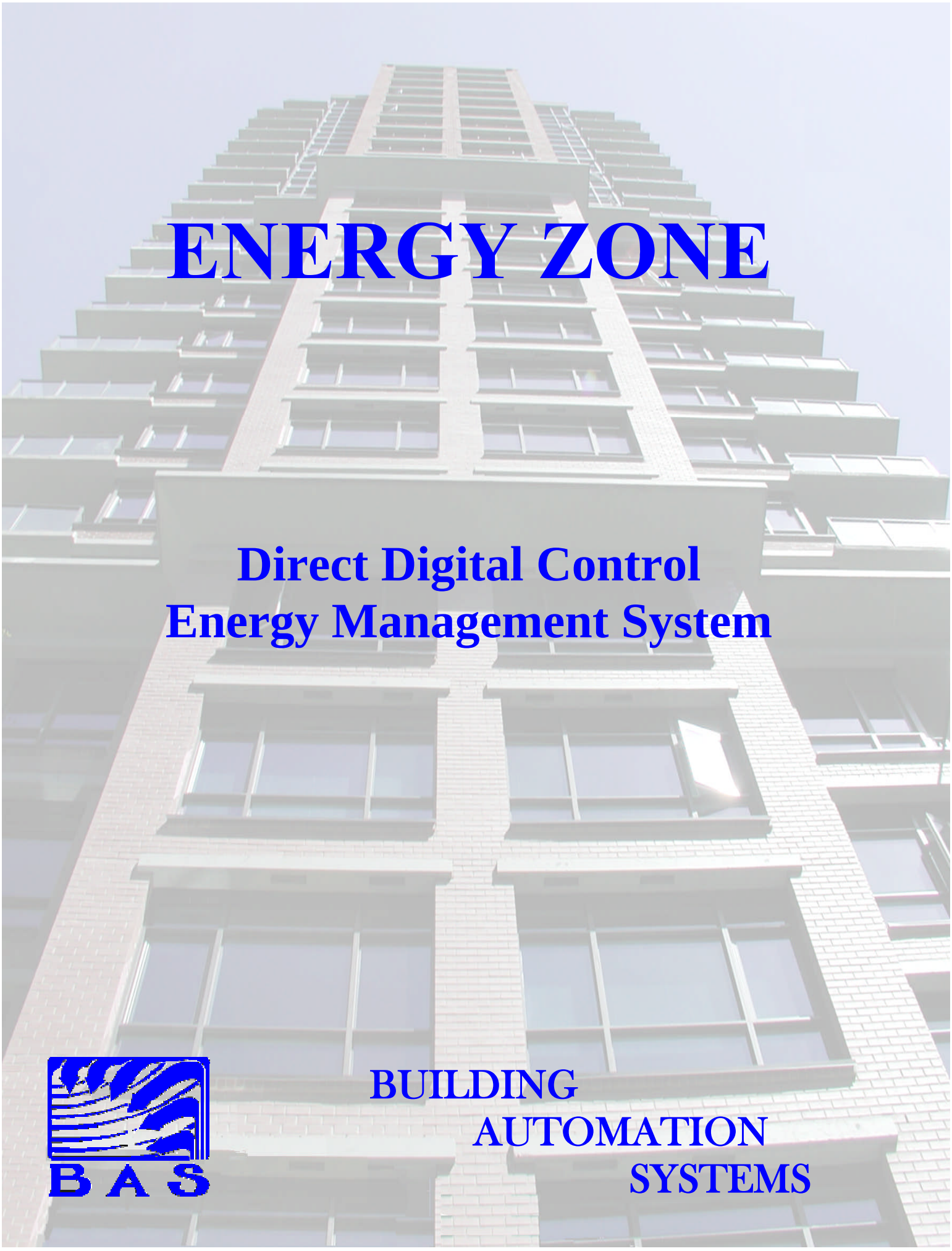

ENERGY ZONE

Direct Digital Control
Energy Management System

BAS

BUILDING
AUTOMATION
SYSTEMS

ENERGY ZONE

Building Energy Management Control System

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Overview of the Energy Zone System

Energy Zone (EZ) software operates in the Microsoft Windows environment and provides a very fast, easy to use, menu driven graphical User interface. 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. Error checking will monitor all User input and alert the User to any out-of-range values. **EZ** is compatible with any other Microsoft Windows based application and can operate simultaneously with those applications in true multitasking fashion. Microsoft Windows comes with the **EZ** system. BAS also includes several useful Windows applications with the **EZ** system.

The heart of the **EZ** system is the Remote System Controller (RSC). The RSC is a 16 bit microcontroller, with full stand alone capability. The **EZ** system networks RSCs from a Windows based PC host computer over an RS-485 communication trunk line. The PC contains the control algorithms for each RSC connected to the trunk line.

Each RSC has a capacity of 28 control points. The PC host computer can control up to 1024 RSCs, providing a system capacity of 57,344 points. Each RSC can control up to 4 HVAC zones for a total of 4096. Each control zone is provided with full system capabilities including its own PID control loop, alarm and control functions, trend logging, and intelligent default control. Larger numbers of RSCs can be controlled by networking PCs together.

During system configuration, an Equipment Schedule is chosen for each RSC. A separate Equipment Schedule, with the appropriate control algorithms for that equipment, is available for 128 different types of HVAC equipment. When an Equipment Schedule is chosen, the **EZ** software will prompt the User to input those parameters necessary for proper equipment control. The software then uses that configuration file to customize the control algorithm for that equipment. The configuration files can be changed at any time.

An EPROM, or an optional battery backed SRAM, located on the RSC contains all Equipment Schedule default 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 PC is lost, the RSC takes over equipment control using pre-programmed heating and cooling setpoints. Additional versions of the EPROM chip are available for custom applications.

The PC includes all software and algorithms for normal system control. When a communication link is established between an RSC and the PC, the PC retrieves data from all RSC inputs and determines the correct state for all outputs based on the configuration file for that RSC. All RSCs are monitored, and the outputs are configured, once every four seconds.

The System software is available in languages other than English. The User can toggle on-the-fly between any two field defined languages.

Software Features

Command Center - The Command Center includes all software and algorithms for normal system control. When a communication link is established between an RSC and the Command Center, the Command Center retrieves data from all RSC inputs and determines the correct state for all outputs based on the configuration file for that RSC. All RSCs are monitored, and the outputs are configured 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 default control algorithms and setpoints.

Microsoft Windows - **EZ** software operates in the Microsoft Windows environment and provides a very fast, easy to use, menu driven graphical User interface. 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.

Dual Language Capability - The System has the ability to toggle between any two User selectable languages on-the-fly. The System is shipped in one version that includes all available language translations. All User defined labels, such as Zone descriptions or Site name, can be entered and stored in both the primary and the alternate language at that site. The entire User interface including screens, dialogs, messages, and menus will toggle between the two selected languages. All alarm messages and alarm, trend, security, and communication logs are stored and displayed in both selected languages. When connected remotely to a site, the remote User can be logged on to the System in a different language than a User at the local Command Center. The languages currently available on the System are Chinese and English. Other languages are being added at this time.

VariZone® - 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 System provides the capability for both pressure dependent and pressure independent Clients. Client Zones consist of dampers and actuators and in some instances fans and backup heat. The System can provide for up to 32 Servers and up to 512 Clients per Server.

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 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 Client site (any location remote to the Host site). Other than a Communication menu for COM port settings, connect, and hang-up, the Remote Client interface looks and functions identical to the Host version. The software communicates over standard phone lines at 33600 baud.

The Host system can also be accessed over a LAN using the Remote Access services built into Windows XP (or later) or through the Internet using a browser.

Equipment Schedules - Control of all equipment is based on pre-programmed control algorithms referred to as Equipment Schedules. The Command Center contains the control algorithms for all RSCs connected to a trunk line. A separate Equipment Schedule, with the appropriate control algorithms for that equipment, is available for 128 different types of HVAC 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 unit control. A configuration file is created by the software that contains all information for that RSC. The software then uses that configuration file to customize the control algorithm for that equipment. The configuration files can be changed at any time.

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 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. 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 system defaults.

Sophisticated Alarm Configuration - Each Control Zone in the system can have up to 16 alarm or special control functions configured, for a total of 16,384 total system alarm or control functions. These conditions are in addition to any Auxiliary Equipment or Equipment Schedule control functions. All inputs at each RSC can be configured for any combination of alarm actions. Those alarm actions are -(1) screen display; (2) printer output; (3) log to hard disk; (4) callout to fax machine terminal; (5) callout to digital pager, and (6) take specific action. The specific action feature can turn on or off any digital output or position any analog output in the system. Master Alarms also can be configured selectively throughout the system, with all regular alarm features available.

Data Exchange - All inputs, outputs, and most configuration data from all RSCs is available to any Windows application that conforms to the Dynamic Data Exchange specification.

Password Security - Five levels of security are available in 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.

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.

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 or printed by any text editor.

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 Auxiliary 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.

Convenient Override Capabilities - The standard time of day schedules for all HVAC equipment and Auxiliary Equipment can be overridden in one of three ways. The three overrides are listed in order of priority: 1) all zones in the building can be programmed for a one time override event to either the occupied or unoccupied mode; 2) each zone or piece of Auxiliary Equipment can be individually programmed for a one time override event to either the occupied or unoccupied mode; or 3) an input activated from the zone 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.

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 TRAV. 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 Auxiliary Equipment can be configured for KW load shedding. All equipment configured for load shed are given a priority from 1-32. 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 in order of priority until KW falls below the preset demand level.

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 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® communication link.

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

Completely Configurable Main System Screen - The main system screen can be easily modified to change the information displayed for each zone.

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 changed 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 scaled to the selected range.

Lighting Control- An Equipment Schedule is provided that is dedicated to control of an interior lighting system. In addition to standard time-of-day ON/OFF control, this Schedule will flash the lights 5 minutes before entering the Unoccupied Mode. This will provide the tenants sufficient time to exit the building or press the setback override button prior to the lighting being turned OFF.

Hardware Features

Command Center - The **EZ** system Command Center is an IBM PC-AT compatible computer. The minimum configuration comes with a 133 MHz Pentium microprocessor, 16 MB RAM, 1.44MB floppy drive, 1.6 GB hard drive, 12x CD-ROM drive, VGA color monitor, mouse, and a 33,600 baud fax modem.

Advanced Communication Link (ACL) - The ACL is the link between the RSC and the Command Center. Each ACL can control up to 1024 RSCs from an expansion slot in the Command Center. 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.

Serial Port Communications – Smaller systems (typically 100,000 sf or less) can communicate with the RSCs using the Command Center's standard RS-232 COM port or USB port rather than an ACL card. This is accomplished using an external RS-232 or USB/RS-485 conversion device. The maximum number of RSCs per serial port is 128. The maximum number of serial ports supported by the system is 4.

Remote System Controller (RSC) - The RSC is built around the NEC 78C10 microcomputer. Each RSC has a total capacity of eight digital outputs, eight digital inputs, eight analog inputs, four analog outputs, and two remote display modules. The RSC requires a 24 Vac power supply. All other voltages necessary for system operation are generated by an onboard power supply. This power supply provides for the RSC and all auxiliary devices. All field wiring connects to the RSC with compression type screw terminals. The RSC is 5.5"x7" and is mounted in a metal enclosure. The RSC could be mounted in any dry location, but would be typically located near the controlled equipment. The RSC is listed by Underwriters Laboratories as Enclosed Energy Management Equipment under UL916.

One RSC can control up to four individual pieces of HVAC equipment. Equipment Schedules are programmed into 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 sets of dip switches are located on the RSC. One set determines the Equipment Schedule and the other set is used for the RSC address and troubleshooting.

RS-485 is used to communicate between each RSC and the PC. Up to 128 RSCs can be placed on each of eight trunk lines. Reliable trunk line communications can be achieved on a variety of wire types and configurations but typically will be handled by a single 24 AWG unshielded twisted wire pair. All RSCs on a trunk line are wired in parallel and either a daisy-chain or a star configuration can be used.

RS-232 communication is also available at each RSC through an RJ-11 connector. This signal format is used for the hand-held portable tester.

A heartbeat LED monitor is located on the RSC. This LED indicates the operational status of the RSC. Two additional LEDs indicate all incoming and outgoing communication from the RSC to the trunk line.

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

Digital Outputs- Digital Outputs at the RSC switch a triac which can directly switch loads up to 1 A @ 24 Vac. Each DO is accompanied by an LED that indicates the state of the DO.

Analog Inputs- All analog inputs are jumper selectable as 0-5 Vdc or 4-20 mA. The analog inputs are provided with an 18 Vdc power supply.

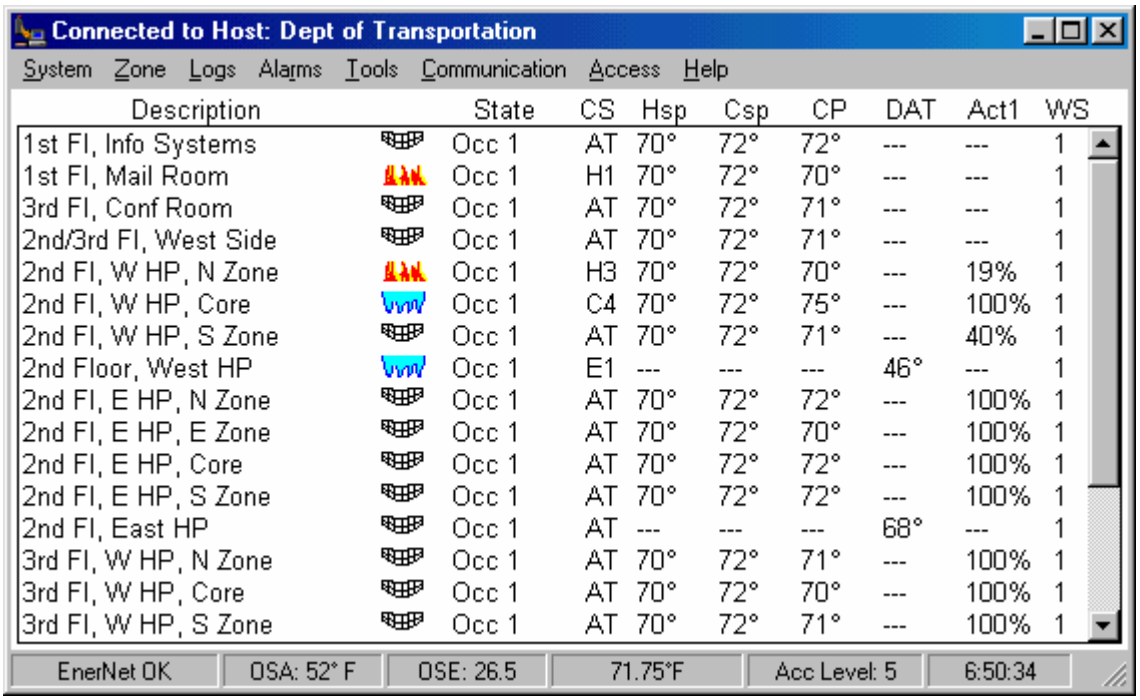
Analog Output Conversion Cards (AO) - All analog output signals originate with an AO card. AO cards provide 4 analog outputs and each output is jumper selectable as either 4-20 mA or 0-10 Vdc. The AO cards connect to the RSC with a 16 pin ribbon cable and connector.

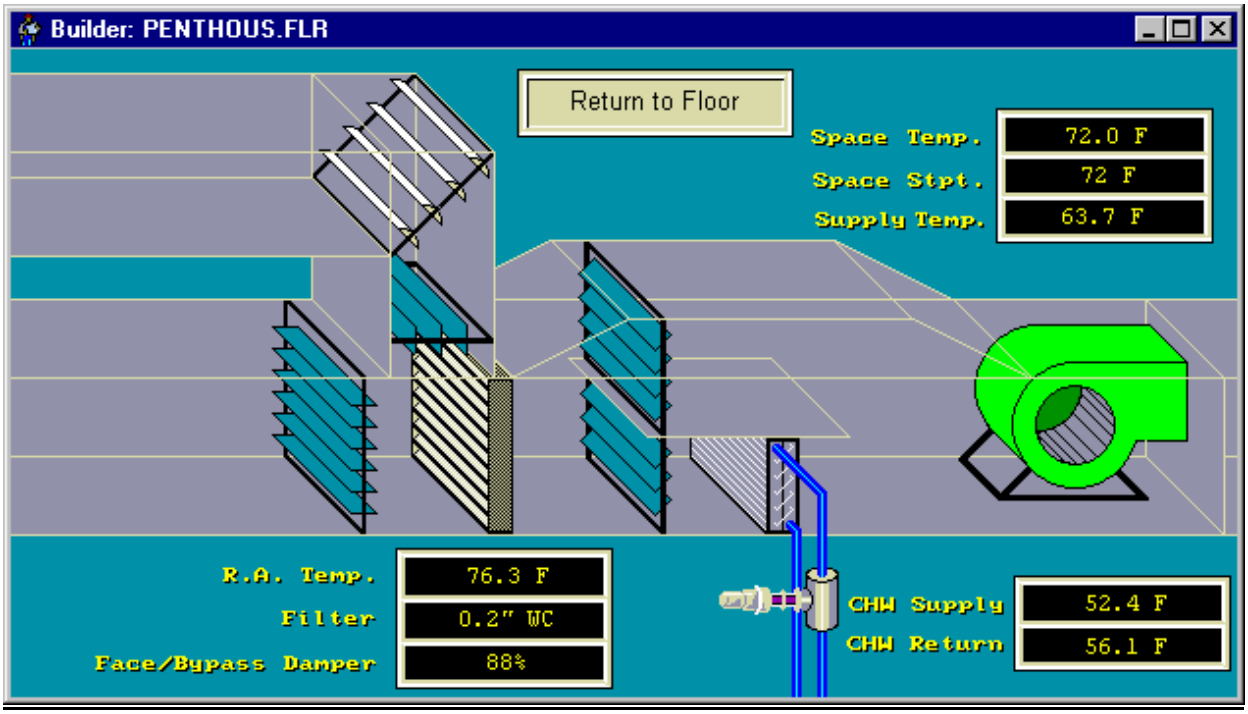
Wall Sensor - The standard wall mounted enclosure uses a 1000 ohm Platinum RTD temperature sensor calibrated for an output of 4-20 mA. An amplifier, filter and calibration pot are included on the wall sensor circuit card. A single wire pair connects the sensor to the RSC. A push button extends from the cover for setback override. An optional setpoint adjustment lever allows the occupant to adjust setpoints up to a maximum +/- 10° F. The sensor is also available with an LCD display and setpoint selection using up/down buttons.

Duct, Well, and Outside Sensors – Temperature sensors are available in all necessary configurations for HVAC applications. All sensors use 1000 ohm Platinum RTDs and are factory calibrated for a 4-20 mA output.

Hand-held Test Device (HTD) - The HTD is a menu driven RS-232 terminal that gives instantaneous access to all RSC data. The HTD connects to the RSC through a standard RJ-11 connector. The RSC supplies power. The RSC communicates with the HTD at 9600 baud. An optional cable is available that allows the RSC to communicate with any standard RS-232 terminal through a 9 pin or a 25 pin connector.

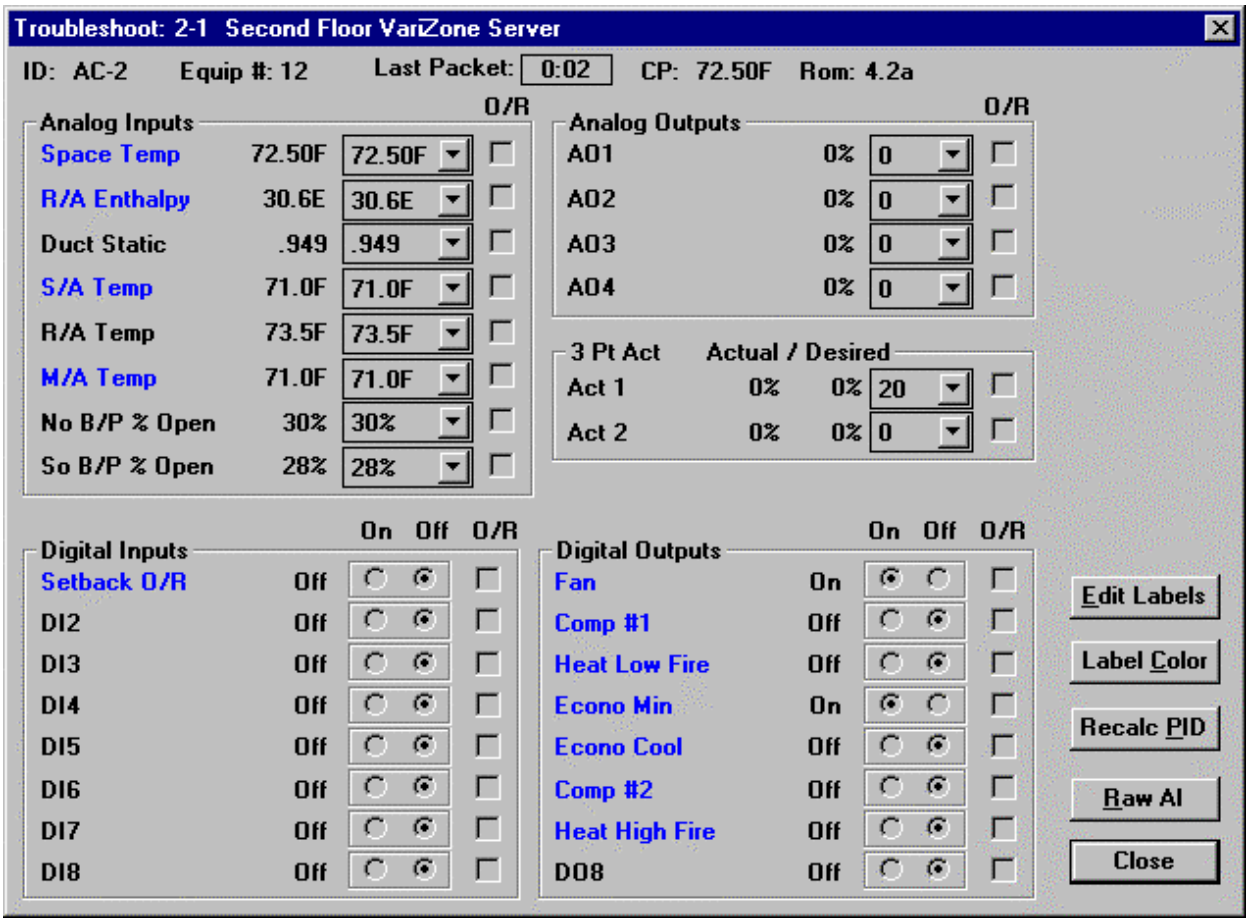
System Monitoring Screen





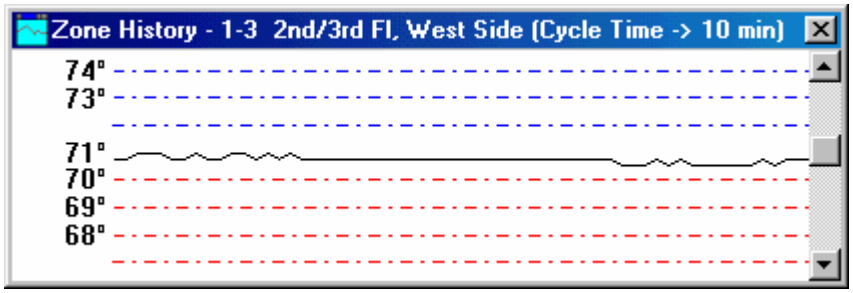
All System functions can be monitored and modified from either the standard System interface or the optional Dynamic Graphic interface package.

Troubleshooting Screen



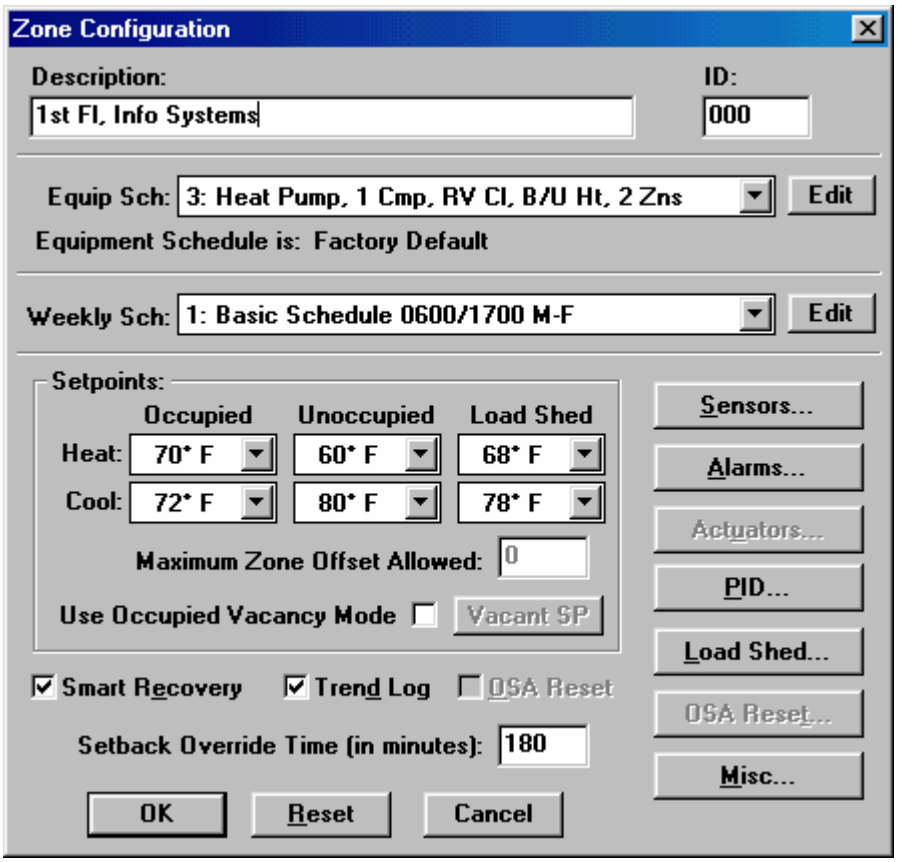
The Troubleshooting screen allows for detailed monitoring and manual override of any Zone input or output.

Zone History Screen



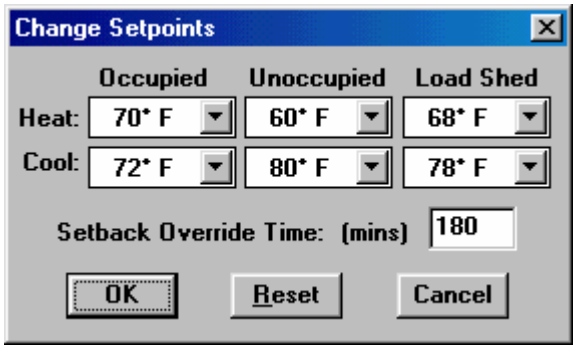
The Zone History option graphs space temperature with the click of a button.

RSC Configuration Screen



Each Zone can be individually configured from this screen.

Change Setpoints Screen



Double-clicking with the mouse on any Zone will bring up the Change Setpoints dialog. Setpoints and setback override times can be changed from this screen.

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

For more information please contact us at:

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