PESA Switching Systems

LC Control Panels

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Table of Contents

SECTION 1
GENERAL

1.1 MANUAL OVERVIEW 1.1
1.2 GENERAL 1.2
Figure 1-1 1RU Control Panels 1.3
Figure 1-2 2RU Control Panels 1.4

SECTION 2
INSTALLATION

2.1 RECEIPT INSPECTION 2.1
2.2 LOCATION 2.1
2.3 MOUNTING 2.1
2.4 POLLING ADDRESS and FUNCTION SETTING 2.1
Figure 2-1 Setting DIP Switches A and B 2.3
2.5 CONTROL PANEL/CONTROLLER INTERCONNECTION 2.3
Figure 2-2 Typical Control Panel Controller Interconnection 2.3
2.6 POWER CONNECTIONS 2.4
Figure 2-3 115V Power Pack 2.4
Figure 2-4 230V Power Pack 2.4

SECTION 3
OPERATION

3.1 GENERAL 3.1
3.2 PANEL OPERATION 3.1
Figure 3-1 Control Panel Operation 3.2

SECTION 4
FUNCTIONAL DESCRIPTION

4.1 GENERAL 4.1
4.2 CONTROL PANEL (REMOTE) CPU BOARD 4.1
4.3 COAXIAL BUS I/O INTERFACE 4.3
Figure 4-1 Coaxial Bus I/O Interface 4.4
4.4 SOURCE/SALVO LAMP CONTROL 4.5
Table 4-1 Lamps and Corresponding Switches for Single Rack Units 4.5
Table 4-2 Lamps and Corresponding Switches for Two Rack Units 4.5
4.5 CONTROL LAMP DRIVE CONTROL 4.6

Table of Contents

SECTION 5
MAINTENANCE

5.1 GENERAL 5.1
5.2 PREVENTIVE MAINTENANCE 5.1
5.3 TEST EQUIPMENT 5.1
Table 5-1 Recommended Test Equipment 5.1
5.4 CORRECTIVE MAINTENANCE 5.1
FACTORY REPAIR SERVICE 5.2
ADJUSTMENT/ALIGNMENT 5.2
TROUBLESHOOTING 5.2

1.1 Manual Overview

This manual provides detailed instructions for installing and operating the PESA Low Cost Pushbutton Control Panels. This manual is divided into five sections as shown.

Section 1, **INTRODUCTION**, summarizes the manual, describes the Low Cost Pushbutton Control Panels, presents a list of terms, and provides panel specifications.

Section 2, **INSTALLATION**, provides installation and setup instructions.

Section 3, **OPERATION**, describes system operation procedures.

Section 4, **FUNCTIONAL DESCRIPTION**, presents an in-depth description of the Low Cost Pushbutton Control Panel.

Section 5, **MAINTENANCE**, explains procedures for maintenance.

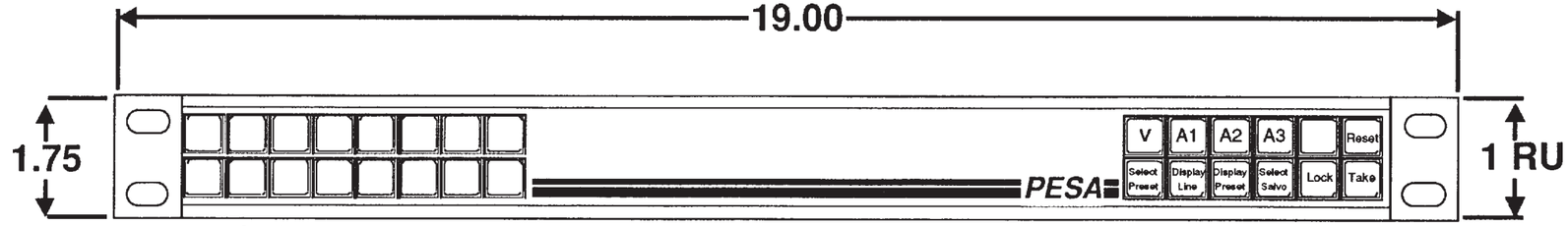
1.2 General Description

PESA has developed a line of Low Cost Pushbutton Control Panels in configurations of 16X, 32X, 40X, 48X, and 64X. All panels operate the same. The only difference is the number of assignable buttons each provides. These Low Cost (LC) Control Panels are used in conjunction with the 6600 Controller to control one output of a PESA Video and/or Audio routing switcher. The Control Panel is keyed to an output which is assigned at the controller level. The different Panels have various numbers of pushbutton selected inputs, which can also be assigned using the system configuration program. Each Panel can control up to four independent levels of switching in any combination of audio or video. A common configuration is one video and three audio levels. Each Panel also has 12 control pushbuttons which are used to select various modes and functions.

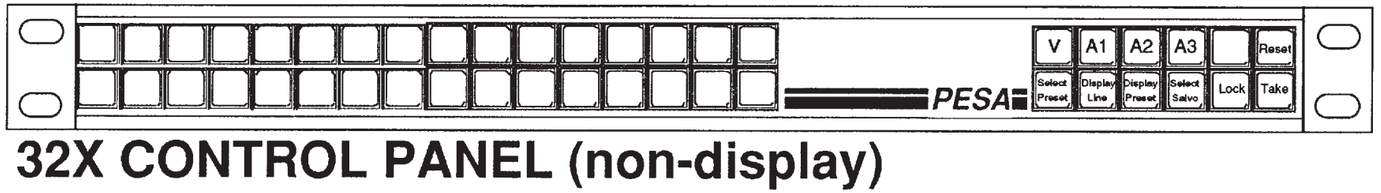
Each Control Panel comes with a remote CPU Board which converts pushbutton selections to control codes that are transmitted via a coaxial bus to the 6600 Controller. The Controller communicates the desired switch over the PESA coax bus in the form of Manchester II encoded data at 62.5K baud. Each panel uses a detachable plug-in power module for DC power.

The 16X, 32X, and 40X LC Control Panels are one Rack Unit (1RU) in height. The 48X and the 64X are two Rack Units (2RU). The following illustrations show the various panels and their specifications. See Figures 1–1 and 1–2.

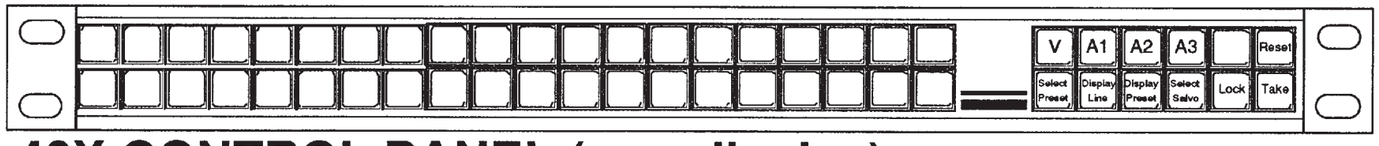
1 RU Control Panels



16X CONTROL PANEL (non-display)



32X CONTROL PANEL (non-display)

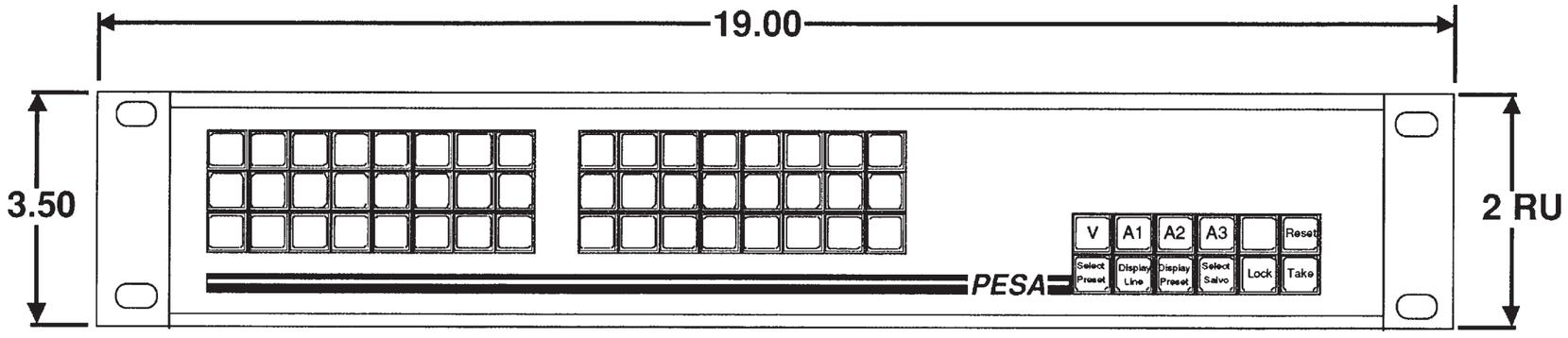


40X CONTROL PANEL (non-display)

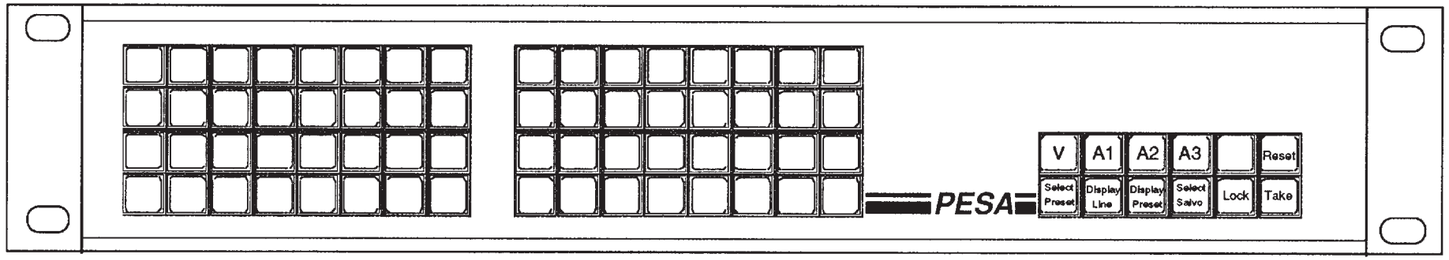
Power Requirements	**110-120VAC** **220-240VAC**
Power Consumption	**5W Maximum**

Dimensions
19"W x 1 3/4"H x 5 3/4"D
482.6mmW x 44.45mmH x 146mmD

Figure 1-1 **1 RU Control Panels**



48X CONTROL PANEL



64X CONTROL PANEL

Power Requirements	110-120VAC 220-240VAC
Power Consumption	5W Maximum

Dimensions

19"W x 3 1/2"H x 3 1/4"D
482.6mmW x 88.9mmH x 82.5mmD

Figure 1-2 2 RU Control Panels

2.1 Receipt Inspection

Control Panels are inspected and tested prior to leaving the factory. Upon receipt, inspect the unit for shipping damage. If damage is detected, notify the carrier immediately. If the unit is satisfactory proceed with the installation.

2.2 Location

The Control Panel is a rack mounted device and should be positioned for convenient visual and physical access. The Control Panel power module requires access to a conventional three prong AC power outlet.

2.3 Mounting

The Control Panels are measured in rack units. The 16X, 32X, and 40X are 1RU in height. The 48X and the 64X are 2RU in height. In mounting the unit, confirm that all mounting holes are used. Mount the unit using appropriate machine screws and nylon washers to avoid damaging paint. For ease of installation, install all screws before tightening.

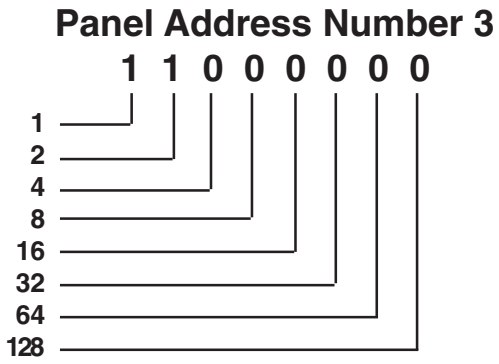
2.4 Polling Address and Function Setting

For the controller to identify a particular control panel, a specific device number or polling address must be assigned to each panel. Sequential binary numbers (00000001 thru 10000000) are used for this purpose. The appropriate binary number is entered into the control panel by setting an internal 8-position DIP switch (A) to the binary number. The DIP switch is located on the remote CPU board (Figure 2–1). The device address is normally assigned and entered at the factory. Site personnel will not be required to enter the number unless there is a control panel exchange or a system expansion. In the event of an expansion the Controller system configuration program will have to be updated to reflect the expansion.

2.4 Polling Address and Function Setting (cont.)

To set the Dip Switch you must first select the address panel number to be assigned. Below is an example of setting a panel to address 3.

Position 8	Off	0
Position 7	Off	0
Position 6	Off	0
Position 5	Off	0
Position 4	Off	0
Position 3	Off	0
Position 2	On	1
Position 1	On	1



Refer to Figure 2-1

The remote CPU board also has a B DIP switch which sets two functions: Panel configuration and Hot Salvo Mode. (Figure 2-1)

Panel Configuration is set up using the B DIP switch so that the software can determine what panel it is running (16X, 32X, 40X, 48X and 64X).

Hot Salvo Mode allows salvos to be taken directly from activating data pushbuttons. The number of salvos available is equal to the number of input buttons on the panel. Once the B DIP switch is set, the panel must be reset (cycle the power). Hot Salvo Mode will now be the default mode instead of Display Status.

The B DIP switch is allocated as follows:

Positions 8 7 6 5
OFF OFF OFF OFF 0 0 0 0 - Set all positions to zero

Position 4	**3**	**2**	**Panel Configuration**
ON	OFF	OFF	1 0 0 16X Control Panel
ON	OFF	ON	1 0 1 32X Control Panel
ON	ON	OFF	1 1 0 40X Control Panel
ON	ON	ON	1 1 1 48X and 64X Control Panels

Position 1 Hot Salvo Mode

OFF	0 - Hot Salvo Mode disabled
ON	1 - Hot Salvo Mode enabled

2.4 Polling Address (Device Number)

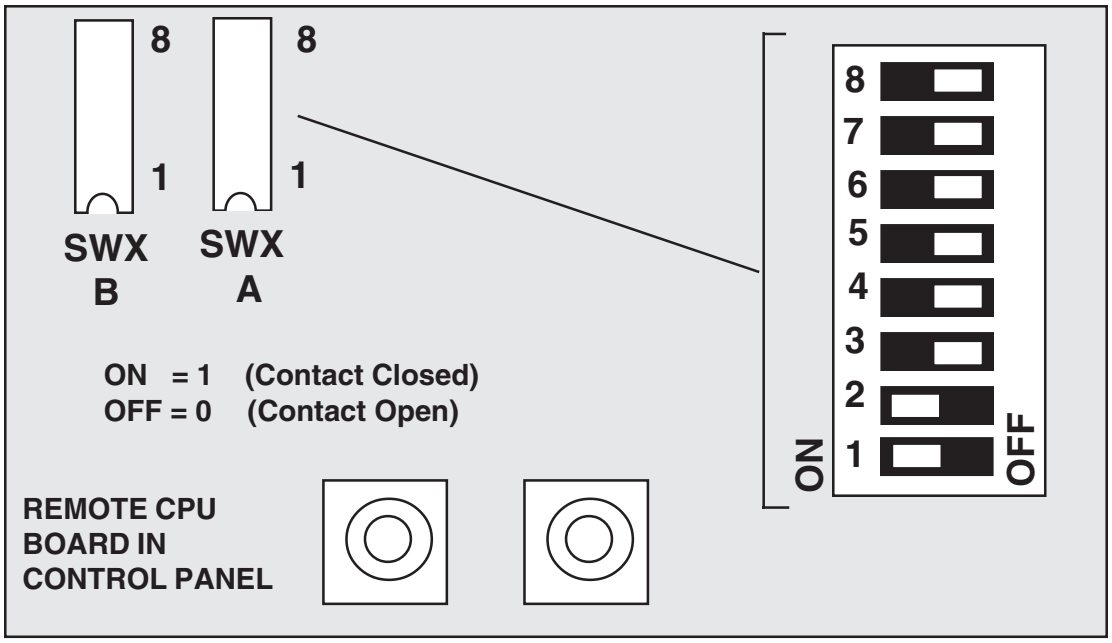


Figure 2-1 Setting DIP Switches A and B

2.5 Control Panel/Controller Interconnection

Each Control Panel has two loop-through BNC connectors located on the rear panel. Control panels are daisy chained to a coax port on the rear of the 6600 Controller rear panel (Figure 2-2). Use RG/59BU coax cable.

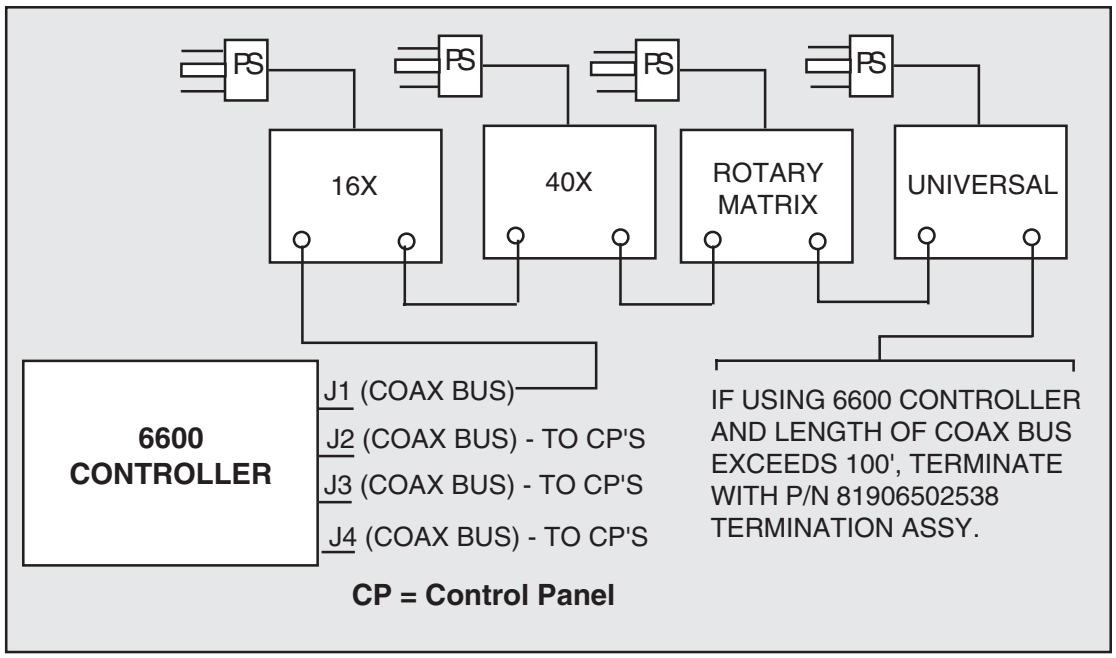


Figure 2-2 Typical Control Panel Controller Interconnection

2.6 Power Connections

Power for the LC Control Panels is supplied by either a Plug-In-The-Wall 115V power packs or 230V power packs.

• 115V: Remove the Power Pack from the box it was shipped in and check to insure that no damage has occurred in shipping. The 3-pin Mate-N-Lock connector should be plugged into the **POWER IN** position on the LC Control Panel. The Power Pack is configured for any standard 110VAC-120VAC plug outlet and will immediately power the unit upon connections to AC Voltage. See Figure 2-3.

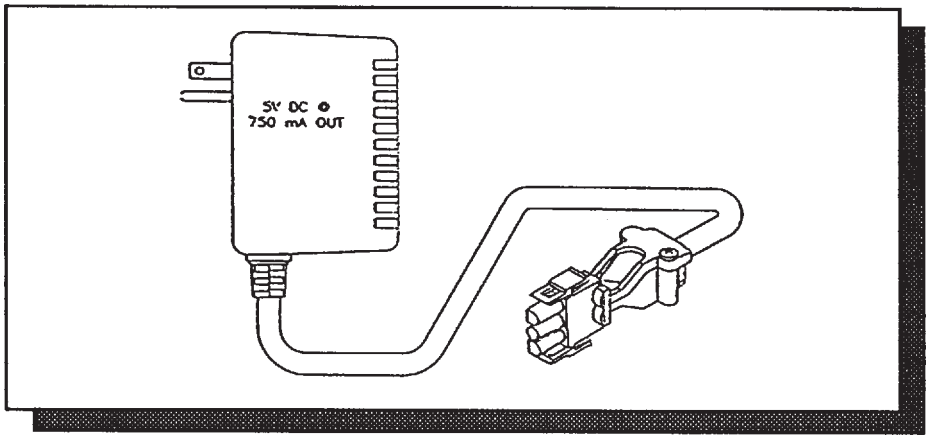


Figure 2-3 Typical Control Panel Controller Interconnection

• 230V: Remove the Power Pack from the box it was shipped in and check to insure that no damage has occurred in shipping. The 3-pin Mate-N-Lock connector should be plugged into the **POWER IN** position on the back of the LC Contro Panel. The 230V version power pack does not have an AC plug. PESA does not provide outlet plugs for 230V Power Packs. Outlet connection must be provided by the customer. A 210V to 240V 50-60Hz power plug outlet for the specific area should be installed. Contact your authorized PESA products distributor or sales representative for assistance. See Figure 2-4.

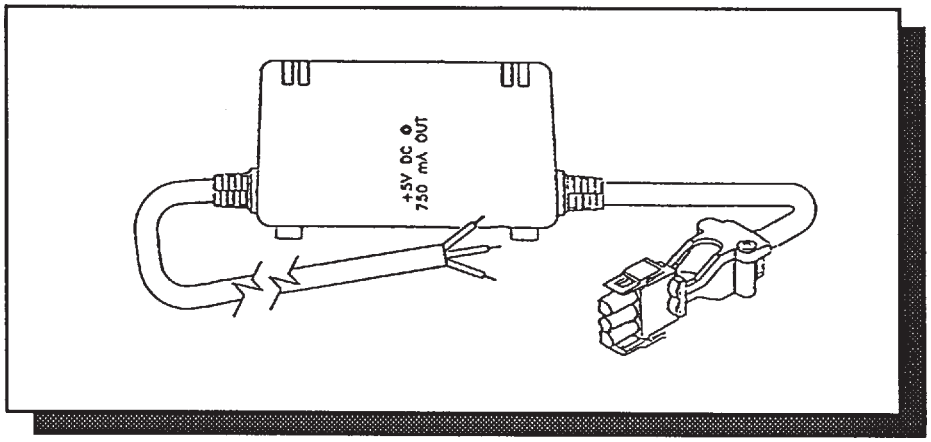


Figure 2-4 Typical Control Panel Controller Interconnection

3.1 General

The Control Panels in a routing switcher system are custom configured at the factory prior to shipment. The information needed to configure the panels comes from the System Design Guide filled out by the customer. If the system includes a terminal, the Panel can be reconfigured on site using the terminal.

The presence of a terminal in the system permits two operations which can affect the operation of a control panel.

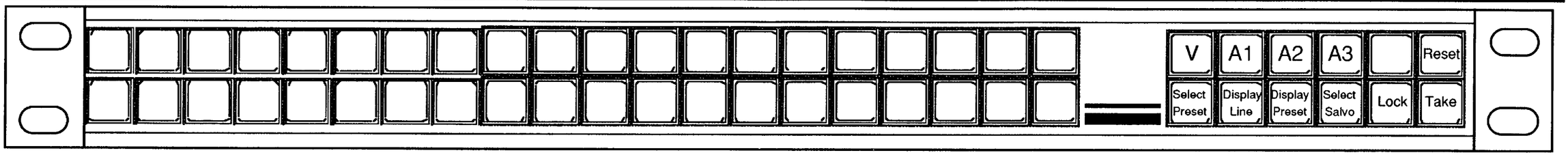
1. SALVO: Salvo switching events can only be entered into the system using a terminal. The SALVO button on the Control Panel is effective only if the information has been previously entered into the salvo group being addressed.

2. BLOCKED INPUTS: The terminal provides the capability of blocking (inhibiting) selected input signals from an output. It is possible that some inputs assigned to a given output panel may not always be available because of this feature.

3.2 Panel Operation

Figure 3–1 shows the front view of a 40X Control Panel as an example. All panels operate in the same manner. Detailed instruction on how to operate the panel is included. Arbitrary source (signal input) names have been added to aid in the instruction.

The Control Panel shown is for a routing switcher system which has been configured for four levels of switching. The system has one VIDEO and three AUDIO channels.



THE PUSHBUTTON CONTROL PANEL

NOTE: THE 40X IS DISPLAYED AS AN EXAMPLE ONLY . ALL PANELS OPERATE THE SAME.

Using the **DISPLAY LINE MODE** (press DISPLAY LINE pushbutton) to check current status.

1. The DISPLAY LINE pushbutton will light.
   - Any AUDIO levels assigned to the same source will also be lit.
   - One SOURCE lamp will be lit indicating the current input. (if no source lamp is lit, the current input is not one of those assigned to the Control Panel.)
   - To check source of other levels, press the pushbutton corresponding to that level (i.e. AUDIO 1 (A1), AUDIO 2 (A2), OR AUDIO 3 (A3)).
     a. The pushbutton will blink and the source lamp for that level will light. If a source pushbutton is not lit, the current input is not one of those assigned to the Control Panel.
     b. Repeat until all level sources have been checked.
     c. Press the DISPLAY LINE pushbutton to return to the initial status display.

Using the **DISPLAY LINE MODE** to change current SOURCE (input) assignments. (If any level select switch is blinking, press the DISPLAY LINE pushbutton.)

1. For "AUDIO follow VIDEO" press the desired SOURCE (IN 1-IN 40) pushbutton. The Control Panel automatically tells the Controller to do the necessary switching. (Note that all four level pushbuttons are lit.)
2. To assign different inputs to each level (AUDIO BREAKAWAY), press the level switch (it will begin blinking) then press the desired SOURCE (IN 1-IN 40) pushbutton. The Controller Panel will tell the Controller to switch the level to the new input.
3. Repeat step 2 above until the desired input has been assigned to each level.

SELECT PRESET MODE. (Allows a level switching sequence to be stored for later execution.)

1. Press the SELECT PRESET pushbutton.
   - The SELECT PRESET lamp will light and the four level lamps will be turned off. One source lamp (IN 1-IN 40) may be lit.
2. To set a level, press the desired source pushbutton (IN 1-IN 40) then press the Video (V) or Audio (**A1, A2, or A3**) level pushbutton to which it is to be assigned.
3. Repeat until the desired inputs have been assigned to each level. If multiple levels are being assigned to the same input, just press the additional level pushbuttons.
4. The stored preset switching sequence is transmitted by pressing the TAKE pushbutton.

RESET. Press and hold the RESET button for 5 (five) seconds to reset power to the panel.

DISPLAY PRESET MODE. This mode allows examination of a level switching sequence stored using the SELECT PRESET MODE.

1. Press the DISPLAY PRESET pushbutton.
   - The DISPLAY PRESET lamp will light.
   - A source lamp, the VIDEO lamp (V) , and any AUDIO lamps (A1, A2, or A3) also assigned to that source will light.
2. To check the input for any level that did not light (step 1 above), press the appropriate level pushbutton and observe the illuminated source lamp.
3. Repeat until all level assignments have been checked.
4. Exit DISPLAY PRESET MODE by pressing DISPLAY LINE.

SELECT SALVO MODE. This mode permits transmission of salvo groups to be initiated from the Control Panel. There may be as many salvo groups as there are pushbuttons.

1. Press the SELECT SALVO button.
   - The SELECT SALVO lamp and SOURCE lamp #1 will light.
2. To transmit a salvo group press the SOURCE pushbutton whose number corresponds to the desired salvo group, then press the TAKE pushbutton. (To transmit salvo group 1 press TAKE).

TAKE. The TAKE pushbutton is used to transmit a preset switching sequence or a salvo group. It has no other function.

LOCK. The LOCK pushbutton is used to lock an output to a specific input. It is an alternate action control. Lock can be initiated or released from any control panel or device. When the LOCK lamp is lit the output is locked. The lamp blinks on the panel where lock was initiated.

HOT SALVO MODE.

1. Ensure that dip switch #1 on DIP Switch B is in the "ON" position.
2. Press the RESET button for 5 seconds to recycle the panel.
   - The SALVO lamp will flash.
3. Press any input button that is associated with a defined salvo to execute that salvo without pressing the TAKE button. All other standard modes can still be accessed.

Figure 3–1 Control Panel Operation

4.1 General

The Control Panel is a dedicated micro computer which operates in programmed sequences initiated by its pushbutton switches. The Panel requires a status table which is provided by the Controller when the system (or the Control Panel) first comes on line. This table defines the parameters which have been assigned to the Panel (i.e., OUTPUT assignment and applicable SOURCE signals it can direct to that output). The table is automatically updated if assignments are changed by other control devices in the system. Serial communication between the Controller and the Control Panel is via coaxial bus in Manchester II code. Use of this code eliminates DC from the bus, provides clock recovery, and gives a relatively high degree of noise immunity.

The Controller continuously polls each Control Panel of the coax bus asking if it requires attention. It does this by placing sequential polling addresses on the bus. Each Control Panel, in turn, compares the bus address with an internal polling address (set via DIP switch A). When the two match, the Control Panel can tell the Controller it requires attention by echoing its address to the bus. The Controller will acknowledge the request and the Panel is free to communicate. The polling sequence will be suspended until the Control Panel is serviced, then resumes where it was interrupted. If the Control Panel does not need to communicate, it watches the bus for a short period to see if the polling address is immediately followed by status update information. If such data is present it is processed into RAM memory, otherwise, the polling address is ignored.

The remainder of this section provides a technical discussion of Control Panels. The discussion is keyed to various simplified diagrams to provide additional clarity.

4.2 Control Panel (Remote) CPU Board

U1 is a complete micro computer on a chip (See page 6-3). In this application however, an external clock and external memory (ROM and RAM) are used. The chip select input is pulled high to disable the chip and Vcc to the chip is maintained to preserve the memory contents.

4.2 Control Panel (Remote) CPU Board (cont.)

The CPU (U1) communicates with the coax bus through Manchester II Encoder/Decoder chip U7. U7 converts (encodes) the serial data output of the CPU (binary) to Manchester II code. The encoded data is connected to the coax bus through a low impedance driver (Q1/Q2). Serial data from the Controller (Manchester II code) is routed to U7 through an input stage (U8) where it is decoded to binary before being sent to the CPU. (The coax bus/U7 interface circuitry is discussed later.)

Program software is loaded on component EPROM U5. U5 is of type 2732A. This EPROM contains all software for panel operation.

The Control Panel begins operating with the termination of the 100 millisecond power up RESET pulse (this circuitry is discussed later). At this point the operating program required initial status information. It monitors the polling addresses being sent by the Controller looking for the address which matches the one programmed into DIP switch A. When the match is made, action is initiated which results in the status table being written to the Control Panel RAM memory. The operating program then has the information needed for normal operation. It updates the Panel indicators and begins to scan the pushbutton switch looking for closures.

CPU U1 has 32 I/O (Input/Output) lines grouped into four eight-bit ports (PA0-PA7, PB0-PB7 PC0-PC7, and PD0-PD7).

The PA port handles onboard requirements of the CPU.

1. PA0 through PA3 are not used off board.

2. PA2 is used onboard so DIP switch A can be read. (Turns on Q3.)

3. PA5 enables (low) the encoder section of U7 so that serial data from the CPU can be transmitted to the Controller.

4. PA6 is the serial data out. It is routed off board and when PA5 is low, to U7 for encoding to Manchester II code.

5. PA7 is the decoded serial data input to the CPU.

4.2 Control Panel (Remote) CPU Board (cont.)

Port PB controls the Source/Salvo Indicators.
1. See Source/Salvo Lamp Drive discussion.

Port PC is the interface with the pushbutton switch matrix.
1. See Pushbutton Switch Matrix discussion.

Port PD controls the Control Lamp indicators.
1. See Control Lamp Drive discussion.

I/O lines PD0 through PD5, PC0 and PC1 are also used to read the polling address programmed into DIP switch A. This address can only be read when Q3 is conducting. At all other times the switch is effectively disconnected from these lines.

4.3 Coaxial Bus I/O Interface

Figure 4–1 shows the interface circuitry between the Control Panel, CPU and the coaxial bus from the Controller. Q1 and Q2 couple the serial data output (Manchester II code) from the encoder section of U7 to the coax bus. The signal from U7 will be 0 or +5 volts. When the signal is +5 volts, Q1 is turned off and transistor Q2 is turned on. If there is noise on the bus, Q2 conducts through R20 insuring the bus will be low. When the signal from U7 is low (0 volts), Q1 is turned on and Q2 is turned off. When Q1 conducts, +5 volts is coupled to the coax bus. The Manchester II code inversion, which occurs through Q1 and Q2, is corrected in the receiving circuits of the Controller. The data placed on the bus is also routed through the Control Panel receiver circuitry. This does not matter since the decoder section of U7 is not active when the Control Panel is transmitting data.

The receiving circuitry of the Control Panel (comparator U8 and associated components) couple serial data from the Controller to the decoder section of U7. (The Manchester II code from the Controller is also inverted.) The input from the bus is diode limited between 0 and +5 volts then routed to the inverting input of U8 through capacitor C14. When the data input is low, the non-inverting input is approximately .1 volts above the inverting input causing U8 pin 13 to be high (about 4.9 volts). If the data input is high, the inverting input is more positive and U8 pin 13 is driven low. The data inversion through U8 corrects the Manchester II code phase before it is sent to the decoder section of U7.

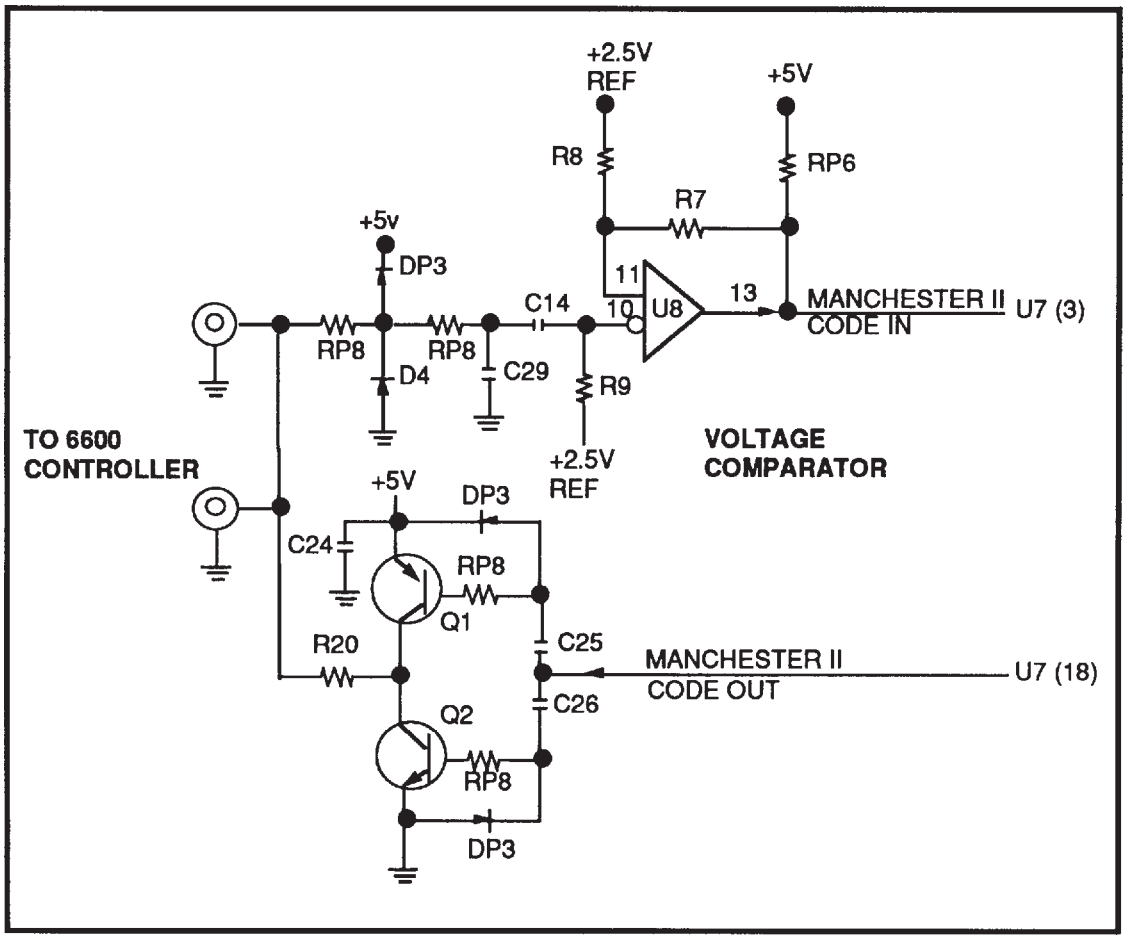


Figure 4-1 Coaxial Bus I/O Interface

4.4 Source/Salvo Lamp Control

SINGLE RACK UNITS –16X, 32X, and 40X

U1 is the column control decoder. A binary number (000-0111) is written to the decoder which produces a high at the corresponding Y output. This high turns on a lamp driver in U2 or U3 (see Y3 output) which, in turn, applies a high to the associated column. The CPU writes the four bit binary code for the selected output to the chip. The first three bits select the output and the fourth bit (MSB) sets the strobe G2A low to enable the chip.

The row input is selected through BCD-to-DECIMAL decoder U4. The BCD code for the desired row is written to U6 by the CPU. U4 responds by setting the corresponding row low. The LED indicator at the junction of the high column and low row will light. Only one Source/Salvo indicator can light at a time.

Lamps correspond to signal sources on each LC Control Panel. Since the lamps are an integral part of the pushbutton, the lamp numbers and the switch numbers correspond. The lamps and corresponding signal sources are as follows:

Table 4-1 Lamps and Corresponding Switches for Single Rack Units

16X	L13–L20 (S1–8) L33–L40 (S9–16)	**32X**	L13–L28 (S1–16) L33–L48 (S17–32)	**40X**	L13–L52 (S1–40)

TWO RACK UNITS –48X and 64X

U4 is the column control decoder. A binary number (000-0111) is written to the decoder which produces a high at the corresponding Y output. This high turns on a lamp driver in U5 or U6 (see Y3 output) which, in turn, applies a high to the associated column. The CPU writes the four bit binary code for the selected output to the chip. The first three bits select the output and the fourth bit (MSB) sets the strobe G2A low to enable the chip.

The row input is selected through BCD-to-DECIMAL decoder U3. The BCD code for the desired row is written to U3 by the CPU. U3 responds by setting the corresponding row low. The LED indicator at the junction of the high column and low row will light. Only one Source/Salvo indicator can light at a time.

Table 4-2 Lamps and Corresponding Switches for Two Rack Units

48X	L13–L24 (S1–11) L29–L40 (S12–24)		L45–L56 (S25–36) L61–L72 (S37–48)	**64X**	L13–L76 (S1–64)

4.5 Control Lamp Drive Control

SINGLE RACK UNITS –16X, 32X and 40X

Control lamps are lit in various combinations to indicate current status. This is accomplished by using clocked D flip-flops (U8 and U9, figures 6-21 and 6-24). The CPU writes 6 bits of data to the inputs of U8 to define the status of lamps 1 through 6 then clocks the chop. The same process is repeated with chip U9 to define the status of lamps 7 through 12. When the chips are clocked, the Q outputs are set to the same state as the corresponding D inputs. Low outputs light associated lamps.

TWO RACK UNITS –48X and 64X

Control lamps are lit in various combinations to indicate current status. This is accomplished by using clocked D flip-flops (U1 and U2, figure 6-21 and 6-24). The CPU writes 6 bits of data to the inputs of U1 to define the status of lamps 1 through 6 then clocks the chop. The same process is repeated with chip U2 to define the status of lamps 7 through 12. When the chips are clocked, the Q outputs are set to the same state as the corresponding D inputs. Low outputs light associated lamps.

5.1 General

Each Control Panel is a solid state electro-mechanical device designed to give long, trouble free service with minimum maintenance requirements. If problems do occur, follow the troubleshooting procedure provided. If additional technical assistance is required, refer to the General Assistance and Service information in the front of the manual.

5.2 Preventive Maintenance

There is little need for preventive maintenance on Control Panels other than the normal care which should be given to any quality electronic equipment.

5.3 Test Equipment

The test equipment recommended for servicing the Low Cost Control Panel is listed in Table 4–1. Equivalent test equipment may be used.

Table 5–1 Recommended Test Equipment

EQUIPMENT	FUNCTION
Oscilloscope - 20 MHz or higher	Waveform Monitoring and Tracing
VOM - 20,000 Ω per volt or higher	Voltage and Resistance Measurements

5.4 Corrective Maintenance

The following paragraphs provide information to assist the servicing technician in maintenance of any model Control Panel. The functional description section of the manual contains board/circuit level technical discussions to assist in identifying specific problems.

5.4 Corrective Maintenance (cont.)

Factory Repair Service

If desired, equipment or boards may be returned to the factory (transportation prepaid) for repair. Refer to the General Assistance and Service information sheet in the front of this manual.

Pack the equipment securely and label with the correct address. Proper packaging saves money. The small amount of extra care and time it takes to cushion a part or unit properly may prevent costly damage while in transit. Make certain that the address is both legible and complete. Failure to do so often results in delay or even loss.

Adjustment/Alignment

Control Panels have no adjustments.

Troubleshooting

Troubleshooting a Control Panel requires the routing switcher system to be used as a test fixture. The Panel does not function except as part of the system. The only troubleshooting which can be accomplished without opening the Control Panel is to check input power (from plug-in power module) and indicator lamps by exchange or replacement. Access to an indicator bulb is by pulling off the key cap. Care should be used when handling the key caps. The cap is in two parts and a part can easily be dropped.

To open the Control Panel for troubleshooting, remove the top cover and disassemble the unit as far as required to gain access to the component side of the three printed circuit boards inside. Place the disassembled panel on a non-conducting surface and arrange the parts so the unit can be operated. You must be able to operate the pushbuttons and observe the resulting status indicators. You must also have sufficient access to the boards to measure voltage or observe waveforms.

Procedure: Put the Control Panel through the operating sequence described in the operation section. Refer to Figure 3–1.

Troubleshooting (cont.)

A. If the Panel is nonresponsive there is a power problem or the CPU is not operating.

1. Refer to the POWER DISTRIBUTION discussion in the functional description section.

2. If power is functioning properly, the CPU is not operating. The CPU requires a clock, a power-up reset, and an input (status table) from the 6600 Controller. Refer to the CONTROL PANEL REMOTE CPU, RESET CIRCUIT, and COAXIAL BUS I/O INTERFACE discussions in the functional section.

> All IC's in the Control Panel install in sockets. If maintenance is to be performed in house, it will be necessary to stock a known good set of IC's for this unit.

B. For partial failures:

1. Pushbutton switches fail to initiate desired operation. Refer to the PUSHBUTTON SWITCH MATRIX discussion, in the functional description.

> If a source input fails to function it may be a blocked input. Check at the CRT terminal.

2. Source of Salvo indicator(s) fail to light. Refer to the SOURCE/SALVO LAMP CONTROL discussion in the functional description section.

3. Control indicators fail to light. Refer to the CONTROL LAMP DRIVE CONTROL discussion in the functional description section.

4. Almost any type of functional failure can be caused by a memory failure (either ROM or RAM). This type of failure can only be checked if a substitute chip is available.