Universal Switching Corporation

OPERATING AND PROGRAMMING MANUAL

Model S2560D

Solid-State Flexible Tri-Stage Switching System
(32x32 to 256x256)

State-of-the-Art Switching Solutions

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Warranty

This Universal Switching Corporation product is warranted against manufacturing defects, and workmanship for a period of two years from the date of shipment from our factory. During this period, Universal Switching will, at its option, either repair or replace products which prove to be defective or out of specification per the original purchase order or contract. Damage by misuse or abnormal conditions of operation, or evidence of partial or complete disassembly beyond normal maintenance or expansion procedures voids this warranty. Since Universal Switching Corporation has no control over conditions of use for the products it manufactures, no warranty is made or implied as to the suitability for the customer's intended use, beyond such performance specifications as are made a part or the purchase order or contract.

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Universal Switching Corporation warrants that its software and firmware designated by Universal Switching Corporation for use with an instrument will execute its programming instructions when properly installed on that instrument. Universal Switching Corporation does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error-free.

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1. Introduction to the System S2560D

The System S2560D is a highly integrated and high performance differential analog or digital switching system. The unit is a 4th generation design, the original design developed in early 1992.

The new design was generated by compiling data from previous applications, user input, and component technology advances allowing the implementation of the latest in control and switching technology. The S2560D intelligent mainframe has been coupled with state-of-the-art controllers and new solid-state switching elements. The system is configured at the factory utilizing the latest standard assemblies and modules.

The S2560D is designed for either high performance differential analog, or differential digital signal switching and incorporates ultra-high reliability solid-state switching elements. The wide bandwidth (DC-125MHz) makes the S2560D a very versatile switch for connecting numerous types of signals, all under remote or local control.

The system model number suffix determines the number and type of modules (digital or analog), type of control CPU and interfaces installed, power supply type and the quantity of filler plates (for the unused module slots) when delivered from the factory. Each module installed in the input or output section delivers another 32 ports. Total expansion of the system is 256 inputs and 256 outputs in the same mainframe.

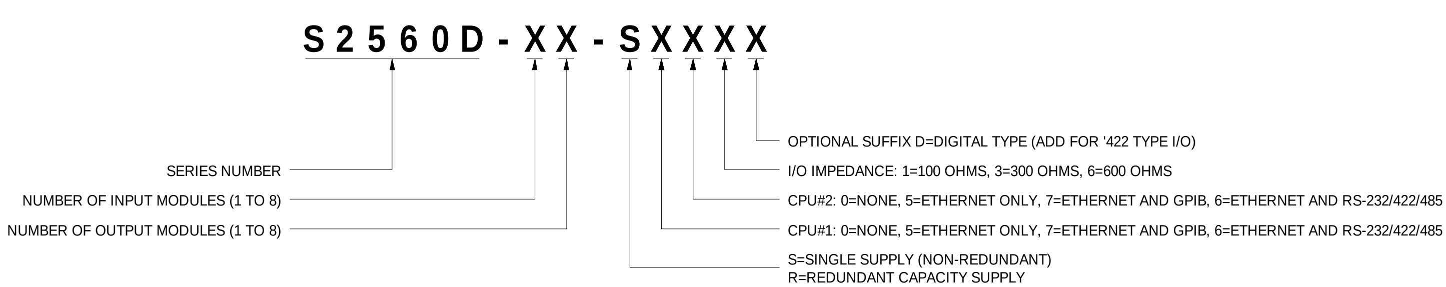
User friendly interfaces, remotely as well as locally, provides for trouble-free configuration and operation of the switch.

Some of the key features are:

- Wide analog or digital bandwidth
- Modular "hot-swap" plug-in design
- Advanced Tri-Stage redundant switching architecture
- Ultra high reliability solid-state switching elements
- Embedded intelligent controllers
- Illuminated key pad and display
- Powerful 488.2 compliant control command set
- Store and recall full switching configurations
- Standard control interface types
- Individual module service control ports
- Field serviceable

1.1. System Model Definition

The S2560D is a flexible architecture that can deliver a host of possibilities for the routing of signals. Below is the model number assignment definition.



1.2. Available I/O Module Types

The S2560D is available with different input and output modules to tailor the system to a specific need. Below is a description of each module type. All modules deliver either thirty-two input or output channels per module. The modules can be mixed within the same unit, but signal levels may shift, be distorted or unusable if dissimilar modules are routed together.

Input Model	**Description**
VSI2560D-D12	DC coupled analog, 100 ohm differential input impedance
VSI2560D-D62	DC coupled analog, 600 ohm differential input impedance
VSI2560D-A12	AC coupled analog, 100 ohm differential input impedance
VSI2560D-A62	AC coupled analog, 600 ohm differential input impedance
VDI2560D-D12	DC coupled digital `422, 100 ohm differential input impedance

Output Model	**Description**
VSO2560D-D12	DC coupled analog, 100 ohm differential output impedance
VSO2560D-D62	DC coupled analog, 600 ohm differential output impedance
VSO2560D-A12	AC coupled analog, 100 ohm differential output impedance
VSO2560D-A62	AC coupled analog, 600 ohm differential output impedance
VDO2560D-D12	DC coupled digital `422, 100 ohm differential output impedance

1.3. Additional System Signal Connection Options

The S2560D is capable of many types of configurations including, but not limited to, audio, video, telemetry and other many useful signal types. The purpose of the S2560D is to interconnect signals, input to outputs. Additional items can be added to enhance the performance or adapt the S2560D system to other purposes.

The S2560D in designed to handle either analog or digital signals delivering differential signal routing. Universal Switching also provides a family of adapter panel assemblies that adapts the S2560D to other requirements. This includes a growing number of analog and digital requirements.

Additional details are further discussed in Section 12.

1.4. Using Multiple Units for Larger Configurations

The unit can be configured to full capacity of 256x256 within a single unit. For applications needing larger configurations, multiple units can be cascaded together as needed. There are different methods depending upon the type of signals being routed and what needs to be accomplished.

1.4.1. Control Issues

The user can individually control multiple units so that there is no control dependency between the units, or they can be configured in a Master/Slave configuration. Using the units in a Master/Slave configuration is simpler for the user to control a larger configuration, however it requires that special firmware be installed in the different units involved, plus if the "master" has a control failure, the slaves would be inoperable too.

1.4.2. Signal Issues

Since the control is fairly simple to configure for larger multiple unit configurations, cascading signals between multiple units is a more daunting topic. Since a single box can be a 256x256, two boxes can be cascaded for either a 256x512, or a 512x256. In the first case, each input must be distributed to two boxes where in the second case, each output must combine the output from two boxes. Consult the factory.

2. System Setup

This section contains information on how to configure the unit in preparation for operation.

It is important to carefully follow the instructions in this section to assure safe and trouble-free operation. The information provided will maximize the performance and expected lifetime of the unit.

2.1. Safety Warnings and Markings

The S2560D has been engineered for user safety as a priority. Included with the unit is one EU approved power cord matched to meet CE requirements. Depending on if a system integrator is utilizing this unit, the system integrator may be responsible for the correct AC power cord specific for the destination country.

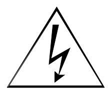
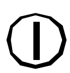
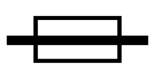
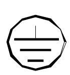
The following warning marking is visible on the outside of the unit. This marking should never be removed and must remain on the unit at all times.

WARNING:
Risk of Electrical Shock.
Remove Power Cord before
removing cover. Refer to User
Manual for Instructions

2.1.1. CE Approvals Pending

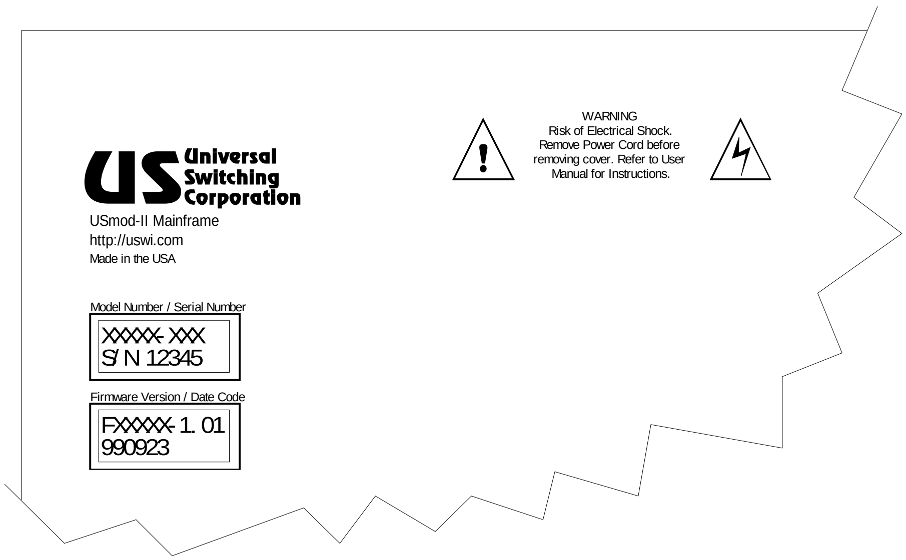
The S2560D has not been qualified to carry the CE mark (and may not be accepted as such) to be exported into all EU Member Countries, and move freely through customs.

The following IEC symbols are utilized as appropriate throughout the unit. This table can be used as a reference.

	Meaning of Symbols	IEC Symbol Reference
	High Voltage: Risk of Electric Shock	ISO 3864, No. 3.3.1 and 5036
	Explaination Needed: Refer to this Operations Manual	ISO 3864, No. 3.3.1
~	AC Voltage	5032
I	Switch ON	5007
O	Switch OFF	5008
	ON/OFF (alternate action with Push-ON, Push-OFF)	5010
	ON/OFF (alternate action with Push-ON, Push-OFF)	5016
	Protective Earth Ground	5019

2.2. Serial Number Label

The S2560D includes a factory assigned serial number that is unique to each piece of equipment. The label contains both the system number and the unique serial number and is located on the bottom of the system.



F11220-1.FCW

2.3. Firmware and Date Code

Next to the serial number labeling is a date code and system firmware version label. This identifies the date of manufacture and the specific system firmware and version that was installed when the system was originally delivered.

> ***NOTE: Units can have the firmware upgraded while in the field. To view the current version, use the front panel menu and display the currently installed version.***

2.4. Unpacking

The unit is shipped in multiple cartons of custom commercial packaging. Follow the **UNPACKING INSTRUCTIONS** located on the side of the box. Please pay attention when opening the shipping container so to not inflict any cosmetic damage to the unit. Check the packing list against the contents of the shipping container.

> ***NOTE: Carefully inspect the packaging for shipping damage and if present, immediately notify Universal Switching Corporation and the Carrier! Keep all shipping materials for the carrier's inspection.***

If the contents are not complete, or there is any kind of mechanical damage or visible defects, you must notify the factory within 5 days of receipt.

2.5. Environmental

You may operate the unit in a normal laboratory environment, production environment, or a more rugged industrial environment without any additional considerations. Protection should be provided against temperature extremes (shock) that can cause condensation.

2.5.1. Storage and Shipping

The unit may be stored or shipped in environments with the following limitations:

- Temperature: -20 degrees C to +75 degrees C
- Humidity: 0 to 90% (non-condensing)
- Altitude: 50,000 feet

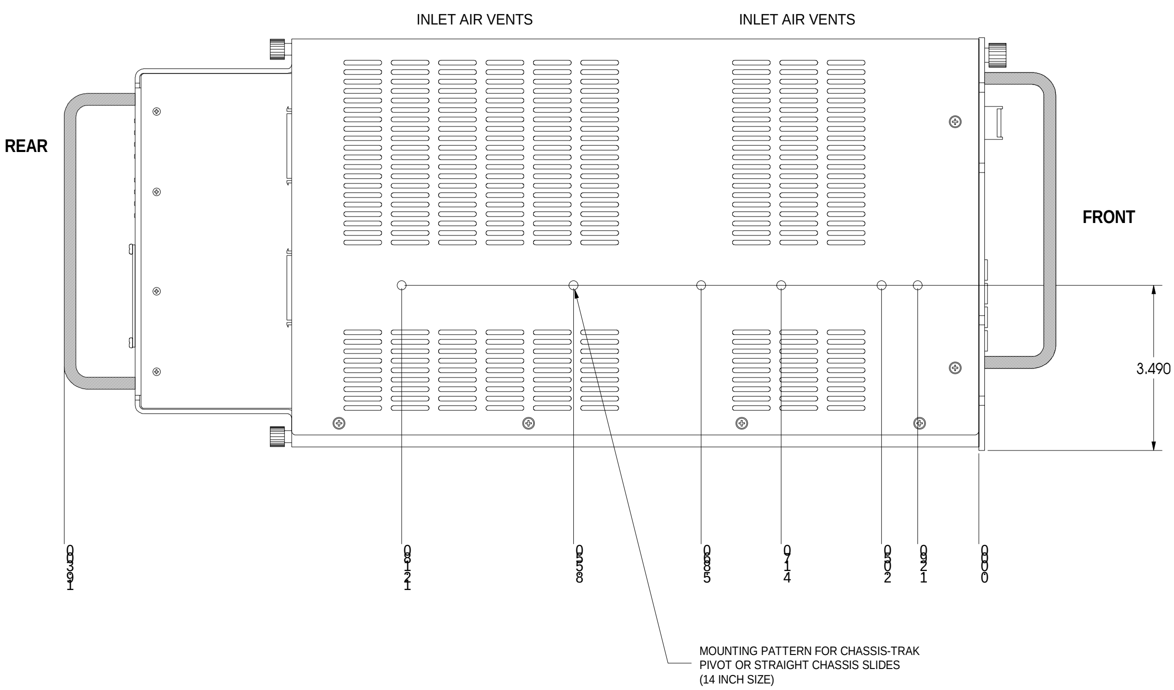
2.5.2. Operating Environment

The unit may be used in any environment with the following limitations:

- Temperature: 0 degrees C to +60 degrees C
- Humidity: 0 to 90% (non-condensing)

2.5.3. Installation Site Parameters

The area that the unit is to be installed should be as clean as possible. A dusty environment would cause an increase in system maintenance. It is recommended that the system be installed in an environmentally controlled area equipped with an air filtration system.



The unit is designed to install in a standard 19” equipment rack. It is comprised of an individual rack mountable mainframe with plug-in modules. All user signal I/O and control signal connections to the unit are at the rear, and therefore would come from inside the equipment rack enclosure.

It is suggested that the unit be secured in the rack assembly by chassis slides in addition to the front panel flanges. This provides easy access for maintenance and excellent mechanical stability. Rack mounting hardware (Quik-Fasteners) are provided with the system to mount the front of the mainframes to the equipment enclosure. These make it easy to install and remove a mainframe.

Each mainframe has an air circulation system included that is pulling cool air from the left side of the system (as viewed from the front) and exhausts warm air via the vents on the right side of the system.

Fans are included internally, but do not include air filtration of the cooling air. Periodic maintenance may be required to clean the air intakes depending upon the installation site.

2.6. Power Requirements

The unit requires a power source of 90 to 264VAC single phase, 47 to 440Hz power. A standard AC power cord is supplied with the unit. The internal supplies are auto-ranging power sections and don't require any user intervention to adjust to the wide range of AC power sources available around the world. The 6-foot long power cord is supplied with a standard NEMA 15A male plug and is included with the unit.

2.6.1. Connecting AC Power

The unit is Safety Class 1 type equipment (equipment with an exposed metal chassis that is connected to earth via the power supply cord).

The supplied 6-foot three-wire power cord provides the required grounding of the unit and mates with the power receptacle on the rear of the unit. A line filter is also included to help eliminate spikes and transients from the AC power source.

Depending on if a system integrator is utilizing this unit, the system integrator may be responsible for the correct AC power cord specific for the destination country.

2.7. Return Shipment of the Unit

If any portion of the unit is to be shipped back to the factory for service or modification, please attach a tag to the system identifying the current owner (including address and phone number) model and serial number of the equipment, as well as a brief description or the required service or suspected problem.

Mark the container ***FRAGILE*** to help insure safe handling by the carrier. In correspondence, refer to the return item by the model number and serial number.

> ***NOTE: Please call the factory for an RMA number prior to returning the unit. No unit will be accepted without an RMA number. Many problems may be solved over the phone, or by replacement modules.***

2.7.1. Return Address

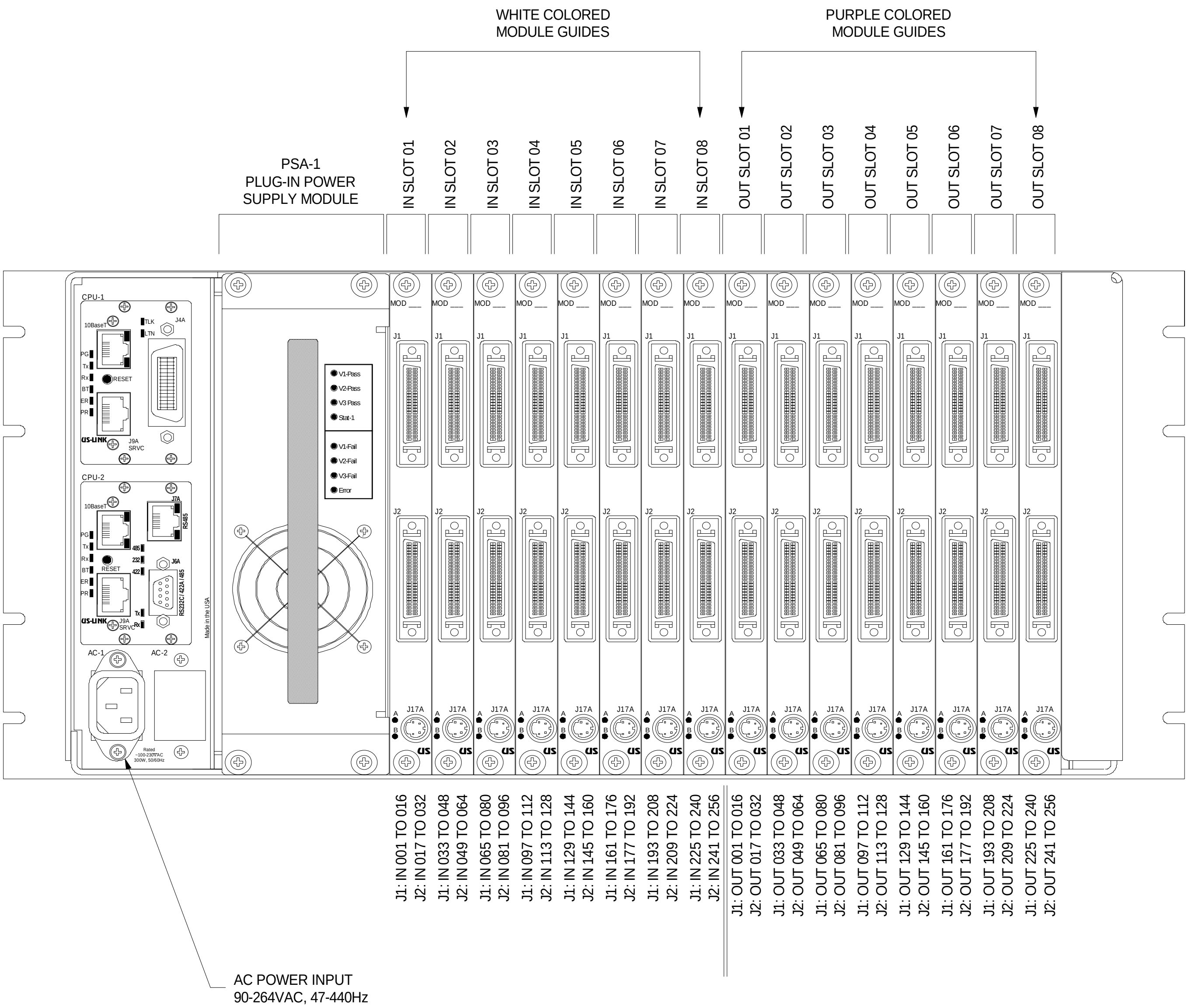
When returning the unit for repair or service, please use the following address:

Universal Switching Corporation
7145 Woodley Avenue
Van Nuys, CA 91406 USA

> ***NOTE: Since companies relocate from time to time, you might want to verify the address of the company prior to shipment. This can be done by viewing our Web-Site: www.uswi.com***

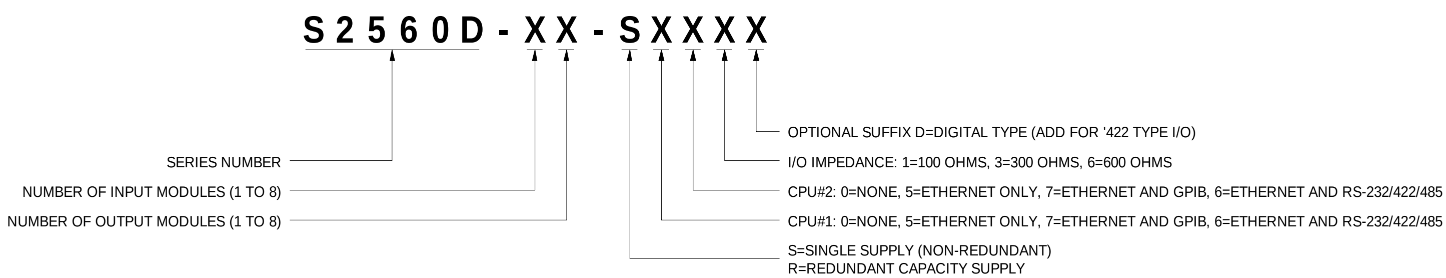
3. System Configuration

This section describes the various features of the Tri-Stage switching system concept and how it is controlled by the distributed embedded microprocessors. Control is distributed to each module of the system to form an efficient multiprocessor design. The main CPU controls all system components. A fully configured system is shown below with 256x256 switching, two types of CPU modules, and the standard plug-in power supply.



3.1. Model Number Suffix Definition

The system model number determines the factory delivered configuration. The dash numbers specify the number of inputs and outputs of the system (the number of modules installed when delivered from the factory), plus other features too.



Example 1: ***S2560D-45-S701***

This example system definition is delivered with four input modules, each having 32 channels for a total of 128 inputs. It also contains five output modules, each providing 32 channels for a system total of 160 outputs.

In addition, it provides a single power supply section (non-redundant configuration), a plug-in CPU with Ethernet and GPIB interfacing in CPU #1 slot (Model C710-488), no CPU installed in the CPU #2 slot, and an I/O impedance of 100 ohms (differential).

Example 2: ***S2560D-86-R761D***

This example system definition is a digital (422) unit (with "D" suffix) delivered with all eight input modules, each having 32 channels for a total of 256 inputs. It also contains six output modules, each providing 32 channels for a system total of 192 outputs.

It also provides a redundant capacity power supply section, a plug-in CPU with Ethernet and GPIB interfacing in CPU #1 slot (Model C710-488), plus a combo serial CPU installed in CPU #2 slot (Model C710-S3), and an I/O impedance of 100 ohms (digital differential).

3.1.1. Number of Inputs vs. Modules

Below is a table that provides a cross-reference for the number of input channels provided for the quantity of installed input modules.

System Model Number	Quantity of Input Modules (VxI2560D-xxx)	Quantity of Input Channels Provided
S2560D-1X-xxxx	1	32
S2560D-2X-xxxx	2	64
S2560D-3X-xxxx	3	96
S2560D-4X-xxxx	4	128
S2560D-5X-xxxx	5	160
S2560D-6X-xxxx	6	192
S2560D-7X-xxxx	7	224
S2560D-8X-xxxx	8	256

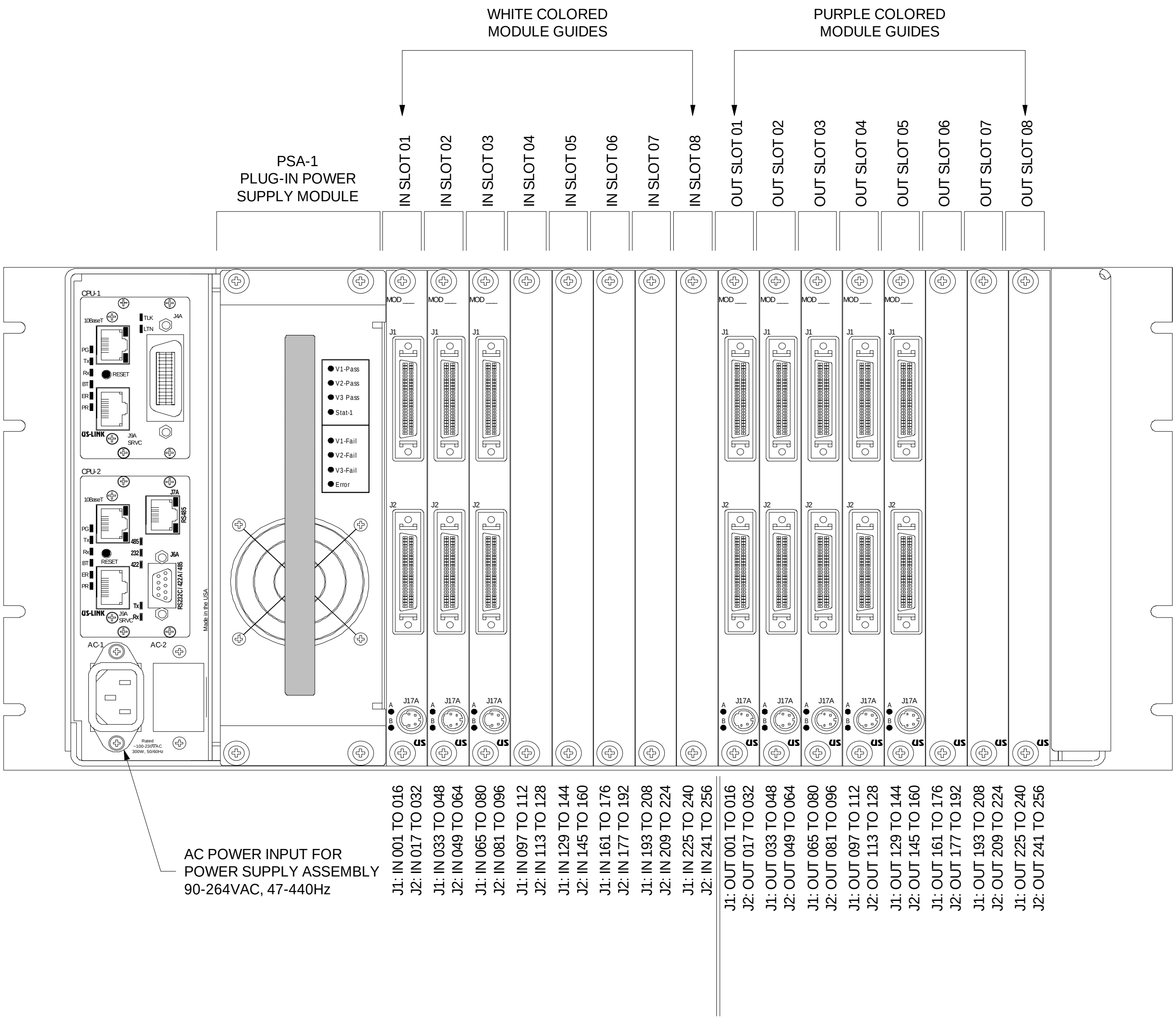
3.1.2. Number of Outputs vs. Modules

Below is a table that provides a cross-reference for the number of output channels provided for the quantity of installed output modules.

System Model Number	Quantity of Output Modules (VxO2560D-xxx)	Quantity of Output Channels Provided
S2560D-X1-xxxx	1	32
S2560D-X2-xxxx	2	64
S2560D-X3-xxxx	3	96
S2560D-X4-xxxx	4	128
S2560D-X5-xxxx	5	160
S2560D-X6-xxxx	6	192
S2560D-X7-xxxx	7	224
S2560D-X8-xxxx	8	256

3.2. System Capacity

The System S2560D is available with different configurations allowing the user to order the number of modules required to meet the application. The system may be delivered with up to 256 inputs and 256 outputs. Shown below is a 96in x 160out array.

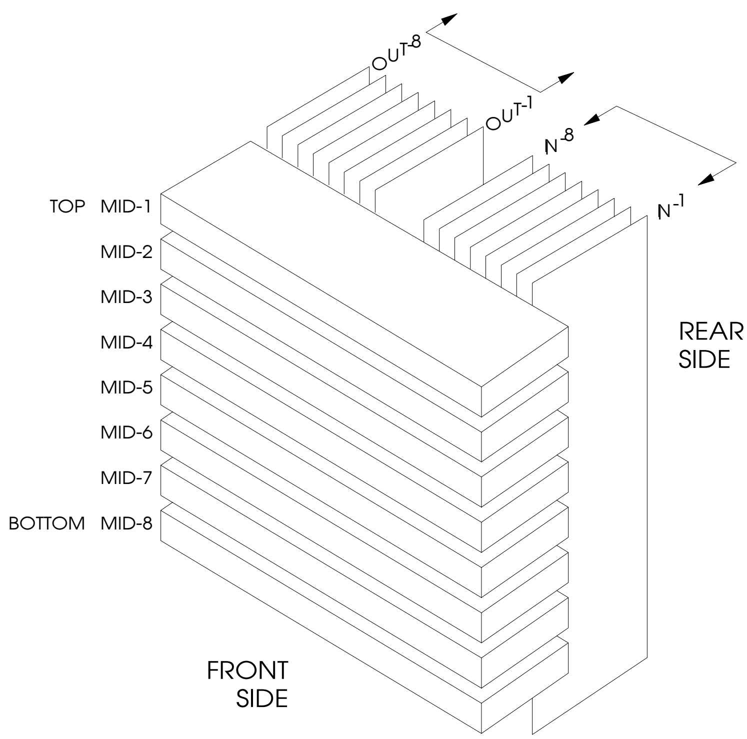


The unit can be expanded by adding additional modules while it is in the field. The unit's firmware automatically senses the newly installed modules and responds accordingly. All I/O modules plug into the rear of the unit, are hot swappable and are secured to the chassis by two captive fasteners.

3.3. Tri-Stage™ Switching Architecture

The S2560D system is a Tri-Stage™ design encompassing many advanced features. The switching configuration is comprised of three individual stages of smaller switching arrays interconnected together to comprise the overall switch configuration. The three stages are referred to as Input Stage, Mid-Stage and Output Stage. Each module within the individual stages is an individual switching array. The main advantage of this type of system is that the total number of crosspoints required is lower than that of the traditional rectangular switching array. Higher signal performance is also achieved due to the smaller switching sections that the signal must pass through.

SYSTEM MODULE MAP



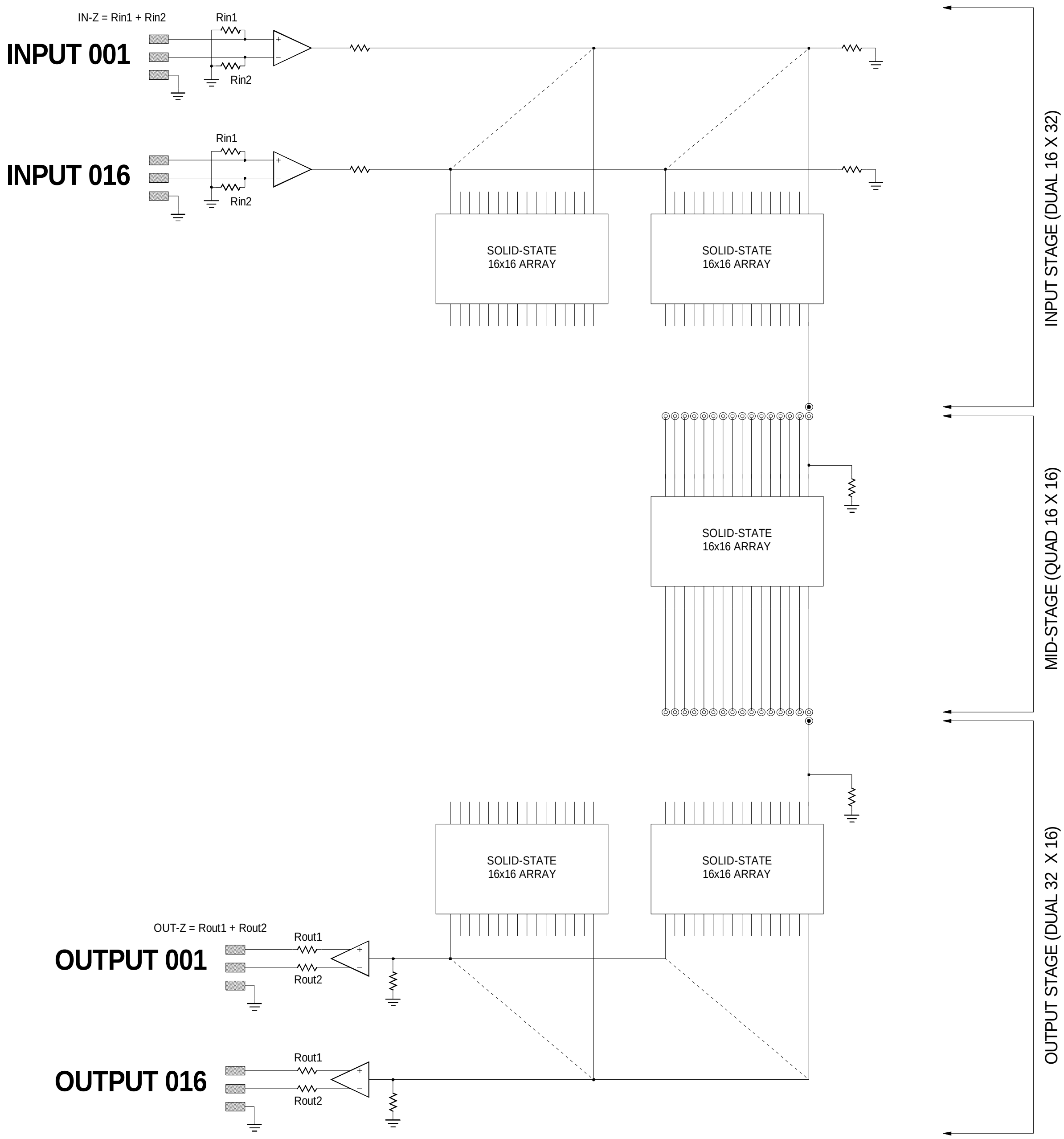
Another advantage to the Tri-Stage™ design is that redundant signal paths are available to route a signal from a given input to a given output. The S2560D system does not provide the internal signal sensing to negotiate a new signal path avoiding a defective one, however it is possible to inform the system of defective switch points to omit from its signal routing algorithms until the defective portion of the system can be repaired or replaced. The user must be able to detect a defective signal routing external to the unit (unless the problem is due to an internal controlling error) for this to be effective. Thirty different signal paths are available to route each input to any given output.

It should be noted that the quantity of mid-stage modules shown in the diagram is eight, however the modules are quad 16x16 sections and therefore provide a total of 32 mid-stages.

Below is a front view with the hinged front panel folded down. Just inside are the eight mid-stage modules. No matter how many input and output modules are installed, the unit must have eight of these modules installed to operate without a "blocking" situation.

3.3.1. Signal Block Diagram

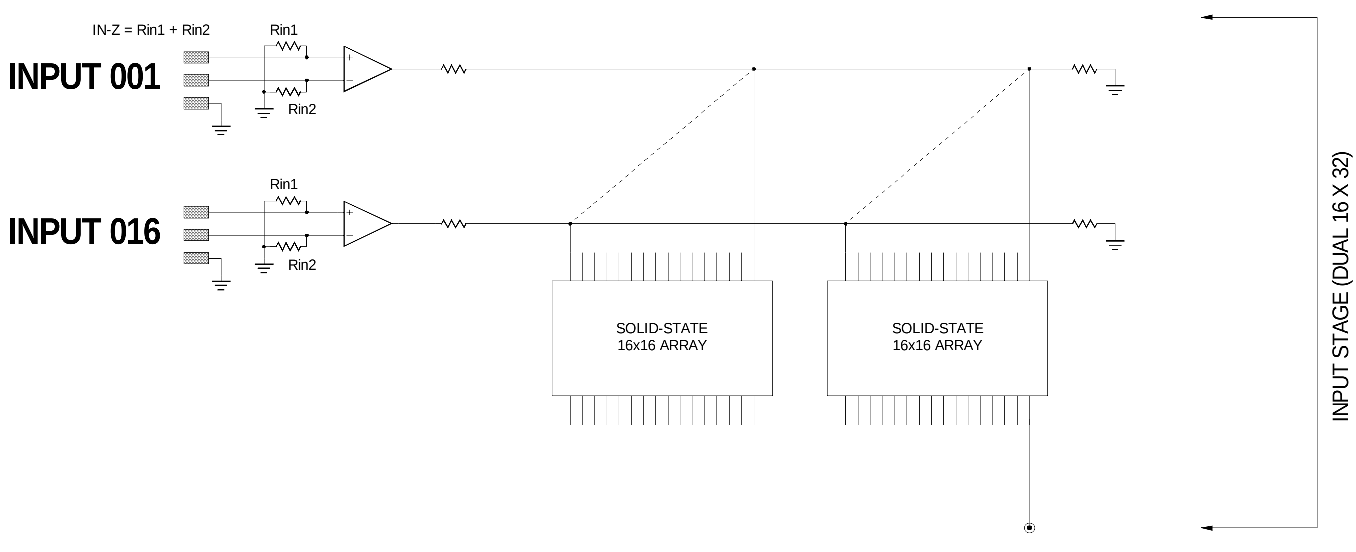
The signal (switching) portion of the S2560D is simple, yet unconventional. As seen in the previous diagram, the switching array is comprised of smaller switching arrays that are cross-connected together to form an efficient design. Details of the individual sections can be seen in the diagram below.



3.3.2. Input Modules (input stage)

The input portion of the system is comprised of a maximum of eight modules (VxI2560D-xxx), each delivering eight input channels. The input modules of the S2560D system are installed into the rear left with white-colored card guides. The input ports on each module are available with either DC coupled or AC coupled.

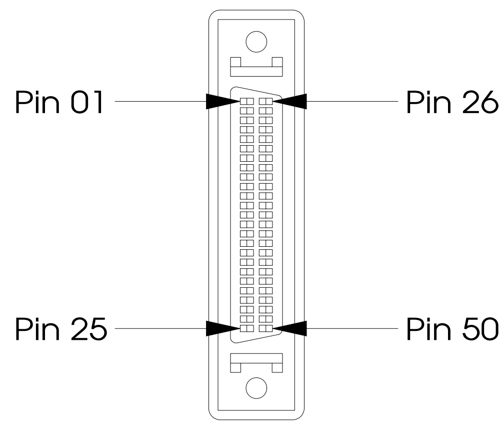
The input module has two independent sixteen differential input ports that may be switched to any of thrity-two different output ports (on the module). It is a dual 16x32 non-blocking full fan-out switching array with solid-state crosspoint elements. The module also contains differential input buffers for each input port, plus an embedded microcontroller to control and status the switching array. ON the "digital" 422 type modules, the input component is a standard "422" type digital receiver, and is not an analog buffer. Control and power are delivered to the module from the mainframe chassis on two different Future-Bus type connectors. One of the two sections on each module is shown below.



The outputs of the input module are Future-Bus type connectors. They too are opposite the two user input signal connectors. These interconnect with the mid-stage modules to form the Tri-Stage switching architecture.

3.3.2.1. Input Signal Connectors

Each of the signal connectors are standard female 50-position connectors, spaced on .675" centers horizontally (module to module). The user connects directly to each set of connectors on the modules via multi-position SCSI-II type connectors. The direct connection provides the best signal response and connection reliability.



The connector is an AMP #749649-5 and is part of the SCSI-II family of connectors. Different configurations of mating connectors could be used, one being AMP #749110-1. This is just the mating portion of the connector and does not include a back-shell.

Each module contains two connectors, each delivering sixteen channels. The upper connector (J1) has the lower numbered channels (01 to 16) and the lower connector has the upper numbered channels (17 to 32).

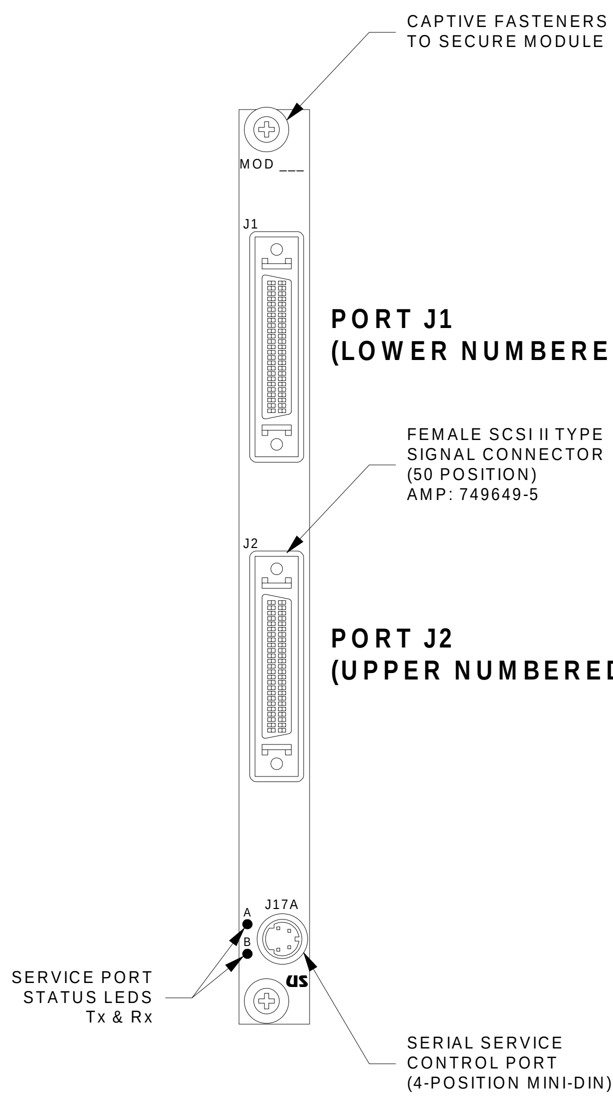
3.3.2.2. Input Connector Pin Assignment

J1 Pin Number	Signal Name	User Designation
1	Input 01 (+)	
2	Input 02 (+)	
3	Input 03 (+)	
4	Input 04 (+)	
5	Ground	
6	Input 05 (+)	
7	Input 06 (+)	
8	Input 07 (+)	
9	Input 08 (+)	
10	Ground	
11	Input 09 (+)	
12	Input 10 (+)	
13	Input 11 (+)	
14	Input 12 (+)	
15	Ground	
16	Input 13 (+)	
17	Input 14 (+)	
18	Input 15 (+)	
19	Input 16 (+)	
20	Ground	
21	VEE (+V)	
22	VEE (+V)	
23	Ground	
24	VDD (-V)	
25	VDD (-V)	
26	Input 01 (-)	
27	Input 02 (-)	
28	Input 03 (-)	
29	Input 04 (-)	
30	Ground	
31	Input 05 (-)	
32	Input 06 (-)	
33	Input 07 (-)	
34	Input 08 (-)	
35	Ground	
36	Input 09 (-)	
37	Input 10 (-)	
38	Input 11 (-)	
39	Input 12 (-)	
40	Ground	
41	Input 13 (-)	
42	Input 14 (-)	
43	Input 15 (-)	
44	Input 16 (-)	
45	Ground	
46	VEE (-V)	
47	VEE (-V)	
48	Ground	
49	VDD (+V)	
50	VDD (+V)	

J2 Pin Number	Signal Name	User Designation
1	Input 17 (+)	
2	Input 18 (+)	
3	Input 19 (+)	
4	Input 20 (+)	
5	Ground	
6	Input 21 (+)	
7	Input 22 (+)	
8	Input 23 (+)	
9	Input 24 (+)	
10	Ground	
11	Input 25 (+)	
12	Input 26 (+)	
13	Input 27 (+)	
14	Input 28 (+)	
15	Ground	
16	Input 29 (+)	
17	Input 30 (+)	
18	Input 31 (+)	
19	Input 32 (+)	
20	Ground	
21	VEE (+V)	
22	VEE (+V)	
23	Ground	
24	VDD (-V)	
25	VDD (-V)	
26	Input 17 (-)	
27	Input 18 (-)	
28	Input 19 (-)	
29	Input 20 (-)	
30	Ground	
31	Input 21 (-)	
32	Input 22 (-)	
33	Input 23 (-)	
34	Input 24 (-)	
35	Ground	
36	Input 25 (-)	
37	Input 26 (-)	
38	Input 27 (-)	
39	Input 28 (-)	
40	Ground	
41	Input 29 (-)	
42	Input 30 (-)	
43	Input 31 (-)	
44	Input 32 (-)	
45	Ground	
46	VEE (-V)	
47	VEE (-V)	
48	Ground	
49	VDD (+V)	
50	VDD (+V)	

3.3.2.3. Removal/Installation of an Input Module

Each input module is secured at the top and bottom with a black captive fastener. The fasteners are attached to a machined connector assembly and can assist the user when it comes time to remove a module from the system.



NOTE: All switching modules are hot-swap type and may be installed or removed while the system is powered. This is useful for downtime critical applications, or for system expansion while the unit is online.

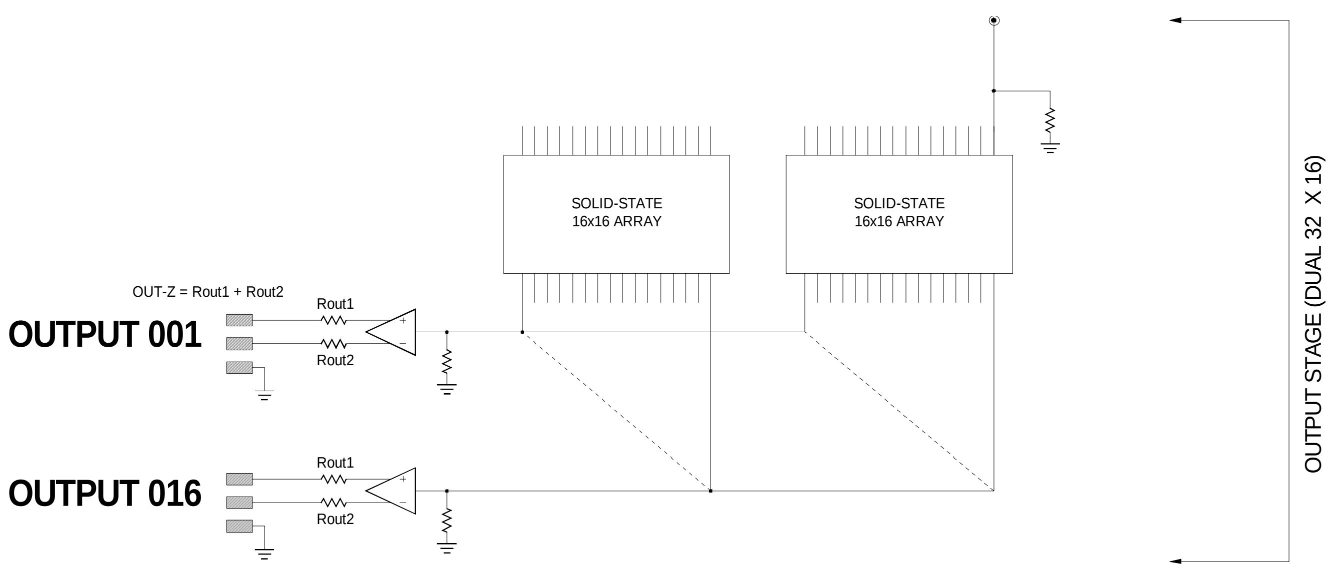
It is suggested (but not required) to remove all attached signal cables prior to removing an input module. The module is somewhat difficult to extract due to the number of interconnects to the mid-stage modules. Use a constant pressure to extract the module using the captive fasteners for leverage.

To install an input module, first make sure that you are installing it into an input slot (white colored card guides). Simply slide the module into the rear of the mainframe until it begins to engage the power and control connectors, then continue until the interconnections are mated and the module fully seated to the mainframe. Since there is significant pressure required to install module, the captive fasteners may be used to draw the module until fully seated.

3.3.3. Output Modules (output stage)

The output portion of the system is comprised of a maximum of eight modules (VxO2560D-xxx), each delivering thirty-two output channels. The output modules of the S2560D system are installed into the rear right of the. The module is designed to be installed into the slots with purple colored card guides. The output port on each module is available with either DC coupled or AC coupled and is impedance matched. The DC coupled version is standard while the AC version must be special ordered.

The output module has two sets of sixteen differential output ports that may be switched from any of two sets of thirty-two different input ports (on the module). It is a dual 32x16 non-blocking full fan-out switching array with solid-state cross-point elements. The module also contains differential output buffer amplifiers for each output port, plus an embedded microprocessor to control and status the switching array. One of the two sections of the module is shown below. For the digital (422) version, the output buffer is replaced with a standard "422" driver and does not include the series resistors as shown below.

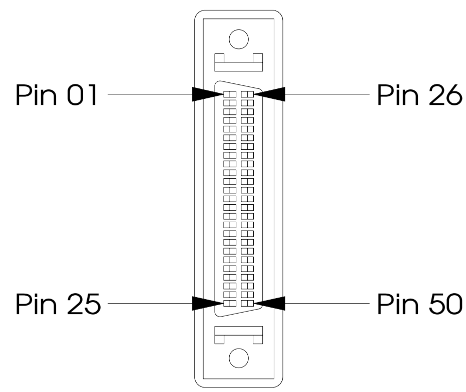


Control and power are delivered to the module from the mainframe chassis on two different Future-Bus type connectors opposite the SCSI-II signal connectors.

The inputs of the module are via additional Future-Bus type connectors. They too are opposite the SCSI-II user signal connectors. These interconnect with the mid-stage modules to form the Tri-Stage switching architecture.

3.3.3.1. Output Signal Connectors

Each of the signal connectors are standard female SCSI fifty-position connectors, spaced on .675" centers horizontally (module to module). The output SCSI connectors are labeled J1 and J2 as shown in the diagram below. For user cabling diagrams, the user may add module identification in the space provided at the top of the module.



Each module delivers thirty-two (32) channels of switching. The user connects directly to each set of connectors on the modules via multi-position SCSI-II type connectors. The direct connection provides the best signal response and connection reliability. The connector is an AMP #749649-5 and is part of the SCSI-II family of connectors. Different configurations of mating connectors could be used, one being AMP #749110-1. This is just the mating portion of the connector and does not include a back-shell.

Each module contains two connectors, each delivering sixteen channels. The upper connector (J1) has the lower numbered channels (01 to 16) and the lower connector has the upper numbered channels (17 to 32).

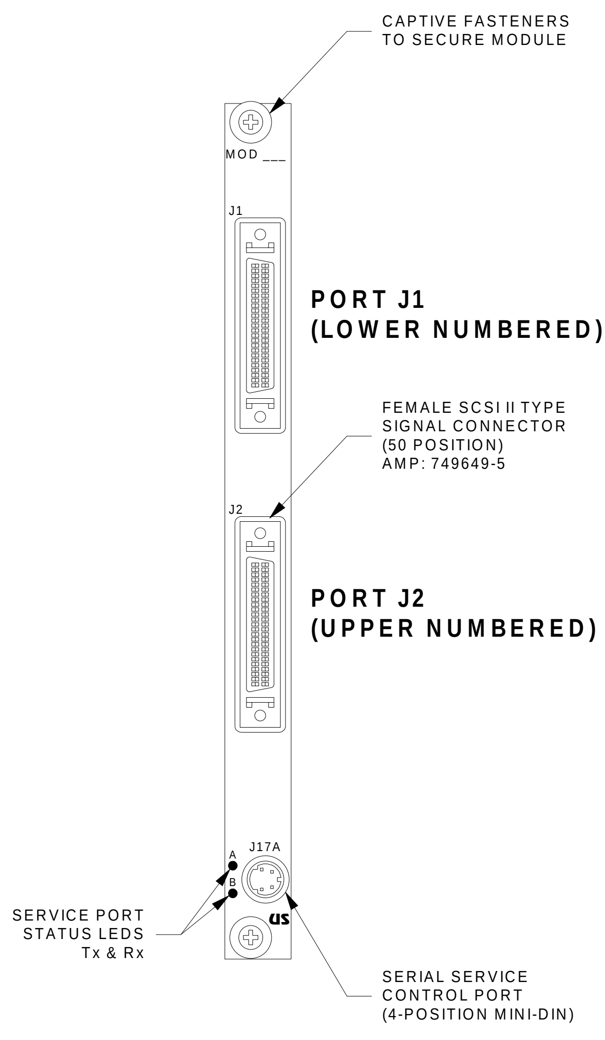
3.3.3.2. Output Connector Pin Assignment

J1Pin Number	Signal Name	User Designation
1	Output 01 (+)	
2	Output 02 (+)	
3	Output 03 (+)	
4	Output 04 (+)	
5	Ground	
6	Output 05 (+)	
7	Output 06 (+)	
8	Output 07 (+)	
9	Output 08 (+)	
10	Ground	
11	Output 09 (+)	
12	Output 10 (+)	
13	Output 11 (+)	
14	Output 12 (+)	
15	Ground	
16	Output 13 (+)	
17	Output 14 (+)	
18	Output 15 (+)	
19	Output 16 (+)	
20	Ground	
21	VEE (+V)	
22	VEE (+V)	
23	Ground	
24	VDD (-V)	
25	VDD (-V)	
26	Output 01 (-)	
27	Output 02 (-)	
28	Output 03 (-)	
29	Output 04 (-)	
30	Ground	
31	Output 05 (-)	
32	Output 06 (-)	
33	Output 07 (-)	
34	Output 08 (-)	
35	Ground	
36	Output 09 (-)	
37	Output 10 (-)	
38	Output 11 (-)	
39	Output 12 (-)	
40	Ground	
41	Output 13 (-)	
42	Output 14 (-)	
43	Output 15 (-)	
44	Output 16 (-)	
45	Ground	
46	VEE (-V)	
47	VEE (-V)	
48	Ground	
49	VDD (+V)	
50	VDD (+V)	

J2 Pin Number	Signal Name	User Designation
1	Output 17 (+)	
2	Output 18 (+)	
3	Output 19 (+)	
4	Output 20 (+)	
5	Ground	
6	Output 21 (+)	
7	Output 22 (+)	
8	Output 23 (+)	
9	Output 24 (+)	
10	Ground	
11	Output 25 (+)	
12	Output 26 (+)	
13	Output 27 (+)	
14	Output 28 (+)	
15	Ground	
16	Output 29 (+)	
17	Output 30 (+)	
18	Output 31 (+)	
19	Output 32 (+)	
20	Ground	
21	VEE (+V)	
22	VEE (+V)	
23	Ground	
24	VDD (-V)	
25	VDD (-V)	
26	Output 17 (-)	
27	Output 18 (-)	
28	Output 19 (-)	
29	Output 20 (-)	
30	Ground	
31	Output 21 (-)	
32	Output 22 (-)	
33	Output 23 (-)	
34	Output 24 (-)	
35	Ground	
36	Output 25 (-)	
37	Output 26 (-)	
38	Output 27 (-)	
39	Output 28 (-)	
40	Ground	
41	Output 29 (-)	
42	Output 30 (-)	
43	Output 31 (-)	
44	Output 32 (-)	
45	Ground	
46	VEE (-V)	
47	VEE (-V)	
48	Ground	
49	VDD (+V)	
50	VDD (+V)	

3.3.3.3. Removal/Installation of an Output Module

Each output module is secured at the top and bottom with a black captive fastener. The fasteners are attached to a machined connector assembly and can assist the user when it comes time to remove a module from the system.



> ***NOTE: All switching modules are hot-swap type and may be installed or removed while the system is powered. This is useful for downtime critical applications, or for system expansion while the unit is online.***

It is suggested (but not required) to remove all attached signal cables prior to removing an output module. The module is somewhat difficult to extract due to the number of interconnects to the mid-stage modules. Use a constant pressure to extract the module using the captive fasteners for leverage.

To install an output module, first make sure that you are installing it into an output slot (purple colored card guides). Simply slide the module into the rear of the mainframe until it begins to engage the power and control connectors, then continue until the connections are mated and the module fully seated to the mainframe. Since there is significant pressure required to install module, the captive fasteners may be used to draw the module until fully seated.

3.3.4. Mid-Stage Modules (mid-stage)

Mid-Stage modules are the switching core of the system. There are eight modules installed at the factory. No matter what the overall matrix configuration size is, eight modules are always included. The mid-stage modules switch signals between the input stage modules and output stage modules. The signals are cross-connected, are but physically interconnect forming the required Tri-Stage architecture. Each module contains four 16 in, 16 out non-blocking arrays.

The modules are visible by opening the front panel access panel assembly. The panel tilts downward after loosening the two captive fasteners at the top of the panel. Ejectors are included on each of the eight modules for simpler installation and removal.

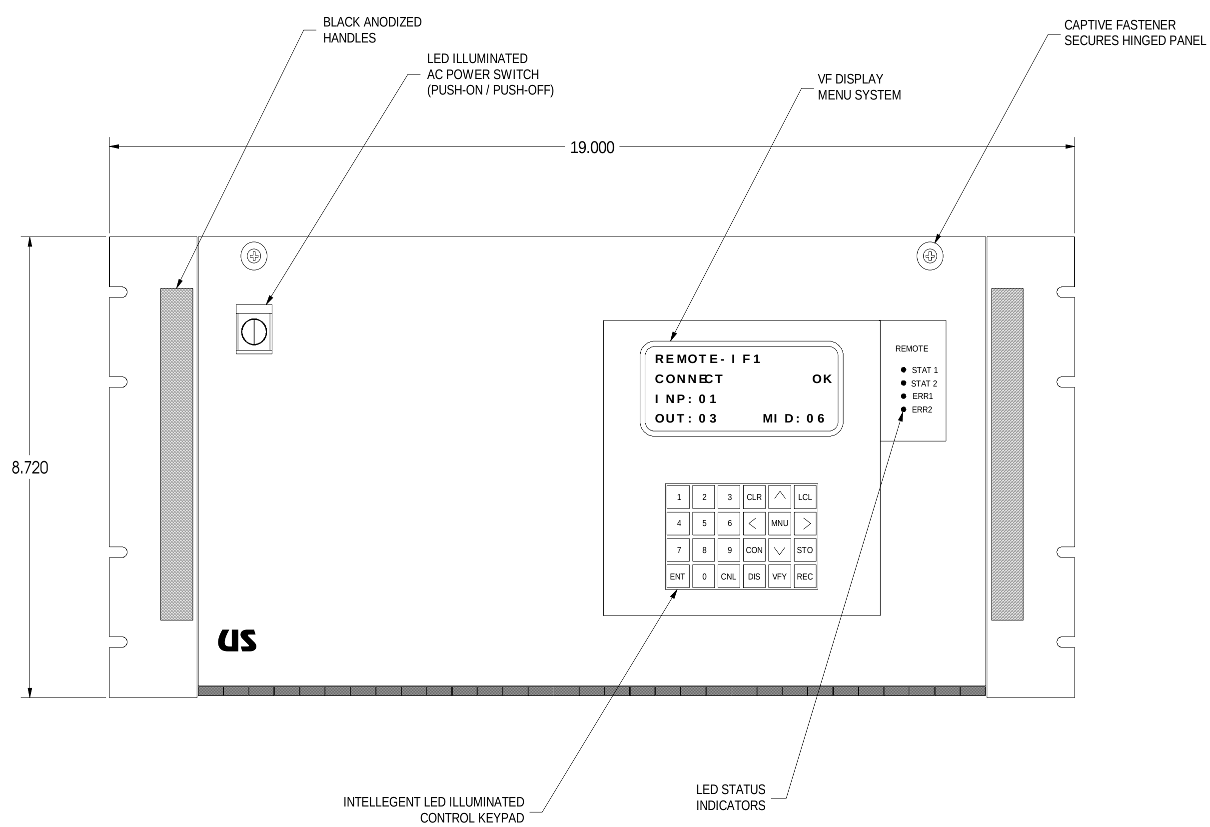
4. Front Panel Overview

This section describes the features of the System S2560D front panel control keypad and vacuum-fluorescent display. The explanation of each feature also provides a basis for their application and usage.

The control panel has been designed for ease of use and functionality. All control keys have "intelligent" backlighting, meaning that they are lit only when they are active (representing a valid choice or command).

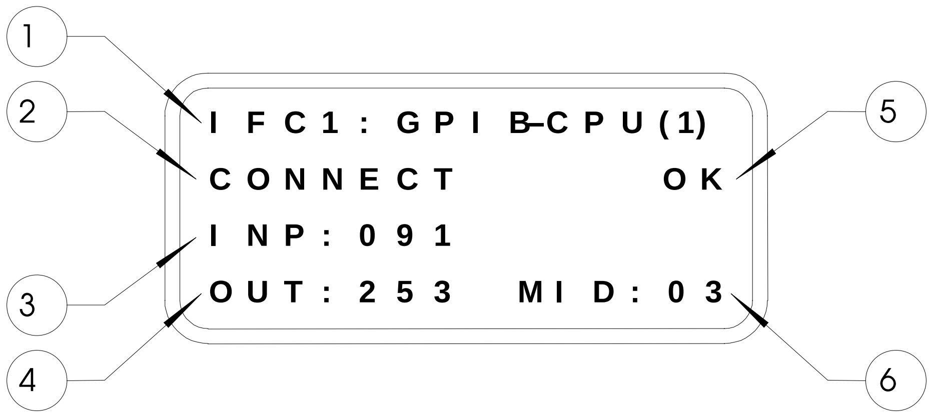
The functions of the 24-position keypad may be divided into the following categories:

- Operators: Connect, Disconnect, Verify, or Clear All
- Control: Store, Recall, Cancel or Local/Remote
- Input: Numerical Keys, 0 through 9
- Misc.: Enter, Menu, and Arrow Keys



4.1. Display Features

The front panel display is a high contrast vacuum fluorescent display for rugged environments and long life. During normal operation (after self-test is complete), the display is divided into six functional areas. These are outlined in the diagram below.



1) Active Remote Control Port (CPU)

2) Function, or operator

3) Input port being selected (001 to 256)

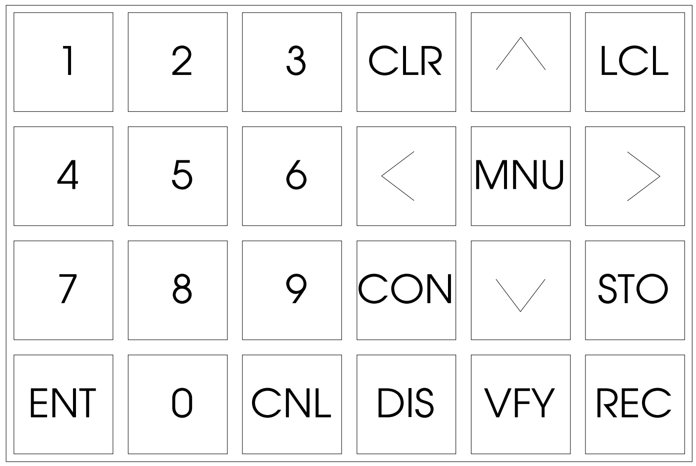
4) Output port being selected (001 to 256)

5) Operation confirmed /Error message

6) Mid-stage switching coordinate

4.2. Control Pad Entries

The front panel manual control pad is designed for switching operations in excess of 5 million entries per push-button.



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When a button is pressed, it provides both audible (if enabled) and tactile feedback to the operator. You may control the unit locally from the manual control pad, or by means of any of the installed remote interfaces.

4.2.1. LCL (local) Key

The **LCL** key will return control to the front panel manual control pad if the controls have been locked out locally or remotely (by a security code). When pressing the "LCL" key, the user will be prompted to enter the security code if the unit is locked. After entering the code, the CPU will unlock the controls. The local keypad can also be locked to prevent unintended switch manipulation by pressing the "LCL" key and then entering a 4-digit security code. See the lockout section for more details.

4.2.2. Connect Function

The connect (**CON**) key is used to connect an input to an output. It is used with the numerical keys to enter an input number, output number combination. The example below connects port input 116 to output 232.

The following sequence should be observed:

- Press connect: **CON**
- Enter the input port number (three digits, 001 to 256): **1 1 6**
- Next, enter the output number (three more digits): **2 3 2**
- Both entries may be edited by using the arrow keys (up, down, left, or right) to select to the entry needing change. Once to the proper location, key in the desired number.
- To execute the command press the **ENT** key, or you may press the cancel **CNL** key to abort the command at any time.

After pressing the enter key, the unit verifies that the port numbers represents a valid entry. If not, the System will alert you by displaying an error code and sounding the beeper. Other possible errors include attempting to connect an output to an already connected input or a switch malfunction.

> ***NOTE: If you are not using the Auto-Route feature, an additional field must be entered for the Mid-Stage used for the routing of the signal (01 to 32).***

The unit now makes the connection you specified and confirms the closure by verifying with each of the embedded CPU's on the selected module that the command was received and confirmed. An OK is displayed if no errors were detected. The mid-stage section used for the routing is displayed in the lower right corner of the display (01 to 32).

If an error occurred while making the connection, the beeper will come on momentarily and an error message will be displayed in place of the "OK".

4.2.3. Disconnect Function

The disconnect (**DIS**) key is used to disconnect (open) an input to output connection. To operate, follow this sequence:

- Press disconnect (**DIS**)
- Enter the input number followed by the output number.
- Both entries may be edited by using the arrow keys (up, down, left, or right) to select the entry to be edited. To execute the command press the **ENT** key, or you may press the cancel (**CNL**) key to abort the command at any time.

After pressing the enter key, the unit verifies that the input/output combination was a valid entry.

The unit then disconnects the combination you specified and confirms it by verifying with the embedded CPU on the module that the command was received and confirmed. An OK is displayed.

> ***NOTE: It is not considered an error to reconnect an already connected input/output combination or to disconnect an already disconnected output.***

4.2.4. Verify Function

The verify (**VFY**) key may be used to verify the connection of a path through the unit without changing it's status. The unit automatically performs this function each time a connect or disconnect is performed, but this command may be used to re-verify it's status.

To use the verify function, press the VFY key, enter the input and output combination and press the enter key. If the combination is connected, the unit will display OK in the status field. If the combination is not connected, the unit will display "VERIFY-DIS OK" indicating that the pair is not connected. If the port is connected to another item, an error code will be returned.

4.2.5. Store and Recall Switching Configurations

The System can store and recall up to 50 different configurations from the CPU's battery backed RAM. This is very useful when changing between configurations rapidly. When a configuration is stored, the entire switching array configuration is saved into the storage memory location including the mid-stage routing.

> ***NOTE: Any stored configurations will be lost if the main CPU's lithium battery jumper is removed, or if the battery life has been exceeded (10 years).***

Storing a switching configuration is accomplished by the following key stroke sequence:

- Press the store (**STO**) key
- Enter the storage memory location (001 to 050) using the numerical keys. The arrow keys may be used to edit the number prior to the next step.
- Press the enter (**ENT**) key to store the configuration.

> ***NOTE: When a configuration is stored in a location, it automatically overwrites any previously stored configuration in that memory location.***

The operation will be confirmed with an OK in the status field of the display. The storage location 000 is reserved by the System to store the current configuration should power be lost to the unit. Upon powering the unit, the System will re-configure to the last matrix setting if the Auto-restore feature is enabled in the setup menu.

To recall a configuration, press the recall (**REC**) key and enter the memory location to be recalled (001 to 050). Press the **ENT** key to execute.

> ***NOTE: When a configuration is recalled, the unit first clears the entire matrix array, and then restores the desired configuration (break before make).***

4.2.6. Clear Function

To clear the entire switching configuration, the clear (**CLR**) key may be used. This will make all signal paths go to the default position (normal mode) disconnecting all previously connected backup connections. To clear the configuration, press the **CLR** key once, then press the ENTER key to confirm.

If the clear key was pressed by accident, you may press the cancel key (**CNL**) to abort the function**. Once you have cleared the matrix, the previous configuration is lost unless you stored it in a memory location.**

4.2.7. Cancel Key

The cancel (**CNL**) key may be used at any time to abort a menu selection or command entered from the manual control pad.

4.3. LED Status Indicators

The unit incorporates various status LED indicators. Some are visible on the front panel, some at the rear of the unit and some are internal to the unit on sub-assemblies.

4.3.1. Front Panel Indicators

The front panel has four discrete LED's located next to the vacuum fluorescent display. They provide a direct visual status of four main parameters. Two of the indicators are for communication information (green), two are warning signals (red). The green LED's provide information about the remote interface and inter-module communication.

4.3.1.1. Indicator Definition

- **STAT 1:** is lit when the unit is receiving control data.
- **STAT 2:** is lit green when the system sending data.
- **ERR 1:** is the main error indicator, and will illuminate red (along with the audible tone sounding if enabled) if an error is detected.
- **ERR 2:** is the main CPU's watch dog timer circuit. This will light if the circuit has detected a CPU failure or if the main 5-volt power supply is below 4.65V.

4.3.2. Rear Indicators

At the rear of the unit, LED's are visible in various locations. Some status indicators are located on the individual plug-in CPU modules (with the remote interface ports).

Visible LED's are on the plug-in power supply assembly. These are driven by the power supply monitoring circuit and display a "pass" or "fail" for each voltage in the system. Also, LED's are located on each of the plug-in switching modules (input and output assemblies). Each module has two LED's, one for transmit and one for receive on local serial service port (4-position DIN) located adjacent to the LED's.

4.3.3. Behind the Front Panel

The front panel of the S2560D folds down to access the mid-stage boards. Located on each of the eight mid-stage boards are three green status LED's.

- **LED 1** indicates SPI activity (command on SPI bus - barely visible unless same mid-stage board is repeatedly addressed)
- **LED 2** indicates RS232 activity (you'll never see this go on in the system unless local service port is used)
- **LED 3** is ON after Connect, OFF after Disconnect (stays on/off until next command is received)

Also visible behind the front panel (further inside on the right side) are three solid-green LED's located on the internal control and power bussing board. These simply indicate the status of the three power supply voltages required on the bussing board. They are not level monitored and only indicate the presence of DC voltage.

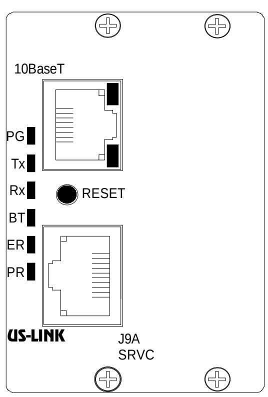
5. Remote Control Assembly: Series C710

All units from Universal Switching include some form of plug-in CPU that provides both the brain of the unit as well as the remote control capacity of the unit. The Series C710 provides this function and was preceded by the older Series C700 type (did not offer embedded Ethernet). The Series C710 is currently available in three formats:

- **C710-E10:** Ethernet control only (10BaseT)
- **C710-488:** Ethernet and GPIB (IEEE-488)
- **C710-S3:** Ethernet and Serial (RS-232C/422A/485)

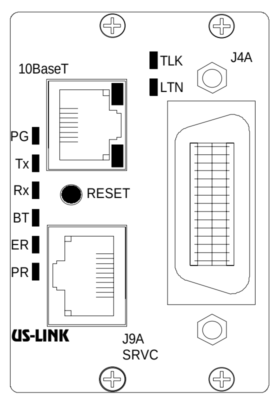
C710-E10

ETHERNET ONLY



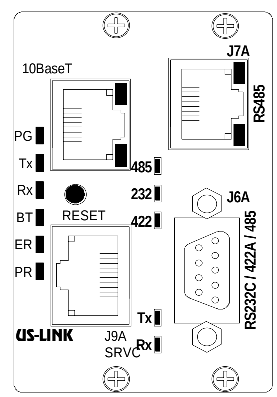
C710-488

ETHERNET AND GPIB



C710-S3

ETHERNET AND SERIAL

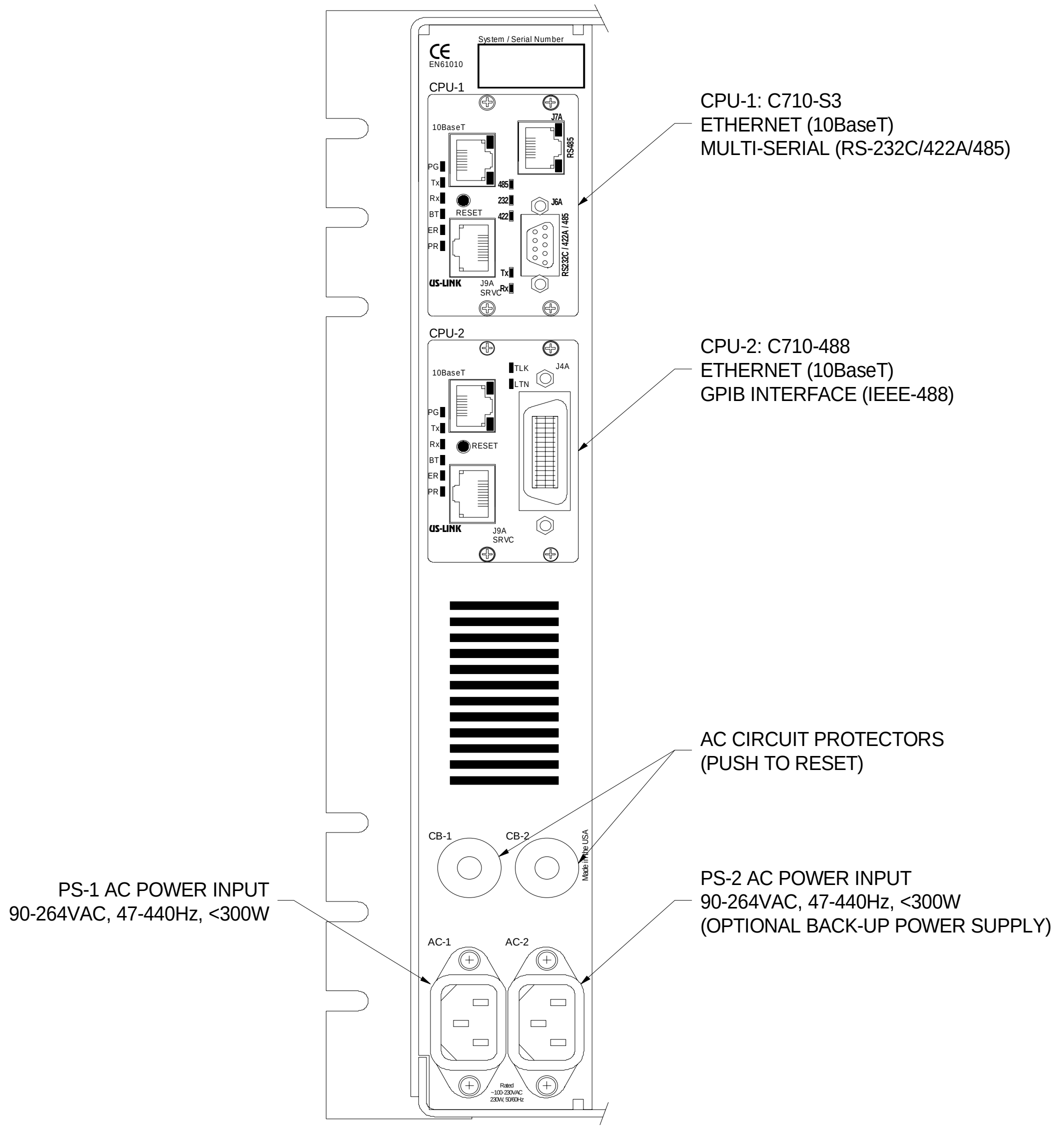


The unit model number determines the type of CPU that is included when the unit is delivered from the factory. Some unit configurations can have two of these assemblies installed for additional flexibility or for a redundant means of control. These CPU assemblies install into the rear of most systems and are secured by two phillips-head screws at the top, and two at the bottom.

The series C710 CPU/interface assemblies allow for flexible control scenarios to be provided. Any two types may be installed in the unit at the same time to support redundant control schemes.

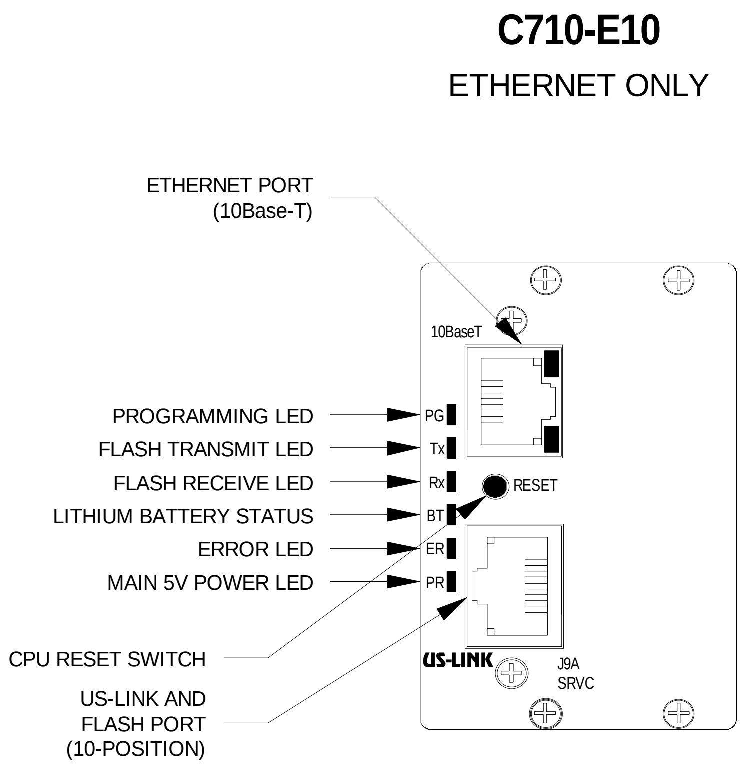
5.1. Multiple CPU Installations

Some unit configurations can have two of these assemblies installed for additional flexibility, or for a redundant means of control. The series C710 CPU/interface assemblies allow for flexible control scenarios to be constructed. Any two types, or two identical types may be installed in the unit at the same time to support redundant control schemes. Below is a rear view of a larger unit (8RU) that contains two CPU slots. The upper slot is CPU-1 and the lower slot is CPU-2.



5.2. C710-E10: Ethernet (only) Interface

The C710-E10 provides only an Ethernet port (10BaseT) control port. Functions of the plug-in CPU can easily be changed which is explained in the following sections.



The plug-in assembly is part of the Series C710 interface/CPU product line. The complete model number is C710-E10 and includes the following features:

- TCP/IP is included
- LED status indicators
- Serial firmware upgrade port (J9A)
- Lithium-backed RAM
- Upgradeable FLASH program area
- Standard **US-LINK** interface for remote control panels

5.2.1. The Ethernet (10BaseT) Port Pin Assignment

The Ethernet port is designed per standard 10BaseT specifications and has standard pin assignments. For reference, the table below shows the pin assignment for the Ethernet port.

Pin	Signal Assignment
1	Tx +
2	Tx -
3	Rx +
4	No Connect
5	Rx -
6	No Connect
7	No Connect
8	No Connect

5.2.2. Default IP Address

When a unit leaves the factory and is configured with the following:

- IP address: 10.100.1.49
- Port: 7145

5.2.2.1. Changing the Ethernet Settings

To change the factory default IP address, you can use the "GET?" and "SET" commands with parameters 33 through 48 to read, change and verify the IP address. See the "Communicating with the Unit" section of this manual.

5.2.2.2. Changing the Ethernet Settings from the Front Panel

At the date of publication of this manual, the user cannot change the Ethernet parameters from the front panel menu system.

5.2.3. The **US-Link** Interface and Service Port

The C710 is equipped with an **US-LINK** type interface used for adding remote control panel assemblies or to link units with multiple chassis together. Both control and status are passed to/from the remote units via the **US-LINK** port.

The design of the port allows remote control panels to be located up to 1000 feet away from the switching system. The connector is a standard 10-position RJ-45 type jack, but the **US-Link** portion only uses the center 4 positions. The port can be mated with any standard Ethernet cable. The port utilizes fixed baud rate half-duplex RS-485 type of serial transmission.

To fully utilize the **US-LINK** port, the proper firmware drivers must be downloaded to the C710-488 via the J9A port. Consult the factory.

5.2.3.1. The Service Port

The C710-488 contains a serial service port (J9A) for downloading new firmware to the plug-in CPU. The connector is shared with the **US-Link** connector. Upgraded firmware enhancements can easily be added to the unit by downloading the new version via this port. A cable is available from the factory and connects to your PC computer or other serial control device. **You must use the factory cable otherwise damage to your PC or the unit may occur.**

Pin	Signal Assignment (J9A)
1	Program (ground to activate programming)
2	RxD (used for programming only)
3	TxD (used for programming only)
4	- RS485 (US-Link)
5	+ RS485 (US-Link)
6	GND
7	GND
8	DSR (used for programming only)
9	DTR (used for programming only)
10	GND

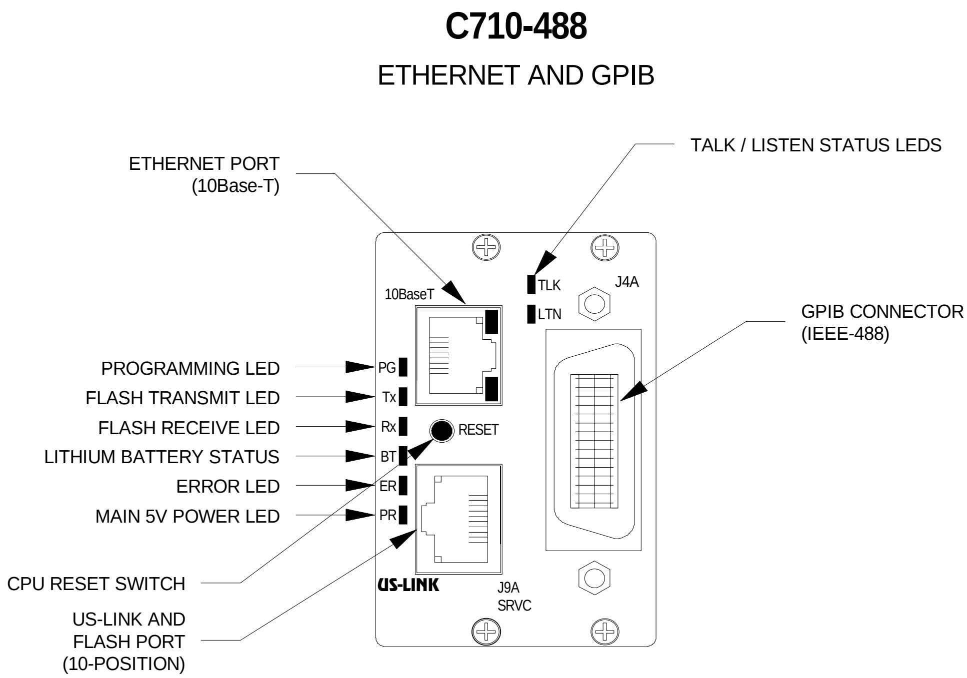
The connection to your PC is simple. Some examples are shown in the diagram below.

5.2.3.1.1.Installing New Firmware Drivers

The C710-488 can accept new firmware drivers via the J9A service port. See the instructions contained with the new firmware package for installation.

5.3. C710-488: Ethernet and GPIB (IEEE-488) Interface

The C710-488 provides both an Ethernet port and a GPIB control port (IEEE-488). **The GPIB port is factory configured for an address of 20.** The address can easily be changed which is explained in the following sections.



The plug-in assembly is part of the Series C710 interface/CPU product line. The complete model number is C710-488 and includes the following features:

- TCP/IP is included
- Standard GPIB interface port (J4A)
- LED status indicators
- Serial firmware upgrade port (J9A)
- Lithium-backed RAM
- Upgradeable FLASH program area
- Standard **US-LINK** interface for remote control panels

5.3.1. The Ethernet (10BaseT) Port Pin Assignment

The Ethernet port is designed per standard 10BaseT specifications and has standard pin assignments. For reference, the table below shows the pin assignment for the Ethernet port.

Pin	Signal Assignment
1	Tx +
2	Tx -
3	Rx +
4	No Connect
5	Rx -
6	No Connect
7	No Connect
8	No Connect

5.3.2. Default IP Address

When a unit leaves the factory and is configured with the following:

- IP address: 10.100.1.49
- Port: 7145

5.3.2.1. Changing the Ethernet Settings

To change the factory default IP address, you can use the "GET?" and "SET" commands with parameters 33 through 48 to read, change and verify the IP address. See the "Communicating with the Unit" section of this manual.

5.3.2.2. Changing the Ethernet Settings from the Front Panel

At the date of publication of this manual, the user cannot change the Ethernet parameters from the front panel menu system.

5.3.3. GPIB Port Pin Assignment

The GPIB port is designed per the IEEE-488.2 specification and has standard pin assignments. For reference, the table below shows the pin assignment for the GPIB port.

Pin	Signal Assignment (J4A)
1	ID 1
2	ID 2
3	ID 3
4	ID 4
5	EOI
6	DAV
7	NRFD
8	NDAC
9	IFC
10	SRQ
11	ATN
12	SHIELD
13	ID 5
14	ID 6
15	ID 7
16	ID 8
17	REN
18	GND (6)
19	GND (7)
20	GND (8)
21	GND (9)
22	GND (10)
23	GND (11)
24	LOGIC GROUND

5.3.4. Setting the GPIB Address

When a unit leaves the factory and is configured with a GPIB interface, **it is pre-configured GPIB address 20**. These settings may be altered in the field by means of the front panel controls.

5.3.4.1. Changing the GPIB Settings from the Front Panel

Front panel modification of the GPIB port setting is available via the menu system. Only the GPIB address and SRQ settings are available as options to be changed. You may select a different GPIB address or disable the SRQ setting on the interface.

To change the GPIB interface parameters from the front panel, the following sequence must be observed (any remote control activity is automatically void and the interface will be reset once the alterations are done).

- Press the MNU (menu) key on the control pad repeatedly until the "Interface Menu", is shown.
- Use the arrow keys (up/down) to move the cursor to the interface (CPU1-CPU2) that you desire to modify, and press ENTER. When depressed, the firmware version of the interface card is shown.
- Use the (left/right) arrow keys to select a parameter to be modified, then use the enter key to alter the value.

When all desired modifications are complete and have been stored, press "CNL" to return to the main screen and resume operation, or press "MNU" again to display the next setup menu

5.3.5. The **US-Link** Interface and Service Port

The C710 is equipped with an **US-LINK** type interface used for adding remote control panel assemblies or to link units with multiple chassis together. Both control and status are passed to/from the remote units via the **US-LINK** port.

The design of the port allows remote control panels to be located up to 1000 feet away from the switching system. The connector is a standard 10-position RJ-45 type jack, but the **US-Link** portion only uses the center 4 positions. The port can be mated with any standard Ethernet cable. The port utilizes fixed baud rate half-duplex RS-485 type of serial transmission.

To fully utilize the **US-LINK** port, the proper firmware drivers must be downloaded to the C710-488 via the J9A port. Consult the factory.

5.3.5.1. The Service Port

The C710-488 contains a serial service port (J9A) for downloading new firmware to the plug-in CPU. The connector is shared with the **US-Link** connector. Upgraded firmware enhancements can easily be added to the unit by downloading the new version via this port. A cable is available from the factory and connects to your PC computer or other serial control device. **You must use the factory cable otherwise damage to your PC or the unit may occur.**

Pin	Signal Assignment (J9A)
1	Program (ground to activate programming)
2	RxD (used for programming only)
3	TxD (used for programming only)
4	- RS485 (US-Link)
5	+ RS485 (US-Link)
6	GND
7	GND
8	DSR (used for programming only)
9	DTR (used for programming only)
10	GND

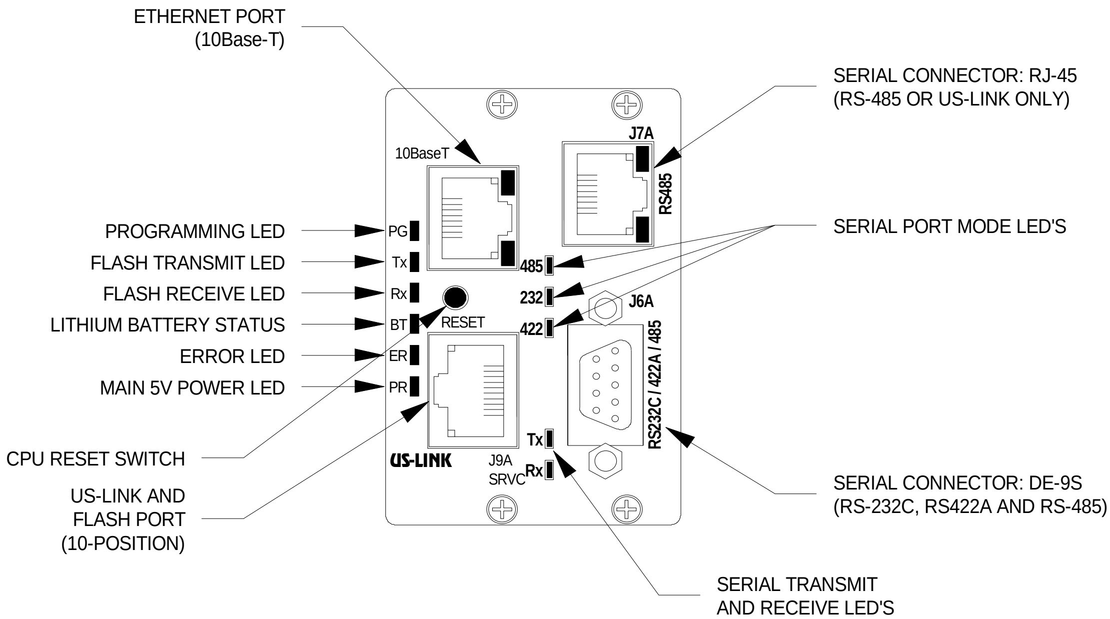
The connection to your PC is simple. Some examples are shown in the diagram below.

5.3.5.1.1. Installing New Firmware Drivers

The C710-488 can accept new firmware drivers via the J9A service port. See the instructions contained with the new firmware package for installation.

5.4. C710-S3: Ethernet and Serial Interface

The C710-S3 provides an Ethernet control port (10baseT) and either RS-232C, RS-422A or multi-drop RS-485 type interfacing. **The serial port is factory configured for 9600 Baud, 8 Data bits, 2 Stop bits, No Parity, and Xon/Xoff flow control.** Changes to these settings are explained in the following sections. The J6A connector is used for RS-232C/422A/485 serial modes, and the J7A connector can be used only for RS-485 (RJ-47 type connector).



The plug-in assembly is part of the Series C710 interface/CPU product line. The complete model number is C710-S3 and includes the following features

- TCP/IP is included
- Standard serial interface port (J6A and J7A)
- LED status indicators
- Jumper selectable RS-232C, RS-422A or Multi-drop RS-485
- Serial firmware upgrade port (J9A)
- Lithium-backed RAM
- Upgradeable FLASH program area

5.4.1. The Ethernet (10BaseT) Port Pin Assignment

The Ethernet port is designed per standard 10BaseT specifications and has standard pin assignments. For reference, the table below shows the pin assignment for the Ethernet port.

Pin	Signal Assignment
1	Tx +
2	Tx -
3	Rx +
4	No Connect
5	Rx -
6	No Connect
7	No Connect
8	No Connect

5.4.2. Default IP Address

When a unit leaves the factory and is configured with the following:

- IP address: 10.100.1.49

- Port: 7145

5.4.2.1. Changing the Ethernet Settings

To change the factory default IP address, you can use the "GET?" and "SET" commands with parameters 33 through 48 to read, change and verify the IP address. See the "Communicating with the Unit" section of this manual.

5.4.2.2. Changing the Ethernet Settings from the Front Panel

At the date of publication of this manual, the user cannot change the Ethernet parameters from the front panel menu system.

5.4.3. Serial Port Pin Assignment: J6A (DE-9S)

The J6A serial port has RS-232C, RS-422A and RS-485 capability. The selection of either type is jumper selectable. Please make sure that only the desired signal wires are used (RS232C, RS422A or RS-485) in your cable, or damage could occur. Pins labeled as "Not Used" may contain active circuits and should not be connected to.

Pin Number	RS-232C Mode	RS-422A Mode	RS-485 Mode
1	Not Used	Transmit Data - (out)	Not Used
2	Transmit Data (out)	Transmit Data + (out)	Not Used
3	Receive Data (in)	Receive Data + (in)	Data +
4	Not Used	Receive Data - (in)	Data -
5	Ground	Ground	Ground
6	Not Used	Clear To Send -	Not Used
7	Clear To Send	Clear To Send +	Not Used
8	Ready To Send	Ready To Send +	Not Used
9	Not Used	Ready To Send -	Not Used

5.4.4. Serial Port Pin Assignment: J7A (RJ-45)

The J7A serial port is used only for RS-485 multi-drop serial control and is a standard RJ-45 type connector. It offers the system engineer a connection alternative to the J6A D-Sub connector. The selection of the RS-485 mode is jumper selectable. An LED indicator identifies the serial control mode. The additional LED indicators built-into the RJ-45 connector are always on (yellow and green).

Please make sure that only the desired signal wires are used (RS232C, RS422A or RS-485) in your cable, or damage could occur. Pins labeled as "Not Used" may contain active circuits and should not be connected to.

Pin Number	RS-485 Mode
1	Not Used
2	Not Used
3	Ground
4	Ground
5	Data +
6	Data -
7	Not Used
8	Not Used

5.4.5. Setting the RJ-45 Serial Port: J7A

When the unit leaves the factory, the serial port is pre-configured for 9600 baud, 8 bits per character, no parity, 2 stop bits, hardware handshaking (Xon-Xoff), and an RS-485 address of ASCII "A".

These settings may be altered in the field by means of the front panel controls with exception of the RS-485 address. The RS-485 multi-drop address is changed only by dipswitch settings on the CPU card. To change this, the CPU must be removed from the unit.

5.4.6. Changing the Serial Settings from the Front Panel

After delivery from the factory, the front panel controls can be used to change most of the serial control parameters. Only the RS-485 address and the control mode (RS-232C, RS-422A or RS-485) must be set by changing jumper settings and/or dipswitches on the CPU assembly.

To change the other serial interface parameters from the front panel, the following sequence must be observed (any remote control activity is automatically void and the interface will be reset once the alterations are done).

- Press the MNU (menu) key on the control pad repeatedly to move to the "Interface Menu". This is the second screen (press MNU twice).
- Use the arrow keys (up/down) to move the cursor to the interface that you desire to modify, and press ENTER. After ENT is pressed, the firmware version of the interface card is displayed.
- Use the (left/right) arrow keys to select a parameter to be modified, and then use the (up/down) arrows to alter the value.

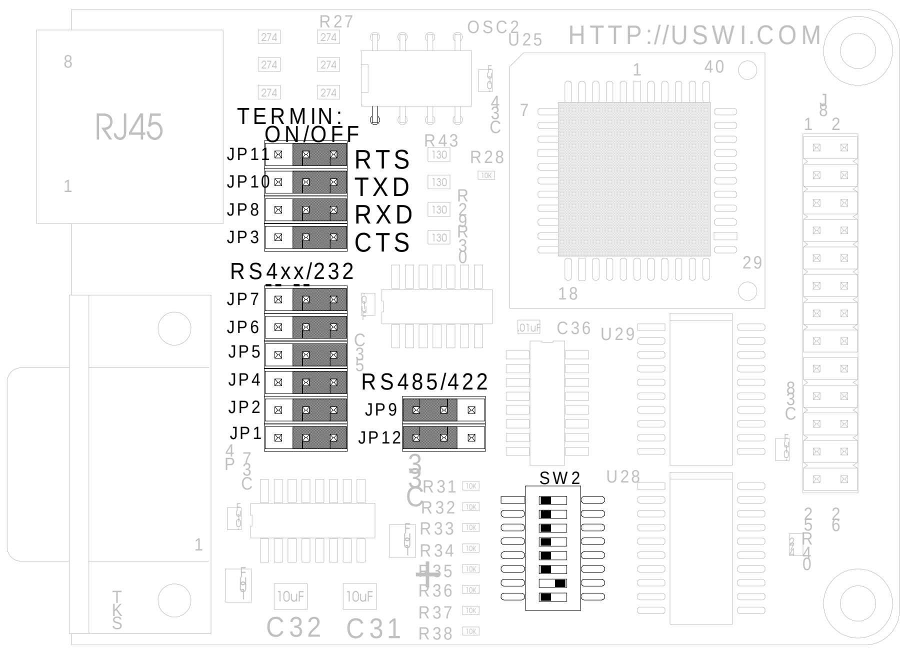
When all desired modifications are complete and have been stored, press "CNL" to return to the main screen and resume operation, or press "MNU" again to display the next setup menu.

5.4.7. Changing the RS-485 Address and/or Serial Mode

> ***NOTE: The CPU must be removed from the unit to view the jumper selections and DIP switch to make changes.***

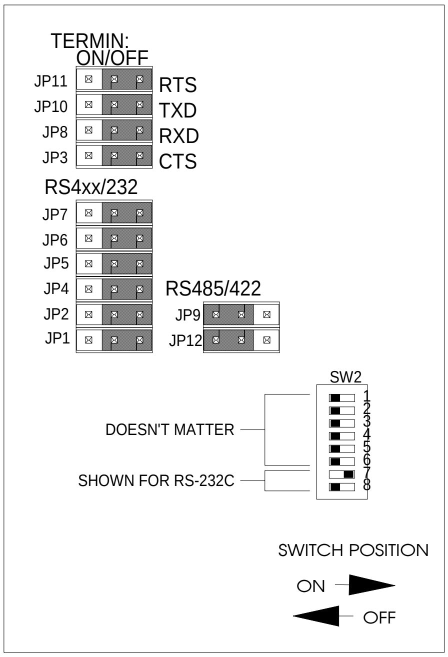
An 8-position dipswitch is located on the plug-in CPU. Also located on this assembly are a number of configuration jumpers. These jumpers and switch settings allow the user to select between the three different serial modes available on the C710-S3 CPU assembly. The locations of these features are highlighted in the diagram below.

SERIAL MODE JUMPERS AND DIP SWITCH
(RS-232C SHOWN)

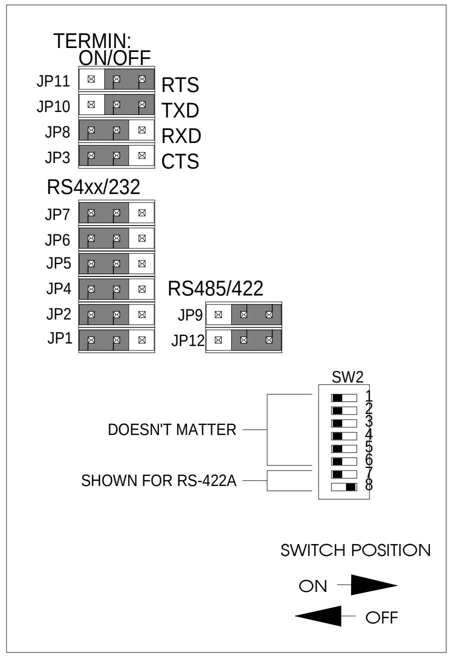


The jumpers are moved to different positions to properly connect drivers and receivers for the different serial modes. The diagram below shows how the jumpers and dipswitch are to be positioned for the different formats.

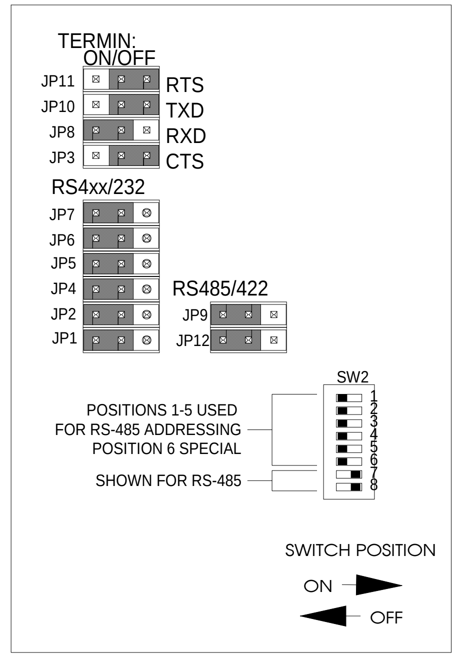
RS-232C



RS-422A



RS-485

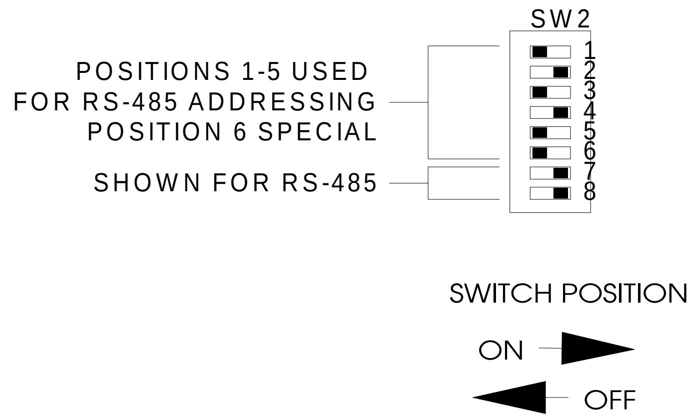


5.4.7.1. Setting the RS-485 Addressing Switch

If the C710-S3 is being used in the RS-485 serial mode, the unit will need to have an address. **The factory default is address 10.** Positions 1 through 5 are used to define the address of the port. Since the RS-485 serial format provides for multiple units to share a common link, the addressing allows for individual control by preceding control data with a binary address. If the binary address byte matches, the unit will respond. Only one device on the RS-485 can have a given address.

Position	Weight
1	1 (LSB)
2	2
3	4
4	8
5	16 (MSB)

The diagram below shows the dipswitch on the CPU in the factory default for most RS-485 type shipments. The addressing positions (1-5) show an address of 10 and positions 7 and 8 are also ON.



5.4.8. The **US-Link** Interface and Service Port

The C710 is equipped with an **US-LINK** type interface used for adding remote control panel assemblies or to link units with multiple chassis together. Both control and status are passed to/from the remote units via the **US-LINK** port.

The design of the port allows remote control panels to be located up to 1000 feet away from the switching system. The connector is a standard 10-position RJ-45 type jack, but the **US-Link** portion only uses the center 4 positions. The port can be mated with any standard Ethernet cable. The port utilizes fixed baud rate half-duplex RS-485 type of serial transmission.

To fully utilize the **US-LINK** port, the proper firmware drivers must be downloaded to the C710-S3 via the J9A port. Consult the factory.

5.4.8.1. The Service Port

The C710-S3 contains a serial service port (J9A) for downloading new firmware to the plug-in CPU. The connector is shared with the **US-Link** connector. Upgraded firmware enhancements can easily be added to the unit by downloading the new version via this port. A cable is available from the factory and connects to your PC computer or other serial control device. **You must use the factory cable otherwise damage to your PC or the unit may occur.**

Pin	Signal Assignment (J9A)
1	Program (ground to activate programming)
2	RxD (used for programming only)
3	TxD (used for programming only)
4	- RS485 (US-Link)
5	+ RS485 (US-Link)
6	GND
7	GND
8	DSR (used for programming only)
9	DTR (used for programming only)
10	GND

The connection to your PC is simple. Some examples are shown in the diagram below.

5.4.8.1.1.Installing New Firmware Drivers

The C710-S3 can accept new firmware drivers via the J9A service port. See the instructions contained with the new firmware package for installation.

6. Communicating with the Unit

This unit contains the C710 type of CPU offered by Universal Switching. This product offers the user the flexibly of controlling the unit via Ethernet with TCP/IP (10baseT), plus it is available in versions that include serial (RS-232C/422A/485) or GPIB (IEEE-488) ports as well. The unit can be configured, controlled and receive status with serial, GPIB or Ethernet (TCP/IP).

The exact compliment is dependent on the configuration that was ordered. The interfaces comply with either IEEE 488.2 (in the case of GPIB) or one of its derivatives (in the case of serial or TCP/IP).

6.1. Remote Resources

Perhaps the most versatile way to communicate is through National Instruments' NI-VISA library. This API contains a series of functions designed for interface-independent, device-independent and platform-independent access to instruments connected to a "host". To use, the calling program calls the function viOpen() with a "resource name" as one of the arguments. If successful, the function returns a handle to a VISA "session" which can be used to call the other VISA functions.

6.1.1. Example Resource Names

Examples of resource names are:

GPIB0::20::INSTR -(The instrument at address 20 on GPIB interface card 0)

ASRL1::INSTR -(The instrument connected to serial port 1)

TCPIP::10.100.1.49::7145::SOCKET - (The instrument at the indicated IP address listening in on port 7145)

The resource name is all NI-VISA needs to figure out how to communicate with the instrument. Some of the chores that VISA handles are:

- It figures out which calls to make to which interface (socket, GPIB, serial or future interfaces)

- It knows the capabilities of each interface. For example, the viReadSTB function will "serial poll" a GPIB instrument, but send "*STB?\n" and read the response on serial or TCP/IP. It knows that serial has a baud rate and that GPIB has, among other lines, attention and trigger.

- Buffers characters, manages time-out.

- Multiple sessions can be opened to each instrument. It will automatically handle contention issues (including locks).

6.1.2. National Instruments Information

For a complete description of the API see the "NI-VISA Programmer Reference Manual" which is available from National Instruments' web sites (www.ni.com).

A minimal "session" could consist of calling viOpen(), viWrite() and viClose(). (Of course you would have to define several data members.) Note that these same calls can be used for any interface just by changing the resource name sent to the viOpen function.

A download of NI-VISA usually contains an application for accessing the API from either a command line or a GUI. This can also be used to access the instrument. Don't forget to append the "linefeed" character ('\n' or 0x0a) as the last character.

All of National Instruments' development environments include "wrappers" to the NI-VISA library. LabVIEW, for instance has "virtual instruments" (LabVIEW's term for function) to all the functions so that, again, a minimal session can be built by "wiring" the Open, Write and Close VIs together.

While the above has mentioned only National Instruments, note that VISA (or Virtual Instrument System Architecture) is the product of an alliance between the largest companies in instrumentation including companies like Tektronix and Agilent. Since National Instruments has more of a presence on the "host" end of instrumentation (where as the other companies actually make instruments) it has evolved has the main source for host software.

At a lower level, your host's operating system should have a TCP/IP socket interface: simply open a session to the instrument's IP address and port. Send commands and queries and receive the responses back. To access GPIB, you probably installed an interface card that included its own set of APIs. (Odds are the interface says "National Instruments" all over it and the API is called

"NI-488.2.") The APIs for accessing serial vary widely from platform to platform.

6.1.3. GUI and Commands Line Level of Control

At the GUI and command line levels, there are several ways to control the instrument. Probably the most familiar is HyperTerminal from Hilgraeve. (Yes, the one that ships with most flavors of Windows). It will work fine with serial as long as you remember to append the linefeeds. It might come as a surprise to know that the version that ships with Windows 2000 also works with TCP/IP (aka Telnet). The pull down, which lets you select the COM port, now includes TCP/IP as an option. Again, don't forget the terminating linefeed.

Most operating systems include some form of Telnet. It will also work as long as you change the port from Telnet's default 23 to one of the C710's ports (start with 7145).

For GPIB, National Instruments includes a command line utility (IBIC) and a GUI utility (Communicator). At the risk of sounding repetitious, don't forget the terminating linefeed and don't forget to change the read-termination method to linefeed.

7. Remote Control Information

The unit is controlled via any of the installed remote interfaces located on the Series C710 plug-in CPU's. The control commands are the same no matter what the electrical interface (GPIB – Ethernet or Serial). Universal Switching's products have a 488.2 compliant control protocol. This protocol is streamlined and is different from the traditional and simple US2, US3 and US4 control protocols that have been used on most products. This manual only explains the 488.2 control protocol.

The 488.2 protocol is the factory default and is enabled by default when a unit is delivered from the factory. **The user may change the protocol to the older USx type, but it is recommended that for new applications that any software be developed utilizing the new 488.2 compliant protocols.**

7.1. Changing Between Control Protocols

The 488.2 protocols are the factory default and are enabled when a unit is delivered from the factory. **The user may change the protocol to the older USx type, but it is recommended that for new applications that any software be developed utilizing the new 488.2 compliant protocols.** Only the newer 488.2 protocols are detailed in this manual. For older protocols, contact the factory.

To change the unit to backwards compatibility (US2, US3 or US4), then send the following command:

- SET 29,0 (sets the unit to backwards compatible protocol), or press the STO button on the front panel keypad and STOre location 223.

To change the unit to 488.2 compatibility (factory default):

- SET 29,1 (sets the unit to 488.2 compatible protocol), or press the STO button on the front panel keypad and STOre location 222.

7.2. Syntax Conventions

The following outlines the proper syntax of the commands for the 488.2 protocol:

- Words in the format XXXxxxxx represent keywords. The upper case part is required; the lower case part is optional. Any combination of upper and lower case characters is acceptable (example: CONnect - the CON is required and minimally acceptable).
- Italicized words represent values (example: output)
- () represents optional words or combinations, | means that a choice can be made among the possibilities.
- Numbers must be whole numbers in base 10. Leading zeros are ignored. Decimal numbers, scientific notation and arithmetic expressions are not accepted. (While the latter may be in contradiction to 488.2, it does appear to be a reasonable limitation.)
- Where spaces are shown, at least one space must appear unless there's a comma. An arbitrary number of spaces can be used in addition to the required one.
- A "compound" command may be formed by placing a ; between commands.
- A command must be terminated with the ASCII linefeed character (0x0a, 10 or Ctrl-J).
- Responses are sent only in reply to queries (commands which end with "?").

7.2.1. CONnect command

This command is used to make a connection within a unit.

CONnect (FRom) (OUtput) *output*, (TO) (INput) *input* (, (ON) ((MOdule) *module* | ALL) | SLot *slot*)

examples:

- Connect from output 1, to input 1, on module 1
- con 1,1,1 (identical to the above)
- con 1,1
- con 1,1,all

7.2.2. DISconnect command

This command is used to disconnection within a unit.

DISconnect ((FRom) (OUput) *output* (, (TO) (INput) *input*) (, (ON) (MOdule) *module* | ALL) | {SLot *slot*})) | (FRom) ALL

examples:

- Disconnect from output 1, to input 1, on module 1
- Disconnect all (same as the current clear command
- Disconnect output 1

7.2.3. QUEry? command

This command is used to query a unit whether it is a single switchpoint, part of the unit, or the whole unit.

QUEry? ((FRom) (OUput) *output* (, (TO) (INput) *input*) (, (ON) (MOdule) *module* | ALL) | {SLot *slot*})) | (FRom) ALL

The response is the input to which the output is connected or 0 if it's disconnected. If an input is specified and the output is not connected or connected to a different input, it will be flagged as an execution error. Queries regarding one output will be checked against the module's response to a Verify command. Queries with the ALL specifier will not be "verified".

Command examples:

- que? 1 (the response would be the input number that is connected to the specified output port)
- que? 1,1
- que? all (the response would be the number of outputs being reported on, followed by the inputs that are connected starting with output 1 and ending with the last output of the unit)

An example response to the "que? all" command (to display which input all of the outputs are connected to). It is one long string.

```
256,1,18,0,64,4,133,169,183,57,53,119,13,250,74,196,
156,43,30,117,45,33,42,35,128,206,128,35,150,53,249,
0,35,61,238,144,183,220,188,163,122,187,44,178,161,
156,230,109,173,106,155,229,81,148,22,247,112,171,55,
163,244,41,39,229,246,72,111,213,1,205,196,211,218,
123,54,192,174,146,112,157,59,132,99,209,234,138,204,
81,82,27,6,10,10,0,39,6,186,73,59,144,208,193,175,99,
229,3,100,36,15,21,103,113,183,234,18,101,163,234,127,
7,130,228,80,37,160,202,217,11,76,131,30,63,128,77,
130,0,218,160,164,57,233,83,128,84,51,68,186,40,226,
212,221,150,185,229,126,165,47,22,188,108,217,213,0,
230,139,113,89,90,141,231,87,203,160,67,138,53,18,97,
131,53,29,76,84,148,20,199,226,227,115,30,201,84,158,
122,84,198,190,27,60,20,44,161,60,6,182,172,76,23,79,
73,0,121,120,176,159,116,77,59,244,217,4,5,252,107,
112,102,94,1,102,120,0,193,172,152,136,231,184,194,74,
207,236,251,85,144,215,170,14,250,163,217,84,243,213,
110,73,137,222
```

Interpreted as:
256 outputs,
output 1 is connected to input 1,
output 2 is connected to input 18,
output 3 is not connected
....
output 256 is connected to input 222

Another example, to query as to which midstages are being used to connect an output, the following command and response would be used.

Command:

que? all mid all

Here is an example response. It is one long string.

```
256,7,22,0,16,23,24,2,30,25,5,11,18,10,13,27,29,30,15,
17,14,1,21,2,16,4,13,22,11,24,31,0,20,13,12,16,11,10,
20,1,25,27,24,28,8,18,6,4,5,14,13,9,5,22,27,25,7,4,10,
1,23,12,6,17,26,7,16,29,25,8,28,12,30,31,6,1,17,26,13,
2,4,10,17,9,18,25,1,5,4,11,16,20,29,0,6,31,26,19,4,16,
11,5,21,25,23,24,20,10,8,7,31,2,30,15,22,11,1,20,6,3,
12,19,31,13,8,23,25,21,16,28,19,2,13,29,1,0,4,8,6,25,
31,9,16,21,11,15,6,26,7,31,3,21,23,4,12,11,29,27,8,28,
22,29,0,16,13,2,6,20,26,3,7,12,8,28,25,24,22,5,28,24,
16,30,21,22,13,15,7,1,8,31,19,2,10,25,21,22,2,29,31,
10,4,8,28,16,12,24,30,23,17,10,0,5,28,13,27,26,29,4,
6,22,23,19,16,9,7,29,27,25,10,28,0,5,24,12,6,3,4,2,
13,30,14,5,30,16,13,20,4,21,1,22,2,7,29,12,10,14,23
```

Interpret as:
256 outputs,
output 1 is routing through midstage 7,
output 2 is routing through midstage 22,
output 3 is not connected
...
output 1 is routing through midstage 23

7.2.4. VALidate? command

This command validates values that might be used in a CONnect or DISconnect command.

VALidate? (FRom) (OUtput) *output,* (TO) (INput) *input* (, (ON) ((MOdule) *module* | ALL) | SLot *slot*)

Checks the "validity" *(i.e. are the values out of range or address a module that's not installed?)* of a combination and returns either 0 or the execution error that would result if used in a connect or disconnect command.

val? 1,9999 (response will be 2 since it's unlikely we'll produce a switch with 9999 inputs)

In the above commands, the module (or mid-stage) takes on a different meaning that depends on the algorithm used as a result of the product specifications. Assuming two 8x16 modules in the system:

- Parallel: this assumes that these are two separate 8x16 modules. The command will be directed to the module indicated in the command, unless ALL is specified in which case the operation will be performed on each module. Note that if "Slots Ganged" is "Yes" on the keypad, the entry of the module will not be possible and ALL will be assumed. The exact rules regarding "partial ganging" need to be determined.

- Outputs End-to-end: this assumes the system is configured as 8 inputs by 32 outputs. The system will automatically route the commands to the correct module. The user has the option (for diagnostic purposes) of specifying a module, in which case output 1, input 1, module 2 has the same effect as output 17, input 1. The Query? All will show the connect on output 17.

- Inputs End-to-end: this assumes the system is configured as 16 inputs by 8 outputs.

7.2.5. GET? and SET commands

These commands allow the user to get and/or set various properties and values of the unit.

GET? *property*

SET *property, value*

Various "properties" can be "set" with a value; Some "properties'" "value" can be read. A separate table will be updated as properties are added (and the list grows!). Note that each one behaves differently: consult the table.

examples:

- set 21, 1 (sets auto interlock on)
- get 21? (gets current auto interlock status)
- get 1? (gets number of outputs)
- set 1,1 (causes an execution error 12)
- set 29,0 (changes unit to "backwards compatibility mode")

7.2.5.1. GET? and SET value table

Below is a table of the available properties that can be read and changed. Note that each one behaves differently so consult the table.

Code	Title	Access	Function
1	Outputs	RO	Largest output
2	Inputs	RO	Largest input
3	Modules	RO	number of modules for which the system is configured
4	Last query error	RO	last query error or zero (see note 1)
5	Slot that the module is in	RW	set: (see Note 2) Get: returns the slot where the module should be
6	Inputs on module	RW	set: (see Note 2) Get: returns the number of inputs on the module
7	Outputs on module	RW	set: (see Note 2) Get: returns the number of outputs on the module
8	Slots	RO	number of slots in the system
9	Module in slot	RW	set: (see Note 2) Get: returns module number in slot or 0
10	Module ID in slot	RW	set: (see Note 2) Get: returns ID of module in slot or 0
11	(Project)		
12	(Project)		
13	(Project)		
14	(Project)		
15	Fault FIFO	RO	Returns next fault or zero if empty, see note 3
16	Last Execution Error	RO	
17	(Project)		
18	(Project)		
19	(Project)		
20	(Project)		
21	Auto Interlock	RW	auto interlock on (1) or off(0)
22	Auto Restore	RW	auto restore on(1) off(0)
23	"VFD" debug	RW	1: SPI traffic appears on Telnet port
24	Beep on Error	RW	1: beep on error, 0: silent
25			
26	Power Supply 1	RO	Last status returned from PS1
27	Power Supply 2	RO	Last status returned from PS2
28	Memories	RO	number of "memories" available to *SAV or *RCL
29	Use 488.2	RW	use 488.2 (1) use backwards-compatibility mode (0)
30	System Integrity	RW	if anything other than 21930, system will restore factory defaults on next reset
31	System cleared	RO	1 if system restored defaults on last restart
32			
33	Current IP address (MS)	RO	nnn of nnn.XXX.XXX.XXX for current IP address
34	Current IP address	RO	nnn of XXX.nnn.XXX.XXX for current IP address
35	Current IP address	RO	nnn of XXX.XXX.nnn.XXX for current IP address
36	Current IP address (LS)	RO	nnn of XXX.XXX.XXX.nnn for current IP address
37	Current Subnet Mask (MS)	RO	nnn of nnn.XXX.XXX.XXX for current subnet mask
38	Current Subnet Mask	RO	nnn of XXX.nnn.XXX.XXX for current subnet mask
39	Current Subnet Mask	RO	nnn of XXX.XXX.nnn.XXX for current subnet mask
40	Current Subnet Mask (LS)	RO	nnn of XXX.XXX.XXX.nnn for current subnet mask
41	IP Address after reset (MS)	RW	nnn of nnn.XXX.XXX.XXX for IP address after next reset
42	IP Address after reset	RW	nnn of XXX.nnn.XXX.XXX for IP address after next reset
43	IP Address after reset	RW	nnn of XXX.XXX.nnn.XXX for IP address after next reset
44	IP Address after reset (LS)	RW	nnn of XXX.XXX.XXX.nnn for IP address after next reset
45	Subnet Mask after reset (MS)	RW	nnn of nnn.XXX.XXX.XXX for subnet mask after next reset

Code	Title	Access	Function
46	Subnet Mask after reset	RW	nnn of XXX.nnn.XXX.XXX for subnet mask after next reset
47	Subnet Mask after reset	RW	nnn of XXX.XXX.nnn.XXX for subnet mask after next reset
48	Subnet Mask after reset (LS)	RW	nnn of XXX.XXX.XXX.nnn for subnet mask after next reset
49	Current gateway (MS)	RO	nnn of nnn.XXX.XXX.XXX for current gateway address
50	Current gateway address	RO	nnn of XXX.nnn.XXX.XXX for current gateway address
51	Current gateway address	RO	nnn of XXX.XXX.nnn.XXX for current gateway address
52	Current gateway (LS)	RO	nnn of XXX.XXX.XXX.nnn for current gateway address
53	Gateway after reset (MS)	RW	nnn of nnn.XXX.XXX.XXX for gateway mask after next reset
54	Gateway after reset	RW	nnn of XXX.nnn.XXX.XXX for gateway mask after next reset
55	Gateway after reset	RW	nnn of XXX.XXX.nnn.XXX for gateway mask after next reset
56	Gateway after reset (LS)	RW	nnn of XXX.XXX.XXX.nnn for gateway mask after next reset
57			
58			
59			
60			
61	serial 1 "DIP switch"	RW	
62			
63			
64	Serial 2 "DIP switch"	RW	
65			
66			
67	GPIB 1 "DIP switch"	RW	
68	GPIB 2 "DIP switch"	RW	
69			

Note 1: As long as the register's corresponding bit in SESR is set, the GET? Command will return the last error. Once the SESR has been cleared (by the *ESR? Query), it will return the last error on the next call then clear itself.

Note 2: The SET determines which module or slot the next GET? Will reference. Example: to find out which slots module 1 & 2 are in, the following can be used: set 5,1; get? 5; set 5,2; get? 5

Note 3: This is shared between all the interfaces. The Fault bit in the SBR clears once it's empty.

Note 4: The "Access" column designations are defined as:

- RW = Read and Write
- RO = Read Only

7.2.6. ETHernet? command

This command is a query that returns the MAC address of the processor board. It is a unique alphanumeric string of hexadecimal numerals arranged as six octets separated by semi-colons.

example:

ETH?

Might return a string like this (without spaces):

1 2 : 3 4 : 5 6 : 7 8 : 9 a : b c

> ***NOTE: Each controller module has a unique MAC address. If the controller module is changed or replaced, the MAC address will change too.***

7.2.7. *SAV and *RCL commands

These commands allow the user to save and recall complete switchpoint configurations in non-volatile memory locations in the unit.

*SAV *memory*

*RCL *memory*

These commands act exactly like STnnn and REnnn (with one exception: storing after a DIS ALL will cause that memory to be flagged as "unused" as opposed to "in use") but hitchhike onto the format of the 488.2 common commands. The user can save and recall complete switchpoint configurations. As a departure from 488.2, however, 0 is not acceptable. The highest number that is acceptable can be found by the GET? 28 query.

examples:

- *SAV 99 (saves current switchpoint configuration to memory location 99)

- *RCL 12 (recalls switchpoint configuration saved in memory location 12)

7.2.8. RESet command

This command performs a system reset.

RESet

Performs a system reset. If SET 30, 0 was performed prior, the system will reset with factory defaults, otherwise, it will perform a "normal" reset. If Autorestore is TRUE (Set/Get? 22), the connections will also be restored.

7.2.9. *IDN? command

This command returns an identification string.

*IDN?

Returns an identification string of the format:

"Universal Switching,pppppppp,s,rrrrrrrrr\n"

where pppppppp is the model code, s is 0 (in lieu of a serial number) and rrrrrrrrr is the revision code. The model code and the revision code are extremely important for resolving support issues. Note that the revision code is subject to change with any firmware updates/revisions.

7.2.10.*TST? command

This command performs a unit self-test.

*TST?

The response is 0 if it completed successfully. A non-zero response indicates the number of modules that were not in their proper slots. Allow several seconds for the test to complete. As the result of the self-test:

Routing to modules that were removed or have stopped responding since the last reset or self-test will generate an execution error 47 instead of generating a fault.

Modules that were inserted since the last restart or self-test will now be used.

Interface setting made via the keypad or though SETs will take affect.

7.2.11.*RST command

This command is the switchpoint reset command.

*RST

This command will clear all the switchpoint routings in all the modules. No other status registers are affected.

7.2.12.*CLS command

This command will clear registers as described below.

*CLS

This will clear the interface's Last Error Registers, Event Status Register and the Status Byte Register (except for MAV, FLT and PSFLT) but not its queued responses. It has no affect on the other interfaces. As a departure from the standard, the Fault Queue is not affected. As a result, after the command, MAV, FLT and PSFLT will reflect the status of their underlying conditions.

7.2.13.*STB? command

This command will return the contents of the Status Byte Register.

*STB?

Returns the contents of the Status Byte Register. Note that bit 6 will be the MSS bit and not RQS and MSS will not be cleared by the operation. (This in contrast to the way GPIB serial polls clear RQS).

7.2.14.*ESR? command

This command will return the contents of the Event Status Register.

*ESR?

Returns the contents of the Event Status Register (ESR). The register is cleared after the read. See below for details of the relationship between the ESR and the Last Error Registers.

7.2.15.*ESE command

This command sets the value of the Events Status Register.

*ESE *n*

This sets the value n (n can be from 0 to 255) in the Event Status Enable Register (ESER). See below.

7.2.16.*ESE? command

This command will read the Event Status Enable Register (ESER).

*ESE?

Returns the current value of the ESER.

7.2.17.*SRE command

This command sets the value of the Service Request Enable Register.

*SRE *n*

Sets the value n (n can be from 0 to 255) in the Service Request Enable Register (SRER).

7.2.18.*SRE? command

This command reads the value of the Service Request Enable Register.

*SRE?

Returns the current value of the SRER.

7.2.19.*PSC command

This command will set the value of the PSC Register to *n*.

*PSC *n*

Set the value *n* (*n* can be 0 or non-zero) in the PSC register.

7.2.20.*PSC? command

Sending this command will read the value of the PSC register.

*PSC?

Returns the current value of the PSC register as value of zero or 1.

7.2.21.*OPC command

This command will set the OPC bit in the ESR.

*OPC

Sets the OPC bit in the ESR. This will cause the SBR to be updated. The bit can only be cleared by *CLS or ESR?.

7.2.22.*OPC? command

*OPC?

Immediately returns 0.

7.2.23.*WAI command

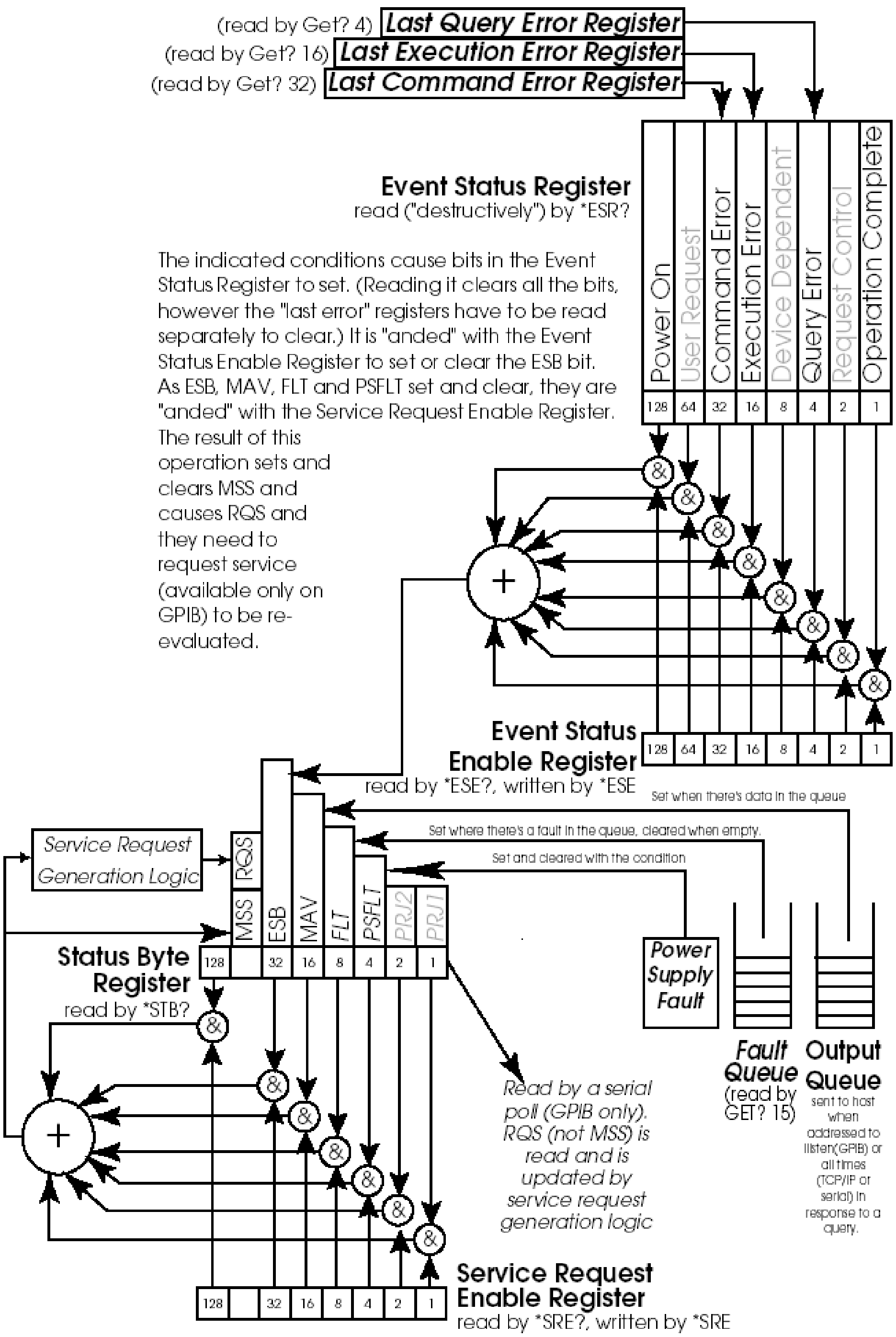
This command is only included for compatibility to the 488.2 standard.

*WAI

Since the device does not support "over-lapped commands, this command does nothing, and does it quickly. It is included for compatibility with the standard.

7.3. Status Register Layout and Description

This device tracks and reports its status using IEEE Standard 488.2.



Italics indicate Universal Switching extensions to the model, dimmed items are not applicable to this product and are always 0.

7.3.1. The Status Byte Register (SBR)

The current system status is summarized in the standard Status Byte Register (SBR). The SBR consists of the following bits with the following weights:

- **The standard Master Summary Status** (MSS, numeric weight of 64) – this bit is dependent on the state of the other bits of the register and the current value of the Service Request Enable Register (SRER, see below for details on it and how the MSS is determined).

- **The standard Event Status Bit** (ESB, numeric weight of 32) – this bit is dependent on the state of the Event Status Register (ESR) and the current value of Event Status Enable Register (ESER) (see below for both).

- **The standard Message Available bit** (MAV, numeric weight of 16) – this bit is set when the Output Queue (see below) has responses for the host in it. It gets cleared when it's empty.

- **The Fault bit** (FLT, numeric weight of 8) – this bit is set when there are faults recorded in the Fault Queue (see below). The usage of this bit is defined by Universal Switching.

- **The Power Supply Fault bit** (PSFLT, numeric weight of 4) – this bit is set and cleared as faults are found or cleared in the power supplies.

The remaining bits (numeric weights 128, 2 and 1) are not defined by either 488.2 or Universal Switching. They are currently always cleared. Universal Switching reserves the right to use the undefined bits in the future or in project-specific applications. **It is suggested that your host application mask these bits out.**

7.3.1.1. Reading the Status Byte Register (SBR)

The SBR is read by issuing the *STB? common command and interpreting the response. The response is a decimal number that, in practice, will be between 0 and 127. The value will indicate which of the five bits are set or cleared. The SBR is read-only.

On GPIB interfaces, the SBR is returned to the host in response to a serial poll. The 488.1 Request Service bit (RQS) is returned instead of the MSS bit in this case. For details, please consult the 488.2

standard. On a technical note, serial polls are handled directly by interface ASICs without the intervention of the processor. As service requests are acted upon by the interface ASICs, the moment-by-moment status of RQS may be changed by the ASIC. MSS, on the other hand, is changed by the processor only. (Note that the serial poll will cause RQS to clear but will have no direct effect on MSS.)

7.3.2. The Service Request Enable Register (SRER)

The standard Service Request Enable Register (SRER) can be read by the common *SRE? command and written by the *SRE command. With the exception of the bit with weight 64, each bit in the SRER corresponds to a bit in the SBR. In general, if at least one bit in the SRER is set and its corresponding bit in the SBR is also set, then MSS will be set. Otherwise, MSS is cleared.

As an example, if the bit with weight 16 is set in the SRER, then MSS will be set whenever MAV is set. Any of the following are examples of commands which will set SRER that way: *SRE 16; *SRE 48; *SRE 56. The bit with weight 64 (which corresponds to the MSS itself) is ignored. In this implementation, all unused and undefined bits are always zero. As an example, the response from *SRE 255; *SRE? will be 56 unless one of the above mentioned bits has been designated to support a project specific function which will be documented separately.

7.3.3. The Event Status Enabled Register (ESER)

In a similar situation, each bit in the standard Event Status Enabled Register (ESER) corresponds to a bit in the Event Status Register (ESR, see below). All eight bits in both registers are defined. If at least one bit in the ESER and its corresponding bit in the ESR are set, then the ESB bit of the SBR will be set, otherwise the ESB will be cleared. The SRER is written to by the *SRE command and read by *SRE?

The Message Available (MAV) bit of the SBR tracks the status of the standard Output Queue. If there are responses waiting in the queue, MAV will be set, if the queue is empty, MAV will be cleared.

In the following contrived example:

STB?;*STB?

The response could possibly be 0;16 or possibly 32;48 (if ESB was previously set). This is because the first command sees an empty queue while the second *STB? sees effect of the first command in the queue on MAV. It should be clear from the above that using *STB? to poll MAV is futile. (In order to read the response from *STB?, you have to address the device to talk as if MAV is set.)

Again, GPIB will behave differently from serial or TCP/IP. The latter two will immediately send their responses back to the host on their own initiative. GPIB, on the other hand, will wait until it is addressed to talk. See below for details on what happens if it's not address to talk prior to the arrival of the next command.

7.3.3.1. The ESER under GPIB Control

GPIB will behave differently from serial or TCP/IP. The latter two will immediately send their responses back to the host on their own initiative. GPIB, on the other hand, will wait until it is addressed to talk.

If the bit with weight 16 is set in SRER, then there will be a request for service. Even without that, the host can still perform a serial poll and from the presence of the 16 in the SBR, it can infer that it needs to be addressed to talk.

The FLT bit of the SBR tracks the condition of the Fault Queue. The Fault Queue (see below) is a list of "faults" detected by the system. Faults require operator and/or manufacturer intervention. See below. The FLT bit can be monitored by the host to detect such conditions. Additionally, its corresponding bit in SRER can be set and thus cause a service request in the event of a fault.

7.3.4. The Event Status Register (ESR)

The standard Event Status Register (ESR) tracks several events. As mentioned above, it works in conjunction with the ESER to determine the value of the SBR's ESB bit. As set forth in 488.2, when a condition that is monitored by one of the bits is encountered, that bit is set and remains set until all the bits are cleared by:

- Reading the ESR with the *ESR? common command
- The common *CLS command
- The common *RST command
- A processor reset

The ESR consists of the following bits and their weights:

- **Power-on (PON, weight 128)** – set when the power is turned on.

- **User Request (URQ, weight 64)** – not used and is always cleared.

- **Command Error (CME, weight 32)** – set when a syntax error (see below).is encountered in a command

- **Execution Error (EXE, weight 16)** – set when an execution error (see below) is encountered in a command.

- **Device Specific Error (DDE, weight 8)** – not used and is always cleared.

- **Query Error (QYE, weight 4)** – indicates that the device was addressed to talk when the output queue was empty or that a new command was received before the output queue was emptied. Both cases are possible under GPIB, but highly unlikely with other interfaces.

- **Request Control (RQC, weight 2)** – not used and always clear.

- **Operation Complete (OPC, weight 1**) – execution of the *OPC common command causes this bit to be immediately set. See the description of the *OPC, *OPC? and *WAI commands for details.

A command error (CME) results from the processor encountering a syntax error in a command. If the command is a compound command, all commands up to the offending command will still be scheduled to execute. The command with the error and any following commands will be discarded. As indicated previously, the CME bit of ESR will be set. Additionally, a numeric code will be placed in the Last Command Error register (see below) to indicate the nature of the syntax error.

An execution error (EXE) results from the processor attempting to execute an otherwise syntactically correct command that violates some condition. Some examples might be an output that's out of range or trying to connect to an output that's already in use when auto-interlock is not activated. Again, if it's a compound command, all commands up to the offending command will be executed. The command with the execution error and any commands following it will be discarded. Again, the EXE bit of ESR will be set and a numeric code will be placed in the Last Execution Error register (see below).

A query error (QYE) will set the QYE bit of the ESR and cause a numeric code to be entered in the Last Query Error register (see below). It does not affect the parsing or execution of otherwise valid commands except to indicate that valid responses may have been lost.

The Last Command Error (LCE), Last Execution Error (LEE) and Last Query Error (LQE) registers and their behavior are specific to UNIVERSAL SWITCHING products. As indicated above, when one of the errors is encountered, a numeric error code placed in one of the registers and its flag in ESR is set. The error code can be read using the GET? Command with the code for that register.

The error code stays in the register until:

- It is replaced by a new error code
- The register is cleared with a *RST, *CLS or processor reset
- The register was read with a *GET? command when its corresponding bit in the ESR is cleared.

7.3.5. Procedure for Recovering Errors

The suggested procedure for recovering these errors is to first read ESR with an *ESR? If its bit in ESR is set, then perform a GET? to recover the code.

7.3.5.1. Example Register Interaction

The following example should help illustrate the interaction between these registers and ESR.

- Suppose that the prior command has caused an execution error 1 (invalid output) and there were no other problems prior to it.

- Assume that LEE is read by the GET? 14 command. In that case, the following:

  GET? 14; GET? 14; *ESR?; GET? 14; GET? 14; *ESR?

  will yield: 1;1;16;1;0;0.

- The first and second reads of the LEE both return 1 since nothing has happened to change it. Reading the ESR returns 16 (the set EXE bit) and clears it. The next read of LEE also returns 1, but since EXE is now cleared, LEE is also cleared. Finally, the last read of LEE and ESR show the results of the clearing.

7.3.5.2. The Fault Queue

The Fault Queue is a FIFO queue of system faults. Faults require intervention by either the operator (plug in the power supply that the janitor unplugged), or the manufacturer (repair the power supply that failed).

The queue can be read with repeated calls to the FAULT? Command. If it's empty, FAUlt? will return 0. If the queue should fill-up, it will over-write the older entries in a "circular" fashion. If there are any entries in the queue, the FLT bit in SBR will be set. Upon reading the last fault (if any) in the queue, FLT will be cleared. **As a departure from 488.2, *CLS and *RST will not clear the queue or the FLT bit.** Only a complete system reset (or reading them as specified above) will clear them.

7.3.6. Register Function Summary

To summarize the register functions:

- The overall status can be determined by reading SBR with the *STB? command:

- A set PSFLT bit indicates a fault currently occurring in one of the power supplies. Note that is bit unique in that it sets and clears independently of host or keypad commands.

- A set FLT bit indicates the need to retrieve serious faults with the FAUlt? command

- A set MAV bit indicates that there's data in the output queue

- A set ESB bit indicates that one or more of the bits in the ESR that were enabled in ESER are set.

- A set MSS bit indicates that one or more of the above three bits is set along with its corresponding bit in the SRER.

- The SRER is "anded" with the FLT, MAV and ESB bit of the SBR to generate the current MSS. It is set with *SRE and read by *SRE?

- The ESR contains several bits which in practice indicate the success or failure of a command to execute and respond. It is set by the various conditions and read by the *ESR? command. Reading it clears it.

- The ESER is "and'ed" with the ESR to generate the SBR's ESB bit. It is written with the *ESE command and can be read with the *ESE? command.

- Set CME, EXE or QYE bits in the ESR indicate that an error code is stored in LCE, LEE or LQE. These are read by GET? xx.

The device maintains a separate set of registers for each interface (assuming there's more than one). In practical terms, this means that each interface can have, for example, a separate SRER or

ESER. The Fault Queue, on the other hand, is common to all interfaces in the device.

It should be apparent from the above that several conditions ultimately determine the current value of MSS. For example, setting the OPC bit of the ESR does not necessarily set MSS. First OPC's bit in the ESER must be set in order for ESB to be set, then ESB's bit in the SRER must be set before the condition exists to set MSS. As each change occurs, the value of MSS is re-evaluated and updated regardless of whether the change was an internal condition or a commanded change of one of the enable registers. On GPIB interfaces, as MSS is set or cleared, the need to request service or cancel a previous service request is also evaluated.

7.3.7. Commands to Evaluate and Control Status (488.2)

The following commands are used to evaluate and control the status of the device. Unless noted, these commands are part of the IEEE 488.2 standard command set. Recall that each interface maintains its own set of registers (but share the Fault Queue).

***STB?** – returns the value of the SBR at the start of the command. Note that the effect of the command on MAV won't be visible until after the command is executed. The most effective place for this command is as the last command of a compound command. Bits 7, 2, 1 and 0 are not used by this device at this time. Host programs should mask them out.

SRE *n – *n* is an integer value between 0 and 255. *n* is "anded" with 00111000 and set in the SRER. This corresponds to the bits that are in use in SBR. If at least one bit is set in SRER and its corresponding bit in SBR is also set then the MSS bit in SBR will be set. Each time the SRER is changed (by this command), the value of MSS is re-evaluated.

***SRE?** – returns the value of the SRER as an integer between 0 and 255. Note that any unused bits are mapped out whenever a value is set in SRER. To illustrate the following command: SRE 255;SRE? will return 56.

***ESR?** – returns the value of the ESR as an integer between 0 and 255. Per 488.2, the reading of the ESR clears it.

***ESE?** – returns the current value of the ESER as an integer between 0 and 255. The value of ESER does not change.

ESE *n – sets the integer value *n* (between 0 and 255) into ESER. If at least one of the bits in ESER is set at the same time as its corresponding bit in ESR, then the ESB bit in SBR is also set. Each time ESER is changed (by this command), the value of ESB and MSS are re-evaluated.

PSC *n – sets the integer value *n* (0 or 1) in the PSC register. If the register is 1, ESER and SRER are cleared on each restart. If its value is zero, ESER and SRER are preserved. One possible use of this feature is that by setting the PON bit in ESER, setting the ESB bit in SRER and setting 0 in PSC, the device will request service from its controller on power-up. (This works only on GPIB.)

***PSC?** – returns the current value of PSC

***CLS** – This will clear the interface's Last Error Registers, Event Status Register and the Status Byte Register (except for MAV, FLT and PSFLT) but not its queued responses. It has no affect on the other interfaces. As a departure from the standard, the Fault Queue is not affected. As a result, after the command, MAV, FLT and PSFLT will reflect the status of their underlying conditions.

***RST** – This command will clear all the switchpoint routings in all the modules. No other status registers are affected

7.3.7.1. Commands to Evaluate and Control Status (non 488.2)

The following commands are used to evaluate the status of the device. They are in addition to IEEE 488.2 commands and their functionality is not defined by that standard.

GET? 15 – returns the oldest entry in the Fault Queue as a number between -32768 and 32767. If the queue is empty it returns 0. If there are entries in the queue, the FLT bit of SBR will be set. Reading the last entry will cause the FLT bit to clear and for MSS to be reevaluated.

The following three read-only registers behave differently from the others properties that can be read with the GET? query commands. Upon detecting an error of one of the above types, its corresponding flag in the ESR is set and the error is recorded in the register. (Any previous, unread error is over-written.) At this point, the register can be read with the GET? query. Once the ESR is cleared or read (which clears it), the Last Error Registers will clear after the next time they are read

GET? 4 - returns the contents of the Last Query Error Register

GET? 16 - returns the contents of the Last Execution Error Register

GET? 32 - returns the contents of the Last Command Error Register

7.3.8. Overlapped Processing

The due to the nature of switching operations, all commands are processed sequentially. There is no overlapped processing. As such the following commands are included for compatibility with other 488.2 devices. They provide no added functionality beyond performing their required functions in as little time as possible. Per the standard these operations wait while the no-operation-pending flag is false. On devices that have only sequential operations, the standard calls for this flag to always be true.

***WAI** – does nothing.

***OPC?** – returns "1".

***OPC** – sets the OPC bit in the ESR. The values of ESB and MSS are re-evaluated.

8. Error Code List

The following is a standard list of error codes from the Series C710 plug-in CPU assemblies. Please note that some codes may not be applicable to all types of equipment or configurations.

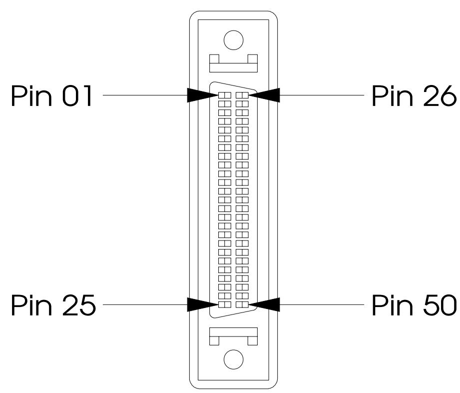
Error #	Description
1	Invalid output parameter
2	Invalid input parameter
3	Invalid command (C700) or ECF opcode (C710)
4	Output already connected to different Input
5	Blocking input connected already
6	Output not connected to anything
7	Input not used
8	Memory location not used yet
9	Bad command argument
10	Invalid slot parameter
11	Not a valid "GET" parameter
12	Not a valid "SET" parameter
14	Store (*SAV) or Recall (*RCL) out of range
15	Set or Get not defined for this system
21	Command length error
22	No mid-stage available
26	Non existing module
27	Coil error from relay(s)
28	Memory location for "STORE" or "*SAV" not available
31	Lost command
32	Wrong mid-stage addressed
40	Power supply #1 low
41	Power supply #2 low
42	Power supply #1 is missing
43	Power supply #2 is missing
47	Missing module in system
48	Module not seen during "REBUILD" command
50	SPI "time-out" error caused by module not responding
61	Wrong 1st argument
62	Wrong 2nd argument
63	Wrong 3rd argument
64	Blank program message unit (IEEE-488.2 standard term)
65	Firmware issue (consult factory)
66	Invalid command header (IEEE-488.2 defined)
67	Command has too many arguments

Error #	Description
68	Command has too few arguments
71	Firmware issue (consult factory)
72	Firmware issue (consult factory)
73	No response

NOTE: If error 28 does occur, try splitting the compound command with all those QUERY? ALL commands and the *SAV into two or more commands.

9. Rear Panel Signal Connectors

The system's signal connectors are located on the individual switching modules. Each module delivers thirty-two (32) channels of switching. The user connects directly to each set of connectors on the modules via multi-position SCSI-II type connectors. The direct connection provides the best signal response and connection reliability.



The connector is an AMP #749649-5 and is part of the SCSI-II family of connectors. Different configurations of mating connectors could be used, one being AMP #749110-1. This is just the mating portion of the connector and does not include a back-shell.

Each module contains two connectors, each delivering sixteen channels. The upper connector (J1) has the lower numbered channels (01 to 16) and the lower connector has the upper numbered channels (17 to 32).

9.1. Input Connector Pin Assignment

Pin Number J1	Input Signal Name	User Designation
1	Input 01 (+)	
2	Input 02 (+)	
3	Input 03 (+)	
4	Input 04 (+)	
5	Ground	
6	Input 05 (+)	
7	Input 06 (+)	
8	Input 07 (+)	
9	Input 08 (+)	
10	Ground	
11	Input 09 (+)	
12	Input 10 (+)	
13	Input 11 (+)	
14	Input 12 (+)	
15	Ground	
16	Input 13 (+)	
17	Input 14 (+)	
18	Input 15 (+)	
19	Input 16 (+)	
20	Ground	
21	VEE (+V)	
22	VEE (+V)	
23	Ground	
24	VDD (-V)	
25	VDD (-V)	
26	Input 01 (-)	
27	Input 02 (-)	
28	Input 03 (-)	
29	Input 04 (-)	
30	Ground	
31	Input 05 (-)	
32	Input 06 (-)	
33	Input 07 (-)	
34	Input 08 (-)	
35	Ground	
36	Input 09 (-)	
37	Input 10 (-)	
38	Input 11 (-)	
39	Input 12 (-)	
40	Ground	
41	Input 13 (-)	
42	Input 14 (-)	
43	Input 15 (-)	
44	Input 16 (-)	
45	Ground	
46	VEE (+V)	
47	VEE (+V)	
48	Ground	
49	VDD (-V)	
50	VDD (-V)	

Pin Number J2	Input Signal Name	User Designation
1	Input 17 (+)	
2	Input 18 (+)	
3	Input 19 (+)	
4	Input 20 (+)	
5	Ground	
6	Input 21 (+)	
7	Input 22 (+)	
8	Input 23 (+)	
9	Input 24 (+)	
10	Ground	
11	Input 25 (+)	
12	Input 26 (+)	
13	Input 27 (+)	
14	Input 28 (+)	
15	Ground	
16	Input 29 (+)	
17	Input 30 (+)	
18	Input 31 (+)	
19	Input 32 (+)	
20	Ground	
21	VEE (+V)	
22	VEE (+V)	
23	Ground	
24	VDD (-V)	
25	VDD (-V)	
26	Input 17 (-)	
27	Input 18 (-)	
28	Input 19 (-)	
29	Input 20 (-)	
30	Ground	
31	Input 21 (-)	
32	Input 22 (-)	
33	Input 23 (-)	
34	Input 24 (-)	
35	Ground	
36	Input 25 (-)	
37	Input 26 (-)	
38	Input 27 (-)	
39	Input 28 (-)	
40	Ground	
41	Input 29 (-)	
42	Input 30 (-)	
43	Input 31 (-)	
44	Input 32 (-)	
45	Ground	
46	VEE (+V)	
47	VEE (+V)	
48	Ground	
49	VDD (-V)	
50	VDD (-V)	

9.2. Output Connector Pin Assignment

Pin Number J1	Output Signal Name	User Designation
1	Output 01 (+)	
2	Output 02 (+)	
3	Output 03 (+)	
4	Output 04 (+)	
5	Ground	
6	Output 05 (+)	
7	Output 06 (+)	
8	Output 07 (+)	
9	Output 08 (+)	
10	Ground	
11	Output 09 (+)	
12	Output 10 (+)	
13	Output 11 (+)	
14	Output 12 (+)	
15	Ground	
16	Output 13 (+)	
17	Output 14 (+)	
18	Output 15 (+)	
19	Output 16 (+)	
20	Ground	
21	VEE (+V)	
22	VEE (+V)	
23	Ground	
24	VDD (-V)	
25	VDD (-V)	
26	Output 01 (-)	
27	Output 02 (-)	
28	Output 03 (-)	
29	Output 04 (-)	
30	Ground	
31	Output 05 (-)	
32	Output 06 (-)	
33	Output 07 (-)	
34	Output 08 (-)	
35	Ground	
36	Output 09 (-)	
37	Output 10 (-)	
38	Output 11 (-)	
39	Output 12 (-)	
40	Ground	
41	Output 13 (-)	
42	Output 14 (-)	
43	Output 15 (-)	
44	Output 16 (-)	
45	Ground	
46	VEE (+V)	
47	VEE (+V)	
48	Ground	
49	VDD (-V)	
50	VDD (-V)	

Pin Number J2	Output Signal Name	User Designation
1	Output 17 (+)	
2	Output 18 (+)	
3	Output 19 (+)	
4	Output 20 (+)	
5	Ground	
6	Output 21 (+)	
7	Output 22 (+)	
8	Output 23 (+)	
9	Output 24 (+)	
10	Ground	
11	Output 25 (+)	
12	Output 26 (+)	
13	Output 27 (+)	
14	Output 28 (+)	
15	Ground	
16	Output 29 (+)	
17	Output 30 (+)	
18	Output 31 (+)	
19	Output 32 (+)	
20	Ground	
21	VEE (+V)	
22	VEE (+V)	
23	Ground	
24	VDD (-V)	
25	VDD (-V)	
26	Output 17 (-)	
27	Output 18 (-)	
28	Output 19 (-)	
29	Output 20 (-)	
30	Ground	
31	Output 21 (-)	
32	Output 22 (-)	
33	Output 23 (-)	
34	Output 24 (-)	
35	Ground	
36	Output 25 (-)	
37	Output 26 (-)	
38	Output 27 (-)	
39	Output 28 (-)	
40	Ground	
41	Output 29 (-)	
42	Output 30 (-)	
43	Output 31 (-)	
44	Output 32 (-)	
45	Ground	
46	VEE (+V)	
47	VEE (+V)	
48	Ground	
49	VDD (-V)	
50	VDD (-V)	

10. Service Information

This section outlines various procedures for removal and installation of the plug-in modules included within the switching system. User service to the unit is limited to very minor repairs because special equipment is required to test and repair the modules.

All modules are software controlled by the main CPU. If a module or card fails in the field, the suspected module may be swapped out with a spare, and sent to the factory for repair.

It is suggested that, for applications critical to down time, a minimum of spare modules or sub-assemblies be purchased and be kept on site. See the factory recommended spares list.

10.1. Service Tools

The highly integrated and modular design allows most of the critical modules and cards to be easily removed by the user. No special tools are required. Only the following tools are required for service:

- Phillips Head Screwdriver
- Bladed Screwdriver
- 3/32 Allen Wrench
- 5/32 Allen Wrench

All of these may normally be found in any test lab environment, or technician's toolbox. Periodic maintenance may be required depending upon the application and the use of the unit. For example, in a dirtier environment, in would be a good idea to simply remove the top cover and blowout any dust accumulated in and around the internal fans and all connectors.

10.1.1. Removing a Switch Module

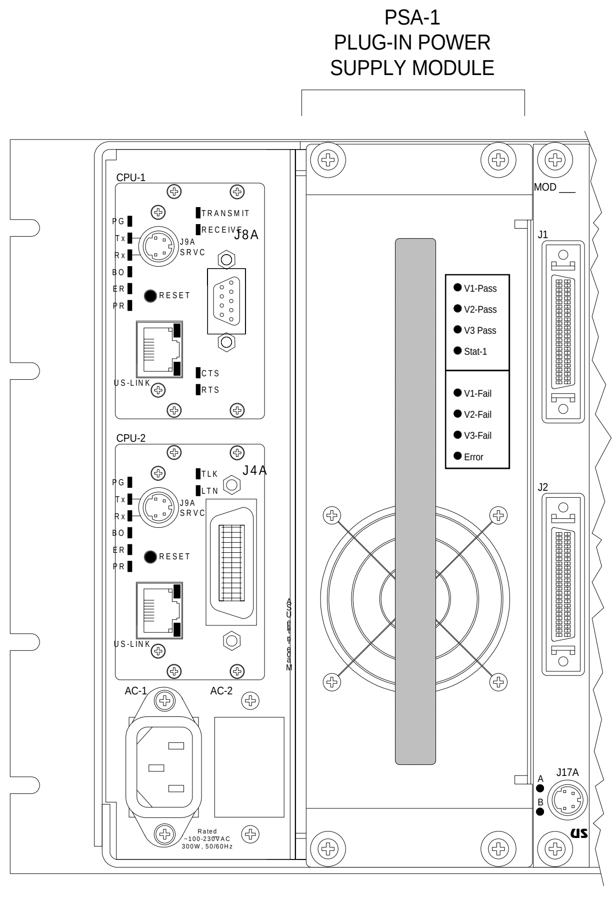
The switch module may be removed by using a screwdriver. Loosen both black captive fasteners on the module installed. Gently, but firmly remove the module straight back towards the rear.

NOTE: It is suggested that the AC power be disconnected from the System before removing the CPU modules.

When installing a module, be sure it is properly aligned with the slot's card guide. The module installs with the components and cover facing up. Slide the module in until the edge connector begins to mate inside the mainframe. Be sure to seat the card all the way by securing the two black captive fasteners with a screwdriver.

11. Model S2560D-000 Mainframe Controller

The S2560D-000 is a mainframe assembly that will accept one plug-in power supply, includes front panel controls and is ready for a CPU controller(s). It is designed to accept a total of 8 input modules and 8 output modules, up to two (2) CPU/interface cards, plus eight mid-stage cards. The rugged design of the unit is enhanced by the modularity of the internal structure. All of the internal subassemblies are easily removed with common hand tools. This allows you to make simple subassembly swaps in the field for low down time.



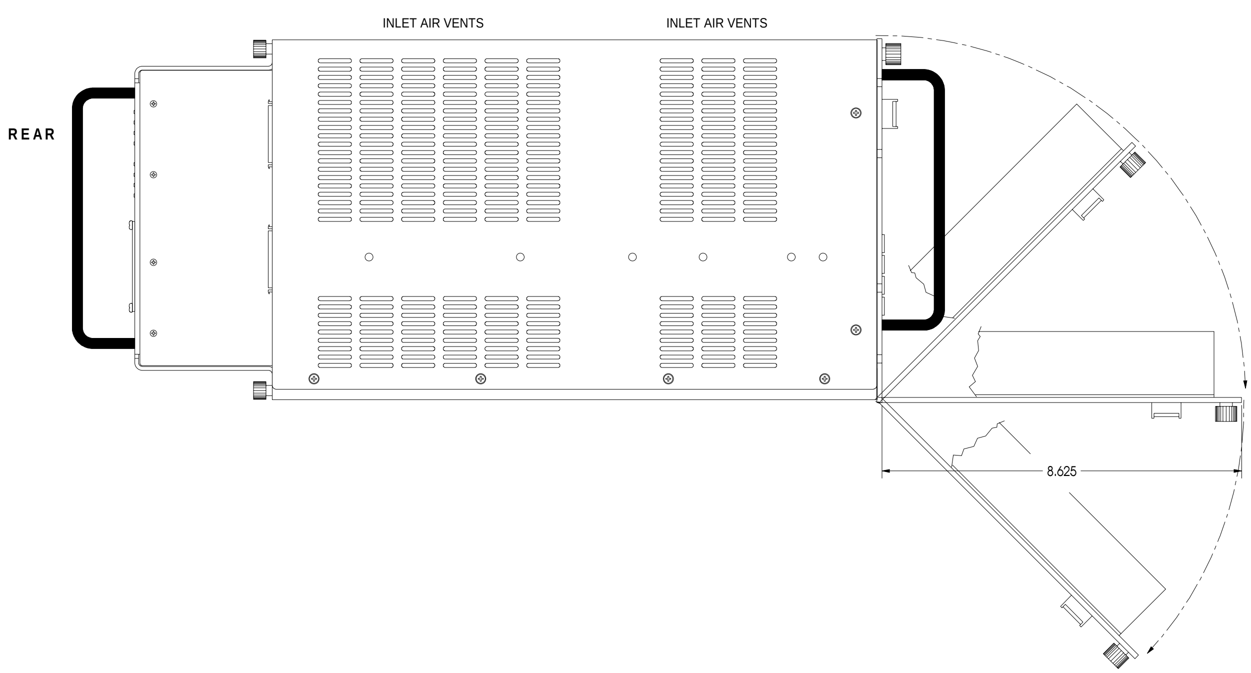
11.1. DC Power Sections

The unit is shipped from the factory with a single power section. It plugs into the rear left of the system.. The S2560D-200 includes a single supply capacity with NO redundancy, while the S2560D-R200 includes a single supply with redundant capacity built in. It is a single supply with two sets of DC supplies.

The supply assembly is a smart supply and is monitored by the embedded CPU of the system. It is plugged into the bulkhead located inside the system. LED indicators are located on the supply assemblies for status and monitoring. A cooling fan is included on the plug-in power section to assist cooling the unit.

11.2. Construction

The mainframe is constructed from a rugged aluminum frame. The frame is gold irradiate plated for resistance to corrosion elements and excellent conductivity. The exterior of the frame is painted in a texture coat epoxy paint per MIL-STD-595B color black. Finger prints and other markings do not easily appear on the finish because of the texture coating, plus it provides and additional measure of protection against possible corrosion.

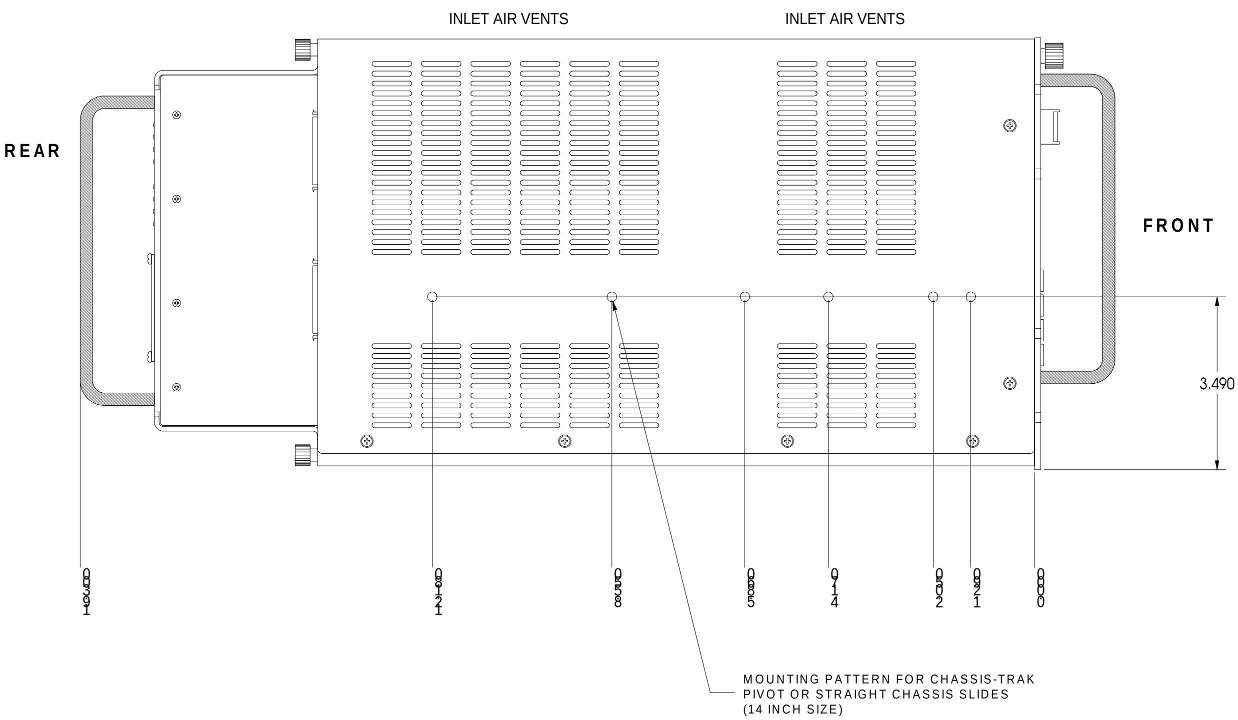


11.2.1.Mounting

The front panel is 1/8" (.125") thick which is standard for most 19" rackmount equipment, and also contains the standard RETMA slots for rackmount equipment. The unit is 5 rack units high (8.72"). It is highly suggested that the unit be mounted using chassis slides, and not via the front panel flanges alone.

11.2.1.1.Chassis slides

It is suggested that the unit not be mounted by the front panel flanges by themselves, but by some chassis slides mounted to the side of the unit. Both pivoting and straight slide types may be mounted. These are available through the factory. Threaded mounting holes for both types are provided. The non-redundant version is shown below (the redundant version is slightly deeper).

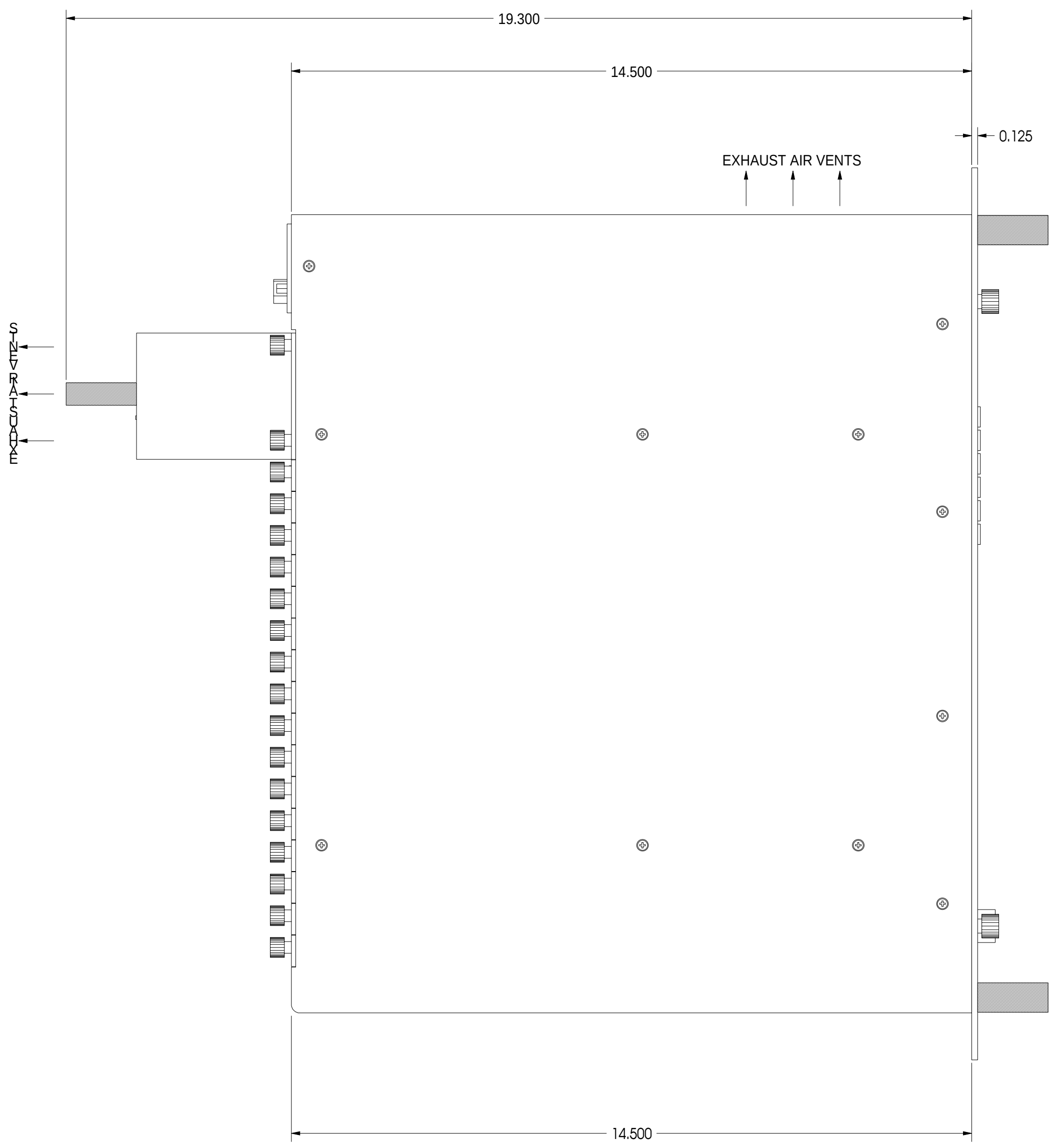


Chassis-Trak ®
Non-pivoting type: C-300-S-140

The type of slide used is up to the *Systems Engineer* in charge of the installation, and the desired result. The slides are not included with the unit, but are an optional item available from Universal Switching Corporation.

11.2.2.Cooling

The unit contains triple temperature regulated cooling fans internal to the unit, which distributes air from inlet slots located on the left sides of the unit, and exhausts the air out right side. No filter is included at the factory. If the unit is used in an excessively dirty environment, consult the factory for assistance.



11.3. Front Panel Controls

This section describes the features of the front panel control keypad and vacuum-fluorescent display. The explanation of each menu feature also provides a basis for their application and usage.

11.3.1.Intelligent Keypad

The control panel has been designed for ease of use and functionality. All control keys are back-lit with a green LED for easy reading in direct sunlight, or in a completely dark room. To ease the operation of the unit even further, only the valid keys are lit (key which have no bearing on the current operation or are not a current choice will not be illuminated). This keypad is referred to as "intelligently back-lit" keypad.

The functions of the 24-position control pad may be divided into the following categories:

- Operators: Connect, Disconnect, Verify, or Clear All
- Control: Store, Recall, Cancel or Local Unlock
- Input: Numerical Keys, 0 through 9
- Misc.: Enter, Menu, and Arrow Keys

11.3.2.Display Features

The front panel display is a high contrast vacuum fluorescent display for rugged environments and long life. During normal operation (after self-test is complete), the display is divided into functional areas. These are outlined in the diagram below.

- 1) Active remote input
- 2) Function, or operator
- 3) Input number
- 4) Output number
- 5) Operation confirmed
- 6) Mid-stage routing number

11.3.3.Power-up Display Screens

The unit displays different screens during the power sequences of the system. Each screen is displayed for only 2-3 seconds and moves to the next screen.

11.3.3.1.Keypad and Display Test Screen

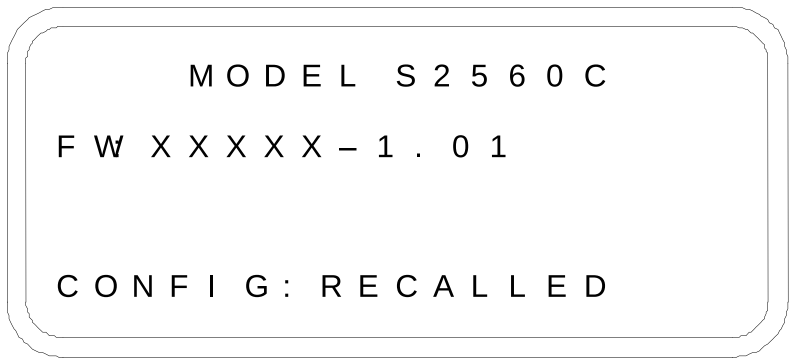
The first screen displayed is the keypad and display CPU screen test. This is accomplished by the actual CPU that is dedicated to controlling what is visible on the display, plus the activity on the illuminated control keypad. It also displays the firmware version of the keypad CPU.

```
UNIVERSAL SWITCHING
M6025–05 V:S600C504
* VFD/KEYPAD READY *
* TEST MODE ACTIVE *
```

11.3.3.2.System ID and Configuration Screen

This screen display comes up after the keypad CPU test only if the main CPU and interface module is installed and functioning. Proper module to module communication must be operational for this screen to appear. It identifies the unit Series and Model numbers of the system on line one, installed firmware version information on line two.

Line three displays any modules installed within the mainframe starting with Slot 01 (top). Installed modules are shown with a sequential number while empty, non-operational or non-recognized modules are shown with a dash (-).



The bottom line of this screen indicates if the unit is recalling the last configuration prior to power-down, or if the configuration is "cleared" of all crosspoint configuration closures. This is a menu selection at the front panel for AUTO RESTORE (yes or no).

11.3.3.3.Normal Screen After Power-Up

Below is the normal screen before any commands have been processed by the system. The top line of the display would be slightly different if a serial interface was installed in place of a GPIB type.

```
RS232-NO   GPIB- OK


INP:
OUT:
```

11.4. Display Menu System

The system may be configured to perform various tasks by setting the unit via menu driven selections. By pressing the MNU key on the front panel control keypad, the user will cycle through four different menu screens. The "normal display" is the screen shown after the unit has finished the power up tests and is idle waiting for commands (shown below).

The sequences of the display menus are shown in the block diagram below. Pressing the MNU key on the control keypad provides access.

11.4.1.Normal Screen

Below is the normal screen during operation. The top line of the display would be slightly different if a serial interface was installed in place of a GPIB type. The second line displays the last command attempted and the result.

```
IFC1:GPIB - CPU(1)
DI CONECT        OK
INP:225
OUT:086     MID 04
```

11.4.2. Local Status Screen

The user can view the cross-point connection status of the system by pressing the MENU key once. The display lists each output in order, and displays the connected input port it might be connected to. A sample of this screen is shown below. This screen example has Output 006 connected to Input 115. All other outputs in this example are not connected and do not have an input number associated.

```
O P   1 =            O P   2 =
O P   3 =            O P   4 =
O P   5 =            O P   6 = 1 1 5
O P   7 =            O P   8 =
```

When this screen is displayed, the keypad control will illuminate the MNU key and the arrows keys too. To view the balance of the output of the system, press the down arrow key. Continue this procedure to view additional output connections.

> ***NOTE: This screen will stay on the display for about 10 seconds, then it will return to the "normal" screen.***

11.4.3.Remote Interface Screen

By pressing the MNU key twice, the interface configuration menu appears on the display. The unit will display the parameters for any installed remote interface cards. The S2560D is factory equipped with either one GPIB port (IEEE-488), or one serial port (RS-232C and RS-422A). Any additional interfaces installed in the field will also be displayed in this menu. The display below shows a GPIB card installed in the IF-1 position.

```
GPIB–CPU(1)   -  READY
GPIB BUS ADRESS:  10
SRQ ENABLED       :YES
```

11.4.3.1.Serial Port Settings

With the interface (CPU) configuration menu on the display, the factory default serial port settings will be displayed. The factory default settings are 9600 baud, 8 data bits/char, no parity, 2 stop bit and software (Xon/Xoff) handshaking.

To edit these parameters, move the blinking cursor to the interface needing changes on the display, press the ENT to view the options. Select setting you desire and press the CNL key when you are done, or select the up/down arrow key to change the next parameter. Once you leave this screen, the settings you selected will remain in non-volatile RAM until changed again.

11.4.3.2.GPIB Interface Settings

With the interface configuration menu on the display, the factory default GPIB port settings will be displayed. The factory default settings are GPIB "ready", GPIB address 10 and SRQ enabled.

Select setting you desire and press the CNL key when you are done, or select the up/down arrow key to change the next parameter. Once you leave this screen, the settings you selected will remain in non-volatile RAM until changed again.

11.4.4.Operations Menu 1

By pressing the MNU key three times (from the normal screen) the Operation Menu 1 will appear on the display. From this menu the items described in the following paragraphs may be changed.

```
AUTO INTERLOCK    :YES
PON AUTO RESTORE  :YES
POWER ON MESSAGE:  NO
SLOTS GANGED      :YES
```

11.4.4.1.Auto Interlock

Two different types of control are available. The Input Interlocking feature enables the user to connect a new input to an output without first disconnecting the previous input connection. With the interlocking feature in enabled (YES), the unit will automatically disconnect any input connected to the specified output port (or relay port) before making the new input connection.

This saves control overhead time by eliminating an entire command (disconnect) to make a new input connection to an output. The "manual" mode forces the user to send a disconnect command for the existing crosspoint connection (port connection) prior to connecting the new input port.

To configure the unit to the AUTO INTERLOCK mode, move the cursor to the line and press enter to change the option. Select setting you desire and press the CNL key when you are done, or select the up/down arrow key to change the next parameter. Once you leave this screen, the settings you selected will remain in non-volatile RAM until changed again.

11.4.4.2.Power On AutoRestore

The Power On AutoRestore parameter may be enabled (YES) or disabled (NO). When enabled, the unit will automatically restore the last configuration from before the unit was turned off (or power was lost to the unit). When disabled, all crosspoints are automatically cleared on power up. The factory default is to have the unit power up with AutoRestore enabled so that the unit is returned to the last known state.

To configure the unit to the Power On AutoRestore mode, move the cursor to the line and press enter to change the option. Select setting you desire and press the CNL key when you are done, or select the up/down arrow key to change the next parameter. Once you leave this screen, the settings you selected will remain in non-volatile RAM until changed again.

11.4.4.3.Power On Message

The unit may be set to automatically send a message via the remote interface after powering up and passing all of the self-tests. This is normally used when the user is controlling the unit from a serial interface port. The factory default is to have no message sent after power up.

To change this setting, from the normal display, press the MNU key three times. The Operations Menu 1 will appear. Using the up/down arrow keys, move the cursor to the Power Up Message line and press the ENT key to change the parameter.

Select setting you desire and press the CNL key when you are done, or select the up/down arrow key to change the next parameter. Once you leave this screen, the settings you selected will remain in non-volatile RAM until changed again.

When POWER ON MESSAGE: YES is selected, the unit will send the system model number and firmware version number after completing the self tests. An example is: MODEL S2560D, VER 1.01. Many systems contain semi-custom firmware tailored to the system configuration, so the message may be slightly different from the one shown.

If you are using GPIB control and the SRQ function is enabled, the unit will assert the SRQ line on the GPIB port when the unit is finished powering and passed all self-tests. When addressed to talk from the GPIB controller, the unit will send the Power On Message.

11.4.4.4.Slots Ganged

If the system is in Ganged mode, all the modules installed are control ganged where crosspoints in each module are connected or disconnected together. This is ideal for many data applications. This feature applies only to the manual front panel controls and not the remote interfaces. The control codes via the remote interface(s) determine if the command is a ganged command or not (slot = 00).

Ganged control will be automatic from the front panel controls so the user will not have to specify the module address routing. If the system is not in GANGED mode, the user must specify the module used in the routing of input/output connections.

Select setting you desire and press the CNL key when you are done, or select the up/down arrow key to change the next parameter. Once you leave this screen, the settings you selected will remain in non-volatile RAM until changed again.

11.4.5.Operations Menu 2

By pressing the MNU key four times (from the normal screen) the Operation Menu 2 will appear on the display. From this menu the items described in the following paragraphs may be changed.

```
DISPAY SAVER       :YES
BEEP ON KEYPRESS:YES
BEEP ON ERROR      :YES
REMOTE PRIORITY:  NO
```

11.4.5.1. Display Saver

The unit incorporates a high contrast vacuum fluorescent display (VFD). To prolong the life and contrast of the display over many years, the display can be set to dim automatically when no entries have been made at the front panel controls for five minutes or more. The display will instantly go to full brightness if a key on the front panel control keypad is pressed. The factory default is to have the display saver enabled (YES).

Select setting you desire and press the CNL key when you are done, or select the up/down arrow key to change the next parameter. Once you leave this screen, the settings you selected will remain in non-volatile RAM until changed again.

11.4.5.2. Beep On Keypress

When the system is equipped with a front panel control keypad and display option, each time a front panel key is pressed, a short beep will sound. This may not be desirable for all applications and may be disabled. The factory default is to have the keypad beeper enabled (YES).

Select setting you desire and press the CNL key when you are done, or select the up/down arrow key to change the next parameter. Once you leave this screen, the settings you selected will remain in non-volatile RAM until changed again.

11.4.5.3.Beep On Error

The unit has an internal beeper to indicate when an error occurred. The factory default is to have the error beep enabled. This assists the user during firmware development and to alert the user of equipment failure. The unit also has a red front panel LED labeled ERR that will **always** go on during an error condition.

Select setting you desire and press the CNL key when you are done, or select the up/down arrow key to change the next parameter. Once you leave this screen, the settings you selected will remain in non-volatile RAM until changed again..

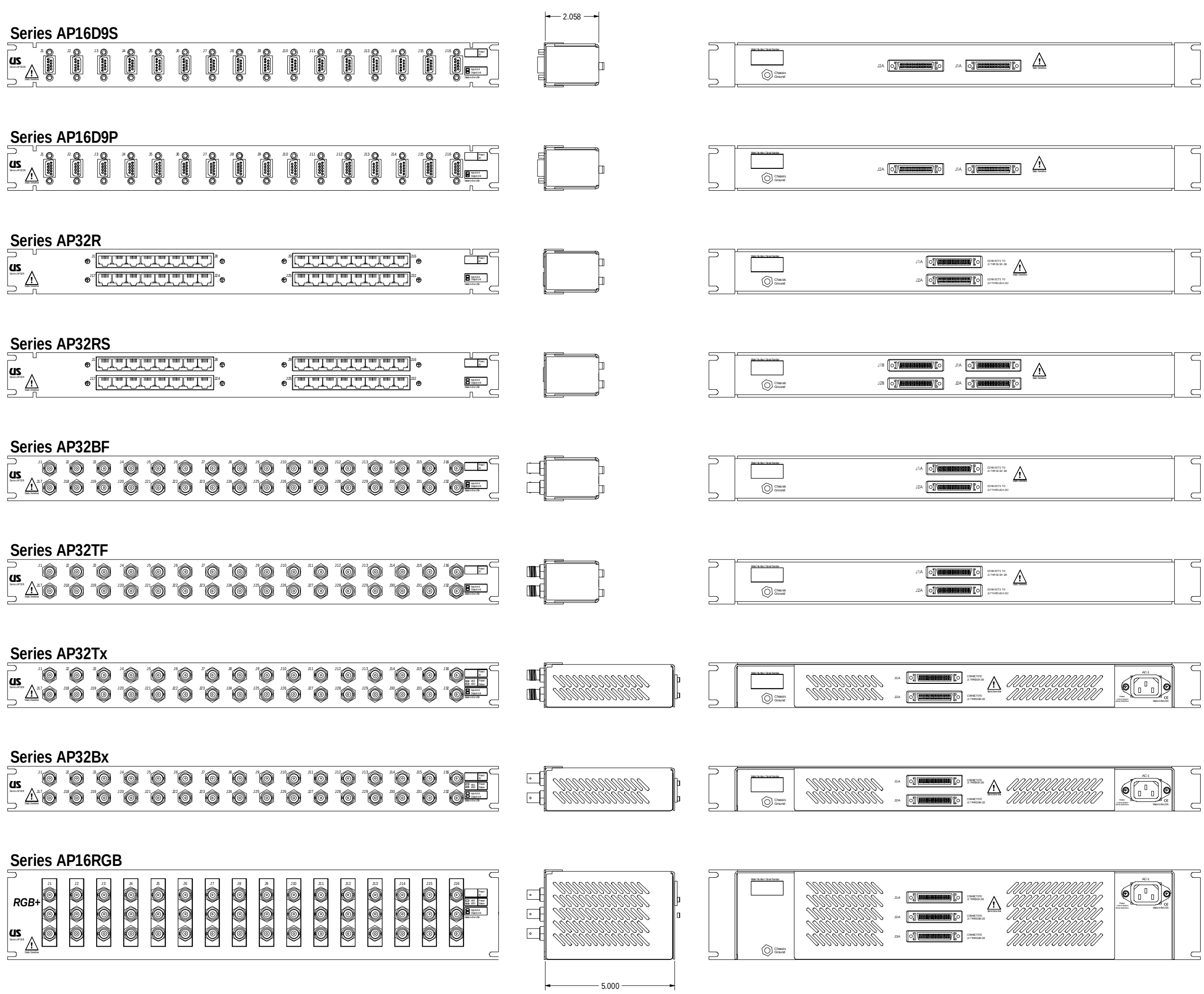
11.4.5.4.Remote Priority

The S2560D offers compatibility to remote control panels offered by Universal Switching Corporation. Special system firmware drivers are required to operate in this fashion. If the system is being used with these panels, the Remote Priority parameter would have an affect. Without the panels, this parameter has no affect.

12. Optional Adapter Panels

The S2560D is capable of many types of configurations including, but not limited to, audio, video, telemetry and other many useful signal types. The purpose of the S2560D is to interconnect signals, input to outputs. Additional items can be added to enhance the performance or adapt the S2560D system to other purposes.

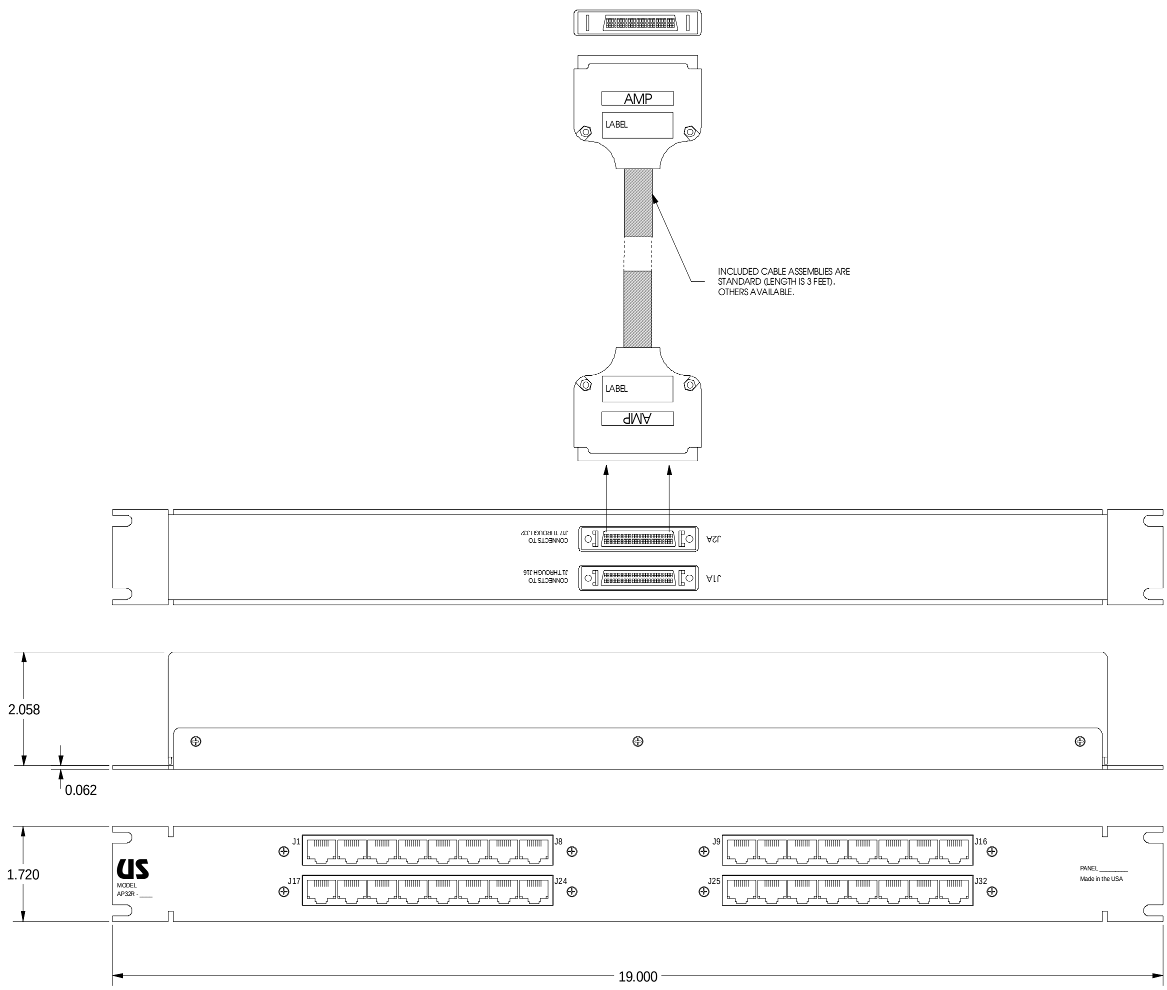
The S2560D in designed to handle either analog or digital signals delivering differential signal routing. Universal Switching also provides a family of adapter panel assemblies that adapts the S2560D to other requirements. This includes a growing number of analog and digital requirements. A few are outlined in this manual.



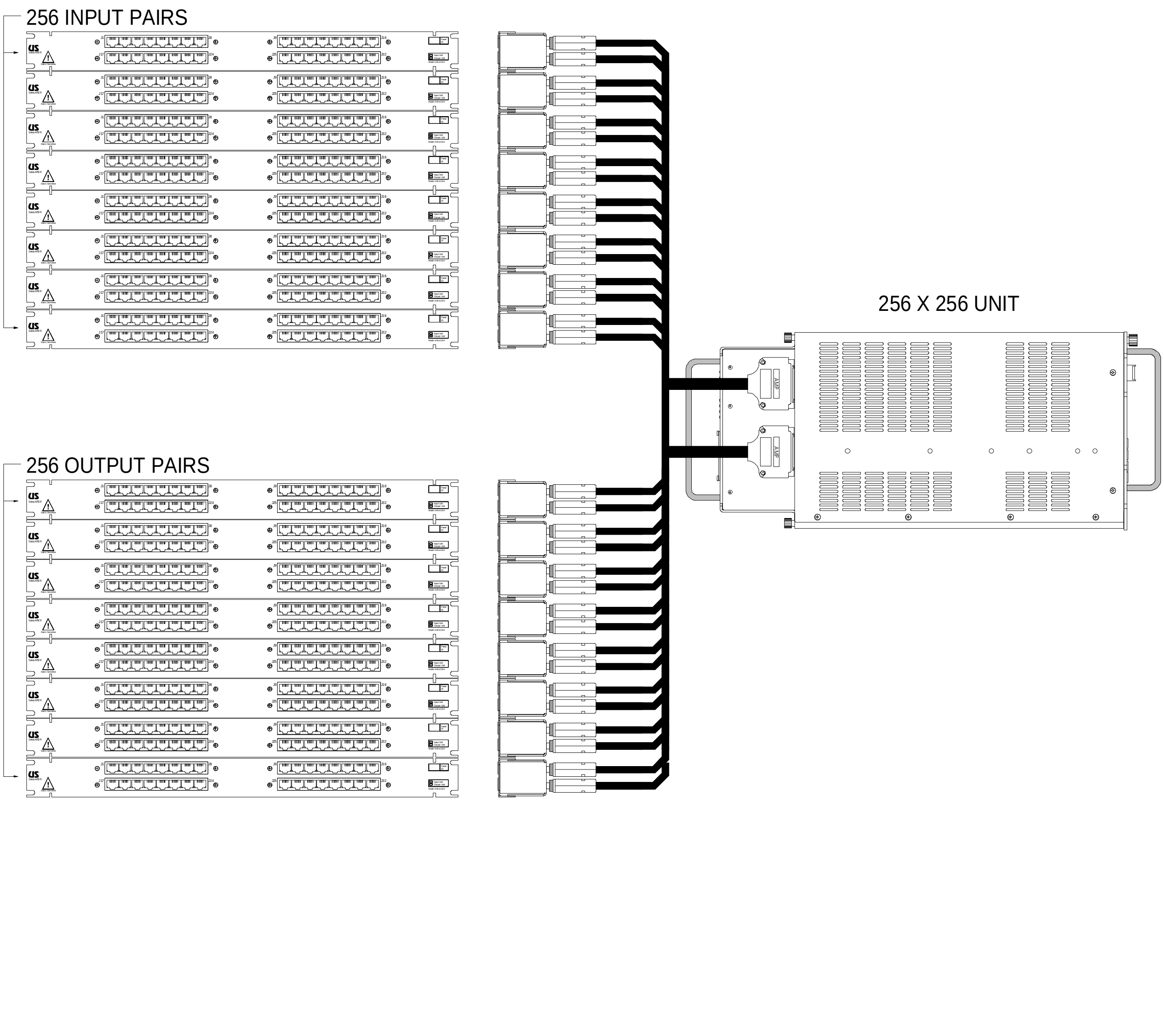
12.1. Model AP32R, Passive Panel

The AP32R unit is designed to provide the system professional with a new alternative traditional switching system or routing system standards. It is specifically designed to provide and interface to the S2560D and the user. The user is provided with a standard RJ45 connector interface with differential pairs. This panel can be used with wither the analog pairs, or the digital (422) type of unit I/O since it is passive.

The AP32R is a totally passive and bi-directional unit that can be connected to the System S2560D. It provides the user with up to 32 individual RJ45 connectors, each providing a single pair of signal paths. It can be used for either input or output signal routing.



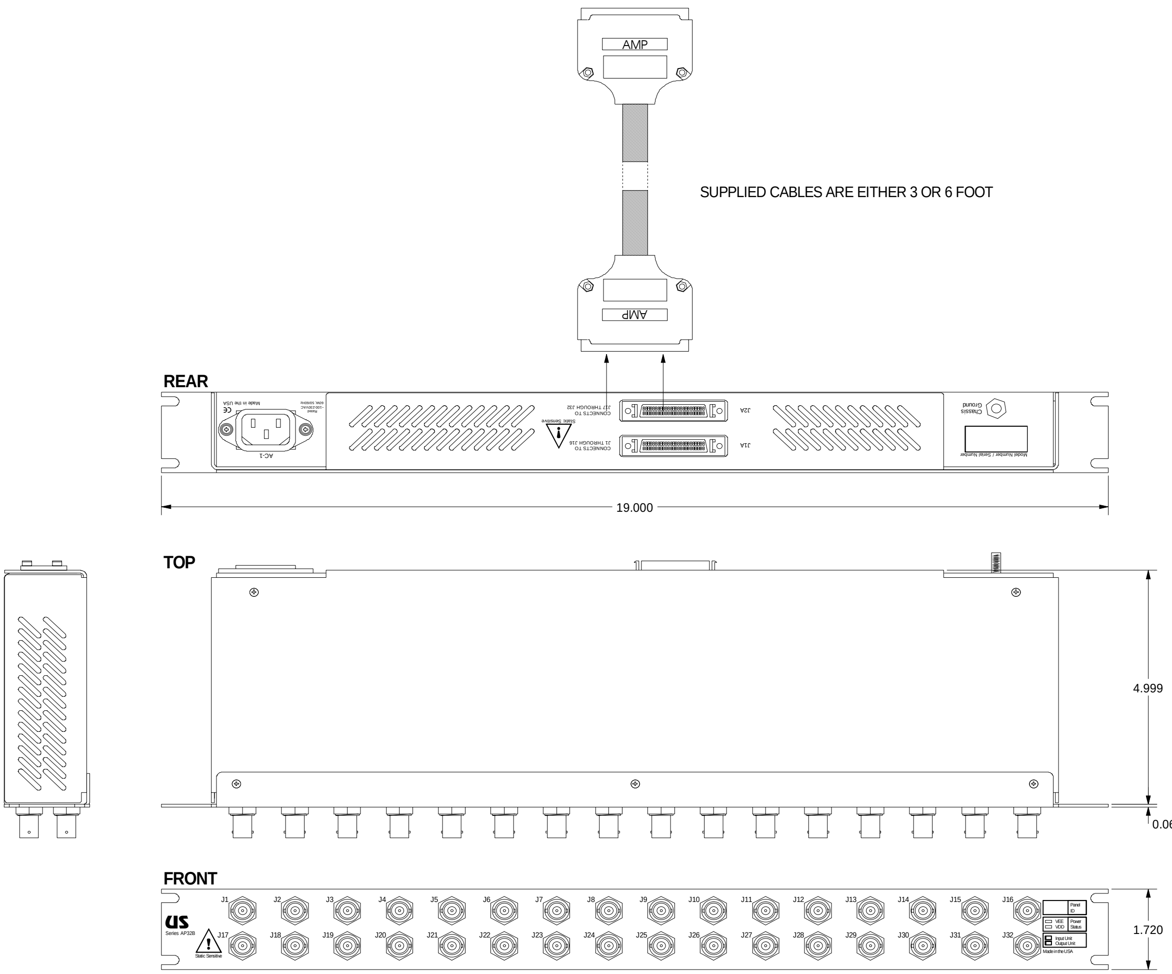
It is designed to route both input connectors on an input module on the S2560D, both output connectors from an S2560D module, or one of each (half input and half output). Below is an S2560D unit with sixteen AP32R units attached for a total configuration of 256 inputs and 256 outputs and RJ45 connectors.



12.2. Model AP32Bx: Active Panel

The AP32Bx panel assemblies are designed to interface between user single-ended signals and the differential signal capacity of the S2560D unit in an analog mode. These are high level, high performance analog units that convert single-ended signals to differential (input type Model AP32BI-xxx) or differential signals to single-ended types (output type Model AP32BO-xxx). They have been designed to be used together.

The input and output types are mechanically identical and are designed to be used on the same unit. On the lower right corner, an identifier is visible indicating what type of assembly it is (input or output).



12.2.1.Input Panel Assembly: Model AP32BI-xxx

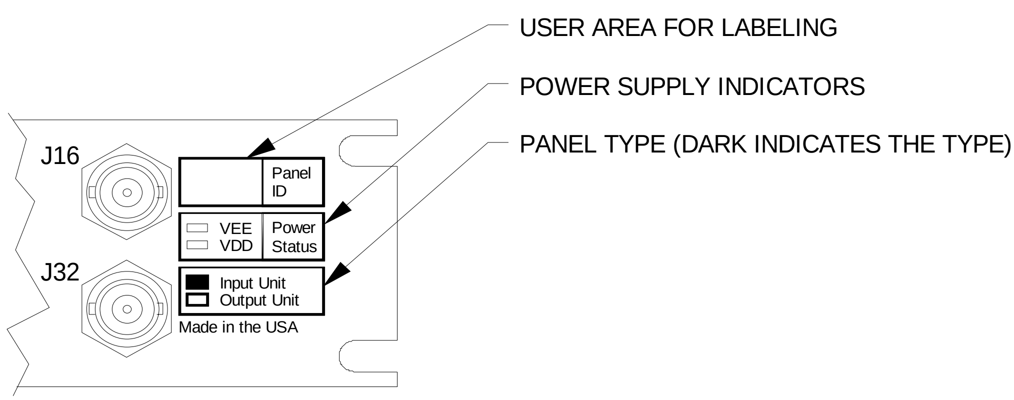
The input version (Model AP32BI) provides three functions.

1. It converts the users single-ended inputs on BNC connectors to interface with the S2560D differential inputs on SCSI-II connectors. It does this both mechanically and electrically.

2. It provides a level of attenuation to the user input signal prior to converting the signal from single-ended to differential. This is so the S2560D system can switch higher input signal levels than if the user were directly connected to the S2560D system.

3. The panel assembly also allows the user connections to the S2560D to be located either on the front of the rack, or in the rear of the rack.

The panel assembly is self-contained including built-in power sections and two cables to connect to the S2560D. The last digit of the model number determines the length of the cables (3=3 feet, 6=6 feet). The second to last digit specifies the input impedance of the adapter panel assembly (5=50 ohms, 7=75 ohms). A six-foot AC power cord is also included.

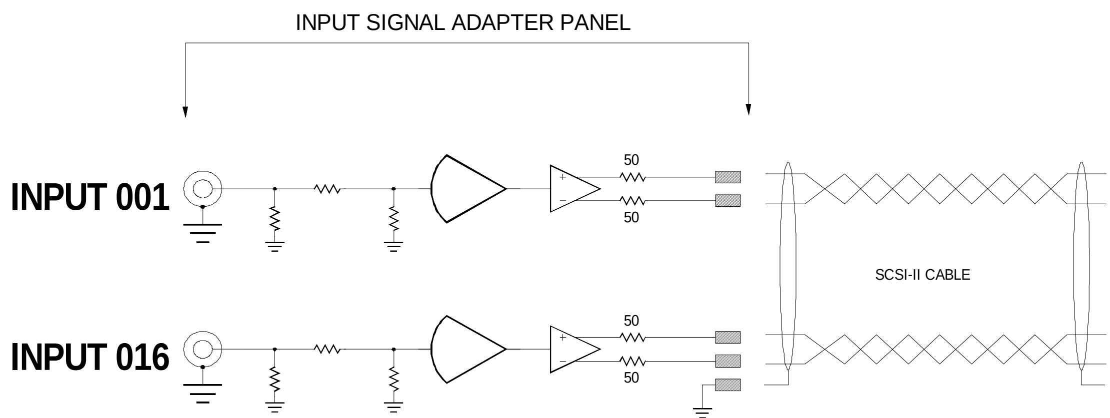


Example:

AP32BI-076 is an input unit with 75 ohms and 6-foot cables.

Inputs to the unit are BNC female with the shell of the BNC's common to chassis ground. Using this adapter panel assembly will allow the System S2560D to route signals up to +/-5 volts.

> ***NOTE: This unit requires that the S2560D unit utilize a 100 ohm input module only.***



12.2.2.Output Panel Assembly: Model AP32BO-xxx

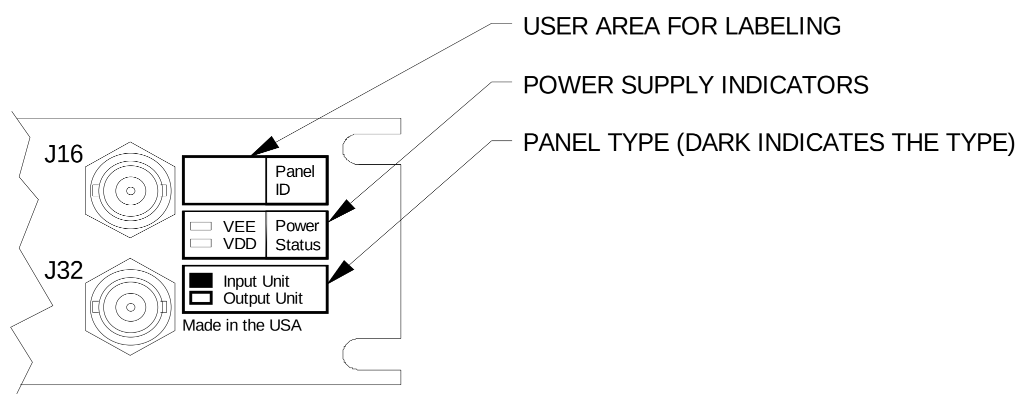
The output version (Model AP32BO) provides three functions.

1. It converts the differential signals from S2560D on SCSI-II connectors to single-ended BNC female connectors. The user mates to the BNC. It does this conversion both mechanically and electrically.

2. It provides a level of gain to the input signal prior to converting the signal from single-ended to differential. This is so the S2560D system can switch higher input signal levels than if the user were directly connected to the S2560D system. The gain of the output panel assembly is factory matched to the attenuation of the input panel assembly.

3. The panel assembly also allows the user connections to the S2560D to be located either on the front of the rack, or in the rear of the rack.

The panel assembly is self-contained including built-in power sections and two cables to connect to the S2560D. The last digit of the model number determines the length of the cables (3=3 feet, 6=6 feet). The second to last digit specifies the input impedance of the adapter panel assembly (5=50 ohms, 7=75 ohms). A six-foot AC power cord is also included.



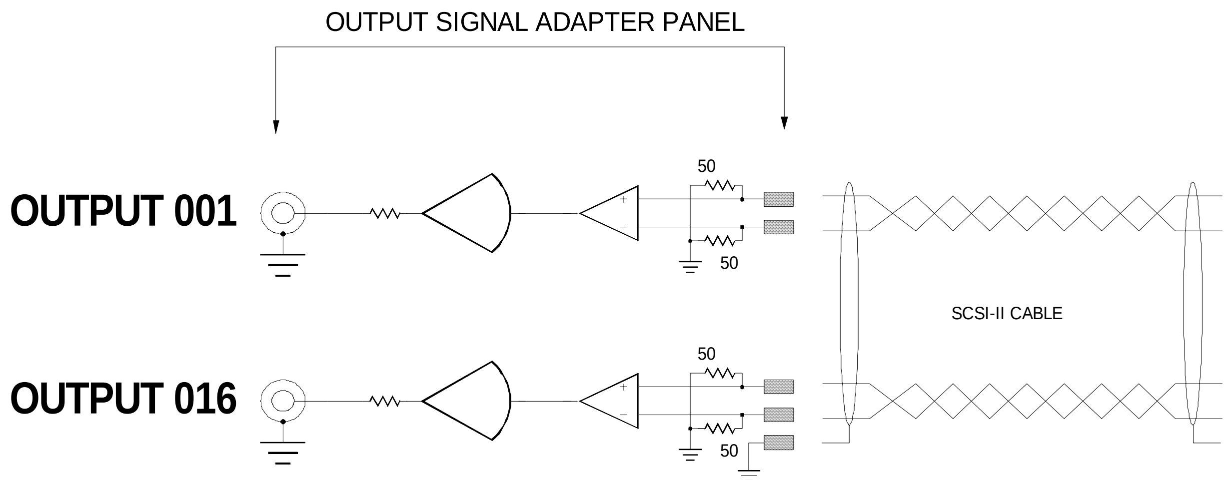
Example:

AP32BO-073 is an input unit with 75 ohms and 6-foot cables.

Connections to the unit are BNC female with the shell of the BNC's common to chassis ground. Using this adapter panel assembly will allow the System S2560D to route signals up to +/-5 volts.

> ***NOTE: This unit requires that the S2560D unit utilize a 100 ohm output module only.***

Below is a simplified signal schematic of the unit (16 channels).



13. General Specifications

• Configuration	32 input by 32 output (minimum) 256 input by 256 output (maximum)
• Frequency range	DC-125MHz (min)
• Flatness	+4dB, -3dB (DC-100MHz)
• Gain	Unity (nominal)
• Max input power	+10dBm (no damage)
• Available impedances	100, 300 or 600 ohms (factory configured)
• Signal coupling	DC
• Signal connectors	SCSI-II (fifty-position)
• Switching technology	High reliability solid-state elements
• Module technology	Hot-Swap input and output modules
• Memory retention	>10 years
• AC power	90-264VAC, <250 Watts, 47-440Hz
• Power section	Single capacity or redundant capacity
• Power cord	NEMA 15A (USA), 6 foot long (detachable)
• Control types available	RS-232C/RS-422A port RS-485 (multi-drop) GPIB (IEEE-488) Ethernet Front panel illuminated keypad
• Operation temp range	0 to +60C
• Storage temp range	-20C to +75C
• Physical size	19.00" W x 19.30" D x 8.72" H
• Weight	<40lbs

NOTE: Signal specifications vary from above with the additional of signal panel adapters. See the individual panel assembly details.

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