

Crestron **PAC2**
Professional Automation Computer

Operations Guide



CRESTRON

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Professional Automation Computer: PAC2

Introduction

Features and Functions

The Professional Automation Computer (PAC2) is the control system that is the heart of the Crestron Lighting Control System. It provides information from the controls located in the living environment to the control modules located in the Crestron Automation Enclosure. The PAC2 enables customers to more efficiently control not only the lighting in their home, but also other systems such as HVAC.

Functional Summary

- Powered by 2-Series Control Engine
- 36 MB of Internal Memory*
- Expansion Slot for Type II Compact Flash and IBM Microdrive® Hard Disk Drive (Up to 4 GB)
- 8 Isolated Relay Ports
- 8 I/O Versiports
- Built-in 8-Segment Cresnet Hub
- Supports SIMPL™ Windows® & SIMPL+™
- 1 Z-Bus Expansion Slot – Ethernet Cards
- 2 Y-Bus Expansion Slots – Crestron Expansion Cards
- Cresnet backup capability (including power)

* For more information on internal memory usage, refer to “On-Board Memory” on page 10.

The breakthrough 2-Series control engine is based on the new 257 MIPS, 32-bit Motorola ColdFire® processor. The on-board 36MB memory is enhanced with a 4GB expansion slot that supports off-the-shelf Type II compact flash memory and the IBM Microdrive® hard disk drive, for on-board storage of program and touchpanel files, room and equipment profiles, upgrades, databases, and schedules.

Crestron's unique dual bus system, with its high-speed I/O bus architecture, provides blazing fast throughput, system wide. The two 40Mb/s Y-BUS expansion slots offer the option of installing any of the CNX-series cards listed in Crestron's 2003 Product Catalog, and all C2-series control cards. The 300Mb/s Z-BUS expansion slot is designed for super high-speed control card applications such as 10/100 Ethernet,

available via Crestron's single-port C2ENET-1 and dual-port C2ENET-2 Ethernet cards.

The PAC2 offers eight programmable analog and digital inputs as well as digital outputs. There are eight normally open relays, isolated with MOV suppression.

The 32 Cresnet connectors that comprise the built-in 8-segment Cresnet hub are located on the top of the PAC2 (NET A – NET H). When powered by the internal supply or an external power supply, they expand the number of Cresnet devices that can be connected to the PAC2. Each group of four connectors can electrically support up to 32 Cresnet devices. When powered by the internal power supply, there is a maximum of 50 watts (DC) available for all network devices connected to the PAC2. The LEDs indicate communication on the Cresnet link.

The PAC2 provides external connections for both a back-up processor and emergency over-ride closure signals. In the absence of Cresnet, a signal is generated to switch power and communication of the Cresnet system to the back-up processor. When the over-ride connection receives a contact closure, a signal is passed to the lighting modules via the fifth wire of the interconnect cable, and the lights are turned on to a programmed preset emergency level. They remain at this level until that contact closure is removed.

For detailed information on the PAC2 input and output ports/connectors, refer to "Ports/Connectors" on page 7.

The 2-Series operating system is vastly upgraded, yet compatible with existing Crestron software and programming. A key feature is the new Crestron Compiler, which allows any existing Crestron SIMPL™ Windows® control program to be recompiled for the 2-Series. The real-time, preemptive multi-tasking/multi-threaded operating system offers a FAT32 file system with long file names. The enhanced SIMPL+™ instruction set is also fully compatible with existing Crestron SIMPL Windows and SIMPL+ programs.

The PAC2 also provides true secure network communications, which is required for today's corporate networks, automated residence systems, and the Internet. The Dual Port 10/100 BaseT Ethernet card (C2ENET-2) will support dynamic and static IP addressing and full duplex TCP/IP and UDP/IP. It offers a WAN port for Internet and remote-location communications and a LAN port for local in-home use. A built-in firewall delivers network security with the Network Address Translator (NAT) and router functions. The built-in Web Server uses memory storage on a compact flash card for remote access and control.

Network Address Translation (NAT), available with the C2ENET-2 card, is a method of connecting multiple computers on an internal network to the Internet (or any other IP network) using one publicly visible IP address. Current implementation for the Crestron 2-Series control systems includes a combination of the Network Address Port Translator protocol (NAPT) and Bi-Directional NAT. NAT functionality is included in the firmware of Crestron 2-Series control processors, and enabled through a dual port Ethernet Z-bus expansion card such as the C2ENET-2.

NOTE: For specific details on NAT, including setup and configuration, refer to the Network Address Translator (NAT) document (latest version of Doc. 6001). It is available from the Downloads | Product Manuals section of the Crestron website (www.crestron.com).

Specifications

Specifications for the PAC2 are provided below.

PAC2 2-Series Automation Control System Specifications

SPECIFICATION	DETAILS
CPU	32-Bit Motorola ColdFire® Processor
Processor Speed	257 MIPS (Dhrystone 2.1 Benchmark)
On-board Memory	36MB (4MB flash, 32MB DRAM, 256KB NVRAM) ¹
Expandable Memory	Compact Flash Slot (up to 4GB) accepts standard Type II Compact Flash or IBM Microdrive®
Acceptable File Extensions SIMPL Windows .smw .spz D3 Pro .smw .spz	<i>projectname</i> .smw (source file) <i>projectname</i> .spz (compiled file for 2-Series) <i>projectname</i> .smw (source file) <i>projectname</i> .spz (compiled file for 2-Series)
Dual Bus Architecture Y-BUS 40 Mb/s Parallel Communications Z-BUS 300 Mb/s Parallel Communications	2 Expansion Card Slots ² 1 Expansion Card Slot ³
Ethernet (Optional Z-BUS cards)	Dynamic/Static IP Addressing Full and Half Duplex TCP/IP and UDP/IP Built-in Firewall for Security (Dual Port Only) Built-in Network Address Translator (Dual Port Only) Built-in Web Server Built-in Router –(Dual Port Only)
Ports/Connectors ⁴ NET ⁵ COMPUTER I/O RELAY OUTPUT POWER OVERRIDE BACKUP NET INPUT FAULT LEFT / RIGHT	33 – Cresnet 4-wire interface (32 on the built-in hub/repeater, and 1 on the front panel) (Expandable via Cresnet Poll Accelerator) ⁶ 1 – DB9F PC interface 8 – Programmable digital/analog inputs & digital outputs 8 – Normally open, isolated relays (MOV suppression) 4 – Internal and External power 2 – External contact closure 1 – External 2-Series control system backup 1 – To external 2-Series control system for fault indication 2 – Lighting module interface
Power Requirements	100-240 VAC, 2.4 A, 50/60 Hz Internal Universal Power Supply
Network Power Fuse Rating	4A, 250V (1¼" x ¼" Slow Blow Fuse Series) 50 watts 24 volts regulated max. (DC) available for Cresnet devices
Reset Buttons	HWR - Initiates system hardware reset SWR – Program Restart / Program Bypass
Environmental Temperature	41° to 113°F (5° to 45°C)
Humidity	10% to 90% RH (non-condensing)
Dimensions & Weight	Height: 3.75 in (9.52 cm) Width: 14.00 in (35.56 cm) Depth: 7.40 in (18.80 cm) Weight: 8.00 lb (3.60 kg)

- For more information on system memory usage, refer to "On-Board Memory" on page 10.
- 40 Mb/s parallel communications; supports any of the CNX-series cards listed in Crestron's 2003 Product Catalog and all C2-series control cards.

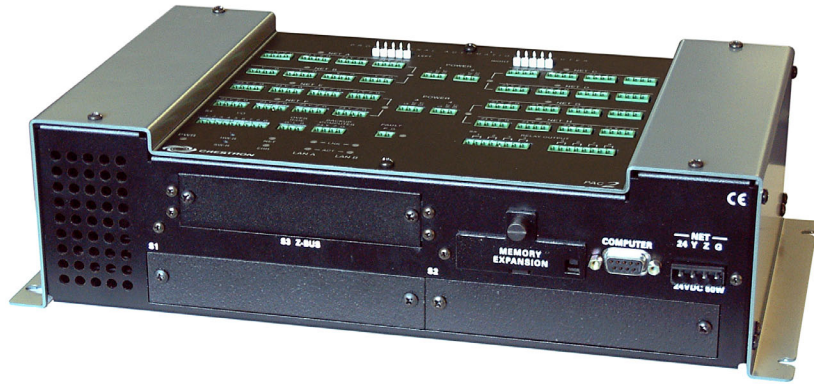
3. Optional Z-BUS Cards: Single port 10/100 Ethernet, Dual Port WAN-LAN-10/100 Ethernet, or Dual Port WAN-LAN-10/100 Ethernet-USB.
4. The PAC2 provides a maximum of 50 watts (DC) for all network devices. Depending on the network power requirements, it may be necessary to add one or more Crestron external 24VDC supplies. Refer to “Built-In Cresnet Hub/Repeater” on page 9 for details, and to “Network Wiring” on page 16 for a caution concerning the use of non-Crestron power supplies.
5. Only 32 net devices may be connected to any group of four connectors on the top panel, and 32 more may be connected to the NET connector on the front panel. For more information on controls, ports, and indicators, refer to “Physical Description” on page 5.
6. Cresnet Accelerator increases effective network speed and fan-out by a factor of eight when a Poll Accelerator is added to the system.

NOTE: The PAC2 supports a large number of devices for physical wiring without the need for a separate CNXHUB. Note, however, that only 252 devices can be program controlled (NET IDs 03 to FE).

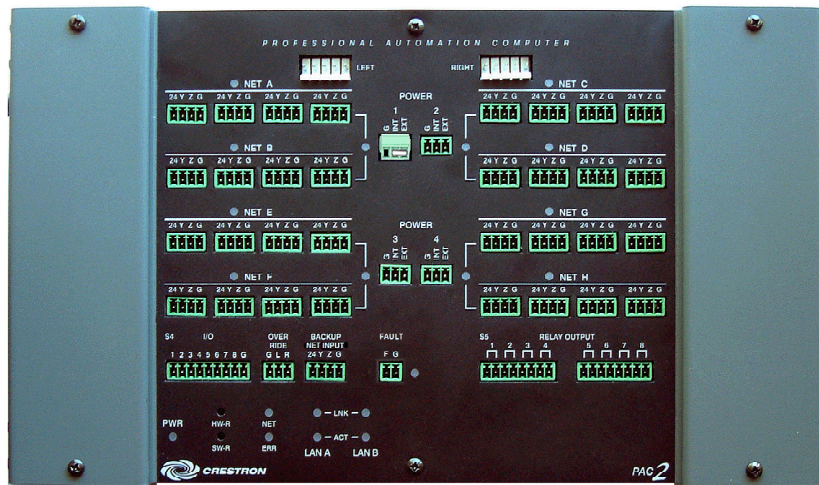
Physical Description

The PAC2 automation control system is housed in a gray and black enclosure with labeling on the top and front panels. The dimensions are shown in the illustrations on the next page.

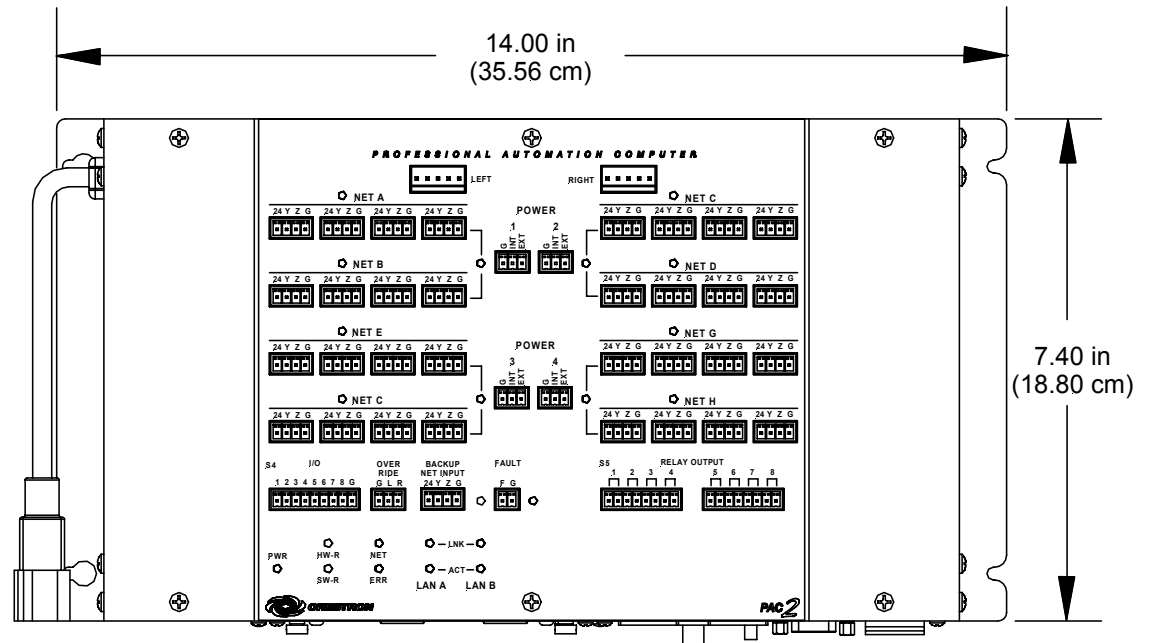
PAC2 Physical View without Optional Y and Z Bus Cards



PAC2 Top View with Optional Jumpered 3-Pin Mini Connector Installed in POWER 1 Port

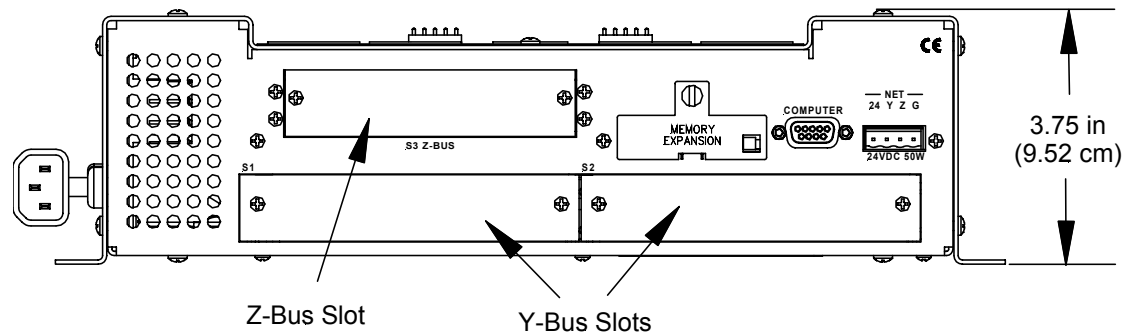


PAC2 Physical Views
Top View

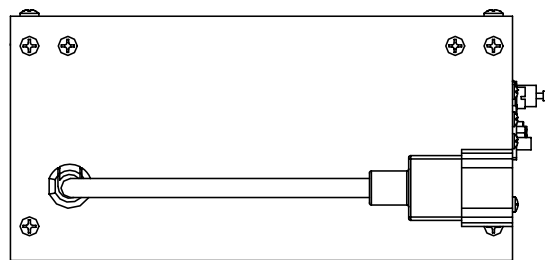


Refer to "Built-in Cresnet Hub/Repeater" in this guide for wiring details and power requirements for the PAC2 NET connectors.

Front View



Left Side View



Ports/Connectors

The ports/connectors provided on the top and front panel of the PAC2 are described in the following paragraphs.



LEFT, RIGHT

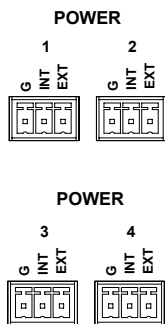
These 5-position connectors, rated at 24VDC, 2A maximum load, provide for Cresnet signals and an additional override contact closure signal. Use the Unit Interconnect Cable Assembly, supplied with the PAC2, to connect to the lighting module(s) or a CAEN Block assembly.



NET A - H

These eight segments provide 32 standard (24 Y Z G) Cresnet connectors (in groups of four) for user interface connections. Each group of four supports 32 electrical Cresnet connections. Connectors are rated at 24VDC, 2A maximum with internal power; 3A maximum with external power.

POWER

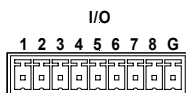


These connectors are used to supply 24VDC power to the built-in hub segments. Each connector provides power to a segment pair—POWER 1 provides power to segments NET A and NET B; POWER 2 provides power to segments NET C and NET D; etc. Internal power is applied to a segment pair by plugging one of the supplied 3-pin mini connectors with installed jumper wire into the appropriate POWER connector. If the power needed for a hub segment exceeds the power available from the internal supply, remove the jumper from the supplied 3-pin mini connector and connect the 24VDC and ground wires from an external source to the EXT and G pins.

For more details, refer to “Built-In Cresnet Hub/Repeater” on page 9.

CAUTION: Use only Crestron power supplies for Crestron equipment. Failure to do so could cause equipment damage or void the Crestron warranty.

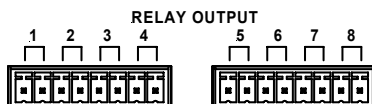
I/O



The I/O port has eight software programmable analog and digital inputs as well as digital outputs. Digital outputs offer 250mA sink from maximum 24 VDC; catch diodes for use with "real world" loads. Digital inputs are rated 0 – 24 VDC, 20K ohms input impedance, logic threshold 1.25 VDC. Analog inputs are rated 0 – 10 VDC, protected to 24 VDC maximum, 20K ohms input impedance; pin-programmable 2K ohms pullup resistor to +5V. For detailed information, refer to “Slot 4: C2I-IO8” on page 32.

NOTE: Digital outputs are TTL values and may not work with devices requiring a “dry” contact closure (e.g., low voltage motor controllers).

RELAY OUTPUT



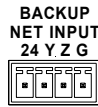
Provide eight normally open, isolated relay contact groups. Each relay contact closure is rated 1A, 30 VAC/DC; MOV arc suppression is provided across contacts for use with "real world" loads. For detailed information, refer to “Slot 5: C2I-RY8” on page 34. Refer to “Bussing Strip Installation” on page 16 for information on commoning (linking) of the terminal block connections.

OVERRIDE



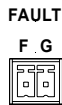
Provides external dry contact closure inputs directly to the 5-position Cresnet interconnect connectors, LEFT and RIGHT. When a switch contact closure is

received between the “G” connection and the “L” or “R” connection (R is used in a double-wide enclosure only), the respective left or right column of modules will set the lights to the programmed emergency override state. The connector is rated at 5V, 10mA maximum.



BACKUP NET INPUT

This connector (Crestron network port labeled 24 Y Z G) allows a backup control system connected here via Cresnet cable to automatically take control of the Cresnet network upon a failure of the internal processor. The connector is rated at 24VDC, Class 2 power source. A 24VDC power supply is diode “ORed” with the internal supply and will power the system if the built-in supply fails. Cresnet will switch over upon a built-in watchdog detecting failure of the CPU. The FAULT LED indicates the failure.



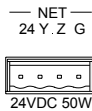
FAULT

Provides a dry contact closure fault signal to notify an external control system when the PAC2 has a system fault. This output should be connected to a digital input of the backup computer. The fault signal is active low. A fault is defined as the CPU not interacting with Cresnet for 10 seconds. The watchdog will switch back if the backup computer’s Cresnet is inactive for 10 seconds.



COMPUTER

This DB9F connector is used when programming with a PC. The port is modem compatible. The modem and/or PC program cable (standard male to female straight-through) is not supplied.



NET

This connector (typical Crestron network port labeled 24 Y Z G) electrically supports up to 32 Cresnet peripherals. Note that there is a 50W maximum load rating on the PAC2 internal power supply, which applies to this connector plus the 32 NET connectors on the top panel. Refer to “Built-In Cresnet Hub/Repeater” on page 9, and “Network Wiring” on page 16 for details.

Indicators

The indicators provided on the top panel of the PAC2 integrated control systems are described below.

PWR (Power)

This LED illuminates when the unit receives power (from any source).

NET

This LED illuminates (blinks) when the central processing unit is processing or communicating with Cresnet devices.

ERR

This LED illuminates when an error condition is detected. This may be the result of a message from the system, a hardware or software failure, a missing/wrong card placed in a slot, or a programming error. To decipher content, examine the message available through Viewport.

FAULT

This LED illuminates when a fault signal is sent to notify an external control system that the PAC2 has switched control to a backup system, since the main system was detected to be inactive.

NOTE: The LAN LEDs are active only if the optional single port or dual port Ethernet card (which is field installed) occupies the Z-BUS slot. LAN A is used for a single port Ethernet card; LAN A and B are used for the dual port card.

LNK A, LNK B (LAN)

These LEDs illuminate when the Ethernet card has established a valid Ethernet connection.

ACT A, ACT B (LAN)

These LEDs illuminate when there is communication (activity) at the respective port on the Ethernet card.

Reset Buttons

Two buttons are provided on the top panel of the 2-Series integrated control systems. Refer to the description of each below.

HW-R

Pressing this button initiates system hardware reset. (Same effect as disconnecting and reconnecting power-reinitializes operating system and program.)

SW-R

Pressing this button alone momentarily while the system is running restarts the program. Pressing this button in combination with the **HW-R** button performs a system restart without reinitializing the program (refer to “Troubleshooting Communications” on page 21).

Built-In Cresnet Hub/Repeater

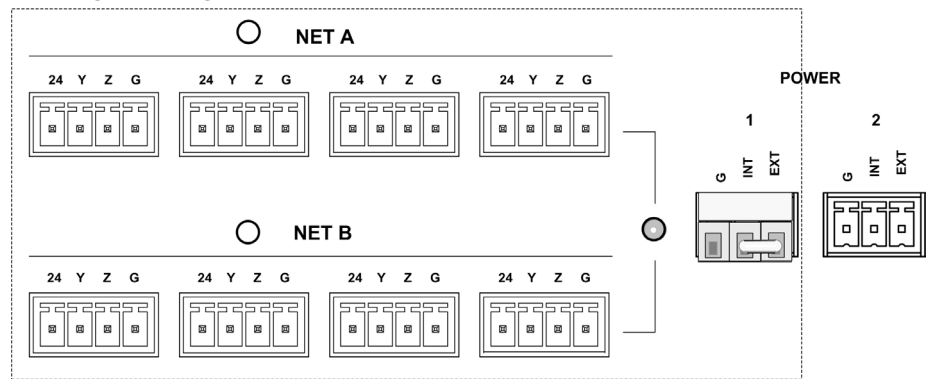
The built-in Cresnet Hub/Repeater serves as a repeater, splitter, and wiring block. The hub allows for 256 or more devices; 32 per segment (A-H) and distribution up to 3000 feet per segment.

There are eight independent segments, each with four Cresnet connectors wired in parallel. Each segment has a dedicated driver/receiver for Cresnet communication. In addition, there is a master NET port on the front panel. The eight **NET (A-H)** activity LEDs illuminate when a device on the respective segment transmits data.

Segments that are not in use or have devices that are not polled by a SIMPL program are logically ‘disconnected’ from the other segments in operation. The LEDs for these segments are not illuminated.

CAUTION: Use only Crestron power supplies for Crestron equipment. Failure to do so could cause equipment damage or void the Crestron warranty.

Power for the hub is supplied through **POWER** ports **1, 2, 3, and 4**, to segment pairs, as shown in the illustration on the next page. When power is applied, the LED adjacent to the port is illuminated.

Powering a Hub Segment Pair

In the illustration above, one of the supplied 3-pin mini connectors with installed jumper wire is plugged into the **POWER 1** port. The PAC 2's internal power supply is connected to the **INT** pin; the port's **EXT** pin is connected to the **24** pin of each connector in the segment pair. Since the jumper connects the **INT** and **EXT** pins of the port, 24VDC is supplied to each connector and the external network devices.

If the power needed for a hub segment exceeds the power available from the internal supply (50 watts, max.), remove the jumper from the supplied 3-pin mini connector to disconnect the internal power supply, then connect the 24VDC and ground wires from an external source (Crestron 24 VDC - regulated power supply) to the **EXT** and **G** pins.

NOTE: If a device or Cresnet network connected to a hub segment has its own power source, do not make any connection to the applicable **POWER** port. Although equipment damage is unlikely, Crestron does not recommend applying two power sources to the same circuit.

Attach wiring per the latest revision of either the Network Interconnection Drawing or the Mini Network Interconnection Drawing. The Cresnet or CAT5 cables can be secured to the 32 supplied mini-Phoenix connectors, which can be plugged into the Cresnet hub ports.

On-Board Memory

The PAC2 has 36MB of built-in memory (non-volatile and volatile). A total of 36MB is broken down as follows: 4MB internal flash (non-volatile), 32MB DRAM (volatile), and 256KB NVRAM (non-volatile memory). Flash memory contains the file system inside the 2-series control engine. NVRAM contains information that is retained after loss of electrical power. Volatile memory is lost after a power failure. Refer to the lists on the next page for a breakdown of memory usage for program-related information stored in the unit.

Internal Flash

The 4MB flash memory consists of approximately 1.5MB used for firmware, and approximately 2.5MB available for SIMPL, SIMPL+, and Web pages. The files that reside in flash conform to a flat directory structure. The table on the next page presents the structure of the overall file system.

File System Structure

TOP LEVEL	SECONDARY LEVEL	DESCRIPTION
\		Root of the file system
	DISPLAY	Legacy directory used in ISYS panels to hold display lists
	SYS	Contains various system configuration files
	SETUP	NAT configuration Web pages
	HTML	Web pages
	SIMPL	Control system program files
	SPLUS	Simpl+ module files
	USER	Used for user-defined files
	MAILBOX	Directory contains the user mailbox file
	CFx	The mounting point for the compact flash files, where x is the number of the compact flash slot (0 = on board slot, i.e., \CF0 refers to the on-board slot)

Although the file system is case insensitive, the case is preserved to maintain file checksums. The compact flash directory only appears when the compact flash is inserted into the system. To reference files on the compact flash, prefix “\CFx\” to any fully qualified path from the Windows environment. For example, if the file in Windows is “\My Directory\My Subdirectory\My file.ext”, the complete 2-series path for a file on the first Compact Flash slot (on-board) is:

“\CF0 \My Directory\My Subdirectory\My file.ext”

Non-volatile

1. SIMPL+ Variables (Default if no options are specified, or using "nonvolatile" qualifier or #DEFAULT_NONVOLATILE)
2. Signals explicitly written to NVRAM* (by symbols such as Analog RAM, Analog RAM from database, Serial RAM, Serial RAM from database, Analog Non-volatile Ramp, Digital RAM, etc.)

*Commonly used for presets (volume/lighting/dial #s).

NOTE: If you extract NVRAM values to a file (**Viewport, File transfer | Save NVRAM to File**), to simplify restoring them in the event of file corruption or to distribute to identical control systems, remember that NVRAM values are position sensitive in the program. When saving the NVRAM is crucial to your application, it is recommended to place all symbols and/or modules that use NVRAM at the beginning of your program. When NVRAM (.nvr file) is re-installed, all the values should line up with the program. If the program is modified, and logic that uses NVRAM is placed before any symbols using NVRAM, the previously stored values will not line up and your presets will have to be re-entered.

Volatile

1. Digital, analog and serial signal values
2. SIMPL+ Variables (if "volatile" qualifier is used, or #DEFAULT_VOLATILE is used)

DRAM

DRAM is used by the operating system for dynamic storage of variables, signals and other constructs used at runtime. The actual amount of DRAM used at any given time depends on the particular program that is running, i.e., usage is variable, or dynamic, during normal operation.

Expandable Memory (Compact Flash)

The on-board 36MB memory of the 2-Series integrated dual bus control system is enhanced with a 4GB expansion slot that supports off-the-shelf Type II compact flash memory and the IBM Microdrive[®] hard drive. The slot is accessible on the front panel of the unit. Complete the procedures in the following subsections to install and remove the memory cards. Power does not have to be disconnected to insert or remove memory. Note that compact flash memory supports FAT32 file structure.

Memory Card Installation

1. Loosen the screw that secures the memory slot cover located to the left of the **COMPUTER** port on the rear panel.
2. Pull on the screw to remove the screw and cover.
3. Observe handling precautions of the memory card manufacturer and insert into the open slot.
4. Align and reposition cover over slot.
5. Tighten the screw.

Memory Card Removal

1. Loosen the screw that secures the memory slot cover located to the left of the **COMPUTER** port on the rear panel.
2. Pull on the screw to remove the screw and cover.
3. Press the eject button located on the extreme right of the slot.
4. Observe handling precautions of the memory card manufacturer and remove card from the slot.
5. Align and reposition cover over slot.
6. Tighten the screw.

Industry Compliance

As of the date of manufacture, this unit has been tested and found to comply with specifications for CE marking and standards per EMC and Radiocommunications Compliance Labelling (N11785)



NOTE: This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Setup

Mounting the PAC2 in the Crestron Automation Enclosure (CAEN)

CAUTION: The CAEN houses equipment that needs to be air-cooled. Therefore, mount in a well-ventilated area. The ambient temperature range must be 32°F to 104°F (0°C to 40°C). The relative humidity must range from 0% to 90% (non-condensing). Furthermore, allow adequate clearance in front of the vented cover for servicing and ventilation.

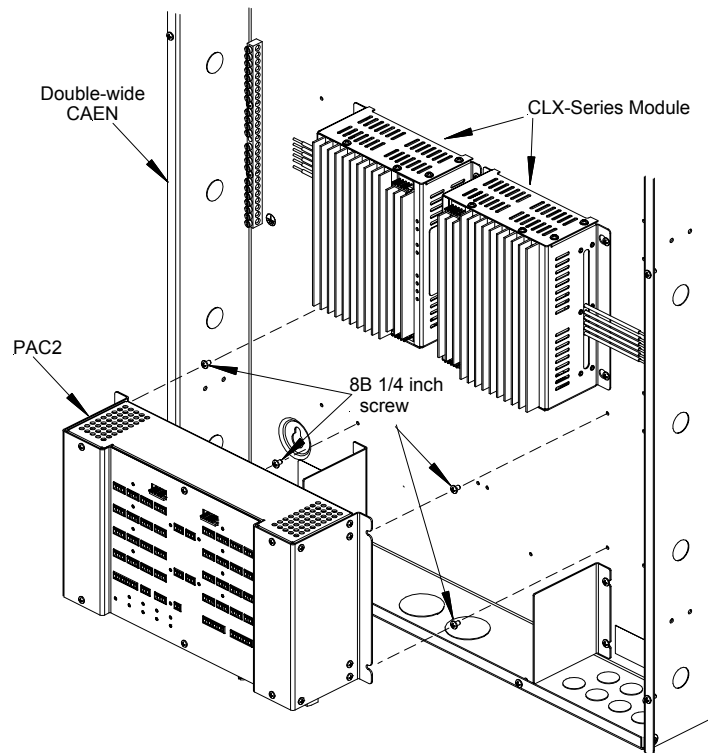
NOTE: The CAEN is intended for indoor use only.

NOTE: Reliable earth grounding of equipment mounted in a CAEN should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g., use of power strips).

The PAC2 has two flanges that allow the unit to be mounted in a CAEN. Refer to the latest revision of the CAEN – Automation Enclosures Installation Guide (Doc. 5940) for more information on the CAEN. The latest version is on the Downloads | Product Manual section of the Crestron website (www.crestron.com). The following procedure assumes that two CLX Series Modules have been installed in a double-wide CAEN. Complete the procedure below to attach the PAC2 to the CAEN. A #2 Phillips screwdriver is required.

1. Using a #2 Phillips screwdriver, attach the four supplied self-tapping pan Phillips screws (8B x ¼ length) by screwing them in partially (to allow room to mount the PAC2) below the modules (refer to illustration on next page).
2. Mount the PAC2 on the CAEN (where you attached the screws), slide the unit to the right to ensure the screws fully engage the slots in the flanges, and tighten the screws.

NOTE: For a single-wide CAEN, attach screws on right (screw them in partially), mount the PAC2 (where you attached screws), attach screws on left and fully tighten all screws.

Mounting the PAC2 in the CAEN**AC Power Connection**

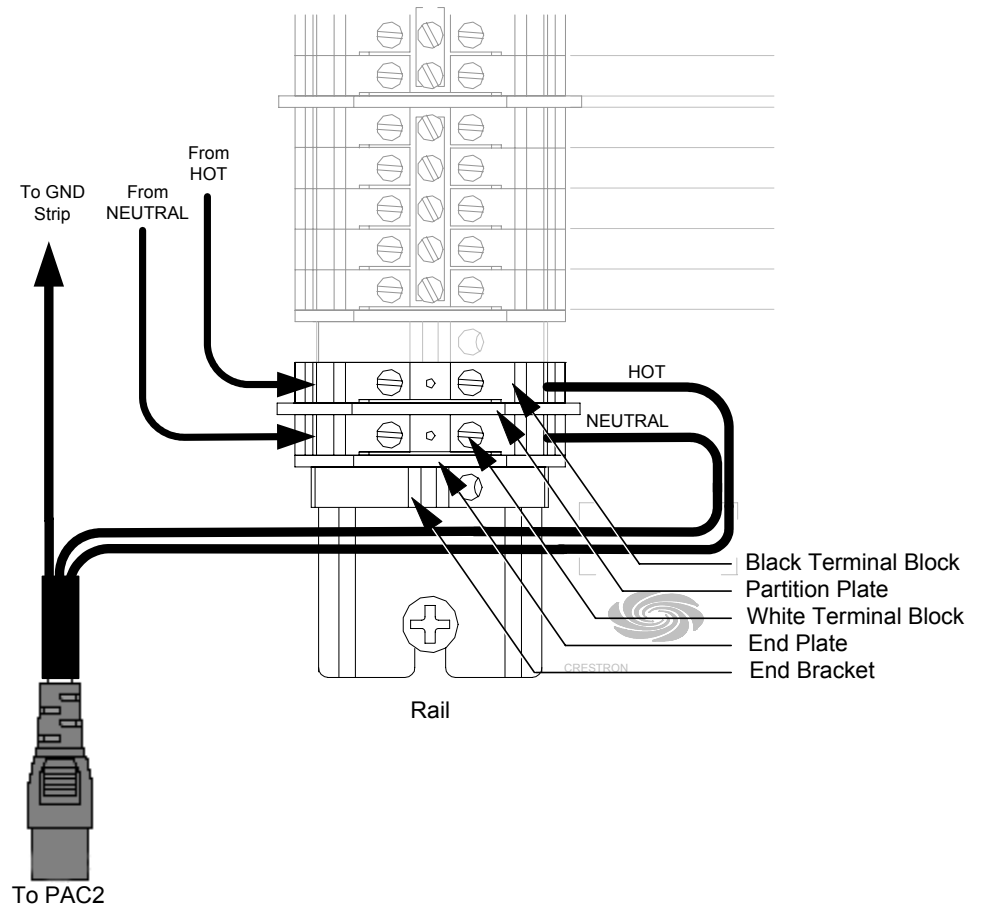
The PAC2 requires AC power for operation. This can be accomplished using the materials listed in the following table. This involves adding the terminal blocks and associated parts to the lower left terminal rail in a double-wide CAEN enclosure, or the lower terminal rail in a single-wide enclosure, and making the necessary wiring connections. The power cable and hardware required for connection are supplied with the PAC2.

Supplied Parts for PAC2 AC Connection

Quantity/Description	Part #
One (1) White, 1-Position Terminal Block	JTTB01-4
One (1) Black, 1-Position Terminal Block	JTTB01-6
One (1) Terminal Block Partition Plate	JTHWXX-3
One (1) Terminal Block End Plate	JTHWXX-2
One (1) Terminal Block End Bracket	JTHHXW-1
One (1) Power Cord	CAXXIPC-65008A-1

Refer to the illustration on the next page and perform the associated procedures.

WARNING: Verify that AC power to the CAEN assembly is turned off before performing any of these assembly or wiring procedures.

PAC2 AC Power Source Assembly and Connection Diagram

1. Assemble the supplied terminal blocks, partition plate, end plate, and end bracket to the power rail, as shown. Ensure that the parts are snug against the existing hardware, and tighten the end bracket screw to secure the parts in place.
2. Connect HOT and NEUTRAL power to the added terminal blocks, as shown.
3. Attach the supplied 3-wire power cord, as shown.

Bussing Strip Installation

The PAC2 is supplied with two brass bussing strips to facilitate commoning (linking) of the S5 Relay Output terminal block connections. The bussing strips are constructed with four terminal block positions, and may be trimmed to size for various applications or different devices. One strip is supplied for each 8-position terminal block.

1. To utilize the bussing strip, determine the number of relays to be commoned for the equipment being installed. If less than four, the strip can be trimmed to size with a pair of scissors or wire snips.
2. Loosen the terminal block screws and insert the first leg of the bussing strip into the first common position on the terminal block. The strip engages the other common positions automatically.
3. Remove approximately 1/8" of the jacket from the common wire and insert the conductor into one of the terminal block common positions. Tighten the terminal block screws to lock the wire and bussing strip into place. Insulate the strip by folding a piece of 3/4" wide vinyl electrical tape over the spine and as much of the individual legs as possible. Excess tape at each end of the strip should be pressed closed, then trimmed to within approximately 1/16" of the end of the strip.
4. When wiring the remaining conductors, remove approximately 1/8" of the jacket and insert the wires into the proper terminal block positions. To prevent the possibility of electrical shorts, it is essential that these conductors do not touch any uninsulated portion of the bussing strip.
5. Secure the wires connected to the terminal block with a tie wrap around the bussing strip to provide strain relief.

Network Wiring

CAUTION: Use only Crestron power supplies for Crestron equipment. Failure to do so could cause equipment damage or void the Crestron warranty.

CAUTION: Possible equipment damage if miswired.

CAUTION: Exceeding the power output (maximum 50W) of the 2-Series automation control system can result in erratic system behavior, system shutdown or a blown fuse.

NOTE: When installing network wiring, refer to the latest revision of the wiring diagram(s) appropriate for your specific system configuration, available from the Downloads | Product Manuals | Software and Wiring Diagrams section of the Crestron website (www.crestron.com).

NOTE: Do not power up system until all wiring is verified. Care should be taken to ensure data (Y, Z) and power (24, G) connections are not crossed.

NOTE: The PAC2 automation control system has thirty-three 4-pin network connectors. Use the following Crestron products to interconnect to other devices within a network (some permit network testing):

- CNTBLOCK, Network Terminal Block
- CNHBLOCK, Multi-Type Network Distribution Block
- CNXHUB, Cresnet Hub/Repeater (regenerates Cresnet signals, so Network Analyzer results are not accurate)
- ST-CNB, SmarTouch/Cresnet Terminal Expander

When calculating the wire gauge for a particular network run, the length of the run and the power factor of each network unit to be connected must be taken into consideration. If network units are to be daisy-chained on the run, the power factor of each network unit to be daisy-chained must be added together to determine the power factor of the entire chain. The length of the run in feet and the power factor of the run should be used in the following resistance equation to calculate the value on the right side of the equation.

Resistance Equation

$$R < \frac{40,000}{L \times PF}$$

Where: R = Resistance (refer to table below). L = Length of run (or chain) in feet. PF = Power factor of entire run (or chain).

The required wire gauge should be chosen such that the resistance value is less than the value calculated in the resistance equation. Refer to the table after this paragraph.

Wire Gauge Values

RESISTANCE (R)	WIRE GAUGE
4	16
6	18
10	20
15	22
13	Doubled CAT5
8.7	Tripled CAT5

NOTE: All network wiring must consist of two twisted-pairs. One twisted pair is the +24V conductor and the GND conductor and the other twisted pair is the Y conductor and the Z conductor.

NOTE: When daisy chaining network units, always twist the ends of the incoming wire and outgoing wire that share a pin on the network connector. After twisting the ends, tin the twisted connection with solder. Apply solder only to the ends of the twisted wires. Avoid tinning too far up or the tinned end becomes brittle and breaks. After tinning the twisted ends, insert the tinned connection into the network connector and tighten the retaining screw. Repeat the procedure for the other three network conductors.

Hardware Hookup

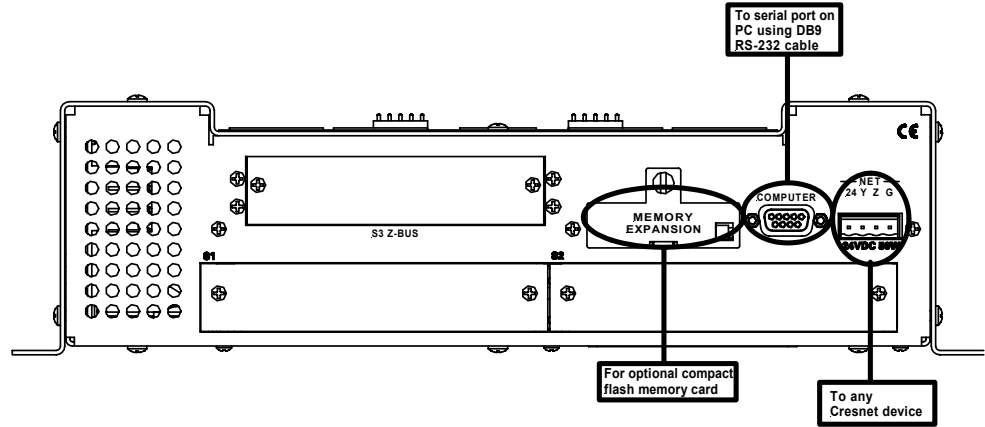
Refer to the hookup diagrams on the next page, and aside from attaching power last, complete the connections in any order. Refer to “Network Wiring” on page 16 and “Built-In Cresnet Hub/Repeater” on page 9 when making network connections.

NOTE: To prevent overheating, do not operate this unit in an area that exceeds the environmental temperature range listed in the table of specifications. Consideration must be given if installed in a closed or multi-unit rack assembly since the operating ambient temperature of the rack environment may be greater than the room ambient. Contact with thermal insulating materials should be avoided on all sides of the unit.

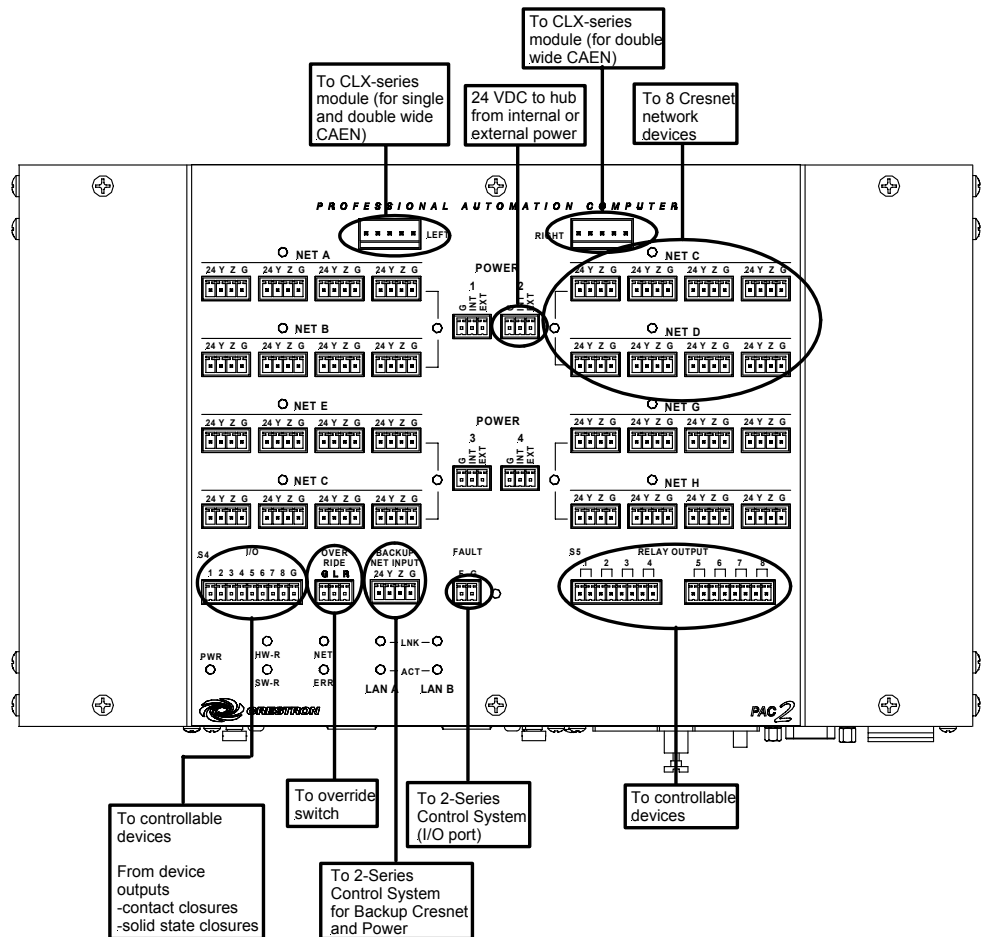
NOTE: The maximum continuous current from equipment under any external load conditions shall not exceed a current limit that is suitable for the minimum wire gauge used in interconnecting cables. The ratings on the connecting unit's supply input should be considered to prevent overloading the wiring.

NOTE: Since the plug on the power supply cord is used to disconnect power from the unit, the socket-outlet shall be installed near the equipment and shall be easily accessible.

Hookup Connections for the 2-Series Automation Control System (front panel)



Hookup Connections for the 2-Series Automation Control System (top panel)



Establishing Communication with the PAC2

Before uploading a program to the control system or performing diagnostic functions, you must connect the control system to the PC. This connection can be serial or (if an optional Z-Bus card is installed) it can be TCP/IP.

NOTE: For laptops and other PCs without a built-in RS-232 port, Crestron recommends the use of PCMCIA cards, rather than USB-to-serial adapters. If a USB-to-serial adapter must be used, Crestron has tested the following devices with good results:

Belkin (large model) F5U103
I/O Gear GUC232A
Keyspan USA-19QW

Other models, even from the same manufacturer, may not yield the same results.

Serial Connection

Connect the COMPUTER port on the PAC2 to one of the COM ports (usually COM 1) on the PC. Use a straight-through RS-232 cable with a DB9 male connector on one end and a DB9 female connector on the other. Most commercially available cables are acceptable; they should have at least 5 pins for transmit, receive, ground, and hardware handshaking (pins 2, 3, 5, 7, and 8).

Open the Crestron Viewport and click **Setup | Communication Settings** to display the “Port Settings” window (refer to graphic on next page). Then click **RS-232** as the connection type.

The PC communication settings specified here should match the default protocol that the PAC2 expects. The settings are as follows:

- Port = COM 1 through COM 8. Select the correct COM port on the PC.
- Baud rate = 115200 (You can set the PC and the PAC2 to a different baud rate, by using the **Functions | Set Baud Rate** command).
- Parity = None.
- Number of data bits = 8.
- Number of stop bits = 1.
- Hardware handshaking (RTS/CTS) enabled.
- Software handshaking (XON/XOFF) not enabled.

“Port Settings” Window: Default PC Settings for RS-232 Communication with the PAC2.

Port Settings

Connection Type: RS-232 TCP/IP (Crestron Terminal Protocol)

Port: Com 1 Com 2 Com 3 Com 4
 Com 5 Com 6 Com 7 Com 8

Baud Rate: 115200 57600 38400 19200 9600
 4800 2400 1200 600 300

Parity: None Even Odd

Data Bits: Seven Eight

Stop Bits: One Two

XON/XOFF RTS/CTS

Line Pacing for ASCII Uploads (in milliseconds):

Mode for Network Transfers: ASCII XModem

OK Cancel

To verify communication, click **Diagnostics | Establish Communications (Find Rack)**. This should display a window that gives the COM port and baud rate.

TCP/IP Connection

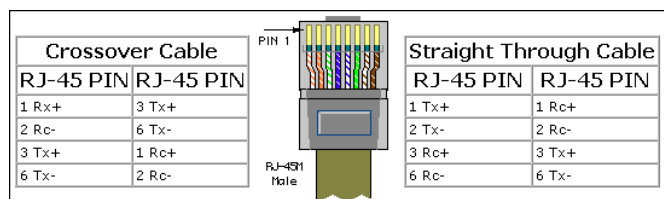
Before you can communicate with the PAC2 over TCP/IP, you must use the RS-232 connection just described to configure the unit's TCP/IP settings. You must also have an optional Z-Bus card installed in the control system.

1. Open Viewport and click **Functions | Set Control System IP Information**.
2. Enter the IP address, IP mask and default router in the text fields. All of these terms are explained in detail in the Crestron e-Control Reference Guide, Doc. 6052. The latest version is available as a PDF on the Crestron website (www.crestron.com).
3. Click **OK** to set the new IP information.

Once you have assigned the IP settings, you can continue to communicate with the PAC2 using the RS-232 connection, or you can establish a TCP/IP connection.

For TCP/IP, use CAT5 straight through cables with 8-pin RJ45 connectors to connect the LAN port on the PAC2 and the LAN port on the PC to the Ethernet hub. Alternatively, you can use a CAT5 crossover cable to connect the two LAN ports directly, without using a hub. The following figure illustrates pinouts for straight through and crossover RJ45 cables. Pins 4, 5, 7, and 8 are not used.

RJ45 Pinouts



Once the cable connections are made, open the Crestron Viewport and click **Setup | Communication Settings** on the menu to display the “Port Settings” window. Then click **TCP/IP** as the connection type. Enter the IP address of the PAC2.

“Port Settings” Window

The screenshot shows the "Port Settings" dialog box with the following configuration:

- Connection Type:** TCP/IP (Crestron Terminal Protocol)
- IP Address:**
 - Fixed
 - Note: To use a port other than the default, use the format <IP Address>:<Port #>
 - 192.168.2.100
- Prompt on Connect:**
 - Always
 - Once per session
- Line Pacing for ASCII Uploads (in milliseconds):** 0
- Mode for Network Transfers:** XModem

To verify communication, click **Diagnostics | Establish Communications (Find Rack)**. This should display a window that gives the IP address and port number.

Setting Network IDs in D3 Pro

Lighting control modules, like all Crestron devices, have a default internal Network ID that is set at the factory. This internal Network ID and the Network ID that is assigned in the D3 Pro lighting program must match. For example, if you have a CNX-B6 keypad in your lighting system, the internal Network ID of that keypad has to match the Network ID that is shown in the program’s *Finish View*.

In some cases, you will need to change the internal Network ID to match the Network ID assigned by D3 Pro. The procedure for setting Network IDs differs depending on the firmware version of the device. With some firmware versions, only the device currently being configured can be connected to the network, while all other devices have to be disconnected from the network. Crestron’s newest firmware upgrades allow automatic configuration of Network IDs, with no need to take devices offline. Devices that can be configured in this way, such as lighting modules and keypads, are referred to as **touch-settable** devices.

D3 Pro provides options for configuring Network IDs in both touch-settable and non touch-settable devices.

For information on setting network IDs, refer to the detailed information contained in the D3 Pro help file, or in Crestron’s D3 Pro Reference Guide, Doc. 5998. The latest version is available as a PDF on the Crestron website (www.crestron.com).

Troubleshooting Communications

Use the following checklist if communication cannot be established with the PAC2.

1. Verify that you are using the correct cables. As described previously, an RS-232 connection requires a straight-through serial cable. That is, pin 1 on one end is connected to pin 1 on the other end; pin 2 connects to pin 2, etc. With a TCP/IP connection, you must use a CAT5 cable with 8-pin RJ45 connectors.
2. With a serial connection, verify that the correct COM port on the PC has been selected. Some computers have more than one COM port; some may be internal (e.g., for a modem). Consult the manufacturer's documentation for further information about the COM ports on your PC.
3. Check the **ERR** LED indicator on the top panel of the PAC2. If this LED is illuminated, unplug the unit and reapply power after a few seconds. If the LED illuminates again, call Crestron customer service.
4. With a serial connection, reset the control system as follows:
 - a. Open Viewport and click **Setup | Communications Settings** to display the "Port Settings" window. Choose **RS-232** as the connection type.
 - b. Set the baud rate of the PC to **115200**.
 - c. Set the baud rate of the PAC2 control system to 115200, as follows:
 - Press and release the **HW-R** button on the unit's top panel.
 - Press and hold the **SW-R** button for approximately three to five seconds. The Viewport console should display the following message:

Viewport Message

```
PAC2 >
Control Console
Changing to default Comm Specs. 115200 N81 RTS/CTS
Switch to new settings....
Bypassing Program Load!!!
```


- Release the **SW-R** button.
- d. If communication still cannot be established:
 - Remove power from the control system.
 - Press and hold the **SW-R** button on the top panel of the PAC2.
 - Reapply power to the control system.
 - The Viewport console should display the message shown above.
 - Release the **SW-R** button.
 - e. Select **Set Baud Rate** on the Viewport **Functions** menu (or press **F8**) and choose any baud rate from the drop-down list. This will attempt to establish a connection at the indicated baud rate. If the connection is successful, both the PC and the control system will be set to the new baud rate.

- f. Reinitialize the unit by recycling the power or pressing the **HW-R** button. If the connection is established, the Viewport console should display some text and the **PAC2>** prompt.
- g. If communication still cannot be established, contact Crestron customer service.

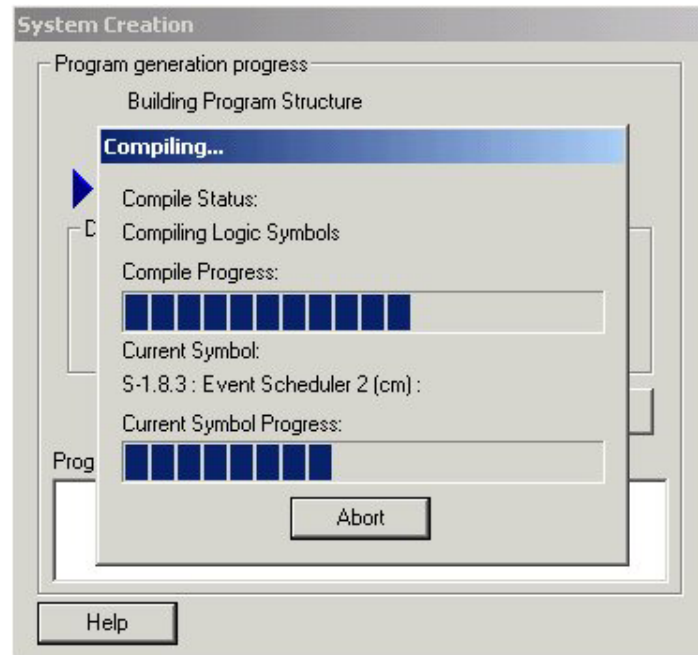
NOTE: In Viewport, you can generate an error log via the ERRlog console command. For more information on console commands, refer to the 2-Series Console Commands Reference Guide, (latest version of Doc. 6002) available from the Download | Product Manuals section of the Crestron website (www.crestron.com).

Compiling and Uploading a D3 Pro Program to the Control System

After you have completed your D3 Pro lighting system program, you must first compile the program and then upload it to the PAC2.

Click the **Build System**  button to generate the touchpanel projects and control system logic program. Here D3 Pro will begin by generating any touchpanel projects that have not already been compiled, and the **Touchpanel Build Status** pane will display information about the project, as in Programming View. However, D3 Pro will not automatically open the VisionTools Pro-e project.

After all the touchpanel projects are created, D3 Pro will generate the PAC2 logic program. A progress bar will display information about the program as it is created and compiled.



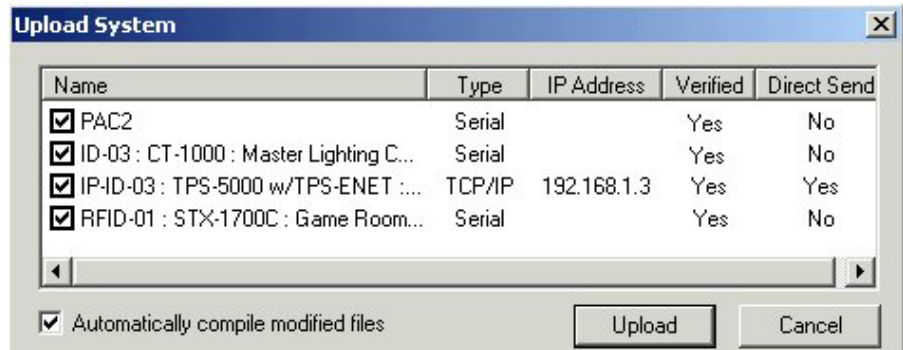
Click **Continue** to finish the compile operation and upload the system.

The program will be saved as an SMW file in the *Program* subfolder, and will contain all the logic that enables communication between the control system, interfaces, controlled devices and other hardware.

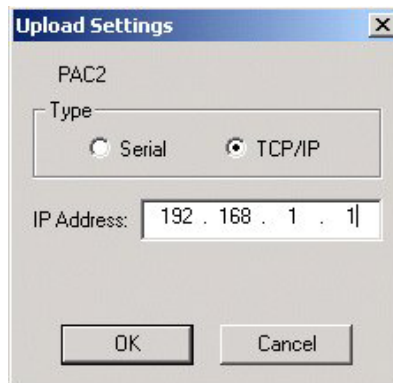
If any errors are generated during programming, they will be displayed in the *Messages* field. You can double-click a message for more information.

Once you have compiled the program files, you are ready to upload them to the control system and user interfaces:

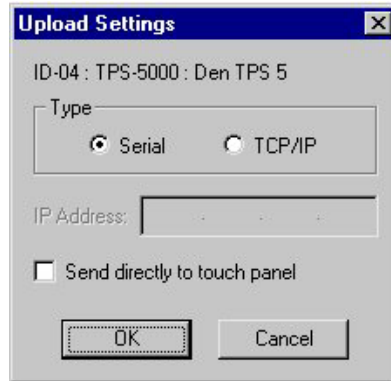
1. Click the **Upload System** button to poll the network and display the list of target devices. If the control system and interfaces have been detected on the network (and thus can receive files) they will be checked off. If a project has not yet been compiled, or else if it has been modified, check *Automatically compile modified files* to recompile the project before upload.



2. You can double-click any device in the upload list to view or change its connection settings. For example, if the PC is connected to the PAC2 via TCP/IP, then you would select TCP/IP as the connection type and enter the IP address of the PAC2.



With touchpanels, various connection types are possible. If the panel is connected to the PAC2, specify the type of connection between the PC and the PAC2: **Serial** or **TCP/IP**.



With TCP/IP, type the IP address of the PAC2.

If the panel is connected directly to a COM port on the PC, select **Serial** as the connection type and check *Send directly to touchpanel*.

To communicate directly to an Ethernet touchpanel, select **TCP/IP** as the connection type, enter the IP address of the panel (not the PAC2) and select *Send directly to touchpanel*.

3. Click **Upload** to begin the file transfer. If the control system already has a program installed in memory, you will be prompted to save that program to disc. To save the program, click **Yes** and browse to the directory where you want to save the SPZ file.


As files are transferred, first to the control system and then to touchpanels, D3 Pro will display a progress bar.

In applications that do not include wireless panels, D3 Pro will display the progress bar as it uploads each project to every selected touchpanel. In applications that do include wireless panels, D3 Pro will interrupt the upload process and prompt you to select the NET ID of the wireless panel. This is the temporary Cresnet ID that is used solely for uploading, and is not used during normal program operation.


4. After transfer, D3 Pro will display information about each file, including the filename and status, i.e., successful or not successful. If any file to be transferred matches what is currently in the device, the Status field will display the message: "No need to upload."

Compiling and Uploading a SIMPL Windows Program to the PAC2

After you have completed your SIMPL Windows program you must compile and upload the program to the PAC2.

To compile the program, simply click the **Convert/Compile** button  on the SIMPL Windows toolbar, or select **Project | Convert/Compile** (you can also press **F12**). A status bar will indicate the progress of the compile operation. After the operation is complete, a window will display information about the program such as the number and type of signals, and memory usage.

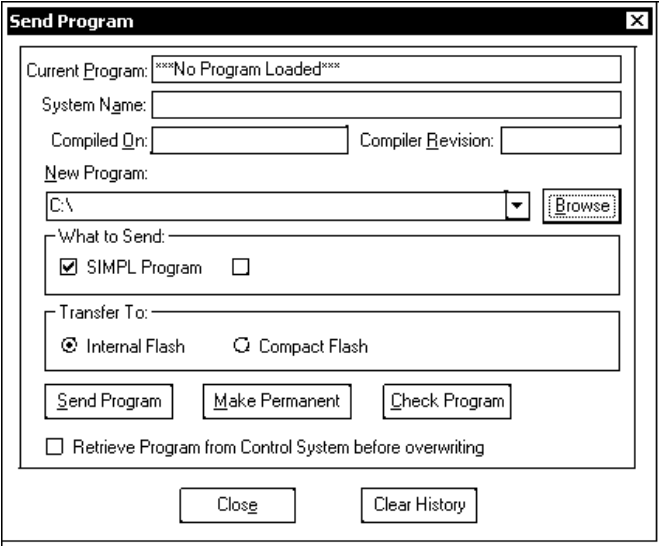
The compiled program will be stored as an SPZ file in the same directory as the source file. There are a number of ways to upload an SPZ file to the PAC2. When any of the options is selected, a "Send Program" window appears (refer to graphic on next page).

- Immediately after compiling the program, you will be prompted to transfer the file to the PAC2.
- Either click the **Transfer** button  on the SIMPL Windows toolbar, or
- Open Viewport and select File **Transfer | Send Program** on the SIMPL Windows main menu.

In the “Send Program” window, click **Browse**, locate the SPZ file and click **Open**. This will display the program's header information and enable one or both of the *What to Send* check boxes. If the program does not contain any SIMPL+ modules only the *SIMPL Program* check box will be enabled. If it does contain SIMPL+ modules, then the *SIMPL+* check box will also be enabled. Select one or both check boxes and then click *Send Program* to begin the transfer.

NOTE: Unlike X-Series processors, the 2-Series processor does not require a permanent memory image. Also, the 2-Series adds the ability to automatically retrieve the current program from the PAC2. To do this, verify that the *Retrieve Program from Control System before overwriting* check box is selected.

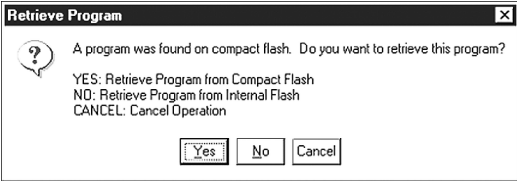
“Send Program” Window



Choose where the program will be sent: **Internal Flash** or **Compact Flash**. (With the Compact Flash option, if the Viewport does not detect a Compact Flash card, you will be prompted to insert a card and retry the upload procedure.) The 2-Series processor also provides the option to retrieve the current program from internal or Compact Flash memory before overwriting it. Simply select the *Retrieve Current Program* check box and specify the filename and directory.

The **Retrieve Program** command copies the current program from either internal or Compact Flash to disk. If the Viewport detects a program in Compact Flash, the following window appears:

“Retrieve Program” Window



As shown on the previous page, click **Yes** to retrieve the program from Compact Flash, or **No** to retrieve the program from internal memory. Click **Cancel** to cancel the operation.

When a program is uploaded, that program's filename is added to the *New Program* drop-down list. This makes it convenient to reload frequently used programs, as they can be selected from the list without need to browse to a directory. To delete the list, click **Clear History**.

You can also click **Check Program** to display the header information of the currently loaded program.

Another way to verify that the program has been transferred successfully is to select **Report Program Information** on the Viewport **Functions** menu. Program information is also displayed in the Viewport console whenever power is removed and re-applied to the PAC2.

Uploading Web pages to the PAC2

The PAC2 provides a built-in Web server for e-Control applications. The PAC2 allots 2.5 MB of memory for “user files” such as Web pages, mailbox, and the compiled program/SPZ file. For detailed information, refer to “Uploading Web Pages” in the Crestron e-Control Reference Guide, Doc. 6052. The latest version is available as a PDF on the Crestron website (www.crestron.com).

NOTE: If you have a Compact Flash reader/writer drive on your PC, you can load HTML pages to a Compact Flash card using Windows Explorer or any other file transfer method. When the card is inserted into the Memory Expansion slot of the PAC2, the Web pages will be recognized as valid for e-Control so long as they are located in a directory called **HTML**. (The **HTML** directory must also include a configuration file called `_config_ini_`, which identifies the default page—contact Crestron for further information.)


NOTE: For IP setup information, refer to the Operation & Installation Guide for the 2-Series Ethernet Interface Expansion Cards: C2ENET-1 & C2ENET-2, Doc. 5962. The latest version is available as a PDF on the Crestron website (www.crestron.com).

Uploading Touchpanel Projects via the PAC2

You can use a connection to the PAC2 to upload VT Pro-e projects to any Cresnet touchpanel. Compiled projects for TPS panels are contained in VTZ files; projects for all other touchpanels are contained in HEX files.

Before uploading, open Viewport and select **Diagnostics | Report Network Devices** to verify that the touchpanel is being detected by the control system. (As with any network device, touchpanels must be identified by unique hexadecimal network IDs. These IDs, set in the SIMPL Windows program, and the IDs set when configuring the touchpanel must match.)

To upload a project:

1. From VT Pro-e: Click the **Project | Upload** button  on the toolbar, or click **File | Upload Project**.

From Viewport: Click **File Transfer | Send Touchpanel** or press **Alt+T**.

2. Select the network ID of the touchpanel, as set in SIMPL Windows and configured on the touchpanel, from the drop-down list.
3. Browse to the HEX or VTZ file to be uploaded. If the file is a HEX file, click **Open** to begin the transfer.

If the file is a VTZ file, choose the pages to send to the TPS panel. The choices are as follows:

- **All Files in Project:** sends the entire project.
- **Only Changed Files:** sends only the files that are different from those that are currently stored in the panel. Note that if any pages in the panel are not present in the project, those pages will be deleted from the panel.
- Additional choices include **Do not send graphic files** and **Do not send sound files**. These are often very large files that need not be reloaded with every transfer.

Updating the Operating System

As with all 2-Series control systems, operating system files for the PAC2 have a .cuz extension. You can obtain .cuz updates (when available) from the software downloads area of the Crestron website. To download an update, click the .cuz file and choose the **Save to Disk** option, then specify the directory where the update will be stored.

NOTE: In some cases Microsoft's Internet Explorer may append a .zip extension to a downloaded .cuz file. For example, a file called "C2-1008.cuz" may appear as "C2-1008.cuz.zip." If this happens, rename the file, removing the .zip extension.

To upload the new .cuz to the control system:

1. Open Viewport and select **File Transfer | Update Control System**.
2. Browse to the .cuz file and click **Open** to start the transfer.
3. After the transfer is complete, the PAC2 will automatically reboot. To confirm the transfer, click **Diagnostics | Check Ops Version**. The Viewport console should display the new .cuz version number.

Running Programs From Compact Flash

On power-up or a hardware reset (**HW-R**), the control system first checks for a program on compact flash and then internal flash. The console command CFAUTORUN controls the actions of the control system when a compact flash is inserted into a running system. If CFAUTORUN is enabled, when a compact flash card is inserted or removed from the system, the system automatically performs a program reset (**SW-R**) and the boot order described above is used to find the program to run. If CFAUTORUN is disabled, then the user must either press the **SW-R** button on the top panel or issue a program reset through the Viewport to switch programs. The PAC2 is shipped with CFAUTORUN enabled.

Other Compact-Flash-Related Functions

In addition to the previous topics that are impacted by compact flash availability, other Viewport command functions-including Erase Program, Erase Web Pages, and

Send Generic Files-permit you to choose between internal flash and compact flash when selecting programs/files for processing.

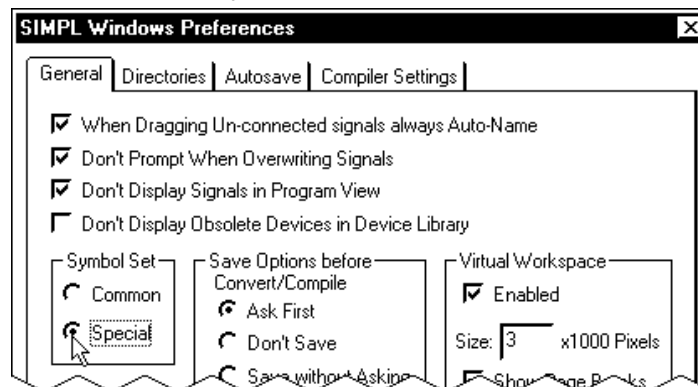
A new SIMPL Windows command **File | Copy Output to Compact Flash** copies a compiled SIMPL Windows program (SPZ) file to a compact flash reader/writer on a PC. Click **Browse** to locate the SPZ file; select the drive letter of the CF reader/writer from the drop-down list. Click **OK** to copy the file.

Advanced Console Commands

The SIMPL Windows online help file provides a full listing of console commands that are valid for **2-Series** control systems. You can access the PAC2 console in a variety of ways: via a serial connection (RS-232) with a PC, over Ethernet via the LAN port, or through Telnet, among many other methods. It is also possible to issue console commands through logic, by adding a Console symbol to the SIMPL Windows program.

The Console symbol is only visible in the *Symbol Library* when **Special** is selected as the *Symbol Set*. Click **Edit | Preferences**. In the *Symbol Set* area of the *General* tab, select **Special** as shown below.

"SIMPL Windows Preferences" Window



Special Symbols are intended for advanced programmers and Crestron employees. If questions arise from using a special symbol, contact Crestron customer service.

Console commands are provided for advanced programmers. However, most functions and commands can be selected from the various Viewport menus.

NOTE: For more information on console commands, refer to the 2-Series Console Commands Reference Guide, (latest version of Doc. 6002) available from the Downloads | Product Manuals section of the Crestron website (www.crestron.com).

Console Commands for Compact Flash

The following commands are provided to enable processing functions for compact flash files/programs:

- CFAUTORUN - Enable the program to autoboot from compact flash.
- CFPROJDIRS - Display a list of project directories on compact flash.
- CFTRANSFER - Transfer a project to/from compact flash.
- MAKEDIR - Create a file directory on compact flash.
- REMOVEDIR - Remove a file directory on compact flash.

Console Commands That Work with Compact or Internal Flash

The following commands have been modified to enable processing functions for compact flash files/programs:

- CD - Permits changing to a directory on compact flash
- DELETE - Enables deleting files from compact flash.
- DIR - Permits listing files on compact flash.
- FREE - If current directory is on compact flash, gives the amount of space available on the compact flash. If internal, gives the amount left on internal flash.
- TYPE – Enables display of files residing on compact flash.
- XGETFILE – Enables retrieving a file from compact flash.
- XPUTFILE – Enables sending a file to compact flash.

Console Commands for Setting IP

- ADDMASTER - Permits adding a master entry to an IP table.
- ADDSLAVE – Enables adding a slave entry to an IP table.
- AUTONEGOT – Enables setting auto negotiation for an Ethernet device.
- IPADDRESS - Enables setting the IP address.
- IPMASK – Enable setting the IP sub mask.
- IPTABLE – Displays the IP table
- REMSLAVE – Enables removing a slave entry from an IP table.
- WEBPORT – Permits specifying the port for the Web server.

Programming Software

You can create a program to control the PAC2 control system using the Crestron programming tools D3 Pro or SIMPL™ Windows®. Customers whose focus is on lighting systems may prefer to use the D3 Pro software since it is designed especially for creating lighting and environmental system control applications. Customers already familiar with SIMPL Windows who are including a lighting system as part of an overall control system project may prefer to continue using SIMPL Windows. Following are the minimum software requirements for the PC:

- SIMPL Windows version 2.03 or later.
Requires SIMPL+ Cross Compiler version 1.1.
- Crestron Database version 15.6.2 or later.
- (Optional) VisionTools™ Pro-e (VT Pro-e) software for designing touchpanel pages.
- (Optional) Crestron D3 Pro, version 1.0 or later—software for lighting and environmental controls.

Programming with D3 Pro

Crestron's D3 Pro lighting software provides all the tools necessary to create a complete Crestron lighting system for residential applications. The lighting system includes the control system logic program, touchpanel projects, and keypad programming, documentation, and real-time lighting adjustment capabilities.

As with all Crestron software, D3 Pro provides extensive right-click and drag-and-drop functionality, in addition to convenient keyboard shortcuts for frequently used functions and commands.

Programming is organized into six system **Views** of the lighting system, each providing a moveable toolbox of devices such as interfaces, fixtures, and control modules. You can add a device to your system simply by selecting it from one of the toolboxes and dragging it to a room. The available toolboxes differ depending on the View, but all Views include a "General" toolbox that allows you to add areas and rooms at any time.

Programming with SIMPL Windows

SIMPL Windows is Crestron's graphical, Windows-based development tool for programming control systems. The SIMPL Windows interface provides two workspaces: the Configuration Manager, for configuring the control system, touchpanels, and controlled network devices; and Program Manager, for designing the logic and functionality of the control system.

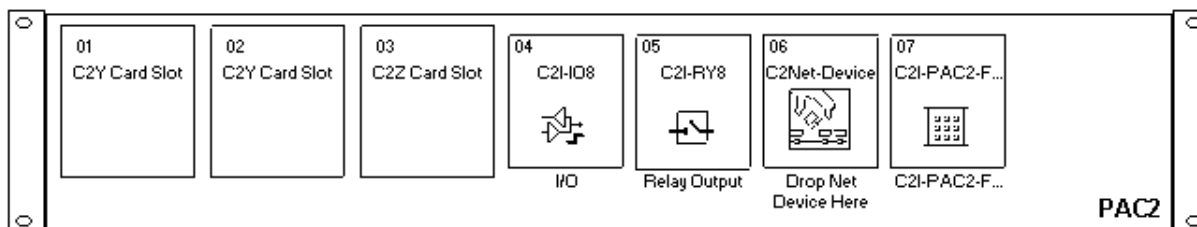
In addition, you can use Crestron's powerful Viewport utility to accomplish multiple system tasks, such as uploading the program to the control system and performing diagnostic functions. Together with the Crestron Database, these tools provide you with the essential components you need to program the PAC2. Crestron software is available on CD-ROM, or can be downloaded from the Crestron website (www.crestron.com)—registration is required for downloading.

NOTE: The information in this section assumes that the reader has knowledge of SIMPL Windows. If not, refer to the extensive help information provided with the software.

PAC2 Device Library Symbols

Configuration Manager is where programmers “build” a Crestron control system by selecting hardware from the *Device Library*. In Configuration Manager, drag the PAC2 from the Control Systems folder of the *Device Library* to *System Views*. Refer to the illustration below.

System Views of the PAC2



Slot 1, 2, 3: Y- and Z-Bus Expansion Slots

The 40Mb/s Y-BUS (slots 1 and 2) supports existing CNX control cards and permits adding multiple IR, serial communications, and/or relay ports to the control system. The 300Mb/s Z-BUS expansion slot (slot 3) supports the C2ENET-1 and -2 control cards, and is designed for super high-speed applications such as 10/100 Ethernet.

Slot 4: C2I-IO8

The PAC2 provides eight I/O ports called Versiports, each of which can function as a digital input, a digital output, or an analog input. Each Versiport has a corresponding pullup resistor.

In Program Manager, drag the C2I-IO8 symbol from *Program View* to *Detail View*. The symbol contains the following signals, arranged here according to mode:

Signals

Digital output mode

- 8 digitals: <o1> through <o8>

Digital input mode

- 8 digitals: <i1> through <i8>

Analog input mode

- 8 analogs: <i1> through <i8>
- For each analog, one corresponding minimum change value: <MinChange1> through <MinChange8>

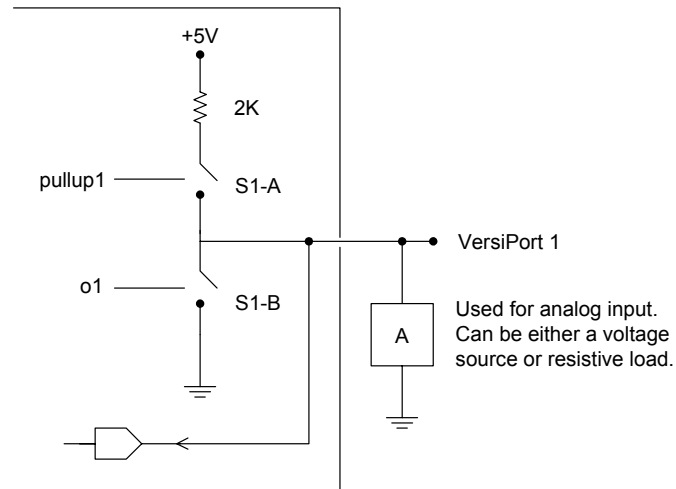
All Versiport modes

- For each Versiport, one corresponding pullup resistor: <pu-disable1> through <pu-disable8>

Defining a signal puts the signal into the corresponding mode. For example, defining the analog input <i1> configures that Versiport as an analog input. A Versiport can operate in one mode only. That is, if you define <o1> you should not also define <i1>.

Description

Internal configuration of a Versiport



Digital Output Mode

When a Versiport is operating in digital output mode, the output pin will be shorted to ground on the rising edge of the corresponding `<o>` signal (switch S1-B in the Versiport diagram will be closed). When `<o>` goes low, the output pin is driven to a value of +5V (switch S1-B is open).

Driving the corresponding `<pu-disable>` signal high can modify this behavior. This is not recommended, though, since it will cause the output pin to float when `<o>` goes low.

Example 1 (recommended):

The `<pu-disable1>` signal is driven low or left undefined. When `<o1>` goes low, Versiport 1 is at +5V. When `<o1>` goes high, Versiport 1 is shorted to ground.

Example 2 (not recommended):

The `<pu-disable1>` signal is driven high. When `<o1>` goes low, Versiport 1 is floating. When `<o1>` goes high, Versiport 1 is shorted to ground.

Digital Input Mode

When a Versiport is operating in digital input mode, the corresponding `<i>` signal will go high whenever the C2I-IO8 detects that the Versiport is shorted to ground (threshold `< +2.5V>`).

NOTE: Here, as with digital output mode, the corresponding pullup resistor should be enabled. That is, `<pu-disable>` should be given the signal name 0 or left undefined; otherwise the input will always read as logic low.

Example 3:

When Versiport 3 is shorted to ground, `<i3>` will go high. When Versiport 3 is not shorted to ground, `<i3>` will go low (so long as `<pu-disable>` equals 0 or is undefined).

Analog Input Mode

In analog input mode, the Versiport is typically tied to a resistive load (such as a humidity sensor) or a voltage source (both can be represented by box "A" in the Versiport diagram).

When a resistive load is tied to a Versiport, the corresponding pullup resistor must be enabled (again, this means that **<pu-disable>** should be given the signal name 0 or left undefined). This creates a voltage divider and provides a varying voltage level, based on the current resistance of the sensor for the C2I-IO8 to read.

Example 4:

A resistive humidity sensor is tied to Versiport 1 (and **<pu-disable1>** is low or undefined). **<i1>** will assume the corresponding analog value.

When a voltage source is tied to a Versiport, the corresponding pullup resistor should be *disabled* (the only case where the default setting should be overridden). This allows the C2I-IO8 to read the value of the voltage source directly.

Example 5:

A voltage source is tied to Versiport 1 and **<pu-disable1>** is given the signal name 1. **<i1>** will assume the corresponding analog value (ranging from 0 to 65535, or 0 to +10V on the input pin).

The C2I-IO8 does not propagate all changes in the analog values of its Versiports, since this can lead to undesirable results if the input source is not clean or has jitter. Rather, the **<MinChange>** signals should be used to specify a "minimum change" value, such that the C2I-IO8 will not propagate the new value until it changes by **<MinChange>**. (The default minimum change value is 2048.)

Example 6:

A voltage source is placed on Versiport 1 and **<MinChange1>** is set to 10 via an Analog Initialize symbol. The value of **<i1>** will not be propagated until it changes by at least 10. If the current value is 500, then a new value will not be reported until it changes to 510 or 490.

Slot 5: C2I-RY8

The C2I-RY8 provides eight isolated relays for controlling low voltage contact closure devices such as drapes, screens and lifts.

In Program Manager, drag the C2I-RY8 symbol from *Program View* to *Detail View*. The symbol contains the following signals:

Signals

- 8 relays: **<A1>** through **<A8>**

When a signal goes high, the corresponding relay closes for as long as the signal remains high. When the signal goes low, the relay opens. If a signal is undefined, the relay is open.

Slot 6: C2Net-Device

The C2Net-Device slot enables the PAC2 to control up to 252 Cresnet devices. Each Cresnet device is assigned a unique identifier called a Net ID, which is a hexadecimal value ranging from 03 to FE.

To view the list of supported devices, expand the control system in the bottom pane of *System Views* and double-click the C2Net-Device slot, or right-click and select **Add Item** from the submenu. Supported devices include network control modules, lighting modules and a variety of Crestron wired touchpanels.

To add a device to the system, expand the C2 Net-Device slot and double-click the desired Net ID, or right click and select **Add Item** from the submenu. Then select the device you want to add. Alternatively, you can drag the device from the Cresnet Modules folder onto the Net ID.

In Program Manager, the C2Net-Device symbol contains no signals; to program a controlled Cresnet device, expand the C2Net-Device symbol in *Program View*. Then drag the device to *Detail View*.

Slot 7: C2I PAC2-Front Panel

The C2I-PAC2-Front Panel symbol represents internal hardware and is not user programmable.

Converting Programs and Modules Created for other Systems

A useful feature of SIMPL Windows is to convert a program created for another type of control system, simply by changing the target to a PAC2.

To do this you first open SIMPL Windows, then drag the PAC2 from the Control Systems folder on the existing control system in *System Views*, drop it on top of the existing control system, and click **Yes** when prompted to confirm the replacement.

If the program contains SIMPL+ or User modules, the conversion might generate error messages. This is because modules and programs often contain symbols with “ambiguous” signals. For example, the inputs of the Serial to Analog symbol can be defined as either analog or serial. Although X-Series processors support ambiguous signals, the 2-Series processor requires all signal types to be strictly defined.

If the program you want to convert contains SIMPL+ or User modules, Crestron recommends that you first convert each module before converting the larger program. In this way, the compiler can resolve any ambiguous signals in the modules and minimize errors when the larger program is converted.

Converting SIMPL+ Modules

1. Open the SIMPL+ module you want to convert.
2. Choose the 2-Series processor as the target by clicking the toolbar button, as shown in the following illustration.

SIMPL+ Toolbar



NOTE: You can select both X and 2-Series as the targets, so that the module will work for both control system types. However, you will be limited to SIMPL+ keywords and functions that are supported on both systems. If you do not choose a target, then the module may or may not work, depending on the constructs that are used.

3. Save and compile the module by clicking the **Save and Compile** toolbar button; alternatively, click **Save and Compile** on the **Build** menu (or press **F12**).

Converting User Modules

1. Open the User module you want to convert.

2. Click **Project | Edit Program Header**.
3. Click **2-Series** in the *Target Control System Classes* list box (refer to graphic below).

You can select other types of control systems as well, but then you will be limited to symbols that are supported by all of these platforms. The module may still work on unselected control systems so long as unsupported symbols are not used. Selecting a control system means that you are *requiring* the module to work there.

“Module Header Information” Window

After you convert each module in a program, you can convert the program as described previously: drag the PAC2 onto the existing control system in *System Views* and click **Yes** to confirm the replacement.

For further information about compile-time errors and detailed explanations about working with modules, refer to the SIMPL Windows online help file.

Problem Solving

Problems may occur with the 2-Series automation control system itself or there may be serial communication difficulties with other devices connected to the control system. The next two sections address possible problem solving tools or procedures for each situation.

Possible Problems with the Control System

Troubleshooting the Control System

The following table provides corrective action for possible trouble situations. If further assistance is required, please contact a Crestron customer service representative.

2-Series Integrated Dual Bus Control System Troubleshooting

TROUBLE	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
Unexpected response from control system.	Network devices are not communicating to the control system.	From the Viewport, poll the network (F4) to verify communication. If all devices respond, use Network Analyzer to check quality of connections and network.
PWR LED does not illuminate.	Control system is not receiving power.	Verify that supplied power cord is properly attached to control system and the other end is securely plugged into an outlet.
ERR LED illuminates.	Hardware or software failure, hardware incompatibility with software definitions, programming error, or system message.	Verify that hardware configuration matches software configuration (i.e., card is in proper slot as defined by program). Use Viewport to display the error log.
Compilation error RLCMCVT166 & RLCMCVT177.	Poor analog versus serial signal definition in the SIMPL Windows program.	Confirm proper signal definition in the program.
System locks up.	Various.	Hold down SW-R button on control system front panel to bypass program and communicate directly with processor. Refer to "Troubleshooting Communications" for more details. Refer also to the "Troubleshooting Non-Functioning Units" procedures following this table.
A/V system device does not respond.	Serial port not placed properly.	Verify serial cables are tightened.
	Used wrong serial port.	Verify that proper serial port is defined.
	Serial cable miswired.	Verify that serial cable is wired correctly for RS-232, 422, 485.

Troubleshooting Non-Functioning Units

Perform the following procedure to correct system lock-up problems that are not resolved via the procedures in "Setting Network IDs in D3 Pro" on page 21.

1. Connect a DB9 straight-through RS-232 cable between the PAC2 and a PC. Refer to "Establishing Communication with the PAC2" on page 19 for more information.

2. Open Viewport and select **Setup | Communication Settings** to open the “Port Settings” window.
3. In the window, select **RS-232** (Connection Type), **57600** (Baud Rate), **N** (Parity), **8** (Data Bits) and **1** (Stop Bits) and click **OK**.
4. Power down the PAC2.
5. While powering up the PAC2, press and hold **ALT** and **K** on the keyboard until the following text (or similar) appears in Viewport:

```
System Monitor [v1.001 (0001)]
12-19-01 16:25:23 32 MB RAM, 4MB FLASH
CS>
```

NOTE: After this, you can increase the baud rate to 115200 (for faster communication) by pressing F8 on the keyboard and then selecting 115200 from the “Set Baud Rate” window.

6. At the Viewport prompt, type **erase** and press Enter. The following text appears in Viewport.

```
CS>erase
->25%->50%->75%->100%
Done
CS>
```

7. Press **ALT** and **O** (not zero) on the keyboard. The “Open” window appears.
8. Find and select the correct firmware file (.CUZ) and click **Open**.

Once “Completed Successfully” appears in Viewport, type **quit** at the Viewport prompt and press Enter.

Network Analyzer

To assist with troubleshooting, the unit contains Crestron’s patent-pending network analyzer to continuously monitor the integrity of the Cresnet network for wiring faults and marginal system performance or other network errors. For more information on how to use the network analyzer, refer to the SIMPL™ Windows® help file and use the index to search for “Network Analyzer”.

NOTE: The PAC2s network analyzer will also monitor the networks connected through the built-in hub/repeater.

Battery Replacement

A Lithium battery is used to power the system clock within the 2-Series automation control system. Under normal conditions, it will last for approximately 10 years. In the event that the clock fails, only an authorized technician should replace it. Refer to caution statement below.

CAUTION: Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

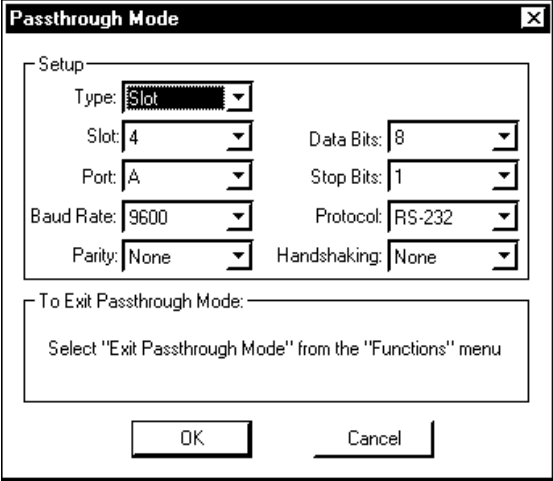
Serial Communication Difficulties with Other Devices Connected to the Control System

It is possible to determine if a communication problem is in the control system or in the device itself by using passthrough mode. Passthrough mode allows data to pass directly from the COMPUTER port to the selected COM port on a Cresnet or Ethernet device (such as ST-COM or CEN-COM), effectively “passing through” the control system. While passthrough mode is running, the program currently in memory is suspended and will not execute. When passthrough mode is exited, the program resumes operation.

Entering passthrough mode for one of the internal COM ports reinitializes it, which clears the data for that port. The COM analyzer also functions while the unit is in passthrough mode.

Passthrough mode is accessed from the Crestron Viewport by selecting **Functions | Enter Passthrough Mode (CNX / 2-Series only)**. The window, shown after this paragraph, is used to select the port configuration for passthrough mode. For more information, refer to “Remote Menu” in the Viewport Help files.

“Passthrough Mode” Window



The screenshot shows a window titled "Passthrough Mode" with a close button (X) in the top right corner. The window contains a "Setup" section with the following fields:

Type:	Slot	Data Bits:	8
Slot:	4	Stop Bits:	1
Port:	A	Baud Rate:	9600
Baud Rate:	9600	Protocol:	RS-232
Parity:	None	Handshaking:	None

Below the setup fields, there is a section titled "To Exit Passthrough Mode:" with the instruction: "Select 'Exit Passthrough Mode' from the 'Functions' menu". At the bottom of the window are two buttons: "OK" and "Cancel".

Further Inquiries

If after reviewing this Operations Guide, you cannot locate specific information or have questions, please take advantage of Crestron's award winning customer service team in your area. Dial one of the following numbers.

- In the US and Canada, call Crestron's corporate headquarters at 1-888-CRESTRON [1-888-273-7876].
- In Europe, call Crestron International at +32-15-50-99-50.
- In Asia, call Crestron Asia at +852-2341-2016.
- In Latin America, call Crestron Latin America at +5255-5093-2160.
- In Australia and New Zealand, call Crestron Pacific at +613-9480-2999.

Future Updates

As Crestron improves functions, adds new features, and extends the capabilities of the PAC2, additional information may be made available as manual updates. These updates are solely electronic and serve as intermediary supplements prior to the release of a complete technical documentation revision.

Check the Crestron website (www.crestron.com) periodically for manual update availability and its subjective value. Updates are available from the Downloads | Product Manuals section and are identified as an “Addendum” in the Download column.

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1. No merchandise may be returned for credit, exchange, or service without prior authorization from CRESTRON. To obtain warranty service for CRESTRON products, contact the factory and request an RMA (Return Merchandise Authorization) number. Enclose a note specifying the nature of the problem, name and phone number of contact person, RMA number, and return address.
2. Products may be returned for credit, exchange, or service with a CRESTRON Return Merchandise Authorization (RMA) number. Authorized returns must be shipped freight prepaid to CRESTRON, Cresskill, N.J., or its authorized subsidiaries, with RMA number clearly marked on the outside of all cartons. Shipments arriving freight collect or without an RMA number shall be subject to refusal. CRESTRON reserves the right in its sole and absolute discretion to charge a 15% restocking fee, plus shipping costs, on any products returned with an RMA.
3. Return freight charges following repair of items under warranty shall be paid by CRESTRON, shipping by standard ground carrier. In the event repairs are found to be non-warranty, return freight costs shall be paid by the purchaser.

CRESTRON Limited Warranty

CRESTRON ELECTRONICS, Inc. warrants its products to be free from manufacturing defects in materials and workmanship under normal use for a period of three (3) years from the date of purchase from CRESTRON, with the following exceptions: disk drives and any other moving or rotating mechanical parts, pan/tilt heads and power supplies are covered for a period of one (1) year; touchscreen display and overlay components are covered for 90 days; batteries and incandescent lamps are not covered.

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CRESTRON shall not be liable to honor the terms of this warranty if the product has been used in any application other than that for which it was intended, or if it has been subjected to misuse, accidental damage, modification, or improper installation procedures. Furthermore, this warranty does not cover any product that has had the serial number altered, defaced, or removed.

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Operations Guide – DOC. 5941
12.02

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