Crestron **AV2 & PRO2**
2-Series Integrated Dual Bus Control System
Operations Guide

CRESTRON

This document was prepared and written by the Technical Documentation department at:

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Integrated Dual Bus Control System: AV2 & PRO2

Introduction

Features and Functions

Crestron's AV2 and PRO2 2-Series Integrated Control Processors are designed for medium to large home and commercial network systems. Like all Crestron control processors, the AV2 and PRO2 units house the control system software program and provide connectivity for communication and control of all devices on the network.

High performance front panel diagnostics and monitoring make the PRO2 ideal for sophisticated control of even the most complex audio, video, lighting, security, and HVAC systems. The AV2 is functionally identical to the PRO2, with the exception that it does not provide the front panel diagnostics and monitoring. Both units are fully expandable with one Z-BUS; three Y-BUS slots are standard on the PRO2 and optional on the AV2.

Functional Summary

- Powered by 2-Series Control Engine
- 36 MB of Internal Memory*
- 4 GB Expansion Slot for Type II Compact Flash and IBM Microdrive® Hard Disk Drive
- Front Panel Diagnostics and Monitoring (PRO2 only)
- 8 IR/Serial Ports
- 8 Isolated Relay Ports
- 8 I/O Versiports
- 6 RS-232/422/485 Ports
- 2 RS-232 Computer Ports (1 front; 1 rear)
- 1 Cresnet Port
- Supports SIMPL™ Windows® & SIMPL+™
- 1 Z-Bus Expansion Slot
- 3 Y-Bus Expansion Slots (Optional on AV2)

* For more information on internal memory usage, refer to "On-Board Memory" on Page 13.

As with all of Crestron's 2-Series control processors, the 2-Series Control Engine is a solutions-driven control technology that is at the very heart of the AV2 and PRO2 Integrated Control Systems. With speed, power, and massive memory, the 2-Series control systems are ideal for enhanced applications like media help desks, videoconferencing, distance learning, and entertainment facilities.

The breakthrough 2-Series control engine is based on the new 257 MIPS, 32-bit Motorola ColdFire® processor. Onboard 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, allowing 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. This dual bus architecture also permits upgrade to new, second generation, higher performance expansion cards, while still using existing cards and software programs. The 40Mb/s Y-BUS supports existing CNX control cards and serves as the pipeline for IR, serial communications, and relays. The 300Mb/s Z-BUS is designed for super high-speed control card applications such as 10/100 Ethernet, USB, USBII, FireWire, disk drive arrays and more.

The 2-Series also provides truly secure network communications, which is required for today's corporate networks and the Internet. A Built-in Firewall delivers the ultimate in security, with Network Address Translation and Router functions.

Network Address Translation (NAT) 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. The Dual Port 10/100 BaseT Ethernet card supports dynamic and static IP addressing and full duplex TCP/IP and UDP/IP. It offers a WAN port for Internet and corporate-wide communications and a LAN port for room use. 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).

The built-in Web Server uses either internal memory or compact flash card memory for remote access and control.

The 2-Series operating system is vastly upgraded, yet compatible with existing Crestron software and programming. Any existing Crestron SIMPL™ Windows® control program can be easily 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.

Specifications

Specifications for the AV2 and PRO2 are given in the following table.

AV2/PRO2 2-Series Integrated Control System Specifications

SPECIFICATION	DETAILS
CPU	32-Bit Motorola ColdFire® Processor
Processor Speed	257 MIPS (Dhrystone 2.1 Benchmark)
Onboard 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®
Dual Bus Architecture	
Y-BUS (Optional on AV2) 40 Mb/s Parallel Communications	3 Expansion Card Slots[2]
Z-BUS 300 Mb/s Parallel Communications	1 Expansion Card Slot[3]
Ethernet (Optional Z-BUS cards)	Dynamic/Static IP Addressing
	Full Duplex TCP/IP and UDP/IP
	Built-in Firewall for Ultimate Security (Dual Port Only)
	Built-in Network Address Translator (Dual Port Only)
	Built-in Router – Built-in Web Server (Dual Port Only)
Ports/Connectors[4]	
NET	1 – Cresnet 4-wire interface (Expandable via Cresnet Poll Accelerator) [5]
COMPUTER	2 – DB9F PC interface (front and rear panel access)
INFRARED – SERIAL OUTPUT	8 – Simultaneous one-way IR or serial output
I/O	8 – Programmable digital/analog inputs & digital outputs
RELAY OUTPUT	8 – Normally open, isolated relays (MOV suppression)
COM (A through F)	6 – DB9 bidirectional serial ports (RS-232, -422, -485); ports C - F are Cresnet Poll Accelerator ready[5]
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 (DC) available for Cresnet devices
Reset Buttons	HWR - Initiates system hardware reset
	SWR – Program Restart / Program Bypass
LCD Display (PRO2 only)	Reverse mode (yellow on black) LCD backlight; 2 lines, up to 40 characters per line.
Environmental Temperature &	41° to 113°F (5° to 45°C)
Humidity	10% to 90% RH (non-condensing)
Dimensions & Weight	Height: 3.47 in (8.81 cm)
	Width: 19.0 in (48.26 cm) – with ears
	17.03 in (43.24 cm) – without ears
	Depth: 9.69 in (24.61 cm)
	Weight: 7.10 lb (3.22 kg) – AV2 with line cord
	8.00 lb (3.62 kg) – PRO2 with line cord

1   For more information on system memory usage, refer to "On-Board Memory" on page 13.

2   40 Mb/s parallel communications and supports current and enhanced Crestron 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   For more information on controls, ports, and indicators, see "Physical Description" on page 4.

5   Cresnet Accelerator increases effective network speed, fan-out, and device addresses by a factor of 8 for each Poll Accelerator added to the system.

Physical Description

The AV2/PRO2 integrated control systems are housed in black enclosures with labeling on the front and rear panels. The dimensions shown in the following illustration apply to both units.

AV2/PRO2 Overall Dimensions

Front and Rear Panels

The front panels of both units include a single RS-232 computer port, standard LEDs, and two reset buttons. The PRO2 front panel also includes a two-line, 40-character per line reverse LCD screen with menu function and selection buttons, and an extended bank of LED indicators. With the exception of the front panel computer port, all connections to the units are made through their rear panels.

The front panels of the AV2 and PRO2 are shown below.

AV2/PRO2 Front Panels

The rear panels of the units are shown below and on the next page. Both units contain a single RS-232 computer port, six COM ports, eight one-way IR/serial ports, eight I/O ports, eight relay ports, a standard 4-wire Cresnet interface connector, and a memory expansion slot.

The Z-BUS slot of both units is shown populated with a C2ENET-2 Ethernet Interface card. The AV2 is shown with the optional Y_BUS card cage installed-no cards mounted; the PRO2 is shown with the Y-BUS slots fully populated.

AV2/PRO2 Rear Panels
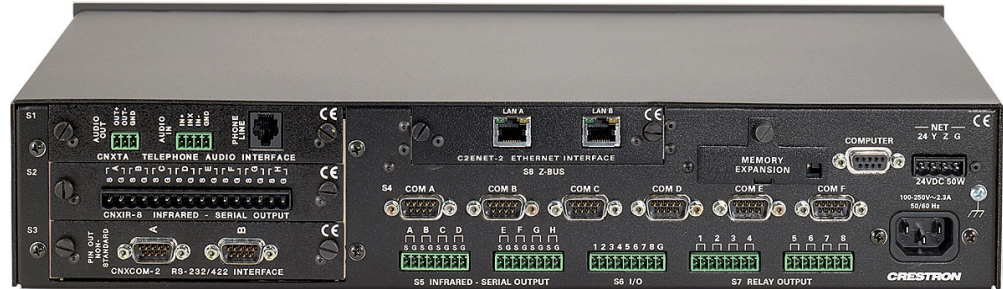
Rubber feet are supplied and can be attached to the base of the unit for stability and to prevent slippage in shelf placement and stacking configurations. The unit may also be rack mounted by attaching the supplied metal flanges (ears). Refer to "Rack Mounting" on page 15 for details.

Ports

The ports provided on the front and rear panels of the AV2/PRO2 integrated control systems are described below.

COM (A – F)
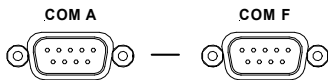
These six software programmable bidirectional serial ports are used for RS-232, RS-422, or RS-485 communication with hardware and software handshaking. Speeds are rated up to 115,200 bps. Ports C through F are Cresnet Poll Accelerator ready. The Cresnet Poll Accelerator effectively increases the network speed, fan-out, and device addresses by a factor of 8 for each Poll Accelerator added to the system. For more information, refer to "Slot 4: C2I-COM6" on page 28.

NOTE: The pinout of each 9-pin port is non-standard (refer to the table after these notes, titled "Non-Standard COM Pinout"); it contains RS-422 pins in addition to RS-232. This may result in a conflict with some equipment and therefore all nine pins should **not** be used. Only the required pins for each communication type should be connected. For RS-232 and –422, pins 2, 3, 5, 7, and 8 are wired straight through.

NOTE: Data Set Ready (DSR) and Data Terminal Ready (DTR) are not supported.

NOTE: To support RS-485, tie pin 1 (RXD-) to pin 9 (TXD-) and pin 4 (TXD+) to pin 6 (RXD+) in the cable (refer to the table after this note, titled "COM Pinout to RS-485 Bus".


Non-Standard COM Pinout

PIN	DIRECTION	DESCRIPTION
1*	To AV2 or PRO2	(RXD-) RS-422 Receive Data (Idles low)
2	To AV2 or PRO2	(RXD) RS-232 Received Data
3	From AV2 or PRO2	(TXD) RS-232 Transmitted Data
4	From AV2 or PRO2	(TXD+) RS-422 Transmit Data (Idles high)
5		RS-232 and RS-422 Signal Common
6	To AV2 or PRO2	(RXD+) RS-422 Receive Data (Idles high)
7	From AV2 or PRO2	(RTS) RS-232 Request to Send
8	To AV2 or PRO2	(CTS) RS-232 Clear to Send
9	From AV2 or PRO2	(TXD-) RS-422 Transmit Data (Idles low)

Where: *= RS-422 transmit and receive are balanced signals requiring two lines plus a ground in each direction. RXD+ and TXD+ should idle high (going low at start of data transmission). RXD- and TXD- should idle low (going high at start of data transmission). If necessary, RXD+/RXD- and TXD+/TXD- may be swapped to maintain correct signal levels.

COM Pinout to RS-485 Bus

| COM (DB9) CONNECTOR	RS-485 BUS
Tie Pins 1 & 9	-
Tie Pins 4 & 6	+
Pin 5	G

INFRARED – SERIAL OUTPUT
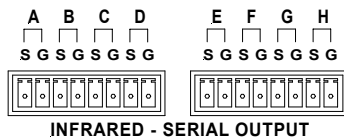
These connectors provide eight serial outputs for IR or serial interface. Each output is labeled S (signal) and G (ground). Infrared output is rated up to 1.2 MHz, at data rates up to 115K. Serial protocols include one-way RS-232. For detailed information, refer to "Slot 5: C2I-IR8" on page 29.

NOTE: Transmission levels on the infrared – serial output connectors are in the 0 to +5VDC range, which may not be compatible with all RS-232 devices.

I/O
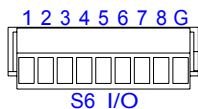
On the rear panel there are eight software programmable analog and digital inputs as well as digital outputs. Digital outputs offer 250mA sync from maximum 24 VDC; catch diodes for use with "real world" loads. Digital inputs are rated 0 – 24 VDC, 20K ohms input impedance, logic threshold 1.25 VDC. Analog 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 6: C2I-IO8" on page 29.

**NOTE:** Digital outputs are TTL values and may not work with devices requiring a "dry" contact closure (e.g., low voltage motor controllers).
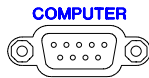
RELAY OUTPUT
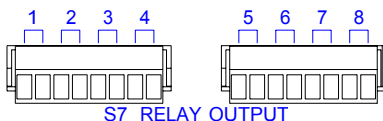
These connectors provide eight normally open, isolated relay contact groups. Each relay contact closure is rated 1A, 30 VAC/DC; MOV arc suppression is provided across contacts for use with "real world" loads. For detailed information, refer to "Slot 7: C2I-RY8" on page 32.
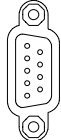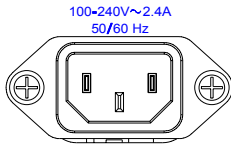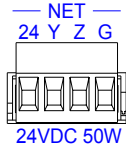
COMPUTER

These DB9F connectors (one on front panel and one on rear) are used when programming with a PC. Each port is modem compatible. The modem and/or PC program cable is not included.

NET

This connector (typical Crestron network port labeled 24 Y Z G) is used for expansion to Cresnet devices. Depending on the expansion slot load, there is a 50 W maximum load rating. Refer to "Network Wiring" on page 17 for details.

(Chassis Ground)

Use this chassis screw to connect the common ground of other system device(s) common ground(s) to the AV2/PRO2.

100 – 240V ~ 2.4A 50/60 Hz (Power Supply)

This is an internal universal power supply connector. Use the supplied power cord to connect to an AC outlet.

Indicators

The indicators provided on the front panel of the AV2/PRO2 integrated control systems are described below.

PWR (Power)

This LED illuminates when the unit is connected to and receives power from an AC outlet.

NET

This LED illuminates 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 hardware or software failure, missing/wrong card placed in a slot, or a programming error. To decipher content, examine the message available from the menu function buttons or through Viewport.

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

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.

NOTE: The LEDs described after this note appear only on the PRO2 configuration.

RXD (COM A - F)

These LEDs illuminate during reception of data from serial devices attached to the respective COM ports.

TXD (COM A - F)

These LEDs illuminate during transmission of data to serial devices attached to the respective COM ports.

RTS (COM A - F)

These LEDs illuminate to reflect the state of the RTS pin on the respective COM port. An illuminated LED means that the RTS line is high. If no handshaking is specified, the RTS line will be high and therefore, the associated LED is also high. When RTS flow control is enabled, RTS indicates the unit is ready to receive data from serial devices attached to the respective COM ports.

CTS (COM A - F)

These LEDs illuminate to reflect the state of the CTS pin on the respective COM port. An illuminated LED means that the CTS line is high. When CTS flow control is enabled, CTS indicates the serial devices on the respective COM ports are ready to accept data from the unit.

IR – SERIAL (A - H)

These LEDs illuminate during activity on the respective IR/SERIAL lines.

INPUT – OUTPUT (1 - 8)

These LEDs illuminate when the input voltage thresholds for the respective I/O ports are exceeded or when the output is active.

RELAY (1 - 8)

These LEDs illuminate when the respective relay is closed.

SLOT (1 - 3)

These LEDs illuminate when an expansion card is inserted into the respective slots. These LEDs extinguish momentarily when data is sent to the card or received from the card.

Reset Buttons

Two buttons are provided on the front 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.)

SW-R

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

PRO2 LCD Screen

The front panel of the PRO2 incorporates a reverse mode (yellow on black) LCD screen, shown below. The screen contains two lines with up to 40 characters per line; it is used to extend features and gain access to the system including the SIMPL program. To the right of the display are four menu selection buttons. These buttons

permit the user to navigate through the menus and also to control the brightness of the display backlight. Below the display are six menu function buttons. These buttons offer extended features of the PRO2. For details, refer to "Programming the LCD Screen (PRO2 only)" on page 34.

Main Menu
(Default LCD Display)

LCD Screen with Menu Selection and Menu Function Buttons

Menu Selection Buttons

MENU

This menu selection button functions as a return and will eventually bring the screen display to the menu default state (Main Menu).

These buttons scroll the listed information UP and DOWN.

BKLT

This button adjusts the brightness of the LCD backlight and the front panel LEDs.

Menu Function Buttons

PANEL

NOTE: If the unit does not have a loaded program with front panel screens defined, the PANEL menu function does not appear on the Main Menu.

This menu function button displays a programmable interface offering command text, indirect text, and hierarchical screen structure. The menu contents are subject to programming and an example of this display is provided in "Programming the LCD Screen (PRO2 only)" on page 34.

INFO

This button displays the default Info Menu, shown after this paragraph. System information, including the loaded SIMPL program version (Rems), hardware specs such as types of expansion cards installed in the card slots (HWare), the Cresnet devices detected (Net), the Ops version (Ops), and the communication settings (Com), is displayed.

NOTE: The information within each of the commands displayed in the Info Menu may exceed the 40 characters permitted per line. If this occurs, use the two right-most menu function buttons to scroll left and right. Refer to the two arrows shown beneath the Info Menu illustrated after this note for location and identification.

Default Info Menu

USE THESE TWO BUTTONS TO REVIEW
INFORMATION SHOWN AFTER ENTERING THE
Rems, HWare, Net, Ops, and Com COMMANDS.

SCROLL
FIELD
LEFT

SCROLL
FIELD
RIGHT
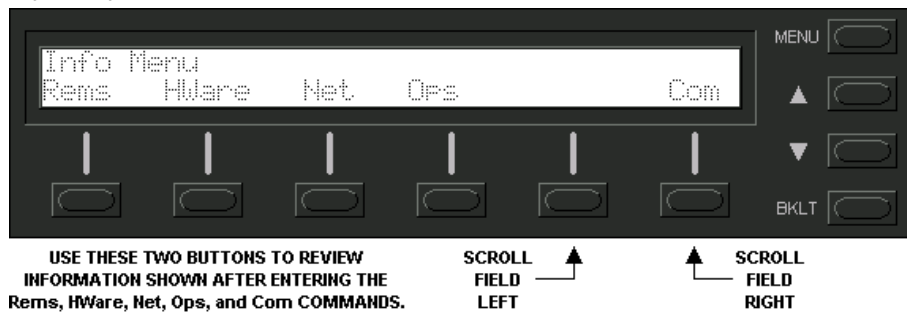
MSG

This button displays a list (error log) of the most recent errors. Error messages may be the result of hardware or software failure, hardware incompatibility with software definitions, or a programming error. The following table lists and defines the four types of error messages that may appear:

Error Message Types

TYPE	DEFINITION
Notice!	An event has occurred that is noteworthy, but will not affect program operation.
Warning	An event has occurred that could affect program operation, but the program can still run normally.
Error	An event has occurred that indicates that the program is not operating as expected.
Fatal	An event has occurred that will prevent the program from running..

The top line of the LCD screen provides a single error message from the error log. In the sample shown below, the message indicates that the system expects a card to be inserted into slot 1. The bottom line of the LCD screen provides commands. The user can use **NEXT** or **PREV** to scroll through the entire error log. Some messages may be too long to be displayed across the top line of the LCD screen; use << and >> to scroll left and right, respectively, or examine them through Viewport. Users may wish to periodically save the error log to a file. This can be an invaluable aid in troubleshooting problems with the control system. In Viewport, select **Function | 2-Series | Error Log | Save Error Log to File** and follow the prompts.

The **CLEAR** button can to used to empty the error log and extinguish the ERR front panel LED. A security message prompts the user to confirm the command.

NOTE: The up and down menu selection buttons to the right of the LCD screen may be used in lieu of the **NEXT** and **PREV** menu function buttons.

MSG Submenu with Sample Message

TIME

This menu can only be obtained by entering the correct access code. The default access code is 1234. Use the Viewport (**Functions | Set Front Panel Password (CNX / 2-Series only)**) to assign a unique access code.

The default Date/Time Menu, shown after this paragraph, permits alterations to the current system date and time shown on the top line. Select either Date or Time to open the respective submenu.

Default Date/Time Menu

The Date Set submenu, shown after this paragraph, permits alterations to the current system date, shown on the top line. Use the Dn (down) and Up selection buttons for month, day, and year decremental or incremental changes, respectively.

Date Set Submenu

The Time Set submenu, shown after this paragraph, permits alterations to the current system time, shown on the top line. Use the Dn (down) and Up selection buttons for hour and minute (Min) decremental or incremental changes, respectively. The AM/PM selection button toggles between AM and PM.

Time Set Submenu

COM

This button allows the user to monitor the transmission and reception traffic on every COM-type device and card that is active in the SIMPL Windows program that is loaded into the 2-Series control system. This includes all devices connected via Cresnet (e.g. ST-COM) and Ethernet (e.g. CEN-COM) as well as the built-in card (slot 4) and cards inserted into the expansion slots (e.g. CNXCOM-2 and C2COM-3). Serial transmission to IR ports can also be monitored. Refer to "COM Analyzer" on page 41 for details.

> **NOTE:** Only COM-type devices and cards in the SIMPL Windows program that are active (not commented out) are monitored.

On-Board Memory

The AV2 and PRO2 each have 36MB of built-in memory (non-volatile and volatile). A total of 36MB is broken down as follows: 4MB 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 below 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 following table 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 (onboard) 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 onboard 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 rear 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 and 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 and 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).

$$CE \quad \mathbf{C}$$

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

Rack Mounting

WARNING: To prevent bodily injury when mounting or servicing this unit in a rack, take special precautions to ensure that the system remains stable. The following guidelines are provided to ensure your safety:

■ The unit should be mounted at the bottom of the rack if it is the only unit in the rack.

■ When mounting this unit in a partially filled rack, load the rack from the bottom to the top with the heaviest component at the bottom of the rack.

■ If the rack is provided with stabilizing devices, install the stabilizers before mounting or servicing the unit in the rack.

NOTE: If rack mounting is not required, rubber feet are provided for shelf placement or stacking. Apply the feet near the corner edges on the underside of the unit.

NOTE: Reliable earthing of rack-mounted equipment 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).

Two "ears" are provided with the 2-Series integrated dual bus control system so that the unit can be rack mounted. These ears must be installed prior to mounting. Complete the procedure below to attach ears to the unit. The only tool required is a #2 Phillips screwdriver.

1. There are 12 screws (#6-32 x 0.375" LG) that secure the sides of the 2-Series control system top cover. Using a #2 Phillips screwdriver, remove the three screws closest to the front panel from one side of the unit.

2. Position a rack ear so that its mounting holes align with the holes vacated by the screws in step 1.

3. Secure the ear to the unit with three screws from step 1, as shown in the illustration after this step.

Ear Attachment for Rack Mounting (PRO2 shown in illustration)

FASTEN WITH THE SAME (3) COVER SCREWS
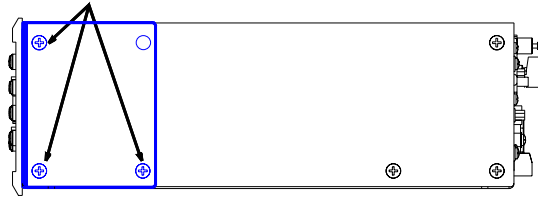
RIGHT SIDE VIEW OF PRO2 WITH
OPTIONAL RACK MOUNTING EARS INSTALLED

4. Repeat procedure (steps 1 through 3) to attach remaining ear to opposite side.

Bussing Strip Installation

The 2-Series integrated dual bus control system is supplied with two brass bussing strips to facilitate commoning (linking) of multiple terminal block connections. The bussing strips are constructed with four terminal block position, 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 ¾" wide vinyl electrical tape (such as Scotch 33+) 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. Securing a tie wrap around the bussing strip is a useful way to strain relieve the wires connected to the terminal block.

Network Wiring

NOTE: When making wire connections, refer to the latest revision of the Cresnet Network Interconnect Drawing (Doc. 5411). The document can be obtained from the Downloads | Product Manuals section of the Crestron website (www. crestron.com).

CAUTION: Possible equipment damage if miswired.

CAUTION: Exceeding the power output (maximum 50W) of the 2-Series integrated dual bus control system can result in system shutdown or a blown fuse.

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: For larger networks (i.e., greater than 28 network devices), it may be necessary to add a Cresnet Hub/Repeater (CNXHUB) to maintain signal quality throughout the network. Also, for networks with lengthy cable runs, it may be desirable to add a hub/repeater after only 20 network devices.

NOTE: Each 2-Series integrated dual bus control system has one 4-pin network connector. 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
  - 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 diagram on the next page and aside from attaching power last, complete the connections in any order. Refer to "Network Wiring" on page 17 when making network connections.

NOTE: To prevent overheating, do not operate this product in an area that exceeds the environmental temperature range listed in the table of leading 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 Integrated Dual Bus Control System
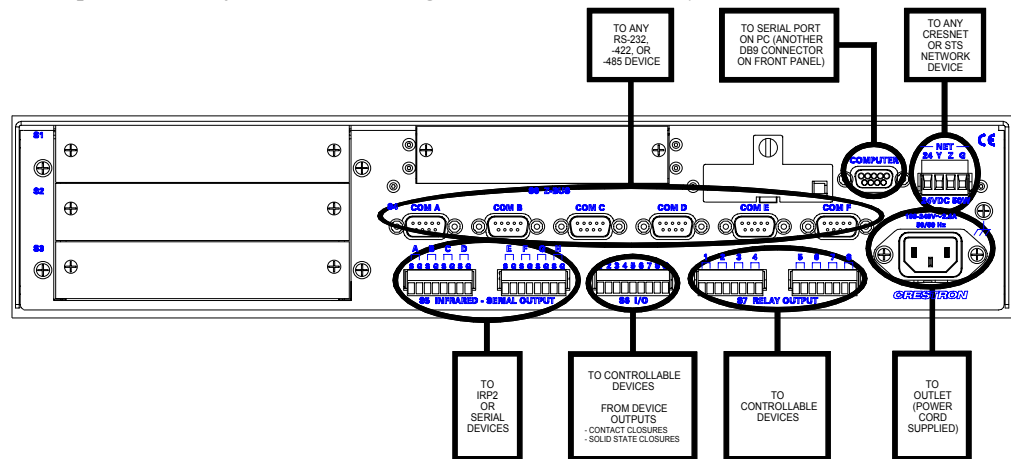
Establishing Communication with the AV2/PRO2

Before uploading a program to the AV2/PRO2 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.

Serial Connection

Connect the COMPUTER port on the control system 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 five 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. Then click **RS-232** as the connection type.

The PC communication settings specified here should match the protocol that the AV2/PRO2 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 control system 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 AV2/PRO2.

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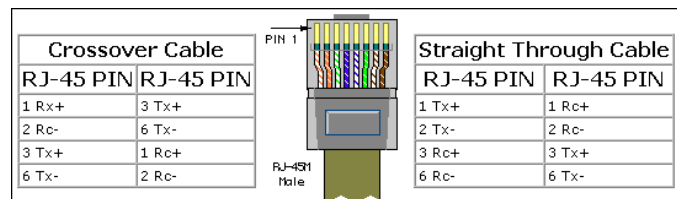
TCP/IP Connection

Before you can communicate with the AV2/PRO2 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 AV2/PRO2 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 AV2/PRO2 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 AV2/PRO2.
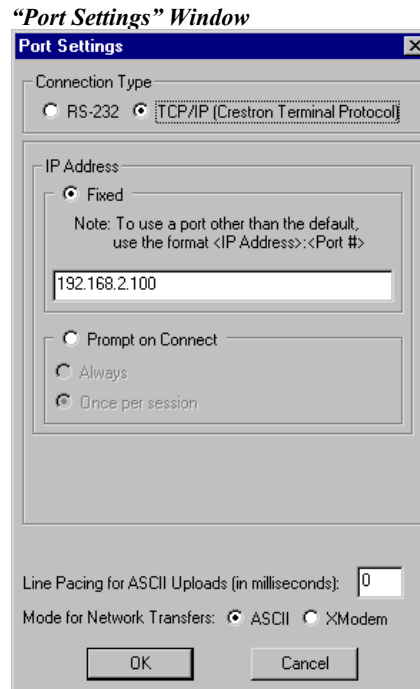
"Port Settings" Window

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

Troubleshooting Communications

Use the following checklist if communication cannot be established with the AV2/PRO2.

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 front panel of the AV2/PRO2. 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 AV2/PRO2 control system to 115200, as follows:

- Press and release the **HWR** button on the unit's front panel.

- Press and hold the **SWR** button for approximately three to five seconds. The Viewport console should display the following message:

Viewport Message

```
PRO2>
Control Console
Changing to default Comm Specs. 115200 N81 RTS/CTS
 Switch to new settings....
Bypassing Program Load!!!
```

- Release the **SWR** button.

    d.   If communication still cannot be established:

- Remove power from the control system.

- Press and hold the **SWR** button on the front panel of the AV2/PRO2.

- Reapply power to the control system.

- The Viewport console should display the message shown above.

- Release the **SWR** 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 **HWR** button. If the connection is established, the Viewport console should display some text and the **<AV2>** or <**PRO2>** prompt.

    g.   If communication still cannot be established, contact Crestron customer service.

Compiling and Uploading a Program to the Control System

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

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 control system.

1.   Immediately after compiling the program you have the option to transfer the file to the control system.

2. Alternatively, click the **Transfer** button on the SIMPL Windows toolbar, or open Viewport and click **File Transfer | Send Program**.

3. 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 control system. Simply verify that the **Retrieve Current Program before overwriting** check box is selected.

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 will be displayed:

Retrieve Program Window
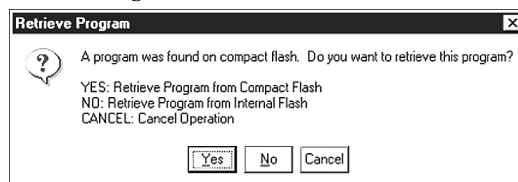
As shown above, click **Yes** to retrieve the program from Compact Flash, or **No** to retrieve the program from internal memory. Click **Cancel** to cancel the operation.

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.

"Send Program" Window
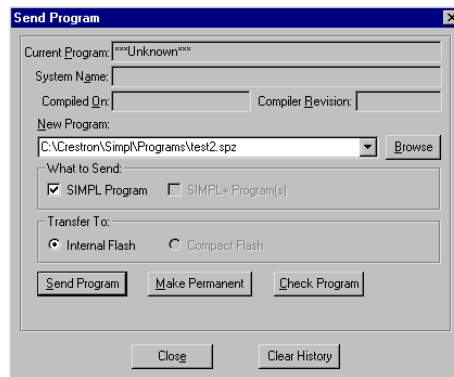
Another way to verify that the program has been transferred successfully is to select **Report Program Information** on the Viewport **Functions** menu. Program information is also displayed in the Viewport console whenever power is removed and re-applied to the AV2/PRO2.

Uploading Web pages to the AV2/PRO2

The AV2/PRO2 provides a built-in Web server for e-Control applications. The AV2/PRO2 allots 2.5 MB of memory for "user files" such as Web pages, mailbox, and the compiled 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 control system, 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 AV2/PRO2

You can use a connection to the AV2/PRO2 to upload VisionTools 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 click **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 are set in the SIMPL Windows program.)

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, 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 AV2/PRO2 have a .cuz extension. You can obtain .cuz updates (when available) from the Software Downloads section 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 | Update Control System**.
2. Browse to the .cuz file and click **Open** to start the transfer.
3. After the transfer is complete, the AV2/PRO2 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 front panel or issue a program reset through the Viewport to switch programs.

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 AV2/PRO2 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
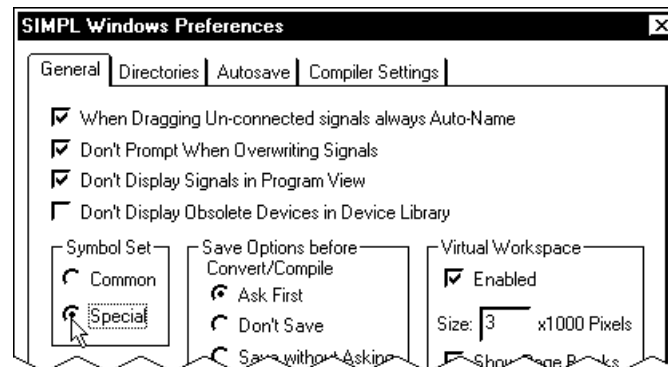
Console commands are provided for advanced programmers. However, most functions and commands can be selected from the various Viewport menus.

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 have been added 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 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.

Programming the AV2 and PRO2

You can create a program that allows you to control the AV2 or PRO2 control system using the Crestron programming tools Crestron Application Builder™ (AppBuilder) and SIMPL™ Windows®. These tools are intended for users with different levels of programming knowledge. The flexibility of each tool is proportional to the degree of programming expertise (i.e., the more flexible, the more a programmer needs to know and account for). Of course, one can initiate programming using the easiest method (Crestron AppBuilder) and use advanced techniques that are available from SIMPL Windows to customize the job.

Following are the minimum software requirements for the PC:

- SIMPL Windows version 2.00 or later, with Library Update 145. (Compact Flash functions require SIMPL Windows version 2.02.08 or higher.)

- Crestron Database version 15.6.2 or later

- (Optional) VisionTools Pro-e software for designing touchpanel pages

- (Optional) Application Builder (also requires SIMPL+ Cross Compiler) software for automatic residential and commercial programming

Programming with the Crestron AppBuilder

The easiest method of programming, but does not offer as much flexibility as SIMPL Windows.

The Crestron AppBuilder offers automatic programming for such residential and commercial applications as audio distribution, home theater, video conferencing, and lighting. The interface of this tool guides you through a few basic steps for designating rooms and specifying the control system, touchpanels, devices, and functionality. The Crestron AppBuilder then programs the system, including all touchpanel projects and control system logic.

The Crestron AppBuilder is fully integrated with Crestron's suite of software development tools, including SIMPL Windows, VT Pro-e, Crestron Database, User IR Database, and User Modules Directory. The Crestron AppBuilder accesses these tools behind the scenes, enabling you to easily create robust systems.

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 AV2/PRO2. 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.

AV2/PRO2 Device Library Symbols

In Configuration Manager, drag the AV2, AV2 with Card Cage, or PRO2 from the Control Systems folder of the *Device Library* to *System Views*. The AV2 with Card Cage and PRO2 symbols are identical; the AV2 does not provide the Y-Bus expansion slots. Refer to the following illustration.

System Views of the AV2 (without optional card cage) and PRO2
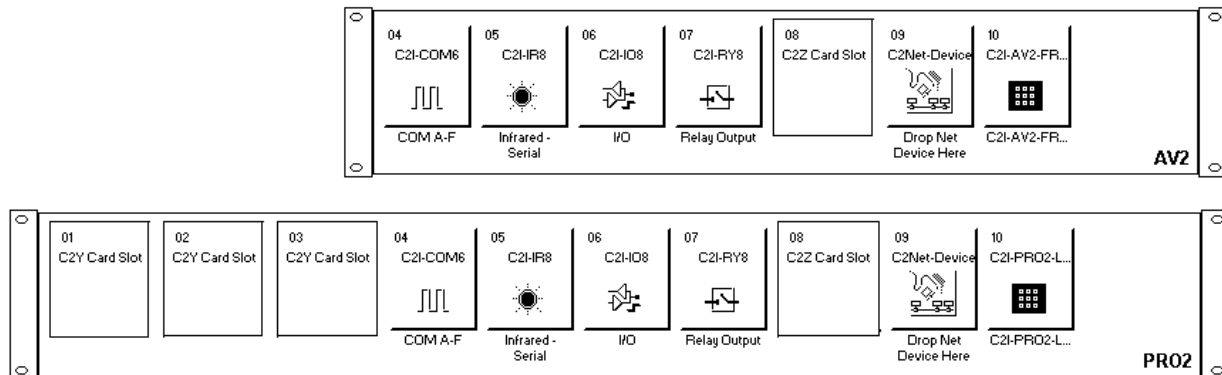
Slot 1, 2, 3: Y-Bus Expansion Slots (Optional on AV2)

The 40Mb/s Y-BUS supports existing CNX control cards and permits adding multiple IR, serial communications, and/or relay ports to the control system.

Slot 4: C2I-COM6

The AV2 and PRO2 provide six serial COM ports (A through F) that enable RS-232, RS-422, and RS-485 communication.

Each port has a built-in serial driver with communication settings that must be specified in Configuration Manager: double-click a COM port to open the "Device Settings" window, and then click the *Serial Settings* tab. These settings define the protocol that a controlled serial device expects, and include the baud rate, parity, and the number of data bits and stop bits. In addition, a device might require hardware or software handshaking, which controls the flow of data between two devices. The exact protocol will be described in the manufacturer's documentation.

The Crestron database includes numerous serial devices, with default logic and pre-configured communication settings that are compatible with the ports on the COM card. Simply drag the serial device from the Crestron Database folder to one of the ports on the COM card and click **Yes** when prompted to replace the built-in serial driver for that port. In most cases, the default logic should be loaded as well.

In Program Manager, the C2I-COM6 symbol contains no signals; to program a serial driver expand the C2I-COM6 card by clicking the plus sign in *Program View*. Then drag the desired serial driver to *Detail View*. (Alternatively, you can double-click the symbol.)

NOTE: By default, RTS idles high and the LED will remain active/illuminated.

Slot 5: C2I-IR8

The AV2 and PRO2 provide 8 output ports (A through H) that enable serial communication in a variety of formats, including infrared and one-way RS-232. Of course, different devices may require additional receiving equipment, cables, adapters, etc.

To add an IR device to the system, drag the device driver from the Crestron or User IR Database to a C2I-IR8 port.

To add an RS-232 device, drag the C2IR one-way serial driver from the Serial Drivers folder to a C2I-IR8 port. Alternatively, you can double-click a C2I-IR8 port and select the C2IR one-way serial driver (or right-click and select **Add Item** from the submenu).

Next, double-click the serial driver to specify the communication settings that are required by the device. These settings define the protocol that the controlled serial device expects, and include the speed of data transmission (baud rate), error checking (parity), and the number of data bits and stop bits. The exact protocol will be described in the manufacturer's documentation.

NOTE: The C2IR serial driver, being one way, does not provide hardware or software handshaking.

In Program Manager, the C2I-IR8 symbol contains no signals; to program an IR device or serial driver, expand the C2I-IR8 card by clicking the plus sign in *Program View*. Then drag the symbol to *Detail View*. (Alternatively, double-click the symbol.)

Slot 6: C2I-IO8

The AV2 and PRO2 provide 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 only operate in one mode. That is, if you define <**o1**> you should not also define <**i1**>.

Description

Internal configuration of a Versiport
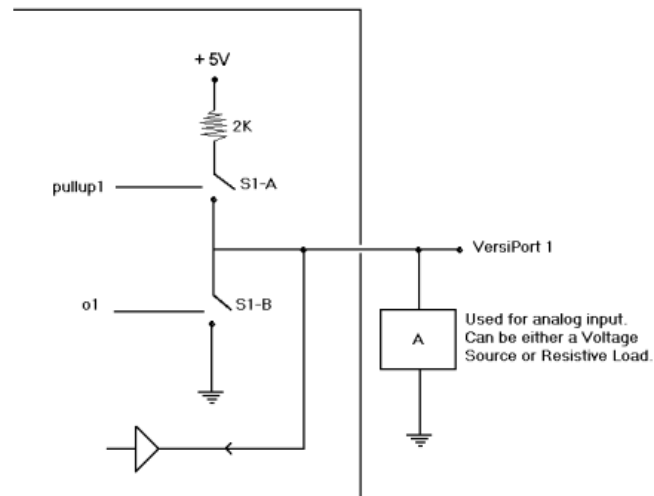
Digital Output Mode

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 7: 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 8: C2Z Card Slot

The 300Mb/s Z-BUS enables the addition of 10/100 Ethernet applications. To prepare for communicating with other devices via the Z-BUS port using a C2ENET -1 or -2 card, you must set up an IP table to identify the IP address and port ID for each of those devices. For detailed information, refer to "Creating an IP Table" in the Crestron e-Control Reference Guide, Doc. 6052. The latest version is available as a PDF on the Crestron website (www.Crestron.com).

Slot 9: C2Net-Device

The C2Net-Device slot enables the AV2 and PRO2 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*.

Converting Programs and Modules Created for other Systems

A useful feature of SIMPL Windows is that you can convert a program created for another type of control system, simply by changing the target to an AV2/PRO2.

To do this you first open the program, and then replace the existing control system with the AV2/PRO2. That is, drag the AV2/PRO2 from the Control Systems folder

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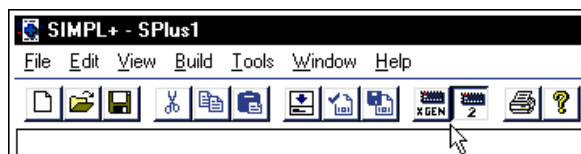
NOTE: You can select both X and 2-Series as the targets, so that the module will work for both control system types. However, you will be limited to SIMPL+ keywords and functions that are supported on both systems. If you do not choose a target, then the module may or may not work, depending on the constructs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

   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 AV2/PRO2 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.

Programming the LCD Screen (PRO2 only)

The PRO2 LCD screen is preprogrammed with a certain level of diagnostic, testing, and network device information. Assuming the PRO2 is connected to a PC running SIMPL Windows, an LCD screen programming utility (Front Panel Editor) enables a programmer to program multi-level pages under the PANEL (left-most, function) button on the LCD screen.

Front Panel Editor

The LCD screen on a PRO2 has different pages that are defined by the programmer. Menu function buttons are assigned to different pages or objects. The LCD screen has a 2x40 character display with six-programmable buttons.

In Front Panel Editor, pages are designed and added to the panel. An example of the default page is shown after this paragraph. Each front page is one display (2x40 characters) and can have as many objects as the physical size of the display allows (objects can not overlap). The top line of the panel is used for informative object displays, such as headings, indirect text, bar graphs, and time/date displays. The bottom line of the panel is for objects that are accessed by the six menu function buttons below the display. The buttons only access the page or object whose field is directly over the button. Objects added to the bottom line of the display can have page jumps or logic programming in SIMPL Windows that cause specific events to occur. These objects are initiated by pressing the function button that is associated with it.

Default Front Panel Page

Creating a Page with Front Panel Editor

NOTE: The creation of a front panel page is discussed in this section. For more details, consult the SIMPL Windows help file. Search for Front Panel Editor.

Assume that a page, as shown after this paragraph, is required. The concept of such an application is that the user can then choose a given device and then, from a lower-level page, control one or more transport functions of the device.

Example of a Front Panel Page

Adding Top-Level Pages and Objects

Use SIMPL Windows and access the Front Panel Editor by selecting **Project | Edit Front Panel**. Click on the **Add** button and enter a new name for the new page. For this example, use "Menu1 – Choose Device" as the name.

Double click on the front panel (green display area) to open the "Edit Panel Object" window. This example requires that headings be added to the page, so choose **Text Object** from the *Object Type* area. In the *Inactive Text* field, enter "Choose device" and click **OK**. The object is displayed on the panel. Click on and drag the object to its desired location on the panel, top row.

Add additional objects (VCR, DVD, CD, Lights, and Volume) to the page by double clicking in the display area where the object is to appear. Repeat the procedure in the previous paragraph; place objects over the appropriate menu function button.

NOTE: Objects on a screen can be copied and pasted for ease of design (using SIMPL Windows v2.00 or later).

Adding Lower-Level Pages and Objects

Lower-level pages can be added for each of the objects on the bottom row of the page just created. For the purpose of this example, one lower-level page is added for the *VCR* object. Simply click on the **Add** button and enter a new name for the new page. For this example, use "Menu2 – VCR Control" as the name.

Return to the "Menu1 – Choose Device" and double click on the *VCR* object. The "Edit Panel Object" window appears. From the *Page Jump* field, select "Menu2 – VCR Control", as shown after this paragraph, and click **OK**. Select the *Simulate* check box to make the Front Panel Editor simulate an actual PRO2 front panel. Click on the *VCR* function button to enable the simulated page jump. The display clears, because "Menu2 – VCR Control" has been named, but no objects have been added yet.

Selecting a Page Jump from the "Edit Panel Object" Window
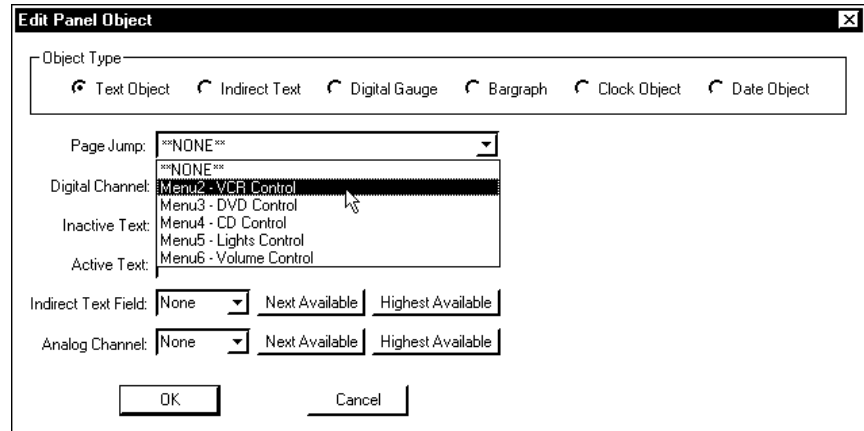
An example VCR Control page, as shown after this paragraph, has a text object that appears as a header on the top row of the display and objects that are control functions assigned to each function button. Objects in the bottom row are shown in the inactive state (none of the buttons are being pressed).

Example VCR Control Page

Use the "Edit Panel Object" window to add objects to this page. Double click on the first object (**play**). From the *Digital Channel* field in the "Edit Panel Object" window, scroll down to or enter "1". In the *Active Text* field, enter "PLAY" as the button's active text. Therefore, when the menu function button associated with digital channel 1 (the VCR button) is pressed, the active text is displayed as a visual cue that the button is pressed. Repeat the procedure for each of the other menu function buttons in the "Menu2 – VCR Control" page, except choose a unique *Digital Channel* and assign the proper control function for each button.

NOTE: Digital channels are also referred to as "join numbers". Join numbers are numeric identifiers assigned to an object or button. It is necessary to identify objects so the input/output signals of the SIMPL program can be named and routed properly. Digital channels for an object on a page are assigned from the *Digital Channel* field on the "Edit Panel Object" window.

NOTE: Pages on the Front Panel Editor can be assigned a join number to facilitate controlled page jumps. Use the "Front Panel Editor" window, as shown after this

note, to assign the join number. In the *Page Channel* area of this window, a specific number can be assigned or with the appropriate button assign the next or highest available.

Asserting the digital signal for a particular page join number (fb*** on the SIMPL Window symbol) results in a jump to that page. When the system is on a page with a join number, the digital signal corresponding to that join number is asserted for as long as the system is on that page (press *** on the SIMPL Windows symbol).

In this note, *** is used to denote a wildcard.

"Front Panel Editor" Window
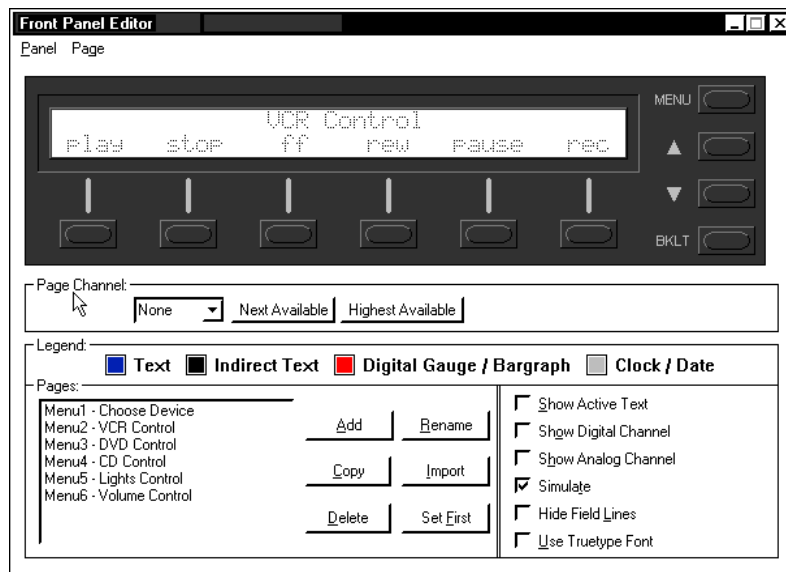
Front Panel Symbol

A powerful tool to assist programmers in naming and routing signals for the LCD screen is the **Synchronize Signals** command. While the panel appears on the PC screen, select **Panel | Synchronize Signal Names** to automatically name all the input and output signals for the front panel in the SIMPL Windows program. To confirm the assignment and display the signal names, double click on *Slot-10: C2I-PRO2-LCDPANEL Pro2 Front Panel,* which is available from the Central Control Modules folder in the *Program View* of SIMPL Windows' Program Manager. The symbol appears in *Detail View*, as shown after this paragraph.

Front Panel Symbol Displayed in SIMPL Windows' Detail View of Programming Manager
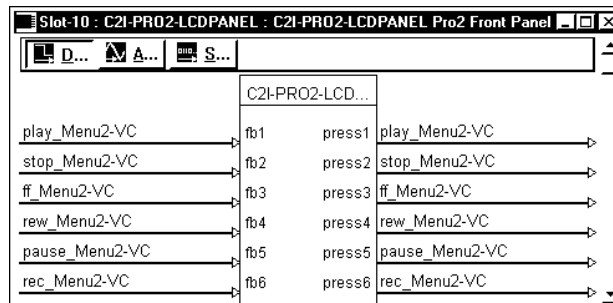
Object Types

The sample discussed in the previous sections utilizes only one of the object types available from the "Edit Panel Object" window, shown below. These object types are not new to Crestron programmers; the same types are available in VisionTools™ Pro-e.

Object Type Area in the "Edit Panel Object" Window

Problem Solving

Problems may occur with the 2-Series integrated dual bus 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.

Possible Problems with the Control System

Troubleshooting the Control System

The table on the next page 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.
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, or programming error.	Verify that hardware configuration matches software configuration (i.e., card is in proper slot as defined by program). If using PRO2, depress MSG button on front panel for specific error. 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.	IRP2 or serial port not placed properly.	Verify placement of IRP2 (hold phosphor card under IRP2 while pressing button) and tighten serial cables.
	Used wrong IR/serial port.	Verify that proper IR or 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 procedures to correct system lock-up problems that are not resolved via the procedures in "Troubleshooting Communications" on page 21.

1. Connect a DB9 straight-through RS232 cable between the AV/PRO2 and a PC. Refer to "Establishing Communication with the AV2/PRO2" 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 AV2/PRO2.

5. While powering up the AV2/PRO2, 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**.

9. 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".

Battery Replacement

A Lithium battery is used to power the system clock within the 2-Series integrated dual bus 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

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. This makes it possible to determine if the communication problem is in the control system or in the device itself. 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. The TX and RX LEDs for the given port illuminate when in passthrough mode.

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 the Viewport Help files.

"Passthrough Mode" Window
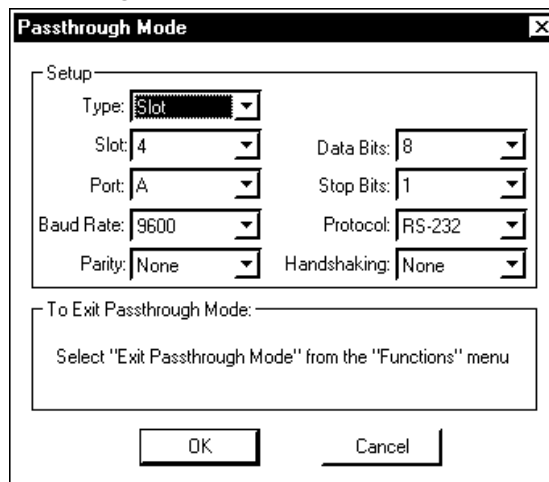
COM Analyzer

NOTE: Only COM-type devices and cards in the SIMPL Windows program that are active (not commented out) are monitored.

Depressing the COM menu function button from the front panel Main Menu (default front panel page) displays a listing of all devices and cards that can be monitored. The listing follows the same order as the system tree in *Configuration Manager*. The top line of the LCD screen provides the COM-type device or card and its port. In the sample shown below, the first active port in the system is the built-in card, port A. The bottom line of the LCD screen provides commands. The user can **SELECT** the COM port shown on the top line or use **NEXT** or **PREV** (appears after scrolling down from the top of the list) to scroll through the entire list of all devices and cards that can be monitored.

Sample of COM-Type Device or Card Listing

NOTE: The **PREV** command only appears after advancing past the first COM-type device or card in the list.

NOTE: The up and down menu selection buttons to the right of the LCD screen may be used in lieu of the **NEXT** and **PREV** menu function buttons.

The data transmitted and received when communicating with another device can be monitored in three formats. Depressing the **SELECT** menu function button displays the Format Type screen, shown after this paragraph. Select the **BIN**, **ASCII**, or **HEX** menu function button to determine the appropriate format.

Select Format Type Screen

Once the **BIN**, **ASCII**, or **HEX** menu function button is selected, the display provides the T/R Screen. The Data Menu in the CNX Series control system contained a **RESET** and **REFRESH** menu function button. These buttons are not necessary for the PRO2, because the data is always 'live'. A buffer constantly records and recycles the data. The buffer is empty when the COM port is first selected and remains empty until data is transmitted or received.

When the port is active, data information races across the T/R Screen; a sample is shown after this paragraph. The transmission and reception traffic is displayed in alternating sequence to facilitate diagnostics. Depressing any of the six-menu function buttons 'freezes' the data information. The up and down menu selection buttons to the right of the LCD screen may be used to advance or reverse the frozen data. Compare the data to expected manufacturer's protocol for the communicating device.

NOTE: Data in the 'freeze' state is denoted by a lower case letter (f) in front on the T and R in the T/R/Screen.

NOTE: Any of the six-menu function buttons toggles the 'freeze' state.

NOTE: The buffer recycles data even when in the 'freeze' state. When the screen is unfrozen, the display jumps to the end of the buffer.

T/R Screen with Frozen Sample

Further Inquiries

If after reviewing this Operations Guide for the AV2 & PRO2, 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.

Firmware Upgrades

To take advantage of all the AV2 and PRO2 features, it is important that the unit contains the latest firmware available. Therefore, please check our website (http://www.crestron.com/downloads/software_updates.asp) for the latest version of firmware. Not every product has a firmware upgrade, but as Crestron improves functions, adds new features, and extends the capabilities of our products, firmware upgrades are posted. For questions regarding upgrade procedures, contact Crestron customer service.

Future Updates

As Crestron improves functions, adds new features, and extends the capabilities of the 2-Series integrated dual bus control system, 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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Merchandise Returns / Repair Service

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.

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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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