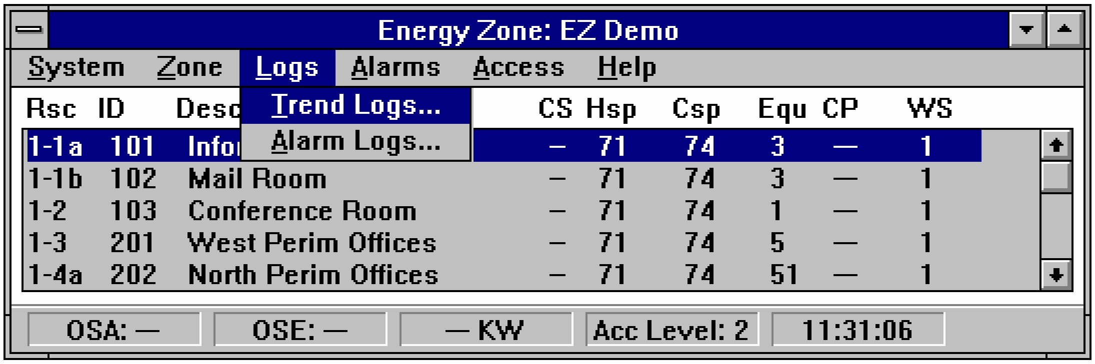
Printing Services - Any portion of the Trend Log may be selected for printing. The currently selected display options will print for all selected entries.

Copy Data - Any portion of the Trend Log may be selected and copied to the Windows Clipboard. The currently selected display options will be copied for all selected entries. From the Clipboard, the data may be pasted into any Windows application.

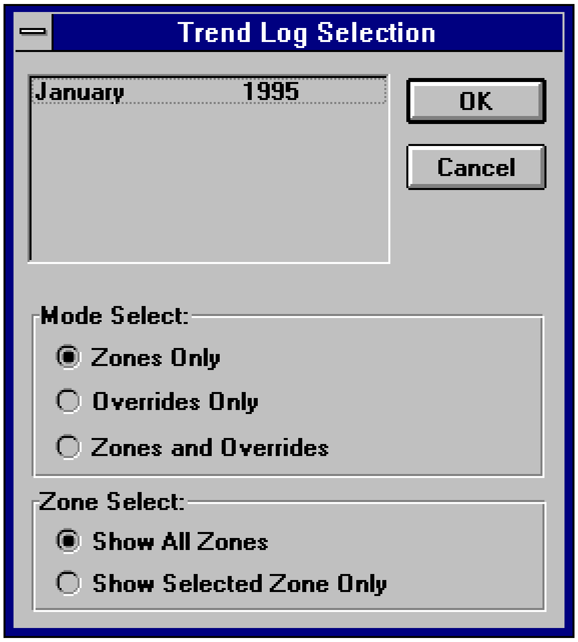
Note: The Trend Log Viewer is an Access Level 2 feature. Level 3 access is necessary to change the Data Log option at a Zone or to setup an alternate data directory.

Log File Selection

The Log File Selection screen is activated by selecting Logs, Trend Logs... form the Menu Bar.



Trend Log Access

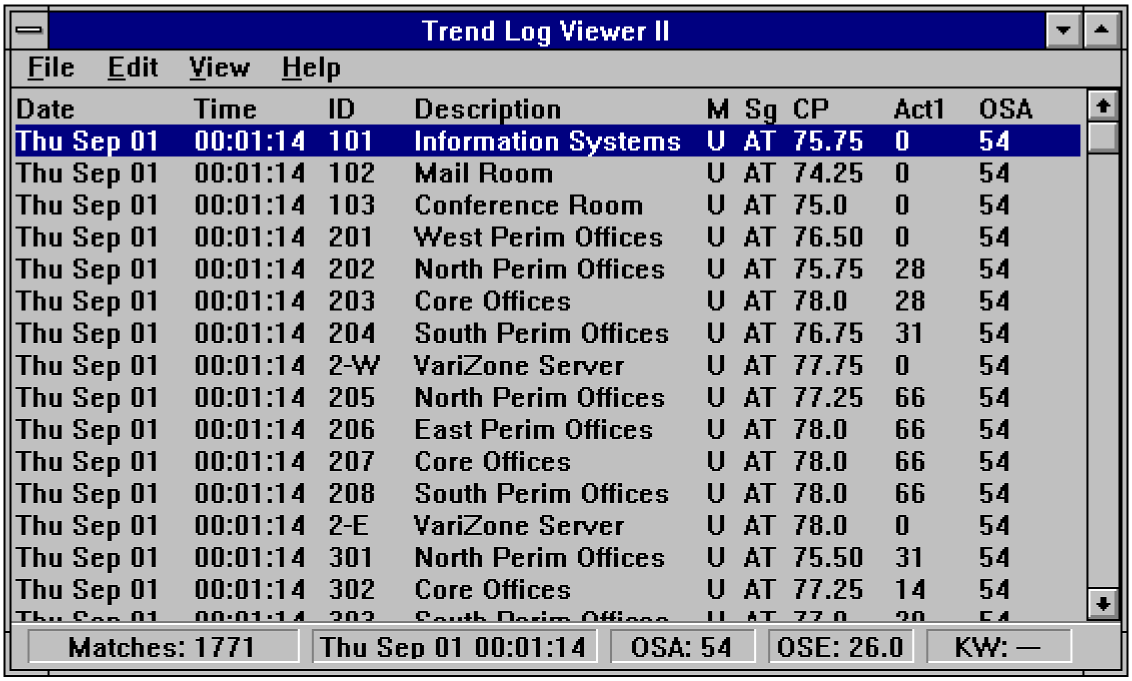


Log File Selection Screen

Select Log - Select the desired month and year for the data to be viewed.
Display Mode - Select Zones Only (Zone point data and status), Overrides Only (time-of-day override events), or Zones and Overrides.
Zone Selection - Choose to Show All Zones or Show Selected Zone Only (this will show data from the Zone that is currently selected in the Zone List Box).

Trend Log Viewer

After the month and Zone selection options are chosen, the Trend Log is displayed. Depending on the selections and the number of entries, the System may take several seconds to retrieve and display the data.



Trend Log Viewer

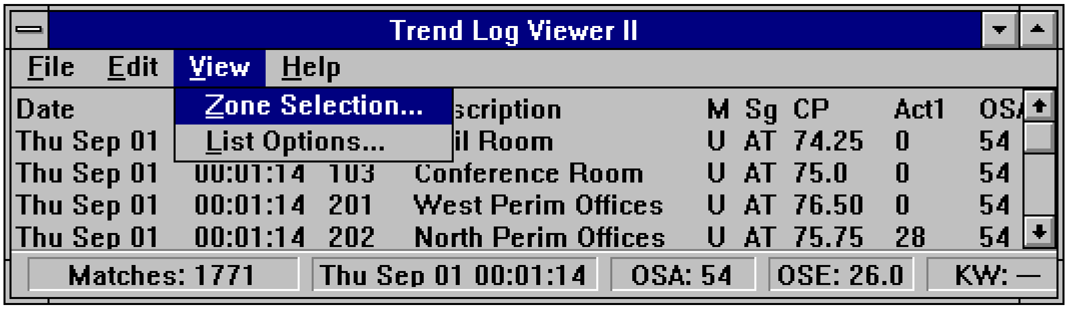
Data Display - The data displayed in the Trend Log Viewer is based on the View selection options made by the User.

Status Line - The Status Line is located at the bottom of the display. The Status Line corresponds to either the first line of data in the current display or, if a line is highlighted, the data from that Zone:

- Matches - This the total number of data lines that meet the search criteria. This number will give an indication of the size of the Trend Log being displayed.
- Date/Time - The date and time of the entry.
- OSA: - The outside air temperature.
- OSE: - The outside air enthalpy.
- KW: - The building KW from the meter assigned to that Zone.

Trend Log Viewer Display Options

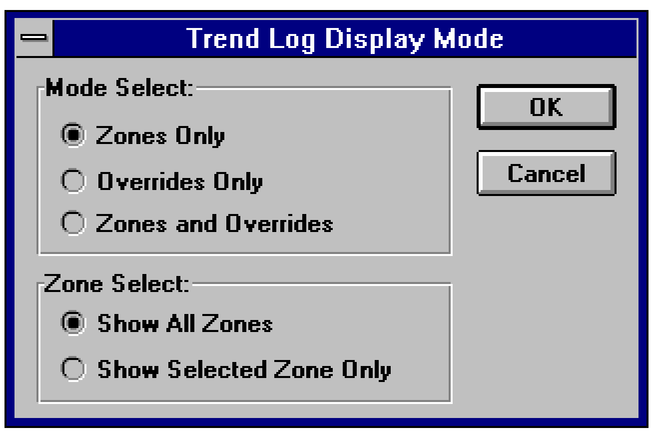
Two display options are available from the View menu of Trend Log Viewer, Zone Selection and List Options.



View Menu

Zone Selection... - Allows the User to change the Zone for which data is displayed.
List Options... - Allows the User to select which input and outputs are to be displayed for the selected Zones.

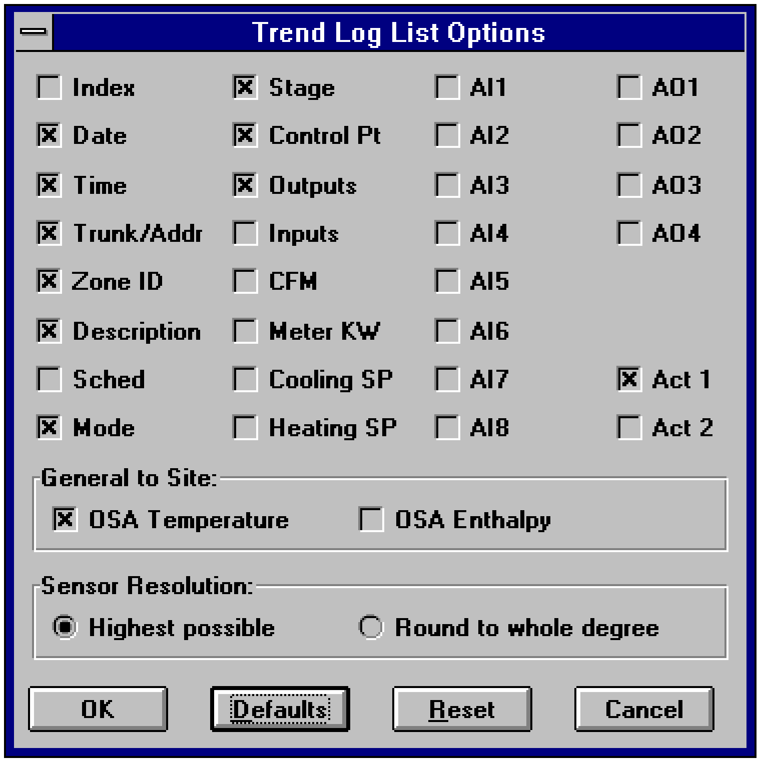
To change Zones for which data is displayed, choose Zone Selection...:



Trend Log Display Options

Select the desired Zone options.

To change the data being displayed for each Zone, select List Options...:



Trend Log List Options

Configuring Trend List Options - To select information for display, simply click on the desired information box with the mouse. Those items checked will be displayed on each line of data.

- **Index** - This represents the line number, starting at line #1 for the first displayed entry of the month in the current log.
- **Date** - The day of the week, month, and date.
- **Time** - The time in 24 hour format including hour, minute, and seconds.
- **Trunk/Addr** - Trunk (1-8), Address (1-32), and if applicable SubZone (a-d).
- **Zone ID** - The Zone ID configured for that Zone.
- **Description** - The Zone Description configured for that Zone.
- **Sched** - The number of the Equipment Schedule.
- **Mode** - This is the current state of the Zone. The valid states are:

  O Occupied.
  U Unoccupied.
  W Warmup.
  C Cooldown.
  D Default (off-line).
  E Early Occupied (The Occupied setpoints were reached early when in Cooldown or Warmup).

- **Stage** - The current stage. The valid stages are:
  C1 - C4 Cooling stage 1 through cooling stage 4.
  H1 - H4 Heating stage 1 through heating stage 4.
  AT Zone is at setpoint.
- **Control Pt.** - The value of the Control Point. This is normally the same as AI1, but could be a calculated value as configured for that Zone.
- **Outputs** - The current state of all digital outputs for the Zone. A display of 0 indicates the output is off, and 1 indicates the output is on. All 8 outputs are listed in order from 1 to 8.
- **Inputs** - The current state of all digital inputs for the Zone. A display of 0 indicates the input is off, and 1 indicates the input is on. All 8 inputs are listed in order from 1 to 8.
- **CFM** - The CFM airflow reading.
- **Meter KW** - The KW as read at the building KW meter assigned to that Zone.
- **Cooling SP** - The current cooling setpoint.
- **Heating SP** - The current heating setpoint.
- **AI1** thru **AI8** - The value of the Analog Input, scaled correctly based on the Zone configuration.
- **AO1** thru **AO4** - The percentage open position the Analog Output.
- **Act 1** - The percentage open position of the first 3 point floating actuator.
- **Act 2** - The percentage open position of the second 3 point floating actuator.

General to Site:

- **OSA Temperature** - The outside air temperature.
- **OSA Enthalpy** - The outside air enthalpy.

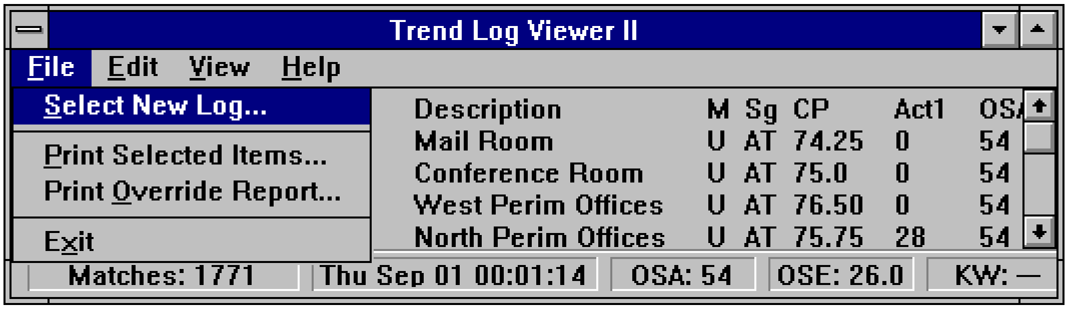
Sensor Resolution:

- **Highest Possible** - Displays analog inputs at the maximum resolution for that input (i.e. Nearest 0.25° F for room temperature).
- **Round to Whole Degree** - Display analog inputs rounded to the nearest whole number.

Note: For Zones that are part of a quad or dual Equipment Schedule, the data that is not applicable will record a 0 in the Trend Log. For example, a dual Zone (which uses digital outputs 1-4) will always display 0 for digital outputs 5-8.

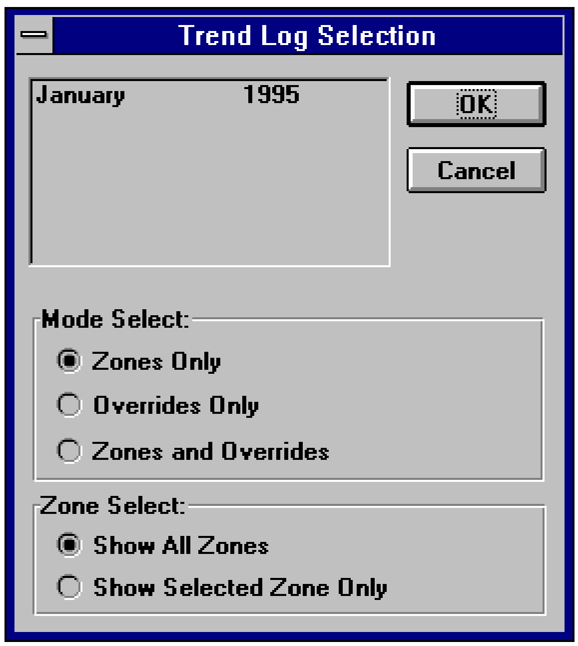
Selecting New Data

To select a new data file for the Trend Log Viewer, choose File, Select New Log...



Trend Log Viewer Main Screen

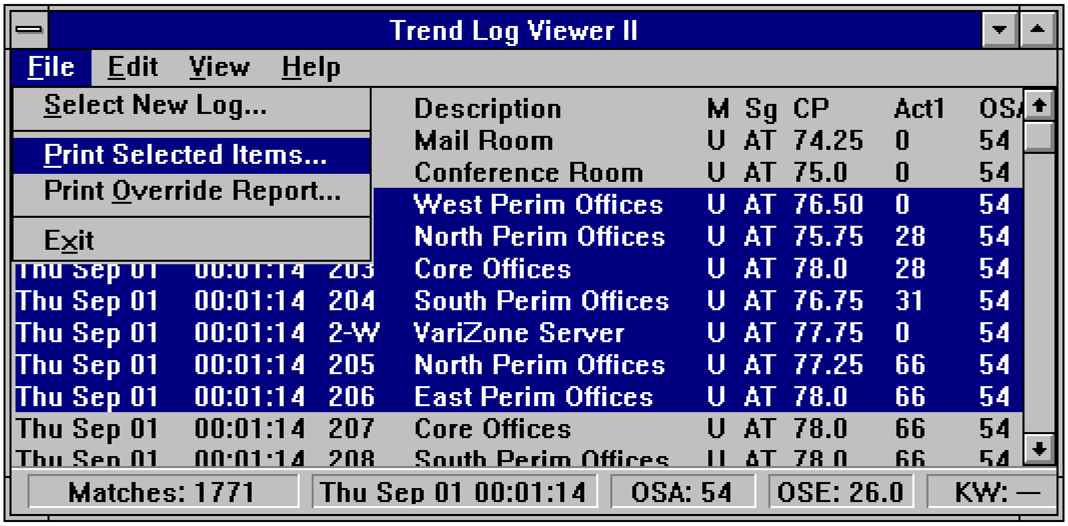
Then select the desired new data.



Log File Selection Screen

Printing Data from the Trend Log Viewer

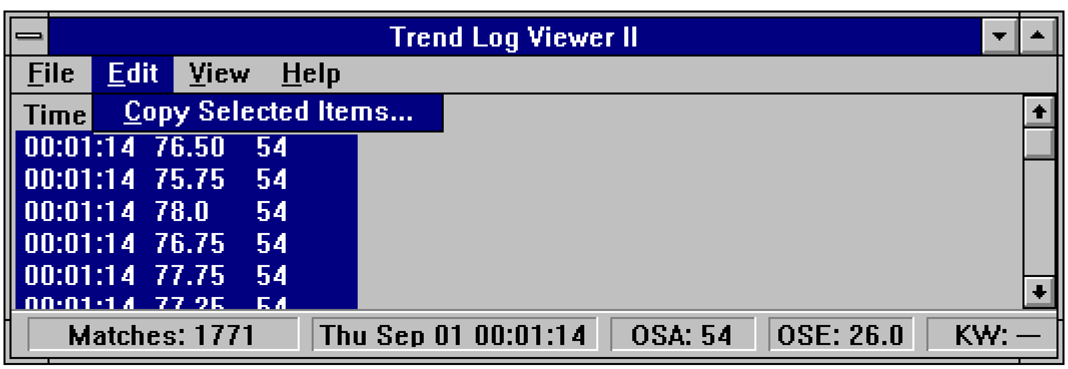
To print data from the Trend Log Viewer, first select the data to be printed with the mouse. Then select File, Print Selected... to send all selected data to the printer.



<u>**Trend Log Viewer Main Screen**</u>

Copying Data to the Windows Clipboard

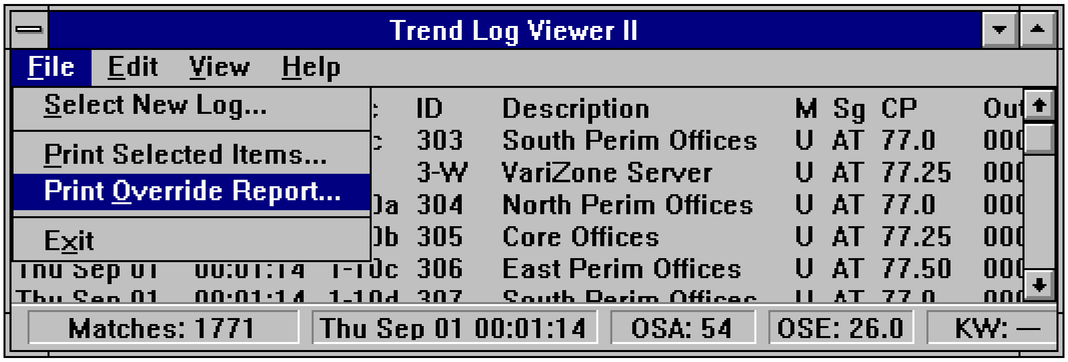
To copy data from the Trend Log Viewer to the Windows Clipboard, first select the data to be copied with the mouse. Then select Edit, Copy Selected Items... to copy all selected data to the Windows Clipboard.



<u>**Trend Log Viewer Main Screen**</u>

Printing the Override Summary Report

To print the Override Summary Report, select File and then Print Override Report... The report will then automatically print.



Trend Log Viewer Main Screen

```
Dept of Transportation: Override Summary Report - September 1994      1/27/95

1-1a  101  3rd Fl, W HP, S Zone

Date          Time        Override Event                  Net Time
Fri Sep  2    19:43:14    Enter Setback Override
Fri Sep  2    22:43:14    Setback Override Timeout        3.0 Hrs
Tue Sep  6    18:00:00    Enter All Zones Override OCC
Tue Sep  6    22:00:00    End of All Zones Override       4.0 Hrs
Thu Sep  8    06:42:22    Enter Setback Override
Thu Sep  8    07:00:00    Setback Override Timeout        0.3 Hrs
Sat Sep 10    08:00:00    Enter Single Zone Override OCC
Tue Sep 10    16:30:00    End of Single Zone Override     8.5 Hrs

                          Total:                         15.8 Hrs
```

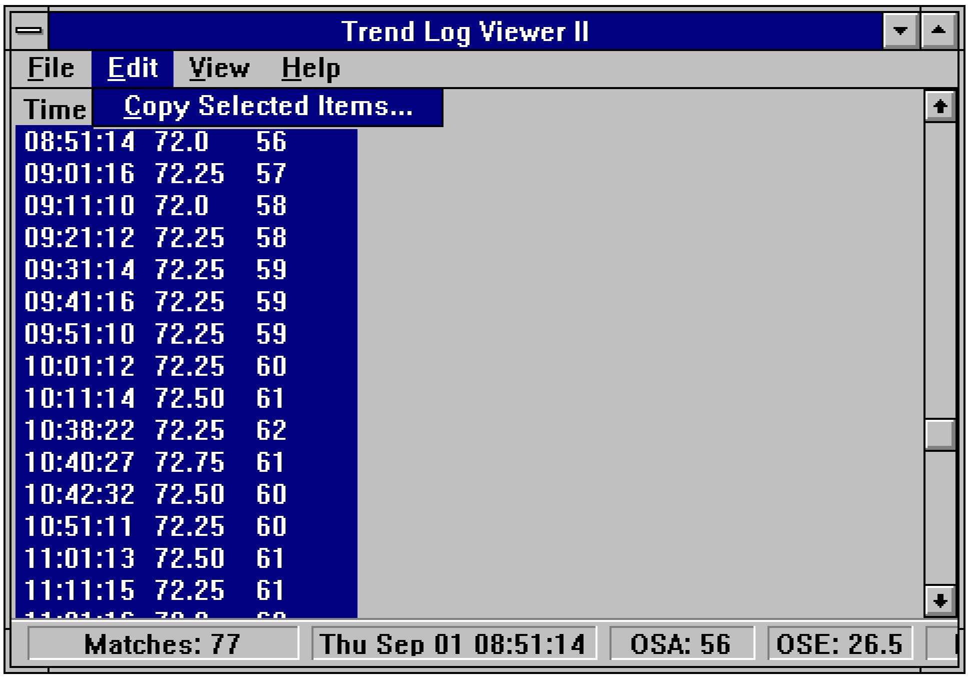
Sample Override Summary Report

A Practical Use Example of Trend Log Viewer

In this example, we will assume that the building engineer has received a complaint from the manager of a group within the building. Some of the employees within this group complained about being too warm yesterday. We must investigate the complaint and respond to the manager by memo.

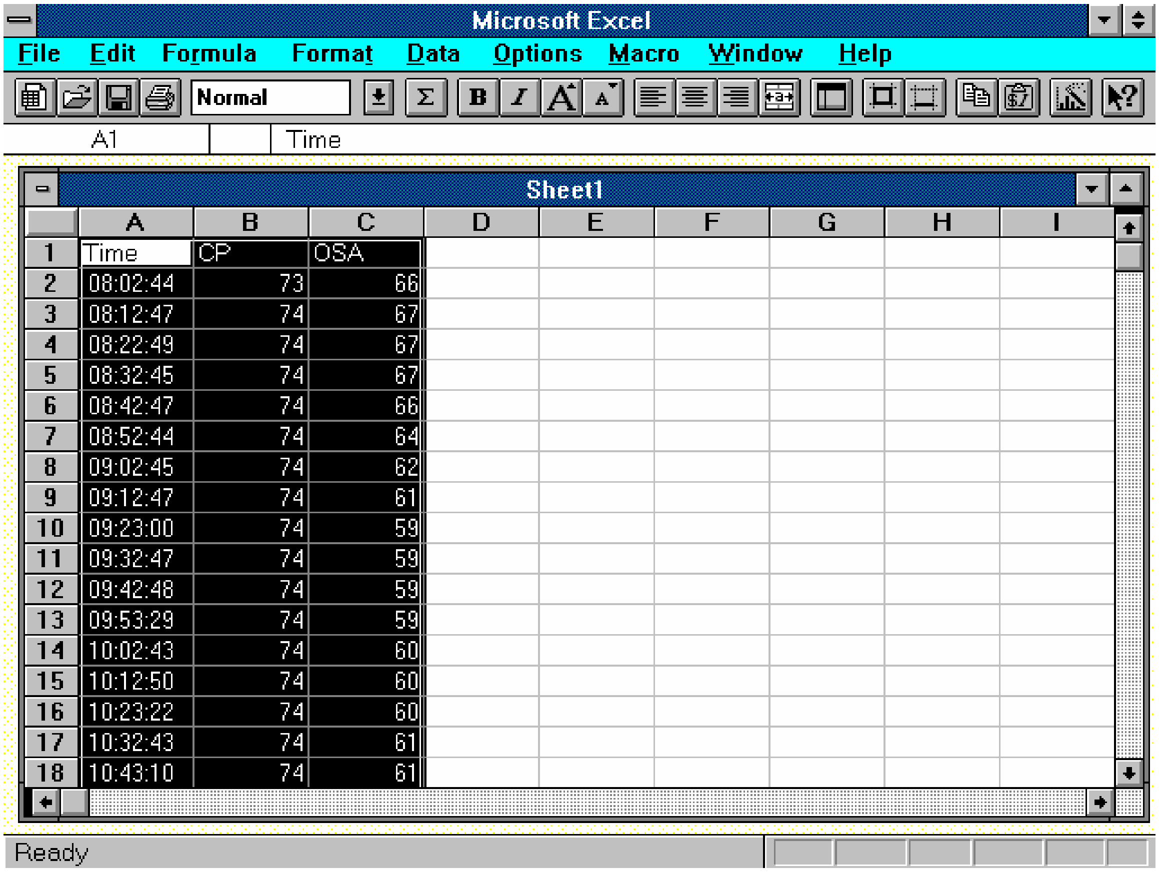
Note: This example assumes that the User has access to Microsoft Excel and a Windows based word processor program. Any questions as how to use either of those two applications should be referred to the documentation supplied with those applications.

First, select the desired month and year, Zone, and list options.
Then highlight the data for the desired time frame and copy to the Windows Clipboard.



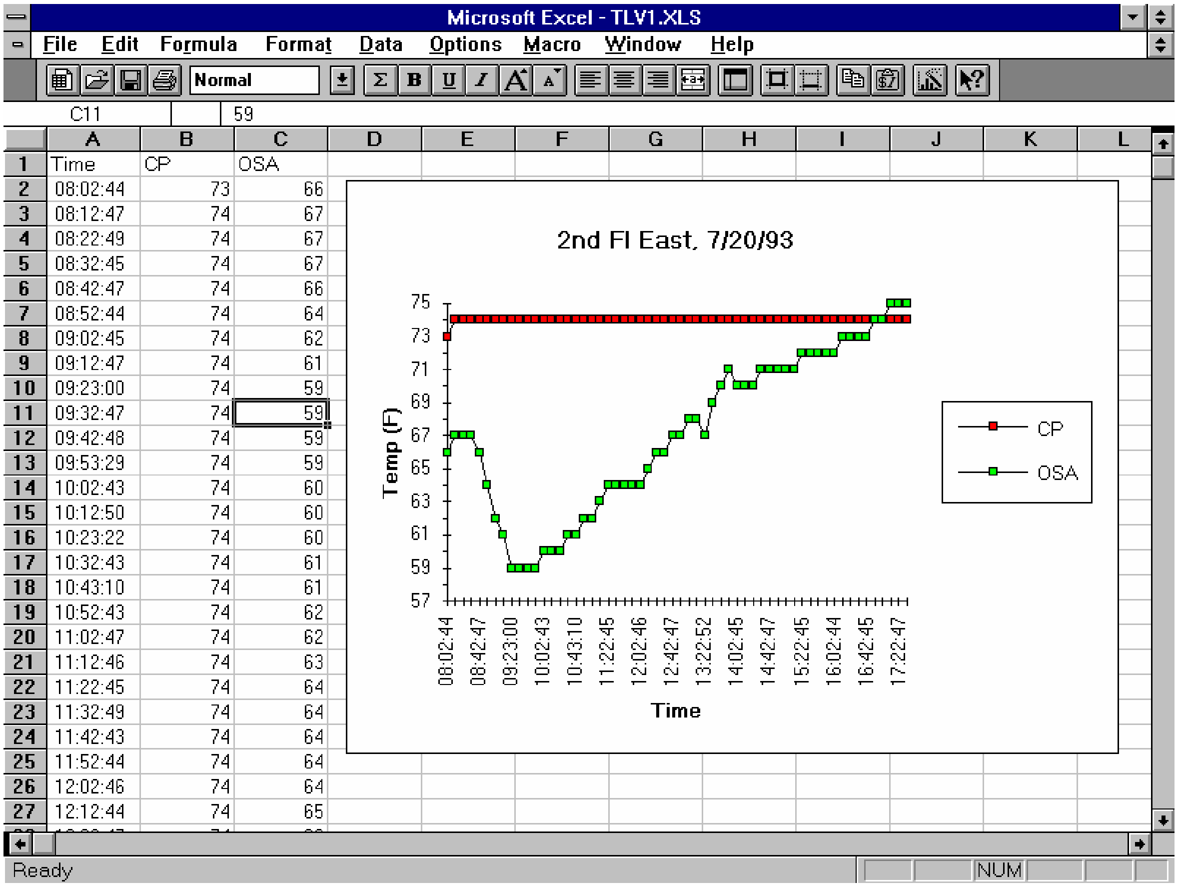
Selecting Data to Copy to Clipboard

Once copied to the Clipboard, the data can be pasted to any other Windows application. Microsoft Excel is a very easy to use and yet powerful application for manipulating Trend Log Data. To use Excel, start the application and paste the data into a spreadsheet.



Excel with Trend Log Data Inserted

Next use the Chart Wizard feature of Excel to create a graph of the data.



Creating an Excel Chart

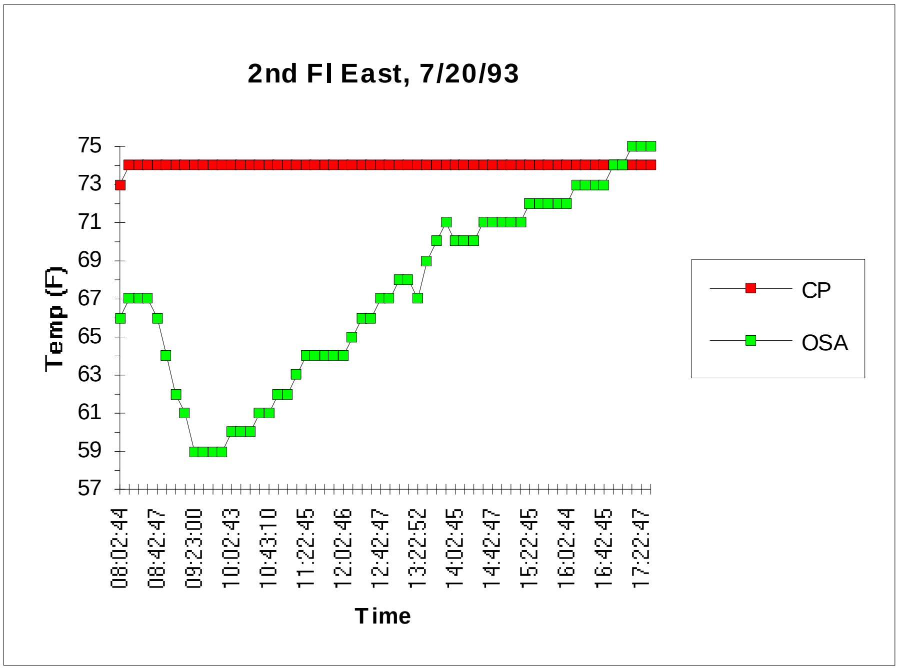
Once a chart is created, it can be selected and then pasted to the Clipboard.

Finally use a word processor, such as Word for Windows, to write a memo to accompany the chart. The chart can be pasted directly into the memo.

To: Mr. Manager
From: Mr. Building Engineer
Subject: Temperature Control Complaints

After receiving complaints from employees on the East perimeter of the 2nd Floor about yesterday's temperatures, I reviewed the Trend Log for that Zone. The Energy Management System we installed last year records the temperatures in all Zones once every 10 minutes. I have charted the space temperatures for yesterday and have also included the outside air temperatures. As the chart indicates, the outside air temperature ranged from 59° F to 75° F while the space temperature did not vary outside a range of 73° F to 74° F. The setpoints for that Zone are 72° F to 74° F.

As you can see, the HVAC System is performing perfectly. If the employees in that Zone desire a different temperature setpoint, please let me know so that I may make the necessary changes.



Let me know if I can be any further assistance.

Chapter 5

Remote Communication

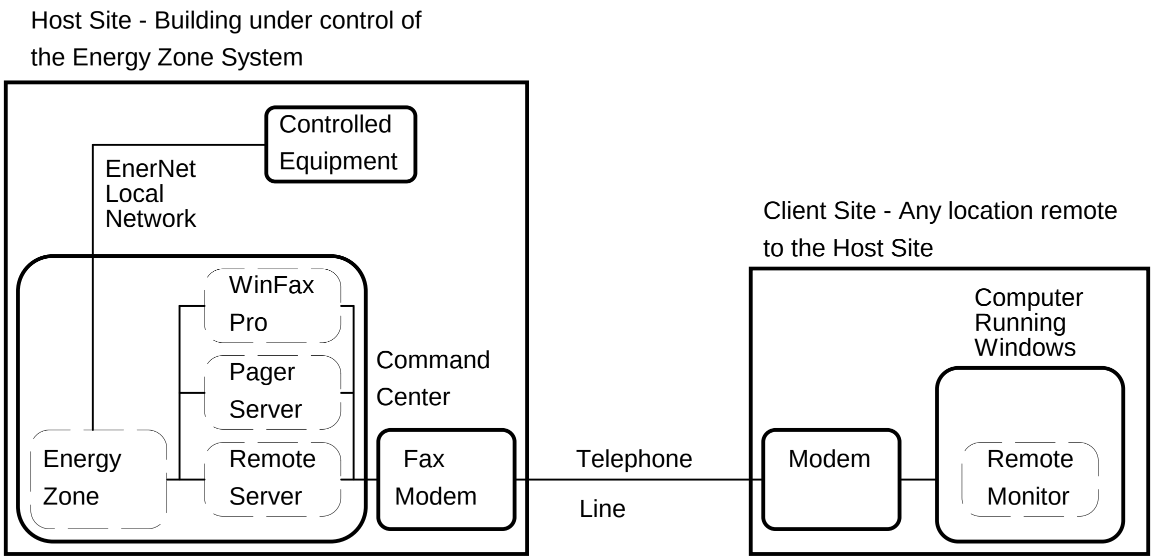
Overview

The **Energy Zone®** Remote Monitoring package provides the User with a very easy to use method of monitoring and controlling an **Energy Zone®** site from a remote location. All **Energy Zone®** Systems are provided with the hardware and software necessary to receive incoming calls from the optional Remote Monitoring version of Building. The standard on-site package also includes the capability for Alarm callout.

Features

- Full Remote Control of any Building Site
- Alarm Callout to Digital Pager
- Alarm Callout to Fax Machine

Specifications



Remote Communication Block Diagram

Remote Server - The on-site communication package runs in the Command Center at an **Energy Zone®** site and monitors the incoming phone line. When called from an Energy Zone Remote Monitoring station, Remote Server will connect the remote User to the Command Center. The User then has access to all System functions and capabilities the same as if at the Command Center. This side of remote communications, which contains the Command Center, is referred to as the Host Site.

Remote Monitor - The Remote Monitor (also referred to as Remote Building) is a software package that allows the User to connect to any **Energy Zone®** Host Site. The Remote Monitor can operate on any platform with a minimum configuration of Microsoft Windows 3.1 and one of the supported modems. This side of remote communications is referred to as the Client Site. If Remote Server is not running at a Host Site, the modem can be used as a Client Site to call into another Host Site. A second modem can be installed at a Host site and dedicated to Remote Monitoring while the primary modem functions as a Remote Server.

The Remote Monitor screen is identical to the screen at the Host Site, except for the title and the addition of the Communication menu item. When connected to a Host Site, all data displayed is current data from the Host Site. This includes the Site Name in the Window Frame and all data in the Status Bar. The time of day displayed in the Status Bar is also transmitted from the Host site.

Pager Server - Pager Server is available to the Command Center for alarm callout to a digital pager. If an alarm occurs which is configured for Pager, Pager Server will use the modem to call the first number in the Phone Book configured for Pager. Pager Server will then transmit the Host Number that has been configured for that Site. The Host Number is a four digit number configured for the Site. If the modem is in use, Pager Server will continue to try to make the call once a minute until successful. A second modem can be dedicated to Pager Alarm callout to prevent delays in alarm callout if the primary modem is in use.

Fax Services - Fax services are provided by Delrina Win Fax Pro. Win Fax is installed by **BAS** on Systems ordered with this capability. For details on the operation of Win Fax, see the provided manuals. Win Fax is available to the Command Center for alarm callout to a fax machine. If an alarm occurs which is configured for Fax, Win Fax will call the first number in the Phone Book configured for Fax. Win Fax will then transmit one page of information, including details on the alarm and a snapshot taken of the Troubleshooting Screen at the time of the Alarm. If the modem is in use or Win Fax can not connect to a remote fax for some reason, Win Fax will continue to try to make the call once a minute until successful. A second fax-modem can be dedicated to Fax Alarm callout to prevent delays in alarm callout if the primary modem is in use.

Telephone Lines - A standard voice grade telephone line is all that is necessary for remote communications. It is always preferable to have a telephone line dedicated to the Command Center, but it is not required.

Hardware - It is important that a 16550AFN UART (Universal Asynchronous Receiver Transmitter) is installed on the COM port used for remote communications. Many computer manufacturers do not provide this UART and it must be field installed. High speed communications are unreliable in Windows without the buffer provided by this chip. Contact **BAS** for technical assistance in determining the correct hardware configuration. A 14,400 baud modem is recommended for remote monitoring. Both a 14,400 baud modem and a 16550AFN UART are included by **BAS** on all **Energy Zone®** Systems. See the list below for supported modems.

Manufacturer	Model	Line Speed	Description	Suggested Computer to Modem Speed
Any Hayes Compatible		2,400	Int or Ext Modem	9,600
Gateway	Telepath II	14,400	Int Fax/Modem	38,400
US Robotics	Sportster 14400	14,400	Int Fax/Modem	38,400
MegaHertz	XJ144 II	14,400	PCMCIA Fax/Mdm	38,400
Hayes	Optima 288 II	28,800	Ext Fax/Modem	38,400
Supra	144LC II	14,400	Ext Fax/Modem	38,400
Zoom	FC9624V II	2,400	Ext Fax/Modem	9,600
Zoom	V.42 bis II	2,400	Ext Modem	9,600

Dialing Script - Remote Building uses a dialing script to configure the modem and place the call to the Host Site. Several dialing scripts are included in the \EZ\DATA directory. The System will use the correct script for the modem selected in Communication Settings. All commands in the dialing scripts are from the Hayes standard AT command set. These scripts can be modified for modems not included in the modem list. The scripts should only be edited by Users with advanced modem experience. The changes can be made with a standard text editor such as Windows Notepad. Contact **BAS** for assistance with script modifications.

CheckSum Errors - All data received by the Remote Monitor is checked for integrity by use of a check sum added to the end of each data packet. Any data that does not pass the check sum test is rejected and reported as a check sum error. The errors provide a relative indication of the quality of the phone connection. The CheckSum Errors can be selected for display on the Status Line of the Remote Monitoring version of Building. This value is the total of all errors accumulated during current session. The fewer the number of errors, the better the connection. If errors are frequent (more than about 10 per minute) then try re-dialing the site for a new line connection. It may be necessary in some cases to lower the baud rate in order to improve communication reliability.

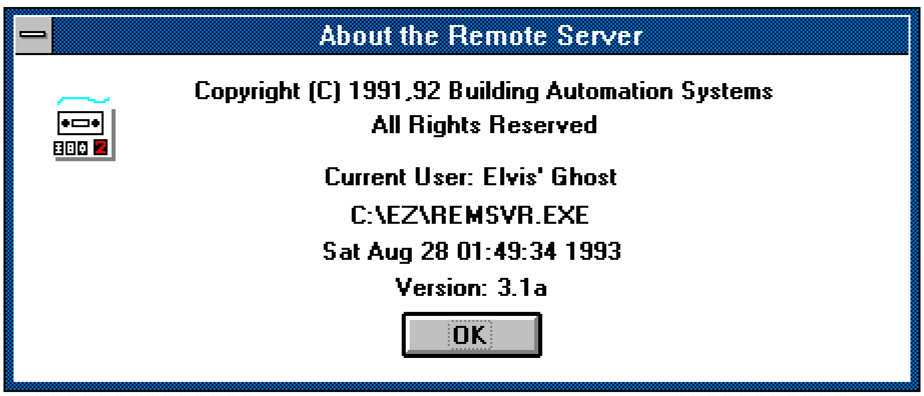
Remote Server

There is no User interface to the Remote Server program. It is started automatically on initial startup by being located in the Windows Start Up group. The Remote Server icon will indicate the current status of the modem. The messages are:

OK - The modem is waiting for an incoming call.
Connect 9600 - A Client Site is connected to the Command Center at 9600 baud.
Resetting - A Client Site has disconnected and Remote Server is preparing for another call.

Configuration of Remote Server is done by **BAS** when a System is shipped. All settings are stored in EZ.INI and are described in Remote Monitoring Configuration.

If About... is selected from the Remote Server System menu, a message box will appear showing the name of the User who is currently logged into the System. The name comes from the Password configuration of the Host Site. If the User is at Access Level 0, no name will appear.



Remote Server About Screen

Disconnecting a Client Site - If a User wants to disconnect a Client Site from the Host Site, use the Remote Server System menu to Close Remote Server and then cycle power to the modem. Remote Server can then be re-started to be available for the next incoming call.

Pager Server

The About Box is the only User interface to the Pager Server program. Pager Server is started automatically on initial startup by being located in the Windows Start Up group. It can be closed by selecting Close from the Pager Server System menu.

Configuration of Pager Server is done by **BAS** when a System is shipped. All settings are stored in EZ.INI and are described in Remote Monitoring Configuration.

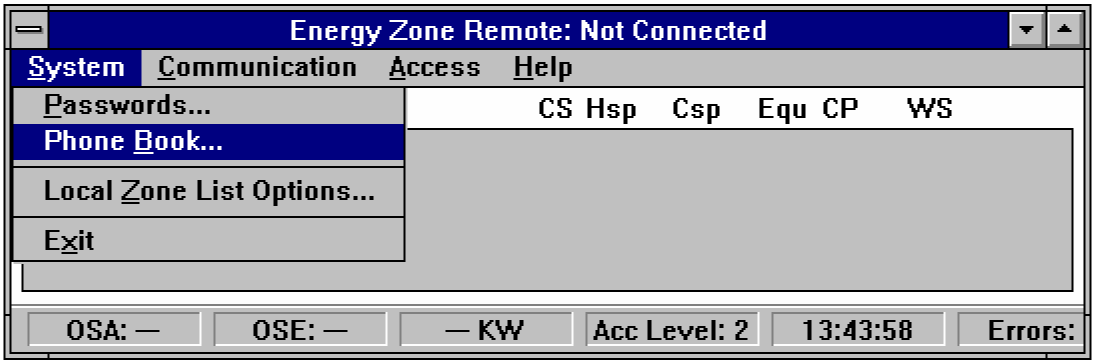
Pager Server About Screen

Win Fax

Win Fax is normally started automatically on initial startup by being located in the Windows Start Up group. For additional details on the operation of Win Fax, see the Win Fax manual. It can be closed by selecting Close from the Win Fax System menu.

Remote Monitoring Configuration

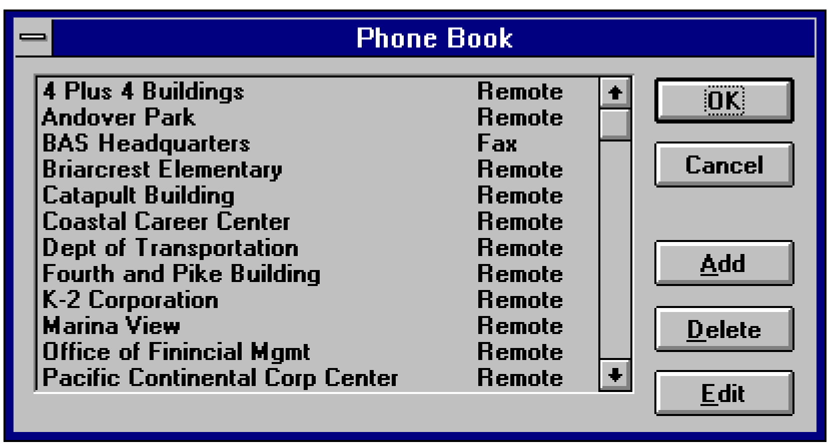
Phone Book - The Phone Book must be configured before connection can be made to a Host Site. The Phone Book is accessed from the System menu in Building.



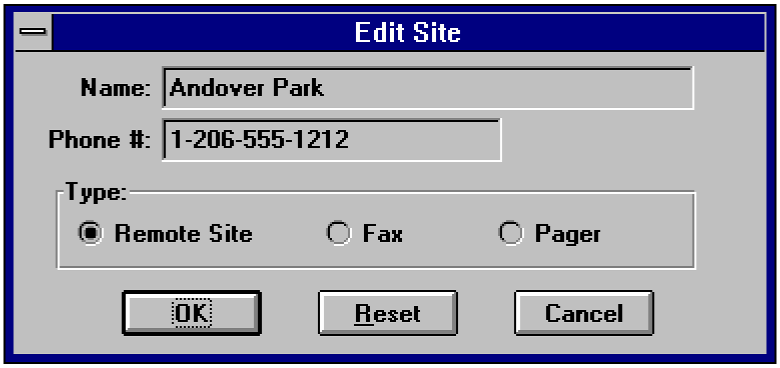
Energy Zone Remote Main Window

Note: The Phone Book is available at Access Level 2.

The Phone Book list box is then displayed. Select an item to Edit, Delete, or Add.



Phone Book Selection Screen



Phone Book Entry Screen

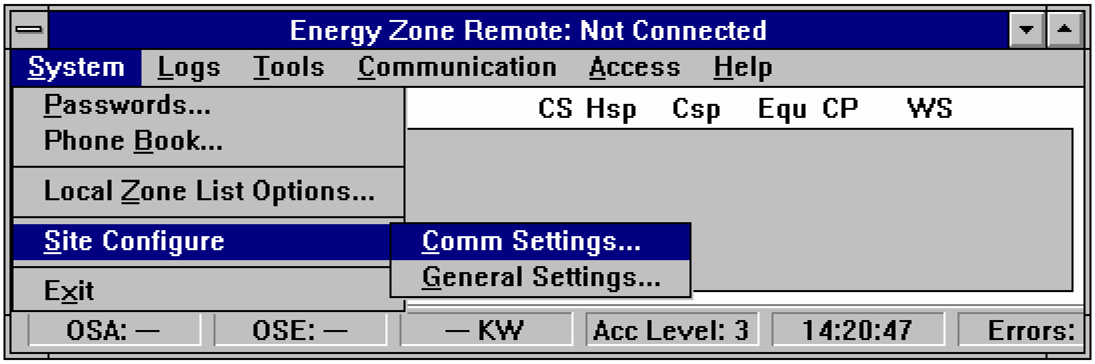
Name: A text description up to 30 characters in length.

Phone #: The phone number can be up to 19 characters in length and can include dashes or spaces. If calling out from an internal phone system, it is sometimes necessary to include a 9 to acquire an outside line and time delays between calling sequences. To cause a time delay, add a comma to the phone number. Each comma adds a 2 second delay. For example; 9,,1-206-555-1212 would dial 9 to acquire an outside line, wait 4 seconds, and then dial the number of the remote site.

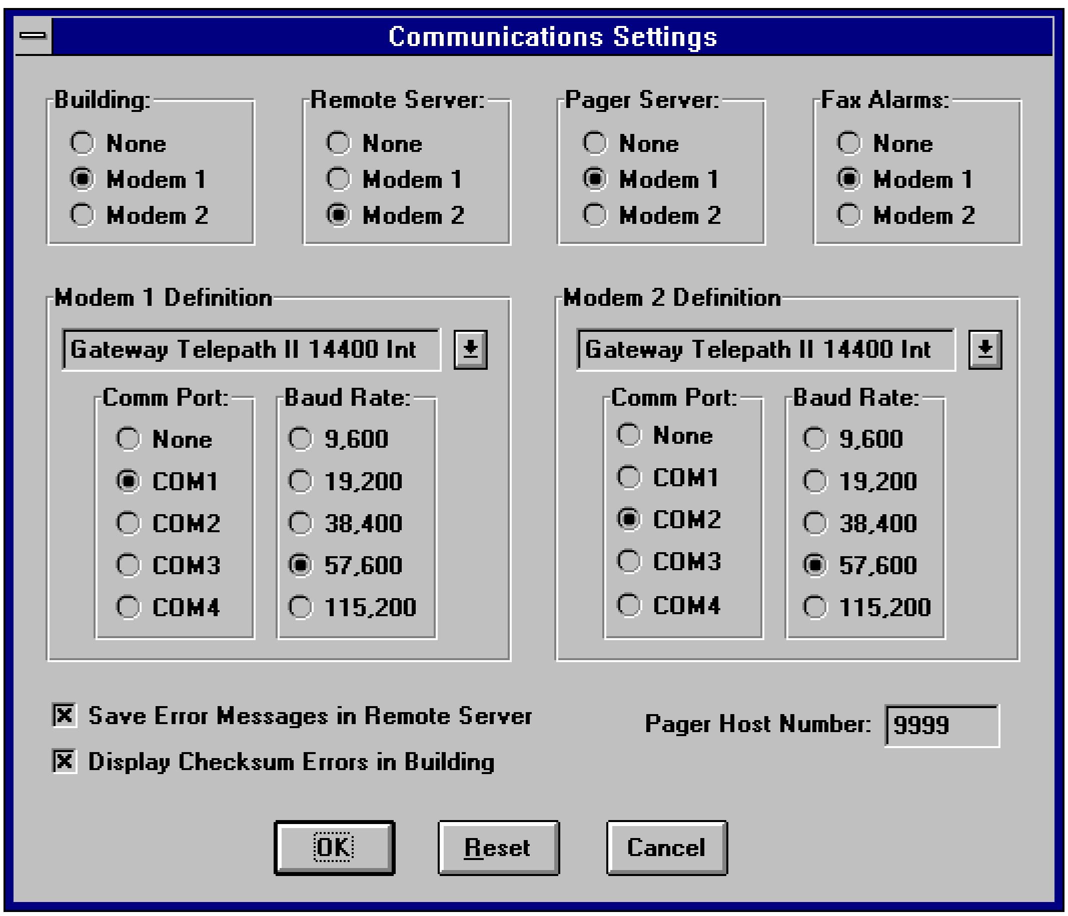
Type: Select correct option.

Note: The System will always use the first Pager number and the first Fax number found in the list when calling out alarms. No problems will occur if additional numbers are entered, but they will be ignored.

Communication Settings Dialog - Select Comm Settings... from the Site Configure item in the System menu.



Energy Zone Remote Main Window



Communications Settings Screen

Building, Remote Server, Pager Server, Fax Alarms - Select the modem to use, or none if this feature is not used.

Modem 1 Definition - Select the model, COM Port connection, and computer to modem baud rate for Modem #1.

Modem 2 Definition - Select the model, COM Port connection, and computer to modem baud rate for Modem #2.

Save Error Messages in Remote Server - If selected, communication errors are recorded in COMMLOG.TXT in the \EZ\DATA directory.

Display Checksum Errors in Building - If selected, the System will display the total number of checksum errors accumulated during any Remote Communication session. The errors are displayed in the status line of Building Remote.

Pager Host Number - This number is sent to a digital pager on alarm. This can be any four digit number.

Note: The Communication Settings Screen is available at Access Level 3.

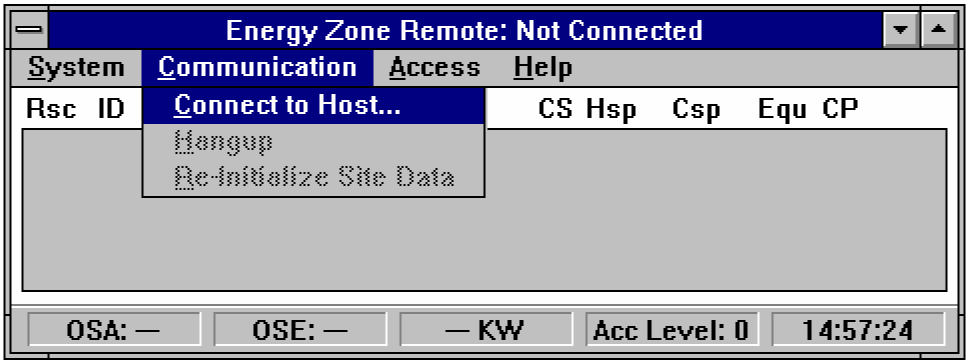
Additional Configuration - Two additional settings are accessed from General Settings... under the Site Configure item in the System menu.

Screen Update Time: This is the number of seconds between requests for an update of the data displayed in the Zone List box. If the screen update speed is configured for less than 10 seconds, an update time of 10 seconds will be used.

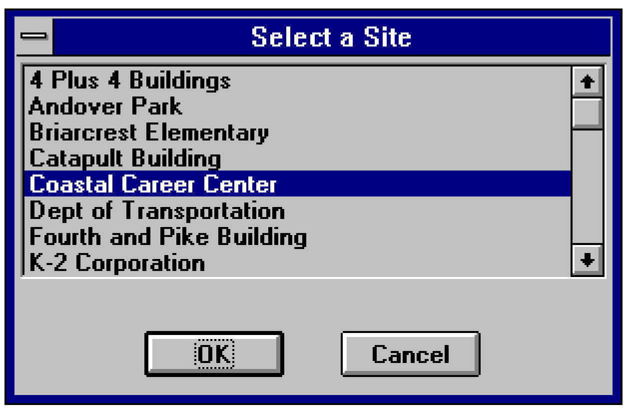
Access Timeout: This is the number of minutes with no keyboard or mouse activity before Remote Building will automatically disconnect the modem.

Remote Monitoring

Connecting to a Remote Host Site -The Remote Building program is started by clicking on the Remote Building icon in the **Energy Zone®** group. To access a Host Site, select Connect to Host... from the Communication menu. This will bring up the Site selection dialog.



Energy Zone Remote Main Window



Site Selection Screen

Select the Host Site from this list. Once the site has been selected, the System will attempt to call and connect to the Command Center at that site.

The Connection Status Screen will appear and remain displayed until successful connection or until 60 seconds has elapsed.

Connection Status Screen

Once connected to a Host Site, general Site data will begin to be transmitted to the Client. After completion, the System will operate as if the User is at the Host Site.

Disconnecting from a Host Site - Select Hangup from the Communication menu. The System will then terminate the connection. The request to Hangup must wait for an opportunity to be transmitted to the Host Site. If this occurs during a period of high data transmission, it is possible that it may take several seconds to disconnect. Choosing Exit from the System menu will close Remote Building and the System will immediately disconnect.

Note: It can take up to 30 seconds for Remote Server to reset after a hang-up. Because of this, do not attempt to re-connect to any site until at least 30 seconds have passed since the last connection.

Note: In order to call from one Host Site to another Host Site, it is necessary to first close Remote Server and the on-site version of Building at the originating, or Client Site. Only one version of Building may be run on any given computer at any given time. Remote Server can remain active at the Host Site if two modems are installed and both applications are configured for a different modem.

Differences Between Local and Remote Operation

All menu selections initiate a request for data from the Host Site. Remote Server will receive and process the request, sending the requested data to the Client Site. Any time that data is requested which requires more than a couple of seconds to transmit, the Progress screen is displayed.

Progress Screen

The Progress screen indicates the status of a data transfer from the Host to the Client Site. Any time a Progress Screen is displayed, no other actions may be initiated. If the requested data is not received in the expected length of time, a message box will display “Timed Out”. The User may make a new menu selection at that time. It is possible to close the Progress screen and regain access to the System by pressing the Escape key.

The “Timed Out” message can result from either the request not reaching the Host or the Client not receiving the expected data packet from the Host. Any request or data packet that can not be verified is rejected. This is usually caused by a poor quality phone line.

Re-Initialize Site Data - Several important data items from the Host are transmitted only once on initial connection. If an error is encountered during transmission of the initial packet of Site data (the ”Timed Out” message is displayed), it is necessary to manually request a new transmission. This is done by selecting Re-Initialize Site Data from the Communication menu.

Trend Log Viewing - Significant delays may be experienced (up to 1 minute) when initially retrieving Trend Log data from a remote Site. This is due the amount of data in the Trend Log that must be sorted prior to transfer. After the initial setup, Remote Server will transmit the first 100 lines of data. Remote Server will only transmit additional data, 100 lines at a time, when requested by Trend Log Viewer at the Client Site.

Config.sys - The Config.sys file from the Host Site may be viewed. This can be helpful in diagnosing operating problems at the Host Site. Requests for Config.sys are made from the Tools menu.

Autoexec.bat - The Autoexec.bat file from the Host Site may be viewed. This can be helpful in diagnosing operating problems at the Host Site. Requests for Autoexec.bat are made from the Tools menu.

Communication Errors Log - All communication errors recorded by Remote Server at the Host Site may be viewed. Requests for the Comm Error Log are made from the Logs menu.

EZ.ini - The EZ.ini file from the Host Site may be viewed only and not edited.

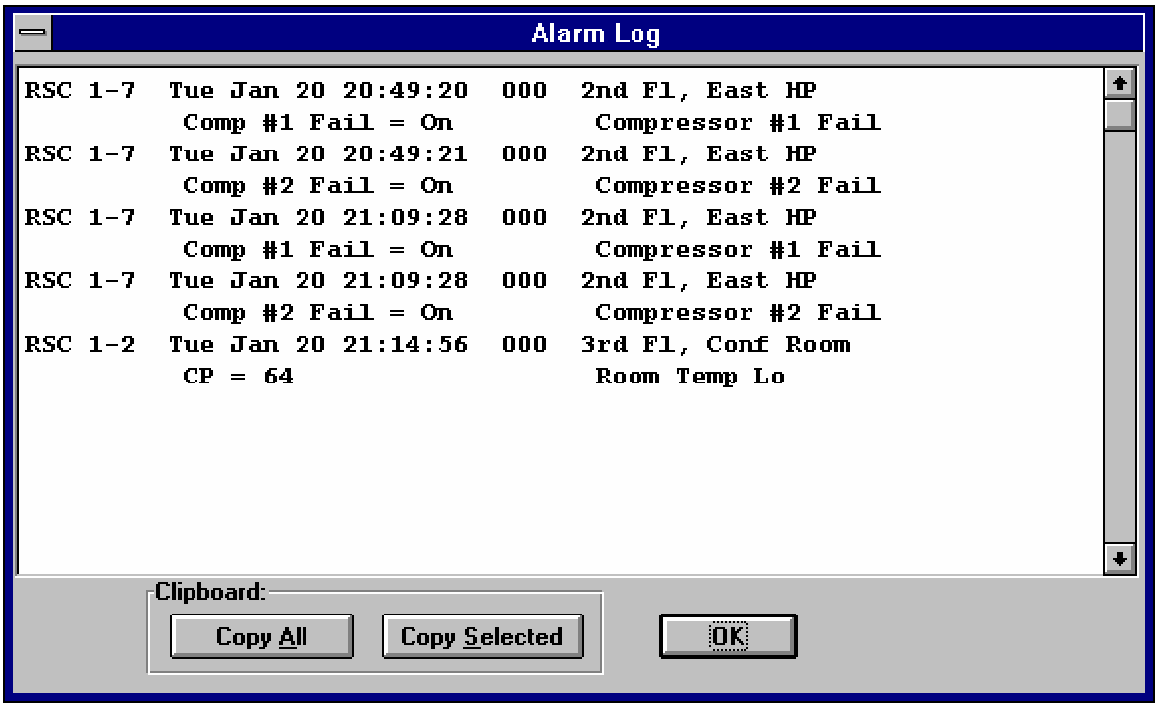
Data Backup Tools - The Backup and Restore Tools are not available when connected remotely. The Host data files can only be backed up or restored from the Host Site.

General Site Settings - The General Settings of the Host Site are not available when connected remotely.

Communication Settings - The Comm Settings of the Host Site are not available when connected remotely.

About Box - Selecting About... from the Help menu while connected to Host will display the version of the software in operation at the Host Site.

Alarm Log Viewing - When viewing the Alarm Log remotely, a different method is used than when at the Host Site. A special Alarm Log screen is displayed. This screen allows for viewing and copying selected portions of the Alarm Log.



Alarm Log Remote Viewing Screen

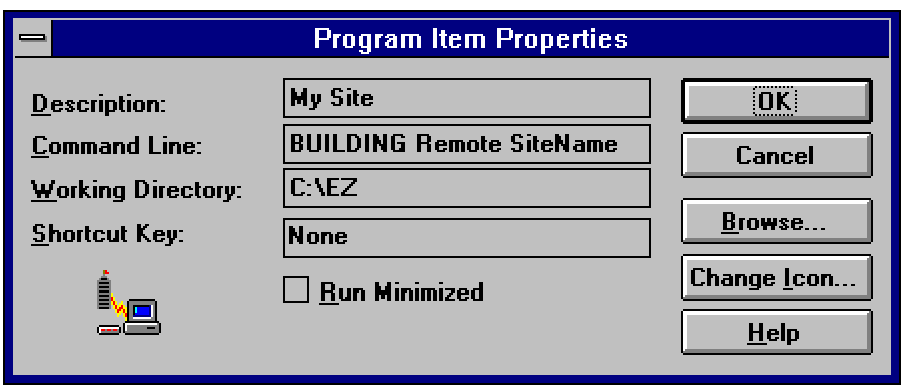
If the Alarm Log is to be printed or saved at the Client Site, then it must first be copied to the Windows Clipboard. The User may either Copy All of the Alarm Log to the Clipboard or select portions and then Copy Selected. It is then possible to Paste the data into any other Windows application, such as Notepad, for off-line viewing, printing, or storage.

Note: The maximum amount of Alarm data that can be transmitted to the Alarm Log Viewer is 8,000 bytes. This corresponds to somewhere between 50-80 Alarms. If more Alarms than this are recorded in the Alarm Log, then only the most recent 8,000 bytes of Alarm data is transmitted.

Creating Custom Site Icons

A custom icon may be created for each site in the phone book. The System will automatically call and connect to that site when the icon is selected in the **Energy Zone®** group. Create site icons using the following procedure:

1. If not already done, create an entry in the Phone Book for the Site.
2. Click once to highlight the Remote Building icon in the **Energy Zone®** group. The Remote Building icon is created during installation of the Remote Monitor package.
3. Select File and then Copy from the Windows Program Manager.
4. Select the **Energy Zone®** group, or other group as desired, and then Ok to create the new icon.
5. Click once to highlight the newly created Remote Building icon.
6. Select File and then Properties from the Windows Program Manager. The Program Item Properties dialog box will appear.
7. Enter a name for the Site in the Description box. This description will be displayed beneath the icon in the **Energy Zone®** group.
8. The Command Line should include the words “Building.exe Remote SiteName.” Substitute an actual SiteName from the Phone Book. The SiteName must be spelled exactly the same as in the Phone Book, including capitalization. It is not necessary to include the full name. Any portion of the name as listed in the Phone Book may be used.
9. Select Change Icon and choose the Remote Monitoring icon from the available Building icons.
10. Repeat this process for each additional Site.



Program Manager Properties Edit Dialog

When the new icon is double-clicked, the Remote Building program will start and automatically call the phone number for the Site.

Chapter 6

Graphics Viewer

Overview

The **Energy Zone®** Graphics Viewer is an optional alternative to the standard Building User interface. A separate application, the Graphics Builder, is used to create the displays used by Viewer. Viewer allows even the largest projects to be quickly scanned to determine System performance. No modification of System configuration (temperature setpoints, time-of-day schedules, etc.) is allowed from Graphics Viewer.

Features

- Unlimited Number of Graphical Displays
- Simple Point-and-Click Mouse Interface

Specifications

The Viewer application is a container used to display graphics created with Graphics Builder. There are few limitations on the number and complexity of displays for a Site. The quality and ease-of-use of any given Viewer site is highly dependent on the care given when creating the displays with Builder. The designer of the displays for a Site should provide either written or clear on-screen instructions for operation of the graphics at that Site.

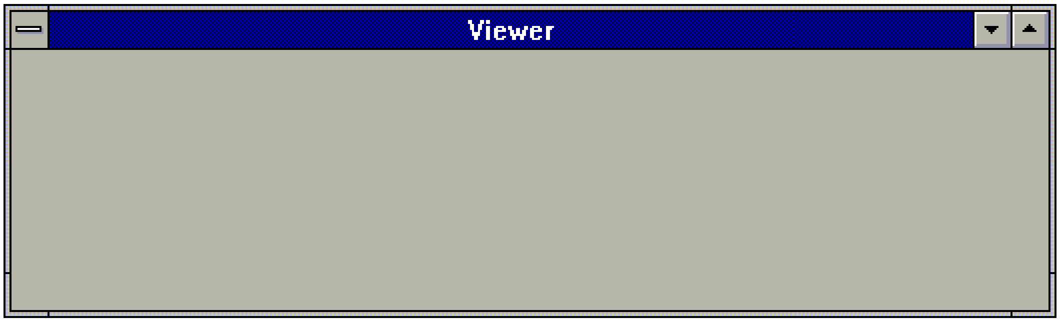
Floorview - Each graphic screen capable of being displayed by Viewer is referred to as a Floorview. A Floorview will generally include a floor plan with Zone data overlaid, but is not restricted to floor plans. Anything that can be saved in a Windows Bitmap format can be the background for a Floorview. Dynamic data, dynamic equipment displays, labels, and links to other Floorviews are overlaid on the background using Builder.

Note: Since no configuration information can be changed from Viewer, there are no Password or security provisions.

Note: RSCPC must be running at the Command Center prior to starting Viewer.

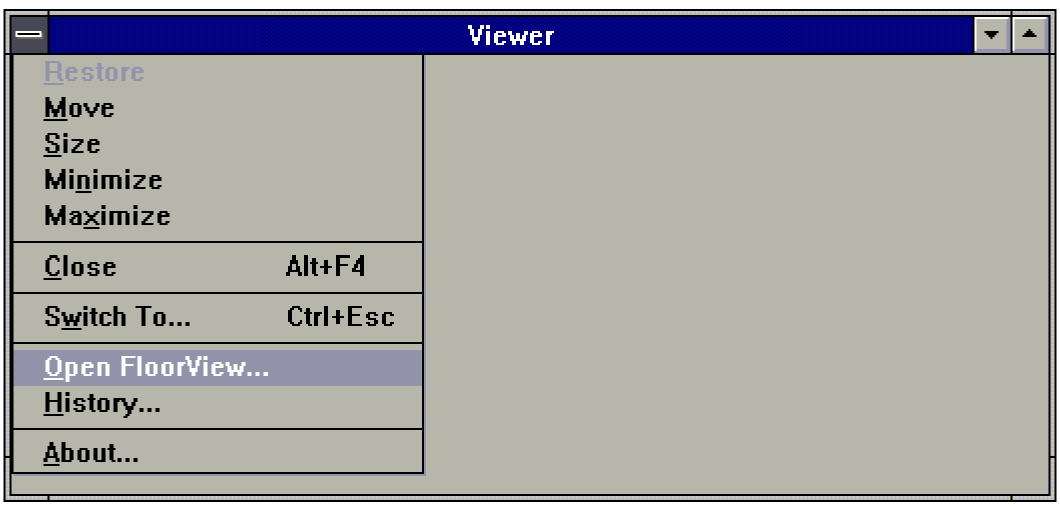
Opening a Floorview

There are four different methods of opening a Floorview. First, the Viewer application is started by selecting the Viewer icon in the **Energy Zone®** group. When the Viewer application begins the following screen will appear:



Graphics Viewer Application Window

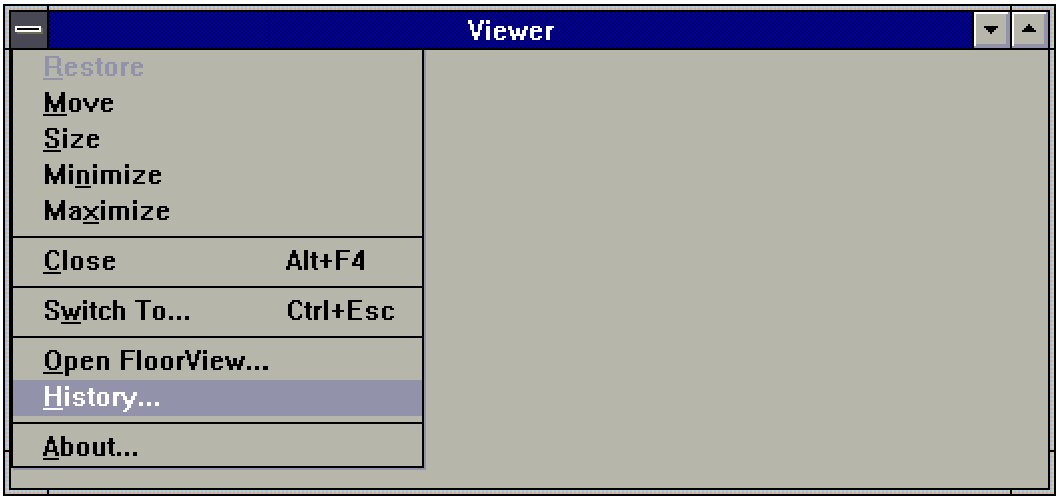
Method 1. From the Viewer System menu choose Open Floorview...



Graphics Viewer Menu

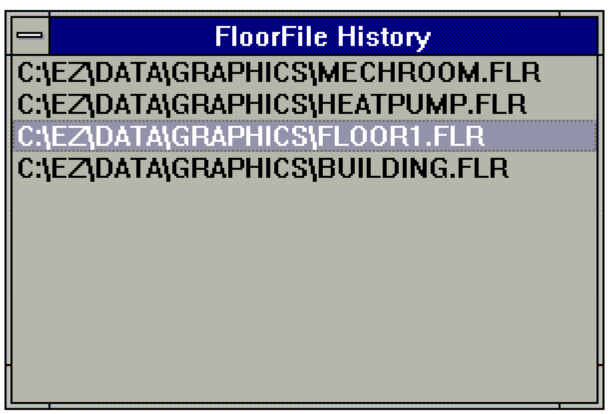
A file open dialog box will appear. Choose the file you would like to load and select OK. The Floorview will load in, updating all System readings as it is loading.

Method 2. This method will work if the User wishes to display a Floorview that was previously displayed during the current session. From the System menu choose History...



Graphics Viewer Menu

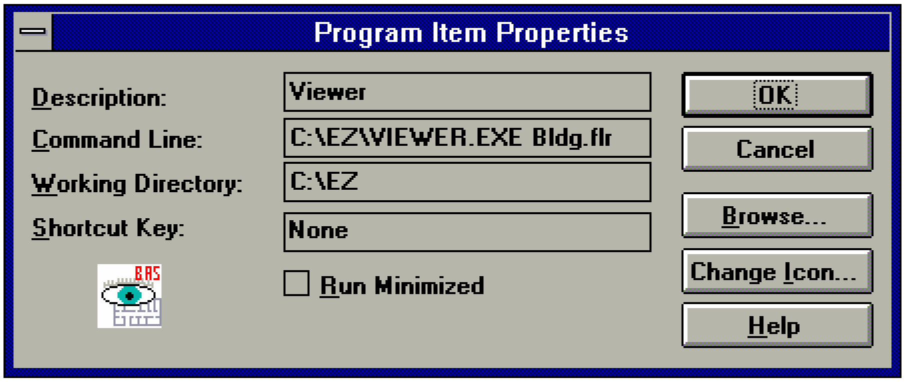
A FloorFile History is then displayed.



FloorFile History Screen

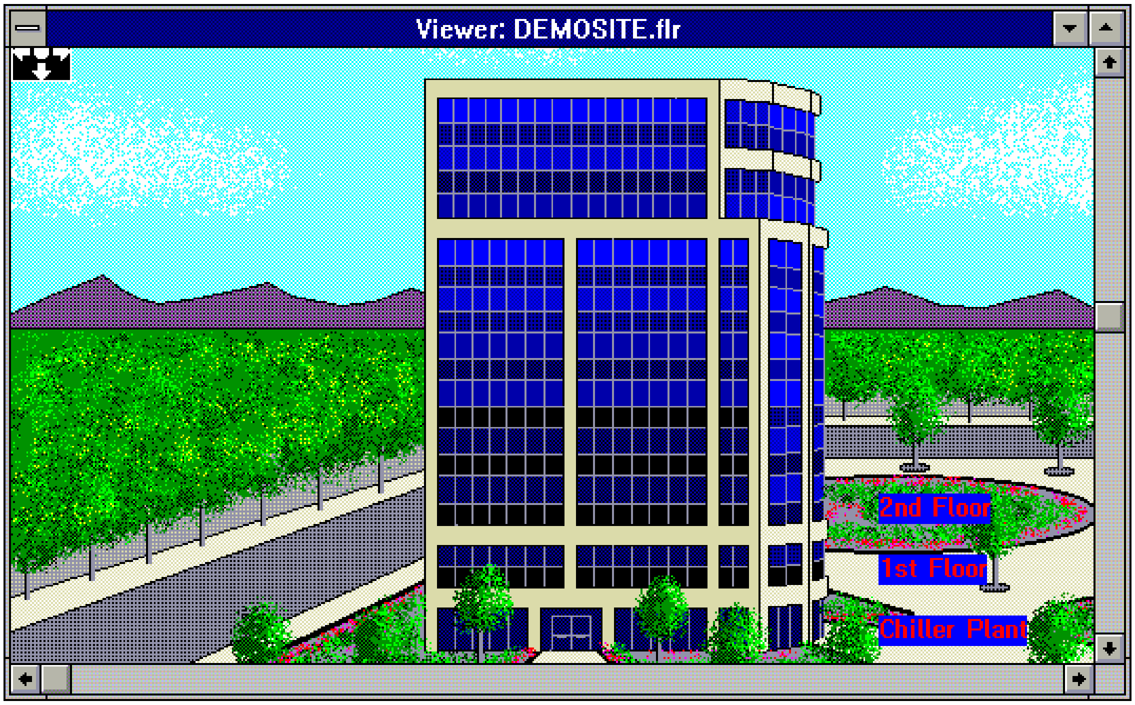
The FloorFile History Screen includes all Floor Files opened during the current session. Point and double-click on the desired Floorview in order to re-open it.

Method 3. Automatically open a Floorview when starting Viewer. This is done by editing the properties of the Viewer icon with Program Manager. Select Viewer by clicking once on the Viewer icon in the **Energy Zone®** group. Select File Properties from Program Manager and edit the Command Line. The Command Line should read “C:\EZ\VIEWER.EXE Bldg.flr”. Substitute the name of the desired Floorview for Bldg.flr. Be sure to include the full file path if the file is not in the \EZ directory.



Program Manager File Properties Screen

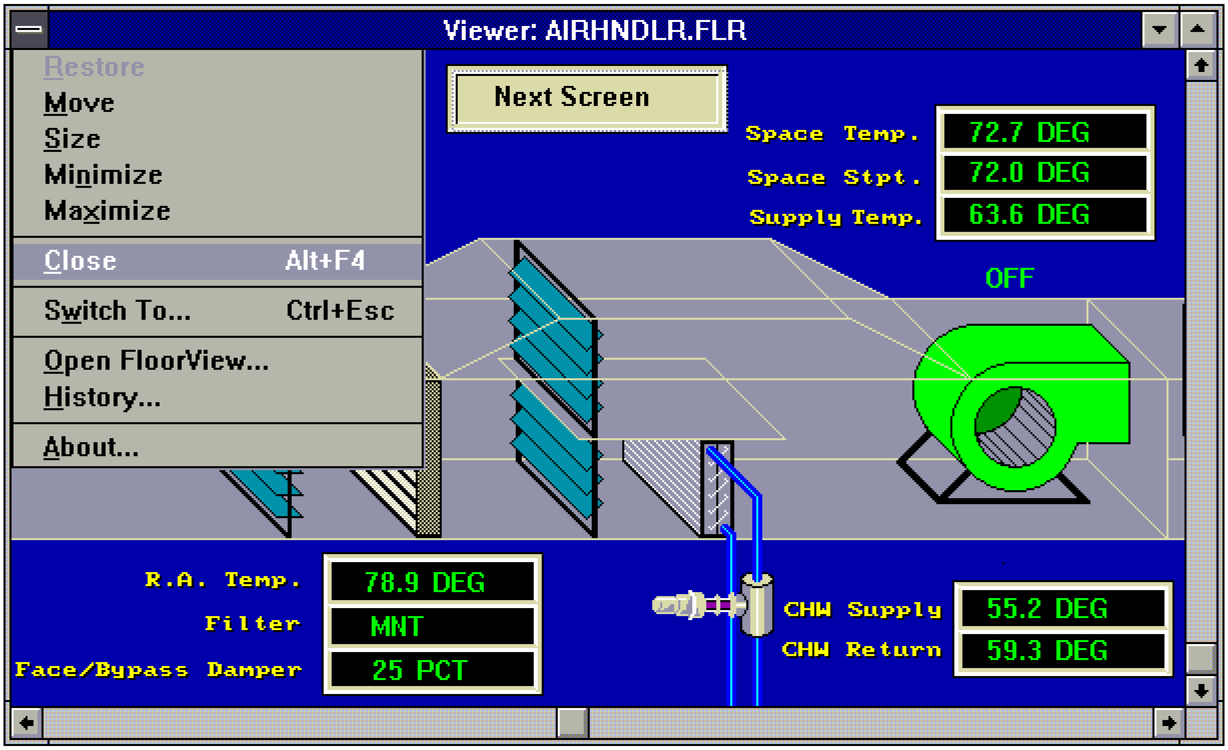
Method 4. Hit Links are used to automatically activate a new Floorview by double-clicking on a designated area of the current Floorview. Hit Links can be located anywhere on a Floorview and must have been created with Builder. The Floorview should provide some indication of where the Hit Link is located.



Viewer Display with Hit Links

Closing Viewer

The Viewer application is closed by selecting Close from the Viewer system menu:



Graphics Viewer Menu

Chapter 7

Graphics Builder

Overview

The Graphics Builder is used to design and build graphic displays that present data to the User at **Energy Zone®** Sites. Any standard Windows Bitmap can be used as a backdrop for the display. Controls are then overlaid on the background that link System data to the display.

Features

- Unlimited Number of Interlinked Graphical Displays
- Pre-defined Dynamic Graphic Displays
- Indicates Zone Alarm Conditions
- Display any System Analog or Digital Values
- Display Zone Configuration Values
- Use any Windows Fonts for Data Display

Specifications

Floorview - Each graphic screen created by Builder is referred to as a Floorview. A Floorview will generally include a floor plan with Zone data overlaid, but is not restricted to floor plans. Anything that can be saved in a Windows Bitmap format can be the background for a Floorview. Dynamic data, dynamic equipment displays, labels, and links to other Floorviews are then overlaid on the background using Builder.

Controls - Those items that can be overlaid on a background bitmap are called Controls. Controls can be static or dynamic, linked to RSCPC through Dynamic Data Exchange (DDE). Any Windows installed font can be used at any Control. The Controls that are available include:

- **On/Off Text** is used to display the status of a Digital Input or Output. Different text can be configured for both the On and the Off states.
- **Text** is static and is only used for labels.
- **DDE Readings** are dynamic and can be linked to most System data values that can change including Digital, Analog, and Zone Configuration values. The available items for a DDE reading are:

AI - Scaled Analog Input 1-8
AlarmOn - Configured Alarms 1-16. The Item # corresponds to the number assigned to the Alarm in the Zone Configuration Alarm Edit list Box of the Building application. The displayed value will be Yes or No.
AO - Percentage open of Analog Output 1-5
CFM - CFM airflow reading on Pressure Independent VAV Zones
CP - Scaled Control Point
Description - Zone Description from the Zone Configuration
DI - Digital Input 1-8. The displayed value will be On or Off
DO - Digital Output 1-8. The displayed value will be On or Off
ID - Zone ID from the Zone Configuration
InAlarm - Indicates if any Alarms are active at the Zone. The displayed value will be Yes or No.
Mode - Current Mode of the Zone (Occupied, Unoccupied, or Offline)
OCSP - Occupied Cooling Setpoint
OHSP - Occupied Heating Setpoint
RAI - Raw (unscaled) Analog Input 1-8. The displayed value will be 0-255.
RAO - Raw (unscaled) Analog Output 1-8. The displayed value will be 0-255.
ROMVer - Version of the EPROM at the RSC
SchedNum - Equipment Schedule # configured for the Zone
SCSP - Load Shed Cooling Setpoint
Setback Time - Number of minutes of Setback Override allowed
SHSP - Load Shed Heating Setpoint
Stage - Current Stage for the Zone (H1, AT, C1, etc.)
State - Current State of the Zone (Occ 1, Occ 2, UnOcc 1, SBOVR, etc.)
UCSP - Unoccupied Cooling Setpoint
UHSP - Unoccupied Heating Setpoint
WeeklySched - Weekly Schedule # assigned to the Zone

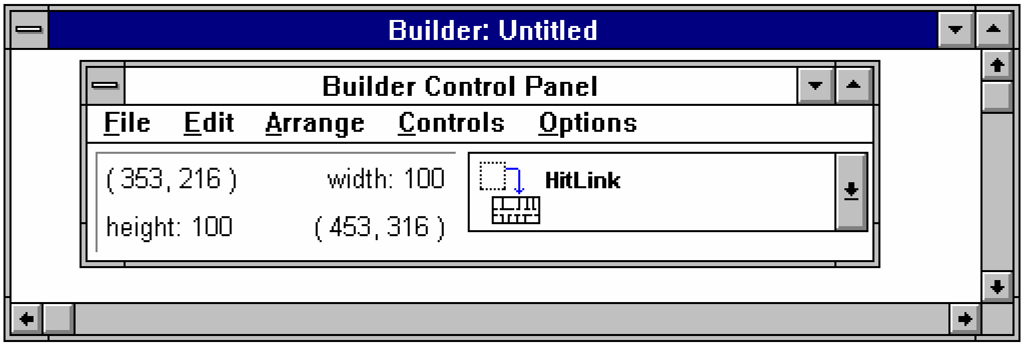
- **HitLinks** provide a means to jump from one Floorview to another. This will allow navigation of the data for a building that can not be easily displayed on one screen. HitLinks can be placed anywhere on a Floorview and can link to any desired Floorview. HitLinks are activated by double-clicking with a mouse on the designated area. The link will connect to the other Floorview only while in Viewer.
- **Override Link** will link data from any number of System addresses to a single Floorview. Override Links can be placed anywhere on a Floorview. This allows the User to create one typical graphic for equipment used throughout the project, such as a heat pump. Override Links can then be placed over the floor plan at each Zone. Double-clicking with a mouse on the designated area will activate the heat pump graphic and read in data from the selected Zone.

  Note: Whenever a HitLink or Override Link is used to activate a new Floorview, the only way to automatically return to the original Floorview is with another HitLink. The designer of a Floorview must ensure the User of Viewer has a means to move to another a Floorview. The User will not be stranded, as it is always possible to manually activated a new Floorview with Viewer.

- **Animated Bitmaps** are linked to any Digital Input or Output and will display an animated bitmap controlled by the state of the linked point. Animated Bitmaps are pre-defined and included with the System. Animated Bitmaps will indicate movement when in the On state, such as rotating blades of a fan.
- **On/Off Bitmaps** are linked to any Digital Input or Output and will change the bitmap displayed based on the state of the monitored point. On/Off Bitmaps are pre-defined and included with the System. On/Off Bitmaps are essentially two separate Static Bitmaps, one displayed in the On state and one displayed in the Off state.
- **Static Bitmaps** are not linked to any System data and do not change. They are provided to assist in creating equipment graphic displays. Static Bitmaps are pre-defined and included with the System.
- **Exclamation Alarms** will display an exclamation point when an alarm condition occurs at the selected Zone. This function can be configured for a specific Alarm or to display when any Alarm occurs. Alarm information can also be displayed using a DDE Reading.

Using Builder

The Builder application is started by selecting the Builder icon in the **Energy Zone®** group. When the Builder application begins the following screen will appear

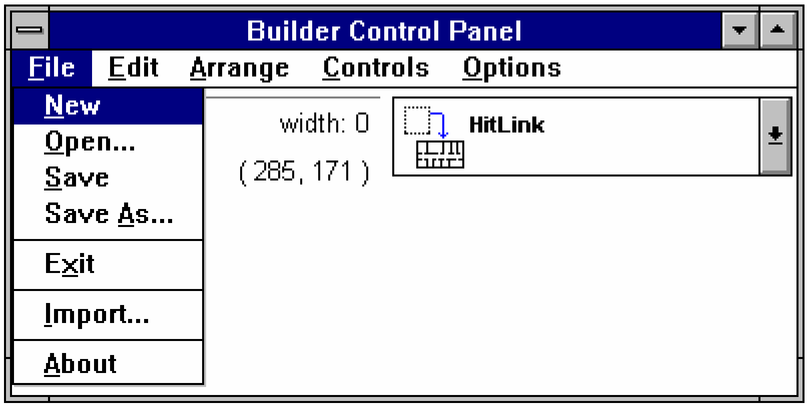


The Builder Application Window

The **Builder Control Panel** overlays the Builder Application window. The Control Panel can be dragged to any position on the desktop. The Builder Control Panel contains the tools that are used to place and edit Controls on the Floorview. The drop down list box in the upper left corner will show the currently selected Control. The left side of the Control Panel displays the coordinates of the currently selected Control.

Opening and Saving a New or Existing Floorview

Floorviews are opened and saved from the File menu of the Builder Control Panel.



The Builder Control Panel

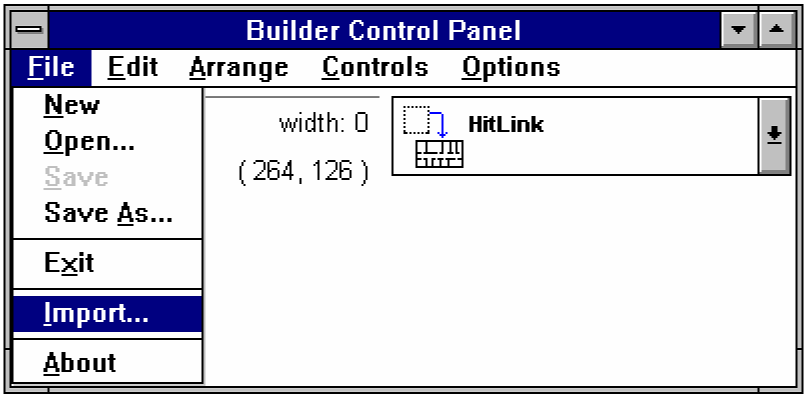
Starting a New Floorview File - Select New... to start a new Floorview

Opening an Existing Floorview File - Select Open... to edit an existing Floorview.

Saving a Floorview File - To save a Floorview file select Save As... Enter an 8 character file name with the extension *.flr*. Once the Floorview file has been saved, further changes to the Floorview can be saved by choosing Save rather than Save As. When Save or Save As is chosen, the Floorview is saved at the current size of the window.

Setting a Background Bitmap

To import a background bitmap, select Import... from the File menu.

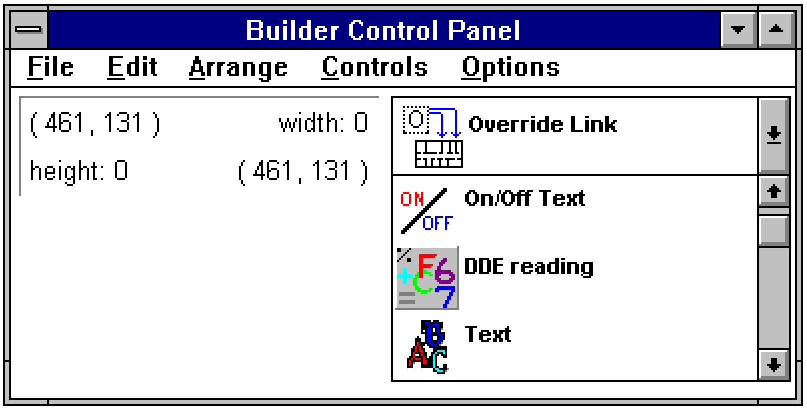


The Builder Control Panel

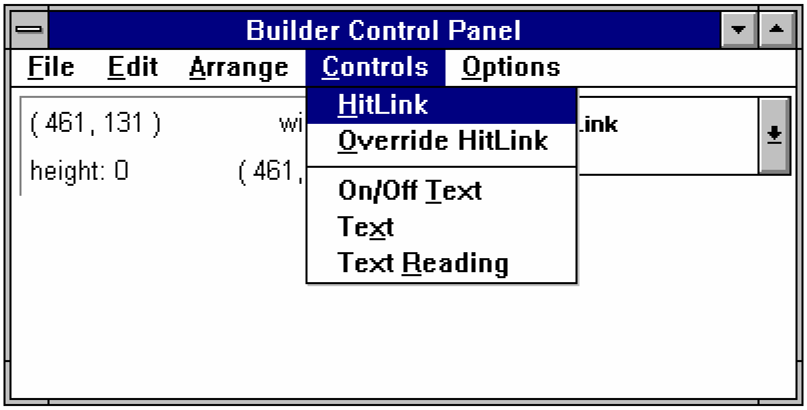
This will bring up a dialog box that allows the User to choose a bitmap file. Any file that conforms to the standard Windows bitmap specification can be imported as a background. Once a bitmap is selected, the bitmap will be painted as the backdrop on the Builder application window. The background can be changed to a different bitmap at any time by simply choosing the Import option. Any Controls that have been placed on the background will be painted in their exact positions and sizes on the new backdrop. Only one background bitmap may be placed within any given Floorview. Once the bitmap has been placed in Builder, it can not be scaled or edited.

Working with Controls

A list box is available in the Builder Control Panel containing all Controls. Several Controls can also be accessed from the Controls menu.



The Control List Box



The Controls Menu

Note: If many of the Controls will be using the same trunk, address, and/or font style, set all desired characteristics with the first Control. The Controls created afterward will automatically contain these characteristics.

Placing a Control - Several types of Controls are available, including On/Off Text, Text (static), DDE Reading, HitLink, Override Link, Animated Bitmap, On/Off Bitmap, Static Bitmap, and Alarms. Follow these steps to insert a Control to the Floorview:

1. Select the Control to insert from either the Controls menu or the list box.
2. When the mouse is moved over the Floorview, an arrow symbol (⇑) will appear:
3. Move the arrow to the approximate area on the Floorview where the Control should be placed and click the left mouse button. The Control is now placed.
4. To move the Control, click once and hold down the left mouse button within the area of the Control. Move the Control to the new location and release the mouse button to release.
5. For Controls that allow configuration options (On/Off Text, DDE Reading, HitLink, Override Link, Animated Bitmap, On/Off Bitmap, and Alarms), double-click within the area of the Control and a dialog box will appear. This dialog box contains the configuration for that Control. There is no dialog box or data associated with a static bitmap Control.

Sizing a Control - To change the size of a Control, first select the Control by clicking on it. Eight small squares will appear around the perimeter of the object. Move the mouse over one of the squares. The pointer should change to a double sided arrow (⇔). The Control can now be stretched or shrunk by dragging the mouse.

Note: If an Animated Bitmap is stretched or shrunk, it will run much more slowly than if it is left at its original size.

Text Font, Size, and Color - When a Control containing text is first created, the font, size, and color of the text matches the settings of the last Control created. Changing these settings is done by selecting the Set Font button from the dialog box for the Control.

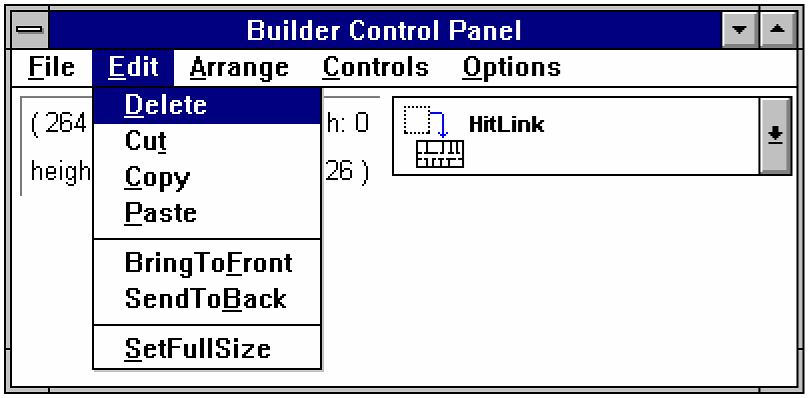
Text Alignment - There are three choices for text alignment: Left, Center, and Right. The default is set as Center, until a Control is edited and the alignment changed. Then, as with the font information, any text Controls created afterward will contain the new alignment. The text alignment aligns the text within the Control's bounding rectangle, not the overall Floorview. Whether the text is aligned to the left, center or right, if the text wraps around within the bounding rectangle, it will break between words rather than in the middle of a word.

Trunk-Address - Those Controls that are linked to System data require entry of the location of the RSC to be monitored. The format to be used is *X-YYZ* where *X* is the Trunk (1-8), *YY* is the Address (1-32), and Z is the sub-zone (a-d).

Manually Aligning Controls - When manually aligning two or more Controls, the coordinate box in the upper left corner of the Builder Control Panel can be helpful. The coordinate box displays the height and width of the Control's bounding rectangle (in pixels) as well as the pixel coordinates of the upper left and lower right corners. The Controls can be easily aligned by matching the coordinates.

Changing a Control's Data - When a Control is first created, it will contain default information. To change the information specific to the Control, first select the Control, then double click on it. A dialog box will appear allowing modification of the Control's settings.

Editing a Floorview



The Builder Edit Menu

Editing Floor Files - Multiple select is supported for all the Control editing commands as well as moving Controls. Multiple Controls can be selected by drawing a rectangle around the objects while holding down the left mouse button down and then releasing. They can also be selected by clicking with the mouse on successive Controls while holding down the Ctrl key. Editing commands follow standard Windows conventions.

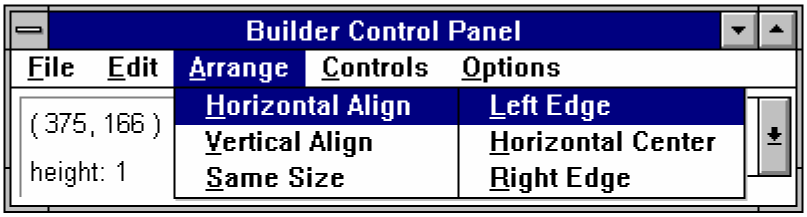
Delete, Cut, Copy, Paste - These tools work on Builder Controls the same as standard Windows edit commands. Builder will not paste to or from other applications.

Bring To Front, Send to Back - This tool is used for overlapping Controls. The selected Control will either move to the front or the back of the overlapping group of Controls.

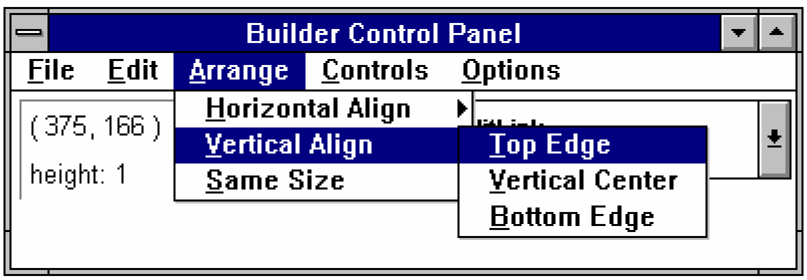
Set Full Size - The Set Full Size option is used to set the size at which the scroll bars become active for the Floorview window. This is used when creating a Floorview that is larger or smaller than the default size. To change the stored window size, first size the window as desired then choose Set Full Size. The window size is now set.

Automatic Alignment of Controls

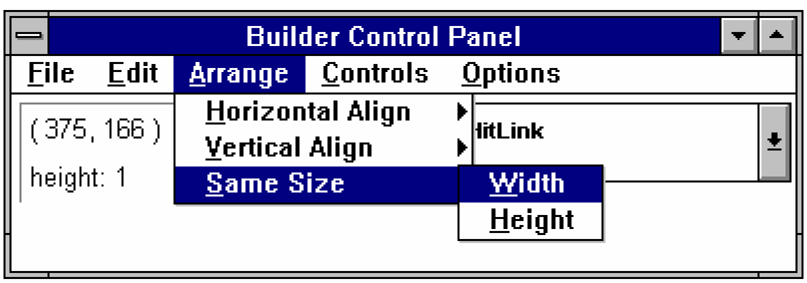
These tools will assist the User in aligning and sizing Controls.



Horizontal Align Menu



Vertical Align Menu



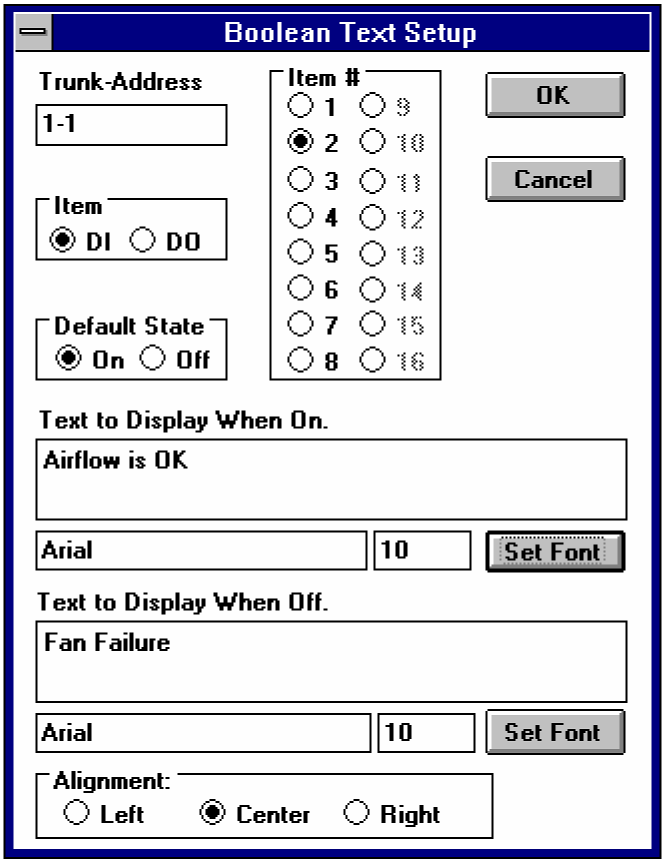
Controls Re-size Menu

To use these features, first select any number of multiple Controls on the existing Floorview. This is done selected by drawing a rectangle around the objects while holding down the left mouse button down and then releasing or by holding down the Ctrl key while clicking on the Controls with the left mouse button. All selected Controls will display the bounding rectangle. The most recently selected Control will have the sizing handles of the bounding rectangle filled solid. This is the Control that will be used as the master for moving or sizing all other selected Controls. Once the controls are selected, pick the desired function from the Arrange menu. After selection, all Controls will be automatically moved or sized.

Note: There is no Undo facility for this function. If unsure of the action, save the Floorview prior to selecting the function.

On/Off Text

The On/Off Text Control is used to relay information about Digital Inputs and Outputs. When the Control is first created, it will display the text “On/Off TEXT”.

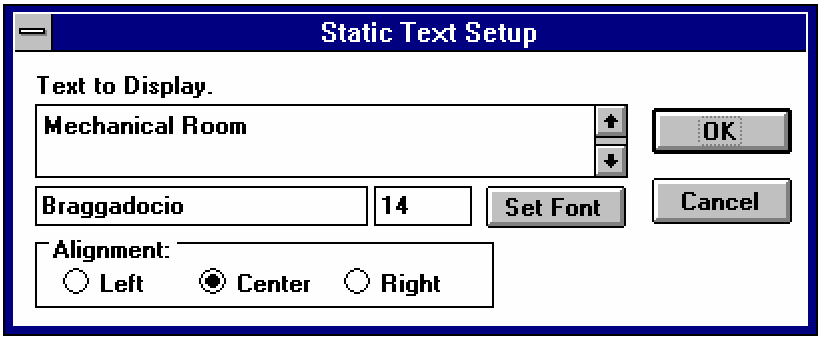


On/Off Text Dialog Box

Trunk-Address: - This is the location of the RSC containing the data.
Item - This is either a DI (Digital Input) or DO (Digital Output).
Item # - This is the number of the DI or DO to be monitored.
Default State - The Default State option button selects whether to display the On text or the Off text prior to linking to System data.
Text to Display When On - Text to be displayed when the DI/DO is in the On state.
Text to Display When Off - Text to be displayed when the DI/DO is in the Off state.

Text (Static)

The Text Control is used to convey information that is not dependent on the state of the actual building controls. For example, this Control can be used to label a Floorview, zone or bitmap. When the Control is first created, it will display the text “Text”.

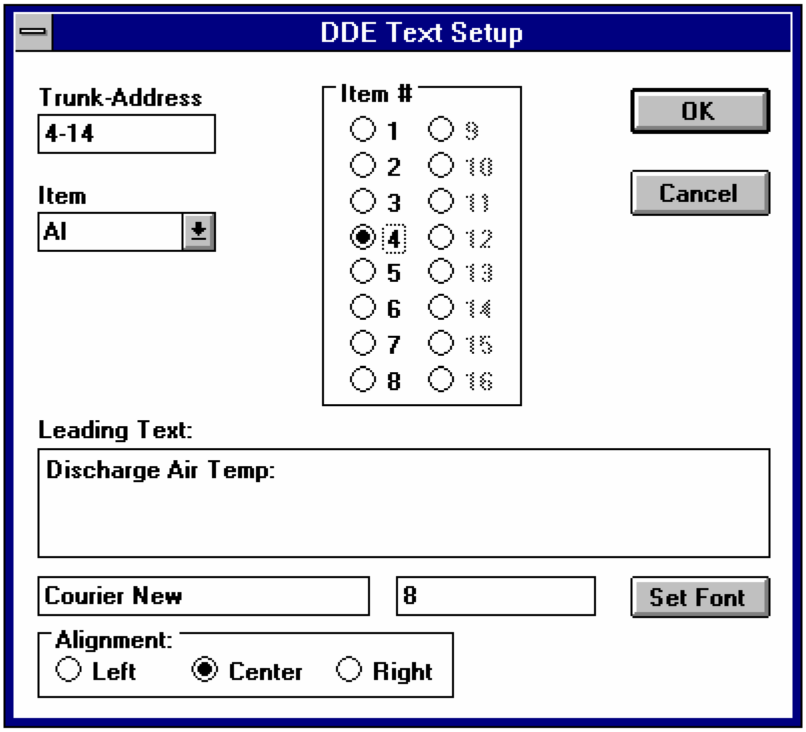


Text Setup Dialog Box

Text to Display - Enter the desired text in this box.

DDE Reading

The DDE Reading Control is used to display an Analog Input or other text readings from the System. When the Control is first created, it will display the text “Reading”.



DDE Text Reading Setup Dialog Box

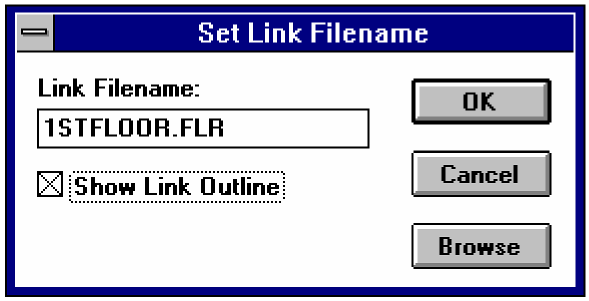
Trunk-Address: - This is the location of the RSC containing the data.

Item - When in Builder the item name and number will appear after the leading text, or by itself if there is no leading text (i.e. Discharge Air Temp: AI4). This is to help keep track of what the item is for each text reading while building the Floorview. The item name and number will be replaced with the reading when the Floorview is loaded in the Viewer application.

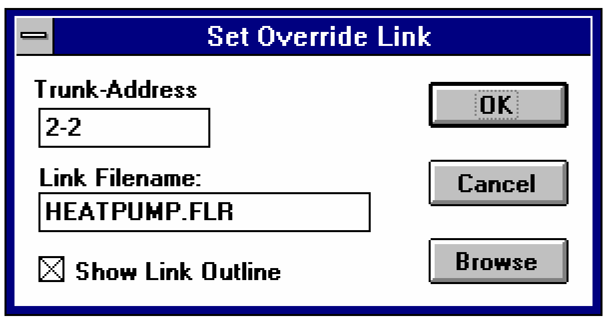
Item # - This is the number of the Item to be monitored.

Leading Text - Text to be displayed in front of the displayed value. A space is automatically added between the leading text and the reading that will be displayed.

HitLinks and Override Links



Hit Link Dialog Box

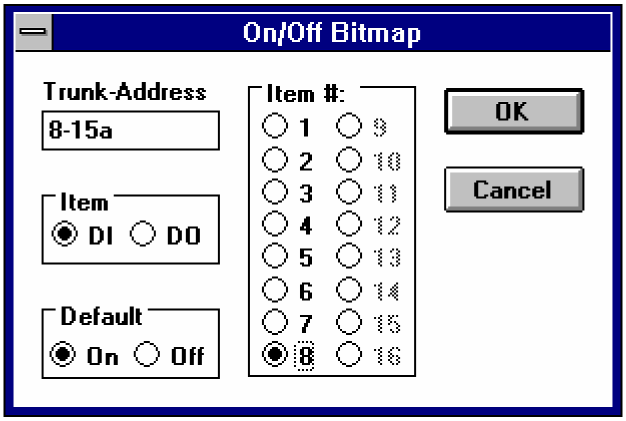


Override Link Dialog Box

Trunk-Address: - This is the location of the RSC data to be read into an Override Link.
Link Filename: - This is the Floorview to display when the Link is selected.
Show Link Outline - This will determine whether or not a dashed line is drawn around the location of the Link in both Builder and Viewer. If the Show Link Outline check box is clear, the location of the Link will not be shown.

Displaying Hidden Links - To display invisible links visible, select Options / Show Link Outlines from the Builder Control Panel. The links will then be visible for the duration of the session or until Show Link Outlines is selected again. This option only has an affect on those Controls that do not have the Show Link Outline box checked and only works in Builder.

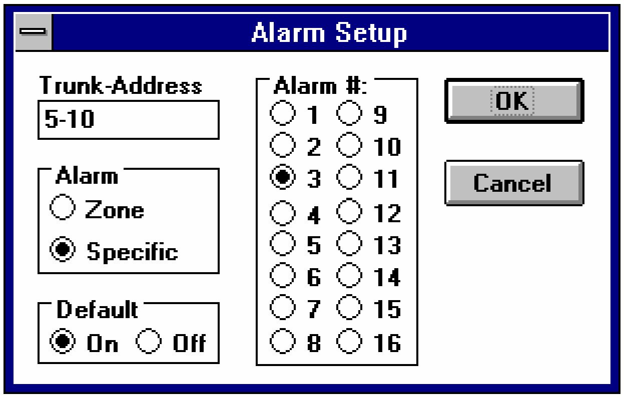
On/Off and Animated Bitmap



On/Off and Animated Bitmap Setup Dialog Box

Trunk-Address: - This is the location of the RSC containing the data.
Item - This is either a DI (Digital Input) or DO (Digital Output).
Item # - This is the number of the DI or DO to be monitored.
Default State - The Default State option button selects whether to display the On state or the Off state of the bitmap prior to linking to System data.

Exclamation Alarms



Alarm Setup Dialog Box

Trunk-Address: - This is the location of the RSC containing the Alarm to be monitored.
Alarm - Select either Zone, indicating any Alarm that has occurred at the Zone, or Specific, requiring the User to select a specific Alarm #.
Alarm # - The Alarm # corresponds to the number assigned to the Alarm in the Zone Configuration Alarm Edit list Box of the Building application.
Default State - The Default State option button selects whether to display the On state or the Off state of the bitmap prior to linking to System data.

Chapter 8

Zone Configuration

Overview

One of the greatest strengths of the **Energy Zone®** (**EZ**) System is the simplicity with which Zone configurations are created and modified. The **EZ** System is so easy to use that it actually will configure itself, which will be adequate for most installations.

Features

- Auto-Configuration
- Multiple Control Zones at a Single RSC
- No Programming Necessary
- Default Software in Each RSC

Specifications

Auto Configuration on Startup - The quickest building configuration can be performed by simply setting an address and equipment schedule at each RSC, connecting them to a trunk line, and energizing the System. If the Command Center finds an RSC on-line with no existing configuration file, a configuration file is created using System defaults.

Multiple Control Zones - The RSC can control multiple Zones. If the equipment uses 3 or 4 digital outputs, then two Zones can be controlled from a single RSC. If the equipment uses 1 or 2 digital outputs, then four Zones can be controlled from a single RSC. The equipment must all be of the same type.

No Programming Necessary - Each RSC comes with an EPROM that is installed and programmed by **BAS**.

Default Software - The term "Default" has two meanings in the **EZ** System:

- RSC Default - Refers to the control algorithms residing in the EPROM at the RSC. These algorithms will determine the control sequence for the connected equipment when the RSC is not in communication with the Command Center. No changes can be made to these algorithms.

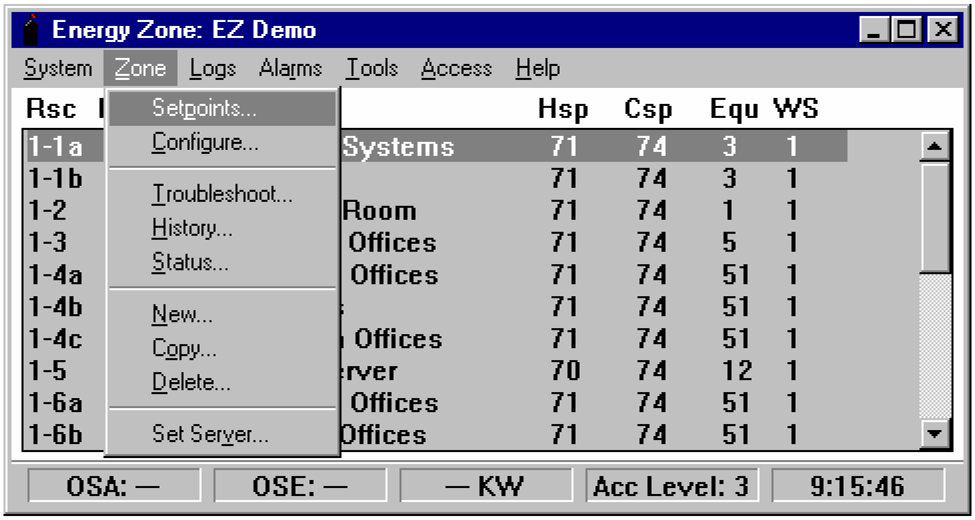
- System Default - Refers to the pre-programmed System setup provided by **BAS** at the Command Center. All of these settings can be easily changed and customized by the User. The new System Default settings can then be reused by the User on other projects. This includes all of the following:
  1. All on-line configuration information for each Equipment schedule. This includes PID configuration, smart recovery, data logging, temperature control setpoints, alarm setpoints, etc.
  2. Weekly time schedules.
  3. Holiday schedules.
  4. Passwords.
  5. And all other configuration information necessary for a trouble free System start-up.

Note: Always select a Single Zone Equipment Schedule if only one Zone is to be attached to the RSC. Select a Dual Zone Equipment Schedule if only two Zones are to be attached to the RSC. If a Quad Zone Equipment Schedule is used and only 3 Zones are attached to the RSC, connect the 3 Zones as a, b, and c and then use the Zone Delete function to delete the unused Zone d.

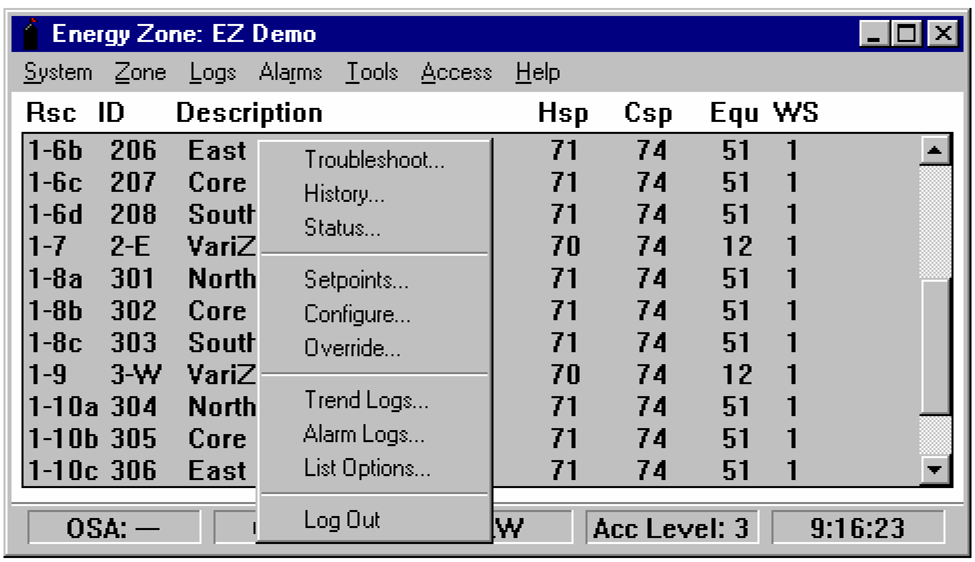
Note: Setpoint configuration requires Access Level 1. All other Zone Configuration actions require the User to be logged into the System at Access Level 3.

Note: The Set Server function is used to link client Zones to a server and is discussed in detail in the VariZone and Variable Air Volume Systems chapter. Status, History, and Troubleshoot are all discussed in the Diagnostic and Troubleshooting Tools chapter. Set Parent and Undo Parent are used to link different Zones to the time-of-day mode of a single Parent. This is discussed in detail in the chapter on Time-of-Day Scheduling.

Zone Configuration Editing Tools



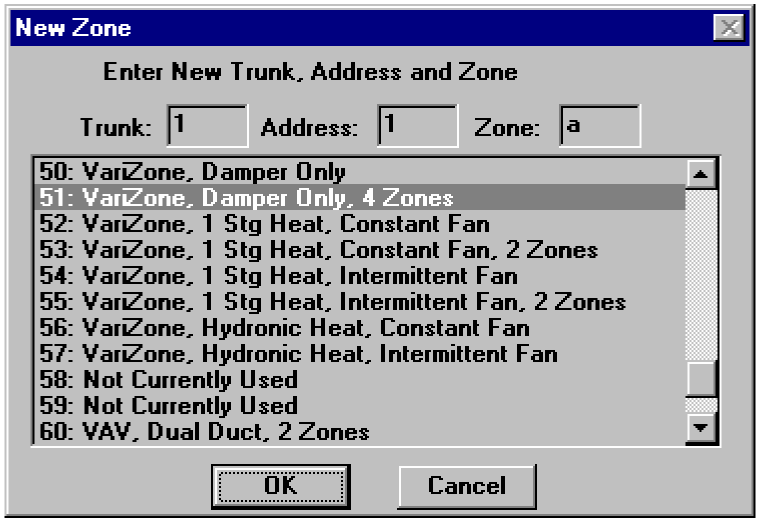
Zone Menu



Floating Zone Menu

Most common Zone configuration tools are accessible from the Zone menu. If the User is logged onto the System at Level 3, a floating menu is accessible by first selecting a Zone and then clicking the right mouse button.

Create New Zone - The first step to create a new Zone configuration is to select Zone and then New... from the primary menu. This will bring up the New Zone dialog box.

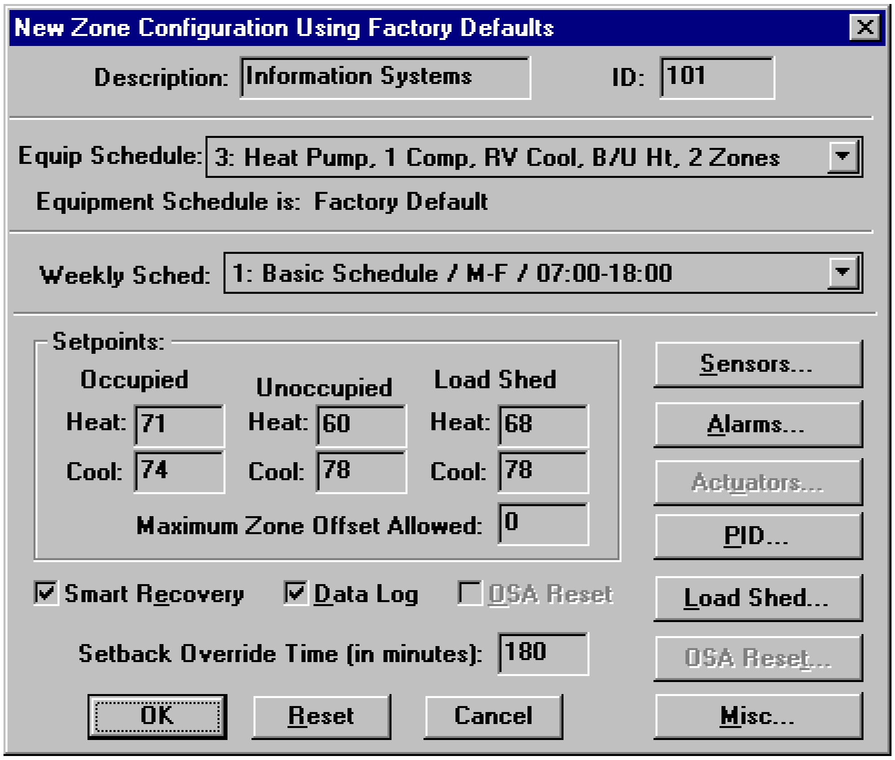


New Zone Entry Screen

Trunk:/Address:/Zone: Enter the Trunk (1-8), Address (1-32), and Zone (a-d) if appropriate.
Equipment Schedule: Use the drop-down list box to select the Equipment Schedule for the new Zone.

Selecting OK will create a new Zone at that address using default configuration settings for that Equipment Schedule. The configuration for the Zone can then be modified using Configure.

Edit Configuration of Existing Zone - To edit an existing Zone first select the Zone in the main window list box. Then select Zone and Configure... from menu. The System will enter the Zone Configuration Screen. This dialog is the starting point for all Zone modifications. The buttons on the right of the dialog bring up detailed dialogs covering the topic on their label. Dimmed items or buttons designate features that are not applicable to the type of equipment chosen.



Zone Configuration Screen

Description: The description is used throughout **Energy Zone®** in places like the main window's Zone list and alarm notifications. The description may be up to twenty characters in length.

ID: The ID is an additional description for the Zone and is usually used for a room number. This item may be up to four characters in length.

Equip. Schedule: The Equipment Schedule defines the type of equipment that is attached to this RSC. Click on the down arrow of the list box for a complete list of all available equipment types.

Equipment Schedule is: This will read either Factory Default, if the ES definition has not been modified in the field, or Custom Configuration if the ES is modified.

Weekly Sched: This defines which weekly time schedule will be used for this Zone. Click on the down arrow of the list box for a complete list of all available weekly schedules.

Setpoints: These six boxes define the temperatures that **Energy Zone®** will maintain in this Zone.

Load Shed setpoints are grayed out unless “Allow this Zone to be Shed” is checked under Load Shed of the Zone configuration.

Maximum Zone Offset Allowed is the amount of offset of Zone setpoints allowed to be input by the Tenant from the Zone. This can be from 0-10° and is a +/- value.(i.e. if 5 is entered, the Tenant can raise or lower the configured setpoints by 5° for a total available span of 10°). Use of this feature requires installation of an optional Setpoint Offset Pot at the wall sensor and configuration of the correct input in the Sensors screen.

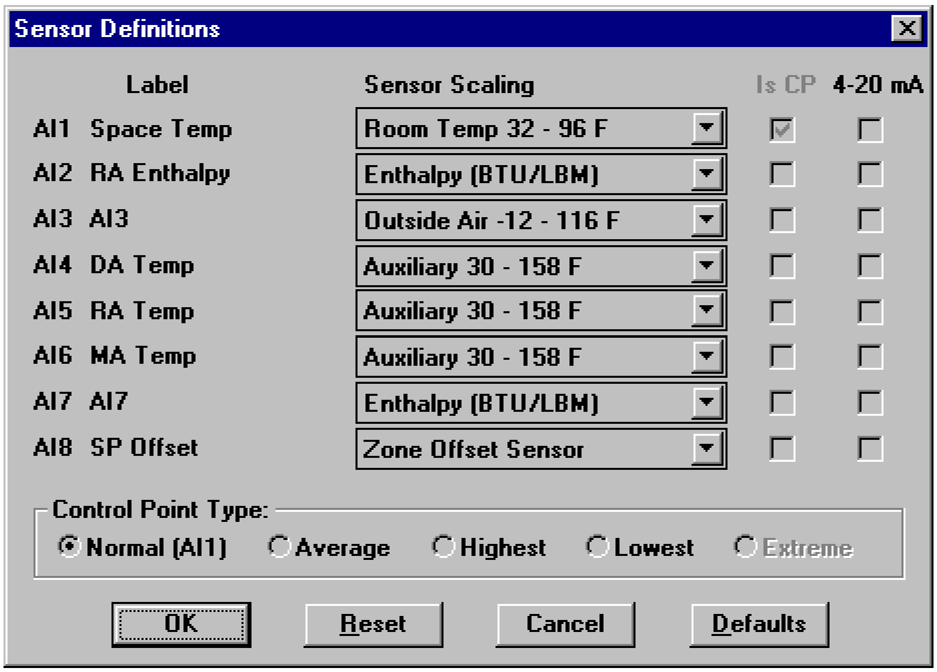
Smart Recovery: Selecting this check box will inform **Energy Zone®** to use Smart Recovery from setback.

Data Log: Selecting this check box will cause **Energy Zone®** to store data from this Zone to the Trend Log.

OSA Reset: Outside Air Reset may be used to calculate the setpoint instead of entering a fixed setpoint. If the OSA Reset box is checked, the OSA Reset Action Button will be accessible. Selecting this button will access a screen used to enter OSA Reset control parameters.

Setback Override Time: Setback Override Time is the number of minutes a Zone will use its occupied setpoints when an occupant presses the button on the wall sensor. Setback Override may be disabled by placing a zero in this box.

Sensors... – Field sensors are wired to the analog input terminals of the RSC. Any of the 8 analog inputs can be scaled to any of the available ranges. To change the scaling, first select the Sensors button from the Zone Configuration screen. Then select a new scale from the list box. The sensor installed and wired to that input must match the scaling range selected on this screen. Control Point (CP) may be a real or calculated value. In most cases the Control Point will be equal to the value of AI1. Calculated Control Point values are configured from this screen. Control Point is the value used as the primary control value for each Zone.



Sensor Definitions Screen

Sensor Scaling - Select a desired scale range from those available in the drop-down list box. Other ranges can be provided in request.

4-20 mA - Check this box for those sensors that have the bottom end of their scale offset above zero by 20%, such as 4-20 mA or 1-5 VDC.

Control Point Definition

Is CP - This option is grayed out unless one of the available buttons listed below is first selected. As a minimum, AI1 must always be selected and is all that is used in most cases. If additional sensors are to be used in determining the control point, then select the desired sensors. All selected sensors are automatically scaled to the same range as AI1.

Normal (AI1) - Uses the input at AI1.

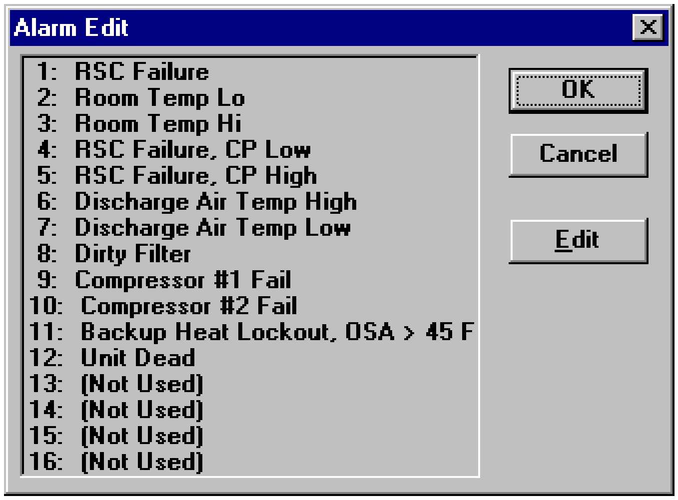
Average - Uses the average of all selected Analog Inputs.

Highest - Uses the highest of all selected Analog Inputs.

Lowest - Uses the lowest of all selected Analog Inputs.

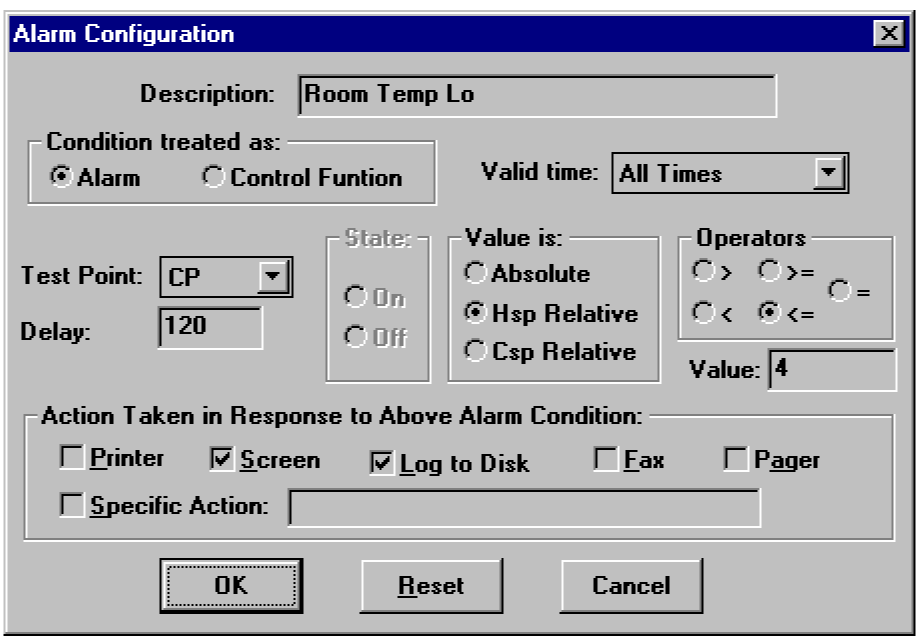
Extreme - Uses the Analog Input that is furthest from setpoint of all selected Analog Inputs.

Alarms... - To edit or add any alarm, first select the Alarms button from the Zone Configuration screen. Then highlight the desired alarm from the list box and select the Edit button.



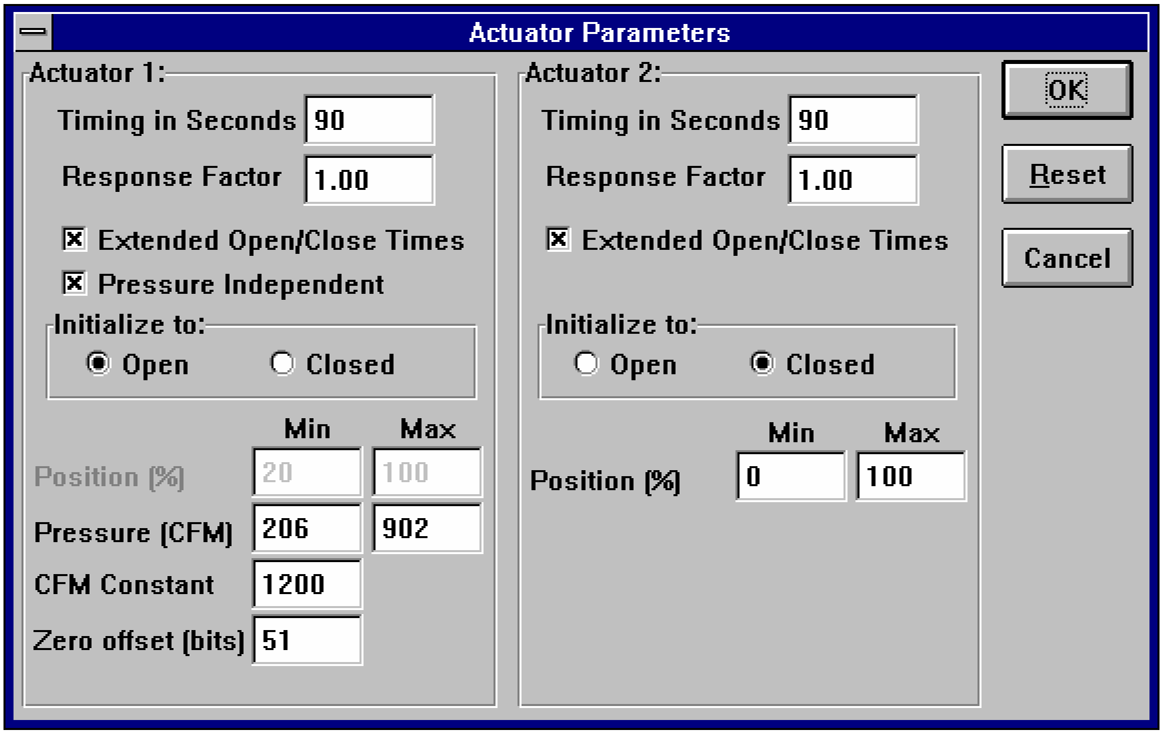
Alarm Edit Screen

Alarm Configuration - See the Alarm and Control Functions Chapter for a detailed discussion.



Alarm Configuration Screen

<u>Actuators...</u> - For equipment that uses actuators, this button will be available from the Zone Configuration screen and brings up a dialog for actuator configuration. Each Zone that uses an actuator must be configured.



<u>Actuator Parameters Screen</u>

Timing in Seconds - is the full stroke timing for 3 point floating actuators. Can be from 0 - 9999.

Response Factor - will adjust the response speed of the control software. Can be from 0.01 - 655.36. A response factor of 1.00 causes the software to use the built-in response. The rate of response to an offset from setpoint can be increased with a larger number, or decreased with a smaller number.

Extend Open/Close Times - will cause the open output of a three point floating actuator to be activated for an additional 20% of the full actuator time whenever the actuator reaches 100%. For example, if a 90 second actuator has reached 100% open the actuator will be activated for an additional 18 seconds in the open direction. This will also occur in the closed direction any time the actuator reaches 0% open. The intent of this feature is to help correct for inaccurate actuator timing caused by variations from actuator to actuator.

Pressure Independent - checkbox will determine if the System will control using CFM or damper % open at the Zone. Pressure independent control will require the addition of a pressure sensor and an airflow monitoring device at the Zone.

Initialize to - tells the System which direction to initialize the actuator to on startup. If this is a pressure independent System that requires calibration for the air flow sensor, select closed. This will force the actuator to the closed position when calibrating the zero for the sensor.

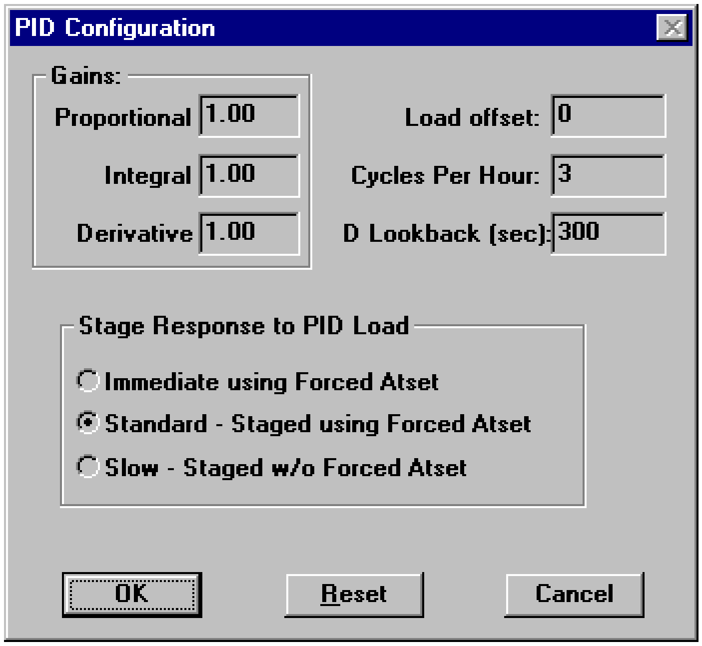
Min and Max - applies to either a Position (%) open damper position if the System is pressure dependent or Pressure (CFM) is the System is pressure independent. When a pressure independent actuator is configured for a minimum CFM of 0, the actuator will go to a 0% open position when minimum is the commanded position.

CFM Constant - only applies to pressure independent Systems. This number is used to calculate a CFM at the Zone. If the airflow monitoring device is integral to the damper, this number should be available from the manufacturer of the damper. Otherwise it can be calculated from the following formula - CFM Constant = 4005 * duct cross sectional area (in SF).

Zero offset (bits) - only applies to pressure independent Systems and represents the input seen by the Command Center when the CFM is at zero. If the System is setup for automatic calibration, this number will be automatically updated at each calibration. Contact **BAS** for assistance in determining this number.

Other Setup Parameters - One other System-wide parameter is necessary for calculating a CFM. Because this is a System-wide parameter, the same type of sensors must be used at all Zones on a given project. The input is BAS K and is entered at the Options - Settings ... menu location. Contact **BAS** for help in determining the correct entries for BAS K.

PID... - To Modify the PID configuration, select the PID button from the Zone Configuration screen.



P.I.D. Configuration Screen

Note: The term PID is an acronym for Proportional, Integral and Derivative. These are the three different factors used to calculate a total heating or cooling load for a given Zone. Proportional is the current temperature's distance from setpoint at the time of the calculation. Integral is a total of all deviations from setpoint for the last cycle period. Derivative is rate of change of the space temperature over the Derivative Lookback period. As a rule, this dialog should not be modified. For properly engineered HVAC Zones, the default values will control a Zone very accurately.

Proportional Gain - will adjust the response of the System to changes in the Proportional factor. A response factor of 1.00 causes the software to use built-in response. Gains larger than 1.0 place more importance on this factor. Gains smaller than 1.0 place less importance on this factor. A gain of zero will cause a this factor to be ignored all together.

Integral Gain - will adjust the response of the System to changes in the Integral factor. A response factor of 1.00 causes the software to use built-in response. Gains larger than 1.0 place more importance on this factor. Gains smaller than 1.0 place less importance on this factor. A gain of zero will cause a this factor to be ignored all together.

Derivative Gain - will adjust the response of the System to changes in the Derivative factor. A response factor of 1.00 causes the software to use built-in response. Gains larger than 1.0 place more importance on this factor. Gains smaller than 1.0 place less importance on this factor. A gain of zero will cause a this factor to be ignored all together.

Load offset - This value will be added (or deducted) from the calculated PID load. This value can be from -128 to +127. In most cases, the load offset should be left at 0. The load offset will only affect loads in the Occupied mode.

Cycles Per Hour - is the total number of PID cycles for this Zone per hour. The Cycle Time would be the 60 minutes divided by the Cycles Per Hour. A larger number will improve control and keep temperature closer to setpoint. A smaller number will extend the life of mechanical equipment by minimizing the number of ON/OFF cycles. The default number for should be used in most cases.

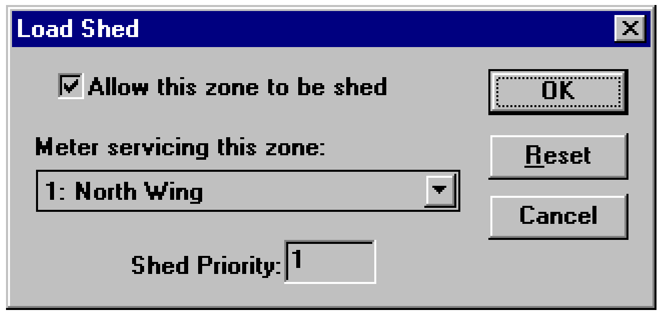
D Lookback (sec) - defines how far back the System will look to determine the rate of change in space temperature over time. The default number for should be used in most cases.

Immediate using Forced Atset - If this box is checked, the System will allow the Zone to go immediately to the stage determined by the load at the beginning of the next Cycle. If the PID load is zero, the stage will go to AtSet. If the PID load inverts (i.e. positive to negative) during the course of a cycle, the System will go to Forced AtSet. This mode of operation is not recommended in most cases.

Standard - Staged using Forced Atset - The default mode for moving from stage to stage is incrementally. The System will not allow a PID cycle to begin at a stage more than one higher than the previous PID stage. For example, if the previous PID stage was Cool 1, the next PID cycle will not exceed Cool 2 no matter what the PID load. The System can reduce stages by more than 1. For example, if the previous PID stage was Cool 4, the next PID cycle can be as low as Cool 1. If the PID load is zero, the stage will go to AtSet. If the PID load inverts (i.e. positive to negative) during the course of a cycle, the System will go to Forced AtSet. This is the most commonly used PID mode for HVAC control Zones.

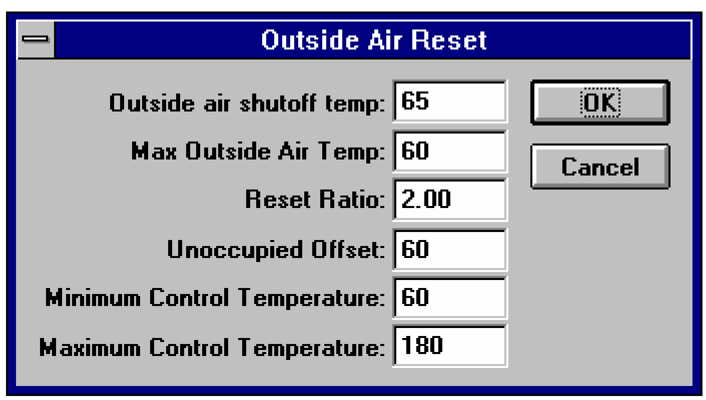
Slow - Staged w/o Forced Atset - This mode is used for equipment that changes the control point quickly, such as a discharge air temperature controller. The System will not allow a PID cycle to begin at a stage more than one higher than the previous PID stage. In addition, +PID Loads increase the stage one step toward C4, -PID Loads increase the stage one step toward H4, and the stage will not change for PID Loads of 0.

Load Shed... - Load shedding is the process of selectively turning off pieces of equipment for the purpose of controlling the energy consumption of a building or site. See the KW Load Shedding Chapter for a more detailed discussion of Load Shedding. To modify Load Shed setup, select the Load Shed button from the Zone Configuration screen.



Load Shed Screen

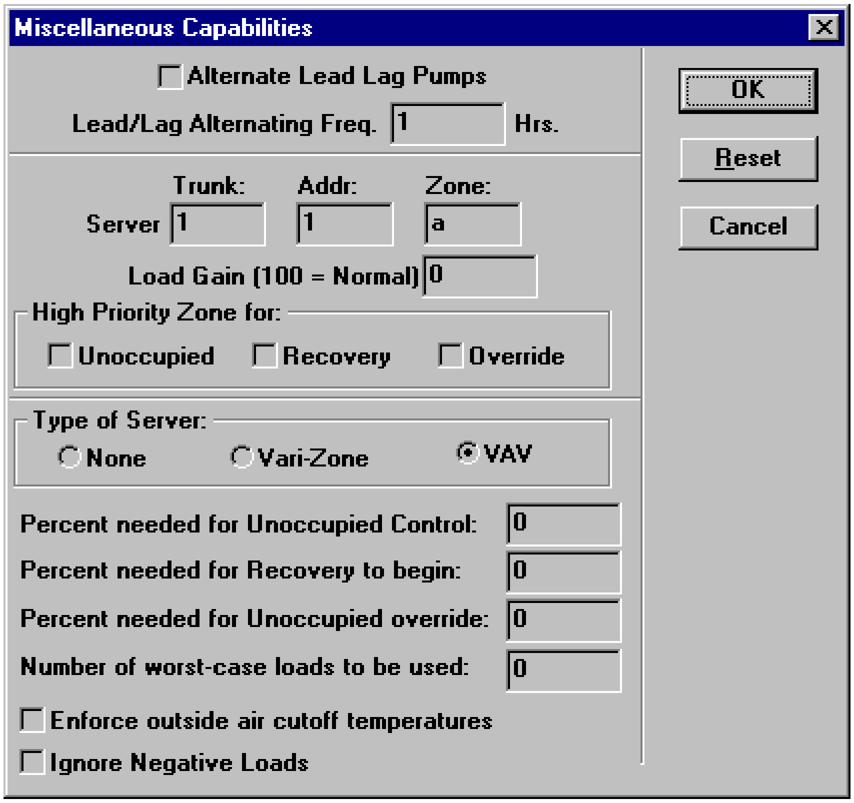
OSA Reset... For equipment relying on OSA Reset, this button will display a dialog requesting the operating parameters for this process. See the **Energy Zone®** Software Features Chapter for a more detailed discussion of OSA Reset configuration. To modify OSA Reset setup, select the OSA Reset button from the Zone Configuration screen.



Outside Air Reset Screen

Outside air shutoff temp: - The OSA temperature at which the Zone will enter AtSet. The PID load is forced to AtSet by causing the Heating Setpoint to follow the Control Point.
Max Outside Air Temp: / Minimum Control Temperature: / Maximum Control Temperature: - These settings are used to locate the ends of the reset ramp.
Reset Ratio: - This is the number of degrees the setpoint will change for each degree of OSA temperature change. The available range is 0.05 to 12.75.
Unoccupied Offset: - This is the number of degrees that the calculated setpoint will be reduced when Unoccupied.

<u>Misc...</u> This screen allows for configuration of some items that only apply to a few Equipment Schedules. See the **VariZone®** and Variable Air Volume Systems Chapter for details on Client and Server Configuration. To modify Miscellaneous Capabilities, select the Misc button from the Zone Configuration screen.



<u>Miscellaneous Capabilities Screen</u>

<u>Lead/Lag Pump Settings</u>

Alternate Lead Lag Pumps: For equipment types that use two loop pumps, checking this option tells Energy Zone to alternate the use of the pumps on a regular basis.

Lead/Lag Alternating Freq.: The number of hours a lead/lag pump should run before switching to the alternate pump. This can be any number from 0-65,535.

<u>VariZone® and VAV Client Settings</u>

Server Trunk: Addr: Zone: The trunk number,address, and Zone of this Zone's Server. If the Set Server function was used, the System will automatically apply the correct address for the selected Server.

Percent of Unit Load:

VariZone® - Percent of Unit Load is the label displayed for this entry when the Zone is a **VariZone®** client. This is the percentage of the **VariZone®** Server's load that this Zone represents. If a **VariZone®** Server had five clients, each with approximately the same square footage, a good starting point would be to set each client's percentage at 20. If the Set Server function was used, the System will automatically apply an equal percentage to all client zones selected. For example, if there are 10 Clients assigned to a given Server then each Client will have an entry of 10.

Load Gain:

VAV - Load Gain is the label displayed for this entry when the Zone is a VAV client. This is the percentage of this Zone's load that should be taken into account when determining the mode of the Server. The default for all Client Zones is 100 (or 100%). This number can be anything from 0 (load ignored) to 255. If the Set Server function was used, the System will automatically apply a value of 100 to all client zones selected.

High Priority Zone for: Checking these boxes will allow this individual Zone to place the server in **Unoccupied** heating or cooling, initiate setback **Recovery**, or **Override** time-of-day to the Occupied mode.

VariZone® and VAV Server Settings

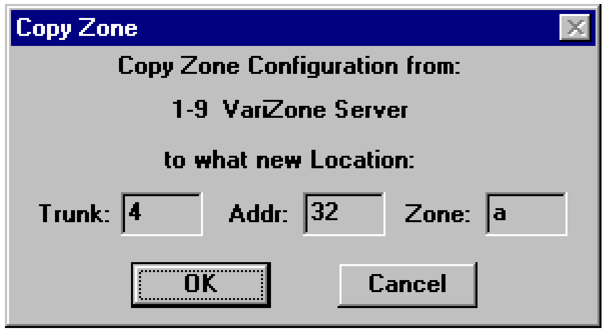
Type of Server: Check the appropriate button.

Percentage needed for Unoccupied Control/Recovery to begin/Unoccupied override: The percentage of all client Zones required to be calling for the selected mode prior to actuation. An entry of 0 will allow any single Zone to initiate the selected mode.

Enforce outside air cutoff temperatures - This option is available for any Zone that is configured as Can be Server in the Equipment Schedule Editor. It is not necessary for the Zone to be actually configured as a Server in the Zone configuration. If checked, the System will override calls for heating when OSA temperature is above the configured setpoint and override calls for cooling when OSA temperature is below the configured setpoint. The setpoints are configured under the System / Control Temperatures menu.

Ignore negative loads - This option is available for any Zone that is configured as Can be Server in the Equipment Schedule Editor. It is intended to be used only at those Zones that are VAV Servers. If checked, the System will ignore all negative Client loads (the Client is below setpoint) when determining the correct mode for the Server. This would generally be selected on VAV servers.

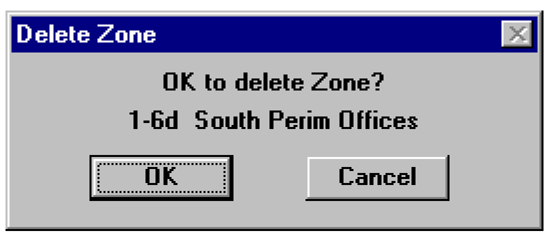
Copy Configuration from Existing Zone - To copy the complete configuration from an existing Zone, first select the desired Zone to copy from in the main window list box. Then select Zone and then Copy... from the primary menu. This will bring up the Copy Zone dialog box.



Copy Zone Entry Screen

Trunk:/Address:/Zone: Enter the Trunk (1-8), Address (1-32), and Zone (a-d) and the System will copy all Zone Configuration information to the new address.

Delete Existing Zone - To delete an existing Zone, first select the Zone in the main window list box. Then select Zone and then Delete... from the primary menu. The System will ask for confirmation to delete the Zone.



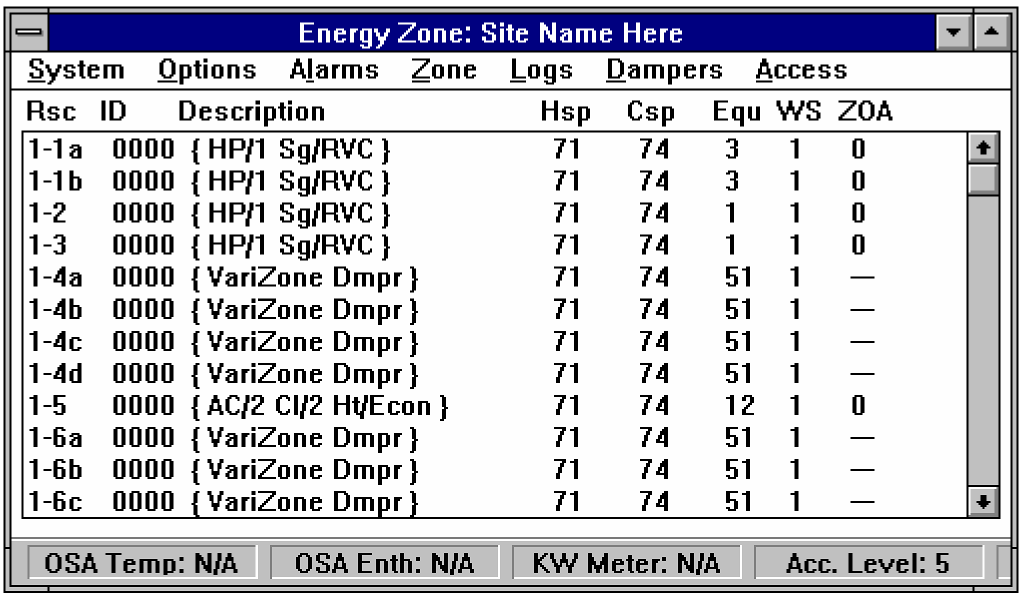
Delete Zone Screen

Select OK and the System will delete that Zone from the System configuration.

Auto-Configuration

When the Command Center establishes communication with an RSC, it first looks for a configuration file for that address. If a file is not found, then a configuration file is created using the System default settings. The defaults used are found in the \EZ\DATA\DEFAULTS directory. The System defaults can be changed or customized by the User. If the System defaults are satisfactory for System operation then the following actions are all that are required:

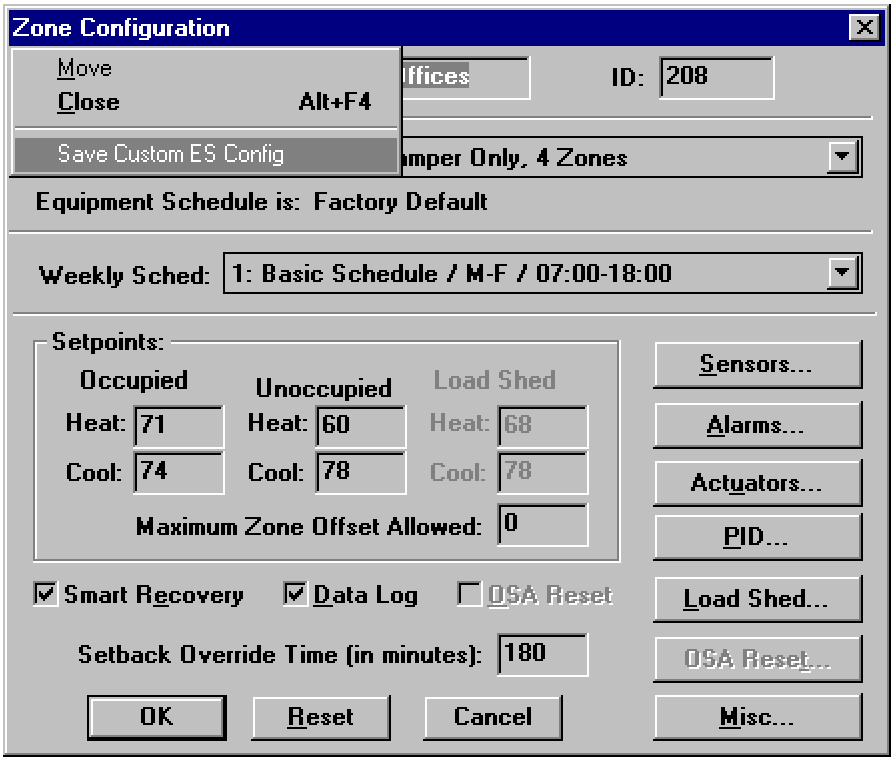
1. Enter a unique name for the description of each Zone under the Zone - Configure menu item.
2. Enter the location of the outside air sensor under the System / Site Configure... / Outside Air RSC ... menu item.
3. Enter a Site Name under the System / Site Configure... / General Settings... menu item.
4. For VAV or VariZone Systems, use the Set Server option under Zone (described earlier in this Chapter) or enter the RSC address for the server at each client Zone and select the Server checkbox under the Zone / Configure - Misc ... menu item.



<u>Main List Box Following Auto-Configuration</u>

Changing Zone Configuration Defaults

The System default settings for any Equipment Schedule can be easily changed. First enter the Zone configuration screen for any Zone using that ES. Make any changes desired. Then select the Control Menu of the Zone Configuration screen (upper left-hand corner). Select Save Custom ES Config. All future configurations of new Zones using that ES will now use the Custom default settings.



Zone Configuration Screen

Chapter 9

Alarm and Control Functions

Overview

Energy Zone® has the capacity for 16 individually programmed Alarm or Control Functions at each Zone in addition to 64 Global Alarms, for a System total of 16,448. Alarms and Control Functions are functionally identical except for their display in the Main List box. Alarms are intended to be used for abnormal or emergency conditions. Control Functions can be used to perform basic Control Functions not requiring an Equipment Schedule. An Alarm or Control Function will override any other Equipment Schedule or Miscellaneous Equipment function attempting to set the state of an output.

Features

- 16 Zone Alarms
- 32 Master Alarms
- 64 Global Alarms
- Callout to Digital Pager
- Callout to Fax Machine

Specifications

Alarm vs Control Function - Alarms and Control Functions are configured identically using the same dialog box. A radio button in the Alarm Configuration dialog box is used to select between Alarm and Control Function. Both are treated identically by the System, except for the following:

- Alarms will change the Icon in the Main List box when any Alarm condition is active at that Zone. Control Functions have no effect on the Icon.
- Alarms will be listed in the Active Alarms screen when active.
- Control Functions will be listed in the Active Control Functions when active.

Note: Any time the term Alarm is used in this chapter, it is intended to mean both Alarm and Control Function.

Alarm Configuration - Each Alarm can be dependent on the following conditions:

- Time of Day Mode
- Point to be Monitored
- Value of the Point
- Length of Time Condition Exists Prior to Alarm

Alarm Output - Once all of these conditions have been met, any combination of the following actions can be taken:

- Display to the Screen
- Send to Printer
- Log to Hard Disk
- Callout to Digital Pager
- Callout to Fax Machine
- Perform Specific Action on an Output

Master Alarms - 32 Master Alarms are available. Master Alarms can both be activated and monitored by any Zone in the System. Each time an Alarm activates which has been configured to output to a Master Alarm, that Master Alarms value will increment by one. When that particular Alarm condition clears, the Master Alarm will decrement by one. The default value of each Master Alarm is 0. Master Alarms can be any value from 0-255.

Global Alarms - 64 Global Alarms are available. Global Alarms are not associated with any particular Zone. Global Alarms are identical to Zone Alarms, except that they are limited as to the inputs that can be monitored. The inputs that can be monitored include Master Alarms, OSA Temperature, OSA Enthalpy, and Building KW.

Alarm Log - All alarms selected for Log to Disk will be saved in the Alarm Log file. These are text based files and can be viewed by any standard text editor. The Windows Notepad application is automatically launched when the User selects a file for viewing.

Automatic Deletion - The System organizes the Alarm Logs by calendar month. The Alarm Logs for the current and the previous month are always available. The Alarm Logs for prior months are automatically deleted at the beginning of a new month. For example, the month of February will be available until midnight on the last day of the following month, March 31. March Alarm Logs will be deleted automatically at midnight on April 30. The User may copy the Alarm Logs prior to the automatic deletion time for long term storage if desired.

Note: The System will not begin to monitor for alarm conditions until 60 seconds has passed following initial System start-up. This will prevent nuisance alarms while the System is initializing and equipment is starting up.

Master and Global Alarms

Master Alarms

Master Alarms are actually a counter with a value from 0-255 and represent the number of times that the particular Master Alarm has been turned on by multiple Alarm conditions. Master Alarms can be used as both a Test Point for the input and as an output in Specific Actions. The System has the capability for 32 Master Alarms. The Master Alarms can be acted on by any Zone as a Specific Action, and monitored by any Zone as a Test Point.

An example for use of Master Alarms is as follows:
1. A building has a total of 200 Control Zones. If the temperature falls below 50° F in only a few Zones, this is not important enough for immediate action. If more than 5 Zones fall below 50° F, an immediate response from Maintenance is necessary.
2. At each RSC, an Alarm is programmed to monitor AI1 (Space Temperature). The Alarm will take affect anytime the Space Temperature in that Zone falls below 50° F.
3. The Specific Action which occurs during this Alarm condition is MA1 ON.
4. Each time another Zone falls below 50° F, the Value of MA1 is increased by 1. When 6 Zones are below 50° F, MA1 is equal to a Value of 6.
5. At one RSC in the System, MA1 is monitored as a Test Point with a Test Value of > 5. The Alarm Action to be taken for this Alarm would be to call a Digital Pager.
6. When more than 5 Zones fall below 50° F, a call is placed to the Pager of an on-call Maintenance person who will respond to the Alarm condition.

Global Alarms

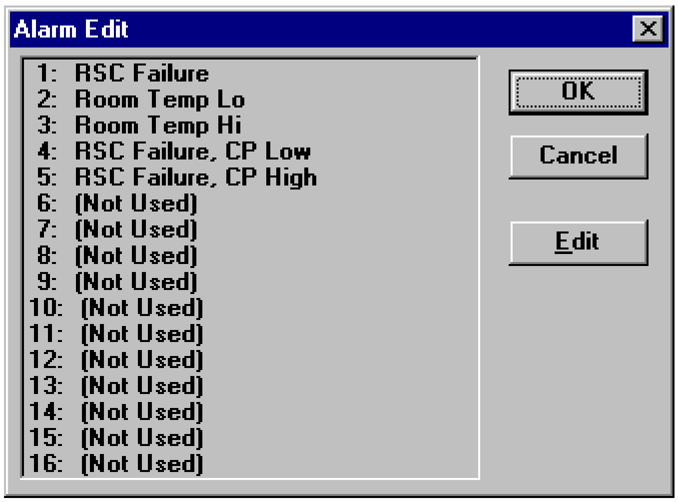
Global Alarms are intended to be used for initiating actions that have an impact on more than one Zone. Although any Zone can be used to initiate the same action, it is often difficult to follow the logic of a System-wide alarm that is initiated from a single Zone. Using Global Alarms to serve this function will simplify future maintenance of the System.

An example for use of Global Alarms is as follows:
1. As in the previous example, a Master Alarm is activated whenever any Zone falls below 50° F.
2. A Global Alarm is configured to place a call to the Pager of an on-call Maintenance person whenever the Master Alarm value exceeds 5.

Alarm/Control Function Configuration Screen

The Alarm Configuration Screen is accessible from the Zone Configuration screen. All options for configuration of both inputs and outputs for a given Alarm or Control Function are programmed from this screen. First select the Zone for which the Alarms are to be configured, and then select Configure.. and Alarms...

Next select the Alarm to be configured. All 16 possible Alarms are displayed including existing configured alarms and those Alarms that are (Unused).

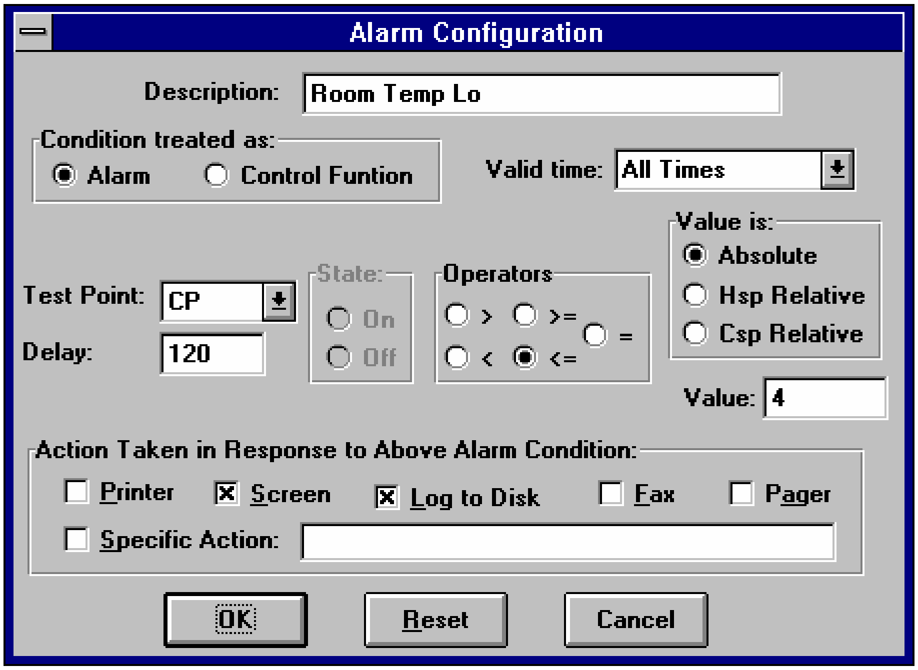


Alarm Edit Selection Screen

Note: The alarms are evaluated in the order in which they appear in the alarm list. The alarm listed at the first position in the Alarm Edit box will be evaluated prior to the Alarm at position 16. The last Alarm to be evaluated will take precedence over any prior alarms. If more than one condition will be configured to act upon an output, place the highest priority alarm at the higher number.

Note: Configuration of an Alarm requires the User to be at Access Level 3.

All conditions for this particular Alarm are programmed from this screen.



Alarm Configuration Screen

General Configuration

Description: - This is the description of the function and is also used as the message for all outputs. If this description is left blank, the Alarm is considered unused. To delete an existing Alarm or Control Function, Edit the Alarm and delete the Description.

Condition treated as: - Determines how the function is to be treated, as either an Alarm or a Control Function.

1. Alarms - If Alarm is selected and all of the conditions are met, the icon in the main list box will appear as a Fireman's Hat. In addition, the Alarm will be listed in the Active Alarms list box.
2. Control Function - If Control Function is selected and all of the conditions are met, the Control Function will be listed in the Active Control Functions list box. The icon in the main list box will not change.

Valid time: - Determines the correct time of day mode to be used when monitoring for the programmed setpoint. The valid modes are All Times, Occupied, Unoccupied, Warmup, and Load Shed.

Input Configuration

Test Point: - This will define the point to be monitored. The possible valid entries are:

Point	Description	Type
CP	Primary Zone Control Point	Analog
AI1-8	Analog Input 1 thru 8	Analog
DI1-8	Digital Input 1 thru 8	Digital
MA1-32	Master Alarm 1 thru 32	Analog
OFL	Communication Status (If the Zone is Offline, then OFL is On)	Digital
OSA	Outside Air Temperature	Analog
OSE	Outside Air Enthalpy	Analog
KW1-8	Building KW Meter 1 thru 8	Analog
DO1-8	Digital Output 1 thru 8	Digital
AO1-4	Analog Output 1 thru 4	Analog

Delay: - The length of time, in seconds, that the Test Point must equal or exceed the Value or State before the function actions are taken.

State: - If the Test Point is Digital, then the State can be selected. The State can be either On or Off.

Operators - If the Test Point is Analog, the Operator can be <, >, =, <=, or >=.

Value: - This Value is to be entered as a number scaled to the same range as the Test Point. Example: If the Test Point is AI1, and it is being used as a Wall Sensor scaled from 32-96° F, then the value must be a number from 32-96.

Value is: - One of the following options must be selected:

1. Absolute - This is used for absolute Test Values.
2. Hsp Relative - The Test Value will be relative to the Heating Setpoint. The Heating Setpoint used is based on the Valid Time selected. If All Times is selected, then the Test Value will be based on the present Time of Day Mode. The Test Value will always be below the Heating Setpoint by the amount entered in the Value box. Example: If the Heating Setpoint is 72° F, the Test Point is AI1, the Operator is <=, and the value is 4, then the Alarm will occur anytime the Room Temperature is <= 68° F.
3. Csp Relative - The Test Value will be relative to the Cooling Setpoint. The Cooling Setpoint used is based on the Valid Time selected. If All Times is selected, then the Test Value will be based on the present Time of Day Mode. The Test Value will always be above the Cooling Setpoint by the amount entered in the Value box. Example: If the Cooling Setpoint is 74° F, the Test Point is AI1, the Operator is >=, and the value is 4, then the Alarm will occur anytime the Room Temperature is >= 78° F.

Output Configuration

Whenever all conditions programmed for an Alarm or Control Function are met, any of the following actions can be programmed to be performed.

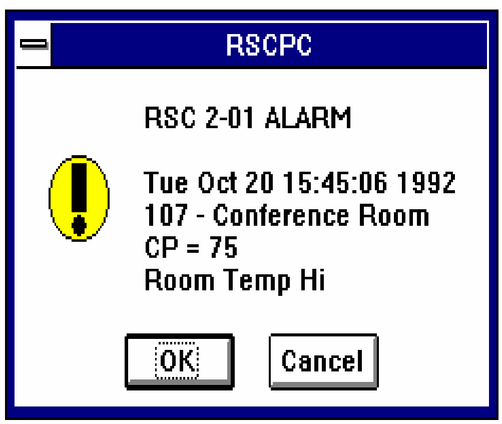
Main List Box - Any Alarm condition will change the icon for that Zone in the Main List Box to a Fireman's Hat. Active Control Functions will not change the icon.

Main List Box Alarm Icon

Printer, Screen, or Log to Disk - Any function programmed for output to the Printer, Screen, or Log to Disk will display the following information: Address of RSC; Day, Date, and Time of Alarm; Room #, Room Description; Point causing alarm and its actual value at the time of alarm; and the User programmed message.

RSC 2-01	Thu Oct 01 14:32:06	107	Conference Room
	Space Temp = 79		Room Temp Hi

Printer or Disk Log Alarm Message



Alarm Screen Message

Pager - Any Alarm configured for Pager will send a four digit number to a digital pager. The number sent to the Pager is the number configured as HostNum under the Options...Settings... menu. The HostNum will be sent to the first Pager phone number found in the Phone Book.

Fax - Any Alarm configured for Fax output will send the following information to a remote fax machine: Address of RSC; Day, Date, and Time of Alarm; Room #, Room Description; Point causing alarm and its actual value at the time of alarm; the User programmed message; a snapshot of the Troubleshooting Screen showing the values of all RSC Inputs and Outputs; and a snapshot of the Zone Status screen.
The Fax message will be sent to the first Fax phone number found in the Phone Book.

Energy Zone Alarm From:
4 + 4 Office Complex

RSC 1-01 Room: Mech
Mechanical Room
Loop Flow Switch = Off
Loop Pump Failed!
Sun Mar 22 11:32:08 1992

Zone Snapshot

Bldg Supply Temp	83.5F	Blr 3-Way Valve	29%
Bldg Return Temp	83.5F	AO2	LO
OSA Temp	64.0F	AO3	LO
CT Inlet Temp	83.5F	AO4	LO
CT Outlet Temp	82.0F	AO5	LO
Blr Inlet Temp	83.0F	AO6	LO
Blr Outlet Temp	83.5F		
AI8	LO		
Setback O/R	OFF	Loop Pump #1	ON
Loop Flow Switch	OFF	Loop Pump #2	OFF
3 Ph Pwr Monitor	ON	Boiler Enable	OFF
DI4	OFF	CT Stage #1	OFF
DI5	OFF	CT Stage #2	OFF
DI6	OFF	CT Stage #3	OFF
DI7	OFF	CT Stage #4	OFF
DI8	OFF	DO8	OFF

Cycle Time: 20:00	Prop: 0	PID Stage: At Set
Cycle Timer: 20:00	Int: 0	Curr Stage: At Set
Stage Time: 20:00	Diff: 0	State: Occ 1
Stage Timer: 20:00	Load: 0	Temp: 83.5F

Faxed Alarm

Specific Action - A Specific Action may be programmed to occur at the RSC that originated the Alarm, or any other RSC in the System. The correct format to be used for entry of a Specific Action is *Trunk-Address Control Point Action*.

Trunk-Address - The Trunk-Address may be omitted if the action is to be taken at the same address as the RSC that originated the Alarm. An Alarm Specific Action will take priority over any other function in the System that attempts to change an Output. If more than one RSC is attempting to override the same output, the RSC with the highest Trunk-Address number will have priority.

Specific Actions can be directed to the physical RSC outputs and address or the Zone logical outputs and address. Example: If an RSC is used for a dual Equipment Schedule, then the physical outputs DO1-8 are setup as logical outputs DO1-4 on Zone A and DO1-4 on Zone B. In order to turn ON DO2 at Zone 1-1B, the Specific Action could be configured as either "1-1 DO6 ON" or "1-1B DO2 ON".

RSC 1-1 Physical Output	Zone 1-1a Logical Output	Zone 1-1b Logical Output
DO1	DO1	N/A
DO2	DO2	N/A
DO3	DO3	N/A
DO4	DO4	N/A
DO5	N/A	DO1
DO6	N/A	DO2
DO7	N/A	DO3
DO8	N/A	DO4

Control Point

DO1-8	Digital Output 1 thru 8
AO1-6	Analog Output 1 thru 6
MA1-32	Master Alarm 1 thru 32
ALTPUMP	Starts the non-running pump if configured for lead/lag pump operation. Do not follow with an Action (ON or OFF) when configuring.
SBOVR	Overrides the Unoccupied Mode. Same as pressing the override button on the Zone wall sensor. The valid time must be set for Unoccupied for this action to work properly. Do not follow with an Action (ON or OFF) when configuring.
BLDGOVR	Performs an All Zones override to the Occupied Mode for the number of hours specified. Entered as BLDGOVR XXX where XXX is the number of hours of override desired from 1-999. Override begins at time of alarm occurance.
INIT	Initializes the Zone. The PID recalculates, all actuators re-initialize, and all alarms reset. This is the same as taking the RSC off-line for more than 3 minutes and then returning on-line. Do not follow with an Action (ON or OFF) when configuring. The delay time must be at least 30 seconds to allow for proper initialization before beginning a new initialization. If a time less than 30 seconds is entered, then 30 seconds will be used.
SHUTDOWN	Places the selected Zone in an inactive state. SHUTDOWN deactivates all digital outputs, control functions, and alarm functions. The only exceptions are any alarm conditions initiated by either a Master Alarm (MA1-32), Outside Air Temperature (OSA), or Outside Air Enthalpy (OSE). The Zone will only return to normal when the condition that has activated the SHUTDOWN is cleared. Do not follow with an Action (ON or OFF) when configuring.

Action

ON	Turns Output ON
OFF	Turns Output OFF
Value	A number in % from 0-100. Sets Analog Output to desired % full open.
Rate	A number in %/minute from+/- 0-100. Sets Analog Output to new relatine position.

Rate - This specific action can be configured for AO's that allows for a rate of change to be controlled, rather than just a fixed position. This rate of change will override any PID calculated changes. This change will occur once a minute as long as the alarm or control function is active. For example, AO1 -5 will reduce the position of AO1 by 5% per minute until the control function or alarm is cleared.

Example #1: Alarm at same Zone as origination of Alarm. This action will turn DO2 OFF anytime all Alarm conditions are met.

Specific Action: `DO2 OFF`

Example #2: Alarm taking an Action at a different Zone than the Zone originating the Alarm. This action will turn DO4 ON at Zone 1-5 anytime all Alarm conditions are met. Zone 1-5 is a single Zone Equipment Schedule.

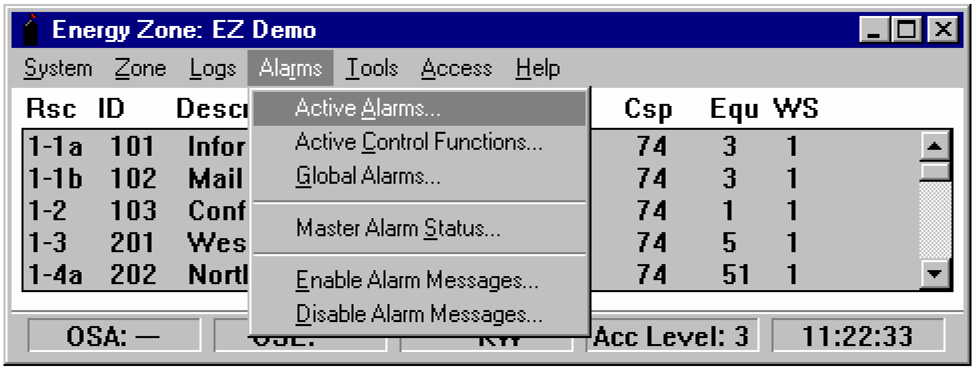
Specific Action: `1-5 DO4 ON`

Example #3: Alarm taking an Action at a different Zone than theZone originating the Alarm. The Zone to which the Action is directed uses a dual Zone Equipment Schedule. This action will turn DO4 ON at 8-23b anytime all Alarm conditions are met.

Specific Action: `8-23 DO8 ON`
OR
Specific Action: `8-23B DO4 ON`

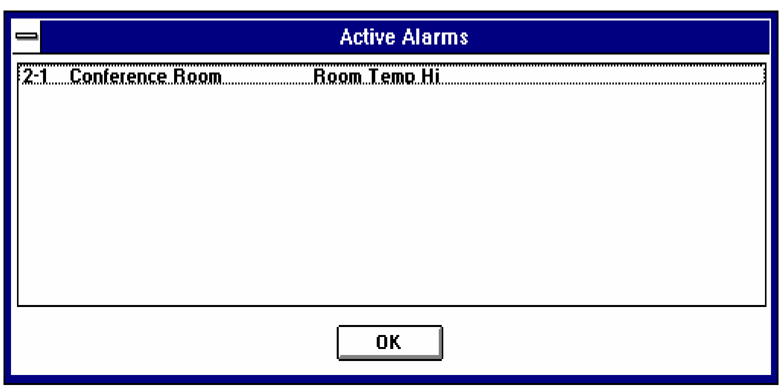
Alarms Menu - Main List Box

Note: Active Alarms, Active Control Functions, and Master Alarm Status are all Access Level 1 functions. Alarm Log viewing is available from the Logs menu and is also a Level 1 function. Global Alarms, Enable Alarms, and Disable Alarms are only available to Access Level 3.



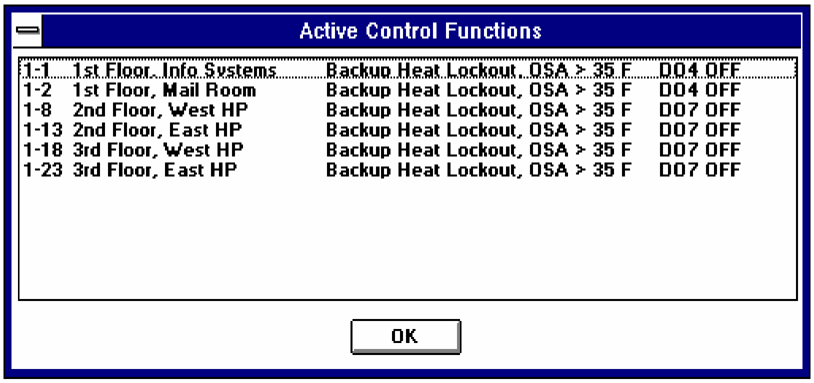
Alarms Menu

Active Alarms... - Active Alarms will Display a list box with a message for all Alarm conditions that are currently active. For each Alarm, the list box will display the Address, Zone Description, and Alarm Message, and if a Specific Action is used the output and state is displayed. If Access Level is at 3 or higher, double-clicking on any displayed Alarm will call up the Alarm Configuration screen for that Alarm. The Alarm can then be changed and saved if desired.



Active Alarm Screen

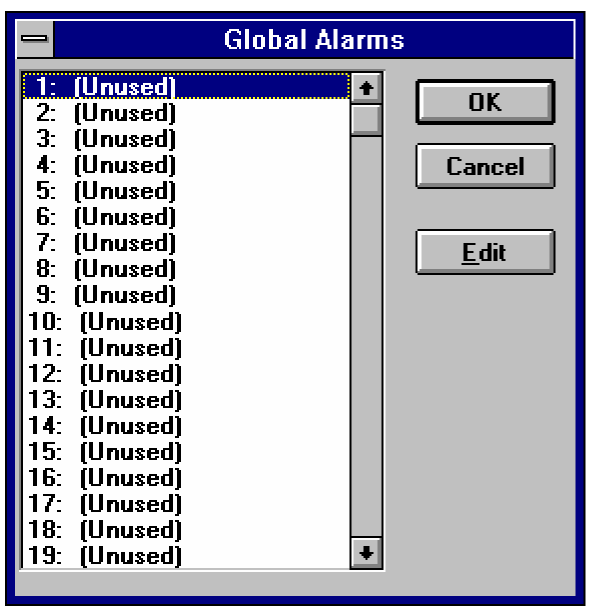
Active Control Functions... - Active Control Functions will Display a list box with a message for all Control Function conditions that are currently active. For each Control Function, the list box will display the Address, Zone Description, Control Function Message, and if a Specific Action is used the output and state is displayed. If Access Level is at 3 or higher, double-clicking on any displayed Control Function will call up the Control Function Configuration screen for that Function. The Control Function can then be changed and saved if desired.



Active Control Functions Screen

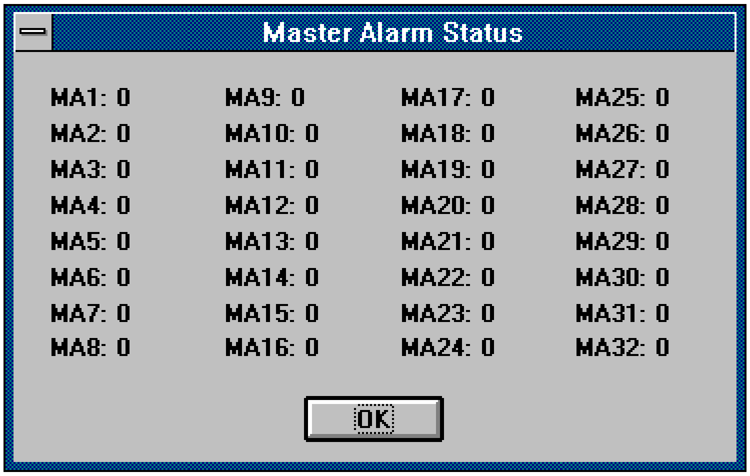
Note: Neither the Active Alarms or the Active Control Functions screen will update dynamically. In order to see changes in status, the screen must be closed and then re-opened.

Global Alarms... - Global Alarms will allow the User to select any one of 64 Global Alarms for configuration or editing. Selecting an alarm will bring up the standard Alarm Configuration screen.



Global Alarm Edit Selection Screen

Master Alarm Status... - Selecting this option will display the status of all System Master Alarms. The status will update dynamically as the status of any Master Alarm changes.



Master Alarm Status Screen

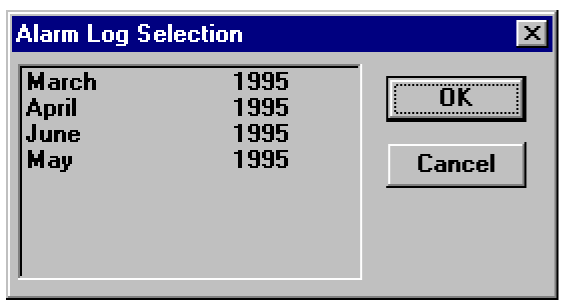
Enable Alarm Messages... - The Enable option allows Alarm conditions and Control Functions to be enabled following a lockout from the Disable option. Selecting Enable will display a dialog box. The User can either choose Selected which will only Enable Alarms or Control Functions on those Zones selected in the Main List box, or All which will Enable All System Alarms or Control Functions.

Enable Alarms Screen

Disable Alarm Messages... - The Disable option allows Alarm conditions and Control Functions to be disabled. This feature is useful during startup, maintenance, or known abnormal conditions. Any Zones that have their Alarms disabled will disable all output actions for any Alarm or Control Functions, except Specific Actions. The outputs to Printer, Pager, Fax, Screen, and Log to Disk are all locked out. The lockout can be manually removed or will be automatically removed after 60 minutes. The Alarms and Control Functions will still be listed in the Active Alarm or Active Control Function list boxes. Any active Alarms will display the Fireman's Hat icon in the Main List box. Selecting Disable will display a dialog box. The User can either choose Selected which will only disable Alarms or Control Functions on those Zones selected in the Main List box, or All which will disable all System Alarms and Control Functions.

Disable Alarms Screen

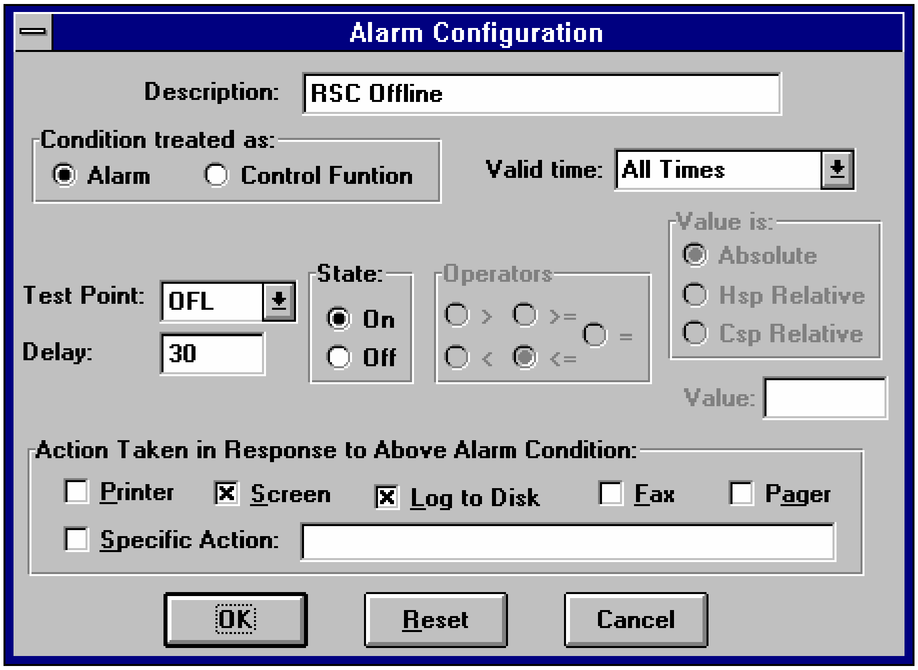
Alarm Logs... - Selecting this option from the Logs menu will display a list box containing all Alarm Logs in the Data Directory. The Alarm Logs are listed by month and year. Selecting any log will start the EZ Editor and load the appropriate Alarm text file.



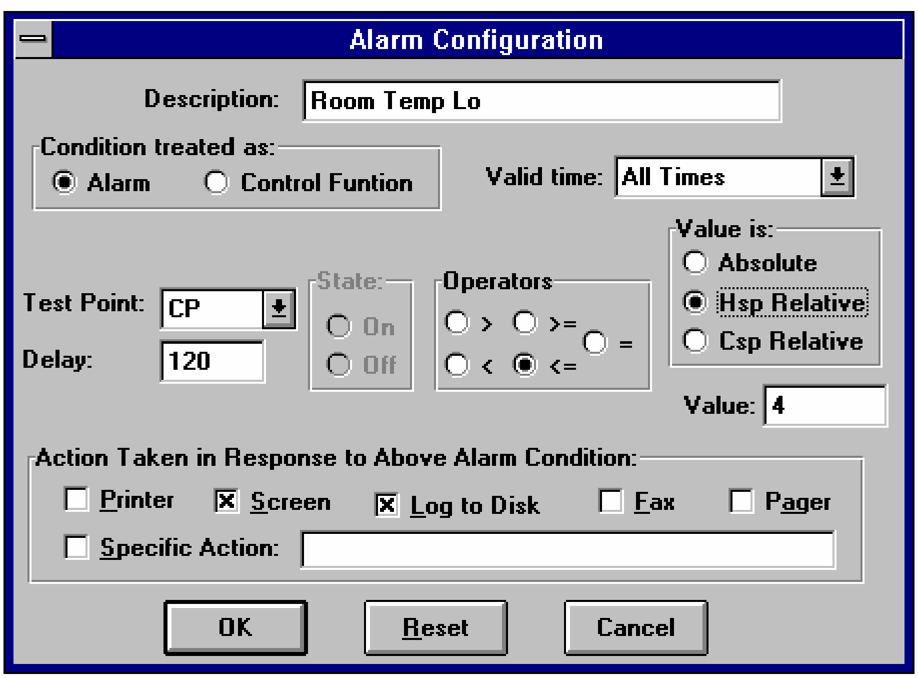
Alarm Log Selection Screen

Some Practical Examples

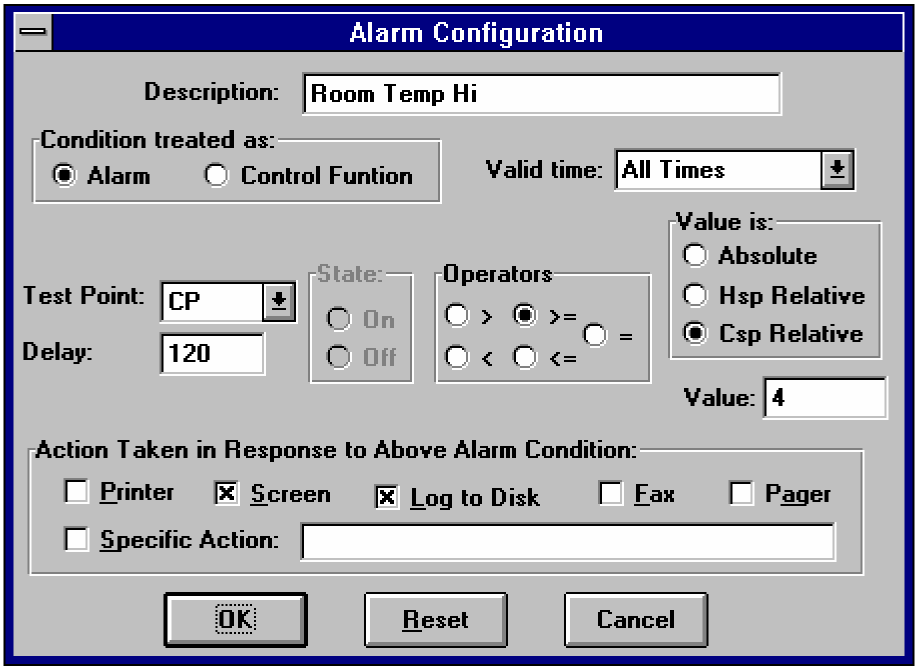
In this first example, we simply want a message printed to the Screen and Logged to the Hard Disk anytime the RSC is considered Off-line by the Command Center for more than 30 seconds.



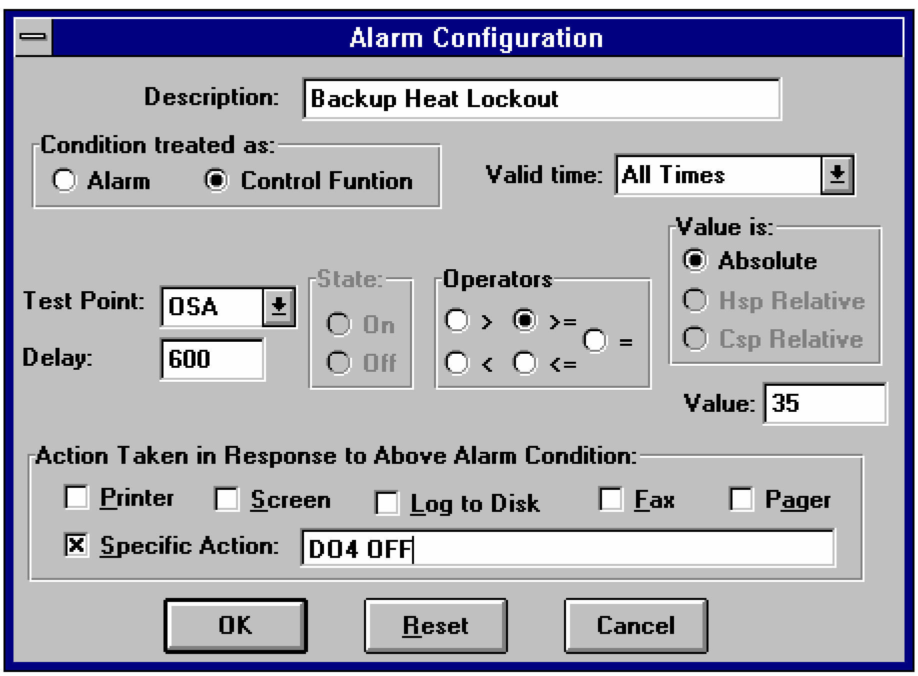
The next example is used for Alarm indication of Low Room Temperature.



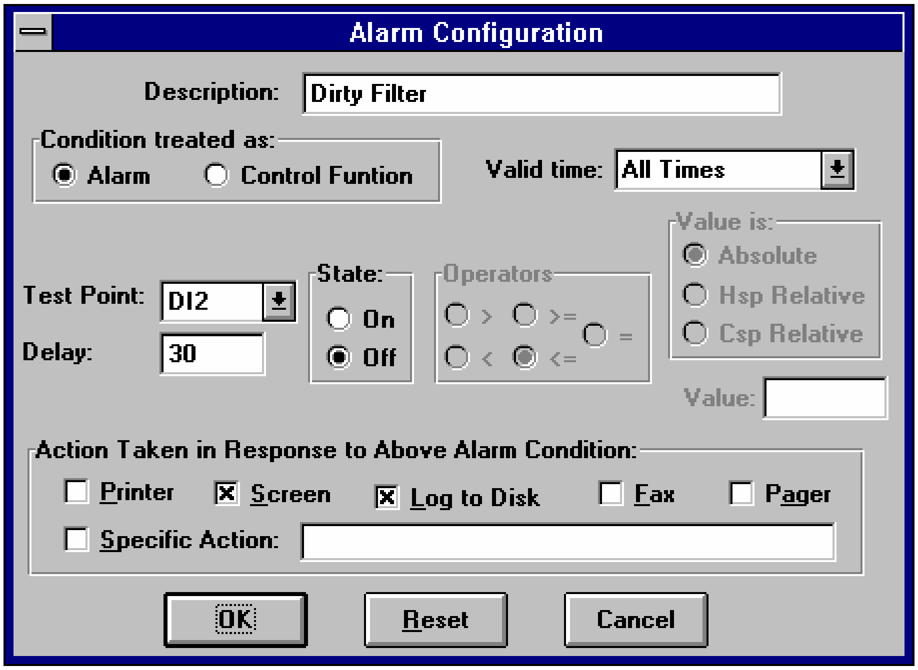
The next example is used for Alarm indication of High Room Temperature.



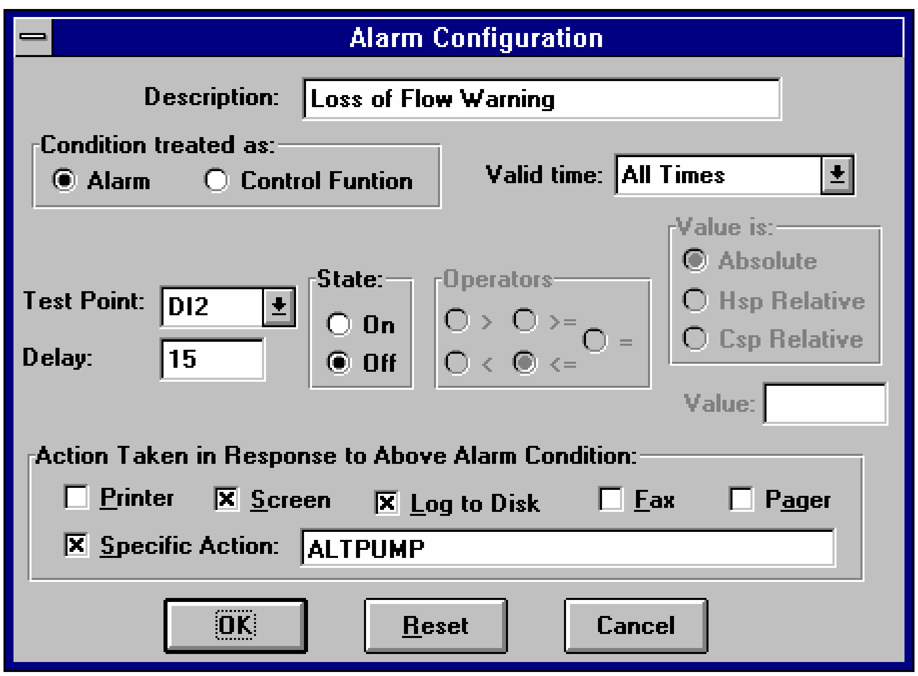
This Control Function is used to lock-out the backup strip heat on a heat pump when the outside air temperature is above the balance point of the unit.



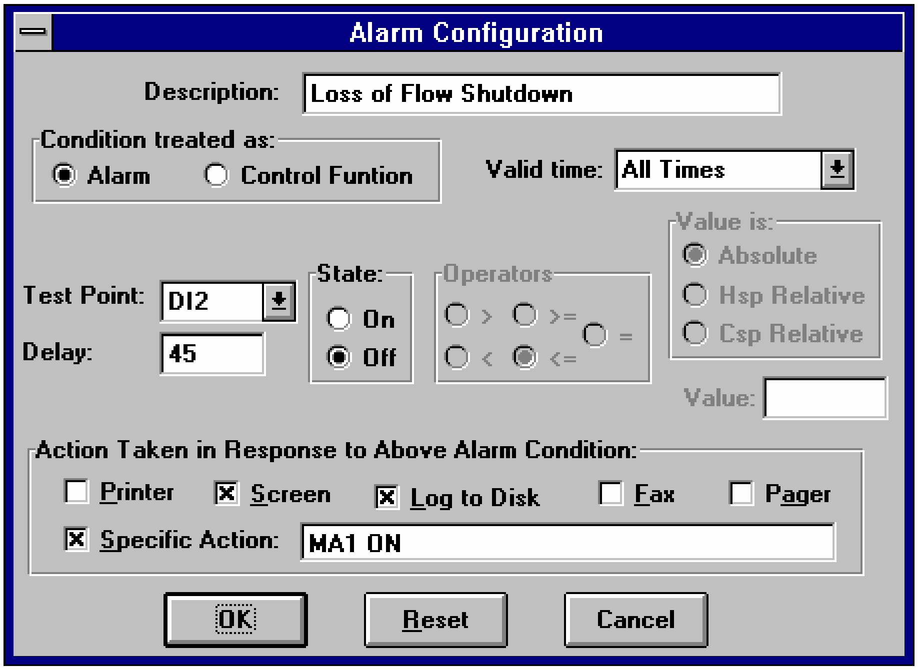
In this example, a differential pressure switch is installed across the unit filter and a wire is routed from the normally closed contacts to DI2. This Alarm is used to indicate a dirty filter.



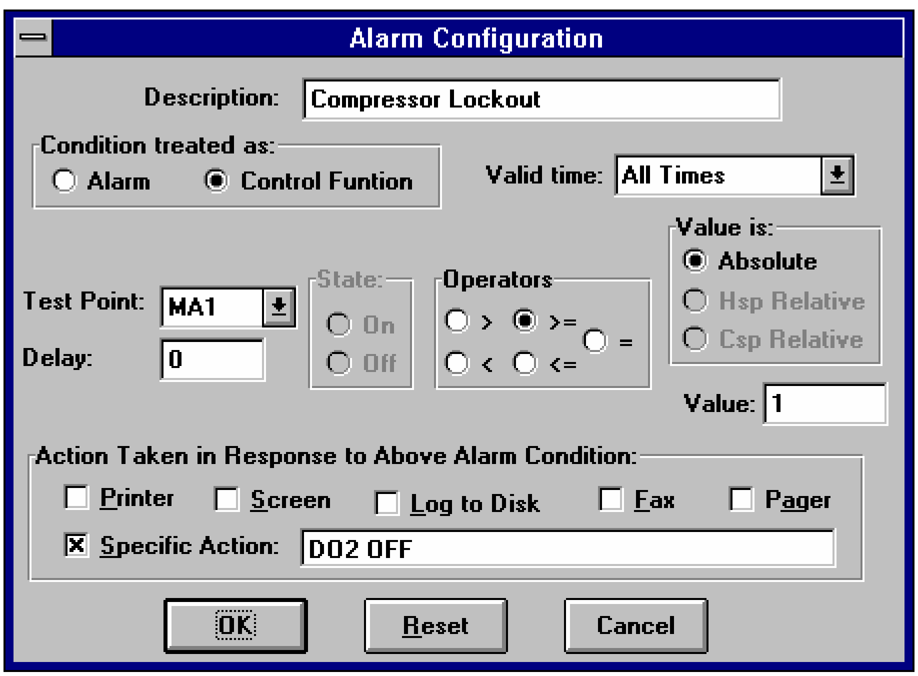
In this example, we are monitoring water flow with a flow paddle switch wired to DI2 in a Hydronic Heat Pump System. This System has two pumps, a Lead and a Lag setup to alternate weekly. In the event of a loss of flow, we first want to start the Lag Pump.



The next alarm will activate a Master Alarm if the Lag Pump is unable to recover System water flow.



The next Alarm will lock out the compressor in a Hydronic Heat Pump following the complete loss of System water flow in the above example.



Chapter 10

Configuration Options

Overview

Several of the System setup options are preset within **Energy Zone®** (**EZ**). These can be customized by the User at each site. The only items that would normally changed at each site would be the Site Name, location of the Outside Air sensors, and User Passwords.

Features

- System Settings
- Outside Air Input Location
- VAV/ **VariZone®** Temperature Override Limits

Specifications

Communication Settings - All settings related to remote communications are discussed in the Remote Communication Chapter.

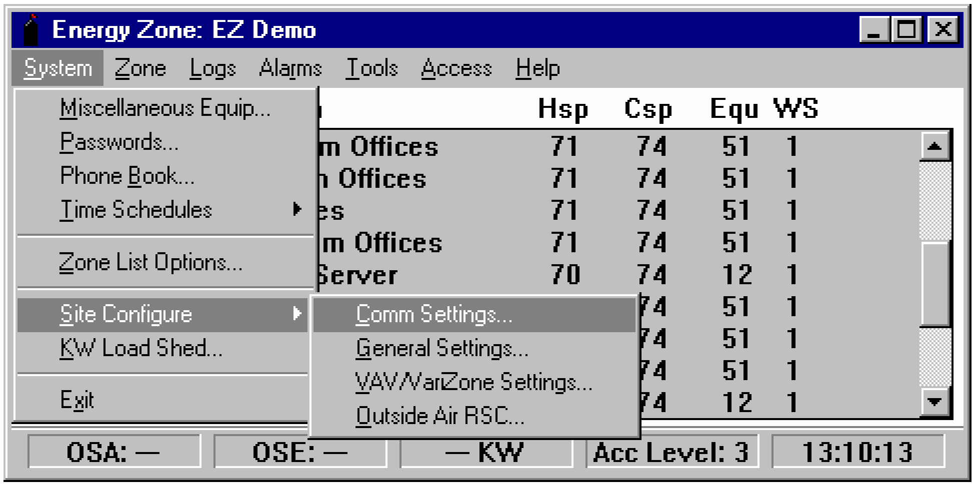
General Settings - This includes several System-wide settings such as Site name, temperature display mode, and screen update frequency.

Outside Air Sensor - The System requires one outside air temperature sensor to be installed. On those projects where **BAS** will be taking direct control of economizers, one outside air enthalpy must also be installed. The OSA sensor input location must be configured so that all Zones have access to the information.

VAV/ VariZone® Settings - These settings are System-wide and apply to Zones configured as either Clients or a Servers. BAS recommends use of factory defaults. The User may change these settings as desired.

Settings Menu

All System-wide settings are accessible from the System Menu.

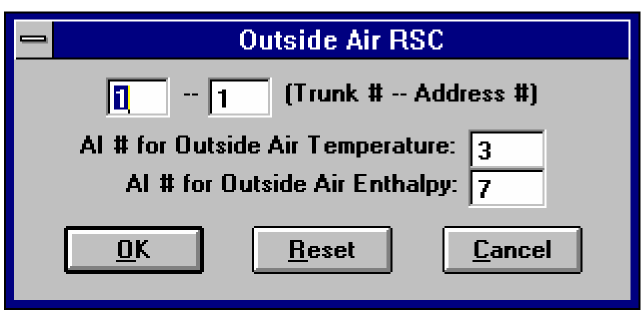


System Menu

Note: The User must be logged onto the System at Access Level 3 to edit General Settings.

Outside Air Input

The Outside Air RSC... is accessible from System / Site Configure... Menu.

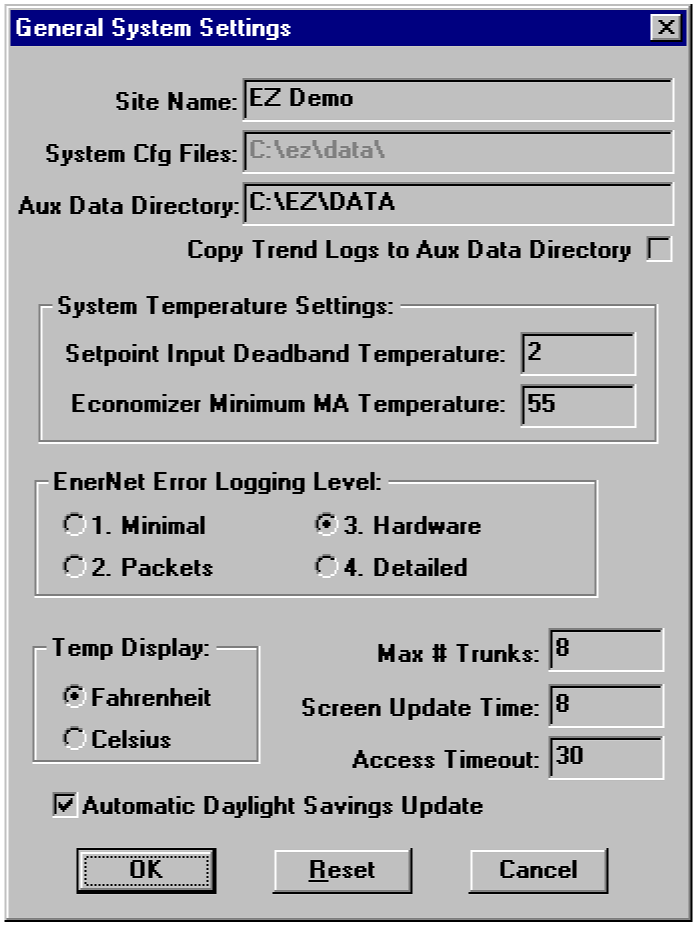


Outside Air RSC Screen

Note: Although any unused analog input location can be configured for OSA, it is recommended AI3 be used for OSA temperature and AI7 be used for OSA enthalpy. This will maintain consistency from project to project.

General Settings

The System General Settings Screen is accessible from the System / Site Configure... Menu.



Settings Screen

Site Name: - This is the name of the project and can be up to 36 characters in length.

System Cfg Files: - This is the location of all data files used by the System. This cannot be changed while the System is in operation and is displayed for information only.

Aux Data Directory: - This is an alternate data path for a copy of the Trend Log. When activated, the System will duplicate each Trend Log entry at this alternate location. This copy of the Trend Log will not be automatically deleted in the same manner as the standard Trend Log.

Copy Trend Logs to Aux Data Directory - This checkbox will activate the Trend Log copy option to the directory specified above.

Setpoint Input Deadband Temperature: - This sets the minimum allowed deadband to be applied when entering new heating and cooling setpoints.

Economizer Minimum MA Temperature: - This value is applied to all Zones with economizers directly modulated by the System.

EnerNet Error Logging Level - Determines the amount of detail to be logged to the Alarm Log as a result of trunk line communication errors. Four levels are available. See Chapter 6, EnerNet, for additional details. **BAS** recommends using the Minimal setting after completion of initial startup.

Temp Display: - The temperature display can be set for either Fahrenheit or Celsius.

Max # Trunks: - The maximum # of trunk lines to be connected to this Command Center. This will determine the amount of memory reserved by the System for Zone data and configuration files. The maximum number is 8. Enter the minimum number possible to conserve RAM.

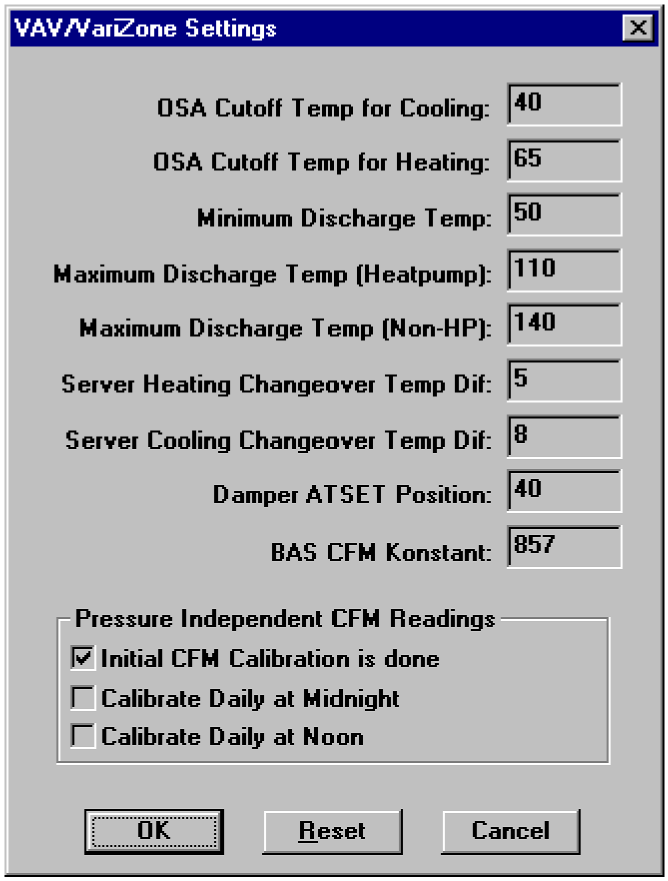
Screen Update Time: - The length of time between screen updates is configurable from 1-65 seconds. **BAS** recommends using 8 seconds.

Access Timeout: - The length of time the Systems will wait since the last keyboard or mouse entry before returning to Access Level 0. Configurable from 0-9999 minutes. **BAS** recommends using 30 minutes.

Automatic Daylight Savings Update - When checked, the System will automatically update the Command Center's clock for Daylight Savings and Standard time transitions. The clock will be moved ahead 1 hour the first Sunday in April and back 1 hour the last Sunday in October.

VAV/VariZone Settings

The VAV/VariZone Settings... are accessible from System / Site Configure... Menu.



VAV/VariZone Settings Screen

OSA Cutoff Temp for Cooling: - The temperature below which cooling loads are ignored by all System Servers for mechanical cooling. Economizer operation is still allowed. The 'Enforce outside air cutoff temperatures' must be checked in the Zone / Misc configuration.

OSA Cutoff Temp for Heating: - The temperature above which heating loads are ignored by the all System Servers for heating. The 'Enforce outside air cutoff temperatures' must be checked in the Zone / Misc configuration.

Minimum Discharge Temp: - The lowest discharge air temperature allowed, measured at AI4. If AI4 drops below this value, the System will continue to drop 1 cooling stage/minute until the limit is no longer exceeded.

Maximum Discharge Temp (Heatpump): - The highest discharge air temperature allowed on heat pumps, measured at AI4. If AI4 rises above this value, the System will continue to drop 1 heating stage/minute until the limit is no longer exceeded.

Maximum Discharge Temp (Non-HP): - The highest discharge air temperature allowed on non-heat pumps, measured at AI4. If AI4 rises above this value, the System will continue to drop 1 heating stage/minute until the limit is no longer exceeded.

Server Heating Changeover Temp Dif: - This temperature difference is between the Server discharge air temperature and the each Client's space temperature. The System requires that the difference exceeds this value before the Client considers the Server as a source of heat.

Server Cooling Changeover Temp Dif: - This temperature difference is between the Server discharge air temperature and the each Client's space temperature. The System requires that the difference exceeds this value before the Client considers the Server as a source of cooling.

Damper ATSET Position: - The damper position used by each Client if the Client is AtSet, but the Server is in either heating or cooling.

BAS CFM Konstant: - This is the constant used to convert input from a pressure transducer on a pressure independent VAV or **VariZone®** System. Configurable from 1-65535.

Initial CFM Calibration is done - Is this is not checked, then RSCPC performs a CFM calibration on start-up. After completion RSCPC will configure this checkbox to ON.

Calibration Daily at Midnight - This causes RSCPC to perform a calibration on all CFM readings each day at midnight.

Calibration Daily at Noon - This causes RSCPC to perform a calibration on all CFM readings each day at noon.

Part III

Hardware

1. Remote System Controller
2. Analog Input Devices
3. Analog Outputs
4. EnerNet®

Chapter 1

Remote System Controller

Overview

The microprocessor based Remote System Controller (RSC) can be programmed with control sequences for 128 different types of HVAC equipment, serving the needs of virtually all equipment found in use today. The RSC, when connected to Command Center with a 2 conductor trunk line, provides the basis for an extremely powerful and versatile Building Automation and Energy Management System.

Features

- 8 Analog Inputs
- 4 Analog Outputs
- 8 Digital Inputs
- 8 Digital Outputs
- Up to 4 HVAC Zones connected to a single RSC
- Communicates with the Command Center using reliable RS-485 communication network
- Dip switch selectable default mode allows operation without Command Center interface
- Advanced microprocessor control algorithms provide highly accurate temperature control
- Test plug allows connection of portable handheld terminal

Specifications

General Description - The RSC is a microprocessor based controller. The design of the RSC circuit board is based on the NEC 78C10 microcomputer. Each RSC has a total capacity of thirty I/O points including eight Digital Outputs, eight Digital Inputs, eight Analog Inputs, four Analog Outputs, and two remote LCD display modules. The Analog Outputs (AO) are controlled by the RSC but require the use of a separate AO board.

Memory Configurations - The RSC contains 256 bytes of on-board RAM. The operating instructions and default Equipment Schedules are provided in one of four possible configurations; 1) 32K EPROM (the most common configuration), 2) 128K EPROM, 3) 32K battery backed SRAM, and 4) 128K battery backed SRAM. Jumpers are used to configure the RSCs for the different memory configurations. These are set at the factory and will not need to be modified in the field.

Default Mode - Equipment Schedules are the control sequences for a given type of HVAC equipment. Equipment Schedules are stored on an EPROM that resides on the RSC. The default mode for all supported Equipment Schedules is programmed into the EPROM (or SRAM) shipped with every RSC. Positioning a dip switch on the RSC will determine which Equipment Schedule is used for RSC default control. The dip switch selectable default mode provides for sophisticated control algorithms without connection to a Command Center, allowing for rapid and trouble free initial building startup. This also ensures continuation of excellent temperature control even after loss of the System Command Center or a communication trunk failure.

Multiple Zone Control - One RSC can control up to 4 HVAC control zones. Each Equipment Schedule is divided into 1, 2, or 4 control Zones depending on the output requirements of the equipment being controlled. When using the Handheld Tester to troubleshoot the RSC, the Zones are identified as follows; 1) Zone A for a single Zone schedule, 2) Zone A and Zone C for a dual Zone schedule, and 3) Zone A, Zone B, Zone C, and Zone D for a quad Zone schedule.

RSC Address - Each RSC on a given trunk line must be assigned a unique address between 1-32. The address does not have to correspond to the physical location or position on the trunk line. One of the two dip switch banks on the RSC is used to set the address.

Communication -Two communication interfaces are available at each RSC. Communication between each RSC and the Command Center follows the RS-485 specification. Up to 32 RSCs can be placed on each of eight trunk lines. Communication is on a standard 2-conductor, 18 AWG, twisted shielded pair (tsp), with all RSCs on a trunk line wired in parallel. Maximum length of the trunk line is 5000'. The trunk line is protected from voltage spikes at each RSC by surge suppressers. Automatic resetting solid state fuses prevent damage to the surge suppressers by sustained faults.

An RS-232 interface is also available at each RSC and is the communication standard used to communicate with the Handheld Tester (HTD). The HTD can be plugged directly into the RSC or into an external RJ-11 jack up to 250’ from the RSC. The presence of the HTD is sensed by the RSC, which will then automatically enter HTD troubleshooting mode.

Externally Provided Power Supply - The RSC requires 10 VA @ 24 Vac from a NEC Class 2 UL Listed transformer. When power reaches the RSC it is first passed through a pair of automatic resetting solid state fuses and an isolation transformer. This combination provides the RSC with almost complete immunity to fluctuations and noise in the 24 VAC power supply. It also protects vital components against faults that could affect RSC operation and reliability.

The power supply must be able to maintain a minimum of 20 Vac under all load conditions. If a Digital Output is switching a large inductive load, such as the coil of a large contactor, the supply voltage is very important. The triac will begin to malfunction if trying to switch an inductive load with a pull-in current of 1 A or more and a supply voltage of 18 Vac or less.

Internally Generated Power Supplies - All DC voltages necessary for system operation are generated by two onboard regulated power supplies, 18 VDC for external components and 5 VDC for onboard digital logic circuits.

Status LEDs - Several status LEDs are provided on the RSC. Most common problems can be isolated by simply checking the status of these LEDs. A Heartbeat LED monitor is located on the RSC and will indicate the operational status and mode of the RSC. Two LEDs indicate the status of communication, one for incoming and one for outgoing transmissions. Eight additional LEDs are provided, one at each Digital Output, to indicate the commanded state of the output.

The Heartbeat LED will start a new flash sequence once every 3 seconds. The number of flashes that occur at the beginning of the sequence indicate the mode of the RSC. The indicated modes are:

1 Flash	On-line with Command Center, normal operation
2 Flashes	Offline, controlling in default mode from the EPROM
3 Flashes	Test Mode, under control of the Handheld Tester
4 Flashes	Init, initializing a new connection with the Command Center
5 Flashes	Reboot, the RSC is in a power-up sequence

LCD Display Modules - Terminals are provided for connection of up to two externally mounted LCD display modules. Support for these modules is limited at this time. They will display the scaled value of a standard range temperature sensor connected to AI1. Additional uses are planned for a future EPROM release.

Analog Inputs - The RSC has the capacity for 8 Analog Inputs. All Analog Inputs are jumper selectable as 0-5 Vdc or 4-20 mA. All 8 AI locations are provided with a separate 18 VDC power supply terminal and a DC common terminal.

Analog Outputs - All modulating Analog Outputs are provided by an AO card. AO cards receive digital control data from the RSC and use the data to generate 4 individual modulating outputs. Each output is jumper selectable as either 4-20 mA or 0-10 VDC. The AO card connects to the RSC by means of a factory provided 16 pin ribbon cable and connector.

Digital Inputs - The RSC has the capacity for 8 Digital Inputs. Digital Inputs are activated by routing 18 Vdc from the RSC power supply to the appropriate RSC input terminal through a field device. This field device could be anything with a set of dry contacts.

Digital Outputs - The RSC has the capacity for 8 Digital Outputs. Control of loads connected to Digital Outputs is provided by triacs mounted on the RSC. Each output can directly switch loads up to 1 A @ 24 Vac. Loads that exceed these ratings should be provided with a pilot duty relay for interface to the RSC. Each DO is accompanied by an LED that indicates the state of the DO.

Digital Output Bank Isolation - The 8 DOs are divided into two banks of 4 DOs each, Bank A (DO1-4) and Bank B (DO5-8). The power supply common to each bank can be shared with the RSC or each bank can use an individual common, isolated from the rest of the RSC. This allows for control of up to two different pieces of HVAC equipment having a factory transformer from one RSC without the use of field installed isolation relays.

Installation - RSCs are sometimes grouped in a central location, but are usually distributed throughout the facility and mounted near the equipment they serve. The RSC is 5 1/2”w x 7”h and is mounted in a 7 1/2”w x 9”h NEMA 1 metal enclosure. Electrical conduit knockouts are provided in both 1/2” and 3/4” sizes. The RSC must be either mounted in a dry location or installed inside a field supplied enclosure. RSCs are available from BAS without an enclosure and can be mounted directly to any flat surface using plastic standoffs.

The RSC and all devices supplied by BAS, except the Command Center, are rated as Class 2 limited energy electrical devices. UL does not require UL certification of any component manufactured and sold by BAS as long as the installation conforms to the NEC for a Class 2 circuit installation. All field wiring connects to the RSC with de-pluggable compression type screw terminal strips. These de-pluggable terminals allow for rapid changeout of damaged RSCs.

RSC Operation

Startup

1. Upon supplying 24 Vac to the RSC, the RSC begins an initialization and self test procedure. The RSC requires an initialization period of 16 seconds. This time is used primarily to ensure a stabilized average for all Analog Input readings.
2. The Heartbeat LED will indicate Reboot (5 flashes).

Normal Operation - On-line with the Command Center

1. If a Command Center is connected to the trunk line, the RSC will establish a communication link with it. During normal operation, the RSC is on-line with the computer. When in this mode, all control functions are handled by the computer. The RSC is a slave to the Command Center.
2. On establishing initial communication with the Command Center, the Heartbeat LED will indicate Init (4 flashes). The initialization process is completed after several seconds. After beginning normal operation at the RSC, the Heartbeat LED will indicate On-line (1 flash).
3. The Command Center communicates with every RSC once every eight seconds. Between updates, the RSC collects data as to the status of all inputs. All Analog Inputs are sampled once every two seconds and the results are averaged over a total of eight samples. Any Digital Input that is activated during this period is reported as on. When requested by the Command Center, the RSC reports the status of all its inputs. At the same time the Command Center directs the RSC as to the state of all of its outputs based on the last reported input state. This cycle repeats continuously.
4. Two LEDs indicate status of communications. The green LED will indicate any traffic on the trunk, both from the Command Center and from all other connected RSCs. The yellow LED will indicate the outgoing data from the RSC.
5. If the RSC loses the link with the Command Center (noisy data, Command Center off-line, broken trunk line, etc.), it will maintain the state of all of the outputs for three minutes while trying to reestablish a link with the Command Center. After the end of three minutes without a link, the RSC will enter default mode. The Heartbeat LED will indicate Offline (2 flashes).

Default Mode

1. Prior to connection to a Command Center, or following a failure of the communication link to the Command Center, the RSC is in default mode. Default operation is indicated at the RSC by the Heartbeat LED flashing the Offline sequence (2 flashes). When in this mode, all control functions are handled by the RSC as a stand-alone controller. The Equipment Schedule to be used is determined by the dip switch settings on the RSC.
2. The RSC uses proportional control when in default mode.

Test Mode

1. The Heartbeat LED will indicate Test (3 flashes).
2. All outputs will maintain their last state unless commanded to change with a Handheld Tester.
3. Any output whose state is changed when in Test mode will maintain that state while in Test mode.
4. All Analog Inputs will update immediately on the Handheld Tester display following a change.
5. When returned to normal operation, the RSC will first enter default mode and then attempt to establish communication with a Command Center.

RSC Inputs and Outputs

1. A certain number of inputs and outputs are necessary for the proper operation of each equipment schedule. See the sequence of operation for a detailed description of the inputs and outputs used on each schedule.
2. Any input or output not dedicated to the operation of a piece of equipment can be used for auxiliary control. An example would be: Digital Output - exhaust fan, lights; Digital Input - air flow switch, pressure switch; Analog Input - discharge air temperature, space humidity.
3. Equipment Schedule #64 is defined as a null schedule with no pre-defined control sequence. All inputs and outputs can be programmed as desired.

Setback Override Button

1. The button on top of the wall sensor is used to send a setback override signal to the Command Center. This button actually shorts the analog temperature signal from the wall sensor to ground. When this happens, the RSC holds Analog Input 1 (space temperature) at the previous value and reports to the Command Center that Digital Input 1 = ON.
2. A switch can be wired from the +18 Vdc power supply to Digital Input 1 and used as an alternative method of signaling a setback override. This would allow for installation of multiple setback override switches.

Economizer Operation

1. All units using an Equipment Schedule with economizer control must have a return air enthalpy sensor installed and wired to Analog Input 2.
2. If the equipment uses an economizer directly modulated by the RSC, a duct sensor must be wired to Analog Input 6 for economizer low limit control. This would normally be mounted in the mixed air plenum but would also work in the discharge air plenum. This is not necessary if the RSC is interfacing to a factory economizer package using Digital Outputs.
3. When on-line with the Command Center, outside air enthalpy is input in one location and passed to all RSCs. The RSC will then make a decision on using the economizer based on differential enthalpy.
4. When in default, the RSC will ignore the economizer and use mechanical cooling only.

VariZone Servers

1. All units configured as a VariZone Server must have a duct sensor installed in the discharge plenum and wired to Analog Input 4. This sensor is used for protection of the equipment during periods of high bypass.

Installation

Note: A label is attached to the back of each RSC enclosure. This label includes the information necessary to answer most of the common installation questions.

Location and Mounting

1. The RSC is provided in a 7 1/2"w x 9"h NEMA 1 metal enclosure. Choose a location that is not exposed to the weather and where controls, connections, and the Test socket are accessible. The RSC enclosure must be connected to earth ground for proper trunk-line surge protection. Attaching the RSC enclosure to a metal structure is generally adequate.
2. The RSC may be installed in wet or damp environments as long as it is installed in a field supplied enclosure that is rated for the environment.

Wiring (See the Equipment Schedule schematic for detailed wiring instructions)

1. General - All wiring must conform to the NEC requirements for a Class 2 Limited Energy circuit in addition to any special local codes. This equipment is not rated for nor intended to fulfill any Life Safety requirements.

2. Power Supply - Provide the RSC with a 10 VA, 24 Vac power supply. De-energize the power supply before making connections to avoid electrical shock or equipment damage. All wiring must comply with local codes and ordinances.

3. Power Supply Jumpers - The Digital Outputs are divided into 2 banks. DO1-4 are on Bank A and DO5-8 are on Bank B. Each bank can either be provided with an independent 24 Vac hot or the banks can be jumpered together. The banks can also be combined with the same power source used to supply the RSC. There are 4 power supply terminals; 1) 24V VHA is the supply to DO Bank A, 2) 24V VHB is the supply to DO Bank B, 3) 24V ACIP is the isolated power supply to the RSC, and 4) 24V ACN is the neutral or common used for the RSC power supply. If the power supply jumpers are installed on the RSC (factory default), the power only needs to be connected to the 24V ACIP and 24V ACN terminals. The jumpers will send the 24 Vac from the 24V ACIP terminal to both Bank A and Bank B.

4. Trunk Line - The communication trunk must be a minimum 18 AWG, 2 conductor Twisted Shielded Pair (TSP) cable. Smaller gauge wire may be used on short trunk lines, down to a minimum of 24 AWG on runs of 500' or less. The trunk line must be connected to all RSCs in parallel. The wiring should be done in a daisy chain configuration. Up to 32 RSCs can be installed on a trunk line, with up to 8 trunk lines per Command Center. The RSCs can be addressed in any order. The polarity of all RSC on the trunk line must be maintained. The RSC terminals are marked plus (+) and minus (-).

   The last RSC (the end of the wiring run) on each trunk should have its termination jumper installed. The jumper will place a 120 ohm termination resistor across the trunk line. The jumper is not installed by default.

   Caution: Do not connect the trunk wires to any device other than the trunk terminals at the RSC or the Command Center. Other voltages on the trunk line can damage all RSCs connected to the trunk line.

   Note: Do not route the trunk line directly adjacent to power wiring or other noise producing devices such as fluorescent lights or computer networks.

5. Digital Outputs (DO) - Connect DO as necessary, following the Equipment Schedule drawing.

6. Analog Inputs (AI) - Provide wiring to all accessory devices in accordance with instructions included with those devices. If an input device from other than BAS is used, it must be able to operate from a 18 Vdc supply and use no more than 0.7 VA. If the device uses a 4-20 mA dc signal, install the 4-20 mA jumper for that AI position (located above the EPROM).

   Caution: The AI terminals on the RSC should not be connected to any voltage higher than 5 Vdc or less than 0 Vdc. **Voltages outside this range will affect operation of the RSC and may cause damage to the RSC processor.**

7. Digital Inputs (DI) - Route a wire from the PWR terminal, through a field device with a set of dry contacts, back to the desired DI position.

8. Analog Outputs (AO) - All AOs are provided by an optional AO board. This board is attached to the RSC with a 16 pin connector and ribbon cable. Once connected, the AO will operate with no additional setup.

Setup

Equipment Schedule Dip Switch Settings - Each RSC must have the switch positions on Dip Switch Bank #1 (the upper bank) set for the Equipment Schedule that provides the desired default control.

Address Dip Switch Settings - Each RSC on a trunk line must have a unique address from 1-32. RSC address settings are made on Dip Switch Bank #2 (the lower bank). Switch Positions 1 through 5 are used to determine the address.

ES # or	Switch Position							Switch Position					
Address #	1	2	3	4	5	6	ES #	1	2	3	4	5	6
1	0	0	0	0	0	0	33	0	0	0	0	0	1
2	1	0	0	0	0	0	34	1	0	0	0	0	1
3	0	1	0	0	0	0	35	0	1	0	0	0	1
4	1	1	0	0	0	0	36	1	1	0	0	0	1
5	0	0	1	0	0	0	37	0	0	1	0	0	1
6	1	0	1	0	0	0	38	1	0	1	0	0	1
7	0	1	1	0	0	0	39	0	1	1	0	0	1
8	1	1	1	0	0	0	40	1	1	1	0	0	1
9	0	0	0	1	0	0	41	0	0	0	1	0	1
10	1	0	0	1	0	0	42	1	0	0	1	0	1
11	0	1	0	1	0	0	43	0	1	0	1	0	1
12	1	1	0	1	0	0	44	1	1	0	1	0	1
13	0	0	1	1	0	0	45	0	0	1	1	0	1
14	1	0	1	1	0	0	46	1	0	1	1	0	1
15	0	1	1	1	0	0	47	0	1	1	1	0	1
16	1	1	1	1	0	0	48	1	1	1	1	0	1
17	0	0	0	0	1	0	49	0	0	0	0	1	1
18	1	0	0	0	1	0	50	1	0	0	0	1	1
19	0	1	0	0	1	0	51	0	1	0	0	1	1
20	1	1	0	0	1	0	52	1	1	0	0	1	1
21	0	0	1	0	1	0	53	0	0	1	0	1	1
22	1	0	1	0	1	0	54	1	0	1	0	1	1
23	0	1	1	0	1	0	55	0	1	1	0	1	1
24	1	1	1	0	1	0	56	1	1	1	0	1	1
25	0	0	0	1	1	0	57	0	0	0	1	1	1
26	1	0	0	1	1	0	58	1	0	0	1	1	1
27	0	1	0	1	1	0	59	0	1	0	1	1	1
28	1	1	0	1	1	0	60	1	1	0	1	1	1
29	0	0	1	1	1	0	61	0	0	1	1	1	1
30	1	0	1	1	1	0	62	1	0	1	1	1	1
31	0	1	1	1	1	0	63	0	1	1	1	1	1
32	1	1	1	1	1	0	64	1	1	1	1	1	1

1 indicates switch in the ON position.
0 indicates switch in the OFF position

System Startup/Checkout

1. Place the RSC in Test Mode by plugging in the Handheld Tester.
2. Energize the RSC.
3. The RSC Heartbeat LED should indicate Test (3 flashes). If not, verify 24 Vac is supplied to the RSC. If power is OK, then the RSC must be replaced.
4. Check calibration of the wall sensor. Verify reading at the Handheld tester.
5. Check the status of all Analog Inputs and Digital Inputs. Analog inputs should read the correct value if an input is connected, or either 1 or 0 if no device is connected. Digital inputs should read the correct value if an input is connected, or 0 if no device is connected.
6. Test the operation of all Digital Outputs. Use caution to energize the outputs in the correct sequence for the attached equipment.
7. Test the operation of any Analog Outputs, if used.
8. If the RSC tests satisfactorily, unplug the Handheld Tester. If the Command Center is on-line, the RSC Heartbeat LED will indicate Init (4 flashes). After several seconds, the initialization should be complete and the Heartbeat LED will indicate On-line (1 flash). If the Command Center is not yet on-line, the RSC will begin operation in default mode, indicates by 2 flashes of the Heartbeat LED.

Handheld Tester Operation

Note: There are differences between the Handheld Tester (HTD) used for Version 3.x and later RSCs and those used for earlier versions of the RSC. Adapters are available to allow use of either HTD on either RSC style. A label affixed to the back of each HTD will show the proper connection procedures for both RSC versions. Attempting to make connection with incompatible versions may damage either the RSC or the HTD.

1. The RSC will automatically enter Test mode when the Handheld Tester (HTD) is plugged into the RSC. The RSC can be locked into Test mode by setting Dip Switch 8 on Switch Bank #2 to ON. If on-line with the Command Center when entering Test mode, the RSC will transmit its status to the Command Center before allowing Test mode. This will take a maximum of 8 seconds. The RSC will indicate Test mode by the Heartbeat changing to Test mode (3 flashes). Once in Test Mode the following options are available:

   F1 - Read all Analog Input and Analog Output values.
   F2 - Position any Analog Output.
   F3 - Display the status of all Digital Inputs and Digital Outputs.
   F4 - Position any Digital Output.
   F5 - Reads the position of all dip switches.
   T - Display the temperature in deg F in .25 deg resolution, current stage, and information about the first two actuators if used.
   U - Display the temperature in deg F in .25 deg resolution, current stage, and information about the second two actuators if used.
   1 - Display the temperature in deg F in .25 deg resolution and current stage for the first Zone (Zone A) on multiple Zone schedules when in T or U modes.
   2 - Display the temperature in deg F in .25 deg resolution and current stage for the second Zone (Zone B) on multiple Zone schedules when in T or U modes.
   3 - Display the temperature in deg F in .25 deg resolution and current stage for the third Zone (Zone C) on multiple Zone schedules when in T or U modes.
   4 - Display the temperature in deg F in .25 deg resolution and current stage for the fourth Zone (Zone D) on multiple Zone schedules when in T or U modes.
   S - Display the current Equipment Schedule # and Address #.
   H - Will increase the current stage one step in the heating direction.
   C - Will increase the current stage one step in the cooling direction.
   A - Forces the RSC to the At Set position.

2. Pressing Enter from any screen will bring up the menu.

```
RSC TEST  S SYS INFO
F1 AI/AO  F2 SET AO
F3 DI/DO  F4 SET DO
F5 DSW    T/U ZONE
```

3. F1 - Read all Analog Input and Analog Output values. This mode displays the current raw value of all Analog Inputs and Analog Outputs in the range of 0-255. The display of the conditioned value on the Temperature screen is more usable in most cases.

```
AI 1-8  000 000 000
000 000 000 000 000

AO 1-4  000 000 000
000
```

4. F2 - Position any Analog Output. This mode allows for the override of any Analog Output to the desired position. The output will remain positioned until Test mode is exited by removing the HTD.

```
  < OVERRIDE AO >

SELECT AO (1-4)?  _
VALUE (000-255)?  _
```

Select the desired output from 1-4. Enter the value for the desired analog position. This number must be in the range of 000-255. (000=0%, 255=100%, etc.)

5. F3 - Display the status of all Digital Inputs and Digital Outputs. This function will display the following:

```
 < DIGITAL VALUES >
POSITION #12345678
   INPUTS 00000000
  OUTPUTS 00000000
```

All Digital Inputs or Outputs indicate either 0 if they are off or 1 if they are on.

6. F4 - Position any Digital Output. This mode allows for the override of any Digital Output to the desired position. The output will remain positioned until Test mode is exited by removing the HTD.

```
  < OVERRIDE DO >

SELECT DO (1-8) ? _
ON(1) OR OFF(0) ? _
```

Select the desired output from 1-8. Enter the value for the desired output position.

7. F5 - Display the status of all Dip Switches. This function will display the following:

```
  < DIP SWITCHES >
POSITION #12345678
 SWITCH 1 00000000
 SWITCH 2 00000000
```

All dip switches indicate either 0 if they are off or 1 if they are on. The number displayed is the binary representation of the Equipment Schedule and Address. It is more convenient to use the Schedule screen to display these values.

8. T - Display several System status items. This function will display the following:

```
Z:A  Stg:INIT   74.25
TIM1:   0   TIM2:   0
SET1: 150   SET2: 150
POS1: 150   POS2: 150
```

Note: The Zones are identified as follows; 1) Zone A for a single Zone schedule, 2) Zone A and Zone C for a dual Zone schedule, and 3) Zone A, Zone B, Zone C, and Zone D for a quad Zone schedule.

Z displays the Zone (A, B, C, or D) for which the first line of data applies.
74.25 is the present temperature in degrees F of the Zone listed.
Stg is the current active stage of the Zone listed. The possible modes are:
INIT - initialization at System startup
AT - RSC is at Setpoint
C1 through C4 - RSC is in cooling, stage 1 through 4
H1 through H4 - RSC is in heating, stage 1 through 4

The next 3 lines provide information for the first two 3 point floating actuators:

TIM1 and TIM2 are the timing in 2 second increments (a display of 150 equals 300 seconds) remaining for the present positioning of actuator 1 and actuator 2.

SET1 and SET2 are the timing in 2 second increments (a display of 150 equals 300 seconds) of the desired position of actuator 1 and actuator 2.

POS1 and POS2 are the timing in 2 second increments (a display of 150 equals 300 seconds) of the actual position of actuator 1 and actuator 2.

9. U - Displays the same information as selecting ‘T’, except that the last 3 lines toggle to display information for the last two 3 point floating actuators. The top line of display will not change. This function will display the following:

```
Z:A  Stg:INIT   74.25
TIM3:   0   TIM4:   0
SET3: 150   SET4: 150
POS3: 150   POS4: 150
```

The last 3 lines provide information for the last two 3 point floating actuators:

TIM3 and TIM4 are the timing in 2 second increments (a display of 150 equals 300 seconds) remaining for the present positioning of actuator 3 and actuator 4.

SET3 and SET4 are the timing in 2 second increments (a display of 150 equals 300 seconds) of the desired position of actuator 3 and actuator 4.

POS3 and POS4 are the timing in 2 second increments (a display of 150 equals 300 seconds) of the actual position of actuator 4 and actuator 4.

10. 1, 2, 3, or 4 - Toggles the Zone for which the top line of data is displayed when in the T or U screen:

```
Z:A  Stg:INIT   74.25
TIM1:   0   TIM2:   0
SET1: 150   SET2: 150
POS1: 150   POS2: 150
```

1 - Will display the current stage and temperature for Zone A.
2 - Will display the current stage and temperature for Zone B.
3 - Will display the current stage and temperature for Zone C.
4 - Will display the current stage and temperature for Zone D.

11. S - Display Equipment Schedule and Address numbers. This function will display the following:

```
ENERTEC/BAS RSC 3.21
 Address:  1
Schedule:  1
 Version:4.0a
```

The first line identifies the hardware model and version.
Address is the Address # from 1-32.
Schedule is the Equipment Schedule # from 1-128.
Version is the Version # of the installed EPROM.

12. H, C, or A - Changes the current stage for the Zone displayed when in the T or U screen. The stages will cycle in the following order: C4 - C3 - C2 - C1 - AT - H1 - H2 - H3 - H4.

H - Will increase the current stage one step in the heating direction.
C - Will increase the current stage one step in the cooling direction.
A - Will force the current stage to At Set.

13. Substituting a PC for a Handheld Tester. The terminal must be configured as a standard RS-232 terminal. If the screen width is configurable, set to 20 characters.

Command Substitutions:

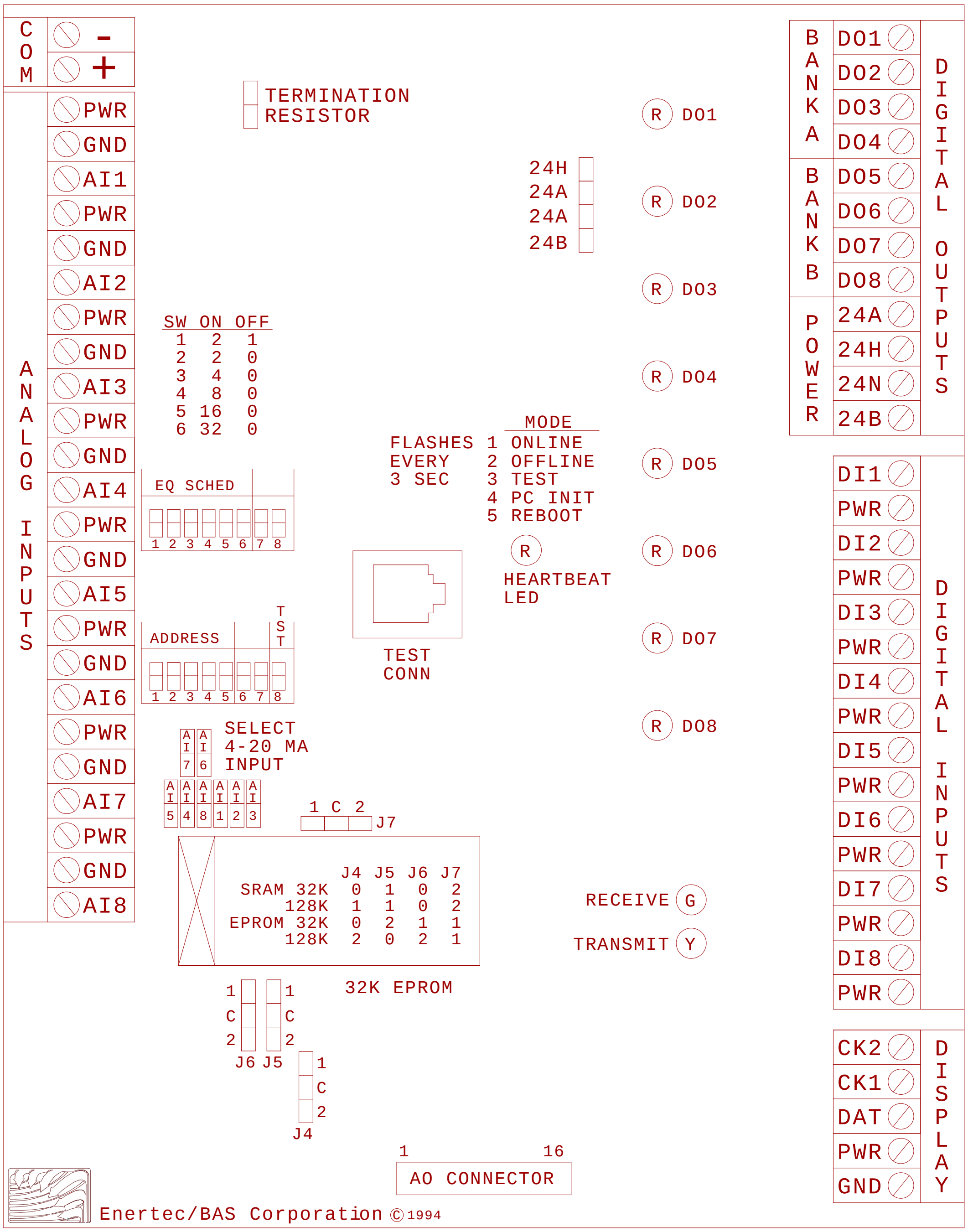
HTD	Terminal
F1	Control Q
F2	Control R
F3	Control S
F4	Control T
F5	Control U

All other command entries same as HTD. All commands must be uppercase.

Terminal settings:

Baud Rate	9600
Data Bits	8
Stop Bits	1
Parity	None
Handshaking	None

RSC Board Layout



Analog Input Devices

Overview

The **Energy Zone®** System uses the LM-34 integrated circuit precision temperature sensor for all temperature sensing requirements. The LM-34 sensor provides an output voltage that is linearly proportional to temperature. The LM-34 is manufactured with a tolerance of +/- .5° F and is easily calibrated to within +/- 0.1° F. This sensor is very stable and reliable over time. Other sensors for conditions such as humidity, enthalpy, pressure, etc. are supplied by the Dealer from their choice of third party manufacturers.

Features

- Linear +10.0 mV/° F scale factor
- Precalibration accuracy of 1.0° F guaranteed (@ 77° F)
- Rated for full -50° to +300° F range
- Long term stability
- Available in wall, outside, duct, and well configurations
- All Analog Input terminals allow for any standard 0-5 Vdc or 4-20 mA dc analog device

Specifications

General Description - The LM-34 temperature sensor is provided in 4 configurations: wall sensor; outside air sensor; duct sensor; and well sensor. All sensors have a standard output of +10 mV/° F (74.6 ° F would output a voltage at the sensor of 746 mVdc). This output is offset and amplified to a range of 0-5 Vdc at the sensor prior to being sent to the RSC. All sensors are calibrated at the factory and in addition are provided with pots for field calibration when necessary.

Wall Sensor - The standard range of the LM-34 WS is 32.00° to 95.75° F (0.00° to 35.42° C). The resolution of this sensor is +/- .25° F (+/- .14° C). The sensor is enclosed in an attractive 2"w x 2.5"h x 1.5"d, off-white plastic enclosure. Wall sensors are provided with a night setback override button. A calibration pot is located on the circuit board under the sensor cover. This calibration pot can provide a span of +/- 8.5 °F. An optional offset pot can be provided which allows the occupant to raise or lower the occupied Zone setpoints. The wall sensor is also available in a vandal-proof flush mount stainless plate version.

Outside Air Sensor - The standard range of the LM-34 OS is -12.0° to 115.5° F (-24.44° to 46.39° C). The resolution of this sensor is +/- .50° F (+/- .28° C). The sensor is enclosed in a 4.25"w x 0.875" diameter plastic pipe. The pipe is attached to a standard 2"x4" weatherproof aluminum "Bell" box. The output from the sensor is wired to a conditioning card mounted inside the sensor enclosure. A calibration pot and an offset pot are both located on the conditioning card.

Duct Air Sensor - The standard range of the LM-34 DS is 30.0° to 157.5° F (-1.11° to 69.72° C). The resolution of this sensor is +/- .50° F (+/- .28° C). The sensor is enclosed in a 5.5"l x 0.25" diameter metal tube. The tube is attached to a standard 2"x4" electrical box. The output from the sensor is wired to a conditioning card mounted inside the enclosure. A calibration pot and an offset pot are both located on the conditioning card.

Well Sensor - The standard range of the LM-34 LS is 0° to 255° F (-17.78° to 123.89° C). The resolution of this sensor is +/- 1° F (+/- .56° C). The sensor is enclosed in a 5.5"l x 0.5" diameter metal tube, which is then threaded into 4"x.5" NPT stainless steel immersion thermowell. The tube is attached to a standard 2"x4" electrical box. The output from the sensor is wired to a conditioning card mounted inside the enclosure. A calibration pot is located on the conditioning card.

Third Party Analog Input Devices - BAS welcomes the use of sensing devices provided by third party suppliers. Industry standard voltage and current devices are supported without modification. The requirements for an Analog Device to be fully compatible with an RSC are:

1. The device must be able to operate on an 18 Vdc supply
2. The device consumes no more than 0.7 VA
3. The signal delivered to the RSC does not fall outside the limits of 0-5 Vdc for a voltage device or 4-20 mAdc for a current device.

LM-34 Operation

Normal Operation

1. During normal operation the LM-34 will sense temperature, convert this temperature to a voltage, and this voltage will be input to the appropriate analog input terminal on the RSC.
2. The signal input range to the RSC is 0-5.00 Vdc on all temperature sensors. A shorted signal (>=5.00 Vdc) will be reported as HI at the Command Center. An open signal (0 Vdc) will be reported as LO at the Command Center.

Setback Override Button

1. The button on top of the wall sensor is used to send a setback override signal to the Command Center. The button must remain depressed for about 2 seconds to be recognized as a valid override signal. This button actually shorts the analog temperature signal from the wall sensor to ground. This is recognized by the RSC that then holds AI1 (space temperature) at the previous value and reports to the Command Center that DI1 = ON.
2. It is also possible to wire a switch from PWR directly to DI1 on the RSC as an alternate method of signaling a setback override.

Optional Offset Pot

1. The Offset Pot will send a voltage to the RSC that is interpreted by the Command Center as an offset to the occupied temperature setpoints for that Zone. When the pot is centered, the output is 2.5 Vdc and no offset is applied. When the pot is fully counter-clockwise, the output is 0 Vdc and the maximum negative offset is applied (more cooling). When the pot is fully clockwise, the output is 5 Vdc and the maximum positive offset is applied (more heating).
2. Each Zone can be configured for 0-10° F offset. The configured offset is applied in both directions, i.e. an offset configured for 3° F will allow a total range from -3° F to +3° F offset from the configured setpoints. The offset is applied to both the heating and cooling setpoints.

Installation

Location and Mounting

1. Standard Wall Sensor - Choose a location on an interior wall that is not exposed to sunlight, drafts from open doors and windows, or other heat sources such as copiers or coffee pots. The sensor should be located in a spot that is representative of the space and exposed to air movement, preferably near a return air diffuser. Ensure that the air flow from a supply diffuser is not blowing directly on the sensor. The optimum mounting height for sensor performance is 60". Building codes will sometimes require a lower mounting height to allow for handicap access (usually 42”). The wall sensor is designed to be mounted directly on the wall.

2. Optional Back Plate - If the sensor is to be mounted on a standard 2"x4" electrical enclosure, the sensor must first be mounted on the optional 2"x4" back plate. The back plate is designed for horizontal mounting.

3. Flush Mount Wall Sensor - The flush mount wall sensor is designed to be mounted to a standard vertical 2"x4" electrical enclosure. The sensor senses room temperature from the stainless steel plate. Some electrical enclosures inside walls are exposed to drafts from outside air. Since the sensor is located on the backside of the plate, this will cause significant errors in temperature sensing. Use caulking or other method where necessary to prevent drafts from reaching the sensor.

2. Outside Air Sensor - Choose a location on the exterior of the building that is not exposed to sunlight (a northern exposure) or other heat sources such as directly above windows or near attic vents. It is recommended that the sensor be mounted in a position that would allow for easy access for maintenance.

3. Duct Air Sensor - Choose a location in the duct that is representative of the overall duct temperature. It is recommended that the sensor be mounted in a position that would allow for easy access for maintenance.

4. Well Sensor - Choose a location in the pipe that is representative of the overall liquid temperature. The sensor mounts in a standard 1/2" NPT stainless steel well, which is provided. It is best to use a thermally conductive compound between the sensor and the well. It is recommended that the sensor be mounted in a position that would allow for easy access for maintenance.

5. Other Devices - Install as per manufacturer’s instructions. If the device uses a 4-20 mA dc signal, install the 4-20 mA jumper on the RSC for that AI. The jumpers are located above the EPROM. The sensor definition for the Zone in the Command Center configuration must also be selected for 4-20 mA input.

Wiring

1. A three conductor wire is used between all 0-5 Vdc sensors and the RSC. A two conductor wire is used for 4-20 mA dc devices. A 4 conductor wire is required where an offset pot is used. A standard Class 2/24 AWG wire is adequate in most applications of 100' or less. The wire should be routed away from sources of electrical noise such as large electrical equipment. Longer wiring runs should be done with larger gauge wire.

2. If the wire must be run through an electrically noisy environment, shielded cable should be used. The shield must be tied to a solid earth ground on one end only, with no other connections to ground.

System Startup/Checkout

<u>Note:</u> Under normal circumstances, it is not necessary to perform this procedure. These sensors come from the factory pre-calibrated. Checking for a reading at the Command Center is generally all that is required.

The temperature sensors can be checked using the following methods:

Wall Sensors

1. The temperature at the sensor location must first be checked. This can be done two ways:
   a. Measure the output voltage of the LM-34 and convert the reading to ° F. This is done by checking the dc voltage between ground (terminal 2) and R-9 (on the side closest to U-2). See the board layout at the end of this chapter for details. The reading can be converted directly from mV dc to ° F. 10 mV dc = 1.0° F (i.e., 754 mV dc = 75.4° F).

   <u>Note:</u> The LM-34 sensor (U-2 on the circuit board) is very sensitive and can change by body heat alone. Do not place your hands, or breathe, near the sensor. Take the voltage reading quickly in order to minimize the possibility of error from body heat.

   b. Measure the temperature at the sensor with an independent measuring device. Use caution in placement of the sensor to insure an accurate reading.
2. The output can then be checked in two ways:
   a. Place the RSC in Troubleshooting Mode and press T on the Handheld tester. This will provide a reading in ° F.
   b. Measure the output voltage of the wall sensor and compare this to the expected reading on the conversion chart in this chapter. This is done by checking the dc voltage between ground (terminal 2) and signal (terminal 1).
3. If necessary, the output can then be calibrated using the pot located on the wall sensor circuit board. The pot is turned clockwise to decrease output and counterclockwise to increase output.
4. The night setback override button can be tested by pressing the button while monitoring the temperature reading on the handheld tester. The reading should drop to 32.00 ° F on the Handheld Tester or 0 Vdc output from the sensor.

Outside, Duct, and Well Sensors

1. The temperature at the sensor location must first be checked. This can be done two ways:
   a. Measure the output voltage of the LM-34 and convert the reading to ° F. This is done by checking the dc voltage between ground and signal at either the sensor terminal strip or the input side of the conditioning card terminal strip. The reading can be converted directly from mV dc to ° F. 10 mV dc = 1.0° F (i.e., 754 mV dc = 75.4° F).
   b. Measure the temperature at the sensor with an independent measuring device. Use caution in placement of the sensor to insure an accurate reading.
2. The output can then be checked in two ways:
   a. Place the RSC in Troubleshooting Mode and press F1 on the handheld tester. This will provide a reading scaled in a range of 0-255. Compare this to the expected reading on the conversion chart in this chapter.
   b. Measure the output voltage of the conditioning card and compare this to the expected reading on the conversion chart in this chapter. This is done by checking the dc voltage between ground and the appropriate AI terminal of the RSC.

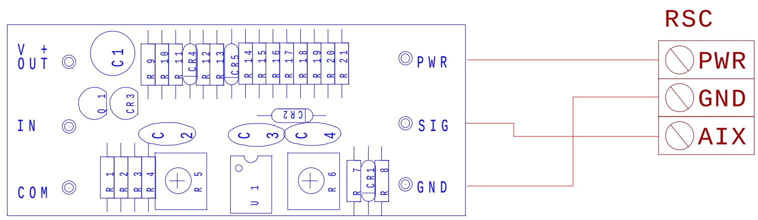
3. If necessary, the output can then be calibrated using the pot located on the conditioning card. The pot is turned clockwise to decrease output and counterclockwise to increase output.

Other Devices

1. Commission as per manufacturer's instructions. Correct interpretation of the sensor's output by the RSC can be verified using charts included in this chapter.

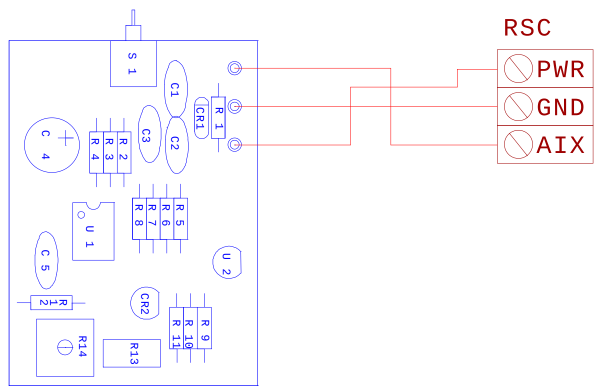
Analog Input Device Connections

DUCT, WELL, OR OSA SENSOR

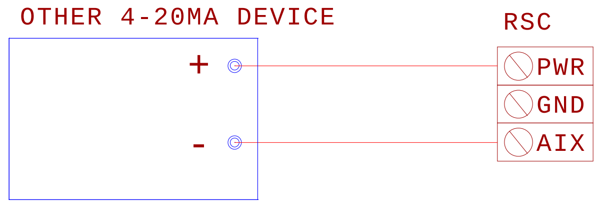


CIRCUIT CARD IS LOCATED
IN SENSOR ENCLOSURE

WALL SENSOR



ENTHALPY SENSOR OR
OTHER 4-20MA DEVICE



SET JUMPER ON RSC
FOR 4-20MA INPUT

Building Automation Systems Analog Input Voltage Conversion Chart Page 1 of 2

32.00° - 95.75° F TEMPERATURE CHART
STANDARD WALL SENSOR RANGE V3.2

HTD	Voltage Input	Temp Act	Temp Ind	HTD	Voltage Input	Temp Act	Temp Ind	HTD	Voltage Input	Temp Act	Temp Ind
000	0.000	32.00	32.0	043	0.843	42.75	42.8	086	1.686	53.50	53.5
001	0.020	32.25	32.3	044	0.863	43.00	43.0	087	1.706	53.75	53.8
002	0.039	32.50	32.5	045	0.882	43.25	43.3	088	1.725	54.00	54.0
003	0.059	32.75	32.8	046	0.902	43.50	43.5	089	1.745	54.25	54.3
004	0.078	33.00	33.0	047	0.922	43.75	43.8	090	1.765	54.50	54.5
005	0.098	33.25	33.3	048	0.941	44.00	44.0	091	1.784	54.75	54.8
006	0.118	33.50	33.5	049	0.961	44.25	44.3	092	1.804	55.00	55.0
007	0.137	33.75	33.8	050	0.980	44.50	44.5	093	1.824	55.25	55.3
008	0.157	34.00	34.0	051	1.000	44.75	44.8	094	1.843	55.50	55.5
009	0.176	34.25	34.3	052	1.020	45.00	45.0	095	1.863	55.75	55.8
010	0.196	34.50	34.5	053	1.039	45.25	45.3	096	1.882	56.00	56.0
011	0.216	34.75	34.8	054	1.059	45.50	45.5	097	1.902	56.25	56.3
012	0.235	35.00	35.0	055	1.078	45.75	45.8	098	1.922	56.50	56.5
013	0.255	35.25	35.3	056	1.098	46.00	46.0	099	1.941	56.75	56.8
014	0.275	35.50	35.5	057	1.118	46.25	46.3	100	1.961	57.00	57.0
015	0.294	35.75	35.8	058	1.137	46.50	46.5	101	1.980	57.25	57.3
016	0.314	36.00	36.0	059	1.157	46.75	46.8	102	2.000	57.50	57.5
017	0.333	36.25	36.3	060	1.176	47.00	47.0	103	2.020	57.75	57.8
018	0.353	36.50	36.5	061	1.196	47.25	47.3	104	2.039	58.00	58.0
019	0.373	36.75	36.8	062	1.216	47.50	47.5	105	2.059	58.25	58.3
020	0.392	37.00	37.0	063	1.235	47.75	47.8	106	2.078	58.50	58.5
021	0.412	37.25	37.3	064	1.255	48.00	48.0	107	2.098	58.75	58.8
022	0.431	37.50	37.5	065	1.275	48.25	48.3	108	2.118	59.00	59.0
023	0.451	37.75	37.8	066	1.294	48.50	48.5	109	2.137	59.25	59.3
024	0.471	38.00	38.0	067	1.314	48.75	48.8	110	2.157	59.50	59.5
025	0.490	38.25	38.3	068	1.333	49.00	49.0	111	2.176	59.75	59.8
026	0.510	38.50	38.5	069	1.353	49.25	49.3	112	2.196	60.00	60.0
027	0.529	38.75	38.8	070	1.373	49.50	49.5	113	2.216	60.25	60.3
028	0.549	39.00	39.0	071	1.392	49.75	49.8	114	2.235	60.50	60.5
029	0.569	39.25	39.3	072	1.412	50.00	50.0	115	2.255	60.75	60.8
030	0.588	39.50	39.5	073	1.431	50.25	50.3	116	2.275	61.00	61.0
031	0.608	39.75	39.8	074	1.451	50.50	50.5	117	2.294	61.25	61.3
032	0.627	40.00	40.0	075	1.471	50.75	50.8	118	2.314	61.50	61.5
033	0.647	40.25	40.3	076	1.490	51.00	51.0	119	2.333	61.75	61.8
034	0.667	40.50	40.5	077	1.510	51.25	51.3	120	2.353	62.00	62.0
035	0.686	40.75	40.8	078	1.529	51.50	51.5	121	2.373	62.25	62.3
036	0.706	41.00	41.0	079	1.549	51.75	51.8	122	2.392	62.50	62.5
037	0.725	41.25	41.3	080	1.569	52.00	52.0	123	2.412	62.75	62.8
038	0.745	41.50	41.5	081	1.588	52.25	52.3	124	2.431	63.00	63.0
039	0.765	41.75	41.8	082	1.608	52.50	52.5	125	2.451	63.25	63.3
040	0.784	42.00	42.0	083	1.627	52.75	52.8	126	2.471	63.50	63.5
041	0.804	42.25	42.3	084	1.647	53.00	53.0	127	2.490	63.75	63.8
042	0.824	42.50	42.5	085	1.667	53.25	53.3	128	2.510	64.00	64.0

Building Automation Systems Analog Input Voltage Conversion Chart Page 2 of 2

32.00° - 95.75° F TEMPERATURE CHART

STANDARD WALL SENSOR RANGE V3.2

HTD	Voltage Input	Temp Act	Temp Ind	HTD	Voltage Input	Temp Act	Temp Ind	HTD	Voltage Input	Temp Act	Temp Ind
129	2.529	64.25	64.3	172	3.373	75.00	75.0	215	4.216	85.75	85.8
130	2.549	64.50	64.5	173	3.392	75.25	75.3	216	4.235	86.00	86.0
131	2.569	64.75	64.8	174	3.412	75.50	75.5	217	4.255	86.25	86.3
132	2.588	65.00	65.0	175	3.431	75.75	75.8	218	4.275	86.50	86.5
133	2.608	65.25	65.3	176	3.451	76.00	76.0	219	4.294	86.75	86.8
134	2.627	65.50	65.5	177	3.471	76.25	76.3	220	4.314	87.00	87.0
135	2.647	65.75	65.8	178	3.490	76.50	76.5	221	4.333	87.25	87.3
136	2.667	66.00	66.0	179	3.510	76.75	76.8	222	4.353	87.50	87.5
137	2.686	66.25	66.3	180	3.529	77.00	77.0	223	4.373	87.75	87.8
138	2.706	66.50	66.5	181	3.549	77.25	77.3	224	4.392	88.00	88.0
139	2.725	66.75	66.8	182	3.569	77.50	77.5	225	4.412	88.25	88.3
140	2.745	67.00	67.0	183	3.588	77.75	77.8	226	4.431	88.50	88.5
141	2.765	67.25	67.3	184	3.608	78.00	78.0	227	4.451	88.75	88.8
142	2.784	67.50	67.5	185	3.627	78.25	78.3	228	4.471	89.00	89.0
143	2.804	67.75	67.8	186	3.647	78.50	78.5	229	4.490	89.25	89.3
144	2.824	68.00	68.0	187	3.667	78.75	78.8	230	4.510	89.50	89.5
145	2.843	68.25	68.3	188	3.686	79.00	79.0	231	4.529	89.75	89.8
146	2.863	68.50	68.5	189	3.706	79.25	79.3	232	4.549	90.00	90.0
147	2.882	68.75	68.8	190	3.725	79.50	79.5	233	4.569	90.25	90.3
148	2.902	69.00	69.0	191	3.745	79.75	79.8	234	4.588	90.50	90.5
149	2.922	69.25	69.3	192	3.765	80.00	80.0	235	4.608	90.75	90.8
150	2.941	69.50	69.5	193	3.784	80.25	80.3	236	4.627	91.00	91.0
151	2.961	69.75	69.8	194	3.804	80.50	80.5	237	4.647	91.25	91.3
152	2.980	70.00	70.0	195	3.824	80.75	80.8	238	4.667	91.50	91.5
153	3.000	70.25	70.3	196	3.843	81.00	81.0	239	4.686	91.75	91.8
154	3.020	70.50	70.5	197	3.863	81.25	81.3	240	4.706	92.00	92.0
155	3.039	70.75	70.8	198	3.882	81.50	81.5	241	4.725	92.25	92.3
156	3.059	71.00	71.0	199	3.902	81.75	81.8	242	4.745	92.50	92.5
157	3.078	71.25	71.3	200	3.922	82.00	82.0	243	4.765	92.75	92.8
158	3.098	71.50	71.5	201	3.941	82.25	82.3	244	4.784	93.00	93.0
159	3.118	71.75	71.8	202	3.961	82.50	82.5	245	4.804	93.25	93.3
160	3.137	72.00	72.0	203	3.980	82.75	82.8	246	4.824	93.50	93.5
161	3.157	72.25	72.3	204	4.000	83.00	83.0	247	4.843	93.75	93.8
162	3.176	72.50	72.5	205	4.020	83.25	83.3	248	4.863	94.00	94.0
163	3.196	72.75	72.8	206	4.039	83.50	83.5	249	4.882	94.25	94.3
164	3.216	73.00	73.0	207	4.059	83.75	83.8	250	4.902	94.50	94.5
165	3.235	73.25	73.3	208	4.078	84.00	84.0	251	4.922	94.75	94.8
166	3.255	73.50	73.5	209	4.098	84.25	84.3	252	4.941	95.00	95.0
167	3.275	73.75	73.8	210	4.118	84.50	84.5	253	4.961	95.25	95.3
168	3.294	74.00	74.0	211	4.137	84.75	84.8	254	4.980	95.50	95.5
169	3.314	74.25	74.3	212	4.157	85.00	85.0	255	5.000	95.75	95.8
170	3.333	74.50	74.5	213	4.176	85.25	85.3				
171	3.353	74.75	74.8	214	4.196	85.50	85.5				

Building Automation Systems Analog Input Voltage Conversion Chart Page 1 of 2

-12.0° - 115.5° F TEMPERATURE CHART

STANDARD OUTSIDE AIR SENSOR RANGE V3.2

HTD	Voltage Input	Temp Act	Temp Ind	HTD	Voltage Input	Temp Act	Temp Ind	HTD	Voltage Input	Temp Act	Temp Ind
000	0.000	-12.00	-12	043	0.843	9.50	10	086	1.686	31.00	31
001	0.020	-11.50	-12	044	0.863	10.00	10	087	1.706	31.50	32
002	0.039	-11.00	-11	045	0.882	10.50	11	088	1.725	32.00	32
003	0.059	-10.50	-11	046	0.902	11.00	11	089	1.745	32.50	33
004	0.078	-10.00	-10	047	0.922	11.50	12	090	1.765	33.00	33
005	0.098	-9.50	-10	048	0.941	12.00	12	091	1.784	33.50	34
006	0.118	-9.00	-9	049	0.961	12.50	13	092	1.804	34.00	34
007	0.137	-8.50	-9	050	0.980	13.00	13	093	1.824	34.50	35
008	0.157	-8.00	-8	051	1.000	13.50	14	094	1.843	35.00	35
009	0.176	-7.50	-8	052	1.020	14.00	14	095	1.863	35.50	36
010	0.196	-7.00	-7	053	1.039	14.50	15	096	1.882	36.00	36
011	0.216	-6.50	-7	054	1.059	15.00	15	097	1.902	36.50	37
012	0.235	-6.00	-6	055	1.078	15.50	16	098	1.922	37.00	37
013	0.255	-5.50	-6	056	1.098	16.00	16	099	1.941	37.50	38
014	0.275	-5.00	-5	057	1.118	16.50	17	100	1.961	38.00	38
015	0.294	-4.50	-5	058	1.137	17.00	17	101	1.980	38.50	39
016	0.314	-4.00	-4	059	1.157	17.50	18	102	2.000	39.00	39
017	0.333	-3.50	-4	060	1.176	18.00	18	103	2.020	39.50	40
018	0.353	-3.00	-3	061	1.196	18.50	19	104	2.039	40.00	40
019	0.373	-2.50	-3	062	1.216	19.00	19	105	2.059	40.50	41
020	0.392	-2.00	-2	063	1.235	19.50	20	106	2.078	41.00	41
021	0.412	-1.50	-2	064	1.255	20.00	20	107	2.098	41.50	42
022	0.431	-1.00	-1	065	1.275	20.50	21	108	2.118	42.00	42
023	0.451	-0.50	-1	066	1.294	21.00	21	109	2.137	42.50	43
024	0.471	0.00	0	067	1.314	21.50	22	110	2.157	43.00	43
025	0.490	0.50	1	068	1.333	22.00	22	111	2.176	43.50	44
026	0.510	1.00	1	069	1.353	22.50	23	112	2.196	44.00	44
027	0.529	1.50	2	070	1.373	23.00	23	113	2.216	44.50	45
028	0.549	2.00	2	071	1.392	23.50	24	114	2.235	45.00	45
029	0.569	2.50	3	072	1.412	24.00	24	115	2.255	45.50	46
030	0.588	3.00	3	073	1.431	24.50	25	116	2.275	46.00	46
031	0.608	3.50	4	074	1.451	25.00	25	117	2.294	46.50	47
032	0.627	4.00	4	075	1.471	25.50	26	118	2.314	47.00	47
033	0.647	4.50	5	076	1.490	26.00	26	119	2.333	47.50	48
034	0.667	5.00	5	077	1.510	26.50	27	120	2.353	48.00	48
035	0.686	5.50	6	078	1.529	27.00	27	121	2.373	48.50	49
036	0.706	6.00	6	079	1.549	27.50	28	122	2.392	49.00	49
037	0.725	6.50	7	080	1.569	28.00	28	123	2.412	49.50	50
038	0.745	7.00	7	081	1.588	28.50	29	124	2.431	50.00	50
039	0.765	7.50	8	082	1.608	29.00	29	125	2.451	50.50	51
040	0.784	8.00	8	083	1.627	29.50	30	126	2.471	51.00	51
041	0.804	8.50	9	084	1.647	30.00	30	127	2.490	51.50	52
042	0.824	9.00	9	085	1.667	30.50	31	128	2.510	52.00	52

Building Automation Systems Analog Input Voltage Conversion Chart Page 2 of 2

-12.0° - 115.5° F TEMPERATURE CHART
STANDARD OUTSIDE AIR SENSOR RANGE V3.2

HTD	Voltage Input	Temp Act	Temp Ind
129	2.529	52.50	53
130	2.549	53.00	53
131	2.569	53.50	54
132	2.588	54.00	54
133	2.608	54.50	55
134	2.627	55.00	55
135	2.647	55.50	56
136	2.667	56.00	56
137	2.686	56.50	57
138	2.706	57.00	57
139	2.725	57.50	58
140	2.745	58.00	58
141	2.765	58.50	59
142	2.784	59.00	59
143	2.804	59.50	60
144	2.824	60.00	60
145	2.843	60.50	61
146	2.863	61.00	61
147	2.882	61.50	62
148	2.902	62.00	62
149	2.922	62.50	63
150	2.941	63.00	63
151	2.961	63.50	64
152	2.980	64.00	64
153	3.000	64.50	65
154	3.020	65.00	65
155	3.039	65.50	66
156	3.059	66.00	66
157	3.078	66.50	67
158	3.098	67.00	67
159	3.118	67.50	68
160	3.137	68.00	68
161	3.157	68.50	69
162	3.176	69.00	69
163	3.196	69.50	70
164	3.216	70.00	70
165	3.235	70.50	71
166	3.255	71.00	71
167	3.275	71.50	72
168	3.294	72.00	72
169	3.314	72.50	73
170	3.333	73.00	73
171	3.353	73.50	74

HTD	Voltage Input	Temp Act	Temp Ind
172	3.373	74.00	74
173	3.392	74.50	75
174	3.412	75.00	75
175	3.431	75.50	76
176	3.451	76.00	76
177	3.471	76.50	77
178	3.490	77.00	77
179	3.510	77.50	78
180	3.529	78.00	78
181	3.549	78.50	79
182	3.569	79.00	79
183	3.588	79.50	80
184	3.608	80.00	80
185	3.627	80.50	81
186	3.647	81.00	81
187	3.667	81.50	82
188	3.686	82.00	82
189	3.706	82.50	83
190	3.725	83.00	83
191	3.745	83.50	84
192	3.765	84.00	84
193	3.784	84.50	85
194	3.804	85.00	85
195	3.824	85.50	86
196	3.843	86.00	86
197	3.863	86.50	87
198	3.882	87.00	87
199	3.902	87.50	88
200	3.922	88.00	88
201	3.941	88.50	89
202	3.961	89.00	89
203	3.980	89.50	90
204	4.000	90.00	90
205	4.020	90.50	91
206	4.039	91.00	91
207	4.059	91.50	92
208	4.078	92.00	92
209	4.098	92.50	93
210	4.118	93.00	93
211	4.137	93.50	94
212	4.157	94.00	94
213	4.176	94.50	95
214	4.196	95.00	95

HTD	Voltage Input	Temp Act	Temp Ind
215	4.216	95.50	96
216	4.235	96.00	96
217	4.255	96.50	97
218	4.275	97.00	97
219	4.294	97.50	98
220	4.314	98.00	98
221	4.333	98.50	99
222	4.353	99.00	99
223	4.373	99.50	100
224	4.392	100.00	100
225	4.412	100.50	101
226	4.431	101.00	101
227	4.451	101.50	102
228	4.471	102.00	102
229	4.490	102.50	103
230	4.510	103.00	103
231	4.529	103.50	104
232	4.549	104.00	104
233	4.569	104.50	105
234	4.588	105.00	105
235	4.608	105.50	106
236	4.627	106.00	106
237	4.647	106.50	107
238	4.667	107.00	107
239	4.686	107.50	108
240	4.706	108.00	108
241	4.725	108.50	109
242	4.745	109.00	109
243	4.765	109.50	110
244	4.784	110.00	110
245	4.804	110.50	111
246	4.824	111.00	111
247	4.843	111.50	112
248	4.863	112.00	112
249	4.882	112.50	113
250	4.902	113.00	113
251	4.922	113.50	114
252	4.941	114.00	114
253	4.961	114.50	115
254	4.980	115.00	115
255	5.000	115.50	116

Building Automation Systems Analog Input Voltage Conversion Chart Page 1 of 2

30.0° - 157.5° F TEMPERATURE CHART

STANDARD DUCT SENSOR RANGE V3.2

HTD	Voltage Input	Temp Act	Temp Ind	HTD	Voltage Input	Temp Act	Temp Ind	HTD	Voltage Input	Temp Act	Temp Ind
000	0.000	30.00	30	043	0.843	51.50	52	086	1.686	73.00	73
001	0.020	30.50	31	044	0.863	52.00	52	087	1.706	73.50	74
002	0.039	31.00	31	045	0.882	52.50	53	088	1.725	74.00	74
003	0.059	31.50	32	046	0.902	53.00	53	089	1.745	74.50	75
004	0.078	32.00	32	047	0.922	53.50	54	090	1.765	75.00	75
005	0.098	32.50	33	048	0.941	54.00	54	091	1.784	75.50	76
006	0.118	33.00	33	049	0.961	54.50	55	092	1.804	76.00	76
007	0.137	33.50	34	050	0.980	55.00	55	093	1.824	76.50	77
008	0.157	34.00	34	051	1.000	55.50	56	094	1.843	77.00	77
009	0.176	34.50	35	052	1.020	56.00	56	095	1.863	77.50	78
010	0.196	35.00	35	053	1.039	56.50	57	096	1.882	78.00	78
011	0.216	35.50	36	054	1.059	57.00	57	097	1.902	78.50	79
012	0.235	36.00	36	055	1.078	57.50	58	098	1.922	79.00	79
013	0.255	36.50	37	056	1.098	58.00	58	099	1.941	79.50	80
014	0.275	37.00	37	057	1.118	58.50	59	100	1.961	80.00	80
015	0.294	37.50	38	058	1.137	59.00	59	101	1.980	80.50	81
016	0.314	38.00	38	059	1.157	59.50	60	102	2.000	81.00	81
017	0.333	38.50	39	060	1.176	60.00	60	103	2.020	81.50	82
018	0.353	39.00	39	061	1.196	60.50	61	104	2.039	82.00	82
019	0.373	39.50	40	062	1.216	61.00	61	105	2.059	82.50	83
020	0.392	40.00	40	063	1.235	61.50	62	106	2.078	83.00	83
021	0.412	40.50	41	064	1.255	62.00	62	107	2.098	83.50	84
022	0.431	41.00	41	065	1.275	62.50	63	108	2.118	84.00	84
023	0.451	41.50	42	066	1.294	63.00	63	109	2.137	84.50	85
024	0.471	42.00	42	067	1.314	63.50	64	110	2.157	85.00	85
025	0.490	42.50	43	068	1.333	64.00	64	111	2.176	85.50	86
026	0.510	43.00	43	069	1.353	64.50	65	112	2.196	86.00	86
027	0.529	43.50	44	070	1.373	65.00	65	113	2.216	86.50	87
028	0.549	44.00	44	071	1.392	65.50	66	114	2.235	87.00	87
029	0.569	44.50	45	072	1.412	66.00	66	115	2.255	87.50	88
030	0.588	45.00	45	073	1.431	66.50	67	116	2.275	88.00	88
031	0.608	45.50	46	074	1.451	67.00	67	117	2.294	88.50	89
032	0.627	46.00	46	075	1.471	67.50	68	118	2.314	89.00	89
033	0.647	46.50	47	076	1.490	68.00	68	119	2.333	89.50	90
034	0.667	47.00	47	077	1.510	68.50	69	120	2.353	90.00	90
035	0.686	47.50	48	078	1.529	69.00	69	121	2.373	90.50	91
036	0.706	48.00	48	079	1.549	69.50	70	122	2.392	91.00	91
037	0.725	48.50	49	080	1.569	70.00	70	123	2.412	91.50	92
038	0.745	49.00	49	081	1.588	70.50	71	124	2.431	92.00	92
039	0.765	49.50	50	082	1.608	71.00	71	125	2.451	92.50	93
040	0.784	50.00	50	083	1.627	71.50	72	126	2.471	93.00	93
041	0.804	50.50	51	084	1.647	72.00	72	127	2.490	93.50	94
042	0.824	51.00	51	085	1.667	72.50	73	128	2.510	94.00	94

Building Automation Systems Analog Input Voltage Conversion Chart Page 2 of 2

30.0° - 157.5° F TEMPERATURE CHART

STANDARD DUCT SENSOR RANGE V3.2

	Voltage	Temp	
HTD	Input	Act	Ind
129	2.529	94.50	95
130	2.549	95.00	95
131	2.569	95.50	96
132	2.588	96.00	96
133	2.608	96.50	97
134	2.627	97.00	97
135	2.647	97.50	98
136	2.667	98.00	98
137	2.686	98.50	99
138	2.706	99.00	99
139	2.725	99.50	100
140	2.745	100.00	100
141	2.765	100.50	101
142	2.784	101.00	101
143	2.804	101.50	102
144	2.824	102.00	102
145	2.843	102.50	103
146	2.863	103.00	103
147	2.882	103.50	104
148	2.902	104.00	104
149	2.922	104.50	105
150	2.941	105.00	105
151	2.961	105.50	106
152	2.980	106.00	106
153	3.000	106.50	107
154	3.020	107.00	107
155	3.039	107.50	108
156	3.059	108.00	108
157	3.078	108.50	109
158	3.098	109.00	109
159	3.118	109.50	110
160	3.137	110.00	110
161	3.157	110.50	111
162	3.176	111.00	111
163	3.196	111.50	112
164	3.216	112.00	112
165	3.235	112.50	113
166	3.255	113.00	113
167	3.275	113.50	114
168	3.294	114.00	114
169	3.314	114.50	115
170	3.333	115.00	115
171	3.353	115.50	116

	Voltage	Temp	
HTD	Input	Act	Ind
172	3.373	116.00	116
173	3.392	116.50	117
174	3.412	117.00	117
175	3.431	117.50	118
176	3.451	118.00	118
177	3.471	118.50	119
178	3.490	119.00	119
179	3.510	119.50	120
180	3.529	120.00	120
181	3.549	120.50	121
182	3.569	121.00	121
183	3.588	121.50	122
184	3.608	122.00	122
185	3.627	122.50	123
186	3.647	123.00	123
187	3.667	123.50	124
188	3.686	124.00	124
189	3.706	124.50	125
190	3.725	125.00	125
191	3.745	125.50	126
192	3.765	126.00	126
193	3.784	126.50	127
194	3.804	127.00	127
195	3.824	127.50	128
196	3.843	128.00	128
197	3.863	128.50	129
198	3.882	129.00	129
199	3.902	129.50	130
200	3.922	130.00	130
201	3.941	130.50	131
202	3.961	131.00	131
203	3.980	131.50	132
204	4.000	132.00	132
205	4.020	132.50	133
206	4.039	133.00	133
207	4.059	133.50	134
208	4.078	134.00	134
209	4.098	134.50	135
210	4.118	135.00	135
211	4.137	135.50	136
212	4.157	136.00	136
213	4.176	136.50	137
214	4.196	137.00	137

	Voltage	Temp	
HTD	Input	Act	Ind
215	4.216	137.50	138
216	4.235	138.00	138
217	4.255	138.50	139
218	4.275	139.00	139
219	4.294	139.50	140
220	4.314	140.00	140
221	4.333	140.50	141
222	4.353	141.00	141
223	4.373	141.50	142
224	4.392	142.00	142
225	4.412	142.50	143
226	4.431	143.00	143
227	4.451	143.50	144
228	4.471	144.00	144
229	4.490	144.50	145
230	4.510	145.00	145
231	4.529	145.50	146
232	4.549	146.00	146
233	4.569	146.50	147
234	4.588	147.00	147
235	4.608	147.50	148
236	4.627	148.00	148
237	4.647	148.50	149
238	4.667	149.00	149
239	4.686	149.50	150
240	4.706	150.00	150
241	4.725	150.50	151
242	4.745	151.00	151
243	4.765	151.50	152
244	4.784	152.00	152
245	4.804	152.50	153
246	4.824	153.00	153
247	4.843	153.50	154
248	4.863	154.00	154
249	4.882	154.50	155
250	4.902	155.00	155
251	4.922	155.50	156
252	4.941	156.00	156
253	4.961	156.50	157
254	4.980	157.00	157
255	5.000	157.50	158

Building Automation Systems Analog Input Voltage Conversion Chart Page 1 of 2

0° - 255° F TEMPERATURE CHART

STANDARD WELL SENSOR RANGE V3.2

HTD	Voltage Input	Temp Act	Temp Ind	HTD	Voltage Input	Temp Act	Temp Ind	HTD	Voltage Input	Temp Act	Temp Ind
000	0.000	0.00	0	043	0.843	43.00	43	086	1.686	86.00	86
001	0.020	1.00	1	044	0.863	44.00	44	087	1.706	87.00	87
002	0.039	2.00	2	045	0.882	45.00	45	088	1.725	88.00	88
003	0.059	3.00	3	046	0.902	46.00	46	089	1.745	89.00	89
004	0.078	4.00	4	047	0.922	47.00	47	090	1.765	90.00	90
005	0.098	5.00	5	048	0.941	48.00	48	091	1.784	91.00	91
006	0.118	6.00	6	049	0.961	49.00	49	092	1.804	92.00	92
007	0.137	7.00	7	050	0.980	50.00	50	093	1.824	93.00	93
008	0.157	8.00	8	051	1.000	51.00	51	094	1.843	94.00	94
009	0.176	9.00	9	052	1.020	52.00	52	095	1.863	95.00	95
010	0.196	10.00	10	053	1.039	53.00	53	096	1.882	96.00	96
011	0.216	11.00	11	054	1.059	54.00	54	097	1.902	97.00	97
012	0.235	12.00	12	055	1.078	55.00	55	098	1.922	98.00	98
013	0.255	13.00	13	056	1.098	56.00	56	099	1.941	99.00	99
014	0.275	14.00	14	057	1.118	57.00	57	100	1.961	100.00	100
015	0.294	15.00	15	058	1.137	58.00	58	101	1.980	101.00	101
016	0.314	16.00	16	059	1.157	59.00	59	102	2.000	102.00	102
017	0.333	17.00	17	060	1.176	60.00	60	103	2.020	103.00	103
018	0.353	18.00	18	061	1.196	61.00	61	104	2.039	104.00	104
019	0.373	19.00	19	062	1.216	62.00	62	105	2.059	105.00	105
020	0.392	20.00	20	063	1.235	63.00	63	106	2.078	106.00	106
021	0.412	21.00	21	064	1.255	64.00	64	107	2.098	107.00	107
022	0.431	22.00	22	065	1.275	65.00	65	108	2.118	108.00	108
023	0.451	23.00	23	066	1.294	66.00	66	109	2.137	109.00	109
024	0.471	24.00	24	067	1.314	67.00	67	110	2.157	110.00	110
025	0.490	25.00	25	068	1.333	68.00	68	111	2.176	111.00	111
026	0.510	26.00	26	069	1.353	69.00	69	112	2.196	112.00	112
027	0.529	27.00	27	070	1.373	70.00	70	113	2.216	113.00	113
028	0.549	28.00	28	071	1.392	71.00	71	114	2.235	114.00	114
029	0.569	29.00	29	072	1.412	72.00	72	115	2.255	115.00	115
030	0.588	30.00	30	073	1.431	73.00	73	116	2.275	116.00	116
031	0.608	31.00	31	074	1.451	74.00	74	117	2.294	117.00	117
032	0.627	32.00	32	075	1.471	75.00	75	118	2.314	118.00	118
033	0.647	33.00	33	076	1.490	76.00	76	119	2.333	119.00	119
034	0.667	34.00	34	077	1.510	77.00	77	120	2.353	120.00	120
035	0.686	35.00	35	078	1.529	78.00	78	121	2.373	121.00	121
036	0.706	36.00	36	079	1.549	79.00	79	122	2.392	122.00	122
037	0.725	37.00	37	080	1.569	80.00	80	123	2.412	123.00	123
038	0.745	38.00	38	081	1.588	81.00	81	124	2.431	124.00	124
039	0.765	39.00	39	082	1.608	82.00	82	125	2.451	125.00	125
040	0.784	40.00	40	083	1.627	83.00	83	126	2.471	126.00	126
041	0.804	41.00	41	084	1.647	84.00	84	127	2.490	127.00	127
042	0.824	42.00	42	085	1.667	85.00	85	128	2.510	128.00	128

Building Automation Systems Analog Input Voltage Conversion Chart Page 2 of 2

0° - 255° F TEMPERATURE CHART

STANDARD WELL SENSOR RANGE V3.2

HTD	Voltage Input	Temp Act	Temp Ind	HTD	Voltage Input	Temp Act	Temp Ind	HTD	Voltage Input	Temp Act	Temp Ind
129	2.529	129.00	129	172	3.373	172.00	172	215	4.216	215.00	215
130	2.549	130.00	130	173	3.392	173.00	173	216	4.235	216.00	216
131	2.569	131.00	131	174	3.412	174.00	174	217	4.255	217.00	217
132	2.588	132.00	132	175	3.431	175.00	175	218	4.275	218.00	218
133	2.608	133.00	133	176	3.451	176.00	176	219	4.294	219.00	219
134	2.627	134.00	134	177	3.471	177.00	177	220	4.314	220.00	220
135	2.647	135.00	135	178	3.490	178.00	178	221	4.333	221.00	221
136	2.667	136.00	136	179	3.510	179.00	179	222	4.353	222.00	222
137	2.686	137.00	137	180	3.529	180.00	180	223	4.373	223.00	223
138	2.706	138.00	138	181	3.549	181.00	181	224	4.392	224.00	224
139	2.725	139.00	139	182	3.569	182.00	182	225	4.412	225.00	225
140	2.745	140.00	140	183	3.588	183.00	183	226	4.431	226.00	226
141	2.765	141.00	141	184	3.608	184.00	184	227	4.451	227.00	227
142	2.784	142.00	142	185	3.627	185.00	185	228	4.471	228.00	228
143	2.804	143.00	143	186	3.647	186.00	186	229	4.490	229.00	229
144	2.824	144.00	144	187	3.667	187.00	187	230	4.510	230.00	230
145	2.843	145.00	145	188	3.686	188.00	188	231	4.529	231.00	231
146	2.863	146.00	146	189	3.706	189.00	189	232	4.549	232.00	232
147	2.882	147.00	147	190	3.725	190.00	190	233	4.569	233.00	233
148	2.902	148.00	148	191	3.745	191.00	191	234	4.588	234.00	234
149	2.922	149.00	149	192	3.765	192.00	192	235	4.608	235.00	235
150	2.941	150.00	150	193	3.784	193.00	193	236	4.627	236.00	236
151	2.961	151.00	151	194	3.804	194.00	194	237	4.647	237.00	237
152	2.980	152.00	152	195	3.824	195.00	195	238	4.667	238.00	238
153	3.000	153.00	153	196	3.843	196.00	196	239	4.686	239.00	239
154	3.020	154.00	154	197	3.863	197.00	197	240	4.706	240.00	240
155	3.039	155.00	155	198	3.882	198.00	198	241	4.725	241.00	241
156	3.059	156.00	156	199	3.902	199.00	199	242	4.745	242.00	242
157	3.078	157.00	157	200	3.922	200.00	200	243	4.765	243.00	243
158	3.098	158.00	158	201	3.941	201.00	201	244	4.784	244.00	244
159	3.118	159.00	159	202	3.961	202.00	202	245	4.804	245.00	245
160	3.137	160.00	160	203	3.980	203.00	203	246	4.824	246.00	246
161	3.157	161.00	161	204	4.000	204.00	204	247	4.843	247.00	247
162	3.176	162.00	162	205	4.020	205.00	205	248	4.863	248.00	248
163	3.196	163.00	163	206	4.039	206.00	206	249	4.882	249.00	249
164	3.216	164.00	164	207	4.059	207.00	207	250	4.902	250.00	250
165	3.235	165.00	165	208	4.078	208.00	208	251	4.922	251.00	251
166	3.255	166.00	166	209	4.098	209.00	209	252	4.941	252.00	252
167	3.275	167.00	167	210	4.118	210.00	210	253	4.961	253.00	253
168	3.294	168.00	168	211	4.137	211.00	211	254	4.980	254.00	254
169	3.314	169.00	169	212	4.157	212.00	212	255	5.000	255.00	255
170	3.333	170.00	170	213	4.176	213.00	213				
171	3.353	171.00	171	214	4.196	214.00	214				

Building Automation Systems Analog Input Voltage Conversion Chart Page 1 of 2

4-20 mA dc Analog Device
Input to RSC V3.2

HTD	Voltage Input	mA Input Act	mA Input Ind	HTD	Voltage Input	mA Input Act	mA Input Ind	HTD	Voltage Input	mA Input Act	mA Input Ind
000	0.000	0.00	0	043	0.843	3.37	3	086	1.686	6.74	7
001	0.020	0.08	0	044	0.863	3.45	3	087	1.706	6.82	7
002	0.039	0.16	0	045	0.882	3.53	4	088	1.725	6.90	7
003	0.059	0.24	0	046	0.902	3.61	4	089	1.745	6.98	7
004	0.078	0.31	0	047	0.922	3.69	4	090	1.765	7.06	7
005	0.098	0.39	0	048	0.941	3.76	4	091	1.784	7.14	7
006	0.118	0.47	0	049	0.961	3.84	4	092	1.804	7.22	7
007	0.137	0.55	1	050	0.980	3.92	4	093	1.824	7.29	7
008	0.157	0.63	1	051	1.000	4.00	4	094	1.843	7.37	7
009	0.176	0.71	1	052	1.020	4.08	4	095	1.863	7.45	7
010	0.196	0.78	1	053	1.039	4.16	4	096	1.882	7.53	8
011	0.216	0.86	1	054	1.059	4.24	4	097	1.902	7.61	8
012	0.235	0.94	1	055	1.078	4.31	4	098	1.922	7.69	8
013	0.255	1.02	1	056	1.098	4.39	4	099	1.941	7.76	8
014	0.275	1.10	1	057	1.118	4.47	4	100	1.961	7.84	8
015	0.294	1.18	1	058	1.137	4.55	5	101	1.980	7.92	8
016	0.314	1.25	1	059	1.157	4.63	5	102	2.000	8.00	8
017	0.333	1.33	1	060	1.176	4.71	5	103	2.020	8.08	8
018	0.353	1.41	1	061	1.196	4.78	5	104	2.039	8.16	8
019	0.373	1.49	1	062	1.216	4.86	5	105	2.059	8.24	8
020	0.392	1.57	2	063	1.235	4.94	5	106	2.078	8.31	8
021	0.412	1.65	2	064	1.255	5.02	5	107	2.098	8.39	8
022	0.431	1.73	2	065	1.275	5.10	5	108	2.118	8.47	8
023	0.451	1.80	2	066	1.294	5.18	5	109	2.137	8.55	9
024	0.471	1.88	2	067	1.314	5.25	5	110	2.157	8.63	9
025	0.490	1.96	2	068	1.333	5.33	5	111	2.176	8.71	9
026	0.510	2.04	2	069	1.353	5.41	5	112	2.196	8.78	9
027	0.529	2.12	2	070	1.373	5.49	5	113	2.216	8.86	9
028	0.549	2.20	2	071	1.392	5.57	6	114	2.235	8.94	9
029	0.569	2.27	2	072	1.412	5.65	6	115	2.255	9.02	9
030	0.588	2.35	2	073	1.431	5.73	6	116	2.275	9.10	9
031	0.608	2.43	2	074	1.451	5.80	6	117	2.294	9.18	9
032	0.627	2.51	3	075	1.471	5.88	6	118	2.314	9.25	9
033	0.647	2.59	3	076	1.490	5.96	6	119	2.333	9.33	9
034	0.667	2.67	3	077	1.510	6.04	6	120	2.353	9.41	9
035	0.686	2.75	3	078	1.529	6.12	6	121	2.373	9.49	9
036	0.706	2.82	3	079	1.549	6.20	6	122	2.392	9.57	10
037	0.725	2.90	3	080	1.569	6.27	6	123	2.412	9.65	10
038	0.745	2.98	3	081	1.588	6.35	6	124	2.431	9.73	10
039	0.765	3.06	3	082	1.608	6.43	6	125	2.451	9.80	10
040	0.784	3.14	3	083	1.627	6.51	7	126	2.471	9.88	10
041	0.804	3.22	3	084	1.647	6.59	7	127	2.490	9.96	10
042	0.824	3.29	3	085	1.667	6.67	7	128	2.510	10.04	10

Building Automation Systems Analog Input Voltage Conversion Chart Page 2 of 2

4-20 mA dc Analog Device

Input to RSC V3.2

HTD	Voltage Input	mA Input Act	mA Input Ind	HTD	Voltage Input	mA Input Act	mA Input Ind	HTD	Voltage Input	mA Input Act	mA Input Ind
129	2.529	10.12	10	172	3.373	13.49	13	215	4.216	16.86	17
130	2.549	10.20	10	173	3.392	13.57	14	216	4.235	16.94	17
131	2.569	10.27	10	174	3.412	13.65	14	217	4.255	17.02	17
132	2.588	10.35	10	175	3.431	13.73	14	218	4.275	17.10	17
133	2.608	10.43	10	176	3.451	13.80	14	219	4.294	17.18	17
134	2.627	10.51	11	177	3.471	13.88	14	220	4.314	17.25	17
135	2.647	10.59	11	178	3.490	13.96	14	221	4.333	17.33	17
136	2.667	10.67	11	179	3.510	14.04	14	222	4.353	17.41	17
137	2.686	10.74	11	180	3.529	14.12	14	223	4.373	17.49	17
138	2.706	10.82	11	181	3.549	14.20	14	224	4.392	17.57	18
139	2.725	10.90	11	182	3.569	14.27	14	225	4.412	17.65	18
140	2.745	10.98	11	183	3.588	14.35	14	226	4.431	17.73	18
141	2.765	11.06	11	184	3.608	14.43	14	227	4.451	17.80	18
142	2.784	11.14	11	185	3.627	14.51	15	228	4.471	17.88	18
143	2.804	11.22	11	186	3.647	14.59	15	229	4.490	17.96	18
144	2.824	11.29	11	187	3.667	14.67	15	230	4.510	18.04	18
145	2.843	11.37	11	188	3.686	14.74	15	231	4.529	18.12	18
146	2.863	11.45	11	189	3.706	14.82	15	232	4.549	18.20	18
147	2.882	11.53	12	190	3.725	14.90	15	233	4.569	18.27	18
148	2.902	11.61	12	191	3.745	14.98	15	234	4.588	18.35	18
149	2.922	11.69	12	192	3.765	15.06	15	235	4.608	18.43	18
150	2.941	11.76	12	193	3.784	15.14	15	236	4.627	18.51	19
151	2.961	11.84	12	194	3.804	15.22	15	237	4.647	18.59	19
152	2.980	11.92	12	195	3.824	15.29	15	238	4.667	18.67	19
153	3.000	12.00	12	196	3.843	15.37	15	239	4.686	18.74	19
154	3.020	12.08	12	197	3.863	15.45	15	240	4.706	18.82	19
155	3.039	12.16	12	198	3.882	15.53	16	241	4.725	18.90	19
156	3.059	12.24	12	199	3.902	15.61	16	242	4.745	18.98	19
157	3.078	12.31	12	200	3.922	15.69	16	243	4.765	19.06	19
158	3.098	12.39	12	201	3.941	15.76	16	244	4.784	19.14	19
159	3.118	12.47	12	202	3.961	15.84	16	245	4.804	19.22	19
160	3.137	12.55	13	203	3.980	15.92	16	246	4.824	19.29	19
161	3.157	12.63	13	204	4.000	16.00	16	247	4.843	19.37	19
162	3.176	12.71	13	205	4.020	16.08	16	248	4.863	19.45	19
163	3.196	12.78	13	206	4.039	16.16	16	249	4.882	19.53	20
164	3.216	12.86	13	207	4.059	16.24	16	250	4.902	19.61	20
165	3.235	12.94	13	208	4.078	16.31	16	251	4.922	19.69	20
166	3.255	13.02	13	209	4.098	16.39	16	252	4.941	19.76	20
167	3.275	13.10	13	210	4.118	16.47	16	253	4.961	19.84	20
168	3.294	13.18	13	211	4.137	16.55	17	254	4.980	19.92	20
169	3.314	13.25	13	212	4.157	16.63	17	255	5.000	20.00	20
170	3.333	13.33	13	213	4.176	16.71	17				
171	3.353	13.41	13	214	4.196	16.78	17				

Building Automation Systems Analog Input Voltage Conversion Chart Page 1 of 2

0-5.00 Vdc Analog Device

Input to RSC V3.2

	Voltage	Input			Voltage	Input			Voltage	Input	
HTD	Input	Act	Ind	HTD	Input	Act	Ind	HTD	Input	Act	Ind
000	0.000	0.00	0	043	0.843	0.84	1	086	1.686	1.69	2
001	0.020	0.02	0	044	0.863	0.86	1	087	1.706	1.71	2
002	0.039	0.04	0	045	0.882	0.88	1	088	1.725	1.73	2
003	0.059	0.06	0	046	0.902	0.90	1	089	1.745	1.75	2
004	0.078	0.08	0	047	0.922	0.92	1	090	1.765	1.76	2
005	0.098	0.10	0	048	0.941	0.94	1	091	1.784	1.78	2
006	0.118	0.12	0	049	0.961	0.96	1	092	1.804	1.80	2
007	0.137	0.14	0	050	0.980	0.98	1	093	1.824	1.82	2
008	0.157	0.16	0	051	1.000	1.00	1	094	1.843	1.84	2
009	0.176	0.18	0	052	1.020	1.02	1	095	1.863	1.86	2
010	0.196	0.20	0	053	1.039	1.04	1	096	1.882	1.88	2
011	0.216	0.22	0	054	1.059	1.06	1	097	1.902	1.90	2
012	0.235	0.24	0	055	1.078	1.08	1	098	1.922	1.92	2
013	0.255	0.25	0	056	1.098	1.10	1	099	1.941	1.94	2
014	0.275	0.27	0	057	1.118	1.12	1	100	1.961	1.96	2
015	0.294	0.29	0	058	1.137	1.14	1	101	1.980	1.98	2
016	0.314	0.31	0	059	1.157	1.16	1	102	2.000	2.00	2
017	0.333	0.33	0	060	1.176	1.18	1	103	2.020	2.02	2
018	0.353	0.35	0	061	1.196	1.20	1	104	2.039	2.04	2
019	0.373	0.37	0	062	1.216	1.22	1	105	2.059	2.06	2
020	0.392	0.39	0	063	1.235	1.24	1	106	2.078	2.08	2
021	0.412	0.41	0	064	1.255	1.26	1	107	2.098	2.10	2
022	0.431	0.43	0	065	1.275	1.27	1	108	2.118	2.12	2
023	0.451	0.45	0	066	1.294	1.29	1	109	2.137	2.14	2
024	0.471	0.47	0	067	1.314	1.31	1	110	2.157	2.16	2
025	0.490	0.49	0	068	1.333	1.33	1	111	2.176	2.18	2
026	0.510	0.51	1	069	1.353	1.35	1	112	2.196	2.20	2
027	0.529	0.53	1	070	1.373	1.37	1	113	2.216	2.22	2
028	0.549	0.55	1	071	1.392	1.39	1	114	2.235	2.24	2
029	0.569	0.57	1	072	1.412	1.41	1	115	2.255	2.26	2
030	0.588	0.59	1	073	1.431	1.43	1	116	2.275	2.27	2
031	0.608	0.61	1	074	1.451	1.45	1	117	2.294	2.29	2
032	0.627	0.63	1	075	1.471	1.47	1	118	2.314	2.31	2
033	0.647	0.65	1	076	1.490	1.49	1	119	2.333	2.33	2
034	0.667	0.67	1	077	1.510	1.51	2	120	2.353	2.35	2
035	0.686	0.69	1	078	1.529	1.53	2	121	2.373	2.37	2
036	0.706	0.71	1	079	1.549	1.55	2	122	2.392	2.39	2
037	0.725	0.73	1	080	1.569	1.57	2	123	2.412	2.41	2
038	0.745	0.75	1	081	1.588	1.59	2	124	2.431	2.43	2
039	0.765	0.76	1	082	1.608	1.61	2	125	2.451	2.45	2
040	0.784	0.78	1	083	1.627	1.63	2	126	2.471	2.47	2
041	0.804	0.80	1	084	1.647	1.65	2	127	2.490	2.49	2
042	0.824	0.82	1	085	1.667	1.67	2	128	2.510	2.51	3

Building Automation Systems Analog Input Voltage Conversion Chart Page 2 of 2

0-5.00 Vdc Analog Device
Input to RSC V3.2

HTD	Voltage Input	Input Act	Input Ind	HTD	Voltage Input	Input Act	Input Ind	HTD	Voltage Input	Input Act	Input Ind
129	2.529	2.53	3	172	3.373	3.37	3	215	4.216	4.22	4
130	2.549	2.55	3	173	3.392	3.39	3	216	4.235	4.24	4
131	2.569	2.57	3	174	3.412	3.41	3	217	4.255	4.26	4
132	2.588	2.59	3	175	3.431	3.43	3	218	4.275	4.27	4
133	2.608	2.61	3	176	3.451	3.45	3	219	4.294	4.29	4
134	2.627	2.63	3	177	3.471	3.47	3	220	4.314	4.31	4
135	2.647	2.65	3	178	3.490	3.49	3	221	4.333	4.33	4
136	2.667	2.67	3	179	3.510	3.51	4	222	4.353	4.35	4
137	2.686	2.69	3	180	3.529	3.53	4	223	4.373	4.37	4
138	2.706	2.71	3	181	3.549	3.55	4	224	4.392	4.39	4
139	2.725	2.73	3	182	3.569	3.57	4	225	4.412	4.41	4
140	2.745	2.75	3	183	3.588	3.59	4	226	4.431	4.43	4
141	2.765	2.77	3	184	3.608	3.61	4	227	4.451	4.45	4
142	2.784	2.78	3	185	3.627	3.63	4	228	4.471	4.47	4
143	2.804	2.80	3	186	3.647	3.65	4	229	4.490	4.49	4
144	2.824	2.82	3	187	3.667	3.67	4	230	4.510	4.51	5
145	2.843	2.84	3	188	3.686	3.69	4	231	4.529	4.53	5
146	2.863	2.86	3	189	3.706	3.71	4	232	4.549	4.55	5
147	2.882	2.88	3	190	3.725	3.73	4	233	4.569	4.57	5
148	2.902	2.90	3	191	3.745	3.75	4	234	4.588	4.59	5
149	2.922	2.92	3	192	3.765	3.77	4	235	4.608	4.61	5
150	2.941	2.94	3	193	3.784	3.78	4	236	4.627	4.63	5
151	2.961	2.96	3	194	3.804	3.80	4	237	4.647	4.65	5
152	2.980	2.98	3	195	3.824	3.82	4	238	4.667	4.67	5
153	3.000	3.00	3	196	3.843	3.84	4	239	4.686	4.69	5
154	3.020	3.02	3	197	3.863	3.86	4	240	4.706	4.71	5
155	3.039	3.04	3	198	3.882	3.88	4	241	4.725	4.73	5
156	3.059	3.06	3	199	3.902	3.90	4	242	4.745	4.75	5
157	3.078	3.08	3	200	3.922	3.92	4	243	4.765	4.77	5
158	3.098	3.10	3	201	3.941	3.94	4	244	4.784	4.78	5
159	3.118	3.12	3	202	3.961	3.96	4	245	4.804	4.80	5
160	3.137	3.14	3	203	3.980	3.98	4	246	4.824	4.82	5
161	3.157	3.16	3	204	4.000	4.00	4	247	4.843	4.84	5
162	3.176	3.18	3	205	4.020	4.02	4	248	4.863	4.86	5
163	3.196	3.20	3	206	4.039	4.04	4	249	4.882	4.88	5
164	3.216	3.22	3	207	4.059	4.06	4	250	4.902	4.90	5
165	3.235	3.24	3	208	4.078	4.08	4	251	4.922	4.92	5
166	3.255	3.26	3	209	4.098	4.10	4	252	4.941	4.94	5
167	3.275	3.27	3	210	4.118	4.12	4	253	4.961	4.96	5
168	3.294	3.29	3	211	4.137	4.14	4	254	4.980	4.98	5
169	3.314	3.31	3	212	4.157	4.16	4	255	5.000	5.00	5
170	3.333	3.33	3	213	4.176	4.18	4				
171	3.353	3.35	3	214	4.196	4.20	4				

Chapter 3

Analog Outputs

Overview

The **Energy Zone®** System has the capacity for four Analog Outputs at every RSC.

Features

- Quad Analog Output Cards are capable of both 4-20 mA and 0-10 Vdc
- Connection to RSC with single 16 pin ribbon cable

Specifications

General - Four modulating analog outputs are provided by a Quad Analog Output (QAO) card. The QAO is 5 1/2”w x 7”h and is mounted in a 7 1/2”w x 9”h NEMA 1 metal enclosure. Electrical conduit knockouts are provided in both 1/2” and 3/4” sizes. QAOs are available from BAS without an enclosure and can be mounted directly to any flat surface using plastic standoffs. The QAO is rated as Class 2 limited energy electrical device.

The QAO receives its digital control data from the RSC. This data is used to generate 4 individual modulating outputs. The output resolution is 8 bits, or 256 steps. Each output is jumper selectable as either 4-20 mA or 0-10 Vdc.

The QAO provides a linear output from 0-10 Vdc or 4-20 mA. The card receives power from both the 5 Vdc and the 18 Vdc supply of the RSC. Two calibration pots are located on the circuit board for each channel. They are used adjust the output gain, one for the 0-10 Vdc and one for the 4-20 mA dc output.

Operation

Analog Output Card

The RSC sends information on the serial data line that corresponds to the percentage full scale. The AO Card will translate this information to a voltage or current output signal.

Installation

Location and Mounting

The QAO must be mounted in close proximity to the RSC for the Zone it serves. The QAO must be either mounted in a dry location or a field supplied enclosure used.

Setup

Two jumpers need to be set for each AO channel used. Set both jumpers to either V, for 0-10 Vdc output, or I, for 4-20 mA dc output.

Wiring

1. The AO card connects to the RSC by means of a factory provided 16 pin ribbon cable and connector. This cable should not exceed 18” in length. The connector and cable will fit through a 3/4” conduit nipple.
2. A standard Class 2 wire is used between the QAO and the controlled device. The wire should be a minimum 20 AWG.

System Startup/Checkout

The easiest way to check AO Cards is to activate the output after connecting the actuator (or other controlled device). If the actuator is correctly positioned then the AO Card is wired and functioning correctly.

1. Use the Handheld Tester or the Command Center to set the output to 100% open (value of 255). The output and the actuator load should go to the commanded state.
2. Adjust the gain using the pot on the circuit card as necessary to set the actuator to 100%.
3. Check the actuator at other points as desired. If using the Handheld Tester, see the conversion chart in this chapter to determine output values for any given desired % open position.

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ANALOG OUTPUT CONVERSION CHART

0-10 Vdc and 4-20 mA dc Outputs

HTD	4-20 mA	0-10 Vdc	% Opn	HTD	4-20 mA	0-10 Vdc	% Opn	HTD	4-20 mA	0-10 Vdc	% Opn
000	4.00	0.00	0.0	043	6.70	1.69	16.9	086	9.40	3.37	33.7
001	4.06	0.04	0.4	044	6.76	1.73	17.3	087	9.46	3.41	34.1
002	4.13	0.08	0.8	045	6.82	1.76	17.6	088	9.52	3.45	34.5
003	4.19	0.12	1.2	046	6.89	1.80	18.0	089	9.58	3.49	34.9
004	4.25	0.16	1.6	047	6.95	1.84	18.4	090	9.65	3.53	35.3
005	4.31	0.20	2.0	048	7.01	1.88	18.8	091	9.71	3.57	35.7
006	4.38	0.24	2.4	049	7.07	1.92	19.2	092	9.77	3.61	36.1
007	4.44	0.27	2.7	050	7.14	1.96	19.6	093	9.84	3.65	36.5
008	4.50	0.31	3.1	051	7.20	2.00	20.0	094	9.90	3.69	36.9
009	4.56	0.35	3.5	052	7.26	2.04	20.4	095	9.96	3.73	37.3
010	4.63	0.39	3.9	053	7.33	2.08	20.8	096	10.02	3.77	37.6
011	4.69	0.43	4.3	054	7.39	2.12	21.2	097	10.09	3.80	38.0
012	4.75	0.47	4.7	055	7.45	2.16	21.6	098	10.15	3.84	38.4
013	4.82	0.51	5.1	056	7.51	2.20	22.0	099	10.21	3.88	38.8
014	4.88	0.55	5.5	057	7.58	2.24	22.4	100	10.28	3.92	39.2
015	4.94	0.59	5.9	058	7.64	2.27	22.7	101	10.34	3.96	39.6
016	5.00	0.63	6.3	059	7.70	2.31	23.1	102	10.40	4.00	40.0
017	5.07	0.67	6.7	060	7.77	2.35	23.5	103	10.46	4.04	40.4
018	5.13	0.71	7.1	061	7.83	2.39	23.9	104	10.53	4.08	40.8
019	5.19	0.75	7.5	062	7.89	2.43	24.3	105	10.59	4.12	41.2
020	5.26	0.78	7.8	063	7.95	2.47	24.7	106	10.65	4.16	41.6
021	5.32	0.82	8.2	064	8.02	2.51	25.1	107	10.71	4.20	42.0
022	5.38	0.86	8.6	065	8.08	2.55	25.5	108	10.78	4.24	42.4
023	5.44	0.90	9.0	066	8.14	2.59	25.9	109	10.84	4.27	42.7
024	5.51	0.94	9.4	067	8.20	2.63	26.3	110	10.90	4.31	43.1
025	5.57	0.98	9.8	068	8.27	2.67	26.7	111	10.97	4.35	43.5
026	5.63	1.02	10.2	069	8.33	2.71	27.1	112	11.03	4.39	43.9
027	5.69	1.06	10.6	070	8.39	2.75	27.5	113	11.09	4.43	44.3
028	5.76	1.10	11.0	071	8.46	2.78	27.8	114	11.15	4.47	44.7
029	5.82	1.14	11.4	072	8.52	2.82	28.2	115	11.22	4.51	45.1
030	5.88	1.18	11.8	073	8.58	2.86	28.6	116	11.28	4.55	45.5
031	5.95	1.22	12.2	074	8.64	2.90	29.0	117	11.34	4.59	45.9
032	6.01	1.26	12.5	075	8.71	2.94	29.4	118	11.40	4.63	46.3
033	6.07	1.29	12.9	076	8.77	2.98	29.8	119	11.47	4.67	46.7
034	6.13	1.33	13.3	077	8.83	3.02	30.2	120	11.53	4.71	47.1
035	6.20	1.37	13.7	078	8.89	3.06	30.6	121	11.59	4.75	47.5
036	6.26	1.41	14.1	079	8.96	3.10	31.0	122	11.66	4.78	47.8
037	6.32	1.45	14.5	080	9.02	3.14	31.4	123	11.72	4.82	48.2
038	6.38	1.49	14.9	081	9.08	3.18	31.8	124	11.78	4.86	48.6
039	6.45	1.53	15.3	082	9.15	3.22	32.2	125	11.84	4.90	49.0
040	6.51	1.57	15.7	083	9.21	3.26	32.5	126	11.91	4.94	49.4
041	6.57	1.61	16.1	084	9.27	3.29	32.9	127	11.97	4.98	49.8
042	6.64	1.65	16.5	085	9.33	3.33	33.3	128	12.03	5.02	50.2

ANALOG OUTPUT CONVERSION CHART

0-10 Vdc and 4-20 mA dc Outputs

HTD	4-20 mA	0-10 Vdc	% Opn	HTD	4-20 mA	0-10 Vdc	% Opn	HTD	4-20 mA	0-10 Vdc	% Opn
129	12.09	5.06	50.6	172	14.79	6.75	67.5	215	17.49	8.43	84.3
130	12.16	5.10	51.0	173	14.86	6.79	67.8	216	17.55	8.47	84.7
131	12.22	5.14	51.4	174	14.92	6.82	68.2	217	17.62	8.51	85.1
132	12.28	5.18	51.8	175	14.98	6.86	68.6	218	17.68	8.55	85.5
133	12.35	5.22	52.2	176	15.04	6.90	69.0	219	17.74	8.59	85.9
134	12.41	5.26	52.5	177	15.11	6.94	69.4	220	17.81	8.63	86.3
135	12.47	5.29	52.9	178	15.17	6.98	69.8	221	17.87	8.67	86.7
136	12.53	5.33	53.3	179	15.23	7.02	70.2	222	17.93	8.71	87.1
137	12.60	5.37	53.7	180	15.30	7.06	70.6	223	17.99	8.75	87.5
138	12.66	5.41	54.1	181	15.36	7.10	71.0	224	18.06	8.79	87.8
139	12.72	5.45	54.5	182	15.42	7.14	71.4	225	18.12	8.82	88.2
140	12.79	5.49	54.9	183	15.48	7.18	71.8	226	18.18	8.86	88.6
141	12.85	5.53	55.3	184	15.55	7.22	72.2	227	18.24	8.90	89.0
142	12.91	5.57	55.7	185	15.61	7.26	72.5	228	18.31	8.94	89.4
143	12.97	5.61	56.1	186	15.67	7.29	72.9	229	18.37	8.98	89.8
144	13.04	5.65	56.5	187	15.73	7.33	73.3	230	18.43	9.02	90.2
145	13.10	5.69	56.9	188	15.80	7.37	73.7	231	18.50	9.06	90.6
146	13.16	5.73	57.3	189	15.86	7.41	74.1	232	18.56	9.10	91.0
147	13.22	5.77	57.6	190	15.92	7.45	74.5	233	18.62	9.14	91.4
148	13.29	5.80	58.0	191	15.99	7.49	74.9	234	18.68	9.18	91.8
149	13.35	5.84	58.4	192	16.05	7.53	75.3	235	18.75	9.22	92.2
150	13.41	5.88	58.8	193	16.11	7.57	75.7	236	18.81	9.26	92.5
151	13.48	5.92	59.2	194	16.17	7.61	76.1	237	18.87	9.30	92.9
152	13.54	5.96	59.6	195	16.24	7.65	76.5	238	18.93	9.33	93.3
153	13.60	6.00	60.0	196	16.30	7.69	76.9	239	19.00	9.37	93.7
154	13.66	6.04	60.4	197	16.36	7.73	77.3	240	19.06	9.41	94.1
155	13.73	6.08	60.8	198	16.42	7.77	77.6	241	19.12	9.45	94.5
156	13.79	6.12	61.2	199	16.49	7.80	78.0	242	19.19	9.49	94.9
157	13.85	6.16	61.6	200	16.55	7.84	78.4	243	19.25	9.53	95.3
158	13.91	6.20	62.0	201	16.61	7.88	78.8	244	19.31	9.57	95.7
159	13.98	6.24	62.4	202	16.68	7.92	79.2	245	19.37	9.61	96.1
160	14.04	6.28	62.7	203	16.74	7.96	79.6	246	19.44	9.65	96.5
161	14.10	6.31	63.1	204	16.80	8.00	80.0	247	19.50	9.69	96.9
162	14.17	6.35	63.5	205	16.86	8.04	80.4	248	19.56	9.73	97.3
163	14.23	6.39	63.9	206	16.93	8.08	80.8	249	19.62	9.77	97.6
164	14.29	6.43	64.3	207	16.99	8.12	81.2	250	19.69	9.81	98.0
165	14.35	6.47	64.7	208	17.05	8.16	81.6	251	19.75	9.84	98.4
166	14.42	6.51	65.1	209	17.11	8.20	82.0	252	19.81	9.88	98.8
167	14.48	6.55	65.5	210	17.18	8.24	82.4	253	19.88	9.92	99.2
168	14.54	6.59	65.9	211	17.24	8.28	82.7	254	19.94	9.96	99.6
169	14.60	6.63	66.3	212	17.30	8.31	83.1	255	20.00	10.00	100
170	14.67	6.67	66.7	213	17.37	8.35	83.5				
171	14.73	6.71	67.1	214	17.43	8.39	83.9				

Quad Analog Output Board Layout

EnerNet®

Overview

EnerNet® is the network of hardware, software, and wiring used for communications between the Command Center and Remote System Controllers (RSCs) in an **Energy Zone®** System. **EnerNet®** is extremely robust and reliable. The heart of EnerNet is the Advanced Communication Link (ACL). The ACL resides in the Command Center and manages the **EnerNet®** and all communications between the Command Center and the Remote System Controllers.

Features

- Uses 2-Wire RS-485 trunk line
- Up to 8 trunk lines per System
- Up to 32 RSCs per trunk line
- Minimum of hardware, operated by 1 plug-in card (ACL) at the Command Center
- Transmits at 9600 baud
- Resistant to noise and electrical interference
- Protection from electrical spikes
- LED indication of Trunk Line status
- Terminations at ACL made with standard RJ-11 connectors

Specifications

General Description - **EnerNet®** communicates with all RSCs in the System once every 8 seconds. During each 8 second cycle, commands are transmitted to each RSC and each RSC in turn responds with the status of all analog and digital inputs. Each data packet, both to and from the ACL, is checked for data errors. Any data packet in which the data can not be verified is rejected. In the event of data errors, or any problem affecting communications, the RSC will maintain all of its outputs at their current state for 3 minutes. After the end of three minutes the RSC will enter default mode.

Command Center - All communications begin at the Command Center. The **Energy Zone®** software transmits its data to and receives data from the ACL through dual ported RAM in the Command Center. The Command Center directs the ACL when to transmit and receive data from the RSCs. Any communication errors identified by the ACL are reported to the Command Center, where appropriate action can be taken by the **Energy Zone®** software. Any RSC that does not transmit valid data for 3 minutes is considered off-line by the Command Center.

Advanced Communication Link (ACL) - The ACL is an intelligent serial communication board, designed to operate in one of the full length standard ISA 8 bit slots of the Command Center. The ACL is powered by an 8 MHz 8088 microprocessor, which manages the 8 RS-232 serial ports. These serial ports are connected by a 37 pin cable to an 8 port breakout box. The ACL continuously monitors the condition of the network and the communication status of all RSCs. Any communication errors are reported to the Command Center and logged in the Alarm Log.

Breakout Box - The breakout box is connected by a 37 pin cable to the ACL. The breakout box performs the conversion from RS-232 to RS-485 and provides the means for connection of the trunk lines from the field.

Trunk Line - Communication between each RSC and the Command Center follows the RS-485 specification. Up to 32 RSCs can be placed on each of eight trunk lines. Communication is on a standard 2-conductor, 18 AWG, twisted shielded pair (tsp), with all RSCs on a trunk line wired in parallel. Maximum length of the trunk line is 5000'. The trunk line is protected from voltage spikes at each RSC by surge suppressers. Automatic resetting solid state fuses prevent damage to the surge suppressers by sustained faults.

Remote System Controller - The RSCs are all connected in parallel to the trunk line. The RSC stores the status of all analog and digital inputs and will transmit this data in response to a command by the ACL. Communication via the RS-232 specification is also available at the RSC, used for the Handheld Tester.

Two LEDs at each RSC indicate the status of communication, one for incoming and one for outgoing transmissions. A green LED will indicate any traffic on the trunk, both from the Command Center and from all other connected RSCs. A yellow LED will indicate the outgoing data from the RSC.

Sequence of Operation

Normal Operation

1. The Command Center will calculate the correct state for each output and place this data in the dual ported RAM.
2. The ACL will retrieve this data from the dual ported ram and transmit on each trunk line once every 8 seconds. This block of data contains commands for each RSC connected to the trunk line. The ACL will cycle through all trunk lines in order (1 first - 8 last).
3. The RSCs will then respond in order of address (address 1 first - address 32 last). The response from the RSC will include address, equipment schedule, analog input values, and digital input values.
4. The ACL will place the response data from the RSC in the dual ported ram.
5. The Command Center will use this data to determine the next commanded state for each RSC and repeat the cycle.

Error Conditions

1. The ACL continuously monitors each trunk line for several alarm conditions. Any errors are reported immediately to the Command Center.
2. The Command Center will store this information in the Alarm Log.
3. If the total time since the last good data received from any RSC exceeds 3 minutes, that RSC is considered off-line at the Command Center. This timer can be monitored on the Troubleshooting Screen at the Command Center.
4. A separate timer at the RSC will begin a countdown after loss of communication with the Command Center. During this countdown, the RSC will maintain the last commanded state on all outputs. After 3 minutes, the RSC will enter default mode and control its outputs based on the default software located in the EPROM.
5. Both the RSC and the Command Center will continuously attempt to reestablish a communication link. If one good data packet is received, this will reset the countdown timers at both locations.

Installation

Location and Mounting

1. ACL - The ACL is installed in the Command Center by BAS.

2. Breakout Box - The Breakout Box is connected to a the ACL with a 6' long 37 pin cable. The Breakout Box should be set directly adjacent to the Command Center.

3. Termination Box - The Termination Box connects to the Breakout Box using standard RJ-11 connectors. Many varieties of Termination Boxes can be used. The type of Termination Box will determine the mounting procedure. The Termination Box must be within 25' of the Breakout Box. The Termination Box should be mounted in an accessible location.

Wiring

1. The following rules must be carefully followed for a trouble free installation (These instructions are not intended to conflict with National or local Electrical Codes. It is the responsibility of the installer to ensure Code compliance.):
   a. A 2 conductor twisted shielded pair cable is used for all trunk line wiring. See wiring layout at the end of this chapter for correct wire size.
   b. Do not run the trunk line through an electrically noisy environment.
   c. The shield around the trunk line must maintain continuity throughout the System. Splice the shield within the RSC enclosure. Tape the splice to prevent shorting the shield to the enclosure. The shield from the trunk line should not terminate or be grounded anywhere except at the Termination Box.
   d. A 120 Ohm termination resistor must be placed across the Trunk Line at the RSC located farthest from the Command Center. This is done by inserting a jumper on the factory provided termination resistor terminals.
   e. All RSCs are to be wired in parallel. The polarity of the trunk line must be maintained throughout. The black wire must be connected to the - terminal on all RSCs and the white or red wire must be connected to the + terminal on all RSCs.
   f. The trunk line should be wired from RSC to RSC in a daisy chain fashion. A star configuration will work in some applications, but is more prone to communication errors.
   g. It is not necessary to have the RSCs addressed consecutively. The RSCs may be addressed and wired in any order.
   h. Do not allow either side of the trunk line to make contact with any voltage source. This is likely to cause severe damage to both the ACL and all RSCs connected to the trunk line.

<u>Table of Trunk Line Wiring Terminations</u>

Function	9 Pin Connector	9 Pin to RJ-11	RJ-11 ACL End	RJ-11 Term Box	Term Box Color	Trunk Wire	RSC
Trunk Line -	2/7	Yellow	2	5	Black	Black	**-** Terminal
Trunk Line +	4/9	Green	3	4	Red	Red/White	+Terminal
Ground	5	Red	4	3	Green	Bare/Shield	N/A

System Startup/Checkout

General Procedure

1. Install trunk line.
2. Verify with a multimeter that no shorts exist (trunk - to trunk +, trunk - to shield, trunk + to shield).
3. Check the resistance between the - trunk and the + trunk with a multimeter. This value should be 100 - 200 ohms.
4. Verify with a multimeter that the shield is properly grounded.
5. Apply power to the Command Center.
6. Apply power to all RSCs.
7. Set communication trunk logging level to Detailed Comm Errs.
8. Verify all connected RSCs respond to the Command Center.
9. Check Alarm Log for communication errors after 24 hours of logging. Make repairs or corrections as necessary.
10. After trunk line is verified, reduce logging level to Minimal.

ACL

1. On initial bootup, the ACL software is downloaded to the ACL. If the ACL is functioning correctly, the following message is displayed: "Load of ACLEMS.CP onto ACL is completed"
2. If the ACL has a problem, the following message is displayed: "ACL does not respond". If this message occurs, contact BAS.

RSC

1. Each RSC will indicate communication with the Command Center using the heartbeat LED. The LED will flash once every 3 seconds if communication has been established with the Command Center. If communication has been lost, the LED will flash twice every three seconds.
2. Communications can also be monitored using the trunk status LEDs. Each RSC and the Command Center will activate the green LED when transmitting. Each individual RSC will indicate a transmission of data be activating the yellow LED on that RSC.

Command Center

1. The Command Center will give an overall indication of communication status using the icon in the main EZ list box. If communication has been established any time during the previous 3 minutes, the icon will indicate one of the possible on-line control modes.
2. The Troubleshooting screen will give a detailed indication of the communication status at each RSC. The System displays the length of time since the last valid packet was received. This time should be generally less than 10 seconds. If this value exceeds 12 seconds, communication errors are occurring which cause data loss.
3. The Alarm Log will maintain a record of all communication errors. These alarms are only indicated in the Alarm Log. An explanation of those error messages is:

    a. Level 1 (Minimal) Logging

    - `Fri Aug 14 17:38:18 ** RSC 1-13 ALARM: BAD RSC CHECKSUM`

    Some part of the packet became corrupted during transmission from the RSC. This is generally not a problem if it only appears occasionally.

- `Fri Aug 14 17:38:18 ** RSC 3-4 ALARM: RSC assumed in default.`

Over three minutes have elapsed since the last valid packet was received from the RSC. This RSC is now assumed to be running in its default mode of operation. From this time until the first valid packet is received, the System will send initialization packets to the RSC. Unless it is known that an RSC was manually taken off-line, this is an important message and should be taken seriously.

b. Level 2 (Loosing Packets) Logging - All Level 1 messages are logged in addition to the following:

- `Fri Aug 14 17:38:18 ** RSC 1-2 ALARM: We're loosing packets.`

Over one minute has elapsed since the last valid packet was received from the RSC. This message should be taken seriously as an indicator that the network connection is weak or in the process of failing.

c. Level 3 (Hardware Errors) Logging - This is the same as Level 2. No additional messages are logged at this time.

d. Level 4 (Detailed Comm Errs) Logging - All Level 1, 2, and 3 messages are logged in addition to the following:

- `Fri Aug 14 17:38:18 ** Trunk 3 ALARM: Bad Packet length = 47`
- `Fri Aug 14 17:38:18 ** RSC 2-14 ALARM: Bad Packet Address = 39`

These two messages should be rare. If they are appearing, treat them as a bad checksum error.

- `Fri Aug 14 17:38:18 ** Trunk 4 ALARM: Overrun Error`

This error will occur when a character is received before the previous character has been removed from the buffer on the ACL. This error should not occur.

- `Fri Aug 14 17:38:18 ** Trunk 4 ALARM: Parity Error`

This error occurs when the parity bit does not concur with the previous bit. **EnerNet®** does not use parity bits and this error should not occur.

- `Fri Aug 14 17:38:18 ** Trunk 4 ALARM: Framing Error`

This error occurs when an incomplete byte of data was received (i.e. missing stop bit). This error generally indicates poor connections.

- `Fri Aug 14 17:38:18 ** Trunk 4 ALARM: Received Break`

This error indicates that the ACL thought it was receiving data but the serial line fell to zero volts. This occurs when pull-up/pull-down resistors are missing from the Breakout Box (these are installed at the factory) or a poor connection exists somewhere on the trunk.

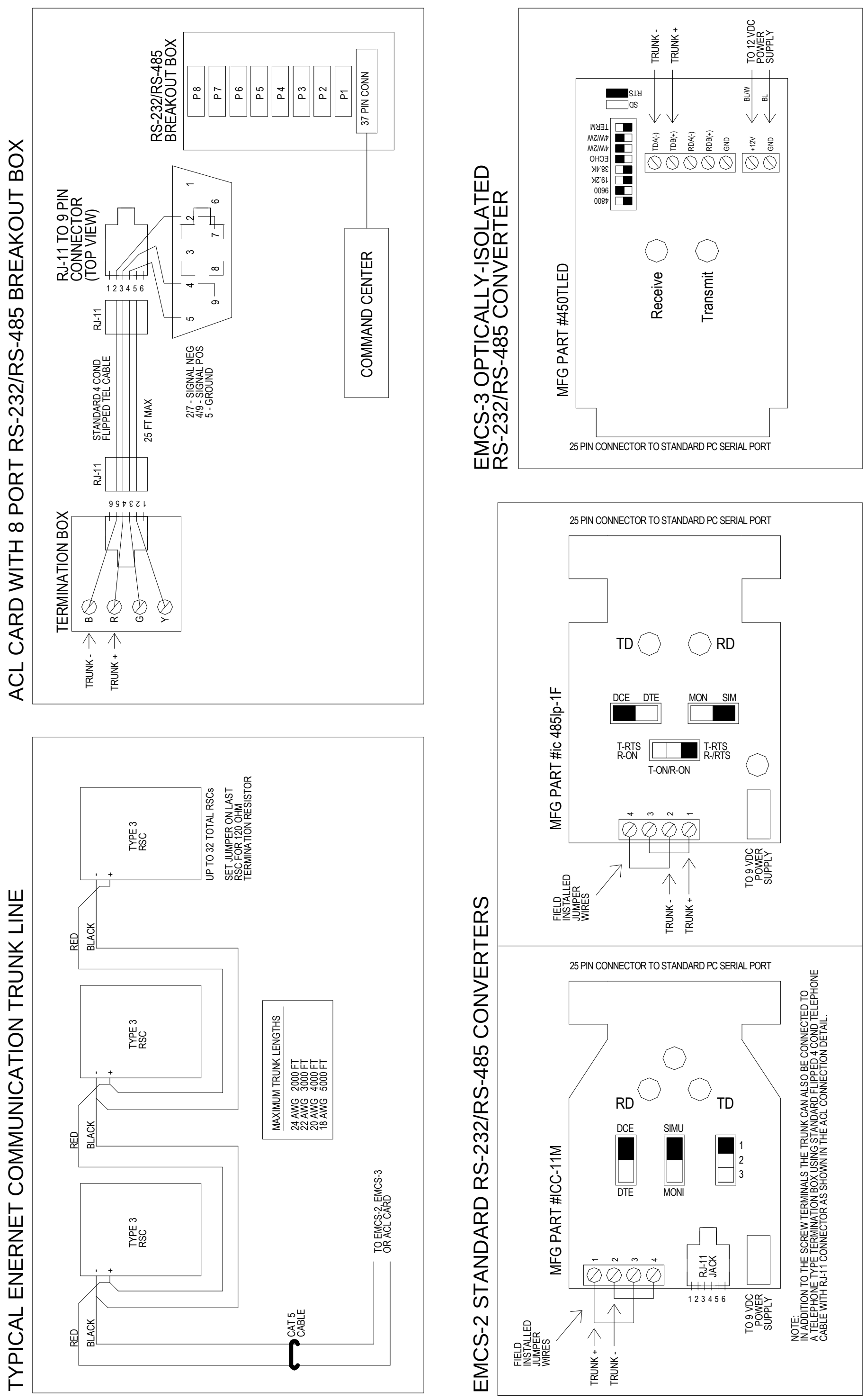
Troubleshooting Trunk Line Problems

Note: An oscilloscope can be very useful in troubleshooting communication problems. The same procedures are followed as when using a multimeter, but the indication is clearer. The scope should be battery powered to prevent grounding the trunk line when connected to the scope.

1. If a complete communication failure has occurred, repeat the steps in the General Procedure above. If everything checks out, continue.
2. With the System all connected and energized, check the trunk line dc voltage with a multimeter at the Termination Box.
   a. Place the positive probe on + trunk and the negative probe on - trunk
   b. The voltage when the ACL is in an idle state should be .25 +/- .05 Vdc.
   c. Once every 8 seconds, the voltage on the line should jump to 1.8 +/- .8 Vdc.
3. If the System checks out at the Termination Box, then repeat step 2 at each RSC location. Also check the Trunk Status LEDs at the RSC. If everything checks out at each RSC location, but communication problems persist, contact **BAS** for assistance.
4. If the System does not check out at the Termination Box, then disconnect the trunk line from the field and repeat step 2. If the ACL does not check out, contact **BAS** for assistance. If the ACL checks out, then the problem is in the wiring or a failed RSC. The RSCs must be eliminated one at a time until the problem is identified.

Note: If the problem is isolated to a couple of RSCs, verify that the addresses are correctly set. If two or more RSCs are set to the same address, they can not communicate with the Command Center.

EnerNet® Wiring Layout



Part IV

Advanced Topics

1. Diagnostic and Troubleshooting Tools
2. KW Load Shedding
3. VariZone® and Variable Air Volume Systems
4. Equipment Schedule Editor
5. DDE Interface
6. File Organization

Chapter 1

Diagnostic and Troubleshooting Tools

Overview

Energy Zone® provides the User with several powerful and easy to use Diagnostic and Troubleshooting tools. These tools are available at the Command Center and can quickly identify and isolate most problems in System operation.

Features

- Zone Status
- Zone History
- Zone Troubleshooting
- All Dampers Maximum, Minimum, and Normal Position

Specifications

Zone Status - Will show the current PID status for the selected zone. A Zone Status Screen may be displayed for more than one Zone at a time. The only limit is the available screen space.

Zone History - Displays a graph of the control point during the last cycle time. A Zone History Screen may be displayed for more than one Zone at a time. The only limit is the available screen space.

Zone Troubleshooting - This screen shows the status of all inputs and outputs for the selected Zone. Troubleshooting will also allow the User to manually override any input or output. The System will only support one Troubleshooting screen at any given time.

Damper Maximum - Will set all air dampers at VariZone and VAV Zones in the System to their Maximum position as configured in the Zone Configuration for that Zone. This will simplify a System air balance.

Damper Minimum - Will set all air dampers at VariZone and VAV Zones in the System to their Minimum position as configured in the Zone Configuration for that Zone. This will simplify a System air balance.

Damper Normal - Will return all air dampers at VariZone and VAV Zones in the System to their correct position as determined by the load in the Zone.

Security Log - The User name, date, and time are stored in a file named SECURITY.TXT each time the System is accessed. This is a text file stored in the \EZ\DATA directory and can be viewed by any text editor, such as Windows Notepad. The System will also make an entry into the log each time the configuration of a Zone is modified. The SECURITY.TXT file will contain the following:

```
Login: John Brown on Fri Jan 08 12:31:12 1993
2-1a configured at Mon Feb 13 17:31:18 1995
```

The name recorded in the Log is the name that is entered in the User Name/Comment box on the Password setup.
Log outs and attempted Log ins are also recorded.

Output Positioning

The position of an output is determined by a specific sequence. The following list shows the order used to determine the position of an output, starting with normal Equipment Schedule control and continuing through to Troubleshooting.

1. Normal Equipment Schedule Control - Will position an output based on time-of-day and load in accordance with the sequence for the Equipment Schedule.
2. Miscellaneous Equipment - Will position an output based on time-of-day.
3. Other Miscellaneous Equipment - If more than one Miscellaneous Equipment item is configured for the same digital output, the configuration that is farthest down the list of equipment as shown in the Miscellaneous Equipment list box will have control of the output.
4. Global Alarms- Global Alarms are monitored prior to Alarms being monitored at each Zone. This will allow individual Zones to override Global Alarms with local conditions. The Global Alarms will be monitored in the same order as their listing in the Global Alarm list box.
5. Alarm or Control Function - Any active Alarm or Control Function configured for a specific action will override the position an output.
6. Other Alarm or Control Functions - Any other Alarm or Control Function configured at that Zone which is higher in the alarm list will override a lower Alarm or Control Function.
7. Alarm or Control Function at Another Zone - The System will monitor for Alarm and Control Functions starting at trunk 1, address 1. The System will then move through to trunk 1, address 32 and continue to trunk 8, address 32. The last Alarm or Control Function that is configured to change the position of an output, and is currently active, will determine the outputs position.
9. Troubleshooting - The Troubleshooting screen will override any other System attempts to position an output.

Determining PID Mode and Stage

Determine PID Load

The System will first determine a Load based on the configuration of PID parameters and offset from setpoint in the Zone. The Load is the result of adding the Proportional, Integral, and Derivative factors. Each of the factors can be any number from -255 to +255. Negative numbers indicate a need for heating and positive numbers indicate a need for cooling. The Load is not allowed to exceed the range of -255 to +255. Any time that the Zone has reached setpoint (Proportional factor = 0), the Integral and Derivative factors are forced to 0 resulting in a 0 Load. Under normal conditions, a Load exceeding 128 indicates poor control and/or mechanical problems in the Zone.

Determine PID Stage

The System monitors the Load continuously, and uses the Load to calculate a PID Stage at the beginning of a new Cycle. The Cycle Time is determined from the Cycles Per Hour configured for that Zone (i.e. If the Cycles Per Hour is configured for 3, the System will initiate a new Cycle at that Zone every 20 minutes). The PID Stage is determined as follows:

Load	PID Stage
-255 to -193	Heat 4
-192 to -129	Heat 3
-128 to -65	Heat 2
-64 to -1	Heat 1
0	At Setpoint
+1 to +64	Cool 1
+65 to +128	Cool 2
+129 to +192	Cool 3
+193 to +255	Cool 4

PID Operation Options

Immediate using Forced Atset

If this box is checked, the System will allow the Zone to go immediately to the stage determined by the load at the beginning of the next Cycle. If the PID load is zero, the stage will go to AtSet. If the PID load inverts (i.e. positive to negative) during the course of a cycle, the System will go to Forced AtSet. This mode of operation is not recommended in most cases.

Standard - Staged using Forced Atset

The default mode for moving from stage to stage is incrementally. The System will not allow a PID cycle to begin at a stage more than one higher than the previous PID stage. For example, if the previous PID stage was Cool 1, the next PID cycle will not exceed Cool 2 no matter what the PID load. The System can reduce stages by more than 1. For example, if the previous PID stage was Cool 4, the next PID cycle can be as low as Cool 1. If the PID load is zero, the stage will go to AtSet. If the PID load inverts (i.e. positive to negative) during the course of a cycle, the System will go to Forced AtSet. This is the most commonly used PID mode for HVAC control Zones.

Slow - Staged w/o Forced Atset
This mode is used for equipment that changes the control point quickly, such as a discharge air temperature controller. The System will not allow a PID cycle to begin at a stage more than one higher than the previous PID stage. In addition, +PID Loads increase the stage one step toward C4, -PID Loads increase the stage one step toward H4, and the stage will not change for PID Loads of 0.

Determining Current Stage

At the beginning of a new Cycle, the PID Stage and the Current Stage will be the same. The length of time the Zone remains at the PID Stage is referred to as Stage Time. The Stage Time is determined as follows:

If Load is	Then Stage Time =
-255 to -193	Cycle Time * (-(Load) - 192)/64
-192 to -129	Cycle Time * (-(Load) - 128)/64
-128 to -65	Cycle Time * (-(Load) - 64)/64
-64 to -1	Cycle Time * -(Load)/64
0	At Setpoint
+1 to +64	Cycle Time * Load/64
+65 to +128	Cycle Time * (Load - 64)/64
+129 to +192	Cycle Time * (Load - 128)/64
+193 to +255	Cycle Time * (Load - 192)/64

If the calculated Stage Time is less than 10% of the Cycle Time, the Stage Time is set to equal 10% of the Cycle Time. If the calculated Stage Time is greater than 90% of the Cycle Time, the Stage Time is set to equal 100% of the Cycle Time.

The System will maintain the Current Stage equal to the PID Stage until the Stage Timer has timed down to 0. When the Stage Timer has reached 0, the current stage will move one step toward At Setpoint (Example: The Current Stage will move from Cool 2 to Cool 1).

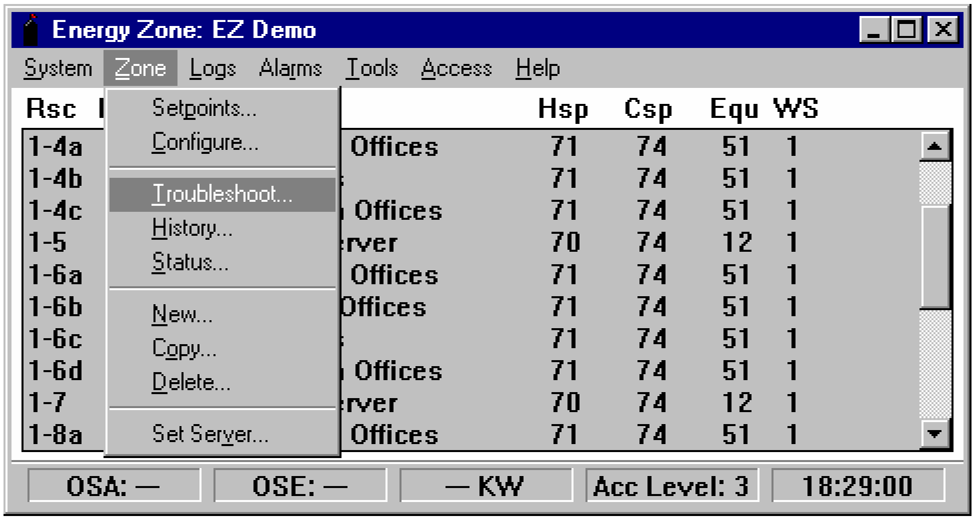
The System will then maintain the Current Stage at the new setting until the end of the Cycle (i.e. The Cycle Timer has reached 0). A new PID Stage and Stage Time will then be calculated based on the present Load.

If the Zone reaches setpoint any time that the Zone is in either heating or cooling, the System will override the Current Stage and force the mode to At Setpoint. This is referred to as Forced AtSet. This can happen occasionally if actual load conditions are not quite as expected. If this happens frequently in a Zone, or if the Zone is forced to AtSet long before the end of the Stage Time, something is wrong with the Zone or the configuration for that Zone. This can happen when the capacity of the HVAC equipment installed in the Zone is significantly greater than what is needed for the actual load conditions. This can also easily occur under some normal conditions such as in unoccupied conference rooms.

Note: The term PID is actually an acronym for Proportional, Integral and Derivative. These are the three different factors used to calculate a total heating or cooling load for a given Zone. Proportional is simply the current temperature's distance from setpoint at the time of the calculation. Integral is a total of all deviations from setpoint for the last cycle period. Derivative is rate of change of the space temperature over the Derivative Lookback period. See the Zone Configuration Chapter for details on PID setup.

Zone Menu

The Diagnostic and Troubleshooting Tools are accessible from the **Energy Zone®** Main List Box Zone Menu.



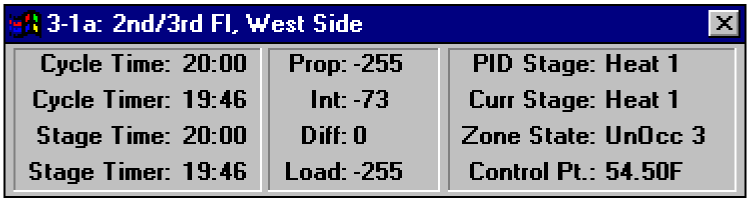
Zone Menu

Select the desired Zone from the Zone List Box and then select the desired action from the Zone Menu.

Note: The User must be logged onto the System at Access Level 3 to access Zone Status, History, Troubleshooting, and Damper Position override.

Zone Status

From the Zone Menu, select Status...



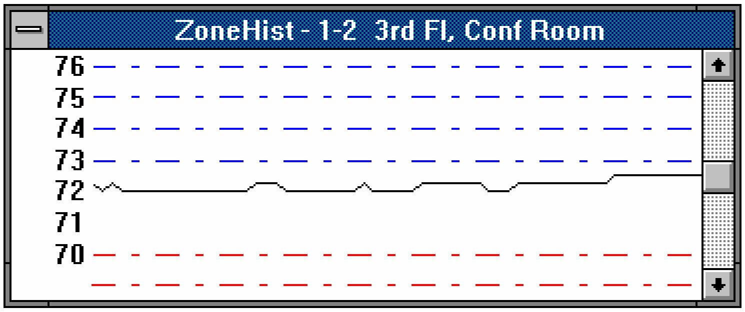
Zone Status Screen

Note: Any number of Zone Status screens may be displayed simultaneously. The Zone Status screen may not be re-sized.

Cycle Time: - The total length of the Cycle Time used in PID calculations for that Zone. Cycle Time can be determined or changed in the PID... settings of the Zone Configuration screen. The Cycles per Hour setting divided into 60 minutes will determine the Cycle Time.
Cycle Timer: - The time remaining in the current Cycle. The PID stage will not change until the Cycle Timer counts down to zero and a new Cycle begins.
Stage Time: - The time calculated by the System for the Zone to remain at the PID stage. If the Stage Time is calculate to be between 0-10% of the Cycle Time, the Stage Time is set to 10% of the Cycle Time. If the Stage Time is calculate to be between 90-100% of the Cycle Time, the Stage Time is set to 100% of the Cycle Time.
Stage Timer: - The actual time remaining for the current PID Stage. The Stage Timer will always start counting at the beginning of a new Cycle. The System will drop to one stage below the PID stage when the Stage Timer reaches zero.
Prop: - The proportional component of the load of the Zone. The value can be from -255 (maximum heating need) to 0 (at setpoint) to +255 (maximum cooling need).
Int: - The integral component of the load of the Zone. The value can be from -255 (maximum heating need) to 0 (at setpoint) to +255 (maximum cooling need).
Diff: - The differential component of the load of the Zone. The value can be from -255 (maximum heating need) to 0 (at setpoint) to +255 (maximum cooling need).
Load: - The total demand load of the Zone. Load is determined by adding the proportional, integral, and differential components. The value can be from -255 (maximum heating need) to 0 (at setpoint) to +255 (maximum cooling need). The load is used to calculate the PID Stage and Stage Time at the beginning of the next Cycle.
PID Stage: - The calculated Stage for that Zone during the current Cycle. The Zone will enter the PID Stage and remain in that Stage for the duration of the Stage Time. Valid Stages are Cool 1 thru Cool 4, At Set, and Heat 1 thru Heat 4.
Curr Stage: - The Current Stage of the Zone. The Current Stage will normally be equal to or one Stage below the PID Stage. The Current Stage can be different if the Zone reaches setpoint prior to the end of the Cycle (Forced At Set) or is overridden by a discharge air temperature minimum or maximum setting.
Zone State: - The current State of the Zone.
Control Pt: - The value of the Analog Input Point used for control of that Zone, displayed in maximum possible resolution.

Zone History

From the Zone Menu, select History...



Zone History Screen

Note: Any number of Zone History screens may be displayed simultaneously. The Zone History screen may be re-sized as desired.

The Zone History Screen will display a dynamic graph of the Control Point. The total time displayed by the graph is equal to the Cycle Time for that Zone. The graph will update once every 8 seconds. The blue dashed lines indicate the cooling setpoint and 3 additional lines at 1 degree increments above the cooling setpoint. The red dashed lines indicate the heating setpoint and 3 additional lines at 1 degree increments below the heating setpoint.

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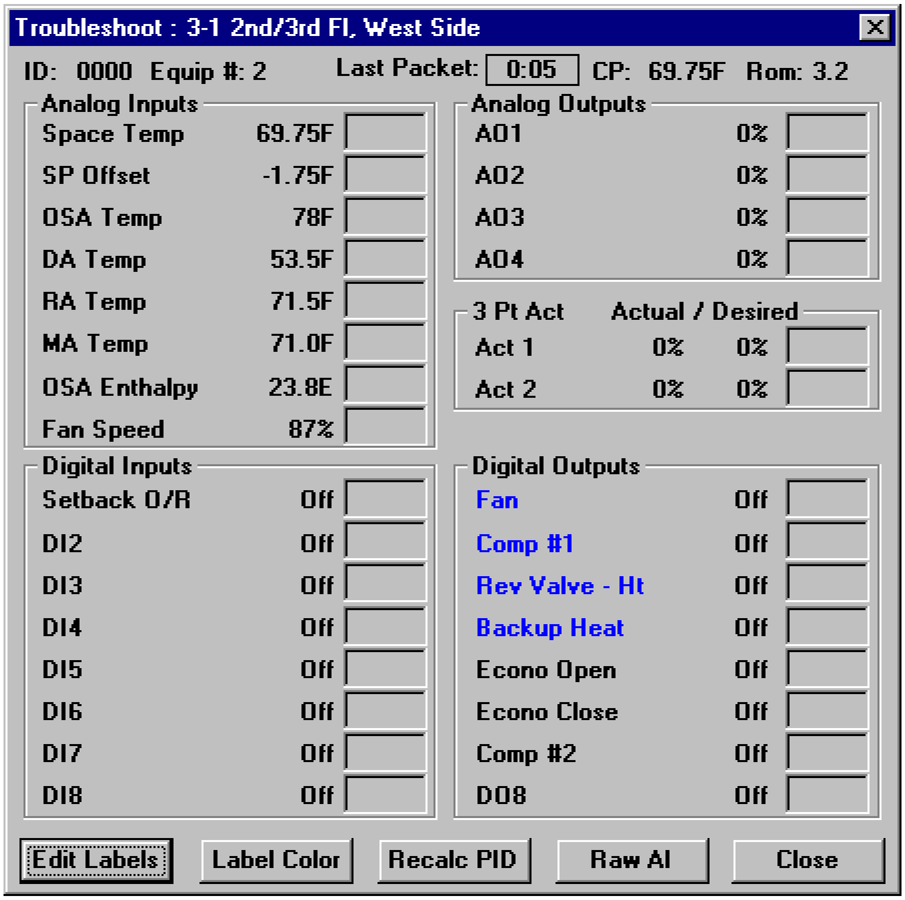
Troubleshooting

From the Zone Menu, select Troubleshooting... Only one Troubleshooting Screen may be displayed and active at any given time. The Troubleshooting screen may not be re-sized.



Troubleshooting Screen

Current Status - The Troubleshooting Screen will show the current status of all inputs and outputs at the selected Zone.

Overriding Inputs or Outputs

1. To override any input or output, place the cursor in the edit box to the right of the value to be changed.
2. Enter a valid value. This would be On or Off for a Digital Input or Output, a value from 0-100 for any Analog Output or Actuator, and a value within the sensors range for an Analog Input. Example: For AI1, the sensor is scaled from 32-96° F, so any number entered as an override must be within this range. For Digital Outputs that are used for 3-point actuators, the actuator position can not be changed by turning a DO On or Off. A new % open position must be entered in the Act 1 or Act 2 field.
3. Moving the cursor out of the edit box will now cause the override to take effect.
4. The override will remain in effect until the edit box is cleared, a new value is entered, or the Troubleshooting Screen is closed.

Caution: Changing the position of an output can have serious consequences. Equipment damage may occur. **Do not change any output or input unless the possible results are clearly understood.**

Edit Labels - Will allow the User to change any of the input or output labels for the Zone.

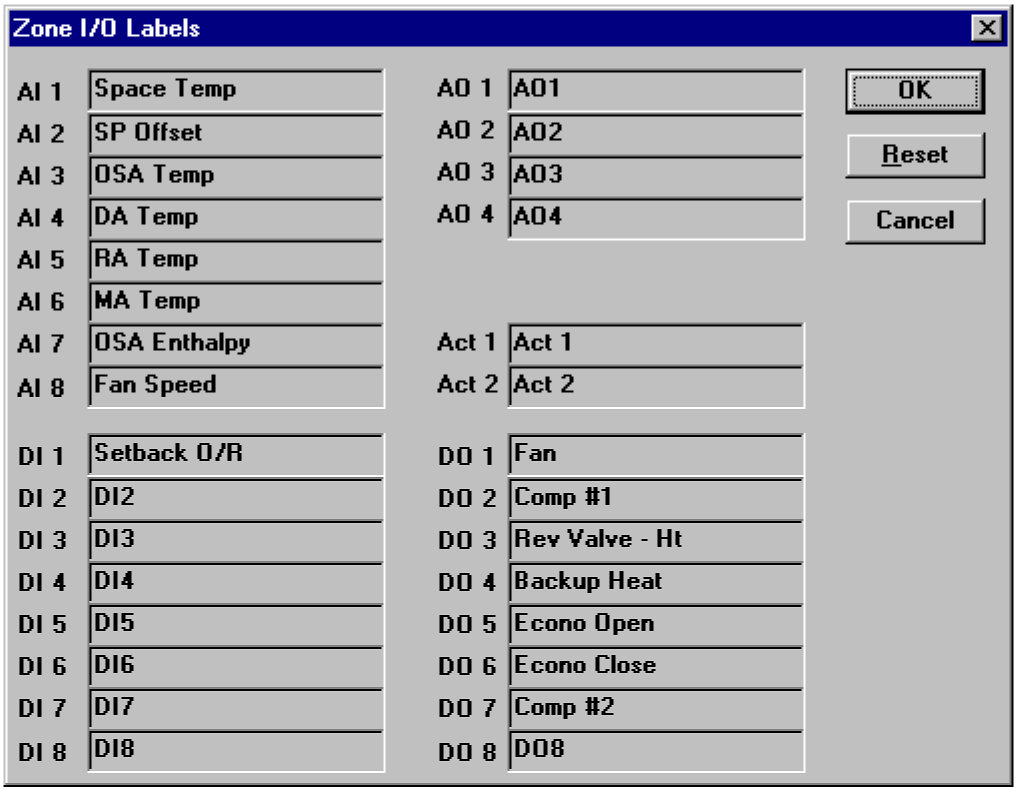
Label Colors - Will allow the User to change the colors displayed on the Troubleshooting screen for different conditions.

Recalc PID - This option will force the System to recalculate the PID values for that Zone and begin a new PID Cycle.

Raw AI - Will cause the System to display all analog inputs in their raw state (0-255) rather than the normal conditioned display. If selected, the button will change to read Scaled AI and return to standard scaled Analog Inputs when selected.

Edit Labels

From the Troubleshooting Screen, select the Edit Labels button.

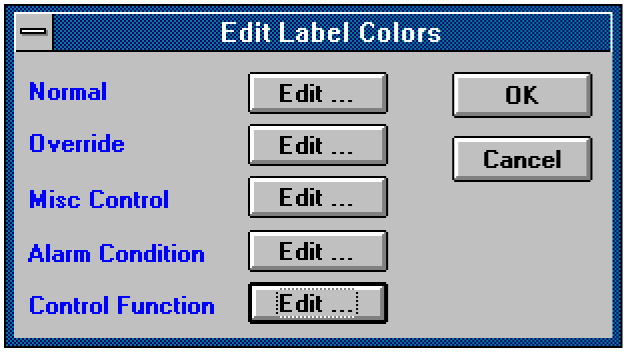


Zone I/O Labels Screen

The User can enter any text desired as a label at any input or output. The new labels are automatically saved as new labels for that Zone. The new labels will only apply to that Zone.

Label Colors

From the Troubleshooting Screen Control Menu, select Label Colors...



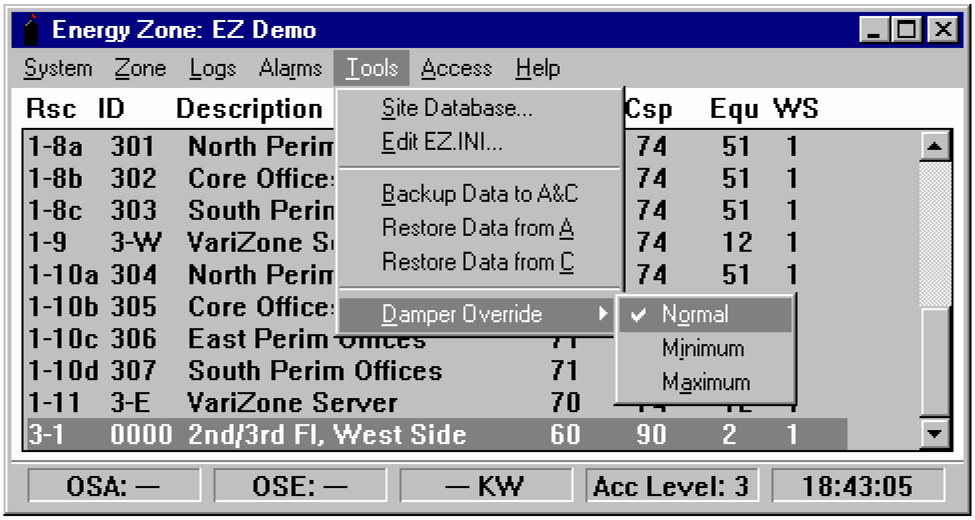
Edit Label Colors Screen

These options will determine the color used for text labels on outputs. The color will indicate the area of program control being used to set the output. If the color of the text is black, the output is not being controlled and will remain off.

Normal - Used for those outputs under standard Equipment Schedule control.
Override - Used for outputs in an override condition from the Troubleshooting screen.
Misc Control - Used for outputs being controlled as a piece of Miscellaneous Equipment.
Alarm Condition - Used to indicate an output has been set due to an Alarm Condition.
Control Function - Used to indicate an output has been set due to a Control Function.

Dampers Menu

The Damper Override menu is accessible from the **Energy Zone®** Tools menu.



Dampers Menu

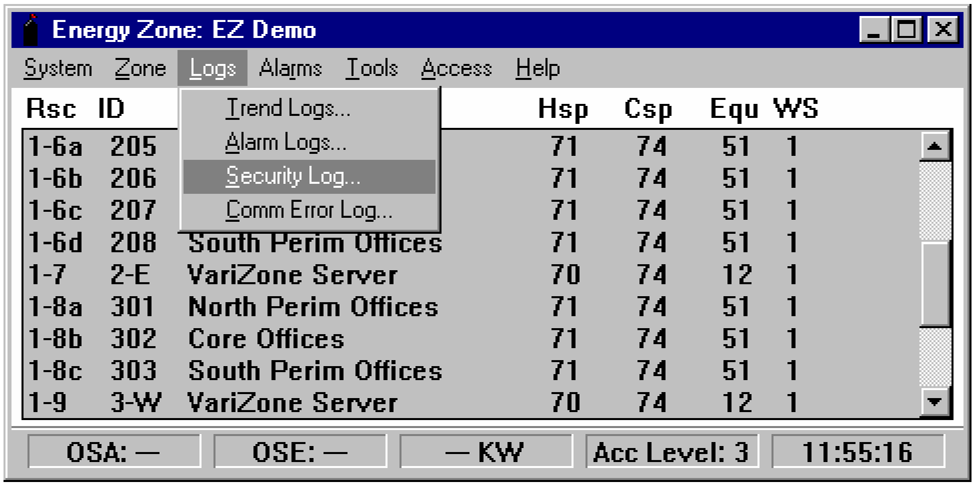
Select the desired Damper control mode.

Maximum - All System Dampers will go to the maximum position as configured in Zone Configuration and remain in that position until a new mode is selected from the Dampers menu.
Minimum - All System Dampers will go to the minimum position as configured in Zone Configuration and remain in that position until a new mode is selected from the Dampers menu.
Normal - All System Dampers will return to normal System control.

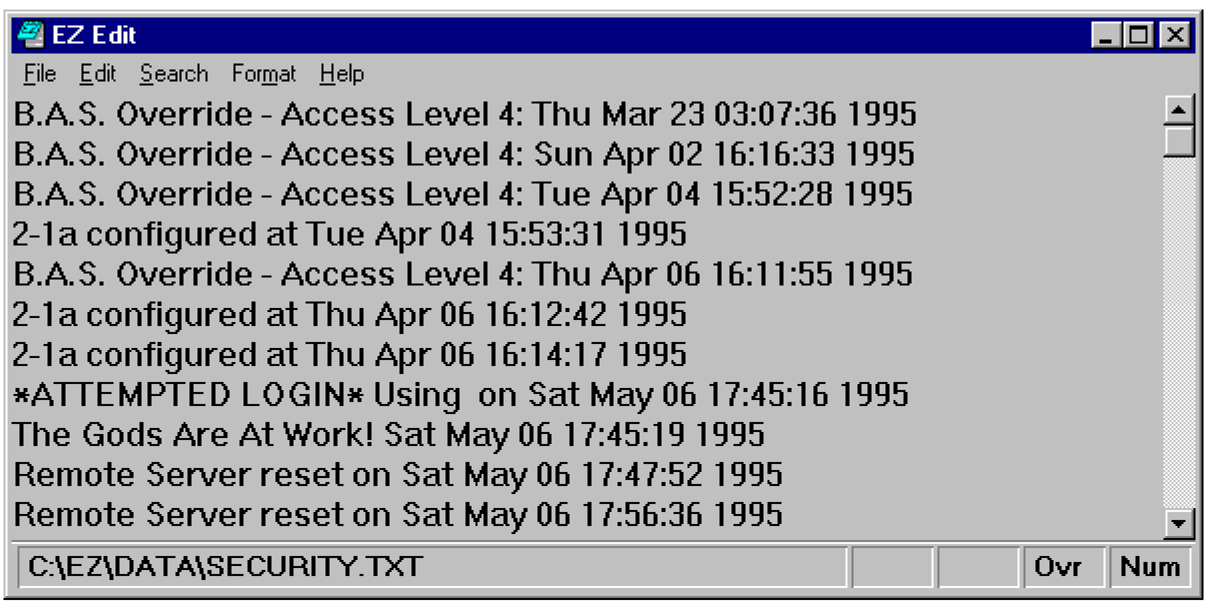
Note: In the event of a power loss or System reset, the Dampers will all return to Normal control.

Security Log

The Security Log is viewed using the EZ Editor and can be accessed from the Security Log... option of the Logs Menu.



Logs Menu



EZ Editor

Chapter 2

KW Load Shedding

Overview

Energy Zone® allows for Load Shedding based on the KW demand level. KW Load Shedding can be assigned by Zone and for each output controlled as Miscellaneous Equipment. Miscellaneous Equipment can also be configured for duty cycling when Load Shed.

Features

- Multiple KW Input Locations
- Special Load Shed Temperature Setpoints
- Load Shed Priority by Zone

Specifications

Multiple KW Meters - The System allows for configuration of up to 16 KW meters per site. Any unused Analog Input at any RSC can be used to input KW, except that only 1 meter may be input per RSC.

KW Input Type - The System requires that the input be an analog value that represents instantaneous KW usage, not accumulated KW-hours.

Load Shed Setpoints - Load Shed heating and cooling setpoints are configured for each Zone which can be Load Shed. When in Load Shed Mode, PID loads for the Zone are calculated form these new setpoints.

Multiple Priorities - Each Zone and each piece of Miscellaneous Equipment can have a priority level assigned. Up to 32 priority levels are available.

Trend Logging of KW - Meter demand level, if a meter is configured for that Zone, is automatically logged with each time stamp for that Zone in the Trend Log.

Description of KW Load Shed Operation

Calculation and Display of Current KW Demand Level
KW demand level is calculated for all configured KW meters once per trunk update cycle (maximum of 8 seconds). The Status Bar at the bottom of the Main Window will always display the KW value for the meter configured as meter #1. If the Zone List Options is selected for KW display, the Main List box will display the KW for the meter configured for Load Shed at that Zone.

Determination of Current Load Shed Priority Level
The current Load Shed Priority Level is determined once a minute for each of the 16 possible configured KW meters. The Priority Level can be anywhere between 0 (KW below setpoint and no Shedding) and 32 (all configured equipment shed). The Level is only calculated if 1) the Weekly Schedule configured for a given meter is in the Occupied Mode, and 2) a KW load shed value other than 0 is configured for the current day. The Level is determined as follows:

% of Setpoint (Actual KW/Configured KW)	Change in Priority Level
>110%	+3
>100% <=110%	+2
>97.5% <=100%	+1
>=95% <=97.5%	No Change
<95%	-1

If the Zone List Options is selected for Meter Shed Priority, the Main List box will display the current priority level for the meter configured for Load Shed at that Zone. If the Zone List Options is selected for Configured Shed Priority, the Main List box will display the configured Load Shed Priority level for that Zone.

Zone Response to a Change in Priority Level
Each Zone will check compare the current KW Load Shed level to its configured Shed Priority level once per trunk update (maximum of 8 seconds). Zones will ignore any Load Shed configuration if any of the following conditions exist, 1) it is configured as a Child in a Parent/Child group, 2) it is configured as a VAV Server, or 3) the Zone is in any mode other than Warmup or Occupied Modes.
If the current KW Shed level equal or exceeds the configured Shed Priority level, the Zone is placed in Load Shed mode. Once the Mode is determined as Shedded 1) the setpoints are changed to the Load Shed setpoints, 2) the Main List Box will display the Load Shed setpoints and Shed Ovr as the State, and 3) the state is recorded as ‘S’ in Trend Log. The Occupied Mode sequence of operation is used when in Load Shed mode. When the KW Load Shed level drops, the Zone will restore the Occupied Heating and Cooling Setpoints.

Miscellaneous Response to a Priority Level
Once per trunk update, each piece of Miscellaneous Equipment will compare it’s configured load shed priority level to the current priority level. The equipment will enter Unoccupied Mode or, if checked for Duty Cycle, will begin to Duty Cycle.

Duty Cycle of Miscellaneous Equipment

Miscellaneous Equipment can be duty cycled when Load Shed. The KW meter setup screen allows for a number of groups to be entered. That number will be used to equally divide all Miscellaneous Equipment items at a given priority level into groups. The duty cycle time is determined by dividing the groups equally into 60 minutes. The equipment within a group will be allowed to operate for this length of time each hour. Example: If there are 20 pieces of Miscellaneous Equipment at Load Shed priority level 12 and 4 groups configured for that KW meter, then 5 pieces of Equipment are assigned to each group. The duty cycle period will be 60 minutes/4 groups or 15 minutes. The System will allow operation of all Equipment within a group for 15 minutes of each hour. This will continue as long as the KW priority level remains the same or higher.

Overview of Load Shed Setup

Configure KW Meters

- Install KW watts transducers at up to 16 at building primary power entry locations. Connect each watts transducer output to any unused analog input at the nearest RSC.
- For each KW meter, use menu item System, KW Load Shed... to setup Load Shed parameters for that meter. The parameters include: input location, weekly schedule to be used; KW demand level; and the number of Miscellaneous Equipment groups.

Configure each Zone for Load Shedding

- For each Zone to be Load Shed, use Zone Configuration to setup Load Shed heating and cooling setpoints, meter to be used for that Zone, and Load Shed Priority.

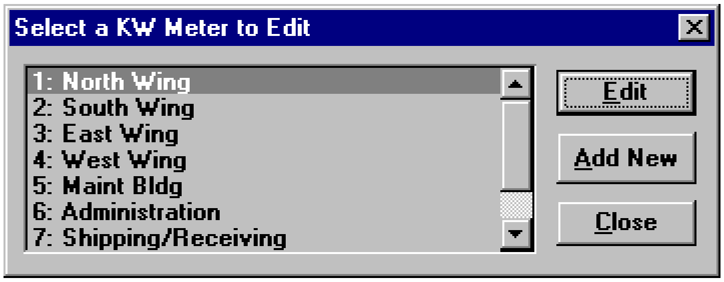
Configure Miscellaneous Equipment for Load Shedding

- Use the Miscellaneous Equipment Configuration screen for each piece of equipment to setup the meter to be used for that equipment, the Load Shed Priority, and whether or not to use duty cycling.

Note: The User must be logged onto the System at Access Level 3 to change any configuration options relating to KW Load Shedding.

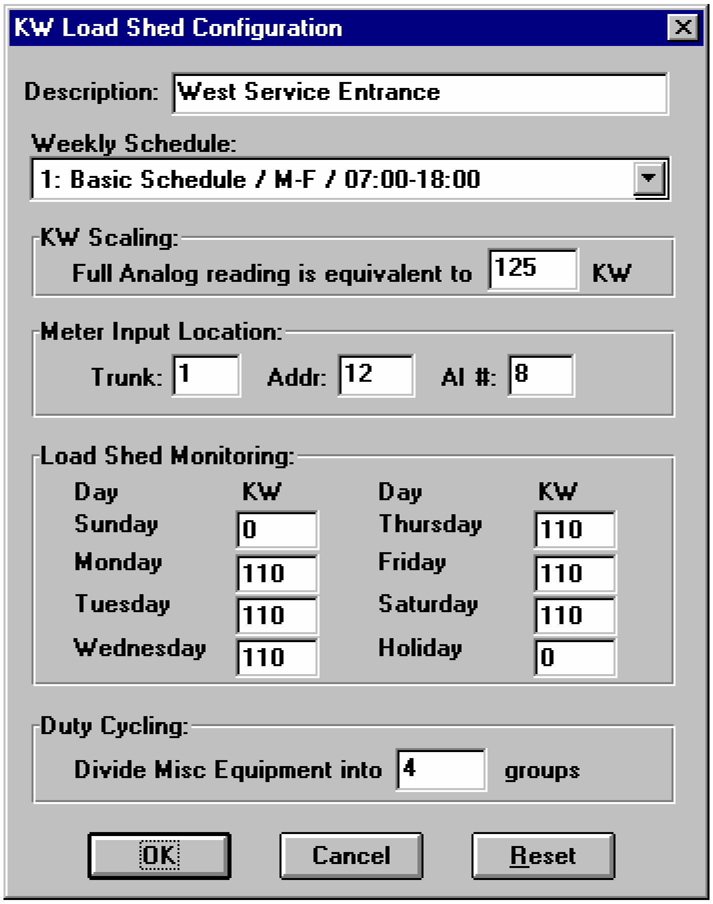
Setup Load Shed Parameters

The meter edit selection box is accessed through System, KW Load Shed...



KW Meter Selection Screen

Once the meter is selected, the Building KW screen is entered.

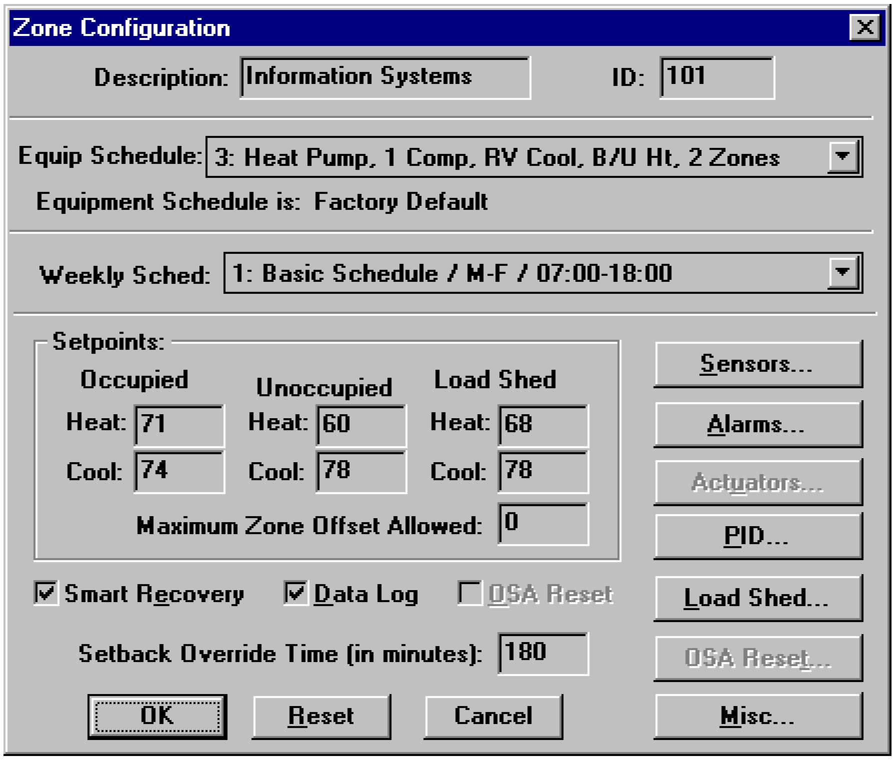


KW Meter Selection Screen

Description - Enter a text description for the meter.
Weekly Schedule - Use the down arrow to choose the Weekly Schedule to be used to determine the time of day for Load Shedding to be active. This can be any of the standard 32 Weekly Schedules.
KW Scaling - Enter a KW value between 1-32,767 that corresponds to 100% full scale of the Analog Input.
Meter Input Location - Enter the AI used for KW meter input.
Load Shed Monitoring - Enter the peak KW demand level above which Load Shedding will occur.
Divide Misc Equip - Miscellaneous Equipment will be divided into groups for duty cycling when Load Shed. The groups will be created among all Miscellaneous Equipment at a given priority level. The number of groups can be a maximum of 32. A value of 0 will disable duty cycling for this meter.

Configure Each Zone for Load Shedding

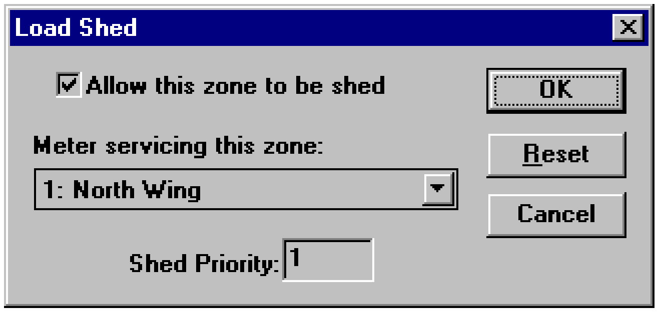
Each Zone is configured for Load Shedding through Zone Configuration.



Zone Configuration

The Zone Configuration Screen is used to enter Load Shedding heating and cooling setpoints.

Select the Load Shed... button to access additional Load Shed configuration information.

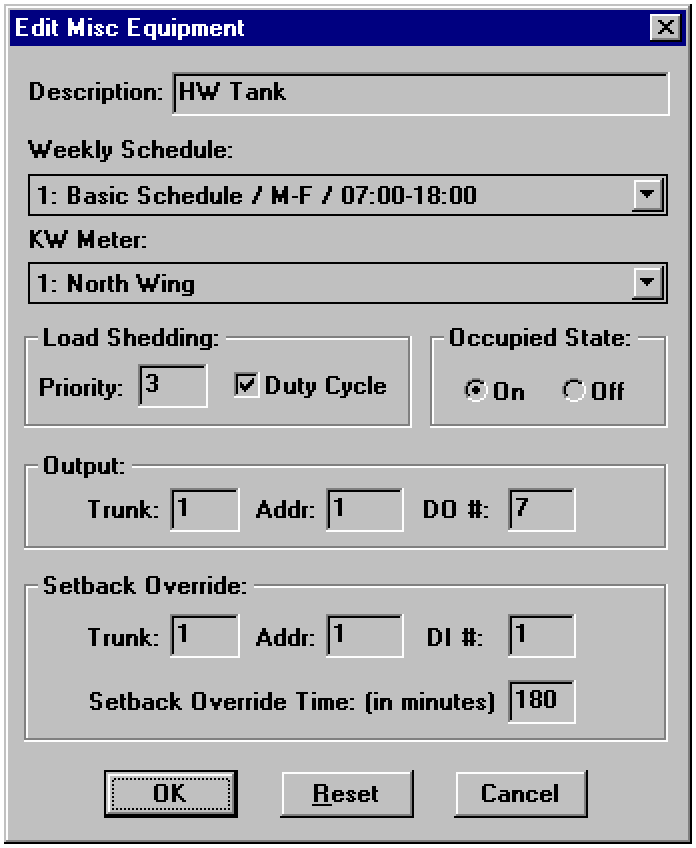


Zone Load Shed Configuration

Allow this zone to be shed - should be checked to enable Load Shedding for this Zone.
Meter servicing this Zone - Select the meter associated with the electrical service for this Zone.
Shed Priority - This can be any number from 1-32. Lower numbers are shed first. Entering a 0 for a Shed Priority will disable Load Shedding for this Zone.

Configure Miscellaneous Equipment for Load Shedding

Each output controlled as Miscellaneous Equipment can be configured for Load Shedding from the Edit Misc Equipment screen.



Miscellaneous Equipment Configuration

KW Meter - Select the meter associated with the electrical service for this Zone.
Shed Priority - This can be any number from 1-32. Lower numbers are shed first. Entering a 0 for a Shed Priority will disable Load Shedding for this output.
Duty Cycle - should be checked to allow for Duty Cycling of this Equipment while Load Shed. If Duty Cycle is not checked, the Equipment will stay in the Unoccupied Mode while Load Shed.

Chapter 3

VariZone® and Variable Air Volume Systems

Overview

The **BAS VariZone®** System provides tenant comfort while serving many Client temperature control Zones with one Server. The **VariZone®** Server is a single HVAC unit capable of providing both heating and cooling. The **BAS** implementation of Variable Air Volume (VAV) follows HVAC industry standards for control sequences and capabilities. Both Systems provide the capability for both pressure dependent and pressure independent control. The Client Zones consist of dampers and actuators, and in some instances fans and backup heat.

Features

- Up to 32 Servers
- Up to 512 Client Zones for each Server
- Easy Setup and Operation
- Accepts use of either Analog or 3 Point Floating Actuators

Specifications

Brief Description of VariZone® Control - BAS implementation of **VariZone®** is based on a combined heating and cooling unit (Server) delivering air to a large number of Zone dampers (Clients). The Server will deliver either heated, cooled, or neutral air based on the needs of the Client Zones. The Clients can have heat installed, with or without a local Zone fan. The Client Zones will modulate their damper in search of a position that will meet the needs of the Zone. All Client Zones will pass their PID load information to the Server for use in calculating a correct stage and mode for the Server.

Brief Description of VAV Control - BAS implementation of VAV is based on a large cooling unit (Server) delivering chilled air to a large number of Zone dampers (Clients). The Server can have heat installed to be used for morning warmup. The Clients can have heat installed, with or without a local Zone fan. The Client Zones will modulate their damper in search of a position that will meet the needs of the Zone. All Client Zones will pass their PID load information to the Server for use in calculating a correct stage for the Server.

Server - Any Equipment Schedule can be configured as a **VariZone®** Server, but ES1-12 are most commonly used. ES40 is intended to be used as a rooftop VAV unit, either discharge air controlled or as a server. ES41 is used as a static pressure control Server. To be a Server, the Zone must be selected as either a VAV or **VariZone®** Server under the Misc section of the Zone configuration.

Discharge Air Temperatures - Discharge air temperature settings allow for override of standard **VariZone®** and VAV controls. These settings will prevent equipment damage and improve temperature control and energy savings. **BAS** recommends that the default settings are not changed in most installations. Discharge air temperatures are configured once and are used System-wide. In addition to the standard inputs for a **VariZone®** or VAV Server unit, a discharge air temperature sensor must be installed and wired to AI4.

VariZone® Bypass Damper Control - A Bypass Damper must be installed on all **VariZone®** Servers. The Bypass Damper provides for control of unit static pressure. Control is provided by a separate stand-alone controller. See Application Note 002 for Bypass Damper control.

VAV Static Pressure Control - ES41 is used to provide static pressure control. The preferred method is an Analog Output providing a control signal to a variable frequency drive purchased from other sources. Most frequency drives will accept a 4-20 ma input, allowing direct control from an RSC. Most drives also provide a voltage or current output to an auxiliary device, allowing for monitoring of frequency drive output by an RSC.

Economizer Mixed Air Temperature Limit - Mixed air temperature settings allow for override of the economizer position on any unit having direct control of its economizer. The mixed air temperature limit is configured once and is used System-wide. In addition to the standard inputs, a mixed air temperature sensor must be installed and wired to AI6.

VAV Servers with both Economizers and an Analog Cooling Output - When both an economizer and a cooling actuator are configured for the same Zone, the load passed to the cooling actuator is 64 less than the true load. This has the effect of moving the cooling actuator to stage 2. This will happen any time the following are true: 1) the Zone is configured as a VAV Server (clients do not have to exist), 2) OSA enthalpy is acceptable for cooling, and 3) the Server has a positive load.

OSA Cutoffs - The System can override PID load demands for staging heating and cooling on both Server types. If OSA temperature is above the high temperature cutoff (usually 65° F), then heating is not allowed. The low OSA temperature cutoff (usually 45° F) applies only to mechanical cooling. Economizer cooling is allowed even below the cutoff temperature. Each Server must be configured to “Enforce OSA Cutoffs” to take advantage of this feature. The OSA cutoff temperatures are configured once and are used System-wide.

Server Change of State - The state of the Server (Setback Override, Setback Recovery, Unoccupied Cooling) can be changed by the needs of the Clients. The number of Clients necessary to initiate the new state is configurable under the Misc section of the Zone configuration for each Server.

Server PID Override - Under normal conditions, the PID load of the Server is calculated from the Clients. The configured setpoints of the Server are continuously monitored and will be used to generate a the Server’s load if exceeded. The Zone List Box and the Status Screen will append a ‘c’ to the displayed load value if the load comes from the Client.

Terminal Regulated Variable Air Volume (TRAV) - This is a relatively new concept in VAV control. This concept uses ES41 configured as a Server. The discharge air temperature is controlled seperately as a single Zone, possible using OSA reset. During the Occupied mode, the Client loads are used to reset the static pressure control. The System will constantly attempt to lower the static pressure without losing control of any Clients. In the Unoccupied mode, the Server fan will be energized, the static pressure output will go to the configured Minimum Position, and the economizer active whenever the OSA enthalpy is acceptable for cooling and the PID load at the Server is 0 (AtSet).

VAV Load Following - When a Server has been configured with Clients, it is common for a small number of Clients to need cooling. That small number is diluted by a large number of satisfied Clients resulting in a small PID load reported to the Server. The Server can be configured for the “Number of worst-case loads to be used:”. This is a number, not a percentage. For example, if this is configured as 5 the System will only consider the 5 Clients having the highest PID load. The average load of these Clients is the PID load passed to the Server. To use all Clients, enter a number of 0.

Client Zones - Client Zones can be damper only, either analog or 3 point floating, damper with re-heat, and damper with re-heat and fan. Each Zone is also configurable as either pressure dependent or pressure independent. Pressure dependent Zones need to be configured for maximum and minimum % open positions. VariZone Client pressure dependent dampers move to the configured position immediately if MIN, MAX, or AtSet positions are called for. Pressure independent Zones need to be configured for maximum and minimum CFM limits.

Pressure Independent Client Zones - The System records the % open damper position in the Zone configuration file anytime that Minimum or Maximum Damper position is achieved. Whenever Min or Max is called for, the damper will first go to the recorded % open position. The damper will then modulate from that point if necessary to achieve Min or Max CFM.

VariZone Clients - VariZone Servers report their Discharge Air Temperature (DAT) to all Clients. The Client will compare the Server’s DAT to their own Space Temperature (SAT). The Server mode will be assumed to be heating anytime that DAT exceeds SAT by the configured Server Heating Temp Dif value or more. The Server mode will be assumed to be cooling anytime that DAT is below SAT by the configured Server Cooling Temp Dif value or more.

Ignore Negative Loads - This feature is configurable under the Misc section of the Zone configuration and only applicable to VAV servers. In most installations it will be desirable to take the PID load of all Client Zones into account when determining the correct stage for the Server. Under these conditions, it is possible to have a large number of negative loads (Zones below setpoint) which offset a large number of positive loads (Zones above setpoint). Under these conditions the Server will be AtSet and not provide any cooling. If this is not appropriate for the installation, then check the “Ignore Negative Loads” option for the Server.

Ignore Unoccupied Clients - The PID loads of Unoccupied Client Zones are automatically ignored by the Server when the Server is in the Occupied Mode. This is not configurable.

VariZone® Design Guidelines

These guidelines should be followed when designing a **VariZone®** System:

1. The System can handle up to 32 Servers and 512 Clients per Server.
2. All Clients and their Server must be configured for the same weekly time schedule. Any override from the Server or any Client Zone, either programmed single Zone or a setback override initiated from the Zone, will place all Clients and the Server in occupied mode.
3. A wall sensor must be installed in a location representative of the area being handled by the Server and wired to the Server RSC. This is used for default control of the Server RSC and in Command Center mode when the Server RSC is on-line and all of the Client RSCs are off-line.
4. When possible, place all Client Zones on the same trunk as the Server RSC. The Client RSCs should be provided with consecutive addresses lower than that of the Server. The Server should be addressed one higher than its highest Client address. These are not mandatory requirements, but make troubleshooting much easier.
5. Use care when establishing the percentage load attributed to each Client Zone. The percentage load should be proportional to the percentage of floor space served by each Client. The load should equal 100%, but it is not necessary. The percentage load is used by the System to weight the vote from a Zone as to the next mode for the Server.
6. The heat losses and gains on all Zones served by a unit should be similar. There are physical limitations as to what the control System can accomplish. If the HVAC unit is serving a computer room (requiring continuous cooling) and a North perimeter Zone (requiring heating) the HVAC system can never adequately satisfy both Zones. The controls will work best on a properly engineered HVAC system, serving Zones with a similar load.
7. If using 3 point floating actuators for the Client Zones, choose actuators with full stroke timing between 90-180 sec. Longer timing will cause overshoot and shorter timing can cause errors in actual position vs. desired position.

VAV Design Guidelines

These guidelines should be followed when designing a VAV System:

1. The System can handle up to 32 Servers and 512 Clients per Server.
2. All Clients and their Server must be configured for the same weekly time schedule. This will prevent operation of the Server for a small number of Zones, which could cause short cycling and reduce equipment life.
3. When possible, place all Client Zones on the same trunk as the Server RSC. The Client RSCs should be provided with consecutive addresses lower than that of the Server. The Server should be addressed one higher than its highest Client address. These are not mandatory requirements, but make troubleshooting much easier.
4. If using 3 point floating actuators for the Client Zones, choose actuators with full stroke timing between 90-180 sec. Longer timing will cause overshoot and shorter timing can cause errors in actual position vs. desired position.
5. Use care when establishing the percentage load gain attributed to each Client Zone. The percentage load gain for most Clients should be 100%. The range is 0% to 255%. Larger gains will cause the Client to have a larger impact on the mode of the Server, smaller gains yield a smaller impact. A load gain of 0% causes the Server to completely ignore that Client's load.

VariZone® Sequence of Operation

Summary

1. The System will first build an on-line data structure. On initial startup, and any time that any Zone is added or deleted from the System, a data structure is built. This data contains information about all Clients and Servers.
2. The Server will determine the appropriate mode (heating, cooling, or AtSet and ventilating) based on the needs of the Client Zones and continuously report to all Clients two pieces of information:
   a. The present mode of the Server.
   b. The mode the Server will be in the next upcoming cycle.

Note: If all of the Client Zones are off-line, the Server Zone will calculate a PID load as per the normal single Zone method, using the default wall sensor wired to its RSC.

3. The Server will then enter the calculated mode and the appropriate stage in order to serve the needs of its Client Zones.

Note: Anytime a **VariZone**® Server enters AtSet while changing modes (i.e. from heating to cooling or from cooling to heating), the Server will only remain in AtSet for 1/2 of the normal cycle time before beginning a new cycle.

4. The Client Zones will then position their dampers based on both their need and the mode of the Server.

Determining Server Mode and Stage in Occupied or Unoccupied Modes

1. All Clients will calculate a PID load.
2. The Server determines a weighted average load based on all Client loads and then determines whether to enter heating mode or cooling mode based on the average load. If the average load is positive, the Server will enter cooling mode. If the average load is negative, the Server will enter heating mode. If the average load is zero, the Server will enter at set mode.

   Average Load = (Client Load #1 * % Load + Client Load #2 * % Load + ...)

3. Once a mode is determined, the Server will enter that mode and use the value of the highest Client load to determine the correct stage.
4. The exception to the rule for determining mode and stage occurs if any Zone has a load greater than +127 or less than -127.
   a. The Server will enter the mode necessary to satisfy any Zones with loads exceeding +/-127.
   b. If more than one Zone exceeds +/-127, the Server will use the Zone with the greatest load value.
   c. If two Zones have an equal load value but in opposite directions (i.e. Zone #1 load = -195, Zone #2 load = +195) the Server will enter heating mode to satisfy that load first.

5. The Server will remain in the calculated stage for the duration of the stage timer unless:
   a. All Client Zones with a load matching the mode of the Server reach setpoint. The Server will then enter AtSet for 1/2 of the normal cycle time.
   b. Any Client Zone increases to exceed a load of +/-127, and that load is opposite to the current mode of the Server. The Server will enter AtSet for 1/2 of the normal cycle time and then enter the correct mode to satisfy the load.
   c. The Server checks all Clients once a minute while in either heating or cooling mode. If none of the Clients have a load equal to or greater than the current Server stage, the Server will drop to one stage lower than the current stage.
   d. The Server also checks for the weighted average of all Client Zones once a minute. If the average is equal to 0, then the Server will enter AtSet for 1/2 of the normal cycle time.

<u>Server Control Example #1</u>

Client Zone	PID Load	% Load	Result
#1	-64	25%	-16
#2	-40	25%	-10
#3	-120	10%	-12
#4	0	10%	0
#5	+100	10%	+10
#6	-100	20%	-20

		Total	-48

The average load is -48, or a heating load. The Server then looks to see what is the largest heating load. This would be -120. The Server used a load of -120 to determine which stage to enter. (This load is used in place of the normal single Zone PID calculation routine.) In this example, the Server would enter 3rd stage heating.

<u>Server Control Example #2</u>

Client Zone	PID Load	% Load	Result
#1	+52	25%	+13
#2	+36	25%	+9
#3	-50	10%	-5
#4	+20	10%	+2
#5	+100	10%	+10
#6	+110	20%	+22

		Total	+51

The average load is +51, or a cooling load. The Server then looks to see what is the largest cooling load. This would be +110. The Server used a load of +110 to determine which stage to enter. In this example, the Server would enter 3rd stage cooling.

Server Control Example #3

Client Zone	PID Load	% Load	Result
#1	+52	25%	+13
#2	+36	25%	+9
#3	-200	10%	-20
#4	+20	10%	2
#5	+100	10%	+10
#6	+110	20%	+22

		Total	+36

The average load is +36, or a cooling load. This would normally indicate that the Server would enter cooling mode, but Zone #3 has a load that exceeds 127. The Server will enter heating mode to satisfy the demand of that Zone first. In this example, the Server would enter 4th stage heating.

Determining Server Mode and Stage in Warmup Mode

In warmup mode, the Clients all calculate a load using the warmup ramp. The first Client to enter warmup will initiate warmup in the Server. The Server will remain in Warmup until all Clients enter Early Occupied or the first scheduled Occupied time is reached.

Determining Server Mode and Stage in Default Mode

The RSC will control the Server as a single Zone unit when in default mode.

Bypass Damper Control

A bypass damper must be installed to ensure proper static pressure control. A differential static pressure floating contact null switch is used for damper actuation. These can be monitored by the System but are controlled independently. This provides for greater reliability in the event of a trunk line failure.

High and Low Limit Discharge Air Control

A discharge air sensor monitors temperatures and shuts off the appropriate stages of heating or cooling to protect the equipment in the event of excessive bypass. These setpoints and whether or not to use them are both configurable.

If a trip temperature is exceeded, the Server will drop down 1 stage. The change will take effect for the duration of the present cycle. The Server will then wait one minute and again monitor the discharge air temperature. If the trip temperature is still exceeded, the Server will drop one more stage. This will continue until the trip temperature is no longer exceeded or all stages are off. Once the stage has been modified, the System will not restore that stage until the beginning of the next PID cycle.

Positioning Client Zone Dampers

1. The **VariZone**® System is designed to operate with either 3 point floating or analog actuators. All Client Zones are configured from the Command Center for minimum and maximum damper position and actuator timing (3 point floating actuators only).
2. At startup and every day at midnight, all 3 point floating damper actuators are energized to the open direction for the twice the time configured as actuator timing. This is also done for a Zone anytime that Zone is re-configured. This will place the actuator in a known position and correct for any timing errors.
3. All 3 point floating damper positioning is done at the RSC. The Command Center will pass the desired position to the RSC and the RSC will energize the actuator for the appropriate time.
4. In default mode, the RSC will energize 3 point floating actuators for 300 seconds in the open direction and hold that position. Analog actuators will go to 100% open and hold that position.
5. When the Server goes off-line, all Client Zone dampers will go to 100% open.
6. Standard PID control is used for the Client Zones. The PID load is used for both input to the Server and positioning of its damper.
7. The Server will continuously report to the Clients two pieces of information: 1) the present mode; and 2) the next planned mode.
8. The damper positioning in all normal modes (Occupied, Unoccupied, and Warmup) is based on several conditions. The damper positioning criteria are:

Condition 1: Occupied, Warmup, or Cooldown Mode and Client At Setpoint

Client Zone = AtSet
Present Server Mode = AtSet
Next Server Mode = AtSet
Then the Damper will Open at 5%/min until it reaches 100%.

Condition 2: Unoccupied Mode and Client At Setpoint

Client Zone = AtSet
Present Server Mode = AtSet
Next Server Mode = AtSet
Then the Damper will Maintain it current position.

Condition 3: Occupied or Warmup Mode and Server is Heating

IF Next Server Mode = Heat **OR** Present Server Mode = Heat **AND**

Client Mode = Heat 1 (PID Load is 0 to -63)
THEN the Damper will Open at 5%/min until it reaches 100%.
Client Mode = Heat 2 (PID Load is -64 to -127)
THEN the Damper will Open at 10%/min until it reaches 100%.
Client Mode = Heat 3 (PID Load is -128 to -191)
THEN the Damper will Open at 20%/min until it reaches 100%.
Client Mode = Heat 4 (PID Load is -192 to -255)
THEN the Damper will go to 100% Open.
Client Mode = AtSet (PID Load is 0)
THEN the Damper will go to the configured AtSet position.
Client Mode = Cool 1 (PID Load is 0 to 63)
THEN the Damper will Close at 5%/min until it reaches Min Position.
Client Mode = Cool 2 (PID Load is 64 to 127)
THEN the Damper will go to Minimum Position.
Client Mode = Cool 3 (PID Load is 128 to 191)
THEN the Damper will Close.
Client Mode = Cool 4 (PID Load is 192 to 255)
THEN the Damper will Close.

Condition 4: Occupied or Cooldown Mode and Server is Cooling

IF Next Server Mode = Cool **OR** Present Server Mode = Cool **AND**

Client Mode = Cool 1 (PID Load is 0 to 63)
THEN the Damper will Open at 5%/min until it reaches 100%.
Client Mode = Cool 2 (PID Load is 64 to 127)
THEN the Damper will Open at 10%/min until it reaches 100%.
Client Mode = Cool 3 (PID Load is 128 to 191)
THEN the Damper will Open at 20%/min until it reaches 100%.
Client Mode = Cool 4 (PID Load is 192 to 255)
THEN the Damper will go to 100% Open.
Client Mode = AtSet (PID Load is 0)
THEN the Damper will go to the configured AtSet position.
Client Mode = Heat 1 (PID Load is 0 to -63)
THEN the Damper will Close at 5%/min until it reaches Min Position.
Client Mode = Heat 2 (PID Load is -64 to -127)
THEN the Damper will go to Minimum Position.
Client Mode = Heat 3 (PID Load is -128 to -191)
THEN the Damper will Close.
Client Mode = Heat 4 (PID Load is -192 to -255)
THEN the Damper will Close.

Condition 5: Unoccupied Mode and Server is Heating

IF Next Server Mode = Heat **OR** Present Server Mode = Heat **AND**

Client Mode = Any Heat Stage (PID Load is 0 to -255)
THEN the Damper will Open.
Client Mode = AtSet (PID Load is 0)
THEN the Damper will Close.
Client Mode = Any Cool Stage (PID Load is 0 to 255)
THEN the Damper will Close.

Condition 6: Unoccupied Mode and Server is Cooling

IF Next Server Mode = Cool **OR** Present Server Mode = Cool **AND**

Client Mode = Any Cool Stage (PID Load is 0 to 255)
THEN the Damper will Open.
Client Mode = AtSet (PID Load is 0)
THEN the Damper will Close.
Client Mode = Any Heat Stage (PID Load is 0 to -255)
THEN the Damper will Close.

VAV Sequence of Operation

Server

If the Type of Server is checked as None under the Zone's Misc configuration, the Server will be controlled by discharge air temperature with no feedback from the Zones. When in default control, the Server will control discharge air at 55° F. Normally the Server will be configured as a VAV Server, causing the Server to determine its mode and stage based on the needs of its Clients. The steps for controlling the Server are:

1. At the beginning of a PID cycle the Server will poll all of its Clients. Each Client will multiply its PID load times its % Load Gain. The Server will then add all resulting Client loads and divide the result by the total number of Clients.
2. This number becomes the PID load for the Server. The stage and stage time are then determined from the PID load just as if the Server were a single Zone unit.
3. If outside air temperature is below the cutoff, the System will not allow mechanical cooling to operate. As long as outside air enthalpy is acceptable for cooling, economizer operation is allowed. This parameter is checked at the beginning of a PID cycle and once a minute. If OSA falls below setpoint during a cycle then the mechanical cooling is stopped.
4. Discharge air temperature is monitored once a minute during operation. If DAT falls below the setpoint, then one stage of mechanical cooling is dropped. At the end of the next minute the DAT is again checked and another stage dropped if it is still below setpoint. This continues until DAT is above setpoint or all mechanical cooling is off. The stages of mechanical cooling which are dropped can not be restored until the next PID cycle.
5. Economizer operation is not affected by the DAT limit. As long as the Server has a positive PID load and OSA is acceptable for cooling, economizer operation is allowed. The economizer is controlled by the mixed air sensor. If the MAT is below the setpoint (usually 55° F) the economizer will modulate toward closed once a minute until MAT increases to setpoint.
6. If all Client Zones reach setpoint prior to the end of the PID cycle, the Server will enter AtSet and shut down all cooling stages.

Client- All Modes except Warmup

The Client Zones will control their dampers as a standard cooling actuator. The damper moves toward open more if more cooling is required, and move toward closed if less cooling is required. A detailed description follows:

Load	Actuator Positioning
-255 to -193	Damper Goes Immediately to 0%
-192 to -129	Damper Goes Immediately to 0%
-128 to -65	Damper Goes Immediately to Minimum Position
-64 to -1	Close at 5%/Minute
0	No Change
+1 to +64	Damper Opens at 5%/Minute
+65 to +128	Damper Opens at 10%/Minute
+129 to +192	Damper opens at 20%/Minute
+193 to +255	Damper Goes Immediately to 100%

It can be seen from the above chart that if the Client Zone is at setpoint (within the deadband), the actuator will maintain its position. The greater the negative PID load, the faster the damper moves toward closed. The greater the positive PID load, the faster the damper moves toward open.

An exception to the actuator positioning chart occurs if the Zone had fallen to a -129 or greater PID load and subsequently increases to above -129. After falling below -129, the damper will close. When the PID load increases to greater than -129, the damper will return to minimum position.

Exceptions to the above occur at damper maximums and minimums. Pressure dependent and pressure independent Zones control differently.

Pressure dependent - The damper minimum position will be overridden anytime the PID load exceeds -129. The damper maximum position, if configured to a value less than 100%, will not be exceeded.

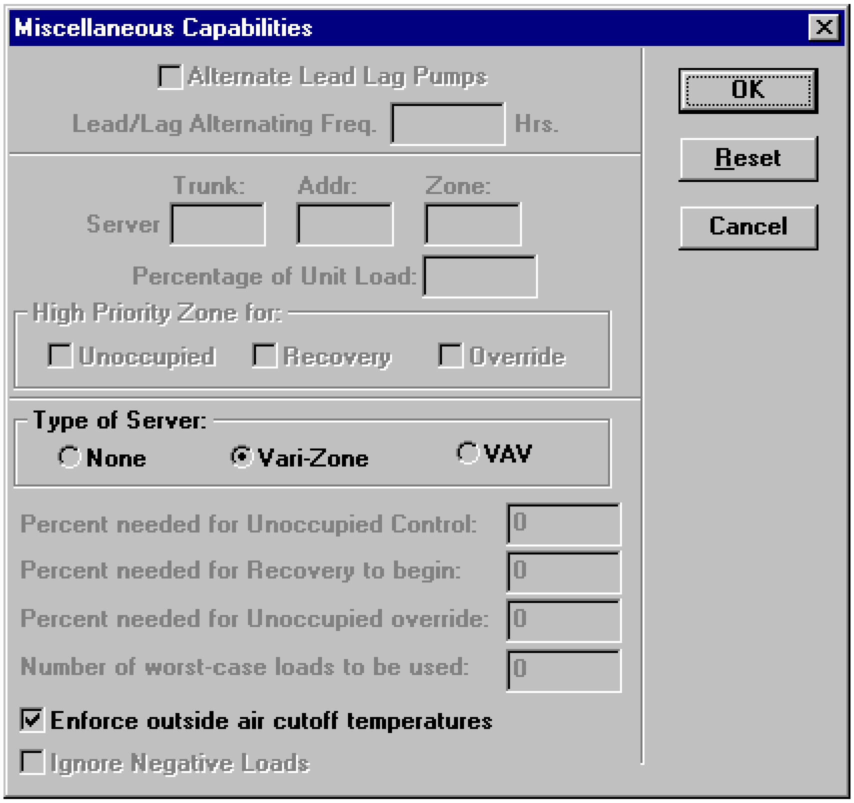
Pressure independent - Minimum and maximum CFMs are configured for each pressure independent Zone. The minimum and maximum CFM limit will override the above control sequences of the Zone. The damper will not open past a position that achieves the maximum CFM for the Zone and begin to modulate closed if the maximum CFM is exceeded. The damper will not close past a position that achieves the minimum CFM for the Zone and will begin to modulate open if the CFM falls below minimum.

Client - Warmup Mode

If the Server has the capability to provide heat it will be used for morning warmup. The Client Zones will open their dampers if the Server is in heating and the Zone temperature is less than the Occupied setpoint. If the Zone is at or above the Occupied setpoint, the damper will close.

VariZone® Server Setup

The configuration for **VariZone®** Servers is accessed through the Misc button of the Zone Configuration screen.



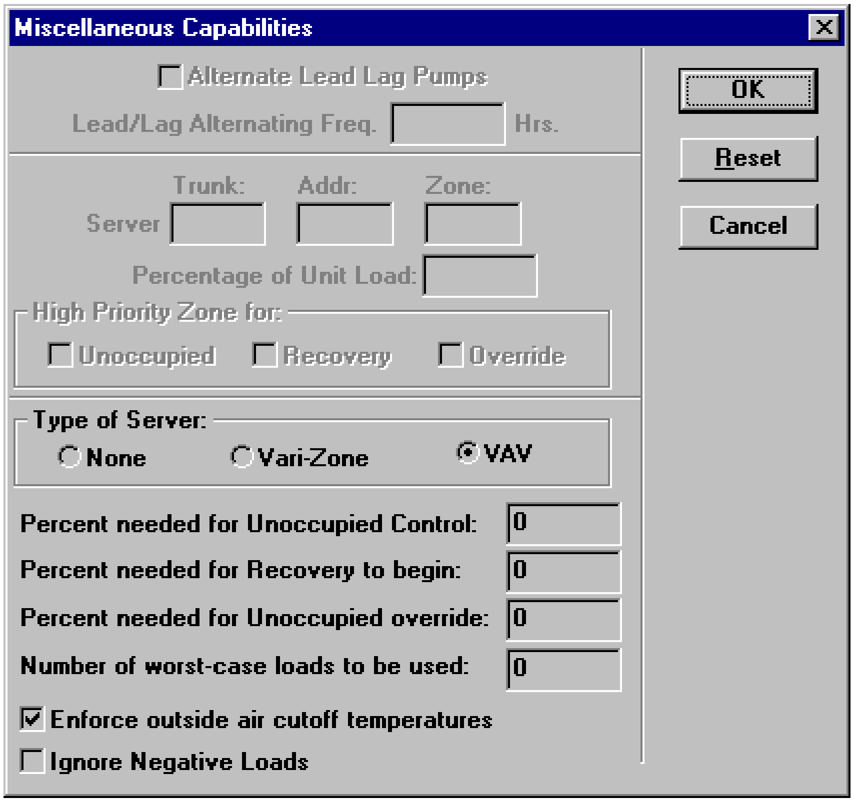
VariZone® Server Setup Screen

Type of Server - Select the **VariZone®** Server button.

Enforce outside air cutoff temperatures - If checked, the System will override calls for heating when OSA temperature is above the configured setpoint and override calls for cooling when OSA temperature is below the configured setpoint. The setpoints are configured under the System / Control Temperatures menu.

VAV Server Setup

The configuration for VAV Servers is accessed through the Misc button of the Zone Configuration screen.



VAV Server Setup Screen

Type of Server - Select the VAV Server button.

Percentage needed for Unoccupied Control/Recovery to begin/Unoccupied override - Enter the percentage of all Client Zones that must be calling before the displayed mode can begin. If a value of 0 is entered, then any Zone in the System can cause the Server to enter the appropriate mode.

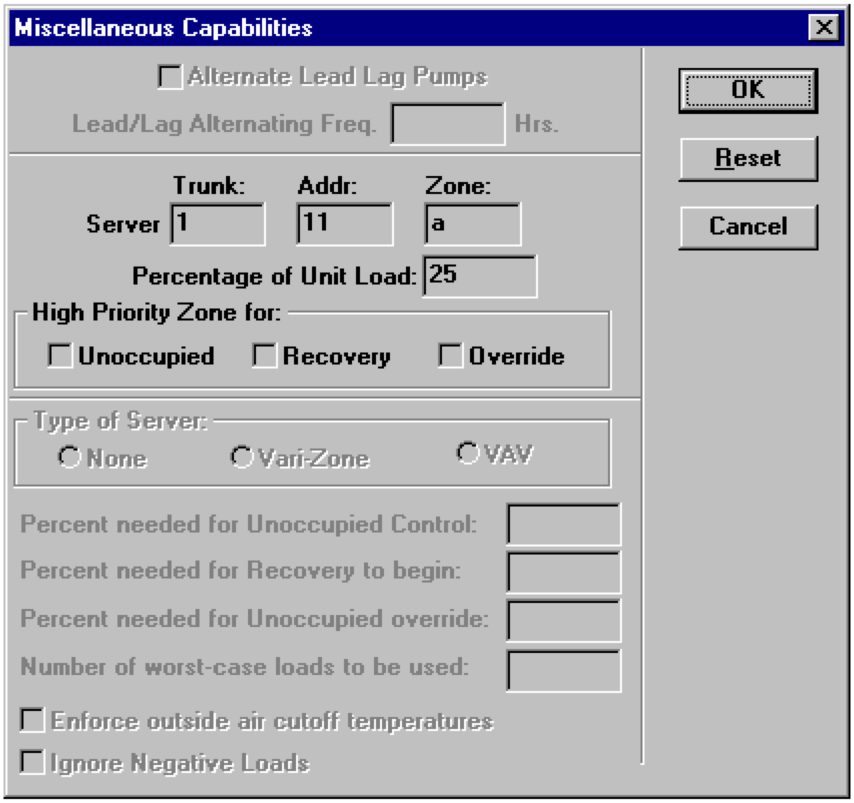
Number of worst-case loads to be used: - This determines the number of worst case Client PID loads to use in determining the load to pass to the Server. If this number is 0, then all Clients assigned to that Server are used.

Enforce outside air cutoff temperatures - If checked, the System will override calls for heating when OSA temperature is above the configured setpoint and override calls for cooling when OSA temperature is below the configured setpoint.

Ignore Negative Loads - If checked, all Client Zones with a negative PID load will be ignored when calculating the PID load for the Server.

VariZone® Client Setup

The configuration for **VariZone®** Client Zones is accessed through the Misc button of the Zone Configuration screen.



VariZone® Client Setup Screen

Server Trunk / Addr / Zone - is the trunk number (1-8), address (1-32), and zone (a-d) of the Server for this Client.

Percentage of Unit Load - is the percentage of the total conditioning load on the Server that is contributed by this Zone.

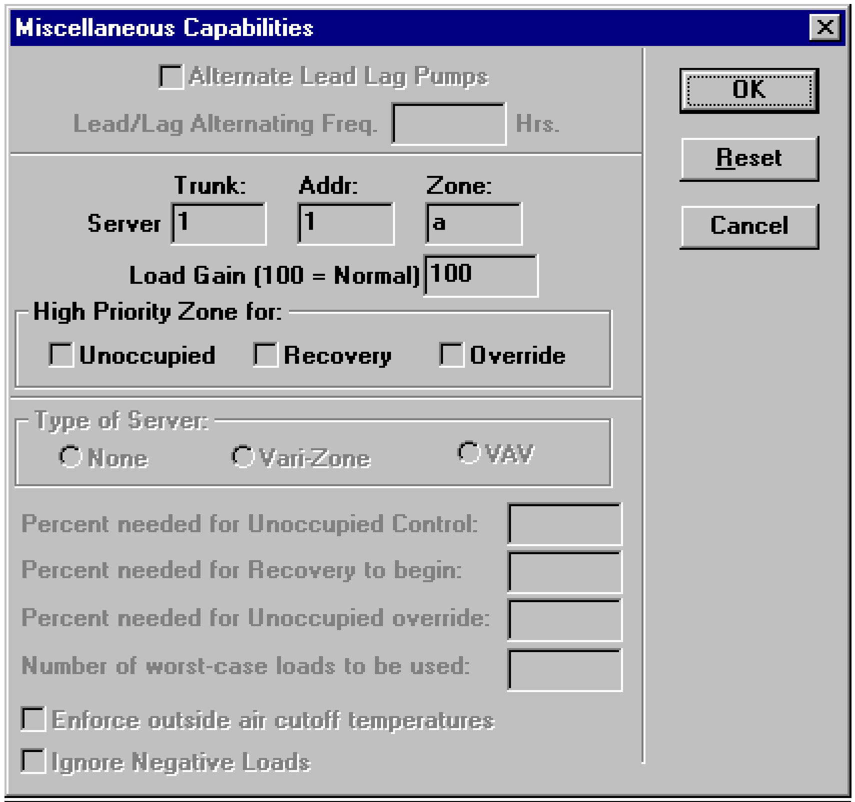
High Priority Zone for Unoccupied/Recovery/Override - Use these checkboxes to force the System to enter the selected mode based on the needs of this one Zone only.

Note: See the Set Zone Server section in this Chapter for automatic configuration of the Server address and Percentage of Unit Load.

Note: Some applications exist where it is desirable to have a Client Zone that does not have a vote in the decision for Server mode and stage. If the percentage entered is 0, that Client will position its damper correctly based on its needs and the mode of the Server, but will not contribute to the decision for Server mode and stage.

VAV Client Setup

The configuration for VAV Client Zones is accessed through the Misc button of the Zone Configuration screen.



VAV Client Setup Screen

Server Trunk / Addr / Zone - is the trunk number (1-8), address (1-32), and zone (a-d) of the Server for this Client.

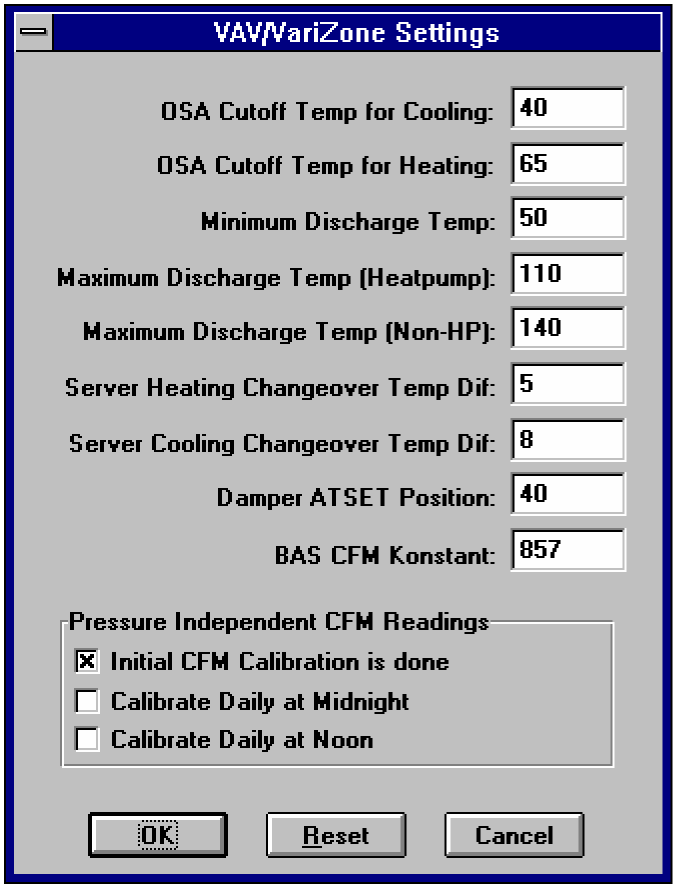
Load Gain - is the multiplier to be used in determining the importance of this Zone and can be any number from 0 to 255.

High Priority Zone for Unoccupied/Recovery/Override - Use these checkboxes to force the System to enter the selected mode based on the needs of this one Zone only.

Note: See the Set Zone Server section in this Chapter for automatic configuration of the Server address and Load Gain.

Control Temperatures

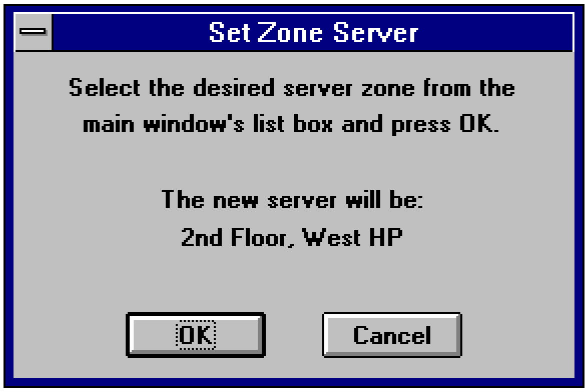
The Control Temperatures for VAV/VariZone Systems is described in detail in the Configuration Options chapter.



Control Temperatures Screen

Set Zone Server

The Set Zone Server function will automatically configure the Server trunk and address entries for all selected **VariZone®** or VAV Client Zones. In addition, the System will enter the Percentage of Unit Load among all selected **VariZone®** Clients and the Load Gain on all VAV Clients. For **VariZone®** Clients the function will equally divide the number of all selected Clients into 100 and use that number as the Percentage of Unit Load. For VAV Clients, the System will enter 100 as the Load Gain for all Clients.



Set Zone Server Screen

To use Set Server, first select all Zones in the Main List box that are to be configured as Clients for a given Server. Then select Set Server from the Zone menu. The Set Zone Server dialog box will appear. Now select the Zone to be configured as the Server for those Clients. The description for that Zone will appear in the dialog box. Selecting OK will cause the System to automatically configure all selected Client Zones.

Chapter 4

Equipment Schedule Editor

Overview

The Equipment Schedule Editor allows the User to modify the Sequence of Operations or re-define the capabilities of any existing Equipment Schedule. An entirely new Equipment Schedule can be created with new equipment definitions that will be immediately put into place by the **Energy Zone®** system. All changes are made by simple point-and-click selections.

Specifications

General Description - The same piece of hardware, the Remote System Controller (RSC), is used for all equipment controlled by the **Energy Zone®** System. What allows this to happen is the Equipment Schedule. An Equipment Schedule in the **Energy Zone®** System is the combination of several items. These items all come pre-configured for each type of equipment supported by the **Energy Zone®** System. The System can be field configured for new types of equipment or modified for existing Equipment Schedule configurations. All characteristics of an Equipment Schedule can be modified with the Editor. New Equipment Schedules can be created at any unused Equipment Schedule location. Included in an Equipment Schedule are:

- The off-line default sequence of operations.
- The on-line sequence of operations and equipment definition.
- The wiring schematics that show how to interface the RSC with the equipment.
- The default configuration used when initially configuring a Zone.

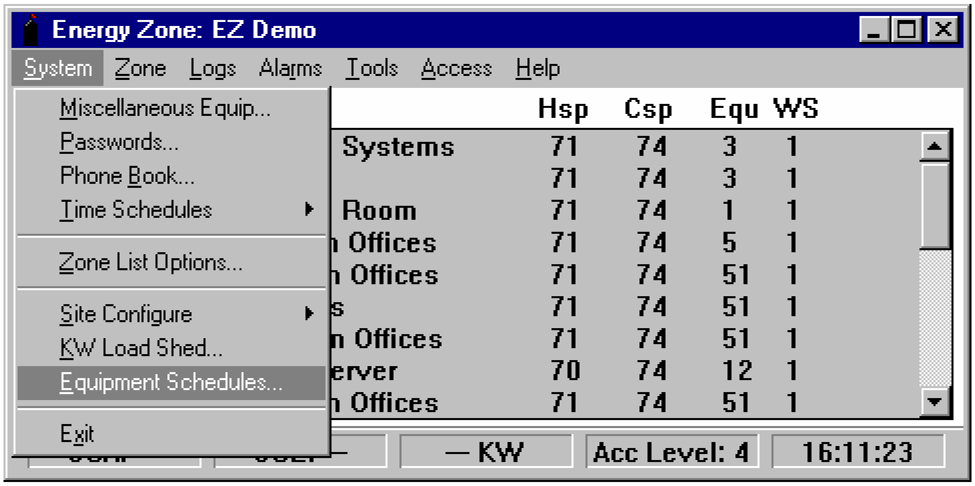
Any changes made by the Equipment Schedule Editor will affect all Zones in the System that use that Equipment Schedule. The changes will only affect operation of the Zone when on-line with the Command Center. The off-line default mode of operation is defined in the EPROM of the RSC and can not be changed by the User in the field. **BAS** can make custom changes to the Equipment Schedule definitions in the EPROM upon request.

Note: Due to the potential consequences of mistakes made with the Equipment Schedule Editor, access to this feature requires the entry of a Level 4 password. This is the only feature in the System requiring a Level 4 password. **BAS** strongly recommends that great care and consideration be used when making changes to an Equipment Schedule. **BAS** can provide assistance if requested. **BAS assumes no responsibility for any damage resulting from misuse of this feature.**

Note: Any output defined by **BAS** on an existing Equipment Schedule should not be redefined to a different use in the field. This is due to the fact that the off-line control of that output will remain as defined by **BAS**.
Example: Equipment Schedule 1, a single stage heat pump, has DO4 defined as backup heat. This particular application has no backup heat, but there is a roof mounted exhaust fan to be used as second stage cooling. If the Equipment Schedule Editor is used to define DO4 as a cooling output, this will work fine when on-line. If the Command Center fails and the RSC enters default mode, the exhaust fan will now be activated as the second stage of heat. It would be better to use an output not defined in the Equipment Schedule, or in this case DO5-DO8. This would work fine when on-line, and the fan would not run when in default mode.

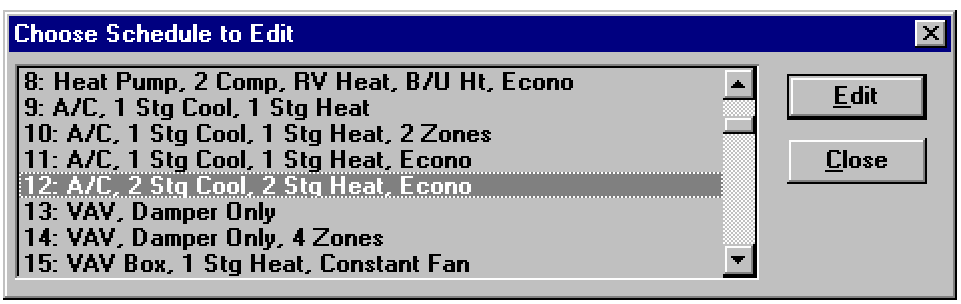
Modifying or Creating an Equipment Schedule

Select Equipment Schedules from the System menu.



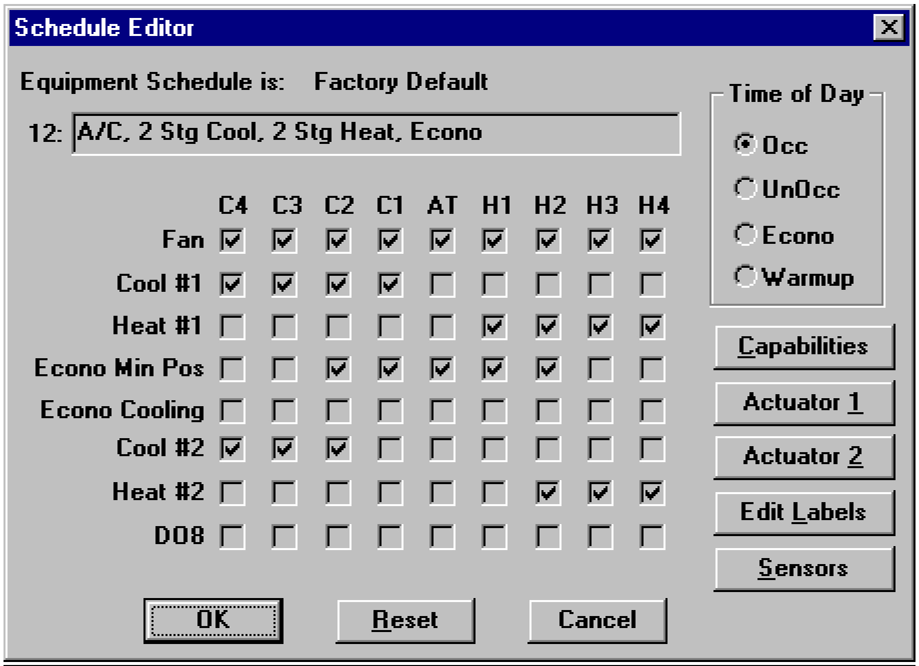
Energy Zone Main Window

Highlight the desired Equipment Schedule and then select OK.



Equipment Schedule Selection List Box

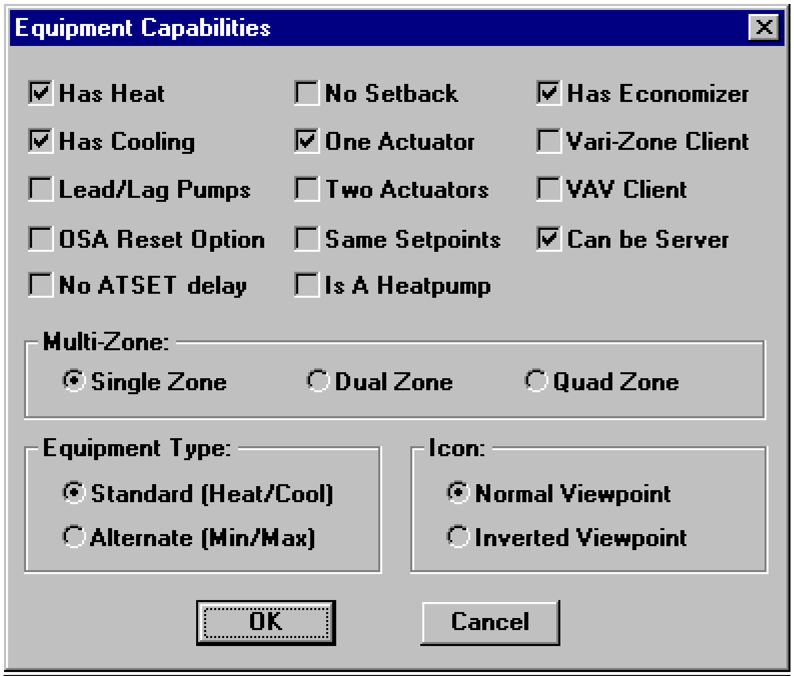
This is the primary screen used for Equipment Schedule definition.



Schedule Editor Screen

Equipment Schedule is: Factory Default, or Custom Configuration if it has been field modified.
Description - This is a text description of the Equipment Schedule.
Output Selection - The output table is organized in rows and columns. The rows represent the digital outputs, DO1 through DO8. If a custom label has been created for the output, that label is displayed. The columns correspond to PID stages. C1 through C4 are cooling stages 1 through 4. H1 through H4 are heating stages 1 through 4. AT is at setpoint. To cause an output to be activated at a given stage, click on the appropriate box with the mouse. An **X** indicates that the output will be on at that stage.
Valid Time - These selection buttons will change the outputs being displayed to the appropriate outputs for the selected time-of-day mode.
Capabilities - Used to define the characteristics of the equipment.
Actuator 1 - Used to define the first actuator.
Actuator 2 - Used to define the second actuator.
Edit Labels - Used to create default labels for the input and output points.
Sensors - Used to define default sensor scaling.

Selecting the Capabilities... button brings up the Equipment Capabilities Screen.



Equipment Capabilities Screen

Check all of the boxes necessary to correctly define the characteristics of the equipment controlled by this Equipment Schedule. The System will allow any combination of selections to be made. Use caution in making selections, as some of the items are mutually exclusive and will result in unpredictable control.

Has Heat - The equipment has the capability to provide heating. Allows for entry of heating setpoints in the Zone configuration. The Heating Icon (flames) will not be displayed in the Main Window unless this box is checked.

Has Cooling - The equipment has the capability to provide cooling. Allows for entry of cooling setpoints in the Zone configuration. The Cooling Icon (icicles) will not be displayed in the Main Window unless this box is checked.

Lead/Lag Pumps - The equipment has 2 loop pumps installed, one at DO1 and one at DO2. Each pump has the capacity for 100% loop flow. Allows entry for lead/lag pump duty cycling in the Zone Misc configuration. Also allows use of the ALTPUMP specific action in the Alarm configuration for that Zone.

OSA Reset Option - Allows for configuration of setpoint reset configuration based on OSA temperature in the Zone configuration screen.

No ATSET delay - Under normal control conditions, the System will not allow a Zone to enter a cooling stage if, at the end of the immediately prior PID cycle, the Zone was in a heating stage. The System will force the Zone into At Setpoint for the entire current PID cycle. The same action will occur when going from heating to cooling. This checkbox will allow the System to transition between stages without a forced time delay.

No Setback - The System will not allow entry of Unoccupied setpoints. The setpoints entered for Occupied mode are also used for Unoccupied mode.

One Actuator - The Zone has one actuator being used.

Two Actuators - The Zone has two actuators being used.

Same Setpoints - The System will only allow entry of setpoints for either the heating or cooling, based on whether Has Heat or Has Cooling is checked. Equipment with Same Setpoints will attempt to control +/-1° F of the setpoint entered.

Is A Heatpump - This equipment is a heat pump. If the Zone requires the use of backup heat (Warmup Stage 2) during recovery from setback, the System will increase the startup time for the following day more than for non-heat pump equipment.

Has Economizer - The equipment has an economizer attached. This schedule will operate in the Economizer mode, as defined in the outputs table, if cooling is required and the Zone's return air enthalpy is higher than outside air enthalpy. Cooldown with the Economizer is also allowed.

Vari-Zone Client - This Zone is a VariZone client. Allows for entry of configuration information in the Zone Misc configuration screen.

VAV Client - This Zone is a Variable Air Volume client. Allows for entry of configuration information in the Zone Misc configuration screen.

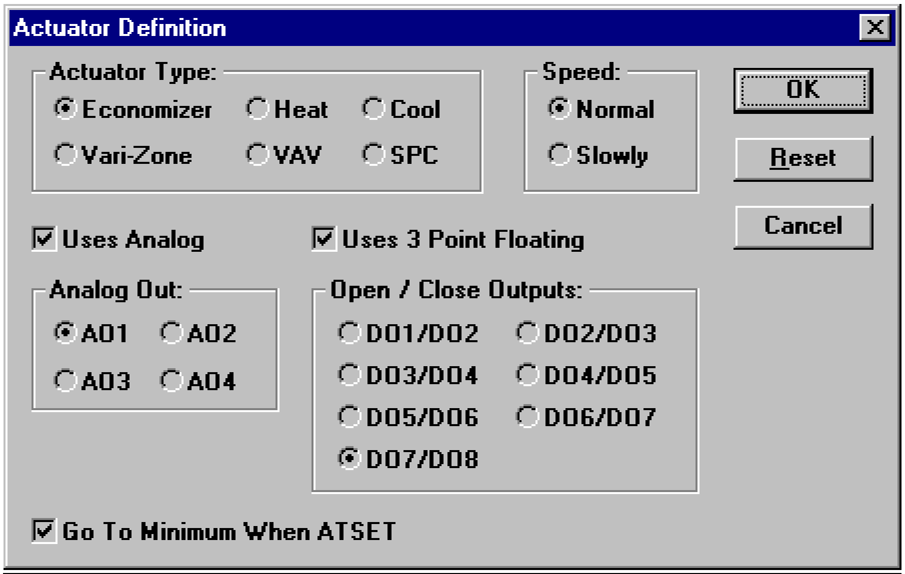
Can be Server - This equipment can be configured in Zone Misc configuration as a VariZone or VAV system server.

Multi-Zone - This tells the System whether it should expect 1, 2, or 4 control Zones connected to the RSC.

Equipment Type: This tells the System whether to use the Standard (Heat/Cool) icons to indicate PID loads or the Alternate (Min/Max) arrow icons to indicate PID loads.

Icon: - Tells the System to use a Normal Viewpoint for icons indicating PID load (i.e. +PID load shows icicles or up arrow) or to use an Inverted Viewpoint load (i.e. +PID load shows flames or down arrow).

Selecting the Actuator 1... or Actuator 2... button brings up the Actuator Edit Screen.



Actuator Edit Screen

Actuator Type: - Select the type of actuator being used.

Economizer - Directly modulates an economizer actuator. Opens the actuator on a call for Cool 1 or higher if OSA enthalpy < return air enthalpy. Requires a mixed air temperature sensor wired to AI6 for low limit control.

Heat - Modulates toward open if the PID load is negative.

Cool - Modulates toward open if the PID load is positive.

VariZone - Compares the needs of the Client to the mode and air delivery temperature of the Server to determine correct position.

VAV - Acts generally as a cooling actuator, but includes some special exceptions such as morning warm-up.

SPC - Static Pressure Controller. The output is controlled in two different modes, stand-alone and Server.

Stand-Alone - When in default or on-line with no Clients, the output will be based on a PID load calculated from AI1 at that Zone. The load will be used to position the output as if it were a heating actuator (i.e., Decrease in static pressure => Decrease at AI1 => Decrease in PID Load => Increase in Output).

Server - If the Zone is configured as a VAV Server and its Clients are on-line, the output will be based on the PID load provided by the Clients. The load will be used to position the output as if it were a cooling actuator (i.e., Temperature increase at Clients => PID Load increase at Clients => PID Load increase passed to Server => Increase in Output).

Speed: Normal/Slowly: This will determine the rate at which the actuator changes its position in response to changes in the PID load. For most HVAC applications, such as a VAV damper, use Normal. Selecting Normal will change the position at a faster rate (more % change/minute) as the control point gets farther from setpoint. This will help control temperatures in systems that have a slow response time. For rapidly changing applications, such as a boiler output, use Slowly. This will prevent severe overshoot and temperature swings.

Go To Minimum When ATSET - Checking this box will cause the actuator to go to the configured minimum position when setpoint is achieved. The normal control of an actuator would leave the actuator in its present position as long as the space is satisfied. Some Zones use a wide deadband and experience poor control unless the actuator is closed when setpoint is achieved.

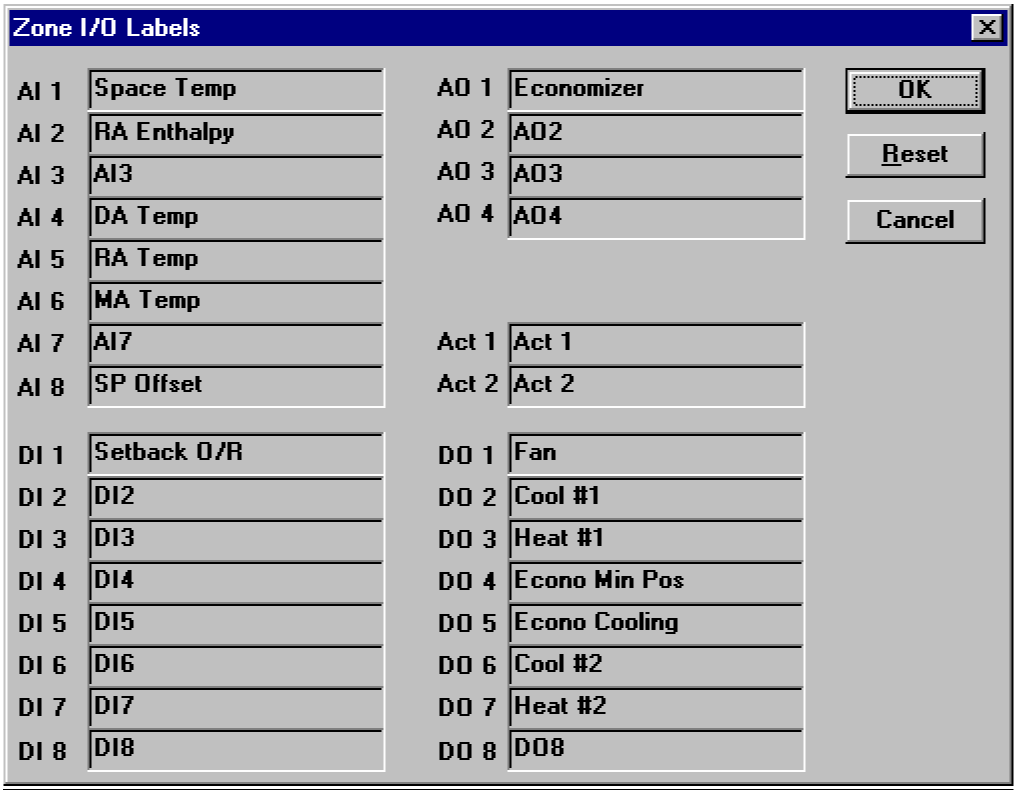
Uses Analog: - Check this box if an Analog Actuator is to be used

Analog Out: - If an Analog Actuator is used, select the output location.

Uses 3 Point Floating: - Check this box if a 3 Point Floating Actuator is to be used

Open / Close Outputs: - If a 3 Point Floating Actuator is used, select the digital output pair used. The first output will be used to open the actuator and the second output to close the actuator.

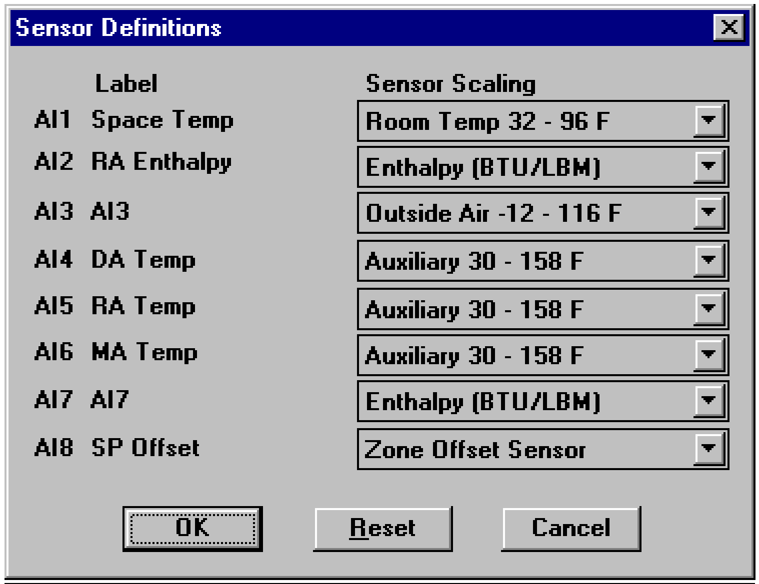
Selecting the Edit Labels... button brings up the Zone I/O Labels Screen.



Zone I/O Labels Screen

Enter the desired text to be used as a default label at each input and output point.

Selecting the Sensors... button brings up the Sensor Definitions Screen.



Sensor Definitions Screen

Select the desired scaling range to be used a default for each analog input location.

DDE Interface

Overview

Dynamic Data Exchange (DDE) is a specification developed by Microsoft to allow for exchange of data between applications in Windows. **Energy Zone®** (**EZ**) complies with this specification, allowing the User to monitor **EZ** with other applications. This can include standard applications such as Microsoft Excel and Microsoft Word for Windows, or custom applications developed using Visual Basic or similar development environments.

Connecting to Energy Zone through DDE

Follow the instructions included with the application being used to connect to **BAS EnerNet Server**. Most applications require the link to be formatted as ***Service, Topic, Item***.

For DDE Links to **BAS**, the ***Service*** will always be *BAS*.

The supported ***Topics*** are *SYSTEM* and *RSC X-YYZ*. The *RSC X-YYZ* ***Topic*** is formatted as follows:

- *X* is any trunk 1 through 8
- *YY* is any address 1 through 32
- *Z* is any subzone a through d. The entry of a subzone is optional. No subzone entry is required if the desired zone is either a single zone Equipment Schedule or an "a" zone.

The supported DDE Request ***Items*** for the *SYSTEM* ***Topic*** are:

Item	Description
SysItems	Returns a list of supported System Items (SysItems, Topics, Formats, Status, and ZoneTrend)
Topics	Returns a list of supported topics, including SYSTEM and RSC followed by all possible zone addresses
Formats	Returns supported formats (TEXT)
Status	Return BAS status (always Ready)
ZoneTrend	Used by Excel to retreive information when plotting trend log data

The supported DDE Poke ***Items*** for the *RSC X-YYZ* ***Topic*** are:

Item	Description
ID	The text from the ID entry of the Zone configuration
Description	The text from the Description entry of the Zone configuration
OHSP	Occupied mode heating setpoint
OCSP	Occupied mode cooling setpoint
UHSP	Unoccupied mode heating setpoint
UCSP	Unoccupied mode cooling setpoint
SHSP	Load Shed mode heating setpoint
SCSP	Load Shed mode cooling setpoint
WeeklySched	Weekly Time Schedule number
SetbackTime	Setback Override Time, in minutes

Caution: The System provides no security level validation for those values that can be Poked.

The supported DDE Request ***Items*** for the *RSC X-YYZ* ***Topic*** are:

Item	Description
TopicItemList	Returns a list of all supported RSC items
Formats	Returns supported formats (TEXT)
ID	The text from the ID entry of the Zone configuration
Description	The text from the Description entry of the Zone configuration
OHSP	Occupied mode heating setpoint
OCSP	Occupied mode cooling setpoint
UHSP	Unoccupied mode heating setpoint
UCSP	Unoccupied mode cooling setpoint
SHSP	Load Shed mode heating setpoint
SCSP	Load Shed mode cooling setpoint
CP	Control Point, correctly scaled
Mode	Simplified version of Operational state (Occ, Unocc, or Warmup)
State	Operational state (i.e. Occ 1, Warmup, Offline, etc.)
Stage	Operational mode (i.e. H1, H2, AT, C3, etc.)
SchedNum	Equipment Schedule Number
ROMVer	EPROM Version Number (Ver.Rev.SubRev)
CFM	Current CFM
WeeklySched	Weekly Time Schedule number
SetbackTime	Setback Override Time, in minutes
AI 1 - AI 8	Analog Inputs 1-8. Scaled the same as in Troubleshooting
AO 1 - AO 4	Analog Outputs 1-6. Scaled from 0-100% open
RAI 1 - RAI 8	Analog Inputs 1-8 in their raw 0-255 range
RAO 1 - RAO 4	Analog Outputs 1-6 in their raw 0-255 range
DI 1 - DI 8	Digital Inputs 1-8. Result is either “On” or “Off”
DO 1 - DO 8	Digital Outputs 1-8. Result is either “On” or “Off”
InAlarm	Any active alarms at this Zone? Result is either “Yes” or “No”
AlarmOn 1 - AlarmOn 16	Is Alarm 1-16 active? Result is either “Yes” or “No”

Note: A space must also be entered between the letters and the number for AlarmOn, DI, DO, AI, and AO values.

Using Microsoft Excel 97 or Later and Microsoft Visual Basic to Connect to Energy Zone

The following is a sample macro created using the macro editor provided with Excel. This macro is intended to be used with the the BAS/Energy Zone system. It is launched by BAS.exe at midnight if there are any point logs configured to be plotted. It will import the point log file, create a chart using the data found in the file, print the chart, and then save the file with the name filename_MM_DD_YY.xls. The filename includes the address, point, and frequency. For example, if a log contained data from AI3 at zone 2-9c and it was being plotted weekly, the filename would be 2-9c_3W_MM_DD_YY.xls. The '3' designates AI3 and can be 1-8 for AI1-8 or 9 if the Control Point is being recorded. The possible frequencies are 'D' for daily, 'W' for weekly, and 'M' for monthly.

```
' Copyright © 1998-2002 Enertec/BAS Corporation.
' There is no Copyright protection on this macro when used with any licensed BAS product. When used
' with a licensed BAS product, it may be modified, copied, and distributed as desired with no exceptions.


Option Explicit

Sub Auto_Open()

Dim appDDEid As Long
Dim TrendFile As String
Dim ChartName As String
Dim NumEntries As Long
Dim FinalRow As Long
Dim ZoneAddress, ZoneID, ZoneDescription As String
Dim NumDays As Integer
Dim YAxisLabel As String
Dim MinY, MaxY, DivY As Integer
Dim XAxisLabel As String
Dim DoPlotAI, DoPlotHSP, DoPlotCSP, DoPlotLoLmt, DoPlotHiLmt, DoPlotOSA As Boolean
Dim HasLegend As Boolean
Dim TickLabelSpc, TickMarkSpc As Integer
Dim TotalColumns As Integer
Dim EndColumn As String
Dim BasChartTitle As String
Dim TheDay, TheMonth, TheYear As Variant
Dim Msg As String
Dim SaveFile, FullPath As String
Dim TheDate, StartDate, EndDate As Date
Dim RangeWithData As Range
Dim DateTime As String
Dim StrLen, I As Long

On Error GoTo ErrorHandler
```



```
' We loop back to this point after plotting and saving a file
DoItAgain:

' Initiate a DDE conversation with BAS.exe
appDDEid = DDEInitiate(app:="BAS", topic:="SYSTEM")

With ActiveSheet
    .Range("A1").Value = DDERequest(appDDEid, "ZoneTrend")
    TrendFile = .Range("A1").Value
End With

' Terminate the DDE conversation
DDETerminate appDDEid

' If no file to load and plot, then exit
If TrendFile Like "xxx" Then GoTo AllDone

' Load the point log file
Workbooks.OpenText FileName:=TrendFile, Origin:=xlWindows, _
    StartRow:=1, DataType:=xlDelimited, TextQualifier:=xlDoubleQuote, _
    ConsecutiveDelimiter:=False, Tab:=True, Semicolon:=False, Comma:=False _
    , Space:=False, Other:=False, FieldInfo:=Array(Array(1, 1), Array(2, 1), _
    Array(3, 1))

' Resize column A to fit the date/time and then select columns A & B
Columns("A:A").Select
Selection.ColumnWidth = 18.57

' Rename the Worksheet
ActiveSheet.Name = "Point Log Data"

' First initialize some parameters
HasLegend = True        ' Set HasLegend to False if none is desired
TotalColumns = 1

DoPlotAI = False
DoPlotHSP = False
DoPlotCSP = False
DoPlotLoLmt = False
DoPlotHiLmt = False
DoPlotOSA = False

' And then retreive some information from the file
With ActiveSheet
    NumEntries = .Range("A1").Value
    ZoneAddress = .Range("A2").Value
    ZoneID = .Range("B2").Value
    ZoneDescription = .Range("C2").Value
    NumDays = .Range("B3").Value
    YAxisLabel = .Range("A4").Value
    MinY = .Range("C4").Value
    MaxY = .Range("E4").Value
```

```
    If .Range("B6").Value = 1 Then
        DoPlotAI = True
        TotalColumns = TotalColumns + 1
    End If

    If .Range("C6").Value = 1 Then
        DoPlotHSP = True
        TotalColumns = TotalColumns + 1
    End If

    If .Range("D6").Value = 1 Then
        DoPlotCSP = True
        TotalColumns = TotalColumns + 1
    End If

    If .Range("E6").Value = 1 Then
        DoPlotLoLmt = True
        TotalColumns = TotalColumns + 1
    End If

    If .Range("F6").Value = 1 Then
        DoPlotHiLmt = True
        TotalColumns = TotalColumns + 1
    End If

    If .Range("G6").Value = 1 Then
        DoPlotOSA = True
        TotalColumns = TotalColumns + 1
        End If

End With

'This shouldn't happen, but if it does then go get 'the next file because there is nothing to plot in this one
If DoPlotAI = False Then GoTo DoItAgain

'Determine the number of rows to be plotted. If we 'don't have at least 1 hours data, then move on
If NumEntries < 6 Then GoTo DoItAgain
Else
    FinalRow = NumEntries + 1
End If
```

```
' Determine the last column to be plotted
If TotalColumns = 7 Then
    EndColumn = "G"
ElseIf TotalColumns = 6 Then
    EndColumn = "F"
ElseIf TotalColumns = 5 Then
    EndColumn = "E"
ElseIf TotalColumns = 4 Then
    EndColumn = "D"
ElseIf TotalColumns = 3 Then
    EndColumn = "C"
ElseIf TotalColumns = 2 Then
    EndColumn = "B"
End If

' Delete unused columns
If DoPlotOSA = False Then
    Columns("G:G").Select
    Selection.Delete Shift:=xlShiftToLeft
End If

If DoPlotHiLmt = False Then
    Columns("F:F").Select
    Selection.Delete Shift:=xlShiftToLeft
End If

If DoPlotLoLmt = False Then
    Columns("E:E").Select
    Selection.Delete Shift:=xlShiftToLeft
End If

If DoPlotCSP = False Then
    Columns("D:D").Select
    Selection.Delete Shift:=xlShiftToLeft
End If

If DoPlotHSP = False Then
    Columns("C:C").Select
    Selection.Delete Shift:=xlShiftToLeft
End If

' Delete rows 1 thru 4 and 6 (contains info we just retreived and no longer need)
Rows("6:6").Select
Selection.Delete Shift:=xlUp
Rows("1:4").Select
Selection.Delete Shift:=xlUp

' If this is a daily log, then strip the seconds from the time stamp.
If NumDays = 1 Then
    XAxisLabel = "Date/Time"
```

```
        If NumEntries < 12 Then
            TickLabelSpc = 1
            TickMarkSpc = 1
        Else
            TickLabelSpc = NumEntries / 12
            TickMarkSpc = NumEntries / 12
        End If

        For I = 2 To FinalRow Step 1
            ActiveSheet.Cells(I, 1).Select
            DateTime = Selection.Value
            StrLen = Len(DateTime)

            If StrLen < 5 Then
              Exit For
            End If

            DateTime = Left(DateTime, StrLen - 3)
            Selection.Value = DateTime

        Next I

    ' If this is a weekly log, then strip the minutes:seconds and replace it with a :00

    ElseIf NumDays = 7 Then
        XAxisLabel = "Date/Time"

        If NumEntries < 14 Then
            TickLabelSpc = 1
            TickMarkSpc = 2
        Else
            TickLabelSpc = NumEntries / 14
            TickMarkSpc = NumEntries / 7
        End If

        For I = 2 To FinalRow Step 1
            ActiveSheet.Cells(I, 1).Select
            DateTime = Selection.Value
            StrLen = Len(DateTime)

            If StrLen < 5 Then
              Exit For
            End If

            DateTime = Left(DateTime, StrLen - 5)
            Selection.Value = DateTime & "00"

        Next I
```

```
' This must be a monthly log, so strip the hours:minutes:seconds.
Else
    XAxisLabel = "Date"

    If NumEntries < 31 Then
        TickLabelSpc = 1
        TickMarkSpc = 2
    Else
        TickLabelSpc = NumEntries / NumDays
        TickMarkSpc = NumEntries / (NumDays / 2)
    End If

    For I = 2 To FinalRow Step 1
        ActiveSheet.Cells(I, 1).Select
        DateTime = Selection.Value
        StrLen = Len(DateTime)

        If StrLen < 5 Then
            Exit For
        End If

        DateTime = Left(DateTime, StrLen - 9)
        Selection.Value = DateTime

    Next I

End If

ActiveSheet.Cells(1, 1).Select

' Configure the titles
StartDate = Date - NumDays
EndDate = Date - 1
BasChartTitle = ZoneDescription & " (" & StartDate & " - " & EndDate & ")"

' Create a chart
Charts.Add

' Do some basic chart configuration
With ActiveChart
    .ChartType = xlLine
    .SetSourceData Source:=Sheets("Point Log Data").Range("B1:" & EndColumn & FinalRow), _
        PlotBy:=xlColumns
    .Location Where:=xlLocationAsObject, Name:="Point Log Data"
End With
```

```
With ActiveChart
    .SeriesCollection(1).XValues = Sheets("Point Log Data").Range("A1:A" & FinalRow)

    .HasDataTable = False
    .HasTitle = True
    .ChartTitle.Characters.Text = BasChartTitle

    .HasAxis(xlCategory, xlPrimary) = True
    .Axes(xlCategory, xlPrimary).HasTitle = False
    .Axes(xlCategory, xlPrimary).HasTitle = True
    .Axes(xlCategory, xlPrimary).AxisTitle.Characters.Text = XAxisLabel

    .HasAxis(xlValue, xlPrimary) = True
    .Axes(xlValue, xlPrimary).HasTitle = True
    .Axes(xlValue, xlPrimary).AxisTitle.Characters.Text = YAxisLabel
End With

' Format the y-axis grid lines (horizontal)
DivY = (MaxY - MinY) / 10

If DivY < 1 Then
    DivY = 1
End If

With ActiveChart.Axes(xlValue)
    .HasMajorGridlines = True
    .HasMinorGridlines = False
    .MinimumScale = MinY
    .MaximumScale = MaxY
    .MinorUnit = DivY
    .MajorUnit = DivY
    .Crosses = xlCustom
    .CrossesAt = 0
    .ReversePlotOrder = False
    .ScaleType = xlLinear
End With

' Format the x-axis grid lines (vertical)
ActiveChart.Axes(xlCategory, xlPrimary).CategoryType = xlCategoryScale

With ActiveChart.Axes(xlCategory)
    .HasMajorGridlines = True
    .HasMinorGridlines = False
    .CrossesAt = 1
    .TickLabelSpacing = TickLabelSpc
    .TickMarkSpacing = TickMarkSpc
    .AxisBetweenCategories = True
    .ReversePlotOrder = False
End With
```

```
' Resize so that there is adequate room for the date/time labels
ActiveSheet.Shapes("Chart 1").ScaleHeight 1.35, msoFalse, msoScaleFromTopLeft

' Configure the chart font
ActiveChart.ChartArea.Select
Selection.AutoScaleFont = False

With Selection.Font
    .Name = "Arial"
    .FontStyle = "Regular"
    .Size = 8
    .Strikethrough = False
    .Superscript = False
    .Subscript = False
    .OutlineFont = False
    .Shadow = False
    .Underline = xlUnderlineStyleNone
    .ColorIndex = 5
    .Background = xlAutomatic
End With

' Change the Title to 12 pt/Bold
ActiveChart.ChartTitle.Select

With Selection.Font
    .FontStyle = "Bold"
    .Size = 12
End With

' Change the Value label to 10 pt/Bold
ActiveChart.Axes(xlValue).AxisTitle.Select

With Selection.Font
    .FontStyle = "Bold"
    .Size = 10
End With

' Change the Category label to 10 pt/Bold
ActiveChart.Axes(xlCategory).AxisTitle.Select

With Selection.Font
    .FontStyle = "Bold"
    .Size = 10
End With
```

```
' Configure the several options for the border, and chart colors
ActiveChart.PlotArea.Select

With Selection.Border
    .ColorIndex = 1
    .Weight = xlThin
    .LineStyle = xlContinuous
End With

With Selection.Interior
    .ColorIndex = 2
    .PatternColorIndex = 2
    .Pattern = xlSolid
End With

If HasLegend = True Then

' If plotting HSP, then configure the HSP Line to Red
    If DoPlotHSP = True Then
        ActiveChart.Legend.LegendEntries(2).LegendKey.Select

        With Selection.Border
            .ColorIndex = 3
            .Weight = xlThin
            .LineStyle = xlContinuous
        End With

        With Selection
            .MarkerBackgroundColorIndex = xlNone
            .MarkerForegroundColorIndex = xlNone
            .MarkerStyle = xlNone
            .Smooth = False
            .MarkerSize = 3
            .Shadow = False
        End With

    End If

' Delete the legend if none desired
Else
    ActiveChart.Legend.Select
    Selection.Delete
End If

' Tilt the Date/Time labels
ActiveChart.Axes(xlCategory).Select
Selection.TickLabels.Orientation = -63
```

```
' Printout the chart
ActiveChart.PrintOut Copies:=1, Collate:=True

' Create a date in the format mm_dd_yy to be used to give the file a unique name before saving it
TheDate = Date
TheDay = DatePart("d", TheDate)
TheMonth = DatePart("m", TheDate)
TheYear = DatePart("yyyy", TheDate)

' Strip the '.log' from the end of the file
TrendFile = Left(TrendFile, Len(TrendFile) - 4)

SaveFile = TrendFile & "_" & TheMonth & "_" & TheDay & "_" & TheYear & ".xls"

' Save the workbook
ActiveWorkbook.SaveAs FileName:=SaveFile, FileFormat:= _
    xlNormal, Password:="", WriteResPassword:="", ReadOnlyRecommended:=False _
    , CreateBackup:=False

' This will close the workbook we created, without saving changes
ActiveWorkbook.Close SaveChanges:=False

GoTo DoItAgain

ErrorHandler:
Msg = "Error #" & Str(Err) & ": " & Error(Err)
MsgBox Msg, vbCritical

End

AllDone:
ActiveWorkbook.Saved = True
Application.Quit

End Sub
```

Using Microsoft Excel 4.0 to Connect to Energy Zone

Excel must use a command macro to communicate through DDE. Instructions for creating and using a sample macro are listed below.

1. Open Excel and select File / New / Macro Sheet.
2. Enter each of the following lines, starting in cell A1 and down through to cell A7.

```
<A1>    GetRoomTemp
<A2>    =RESULT(2)
<A3>    =INITIATE("BAS","RSC 1-3b")
<A4>    =SET.NAME("RoomTemp",REQUEST(A3,"AI 1"))
<A5>    =TERMINATE(A3)
<A6>    =FORMULA(RoomTemp)
<A7>    =RETURN()
```

3. Return the cursor to cell A1.
4. Select Formula / Define Name.
5. The name GetRoomTemp should be displayed in the Name field.
6. Select the Command button.
7. Enter the letter t in the Ctrl + _ box.
8. Select Add.
9. Select OK.
10. Select File / Save and save the macro as gettemp.xlm.
11. Select File / New / Worksheet.
12. Press Ctrl + t in any cell. The current room temperature at Zone 1-3b is entered into the cell.
13. Any time that this macro is to be used, the Macro Sheet gettemp.xlm must be open.

Explanation of lines used in macro.

The first line names the macro.
The next line defines the result to be returned to the spreadsheet as text.
The next line initiates a DDE conversation with Zone 3b on Trunk 1 of Energy Zone (RSCPC). This is referred to as Opening a Channel.
The next line requests the data item AI1 and writes this value into the variable RoomTemp. This data comes from the channel identified in cell A3. This macro assumes that the =INITIATE formula is in cell A3.
The next line terminates the conversation. This is referred to as closing the channel.
The next line inserts the results to the active cell of the spreadsheet.
The last line ends the macro.

Using Microsoft Word for Windows 2.0 to Connect to Energy Zone

Word must use a macro to communicate through DDE. A sample macro is listed below. This macro will retrieve the value of the room temperature at Zone 1-3b. This will then be displayed in the currently open document as "Room Temp is 72.25F"

1. Open Word and select File / New / Normal.
2. Select Tools / Macro.
3. Type GetRoomTemp in the Macro Name box.
4. Select the Global Macros button and then the Edit button.
5. Enter the following lines:

```
Dim Shared RoomTemp$
Dim Shared Data$

Sub MAIN
    SysChan = DDEInitiate("BAS","RSC 1-3b")
    RoomTemp$  = DDRequest(SysChan,"AI 1")
    DDETerminate SysChan
    Data$ = "Room Temp is" + RoomTemp$
    Insert Data$
End Sub
```

6. Close the Window which contains the Macro just entered.
7. Answer yes to "Do you want to keep the changes?".
8. Select Tools / Options.
9. Select Keyboard under Category.
10. Select the Macros and Global buttons and then select GetRoomTemp in the Macro list box.
11. Check the Ctrl+ box and enter T in the key box.
12. Select Add.
13. Select Close.
14. Press Ctrl+T at any place in the document. The text "Room Temp is 72.25F" will be entered at that location.
15. This function can now be used at any time in any document by pressing Ctrl+T.

Explanation of lines used in macro.

The first two lines define variables to be used in the macro.
The next line begins the macro.
The next line initiates a DDE conversation with Zone 3b on Trunk 1 of Energy Zone (RSCPC). This is referred to as Opening a Channel.
The next line requests the data item AI 1 and writes this value into the variable RoomTemp$.
The next line terminates the conversation. This is referred to as closing the channel.
The next line places text into the variable Data$.
This next line enters the contents of the variable Data$ into the currently open document.
The last line ends the macro.

Chapter 6

File Organization

Overview

The **Energy Zone®** (**EZ**) data directory contains a broad selection of files and options that make **EZ** both the most easily operated and complete system available. A number of these files may be modified directly by the User. The files that may be changed manually all have file names that end in ".TXT" and may be edited using the EZ Editor or the Notepad editor that comes with Windows. The remaining files should only be modified by the **EZ** software. The **EZ** System provides the User with a simple method of creating a backup of all critical data files.

Backing up Energy Zone data files

The **EZ** System uses a *.ZIP format for backup of configuration files. The files can be expanded with any utility that can read the *.ZIP format. It is strongly recommended that all files in the \EZ\DATA directory are backed up to floppy disks at the completion of initial site configuration. These floppy disks should be stored off-site, preferably at the Dealer. After initial startup, these files should be backed up monthly. It is not necessary to backup the Trend Log or the Alarm Log files.

1. Place a floppy disk in drive A: and click on Backup Data to A&C under the Tools menu item.
2. This will create a compressed copy of all data and store it on Drive C: as \EZ\DATA\BACKUP\EZDATA.ZIP.
3. If this file already exists, it will first make a copy of the existing file named EZDATA.BAK.
4. Both files will then be copied to Drive A:.

Note: If RSCPC is running, the trunk files are open and can not be copied. If the System has been running more than one day, then backups of the trunk files were created at midnight the previous day. These backups will be saved in the data backup process. If it is the first day of operation, or changes were made which must now be saved, RSCPC must be closed prior to beginning the backup.

Restoring Energy Zone data files

The Restore utility will restore all **EZ** files to their original directories. The directories will be created if necessary. The User will be asked to confirm overwrite of any existing files.

1. Close RSCPC.
2. Start Building.
3. If restoring from Drive C:, select Restore Data From C: from the Tools menu.
4. If restoring from Drive A:, select the Restore Data From A: from the Tools menu.
5. Check the date and time of the Trunk configuration files, both TRUNKxx.CFG and TRUNKxx.BAK.
6. If the most recent Trunk configuration files are in the backup format (TRUNKxx.BAK), then copy the TRUNKxx.BAK files to TRUNKxx.CFG using File Manager.

Directories

EZ Directory

The bulk of the **EZ** System program and data files reside in the **EZ** directory and its sub directories.

C:\EZ	Contains executable program files.
C:\EZ\DATA	Contains data files.
C:\EZ\DATA\LABELS	Contains labels used when displaying all system I/O.
C:\EZ\DATA\DEFAULTS	Contains default configurations for all equipment schedules.
C:\EZ\DATA\BACKUP	Contains data file backups and utilities.
C:\EZ\DATA\CUSTOM	Custom ES and Zone default configurations created in the field..
C:\EZ\DATA\GRAPHICS	Contains graphics data files.

Windows Directory

The C:\WINDOWS directory contains two files used by **EZ**.

Root Directory

The C:\ directory contains modifications to the AUTOEXEC.BAT and CONFIG.SYS files.

Alternate Data Directory

The DualLog and AuxLogDir settings in EZ.INI are used to enable and setup an alternate data path for a duplicate Trend Log and Alarm Log. All Trend and Alarm data will be simultaneously written to both locations. This will allow a user access to copies of all Trend and Alarm data without being able to damage the original. The duplicate logs will also not be automatically deleted as are the primary Trend and Alarm Logs.

C:\EZ Files

ACL.CP, ACLLOAD.EXE - Executable program files used for operation of the ACL card. ACLLOAD resets the ACL card and then downloads the control program, ACLEMS. These programs are run by the EZ.BAT file and only run on initial start-up or reset.

BASLOGO.BMP - A bitmap version of the **BAS** logo. This file is not normally used.

BUILDER.EXE - The graphics building application.

BUILDING.EXE - The primary User interface for the **EZ** system. BUILDING has the capability to be used either locally, communicating with RSCPC, or remotely, communicating with a host site (operating building) through a modem.

CTL3D.DLL - A library that provides the 3D effect on **EZ** display screens.

CUSTOM.DLL - A library of graphics bitmap images used for graphics BUILDER and VIEWER.

EZ.BAT - A DOS batch file that is used to setup and start the **EZ** system on initial power-up.

EZEDIT.EXE - The EZ text editor used to view the Alarm Log, Security Log, and EZ.ini.

LOGIO.DLL - A library of routines used for scaling of all inputs and outputs.

PAGESVR.EXE - The executable program used for alarm callout to a digital pager.

REMOTE.ICO - Icon used for display of Remote Version of Building in Energy Zone Group.

RSCPC.EXE - The executable program used for system operation. This program must be running at all times that the system is in operation. This program runs in the background and has no User interface.

REMSVR.EXE - The executable program used at the host site (operating building) for remote communication. REMSVR provides a link between RSCPC and the modem.

SCALE.DLL - A routine used for scaling of Analog Inputs.

SPIN.DLL - A routine used for some displays.

VIEWER.EXE - The executable program used for display of graphics displays created by BUILDER. VIEWER accesses on-line data by communicating with RSCPC.

C:\EZ\DATA Files

ALM0192.TXT - Alarm File. The file containing all alarm messages from alarms that Command Center and were configured to log to disk. The file names for the alarm log follow the convention ALM*MMYY*.TXT where *MM* is the month and *YY* is the year of all alarms contained in that file. This file can be edited by a standard text editor, such as EZ Editor.

BLDGOVER.CFG - Building Overrides. The file containing the starting time, ending time and override state for all programmed building override conditions.

COMMLOG.TXT - This file contains information about errors reported by Remote Server during remote communication sessions. This file can be edited by a standard text editor, such as EZ Editor.

CTRLTMPS.CFG - This file contains various System-wide temperature settings.

DIAL.GEN - Dialing script file for Generic Hayes compatible modem.

DIAL.OPT - Dialing script file for Hayes Optima modem.

DIAL.SLC - Dialing script file for Supra FaxModem modem.

DIAL.TE2 - Dialing script file for Gateway Telepath 2 modem.

DIAL.XJK - Dialing script file for MegaHertz X-Jack modem.

DIAL.ZOO - Dialing script file for Zoom modem.

GALARMS.CFG - Global Alarms Configuration. Contains configuration information for all system global alarms.

HOL1992.CFG - Holiday Designations. All holiday designations for a given year are stored in a single file. The file names for these yearly files follow the convention HOL*YYYY*.CFG where *YYYY* is the year that is represented by that file. **EZ** comes pre-configured with the ten federal holidays through the year 2010.

LOADSHED.CFG - KW Load Shedding Configuration. All information for Load Shed setup is contained in this file.

MISC.CFG - Miscellaneous Equipment and Outside Air. The file containing all miscellaneous equipment configuration and the outside air temperature and enthalpy information.

OUTPUTS.DAT - Equipment Capabilities File. Includes the definitions for all 64 types of equipment supported by **EZ**.

OUTPUTS.BAK - Equipment Capabilities File Backup. Automatically created each time the factory version of the Equipment Schedule Editor is used.

OVER0195.LOG - This file stores information which is used by the Trend Log Viewer in the Override Summary Report. The file names for the override log follow the convention OVER*MMYY*.LOG where *MM* is the month and *YY* is the year of all data contained in that file.

PAGE.GEN - Paging script file for Generic Hayes compatible modem.

PAGE.OPT - Paging script file for Hayes Optima modem.

PAGE.SLC - Paging script file for Supra FaxModem modem.

PAGE.TE2 - Paging script file for Gateway Telepath 2 modem.

PAGE.XJK - Paging script file for MegaHertz X-Jack modem.

PAGE.ZOO - Paging script file for Zoom modem.

PASSFILE.CFG - Password File. All User name and password information is kept in this file.

PHONE.CFG - Phone book File. This file contains all configured fax, pager, and remote site phone numbers.

RECOVER.CFG - Smart Recovery Data. After each time **EZ** executes a Smart Recovery transition into Occupied, RECOVER.CFG is automatically updated as an aid to the calculation for the next recovery period. If this file is deleted, it will be re-created with default values at the time of the next Warmup calculation.

SCHEDLAB.TXT - Schedule Labels File. The file containing the text description for all equipment schedules. This file is created and modified by the Equipment Schedule editor and can also be edited by a standard text editor, such as EZ Editor.

SCHEDLAB.BAK - Schedule Labels File Backup. Automatically created each time the factory version of the Equipment Schedule Editor is used.

SECURITY.TXT - This file contains the user name and time of Log In for all access to the System. This file is saved with the hidden attribute set. This file can be edited by a standard text editor, such as EX Editor.

TRUNK01.BAK - Zone Configuration File Backups. All trunk configuration files are automatically backed up every night at midnight. These files may be conveniently backed up to a floppy disk for off-site storage. These files use a naming convention of TRUNK*XX*.CFG where *XX* is a trunk letter 01 through 08.

TRUNK01.CFG - Zone Configuration Files. All data directly responsible for the control of all zones on a given trunk reside in a trunk configuration file. These files use a naming convention of TRUNK*XX*.CFG where *XX* is a trunk letter 01 through 08.

TRND0192.LOG - Trend Log File. The file containing all trend log data from zones that were configured to log to disk. The file names for the trend log follow the convention TRND*MMYY*.LOG where *MM* is the month and *YY* is the year of all data contained in that file.

TRENDLOG.CFG - Trend Log Configuration File. This file contains configuration information for the trend log.

WEEKLY01.CFG - Weekly Time Schedules. Each of the programmed time schedules reside in their own file whose name is in the form WEEKLY*XX*.CFG where *XX* is replaced with weekly schedule number 01 through 32.

C:\EZ\DATA\LABELS Files

LABS001.TXT - Factory Default Point Labels. Any time a label is needed, the System will first search in the C:\EZ\DATA\CUSTOM directory. If a label file for a given Zone or Equipment Schedule cannot be found, a factory default label file is used. There are default label files for each type of equipment. The names of the default files are LABS*XXX*.TXT where *XXX* is the equipment type number in the range 001 through 064. All **EZ** systems come with default labels for factory supported equipment types.

C:\EZ\DATA\DEFAULTS Files

DEF001.CFG - Factory Default Configuration Settings. To help with quick and accurate installation of **EZ** systems, intelligent default values are provided for all 64 possible types of equipment. The files in this directory are named DEF*XXX*.CFG where *XXX* is the equipment type in the range of 001 through 064. These are used whenever a User selects "New..." from the Zone menu and no field customized files are found in the C:\EZ\DATA\CUSTOM directory.

C:\EZ\DATA\BACKUP Files

EZBACK.BAT -- DOS batch file used to backup **EZ** data files to both Drive A: and the \EZ\DATA\BACKUP directory of Drive C:.

EZBACK.PIF -- DOS batch file used to backup **EZ** data files to both Drive A: and the \EZ\DATA\BACKUP directory of Drive C:.

EZDATA.BAK - A compressed file containing all site specific configuration files from the previous backup session. This file is created by the backup utility and is a copy of EZDATA.ZIP prior to performing a backup of the current data.

EZDATA.ZIP - A compressed file containing all site specific configuration files. This file is created by the backup utility.

EZRESTRA.PIF -- Windows DOS PIF file used to restore **EZ** data files from Drive A:.

EZRESTRC.PIF - Windows DOS PIF file used to restore **EZ** data files from the \EZ\DATA\BACKUP directory of Drive C:.

EXCLUDE.TXT - A text file listing data files which are excluded from the backup utility.

PKZIP.EXE - File compression utility used for data backup.

PKUNZIP.EXE - File expansion utility used for data restore.

C:\EZ\DATA\GRAPHICS Files

FLORPLAN.FLR - Graphics Screen Displays. The graphic files used by BUILDER and VIEWER for dynamic graphics displays. All files have a User defined 8 character name with the .FLR extension.

C:\EZ\DATA\CUSTOM Files

DEF001.CFG - Field Customized Default Configuration Settings. The files in this directory are named DEF*XXX*.CFG where *XXX* is the equipment type in the range of 001 through 064. These are used whenever a User selects "New..." from the Zone menu.

LABSA01a.TXT - Site Specific RSC Point Labels. Each Zone can have its own label file with the name LABS*XYYZ*.TXT, where *X* should be replaced with the trunk letter, *YY* with the RSC address 01 through 32, and *Z* with the sub-zone a-d.

LABS001.TXT - Field Customized Default Point Labels. If a label file for a given zone cannot be found, the System looks for a field customized default label file. There can be one of these files for each type of equipment. The names of the default files are LABS*XXX*.TXT where *XXX* is the equipment type number in the range 001 through 064.

OUT001.DAT - Field Customized Single Equipment Schedule Capabilities File. The files in this directory are named OUT*XXX*.DAT where *XXX* is the equipment type in the range of 001 through 064. These definitions are used in place of the factory defaults found in C:\EZ\DATA\OUTPUTS.DAT. These files are saved any time the User chooses OK from the Equipment Schedule Editor.

SCHEDLAB.001 - Field Customized Schedule Labels File. The files in this directory are named SCHEDLAB.*XXX* where *XXX* is the equipment type in the range of 001 through 064. These definitions are used in place of the factory defaults found in C:\EZ\DATA\SCHEDLAB.TXT. These files are saved any time the User chooses OK from the Equipment Schedule Editor.

C:\WINDOWS Files

EZ.GRP - **EZ** Group. The group of icons used by Program Manager to display the **EZ** Group of applications.

EZ.INI - **EZ** Options. Contains many optional settings for operation of the **EZ** system. This file can be edited by a standard text editor, such as Windows Notepad.

EZ.INI Settings

EZ.INI contains many optional settings that are changed by the **EZ** software when the User selects different options from the various menus. These settings can also be changed by a text editor, such as NOTEPAD. It is generally not recommended to make changes using a text editor. The changes should be done automatically using the **EZ** software.

[Energy Zone]	
SiteName=Wash. State Energy Office	This is the site name used on all screens.
TempDisp=F	This is either F for Fahrenheit or C for Celsius.
ScreenUpdate=6	This is the # of seconds between screen updates.
DataDir=C:\EZ\DATA	Directory where all data is stored.
AccessTimeout=30	The # of minutes until access returns to Level 0.
AutoDST=1	Daylight Savings Time Clock Update. 1 = yes, 0 = no
DeadBand=2	Max allowed Setpoints Deadband in °F.
EconoMin=55	Min allowed Economizer MA Temp in °F.
XPos=-3	Last screen position for Building.
YPos=-5	Last screen position for Building.
Width=646	Last screen width for Building.
Height=286	Last screen width for Building.
HistXPos=107	Last screen position for Zone History in Building.
HistYPos=75	Last screen position for Zone History in Building.
HistWidth=534	Last screen width for Zone History in Building.
HistHeight=78	Last screen width for Zone History in Building.
ZoneBoxOpts=0x7c07	Options used for the Main List box display.
ZoneBoxOpts2=0x0	Additional Main List box display options.
[Remote Comm]	The settings used for all Remote Communications.
BuildingModem=1	The Modem # used for Remote Building.
RemSvrModem=1	The Modem # used for Remote Server.
PgrSvrModem=1	The Modem # used for Pager Server.
FaxModem=0	The Modem # used for Fax Alarms.
Modem1Type=Gateway Telepath II 14400 Int	The modem type used for Modem #1.
Modem1Port=1	The COM Port connected to the Modem #1.
Modem1Baud=384	The Comp-Modem baud rate for Modem #1.
Modem2Type=Gateway Telepath II 14400 Int	The modem type used for Modem #2.
Modem2Port=2	The COM Port connected to the Modem #2.
Modem2Baud=384	The Comp-Modem baud rate for Modem #2.
RemSvrErrors=0	Save Remote Server Errors: 1 = yes, 0 = no Errors are saved in COMMLOG.TXT
WatchSum=0	Monitor for CheckSum Errors. 1 = yes, 0 = no Errors are displayed in the Main List box status bar.
HostNum=0001	Site ID used to send to a digital pager on alarm.

[Zone Box]	
AI1Label=SAT	These labels are used on the main list box.
AI2Label=RAE	
AI3Label=OSA	
AI4Label=DAT	
AI5Label=RAT	
AI6Label=MAT	
AI7Label=OAE	
AI8Label=AI8	
[Trend Log]	
XPos=-3	Last screen position for Trend Viewer.
YPos=-5	Last screen position for Trend Viewer.
Width=646	Last screen width for Trend Viewer.
Height=286	Last screen width for Trend Viewer.
TrendBoxOpts=0x503	Options used for the Trend Viewer display.
TrendBoxOpts2=0x7	More Options used for the Trend Viewer display.
TrendLogOpts=0x2	Trend Log selection options.
CacheBlocks=20	Number of blocks (100 lines each) of Trend Log cached while viewing. Can be from 2 to 200.
[TroubleShoot]	Configuration for Troubleshooting Screen.
ClrNorm=ff0000	Color of outputs in normal control.
ClrOver=ff00ff	Color of outputs in Troubleshooting Override.
ClrMisc=40ff00	Color of outputs in Misc Equip control.
ClrAlarm=ff	Color of outputs in Alarm control.
ClrCont=408080	Color of outputs in Control Function control.
[EnerNet]	
ACLDPSEG=D000	The address of the ACL Dual Ported RAM segment.
MaxTrunks=8	This is the # of communication trunk lines.
LoggingLevel=1	Level 1-4 for logging comm errors.
[EZ Editor]	These are all used for setup of EZEDIT.EXE.
Flags=8192	
Tabs=8	
WinPosX=22	
WinPosY=17	
WinSizeX=600	
WinSizeY=422	
Font_lfHeight=-16	
Font_lfWidth=0	
Font_lfWeight=700	
Font_lfItalic=0	
Font_lfUnderline=0	
Font_lfStrikeOut=0	
Font_lfCharSet=0	
Font_lfOutPrecision=1	
Font_lfClipPrecision=2	
Font_lfQuality=1	
Font_lfPitchAndFamily=34	
Font_lfFaceName=System	

EZ System File Contents

The following text based files are part of the **EZ** System. These files can be edited by a text editor, such as EZ Editor. It is generally not recommended to make changes in these files. Contact **BAS** for support if necessary.

Modifications to AUTOEXEC.BAT

The following line is added to AUTOEXEC.BAT:

C:\EZ\EZ.BAT	Starts the **EZ** batch file.

If a line is included that launches Windows (Win), that line is deleted.

EZ.BAT

The following lines make up EZ.BAT:

SET PATH=%PATH%;C:\EZ

CD \EZ	
SET PATH=%PATH%;C:\EZ	Adds **EZ** to the existing DOS path.
ACLLOAD ISA 0300 D0000	Resets the ACL card, downloads its control program, and configures both the IO port address and the dual port memory address.
WIN :	Starts Windows and **EZ**. This command is not used for Systems shipping with Windows 95.

EZBACK.BAT

```
copy c:\ez\data\backup\ezdata.zip c:\ez\data\backup\ezdata.bak
pkzip -P -r -x@\ez\data\backup\exclude.txt c:\ez\data\backup\ezdata.zip c:\ez\data\*.*
        c:\windows\ez.ini
copy c:\ez\data\backup\ezdata.zip a:\
copy c:\ez\data\backup\ezdata.bak a:\
copy c:\ez\data\backup\pkunzip.exe a:\
```

EXCLUDE.TXT

```
C:/EZ/DATA/*.LOG
C:/EZ/DATA/*.TXT
C:/EZ/DATA/BACKUP/*.*
```

DIAL.GEN

```
DIAL SCRIPT
:RESET
TRANSMIT ATZ0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DEFAULTS
GOTO RESET

:DEFAULTS
TRANSMIT AT&F^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT1
GOTO DEFAULTS

:INIT1
TRANSMIT AT&C1&D2X4^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT2
GOTO INIT1

:INIT2
TRANSMIT ATM1^M
PAUSE 2
WAITFOR OK,5
IFFOUND WRITE
GOTO INIT2

:WRITE
TRANSMIT AT&W0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DIAL
GOTO WRITE

:DIAL
TRANSMIT ATDT$PHONE$^M
PAUSE 60
CLOSE
```

DIAL.OPT

```
DIAL SCRIPT
:RESET
TRANSMIT ATZ0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DEFAULTS
GOTO RESET

:DEFAULTS
TRANSMIT AT&F^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT1
GOTO DEFAULTS

:INIT1
TRANSMIT AT&C1&D2&Q9S7=60S10=50^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT2
GOTO INIT1

:INIT2
TRANSMIT AT&K3M1L0^M
PAUSE 2
WAITFOR OK,5
IFFOUND WRITE
GOTO INIT2

:WRITE
TRANSMIT AT&W0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DIAL
GOTO WRITE

:DIAL
TRANSMIT ATDT$PHONE$^M
PAUSE 60
CLOSE
```

DIAL.SLC

```
DIAL SCRIPT
:RESET
TRANSMIT ATZ0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DEFAULTS
GOTO RESET

:DEFAULTS
TRANSMIT AT&F2^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT1
GOTO DEFAULTS

:INIT1
TRANSMIT ATS7=60S10=50^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT2
GOTO INIT1

:INIT2
TRANSMIT ATM1L0^M
PAUSE 2
WAITFOR OK,5
IFFOUND WRITE
GOTO INIT2

:WRITE
TRANSMIT AT&W0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DIAL
GOTO WRITE

:DIAL
TRANSMIT ATDT$PHONE$^M
PAUSE 60
CLOSE
```

DIAL.TE2

```
DIAL SCRIPT
:RESET
TRANSMIT ATZ^M
PAUSE 2
WAITFOR OK,5
IFFOUND DEFAULTS
GOTO RESET

:DEFAULTS
TRANSMIT AT&F^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT1
GOTO DEFAULTS

:INIT1
TRANSMIT AT&C1&D2&R2&H1&B1&S1B0X4S7=60S10=50^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT2
GOTO INIT1

:INIT2
TRANSMIT AT&A0M1L0^M
PAUSE 2
WAITFOR OK,5
IFFOUND WRITE
GOTO INIT2

:WRITE
TRANSMIT AT&W^M
PAUSE 2
WAITFOR OK,5
IFFOUND DIAL
GOTO WRITE

:DIAL
TRANSMIT ATDT$PHONE$^M
PAUSE 60
CLOSE
```

DIAL.XJK

```
DIAL SCRIPT
:RESET
TRANSMIT ATZ0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DEFAULTS
GOTO RESET

:DEFAULTS
TRANSMIT AT&F0^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT1
GOTO DEFAULTS

:INIT1
TRANSMIT AT&C1&D2&K3M1L0^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT2
GOTO INIT1

:INIT2
TRANSMIT AT\G0\N3%C2S7=60S10=50^M
PAUSE 2
WAITFOR OK,5
IFFOUND WRITE
GOTO INIT2

:WRITE
TRANSMIT AT&W0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DIAL
GOTO WRITE

:DIAL
TRANSMIT ATDT$PHONE$^M
PAUSE 60
CLOSE
```

DIAL.ZOO

```
:RESET
TRANSMIT ATZ0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DEFAULTS
GOTO RESET

:DEFAULTS
TRANSMIT AT&F^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT1
GOTO DEFAULTS

:INIT1
TRANSMIT AT&C1&D2&K3&Q5M1L0^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT2
GOTO INIT1

:INIT2
TRANSMIT AT%C1S7=60S10=50S36=7^M
PAUSE 2
WAITFOR OK,5
IFFOUND WRITE
GOTO INIT2

:WRITE
TRANSMIT AT&W0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DIAL
GOTO WRITE

:DIAL
TRANSMIT ATDT$PHONE$^M
PAUSE 60
CLOSE
```

PAGE.GEN

```
DIAL SCRIPT
:RESET
TRANSMIT ATZ0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DEFAULTS
GOTO RESET

:DEFAULTS
TRANSMIT AT&F^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT1
GOTO DEFAULTS

:INIT1
TRANSMIT AT&C1&D2X4^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT2
GOTO INIT1

:INIT2
TRANSMIT ATM0^M
PAUSE 2
WAITFOR OK,5
IFFOUND WRITE
GOTO INIT2

:WRITE
TRANSMIT AT&W0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DIAL
GOTO WRITE

:DIAL
TRANSMIT ATDT$PHONE$,,,,,,$HOSTNUM$#^M
PAUSE 20
CLOSE
```

PAGE.OPT

```
DIAL SCRIPT
:RESET
TRANSMIT ATZ0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DEFAULTS
GOTO RESET

:DEFAULTS
TRANSMIT AT&F^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT1
GOTO DEFAULTS

:INIT1
TRANSMIT AT&C1&D2&Q9S7=60S10=50^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT2
GOTO INIT1

:INIT2
TRANSMIT AT&K3M0^M
PAUSE 2
WAITFOR OK,5
IFFOUND WRITE
GOTO INIT2

:WRITE
TRANSMIT AT&W0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DIAL
GOTO WRITE

:DIAL
TRANSMIT ATDT$PHONE$,,,,,,$HOSTNUM$#^M
PAUSE 20
CLOSE
```

PAGE.SLC

```
DIAL SCRIPT
:RESET
TRANSMIT ATZ0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DEFAULTS
GOTO RESET

:DEFAULTS
TRANSMIT AT&F2^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT1
GOTO DEFAULTS

:INIT1
TRANSMIT ATS7=60S10=50^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT2
GOTO INIT1

:INIT2
TRANSMIT ATM0^M
PAUSE 2
WAITFOR OK,5
IFFOUND WRITE
GOTO INIT2

:WRITE
TRANSMIT AT&W0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DIAL
GOTO WRITE

:DIAL
TRANSMIT ATDT$PHONE$,,,,,,$HOSTNUM$#^M
PAUSE 20
CLOSE
```

PAGE.TE2

```
DIAL SCRIPT
:RESET
TRANSMIT ATZ^M
PAUSE 2
WAITFOR OK,5
IFFOUND DEFAULTS
GOTO RESET

:DEFAULTS
TRANSMIT AT&F^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT1
GOTO DEFAULTS

:INIT1
TRANSMIT AT&C1&D2&R2&H1&B1&S1B0X4S7=60S10=50^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT2
GOTO INIT1

:INIT2
TRANSMIT AT&A0M0^M
PAUSE 2
WAITFOR OK,5
IFFOUND WRITE
GOTO INIT2

:WRITE
TRANSMIT AT&W^M
PAUSE 2
WAITFOR OK,5
IFFOUND DIAL
GOTO WRITE

:DIAL
TRANSMIT ATDT$PHONE$,,,,,,$HOSTNUM$#^M
PAUSE 20
CLOSE
```

PAGE.XJK

```
DIAL SCRIPT
:RESET
TRANSMIT ATZ0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DEFAULTS
GOTO RESET

:DEFAULTS
TRANSMIT AT&F0^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT1
GOTO DEFAULTS

:INIT1
TRANSMIT AT&C1&D2&K3M0^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT2
GOTO INIT1

:INIT2
TRANSMIT AT\G0\N3%C2S7=60S10=50^M
PAUSE 2
WAITFOR OK,5
IFFOUND WRITE
GOTO INIT2

:WRITE
TRANSMIT AT&W0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DIAL
GOTO WRITE

:DIAL
TRANSMIT ATDT$PHONE$,,,,,,$HOSTNUM$#^M
PAUSE 20
CLOSE
```

PAGE.ZOO

```
DIAL SCRIPT
:RESET
TRANSMIT ATZ0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DEFAULTS
GOTO RESET

:DEFAULTS
TRANSMIT AT&F^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT1
GOTO DEFAULTS

:INIT1
TRANSMIT AT&C1&D2&K3&Q5M0^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT2
GOTO INIT1

:INIT2
TRANSMIT AT%C1S7=60S10=50S36=7^M
PAUSE 2
WAITFOR OK,5
IFFOUND WRITE
GOTO INIT2

:WRITE
TRANSMIT AT&W0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DIAL
GOTO WRITE

:DIAL
TRANSMIT ATDT$PHONE$,,,,,,$HOSTNUM$#^M
PAUSE 20
CLOSE
```

Dealer Topics

1. Putting It All Together
2. Sample 15900 Specification
3. AquaZone®
4. Dealer Estimating Program

Chapter 1

Putting It All Together

Energy Zone® Installation

This chapter will combine information from all other chapters and show the dealer how to perform a complete **Energy Zone®** installation, from estimating to final checkout.

Major Steps in an Energy Zone® Installation

- Initial System Engineering & Cost Estimate
- Final System Engineering
- System Hardware Installation
- Hardware Startup
- Software Configuration
- System Startup and Checkout
- Troubleshooting
- Closeout

Initial System Engineering and Cost Estimate

Survey Building

1. HVAC Equipment - Determine Type, Make, and Model. Get copies of equipment wiring schematics if possible.
2. Energy Using Equipment - Identify any exhaust fans, hot water tanks, lighting circuits, baseboard heaters, etc. which can be controlled. Note the relative location of this equipment to the nearest RSC to be used for control.
3. If the system is to be installed in an existing building, investigate tenant complaints about HVAC and indoor air quality. Considerable discretion must be used with this method as this can sometimes cause more problems than it can solve.
4. Confer with owner, maintenance contractor, and building manager.

Determine Equipment Schedules

1. Match ES to installed equipment
2. Evaluate special control functions

Determine Type of Enclosures/ Wiring System

1. Are the enclosures to be inside or outside?
2. Does the project require screw cover, hinged cover, or locking enclosures?
3. Can the wire be run exposed open conductor Class 2, or must wire be installed in conduit?
4. If open conductor, must the wire be plenum or riser rated?

Determine Physical Layout, Addresses, and Create One-Line Riser Diagram

1. Layout trunk lines in a method which would allow for easy installation.
2. Address zones in a logical manner. The main list box and trend log are displayed in trunk and address order. For VariZone, all clients should be consecutively addressed, with the server one higher than the highest client.
3. Create One line showing all wire sizes and locations.
4. Use this riser for quotes from installation sub-contractors.

Estimate Installation Cost

1. Use **EZ** Estimate Spreadsheet
2. Compare results to expected results.

Complete Proposal

1. Investigate availability of funding from local utilities for Energy Conservation measures.
2. Submit proposal to customer.

Final System Engineering

Verify Equipment Schedules
1. Make final check of equipment type to verify that correct equipment schedules have been chosen.
2. Determine if any modifications need to be made to standard schedule:
   a. Does the equipment have a type of controller installed which would make it impractical to take over direct control of the economizer?
   b. Is the equipment a heat pump that controls the reversing valve internally? The best solution for this is generally to use an A/C schedule.

Layout Miscellaneous Equipment
1. Determine equipment to be controlled, control strategy to be used, and RSC to control it from.

Determine Options
1. Remote Communication to Site
2. Remote Communication from Site
3. KW Load shedding - Pulse or Analog
4. Graphic Displays

Create Detailed Wiring Diagrams
1. In most cases, the equipment schedule wiring diagrams provided by BAS are adequate for termination drawings.
2. Make any final modifications to the one-line riser diagrams.
3. Create termination detail drawings for any miscellaneous equipment and additional input devices.

Make System Summary List
1. A system summary list is very helpful for system installation and configuration.
2. It is convenient and practical to use Cardfile, the database application supplied with Windows.
3. This list should include RSC trunk, address, description, and equipment schedule.
4. All miscellaneous equipment should be identified and include trunk, address, and DO used for control.
5. All inputs not included as part of the equipment schedule should be identified and include trunk, address, AI number, and type of input device used.

Determine any Special Alarm Conditions
1. Are there any special alarm conditions unique to this project?
2. If heat pumps are used, energy saving can be achieved by locking out any backup heat until the outside air temperature has reached the balance point for the system.

Order Hardware
1. Order the hardware from **BAS**.

System Hardware Installation

Prepare RSC

1. Print and apply labels with Zone name and address.
2. Set all dip switches for correct address and equipment schedule.

Pull Wire

1. Install all system wire according to trunk line riser and code.

Verify Integrity of Trunk Line

1. Check trunk line for short or open conditions prior to making terminations at each RSC or the ACL.

Make Terminations

1. Make all terminations according to the wiring diagrams.

Hardware Startup

RSC Start-up Sequence

Caution: It may be necessary to verify a correct 24 Vac power supply prior to energizing the RSC. The secondary side of the 24 Vac power supply must not be grounded. If this ground wire cannot be lifted and the unit transformer is to be used for the RSC power supply, an isolation transformer must be used. This will cause trunk line communication difficulties. Most manufacturers of gas heating equipment and hydronic heat pumps will ground one side of the 24 Vac power supply. An isolation transformer must be used in these cases.

1. Energize RSC.
2. Verify Address and ES Number.
3. Check all AI for correct value.
4. Check all DI for correct state.
5. Test DO and/or AO.
6. Leave zone operating in default.

Software Configuration

Auto Configure

1. The simplest method of configuration is to use the auto-configure feature of the System. When the System is energized, if a configuration file does not exist for any zone, the System will create a configuration file based on the equipment schedule number found at the RSC. The only changes needed would be adding a unique name for each zone.

Note: The default Equipment Schedule configuration can be modified prior to Auto-Configuration in order to save time in customizing Zones. For example, if a special Alarm condition is to be monitored in all Zones using ES-12, then configure one Zone with the special Alarm and select Save as Default for the Zone Configuration system menu. Next allow the System to Auto-Configure and all Zones using ES-12 will include the Alarm.

Pre-configure Off-site

1. Any PC running windows can run BUILDING and create configuration files for the building. These can be copied to as floppy disk and transferred to the project computer.

Configure On-site

1. Configuration of all system zones can be done on the project computer prior to connecting any trunk line to the ACL.

Make Backups

1. Once the configuration is completed, all configuration files (in the \EZ\DATA directory) should be backed up to a floppy disk and archived by the dealer. Leave a copy of all backup floppy disks on site. It the system has been operational for any time, do not backup the trend log and alarm files.
2. If changes are made to the building after initial startup, those changed data files should be backed up to a floppy disk.
3. It is also practical to make a copy of all **EZ** files on the Command Center in the same directory as the originals. The backup should be given new file extensions, such as .BAK.

System Startup and Checkout

Energize Command Center

1. Energize the Command Center and connect all RSC to the ACL. Energize all connected RSC.

RSC Communication Status

1. All RSCs should indicate on-line at the Command Center.

Check Trunk Line Integrity

1. Set Error Logging to 4 and monitor the Alarm Log for minimum of 24 hours. If the building is not occupied and all systems not fully operational, this should be repeated after the building is fully occupied.
2. Once integrity has been verified, the Logging level should be reduced to Level 1.

Trend Log all RSCs

1. All zones should be configured to Trend Log for a few days. The length of time will depend on the size and complexity of the project.
2. Once correct system operation has been verified, it is only necessary to trend critical zones.

Troubleshooting

Note: See the appropriate chapter for detailed Troubleshooting on any piece of hardware.

Communication Errors

1. If communication errors occur, some of the most common problems are:
   a. Incorrectly addressed RSCs. If two RSCs indicate off-line on the same trunk, it is possible that both have been configured for the same address.
   b. Polarity not maintained on the trunk line. The +/- polarity must be maintained at all trunk line terminations.
   c. Trunk line shorts, opens, or grounds.
2. It is possible to perform some evaluation of the trunk line using a digital multimeter. The trunk line should read .2-.5 vdc from + to - on the trunk line when no communication is occurring. Once every 8 seconds, voltage should change on the line to between 1 and 4 vdc for a short time while the ACL is communicating. After about 1 second, the voltage should again change while the RSC are responding.
3. A more detailed evaluation can be performed with an oscilloscope. A battery powered scope should be used to prevent a short to ground in the trunk line.

Closeout

As-builts

1. Make all corrections to the control diagrams and schematics for as-built conditions.

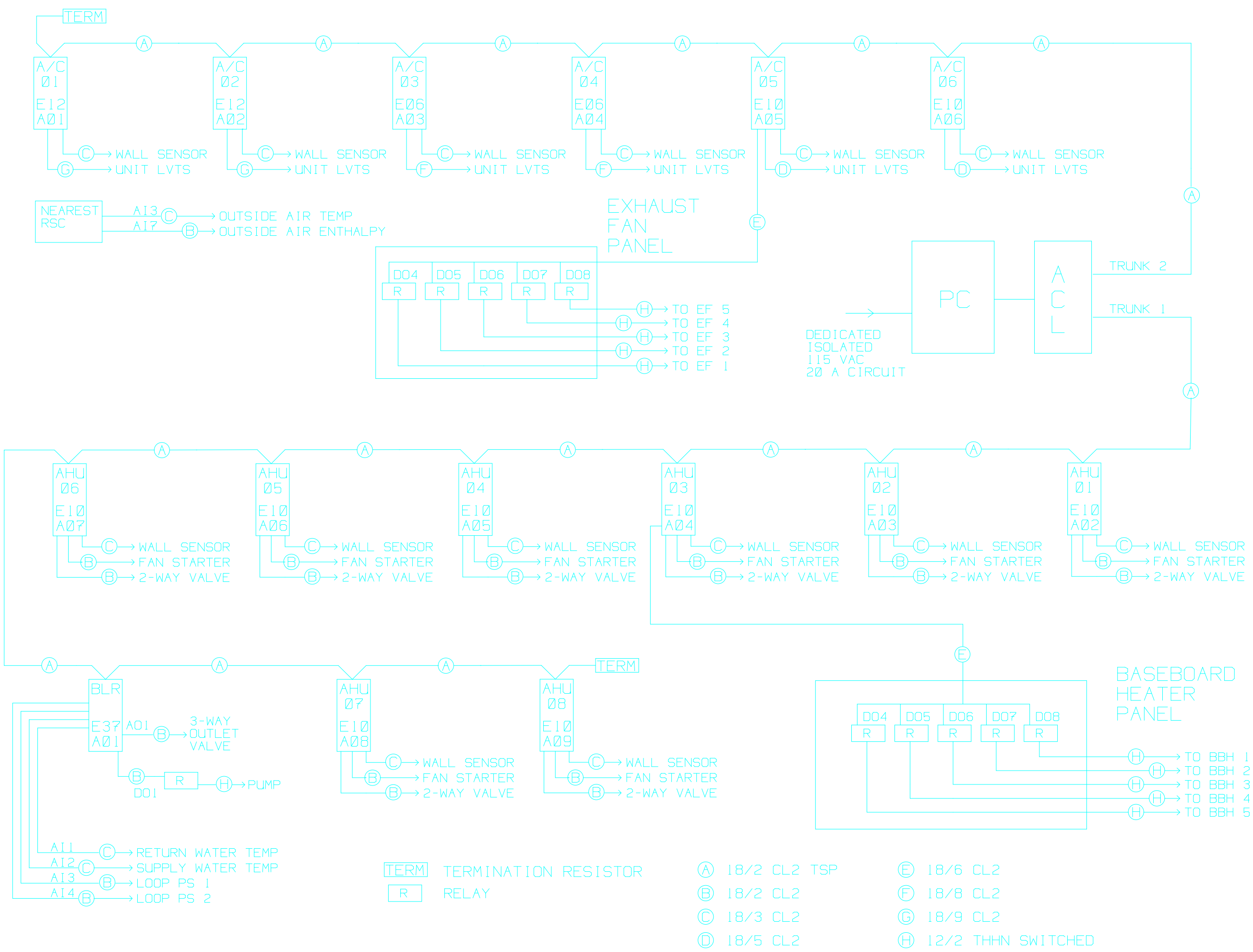
Operating and Maintenance Manuals

1. Create as many O&M as necessary for the project requirements.

Training

1. Provide training as required by the project.

Sample System One Line Riser Diagram



Sample 15900 Specification

Description

This chapter include a sample specification for the **Energy Zone®** System which will assist the Dealer on those construction projects managed by an architect. The specification is intended to conform the standard AIA guidelines.

BAS

Energy Zone®

Energy Management and Control System

Sample Section 15900 Specification

Building Automation Systems
628 Plymouth St. SW
Olympia, WA 98502
Fax: (360) 352-4112
1-800-875-#1DDC

ENERGY MANAGEMENT CONTROL SYSTEM (EMCS)

PART I - GENERAL

1.01 SCOPE

A. CONFORM: To General Conditions, Supplementary Conditions and Division 1 - General Requirements.

B. SECTION INCLUDES: Instrumentation, temperature controls, and energy management for all HVAC units and other energy consuming equipment.

C. EXTENT: The control system shall consist of a Windows based PC, Remote System Controllers (RSC), sensors, automatic valves and dampers with actuators, operating software, operator training, installation labor, warranty, and all other necessary material and labor to provide a complete workable system.

D. MANUFACTURER: Provide a complete building automation system manufactured by Building Automation Systems (Phone: 360-943-2952) and installed by factory authorized and trained technicians.

E. ALTERNATE BIDDERS: Alternate bidders must include all hardware and software functions as described in the base bid. All alternate bidders must obtain ten day prior approval and be listed in addendum. Alternate bidders shall provide the engineer a letter stating that they are familiar with the control specifications and that they will assume full responsibility for meeting all requirements. This shall include all equipment data cuts sheets of proposed system. Wording such as "will meet or exceed specified equipment" without data will not be accepted. Bidders must be the contractual authorized representative of the proposed system with factory trained personnel employed in the local office.

1.02 SYSTEM DESCRIPTION

A. GENERAL: Provide a distributed processing system complete with Direct Digital Control (DDC) and Direct Analog Control (DAC) software. This system is to be capable of controlling all HVAC equipment (heat pumps, air conditioners, unit ventilators, return fans, dampers, pumps, exhaust fans, etc.) and other specified equipment directly, without intervening conventional controls. System shall be completely pre-calibrated with no controller setpoint adjustments or calibration required.

B. BASIC SYSTEM FEATURES

1. System shall use software operating in the Microsoft Windows multitasking environment. This will allow use of the Central Processing Unit (Command Center) for routine office tasks simultaneously with building energy management.
2. One model of the Remote System Controller (RSC) shall be configurable for control of all equipment. Multiple versions of field controllers are not acceptable.
3. Each RSC shall be provided with control algorithms preprogrammed for all listed Equipment Schedules.
4. All system components shall be UL listed. UL recognized controllers are only acceptable if included as a component of a UL certified control panel.

1.03 SUBMITTALS

A. FORMAT: Make submittals in accordance with Section _______.

B. EQUIPMENT LIST: Furnish a complete list of equipment to be furnished including a manufacturer's catalog sheet for each item on the material list.

C. ENGINEERING DRAWINGS: Provide a complete set of engineering drawings, prior to installation, for approval that will include the following information:

1. Interconnect drawings:
   a. Show all field wiring and interconnecting equipment and devices.
   b. Identify the type and size of wire and assign unique numbers or colors to every wire.
   c. Identify equipment and devices by the reference designators shown on the plan drawings.
2. Wiring diagrams:
   a. Show internal wiring of all panels.
   b. Show general physical arrangement of component devices installed in the panels.
   c. Provide partial elementary ladder diagrams to show the function of circuits employing switching logic.
   d. As built Drawings: Within 10 days prior to final acceptance, update the engineering drawings to reflect the actual "as-built" condition and deliver three copies to the Mechanical Contractor for distribution.

1.04 INSTALLATION AND QUALITY

A. **GENERAL:** The control equipment and connecting wiring shall be installed in a neat workmanlike manner by trained mechanics under direct supervision of the Energy Management Control System (EMCS) Contractor, conforming to all applicable state and local codes.

B. **CONTROL WIRING AND CONDUIT:** All wiring and conduit shall be installed in accordance with the National Electrical Code and all applicable local codes. All control wiring in mechanical rooms shall be installed in raceway unless specifically noted that it is acceptable to run exposed.

C. **VALVES AND WELLS:** Automatic temperature control valves and separable wells for immersion elements furnished by the EMCS Manufacturer shall be installed by the Mechanical Contractor under the EMCS Contractor's supervision.

D. **DAMPERS AND OTHER CONTROL DEVICES:** All automatic dampers and other air control devices furnished by the EMCS Manufacturer shall be installed by the Mechanical Contractor, or the Sheet Metal Contractor, under the EMCS Contractor's supervision. Dampers shall be linked to the damper motor by the EMCS Contractor.

E. **PAINTING:** All finish painting required for the temperature control piping and equipment shall be provided by others as specified in Section __________.

F. **CONCRETE WORK:** Any concrete work required for completion of the temperature control portion of the work shall be provided by the Mechanical Contractor in accordance with drawings supplied by the EMCS Contractor.

G. **LINE VOLTAGE:** All Line Voltage electrical circuits shall be installed by Division 16.

1.05 POST INSTALLATION INSTRUCTION

A. **UPON COMPLETION:** The Energy Management Control Contractor, in conjunction with the HVAC representatives, shall instruct operating personnel in the operation of the system. The EMCS Contractor shall provide 16 hours of on-site training in the operation of the system for maintenance personnel and other employees as deemed necessary by the administration.

1.06 OPERATION AND MAINTENANCE MANUALS (O&M)

A. MANUALS: At final acceptance and system turnover, deliver to the Mechanical Contractor the required number of bound copies of the O&M, describing the operations, maintenance and servicing requirements of the overall systems and all equipment provided. Provide the following information in separate section each with tab index:

1. Material list.
2. Technical literature for all equipment including catalog sheets, calibration, adjustments and operation instructions, and installation instructions.
3. A list of spare parts recommended for purchase by the owner.
4. System description and complete sequence of operation.
5. Reduced size (8 1/2" x 11") copies of as-built engineering drawings.
6. Input/output (I/0) summary forms for the system listing all connected analog and digital input and output functions and the types of all points.
7. Control programs specific to this system.

1.07 SERVICE AND GUARANTEE

A. TWO YEAR WARRANTY: The control system herein specified shall be free from defects and workmanship and material under normal use and service. If within twelve (12) months from the date of completion any of the equipment herein described is proved to be defective in workmanship or materials, it will be repaired or replaced free of charge. If within twenty-four (24) months from the date of completion any of the equipment herein described is proved to be defective in workmanship or materials, it will be repaired or replaced for the cost of labor only.

B. ADJUSTMENTS AND SERVICE: After completion of the installation the EMCS Contractor shall regulate and adjust all thermostats, control valves, control dampers and other equipment provided under the EMCS contract. The EMCS Contractor shall provide any service incidental to the proper performance of the control system under guarantees outlined above for the period of one year. Normal maintenance of the system or adjustments or components is not to be considered part of the guarantee.

C. SERVICE AGREEMENT: The EMCS Contractor will make available to the owner an annual service agreement covering all labor and material required to efficiently maintain the control system during and after the warranty period.

PART II - DIRECT DIGITAL CONTROL SYSTEM (DDC)

2.01 BASIC SYSTEM

A. GENERAL: The Direct Digital Control System (DDC) shall be fully integrated and installed as a complete package of controls and instrumentation. The system shall include all computer software and hardware, operator input/output devices, sensors and controls required for complete operation. The EMCS contractor shall provide all low voltage wiring, installation (except those items noted elsewhere), supervision and labor including calibration, adjustments, operator training and checkout necessary for a complete and full operating system.

B. SYSTEM STRUCTURE

1. The system shall be a complete, stand-alone Energy Management and Temperature Control System consisting of:
   a. Command Center which utilizes state-of-the-art technology, simple user-friendly operation, high reliability and modular construction.
   b. Remote System Controllers (RSC) located at each control zone.
   c. Software utilizing a graphical user interface and requiring only simple fill-in-the-blank configuration for all system operations.
2. The basic elements of the system structure shall be built up only on standard components kept in inventory by the supplier. The components shall not require customizing other than setting switches and configuring the software to perform required functions.
3. The system shall be a true distributed processing system. All software control functions to be performed by the RSC. Control software to be in nonvolatile memory. The RSC shall communicate with the Command Center. There shall be no system hardware necessary between the Command Center and the RSC.

C. OPERATING SYSTEM

1. The system software shall operate in the Microsoft Windows (Windows XP, Vista, or later release) environment. The system shall allow the Building Energy Management System to operate in the background while the system operator runs any standard Windows based application. The system shall be notified of any system alarm or off-line occurrence, regardless of any current application being run.

D. COMMAND CENTER

1. The Command Center is to be a standard, Windows based PC with a minimum 2 gHz Pentium processor. Unit to have auto start-up feature. Locate system Command Center as indicated on drawings or directed by the owner's representative. Include the following features as standard:
   a. Minimum 1GB RAM
   b. 200 gigabyte internal hard disk drive
   c. CD-R drive
   d. 56K baud fax modem (for remote access by telephone line) or Ethernet port (for remote access by Internet)
   e. Battery backed up clock/calendar
   f. Local bus accelerated VGA graphics and color monitor
   g. Mouse

E. REMOTE SYSTEM CONTROLLER (RSC): The RSC shall communicate directly with the Command Center and also be stand-alone, maintaining its own control strategy in the event of communication failure with the Command Center. The RSC shall contain built in RAM and ROM. The RSC shall be capable of controlling any type of HVAC device. The program shall be changed by simply repositioning of dip switches and all RSCs shall be interchangeable. The RSC shall contain at least eight analog and eight digital inputs, eight digital outputs, and four analog outputs. Each RSC shall be linked by a single pair of wires. All RSCs shall have default control software which is dip switch selectable.

F. CAPABILITY: The EMCS shall monitor and control all functions relating to Building Automation, Temperature Control and Energy Management as specified. The system RSCs shall directly control all HVAC units, duct damper actuators, valve actuators, pumps, cooling tower, boiler, exhaust fans and other specified equipment. The sequence of operation precisely identifies all points of monitoring and control. The point monitoring and controlling functions to be performed by the system shall include but not be limited to the following capabilities:
1. 8 Digital inputs (contact closures)
2. 8 Analog inputs (varying voltage/current/resistance/pneumatic signals)
3. 8 Digital outputs (start/stop or 3 point floating using digital timing)
4. 4 Analog outputs (varying voltage/current/resistance/pneumatic signals)

G. CAPACITY: The base system shall have a minimum 7680 point capacity without the addition of any components other than RSCs. The base system shall have the capability to control up to 1024 HVAC zones. Additions to system shall be accomplished by adding subsequent RSCs while system is on line.

H. FAILURE: Upon failure of any RSC, system shall display off line occurrence for each individual affected point at the Command Center. Provide routine communication verification for each RSC. In event of Command Center failure, each RSC shall operate in stand-alone mode operating equipment at default values.

I. OPERATOR INTERFACE: The system is to be fully menu-driven. All system titles, prompts, and instructions to be in English language and user friendly. All entries to be in natural units, i.e., a setpoint value shall be entered in its actual control value, such as 74 F. All operator commands, changes, and data displays identified in the sequence of operation shall be available and executable at a single operator's station.

J. SYSTEM CONFIGURATION: All system configuration shall be through menus with user prompted dialog boxes. Programming experience shall not be necessary for any modifications or additions to the system.

K. REMOTE OPERATION: All functions of the Command Center shall be available by remote control via standard modem communications using a telephone line and/or via the Internet using an Ethernet lan connection. The system Command Center shall automatically inform the remote central system of alarm conditions and report unit identifier and alarm status upon occurrence. The remote Command Center shall exactly duplicate all capabilities as are provided by the local Command Center. Provide modem for remote monitoring during warranty period. The owner shall provide a dial-up telephone line for EMCS contractor monitoring of system during one-year warranty period.

L. REMOTE ALARM CALLOUT: Any alarm can be configured to callout to any combination of a standard digital pager, a standard fax machine, and an email/text message.

M. LOCAL TESTING/TROUBLESHOOTING: A portable handheld terminal can be plugged into the RSC to allow for local monitoring of all RSC functions and input of test signals for troubleshooting. The handheld terminal shall be powered from the RSC.

2.02 ENERGY REDUCTION SOFTWARE

A. GENERAL: The EMCS shall be designed to control all equipment for which significant energy savings can be achieved, equipment which is involved in building temperature control, or equipment which is otherwise specified. This shall be accomplished utilizing a combination of different methods. Provide engineering, consulting, programming and training time to develop and implement the following energy reduction software.

B. SCHEDULING

1. Time Schedules: The EMCS shall have the capability to provide 32 different weekly schedules. Each schedule to be 8-day type, 4 entries per day. All entries to be in 24 hour format. Each complete schedule shall be displayed at one time on the Command Center for easy editing.
2. Holiday Scheduling: System shall have the capability to program holidays for a minimum of 20 years in advance. Holiday schedule will display each month and allow for easy editing. The 10 federal holidays shall be pre-programmed through the year 2010.

C. DEMAND LIMITING: Provide kW demand limiting software. System shall support at least eight demand meters. Any piece of controlled equipment can be cycled by the demand limiting software. Provide control of maximum and minimum temperatures and duty cycling of shed equipment.

D. SETBACK RECOVERY WITH ADAPTIVE OPTIMUM START

1. Morning Warm-up: The system shall monitor the outdoor air temperature and zone temperature to calculate the time to turn on each individual HVAC unit based on past optimal start cycles. By specifying building occupancy times and temperature, the system shall control comfort levels to meet these guidelines. The system shall monitor setback recovery performance and adapt future recovery times based on zone history.
2. Morning Cool-down: HVAC equipment shall operate in economizer cooling mode when available and as required to reduce space temperature.

E. ECONOMIZER CONTROL

1. The system shall monitor outside air enthalpy at a single point and return air enthalpy for each zone with an economizer.
2. On a call for cooling from the zone, the system shall compare enthalpy of the outside air with enthalpy of the zone. If enthalpy of outside air is lower, modulate outside air and relief dampers open, and return air damper closed. If enthalpy of outside air is higher than zone air, maintain outside air dampers at minimum position.

F. OUTDOOR AIR RESET CONTROL: Provide reset of controlled temperature, based on outside air temperature.

G. LIGHTING CONTROL: Provide the capability to control interior and exterior lighting systems. In addition to standard time-of-day ON/OFF control, interior system control shall flash the lights 5 minutes before entering the Unoccupied Mode. This feature shall provide the tenants sufficient time to exit the building or press the setback override button prior to the lighting being turned OFF.

2.03 MISCELLANEOUS FUNCTIONS

A. AUTOMATIC CONFIGURATION: The addition of any RSC on the network shall be automatically recognized by the Command Center. The dip switches at the RSC shall be read by the Command Center to determine equipment type and a configuration file created for that zone using system defaults. No additional configuration shall be required, except for addition of an optional zone description on the main list box. All advanced control features such as PID control, adaptive setback recovery, zone high and low temperature alarms, trend and alarm logging, holiday schedules, and weekly schedules shall be provided with the default configuration.

B. AUTOMATIC RESTART: The system shall automatically restart following a power failure, with no User intervention required.

C. NO PROGRAMMING REQUIRED: System shall have complete capability to modify all system control parameters through a User prompted fill-in-the-blank and a point-and-click graphical interface. No programming and no additional equipment or software shall be required.

D. ALARM CAPABILITIES

1. For each input and output point, provide operator assignable high and low alarm limits, delay time, and time of day mode for alarm condition.
2. For each alarm, provide the following assignable alarm responses:
   a. Display alarm message including programmable alarm description, time of occurrence, current point value at time of alarm, address, room #, and description of zone.
   b. Send above alarm message to fax machine at remote location. Alarm message shall be sent in addition to the status of all inputs and outputs in that zone at the time of alarm.
   c. Print above alarm message.
   d. Store above alarm message in alarm log on hard disk.
   e. Call alarm to digital pager.
   f. Change the position or status of any output in the system.

E. DYNAMIC GRAPHICS: A dynamic graphic software package shall be provided. The Graphic Builder software shall have the capability of constructing and viewing floor plan drawings, mechanical equipment piping diagrams and mechanical systems drawings while system is on line. The Graphic Viewer shall display current point data information. The graphics system shall be capable of providing the user access to all system commands, configuration data, and current zone operational data.

F. TEMPERATURE CONTROL: Proportional, integral, and derivative control modes are standard. Proportional, integral, and derivative gains can all be changed for each control zone. The User can also change the cycle rate (cycles per hour) and derivative look back time. A zone history graph, to aid the User in PID loop tuning, shall be available for all zones.

G. LOGS

1. Trend Log: Provide a trend log. Operator may assign any RSC for storage. Provide for review of data on CRT and printer. System shall automatically begin entry into each log as scheduled. Each point in the log shall have unlimited entries, all data stored on the system hard disk for future retrieval. Create a new trend log at the beginning of each month. The Trend Log shall be configurable for any time interval from 1 second to 1 week.
2. Current Alarm Status: Display all points currently in alarm.
3. Alarm History: Log all alarm occurrences for the current month. Create a new alarm log at the beginning of each month.
4. A Runtime log shall include the total run time of all digital outputs, recorded to the nearest second.
5. A Security Log shall record all system access and all RSC configuration.
6. An Override Log shall record all setback override conditions and total all override time monthly by zone.

H. DYNAMIC DATA EXCHANGE: All inputs, outputs, and most configuration data from all RSCs shall be available to any Windows application that conforms to the Microsoft Dynamic Data Exchange specification.

I. PASSWORD/SECURITY: Provide a programmable password which can accept alpha-numeric characters. Password will not be needed for access to monitoring programs. Provide a minimum of six levels of security. Automatically log-off if no activity for 30 minutes (programmable).

J. VARIABLE AIR VOLUME: Variable air volume systems shall be provided with the following additional software features:

1. Pressure Independent Damper Control **-** All VAV or VariZone RSCs can be selected to use either pressure dependent or pressure independent damper control.
2. Terminal Regulated VAV Control **-** This feature uses input from all of the clients (zone dampers) to reset a variable frequency drive on the VAV server (rooftop air handler). The duct static pressure is allowed to vary, within preset limits, to the minimum necessary to satisfy the clients.

K. REAL-TIME CLOCK/BATTERY STANDBY POWER: Real-time clock shall be self-contained and accurately controlled by a quartz crystal. The clock shall be set via the keyboard and may be viewed on the display. A battery standby power supply shall be used to maintain clock operation when primary power fails. When primary power returns, the system shall automatically "reboot" to the appropriate schedules and require no action from maintenance personnel to re-initialize. Battery back-up shall be provided for 30 days of clock operation.

2.04 CONTROL COMPONENTS

A. TEMPERATURE SENSORS

1. All temperature sensors are to be solid state electronic transmitters, integrated circuit temperature sensors, providing precise inherent calibration, and be totally changeable. Wall sensors to be protected by a tamperproof enclosure. Duct sensors to electronically identical, housing suitable for the application. Metal guards shall be provided as shown on drawings.
2. Zone sensor to contain push-button bypass switch. The operator shall program the time of override operation at the keyboard from 0 to 15 hours. Operator shall be able to alter override time or return area to automatic control.

B. ENTHALPY SENSORS: Enthalpy sensors are to be solid state and combine temperature and humidity of air system in which sensor is located. Provide one sensor for outside air and one sensor for the return air of each unit with an economizer.

C. CONTROL DAMPERS: Provide low leakage control dampers. Dampers shall have blade seals and stops with all aluminum construction.

D. **CONTROL VALVES:** Control valve shall be correctly selected for service and flow of system served. Cast iron body in corrosive environments, provide opening and closing rate control where shown. Provide spring return where noted as normally open or normally closed.

E. **DAMPER AND VALVE ACTUATORS:** Provide actuators in sufficient size, quantity, and type matched to application. Proportional or 3 point floating as required.

F. **ENCLOSURES:** All enclosures to be UL listed and rated for the environment in which they are installed.

G. **CONTROL RELAYS/CONTACTORS:** Shall be the single coil electrically operated. Number of contacts and rating shall be selected for the application intended.

H. **AIR FLOW SWITCHES:** General purpose utilizing differential air pressure, adjustable 0.1 in. W.C. to 2.0 in., neoprene diaphragm, all aluminum construction.

I. **BUILDING POWER MONITOR:** Power monitor to be provided by the serving electric utility. Power monitor shall measure line voltage, current and power factor with ability to internally compute consumed energy. Output pulse proportional to kWh used. Maximum error +/-.5% full scale. EMCS contractor to interface output pulse to the EMCS.

PART III - EXECUTION AND SEQUENCE OF OPERATION

3.01 ALL HVAC UNITS

A. **GENERAL:** Provide and install devices, relays, switches, sensors, dampers, conduit, and wiring to provide a complete and operating DDC system.

B. **EACH HVAC UNIT:** Shall be controlled via a wall mounted electronic sensor with override push-button. Sensors shall provide associated RSC with current temperature status. RSC shall directly and individually control all necessary HVAC components.

C. **DEMAND CONTROL:** Demand control shutdown signal from the EMCS shall de-energize significant electric loads (electric heat, compressors, etc.). Each HVAC unit shall be independently controlled and scheduled. Fans shall continue to operate. Demand control remains in operation under all modes of operation.

D. **INTERLOCKS:** See interlock schedule on plans for list of interlocked exhaust fans. Interlock exhaust fans through the EMCS. System shall be able to independently schedule or interlock fans through the Command Center.

E. **ADDITIONAL CONTROLS/INDICATION:** In addition to the below listed sequence of operation, provide the following through the EMCS operator's terminal for each HVAC unit.

1. Zone space temperature indication
2. Adjustment of heating and cooling setpoint, both occupied or unoccupied heating
3. Current mode (heating, cooling or at setpoint)
4. Status of all inputs and outputs
5. Time scheduling of each zone, normal and holiday
6. Local override of zone, programmable 0-15 hours
7. Log of override usage
8. Proportional/Integral/Differential control action
9. Digital and analog alarm processing
10. Alarm history
11. Trend logs
12. Floor plan and system dynamic graphics
13. Damper positions
14. Mixed air temperature
15. Adjustment of minimum damper position
16. Warm-up and economizer cycle control

3.02 TYPICAL HVAC UNITS

A. **OCCUPIED VENTILATION CYCLE:** When both the occupied heating and cooling setpoints have been met during the occupied period, the unit is in a ventilation mode. The outside air damper is at minimum position and the fan is running.

B. OCCUPIED HEATING: On a demand for heat, heat shall be staged on. Fan shall operate continuously. When the heating setpoint has been achieved, the heat shall be staged off.

C. OCCUPIED COOLING: On a demand for cooling, the return air dampers shall modulate closed, and the outside air dampers shall modulate open, as long as the enthalpy of the outside air is acceptable for cooling. When the enthalpy of the outside air is too high, the outside air dampers shall maintain minimum position and the cooling shall be staged on. Fan shall operate continuously. When the cooling setpoint has been achieved, return the outside air damper to the minimum position and/or stage the cooling off.

D. UNOCCUPIED CYCLE: Provide independent night setback operation for each HVAC unit. Fans, heat, and cooling system shall intermittently cycle with return air dampers open and outside air dampers closed to maintain minimum room temperature. Provide each unit with a room by-pass switch to restore day mode. 0-15 hour by-pass time period shall be adjustable from the CRT.

E. WARMUP MODE: Upon a zone optimal start signal from the EMCS, based on outside and individual zone room temperature, the fans shall run continuously. The heat shall cycle as necessary to maintain calculated warm-up ramp. The outside and exhaust dampers shall remain closed on warm-up. System shall monitor performance of the recovery in each zone. System shall store history and modify the next days recovery based on actual prior performance.

3.03 LIST OF EQUIPMENT SCHEDULES

A. Provide system with preprogrammed, dip switch selectable, control algorithms for all of the following listed HVAC equipment:

#1- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Cooling
#2- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Heating
#3- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Cooling, 2 Units
#4- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Heating, 2 Units
#5- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, Economizer (Stg or Anl), RV Cooling
#6- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, Economizer (Stg or Anl), RV Heating
#7- Heat Pump, Single Zone or **VariZone®** Server, 2 Compressors, Backup Heat, Economizer (Stg or Anl), RV Cooling
#8- Heat Pump, Single Zone or **VariZone®** Server, 2 Compressors, Backup Heat, Economizer (Stg or Anl), RV Heating
#9- Air Conditioner, Single Zone or **VariZone®** Server, 1 Compressor, Heat, No Economizer
#10- Air Conditioner, Single Zone or **VariZone®** Server, 1 Compressor, Heat, No Economizer, 2 Units
#11- Air Conditioner, Single Zone or **VariZone®** Server, 1 Compressor, Heat, Economizer (Stg or Anl)
#12- Air Conditioner, Single Zone or **VariZone®** Server, 2 Stages Cooling, 2 Stages Heat, Economizer (Stg or Anl)
#13- VAV Damper, Cooling Only, 3 Point Floating or Analog Actuator
#14- VAV Damper, Cooling Only, 3 Point Floating or Analog Actuator, 4 Zones
#15- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Constant Air Volume

#16- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Constant Air Volume, 2 Zones
#17- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Variable Air Volume
#18- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Variable Air Volume, 2 Zones
#19- VAV Box, Fan, Cooling, Hydronic Heat, 3 Point Floating or Analog Actuators, Constant Air Volume
#20- VAV Box, Fan, Cooling, Hydronic Heat, 3 Point Floating or Analog Actuators, Variable Air Volume
#21- Fan Coil, Heating, 4 Units
#22- Fan Coil, Cooling, 4 Units
#23- Unit Ventilator, Electric Heat, Economizer (Stg or Anl)
#24- Unit Ventilator, Electric Heat, Economizer (Stg or Anl), 2 Units
#25- Unit Ventilator, Electric Heat, Modulating Economizer, 3 Point Floating or Analog Actuator
#26- Unit Ventilator, Electric Heat, Modulating Economizer, 3 Point Floating or Analog Actuator, 2 Units
#27- Unit Ventilator, Hydronic Heat, 3 Point Floating or Analog Actuator, Economizer,
#28- Unit Ventilator, Hydronic Heat, Modulating Economizer, 3 Point Floating or Analog Actuators
#29- Air Handling Unit, 4 Stage Heat, Outdoor Reset
#30- Air Handling Unit, 3 Way Mixing Valve, 3 Point Floating or Analog Actuator, Outdoor Reset
#31- Air Handling Unit, 3 Stage Heat, Modulating Cooling, Modulating Economizer, Analog Actuators, 2 Units
#32- Hydronic Heat Pump Loop Control, 1 Stage Heat, 4 Stage Cooling, 2 Loop Pumps
#33- Chiller, 4 Stage Cooling, 2 Chill Water Pumps
#34- Not Currently Used
#35- Boiler, 4 Stage Heat, Outdoor Reset
#36- Boiler, 3 Way Mixing Valve, 3 Point Floating or Analog Actuator, Outdoor Reset
#37-39 Not Currently Used
#40- Air Handling Unit, 4 Stg Cool, 1 Stg Heat, Analog Cool, 3 Pt or Analog Economizer, Single Zone or VAV Server
#41- Air Handling Unit, Modulating Duct Static Pressure Control, Single Zone or VAV Server, 2 Units
#42- Air Handling Unit, Modulating Building Static Pressure Control, 2 Units
#43-49 Not Currently Used
#50- **VariZone®** Damper, 3 Point Floating or Analog Actuator
#51- **VariZone®** Damper, 3 Point Floating or Analog Actuator, 4 Zones
#52- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Constant Air Volume
#53- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Constant Air Volume, 2 Zones
#54- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Variable Air Volume
#55- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Variable Air Volume, 2 Zones
#56- **VariZone®** Box, Fan Powered, Hydronic B/U Heat, 3 Point Floating or Analog Actuators, Constant Air Volume
#57- **VariZone®** Box, Fan Powered, Hydronic B/U Heat, 3 Point Floating or Analog Actuators, Variable Air Volume
#58- Not Currently Used
#59- Modulating Heat, 3 Point Floating or Analog Actuator, 4 Zones
#60- VAV Dampers, Dual Duct System, 3 Point Floating or Analog Actuators, 2 Zones
#61-62 Not Currently Used
#63- Lighting Control, 8 Zones
#64- Reserved for Custom Output Definition

Chapter 3

AquaZone®

Description

This chapter includes specifications and operating instructions for **AquaZone®**. **AquaZone®** is a specific application of an RSC for indoor swimming pool systems.

AquaZone®

Swimming Pool Temperature Control

System Description and Operating Instructions

Building Automation Systems
628 Plymouth St. SW
Olympia, WA 98502
Fax: (360) 352-4112
1-800-875-#1DDC

General Information

A. System Description

1. The **AquaZone®** System is designed to automatically operate the a package heat pump with the capacity for pool water heating, space heating, and space humidity control. System operation is based on a Remote System Controller (RSC), manufactured by Building Automation Systems. The RSC is a programmable microcomputer based controller. The RSC is capable of controlling 8 digital outputs and 6 analog outputs and monitoring 8 digital inputs and 8 analog inputs.

2. **AquaZone®** basic control handles:
   a. Indoor Air Fan
   b. 2 Stages Space Heat
   c. 1 Stage De-Humidifier
   d. Modulating Economizer
   e. Auxiliary Exhaust Fan
   f. 2 Stages Pool Water Heat

3. Field selectable control options are:
   a. 1 Stage Auxiliary Cooling
   b. Space Temperature Setback Enable/Disable
   c. Pool Water Temperature Setback Enable/Disable
   d. Testing Mode
   e. Troubleshooting Mode

4. Field adjustable setpoints are :
   a. Room Temperature and Humidity
   b. Pool Water Temperature
   c. OSA Enthalpy for Economizer Operation
   d. OSA Damper Minimum Position

5. A wall mounted LCD display unit provides an easily read user display board for adjustment of setpoints.

6. An optional handheld tester is used for advanced System troubleshooting, startup, and testing.

B. Software Features

1. **Multiple Functions** - Continuously monitors all inputs and setpoints for demand. Because the single package heat pumps are only able to perform one function at a time, the System was designed will meet demand in the following order:
   a. Pool Water Heat
   b. Room Humidity Control
   c. Room Temperature Control

2. **Auxiliary heat capability** - The single function mode of **AquaZone®** can be expanded to control room temperature. If **AquaZone®** is operating in either Pool Heat or Room Humidity control mode and the room temperature falls below setpoint, then auxiliary heat is energized to satisfy the demand.

3. **Automatic mode shifting** - If the System is operating to satisfy a lower priority demand and a higher priority demand occurs, then the System will shift to meet the higher priority demand. For example:

   - All System setpoints are satisfied.
   - Room temperature falls below setpoint and the System starts up in 1st stage heat.
   - Before room temperature reaches setpoint, pool water temperature falls below setpoint.
   - After room temperature runs for the required minimum on time, the System will enter AtSet.
   - After the minimum time AtSet, the System will enter pool heating mode and remain there until pool water temperature is satisfied.
   - The System will then cycle through AtSet and return to room heating until room temperature is at setpoint.

4. **Minimum time lapse operations** - All modes are provided with a 5 minute minimum on and 5 minute minimum off time delay. The System will spend 5 minutes in the AtSet mode before changing to a new mode of operation.

5. **Efficient fan control** - The main fan will operate continuously when in the occupied mode and cycle on and off as necessary to meet demand when in the unoccupied mode.

6. **Energy efficient damper control** - The economizer damper motor will be maintained at minimum position at all times unless the sequence of operations indicates otherwise when in the occupied mode. When the space is in the unoccupied mode, the damper is closed unless needed for either cooling or humidity control.

7. **Dehumidification override** - If the room humidity falls below 40%, the compressor heat mode is locked out and the auxiliary heat will be energized on a call for 1st stage heat. This prevents excessive dehumidification of the space.

8. **Power loss notification** - The LCD display will indicate a loss of electric power on initial startup, or after a loss of power. The display will continue to indicate the power loss until one of the display buttons is pressed. All System settings will return to default values. This includes Space Temperature, Space Humidity, and Pool Water Temperature settings.

C. Wiring guidelines

1. All wiring for sensor inputs should be minimum 20 gauge shielded cable.

2. Avoid routing sensor input and LCD display cables in the vicinity of line voltage AC power sources.

Operating Instructions

A. LCD Display Unit

1. On initial startup the LCD will display `Init` to indicate System initialization. This will take about 15 seconds. After initialization, the display will indicate `ELEC`. The display will return to normal after pressing any of the display buttons.

2. The LCD Display Unit has 2 sets of buttons, SEL to select the item to be displayed and ADJ to adjust the displayed setpoint. Each set of buttons has both an up and a down button.

3. Pushing the SEL up or down button will cycle through the System settings and readings in the following order:

   `Pr` - Pool Water Temperature Reading in F
   `PO` - Pool Water Temperature Setpoint in F (Occupied)
   `PU` - Pool Water Temperature Setpoint in F (Unoccupied)
   `Sr` - Space Temperature Reading in F
   `SO` - Space Temperature Setpoint in F (Occupied)
   `SU` - Space Temperature Setpoint in F (Unoccupied)
   `Hr` - Space Humidity Reading in %RH
   `HS` - Space Humidity Setpoint in %RH

4. Once the desired setpoint is displayed, pushing the ADJ up or down buttons will change the setpoint.

B. Change Room Temperature

1. Use the SEL buttons on the LCD display unit to select either `SO` to adjust Occupied Space Heating temperature or `SU` to adjust Unoccupied Space Heating temperature.
2. Press either the ADJ up or ADJ down buttons to change the setpoint.

C. Change Room Humidity

1. Use the SEL buttons on the LCD display until to select `HS`.
2. Press either the ADJ up or ADJ down buttons to change the setpoint.

D. Change Pool Water Temperature

1. Use the SEL buttons on the LCD display unit to select either `PO` to adjust Occupied Pool Water Heating temperature or `PU` to adjust Unoccupied Pool Water Heating temperature.
2. Press either the ADJ up or ADJ down buttons to change the setpoint.

E. <u>Change Outside Air Enthalpy Setpoint (Economizer allowed)</u>

Set the dip switch positions 1, 2, and 3 on switch bank #2 for the desired setpoint. See chart at end of manual for possible settings.

F. <u>Change Outside Damper Minimum Position Setting</u>

Set the dip switch positions 4, 5, and 6 on switch bank #2 for the desired setpoint. See chart at end of manual for possible settings.

G. <u>Auxiliary Add-on Cooling</u>

Set the dip switch position 1 on switch bank #1 to ON if auxiliary cooling is available and OFF if it is not.

H. <u>Place System in Space Temperature Setback</u>

Energize DI2 with a 5 vdc signal from the 5 vdc power supply on the RSC. The System will remain in setback as long as a continuous contact is maintained. This action is only effective if the System has been selected to allow space setback (Dip Switch 1-2 ON).

I. <u>Place System in Pool Water Temperature Setback</u>

Energize DI3 with a 5 vdc signal from the 5 vdc power supply on the RSC. The System will remain in setback as long as a continuous contact is maintained. This action is only effective if the System has been selected to allow pool water setback (Dip Switch 1-3 ON).

J. <u>Place System in Setback Override</u>

Press the button on the top of the wall temperature sensor housing or energize DI1 with a 5 vdc signal from the 5 vdc power supply on the RSC. Maintain the switch contact for about 1 second. This action overrides both pool and space setback simultaneously.

Troubleshooting Instructions

The optional Handheld Tester operates in two modes - Monitoring mode and Override mode.

Note: Test Mode allows for reduced delay times during testing. This mode is entered by moving dip switch 5 on switch bank #2 to on. When in test mode, all System timers are reduced to 10% of their normal value. The state timer is 30 seconds and the damper timer is 6 seconds.

A. Monitoring Mode - This mode is intended for monitoring of System parameters only.

1. To enter monitoring mode, plug in the Handheld Tester and press Enter. The following menu appears:

```
S- SYSTEM     C- COOL
H- HUMID      W- HEAT
P- POOL       O- OSA
              SEL ? _
```

   Press the key for the desired mode.

2. **SYSTEM** - The following information is displayed on the SYSTEM screen:

```
MODE: Pool Heat
AUX CL: NO
SETBACK OR: OFF
TIMEOUT:  0
```

   MODEs are At Setpoint, Pool Heat, Humidity, Room Cool, or Room Heat.
   AUX CL is for auxiliary cooling and can be either YES or NO.
   SETBACK OR indicates whether the System is in setback override and is either ON or OFF.
   TIMEOUT indicates the time remaining on the current minimum stage timer from 0-300 seconds. This is displayed as the number of 2 second increments remaining and displays 0-150.

3. **HUMID** (Room Humidity Control) - The following information is displayed on the HUMID screen:

```
HUM: 75%    SET: 75%
MODE: AtSet
DMPR: 20%  MAT: 75 F
TIMEOUT:  0    0
```

   HUM is the present room humidity reading from 0-100% relative humidity.
   SET is the room humidity control setpoint from 45-82% relative humidity.
   MODEs are AtSet, Stg 1, Stg 2, and Stg 3 Emerg.
   DMPR is the present position of the economizer damper motor from 0-100% open.
   MAT is the temperature of the mixed air plenum from 30-157 F.
   TIMEOUT shows 2 countdown timers. The first timer indicates the time remaining before another position change is allowed on the economizer damper position from 0-60 seconds. This is displayed as the number of 2 second increments remaining and displays 0-30. The second timer represents the time remaining on the current minimum stage timer from 0-300 seconds. This is displayed as the number of 2 second increments remaining and displays 0-150.

4. **`POOL`** (Pool Water Temperature Control) -The following information is displayed on the `POOL` screen:

```
PWT: 83 F   SET: 85 F
MODE: Occ Stg 1
SETBACK: Disable
TIMEOUT:   0
```

`PWT` is the present pool water temperature from 30-157 F
`SET` is the Pool water temperature control setpoint from 60-110 F.
`MODE`s are Occ or UnOcc and AtSet or Stg 1.
`SETBACK` indicates whether or not setback override mode is allowed. The display values are Enable or Disable.
`TIMEOUT` indicates the time remaining on the current minimum stage timer from 0-300 seconds. This is displayed as the number of 2 second increments remaining and displays 0-150.

5. **`COOL`** (Room Temperature Control, cooling mode) - The following information is displayed on the `COOL` screen:

```
SAT: 75 F   SET: 75 F
MODE: Occ AtSet
DMPR: 20%   MAT: 75 F
TIMEOUT:  0    0
```

`SAT` is the present room temperature from 0-100 F.
`SET` is the room temperature control setpoint from 55-92 F.
`MODE`s are UnOcc, Occ AtSet, Occ Stg 1, Occ Stg 2, or Occ Stg 3.
`DMPR` is the present position of the economizer damper motor from 0-100% open.
`MAT` is the temperature of the mixed air plenum from 30-157 F.
`TIMEOUT` shows 2 countdown timers. The first timer indicates the time remaining before another position change is allowed on the economizer damper position from 0-60 seconds. This is displayed as the number of 2 second increments remaining and displays 0-30. The second timer represents the time remaining on the current minimum stage timer from 0-300 seconds. This is displayed as the number of 2 second increments remaining and displays 0-150.

6. **`HEAT`** (Room Temperature Control, heating mode) - The following information is displayed on the `HEAT` screen:

```
SAT: 75 F   SET: 75 F
MODE: Occ AtSet
SETBACK: Enable
TIMEOUT:   0
```

`SAT` is the present room temperature from 0-100 F.
`SET` is the room temperature control setpoint from 55-92 F.
`MODE`s are Occ or UnOcc and AtSet, Stg 1, Stg 2, or Stg 3.
`SETBACK` indicates whether or not setback override mode is allowed. The display values are Enable or Disable.
`TIMEOUT` indicates the time remaining on the current minimum stage timer from 0-300 seconds. This is displayed as the number of 2 second increments remaining and displays 0-150.

7. **OSA** (Economizer Status) - The following information is displayed on the OSA screen**:**

```
ECONO: Min Pos
DMPR: 20%    MIN: 20%
ENTH: 55%    SET: 38%
MAT: 75F    SET: 55 F
```

ECONO indicates the status of the economizer. The modes are Active, Min Pos, or Closed.
DMPR is the present position of the economizer damper motor from 0-100% open.
MIN indicates the setpoint for outside air damper minimum open position. The range is 0-35%.
ENTH indicates the enthalpy of the outside air in a range of 0-100% relative enthalpy. This corresponds to a range of approximately 5-55 btu/lbm.
SET is the setpoint for control of economizer operation in the range of 38-66% relative enthalpy.
MAT is the temperature of the mixed air plenum from 30-157 F.
SET is the setpoint for control of mixed air temperature. The range is 30-157 F and is presently set in System software at 55 F.

B. Override Mode

1. Set the dip switch position 6 on switch bank #1 to ON to enter Override Mode. Once in Override Mode the following options are available:

   F1 - Read all Analog Input and Analog Output values.
   F2 - Position any Analog Output.
   F3 - Display the status of all Digital Inputs and Digital Outputs.
   F4 - Position any Digital Output.
   F5 - Reads the position of all dip switches.

2. F1 - Read all Analog Input and Analog Output values. This mode displays the current raw value of all analog inputs and analog outputs in the range of 0-255. The display of the conditioned value on the Temperature screen is more usable in most cases.

```
AI 1-8  000 000 000
000 000 000 000 000

AO 1-8  000 000 000
000 000 000
```

3. F2 - Position any Analog Output. This mode allows for the override of any analog output to the desired position. The output will remain positioned until Troubleshooting mode is exited by setting the dip switch position 6 on switch bank #2 to OFF. The first entry line is:

```
SELECT AO (1-6) ? _
```

   Select the desired output from 1-6. The next entry line is:

```
VALUE (000-255) ? _
```

   Enter the value for the desired analog position. This number must be in the range of 000-255. (000=0%, 255=100%, etc.)

4. F3 - Display the status of all Digital Inputs and Digital Outputs. This function will display the following:

```
DI 8-1   00000000
DO 8-1   00000000
```

   All digital inputs or outputs indicate either 0 if they are off or 1 if they are on. The first digit displayed is #8 and the last is #1.

5. F4 - Position any Digital Output. This mode allows for the override of any digital output to the desired position. The output will remain positioned until Troubleshooting mode is exited by setting the dip switch position 6 on switch bank #2 to OFF. The first entry line is:

```
SELECT DO (1-8) ? _
```

   Select the desired output from 1-8. The next entry line is:

```
ON (1) OR OFF (0) ? _
```

   Enter the value for the desired output position.

6. F5 - Display the status of all Dip Switches. This function will display the following:

```
SWITCH 1 6-1   000000
SWITCH 2 6-1   000000
```

   All dip switches indicate either 0 if they are off or 1 if they are on. The first digit displayed is #6 and the last is #1. The number displayed is the binary representation of the Equipment Schedule and Address. It is more convenient to use the Schedule screen to display these values.

Equipment Schedule Information

LCD Wall Mounted Display Unit Ranges

Item	Range	Default Setting
Pr	30-157 F	n/a
PO	60-110 F	80 F
PU	60-110 F	65 F
Sr	32-96 F	n/a
SO	60-90 F	78 F
SU	60-90 F	60 F
Hr	0-100 %RH	n/a
HS	45-75 %RH	60 %RH

Dip Switch Settings

Dip Switch 1 - Configuration Options

Pos	ON	OFF
1	Aux Cooling Available	No Aux Cooling*
2	Space Temp Setback Used	No Space Setback*
3	Pool Temp Setback Used	No Pool Setback*
4	Not Used	
5	Test Mode	Normal Operation*
6	Troubleshooting Mode	Normal Operation*

Dip Switch 2

OSA Enthalpy Setpoint		OSA Damper Min Position	
Setpoint	Position 1 2 3	Setpoint	Position 4 5 6
38 %	0 0 0	0 %	0 0 0
42 %	1 0 0	5%	1 0 0
46 %	0 1 0	10 %	0 1 0
50 %	1 1 0 *	15%	1 1 0 *
54 %	0 0 1	20 %	0 0 1
58 %	1 0 1	25 %	1 0 1
62 %	0 1 1	30 %	0 1 1
66 %	1 1 1	35 %	1 1 1

* Factory Default Settings

Note: Outside air enthalpy setpoint represents % of full scale in the range of 5-55 BTU/LBM at which economizer operation will be allowed. 0% = 5 BTU/LBM, 38% = 24 BTU/LBM, 66% = 38 BTU/LBM, 100% = 55 BTU/LBM. 70 F air with 41% RH is equal to 24 BTU/LBM enthalpy and 80 F air with 75% RH is equal to 38 BTU/LBM enthalpy.

EQUIPMENT SCHEDULE #193

Pool Water, Space Heating, and Humidity Control System

DIGITAL OUTPUTS
DO1 - Main Unit Fans
DO2 - Compressor Heat
DO3 - Auxiliary Heat
DO4 - Humidity Control
DO5 - Pool Heat
DO6 - Auxiliary Fan
DO7 - Auxiliary Cooling
DO8 - Auxiliary Pool Heat

DIGITAL INPUTS
DI1 - Setback Override
DI2 - Space Temp Setback
DI3 - Pool Temp Setback
DI5 - LCD Display Adjust +
DI6 - LCD Display Adjust -
DI7 - LCD Display Select +
DI7 - LCD Display Select -

ANALOG INPUTS
AI1 - Space Temperature
AI2 - Space Humidity
AI3 - OSA Enthalpy
AI4 - Mixed Air Temp
AI5 - Pool Water

ANALOG OUTPUTS
AO1 - Economizer Damper
AO6 - LCD Display

POOL WATER HEATING - OCCUPIED MODE

Temp	M Fan	Comp	B/U Ht	Hum	Pl Ht	A Fan	A Cool	A Pl Ht	Dmpr	AO2	AO3	AO4
>80	ON								MIN			
<=80 >78	ON				ON				MIN			
<=78	ON				ON			ON	MIN			

POOL WATER HEATING - UNOCCUPIED MODE

Temp	M Fan	Comp	B/U Ht	Hum	Pl Ht	A Fan	A Cool	A Pl Ht	Dmpr	AO2	AO3	AO4
>65									CLS			
<=65 >63	ON				ON				CLS			
<=63	ON				ON			ON	CLS			

Note: Setpoints shown are defaults.
When a stage is activated, that stage will remain on until pool water tempertaure raises 2 F.

SPACE HUMIDITY CONTROL - ALL MODES - ECONOMIZER INACTIVE

Humid	M Fan	Comp	B/U Ht	Hum	Pl Ht	A Fan	A Cool	A Pl Ht	Dmpr	AO2	AO3	AO4
>=60 <70	ON			ON					MIN			
>=70	ON			ON		ON			OPN			

SPACE HUMIDITY CONTROL - ALL MODES - ECONOMIZER INACTIVE

Humid	M Fan	Comp	B/U Ht	Hum	Pl Ht	A Fan	A Cool	A Pl Ht	Dmpr	AO2	AO3	AO4
>=60 <65	ON								MOD			
>=65 <70	ON			ON					MOD			
>=70	ON			ON		ON			OPN			

Note: Setpoints shown are defaults.
When a stage is activated, that stage will remain on until space humidity drops 3%.
The Economizer is active when OSA Enthalpy is below setpoint.

EQUIPMENT SCHEDULE #193

Pool Water, Space Heating, and Humidity Control System

SPACE HEATING - OCCUPIED MODE - UNIT NOT IN POOL HEATING OR HUMIDITY MODES

Temp	M Fan	Comp	B/U Ht	Hum	Pl Ht	A Fan	A Cool	A Pl Ht	Dmpr	AO2	AO3	AO4
>76	ON								MIN			
<=76 >74	ON	ON							MIN			
<=74 >72	ON	ON	ON						MIN			
<=72	ON	ON	ON						CLS			

SPACE HEATING - UNOCCUPIED MODE - UNIT NOT IN POOL HEATING OR HUMIDITY MODES

Temp	M Fan	Comp	B/U Ht	Hum	Pl Ht	A Fan	A Cool	A Pl Ht	Dmpr	AO2	AO3	AO4
>58									CLS			
<=58 >56	ON	ON							CLS			
<=56	ON	ON	ON						CLS			

SPACE HEATING - OCCUPIED MODE - UNIT IN POOL HEATING OR HUMIDITY MODES

Temp	M Fan	Comp	B/U Ht	Hum	Pl Ht	A Fan	A Cool	A Pl Ht	Dmpr	AO2	AO3	AO4
>76	ON								MIN			
<=76	ON		ON						MIN			

SPACE HEATING - UNOCCUPIED MODE - UNIT IN POOL HEATING OR HUMIDITY MODES

Temp	M Fan	Comp	B/U Ht	Hum	Pl Ht	A Fan	A Cool	A Pl Ht	Dmpr	AO2	AO3	AO4
>58									CLS			
<=58	ON		ON						CLS			

Note: Setpoints shown are defaults.
When a stage is activated, that stage will remain on until space tempertaure raises 2 F.

EQUIPMENT SCHEDULE #193

Pool Water, Space Heating, and Humidity Control System

SPACE COOLING - OCCUIPED MODE - ECONOMIZER ACTIVE - NO AUX COOLING

Temp	M Fan	Comp	B/U Ht	Hum	Pl Ht	A Fan	A Cool	A Pl Ht	Dmpr	AO2	AO3	AO4
<80	ON								MIN			
>=80 <82	ON								MOD			
>=82	ON					ON			OPN			

SPACE COOLING - OCCUIPED MODE - ECONOMIZER INACTIVE - NO AUX COOLING

Temp	M Fan	Comp	B/U Ht	Hum	Pl Ht	A Fan	A Cool	A Pl Ht	Dmpr	AO2	AO3	AO4
<82	ON								MIN			
>=82	ON					ON			OPN			

SPACE COOLING - OCCUIPED MODE - ECONOMIZER ACTIVE - AUX COOLING

Temp	M Fan	Comp	B/U Ht	Hum	Pl Ht	A Fan	A Cool	A Pl Ht	Dmpr	AO2	AO3	AO4
<80	ON								MIN			
>=80 <82	ON								MOD			
>=82 <84	ON						ON		MOD			
>=84	ON					ON	ON		OPN			

SPACE COOLING - OCCUIPED MODE - ECONOMIZER INACTIVE - AUX COOLING

Temp	M Fan	Comp	B/U Ht	Hum	Pl Ht	A Fan	A Cool	A Pl Ht	Dmpr	AO2	AO3	AO4
<80	ON								MIN			
>=80 <82	ON						ON		MIN			
>=82 <84	ON						ON		MIN			
>=84	ON					ON	ON		OPN			

Note: Setpoints shown are defaults.
When a stage is activated, that stage will remain on until space tempertaure drops 2 F.
The Economizer is active when OSA Enthalpy is below setpoint.
No cooling is available in the unoccupied mode.

List Of Abbreviations

MOD - Open economizer damper motor and modulate toward closed if mixed air temp < 55 F.
MIN - Open economizer damper motor to position determined by dip switch setting.
OPN - Fully open economizer damper motor.
CLS - Fully close economizer damper motor.

Chapter 4

Dealer Estimating Program

Overview

The **BAS** estimating program operates as a worksheet in Microsoft Excel 5.0. It is intended to be used by dealers and contractors for estimating total costs, including labor and materials, for **Energy Zone®** installations. Using this program will allow you to bid an Energy Management project of any size in a matter of a few minutes.

Features

- **Data Entry Sheet:** This is the only area on the spreadsheet that requires user input. A printout of this sheet has been included as an example, but is not normally printed.
- **Proposal:** This document may be given to the client. It is not intended to be the only document given to the client, and it should be accompanied by a cover letter.
- **Materials Order Form:** This document is to be sent to **BAS** to order materials.
- **Dealer Data Summary Sheet:** This is for the dealer's file.

Data Entry Sheet

Note: Entries are to be made only in cells with red text. All other cells are either fixed or calculated by the program.

A. Client Data

1. Project - This information is used for purposes of record and printed on the Proposal.
2. Customer - This information is used for purposes of record and printed on the Proposal.
3. Building - The Use and Type are used for purposes of record only. The Size is used to calculate some of the information on the Dealer Data Summary Sheet but has no effect on the price.
4. Miscellaneous - The Mech System is used for purposes of record only. The Sales Tax is used only on the Proposal. If the sale is not taxable, enter 0.

B. Energy Zone Data

1. For each Equipment Schedule used, enter the ES Used and the # of RSCs using that ES. The program allows up to eight different ES to be used on any given project. For multiple zone ES, the spreadsheet assumes maximum possible distribution (i.e. ES #14 assumes 4 zones). The Maximum # of Zones possible for that ES# and RSC count is calculated and displayed. If the maximum possible zone count is not being used for a given schedule, then make the appropriate entries in the Deduct Wall Sensor column.
2. Total # RSCs - This figure represents the total number of RSCs used for HVAC control.
3. Total Control Zones - This figure represents the total number of control zones used for HVAC control.
4. Deduct Non-Zones - Enter the number of zones that would not be considered HVAC control zones. For example, on a VariZone System the rooftop heat pump servers would require an RSC and be included in the Equipment Schedule count, but would not normally be considered a control zone. This figure will be deducted from the total zone count and the result displayed on the Proposal and Dealer Summary Data Sheet.
5. Total Comfort Zones - This figure is the Total All Zones minus Deduct Non-Zones.
6. Non-BAS Materials - This entry is the lump sum cost for all materials not provided by BAS, except installation materials such as wire and electrical enclosures. This would include dampers and actuators, valves, computer tables, etc.
7. Installation Mat/Zone - This would include the electrical and mechanical materials required for installation in each zone. Enclosures, wire, screws, etc. would be included in this figure. Make sure that this figure is per zone, not a total for the project.
8. Head End Type (S,A,C) – Indicate S for Standard (Conputer/ACL/Software), A for ACL (ACL and Software w/o a Computer), or C for Comm Port Version (Software and external converter for using a Comm Port for trunk communication.)
9. Wall Sensor Type (S,B,F) - Enter the type of wall sensors needed, Standard, Standard with 2x4 Backplate included, or Stainless Steel Flush mount.
10. Deduct Enclosures - The program assumes an Enclosure will be provided with each RSC. Use this entry if you don't want Enclosures provided by BAS.
11. # of extra RSCs/Wall/Duct/Well Sensors/AO Cards/SP Offset Pots - The quantity of cards necessary for each equipment schedule will be automatically determined. These entries are to be used for extras such as lighting control, humidity sensors, return air sensors, and other things not already covered by additional capacity at the RSC.
12. # of VariZone Servers - This will be the number of HVAC units to be used as a VariZone server.
13. Rem Comm to Site - Answer yes if you need the ability to call in to the site from a central office. This would only be necessary to be purchased one time per customer.

14. Handheld Tester - Answer yes if the building owner needs a handheld tester.

C. Dealer Data

1. Name/Address/Salesman - This information is used for purposes of record and printed on the Proposal.
2. Field Labor Factor - For all equipment schedules, this program will calculate a given amount of hours of labor. It is important that you review these figures on the Dealer Summary Data Sheet for accuracy. If you find that these numbers are consistently higher or lower than your actual experience, you can adjust the hours using this factor. The base numbers are determined assuming new construction, open access, wire installed as open conductor, and no particular difficulties.
3. Office Labor Factor - For each project, this program will calculate an estimated number of hours of office labor. This includes engineering, O&Ms, etc. It is important that you review these figures on the Dealer Summary Data Sheet for accuracy. If you find that these numbers are consistently higher or lower than your actual experience, you can adjust the hours using this factor. Some projects will require more elaborate submittals or O&Ms, and therefore require a larger factor for office labor. Some retrofit projects will require a more detailed examination of the existing installation.
4. Training Labor Factor - For each project, this program will calculate an estimated number of hours required to provide the Customer with training. The program assumes that you will only be providing training to end users and not technicians or engineers. It is important that you review these figures on the Dealer Summary Data Sheet for accuracy. If you find that these numbers are consistently higher or lower than your actual experience, you can adjust the hours using this factor.
5. P.O. # - This is the Dealer's Purchase Order # for the materials being ordered from BAS. This number will be displayed on the Materials Order Form.
6. Field Labor Rate - Actual cost for field labor.
7. Office Labor Rate - Actual cost for office labor.
8. BAS Multiplier - This is the multiplier to be used to determine your actual net cost from the list price.
9. Overhead - This figure represents your Company’s overhead percentage. It is multiplied by the total job cost before profit. It is added to Total Cost and Profit to arrive at the Total Bid.
10. Profit - This figure represents your Company’s profit percentage. It is multiplied by the total job cost before overhead. It is added to Total Cost and Overhead to arrive at the Total Bid.

Appendixes

A. Equipment Schedule Sequence of Operations
B. Equipment Schedule Drawings
C. Application Notes

Appendix A

Default Equipment Schedule
Sequence of Operations

List of Equipment Schedules

#1- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Cooling
#2- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Heating
#3- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Cooling, 2 Units
#4- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Heating, 2 Units
#5- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, Economizer (Stg or Anl), RV Cooling
#6- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, Economizer (Stg or Anl), RV Heating
#7- Heat Pump, Single Zone or **VariZone®** Server, 2 Compressors, Backup Heat, Economizer (Stg or Anl), RV Cooling
#8- Heat Pump, Single Zone or **VariZone®** Server, 2 Compressors, Backup Heat, Economizer (Stg or Anl), RV Heating
#9- Air Conditioner, Single Zone or **VariZone®** Server, 1 Compressor, Heat, No Economizer
#10- Air Conditioner, Single Zone or **VariZone®** Server, 1 Compressor, Heat, No Economizer, 2 Units
#11- Air Conditioner, Single Zone or **VariZone®** Server, 1 Compressor, Heat, Economizer (Stg or Anl)
#12- Air Conditioner, Single Zone or **VariZone®** Server, 2 Stages Cooling, 2 Stages Heat, Economizer (Stg or Anl)
#13- VAV Damper, Cooling Only, 3 Point Floating or Analog Actuator
#14- VAV Damper, Cooling Only, 3 Point Floating or Analog Actuator, 4 Zones
#15- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Constant Air Volume
#16- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Constant Air Volume, 2 Zones
#17- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Variable Air Volume
#18- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Variable Air Volume, 2 Zones
#19- VAV Box, Fan, Cooling, Hydronic Heat, 3 Point Floating or Analog Actuators, Constant Air Volume
#20- VAV Box, Fan, Cooling, Hydronic Heat, 3 Point Floating or Analog Actuators, Variable Air Volume
#21- Fan Coil, Heating, 4 Units
#22- Fan Coil, Cooling, 4 Units
#23- Unit Ventilator, Electric Heat, Economizer (Stg or Anl)
#24- Unit Ventilator, Electric Heat, Economizer (Stg or Anl), 2 Units
#25- Unit Ventilator, Electric Heat, Modulating Economizer, 3 Point Floating or Analog Actuator
#26- Unit Ventilator, Electric Heat, Modulating Economizer, 3 Point Floating or Analog Actuator, 2 Units
#27- Unit Ventilator, Hydronic Heat, 3 Point Floating or Analog Actuator, Economizer,
#28- Unit Ventilator, Hydronic Heat, Modulating Economizer, 3 Point Floating or Analog Actuators
#29- Air Handling Unit, 4 Stage Heat, Outdoor Reset
#30- Air Handling Unit, 3 Way Mixing Valve, 3 Point Floating or Analog Actuator, Outdoor Reset
#31- Air Handling Unit, 3 Stage Heat, Modulating Cooling, Modulating Economizer, Analog Actuators, 2 Units
#32- Hydronic Heat Pump Loop Control, 1 Stage Heat, 4 Stage Cooling, 2 Loop Pumps
#33- Chiller, 4 Stage Cooling, 2 Chill Water Pumps
#34- Not Currently Used
#35- Boiler, 4 Stage Heat, Outdoor Reset
#36- Boiler, 3 Way Mixing Valve, 3 Point Floating or Analog Actuator, Outdoor Reset
#37-39 Not Currently Used
#40- Air Handling Unit, 4 Stg Cool, 1 Stg Heat, Analog Cool, 3 Pt or Analog Economizer, Single Zone or VAV Server
#41- Air Handling Unit, Modulating Duct Static Pressure Control, Single Zone or VAV Server, 2 Units
#42- Air Handling Unit, Modulating Building Static Pressure Control, 2 Units
#43-49 Not Currently Used
#50- **VariZone®** Damper, 3 Point Floating or Analog Actuator
#51- **VariZone®** Damper, 3 Point Floating or Analog Actuator, 4 Zones
#52- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Constant Air Volume
#53- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Constant Air Volume, 2 Zones
#54- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Variable Air Volume
#55- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Variable Air Volume, 2 Zones
#56- **VariZone®** Box, Fan Powered, Hydronic B/U Heat, 3 Point Floating or Analog Actuators, Constant Air Volume
#57- **VariZone®** Box, Fan Powered, Hydronic B/U Heat, 3 Point Floating or Analog Actuators, Variable Air Volume
#58- Not Currently Used
#59- Modulating Heat, 3 Point Floating or Analog Actuator, 4 Zones
#60- VAV Dampers, Dual Duct System, 3 Point Floating or Analog Actuators, 2 Zones
#61-62 Not Currently Used
#63- Lighting Control, 8 Zones
#64- Reserved for Custom Output Definition

Energy Zone DDC System
Summary of Pre-Configured Equipment Schedule Capabilities

Equipment Type - Heat Pump

ES#	Typical Application	Temp Range(F)	# Zones	# of Comp	B/U Heat	Rev Vlv	Econo Cont	Fan Control	Can be Server
1	WS Heat Pump	32-96	1	1	Y	Cl	No	Intelligent	Yes
2	WS Heat Pump	32-96	1	1	Y	Ht	No	Intelligent	Yes
3	WS Heat Pump	32-96	2	1	Y	Cl	No	Intelligent	Yes
4	WS Heat Pump	32-96	2	1	Y	Ht	No	Intelligent	Yes
5	Package Heat Pump	32-96	1	1	Y	Cl	Stg/Anl	Intelligent	Yes
6	Package Heat Pump	32-96	1	1	Y	Ht	Stg/Anl	Intelligent	Yes
7	Package Heat Pump	32-96	1	2	Y	Cl	Stg/Anl	Intelligent	Yes
8	Package Heat Pump	32-96	1	2	Y	Ht	Stg/Anl	Intelligent	Yes

Equipment Type - Conventional Heating/Cooling

ES#	Typical Application	Temp Range(F)	# Zones	# Stages Cool	# Stages Heat	Mod Heat	Mod Cool	Econo Cont	Fan Control	Can be Server	OSA Reset
9	Air Conditioner	32-96	1	1					Intelligent	Yes	
10	Air Conditioner	32-96	2	1	1				Intelligent	Yes	
11	Air Conditioner	32-96	1	2	1			Stg/Anl	Intelligent	Yes	
12	Air Conditioner	32-96	1	3	2			Stg/Anl	Intelligent	Yes	
21	Fan Coil	32-96	4		4				Intelligent		
22	Fan Coil	32-96	4	4					Intelligent		
23	Unit Ventilator	32-96	1	1	1	Anl		Stg/Anl	Intelligent		
24	Unit Ventilator	32-96	2	1	1	Anl		Stg/Anl	Intelligent		
25	Unit Ventilator	32-96	1		1	Anl		3 Pt/Anl	Intelligent		
26	Unit Ventilator	32-96	2		1	Anl		3 Pt/Anl	Intelligent		
27	Unit Ventilator	32-96	1	2		3 Pt/Anl		Stg/Anl	Intelligent		
28	Unit Ventilator	32-96	1	2		3 Pt/Anl		3 Pt/Anl	Intelligent		
59	Hot Water Valve	32-96	4			3 Pt/Anl					

Equipment Type - Mechanical Systems

ES#	Typical Application	Temp Range(F)	# Zones	# Stages Cool	# Stages Heat	Mod Heat	Mod Cool	Econo Cont	Fan Control	Can be Server	OSA Reset	Alternate Lead/Lag Pumps
29	Make-up Air Handler	30-158	1		4				Intelligent		Yes	
30	Make-up Air Handler	30-158	1			3 Pt/Anl			Intelligent		Yes	
31	Air Handling Unit	32-96	2		3		Anl	Anl	Intelligent			
32	Hyd HP Loop Control	30-158	1	4	1	Anl						Yes
33	Chiller	30-158	1	4								Yes
35	Boiler	0-255	1		4						Yes	
36	Boiler	0-255	1			3 Pt/Anl					Yes	
40	DAT Controller	30-158	1	4	1		Anl	3 Pt/Anl		Yes		
41	Duct SP Controller	0-3" WC	2			Anl (1)	Anl (2)		TRAV	Yes		
42	Bldg SP Controller	+/-.25" WC	2				Anl					

(1) When in stand alone mode, the Analog Output will decrease when the PID load is positive.
(2) When in VAV Server mode, the Analog Output will increase when the PID load is positive.
Note: This Note only applies to Rev 3.2 RSC's which contain EPROM Ver 4.0b or later.
ES-41 contains a special modification in the RSC EPROM. The RSC will use the commanded position for AO1 and generate a position for AO2. The calculated position for AO2 will be the inverse of AO1. For example, if the commanded output for AO1 is 85%, then the RSC will position AO2 to 15%. AO2 position can not be directly controlled by the User, even with the Handheld Tester. AO2 will always follow the commanded position for AO1.

Equipment Type - Variable Air Volume Client Zones

ES#	Typical Application	Temp Range(F)	# Zones	# Stages Cool	# Stages Heat	Mod Heat	Mod Cool	Can be Pres Ind	Fan Control
13	Damper Only	32-96	1				3 Pt/Anl	Yes	
14	Damper Only	32-96	4				3 Pt/Anl	Yes	
15	Fan Powered Box	32-96	1		1		3 Pt/Anl	Yes	Intelligent
16	Fan Powered Box	32-96	2		1		3 Pt/Anl	Yes	Intelligent
17	Fan Powered Box	32-96	1		2		3 Pt/Anl	Yes	Variable
18	Fan Powered Box	32-96	2		2		3 Pt/Anl	Yes	Variable
19	Fan Powered Box	32-96	1			3 Pt/Anl	3 Pt/Anl	Yes	Intelligent
20	Fan Powered Box	32-96	1		1	3 Pt/Anl	3 Pt/Anl	Yes	Variable
60	Dual Duct	32-96	2					Yes	

Equipment Type - VariZone* Client Zones

ES#	Typical Application	Temp Range(F)	# Zones	# Stages Cool	# Stages Heat	Mod Heat	Mod Damper	Can be Pres Ind	Fan Control
50	Damper Only	32-96	1				3 Pt/Anl	Yes	
51	Damper Only	32-96	4				3 Pt/Anl	Yes	
52	Fan Powered Box	32-96	1		1		3 Pt/Anl	Yes	Intelligent
53	Fan Powered Box	32-96	2		1		3 Pt/Anl	Yes	Intelligent
54	Fan Powered Box	32-96	1		2		3 Pt/Anl	Yes	Variable
55	Fan Powered Box	32-96	2		2		3 Pt/Anl	Yes	Variable
56	Fan Powered Box	32-96	1			3 Pt/Anl	3 Pt/Anl	Yes	Intelligent
57	Fan Powered Box	32-96	1		1	3 Pt/Anl	3 Pt/Anl	Yes	Variable

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #1

Heat Pump, 1 Stage, Backup Heat, No Economizer, Reversing Valve Cooling

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan	DI1 - Setback Override
DO2 - Compressor	
DO3 - Reversing Valve	**ANALOG INPUTS**
DO4 - Backup Heat	AI1 - Space Temperature

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Comp	RV	B/U Ht	DO5	DO6	DO7	DO8	AO1	AO2	AO3	AO4
>74	ON	ON	ON									
>=71 <=74	ON											
<71 >=70	ON	ON										
<70	ON	ON		ON								

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	DO5	DO6	DO7	DO8	AO1	AO2	AO3	AO4
Cool 1	ON	ON	ON									
At Set	ON											
Heat 1	ON	ON										
Heat 2	ON	ON		ON								

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	DO5	DO6	DO7	DO8	AO1	AO2	AO3	AO4
Cool 1	ON	ON	ON									
At Set												
Heat 1	ON	ON										
Heat 2	ON	ON		ON								

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	DO5	DO6	DO7	DO8	AO1	AO2	AO3	AO4
Warm 1	ON	ON										
Warm 2	ON	ON		ON								

EQUIPMENT SCHEDULE #2

Heat Pump, 1 Stage, Backup Heat, No Economizer, Reversing Valve Heating

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan	DI1 - Setback Override
DO2 - Compressor	
DO3 - Reversing Valve	**ANALOG INPUTS**
DO4 - Backup Heat	AI1 - Space Temperature

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Comp	RV	B/U Ht	DO5	DO6	DO7	DO8	AO1	AO2	AO3	AO4
>74	ON	ON										
>=71 <=74	ON											
<71 >=70	ON	ON	ON									
<70	ON	ON	ON	ON								

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	DO5	DO6	DO7	DO8	AO1	AO2	AO3	AO4
Cool 1	ON	ON										
At Set	ON											
Heat 1	ON	ON	ON									
Heat 2	ON	ON	ON	ON								

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	DO5	DO6	DO7	DO8	AO1	AO2	AO3	AO4
Cool 1	ON	ON										
At Set												
Heat 1	ON	ON	ON									
Heat 2	ON	ON	ON	ON								

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	DO5	DO6	DO7	DO8	AO1	AO2	AO3	AO4
Warm 1	ON	ON	ON									
Warm 2	ON	ON	ON	ON								

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #3a

2 Heat Pumps, 1st Unit, 1 Stage, Backup Heat, No Economizer, Reversing Valve Cooling

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Compressor #1	DI5 - Setback Override #2
DO3 - Reversing Valve #1	
DO4 - Backup Heat #1	**ANALOG INPUTS**
DO5 - Fan #2	AI1 - Space Temperature #1
DO6 - Compressor #2	AI5 - Space Temperature #2
DO7 - Reversing Valve #2	
DO8 - Backup Heat #2	Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
>74	ON	ON	ON		ON	ON	ON					
>=71 <=74	ON				ON							
<71 >=70	ON	ON			ON	ON						
<70	ON	ON		ON	ON	ON		ON				

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
Cool 1	ON	ON	ON		ON	ON	ON					
At Set	ON				ON							
Heat 1	ON	ON			ON	ON						
Heat 2	ON	ON		ON	ON	ON		ON				

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
Cool 1	ON	ON	ON		ON	ON	ON					
At Set												
Heat 1	ON	ON			ON	ON						
Heat 2	ON	ON		ON	ON	ON		ON				

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
Warm 1	ON	ON			ON	ON						
Warm 2	ON	ON		ON	ON	ON		ON				

EQUIPMENT SCHEDULE #3b

2 Heat Pumps, 2nd Unit, 1 Stage, Backup Heat, No Economizer, Reversing Valve Cooling

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Compressor #1	DI5 - Setback Override #2
DO3 - Reversing Valve #1	
DO4 - Backup Heat #1	**ANALOG INPUTS**
DO5 - Fan #2	AI1 - Space Temperature #1
DO6 - Compressor #2	AI5 - Space Temperature #2
DO7 - Reversing Valve #2	
DO8 - Backup Heat #2	Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
>74	ON	ON	ON		ON	ON	ON					
>=71 <=74	ON				ON							
<71 >=70	ON	ON			ON	ON						
<70	ON	ON		ON	ON	ON		ON				

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
Cool 1	ON	ON	ON		ON	ON	ON					
At Set	ON				ON							
Heat 1	ON	ON			ON	ON						
Heat 2	ON	ON		ON	ON	ON		ON				

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
Cool 1	ON	ON	ON		ON	ON	ON					
At Set												
Heat 1	ON	ON			ON	ON						
Heat 2	ON	ON		ON	ON	ON		ON				

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
Warm 1	ON	ON			ON	ON						
Warm 2	ON	ON		ON	ON	ON		ON				

EQUIPMENT SCHEDULE #4a

2 Heat Pumps, 1st Unit, 1 Stage, Backup Heat, No Economizer, Reversing Valve Heating

DIGITAL OUTPUTS	**DIGITAL INPUTS**
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Compressor #1	DI5 - Setback Override #2
DO3 - Reversing Valve #1	
DO4 - Backup Heat #1	**ANALOG INPUTS**
DO5 - Fan #2	AI1 - Space Temperature #1
DO6 - Compressor #2	AI5 - Space Temperature #2
DO7 - Reversing Valve #2	
DO8 - Backup Heat #2	Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
>74	ON	ON			ON	ON						
>=71 <=74	ON				ON							
<71 >=70	ON	ON	ON		ON	ON	ON					
<70	ON	ON	ON	ON	ON	ON	ON	ON				

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
Cool 1	ON	ON			ON	ON						
At Set	ON				ON							
Heat 1	ON	ON	ON		ON	ON	ON					
Heat 2	ON	ON	ON	ON	ON	ON	ON	ON				

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
Cool 1	ON	ON			ON	ON						
At Set												
Heat 1	ON	ON	ON		ON	ON	ON					
Heat 2	ON	ON	ON	ON	ON	ON	ON	ON				

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
Warm 1	ON	ON	ON		ON	ON	ON					
Warm 2	ON	ON	ON	ON	ON	ON	ON	ON				

EQUIPMENT SCHEDULE #4b

2 Heat Pumps, 2nd Unit, 1 Stage, Backup Heat, No Economizer, Reversing Valve Heating

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Compressor #1	DI5 - Setback Override #2
DO3 - Reversing Valve #1	
DO4 - Backup Heat #1	**ANALOG INPUTS**
DO5 - Fan #2	AI1 - Space Temperature #1
DO6 - Compressor #2	AI5 - Space Temperature #2
DO7 - Reversing Valve #2	
DO8 - Backup Heat #2	Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
>74	ON	ON			ON	ON						
>=71 <=74	ON				ON							
<71 >=70	ON	ON	ON		ON	ON	ON					
<70	ON	ON	ON	ON	ON	ON	ON	ON				

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
Cool 1	ON	ON			ON	ON						
At Set	ON				ON							
Heat 1	ON	ON	ON		ON	ON	ON					
Heat 2	ON	ON	ON	ON	ON	ON	ON	ON				

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
Cool 1	ON	ON			ON	ON						
At Set												
Heat 1	ON	ON	ON		ON	ON	ON					
Heat 2	ON	ON	ON	ON	ON	ON	ON	ON				

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	Fan	Comp	RV	B/U Ht	AO1	AO2	AO3	AO4
Warm 1	ON	ON	ON		ON	ON	ON					
Warm 2	ON	ON	ON	ON	ON	ON	ON	ON				

EQUIPMENT SCHEDULE #5

Heat Pump, 1 Stage, Backup Heat, Economizer (Staged & Analog), Reversing Valve Cooling

DIGITAL OUTPUTS
DO1 - Fan
DO2 - Compressor
DO3 - Reversing Valve
DO4 - Backup Heat
DO5 - Economizer Min Pos/Pwr Supply
DO6 - Economizer Cooling

ANALOG OUTPUTS
AO1 - Economizer Actuator

DIGITAL INPUTS
DI1 - Setback Override

ANALOG INPUTS
AI1 - Space Temperature
AI2 - Return Air Enthalpy *
AI6 - Mixed Air Temperature *

* If using Analog Economizer

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Comp	RV	B/U Ht	M Pos	Econo	DO7	DO8	Econo	AO2	AO3	AO4
>76	ON	ON	ON						CLS			
>75 <=76	ON	ON	ON		ON				MIN			
>74 <=75	ON	ON	ON		ON				MIN			
>=71 <=74	ON				ON				MIN			
<71 >=70	ON	ON			ON				MIN			
<70 >=69	ON	ON		ON	ON				MIN			
<69	ON	ON		ON					CLS			

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Comp	RV	B/U Ht	M Pos	Econo	DO7	DO8	Econo	AO2	AO3	AO4
Econo 2	ON	ON	ON		ON	ON			OPN			
Econo 1	ON				ON	ON			OPN			
At Set	ON				ON				MIN			
Heat 1	ON	ON			ON				MIN			
Heat 2	ON	ON		ON	ON				MIN			
Heat 3	ON	ON		ON					CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Comp	RV	B/U Ht	M Pos	Econo	DO7	DO8	Econo	AO2	AO3	AO4
Econo 2	ON	ON	ON		ON	ON			OPN			
Econo 1	ON				ON	ON			OPN			
At Set									CLS			
Heat 1	ON	ON							CLS			
Heat 2	ON	ON		ON					CLS			

EQUIPMENT SCHEDULE #5

Heat Pump, 1 Stage, Backup Heat, Economizer (Staged & Analog), Reversing Valve Cooling

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Comp	RV	B/U Ht	M Pos	Econo	DO7	DO8	Econo	AO2	AO3	AO4
Cool 3	ON	ON	ON						CLS			
Cool 2	ON	ON	ON		ON				MIN			
Cool 1	ON	ON	ON		ON				MIN			
At Set	ON				ON				MIN			
Heat 1	ON	ON			ON				MIN			
Heat 2	ON	ON		ON	ON				MIN			
Heat 3	ON	ON		ON					CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Comp	RV	B/U Ht	M Pos	Econo	DO7	DO8	Econo	AO2	AO3	AO4
Cool 1	ON	ON	ON						CLS			
At Set									CLS			
Heat 1	ON	ON							CLS			
Heat 2	ON	ON		ON					CLS			

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	M Pos	Econo	DO7	DO8	Econo	AO2	AO3	AO4
Warm 1	ON	ON							CLS			
Warm 2	ON	ON		ON					CLS			

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Comp	RV	B/U Ht	M Pos	Econo	DO7	DO8	Econo	AO2	AO3	AO4
Econo 1	ON				ON	ON			OPN			

EQUIPMENT SCHEDULE #6

Heat Pump, 1 Stage, Backup Heat, Economizer (Staged & Analog), Reversing Valve Heating

DIGITAL OUTPUTS	**DIGITAL INPUTS**
DO1 - Fan	DI1 - Setback Override
DO2 - Compressor	
DO3 - Reversing Valve	**ANALOG INPUTS**
DO4 - Backup Heat	AI1 - Space Temperature
DO5 - Economizer Min Pos/Pwr Supply	AI2 - Return Air Enthalpy *
DO6 - Economizer Cooling	AI6 - Mixed Air Temperature *
ANALOG OUTPUTS	* If using Analog Economizer
AO1 - Economizer Actuator	

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Comp	RV	B/U Ht	M Pos	Econo	DO7	DO8	Econo	AO2	AO3	AO4
>76	ON	ON							CLS			
>75 <=76	ON	ON			ON				MIN			
>74 <=75	ON	ON			ON				MIN			
>=71 <=74	ON				ON				MIN			
<71 >=70	ON	ON	ON		ON				MIN			
<70 >=69	ON	ON	ON	ON	ON				MIN			
<69	ON	ON	ON	ON					CLS			

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Comp	RV	B/U Ht	M Pos	Econo	DO7	DO8	Econo	AO2	AO3	AO4
Econo 2	ON	ON			ON	ON			OPN			
Econo 1	ON				ON	ON			OPN			
At Set	ON				ON				MIN			
Heat 1	ON	ON	ON		ON				MIN			
Heat 2	ON	ON	ON	ON	ON				MIN			
Heat 3	ON	ON	ON	ON					CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Comp	RV	B/U Ht	M Pos	Econo	DO7	DO8	Econo	AO2	AO3	AO4
Econo 2	ON	ON			ON	ON			OPN			
Econo 1	ON				ON	ON			OPN			
At Set									CLS			
Heat 1	ON	ON	ON						CLS			
Heat 2	ON	ON	ON	ON					CLS			

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #6

Heat Pump, 1 Stage, Backup Heat, Economizer (Staged & Analog), Reversing Valve Heating

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Comp	RV	B/U Ht	M Pos	Econo	DO7	DO8	Econo	AO2	AO3	AO4
Cool 3	ON	ON							CLS			
Cool 2	ON	ON			ON				MIN			
Cool 1	ON	ON			ON				MIN			
At Set	ON				ON				MIN			
Heat 1	ON	ON	ON		ON				MIN			
Heat 2	ON	ON	ON	ON	ON				MIN			
Heat 3	ON	ON	ON	ON					CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Comp	RV	B/U Ht	M Pos	Econo	DO7	DO8	Econo	AO2	AO3	AO4
Cool 1	ON	ON							CLS			
At Set									CLS			
Heat 1	ON	ON	ON						CLS			
Heat 2	ON	ON	ON	ON					CLS			

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Comp	RV	B/U Ht	M Pos	Econo	DO7	DO8	Econo	AO2	AO3	AO4
Warm 1	ON	ON	ON						CLS			
Warm 2	ON	ON	ON	ON					CLS			

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Comp	RV	B/U Ht	M Pos	Econo	DO7	DO8	Econo	AO2	AO3	AO4
Econo 1	ON				ON	ON			OPN			

EQUIPMENT SCHEDULE #7

Heat Pump, 2 Stage, Backup Heat, Economizer (Staged & Analog), Reversing Valve Cooling

DIGITAL OUTPUTS
DO1 - Fan
DO2 - Compressor
DO3 - Reversing Valve
DO4 - Backup Heat
DO5 - Economizer Min Pos/Pwr Supply
DO6 - Economizer Cooling
DO7 - Compressor #2

ANALOG OUTPUTS
AO1 - Economizer Actuator

DIGITAL INPUTS
DI1 - Setback Override

ANALOG INPUTS
AI1 - Space Temperature
AI2 - Return Air Enthalpy *
AI6 - Mixed Air Temperature *

* If using Analog Economizer

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Cmp 1	RV	B/U Ht	M Pos	Econo	Cmp 2	DO8	Econo	AO2	AO3	AO4
>76	ON	ON	ON				ON		CLS			
>75 <=76	ON	ON	ON		ON		ON		MIN			
>74 <=75	ON	ON	ON		ON				MIN			
>=71 <=74	ON				ON				MIN			
<71 >=70	ON	ON			ON				MIN			
<70 >=69	ON	ON			ON		ON		MIN			
<69	ON	ON		ON			ON		CLS			

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cmp 1	RV	B/U Ht	M Pos	Econo	Cmp 2	DO8	Econo	AO2	AO3	AO4
Econo 3	ON	ON	ON		ON	ON	ON		OPN			
Econo 2	ON	ON	ON		ON	ON			OPN			
Econo 1	ON				ON	ON			OPN			
At Set	ON				ON				MIN			
Heat 1	ON	ON			ON				MIN			
Heat 2	ON	ON			ON		ON		MIN			
Heat 3	ON	ON		ON			ON		CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cmp 1	RV	B/U Ht	M Pos	Econo	Cmp 2	DO8	Econo	AO2	AO3	AO4
Econo 3	ON	ON	ON		ON	ON	ON		OPN			
Econo 2	ON	ON	ON		ON	ON			OPN			
Econo 1	ON				ON	ON			OPN			
At Set									CLS			
Heat 1	ON	ON							CLS			
Heat 2	ON	ON					ON		CLS			
Heat 3	ON	ON		ON			ON		CLS			

EQUIPMENT SCHEDULE #7

Heat Pump, 2 Stage, Backup Heat, Economizer (Staged & Analog), Reversing Valve Cooling

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Cmp 1	RV	B/U Ht	M Pos	Econo	Cmp 2	DO8	Econo	AO2	AO3	AO4
Cool 3	ON	ON	ON				ON		CLS			
Cool 2	ON	ON	ON		ON		ON		MIN			
Cool 1	ON	ON	ON		ON				MIN			
At Set	ON				ON				MIN			
Heat 1	ON	ON			ON				MIN			
Heat 2	ON	ON			ON		ON		MIN			
Heat 3	ON	ON		ON			ON		CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Cmp 1	RV	B/U Ht	M Pos	Econo	Cmp 2	DO8	Econo	AO2	AO3	AO4
Cool 2	ON	ON	ON				ON		CLS			
Cool 1	ON	ON	ON						CLS			
At Set									CLS			
Heat 1	ON	ON							CLS			
Heat 2	ON	ON					ON		CLS			
Heat 3	ON	ON		ON			ON		CLS			

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Cmp 1	RV	B/U Ht	M Pos	Econo	Cmp 2	DO8	Econo	AO2	AO3	AO4
Warm 1	ON	ON					ON		CLS			
Warm 2	ON	ON		ON			ON		CLS			

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cmp 1	RV	B/U Ht	Min Pos	Econo	Cmp 2	DO8	Econo	AO2	AO3	AO4
Econo 1	ON				ON	ON			CLS			

Equipment Schedule Sequence of Operations
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EQUIPMENT SCHEDULE #8

Heat Pump, 2 Stage, Backup Heat, Economizer (Staged & Analog), Reversing Valve Heating

DIGITAL OUTPUTS

DO1 - Fan
DO2 - Compressor
DO3 - Reversing Valve
DO4 - Backup Heat
DO5 - Economizer Min Pos/Pwr Supply
DO6 - Economizer Cooling
DO7 - Compressor #2

ANALOG OUTPUTS

AO1 - Economizer Actuator

DIGITAL INPUTS

DI1 - Setback Override

ANALOG INPUTS

AI1 - Space Temperature
AI2 - Return Air Enthalpy *
AI6 - Mixed Air Temperature *

* If using Analog Economizer

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Cmp 1	RV	B/U Ht	M Pos	Econo	Cmp 2	DO8	Econo	AO2	AO3	AO4
>76	ON	ON					ON		CLS			
>75 <=76	ON	ON			ON		ON		MIN			
>74 <=75	ON	ON			ON				MIN			
>=71 <=74	ON				ON				MIN			
<71 >=70	ON	ON	ON		ON				MIN			
<70 >=69	ON	ON	ON		ON		ON		MIN			
<69	ON	ON	ON	ON			ON		CLS			

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cmp 1	RV	B/U Ht	M Pos	Econo	Cmp 2	DO8	Econo	AO2	AO3	AO4
Econo 3	ON	ON			ON	ON	ON		OPN			
Econo 2	ON	ON			ON	ON			OPN			
Econo 1	ON				ON	ON			OPN			
At Set	ON				ON				MIN			
Heat 1	ON	ON	ON		ON				MIN			
Heat 2	ON	ON	ON		ON		ON		MIN			
Heat 3	ON	ON	ON	ON			ON		CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cmp 1	RV	B/U Ht	M Pos	Econo	Cmp 2	DO8	Econo	AO2	AO3	AO4
Econo 3	ON	ON			ON	ON	ON		OPN			
Econo 2	ON	ON			ON	ON			OPN			
Econo 1	ON				ON	ON			OPN			
At Set									CLS			
Heat 1	ON	ON	ON						CLS			
Heat 2	ON	ON	ON				ON		CLS			
Heat 3	ON	ON	ON	ON			ON		CLS			

EQUIPMENT SCHEDULE #8

Heat Pump, 2 Stage, Backup Heat, Economizer (Staged & Analog), Reversing Valve Heating

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Cmp 1	RV	B/U Ht	M Pos	Econo	Cmp 2	DO8	Econo	AO2	AO3	AO4
Cool 3	ON	ON					ON		CLS			
Cool 2	ON	ON			ON		ON		MIN			
Cool 1	ON	ON			ON				MIN			
At Set	ON				ON				MIN			
Heat 1	ON	ON	ON		ON				MIN			
Heat 2	ON	ON	ON		ON		ON		MIN			
Heat 3	ON	ON	ON	ON			ON		CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Cmp 1	RV	B/U Ht	M Pos	Econo	Cmp 2	DO8	Econo	AO2	AO3	AO4
Cool 2	ON	ON					ON		CLS			
Cool 1	ON	ON							CLS			
At Set									CLS			
Heat 1	ON	ON	ON						CLS			
Heat 2	ON	ON	ON				ON		CLS			
Heat 3	ON	ON	ON	ON			ON		CLS			

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Cmp 1	RV	B/U Ht	M Pos	Econo	Cmp 2	DO8	Econo	AO2	AO3	AO4
Warm 1	ON	ON	ON				ON		CLS			
Warm 2	ON	ON	ON	ON			ON		CLS			

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cmp 1	RV	B/U Ht	Min Pos	Econo	Cmp 2	DO8	Econo	AO2	AO3	AO4
Econo 1	ON				ON	ON			CLS			

EQUIPMENT SCHEDULE #9

Air Conditioner, 1 Cool, 1 Heat, No Economizer

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan	DI1 - Setback Override
DO2 - Cool	
DO3 - Heat	**ANALOG INPUTS**
	AI1 - Space Temperature

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Cool	Heat	DO4	DO5	DO6	DO7	DO8	AO1	AO2	AO3	AO4
>74	ON	ON										
>=71 <=74	ON											
<71	ON		ON									

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Cool	Heat	DO4	DO5	DO6	DO7	DO8	AO1	AO2	AO3	AO4
Cool 1	ON	ON										
At Set	ON											
Heat 1	ON		ON									

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Cool	Heat	DO4	DO5	DO6	DO7	DO8	AO1	AO2	AO3	AO4
Cool 1	ON	ON										
At Set												
Heat 1	ON		ON									

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Cool	Heat	DO4	DO5	DO6	DO7	DO8	AO1	AO2	AO3	AO4
Warm 1	ON		ON									

EQUIPMENT SCHEDULE #10a

2 Air Conditioners, 1st Unit, 1 Cool, 1 Heat, No Economizer

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Cool #1	DI5 - Setback Override #2
DO3 - Heat #1	
DO5 - Fan #2	**ANALOG INPUTS**
DO6 - Cool #2	AI1 - Space Temperature #1
DO8 - Heat #2	AI5 - Space Temperature #2

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Cool	Heat	DO4	Fan	Cool	Heat	DO8	AO1	AO2	AO3	AO4
>74	ON	ON			ON	ON						
>=71 <=74	ON				ON							
<71	ON		ON		ON		ON					

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Cool	Heat	DO4	Fan	Cool	Heat	DO8	AO1	AO2	AO3	AO4
Cool 1	ON	ON			ON	ON						
At Set	ON				ON							
Heat 1	ON		ON		ON		ON					

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Cool	Heat	DO4	Fan	Cool	Heat	DO8	AO1	AO2	AO3	AO4
Cool 1	ON	ON			ON	ON						
At Set												
Heat 1	ON		ON		ON		ON					

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Cool	Heat	DO4	Fan	Cool	Heat	DO8	AO1	AO2	AO3	AO4
Warm 1	ON		ON		ON		ON					

EQUIPMENT SCHEDULE #10b

2 Air Conditioners, 2nd Unit, 1 Cool, 1 Heat, No Economizer

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Cool #1	DI5 - Setback Override #2
DO3 - Heat #1	
DO5 - Fan #2	**ANALOG INPUTS**
DO6 - Cool #2	AI1 - Space Temperature #1
DO8 - Heat #2	AI5 - Space Temperature #2
	Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Cool	Heat	DO4	Fan	Cool	Heat	DO8	AO1	AO2	AO3	AO4
>74	ON	ON			ON	ON						
>=71 <=74	ON				ON							
<71	ON		ON		ON		ON					

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Cool	Heat	DO4	Fan	Cool	Heat	DO8	AO1	AO2	AO3	AO4
Cool 1	ON	ON			ON	ON						
At Set	ON				ON							
Heat 1	ON		ON		ON		ON					

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Cool	Heat	DO4	Fan	Cool	Heat	DO8	AO1	AO2	AO3	AO4
Cool 1	ON	ON			ON	ON						
At Set												
Heat 1	ON		ON		ON		ON					

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Cool	Heat	DO4	Fan	Cool	Heat	DO8	AO1	AO2	AO3	AO4
Warm 1	ON		ON		ON		ON					

EQUIPMENT SCHEDULE #11

Air Conditioner, 1 Cool, 1 Heat, Economizer (Staged & Analog)

DIGITAL OUTPUTS	**DIGITAL INPUTS**
DO1 - Fan	DI1 - Setback Override
DO2 - Cool	
DO3 - Heat	**ANALOG INPUTS**
DO4 - Economizer Min Pos/Pwr Supply	AI1 - Space Temperature
DO5 - Economizer Cooling	AI2 - Return Air Enthalpy *
	AI6 - Mixed Air Temperature *
ANALOG OUTPUTS	
AO1 - Economizer Actuator	* If using Analog Economizer

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Cool	Heat	M Pos	Econo	DO6	DO7	DO8	Econo	AO2	AO3	AO4
>76	ON	ON							CLS			
>75 <=76	ON	ON		ON					MIN			
>74 <=75	ON	ON		ON					MIN			
>=71 <=74	ON			ON					MIN			
<71 >=70	ON		ON	ON					MIN			
<70 >=69	ON		ON	ON					MIN			
<69	ON		ON						CLS			

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cool	Heat	M Pos	Econo	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Econo 2	ON	ON		ON	ON				OPN			
Econo 1	ON			ON	ON				OPN			
At Set	ON			ON					MIN			
Heat 1	ON		ON	ON					MIN			
Heat 2	ON		ON	ON					MIN			
Heat 2	ON		ON						CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cool	Heat	M Pos	Econo	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Econo 2	ON	ON		ON	ON				OPN			
Econo 1	ON			ON	ON				OPN			
At Set									CLS			
Heat 1	ON	ON							CLS			

EQUIPMENT SCHEDULE #11

Air Conditioner, 1 Cool, 1 Heat, Economizer (Staged & Analog)

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Cool	Heat	M Pos	Econo	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Cool 3	ON	ON							CLS			
Cool 2	ON	ON		ON					MIN			
Cool 1	ON	ON		ON					MIN			
At Set	ON			ON					MIN			
Heat 1	ON		ON	ON					MIN			
Heat 2	ON		ON	ON					MIN			
Heat 2	ON		ON						CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Cool	Heat	M Pos	Econo	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Cool 1	ON	ON							CLS			
At Set									CLS			
Heat 1	ON		ON						CLS			

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Cool	Heat	M Pos	Econo	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Warm 1	ON		ON						CLS			

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cool	Heat	M Pos	Econo	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Econo 1	ON			ON	ON				OPN			

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #12

Air Conditioner, 2 Cool, 2 Heat, Economizer (Staged & Analog)

DIGITAL OUTPUTS
DO1 - Fan
DO2 - Cool #1
DO3 - Heat #1
DO4 - Economizer Min Pos/Pwr Supply
DO5 - Economizer Cooling
DO6 - Cool #2
DO7 - Heat #2

ANALOG OUTPUTS
AO1 - Economizer Actuator

DIGITAL INPUTS
DI1 - Setback Override

ANALOG INPUTS
AI1 - Space Temperature
AI2 - Return Air Enthalpy *
AI6 - Mixed Air Temperature *

* If using Analog Economizer

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Cool 1	Heat 1	M Pos	Econo	Cool 2	Heat 2	DO8	Econo	AO2	AO3	AO4
>76	ON	ON				ON			CLS			
>75 <=76	ON	ON		ON		ON			MIN			
>74 <=75	ON	ON		ON					MIN			
>=71 <=74	ON			ON					MIN			
<71 >=70	ON		ON	ON					MIN			
<70 >=69	ON		ON	ON			ON		MIN			
<69	ON		ON				ON		CLS			

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cool 1	Heat 1	M Pos	Econo	Cool 2	Heat 2	DO8	Econo	AO2	AO3	AO4
Econo 3	ON	ON		ON	ON	ON			OPN			
Econo 2	ON	ON		ON	ON				OPN			
Econo 1	ON			ON	ON				OPN			
At Set	ON			ON					MIN			
Heat 1	ON		ON	ON					MIN			
Heat 2	ON		ON	ON			ON		MIN			
Heat 3	ON		ON				ON		CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cool 1	Heat 1	M Pos	Econo	Cool 2	Heat 2	DO8	Econo	AO2	AO3	AO4
Econo 3	ON	ON		ON	ON	ON			OPN			
Econo 2	ON	ON		ON	ON				OPN			
Econo 1	ON			ON	ON				OPN			
At Set									CLS			
Heat 1	ON		ON						CLS			
Heat 2	ON		ON				ON		CLS			

EQUIPMENT SCHEDULE #12

Air Conditioner, 2 Cool, 2 Heat, Economizer (Staged & Analog)

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Cool 1	Heat 1	M Pos	Econo	Cool 2	Heat 2	DO8	Econo	AO2	AO3	AO4
Cool 3	ON	ON				ON			CLS			
Cool 2	ON	ON		ON		ON			MIN			
Cool 1	ON	ON		ON					MIN			
At Set	ON			ON					MIN			
Heat 1	ON		ON	ON					MIN			
Heat 2	ON		ON	ON			ON		MIN			
Heat 3	ON		ON				ON		CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Cool 1	Heat 1	M Pos	Econo	Cool 2	Heat 2	DO8	Econo	AO2	AO3	AO4
Cool 2	ON	ON				ON			CLS			
Cool 1	ON	ON							CLS			
At Set									CLS			
Heat 1	ON		ON						CLS			
Heat 2	ON		ON				ON		CLS			

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Cool 1	Heat 1	M Pos	Econo	Cool 2	Heat 2	DO8	Econo	AO2	AO3	AO4
Warm 1	ON		ON				ON		CLS			

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cool 1	Heat 1	M Pos	Econo	Cool 2	Heat 2	DO8	Econo	AO2	AO3	AO4
Econo 1	ON			ON	ON				OPN			

EQUIPMENT SCHEDULE #13

VAV Box, Cooling Only, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS	**DIGITAL INPUTS**
DO1 - Damper Motor Open	DI1 - Setback Override
DO2 - Damper Motor Close	
	ANALOG INPUTS
ANALOG OUTPUTS	AI1 - Space Temperature
AO1 - Damper Motor	AI2 - CFM (optional)

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	DO3	DO4	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
>76	+20%								+20%			
>75 <=76	+10%								+10%			
>74 <=75	+5%								+5%			
>=71 <=74												
<71 >=70		-5%							-5%			
<70 >=69		MIN							MIN			
<69		CLS							CLS			

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	DO3	DO4	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 3	+20%								+20%			
Cool 2	+10%								+10%			
Cool 1	+5%								+5%			
At Set												
Heat 1		-5%							-5%			
Heat 2		MIN							MIN			
Heat 3		CLS							CLS			

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	DO3	DO4	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
At Set		CLS							CLS			

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	DO3	DO4	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Heat 1	OPN								OPN			

EQUIPMENT SCHEDULE #14a

4 VAV Boxes, 1st Zone, Cooling Only, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS
DO1 - Damper Motor #1 Open
DO2 - Damper Motor #1 Close
DO3 - Damper Motor #2 Open
DO4 - Damper Motor #2 Close
DO5 - Damper Motor #3 Open
DO6 - Damper Motor #3 Close
DO7 - Damper Motor #4 Open
DO8 - Damper Motor #4 Close

ANALOG OUTPUTS
AO1 - Damper Motor #1
AO2 - Damper Motor #2
AO3 - Damper Motor #3
AO4 - Damper Motor #4

DIGITAL INPUTS
DI1 - Setback Override #1
DI3 - Setback Override #2
DI5 - Setback Override #3
DI7 - Setback Override #4

ANALOG INPUTS
AI1 - Space Temperature #1
AI2 - CFM #1 (optional)
AI3 - Space Temperature #2
AI4 - CFM #2 (optional)
AI5 - Space Temperature #3
AI6 - CFM #3 (optional)
AI7 - Space Temperature #4
AI8 - CFM #4 (optional)

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
>76	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
>75 <=76	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
>74 <=75	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
>=71 <=74												
<71 >=70		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
<70 >=69		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
<69		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
Cool 2	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
Cool 1	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
At Set												
Heat 1		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
Heat 2		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
Heat 3		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
At Set		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Heat 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

EQUIPMENT SCHEDULE #14b

4 VAV Boxes, 2nd Zone, Cooling Only, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS	**DIGITAL INPUTS**
DO1 - Damper Motor #1 Open	DI1 - Setback Override #1
DO2 - Damper Motor #1 Close	DI3 - Setback Override #2
DO3 - Damper Motor #2 Open	DI5 - Setback Override #3
DO4 - Damper Motor #2 Close	DI7 - Setback Override #4
DO5 - Damper Motor #3 Open	
DO6 - Damper Motor #3 Close	**ANALOG INPUTS**
DO7 - Damper Motor #4 Open	AI1 - Space Temperature #1
DO8 - Damper Motor #4 Close	AI2 - CFM #1 (optional)
	AI3 - Space Temperature #2
ANALOG OUTPUTS	AI4 - CFM #2 (optional)
AO1 - Damper Motor #1	AI5 - Space Temperature #3
AO2 - Damper Motor #2	AI6 - CFM #3 (optional)
AO3 - Damper Motor #3	AI7 - Space Temperature #4
AO4 - Damper Motor #4	AI8 - CFM #4 (optional)
	Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
>76	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
>75 <=76	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
>74 <=75	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
>=71 <=74												
<71 >=70		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
<70 >=69		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
<69		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
Cool 2	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
Cool 1	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
At Set												
Heat 1		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
Heat 2		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
Heat 3		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
At Set		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Heat 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

EQUIPMENT SCHEDULE #14c

4 VAV Boxes, 3rd Zone, Cooling Only, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS

DO1 - Damper Motor #1 Open
DO2 - Damper Motor #1 Close
DO3 - Damper Motor #2 Open
DO4 - Damper Motor #2 Close
DO5 - Damper Motor #3 Open
DO6 - Damper Motor #3 Close
DO7 - Damper Motor #4 Open
DO8 - Damper Motor #4 Close

ANALOG OUTPUTS

AO1 - Damper Motor #1
AO2 - Damper Motor #2
AO3 - Damper Motor #3
AO4 - Damper Motor #4

DIGITAL INPUTS

DI1 - Setback Override #1
DI3 - Setback Override #2
DI5 - Setback Override #3
DI7 - Setback Override #4

ANALOG INPUTS

AI1 - Space Temperature #1
AI2 - CFM #1 (optional)
AI3 - Space Temperature #2
AI4 - CFM #2 (optional)
AI5 - Space Temperature #3
AI6 - CFM #3 (optional)
AI7 - Space Temperature #4
AI8 - CFM #4 (optional)

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
>76	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
>75 <=76	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
>74 <=75	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
>=71 <=74												
<71 >=70		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
<70 >=69		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
<69		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
Cool 2	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
Cool 1	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
At Set												
Heat 1		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
Heat 2		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
Heat 3		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
At Set		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Heat 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

EQUIPMENT SCHEDULE #14d

4 VAV Boxes, 4th Zone, Cooling Only, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Damper Motor #1 Open	DI1 - Setback Override #1
DO2 - Damper Motor #1 Close	DI3 - Setback Override #2
DO3 - Damper Motor #2 Open	DI5 - Setback Override #3
DO4 - Damper Motor #2 Close	DI7 - Setback Override #4
DO5 - Damper Motor #3 Open	
DO6 - Damper Motor #3 Close	**ANALOG INPUTS**
DO7 - Damper Motor #4 Open	AI1 - Space Temperature #1
DO8 - Damper Motor #4 Close	AI2 - CFM #1 (optional)
	AI3 - Space Temperature #2
ANALOG OUTPUTS	AI4 - CFM #2 (optional)
AO1 - Damper Motor #1	AI5 - Space Temperature #3
AO2 - Damper Motor #2	AI6 - CFM #3 (optional)
AO3 - Damper Motor #3	AI7 - Space Temperature #4
AO4 - Damper Motor #4	AI8 - CFM #4 (optional)
	Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
>76	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
>75 <=76	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
>74 <=75	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
>=71 <=74												
<71 >=70		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
<70 >=69		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
<69		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
Cool 2	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
Cool 1	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
At Set												
Heat 1		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
Heat 2		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
Heat 3		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
At Set		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Heat 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

EQUIPMENT SCHEDULE #15

VAV Box, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Constant Air Volume

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Damper Motor Open	DI1 - Setback Override
DO2 - Damper Motor Close	
DO3 - Fan	**ANALOG INPUTS**
DO4 - Heat	AI1 - Space Temperature
	AI2 - CFM (optional)
ANALOG OUTPUTS	
AO1 - Damper Motor	

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
>76	+20%		ON						+20%			
>75 <=76	+10%		ON						+10%			
>74 <=75	+5%		ON						+5%			
>=71 <=74			ON									
<71 >=70		-5%	ON	ON					-5%			
<70 >=69		MIN	ON	ON					MIN			
<69		CLS	ON	ON					CLS			

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 3	+20%		ON						+20%			
Cool 2	+10%		ON						+10%			
Cool 1	+5%		ON						+5%			
At Set			ON									
Heat 1		-5%	ON	ON					-5%			
Heat 2		MIN	ON	ON					MIN			
Heat 3		CLS	ON	ON					CLS			

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
At Set		CLS							CLS			
Heat 1		CLS	ON	ON								

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Heat 1	OPN		ON						OPN			
Heat 2	OPN		ON	ON					OPN			

Equipment Schedule Sequence of Operations
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EQUIPMENT SCHEDULE #16a

2 VAV Boxes, 1st Unit, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Constant Air Volume

DIGITAL OUTPUTS
DO1 - Damper Motor #1 Open
DO2 - Damper Motor #1 Close
DO3 - Fan #1
DO4 - Heat #1
DO5 - Damper Motor #2 Open
DO6 - Damper Motor #2 Close
DO7 - Fan #2
DO8 - Heat #2

DIGITAL INPUTS
DI1 - Setback Override #1
DI5 - Setback Override #2

ANALOG INPUTS
AI1 - Space Temperature #1
AI2 - CFM #1 (optional)
AI5 - Space Temperature #2
AI6 - CFM #2 (optional)

ANALOG OUTPUTS
AO1 - Damper Motor #1
AO3 - Damper Motor #2

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
>76	+20%		ON		+20%		ON		+20%		+20%	
>75 <=76	+10%		ON		+10%		ON		+10%		+10%	
>74 <=75	+5%		ON		+5%		ON		+5%		+5%	
>=71 <=74			ON				ON					
<71 >=70		-5%	ON	ON		-5%	ON	ON	-5%		-5%	
<70 >=69		MIN	ON	ON		MIN	ON	ON	MIN		MIN	
<69		CLS	ON	ON		CLS	ON	ON	CLS		CLS	

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 3	+20%		ON		+20%		ON		+20%		+20%	
Cool 2	+10%		ON		+10%		ON		+10%		+10%	
Cool 1	+5%		ON		+5%		ON		+5%		+5%	
At Set			ON				ON					
Heat 1		-5%	ON	ON		-5%	ON	ON	-5%		-5%	
Heat 2		MIN	ON	ON		MIN	ON	ON	MIN		MIN	
Heat 3		CLS	ON	ON		CLS	ON	ON	CLS		CLS	

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
At Set		CLS				CLS			CLS		CLS	
Heat 1		CLS	ON	ON		CLS	ON	ON				

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Heat 1	OPN		ON		OPN		ON		OPN		OPN	
Heat 2	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

EQUIPMENT SCHEDULE #16b

2 VAV Boxes, 2nd Unit, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Constant Air Volume

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Damper Motor #1 Open	DI1 - Setback Override #1
DO2 - Damper Motor #1 Close	DI5 - Setback Override #2
DO3 - Fan #1	
DO4 - Heat #1	**ANALOG INPUTS**
DO5 - Damper Motor #2 Open	AI1 - Space Temperature #1
DO6 - Damper Motor #2 Close	AI2 - CFM #1 (optional)
DO7 - Fan #2	AI5 - Space Temperature #2
DO8 - Heat #2	AI6 - CFM #2 (optional)
	ANALOG OUTPUTS
	AO1 - Damper Motor #1
	AO3 - Damper Motor #2
	Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
>76	+20%		ON		+20%		ON		+20%		+20%	
>75 <=76	+10%		ON		+10%		ON		+10%		+10%	
>74 <=75	+5%		ON		+5%		ON		+5%		+5%	
>=71 <=74			ON				ON					
<71 >=70		-5%	ON	ON		-5%	ON	ON	-5%		-5%	
<70 >=69		MIN	ON	ON		MIN	ON	ON	MIN		MIN	
<69		CLS	ON	ON		CLS	ON	ON	CLS		CLS	

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 3	+20%		ON		+20%		ON		+20%		+20%	
Cool 2	+10%		ON		+10%		ON		+10%		+10%	
Cool 1	+5%		ON		+5%		ON		+5%		+5%	
At Set			ON				ON					
Heat 1		-5%	ON	ON		-5%	ON	ON	-5%		-5%	
Heat 2		MIN	ON	ON		MIN	ON	ON	MIN		MIN	
Heat 3		CLS	ON	ON		CLS	ON	ON	CLS		CLS	

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
At Set		CLS				CLS			CLS		CLS	
Heat 1		CLS	ON	ON		CLS	ON	ON				

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Heat 1	OPN		ON		OPN		ON		OPN		OPN	
Heat 2	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

EQUIPMENT SCHEDULE #17

VAV Box, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Variable Air Volume

DIGITAL OUTPUTS
DO1 - Damper Motor Open
DO2 - Damper Motor Close
DO3 - Fan
DO4 - Heat

ANALOG OUTPUTS
AO1 - Damper Motor

DIGITAL INPUTS
DI1 - Setback Override

ANALOG INPUTS
AI1 - Space Temperature
AI2 - CFM (optional)

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
>76	+20%								+20%			
>75 <=76	+10%								+10%			
>74 <=75	+5%								+5%			
>=71 <=74												
<71 >=70		-5%	ON						-5%			
<70 >=69		MIN	ON	ON					MIN			
<69		CLS	ON	ON					CLS			

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 3	+20%								+20%			
Cool 2	+10%								+10%			
Cool 1	+5%								+5%			
At Set												
Heat 1		-5%	ON						-5%			
Heat 2		MIN	ON	ON					MIN			
Heat 3		CLS	ON	ON					CLS			

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
At Set		CLS							CLS			
Heat 1		CLS	ON	ON								

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Heat 1	OPN								OPN			
Heat 2	OPN		ON	ON					OPN			

Equipment Schedule Sequence of Operations
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EQUIPMENT SCHEDULE #18a

2 VAV Boxes, 1st Unit, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Variable Air Volume

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Damper Motor #1 Open	DI1 - Setback Override #1
DO2 - Damper Motor #1 Close	DI5 - Setback Override #2
DO3 - Fan #1	
DO4 - Heat #1	**ANALOG INPUTS**
DO5 - Damper Motor #2 Open	AI1 - Space Temperature #1
DO6 - Damper Motor #2 Close	AI2 - CFM #1 (optional)
DO7 - Fan #2	AI5 - Space Temperature #2
DO8 - Heat #2	AI6 - CFM #2 (optional)
	ANALOG OUTPUTS
	AO1 - Damper Motor #1
	AO3 - Damper Motor #2
	Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
>76	+20%				+20%				+20%		+20%	
>75 <=76	+10%				+10%				+10%		+10%	
>74 <=75	+5%				+5%				+5%		+5%	
>=71 <=74												
<71 >=70		-5%	ON			-5%	ON		-5%		-5%	
<70 >=69		MIN	ON	ON		MIN	ON	ON	MIN		MIN	
<69		CLS	ON	ON		CLS	ON	ON	CLS		CLS	

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 3	+20%				+20%				+20%		+20%	
Cool 2	+10%				+10%				+10%		+10%	
Cool 1	+5%				+5%				+5%		+5%	
At Set												
Heat 1		-5%	ON			-5%	ON		-5%		-5%	
Heat 2		MIN	ON	ON		MIN	ON	ON	MIN		MIN	
Heat 3		CLS	ON	ON		CLS	ON	ON	CLS		CLS	

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
At Set		CLS				CLS			CLS		CLS	
Heat 1		CLS	ON	ON		CLS	ON	ON				

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Heat 1	OPN				OPN				OPN		OPN	
Heat 1	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #18b

2 VAV Boxes, 2nd Unit, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Variable Air Volume

DIGITAL OUTPUTS

DO1 - Damper Motor #1 Open
DO2 - Damper Motor #1 Close
DO3 - Fan #1
DO4 - Heat #1
DO5 - Damper Motor #2 Open
DO6 - Damper Motor #2 Close
DO7 - Fan #2
DO8 - Heat #2

DIGITAL INPUTS

DI1 - Setback Override #1
DI5 - Setback Override #2

ANALOG INPUTS

AI1 - Space Temperature #1
AI2 - CFM #1 (optional)
AI5 - Space Temperature #2
AI6 - CFM #2 (optional)

ANALOG OUTPUTS

AO1 - Damper Motor #1
AO3 - Damper Motor #2

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
>76	+20%				+20%				+20%		+20%	
>75 <=76	+10%				+10%				+10%		+10%	
>74 <=75	+5%				+5%				+5%		+5%	
>=71 <=74												
<71 >=70		-5%	ON			-5%	ON		-5%		-5%	
<70 >=69		MIN	ON	ON		MIN	ON	ON	MIN		MIN	
<69		CLS	ON	ON		CLS	ON	ON	CLS		CLS	

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 3	+20%				+20%				+20%		+20%	
Cool 2	+10%				+10%				+10%		+10%	
Cool 1	+5%				+5%				+5%		+5%	
At Set												
Heat 1		-5%	ON			-5%	ON		-5%		-5%	
Heat 2		MIN	ON	ON		MIN	ON	ON	MIN		MIN	
Heat 3		CLS	ON	ON		CLS	ON	ON	CLS		CLS	

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
At Set		CLS				CLS			CLS		CLS	
Heat 1		CLS	ON	ON		CLS	ON	ON				

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Heat 1	OPN				OPN				OPN		OPN	
Heat 1	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

EQUIPMENT SCHEDULE #19

VAV Box, Fan Powered, Cooling/Hydronic Heat, 3 Point Floating or Analog Actuators, Constant Air Volume

DIGITAL OUTPUTS
DO1 - Damper Motor Open
DO2 - Damper Motor Close
DO3 - Fan
DO4 - Valve Motor Open
DO5 - Valve Motor Close

DIGITAL INPUTS
DI1 - Setback Override

ANALOG INPUTS
AI1 - Space Temperature
AI2 - CFM (optional)

ANALOG OUTPUTS
AO1 - Damper Motor
AO2 - Valve Motor

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
>76	+20%		ON		CLS				+20%	CLS		
>75 <=76	+10%		ON		CLS				+10%	CLS		
>74 <=75	+5%		ON		CLS				+5%	CLS		
>=71 <=74			ON		CLS					CLS		
<71 >=70		-5%	ON	+5%					-5%	+5%		
<70 >=69		MIN	ON	+10%					MIN	+10%		
<69		CLS	ON	+20%					CLS	+20%		

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
Cool 3	+20%		ON		CLS				+20%	CLS		
Cool 2	+10%		ON		CLS				+10%	CLS		
Cool 1	+5%		ON		CLS				+5%	CLS		
At Set			ON		CLS					CLS		
Heat 1		-5%	ON	+5%					-5%	+5%		
Heat 2		MIN	ON	+10%					MIN	+10%		
Heat 3		CLS	ON	+20%					CLS	+20%		

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
At Set		CLS			CLS				CLS	CLS		
Heat 1		CLS	ON	+5%					CLS	+5%		
Heat 2		CLS	ON	+10%					CLS	+10%		
Heat 3		CLS	ON	+20%					CLS	+20%		

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
Heat 1	OPN		ON		CLS				OPN	CLS		
Heat 2	OPN		ON	OPN					OPN	OPN		

EQUIPMENT SCHEDULE #20

VAV Box, Fan Powered, Cooling/Hydronic Heat, 3 Point Floating or Analog Actuators, Variable Air Volume

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Damper Motor Open	DI1 - Setback Override
DO2 - Damper Motor Close	
DO3 - Fan	**ANALOG INPUTS**
DO4 - Valve Motor Open	AI1 - Space Temperature
DO5 - Valve Motor Close	AI2 - CFM (optional)
	ANALOG OUTPUTS
	AO1 - Damper Motor
	AO2 - Valve Motor

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
>76	+20%				CLS				+20%	CLS		
>75 <=76	+10%				CLS				+10%	CLS		
>74 <=75	+5%				CLS				+5%	CLS		
>=71 <=74					CLS					CLS		
<71 >=70		-5%	ON	+5%					-5%	+5%		
<70 >=69		MIN	ON	+10%					MIN	+10%		
<69		CLS	ON	+20%					CLS	+20%		

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
Cool 3	+20%				CLS				+20%	CLS		
Cool 2	+10%				CLS				+10%	CLS		
Cool 1	+5%				CLS				+5%	CLS		
At Set					CLS					CLS		
Heat 1		-5%	ON	+5%					-5%	+5%		
Heat 2		MIN	ON	+10%					MIN	+10%		
Heat 3		CLS	ON	+20%					CLS	+20%		

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
At Set		CLS			CLS				CLS	CLS		
Heat 1		CLS	ON	+5%					CLS	+5%		
Heat 2		CLS	ON	+10%					CLS	+10%		
Heat 3		CLS	ON	+20%					CLS	+20%		

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
Heat 1	OPN				CLS				OPN	CLS		
Heat 2	OPN		ON	OPN					OPN	OPN		

EQUIPMENT SCHEDULE #21a

4 Fan Coil Units, 1st Unit, Heating Only

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Heat #1	DI3 - Setback Override #2
DO3 - Fan #2	DI5 - Setback Override #3
DO4 - Heat #2	DI7 - Setback Override #4
DO5 - Fan #3	
DO6 - Heat #3	**ANALOG INPUTS**
DO7 - Fan #4	AI1 - Space Temperature #1
DO8 - Heat #4	AI3 - Space Temperature #2
	AI5 - Space Temperature #3
	AI7 - Space Temperature #4

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
>=71	ON		ON		ON		ON					
<71	ON	ON	ON	ON	ON	ON	ON	ON				

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
At Set	ON		ON		ON		ON					
Heat 1	ON	ON	ON	ON	ON	ON	ON	ON				

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
At Set												
Heat 1	ON	ON	ON	ON	ON	ON	ON	ON				

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
Heat 1	ON	ON	ON	ON	ON	ON	ON	ON				

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #21b
4 Fan Coil Units, 2nd Unit, Heating Only

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Heat #1	DI3 - Setback Override #2
DO3 - Fan #2	DI5 - Setback Override #3
DO4 - Heat #2	DI7 - Setback Override #4
DO5 - Fan #3	
DO6 - Heat #3	**ANALOG INPUTS**
DO7 - Fan #4	AI1 - Space Temperature #1
DO8 - Heat #4	AI3 - Space Temperature #2
	AI5 - Space Temperature #3
	AI7 - Space Temperature #4

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
>=71	ON		ON		ON		ON					
<71	ON	ON	ON	ON	ON	ON	ON	ON				

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
At Set	ON		ON		ON		ON					
Heat 1	ON	ON	ON	ON	ON	ON	ON	ON				

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
At Set												
Heat 1	ON	ON	ON	ON	ON	ON	ON	ON				

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
Heat 1	ON	ON	ON	ON	ON	ON	ON	ON				

EQUIPMENT SCHEDULE #21c

4 Fan Coil Units, 3rd Unit, Heating Only

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Heat #1	DI3 - Setback Override #2
DO3 - Fan #2	DI5 - Setback Override #3
DO4 - Heat #2	DI7 - Setback Override #4
DO5 - Fan #3	
DO6 - Heat #3	**ANALOG INPUTS**
DO7 - Fan #4	AI1 - Space Temperature #1
DO8 - Heat #4	AI3 - Space Temperature #2
	AI5 - Space Temperature #3
	AI7 - Space Temperature #4

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
>=71	ON		ON		ON		ON					
<71	ON	ON	ON	ON	ON	ON	ON	ON				

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
At Set	ON		ON		ON		ON					
Heat 1	ON	ON	ON	ON	ON	ON	ON	ON				

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
At Set												
Heat 1	ON	ON	ON	ON	ON	ON	ON	ON				

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
Heat 1	ON	ON	ON	ON	ON	ON	ON	ON				

EQUIPMENT SCHEDULE #21d

4 Fan Coil Units, 4th Unit, Heating Only

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Heat #1	DI3 - Setback Override #2
DO3 - Fan #2	DI5 - Setback Override #3
DO4 - Heat #2	DI7 - Setback Override #4
DO5 - Fan #3	
DO6 - Heat #3	**ANALOG INPUTS**
DO7 - Fan #4	AI1 - Space Temperature #1
DO8 - Heat #4	AI3 - Space Temperature #2
	AI5 - Space Temperature #3
	AI7 - Space Temperature #4

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
>=71	ON		ON		ON		ON					
<71	ON	ON	ON	ON	ON	ON	ON	ON				

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
At Set	ON		ON		ON		ON					
Heat 1	ON	ON	ON	ON	ON	ON	ON	ON				

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
At Set												
Heat 1	ON	ON	ON	ON	ON	ON	ON	ON				

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Heat	Fan	Heat	Fan	Heat	Fan	Heat	AO1	AO2	AO3	AO4
Heat 1	ON	ON	ON	ON	ON	ON	ON	ON				

EQUIPMENT SCHEDULE #22a

4 Fan Coil Units, 1st Unit, Cooling Only

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Cool #1	DI3 - Setback Override #2
DO3 - Fan #2	DI5 - Setback Override #3
DO4 - Cool #2	DI7 - Setback Override #4
DO5 - Fan #3	
DO6 - Cool #3	**ANALOG INPUTS**
DO7 - Fan #4	AI1 - Space Temperature #1
DO8 - Cool #4	AI3 - Space Temperature #2
	AI5 - Space Temperature #3
	AI7 - Space Temperature #4

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Cool	Fan	Cool	Fan	Cool	Fan	Cool	AO1	AO2	AO3	AO4
>74	ON	ON	ON	ON	ON	ON	ON	ON				
<=74	ON		ON		ON		ON					

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Cool	Fan	Cool	Fan	Cool	Fan	Cool	AO1	AO2	AO3	AO4
Cool 1	ON	ON	ON	ON	ON	ON	ON	ON				
At Set	ON		ON		ON		ON					

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Cool	Fan	Cool	Fan	Cool	Fan	Cool	AO1	AO2	AO3	AO4
Cool 1	ON	ON	ON	ON	ON	ON	ON	ON				
At Set												

EQUIPMENT SCHEDULE #22b

4 Fan Coil Units, 2nd Unit, Cooling Only

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Cool #1	DI3 - Setback Override #2
DO3 - Fan #2	DI5 - Setback Override #3
DO4 - Cool #2	DI7 - Setback Override #4
DO5 - Fan #3	
DO6 - Cool #3	**ANALOG INPUTS**
DO7 - Fan #4	AI1 - Space Temperature #1
DO8 - Cool #4	AI3 - Space Temperature #2
	AI5 - Space Temperature #3
	AI7 - Space Temperature #4

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Cool	Fan	Cool	Fan	Cool	Fan	Cool	AO1	AO2	AO3	AO4
>74	ON	ON	ON	ON	ON	ON	ON	ON				
<=74	ON		ON		ON		ON					

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Cool	Fan	Cool	Fan	Cool	Fan	Cool	AO1	AO2	AO3	AO4
Cool 1	ON	ON	ON	ON	ON	ON	ON	ON				
At Set	ON		ON		ON		ON					

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Cool	Fan	Cool	Fan	Cool	Fan	Cool	AO1	AO2	AO3	AO4
Cool 1	ON	ON	ON	ON	ON	ON	ON	ON				
At Set												

EQUIPMENT SCHEDULE #22c

4 Fan Coil Units, 3rd Unit, Cooling Only

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Cool #1	DI3 - Setback Override #2
DO3 - Fan #2	DI5 - Setback Override #3
DO4 - Cool #2	DI7 - Setback Override #4
DO5 - Fan #3	
DO6 - Cool #3	**ANALOG INPUTS**
DO7 - Fan #4	AI1 - Space Temperature #1
DO8 - Cool #4	AI3 - Space Temperature #2
	AI5 - Space Temperature #3
	AI7 - Space Temperature #4
	Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Cool	Fan	Cool	Fan	Cool	Fan	Cool	AO1	AO2	AO3	AO4
>74	ON	ON	ON	ON	ON	ON	ON	ON				
<=74	ON		ON		ON		ON					

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Cool	Fan	Cool	Fan	Cool	Fan	Cool	AO1	AO2	AO3	AO4
Cool 1	ON	ON	ON	ON	ON	ON	ON	ON				
At Set	ON		ON		ON		ON					

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Cool	Fan	Cool	Fan	Cool	Fan	Cool	AO1	AO2	AO3	AO4
Cool 1	ON	ON	ON	ON	ON	ON	ON	ON				
At Set												

EQUIPMENT SCHEDULE #22d

4 Fan Coil Units, 4th Unit, Cooling Only

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Cool #1	DI3 - Setback Override #2
DO3 - Fan #2	DI5 - Setback Override #3
DO4 - Cool #2	DI7 - Setback Override #4
DO5 - Fan #3	
DO6 - Cool #3	**ANALOG INPUTS**
DO7 - Fan #4	AI1 - Space Temperature #1
DO8 - Cool #4	AI3 - Space Temperature #2
	AI5 - Space Temperature #3
	AI7 - Space Temperature #4

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Cool	Fan	Cool	Fan	Cool	Fan	Cool	AO1	AO2	AO3	AO4
>74	ON	ON	ON	ON	ON	ON	ON	ON				
<=74	ON		ON		ON		ON					

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Cool	Fan	Cool	Fan	Cool	Fan	Cool	AO1	AO2	AO3	AO4
Cool 1	ON	ON	ON	ON	ON	ON	ON	ON				
At Set	ON		ON		ON		ON					

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Cool	Fan	Cool	Fan	Cool	Fan	Cool	AO1	AO2	AO3	AO4
Cool 1	ON	ON	ON	ON	ON	ON	ON	ON				
At Set												

EQUIPMENT SCHEDULE #23

Unit Ventilator, Electric Heat, Economizer (Staged & Analog)

DIGITAL OUTPUTS
DO1 - Fan
DO2 - Heat
DO3 - Economizer Min Pos/Pwr Supply
DO4 - Economizer Cooling

ANALOG OUTPUTS
AO1 - Economizer Cooling

DIGITAL INPUTS
DI1 - Setback Override

ANALOG INPUTS
AI1 - Space Temperature
AI2 - Return Air Enthalpy *
AI6 - Mixed Air Temperature *

* If using Analog Economizer

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Heat	M Pos	Econo	DO5	DO6	DO7	DO8	Econo	AO2	AO3	AO4
>76	ON								CLS			
>75 <=76	ON		ON						MIN			
>74 <=75	ON		ON						MIN			
>=71 <=74	ON		ON						MIN			
<71 >=70	ON	ON	ON						MIN			
<70 >=69	ON	ON	ON						MIN			
<69	ON	ON							CLS			

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Heat	M Pos	Econo	DO5	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Econo 1	ON		ON	ON					OPN			
At Set	ON		ON						MIN			
Heat 1	ON	ON	ON						MIN			
Heat 2	ON	ON	ON						MIN			
Heat 3	ON	ON							CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Heat	M Pos	Econo	DO5	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Econo 1	ON		ON	ON					OPN			
At Set									CLS			
Heat 1	ON	ON							CLS			

EQUIPMENT SCHEDULE #23

Unit Ventilator, Electric Heat, Economizer (Staged & Analog)

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Heat	M Pos	Econo	DO5	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Cool 3	ON								CLS			
Cool 2	ON		ON						MIN			
Cool 1	ON		ON						MIN			
At Set	ON		ON						MIN			
Heat 1	ON	ON	ON						MIN			
Heat 2	ON	ON	ON						MIN			
Heat 3	ON	ON							CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Heat	M Pos	Econo	DO5	DO6	DO7	DO8	Econo	AO2	AO3	AO4
At Set									CLS			
Heat 1	ON	ON							CLS			

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Heat	M Pos	Econo	DO5	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Warm 1	ON	ON							CLS			

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Heat	M Pos	Econo	DO5	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Econo 1	ON		ON	ON					OPN			

EQUIPMENT SCHEDULE #24a

2 Unit Ventilators, 1st Unit, Electric Heat, Economizer (Staged & Analog)

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Heat #1	DI5 - Setback Override #2
DO3 - Economizer Min Pos/Pwr Supply #1	
DO4 - Economizer Cooling #1	**ANALOG INPUTS**
DO5 - Fan #2	AI1 - Space Temperature #1
DO6 - Heat #2	AI2 - Return Air Enthalpy #1 *
DO7 - Economizer Min Pos/Pwr Supply #2	AI4 - Mixed Air Temperature #1 *
DO8 - Economizer Cooling #2	AI5 - Space Temperature #2
	AI6 - Return Air Enthalpy #2 *
	AI8 - Mixed Air Temperature #2 *
ANALOG OUTPUTS	
AO1 - Economizer Cooling	* If using Analog Economizer
AO3 - Economizer Cooling	Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Heat	M Pos	Econo	Fan	Heat	M Pos	Econo	Econo	AO2	Econo	AO4
>76	ON				ON				CLS		CLS	
>75 <=76	ON		ON		ON		ON		MIN		MIN	
>74 <=75	ON		ON		ON		ON		MIN		MIN	
>=71 <=74	ON		ON		ON		ON		MIN		MIN	
<71 >=70	ON	ON	ON		ON	ON	ON		MIN		MIN	
<70 >=69	ON	ON	ON		ON	ON	ON		MIN		MIN	
<69	ON	ON			ON	ON			CLS		CLS	

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Heat	M Pos	Econo	Fan	Heat	M Pos	Econo	Econo	AO2	Econo	AO4
Econo 1	ON		ON	ON	ON		ON	ON	OPN		OPN	
At Set	ON		ON		ON		ON		MIN		MIN	
Heat 1	ON	ON	ON		ON	ON	ON		MIN		MIN	
Heat 2	ON	ON	ON		ON	ON	ON		MIN		MIN	
Heat 3	ON	ON			ON	ON			CLS		CLS	

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Heat	M Pos	Econo	Fan	Heat	M Pos	Econo	Econo	AO2	Econo	AO4
Econo 1	ON		ON	ON	ON		ON	ON	OPN		OPN	
At Set									CLS		CLS	
Heat 1	ON	ON			ON	ON			CLS		CLS	

EQUIPMENT SCHEDULE #24a

2 Unit Ventilators, 1st Unit, Electric Heat, Economizer (Staged & Analog)

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Heat	M Pos	Econo	Fan	Heat	M Pos	Econo	Econo	AO2	Econo	AO4
Cool 3	ON				ON				CLS		CLS	
Cool 2	ON		ON		ON		ON		MIN		MIN	
Cool 1	ON		ON		ON		ON		MIN		MIN	
At Set	ON		ON		ON		ON		MIN		MIN	
Heat 1	ON	ON	ON		ON	ON	ON		MIN		MIN	
Heat 2	ON	ON	ON		ON	ON	ON		MIN		MIN	
Heat 3	ON	ON			ON	ON			CLS		CLS	

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Heat	M Pos	Econo	Fan	Heat	M Pos	Econo	Econo	AO2	Econo	AO4
At Set									CLS		CLS	
Heat 1	ON	ON			ON	ON			CLS		CLS	

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Heat	M Pos	Econo	Fan	Heat	M Pos	Econo	Econo	AO2	Econo	AO4
Warm 1	ON	ON			ON	ON			CLS		CLS	

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Heat	M Pos	Econo	Fan	Heat	M Pos	Econo	Econo	AO2	Econo	AO4
Econo 1	ON		ON	ON	ON		ON	ON	OPN		OPN	

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #24b

2 Unit Ventilators, 2nd Unit, Electric Heat, Economizer (Staged & Analog)

DIGITAL OUTPUTS

DO1 - Fan #1
DO2 - Heat #1
DO3 - Economizer Min Pos/Pwr Supply #1
DO4 - Economizer Cooling #1
DO5 - Fan #2
DO6 - Heat #2
DO7 - Economizer Min Pos/Pwr Supply #2
DO8 - Economizer Cooling #2

ANALOG OUTPUTS

AO1 - Economizer Cooling
AO3 - Economizer Cooling

DIGITAL INPUTS

DI1 - Setback Override #1
DI5 - Setback Override #2

ANALOG INPUTS

AI1 - Space Temperature #1
AI2 - Return Air Enthalpy #1 *
AI4 - Mixed Air Temperature #1 *
AI5 - Space Temperature #2
AI6 - Return Air Enthalpy #2 *
AI8 - Mixed Air Temperature #2 *

* If using Analog Economizer

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Heat	M Pos	Econo	Fan	Heat	M Pos	Econo	Econo	AO2	Econo	AO4
>76	ON				ON				CLS		CLS	
>75 <=76	ON		ON		ON		ON		MIN		MIN	
>74 <=75	ON		ON		ON		ON		MIN		MIN	
>=71 <=74	ON		ON		ON		ON		MIN		MIN	
<71 >=70	ON	ON	ON		ON	ON	ON		MIN		MIN	
<70 >=69	ON	ON	ON		ON	ON	ON		MIN		MIN	
<69	ON	ON			ON	ON			CLS		CLS	

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Heat	M Pos	Econo	Fan	Heat	M Pos	Econo	Econo	AO2	Econo	AO4
Econo 1	ON		ON	ON	ON		ON	ON	OPN		OPN	
At Set	ON		ON		ON		ON		MIN		MIN	
Heat 1	ON	ON	ON		ON	ON	ON		MIN		MIN	
Heat 2	ON	ON	ON		ON	ON	ON		MIN		MIN	
Heat 3	ON	ON			ON	ON			CLS		CLS	

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Heat	M Pos	Econo	Fan	Heat	M Pos	Econo	Econo	AO2	Econo	AO4
Econo 1	ON		ON	ON	ON		ON	ON	OPN		OPN	
At Set									CLS		CLS	
Heat 1	ON	ON			ON	ON			CLS		CLS	

EQUIPMENT SCHEDULE #24b

2 Unit Ventilators, 2nd Unit, Electric Heat, Economizer (Staged & Analog)

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Heat	M Pos	Econo	Fan	Heat	M Pos	Econo	Econo	AO2	Econo	AO4
Cool 3	ON				ON				CLS		CLS	
Cool 2	ON		ON		ON		ON		MIN		MIN	
Cool 1	ON		ON		ON		ON		MIN		MIN	
At Set	ON		ON		ON		ON		MIN		MIN	
Heat 1	ON	ON	ON		ON	ON	ON		MIN		MIN	
Heat 2	ON	ON	ON		ON	ON	ON		MIN		MIN	
Heat 3	ON	ON			ON	ON			CLS		CLS	

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Heat	M Pos	Econo	Fan	Heat	M Pos	Econo	Econo	AO2	Econo	AO4
At Set									CLS		CLS	
Heat 1	ON	ON			ON	ON			CLS		CLS	

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Heat	M Pos	Econo	Fan	Heat	M Pos	Econo	Econo	AO2	Econo	AO4
Warm 1	ON	ON			ON	ON			CLS		CLS	

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Heat	M Pos	Econo	Fan	Heat	M Pos	Econo	Econo	AO2	Econo	AO4
Econo 1	ON		ON	ON	ON		ON	ON	OPN		OPN	

EQUIPMENT SCHEDULE #25

Unit Ventilator, Electric Heat, Modulating Economizer, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS	**DIGITAL INPUTS**
DO1 - Fan	DI1 - Setback Override
DO2 - Heat	
DO3 - Economizer Open	**ANALOG INPUTS**
DO4 - Economizer Close	AI1 - Space Temperature
	AI2 - Return Air Enthalpy
ANALOG OUTPUTS	AI6 - Mixed Air Temperature
AO1 - Economizer Actuator	

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Heat	Dm Op	Dm Cl	DO5	DO6	DO7	DO8	Econo	AO2	AO3	AO4
>76	ON			CLS					CLS			
>75 <=76	ON		MIN						MIN			
>74 <=75	ON		MIN						MIN			
>=71 <=74	ON		MIN						MIN			
<71 >=70	ON	ON	MIN						MIN			
<70 >=69	ON	ON	MIN						MIN			
<69	ON	ON		CLS					CLS			

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Temp	Fan	Heat	Dm Op	Dm Cl	DO5	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Econo 1	ON		OPN						OPN			
At Set	ON		MIN						MIN			
Heat 1	ON	ON	MIN						MIN			
Heat 2	ON	ON	MIN						MIN			
Heat 3	ON	ON		CLS					CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Temp	Fan	Heat	Dm Op	Dm Cl	DO5	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Econo 1	ON		OPN						OPN			
At Set				CLS					CLS			
Heat 1	ON	ON		CLS					CLS			

EQUIPMENT SCHEDULE #25

Unit Ventilator, Electric Heat, Modulating Economizer, 3 Point Floating or Analog Actuator

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Temp	Fan	Heat	Dm Op	Dm Cl	DO5	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Cool 3	ON			CLS					CLS			
Cool 2	ON		MIN						MIN			
Cool 1	ON		MIN						MIN			
At Set	ON		MIN						MIN			
Heat 1	ON	ON	MIN						MIN			
Heat 2	ON	ON	MIN						MIN			
Heat 3	ON	ON		CLS					CLS			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Temp	Fan	Heat	Dm Op	Dm Cl	DO5	DO6	DO7	DO8	Econo	AO2	AO3	AO4
At Set				CLS					CLS			
Heat 1	ON	ON		CLS					CLS			

WARMUP MODE CONTROL SEQUENCE

Temp	Fan	Heat	Dm Op	Dm Cl	DO5	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Warm 1	ON	ON		CLS					CLS			

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Temp	Fan	Heat	Dm Op	Dm Cl	DO5	DO6	DO7	DO8	Econo	AO2	AO3	AO4
Econo 1	ON		OPN						OPN			

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #26a

2 Unit Ventilators, 1st Unit, Electric Heat, Modulating Economizer, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS
DO1 - Fan #1
DO2 - Heat #1
DO3 - Economizer #1 Open
DO4 - Economizer #1 Close
DO5 - Fan #2
DO6 - Heat #2
DO7 - Economizer #2 Open
DO8 - Economizer #2 Close

ANALOG OUTPUTS
AO1 - Economizer Actuator #1
AO3 - Economizer Actuator #2

DIGITAL INPUTS
DI1 - Setback Override #1
DI5 - Setback Override #2

ANALOG INPUTS
AI1 - Space Temperature #1
AI2 - Return Air Enthalpy #1
AI4 - Mixed Air Temperature #1
AI5 - Space Temperature #2
AI6 - Return Air Enthalpy #2
AI8 - Mixed Air Temperature #2

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Econo	AO2	Econo	AO4
>76	ON			CLS	ON			CLS	CLS		CLS	
>75 <=76	ON		MIN		ON		MIN		MIN		MIN	
>74 <=75	ON		MIN		ON		MIN		MIN		MIN	
>=71 <=74	ON		MIN		ON		MIN		MIN		MIN	
<71 >=70	ON	ON	MIN		ON	ON	MIN		MIN		MIN	
<70 >=69	ON	ON	MIN		ON	ON	MIN		MIN		MIN	
<69	ON	ON		CLS	ON	ON		CLS	CLS		CLS	

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Temp	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Econo	AO2	Econo	AO4
Econo 1	ON		OPN		ON		OPN		OPN		OPN	
At Set	ON		MIN		ON		MIN		MIN		MIN	
Heat 1	ON	ON	MIN		ON	ON	MIN		MIN		MIN	
Heat 2	ON	ON	MIN		ON	ON	MIN		MIN		MIN	
Heat 3	ON	ON		CLS	ON	ON		CLS	CLS		CLS	

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Temp	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Econo	AO2	Econo	AO4
Econo 1	ON		OPN		ON		OPN		OPN		OPN	
At Set				CLS				CLS	CLS		CLS	
Heat 1	ON	ON		CLS	ON	ON		CLS	CLS		CLS	

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #26a

2 Unit Ventilators, 1st Unit, Electric Heat, Modulating Economizer, 3 Point Floating or Analog Actuator

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Temp	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Econo	AO2	Econo	AO4
Cool 3	ON			CLS	ON			CLS	CLS		CLS	
Cool 2	ON		MIN		ON		MIN		MIN		MIN	
Cool 1	ON		MIN		ON		MIN		MIN		MIN	
At Set	ON		MIN		ON		MIN		MIN		MIN	
Heat 1	ON	ON	MIN		ON	ON	MIN		MIN		MIN	
Heat 2	ON	ON	MIN		ON	ON	MIN		MIN		MIN	
Heat 3	ON	ON		CLS	ON	ON		CLS	CLS		CLS	

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Temp	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Econo	AO2	Econo	AO4
At Set				CLS				CLS	CLS		CLS	
Heat 1	ON	ON		CLS	ON	ON		CLS	CLS		CLS	

WARMUP MODE CONTROL SEQUENCE

Temp	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Econo	AO2	Econo	AO4
Warm 1	ON	ON		CLS	ON	ON		CLS	CLS		CLS	

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Temp	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Econo	AO2	Econo	AO4
Econo 1	ON		OPN		ON		OPN		OPN		OPN	

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #26b

2 Unit Ventilators, 2nd Unit, Electric Heat, Modulating Economizer, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Heat #1	DI5 - Setback Override #2
DO3 - Economizer #1 Open	
DO4 - Economizer #1 Close	**ANALOG INPUTS**
DO5 - Fan #2	AI1 - Space Temperature #1
DO6 - Heat #2	AI2 - Return Air Enthalpy #1
DO7 - Economizer #2 Open	AI4 - Mixed Air Temperature #1
DO8 - Economizer #2 Close	AI5 - Space Temperature #2
	AI6 - Return Air Enthalpy #2
ANALOG OUTPUTS	AI8 - Mixed Air Temperature #2
AO1 - Economizer Actuator #1	
AO3 - Economizer Actuator #2	Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Econo	AO2	Econo	AO4
>76	ON			CLS	ON			CLS	CLS		CLS	
>75 <=76	ON		MIN		ON		MIN		MIN		MIN	
>74 <=75	ON		MIN		ON		MIN		MIN		MIN	
>=71 <=74	ON		MIN		ON		MIN		MIN		MIN	
<71 >=70	ON	ON	MIN		ON	ON	MIN		MIN		MIN	
<70 >=69	ON	ON	MIN		ON	ON	MIN		MIN		MIN	
<69	ON	ON		CLS	ON	ON		CLS	CLS		CLS	

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Temp	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Econo	AO2	Econo	AO4
Econo 1	ON		OPN		ON		OPN		OPN		OPN	
At Set	ON		MIN		ON		MIN		MIN		MIN	
Heat 1	ON	ON	MIN		ON	ON	MIN		MIN		MIN	
Heat 2	ON	ON	MIN		ON	ON	MIN		MIN		MIN	
Heat 3	ON	ON		CLS	ON	ON		CLS	CLS		CLS	

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Temp	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Econo	AO2	Econo	AO4
Econo 1	ON		OPN		ON		OPN		OPN		OPN	
At Set				CLS				CLS	CLS		CLS	
Heat 1	ON	ON		CLS	ON	ON		CLS	CLS		CLS	

EQUIPMENT SCHEDULE #26b

2 Unit Ventilators, 2nd Unit, Electric Heat, Modulating Economizer, 3 Point Floating or Analog Actuator

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Temp	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Econo	AO2	Econo	AO4
Cool 3	ON			CLS	ON			CLS	CLS		CLS	
Cool 2	ON		MIN		ON		MIN		MIN		MIN	
Cool 1	ON		MIN		ON		MIN		MIN		MIN	
At Set	ON		MIN		ON		MIN		MIN		MIN	
Heat 1	ON	ON	MIN		ON	ON	MIN		MIN		MIN	
Heat 2	ON	ON	MIN		ON	ON	MIN		MIN		MIN	
Heat 3	ON	ON		CLS	ON	ON		CLS	CLS		CLS	

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Temp	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Econo	AO2	Econo	AO4
At Set				CLS				CLS	CLS		CLS	
Heat 1	ON	ON		CLS	ON	ON		CLS	CLS		CLS	

WARMUP MODE CONTROL SEQUENCE

Temp	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Econo	AO2	Econo	AO4
Warm 1	ON	ON		CLS	ON	ON		CLS	CLS		CLS	

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Temp	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Econo	AO2	Econo	AO4
Econo 1	ON		OPN		ON		OPN		OPN		OPN	

Equipment Schedule Sequence of Operations
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EQUIPMENT SCHEDULE #27

Unit Ventilator, 2 Cool, Hydronic Heat, 3 Point Floating or Analog Actuator, Economizer

DIGITAL OUTPUTS
DO1 - Fan
DO2 - Valve Motor Open
DO3 - Valve Motor Close
DO4 - Economizer Min Pos/Pwr Supply
DO5 - Economizer Cooling
DO6 - Cooling Stage #1
DO7 - Cooling Stage #2

ANALOG OUTPUTS
AO1 - Valve Motor

DIGITAL INPUTS
DI1 - Setback Override

ANALOG INPUTS
AI1 - Space Temperature
AI2 - Return Air Enthalpy

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Vlv Op	Vlv Cl	M Pos	Econo	Cool 1	Cool 2	DO8	Valve	AO2	AO3	AO4
>76	ON		CLS			ON	ON		CLS			
>75 <=76	ON		CLS	ON		ON	ON		CLS			
>74 <=75	ON		CLS	ON		ON			CLS			
>=71 <=74	ON		CLS	ON					CLS			
<71 >=70	ON	+5%		ON					+5%			
<70 >=69	ON	+10%		ON					+10%			
<69	ON	+20%							+20%			

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Temp	Fan	Vlv Op	Vlv Cl	M Pos	Econo	Cool 1	Cool 2	DO8	Valve	AO2	AO3	AO4
Econo 3	ON		CLS	ON	ON	ON	ON		CLS			
Econo 2	ON		CLS	ON	ON	ON			CLS			
Econo 1	ON		CLS	ON	ON				CLS			
At Set	ON		CLS	ON					CLS			
Heat 1	ON	+5%		ON					+5%			
Heat 2	ON	+10%		ON					+10%			
Heat 3	ON	+20%							+20%			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Temp	Fan	Vlv Op	Vlv Cl	M Pos	Econo	Cool 1	Cool 2	DO8	Valve	AO2	AO3	AO4
Econo 3	ON		CLS	ON	ON	ON	ON		CLS			
Econo 2	ON		CLS	ON	ON	ON			CLS			
Econo 1	ON		CLS	ON	ON				CLS			
At Set			CLS						CLS			
Heat 1	ON	+5%							+5%			
Heat 2	ON	+10%							+10%			
Heat 3	ON	+20%							+20%			

EQUIPMENT SCHEDULE #27

Unit Ventilator, 2 Cool, Hydronic Heat, 3 Point Floating or Analog Actuator, Economizer

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Temp	Fan	Vlv Op	Vlv Cl	M Pos	Econo	Cool 1	Cool 2	DO8	Valve	AO2	AO3	AO4
Cool 3	ON		CLS			ON	ON		CLS			
Cool 2	ON		CLS	ON		ON	ON		CLS			
Cool 1	ON		CLS	ON		ON			CLS			
At Set	ON		CLS	ON					CLS			
Heat 1	ON	+5%		ON					+5%			
Heat 2	ON	+10%		ON					+10%			
Heat 3	ON	+20%							+20%			

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Temp	Fan	Vlv Op	Vlv Cl	M Pos	Econo	Cool 1	Cool 2	DO8	Valve	AO2	AO3	AO4
Cool 2	ON		CLS			ON	ON		CLS			
Cool 1	ON		CLS			ON			CLS			
At Set			CLS						CLS			
Heat 1	ON	+5%							+5%			
Heat 2	ON	+10%							+10%			
Heat 3	ON	+20%							+20%			

WARMUP MODE CONTROL SEQUENCE

Temp	Fan	Vlv Op	Vlv Cl	M Pos	Econo	Cool 1	Cool 2	DO8	Valve	AO2	AO3	AO4
Warm 1	ON	OPN							OPN			

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Temp	Fan	Vlv Op	Vlv Cl	M Pos	Econo	Cool 1	Cool 2	DO8	Valve	AO2	AO3	AO4
Econo 1	ON		CLS	ON	ON				CLS			

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #28

Unit Ventilator, 2 Cool, Hydronic Heat, Mod Economizer, 3 Point Floating or Analog Actuators

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan	DI1 - Setback Override
DO2 - Valve Motor Open	
DO3 - Valve Motor Close	**ANALOG INPUTS**
DO4 - Economizer Open	AI1 - Space Temperature
DO5 - Economizer Close	AI2 - Return Air Enthalpy
DO6 - Cooling Stage #1	AI6 - Mixed Air Temperature
DO7 - Cooling Stage #2	
ANALOG OUTPUTS	
AO1 - Valve Motor	
AO2 - Economizer Actuator	

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Vlv Op	Vlv Cl	Dm Op	Dm Cl	Cool 1	Cool 2	DO8	Valve	Econo	AO3	AO4
>76	ON		CLS		CLS	ON	ON		CLS	CLS		
>75 <=76	ON		CLS	MIN		ON	ON		CLS	MIN		
>74 <=75	ON		CLS	MIN		ON			CLS	MIN		
>=71 <=74	ON		CLS	MIN					CLS	MIN		
<71 >=70	ON	+5%		MIN					+5%	MIN		
<70 >=69	ON	+10%		MIN					+10%	MIN		
<69	ON	+20%			CLS				+20%	CLS		

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Temp	Fan	Vlv Op	Vlv Cl	Dm Op	Dm Cl	Cool 1	Cool 2	DO8	Valve	Econo	AO3	AO4
Econo 3	ON		CLS	OPN		ON	ON		CLS	OPN		
Econo 2	ON		CLS	OPN		ON			CLS	OPN		
Econo 1	ON		CLS	OPN					CLS	OPN		
At Set	ON		CLS	MIN					CLS	MIN		
Heat 1	ON	+5%		MIN					+5%	MIN		
Heat 2	ON	+10%		MIN					+10%	MIN		
Heat 3	ON	+20%			CLS				+20%	CLS		

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Temp	Fan	Vlv Op	Vlv Cl	Dm Op	Dm Cl	Cool 1	Cool 2	DO8	Valve	Econo	AO3	AO4
Econo 3	ON		CLS	OPN		ON	ON		CLS	OPN		
Econo 2	ON		CLS	OPN		ON			CLS	OPN		
Econo 1	ON		CLS	OPN					CLS	OPN		
At Set			CLS		CLS				CLS	CLS		
Heat 1	ON	+5%			CLS				+5%	CLS		
Heat 2	ON	+10%			CLS				+10%	CLS		
Heat 3	ON	+20%			CLS				+20%	CLS		

EQUIPMENT SCHEDULE #28

Unit Ventilator, 2 Cool, Hydronic Heat, Mod Economizer, 3 Point Floating or Analog Actuators

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Temp	Fan	Vlv Op	Vlv Cl	Dm Op	Dm Cl	Cool 1	Cool 2	DO8	Valve	Econo	AO3	AO4
Cool 3	ON		CLS		CLS	ON	ON		CLS	CLS		
Cool 2	ON		CLS	MIN		ON	ON		CLS	MIN		
Cool 1	ON		CLS	MIN		ON			CLS	MIN		
At Set	ON		CLS	MIN					CLS	MIN		
Heat 1	ON	+5%		MIN					+5%	MIN		
Heat 2	ON	+10%		MIN					+10%	MIN		
Heat 3	ON	+20%			CLS				+20%	CLS		

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Temp	Fan	Vlv Op	Vlv Cl	Dm Op	Dm Cl	Cool 1	Cool 2	DO8	Valve	Econo	AO3	AO4
Cool 2	ON		CLS		CLS	ON	ON		CLS	CLS		
Cool 1	ON		CLS		CLS	ON			CLS	CLS		
At Set			CLS		CLS				CLS	CLS		
Heat 1	ON	+5%			CLS				+5%	CLS		
Heat 2	ON	+10%			CLS				+10%	CLS		
Heat 3	ON	+20%			CLS				+20%	CLS		

WARMUP MODE CONTROL SEQUENCE

Temp	Fan	Vlv Op	Vlv Cl	Dm Op	Dm Cl	Cool 1	Cool 2	DO8	Valve	Econo	AO3	AO4
Warm 1	ON	OPN			CLS				OPN	CLS		

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Temp	Fan	Vlv Op	Vlv Cl	Dm Op	Dm Cl	Cool 1	Cool 2	DO8	Valve	Econo	AO3	AO4
Econo 1	ON	CLS		OPN					CLS	OPN		

EQUIPMENT SCHEDULE #29

Air Handling Unit, 4 Stage Heat, Outdoor Reset

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan	DI1 - Setback Override
DO2 - Heat Stage 1	
DO3 - Heat Stage 2	**ANALOG INPUTS**
DO4 - Heat Stage 3	AI1 - Controlled Temperature
DO5 - Heat Stage 4	

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Heat 1	Heat 2	Heat 3	Heat 4	DO6	DO7	DO8	AO1	AO2	AO3	AO4
>=108	ON											
<108 >=106	ON	ON										
<106 >=104	ON	ON	ON									
<104 >=102	ON	ON	ON	ON								
<102	ON	ON	ON	ON	ON							

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Heat 1	Heat 2	Heat 3	Heat 4	DO6	DO7	DO8	AO1	AO2	AO3	AO4
At Set	ON											
Heat 1	ON	ON										
Heat 2	ON	ON	ON									
Heat 3	ON	ON	ON	ON								
Heat 4	ON	ON	ON	ON	ON							

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Heat 1	Heat 2	Heat 3	Heat 4	DO6	DO7	DO8	AO1	AO2	AO3	AO4
At Set												
Heat 1	ON	ON										
Heat 2	ON	ON	ON									
Heat 3	ON	ON	ON	ON								
Heat 4	ON	ON	ON	ON	ON							

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Heat 1	Heat 2	Heat 3	Heat 4	DO6	DO7	DO8	AO1	AO2	AO3	AO4
Warm 1	ON	ON	ON	ON	ON							

EQUIPMENT SCHEDULE #30

Air Handling Unit, Hydronic Heat, 3 Point Floating or Analog Actuator, Outdoor Reset

DIGITAL OUTPUTS
DO1 - Fan
DO2 - Valve Motor Open
DO3 - Valve Motor Close

ANALOG OUTPUTS
AO1 - Valve Motor

DIGITAL INPUTS
DI1 - Setback Override

ANALOG INPUTS
AI1 - Controlled Temperature

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Vlv Op	Vlv Cl	DO4	DO5	DO6	DO7	DO8	Valve	AO2	AO3	AO4
>=112	ON		CLS						CLS			
<112 >=110	ON		-5%						-5%			
<110 >=108	ON											
<108 >=106	ON	+5%							+5%			
<106 >=104	ON	+10%							+10%			
<104	ON	+20%							+20%			

OCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Vlv Op	Vlv Cl	DO4	DO5	DO6	DO7	DO8	Valve	AO2	AO3	AO4
Cool 2	ON		CLS						CLS			
Cool 1	ON		-5%						-5%			
At Set	ON											
Heat 1	ON	+5%							+5%			
Heat 2	ON	+10%							+10%			
Heat 3	ON	+20%							+20%			

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Fan	Vlv Op	Vlv Cl	DO4	DO5	DO6	DO7	DO8	Valve	AO2	AO3	AO4
At Set			CLS						CLS			
Heat 1	ON	+5%							+5%			
Heat 2	ON	+10%							+10%			
Heat 3	ON	+20%							+20%			

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Vlv Op	Vlv Cl	DO4	DO5	DO6	DO7	DO8	Valve	AO2	AO3	AO4
Warm 1	ON	OPN							OPN			

Equipment Schedule Sequence of Operations
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EQUIPMENT SCHEDULE #31a

2 Air Handling Units, 1st Unit, 3 Stage Heat, Modulating Economizer, Modulating Cooling

DIGITAL OUTPUTS
DO1 - Fan #1
DO2 - Heat Stage 1 - Unit #1
DO3 - Heat Stage 2 - Unit #1
DO4 - Heat Stage 3 - Unit #1
DO5 - Fan #2
DO6 - Heat Stage 1 - Unit #2
DO7 - Heat Stage 2 - Unit #2
DO8 - Heat Stage 3 - Unit #2

ANALOG OUTPUTS
AO1 - Economizer Actuator #1
AO2 - Cooling Valve Motor #1
AO3 - Economizer Actuator #2
AO4 - Cooling Valve Motor #2

DIGITAL INPUTS
DI1 - Setback Override #1
DI5 - Setback Override #2

ANALOG INPUTS
AI1 - Space Temperature #1
AI2 - Return Air Enthalpy #1
AI4 - Mixed Air Temperature #1
AI5 - Space Temperature #2
AI6 - Return Air Enthalpy #2
AI8 - Mixed Air Temperature #2

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Heat 1	Heat 2	Heat 3	Fan	Heat 1	Heat 2	Heat 3	Econo	Cool	Econo	Cool
>77	ON				ON				CLS	OPN	CLS	OPN
>76 <=77	ON				ON				CLS	+20%	CLS	+20%
>75 <=76	ON				ON				MIN	+10%	MIN	+10%
>74 <=75	ON				ON				MIN	+5%	MIN	+5%
>=71 <=74	ON				ON				MIN		MIN	
<71 >=70	ON	ON			ON	ON			MIN	-5%	MIN	-5%
<70 >=69	ON	ON	ON		ON	ON	ON		MIN	CLS	MIN	CLS
<69	ON	ON	ON	ON	ON	ON	ON	ON	CLS	CLS	CLS	CLS

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Heat 1	Heat 2	Heat 3	Fan	Heat 1	Heat 2	Heat 3	Econo	Cool	Econo	Cool
Econo 4	ON				ON				OPN	+10%	OPN	+10%
Econo 3	ON				ON				OPN	+5%	OPN	+5%
Econo 2	ON				ON				OPN		OPN	
Econo 1	ON				ON				OPN	-5%	OPN	-5%
At Set	ON				ON				MIN	CLS	MIN	CLS
Heat 1	ON	ON			ON	ON			MIN	CLS	MIN	CLS
Heat 2	ON	ON	ON		ON	ON	ON		MIN	CLS	MIN	CLS
Heat 3	ON	ON	ON	ON	ON	ON	ON	ON	CLS	CLS	CLS	CLS

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Heat 1	Heat 2	Heat 3	Fan	Heat 1	Heat 2	Heat 3	Econo	Cool	Econo	Cool
Econo 4	ON				ON				OPN	+10%	OPN	+10%
Econo 3	ON				ON				OPN	+5%	OPN	+5%
Econo 2	ON				ON				OPN		OPN	
Econo 1	ON				ON				OPN	-5%	OPN	-5%
At Set									CLS	CLS	CLS	CLS
Heat 1	ON	ON			ON	ON			CLS	CLS	CLS	CLS
Heat 2	ON	ON	ON		ON	ON	ON		CLS	CLS	CLS	CLS
Heat 3	ON	ON	ON	ON	ON	ON	ON	ON	CLS	CLS	CLS	CLS

EQUIPMENT SCHEDULE #31a

2 Air Handling Units, 1st Unit, 3 Stage Heat, Modulating Economizer, Modulating Cooling

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Heat 1	Heat 2	Heat 3	Fan	Heat 1	Heat 2	Heat 3	Econo	Cool	Econo	Cool
Cool 4	ON				ON				CLS	OPN	CLS	OPN
Cool 3	ON				ON				CLS	+20%	CLS	+20%
Cool 2	ON				ON				MIN	+10%	MIN	+10%
Cool 1	ON				ON				MIN	+5%	MIN	+5%
At Set	ON				ON				MIN		MIN	
Heat 1	ON	ON			ON	ON			MIN	-5%	MIN	-5%
Heat 2	ON	ON	ON		ON	ON	ON		MIN	CLS	MIN	CLS
Heat 3	ON	ON	ON	ON	ON	ON	ON	ON	CLS	CLS	CLS	CLS

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Heat 1	Heat 2	Heat 3	Fan	Heat 1	Heat 2	Heat 3	Econo	Cool	Econo	Cool
Cool 4	ON				ON				CLS	OPN	CLS	OPN
Cool 3	ON				ON				CLS	+20%	CLS	+20%
Cool 2	ON				ON				CLS	+10%	CLS	+10%
Cool 1	ON				ON				CLS	+5%	CLS	+5%
At Set									CLS	CLS	CLS	CLS
Heat 1	ON	ON			ON	ON			CLS	CLS	CLS	CLS
Heat 2	ON	ON	ON		ON	ON	ON		CLS	CLS	CLS	CLS
Heat 3	ON	ON	ON	ON	ON	ON	ON	ON	CLS	CLS	CLS	CLS

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Heat 1	Heat 2	Heat 3	Fan	Heat 1	Heat 2	Heat 3	Econo	Cool	Econo	Cool
Warm 1	ON	ON	ON	ON	ON	ON	ON	ON	CLS	CLS	CLS	CLS

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Heat 1	Heat 2	Heat 3	Fan	Heat 1	Heat 2	Heat 3	Econo	Cool	Econo	Cool
Econo 1	ON				ON				OPN	CLS	OPN	CLS

EQUIPMENT SCHEDULE #31b

2 Air Handling Units, 2nd Unit, 3 Stage Heat, Modulating Economizer, Modulating Cooling

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Fan #1	DI1 - Setback Override #1
DO2 - Heat Stage 1 - Unit #1	DI5 - Setback Override #2
DO3 - Heat Stage 2 - Unit #1	
DO4 - Heat Stage 3 - Unit #1	**ANALOG INPUTS**
DO5 - Fan #2	AI1 - Space Temperature #1
DO6 - Heat Stage 1 - Unit #2	AI2 - Return Air Enthalpy #1
DO7 - Heat Stage 2 - Unit #2	AI4 - Mixed Air Temperature #1
DO8 - Heat Stage 3 - Unit #2	AI5 - Space Temperature #2
	AI6 - Return Air Enthalpy #2
ANALOG OUTPUTS	AI8 - Mixed Air Temperature #2
AO1 - Economizer Actuator #1	
AO2 - Cooling Valve Motor #1	
AO3 - Economizer Actuator #2	
AO4 - Cooling Valve Motor #2	Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Heat 1	Heat 2	Heat 3	Fan	Heat 1	Heat 2	Heat 3	Econo	Cool	Econo	Cool
>77	ON				ON				CLS	OPN	CLS	OPN
>76 <=77	ON				ON				CLS	+20%	CLS	+20%
>75 <=76	ON				ON				MIN	+10%	MIN	+10%
>74 <=75	ON				ON				MIN	+5%	MIN	+5%
>=71 <=74	ON				ON				MIN		MIN	
<71 >=70	ON	ON			ON	ON			MIN	-5%	MIN	-5%
<70 >=69	ON	ON	ON		ON	ON	ON		MIN	CLS	MIN	CLS
<69	ON	ON	ON	ON	ON	ON	ON	ON	CLS	CLS	CLS	CLS

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Heat 1	Heat 2	Heat 3	Fan	Heat 1	Heat 2	Heat 3	Econo	Cool	Econo	Cool
Econo 4	ON				ON				OPN	+10%	OPN	+10%
Econo 3	ON				ON				OPN	+5%	OPN	+5%
Econo 2	ON				ON				OPN		OPN	
Econo 1	ON				ON				OPN	-5%	OPN	-5%
At Set	ON				ON				MIN	CLS	MIN	CLS
Heat 1	ON	ON			ON	ON			MIN	CLS	MIN	CLS
Heat 2	ON	ON	ON		ON	ON	ON		MIN	CLS	MIN	CLS
Heat 3	ON	ON	ON	ON	ON	ON	ON	ON	CLS	CLS	CLS	CLS

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Heat 1	Heat 2	Heat 3	Fan	Heat 1	Heat 2	Heat 3	Econo	Cool	Econo	Cool
Econo 4	ON				ON				OPN	+10%	OPN	+10%
Econo 3	ON				ON				OPN	+5%	OPN	+5%
Econo 2	ON				ON				OPN		OPN	
Econo 1	ON				ON				OPN	-5%	OPN	-5%
At Set									CLS	CLS	CLS	CLS
Heat 1	ON	ON			ON	ON			CLS	CLS	CLS	CLS
Heat 2	ON	ON	ON		ON	ON	ON		CLS	CLS	CLS	CLS
Heat 3	ON	ON	ON	ON	ON	ON	ON	ON	CLS	CLS	CLS	CLS

EQUIPMENT SCHEDULE #31b

2 Air Handling Units, 2nd Unit, 3 Stage Heat, Modulating Economizer, Modulating Cooling

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Heat 1	Heat 2	Heat 3	Fan	Heat 1	Heat 2	Heat 3	Econo	Cool	Econo	Cool
Cool 4	ON				ON				CLS	OPN	CLS	OPN
Cool 3	ON				ON				CLS	+20%	CLS	+20%
Cool 2	ON				ON				MIN	+10%	MIN	+10%
Cool 1	ON				ON				MIN	+5%	MIN	+5%
At Set	ON				ON				MIN		MIN	
Heat 1	ON	ON			ON	ON			MIN	-5%	MIN	-5%
Heat 2	ON	ON	ON		ON	ON	ON		MIN	CLS	MIN	CLS
Heat 3	ON	ON	ON	ON	ON	ON	ON	ON	CLS	CLS	CLS	CLS

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Heat 1	Heat 2	Heat 3	Fan	Heat 1	Heat 2	Heat 3	Econo	Cool	Econo	Cool
Cool 4	ON				ON				CLS	OPN	CLS	OPN
Cool 3	ON				ON				CLS	+20%	CLS	+20%
Cool 2	ON				ON				CLS	+10%	CLS	+10%
Cool 1	ON				ON				CLS	+5%	CLS	+5%
At Set									CLS	CLS	CLS	CLS
Heat 1	ON	ON			ON	ON			CLS	CLS	CLS	CLS
Heat 2	ON	ON	ON		ON	ON	ON		CLS	CLS	CLS	CLS
Heat 3	ON	ON	ON	ON	ON	ON	ON	ON	CLS	CLS	CLS	CLS

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Heat 1	Heat 2	Heat 3	Fan	Heat 1	Heat 2	Heat 3	Econo	Cool	Econo	Cool
Warm 1	ON	ON	ON	ON	ON	ON	ON	ON	CLS	CLS	CLS	CLS

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Heat 1	Heat 2	Heat 3	Fan	Heat 1	Heat 2	Heat 3	Econo	Cool	Econo	Cool
Econo 1	ON				ON				OPN	CLS	OPN	CLS

EQUIPMENT SCHEDULE #32

Hydronic Heat Pump Loop Control, 1 Stage Heat, 4 Stage Cooling, 2 Loop Pumps

DIGITAL OUTPUTS
DO1 - Loop Pump #1
DO2 - Loop Pump #2
DO3 - Heat
DO4 - Cool Stage #1
DO5 - Cool Stage #2
DO6 - Cool Stage #3
DO7 - Cool Stage #4
DO8 - Alarm Output

DIGITAL INPUTS
DI1 - Setback Override
DI2 - Loop Flow Switch

ANALOG INPUTS
AI1 - Loop Temperature

ANALOG OUTPUTS
AO1 - Valve Motor / Heating

DEFAULT MODE CONTROL SEQUENCE

Temp	Pmp 1	Pmp 2	Heat	Cool 1	Cool 2	Cool 3	Cool 4	Alarm	Valve	AO2	AO3	AO4
>100	ON			ON	ON	ON	ON	ON	CLS			
>85 <=100	ON			ON	ON	ON	ON		CLS			
>83 <=85	ON			ON	ON				CLS			
>81 <=83	ON			ON					-5%			
>=65 <=81	ON											
<65 >=63	ON		ON						+5%			
<63 >=61	ON		ON						+10%			
<61 >=50	ON		ON						+20%			
<50	ON		ON					ON	OPN			

OCCUPIED AND UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Pmp 1	Pmp 2	Heat	Cool 1	Cool 2	Cool 3	Cool 4	Alarm	Valve	AO2	AO3	AO4
Cool 4	ON			ON	ON	ON	ON		CLS			
Cool 3	ON			ON	ON	ON			CLS			
Cool 2	ON			ON	ON				CLS			
Cool 1	ON			ON					-5%			
At Set	ON											
Heat 1	ON		ON						+5%			
Heat 2	ON		ON						+10%			
Heat 3	ON		ON						+20%			

Note: If DI2 is OFF for more than 10 seconds in default mode, the RSC will shutdown Pump 1, start Pump 2, shutdown all heating and cooling stages, and activate the Alarm output. If flow is not restored within an additional 20 seconds, Pump 2 will also be shut down and this condition will remain until power is cycled to the RSC. If flow is restored within 20 seconds using Pump 2, the RSC will return to normal control using Pump 2. This feature is included on all EPROMS Version 4.0f and later.

EQUIPMENT SCHEDULE #33

Chiller, 4 Stage Cooling, 2 Chill Water Pumps

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Loop Pump #1	DI1 - Setback Override
DO2 - Loop Pump #2	DI2 - Loop Flow Switch
DO3 - Cool Stage #1	
DO4 - Cool Stage #2	**ANALOG INPUTS**
DO5 - Cool Stage #3	AI1 - Loop Temperature
DO6 - Cool Stage #4	

DEFAULT MODE CONTROL SEQUENCE

Temp	Pmp 1	Pmp 2	Cool 1	Cool 2	Cool 3	Cool 4	DO7	DO8	AO1	AO2	AO3	AO4
>58	ON		ON	ON	ON	ON						
>57 <=58	ON		ON	ON	ON							
>56 <=57	ON		ON	ON								
>55 <=56	ON		ON									
<=55	ON											

OCCUPIED MODE CONTROL SEQUENCE

Stage	Pmp 1	Pmp 2	Cool 1	Cool 2	Cool 3	Cool 4	DO7	DO8	AO1	AO2	AO3	AO4
Cool 4	ON		ON	ON	ON	ON						
Cool 3	ON		ON	ON	ON							
Cool 2	ON		ON	ON								
Cool 1	ON		ON									
At Set	ON											

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Pmp 1	Pmp 2	Cool 1	Cool 2	Cool 3	Cool 4	DO7	DO8	AO1	AO2	AO3	AO4
	ALL	OFF										

EQUIPMENT SCHEDULE #34

Not Currently Used

Equipment Schedule Sequence of Operations
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EQUIPMENT SCHEDULE #35

Boiler, 4 Stage, Outdoor Reset

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Pump	DI1 - Setback Override
DO2 - Heat Stage 1	
DO3 - Heat Stage 2	**ANALOG INPUTS**
DO4 - Heat Stage 3	AI1 - Controlled Temperature
DO5 - Heat Stage 4	

DEFAULT MODE CONTROL SEQUENCE

Temp	Pump	Heat 1	Heat 2	Heat 3	Heat 4	DO6	DO7	DO8	AO1	AO2	AO3	AO4
>=156	ON											
<156 >=152	ON	ON										
<152 >=148	ON	ON	ON									
<148 >=144	ON	ON	ON	ON								
<144	ON	ON	ON	ON	ON							

OCCUPIED MODE CONTROL SEQUENCE

Stage	Pump	Heat 1	Heat 2	Heat 3	Heat 4	DO6	DO7	DO8	AO1	AO2	AO3	AO4
At Set	ON											
Heat 1	ON	ON										
Heat 2	ON	ON	ON									
Heat 3	ON	ON	ON	ON								
Heat 4	ON	ON	ON	ON	ON							

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Pump	Heat 1	Heat 2	Heat 3	Heat 4	DO6	DO7	DO8	AO1	AO2	AO3	AO4
At Set												
Heat 1	ON	ON										
Heat 2	ON	ON	ON									
Heat 3	ON	ON	ON	ON								
Heat 4	ON	ON	ON	ON	ON							

WARMUP MODE CONTROL SEQUENCE

Stage	Pump	Heat 1	Heat 2	Heat 3	Heat 4	DO6	DO7	DO8	AO1	AO2	AO3	AO4
Warm 1	ON	ON	ON	ON	ON							

EQUIPMENT SCHEDULE #36

Boiler, 3 Way Mixing Valve, 3 Point Floating or Analog Actuator, Outdoor Reset

DIGITAL OUTPUTS
DO1 - Pump
DO2 - Valve Motor Open to Hot Water
DO3 - Valve Motor Open to Recirc

ANALOG OUTPUTS
AO1 - Valve Motor

DIGITAL INPUTS
DI1 - Setback Override

ANALOG INPUTS
AI1 - Controlled Temperature

DEFAULT MODE CONTROL SEQUENCE

Temp	Pump	Vlv Op	Vlv Cl	DO4	DO5	DO6	DO7	DO8	Valve	AO2	AO3	AO4
>=164	ON		CLS						CLS			
<164 >=160	ON		-5%						-5%			
<160 >=156	ON											
<156 >=152	ON	+5%							+5%			
<152 >=148	ON	+10%							+10%			
<148	ON	+20%							+20%			

OCCUPIED MODE CONTROL SEQUENCE

Stage	Pump	Vlv Op	Vlv Cl	DO4	DO5	DO6	DO7	DO8	Valve	AO2	AO3	AO4
Cool 2	ON		CLS						CLS			
Cool 1	ON		-5%						-5%			
At Set	ON											
Heat 1	ON	+5%							+5%			
Heat 2	ON	+10%							+10%			
Heat 3	ON	+20%							+20%			

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Pump	Vlv Op	Vlv Cl	DO4	DO5	DO6	DO7	DO8	Valve	AO2	AO3	AO4
At Set			CLS						CLS			
Heat 1	ON	+5%							+5%			
Heat 2	ON	+10%							+10%			
Heat 3	ON	+20%							+20%			

WARMUP MODE CONTROL SEQUENCE

Stage	Pump	Vlv Op	Vlv Cl	DO4	DO5	DO6	DO7	DO8	Valve	AO2	AO3	AO4
Warm 1	ON	OPN							OPN			

EQUIPMENT SCHEDULE #37

Not Currently Used

EQUIPMENT SCHEDULE #38

Not Currently Used

EQUIPMENT SCHEDULE #39

Not Currently Used

EQUIPMENT SCHEDULE #40

Air Handling Unit, 4 Stg Cool, 1 Stg Heat, Analog Cool, 3 Pt or Analog Economizer, Single Zone or VAV Server

DIGITAL OUTPUTS
DO1 - Air Handler
DO2 - Cool Stage #1
DO3 - Cool Stage #2
DO4 - Cool Stage #3
DO5 - Cool Stage #4
DO6 - Economizer Open
DO7 - Economizer Close
DO8 - Warmup Heat

DIGITAL INPUTS
DI1 - Setback Override

ANALOG INPUTS
AI1 - Discharge Temperature
AI2 - Return Air Enthalpy
AI4 - Discharge Temperature
AI6 - Mixed Air Temperature

ANALOG OUTPUTS
AO1 - Economizer Actuator
AO2 - Cooling Valve Actuator

DEFAULT MODE CONTROL SEQUENCE

Temp	Fan	Cool 1	Cool 2	Cool 3	Cool 4	Dm Op	Dm Cl	Heat	Econo	Valve	AO3	AO4
>59	ON	ON	ON	ON	ON		CLS		CLS	OPN		
>58 <=59	ON	ON	ON	ON	ON		CLS		CLS	+20%		
>57 <=58	ON	ON	ON	ON		MIN			MIN	+10%		
>56 <=57	ON	ON	ON			MIN			MIN	+5%		
>=54 <=56	ON	ON				MIN			MIN			
>53 <=54	ON					MIN			MIN	-5%		
>52 <=53	ON					MIN			MIN	CLS		
<=52	ON						CLS		CLS	CLS		

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cool 1	Cool 2	Cool 3	Cool 4	Dm Op	Dm Cl	Heat	Econo	Valve	AO3	AO4
Econo 4	ON	ON	ON	ON	ON	OPN			OPN	+10%		
Econo 3	ON	ON	ON			OPN			OPN	+5%		
Econo 2	ON	ON				OPN			OPN			
Econo 1	ON					OPN			OPN	-5%		
At Set	ON					MIN			MIN	CLS		
Heat 1	ON					MIN			MIN	CLS		
Heat 2	ON					MIN			MIN	CLS		
Heat 3	ON						CLS		CLS	CLS		

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cool 1	Cool 2	Cool 3	Cool 4	Dm Op	Dm Cl	Heat	Econo	Valve	AO3	AO4
Econo 4	ON	ON	ON	ON	ON	OPN			OPN	+10%		
Econo 3	ON	ON	ON			OPN			OPN	+5%		
Econo 2	ON	ON				OPN			OPN			
Econo 1	ON					OPN			OPN	-5%		
At Set							CLS		CLS	CLS		

Equipment Schedule Sequence of Operations
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EQUIPMENT SCHEDULE #40

Air Handling Unit, 4 Stage Cooling, Modulating Economizer, Single Zone or VAV Server

OCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Cool 1	Cool 2	Cool 3	Cool 4	Dm Op	Dm Cl	Heat	Econo	Valve	AO3	AO4
Cool 4	ON	ON	ON	ON	ON		CLS		CLS	OPN		
Cool 3	ON	ON	ON	ON			CLS		CLS	+20%		
Cool 2	ON	ON	ON			MIN			MIN	+10%		
Cool 1	ON	ON				MIN			MIN	+5%		
At Set	ON					MIN			MIN			
Heat 1	ON					MIN			MIN	-5%		
Heat 2	ON					MIN			MIN	CLS		
Heat 3	ON						CLS		CLS	CLS		

UNOCCUPIED MODE CONTROL SEQUENCE - ECONOMIZER INACTIVE

Stage	Fan	Cool 1	Cool 2	Cool 3	Cool 4	Dm Op	Dm Cl	Heat	Econo	Valve	AO3	AO4
Cool 4	ON	ON	ON	ON	ON		CLS		CLS	OPN		
Cool 3	ON	ON	ON	ON			CLS		CLS	+20%		
Cool 2	ON	ON	ON				CLS		CLS	+10%		
Cool 1	ON	ON					CLS		CLS	+5%		
At Set							CLS		CLS	CLS		

WARMUP MODE CONTROL SEQUENCE

Stage	Fan	Cool 1	Cool 2	Cool 3	Cool 4	Dm Op	Dm Cl	Heat	Econo	Valve	AO3	AO4
Warm 1	ON						CLS	ON	CLS	CLS		

COOLDOWN MODE CONTROL SEQUENCE - ECONOMIZER ACTIVE

Stage	Fan	Cool 1	Cool 2	Cool 3	Cool 4	Dm Op	Dm Cl	Heat	Econo	Valve	AO3	AO4
Econo 1	ON					OPN			OPN	CLS		

EQUIPMENT SCHEDULE #41a

2 Air Handling Units, Modulating Duct Static Pressure Control, Single Zone or VAV Server

DIGITAL OUTPUTS	DIGITAL INPUTS
	DI1 - Setback Override #1
	DI5 - Setback Override #2
	ANALOG INPUTS
	AI1 - Static Pressure #1
	AI5 - Static Pressure #2
	ANALOG OUTPUTS
	AO1 - Static Pressure Controller #1
	AO2 - Static Pressure Controller #1 - Inverse Output
	AO3 - Static Pressure Controller #2
	AO4 - Static Pressure Controller #2 - Inverse Output

DEFAULT MODE CONTROL SEQUENCE

% Full Scale	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8	SPC #1	SPC #1	SPC #2	SPC #2
>69.0									-20%	+20%	-20%	+20%
>67.5 <=69.0									-10%	+10%	-10%	+10%
>65.9 <=67.5									-5%	+5%	-5%	+5%
>59.6 <=65.9												
>58.0 <=59.6									+5%	-5%	+5%	-5%
>56.5 <=58.0									+10%	-10%	+10%	-10%
<=58.0									+20%	-20%	+20%	-20%

OCCUPIED MODE CONTROL SEQUENCE

PID Load	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8	SPC #1	SPC #1	SPC #2	SPC #2
>127									-20%	+20%	-20%	+20%
>64 <=127									-10%	+10%	-10%	+10%
>1 <=63									-5%	+5%	-5%	+5%
0												
<-1 >=-63									+5%	-5%	+5%	-5%
<-64 >=-127									+10%	-10%	+10%	-10%
<-128									+20%	-20%	+20%	-20%

UNOCCUPIED MODE CONTROL SEQUENCE

PID Load	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8	SPC #1	SPC #1	SPC #2	SPC #2
>127									-20%	+20%	-20%	+20%
>64 <=127									-10%	+10%	-10%	+10%
>1 <=63									-5%	+5%	-5%	+5%
0												
<-1 >=-63									+5%	-5%	+5%	-5%
<-64 >=-127									+10%	-10%	+10%	-10%
<-128									+20%	-20%	+20%	-20%

Note: This Note only applies to Rev 3.2 RSC's which contain EPROM Ver 4.0b or later.
ES-41 contains a special modification in the RSC EPROM. The RSC will use the commanded position for AO1 and generate a position for AO2. The calculated position for AO2 will be the inverse of AO1. For example, if the commanded output for AO1 is 85%, then the RSC will position AO2 to 15%. AO2 position can not be directly controlled by the User, even with the Handheld Tester. AO2 will always follow the commanded position for AO1.

EQUIPMENT SCHEDULE #41b

2 Air Handling Units, Modulating Duct Static Pressure Control, Single Zone or VAV Server

DIGITAL OUTPUTS

DIGITAL INPUTS
DI1 - Setback Override #1
DI5 - Setback Override #2

ANALOG INPUTS
AI1 - Static Pressure #1
AI5 - Static Pressure #2

ANALOG OUTPUTS
AO1 - Static Pressure Controller #1
AO2 - Static Pressure Controller #1 - Inverse Output
AO3 - Static Pressure Controller #2
AO4 - Static Pressure Controller #2 - Inverse Output

DEFAULT MODE CONTROL SEQUENCE

% Full Scale	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8	SPC #1	SPC #1	SPC #2	SPC #2
>69.0									-20%	+20%	-20%	+20%
>67.5 <=69.0									-10%	+10%	-10%	+10%
>65.9 <=67.5									-5%	+5%	-5%	+5%
>59.6 <=65.9												
>58.0 <=59.6									+5%	-5%	+5%	-5%
>56.5 <=58.0									+10%	-10%	+10%	-10%
<=58.0									+20%	-20%	+20%	-20%

OCCUPIED MODE CONTROL SEQUENCE

PID Load	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8	SPC #1	SPC #1	SPC #2	SPC #2
>127									-20%	+20%	-20%	+20%
>64 <=127									-10%	+10%	-10%	+10%
>1 <=63									-5%	+5%	-5%	+5%
0												
<(-1) >=(-63)									+5%	-5%	+5%	-5%
<(-64) >=(-127)									+10%	-10%	+10%	-10%
<(-128)									+20%	-20%	+20%	-20%

UNOCCUPIED MODE CONTROL SEQUENCE

PID Load	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8	SPC #1	SPC #1	SPC #2	SPC #2
>127									-20%	+20%	-20%	+20%
>64 <=127									-10%	+10%	-10%	+10%
>1 <=63									-5%	+5%	-5%	+5%
0												
<(-1) >=(-63)									+5%	-5%	+5%	-5%
<(-64) >=(-127)									+10%	-10%	+10%	-10%
<(-128)									+20%	-20%	+20%	-20%

Note: This Note only applies to Rev 3.2 RSC's which contain EPROM Ver 4.0b or later.
ES-41 contains a special modification in the RSC EPROM. The RSC will use the commanded position for AO3 and generate a position for AO4. The calculated position for AO4 will be the inverse of AO3. For example, if the commanded output for AO3 is 85%, then the RSC will position AO4 to 15%. AO4 position can not be directly controlled by the User, even with the Handheld Tester. AO4 will always follow the commanded position for AO3.

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #42a

2 Air Handling Units, Modulating Building Static Pressure Control

DIGITAL OUTPUTS	DIGITAL INPUTS
	DI1 - Setback Override #1
	DI5 - Setback Override #2
	ANALOG INPUTS
	AI1 - Static Pressure #1
	AI5 - Static Pressure #2
	ANALOG OUTPUTS
	AO1 - Static Pressure Controller #1
	AO3 - Static Pressure Controller #2

DEFAULT MODE CONTROL SEQUENCE

% Full Scale	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8	SPC #1	AO2	SPC #2	AO4
>69.0									+20%		+20%	
>67.5 <=69.0									+10%		+10%	
>65.9 <=67.5									+5%		+5%	
>59.6 <=65.9												
>58.0 <=59.6									-5%		-5%	
>56.5 <=58.0									-10%		-10%	
<=58.0									-20%		-20%	

OCCUPIED MODE CONTROL SEQUENCE

PID Load	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8	SPC #1	AO2	SPC #2	AO4
>127									+20%		+20%	
>64 <=127									+10%		+10%	
>1 <=63									+5%		+5%	
0												
<-1 >=-63									-5%		-5%	
<-64 >=-127									-10%		-10%	
<-128									-20%		-20%	

UNOCCUPIED MODE CONTROL SEQUENCE

PID Load	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8	SPC #1	AO2	SPC #2	AO4
>127									+20%		+20%	
>64 <=127									+10%		+10%	
>1 <=63									+5%		+5%	
0												
<-1 >=-63									-5%		-5%	
<-64 >=-127									-10%		-10%	
<-128									-20%		-20%	

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #42b

2 Air Handling Units, Modulating Building Static Pressure Control

DIGITAL OUTPUTS

DIGITAL INPUTS

DI1 - Setback Override #1
DI5 - Setback Override #2

ANALOG INPUTS

AI1 - Static Pressure #1
AI5 - Static Pressure #2

ANALOG OUTPUTS

AO1 - Static Pressure Controller #1
AO3 - Static Pressure Controller #2

DEFAULT MODE CONTROL SEQUENCE

% Full Scale	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8	SPC #1	AO2	SPC #2	AO4
>69.0									+20%		+20%	
>67.5 <=69.0									+10%		+10%	
>65.9 <=67.5									+5%		+5%	
>59.6 <=65.9												
>58.0 <=59.6									-5%		-5%	
>56.5 <=58.0									-10%		-10%	
<=58.0									-20%		-20%	

OCCUPIED MODE CONTROL SEQUENCE

PID Load	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8	SPC #1	AO2	SPC #2	AO4
>127									+20%		+20%	
>64 <=127									+10%		+10%	
>1 <=63									+5%		+5%	
0												
<(-1) >=(-63)									-5%		-5%	
<(-64) >=(-127)									-10%		-10%	
<(-128)									-20%		-20%	

UNOCCUPIED MODE CONTROL SEQUENCE

PID Load	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8	SPC #1	AO2	SPC #2	AO4
>127									+20%		+20%	
>64 <=127									+10%		+10%	
>1 <=63									+5%		+5%	
0												
<(-1) >=(-63)									-5%		-5%	
<(-64) >=(-127)									-10%		-10%	
<(-128)									-20%		-20%	

EQUIPMENT SCHEDULE #43

Not Currently Used

EQUIPMENT SCHEDULE #44

Not Currently Used

EQUIPMENT SCHEDULE #45

Not Currently Used

EQUIPMENT SCHEDULE #46

Not Currently Used

EQUIPMENT SCHEDULE #47

Not Currently Used

EQUIPMENT SCHEDULE #48

Not Currently Used

EQUIPMENT SCHEDULE #49

Not Currently Used

EQUIPMENT SCHEDULE #50

VariZone Damper, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS	**DIGITAL INPUTS**
DO1 - Damper Motor Open	DI1 - Setback Override
DO2 - Damper Motor Close	
	ANALOG INPUTS
ANALOG OUTPUTS	AI1 - Space Temperature
AO1 - Damper Actuator	AI2 - CFM (optional)

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	DO3	DO4	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
All	OPN								OPN			

OCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	DO3	DO4	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
At Set	OPN								OPN			

OCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	DO3	DO4	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 4		CLS							CLS			
Cool 3		CLS							CLS			
Cool 2		MIN							MIN			
Cool 1		-5%							-5%			
At Set	MID	MID							MID			
Heat 1	+5%								+5%			
Heat 2	+10%								+10%			
Heat 3	+20%								+20%			
Heat 4	OPN								OPN			

OCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	DO3	DO4	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 4		OPN							OPN			
Cool 3		+20%							+20%			
Cool 2		+10%							+10%			
Cool 1		+5%							+5%			
At Set	MID	MID							MID			
Heat 1	-5%								-5%			
Heat 2	MIN								MIN			
Heat 3	CLS								CLS			

EQUIPMENT SCHEDULE #50

VariZone Damper, 3 Point Floating or Analog Actuator

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	DO3	DO4	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
At Set	OPN								OPN			

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	DO3	DO4	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 1		CLS							CLS			
At Set		CLS							CLS			
Heat 1	OPN								OPN			

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	DO3	DO4	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 1	OPN								OPN			
At Set		CLS							CLS			
Heat 1		CLS							CLS			

WARMUP MODE CONTROL SEQUENCE - SERVER IN WARMUP

Stage	Dm Op	Dm Cl	DO3	DO4	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 3		CLS							CLS			
Cool 2		MIN							MIN			
Cool 1		-5%							-5%			
At Set	MID	MID							MID			
Heat 1	+5%								+5%			
Heat 2	+10%								+10%			
Heat 3	+20%								+20%			
Heat 4	OPN								OPN			

EQUIPMENT SCHEDULE #51a

4 VariZone Dampers, 1st Zone, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS
DO1 - Damper Motor #1 Open
DO2 - Damper Motor #1 Close
DO3 - Damper Motor #2 Open
DO4 - Damper Motor #2 Close
DO5 - Damper Motor #3 Open
DO6 - Damper Motor #3 Close
DO7 - Damper Motor #4 Open
DO8 - Damper Motor #4 Close

ANALOG OUTPUTS
AO1 - Damper Motor #1
AO2 - Damper Motor #2
AO3 - Damper Motor #3
AO4 - Damper Motor #4

DIGITAL INPUTS
DI1 - Setback Override #1
DI3 - Setback Override #2
DI5 - Setback Override #3
DI7 - Setback Override #4

ANALOG INPUTS
AI1 - Space Temperature #1
AI2 - CFM #1 (optional)
AI3 - Space Temperature #2
AI4 - CFM #2 (optional)
AI5 - Space Temperature #3
AI6 - CFM #3 (optional)
AI7 - Space Temperature #4
AI8 - CFM #4 (optional)

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
All	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

OCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
At Set	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

OCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Cool 2		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
Cool 1		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
At Set	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID
Heat 1	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
Heat 2	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
Heat 3	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
Heat 4	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

OCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 4		OPN		OPN		OPN		OPN	OPN	OPN	OPN	OPN
Cool 3		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%
Cool 2		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
Cool 1		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
At Set	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID
Heat 1	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
Heat 2	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
Heat 3	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS

EQUIPMENT SCHEDULE #51a

4 VariZone Dampers, 1st Zone, 3 Point Floating or Analog Actuator

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
At Set	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 1		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
At Set		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Heat 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN
At Set		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Heat 1		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

WARMUP MODE CONTROL SEQUENCE - SERVER IN WARMUP

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Cool 2		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
Cool 1		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
At Set	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID
Heat 1	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
Heat 2	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
Heat 3	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
Heat 4	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

EQUIPMENT SCHEDULE #51b

4 VariZone Dampers, 2nd Zone, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Damper Motor #1 Open	DI1 - Setback Override #1
DO2 - Damper Motor #1 Close	DI3 - Setback Override #2
DO3 - Damper Motor #2 Open	DI5 - Setback Override #3
DO4 - Damper Motor #2 Close	DI7 - Setback Override #4
DO5 - Damper Motor #3 Open	
DO6 - Damper Motor #3 Close	**ANALOG INPUTS**
DO7 - Damper Motor #4 Open	AI1 - Space Temperature #1
DO8 - Damper Motor #4 Close	AI2 - CFM #1 (optional)
	AI3 - Space Temperature #2
ANALOG OUTPUTS	AI4 - CFM #2 (optional)
AO1 - Damper Motor #1	AI5 - Space Temperature #3
AO2 - Damper Motor #2	AI6 - CFM #3 (optional)
AO3 - Damper Motor #3	AI7 - Space Temperature #4
AO4 - Damper Motor #4	AI8 - CFM #4 (optional)

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
All	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

OCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
At Set	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

OCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Cool 2		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
Cool 1		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
At Set	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID
Heat 1	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
Heat 2	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
Heat 3	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
Heat 4	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

OCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 4		OPN		OPN		OPN		OPN	OPN	OPN	OPN	OPN
Cool 3		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%
Cool 2		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
Cool 1		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
At Set	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID
Heat 1	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
Heat 2	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
Heat 3	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS

EQUIPMENT SCHEDULE #51b

4 VariZone Dampers, 2nd Zone, 3 Point Floating or Analog Actuator

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
At Set	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 1		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
At Set		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Heat 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN
At Set		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Heat 1		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

WARMUP MODE CONTROL SEQUENCE - SERVER IN WARMUP

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Cool 2		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
Cool 1		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
At Set	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID
Heat 1	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
Heat 2	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
Heat 3	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
Heat 4	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

EQUIPMENT SCHEDULE #51c

4 VariZone Dampers, 3rd Zone, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS
- DO1 - Damper Motor #1 Open
- DO2 - Damper Motor #1 Close
- DO3 - Damper Motor #2 Open
- DO4 - Damper Motor #2 Close
- DO5 - Damper Motor #3 Open
- DO6 - Damper Motor #3 Close
- DO7 - Damper Motor #4 Open
- DO8 - Damper Motor #4 Close

ANALOG OUTPUTS
- AO1 - Damper Motor #1
- AO2 - Damper Motor #2
- AO3 - Damper Motor #3
- AO4 - Damper Motor #4

DIGITAL INPUTS
- DI1 - Setback Override #1
- DI3 - Setback Override #2
- DI5 - Setback Override #3
- DI7 - Setback Override #4

ANALOG INPUTS
- AI1 - Space Temperature #1
- AI2 - CFM #1 (optional)
- AI3 - Space Temperature #2
- AI4 - CFM #2 (optional)
- AI5 - Space Temperature #3
- AI6 - CFM #3 (optional)
- AI7 - Space Temperature #4
- AI8 - CFM #4 (optional)

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
All	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

OCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
At Set	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

OCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Cool 2		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
Cool 1		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
At Set	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID
Heat 1	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
Heat 2	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
Heat 3	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
Heat 4	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

OCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 4		OPN		OPN		OPN		OPN	OPN	OPN	OPN	OPN
Cool 3		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%
Cool 2		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
Cool 1		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
At Set	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID
Heat 1	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
Heat 2	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
Heat 3	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS

EQUIPMENT SCHEDULE #51c

4 VariZone Dampers, 3rd Zone, 3 Point Floating or Analog Actuator

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
At Set	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 1		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
At Set		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Heat 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN
At Set		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Heat 1		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

WARMUP MODE CONTROL SEQUENCE - SERVER IN WARMUP

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Cool 2		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
Cool 1		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
At Set	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID
Heat 1	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
Heat 2	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
Heat 3	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
Heat 4	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

EQUIPMENT SCHEDULE #51d

4 VariZone Dampers, 4th Zone, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS

DO1 - Damper Motor #1 Open
DO2 - Damper Motor #1 Close
DO3 - Damper Motor #2 Open
DO4 - Damper Motor #2 Close
DO5 - Damper Motor #3 Open
DO6 - Damper Motor #3 Close
DO7 - Damper Motor #4 Open
DO8 - Damper Motor #4 Close

ANALOG OUTPUTS

AO1 - Damper Motor #1
AO2 - Damper Motor #2
AO3 - Damper Motor #3
AO4 - Damper Motor #4

DIGITAL INPUTS

DI1 - Setback Override #1
DI3 - Setback Override #2
DI5 - Setback Override #3
DI7 - Setback Override #4

ANALOG INPUTS

AI1 - Space Temperature #1
AI2 - CFM #1 (optional)
AI3 - Space Temperature #2
AI4 - CFM #2 (optional)
AI5 - Space Temperature #3
AI6 - CFM #3 (optional)
AI7 - Space Temperature #4
AI8 - CFM #4 (optional)

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
All	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

OCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
At Set	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

OCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Cool 2		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
Cool 1		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
At Set	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID
Heat 1	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
Heat 2	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
Heat 3	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
Heat 4	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

OCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 4		OPN		OPN		OPN		OPN	OPN	OPN	OPN	OPN
Cool 3		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%
Cool 2		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
Cool 1		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
At Set	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID
Heat 1	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
Heat 2	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
Heat 3	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS

EQUIPMENT SCHEDULE #51d

4 VariZone Dampers, 4th Zone, 3 Point Floating or Analog Actuator

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
At Set	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 1		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
At Set		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Heat 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN
At Set		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Heat 1		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS

WARMUP MODE CONTROL SEQUENCE - SERVER IN WARMUP

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Cool 2		MIN		MIN		MIN		MIN	MIN	MIN	MIN	MIN
Cool 1		-5%		-5%		-5%		-5%	-5%	-5%	-5%	-5%
At Set	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID	MID
Heat 1	+5%		+5%		+5%		+5%		+5%	+5%	+5%	+5%
Heat 2	+10%		+10%		+10%		+10%		+10%	+10%	+10%	+10%
Heat 3	+20%		+20%		+20%		+20%		+20%	+20%	+20%	+20%
Heat 4	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

EQUIPMENT SCHEDULE #52

VariZone Box, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Constant Air Volume

DIGITAL OUTPUTS
DO1 - Damper Motor Open
DO2 - Damper Motor Close
DO3 - Fan
DO4 - Heat

ANALOG OUTPUTS
AO1 - Damper Actuator

DIGITAL INPUTS
DI1 - Setback Override

ANALOG INPUTS
AI1 - Space Temperature
AI2 - CFM (optional)

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
>=71	OPN		ON						OPN			
<71	OPN		ON	ON					OPN			

OCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
At Set	OPN		ON						OPN			

OCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 3		CLS	ON						CLS			
Cool 2		MIN	ON						MIN			
Cool 1		-5%	ON						-5%			
At Set	MID	MID	ON						MID			
Heat 1	+5%		ON						+5%			
Heat 2	+10%		ON	ON					+10%			
Heat 3	+20%		ON	ON					+20%			
Heat 4	OPN		ON	ON					OPN			

OCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 4		OPN	ON						OPN			
Cool 3		+20%	ON						+20%			
Cool 2		+10%	ON						+10%			
Cool 1		+5%	ON						+5%			
At Set	MID	MID	ON						MID			
Heat 1	-5%		ON						-5%			
Heat 2	MIN		ON	ON					MIN			
Heat 3	CLS		ON	ON					CLS			

EQUIPMENT SCHEDULE #52

VariZone Box, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Constant Air Volume

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
At Set	OPN								OPN			

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 1		CLS	ON						CLS			
At Set		CLS							CLS			
Heat 1	OPN		ON						OPN			
Heat 2	OPN		ON	ON					OPN			

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 1	OPN		ON						OPN			
At Set		CLS							CLS			
Heat 1		CLS	ON	ON					CLS			

WARMUP MODE CONTROL SEQUENCE - SERVER IN WARMUP

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 3		CLS	ON						CLS			
Cool 2		MIN	ON						MIN			
Cool 1		-5%	ON						-5%			
At Set	MID	MID	ON						MID			
Heat 1	+5%		ON						+5%			
Heat 2	+10%		ON	ON					+10%			
Heat 3	+20%		ON	ON					+20%			
Heat 4	OPN		ON	ON					OPN			

EQUIPMENT SCHEDULE #53a

2 VariZone Boxes, 1st Zone, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Constant Air Volume

DIGITAL OUTPUTS
DO1 - Damper Motor #1 Open
DO2 - Damper Motor #1 Close
DO3 - Fan #1
DO4 - Heat #1
DO5 - Damper Motor #2 Open
DO6 - Damper Motor #2 Close
DO7 - Fan #2
DO8 - Heat #2

DIGITAL INPUTS
DI1 - Setback Override #1
DI5 - Setback Override #2

ANALOG INPUTS
AI1 - Space Temperature #1
AI2 - CFM #1 (optional)
AI5 - Space Temperature #2
AI6 - CFM #2 (optional)

ANALOG OUTPUTS
AO1 - Damper Actuator #1
AO3 - Damper Actuator #2

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
>=71	OPN		ON		OPN		ON		OPN		OPN	
<71	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

OCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
At Set	OPN		ON		OPN		ON		OPN		OPN	

OCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 3		CLS	ON			CLS	ON		CLS		CLS	
Cool 2		MIN	ON			MIN	ON		MIN		MIN	
Cool 1		-5%	ON			-5%	ON		-5%		-5%	
At Set	MID	MID	ON		MID	MID	ON		MID		MID	
Heat 1	+5%		ON		+5%		ON		+5%		+5%	
Heat 2	+10%		ON	ON	+10%		ON	ON	+10%		+10%	
Heat 3	+20%		ON	ON	+20%		ON	ON	+20%		+20%	
Heat 4	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

OCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 4		OPN	ON			OPN	ON		OPN		OPN	
Cool 3		+20%	ON			+20%	ON		+20%		+20%	
Cool 2		+10%	ON			+10%	ON		+10%		+10%	
Cool 1		+5%	ON			+5%	ON		+5%		+5%	
At Set	MID	MID	ON		MID	MID	ON		MID		MID	
Heat 1	-5%		ON		-5%		ON		-5%		-5%	
Heat 2	MIN		ON	ON	MIN		ON	ON	MIN		MIN	
Heat 3	CLS		ON	ON	CLS		ON	ON	CLS		CLS	

EQUIPMENT SCHEDULE #53a

2 VariZone Boxes, 1st Zone, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Constant Air Volume

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
At Set	OPN				OPN				OPN		OPN	

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 1		CLS	ON			CLS	ON		CLS		CLS	
At Set		CLS				CLS			CLS		CLS	
Heat 1	OPN		ON		OPN		ON		OPN		OPN	
Heat 2	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 1	OPN		ON		OPN		ON		OPN		OPN	
At Set		CLS				CLS			CLS		CLS	
Heat 1		CLS	ON	ON		CLS	ON	ON	CLS		CLS	

WARMUP MODE CONTROL SEQUENCE - SERVER IN WARMUP

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 3		CLS	ON			CLS	ON		CLS		CLS	
Cool 2		MIN	ON			MIN	ON		MIN		MIN	
Cool 1		-5%	ON			-5%	ON		-5%		-5%	
At Set	MID	MID	ON		MID	MID	ON		MID		MID	
Heat 1	+5%		ON		+5%		ON		+5%		+5%	
Heat 2	+10%		ON	ON	+10%		ON	ON	+10%		+10%	
Heat 3	+20%		ON	ON	+20%		ON	ON	+20%		+20%	
Heat 4	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #53b

2 VariZone Boxes, 2nd Zone, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Constant Air Volume

DIGITAL OUTPUTS

DO1 - Damper Motor #1 Open
DO2 - Damper Motor #1 Close
DO3 - Fan #1
DO4 - Heat #1
DO5 - Damper Motor #2 Open
DO6 - Damper Motor #2 Close
DO7 - Fan #2
DO8 - Heat #2

DIGITAL INPUTS

DI1 - Setback Override #1
DI5 - Setback Override #2

ANALOG INPUTS

AI1 - Space Temperature #1
AI2 - CFM #1 (optional)
AI5 - Space Temperature #2
AI6 - CFM #2 (optional)

ANALOG OUTPUTS

AO1 - Damper Actuator #1
AO3 - Damper Actuator #2

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
>=71	OPN		ON		OPN		ON		OPN		OPN	
<71	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

OCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
At Set	OPN		ON		OPN		ON		OPN		OPN	

OCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 3		CLS	ON			CLS	ON		CLS		CLS	
Cool 2		MIN	ON			MIN	ON		MIN		MIN	
Cool 1		-5%	ON			-5%	ON		-5%		-5%	
At Set	MID	MID	ON		MID	MID	ON		MID		MID	
Heat 1	+5%		ON		+5%		ON		+5%		+5%	
Heat 2	+10%		ON	ON	+10%		ON	ON	+10%		+10%	
Heat 3	+20%		ON	ON	+20%		ON	ON	+20%		+20%	
Heat 4	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

OCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 4		OPN	ON			OPN	ON		OPN		OPN	
Cool 3		+20%	ON			+20%	ON		+20%		+20%	
Cool 2		+10%	ON			+10%	ON		+10%		+10%	
Cool 1		+5%	ON			+5%	ON		+5%		+5%	
At Set	MID	MID	ON		MID	MID	ON		MID		MID	
Heat 1	-5%		ON		-5%		ON		-5%		-5%	
Heat 2	MIN		ON	ON	MIN		ON	ON	MIN		MIN	
Heat 3	CLS		ON	ON	CLS		ON	ON	CLS		CLS	

EQUIPMENT SCHEDULE #53b

2 VariZone Boxes, 2nd Zone, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Constant Air Volume

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
At Set	OPN				OPN				OPN		OPN	

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 1		CLS	ON			CLS	ON		CLS		CLS	
At Set		CLS				CLS			CLS		CLS	
Heat 1	OPN		ON		OPN		ON		OPN		OPN	
Heat 2	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 1	OPN		ON		OPN		ON		OPN		OPN	
At Set		CLS				CLS			CLS		CLS	
Heat 1		CLS	ON	ON		CLS	ON	ON	CLS		CLS	

WARMUP MODE CONTROL SEQUENCE - SERVER IN WARMUP

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 3		CLS	ON			CLS	ON		CLS		CLS	
Cool 2		MIN	ON			MIN	ON		MIN		MIN	
Cool 1		-5%	ON			-5%	ON		-5%		-5%	
At Set	MID	MID	ON		MID	MID	ON		MID		MID	
Heat 1	+5%		ON		+5%		ON		+5%		+5%	
Heat 2	+10%		ON	ON	+10%		ON	ON	+10%		+10%	
Heat 3	+20%		ON	ON	+20%		ON	ON	+20%		+20%	
Heat 4	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

EQUIPMENT SCHEDULE #54

VariZone Box, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Variable Air Volume

DIGITAL OUTPUTS
DO1 - Damper Motor Open
DO2 - Damper Motor Close
DO3 - Fan
DO4 - Heat

ANALOG OUTPUTS
AO1 - Damper Actuator

DIGITAL INPUTS
DI1 - Setback Override

ANALOG INPUTS
AI1 - Space Temperature
AI2 - CFM (optional)

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
>=71	OPN								OPN			
<71	OPN		ON	ON					OPN			

OCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
At Set	OPN								OPN			

OCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 3		CLS							CLS			
Cool 2		MIN							MIN			
Cool 1		-5%							-5%			
At Set	MID	MID							MID			
Heat 1	+5%								+5%			
Heat 2	+10%		ON	ON					+10%			
Heat 3	+20%		ON	ON					+20%			
Heat 4	OPN		ON	ON					OPN			

OCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 4		OPN							OPN			
Cool 3		+20%							+20%			
Cool 2		+10%							+10%			
Cool 1		+5%							+5%			
At Set	MID	MID							MID			
Heat 1	-5%								-5%			
Heat 2	MIN		ON	ON					MIN			
Heat 3	CLS		ON	ON					CLS			

EQUIPMENT SCHEDULE #54

VariZone Box, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Variable Air Volume

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
At Set	OPN								OPN			

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 1		CLS							CLS			
At Set		CLS							CLS			
Heat 1	OPN								OPN			
Heat 2	OPN		ON	ON					OPN			

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 1	OPN								OPN			
At Set		CLS							CLS			
Heat 1		CLS	ON	ON					CLS			

WARMUP MODE CONTROL SEQUENCE - SERVER IN WARMUP

Stage	Dm Op	Dm Cl	Fan	Heat	DO5	DO6	DO7	DO8	Dmpr	AO2	AO3	AO4
Cool 3		CLS							CLS			
Cool 2		MIN							MIN			
Cool 1		-5%							-5%			
At Set	MID	MID							MID			
Heat 1	+5%								+5%			
Heat 2	+10%		ON	ON					+10%			
Heat 3	+20%		ON	ON					+20%			
Heat 4	OPN		ON	ON					OPN			

EQUIPMENT SCHEDULE #55a

2 VariZone Boxes, 1st Zone, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Variable Air Volume

DIGITAL OUTPUTS
DO1 - Damper Motor #1 Open
DO2 - Damper Motor #1 Close
DO3 - Fan #1
DO4 - Heat #1
DO5 - Damper Motor #2 Open
DO6 - Damper Motor #2 Close
DO7 - Fan #2
DO8 - Heat #2

DIGITAL INPUTS
DI1 - Setback Override #1
DI5 - Setback Override #2

ANALOG INPUTS
AI1 - Space Temperature #1
AI2 - CFM #1 (optional)
AI5 - Space Temperature #2
AI6 - CFM #2 (optional)

ANALOG OUTPUTS
AO1 - Damper Actuator #1
AO3 - Damper Actuator #2

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
>=71	OPN				OPN				OPN		OPN	
<71	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

OCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
At Set	OPN				OPN				OPN		OPN	

OCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 3		CLS				CLS			CLS		CLS	
Cool 2		MIN				MIN			MIN		MIN	
Cool 1		-5%				-5%			-5%		-5%	
At Set	MID	MID			MID	MID			MID		MID	
Heat 1	+5%				+5%				+5%		+5%	
Heat 2	+10%		ON	ON	+10%		ON	ON	+10%		+10%	
Heat 3	+20%		ON	ON	+20%		ON	ON	+20%		+20%	
Heat 4	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

OCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 4		OPN				OPN			OPN		OPN	
Cool 3		+20%				+20%			+20%		+20%	
Cool 2		+10%				+10%			+10%		+10%	
Cool 1		+5%				+5%			+5%		+5%	
At Set	MID	MID			MID	MID			MID		MID	
Heat 1	-5%				-5%				-5%		-5%	
Heat 2	MIN		ON	ON	MIN		ON	ON	MIN		MIN	
Heat 3	CLS		ON	ON	CLS		ON	ON	CLS		CLS	

EQUIPMENT SCHEDULE #55a

2 VariZone Boxes, 1st Zone, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Variable Air Volume

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
At Set	OPN				OPN				OPN		OPN	

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 1		CLS				CLS			CLS		CLS	
At Set		CLS				CLS			CLS		CLS	
Heat 1	OPN				OPN				OPN		OPN	
Heat 2	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 1	OPN				OPN				OPN		OPN	
At Set		CLS				CLS			CLS		CLS	
Heat 1		CLS	ON	ON		CLS	ON	ON	CLS		CLS	

WARMUP MODE CONTROL SEQUENCE - SERVER IN WARMUP

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 3		CLS				CLS			CLS		CLS	
Cool 2		MIN				MIN			MIN		MIN	
Cool 1		-5%				-5%			-5%		-5%	
At Set	MID	MID			MID	MID			MID		MID	
Heat 1	+5%				+5%				+5%		+5%	
Heat 2	+10%		ON	ON	+10%		ON	ON	+10%		+10%	
Heat 3	+20%		ON	ON	+20%		ON	ON	+20%		+20%	
Heat 4	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #55b

2 VariZone Boxes, 2nd Zone, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Variable Air Volume

DIGITAL OUTPUTS
- DO1 - Damper Motor #1 Open
- DO2 - Damper Motor #1 Close
- DO3 - Fan #1
- DO4 - Heat #1
- DO5 - Damper Motor #2 Open
- DO6 - Damper Motor #2 Close
- DO7 - Fan #2
- DO8 - Heat #2

DIGITAL INPUTS
- DI1 - Setback Override #1
- DI5 - Setback Override #2

ANALOG INPUTS
- AI1 - Space Temperature #1
- AI2 - CFM #1 (optional)
- AI5 - Space Temperature #2
- AI6 - CFM #2 (optional)

ANALOG OUTPUTS
- AO1 - Damper Actuator #1
- AO3 - Damper Actuator #2

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
>=71	OPN				OPN				OPN		OPN	
<71	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

OCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
At Set	OPN				OPN				OPN		OPN	

OCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 3		CLS				CLS			CLS		CLS	
Cool 2		MIN				MIN			MIN		MIN	
Cool 1		-5%				-5%			-5%		-5%	
At Set	MID	MID			MID	MID			MID		MID	
Heat 1	+5%				+5%				+5%		+5%	
Heat 2	+10%		ON	ON	+10%		ON	ON	+10%		+10%	
Heat 3	+20%		ON	ON	+20%		ON	ON	+20%		+20%	
Heat 4	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

OCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 4		OPN				OPN			OPN		OPN	
Cool 3		+20%				+20%			+20%		+20%	
Cool 2		+10%				+10%			+10%		+10%	
Cool 1		+5%				+5%			+5%		+5%	
At Set	MID	MID			MID	MID			MID		MID	
Heat 1	-5%				-5%				-5%		-5%	
Heat 2	MIN		ON	ON	MIN		ON	ON	MIN		MIN	
Heat 3	CLS		ON	ON	CLS		ON	ON	CLS		CLS	

EQUIPMENT SCHEDULE #55b

2 VariZone Boxes, 2nd Zone, Fan Powered, Elec Heat, 3 Point Floating or Analog Actuator, Variable Air Volume

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
At Set	OPN				OPN				OPN		OPN	

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 1		CLS				CLS			CLS		CLS	
At Set		CLS				CLS			CLS		CLS	
Heat 1	OPN				OPN				OPN		OPN	
Heat 2	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 1	OPN				OPN				OPN		OPN	
At Set		CLS				CLS			CLS		CLS	
Heat 1		CLS	ON	ON		CLS	ON	ON	CLS		CLS	

WARMUP MODE CONTROL SEQUENCE - SERVER IN WARMUP

Stage	Dm Op	Dm Cl	Fan	Heat	Dm Op	Dm Cl	Fan	Heat	Dmpr	AO2	Dmpr	AO4
Cool 3		CLS				CLS			CLS		CLS	
Cool 2		MIN				MIN			MIN		MIN	
Cool 1		-5%				-5%			-5%		-5%	
At Set	MID	MID			MID	MID			MID		MID	
Heat 1	+5%				+5%				+5%		+5%	
Heat 2	+10%		ON	ON	+10%		ON	ON	+10%		+10%	
Heat 3	+20%		ON	ON	+20%		ON	ON	+20%		+20%	
Heat 4	OPN		ON	ON	OPN		ON	ON	OPN		OPN	

EQUIPMENT SCHEDULE #56

VariZone Box, Fan Powered, Hydronic Heat, 3 Point Floating or Analog Actuators, Constant Air Volume

DIGITAL OUTPUTS

DO1 - Damper Motor Open
DO2 - Damper Motor Close
DO3 - Fan
DO4 - Valve Motor Open
DO5 - Valve Motor Close

DIGITAL INPUTS

DI1 - Setback Override

ANALOG INPUTS

AI1 - Space Temperature
AI2 - CFM (optional)

ANALOG OUTPUTS

AO1 - Damper Actuator
AO2 - Valve Actuator

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
>=71	OPN		ON		CLS				OPN	CLS		
<71 >=70	OPN		ON	+5%					OPN	+5%		
<70 >=69	OPN		ON	+10%					OPN	+10%		
<69	OPN		ON	+20%					OPN	+20%		

OCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
At Set	OPN		ON		CLS				OPN	CLS		

OCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
Cool 3		CLS	ON		CLS				CLS	CLS		
Cool 2		MIN	ON		CLS				MIN	CLS		
Cool 1		-5%	ON		CLS				-5%	CLS		
At Set	MID	MID	ON		CLS				MID	CLS		
Heat 1	+5%		ON		CLS				+5%	CLS		
Heat 2	+10%		ON	+5%					+10%	+5%		
Heat 3	+20%		ON	+10%					+20%	+10%		
Heat 4	OPN		ON	+20%					OPN	+20%		

OCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
Cool 4		OPN	ON		CLS				OPN	CLS		
Cool 3		+20%	ON		CLS				+20%	CLS		
Cool 2		+10%	ON		CLS				+10%	CLS		
Cool 1		+5%	ON		CLS				+5%	CLS		
At Set	MID	MID	ON		CLS				MID	CLS		
Heat 1	-5%		ON		CLS				-5%	CLS		
Heat 2	MIN		ON	+5%					MIN	+5%		
Heat 3	CLS		ON	+10%					CLS	+10%		
Heat 4	CLS		ON	+20%					CLS	+20%		

EQUIPMENT SCHEDULE #56

VariZone Box, Fan Powered, Hydronic Heat, 3 Point Floating or Analog Actuators, Constant Air Volume

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
At Set	OPN				CLS				OPN	CLS		

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
Cool 1		CLS	ON		CLS				CLS	CLS		
At Set		CLS			CLS				CLS	CLS		
Heat 1	OPN		ON		CLS				OPN	CLS		
Heat 2	OPN		ON	OPN					OPN	OPN		

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
Cool 1	OPN		ON		CLS				OPN	CLS		
At Set		CLS			CLS				CLS	CLS		
Heat 1		CLS	ON	OPN					CLS	OPN		

WARMUP MODE CONTROL SEQUENCE - SERVER IN WARMUP

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
Cool 3		CLS	ON		CLS				CLS	CLS		
Cool 2		MIN	ON		CLS				MIN	CLS		
Cool 1		-5%	ON		CLS				-5%	CLS		
At Set	MID	MID	ON		CLS				MID	CLS		
Heat 1	+5%		ON		CLS				+5%	CLS		
Heat 2	+10%		ON	+5%					+10%	+5%		
Heat 3	+20%		ON	+10%					+20%	+10%		
Heat 4	OPN		ON	+20%					OPN	+20%		

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #57

VariZone Box, Fan Powered, Hydronic Heat, 3 Point Floating or Analog Actuators, Variable Air Volume

DIGITAL OUTPUTS
DO1 - Damper Motor Open
DO2 - Damper Motor Close
DO3 - Fan
DO4 - Valve Motor Open
DO5 - Valve Motor Close

DIGITAL INPUTS
DI1 - Setback Override

ANALOG INPUTS
AI1 - Space Temperature
AI2 - CFM (optional)

ANALOG OUTPUTS
AO1 - Damper Actuator
AO2 - Valve Actuator

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
>=71	OPN				CLS				OPN	CLS		
<71 >=70	OPN		ON	+5%					OPN	+5%		
<70 >=69	OPN		ON	+10%					OPN	+10%		
<69	OPN		ON	+20%					OPN	+20%		

OCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
At Set	OPN				CLS				OPN	CLS		

OCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
Cool 3		CLS			CLS				CLS	CLS		
Cool 2		MIN			CLS				MIN	CLS		
Cool 1		-5%			CLS				-5%	CLS		
At Set	MID	MID			CLS				MID	CLS		
Heat 1	+5%				CLS				+5%	CLS		
Heat 2	+10%		ON	+5%					+10%	+5%		
Heat 3	+20%		ON	+10%					+20%	+10%		
Heat 4	OPN		ON	+20%					OPN	+20%		

OCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
Cool 4		OPN			CLS				OPN	CLS		
Cool 3		+20%			CLS				+20%	CLS		
Cool 2		+10%			CLS				+10%	CLS		
Cool 1		+5%			CLS				+5%	CLS		
At Set	MID	MID			CLS				MID	CLS		
Heat 1	-5%				CLS				-5%	CLS		
Heat 2	MIN		ON	+5%					MIN	+5%		
Heat 3	CLS		ON	+10%					CLS	+10%		
Heat 4	CLS		ON	+20%					CLS	+20%		

EQUIPMENT SCHEDULE #57

VariZone Box, Fan Powered, Hydronic Heat, 3 Point Floating or Analog Actuators, Variable Air Volume

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER AT SET

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
At Set	OPN				CLS				OPN	CLS		

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER HEATING

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
Cool 1		CLS			CLS				CLS	CLS		
At Set		CLS			CLS				CLS	CLS		
Heat 1	OPN				CLS				OPN	CLS		
Heat 2	OPN		ON	OPN					OPN	OPN		

UNOCCUPIED MODE CONTROL SEQUENCE - SERVER COOLING

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
Cool 1	OPN				CLS				OPN	CLS		
At Set		CLS			CLS				CLS	CLS		
Heat 1		CLS	ON	OPN					CLS	OPN		

WARMUP MODE CONTROL SEQUENCE - SERVER IN WARMUP

Stage	Dm Op	Dm Cl	Fan	Vlv Op	Vlv Cl	DO6	DO7	DO8	Dmpr	Valve	AO3	AO4
Cool 3		CLS			CLS				CLS	CLS		
Cool 2		MIN			CLS				MIN	CLS		
Cool 1		-5%			CLS				-5%	CLS		
At Set	MID	MID			CLS				MID	CLS		
Heat 1	+5%				CLS				+5%	CLS		
Heat 2	+10%		ON	+5%					+10%	+5%		
Heat 3	+20%		ON	+10%					+20%	+10%		
Heat 4	OPN		ON	+20%					OPN	+20%		

EQUIPMENT SCHEDULE #58

Not Currently Used

EQUIPMENT SCHEDULE #59a

4 Modulating Heat Zones, 1st Zone, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS
DO1 - Heating Actuator #1 Open
DO2 - Heating Actuator #1 Close
DO3 - Heating Actuator #2 Open
DO4 - Heating Actuator #2 Close
DO5 - Heating Actuator #3 Open
DO6 - Heating Actuator #3 Close
DO7 - Heating Actuator #4 Open
DO8 - Heating Actuator #4 Close

ANALOG OUTPUTS
AO1 - Heating Actuator #1
AO2 - Heating Actuator #2
AO3 - Heating Actuator #3
AO4 - Heating Actuator #4

DIGITAL INPUTS
DI1 - Setback Override #1
DI3 - Setback Override #2
DI5 - Setback Override #3
DI7 - Setback Override #4

ANALOG INPUTS
AI1 - Space Temperature #1
AI3 - Space Temperature #2
AI5 - Space Temperature #3
AI7 - Space Temperature #4

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
>76	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS
>75 <=76	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
>74 <=75	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
>=71 <=74												
<71 >=70		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
<70 >=69		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
<69		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS
Cool 2	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
Cool 1	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
At Set												
Heat 1		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
Heat 2		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
Heat 3		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS
Cool 2	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
Cool 1	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
At Set												
Heat 1		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
Heat 2		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
Heat 3		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Heat 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

EQUIPMENT SCHEDULE #59b

4 Modulating Heat Zones, 2nd Zone, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Heating Actuator #1 Open	DI1 - Setback Override #1
DO2 - Heating Actuator #1 Close	DI3 - Setback Override #2
DO3 - Heating Actuator #2 Open	DI5 - Setback Override #3
DO4 - Heating Actuator #2 Close	DI7 - Setback Override #4
DO5 - Heating Actuator #3 Open	
DO6 - Heating Actuator #3 Close	**ANALOG INPUTS**
DO7 - Heating Actuator #4 Open	AI1 - Space Temperature #1
DO8 - Heating Actuator #4 Close	AI3 - Space Temperature #2
	AI5 - Space Temperature #3
ANALOG OUTPUTS	AI7 - Space Temperature #4
AO1 - Heating Actuator #1	
AO2 - Heating Actuator #2	
AO3 - Heating Actuator #3	
AO4 - Heating Actuator #4	Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
>76	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS
>75 <=76	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
>74 <=75	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
>=71 <=74												
<71 >=70		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
<70 >=69		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
<69		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS
Cool 2	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
Cool 1	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
At Set												
Heat 1		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
Heat 2		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
Heat 3		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS
Cool 2	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
Cool 1	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
At Set												
Heat 1		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
Heat 2		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
Heat 3		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Heat 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

Equipment Schedule Sequence of Operations
Enertec/BAS Confidential

EQUIPMENT SCHEDULE #59c

4 Modulating Heat Zones, 3rd Zone, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Heating Actuator #1 Open	DI1 - Setback Override #1
DO2 - Heating Actuator #1 Close	DI3 - Setback Override #2
DO3 - Heating Actuator #2 Open	DI5 - Setback Override #3
DO4 - Heating Actuator #2 Close	DI7 - Setback Override #4
DO5 - Heating Actuator #3 Open	
DO6 - Heating Actuator #3 Close	**ANALOG INPUTS**
DO7 - Heating Actuator #4 Open	AI1 - Space Temperature #1
DO8 - Heating Actuator #4 Close	AI3 - Space Temperature #2
	AI5 - Space Temperature #3
ANALOG OUTPUTS	AI7 - Space Temperature #4
AO1 - Heating Actuator #1	
AO2 - Heating Actuator #2	
AO3 - Heating Actuator #3	
AO4 - Heating Actuator #4	Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
>76	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS
>75 <=76	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
>74 <=75	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
>=71 <=74												
<71 >=70		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
<70 >=69		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
<69		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS
Cool 2	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
Cool 1	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
At Set												
Heat 1		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
Heat 2		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
Heat 3		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS
Cool 2	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
Cool 1	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
At Set												
Heat 1		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
Heat 2		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
Heat 3		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Heat 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

EQUIPMENT SCHEDULE #59d

4 Modulating Heat Zones, 4th Zone, 3 Point Floating or Analog Actuator

DIGITAL OUTPUTS

DO1 - Heating Actuator #1 Open
DO2 - Heating Actuator #1 Close
DO3 - Heating Actuator #2 Open
DO4 - Heating Actuator #2 Close
DO5 - Heating Actuator #3 Open
DO6 - Heating Actuator #3 Close
DO7 - Heating Actuator #4 Open
DO8 - Heating Actuator #4 Close

ANALOG OUTPUTS

AO1 - Heating Actuator #1
AO2 - Heating Actuator #2
AO3 - Heating Actuator #3
AO4 - Heating Actuator #4

DIGITAL INPUTS

DI1 - Setback Override #1
DI3 - Setback Override #2
DI5 - Setback Override #3
DI7 - Setback Override #4

ANALOG INPUTS

AI1 - Space Temperature #1
AI3 - Space Temperature #2
AI5 - Space Temperature #3
AI7 - Space Temperature #4

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
>76	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS
>75 <=76	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
>74 <=75	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
>=71 <=74												
<71 >=70		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
<70 >=69		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
<69		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%

OCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS
Cool 2	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
Cool 1	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
At Set												
Heat 1		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
Heat 2		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
Heat 3		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%

UNOCCUPIED MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Cool 3	CLS		CLS		CLS		CLS		CLS	CLS	CLS	CLS
Cool 2	MIN		MIN		MIN		MIN		MIN	MIN	MIN	MIN
Cool 1	-5%		-5%		-5%		-5%		-5%	-5%	-5%	-5%
At Set												
Heat 1		+5%		+5%		+5%		+5%	+5%	+5%	+5%	+5%
Heat 2		+10%		+10%		+10%		+10%	+10%	+10%	+10%	+10%
Heat 3		+20%		+20%		+20%		+20%	+20%	+20%	+20%	+20%

WARMUP MODE CONTROL SEQUENCE

Stage	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dm Op	Dm Cl	Dmpr	Dmpr	Dmpr	Dmpr
Heat 1	OPN		OPN		OPN		OPN		OPN	OPN	OPN	OPN

EQUIPMENT SCHEDULE #60a

VAV Box, 1st Zone, Dampers Only, Dual Duct, 3 Point Floating or Analog Actuators, 2 Zones

DIGITAL OUTPUTS
DO1 - Cooling Damper Motor #1 Open
DO2 - Cooling Damper Motor #1 Close
DO3 - Heatling Damper Motor #1 Open
DO4 - Heating Damper Motor #1 Close
DO5 - Cooling Damper Motor #2 Open
DO6 - Cooling Damper Motor #2 Close
DO7 - Heatling Damper Motor #2 Open
DO8 - Heating Damper Motor #2 Close

DIGITAL INPUTS
DI1 - Setback Override #1
DI5 - Setback Override #2

ANALOG INPUTS
AI1 - Space Temperature #1
AI2 - CFM #1 (optional)
AI5 - Space Temperature #2
AI6 - CFM #2 (optional)

ANALOG OUTPUTS
AO1 - Cooling Damper Motor #1
AO2 - Heating Damper Motor #1
AO3 - Cooling Damper Motor #2
AO4 - Heating Damper Motor #2

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Dm	Htg Dm	Clg Dm	Htg Dm
>76	+20%			CLS	+20%			CLS	+20%	CLS	+20%	CLS
>75 <=76	+10%			CLS	+10%			CLS	+10%	CLS	+10%	CLS
>74 <=75	+5%			CLS	+5%			CLS	+5%	CLS	+5%	CLS
>=71 <=74				CLS				CLS		CLS		CLS
<71 >=70		-5%	+5%			-5%	+5%		-5%	+5%	-5%	+5%
<70 >=69		MIN	+10%			MIN	+10%		MIN	+10%	MIN	+10%
<69		CLS	+20%			CLS	+20%		CLS	+20%	CLS	+20%

OCCUPIED MODE CONTROL SEQUENCE

Temp	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Dm	Htg Dm	Clg Dm	Htg Dm
Cool 3	+20%			CLS	+20%			CLS	+20%	CLS	+20%	CLS
Cool 2	+10%			CLS	+10%			CLS	+10%	CLS	+10%	CLS
Cool 1	+5%			CLS	+5%			CLS	+5%	CLS	+5%	CLS
At Set				CLS				CLS		CLS		CLS
Heat 1		-5%	+5%			-5%	+5%		-5%	+5%	-5%	+5%
Heat 2		MIN	+10%			MIN	+10%		MIN	+10%	MIN	+10%
Heat 3		CLS	+20%			CLS	+20%		CLS	+20%	CLS	+20%

UNOCCUPIED MODE CONTROL SEQUENCE

Temp	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Dm	Htg Dm	Clg Dm	Htg Dm
At Set		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Heat 1		CLS	+5%			CLS	+5%		CLS	+5%	CLS	+5%
Heat 2		CLS	+10%			CLS	+10%		CLS	+10%	CLS	+10%
Heat 3		CLS	+20%			CLS	+20%		CLS	+20%	CLS	+20%

WARMUP MODE CONTROL SEQUENCE

Temp	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Dm	Htg Dm	Clg Dm	Htg Dm
Heat 1		CLS	OPN			CLS	OPN		CLS	OPN	CLS	OPN
Heat 2		CLS	OPN			CLS	OPN		CLS	OPN	CLS	OPN

EQUIPMENT SCHEDULE #60b

VAV Box, 2nd Zone, Dampers Only, Dual Duct, 3 Point Floating or Analog Actuators, 2 Zones

DIGITAL OUTPUTS
DO1 - Cooling Damper Motor #1 Open
DO2 - Cooling Damper Motor #1 Close
DO3 - Heatling Damper Motor #1 Open
DO4 - Heating Damper Motor #1 Close
DO5 - Cooling Damper Motor #2 Open
DO6 - Cooling Damper Motor #2 Close
DO7 - Heatling Damper Motor #2 Open
DO8 - Heating Damper Motor #2 Close

DIGITAL INPUTS
DI1 - Setback Override #1
DI5 - Setback Override #2

ANALOG INPUTS
AI1 - Space Temperature #1
AI2 - CFM #1 (optional)
AI5 - Space Temperature #2
AI6 - CFM #2 (optional)

ANALOG OUTPUTS
AO1 - Cooling Damper Motor #1
AO2 - Heating Damper Motor #1
AO3 - Cooling Damper Motor #2
AO4 - Heating Damper Motor #2

Shaded Areas Not Applicable to this Schedule.

DEFAULT MODE CONTROL SEQUENCE

Temp	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Dm	Htg Dm	Clg Dm	Htg Dm
>76	+20%			CLS	+20%			CLS	+20%	CLS	+20%	CLS
>75 <=76	+10%			CLS	+10%			CLS	+10%	CLS	+10%	CLS
>74 <=75	+5%			CLS	+5%			CLS	+5%	CLS	+5%	CLS
>=71 <=74				CLS				CLS		CLS		CLS
<71 >=70		-5%	+5%			-5%	+5%		-5%	+5%	-5%	+5%
<70 >=69		MIN	+10%			MIN	+10%		MIN	+10%	MIN	+10%
<69		CLS	+20%			CLS	+20%		CLS	+20%	CLS	+20%

OCCUPIED MODE CONTROL SEQUENCE

Temp	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Dm	Htg Dm	Clg Dm	Htg Dm
Cool 3	+20%			CLS	+20%			CLS	+20%	CLS	+20%	CLS
Cool 2	+10%			CLS	+10%			CLS	+10%	CLS	+10%	CLS
Cool 1	+5%			CLS	+5%			CLS	+5%	CLS	+5%	CLS
At Set				CLS				CLS		CLS		CLS
Heat 1		-5%	+5%			-5%	+5%		-5%	+5%	-5%	+5%
Heat 2		MIN	+10%			MIN	+10%		MIN	+10%	MIN	+10%
Heat 3		CLS	+20%			CLS	+20%		CLS	+20%	CLS	+20%

UNOCCUPIED MODE CONTROL SEQUENCE

Temp	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Dm	Htg Dm	Clg Dm	Htg Dm
At Set		CLS		CLS		CLS		CLS	CLS	CLS	CLS	CLS
Heat 1		CLS	+5%			CLS	+5%		CLS	+5%	CLS	+5%
Heat 2		CLS	+10%			CLS	+10%		CLS	+10%	CLS	+10%
Heat 3		CLS	+20%			CLS	+20%		CLS	+20%	CLS	+20%

WARMUP MODE CONTROL SEQUENCE

Temp	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Op	Clg Cl	Htg Op	Htg Cl	Clg Dm	Htg Dm	Clg Dm	Htg Dm
Heat 1		CLS	OPN			CLS	OPN		CLS	OPN	CLS	OPN
Heat 2		CLS	OPN			CLS	OPN		CLS	OPN	CLS	OPN

EQUIPMENT SCHEDULE #61

Not Currently Used

EQUIPMENT SCHEDULE #62

Not Currently Used

EQUIPMENT SCHEDULE #63

Lighting Control, 8 Zones

DIGITAL OUTPUTS	DIGITAL INPUTS
DO1 - Lighting Zone #1	DI1 - Setback Override Zone #1
DO2 - Lighting Zone #2	DI2 - Setback Override Zone #2
DO3 - Lighting Zone #3	DI3 - Setback Override Zone #3
DO4 - Lighting Zone #4	DI4 - Setback Override Zone #4
DO5 - Lighting Zone #5	DI5 - Setback Override Zone #5
DO6 - Lighting Zone #6	DI6 - Setback Override Zone #6
DO7 - Lighting Zone #7	DI7 - Setback Override Zone #7
DO8 - Lighting Zone #8	DI8 - Setback Override Zone #8

EQUIPMENT SCHEDULE #64

Reserved for Custom Definition

Notes

Equipment Schedules 1-4, 9, 10, 21, 29, 30

Note 1: Warmup Mode - The zone will enter Early Occupied mode and use Occupied mode sequence of operations after reaching Occupied heating setpoint.

Equipment Schedules 5-8, 11, 12, 23-28, 31

Note 1: Warmup Mode - The zone will enter Early Occupied mode and use Occupied mode sequence of operations after reaching Occupied heating setpoint.

Note 2: Cooldown Mode - The zone will re-enter Unoccupied Mode and stay there as long as the space temp remains below the Occupied cooling setpoint.

Equipment Schedules 13, 14

Note 1: The Damper will not be used for Warmup Mode unless Warmup has been selected as an option for this zone, Central Station Air Handler has heat installed, and the heat is on. Once Occupied setpoint has been reached, the damper will close until Occupied start time.

Equipment Schedules 15-20

Note 1: Warmup Mode - The zone will enter Early Occupied mode and use Occupied mode sequence of operations after reaching Occupied heating setpoint, except the damper will remain closed until Occupied start time. The Damper will not be used for Warmup Mode unless Warmup has been selected for this zone, Central Station Air Handler has heat installed, and the heat is on.

Note 2: The zone installed heat will not be energized until the damper motor is at minimum position, except during Warmup.

Equipment Schedules 32, 33

Note 1: Default Mode - If DI2 (Flow Switch) is on, DO1 (Pump #1) will be on. If DI2 is off, DO2 (Pump #2) will be energized. If only one loop pump is to be used, install a jumper from +5 vdc to DI2.

VariZone and VAV Servers

Note 1: When a zone is defined as a VariZone or a VAV Server, a discharge air temperature sensor must be connected to AI4. This sensor will be used to limit DAT and prevent damage to the equipment.

3 Point Floating Actuators

Note 1: RSC Default Mode timing for 3 point actuators is 90 seconds.

Economizer Control

Note 1: Any equipment using an economizer must have a return air enthalpy sensor connected to AI2 and a duct temperature sensor connected to AI6 and monitoring either mixed air or discharge air.

Economizer Active

Note 1: The economizer is considered active any time return air enthalpy is greater than outside air enthalpy.

List of Abbreviations

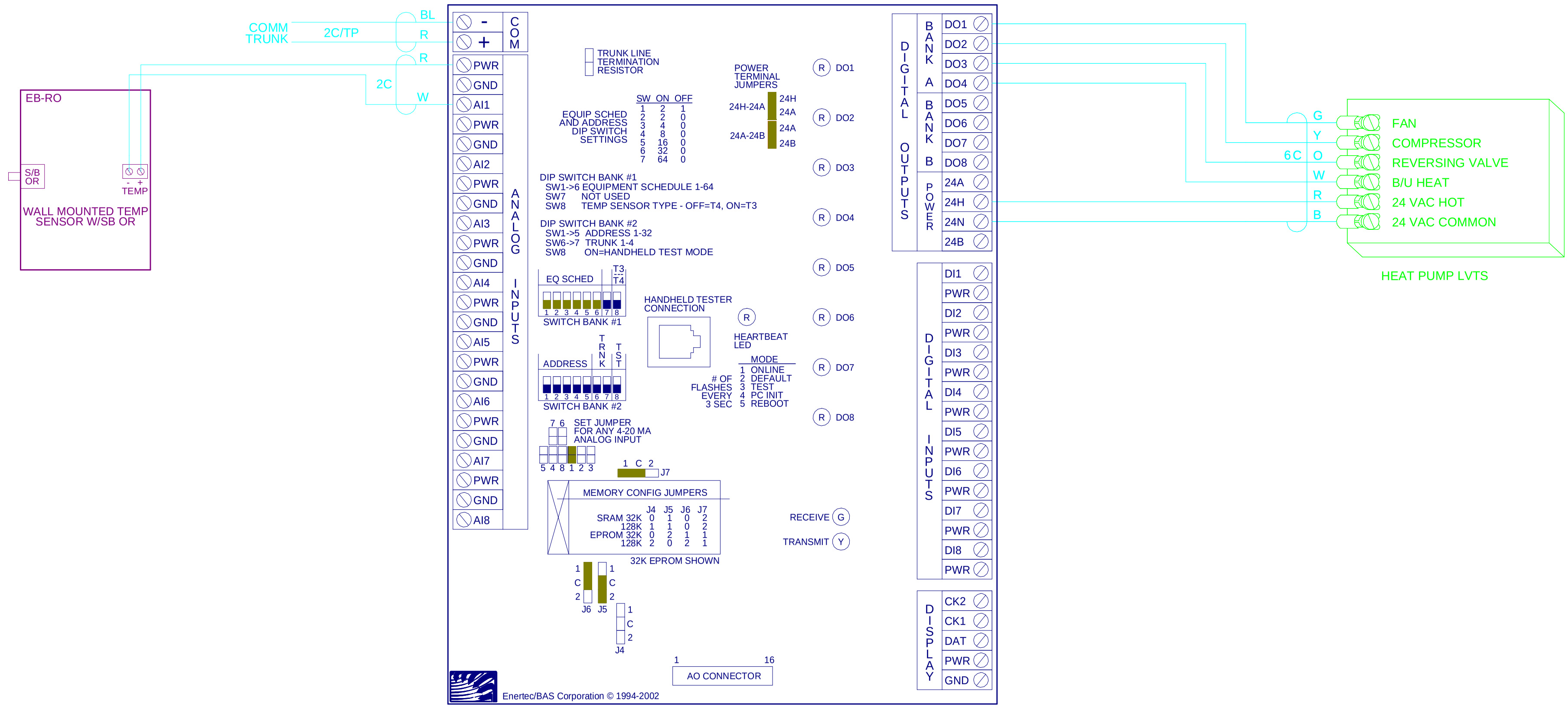
MIN - Actuator goes immediately to Minimum Position
CLS - Actuator goes immediately to Fully Closed
OPN - Actuator goes immediately to Fully Open (Override by MAT if Economizer)
MID - Actuator goes immediately to 50% Open
% - Indicates % of Total Actuator Travel per Minute

Appendix B

Equipment Schedule Drawings

List of Equipment Schedules

#1- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Cooling
#2- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Heating
#3- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Cooling, 2 Units
#4- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, No Economizer, RV Heating, 2 Units
#5- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, Economizer (Stg or Anl), RV Cooling
#6- Heat Pump, Single Zone or **VariZone®** Server, 1 Compressor, Backup Heat, Economizer (Stg or Anl), RV Heating
#7- Heat Pump, Single Zone or **VariZone®** Server, 2 Compressors, Backup Heat, Economizer (Stg or Anl), RV Cooling
#8- Heat Pump, Single Zone or **VariZone®** Server, 2 Compressors, Backup Heat, Economizer (Stg or Anl), RV Heating
#9- Air Conditioner, Single Zone or **VariZone®** Server, 1 Compressor, Heat, No Economizer
#10- Air Conditioner, Single Zone or **VariZone®** Server, 1 Compressor, Heat, No Economizer, 2 Units
#11- Air Conditioner, Single Zone or **VariZone®** Server, 1 Compressor, Heat, Economizer (Stg or Anl)
#12- Air Conditioner, Single Zone or **VariZone®** Server, 2 Stages Cooling, 2 Stages Heat, Economizer (Stg or Anl)
#13- VAV Damper, Cooling Only, 3 Point Floating or Analog Actuator
#14- VAV Damper, Cooling Only, 3 Point Floating or Analog Actuator, 4 Zones
#15- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Constant Air Volume
#16- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Constant Air Volume, 2 Zones
#17- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Variable Air Volume
#18- VAV Box, Fan, Cooling, Electric Heat, 3 Point Floating or Analog Actuator, Variable Air Volume, 2 Zones
#19- VAV Box, Fan, Cooling, Hydronic Heat, 3 Point Floating or Analog Actuators, Constant Air Volume
#20- VAV Box, Fan, Cooling, Hydronic Heat, 3 Point Floating or Analog Actuators, Variable Air Volume
#21- Fan Coil, Heating, 4 Units
#22- Fan Coil, Cooling, 4 Units
#23- Unit Ventilator, Electric Heat, Economizer (Stg or Anl)
#24- Unit Ventilator, Electric Heat, Economizer (Stg or Anl), 2 Units
#25- Unit Ventilator, Electric Heat, Modulating Economizer, 3 Point Floating or Analog Actuator
#26- Unit Ventilator, Electric Heat, Modulating Economizer, 3 Point Floating or Analog Actuator, 2 Units
#27- Unit Ventilator, Hydronic Heat, 3 Point Floating or Analog Actuator, Economizer,
#28- Unit Ventilator, Hydronic Heat, Modulating Economizer, 3 Point Floating or Analog Actuators
#29- Air Handling Unit, 4 Stage Heat, Outdoor Reset
#30- Air Handling Unit, 3 Way Mixing Valve, 3 Point Floating or Analog Actuator, Outdoor Reset
#31- Air Handling Unit, 3 Stage Heat, Modulating Cooling, Modulating Economizer, Analog Actuators, 2 Units
#32- Hydronic Heat Pump Loop Control, 1 Stage Heat, 4 Stage Cooling, 2 Loop Pumps
#33- Chiller, 4 Stage Cooling, 2 Chill Water Pumps
#34- Not Currently Used
#35- Boiler, 4 Stage Heat, Outdoor Reset
#36- Boiler, 3 Way Mixing Valve, 3 Point Floating or Analog Actuator, Outdoor Reset
#37-39 Not Currently Used
#40- Air Handling Unit, 4 Stg Cool, 1 Stg Heat, Analog Cool, 3 Pt or Analog Economizer, Single Zone or VAV Server
#41- Air Handling Unit, Modulating Duct Static Pressure Control, Single Zone or VAV Server, 2 Units
#42- Air Handling Unit, Modulating Building Static Pressure Control, 2 Units
#43-49 Not Currently Used
#50- **VariZone®** Damper, 3 Point Floating or Analog Actuator
#51- **VariZone®** Damper, 3 Point Floating or Analog Actuator, 4 Zones
#52- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Constant Air Volume
#53- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Constant Air Volume, 2 Zones
#54- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Variable Air Volume
#55- **VariZone®** Box, Fan Powered, Electric B/U Heat, 3 Point Floating or Analog Actuator, Variable Air Volume, 2 Zones
#56- **VariZone®** Box, Fan Powered, Hydronic B/U Heat, 3 Point Floating or Analog Actuators, Constant Air Volume
#57- **VariZone®** Box, Fan Powered, Hydronic B/U Heat, 3 Point Floating or Analog Actuators, Variable Air Volume
#58- Not Currently Used
#59- Modulating Heat, 3 Point Floating or Analog Actuator, 4 Zones
#60- VAV Dampers, Dual Duct System, 3 Point Floating or Analog Actuators, 2 Zones
#61-62 Not Currently Used
#63- Lighting Control, 8 Zones
#64- Reserved for Custom Output Definition



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www.enertec-bas.com

PROJECT NAME

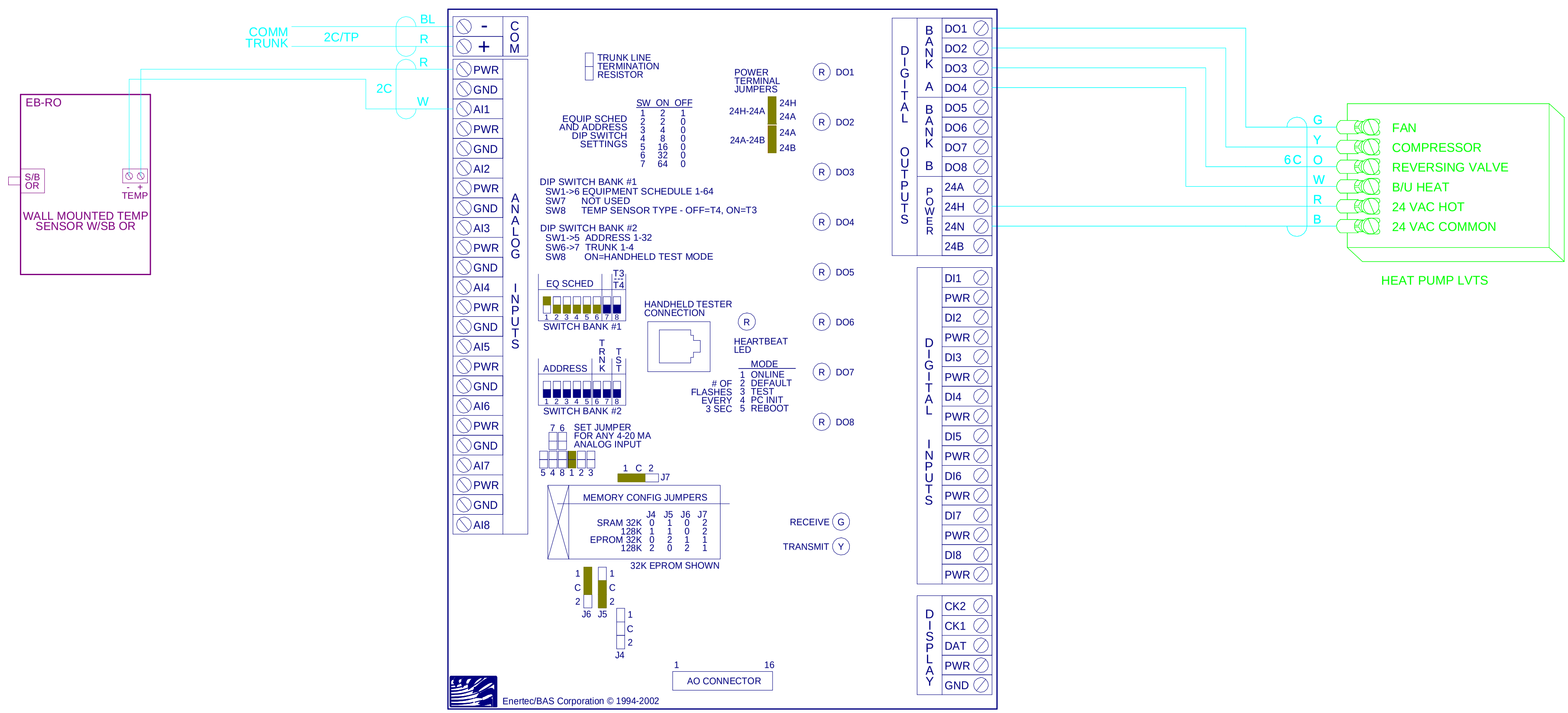
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 1 ES DESCRIPTION: HEAT PUMP, 1 ZONE, 1 COMPRESSOR, BACKUP HEAT, RV COOLING

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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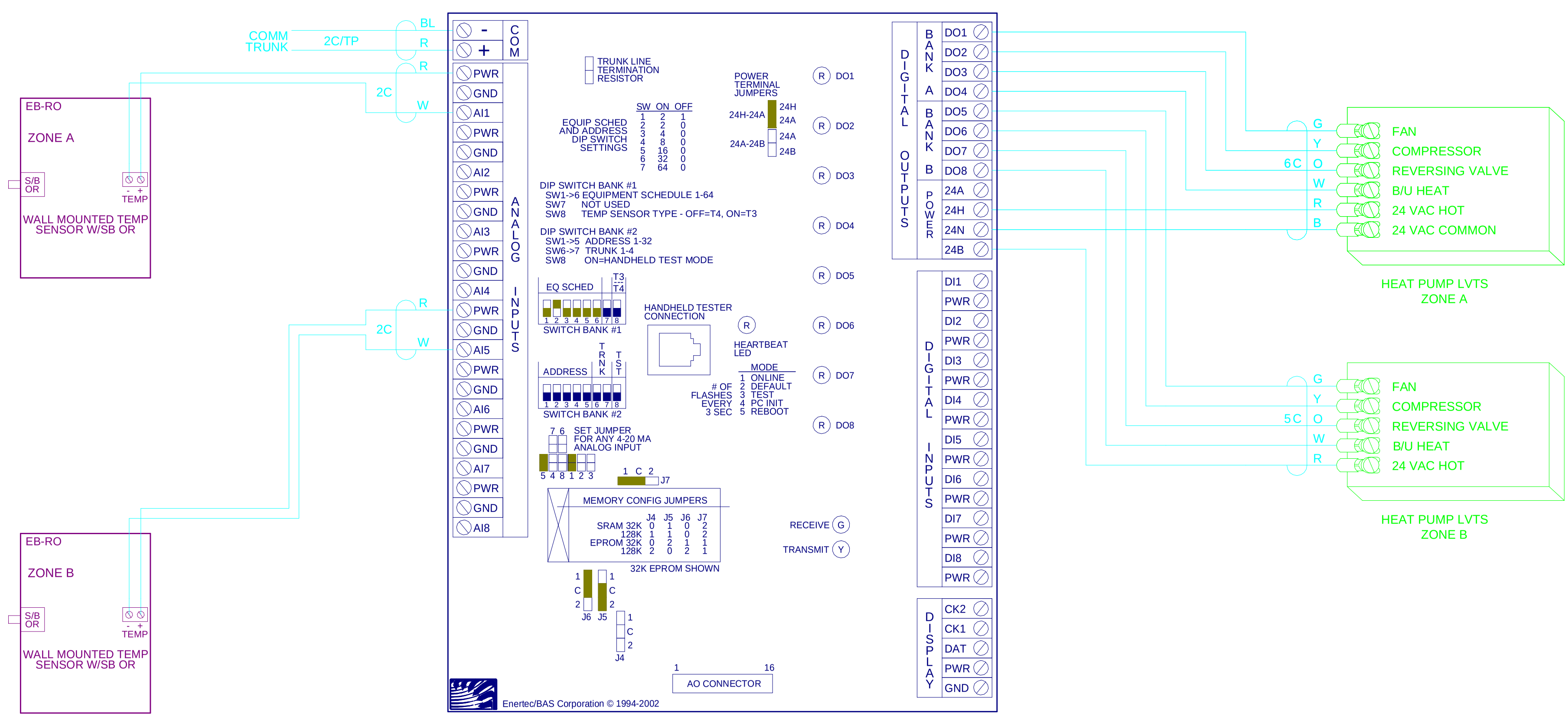
PROJECT NAME
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 2 ES DESCRIPTION: HEAT PUMP, 1 ZONE, 1 COMPRESSOR, BACKUP HEAT, RV HEATING

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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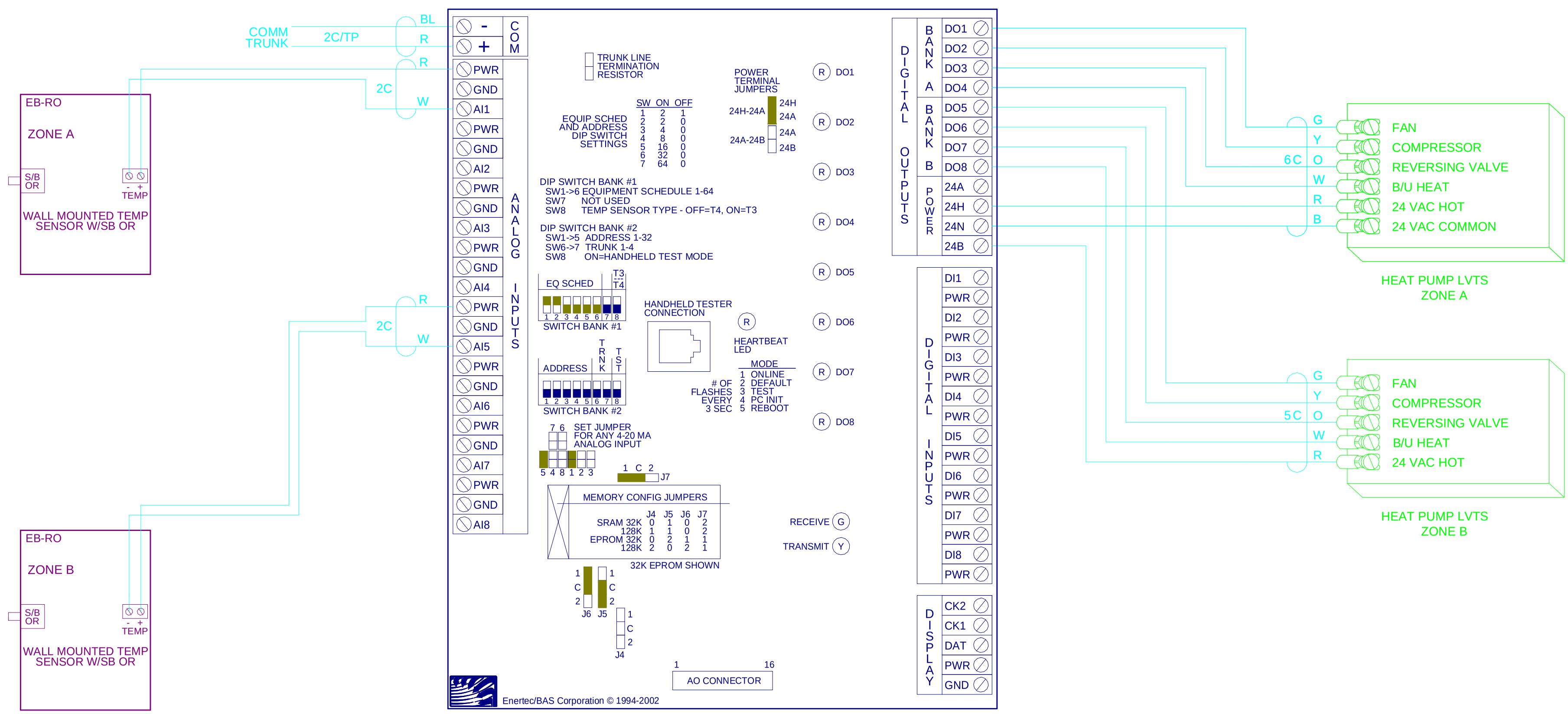
PROJECT NAME
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 3 ES DESCRIPTION: HEAT PUMP, 2 ZONES, 1 COMPRESSOR, BACKUP HEAT, RV COOLING

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 4 ES DESCRIPTION: HEAT PUMP, 2 ZONES, 1 COMPRESSOR, BACKUP HEAT, RV HEATING

REVISIONS	DATE	BY

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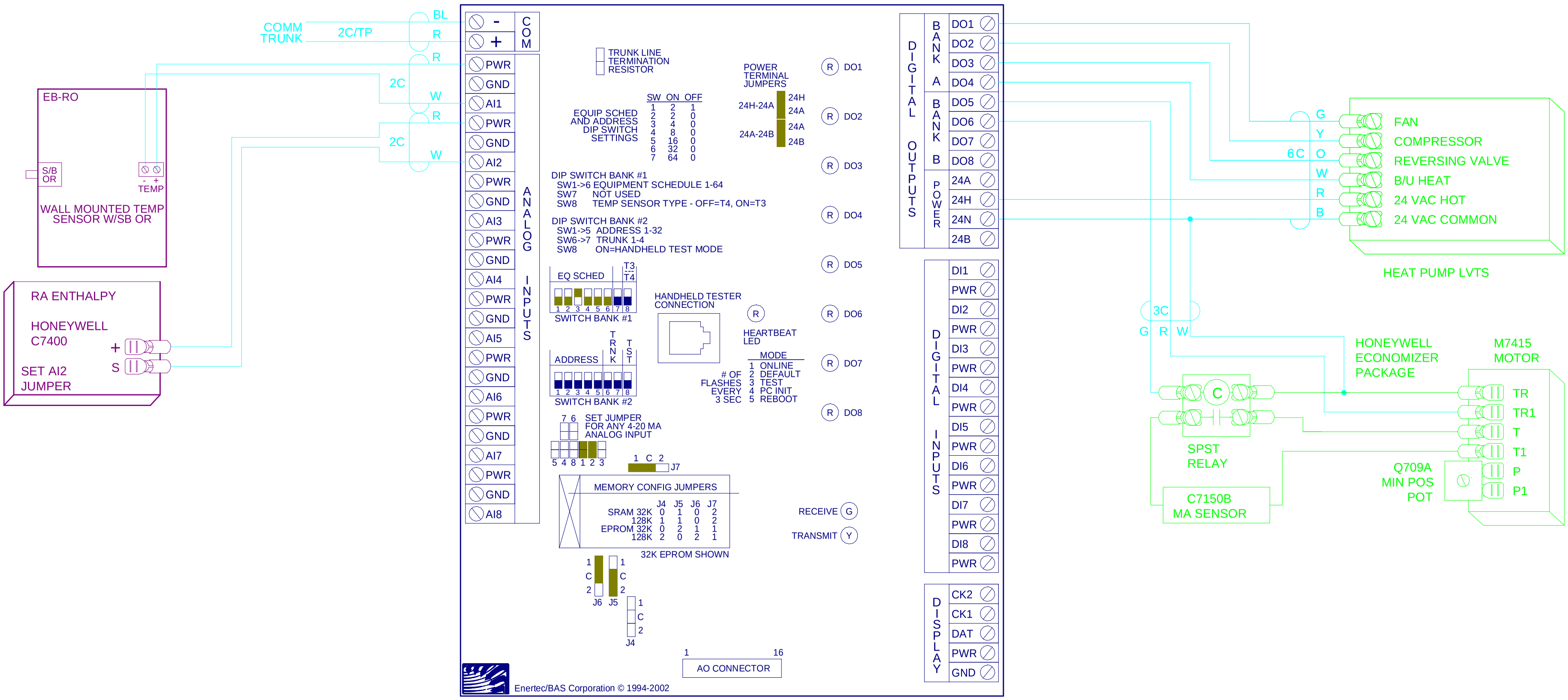
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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PROJECT NAME

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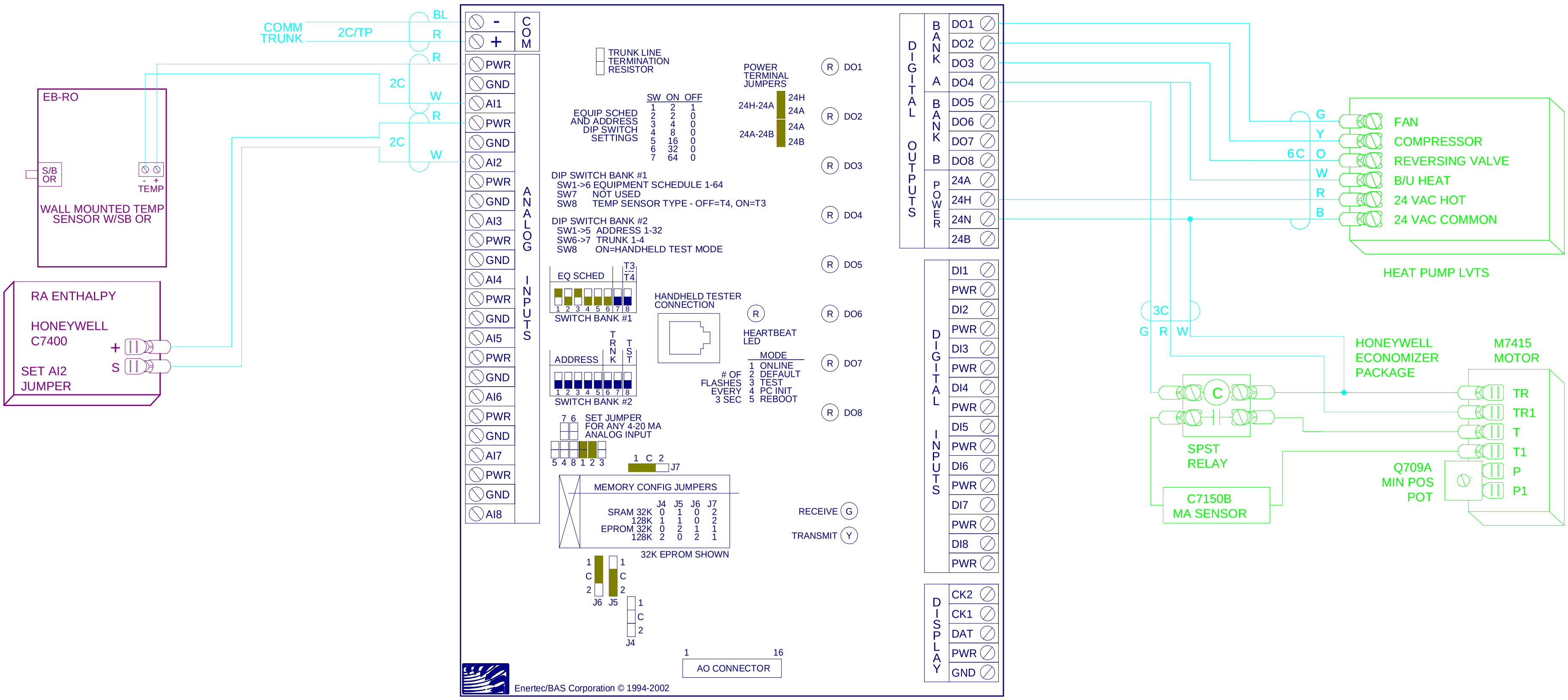
CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 5 | ES DESCRIPTION: HEAT PUMP, 1 COMP, B/U HEAT, RV COOLING, ECONOMIZER

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 6 ES DESCRIPTION: HEAT PUMP, 1 COMP, B/U HEAT, RV HEATING, ECONOMIZER

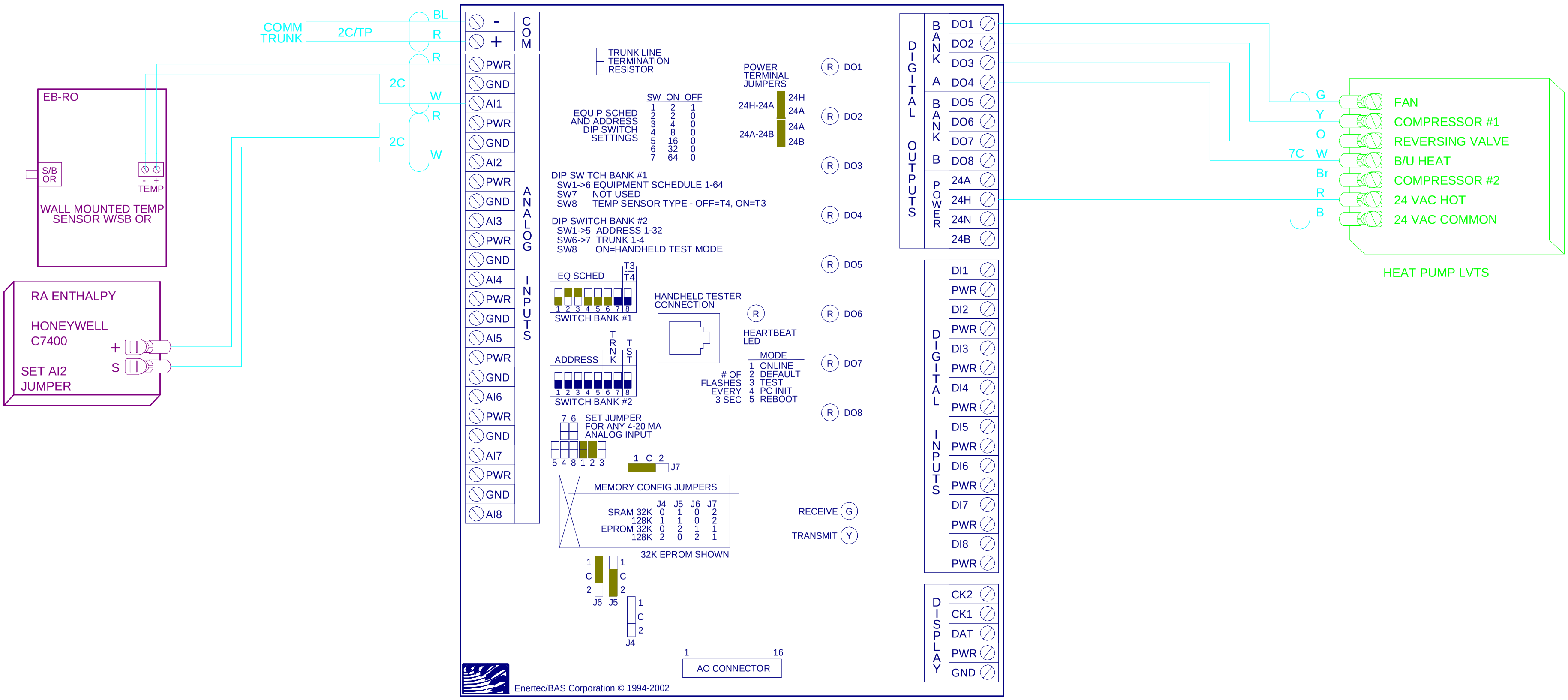
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME

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CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 7 ES DESCRIPTION: HEAT PUMP, 2 COMPRESSORS, B/U HEAT, RV COOLING, ECONOMIZER

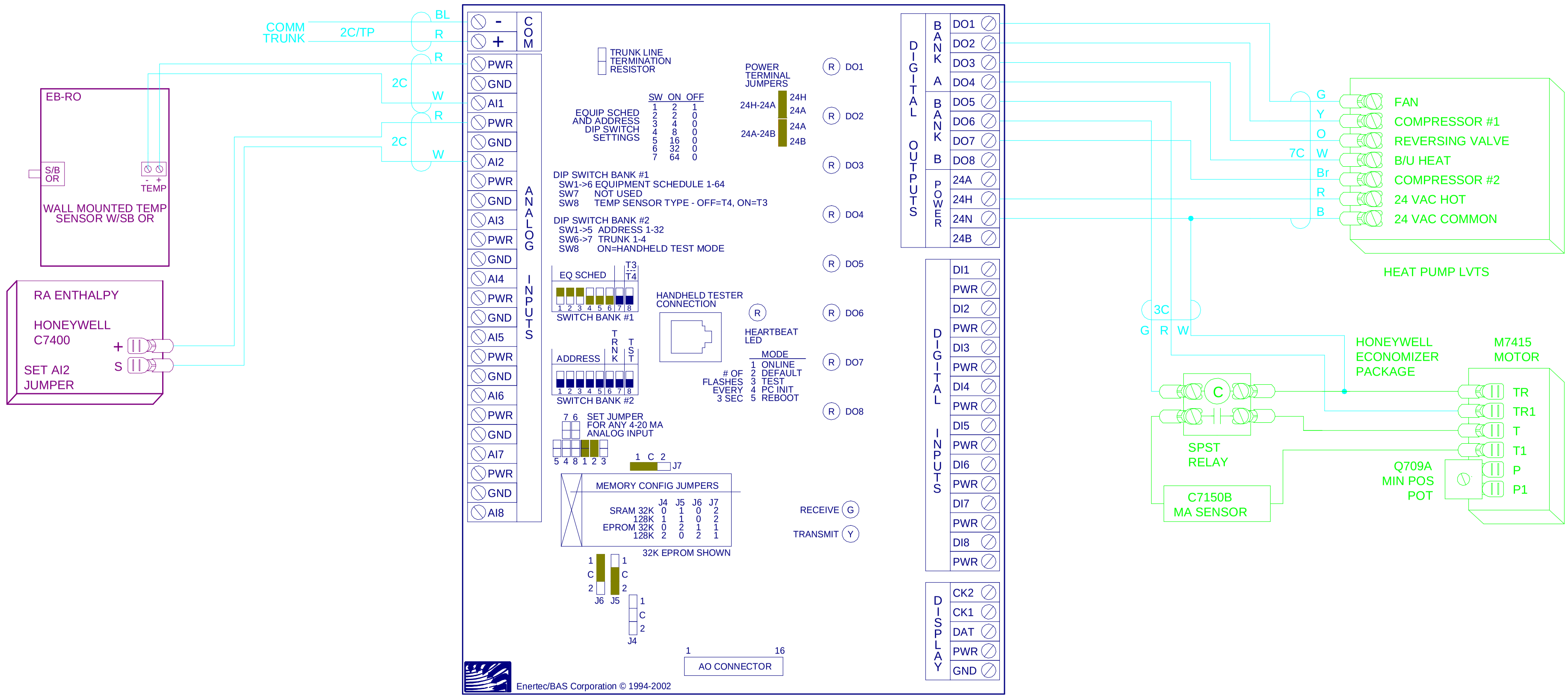
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME
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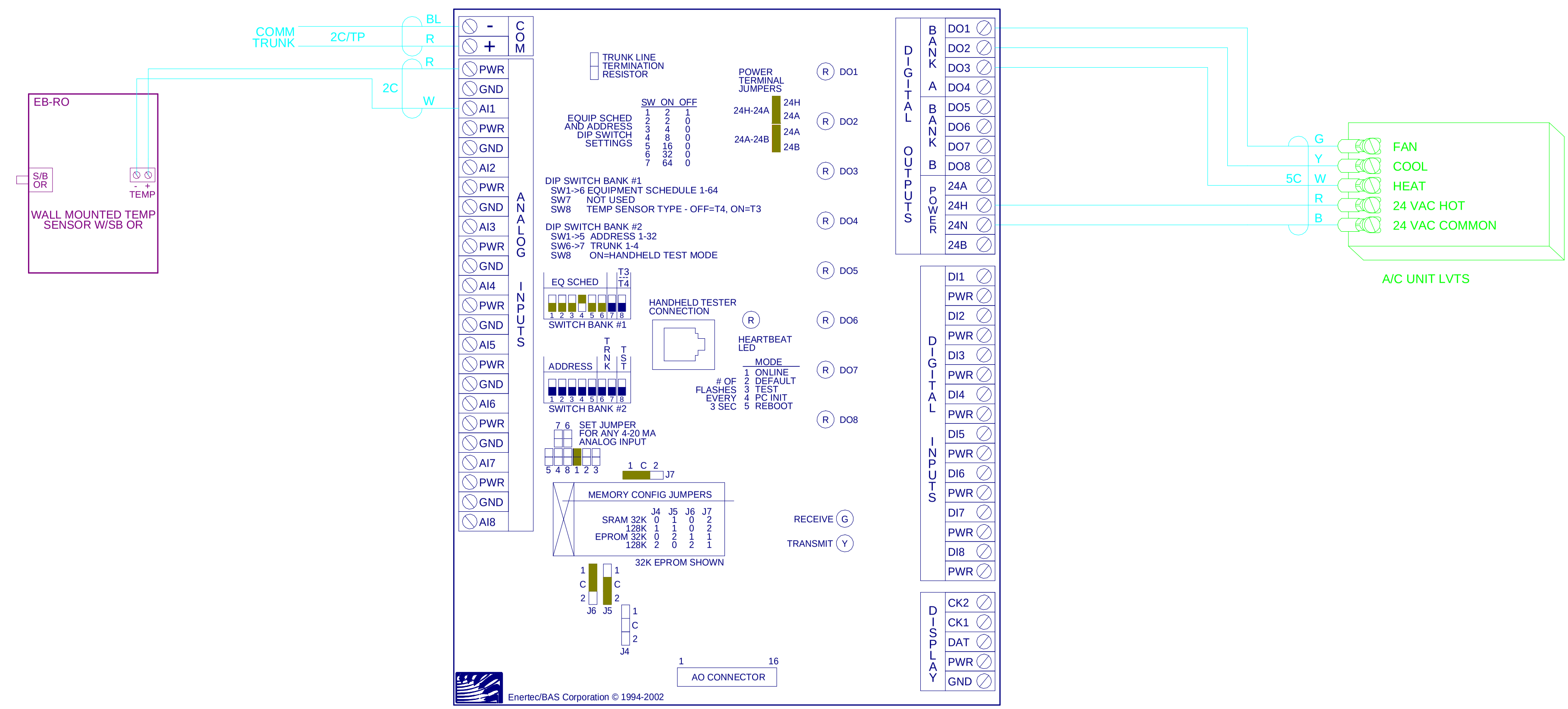
CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 8 ES DESCRIPTION: HEAT PUMP, 2 COMPRESSORS, B/U HEAT, RV HEATING, ECONOMIZER

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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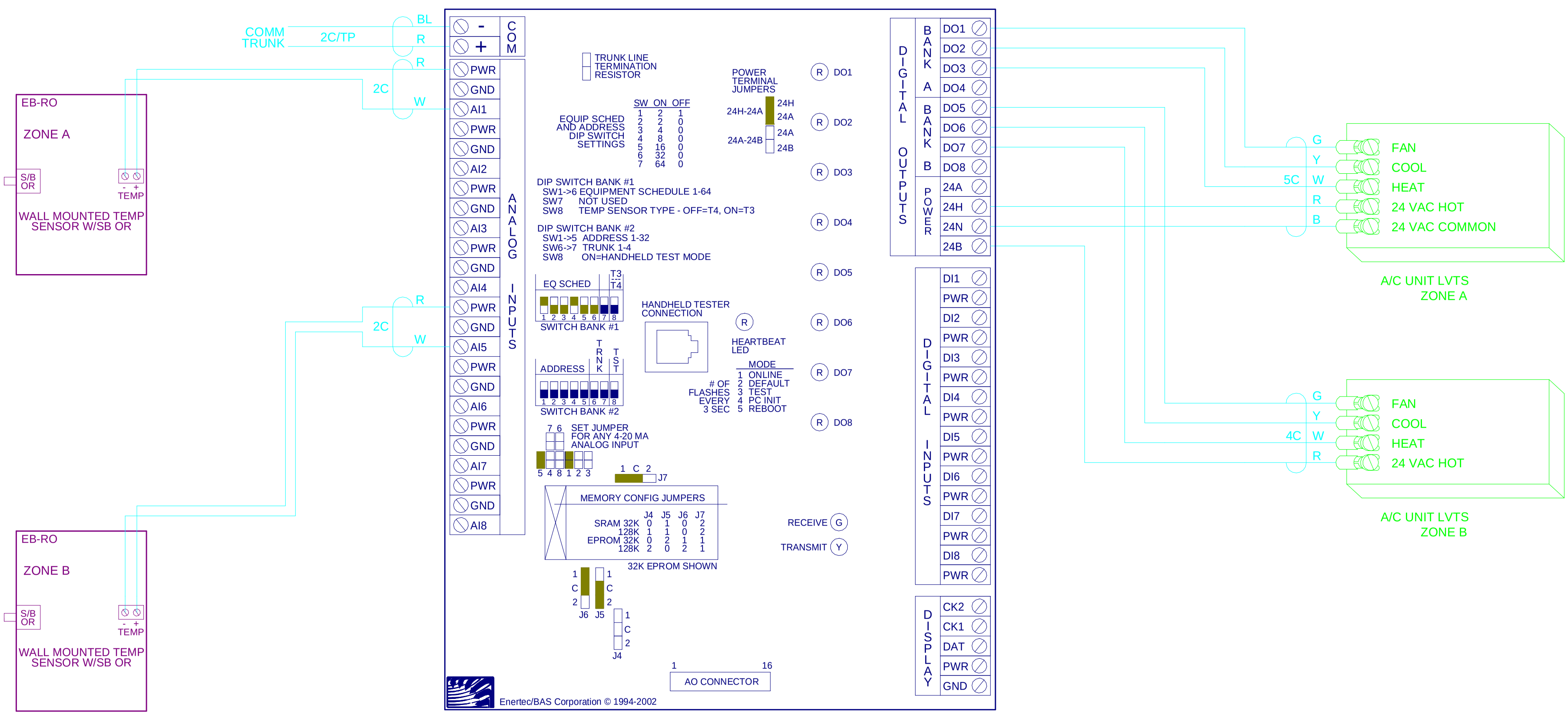
	CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC			
	ES #: 9 ES DESCRIPTION: A/C UNIT, 1 COOL, 1 HEAT, NO ECONOMIZER			

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 10 | ES DESCRIPTION: A/C UNIT, 1 COOL, 1 HEAT, NO ECONO, 2 ZONES

REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

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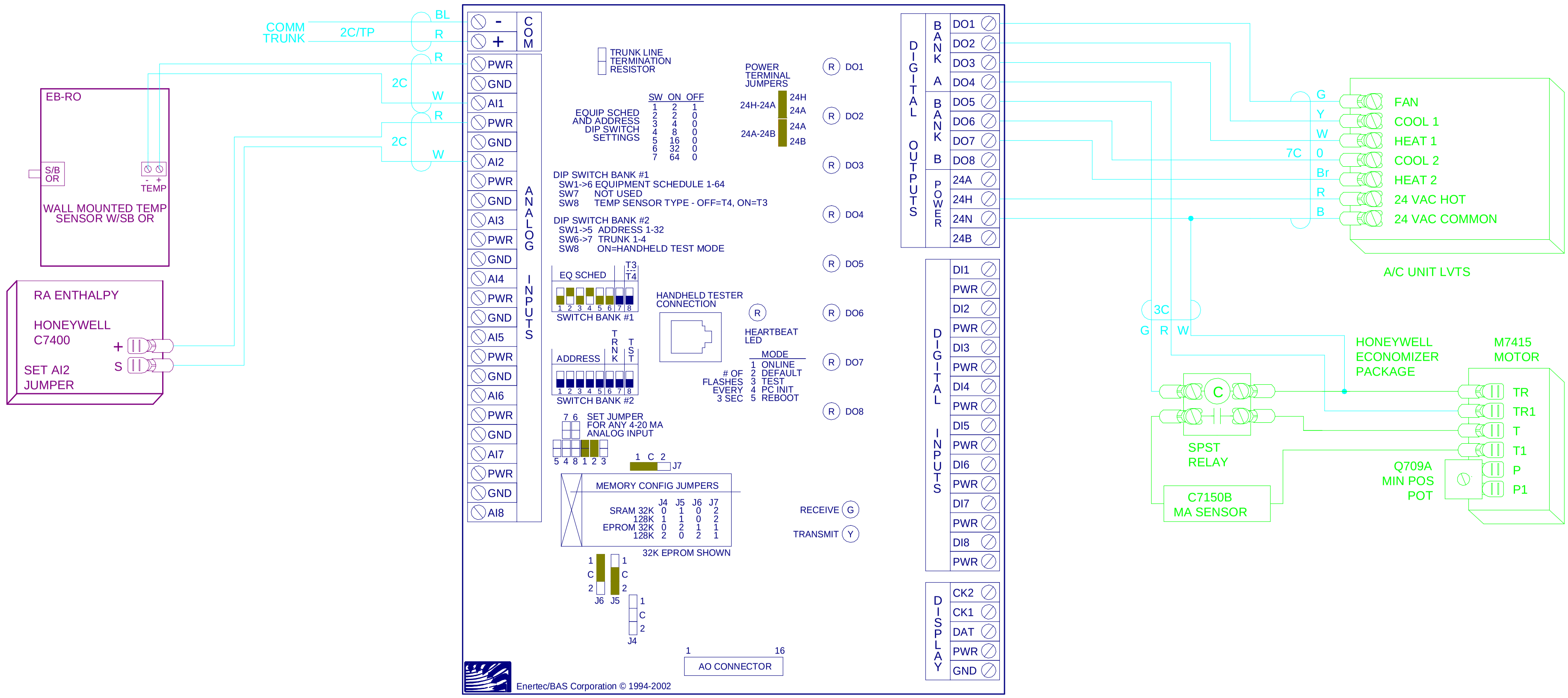

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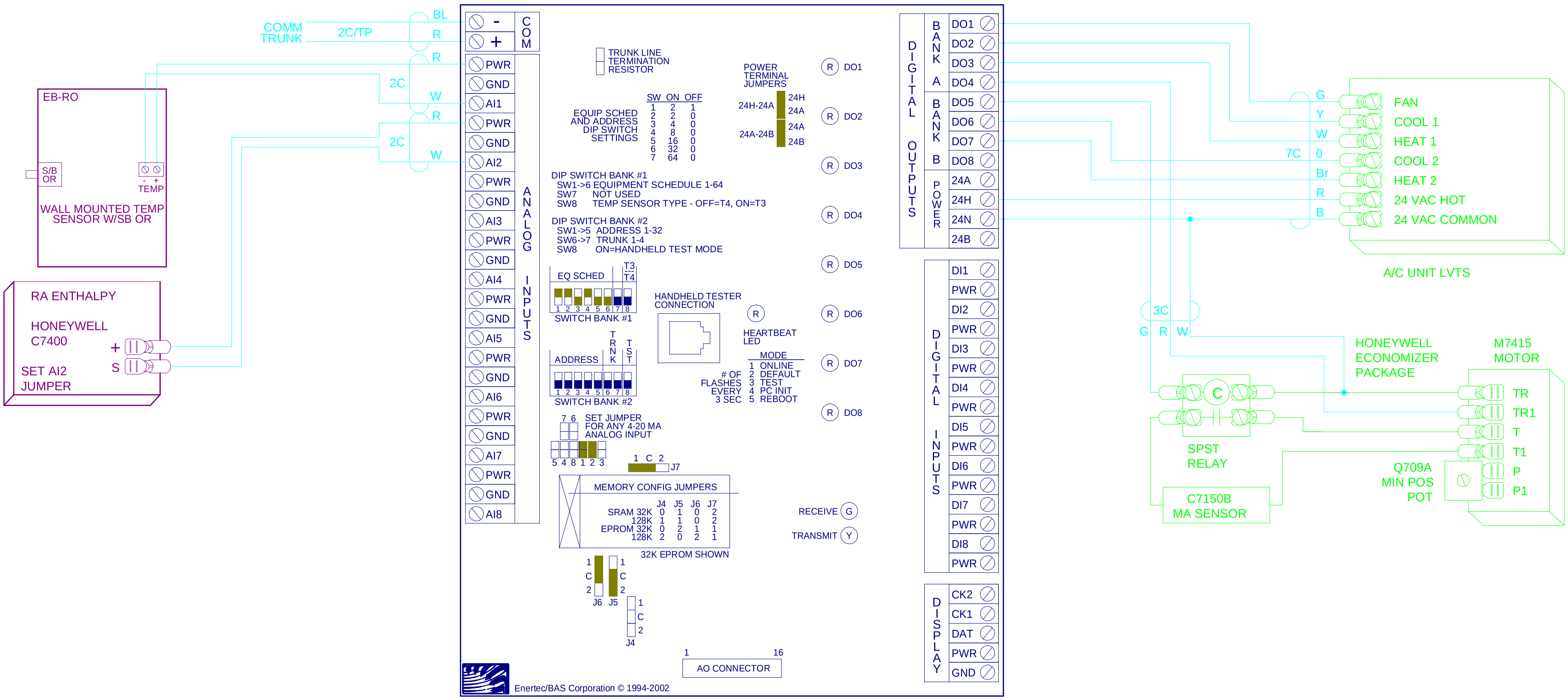
CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 11 ES DESCRIPTION: A/C UNIT, 1 COOL, 1 HEAT, ECONOMIZER

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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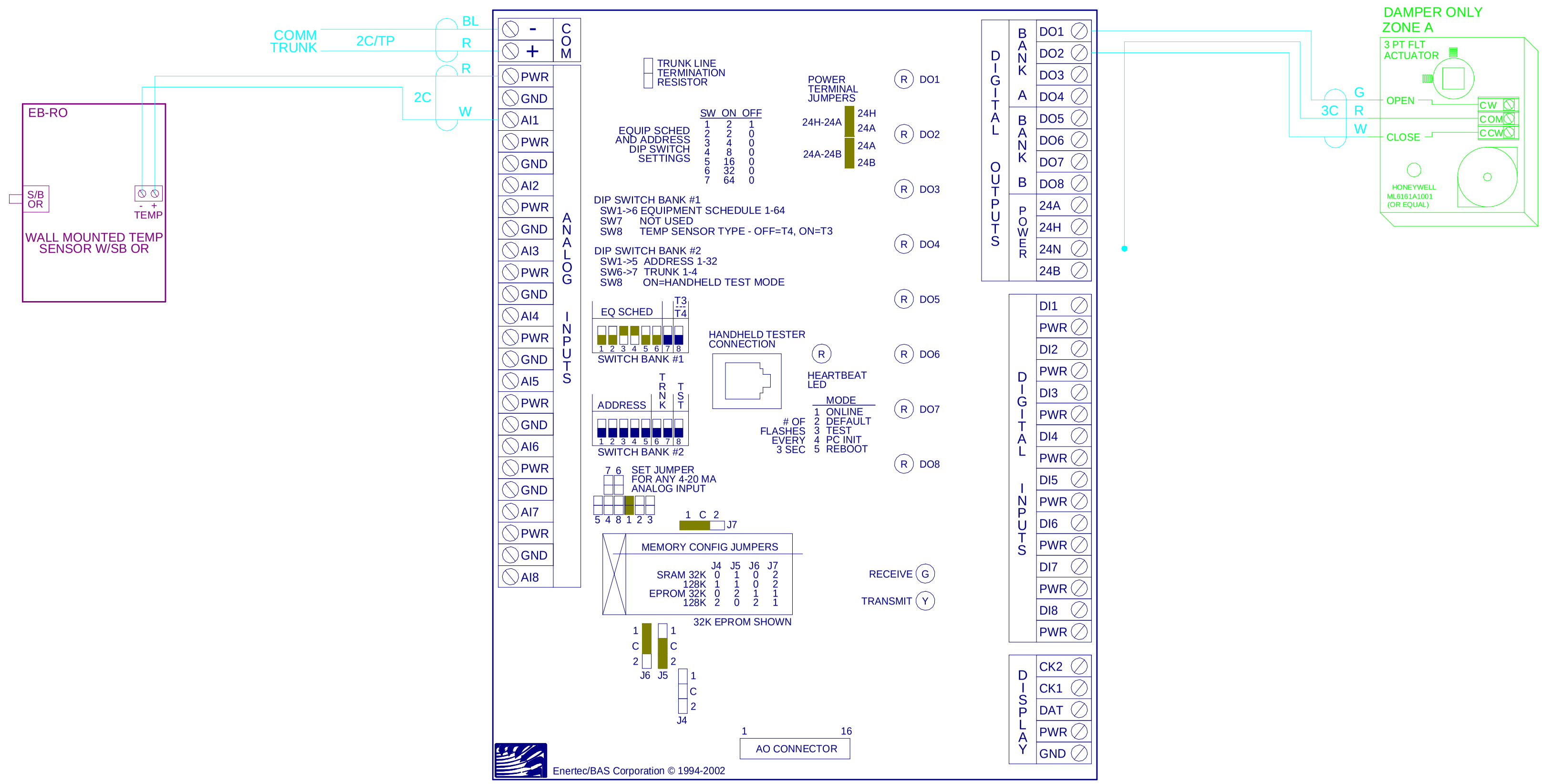
CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 12 | ES DESCRIPTION: A/C UNIT, 2 COOL, 2 HEAT, ECONOMIZER

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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PROJECT NAME

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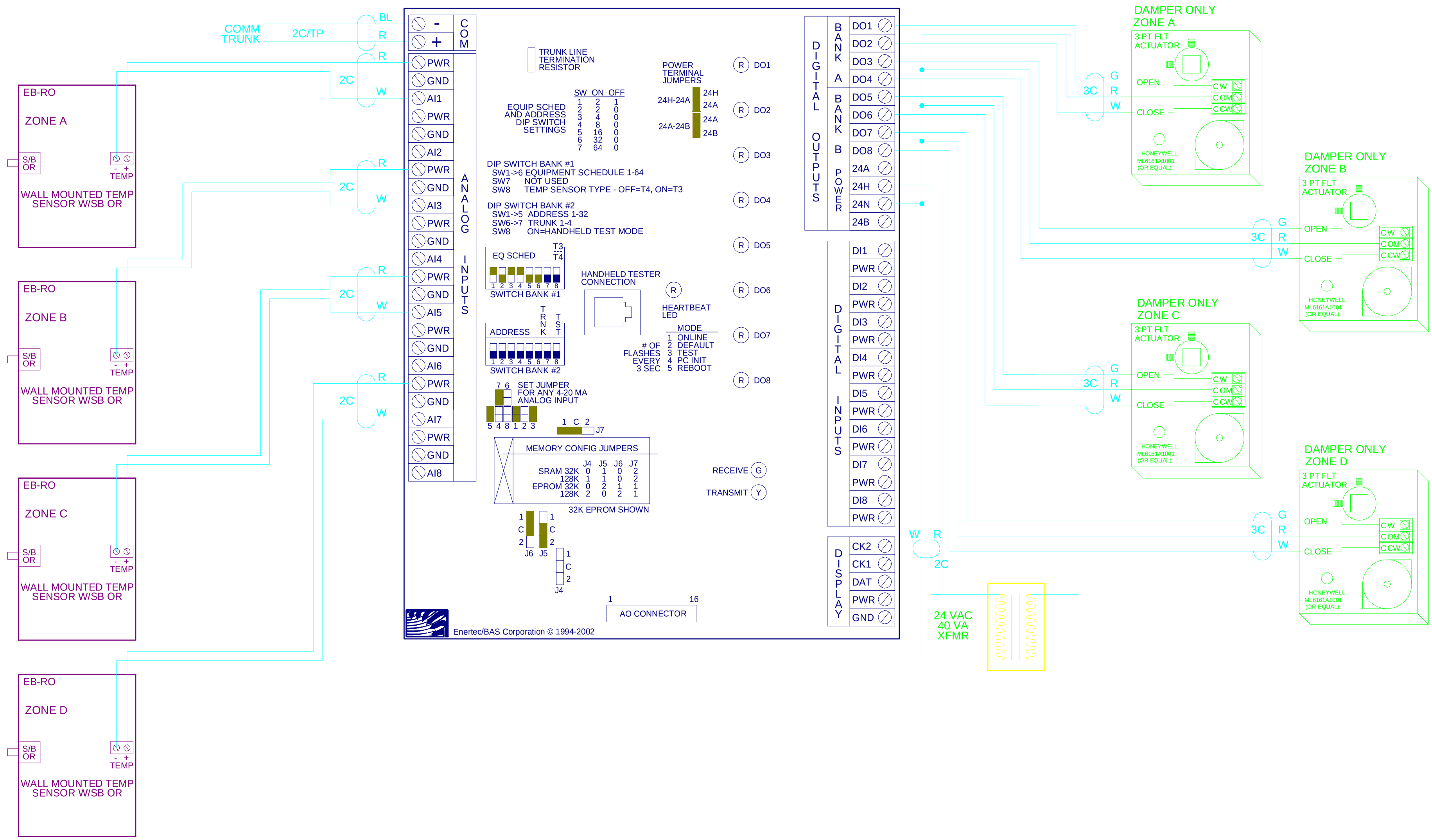
CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 13 ES DESCRIPTION: VAV BOX, DAMPER ONLY

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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PROJECT NAME

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CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 14 ES DESCRIPTION: VAV BOX, DAMPER ONLY, 4 ZONES

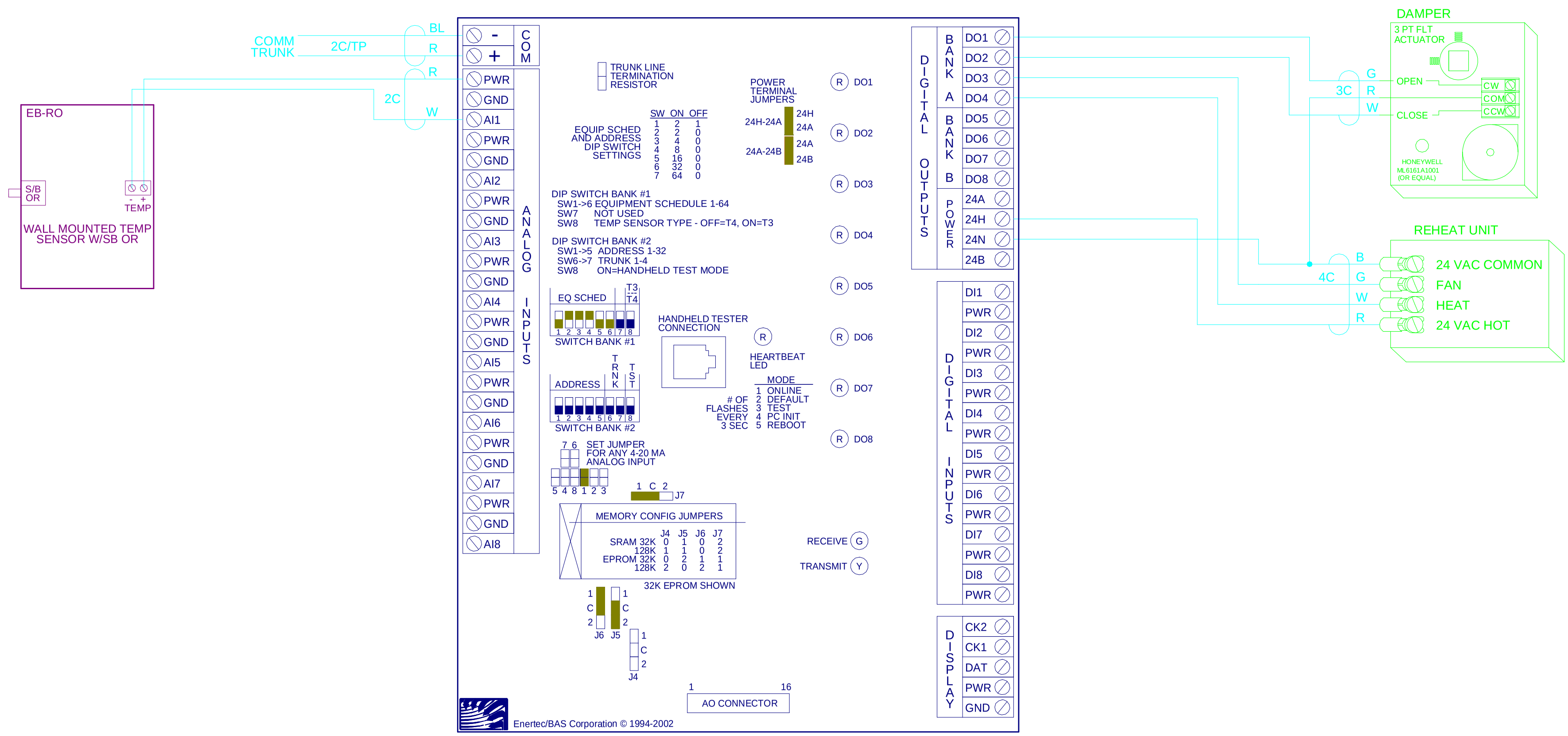
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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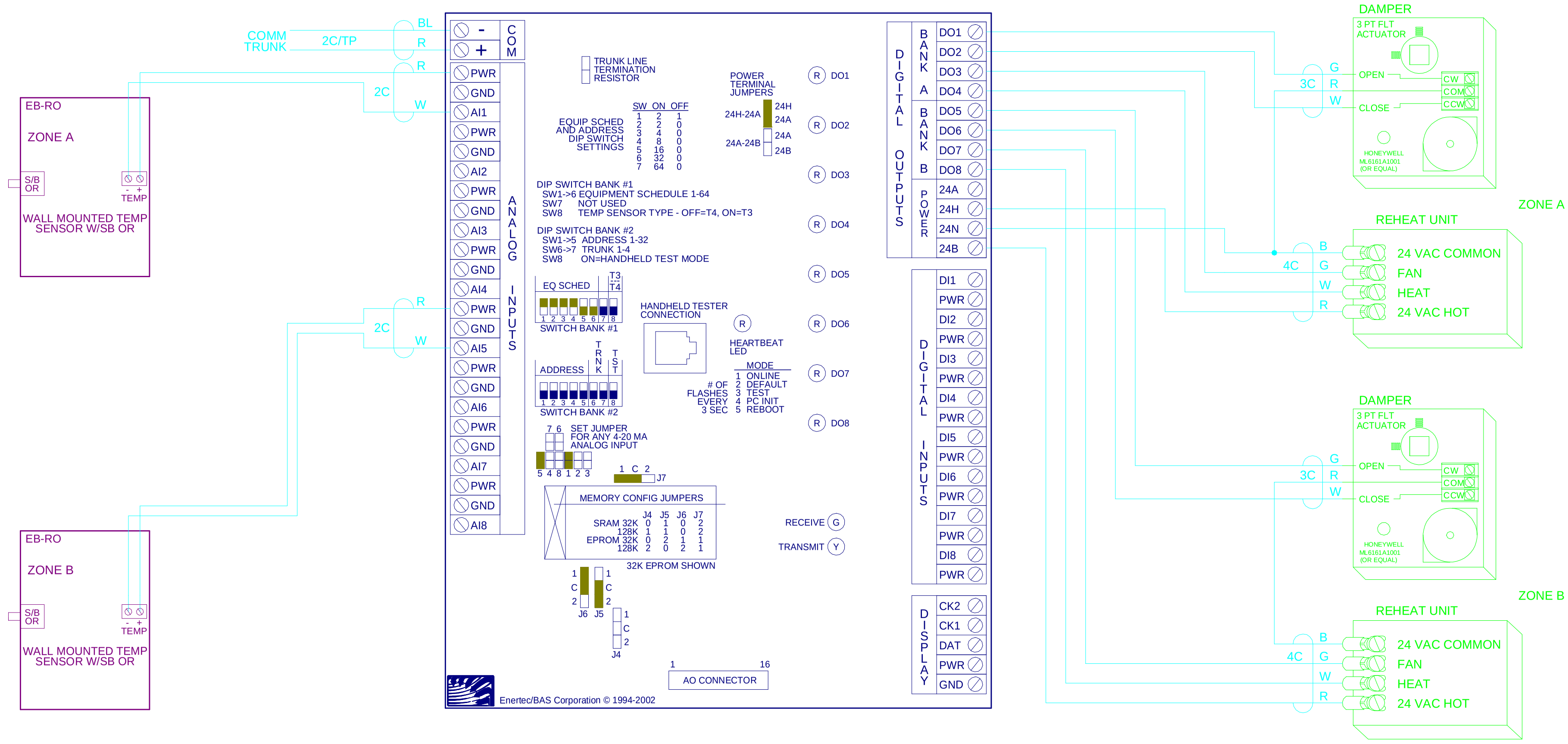
CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 15 ES DESCRIPTION: VAV BOX, 1 HEAT, CONSTANT FAN

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 16 ES DESCRIPTION: VAV BOX, 1 HEAT, CONSTANT FAN, 2 ZONES

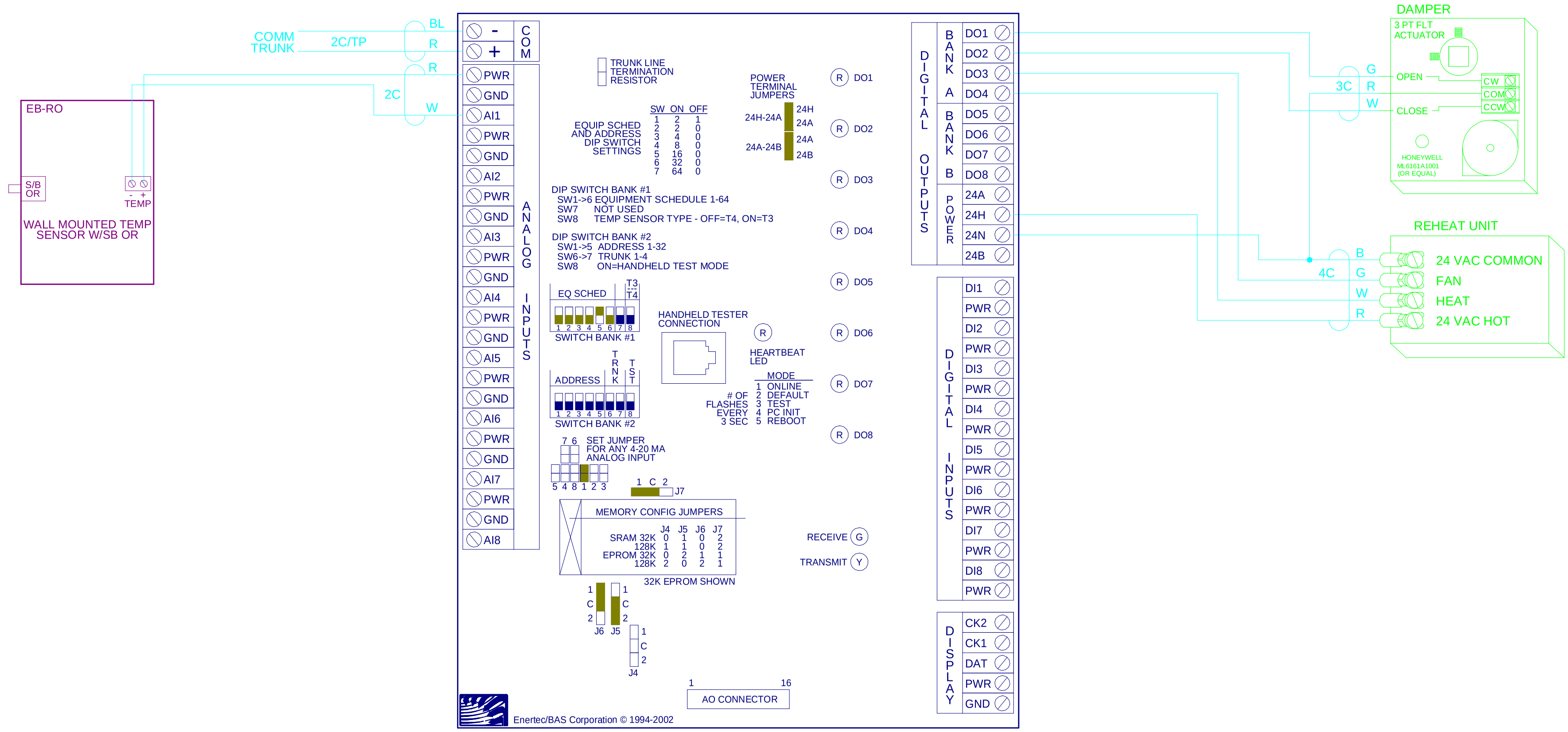
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 17 ES DESCRIPTION: VAV BOX, 1 HEAT, INTERMITTENT FAN

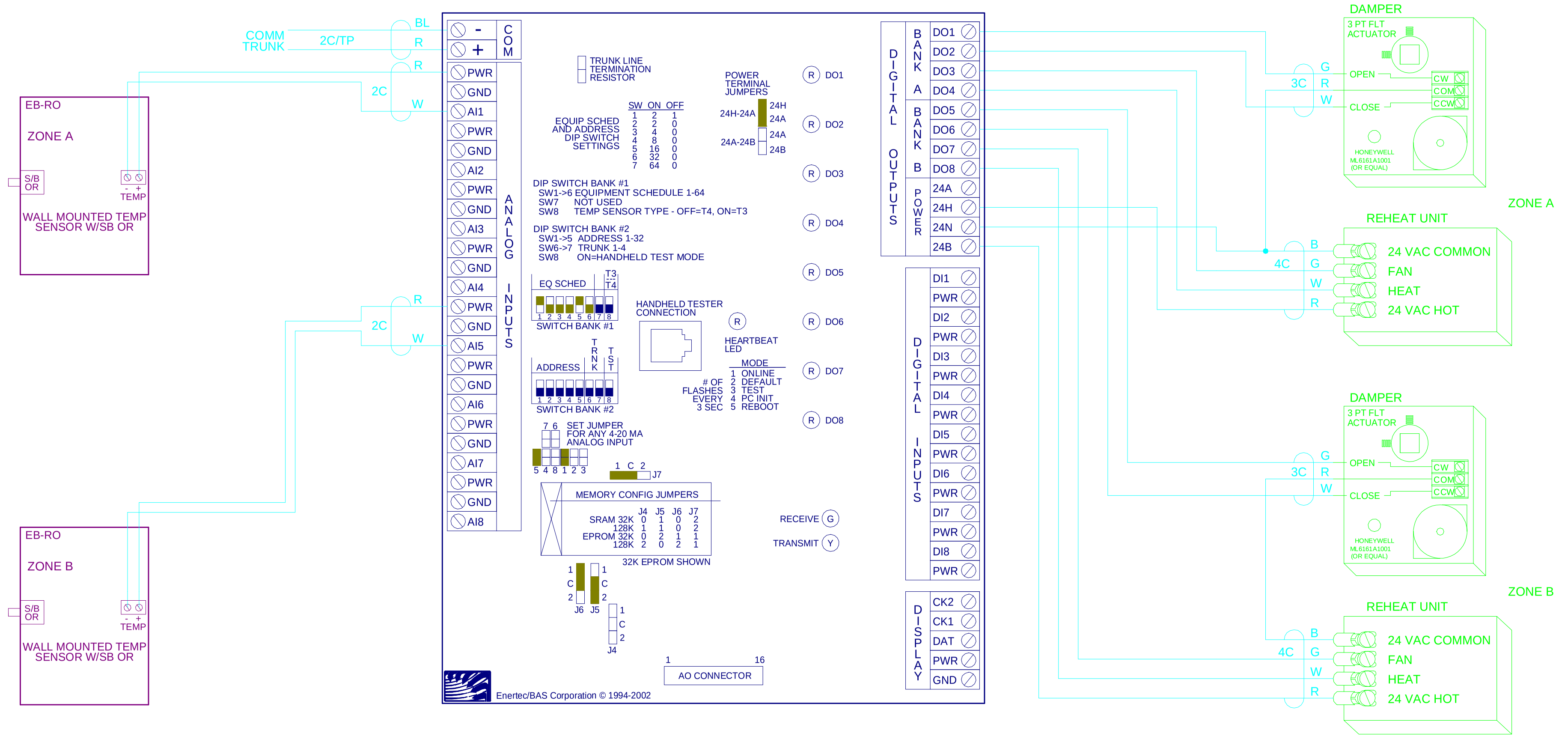
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



BAS	Enertec/BAS Corporation 628 Plymouth St SW, Olympia, WA 98502 (360) 943-2952 www.enertec-bas.com	PROJECT NAME PROJECT ADDRESS	REVISIONS / DATE / BY	SHEET 1 OF 1
		CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC		JOB NO: XX-XXXX
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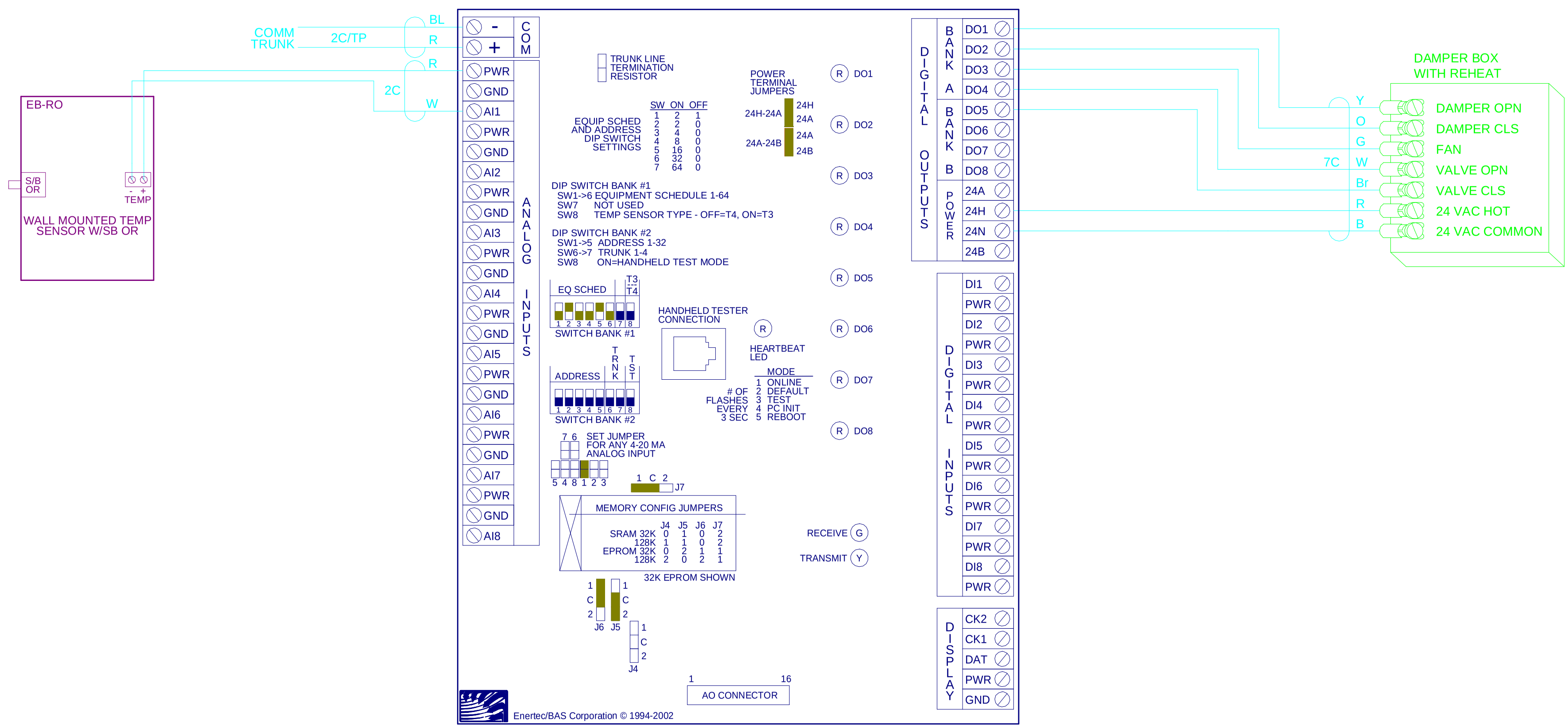
				DATE: AUGUST 27, 2007



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PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 19 ES DESCRIPTION: VAV BOX, MODULATING HEAT, CONSTANT FAN

REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

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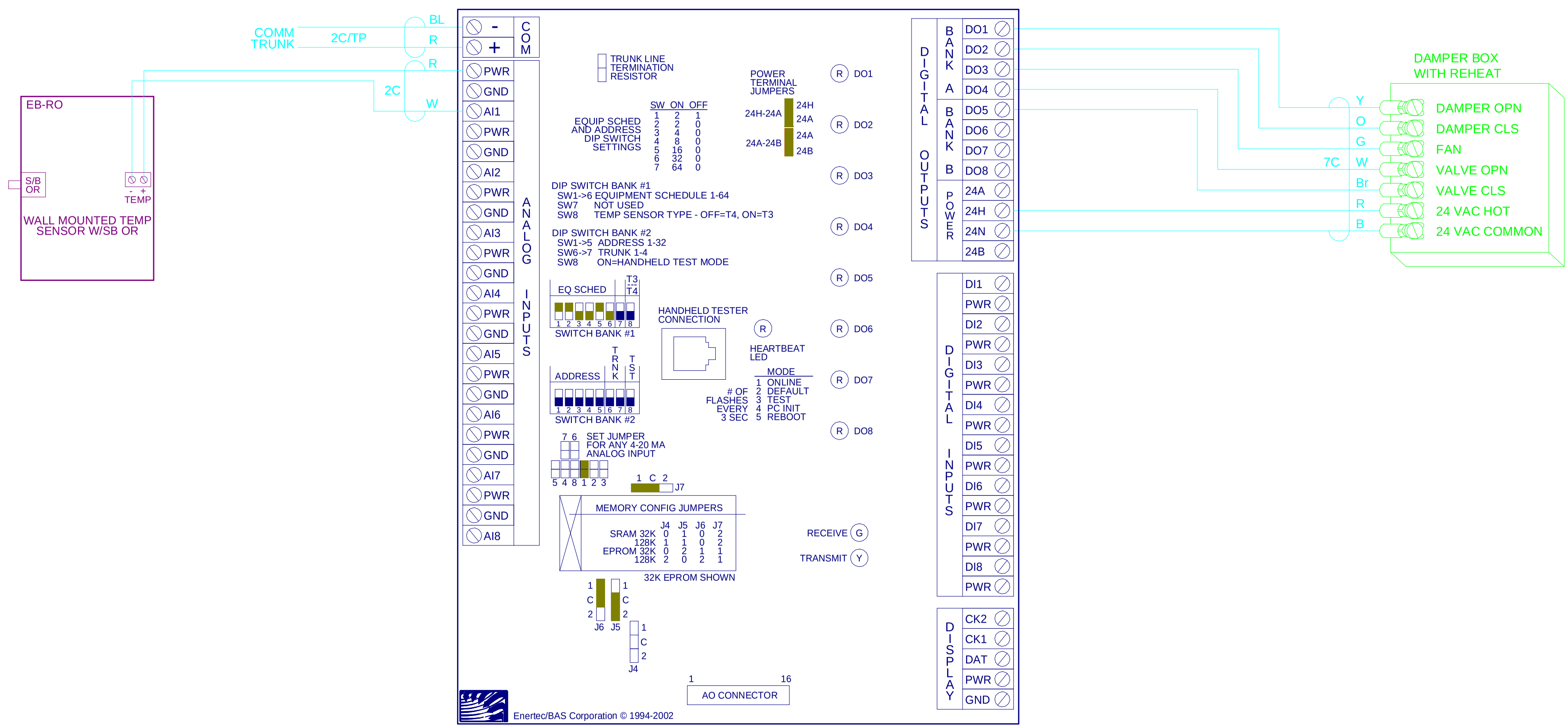
DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 20 ES DESCRIPTION: VAV BOX, MODULATING HEAT, INTERMITTENT FAN

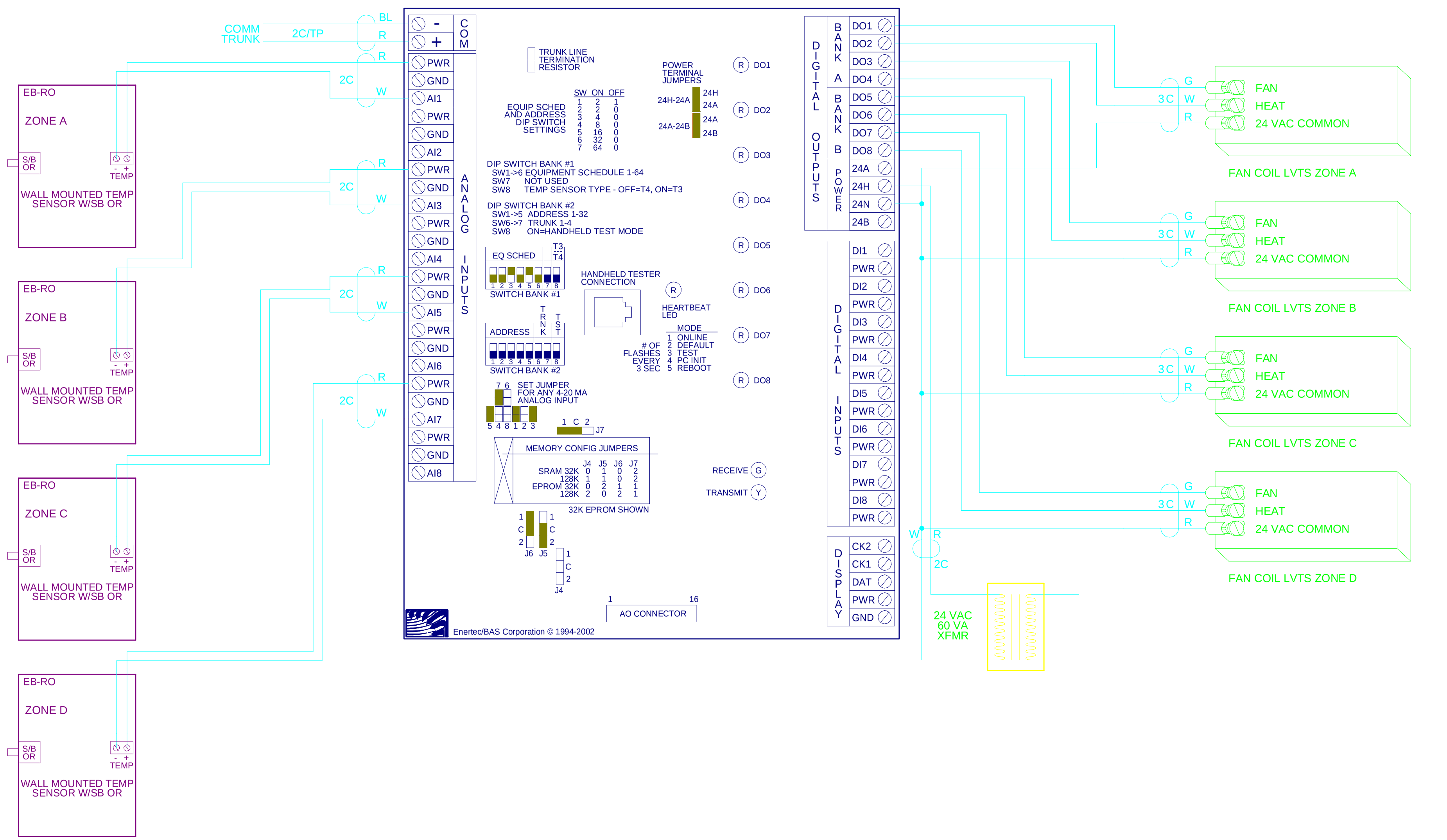
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME

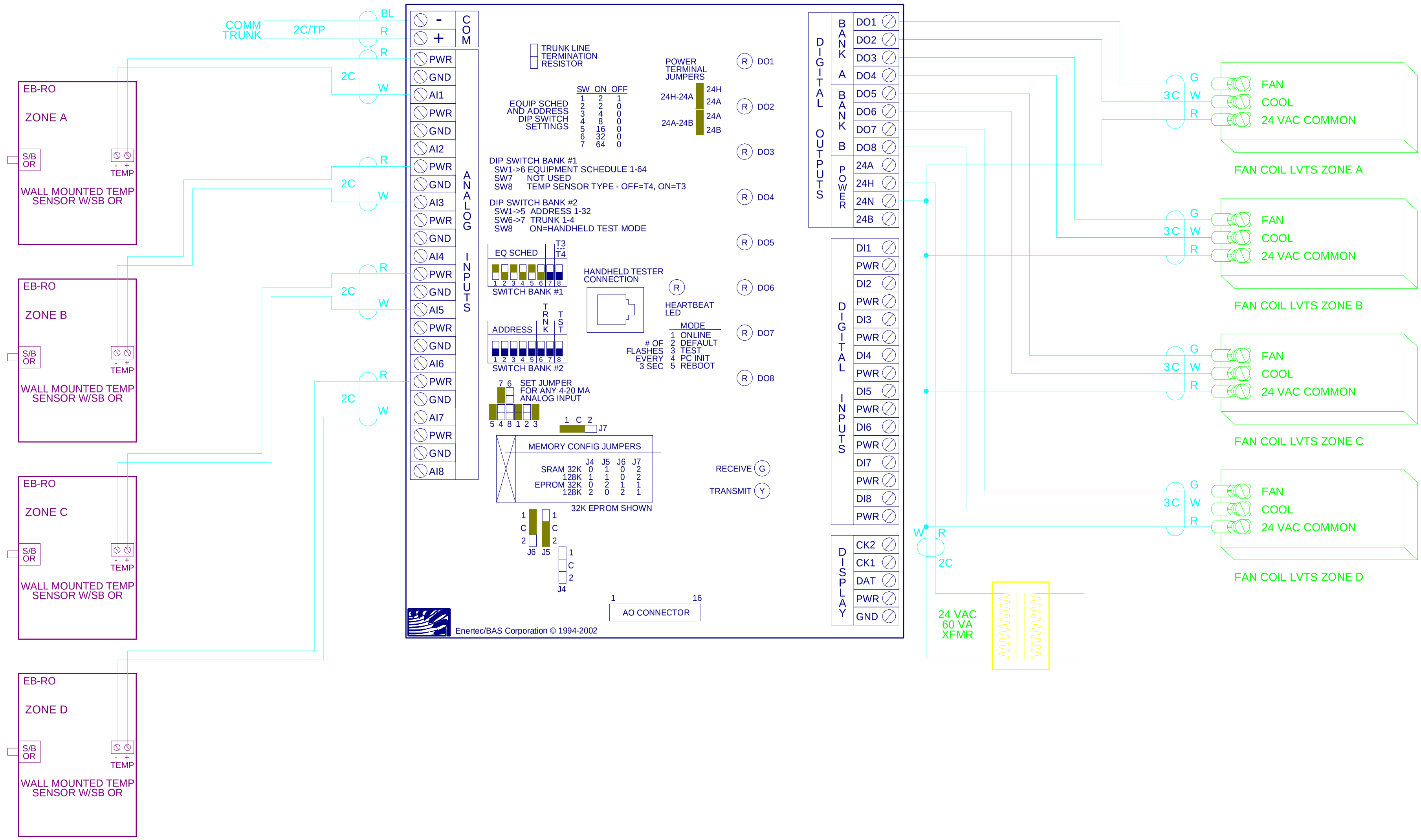
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 21 ES DESCRIPTION: FAN COIL, 1 HEAT, 4 ZONES

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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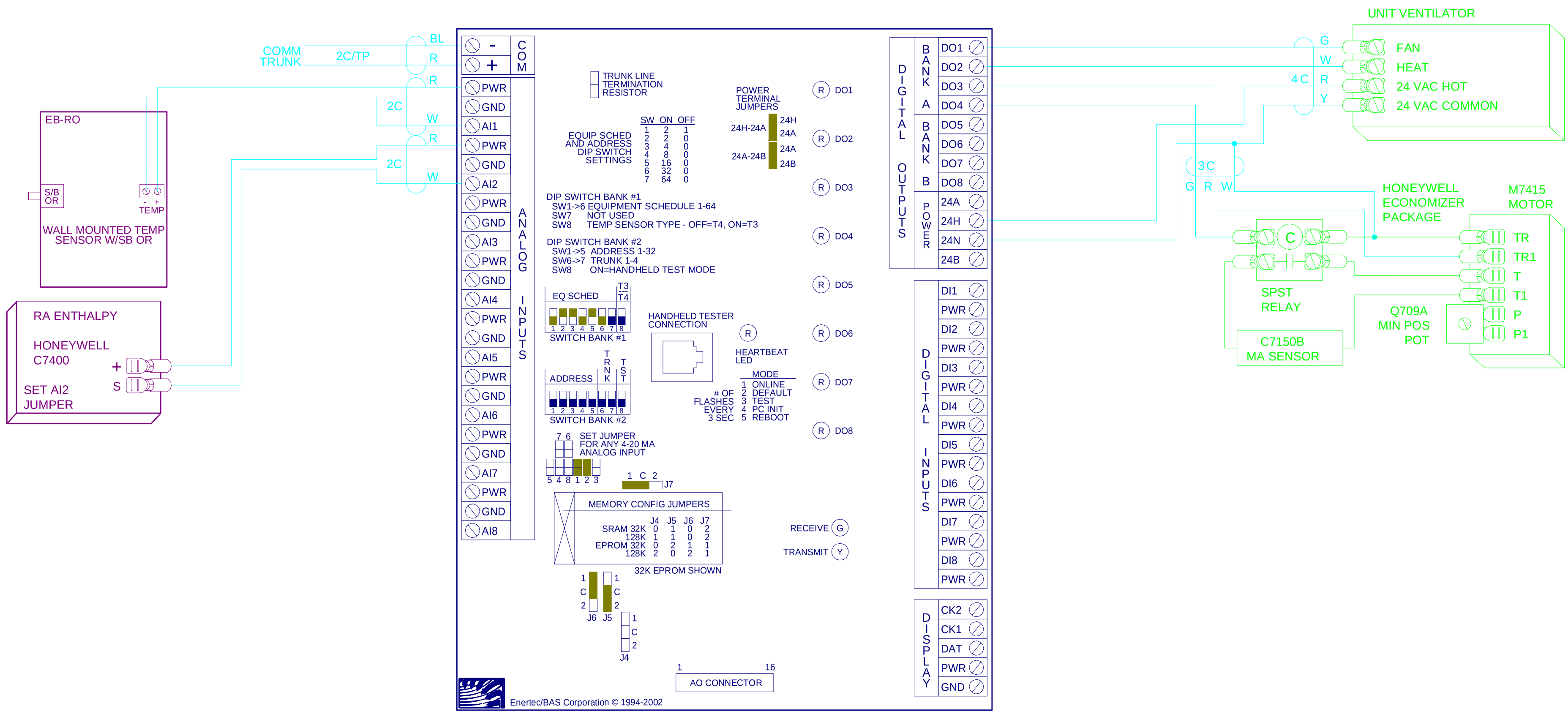
PROJECT NAME
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 22 ES DESCRIPTION: FAN COIL, 1 COOL, 4 ZONES

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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PROJECT NAME

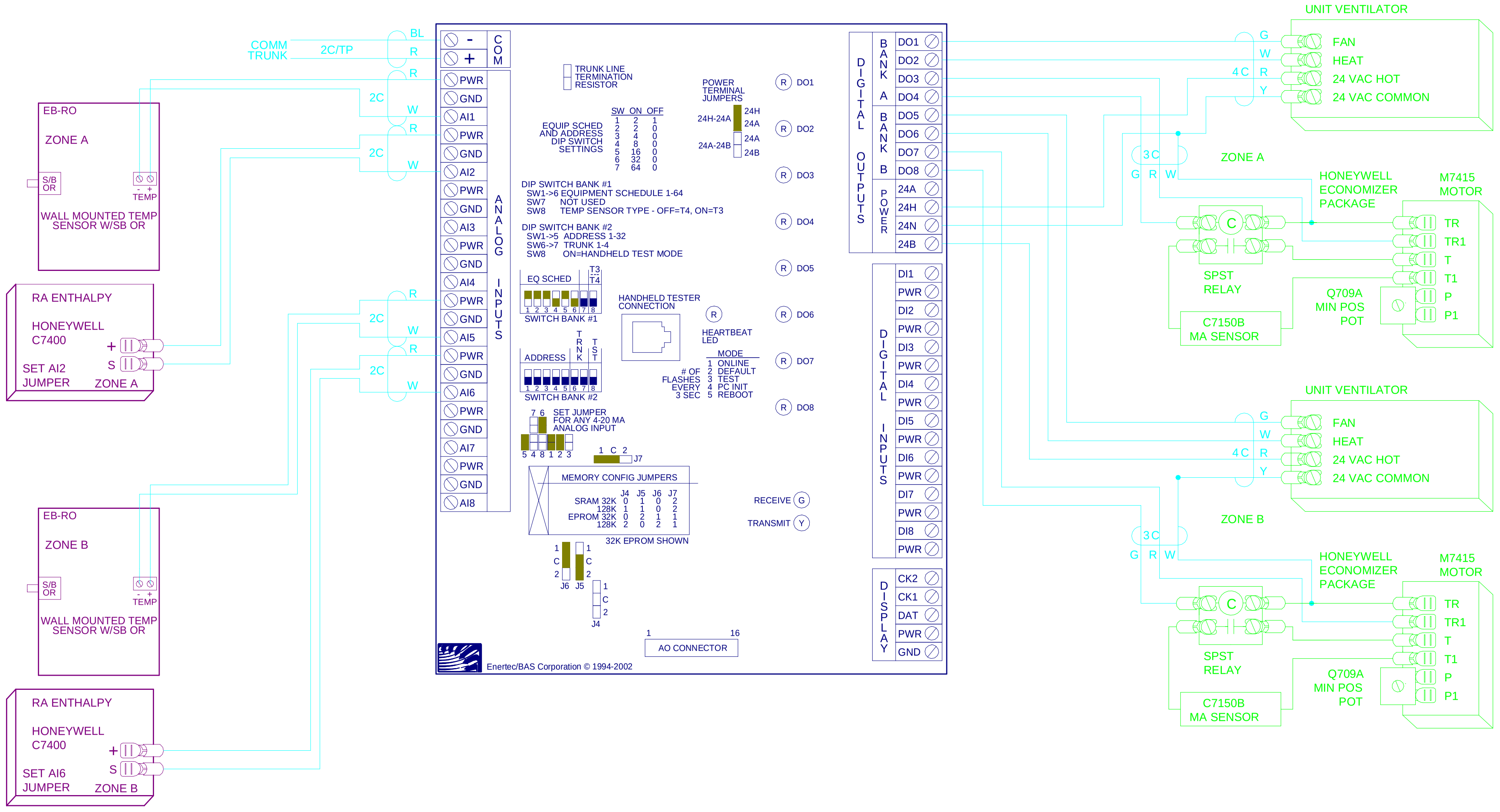
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 23 ES DESCRIPTION: UNIT VENTILATOR, 1 HEAT, STAGED ECONOMIZER

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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PROJECT NAME

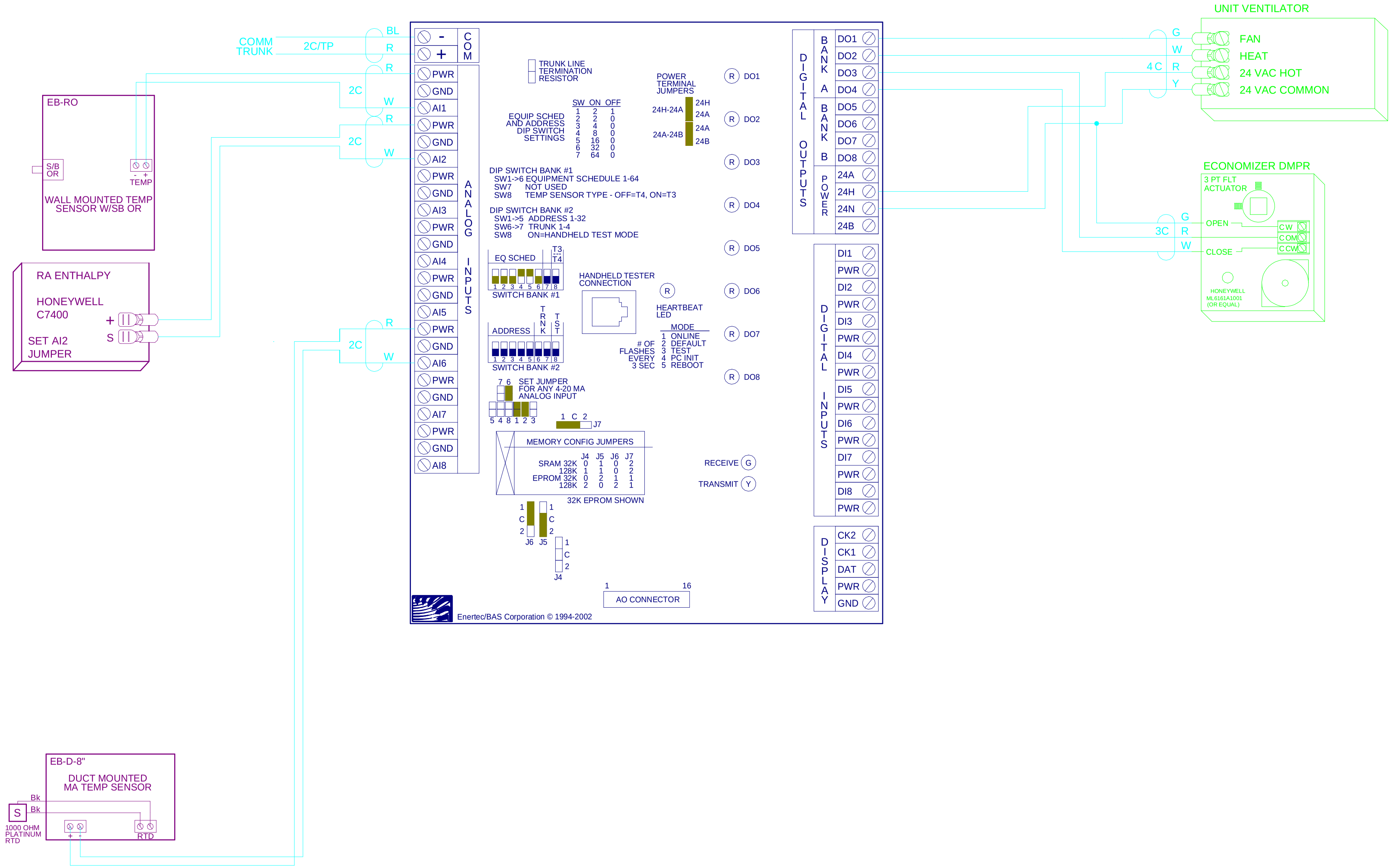
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 24 ES DESCRIPTION: UNIT VENTILATOR, 1 HEAT, STAGED ECONOMIZER, 2 ZONES

REVISIONS	DATE	BY

SHEET	1 OF 1
JOB NO:	XX-XXXX
DRAWN BY:	RBJ
DATE:	AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 25 ES DESCRIPTION: UNIT VENTILATOR, 1 HEAT, MODULATING ECONOMIZER

REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

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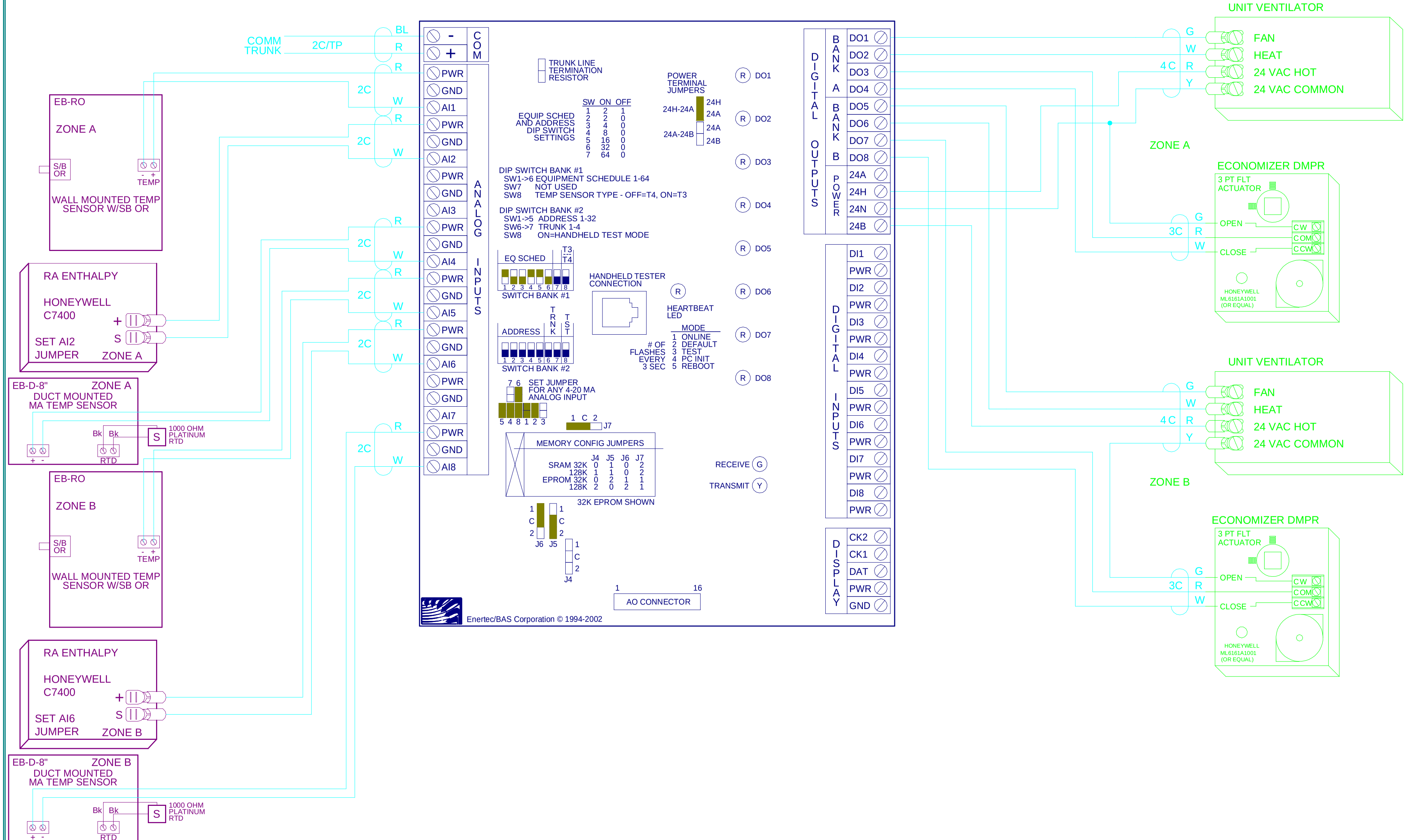

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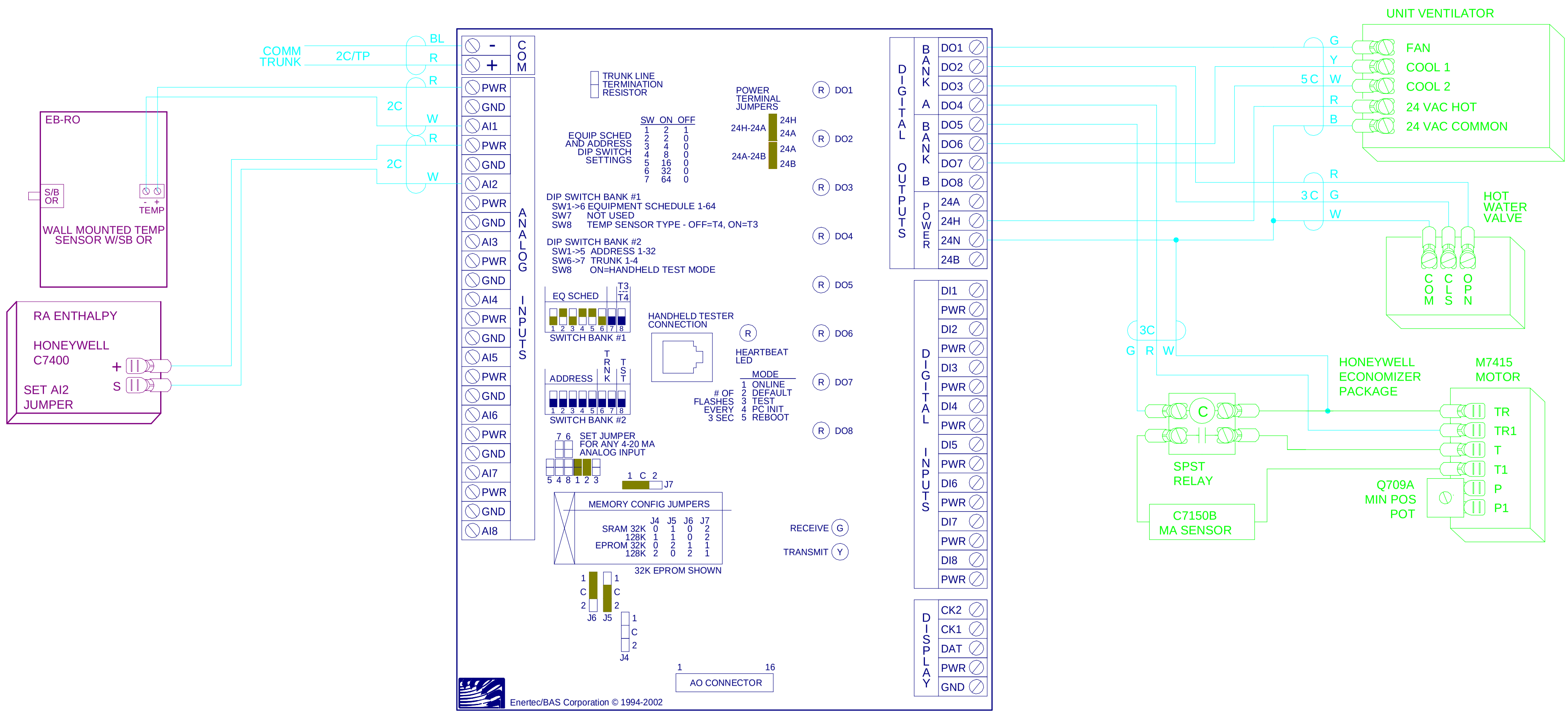
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 26 ES DESCRIPTION: UNIT VENTILATOR, 1 HEAT, MODULATING ECONOMIZER, 2 ZONES

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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PROJECT NAME

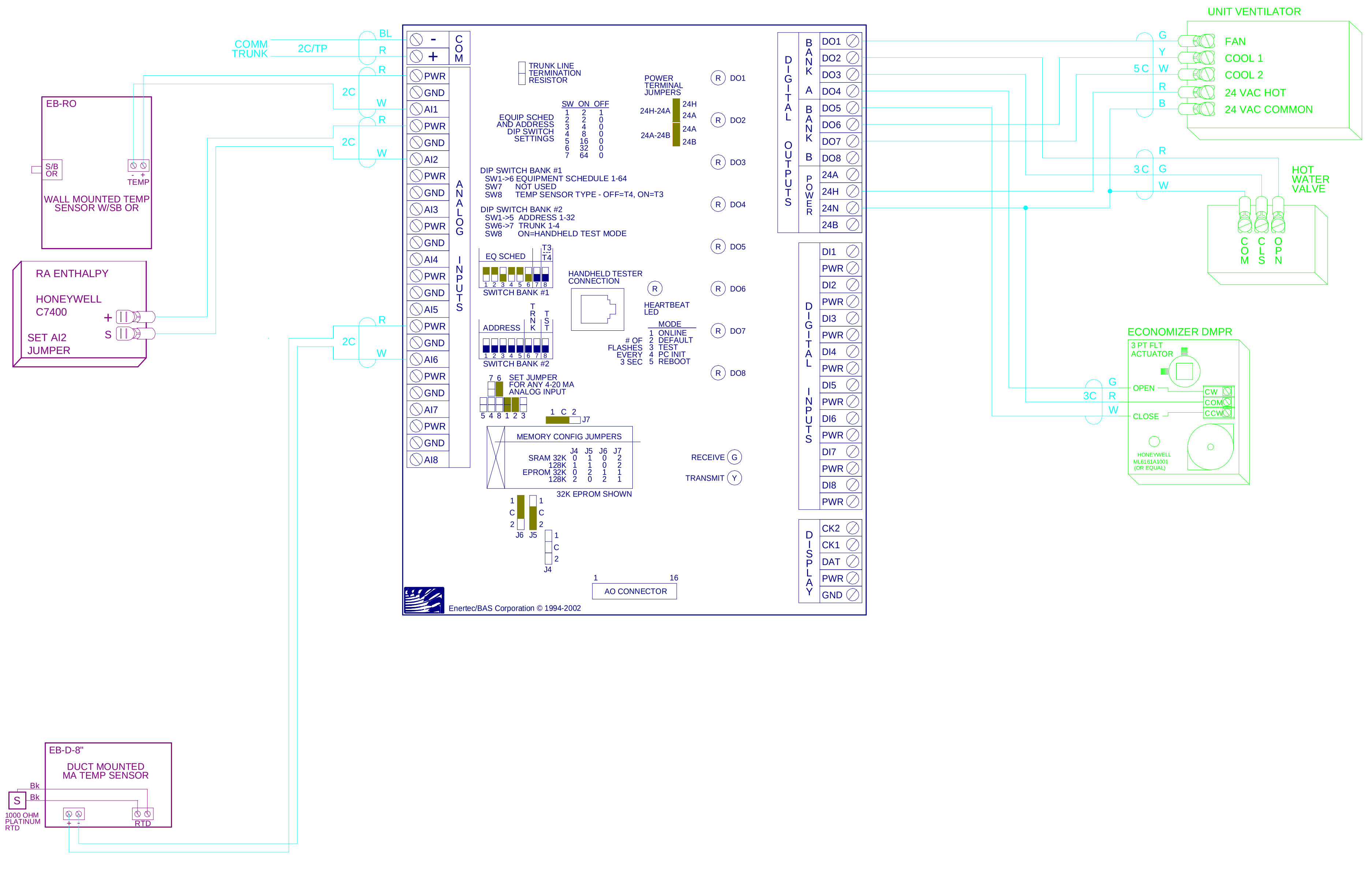
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 27 ES DESCRIPTION: UNIT VENTILATOR, MODULATING HEAT, 2 COOL, STAGED ECONOMIZER

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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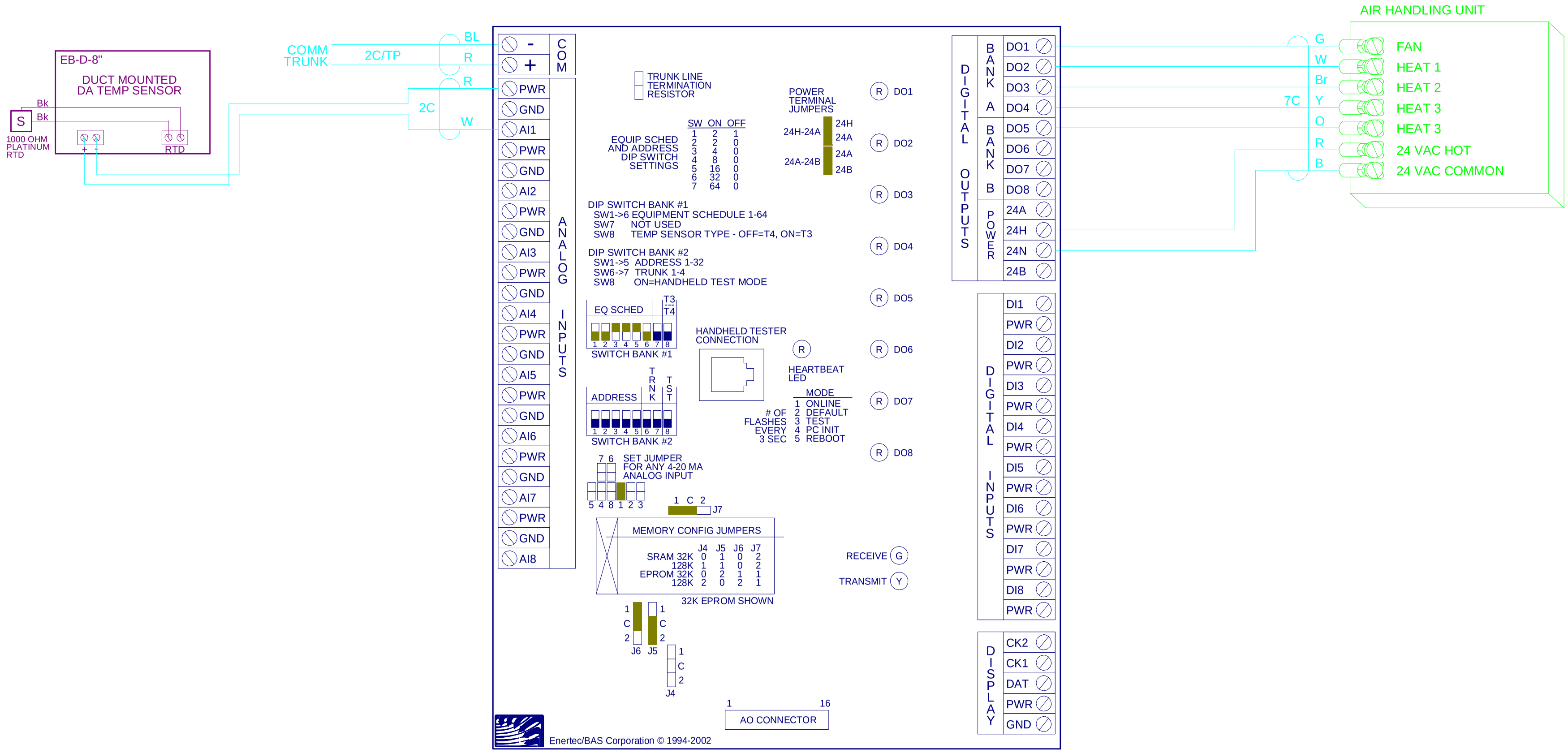

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PROJECT NAME

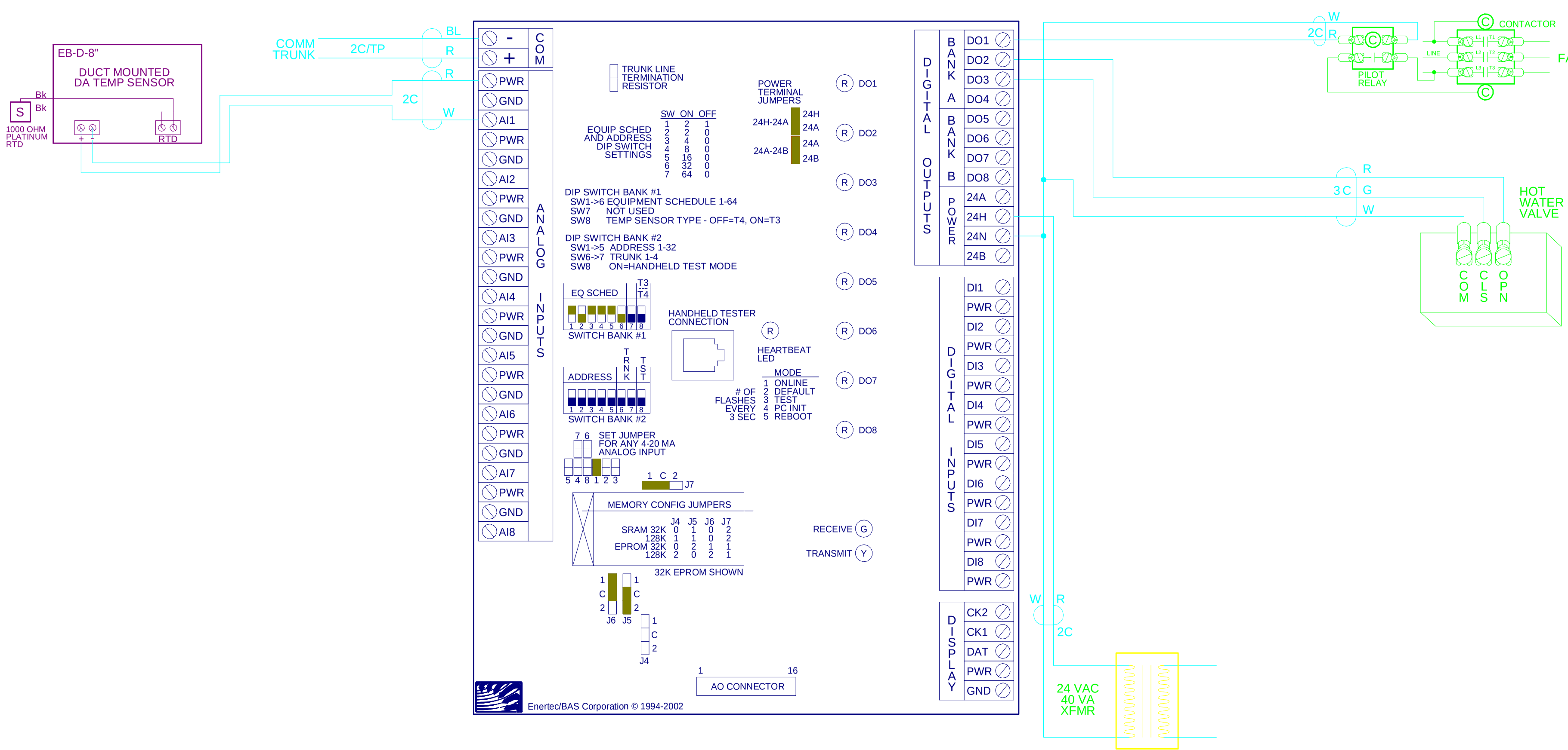
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 29 ES DESCRIPTION: A/H UNIT, 4 HEAT, DA CONTROL, OSA RESET

REVISIONS	DATE	BY

SHEET	1 OF 1
JOB NO:	XX-XXXX
DRAWN BY:	RBJ
DATE:	AUGUST 27, 2007



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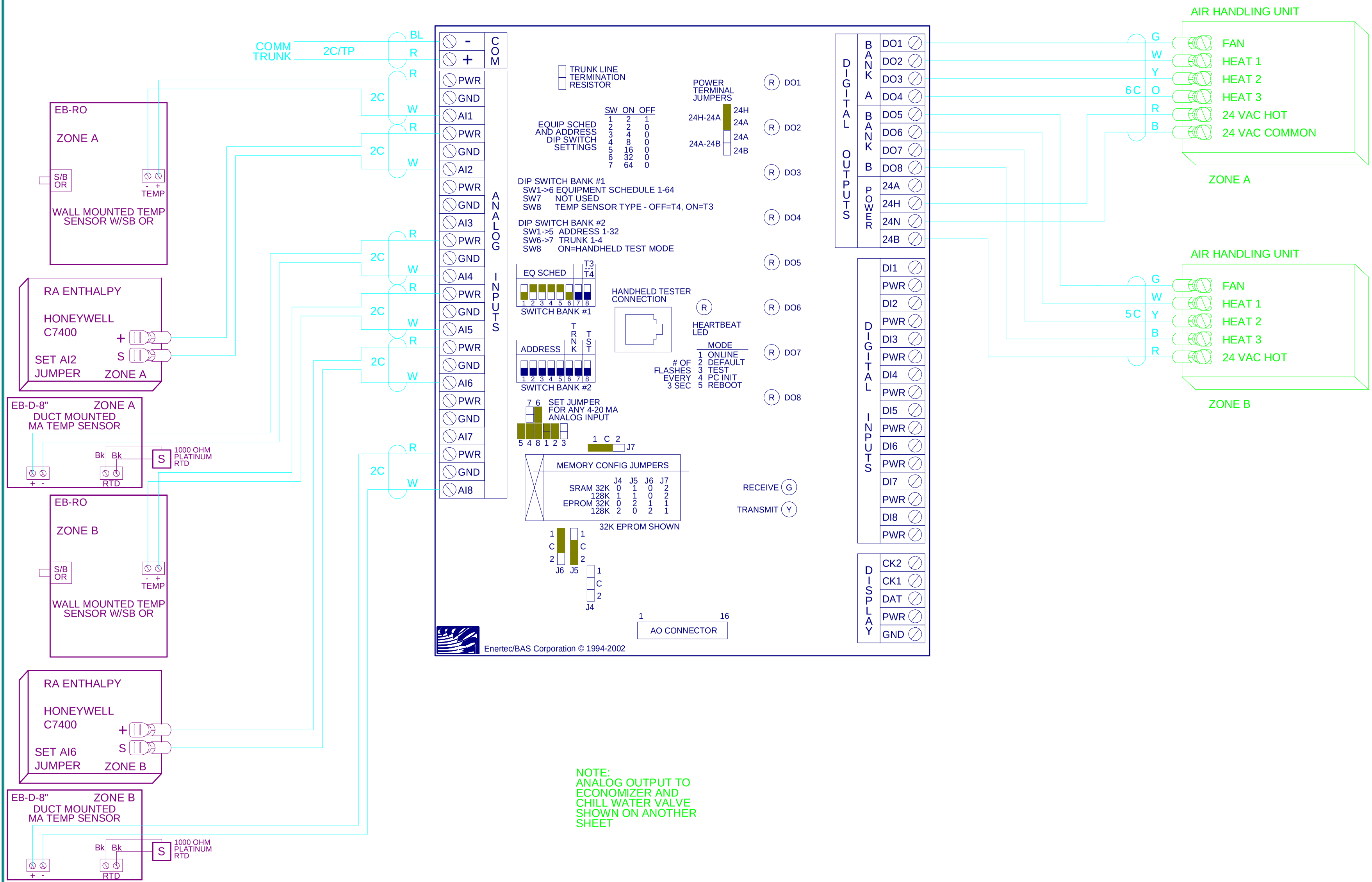
PROJECT NAME
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 30 ES DESCRIPTION: A/H UNIT, MODULATING HEAT, DA CONTROL, OSA RESET

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



NOTE:
ANALOG OUTPUT TO
ECONOMIZER AND
CHILL WATER VALVE
SHOWN ON ANOTHER
SHEET

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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 31 ES DESCRIPTION: A/H UNIT, 3 HEAT, ANALOG COOLING & ECONOMIZER, 2 UNITS

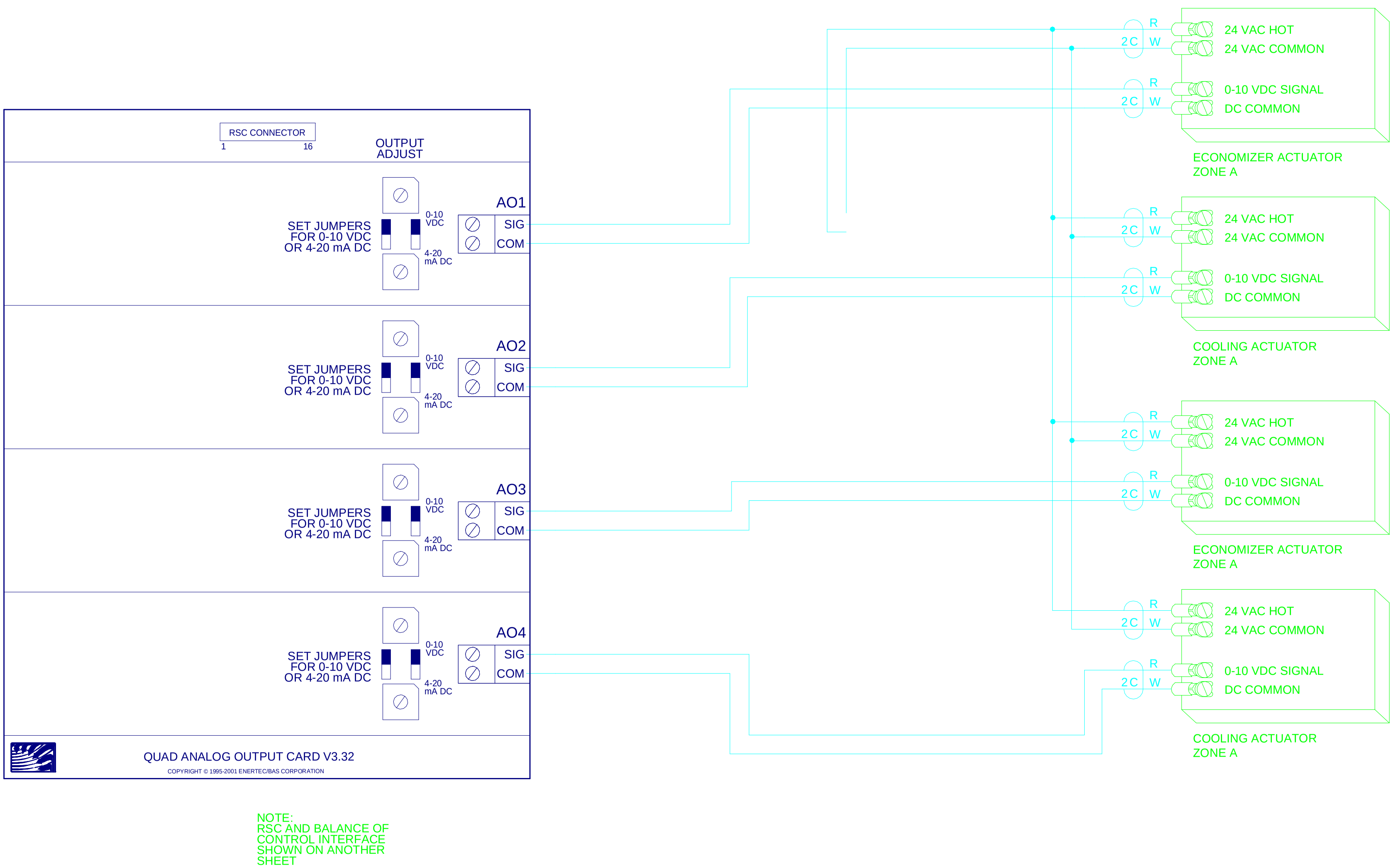
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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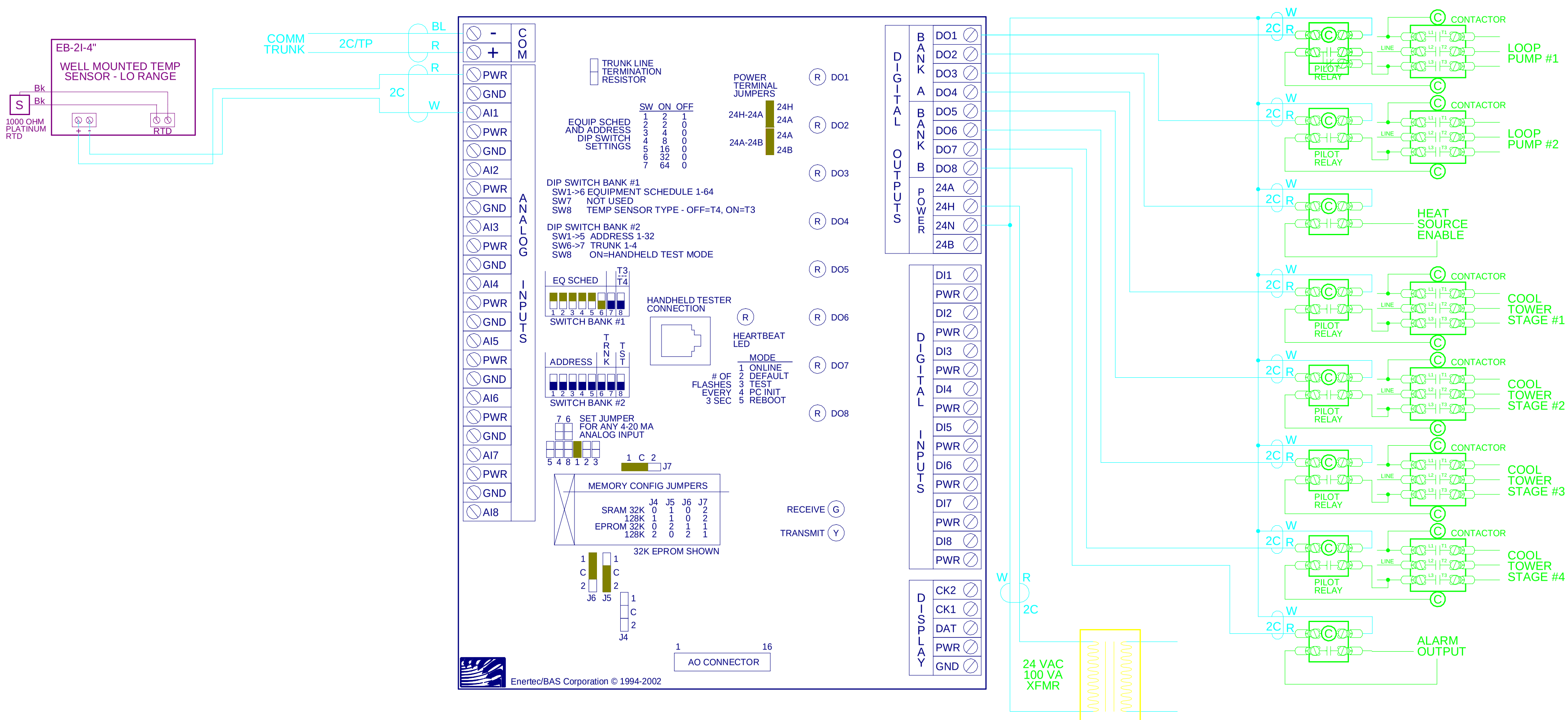
	CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC		JOB NO: XX-XXXX
	ES #:		DRAWN BY: RBJ
	ES DESCRIPTION: QUAD ANALOG OUTPUT CARD, 0-10 VDC OR 4-20 MA DC		DATE: AUGUST 27, 2007



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PROJECT NAME

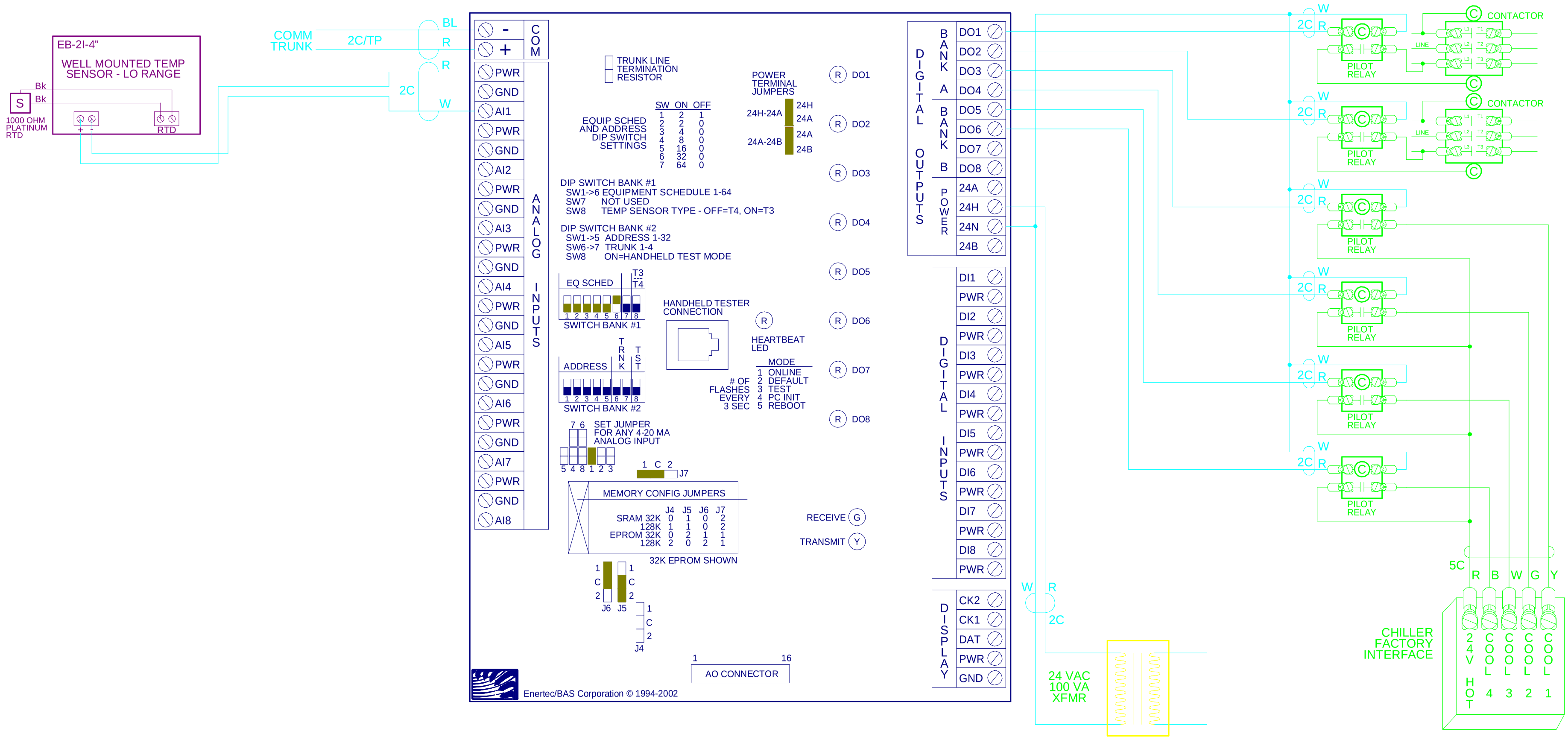
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 32 ES DESCRIPTION: HYDRONIC HP WTR LOOP, 1 HEAT, 4 COOL, 2 LOOP PUMPS

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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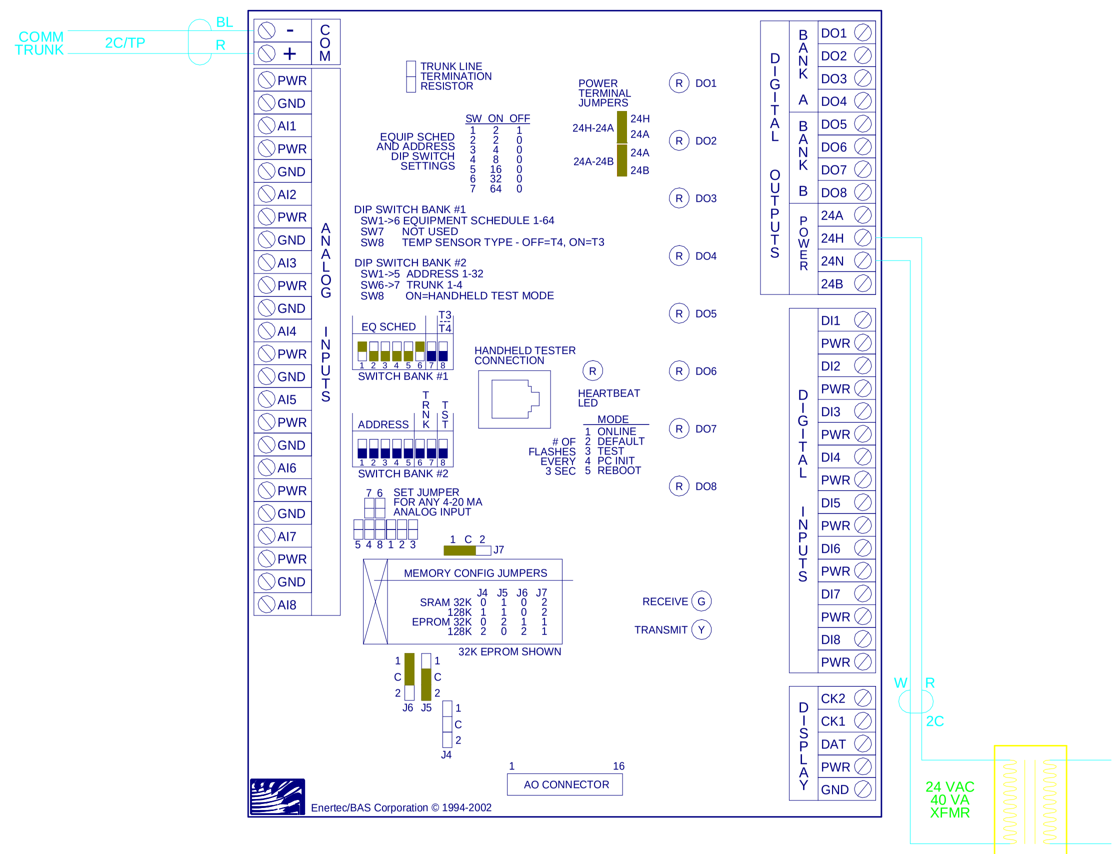
	CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC		JOB NO: XX-XXXX
	ES #: 33	ES DESCRIPTION: CHILL WATER LOOP, 4 COOL, 2 LOOP PUMPS		DRAWN BY: RBJ
			DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 34 ES DESCRIPTION: NOT CURRENTLY USED

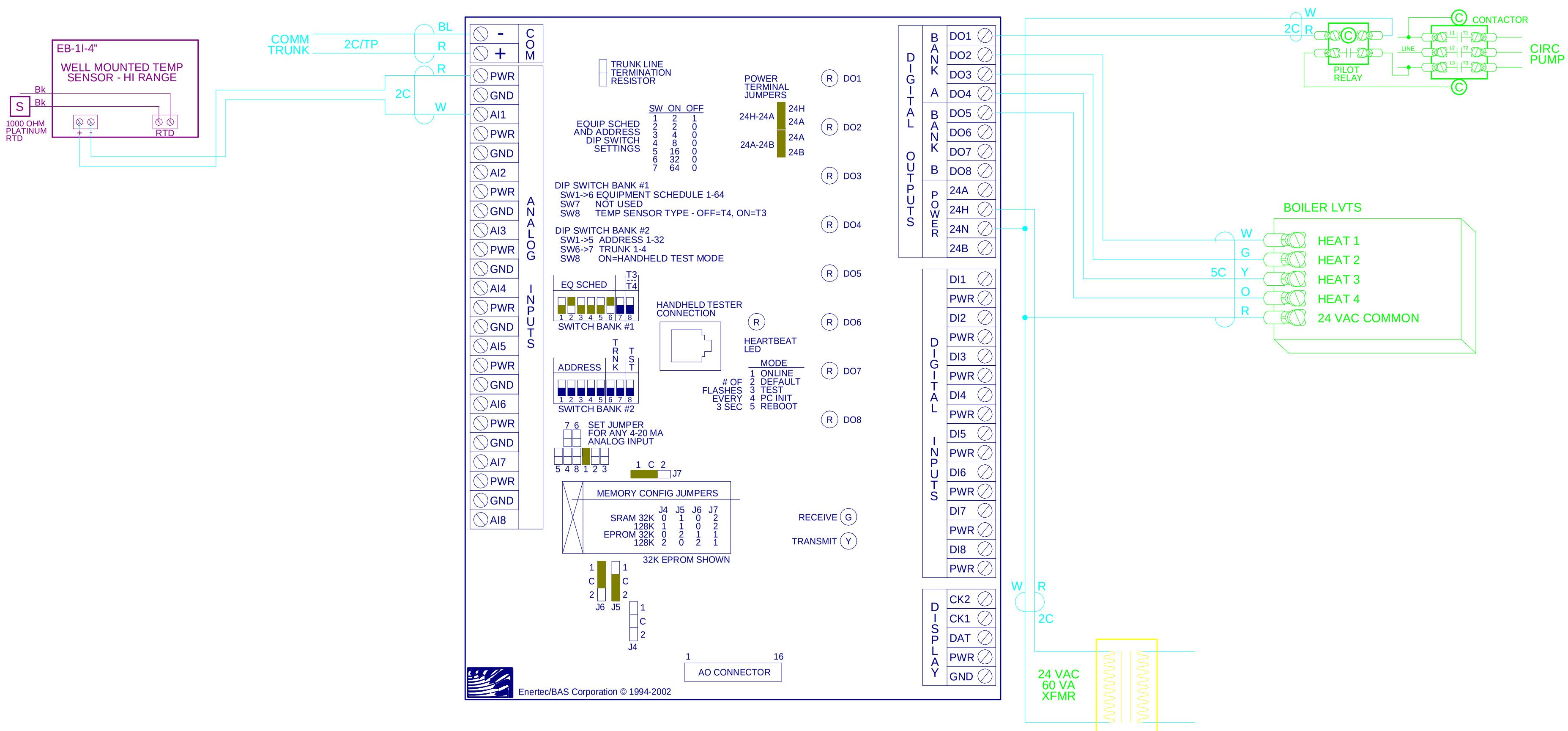
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME

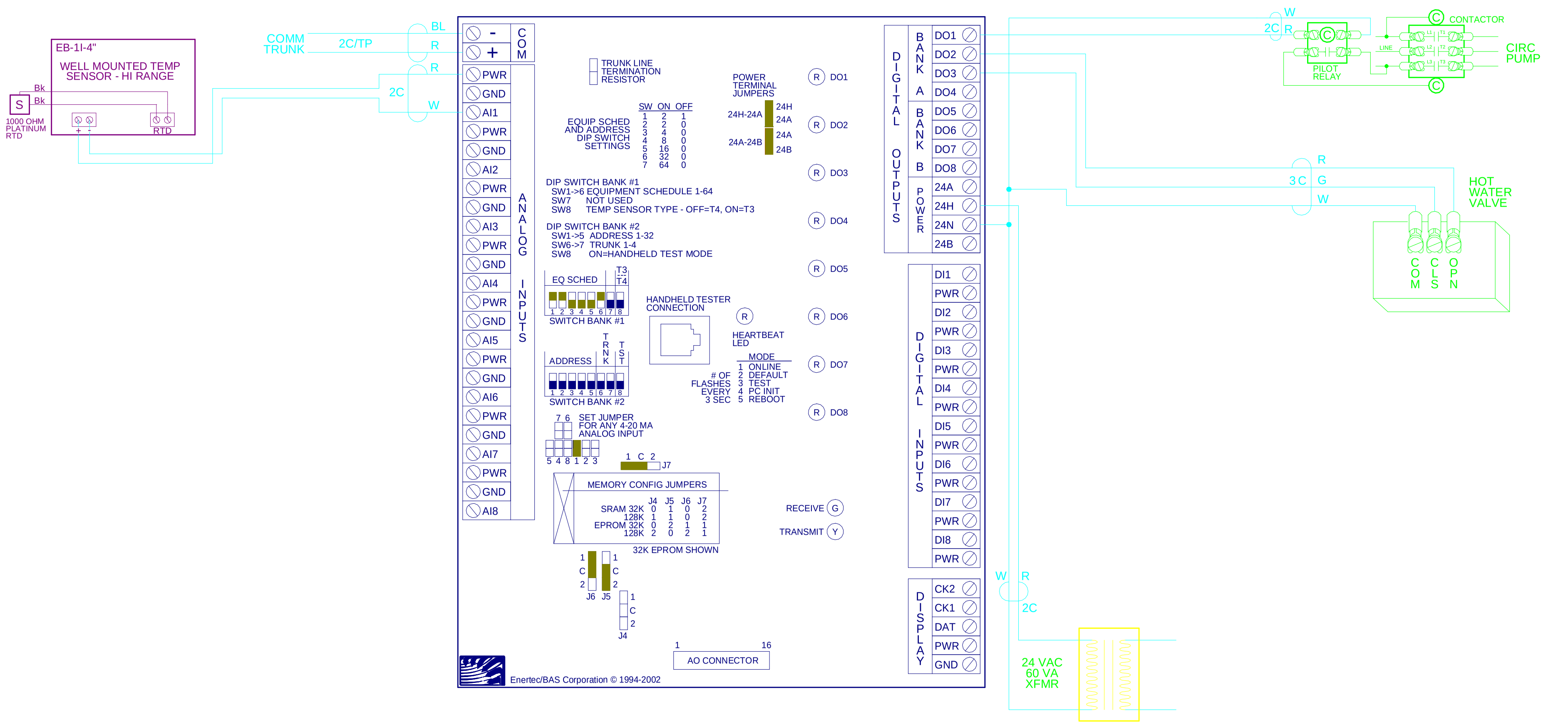
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 35 ES DESCRIPTION: BOILER, 4 HEAT, OSA RESET

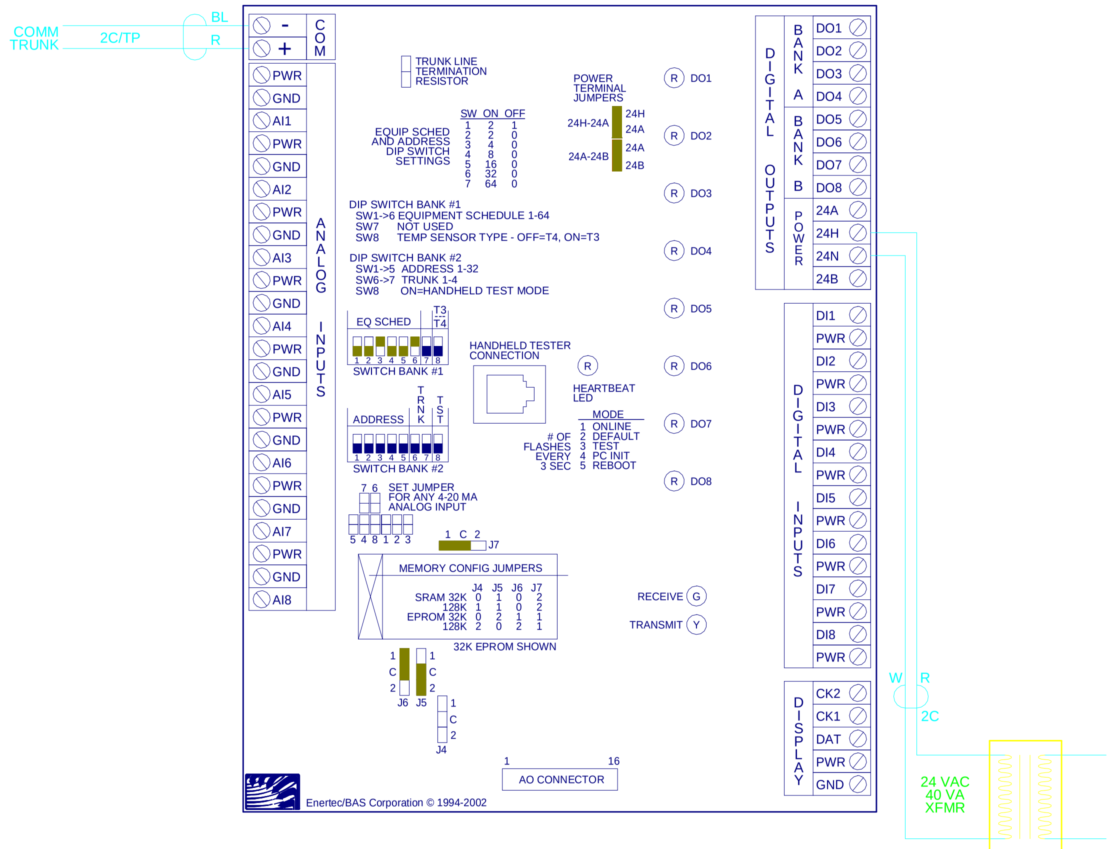
REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



Enertec/BAS Corporation	**PROJECT NAME**	SHEET 1 OF 1
628 Plymouth St SW, Olympia, WA 98502	PROJECT ADDRESS	JOB NO: XX-XXXX
(360) 943-2952	CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC	DRAWN BY: RBJ
www.enertec-bas.com	ES #: 36 ES DESCRIPTION: BOILER, MODULATING CAPACITY CONTROL, OSA RESET	DATE: AUGUST 27, 2007

REVISIONS	DATE	BY



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PROJECT NAME

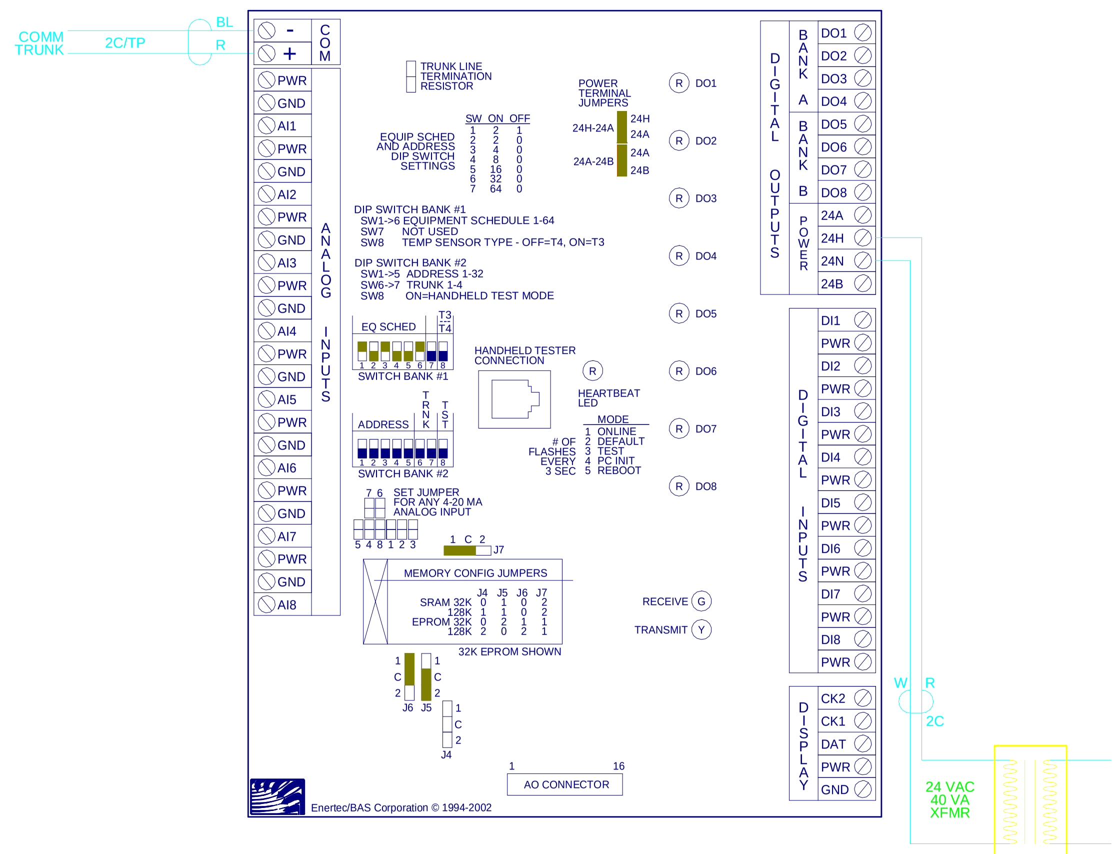
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 37 ES DESCRIPTION: NOT CURRENTLY USED

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 38 ES DESCRIPTION: NOT CURRENTLY USED

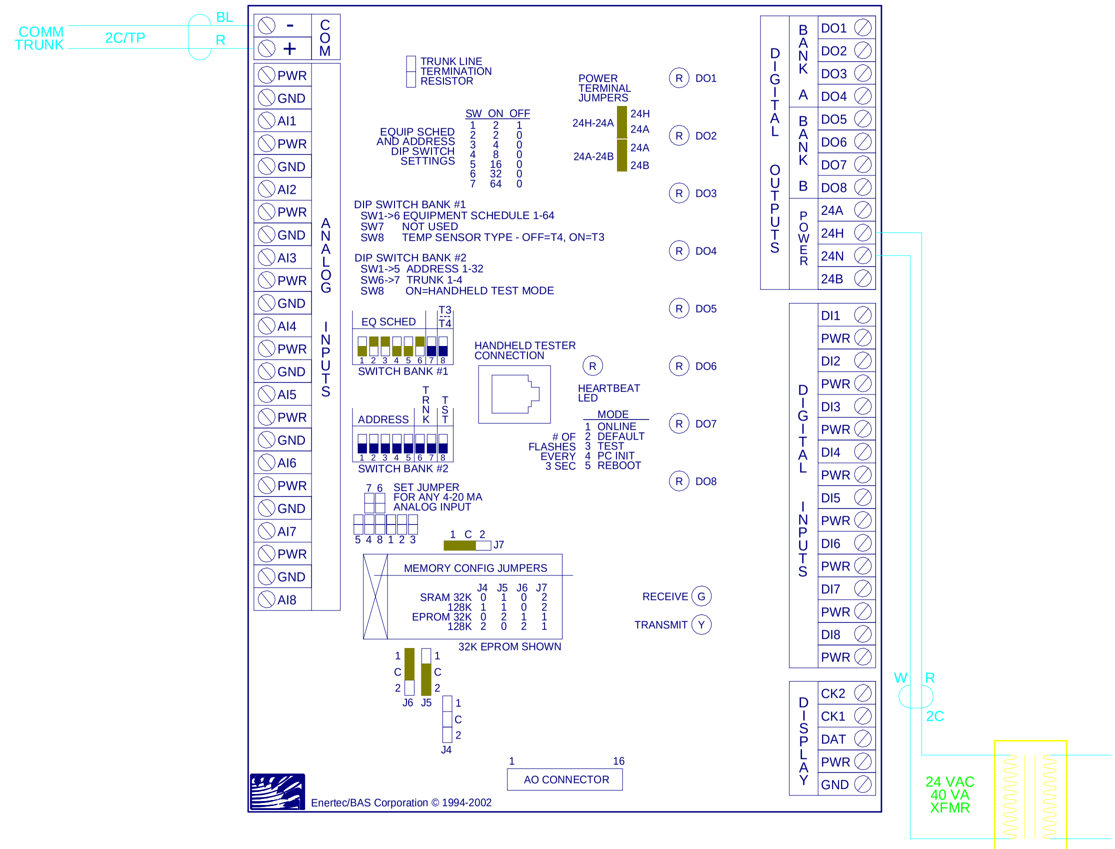
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 39 ES DESCRIPTION: NOT CURRENTLY USED

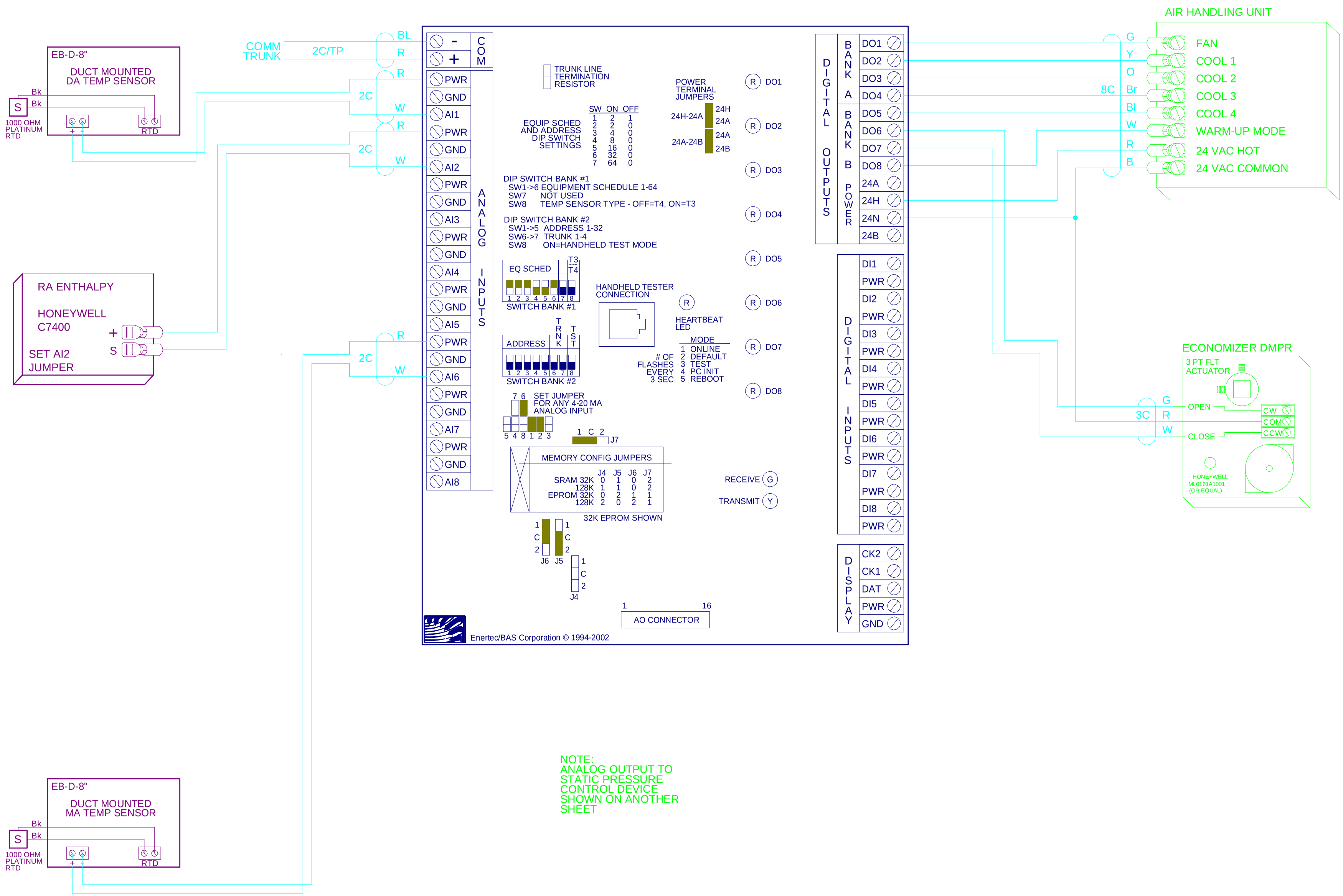
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



NOTE:
ANALOG OUTPUT TO STATIC PRESSURE CONTROL DEVICE SHOWN ON ANOTHER SHEET

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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 40 ES DESCRIPTION: A/H UNIT, 4 STAGE & MODULATING COOL, DA CONTROL, MODULATING ECONO

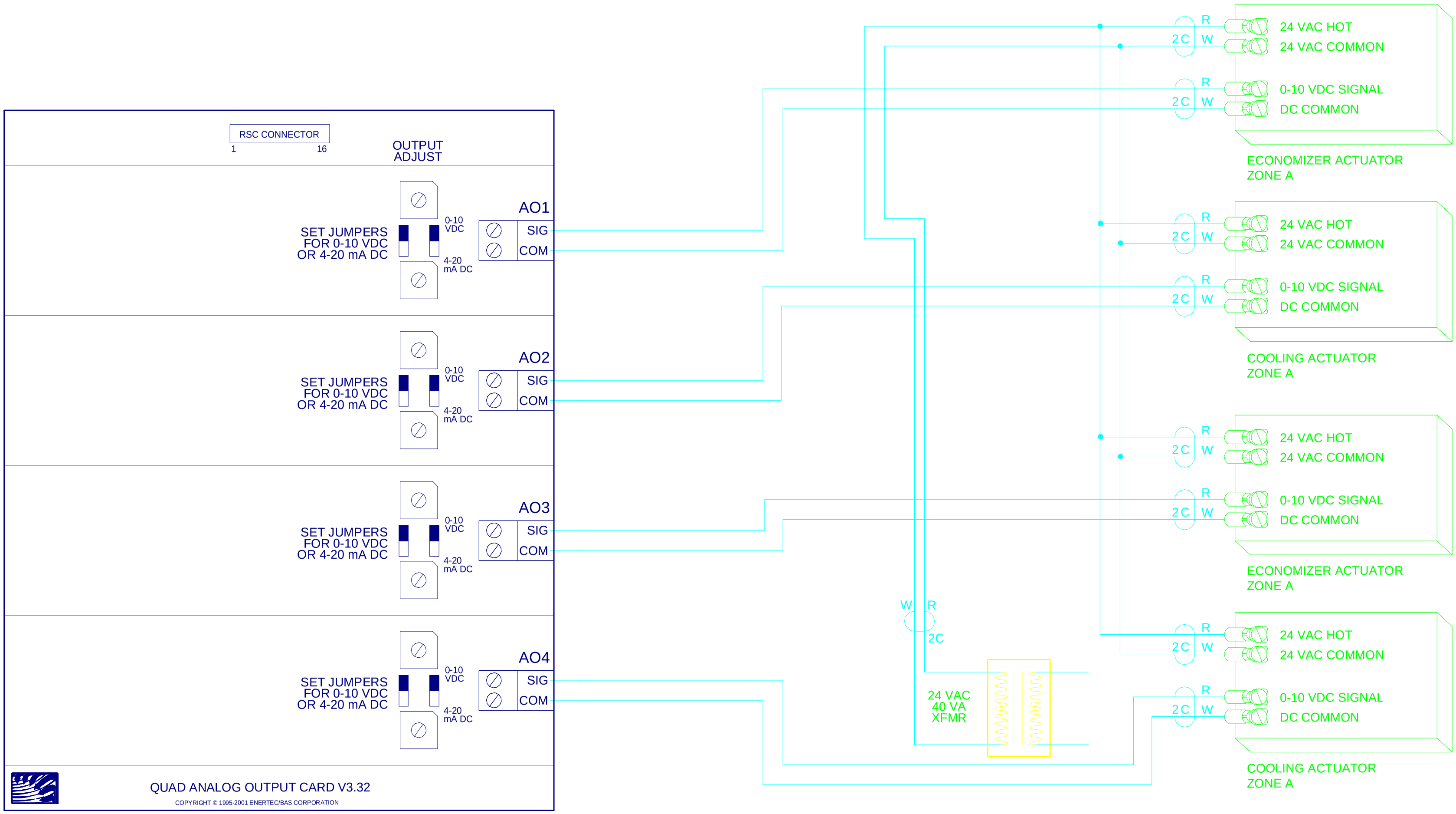
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



NOTE:
RSC AND BALANCE OF CONTROL INTERFACE SHOWN ON ANOTHER SHEET

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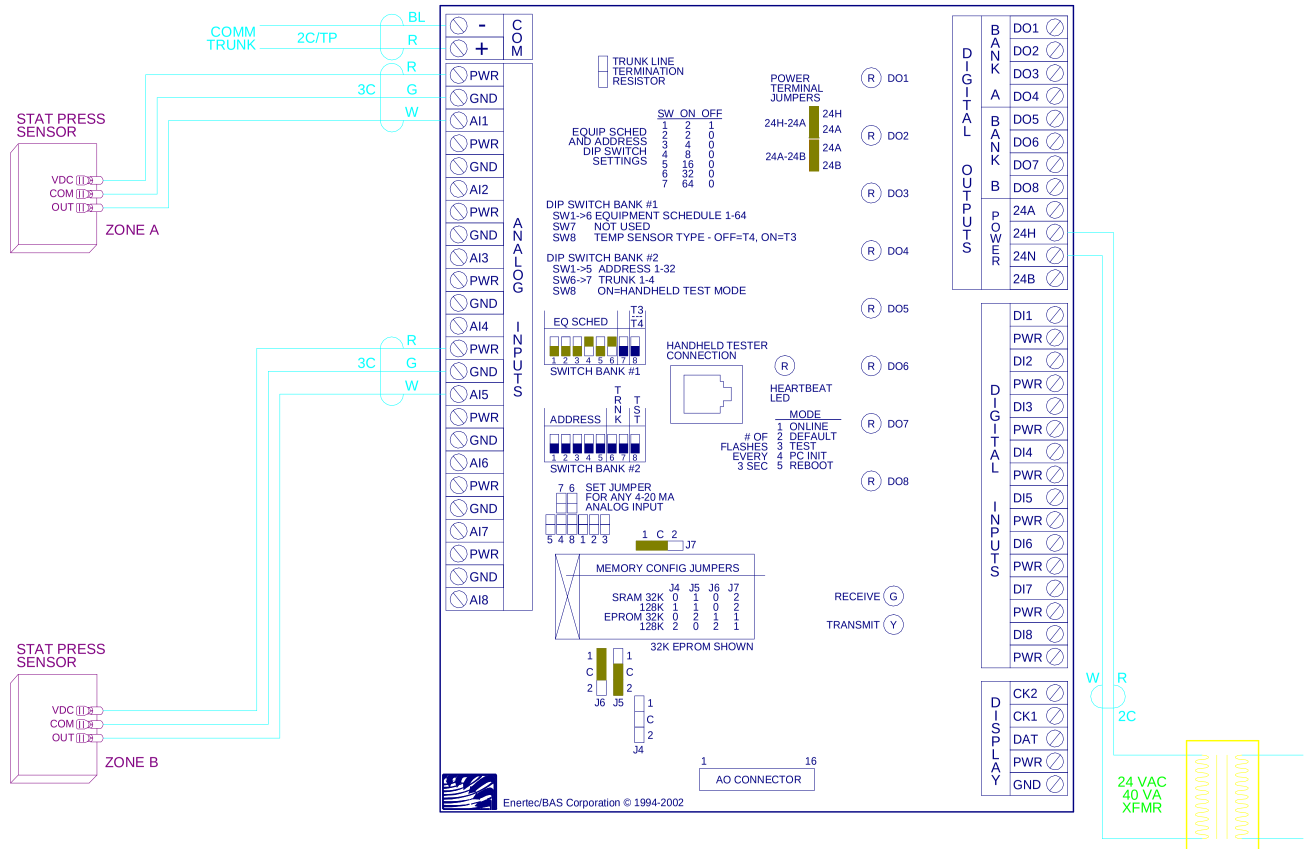
	COPYRIGHT © 1988-2007 ENERTEC/BAS CORPORATION	CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC		JOB NO: XX-XXXX
		ES #: ES DESCRIPTION: QUAD ANALOG OUTPUT CARD, 0-10 VDC OR 4-20 MA DC		DRAWN BY: RBJ
				DATE: AUGUST 27, 2007



NOTE:
ANALOG OUTPUT TO
STATIC PRESSURE
CONTROL DEVICE
SHOWN ON ANOTHER
SHEET

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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 41 ES DESCRIPTION: A/H UNIT, MODULATING DUCT STATIC PRESSURE CONTROL, 2 UNITS

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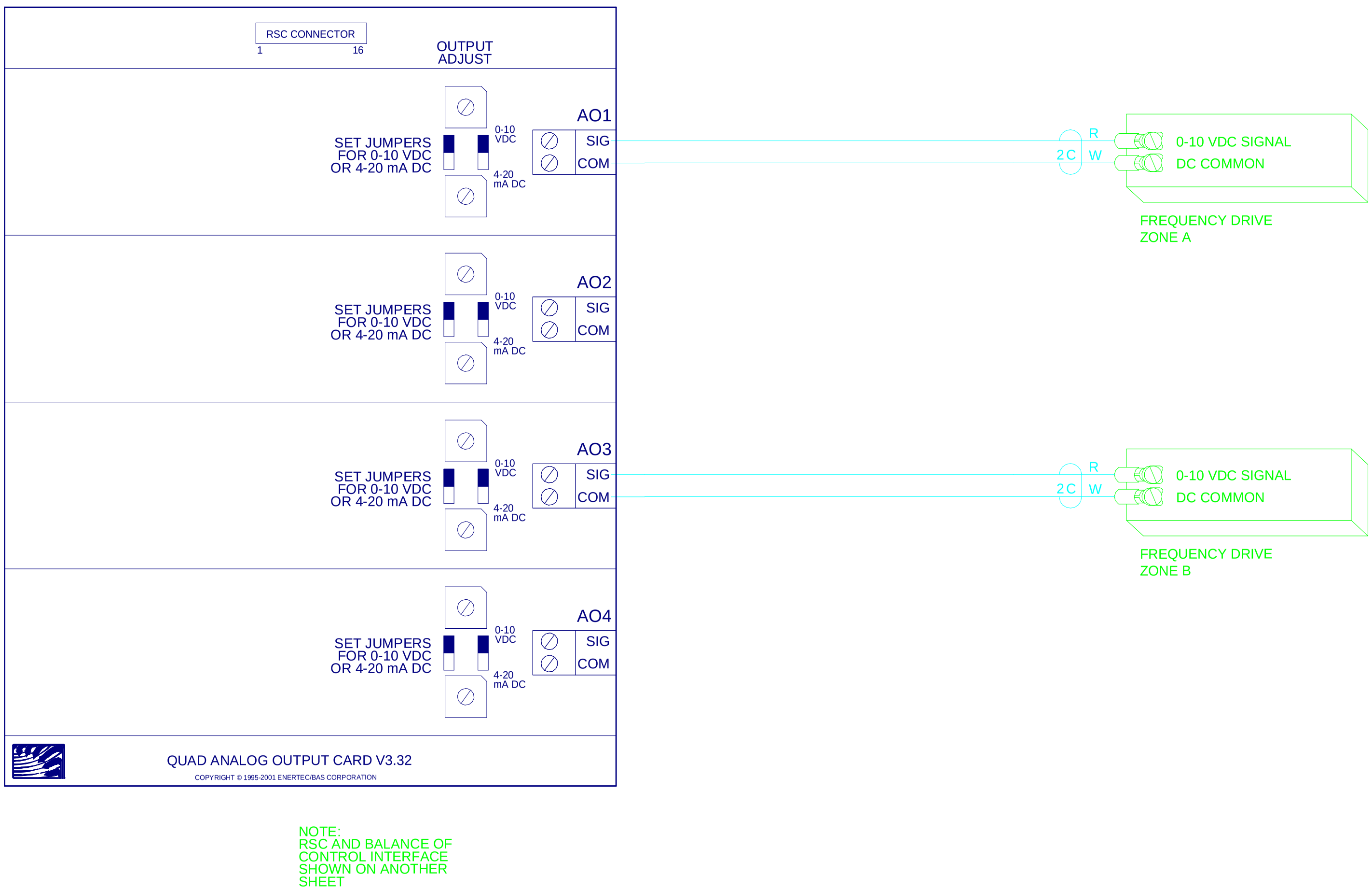
SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #:

ES DESCRIPTION: QUAD ANALOG OUTPUT CARD, 0-10 VDC OR 4-20 MA DC

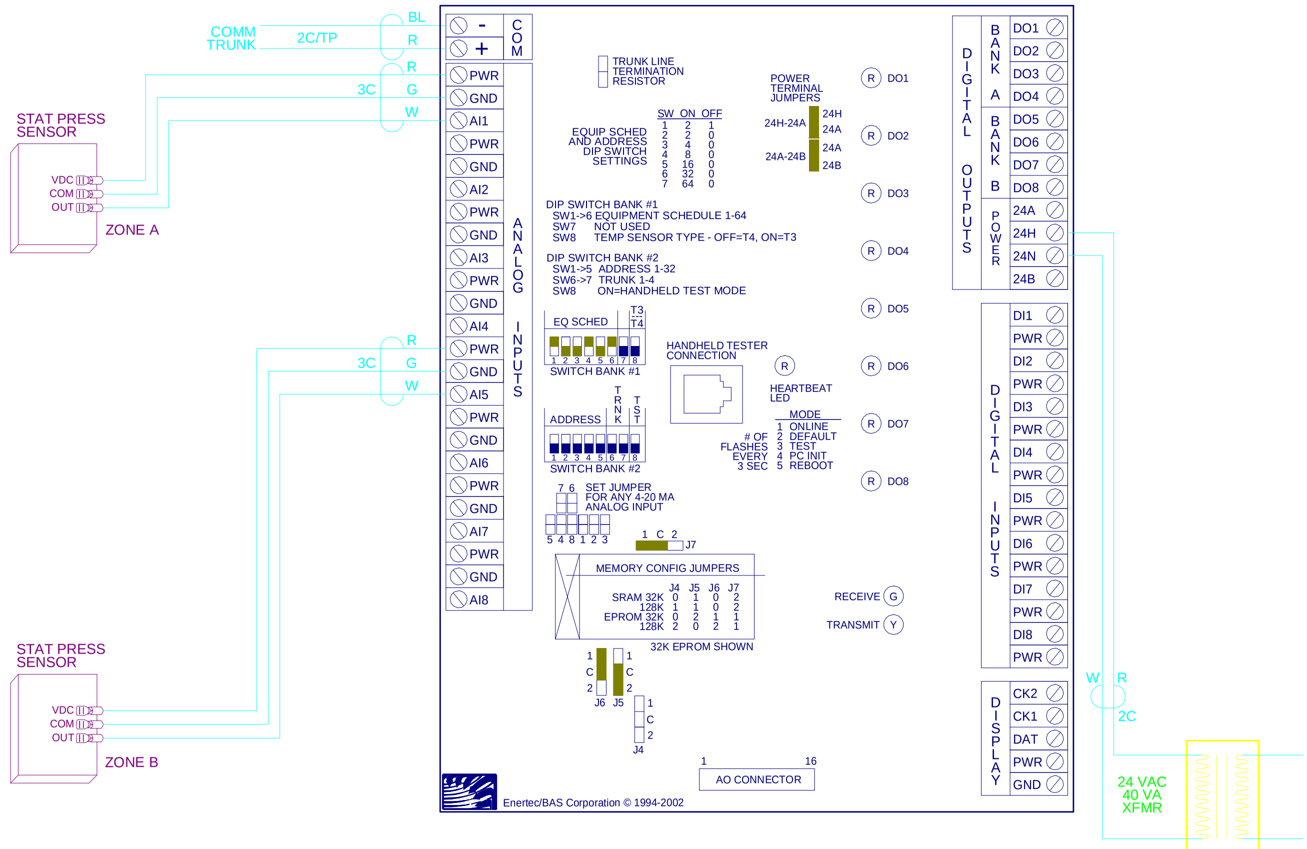
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



NOTE:
ANALOG OUTPUT TO
STATIC PRESSURE
CONTROL DEVICE
SHOWN ON ANOTHER
SHEET

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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 42 ES DESCRIPTION: A/H UNIT, MODULATING BUILDING PRESSURE CONTROL, 2 UNITS

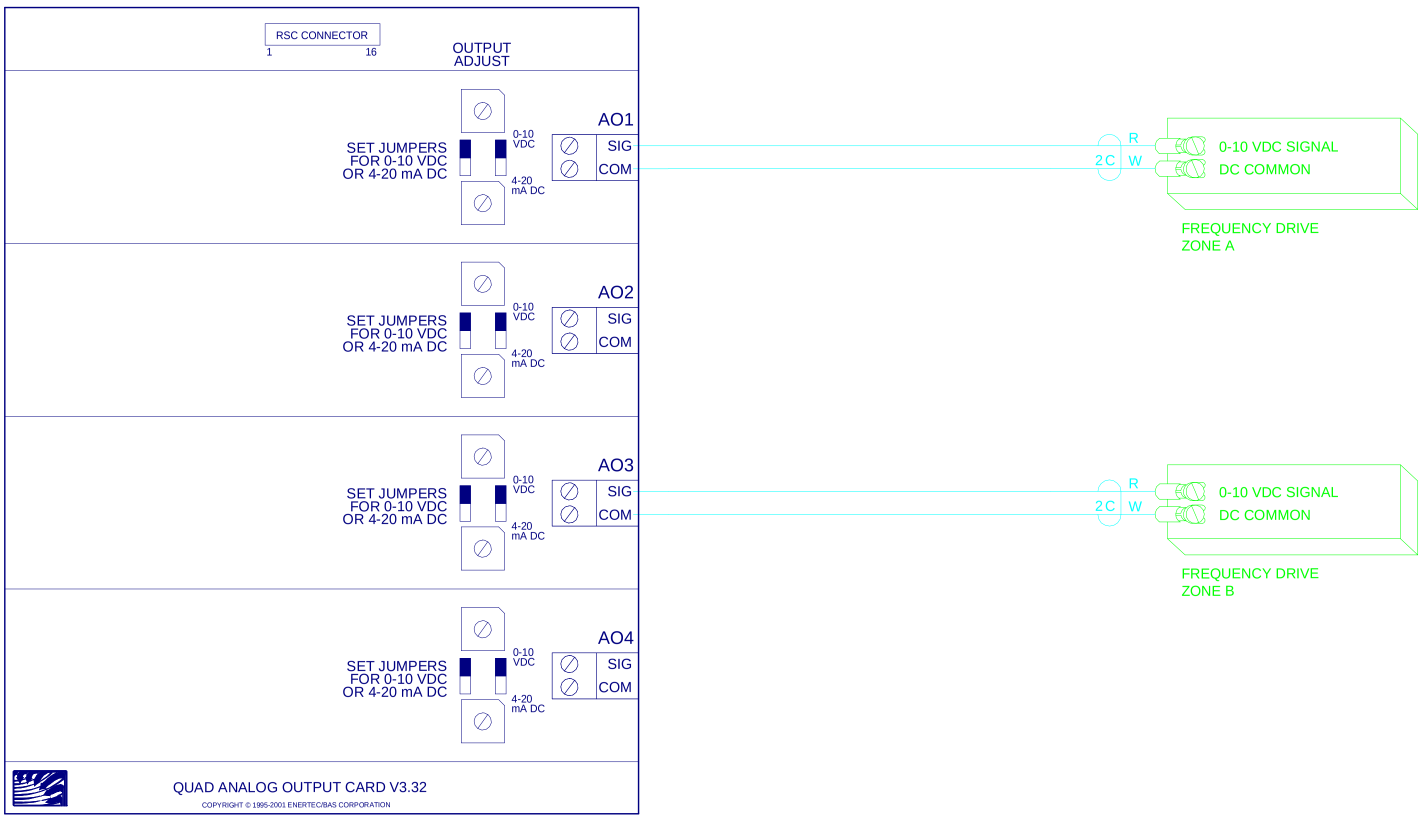
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



NOTE:
RSC AND BALANCE OF CONTROL INTERFACE SHOWN ON ANOTHER SHEET

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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #:

ES DESCRIPTION: QUAD ANALOG OUTPUT CARD, 0-10 VDC OR 4-20 MA DC

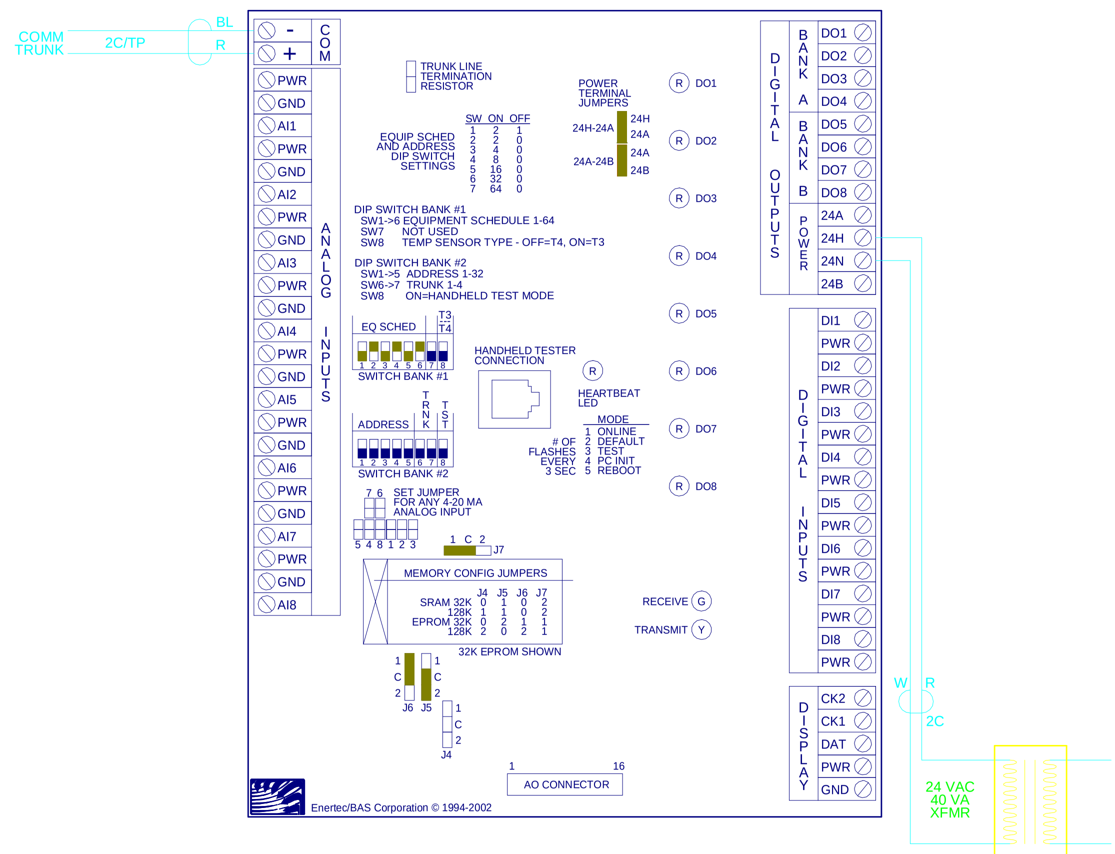
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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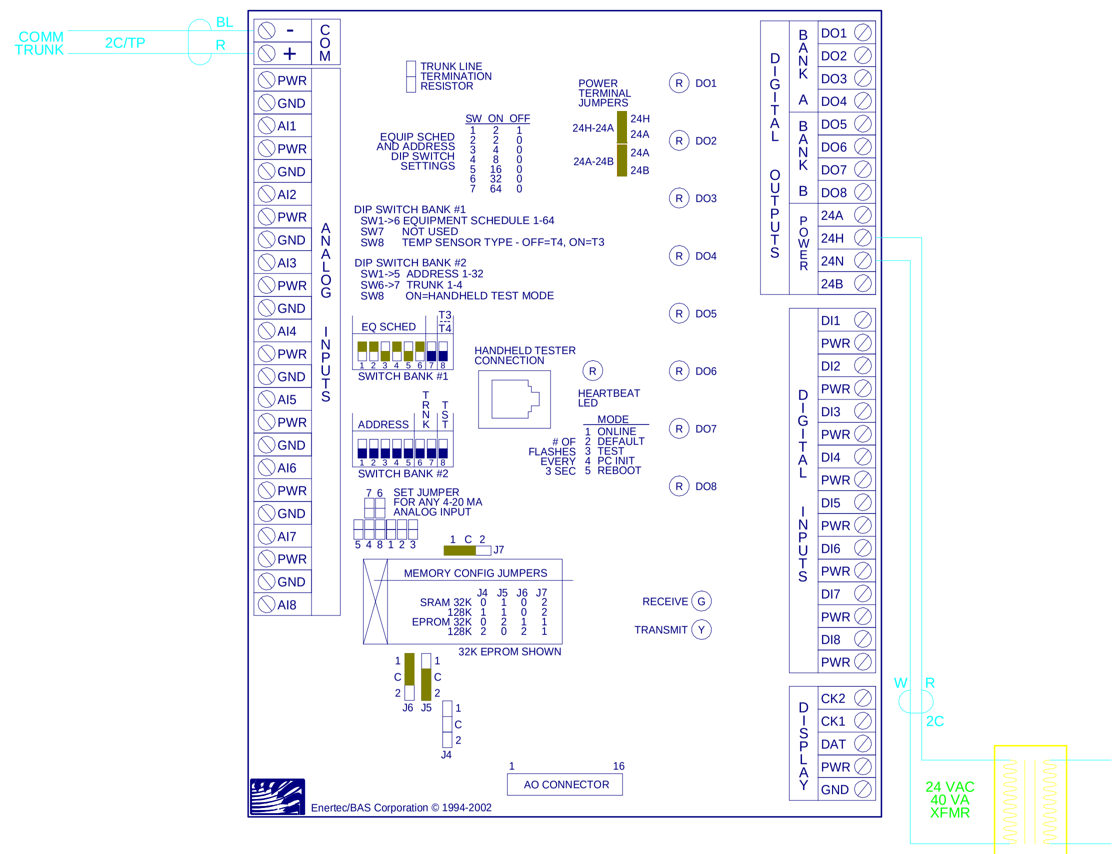

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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 44 ES DESCRIPTION: NOT CURRENTLY USED

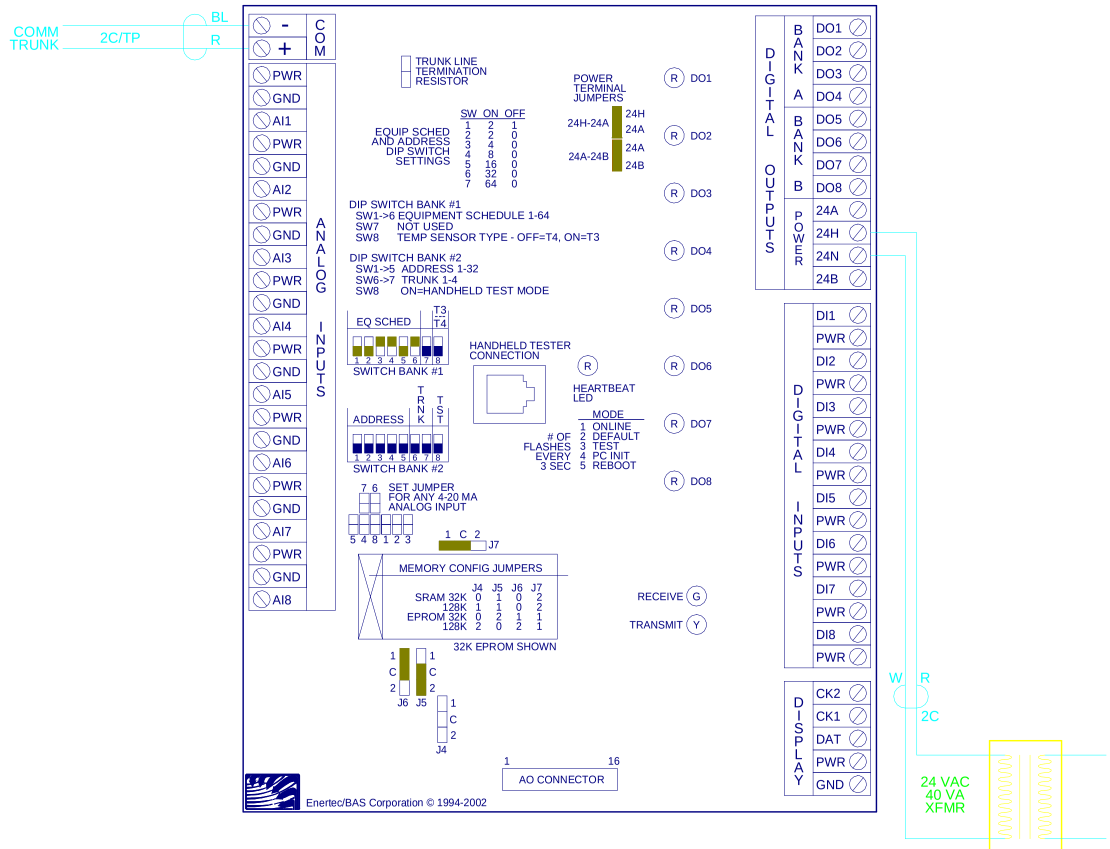
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 45 ES DESCRIPTION: NOT CURRENTLY USED

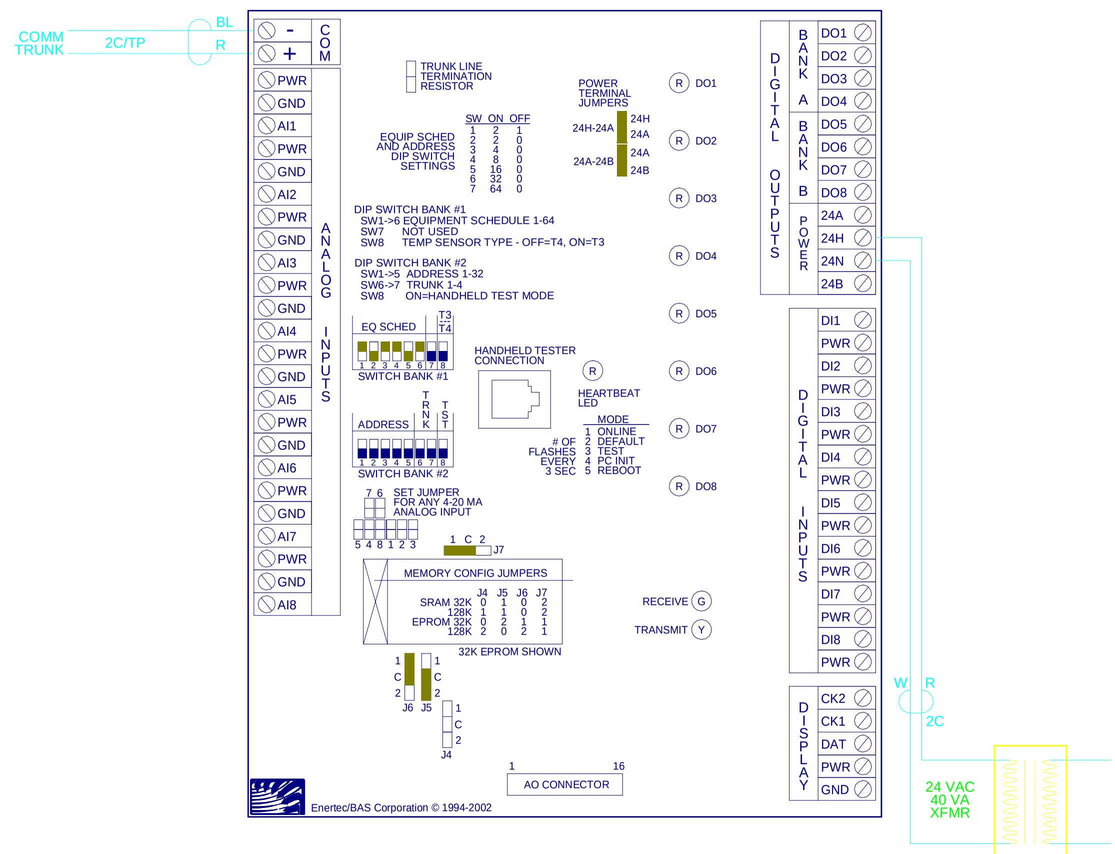
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME

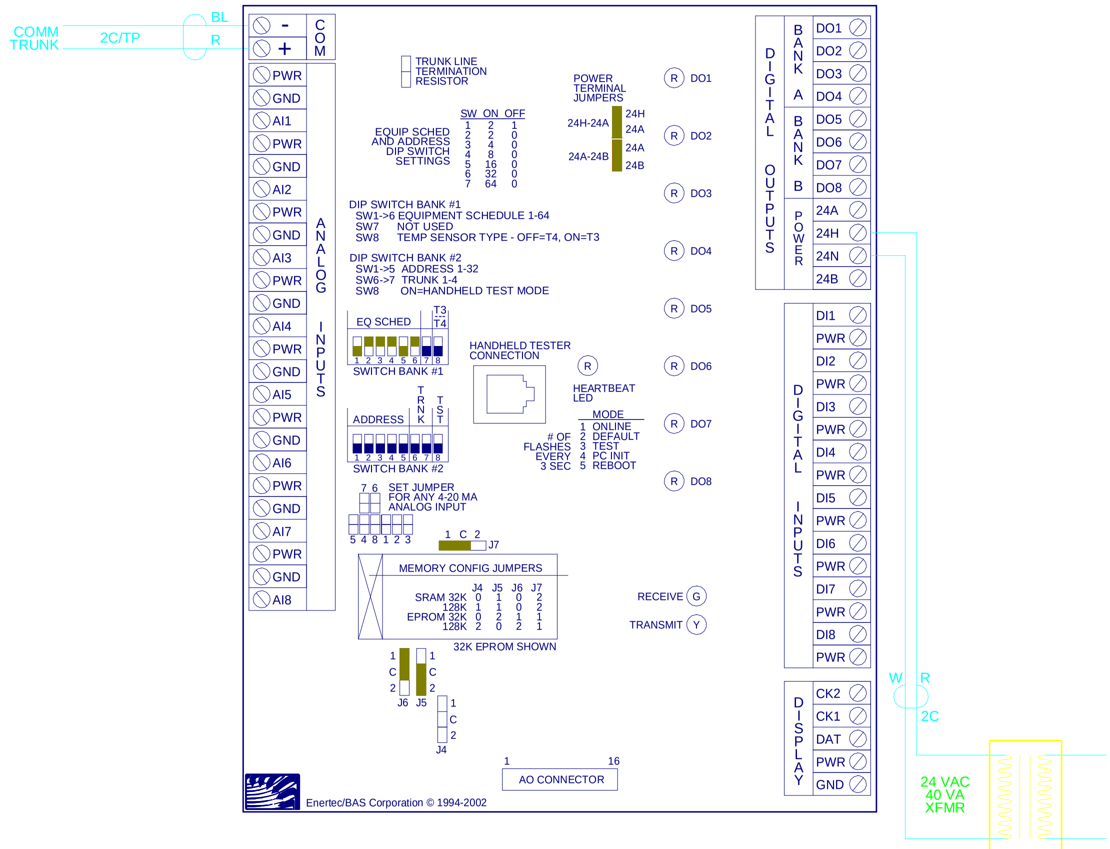
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 46 ES DESCRIPTION: NOT CURRENTLY USED

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 47 ES DESCRIPTION: NOT CURRENTLY USED

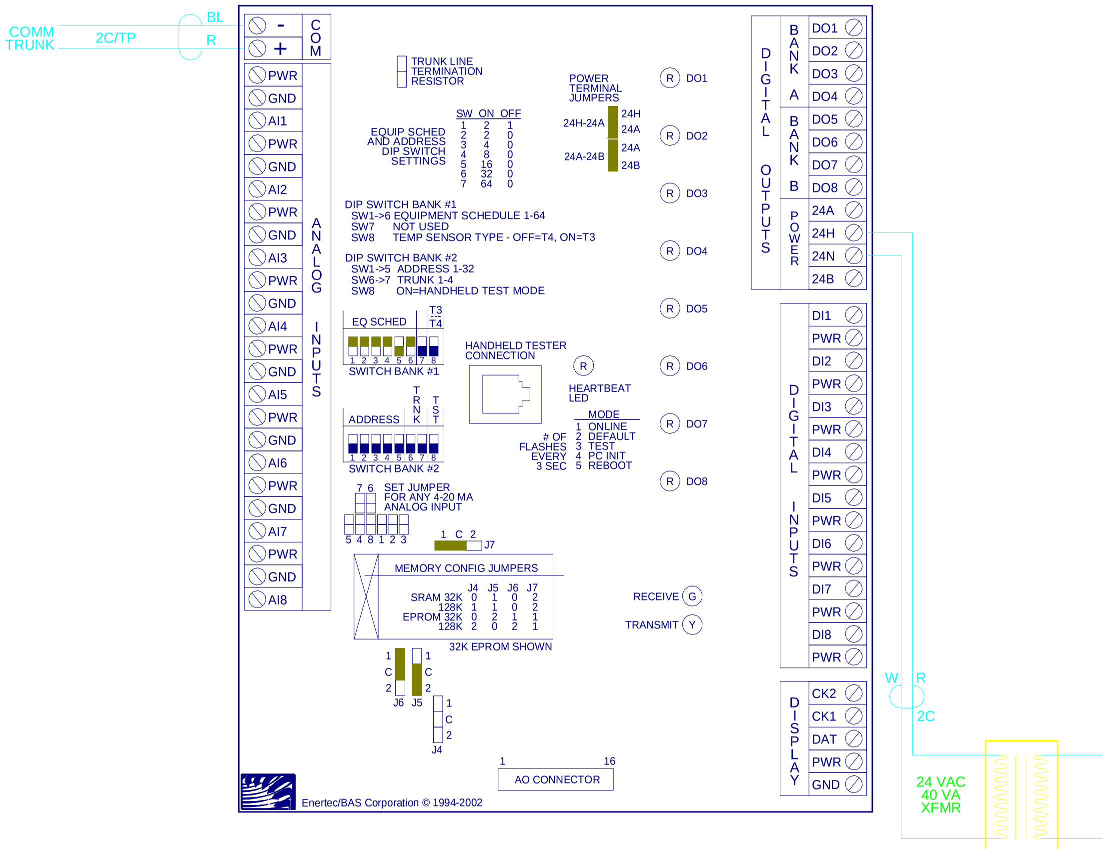
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 48 ES DESCRIPTION: NOT CURRENTLY USED

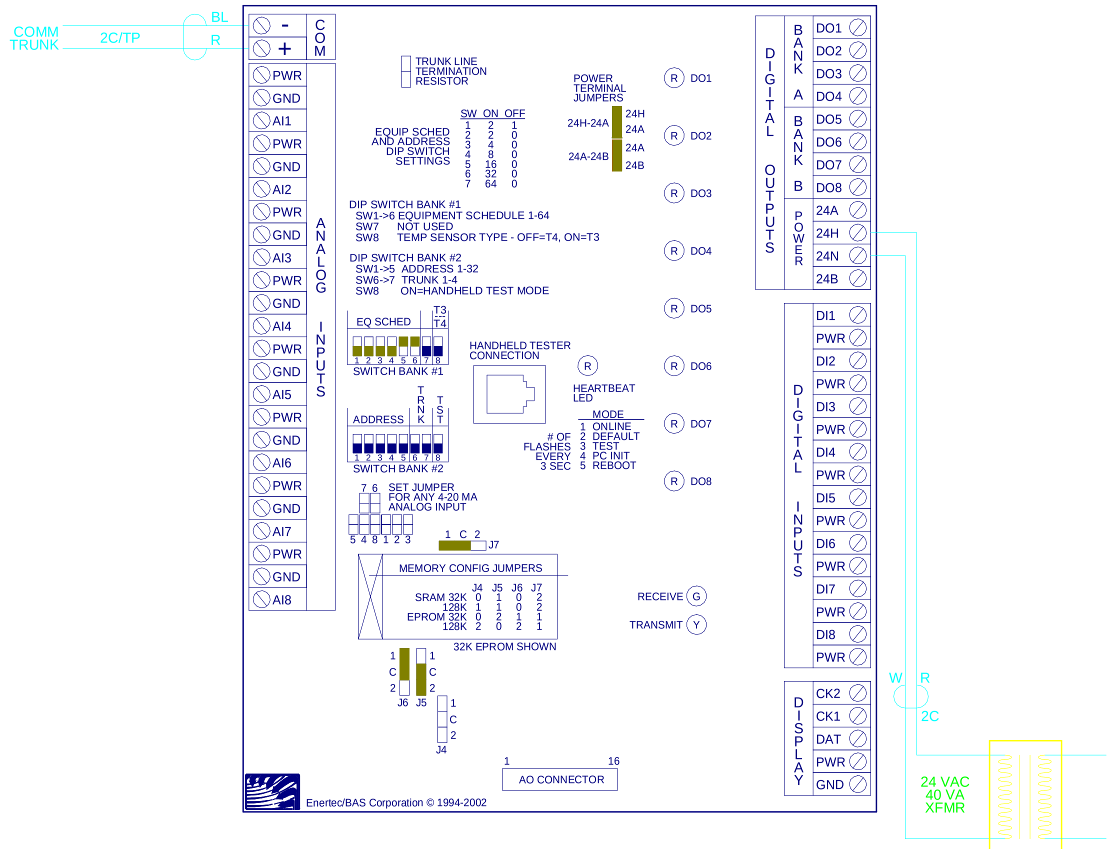
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME

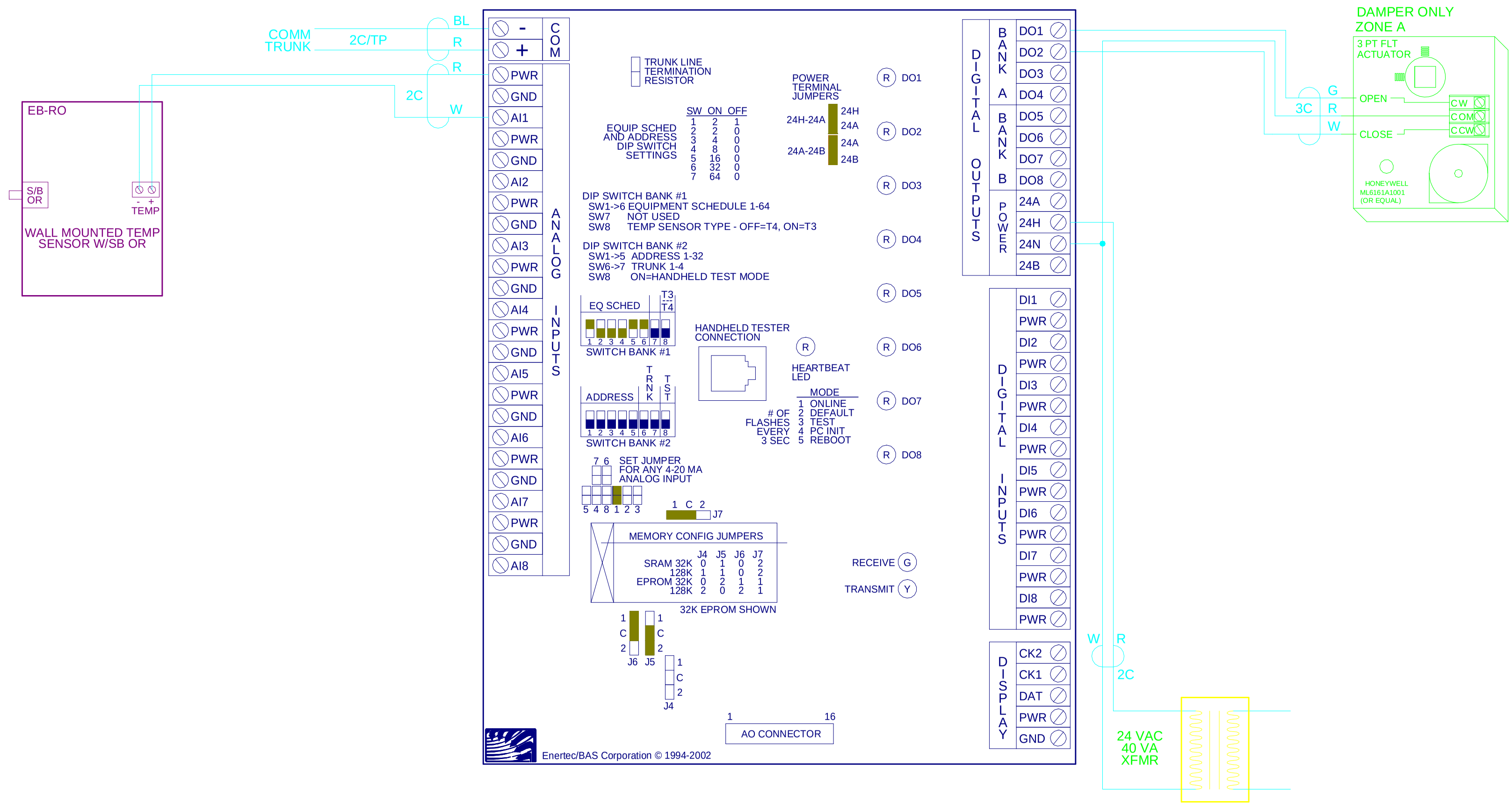
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 49 ES DESCRIPTION: NOT CURRENTLY USED

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 50 ES DESCRIPTION: VARIZONE DAMPER

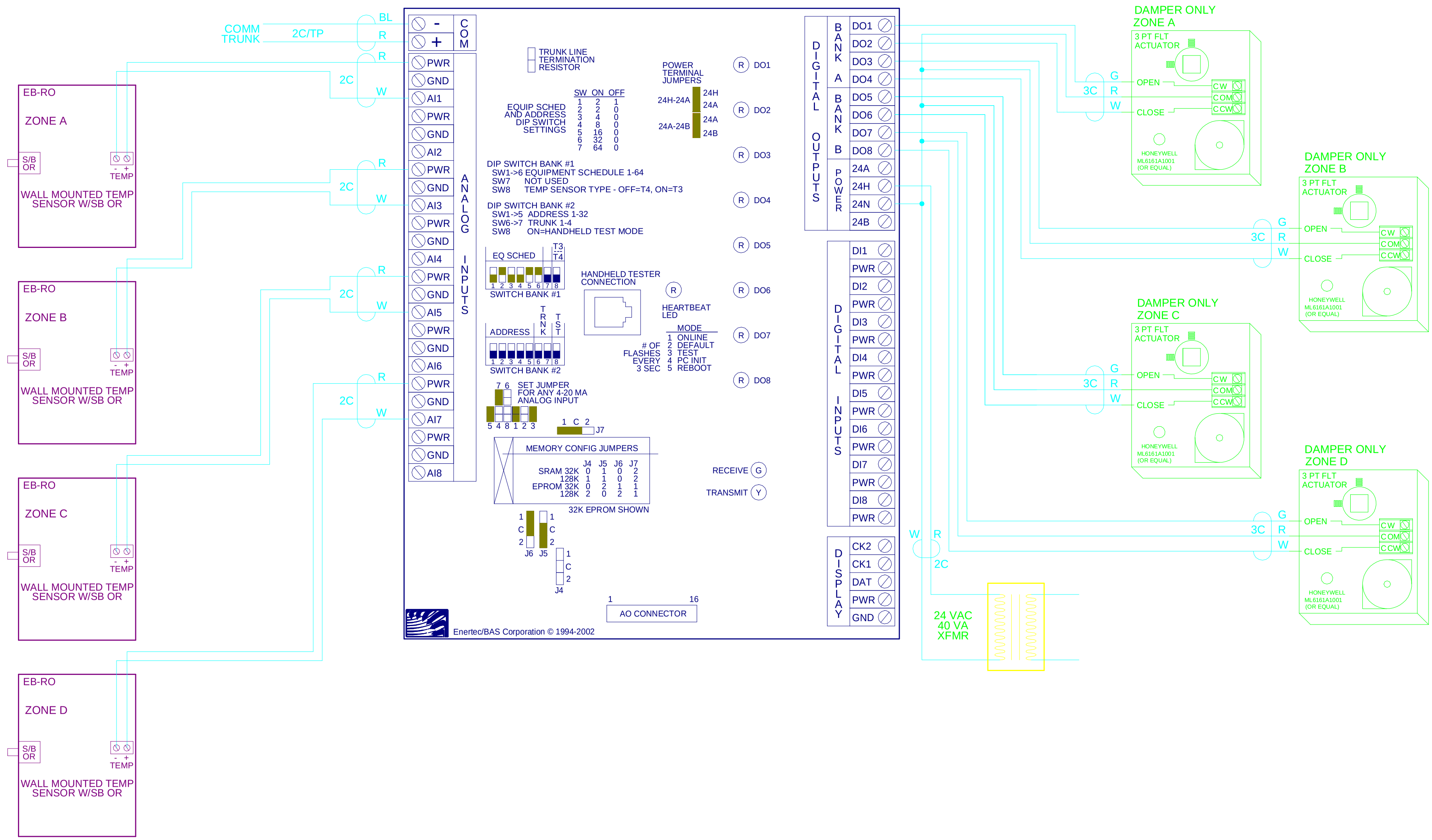
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 51 ES DESCRIPTION: VARIZONE DAMPER, 4 ZONES

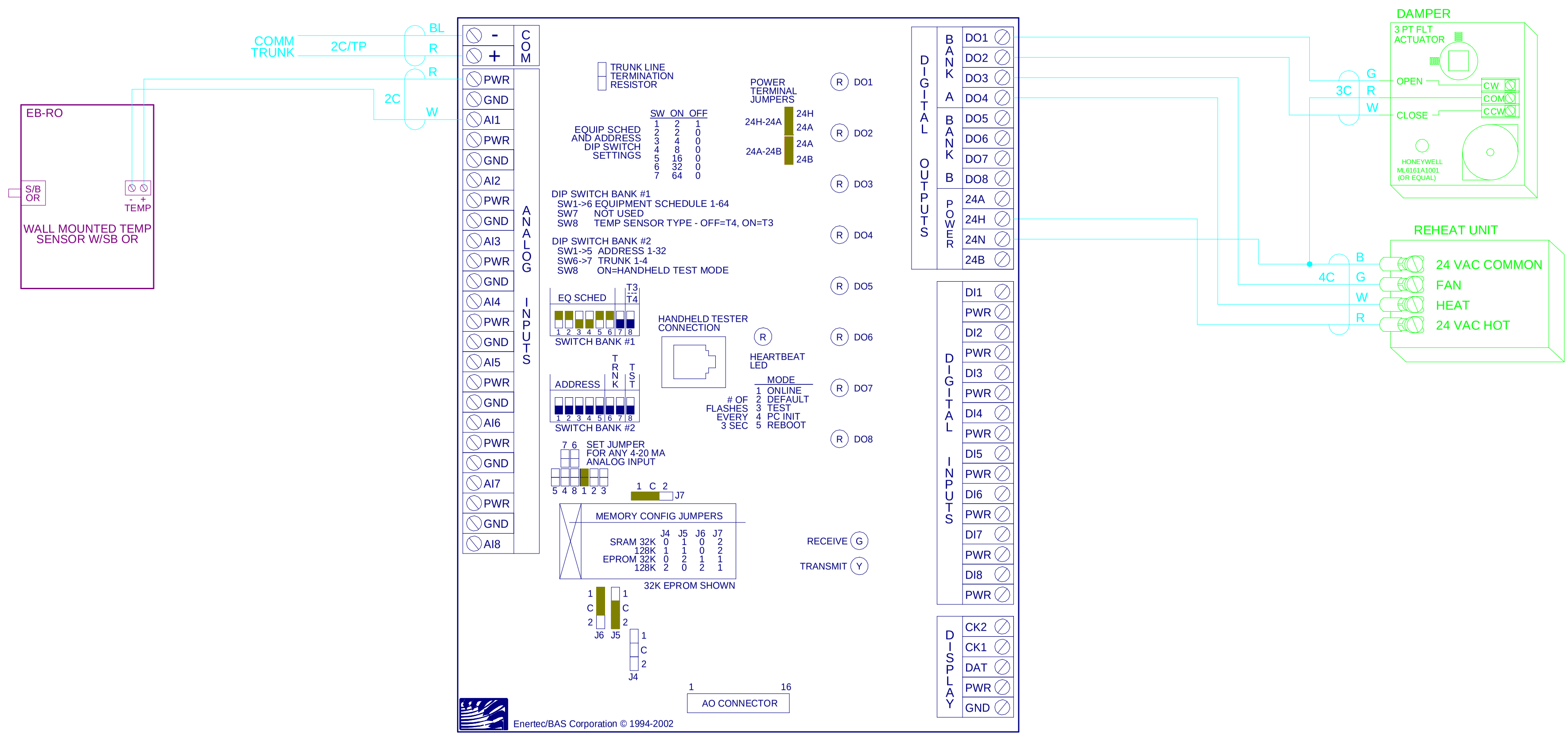
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME

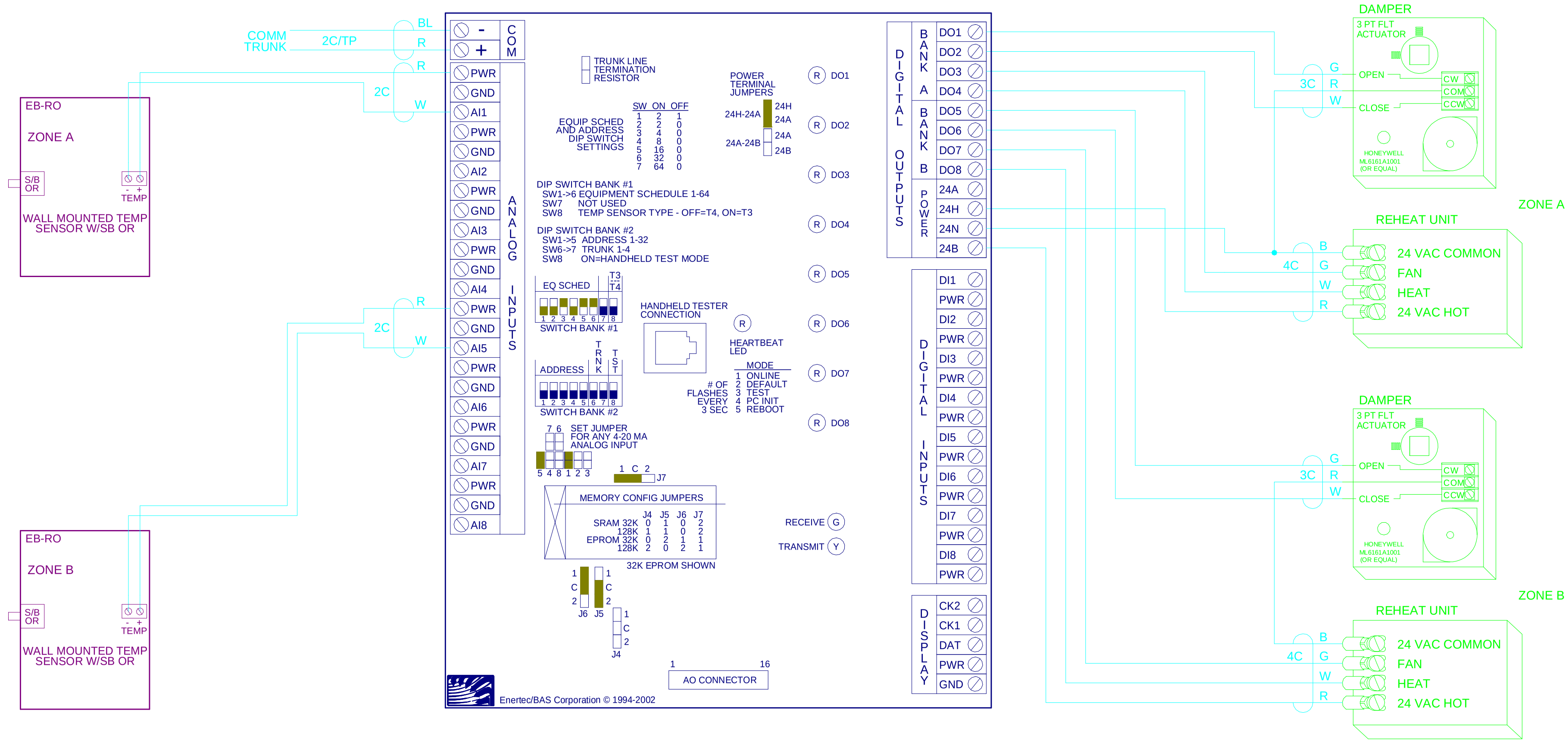
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 52 ES DESCRIPTION: VARIZONE BOX, 1 HEAT, CONSTANT FAN

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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PROJECT NAME

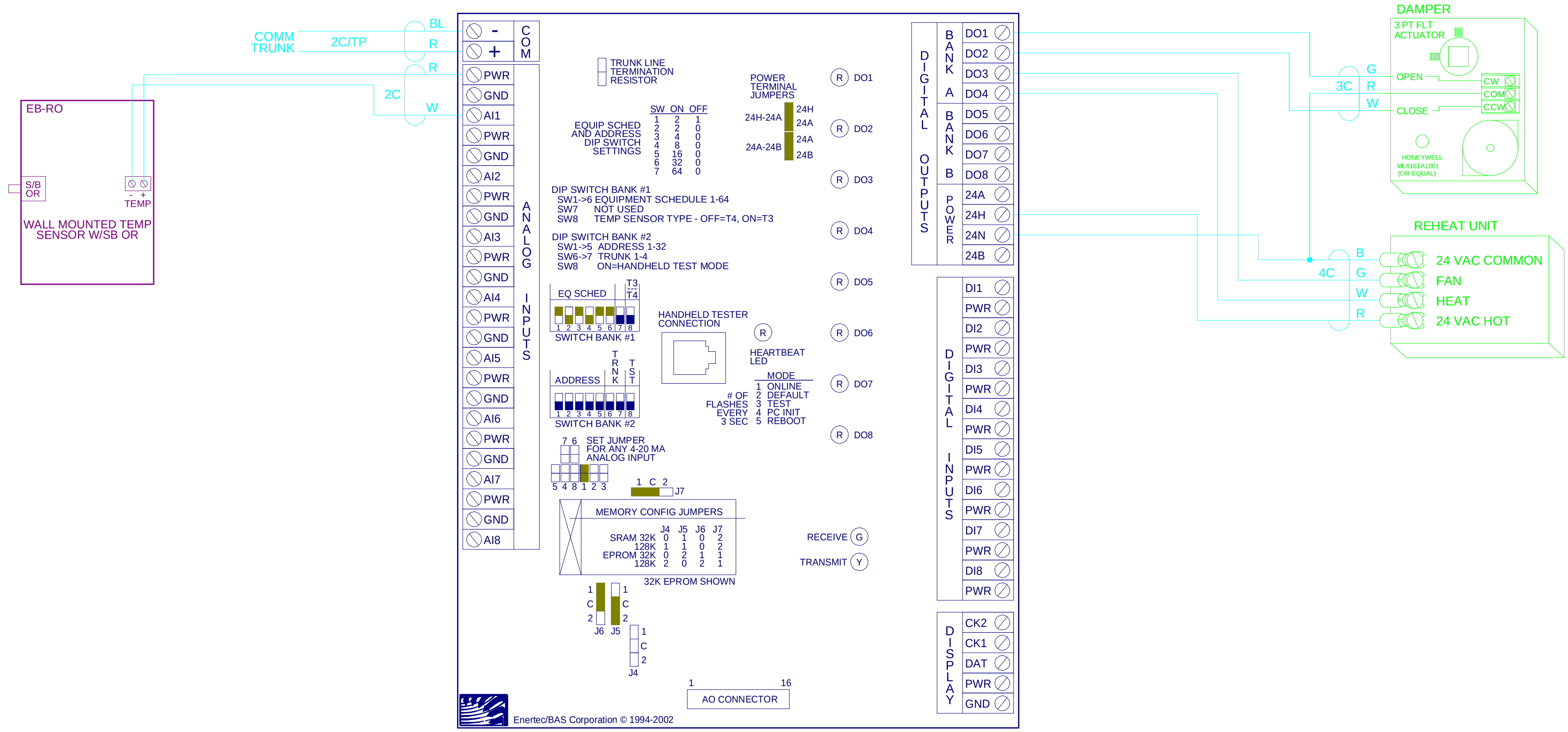
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 53 ES DESCRIPTION: VARIZONE BOX, 1 HEAT, CONSTANT FAN, 2 ZONES

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



Enertec/BAS Corporation
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(360) 943-2952
www.enertec-bas.com

PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 54 ES DESCRIPTION: VARIZONE BOX, 1 HEAT, INTERMITTENT FAN

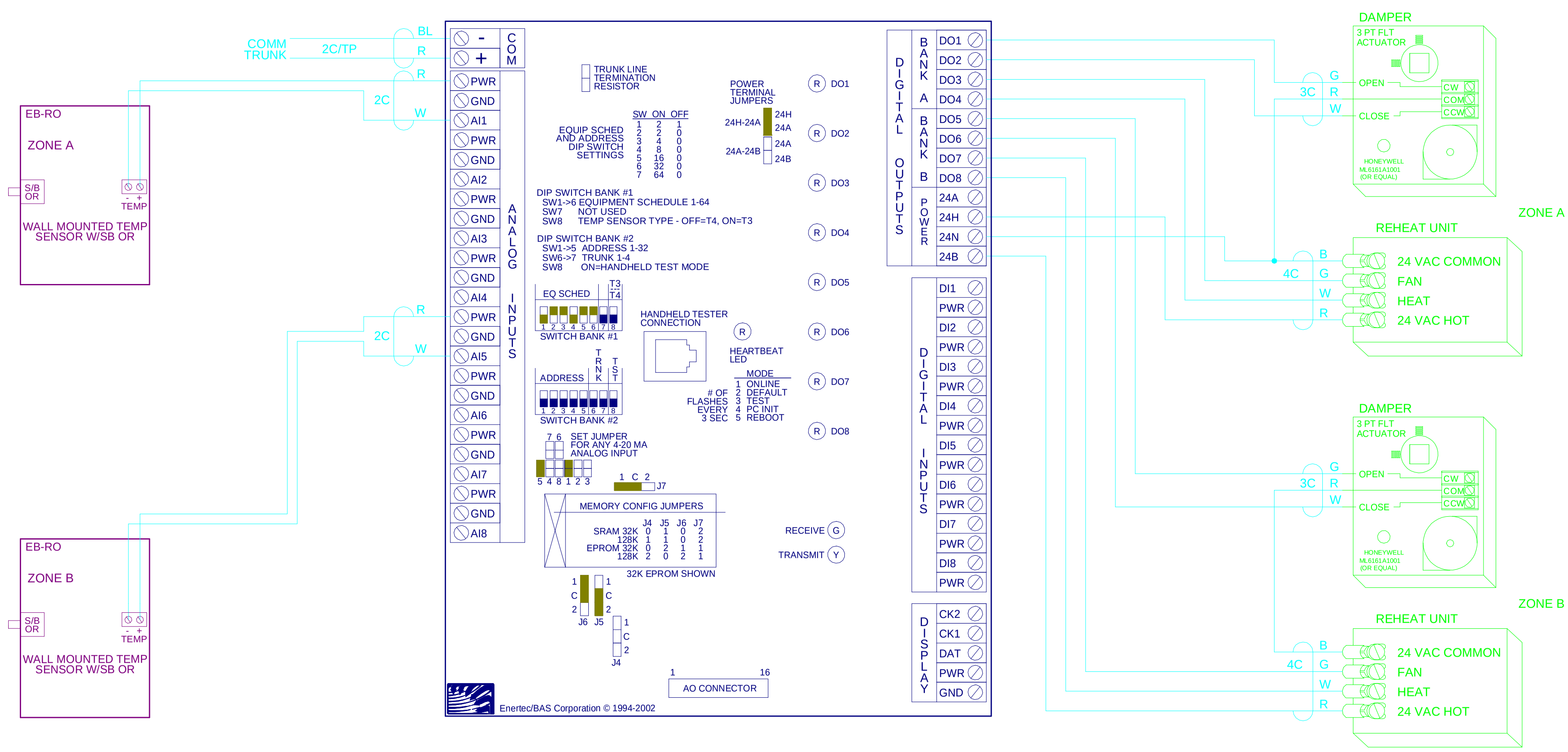
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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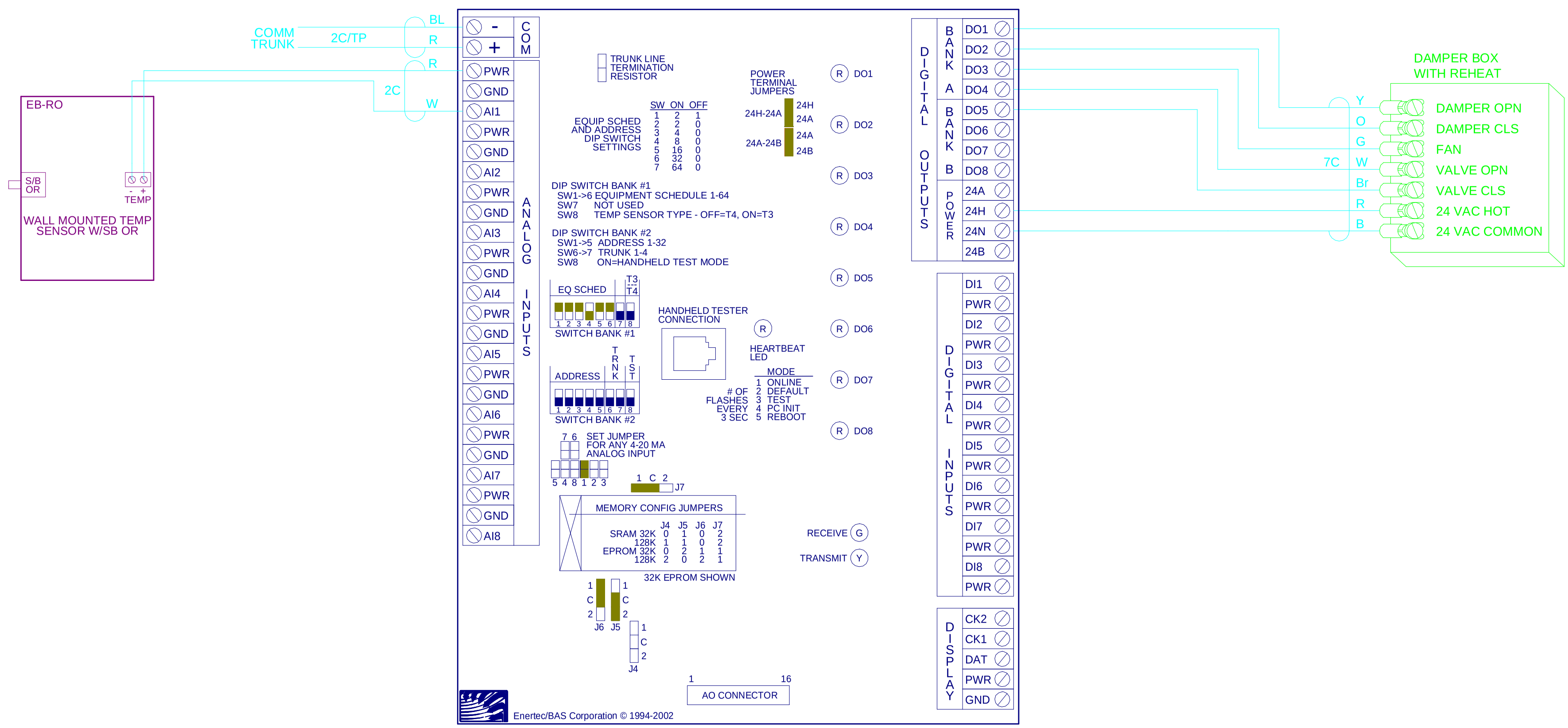
	CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC			
	ES #: 55 ES DESCRIPTION: VARIZONE BOX, 1 HEAT, INTERMITTENT FAN, 2 ZONES			

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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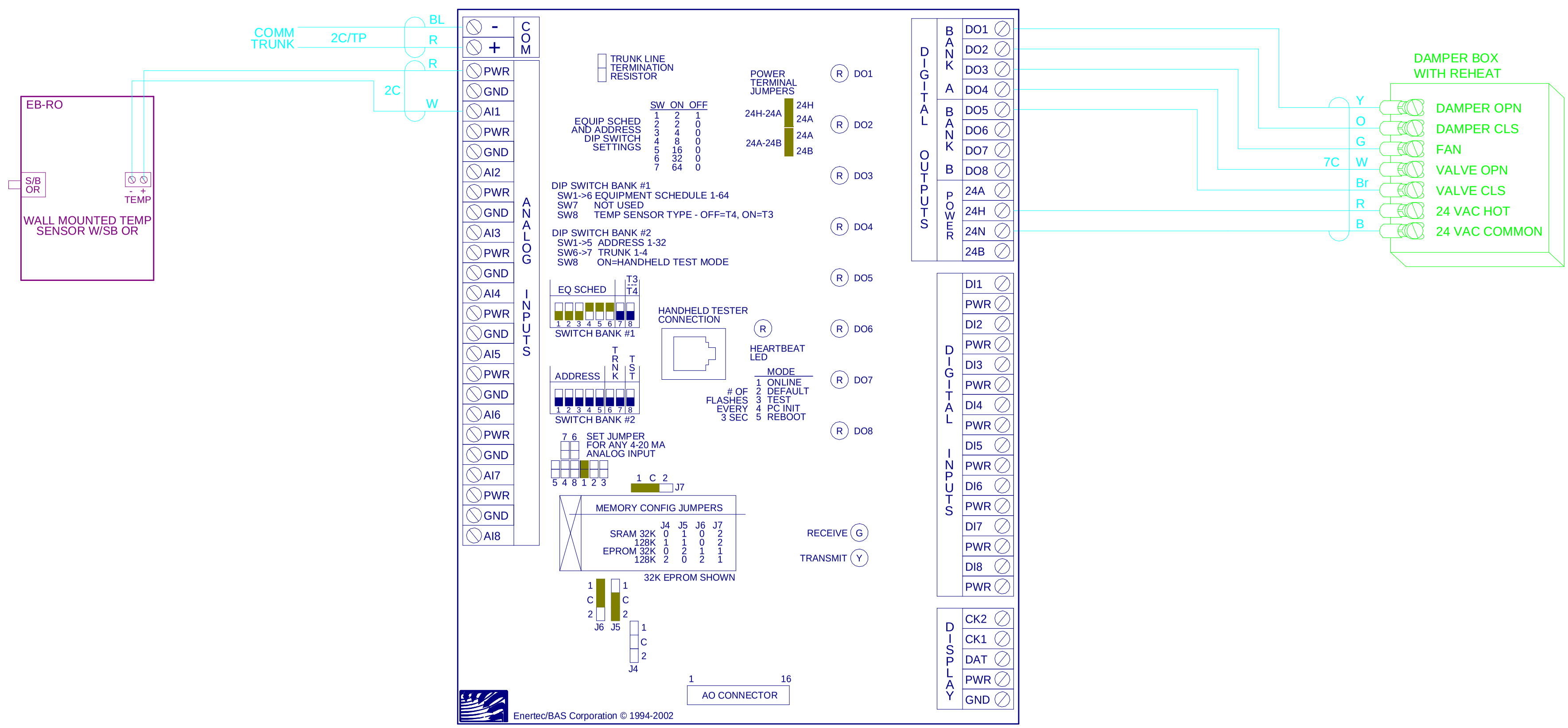
PROJECT NAME
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 56 ES DESCRIPTION: VARIZONE BOX, MODULATING HEAT, CONSTANT FAN

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 57 ES DESCRIPTION: VARIZONE BOX, MODULATING HEAT, INTERMITTENT FAN

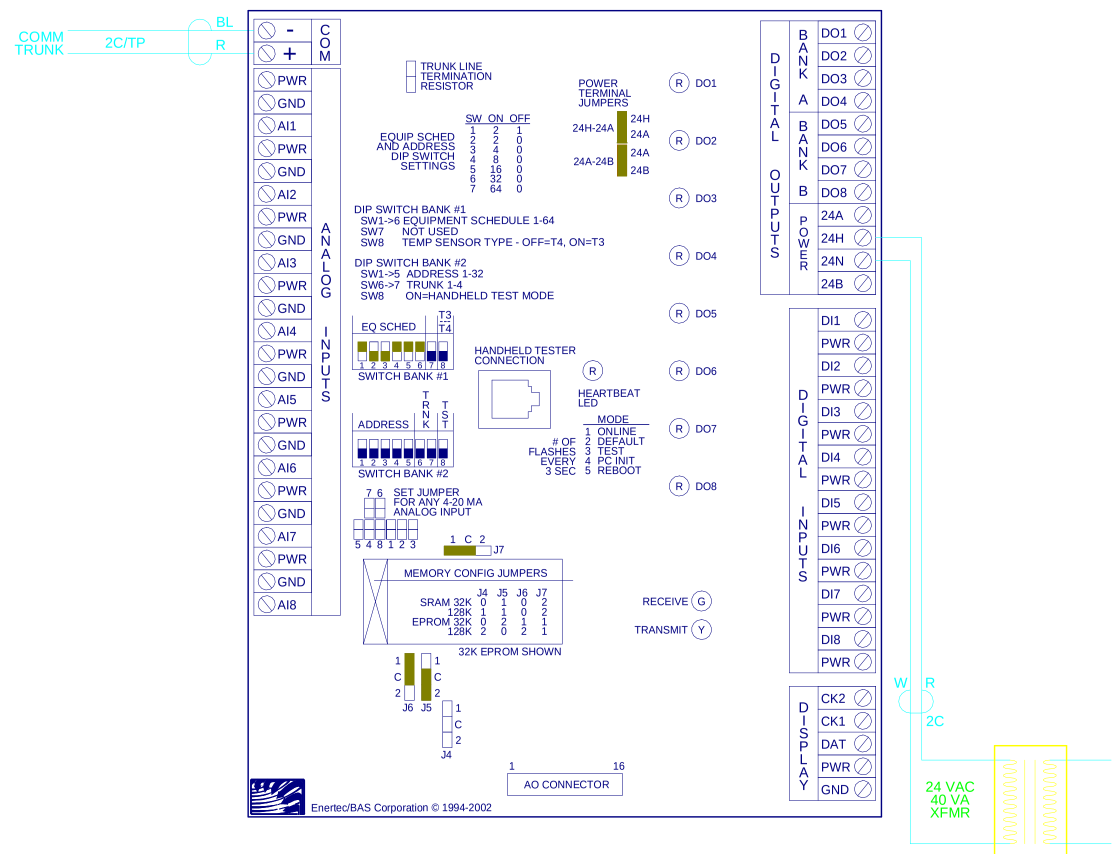
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 58 ES DESCRIPTION: NOT CURRENTLY USED

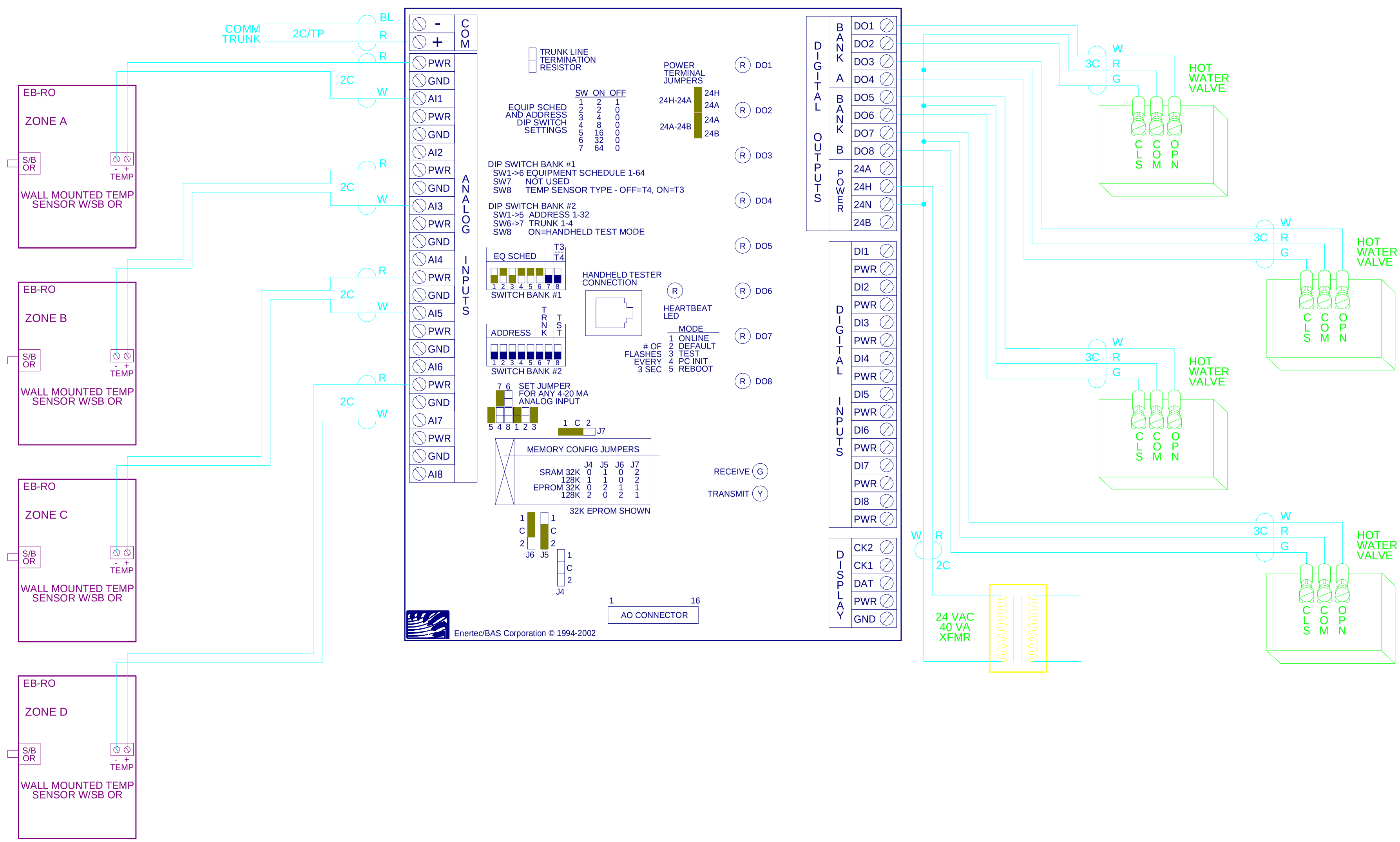
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 59 ES DESCRIPTION: MODULATING HEAT, 4 ZONES

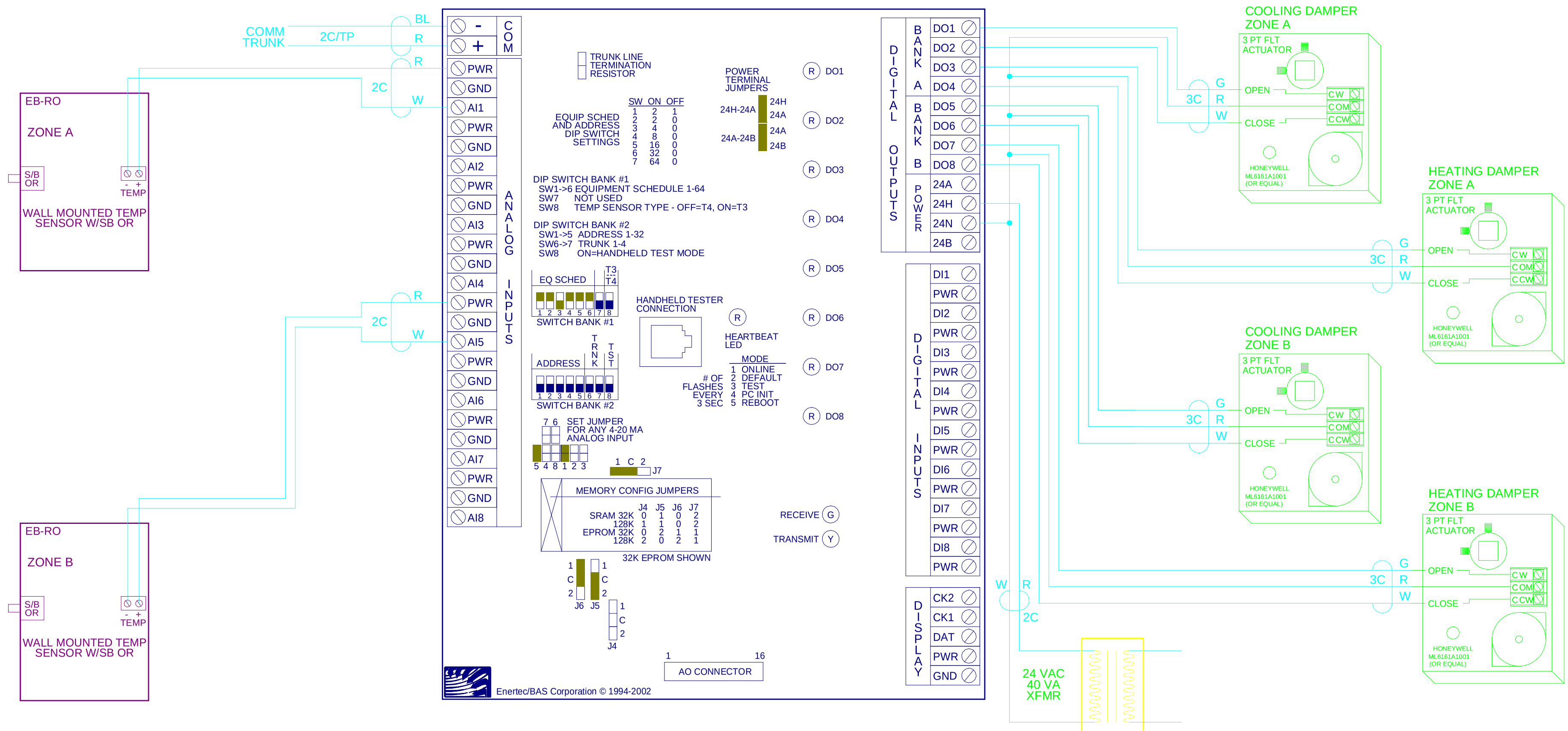
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 60 ES DESCRIPTION: VAV DAMPERS, DUAL DUCT SYSTEM, 2 ZONES

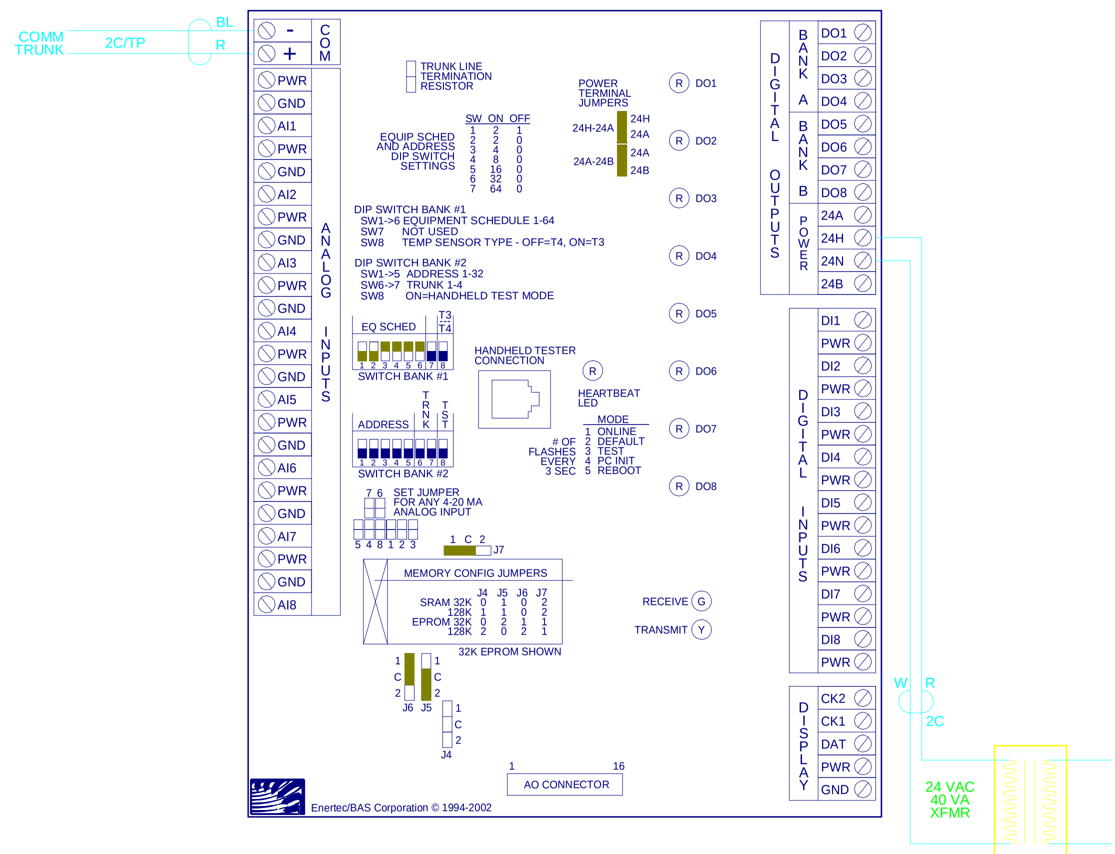
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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PROJECT NAME

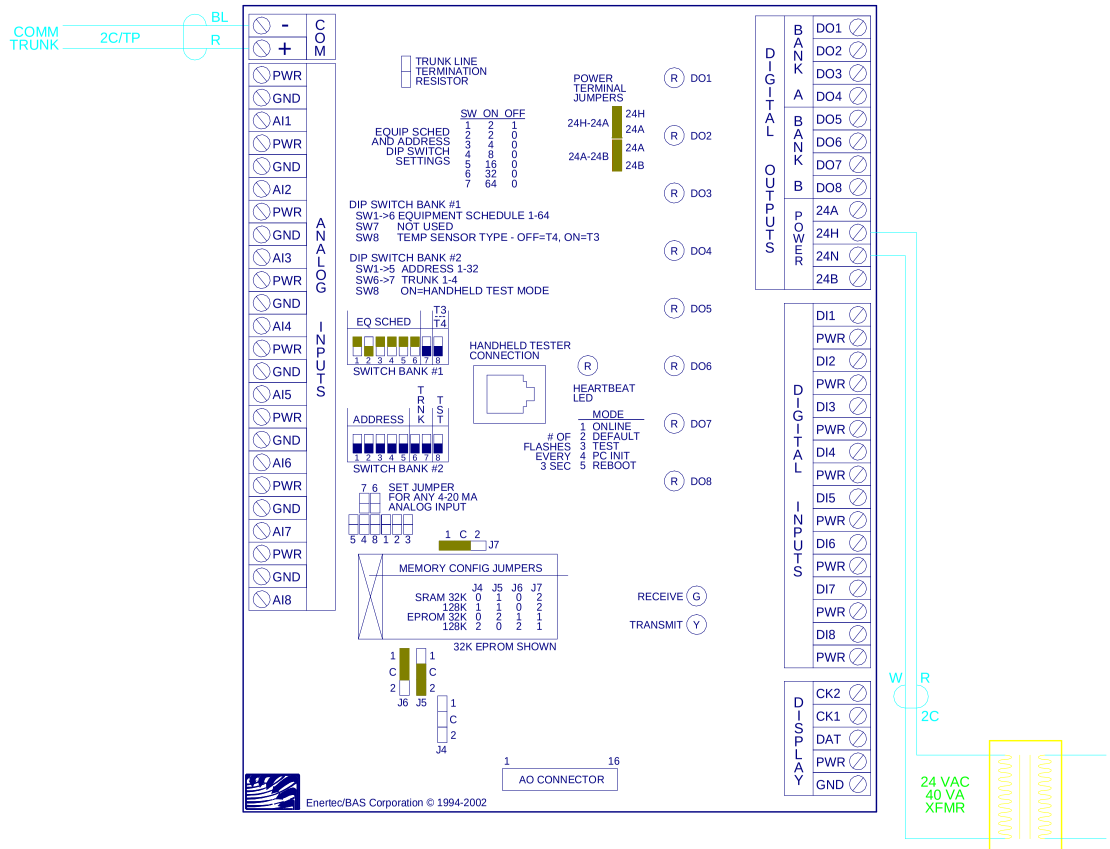
PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 61 ES DESCRIPTION: NOT CURRENTLY USED

REVISIONS	DATE	BY

SHEET 1 OF 1
JOB NO: XX-XXXX
DRAWN BY: RBJ
DATE: AUGUST 27, 2007



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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 62 ES DESCRIPTION: NOT CURRENTLY USED

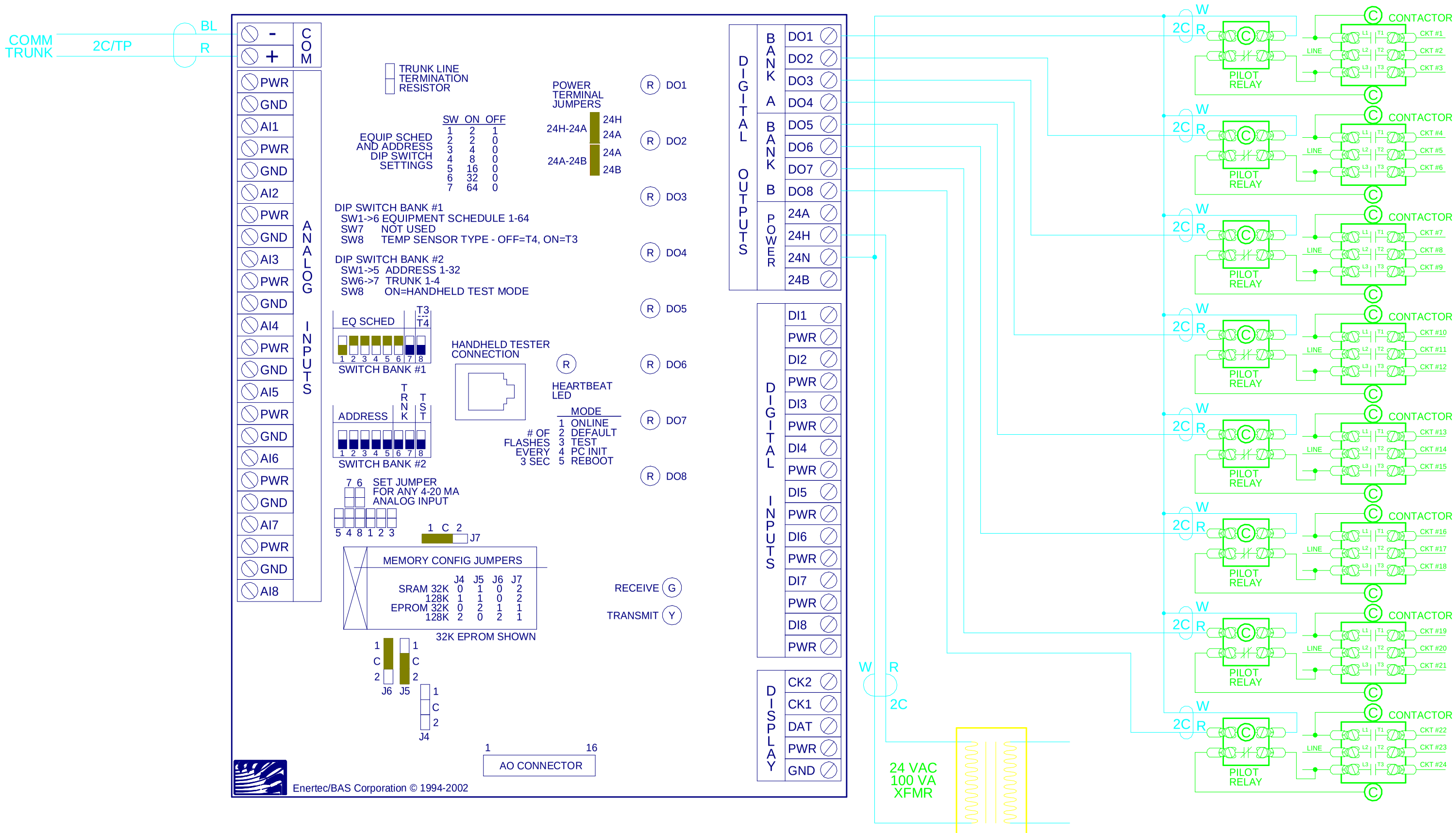
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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(360) 943-2952
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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 63 ES DESCRIPTION: LIGHTING CONTROL, 8 ZONES

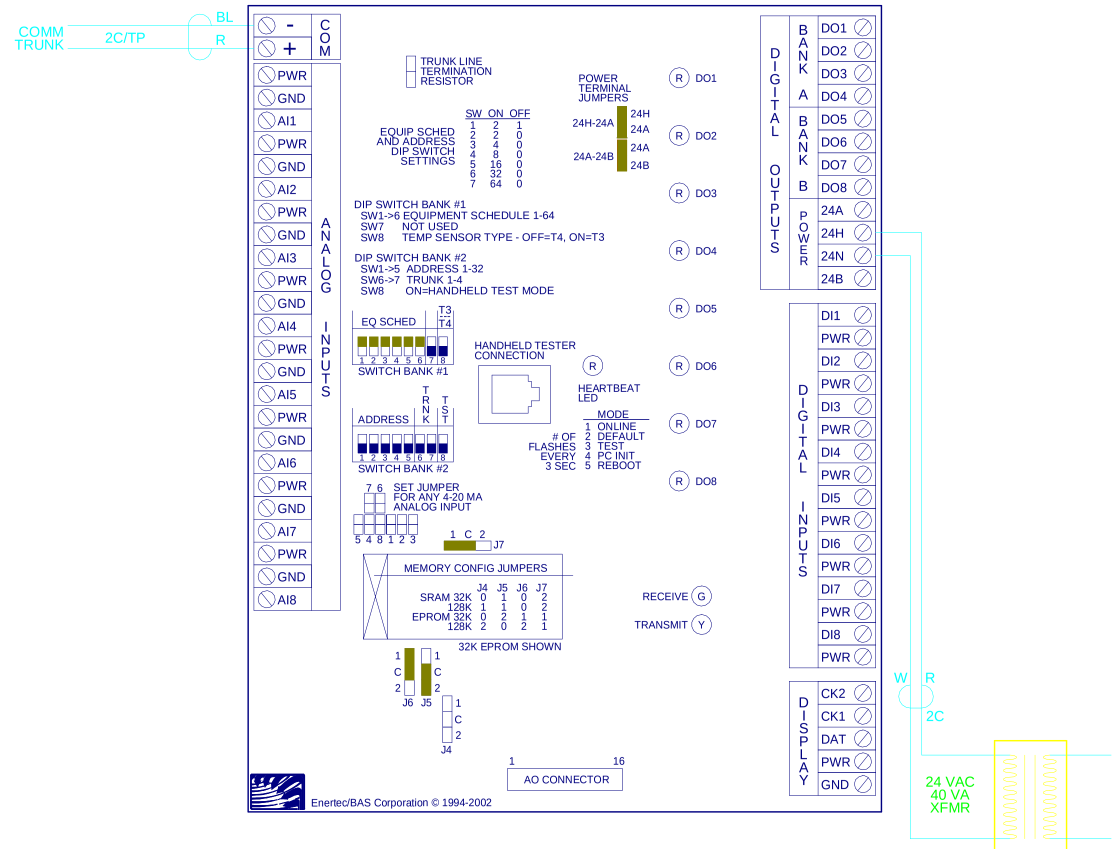
REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007



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(360) 943-2952
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PROJECT NAME

PROJECT ADDRESS

CONTENTS: TYPICAL UNIT LOW VOLTAGE CONTROL WIRING SCHEMATIC

ES #: 64 ES DESCRIPTION: NULL EQUIPMENT SCHEDULE

REVISIONS	DATE	BY

SHEET 1 OF 1

JOB NO: XX-XXXX

DRAWN BY: RBJ

DATE: AUGUST 27, 2007

Appendix C

Application Notes

B A S Index of Application Notes

1. Use of a Potentiometer as an Analog Input
2. Bypass Damper Control in VariZone® Systems
3. Guidelines for Scaling of Analog Inputs
4. EPROM Changeout Procedure
5. Input of a 0-10 vdc device directly to an Analog Input
6. Use of a Johnson Controls DPT-2000-2 Pressure Transmitter to Measure Zone CFM
7. Setup Calculations for Zone CFM Monitoring
8. Use of a Zone Setpoint Offset Potentiometer
9. Combining 2 Equipment Schedules on 1 RSC
10. Combining Equipment Schedules 41 & 42 on a Single RSC
11. Using a US Robotics 14,400 Internal Fax-Modem
12. Lighting Control
13. Using Another Application to View Trend Log Data
14. Installing an ACL Card in a Windows 95/98 System

BAS Application Note 001

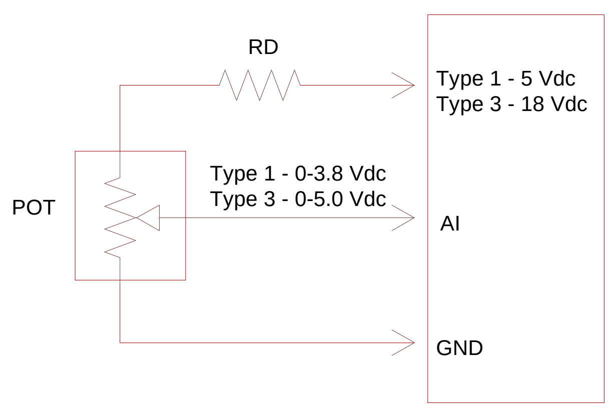
Use of a Potentiometer as an Analog Input

Any potentiometer can be used as an input device. This requires the use of a voltage dropping resistor (RD) between the power supply and the pot. The purpose of this resistor is to limit the maximum analog input voltage to the maximum allowed by the RSC. The value of the dropping resistor can be determined as follows:

Rev 1 RSC
RD = POT*14,723 / (POT+46,625)   (Where the values of POT and RD are resistance in ohms.)

Rev 3 RSC
RD = POT*121,225 / (POT+46,625)   (Where the values of POT and RD are resistance in ohms.)

It is always a good practice to measure the actual value of the total pot resistance. Often a nominal resistance as listed by a manufacturer will vary as much as 20%. It is not usually necessary to measure each pot from a given manufacturer. The values will generally be consistent for any given product.



The below chart shows some common potentiometer values, their corresponding design dropping resistor value, and the off-the-shelf available resistor values. Always use 1% resistors for greater accuracy. Select a 25,000 ohm pot if a choice is available as to the pot value to use.

Pot	Rev 1		Rev 3	
Value	RD Value	1% Res	RD Value	1% Res
500	156	158	1286	1.30K
1000	309	309	2545	2.55K
5000	1426	1.43K	11741	11.8K
10000	2600	2.61K	21408	21.5K
25000	5139	5.11K	42312	42.2K

BAS

Application Note 002

Bypass Damper Control in VariZone® Systems

A Bypass Damper must be installed on a **VariZone®** server in order to maintain reasonably constant static pressure during changes in Client Zone damper positions. In order to achieve maximum equipment safety, **BAS** requires that bypass be independent from RSC control.

The size and location of the bypass damper and the design static pressure must be determined by the mechanical engineer. The pressure pickup for the static pressure controller should be installed about 2/3 of the way down the main duct run. Some installations may require field testing to determine a representative location for monitoring static pressure.

The simplest and most reliable method for controlling static pressure is to use a Dwyer Model 3001 Photohelic Differential Pressure Switch/Gage. The Model 3001 has a 0-1" WC control range and is available in several other ranges. This device provides reliable indication and control. The attached drawing shows proper application of this device.

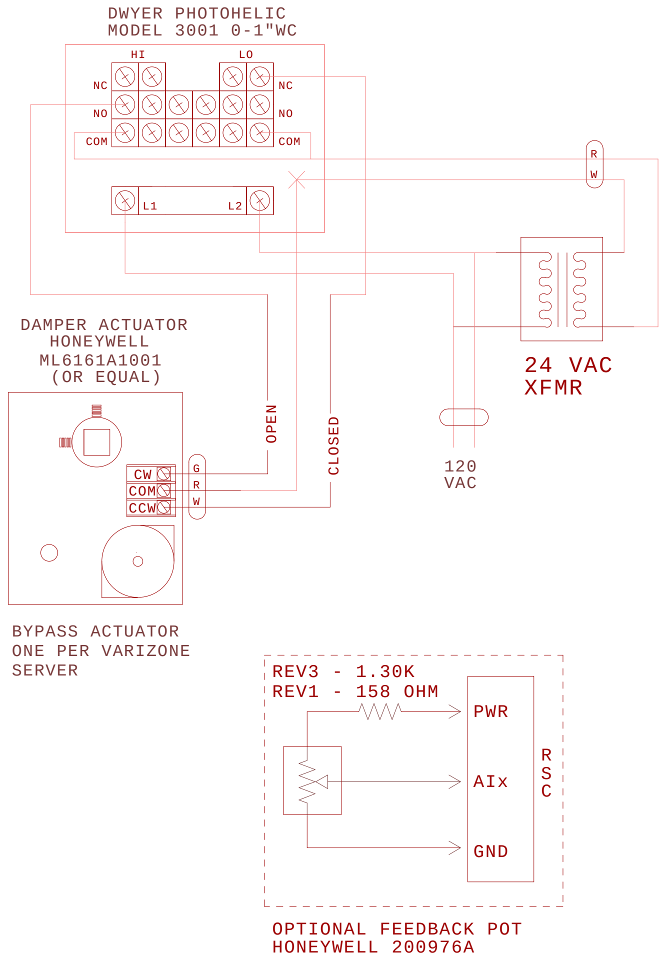
A feedback potentiometer may be installed on the bypass actuator and wired to a spare analog input as damper position feedback. When a feedback pot is used, a dropping resistor must be field installed. The value of this resistor is dependent on the value of the pot. The Honeywell pot is a nominal 500 ohms. Most pots are not exactly 500 ohms and the resistance value of the pot must be measured if high accuracy is required. The value of the dropping resistor (RD) is calculated using the procedure outlined in Application Note 001.

After the pot is installed, the input is then scaled on the Zone / Configuration / Sensors screen to a Percentage (0-100%) value. The diagram below is used when the motor moves CW to open. If the motor moves CCW to open then either; 1) Move the blue wire to PWR, the white wire to GND, and install the resistor on the blue wire or; 2) Scale the input on the Zone / Configuration / Sensors screen to an Inverse Percentage (100-0%) value.

This feedback setup will provide an output that is directly proportional to the full 90° actuator stroke. If the actuator is not using the full 90° stroke, the operator must interpret the display accordingly. For example, a 45° stroke will display either 0-50% or 50-100% (depending on which end the actuator movement is).

Stroke the actuator fully in both directions after installation. The pot has a slipping collar that must be adjusted to match the actuator and this is accomplished automatically after stroking the actuator with the pot attached.

Bypass Damper Control Drawing



BAS Application Note 003

Guidelines for Scaling of Analog Inputs

Although any Analog Input can be scaled to any of the available scaling ranges it is more practical to follow some established guidelines for scaling ranges. A few of the Analog Inputs must follow mandatory scaling ranges for proper system operation. **BAS** makes recommendations for use of the other Analog Inputs to maintain consistency from one project to another. The following are the recommended scaling ranges:

Equipment Schedule 1, 2, 9

Input Location	Range	Label	Use
AI1*	32.00-95.75	° F	Room Temperature
AI2	Var	° F	Zone SP Offset Pot
AI3	(-12.0)-115.5	° F	Outside Air Temperature
AI4 (1)	30.0-157.5	° F	Discharge Air Temperature
AI5	30.0-157.5	° F	Return Air Temperature
AI6	30.0-157.5	° F	Mixed Air Temperature
AI7	18.0-36.0	BTU/LBM	Outside Air Enthalpy
AI8	0-100	%	Aux Input

* Mandatory Inputs.
(1) Mandatory if used as a VariZone or VAV Server.

Equipment Schedule 3, 4, 10

Input Location	Range	Label	Use
AI1*	32.00-95.75	° F	Room Temperature
AI2	Var	° F	Zone SP Offset Pot
AI3	30.0-157.5	° F	Return Air Temperature
AI4 (1)	30.0-157.5	° F	Discharge Air Temperature

* Mandatory Inputs.
(1) Mandatory if used as a VariZone or VAV Server.

Equipment Schedule 5-8, 11, 12

Input Location	Range	Label	Use
AI1*	32.00-95.75	° F	Room Temperature
AI2 (1)	18.0-36.0	BTU/LBM	Return Air Enthalpy
AI3	(-12.0)-115.5	° F	Outside Air Temperature
AI4 (2)	30.0-157.5	° F	Discharge Air Temperature
AI5	30.0-157.5	° F	Return Air Temperature
AI6 (3)	30.0-157.5	° F	Mixed Air Temperature
AI7	18.0-36.0	BTU/LBM	Outside Air Enthalpy
AI8	Var	° F	Zone SP Offset Pot

* Mandatory Inputs.
(1) Mandatory if using an economizer.
(2) Mandatory if used as a VariZone or VAV Server.
(3) Mandatory if economizer is a modulating actuator controlled directly by RSC.

Equipment Schedule 23, 25, 27, 28

Input Location	Range	Label	Use
AI1*	32.00-95.75	° F	Room Temperature
AI2 (1)	18.0-36.0	BTU/LBM	Return Air Enthalpy
AI3	(-12.0)-115.5	° F	Outside Air Temperature
AI4	30.0-157.5	° F	Discharge Air Temperature
AI5	30.0-157.5	° F	Return Air Temperature
AI6 (2)	30.0-157.5	° F	Mixed Air Temperature
AI7	18.0-36.0	BTU/LBM	Outside Air Enthalpy
AI8	Var	° F	Zone SP Offset Pot

* Mandatory Inputs.
(1) Mandatory if using an economizer.
(2) Mandatory if economizer is a modulating actuator controlled directly by RSC.

Equipment Schedule 13, 15, 17, 19, 20, 50, 52, 54, 56, 57

Input Location	Range	Label	Use
AI1*	32.00-95.75	° F	Room Temperature
AI2 (1)	Var	CFM	Air Flow
AI3	(-12.0)-115.5	° F	Outside Air Temperature
AI4	30.0-157.5	° F	Discharge Air Temperature
AI5	30.0-157.5	° F	Return Air Temperature
AI6	30.0-157.5	° F	Mixed Air Temperature
AI7	18.0-36.0	BTU/LBM	Outside Air Enthalpy
AI8	Var	° F	Zone SP Offset Pot

* Mandatory Inputs.
(1) Mandatory if pressure independent control is used.

Equipment Schedule 14, 51

Input Location	Range	Label	Use
AI1*	32.00-95.75	° F	Room Temperature
AI2 (1)	Var	CFM	Air Flow
or			
AI2	Var	° F	Zone SP Offset Pot

* Mandatory Inputs.
(1) Mandatory if pressure independent control is used.

Equipment Schedule 16, 18, 53, 55, 60

Input Location	Range	Label	Use
AI1*	32.00-95.75	° F	Room Temperature
AI2 (1)	(2)	CFM	Air Flow
AI3	Var	° F	Zone SP Offset Pot
AI4	30.0-157.5	° F	Supply Air Temperature

* Mandatory Inputs.
(1) Mandatory if pressure independent control is used.

Equipment Schedule 21, 22

Input Location	Range	Label	Use
AI1*	32.00-95.75	° F	Room Temperature
AI2	30.0-157.5	° F	Discharge Air Temperature
or			
AI2	Var	° F	Zone SP Offset Pot

* Mandatory Inputs.

Equipment Schedule 24, 26, 31

Input Location	Range	Label	Use
AI1*	32.00-95.75	° F	Room Temperature
AI2 (1)	18.0-36.0	BTU/LBM	Return Air Enthalpy
AI3	Var	° F	Zone SP Offset Pot
AI4 (2)	30.0-157.5	° F	Mixed Air Temperature

* Mandatory Inputs.
(1) Mandatory if using an economizer.
(2) Mandatory if economizer is a modulating actuator controlled directly by RSC.

Equipment Schedule 29, 30

Input Location	Range	Label	Use
AI1*	30.0-157.5	° F	Controlled Temperature
AI2	Var	° F	Zone SP Offset Pot
AI3	(-12.0)-115.5	° F	Outside Air Temperature
AI4	30.0-157.5	° F	Discharge Air Temperature
AI5	30.0-157.5	° F	Return Air Temperature
AI6	30.0-157.5	° F	Mixed Air Temperature
AI7	18.0-36.0	BTU/LBM	Outside Air Enthalpy
AI8	0-100	%	Aux Input

* Mandatory Inputs.

Equipment Schedule 32

Input Location	Range	Label	Use
AI1*	30.0-157.5	° F	Water Loop Return Temperature
AI2	0-100	%	Aux Input
AI3	(-12.0)-115.5	° F	Outside Air Temperature
AI4	30.0-157.5	° F	Water Loop Supply Temperature
AI5	30.0-157.5	° F	Cooling Tower Outlet Temperature
AI6	0-255	° F	Boiler Outlet Temperature
AI7	18.0-36.0	BTU/LBM	Outside Air Enthalpy
AI8	0-100	%	Aux Input

* Mandatory Inputs.

Equipment Schedule 33

Input Location	Range	Label	Use
AI1*	30.0-157.5	° F	Chilled Water Supply Temperature
AI2	0-100	%	Aux Input
AI3	(-12.0)-115.5	° F	Outside Air Temperature
AI4	30.0-157.5	° F	Chilled Water Return Temperature
AI5	30.0-157.5	° F	Water Loop Temperature
AI6	30.0-157.5	° F	Water Loop Temperature
AI7	18.0-36.0	BTU/LBM	Outside Air Enthalpy
AI8	0-100	%	Aux Input

* Mandatory Inputs.

Equipment Schedule 35, 36

Input Location	Range	Label	Use
AI1*	0-255	° F	Hot Water Supply Temperature
AI2	0-100	%	Aux Input
AI3	(-12.0)-115.5	° F	Outside Air Temperature
AI4	0-255	° F	Hot Water Return Temperature
AI5	0-255	° F	Water Loop Temperature
AI6	0-255	° F	Water Loop Temperature
AI7	18.0-36.0	BTU/LBM	Outside Air Enthalpy
AI8	0-100	%	Aux Input

* Mandatory Inputs.

Equipment Schedule 40

Input Location	Range	Label	Use
AI1*	30.0-157.5	° F	Discharge Air Temperature
AI2 (1)	18.0-36.0	BTU/LBM	Return Air Enthalpy
AI3	(-12.0)-115.5	° F	Outside Air Temperature
AI4 (2)	30.0-157.5	° F	Discharge Air Temperature
AI5	30.0-157.5	° F	Return Air Temperature
AI6 (3)	30.0-157.5	° F	Mixed Air Temperature
AI7	18.0-36.0	BTU/LBM	Outside Air Enthalpy
AI8	Var	° F	Zone SP Offset Pot

* Mandatory Inputs.
(1) Mandatory if using an economizer.
(2) Mandatory if used as a VariZone or VAV Server.
(3) Mandatory if economizer is a modulating actuator controlled directly by RSC.

Equipment Schedule 41, 42

Input Location	Range	Label	Use
AI1*	Var	" WC	Discharge Static Pressure
AI2	0-100	%	Aux Input
AI3	(-12.0)-115.5	° F	Outside Air Temperature
AI4	30.0-157.5	° F	Discharge Air Temperature

* Mandatory Inputs.

BAS **Application Note 004**

EPROM or SRAM Changeout Procedure

1. This procedure applies equally to EPROM or SRAM changeouts.
2. If changing a Rev 3 or later RSC, verify memory jumpers are configured correctly for the size and type of memory chip. The label on the back of the RSC enclosure includes a table with jumper configurations.
3. To change the EPROM, first touch a piece of metal attached to earth ground to discharge any possible static electricity.
4. De-energize the RSC.
5. Gently pry the existing EPROM from the RSC using a small flat bladed screwdriver.
6. Plug the new EPROM into the socket. Use caution to ensure that all pins are properly seated into their respective socket. Also ensure that the EPROM is properly aligned on the RSC. The notch on one end of the EPROM should match with the notch drawn on the circuit board.
7. Restore Power to the RSC.

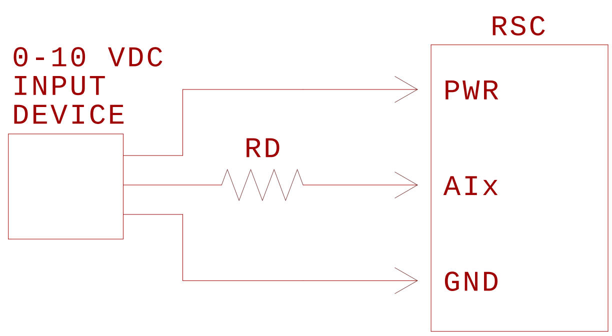
Application Note 005

Input of a 0-10 vdc device directly to an Analog Input

Any 0-10 vdc device can be directly input to an Analog Input by routing the signal through a dropping ohm resistor. Install the resistor between the input device and AI terminal of the RSC.

Rev 1 RSC
RD = 76.8K ohm / 1%

Rev 3 RSC
RD = 46.4K ohm / 1%



Calculating the resistor value for other than a 10 vdc device:

Rev 1 RSC

$$RD = \frac{(Vmax - 3.8)}{8.15} * 100,000$$

Rev 3 RSC

$$RD = \frac{(Vmax - 5.0)}{10.72} * 100,000$$

RD = the dropping resistor value, in ohms
Vmax = the maximum voltage output of the device

Application Note 006

Use of a Johnson Controls DPT-2000-2 Pressure Transmitter to Measure Zone CFM

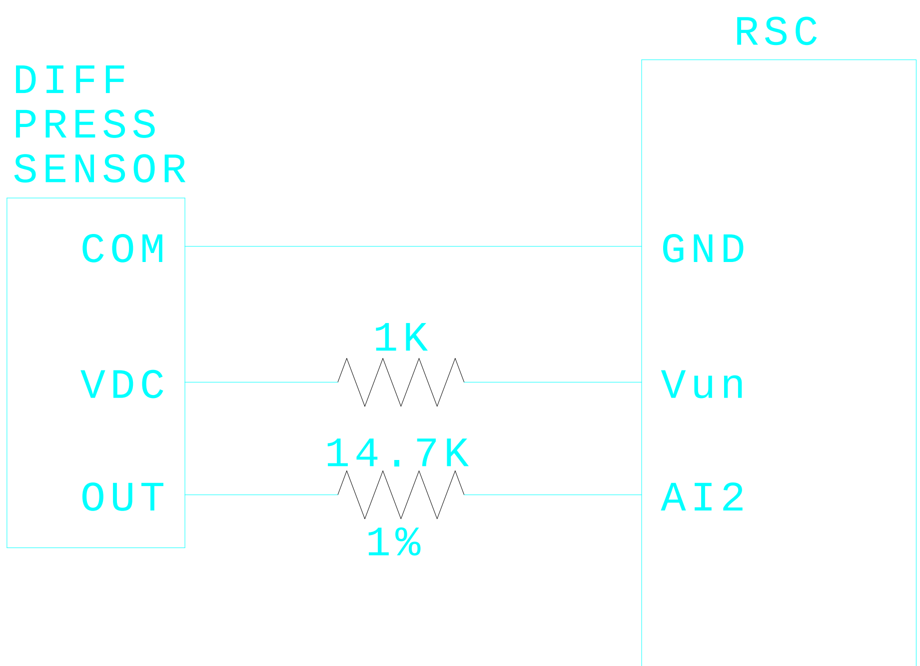
Note: **BAS** does not specifically endorse the use of this pressure sensor. This information is presented to help the Installer use a product that has performed well in **BAS** installations and is comparatively inexpensive. This sensor is manufactured by AutoTran and is also available as AutoTran part number 600D1.5"24D4-A.

The following value need to be configured for proper operation with this device; 1) VAV/VariZone ... dialog: BAS K = 857, 2) Zone / Actuators dialog: Offset = 51; and 3) Zone / Actuators dialog: CFM K = the engineered constant for the damper in use at that zone (see Application Note 007 for details).

Rev 1 RSC Only

This sensor is 0-1.5"wcd input with an output of 1-5 Vdc. An input resistor (14.7k ohm, 1%) is added to the output to drop the voltage at the RSC to a maximum of 3.8 Vdc. The maximum pressure resolution is 0.0074" wc.

Installation of this device requires the addition of a 1k ohm resistor on the power supply. This will lower Vun to below the maximum of 30 Vdc required by the sensor.



B A S Application Note 007

Setup Calculations for Zone CFM Monitoring

Rev 1 RSC Only - Determination of Minimum Input Voltage

For sensors that use an input resistor, a minimum input voltage value must be determined in order to calculate an offset. Determine the minimum voltage at the AI terminal of the RSC as follows:

AI Min Volts = Esensmin - ((Esensmin * Rin)/(Rin + 46,625))

Esensmin = The minimum sensor output voltage as specified by the sensor manufacturer.
Rin = The value in ohms of the input resistor.

Determination of Offset

The Offset value must be input in the Actuators configuration at each Zone using a CFM sensor.

Rev 1 RSC
First determine the minimum voltage from the calculation above.

Offset = 255*AI MinVolts/3.8

Rev 3 RSC
Rev 3 RSCs use sensors that do not require an input resistor, and the minimum voltage is equal to the voltage as specified by the sensor manufacturer.

Offset = 255*AI MinVolts/5.0

AI MinVolts = The Vdc input to the RSC from the sensor corresponding to 0" wcd input.

Determination of BAS K

The BAS K value is input once in the VAV/VariZone Settings dialog. This value is used System-wide by all Zones.

BAS K = 10,000*SQR(Pmax/(255-Offset))

Pmax = The top end of the scale, in "wcd, of the pressure sensor being used.

Determination of CFM K for VAV Boxes

The CFM K value must be input in the Actuators configuration at each Zone using a CFM sensor.

Always use the CFM K as provided by the VAV box and/or air flow pick-up tube manufacturer. If that information is not available, then calculate a CFM K using the following:

CFM K = 4005 * Duct Area

Duct Area = the cross sectional area of the duct where the velocity pressure sensor is located. The units of Duct Area are square feet.

For Round Ducts (Diam is in inches)

Duct Area = (π * (Diam/2)^2) / 144

For Square or Rectangular Ducts (Length and Width are in inches)

Duct Area = (Length * Width) / 144

BAS Application Note 008

Use of a Zone Setpoint Offset Potentiometer

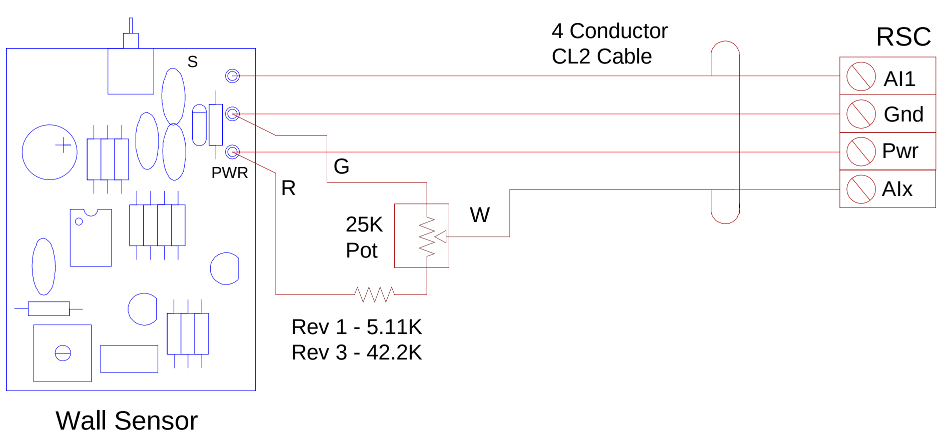
An optional setpoint offset potentiometer is available that allows the occupant to have limited control over the temperature in their space. If installed at the wall sensor, the pot only requires one additional wire for a total of four. If installed at another location, the pot will require three conductors. Application Note 003 lists suggested Analog Input locations. Once installed, the offset must be configured at the Command Center. The Zone Offset feature is supported in BAS software Version 3.5 or later. A brief description of the setup and operation follows:

Operation

1. When the pot is centered, a voltage of 1.90 Vdc (Rev 1 RSC) or 2.50 Vdc (Rev 3 RSC) is sent to the AI and interpreted by the System as zero offset. Fully clockwise inputs 3.80 Vdc (Rev 1 RSC) or 5.00 Vdc (Rev 3 RSC) and equals a full plus offset at the PC. Fully counter-clockwise inputs 0.0 vdc and equals a full minus offset at the System.
2. The offset is added (or subtracted) from the configured Occupied heating and cooling setpoints to generate new operational setpoints. The original configuration is not affected. Setpoints are not changed in any mode but Occupied. The setpoints displayed in the main list box are after offset modification. The reported space temperature is not affected.
3. The Zone Offset Allowed and the actual Zone Offset can be selected for display in the main list box through the Zone List Options screen.

Setup

1. Select a scaling of 'Zone Offset Sensor' at the AI location being used.
2. At the Zone configuration screen, enter the 'Maximum Zone Offset Allowed'. This can be any value from 0 to 10° F and represents the offset allowed, not the total span. An entry of 5 will allow a range of -5° F to +5° F for a total span of 10° F. An entry of zero will disable the offset.
3. If the knob must be re-installed on the pot, disconnect the pot and use a multimeter to adjust the pot to a reading of 14K (Rev 1 RSC) or 11.5K (Rev 3 RSC) from W-G. The knob should now be installed at the indication of zero offset.



BAS Application Note 009

Combining 2 Equipment Schedules on 1 RSC

It is possible to combine the operating sequences of 2 different Equipment Schedules on 1 RSC when in the On-line mode. This should only be attempted by advanced Users after carefully investigating all possible conflicts between Default mode and On-line mode. Any configuration of this type must always be thoroughly field tested after installation.

The following steps should be followed when configuring 2 ES at an RSC:

1. Wire and install the RSC based on a Default ES which will provide acceptable Default control in both Zones.
2. Both ES used at the RSC must be setup for Dual Zone operation with the Equipment Schedule Editor. An existing Dual Zone Schedule should be used. BAS has only tested combinations of existing Dual Zone Schedules and the User must take full responsibility for proper operation of Dual Zone combinations created in the field.
3. Manually configure the Zone (either A or B) at the Command Center that does not follow the ES number configured at the RSC dip switch.
4. Either manually configure or energize and Auto-Configure the Zone which follows the dip switch settings at the RSC.

B A S Application Note 010

Combining Equipment Schedules 41 & 42 on 1 RSC

Note: This description only applies to RSCs set to ES-41 with EPROM version 4.0b or later.

The purpose of this procedure is to allow 1 RSC to perform a job normally requiring 2 RSCs. This will generally translate into a cost savings, but due to the complexity of this procedure can result in increased costs. This should only be attempted by experienced Dealers. Due to the non-standard nature of this setup, it is also very important to fully document all changes made and make this documentation available at the Site.

Most Duct Static Pressure control applications will also have a need to control Building Static Pressure. Both of these devices can be controlled from a single RSC, but some special provisions have to be made. All standard Dual Zone operation requires both Zones to have an identical control sequence. This is not true when a duct static pressure controller (an A Zone) is connected to the same RSC as a building static pressure controller (a B Zone). The duct SP control needs to modulate in the negative direction (reduce speed of the fan motor) with a positive PID (increasing static pressure). The building SP control needs to modulate in the positive direction (increase speed of the fan motor) with a positive PID load (increasing building static pressure). Special provisions have been made at the RSC to allow for this combination.

This procedure will only work when ES-42 is not being used any where else on the Site in a standard Dual Zone configuration (i.e. both Zones on an RSC configured to ES-42). This is because changes have to be made to ES-42 with the Equipment Schedule Editor that will affect all Zones using ES-42.

Installation

1. Set the dip switches on the RSC to ES-41.
2. Wire and install the RSC using standard ES-41 (for the A Zone) and ES-42 (for the B Zone) wiring schematics, except that the AO for the B Zone (ES-42) should be connected to AO4.

Setup at the Command Center

1. Edit ES-42 using the Equipment Schedule Editor. Change Actuator 1 type to Heat (default is Cool) and the Icon to Inverted Viewpoint.
2. Manually create a new Zone at the B Zone address using ES-42.
3. Change the Actuator setup of the B Zone to Initialize to Open.
4. Manually configure the A Zone to ES-41 or energize and Auto-Configure. Use standard default settings for the A Zone.

Operation at the RSC

Note: The operation is the same at both the A Zone and the B Zone.

1. The RSC will use the commanded position for AO1 and internally calculate a position for AO2.
2. The calculated position for AO2 will be the inverse of AO1. For example, if the commanded output for AO1 is 85%, then the RSC will position AO2 to 15%.
3. AO2 position can not be directly controlled by the User, even with the Handheld Tester. AO2 will always follow the commanded position for AO1.
4. All screens at the Command Center, including the Troubleshooting screen, will display the commanded position for AO1 and AO2. The commanded position for AO1 will always equal its actual position. The commanded position for AO2 will always be 0%, since it is not normally controlled by this schedule.
5. The AO position display screen of the Handheld Tester will correctly display the output being sent to the AO card for AO1 and AO2.

BAS Application Note 011

Using a US Robotics 14,400 Internal Fax-Modem

The standard modem provided by BAS is a Gateway Telepath II 14,400 internal fax-modem. This modem is manufactured by US Robotics and is supposed to be identical to their Sportster 14,400 internal fax-modem. Some Sportster modems have had trouble when used with BAS remote software. The following recommendations come from USR tech support. They are not necessarily listed in order of importance.

1. Verify modem jumpers/dip switches set to factory defaults. If using COM1 then configure to I/O 03F8/IRQ 4, COM2 set to I/O 02F8/IRQ 3.

2. Verify no other hardware conflicts at I/O address and IRQ used by modem. Must determine using diagnostic software, like MSD.

3. Make sure that settings in Windows/Control Panel/Ports/Settings is configured for Hardware flow control.

4. Make sure that settings in Windows/Control Panel/Ports/Settings/Advanced matches the modem configuration for I/O and IRQ.

5. If using Windows 3.1, upgrade to Windows for Workgroups 3.11. The comm driver has significant changes from the 3.1 version.

6. As a last resort, use a text editor such as Notepad to make the following changes to \ez\data\dial.te2. The new script commands are underlined, the existing commands to be removed are in brackets [ ].

```
DIAL SCRIPT
:RESET
[ TRANSMIT ATZ^M ]
TRANSMIT ATZ1^M
PAUSE 2
WAITFOR OK,5
IFFOUND DEFAULTS
GOTO RESET

:DEFAULTS
[TRANSMIT AT&F^M]
TRANSMIT AT&F1^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT1
GOTO DEFAULTS
```

```
:INIT1
[TRANSMIT AT&C1&D2&R2&H1&B1&S1B0X4S7=60S10=50^M]
TRANSMIT AT&C1&D2&R2&H1&B1&S0B0X4S7=60S10=50^M
PAUSE 2
WAITFOR OK,5
IFFOUND INIT2
GOTO INIT1

:INIT2
TRANSMIT AT&A0M1L0^M
PAUSE 2
WAITFOR OK,5
IFFOUND WRITE
GOTO INIT2

:WRITE
[TRANSMIT AT&W^M]
TRANSMIT AT&W0^M
PAUSE 2
WAITFOR OK,5
IFFOUND DIAL
GOTO WRITE

:DIAL
TRANSMIT ATDT$PHONE$^M
PAUSE 60
CLOSE
```

B A S Application Note 012

Lighting Control

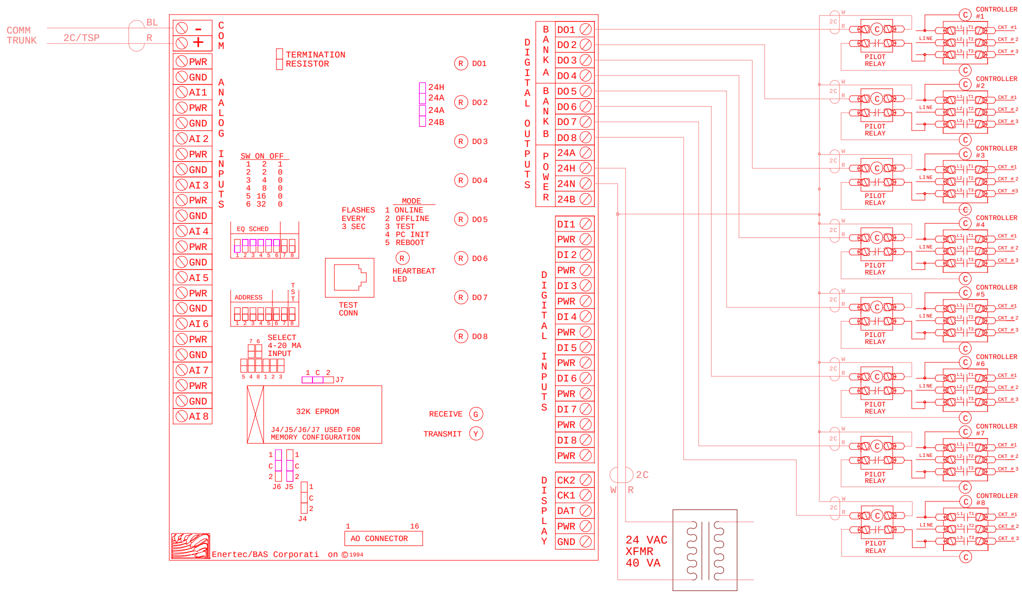
Lighting control can be accomplished by any one of several available methods. All methods use a normally closed pilot duty relay between the RSC and the lighting contactor. The digital output of the RSC is then configured to be ON in the Unoccupied mode, which will activate the relay and de-energize the lighting circuit. This process will provide a virtually fail-safe method of ensuring that lighting is not lost in the event of a hardware failure. A brief description of each method follows:

1. Use Miscellaneous Equipment to activate outputs any RSC that has DOs not being controlled by the selected Equipment Schedule of that RSC. This is a straightforward and economical method.
2. Use the Equipment Schedule Editor to modify an existing Equipment Schedule. This provides the advantage of tying the lights to the time-of-day mode of the HVAC equipment sharing that RSC.
3. Use any combination of Control Functions to energize the output under the desired conditions. This method provides the greatest flexibility.
4. Use Equipment Schedule 63. This ES has been dedicated to lighting control and has a few enhancements not available to other schedules. This schedule has all 8 DOs available for use as lighting outputs. One of the 3 methods listed above must be used for Occ/Unocc control of the outputs. What makes this schedule unique is what happens when the output is commanded to be ON by the Command Center. This would mean that the lighting zone has entered Unoccupied Mode. When the command is first received, the RSC will turn off the lights for 2 sec, wait 10 sec, and then turn off the lights for another 2 sec. The RSC will place the lights in Unoccupied 5 minutes after first receiving the command. This is intended to allow the tenant sufficient time to exit the space, or activate a setback override if necessary. ES-63 is available on any RSC using EPROM 4.1b or later. Contact BAS for an EPROM upgrade if necessary.

Note: When connecting lights to an unused output on an RSC, first verify that the output is not included in the default definition of the Equipment Schedule. An output may unused in a given application and yet be defined by the Equipment Schedule as belonging to the equipment. This is not a problem when on-line, as the Command Center software will allow an output defined as Miscellaneous Equipment to override the Equipment Schedule definition. The problem occurs in default. The RSC will turn on and off all pre-defined outputs as necessary to maintain temperature in the space.

Setback override can be accomplished by:
1. Configuring the System to monitor to an existing HVAC zone sensor override button by using the Miscellaneous Equipment definition screen.
2. Installing a dedicated normally open push-button.
3. Activate a Master Alarm from any number of HVAC zones. Monitor the Master Alarm with a Control Function configured from Global Alarms. If the Master Alarm is activated, then use a specific action to turn on the light (i.e. 1-23 DO7 OFF). This method is useful when the lighting zone encompasses several HVAC zones.

The following schematic shows the recommended method of interfacing lights to an RSC. This drawing shows ES-63, but can be applied to any lighting control application.



Equipment Schedule 63 Wiring Schematic

B A S Application Note 013

Using Another Application to View Trend Log Data

Trend Log Data can be viewed and analyzed in 3 ways:
1. Using Trend Log Viewer. This is the simplest and most common method, but no analytical functions can be performed on the data.
2. Copying the data from Trend Log Viewer to the Clipboard and then pasting the data into another application such as Microsoft Excel. This is a simple method for analyzing small amounts of data. The data is in a comma de-limited format and all readings, timestamps, addresses, etc. are scaled and formatted just as they are displayed in the Viewer screen.
3. Writing a custom application to read the Trend Log data in it's native format. This can be done using any programming language such as C or Visual Basic. Several applications, such as Microsoft Access, can also be configured to read this data directly from the Trend Log file.

This Application Note will provide the information necessary for a programmer to access the data directly from the Trend Log file. If any User has written a routine for data access that they wish to share, e-mail it to support@enertec-bas.com and we will make it available to other Users. Microsoft C format header files containing data structures and defines can be provided upon request. Since analog inputs are stored in a raw (0-255) format it is generally necessary to scale these numbers to their real world equivalent. Analog input scaling routines can also be provided upon request.

Note: Trend Logs can contain vast amounts of data. A project with the maximum possible number of Zones (1,024), stamping data once every 10 minutes (4,464 entries/Zone), will contain 4,606,848 records and a total of 147,419,136 bytes.

Trend Log Records

Trend Logs are stored in the \BAS\DATA directory. The file names for the Trend Log follow the convention TRND*MMYY*.LOG where *MM* is the month and *YY* is the year of all data contained in that file. All records are of a fixed length. That length is currently 32 bytes. There are 4 types of records. Those are:
- File Header - A file header is written one time to the beginning of the Trend Log file.
- Zone Data Header - A single Data Header is written prior to recording a group of Zone entries.
- Zone I/O Data - One entry is recorded for each Zone selected to be Trend Logged. In addition to the value of all inputs and outputs, this data also includes information about the operational state of the Zone. Zone data entries are grouped and recorded by trunk.
- Override Data - Each occurrence of a Time-of-Day override is individually recorded.

A detailed breakdown of each record type follows:

File Header

Byte	Description
1	Type - Always 0x01
2	RecLen - Number of bytes in each record - Currently 32 bytes
3	Ver - Version number of this file - Currently 1
4	Rev - Revision number of this file - Currently 0
5-32	Reserved

Zone Data Header

Byte	Description
1	Type - Always 0x02
2-5	Time - Standard C Time format (the number of seconds elapsed since midnight (00:00:00), January 1, 1970, Universal coordinated time)
6	OSATemp - Outside Air Temperature, stored as a 0-255 value representing a temperature of (-12.0) - 112.5° F.
7	OSAEnth - Outside Air Enthalpy, stored as a 0-255 value representing an enthalpy of 36.0 - 18.0 BTU/lbm. (Note the inverse signal.)
8-32	Reserved

Zone I/O Data

Byte	Description
1	Type - Always 0x03
2	Trunk - Trunk number of Zone being logged (1 - 8)
3	Addr - Address of RSC containing the Zone (1 - 33)
4	SubZone - Number for the Zone on that RSC (1 - 4)
5	EquipSched - Equipment schedule number for RSC (0 - 63)
6	StateText - Occupied, Unoccupied, Warmup, etc. See list below.

'D' (0x44) - Default
'U' (0x55) - Unoccupied
'O' (0x4F) - Occupied
'E' (0x45) - Early Occupied from Warmup or Cooldown
'W' (0x57) - Warmup
'C' (0x43) - Cooldown
'S' (0x53) - Load Shed

7	Stage - Heating Stages, Coo1ing Stages, or At Setpoint.

0x00	Cooling Stage 4
0x01	Cooling Stage 3
0x02	Cooling Stage 2
0x03	Cooling Stage 1
0x04	At Setpoint
0x05	Heating Stage 1
0x06	Heating Stage 2
0x07	Heating Stage 3
0x08	Heating Stage 4
0x09	Economizer Cooling Stage 4
0x0A	Economizer Cooling Stage 3
0x0B	Economizer Cooling Stage 2
0x0C	Economizer Cooling Stage 1

8	Act1Pos - The percent open position of Actuator 1 (0-100).
9	Act2Pos - The percent open position of Actuator 2 (0-100).
10	ControlPoint - The Zone's Control Point, stored as a 0-255 value.
11-18	AIs[8] - Analog Inputs 1-8, stored as a 0-255 value.
19	DIs - Digital Input byte. Each bit represents the value of the corresponding Digital Input. If bit 1 is on, then Digital Input 1 is on, etc.
20-23	AOs[4] - Analog Outputs 1-4, stored as a 0-255 value
24-25	Reserved
26	DOs - Digital Output byte. Each bit represents the value of the corresponding Digital Output. If bit 1 is on, then Digital Output 1 is on, etc.
27-28	CFM - Scaled CFM value for Zones using Pressure Independent damper control.
29	OperHsp - The Heating Setpoint currently in use by the Zone, stored as a 0-255 value.
30	OperCsp - The Cooling Setpoint currently in use by the Zone, stored as a 0-255 value.
31-32	KWReading - Scaled KW meter reading of the meter assigned to this Zone if the Zone is configured for KW Load Shedding.

Time-of-Day Override

Byte	**Description**
1	Type - Always 0x04
2	Condition - Event being logged.

0x01	Begin Zone setback override
0x02	End Zone setback override
0x03	Begin single Zone override
0x04	End single Zone override
0x05	Begin all Zones override
0x06	End all Zones override
0x07	A Zone setback override was not terminated

3	State - Only used for single or all Zones override. Not used for Zone setback override. 0x00 Single or all Zones override end 0x01 Single or all Zones override to Unoccupied 0x02 Single or all Zones override to Occupied
4-7	Time - Time that event occurred . Standard C Time format (the number of seconds elapsed since midnight (00:00:00), January 1, 1970, Universal coordinated time)
8	Trunk - Trunk number of Zone being logged (1 - 8). 0 if an all Zones override.
9	Addr - Address of RSC containing the Zone (1 - 33). 0 if an all Zones override.
10	SubZone - Number for the Zone on that RSC (1 - 4). 0 if an all Zones override.
11	EquipSched - Equipment schedule number for RSC (0 - 63)
12-32	Reserved

BAS **Application Note 014**

Installing an ACL Card in a Windows 95/98 System

1. Select Start/Settings/Control Panel. Double-click on the System icon.
2. Select the Device Manager tab.
3. With the Computer item selected (default), click the Properties button.
4. From the View Properties tab, select the Input/Output (I/O) radio button.
5. Scroll down through the I/O settings and verify that 0300-0303 is available. The ACL must have a dedicated I/O address. The I/O address will occupy 4 bytes. The addresses that can be used by the ACL card are 0200, 0300, and 0700. The default address of 0300-0303 will sometimes conflict with a network board if installed.
6. From the View Properties tab, select the Memory radio button.
7. Scroll down through the Memory settings and verify that 000D000-000D3FFF is available. The ACL must have 16k of system RAM reserved. The RAM can be any 16k block in upper memory, but must start on an even 16K boundary. The default memory segment is D0000-D3FFF.
8. From the Reserve Resources tab, select the Input/Output (I/O) radio button.
9. Click the Add button. Enter 0300 as a Start value and 0303 as an End value (or other available address).
10. Click OK.
11. From the Reserve Resources tab, select the Memory radio button.
12. Click the Add button. Enter 000D0000 as a Start value and 000D3FFF as an End value (or other available memory area).
13. Click OK.
14. Click OK to exit Computer Properties.
15. Click OK to exit System Properties.
16. Edit C:\Autoexec.bat. Add the following lines at the end of the file:
    CD \BAS
    C:\BAS\BAS.BAT
17. The I/O address and memory address must be reported to the ACL. If an I/O address other than the default of 0300 or memory location other than the default of D0000 is used, edit the ACLLOAD ISA 0300 D0000 statement in C:\BAS.BAT to match the reserved resources.
18. Launch the BAS software and select System/Site Configure/EnerNet Settings. Select the ACL Card as EnerNet Type. Enter the Max # of Trunks (up to 8). If a memory location other than D0000 is used enter the correct value as ACL DP Segment.
19. Click OK.
20. Shutdown the computer and install the ACL card. The reserved IO Address must match the dip switch settings of the ACL board. The available I/O settings are:
    0200 All 8 OFF
    0300 1=ON, 2-8=OFF
    0700 1-7=OFF, 8=ON
21. Reboot the computer and verify System starts normally.