87 Series Composite Video Switch Manual

(Rev A)

Part Numbers
87-111-104-A (4x1)
87-111-108-A (8x1)
87-111-112-A (12x1)
87-111-116-A (16x1)

Video Accessory Corporation
1243 Sherman Drive, Suite 8
Longmont, Colorado 80501
303-443-1319
www.vac-brick.com

Two Year Limited Warranty

All Video Accessory Corporation (VAC) products have a full two year limited warranty. Exclusions to the warranty include but are not limited to damage to external components, power LED failure where the product continues to function, and electrical damage due to lightning. The warranty shall be void if any alteration or repair of a VAC product is attempted by anyone not authorized by VAC. This warranty is expressly in lieu of all other warranties express or implied, including warranties of merchantability and fitness for use, and of all other obligations or liabilities on the part of VAC, and it neither assumes nor authorizes any other person to assume for it any liability in connection with the sale of this product. This warranty shall not apply to the product or any part thereof subjected to accident, negligence, alteration, abuse, or misuse. No warranty whatsoever is made with respect to accessories or parts supplied by anyone other than VAC, and this warranty shall extend only to the original purchaser of this product. The warranty provided in this article is exclusive and in lieu of, and buyer hereby waives, all other remedies, express or implied, arising by law or otherwise, including consequential damages, whether or not occasioned by negligence of VAC. This warranty shall not be extended, altered or varied except by written instrument signed by VAC and buyer, and shall only apply within the boundaries of the continental United States. Liability of VAC is limited to repair or replacement at the option of VAC. Warranty work is to be sent to VAC. Freight charges will be the responsibility of the purchaser.

Table of Contents

Document History

Rev:	Date:	Action:
A	May 31, 2012	Original Release

1 Overview

The 87-Series composite video switches are feature rich devices configurable to operate using several different modes of operation. Modes include; Basic switch functions, Timed switching function, and Automatic switching functions. Models with 8 inputs or more have an integrated 1x2 DA (two outputs).

A multi-color LED (green/orange/yellow) provides power status and an indication of the selected option during power-up.

The USB port permits the user to change configuration parameters and store the changes into the internal non-volatile memory as the power up default setting.

The internal power supply is fully isolated to permit the user to control ground loops. Power and control connectors have an integrated threaded/screw flange for shock and high vibration environments.

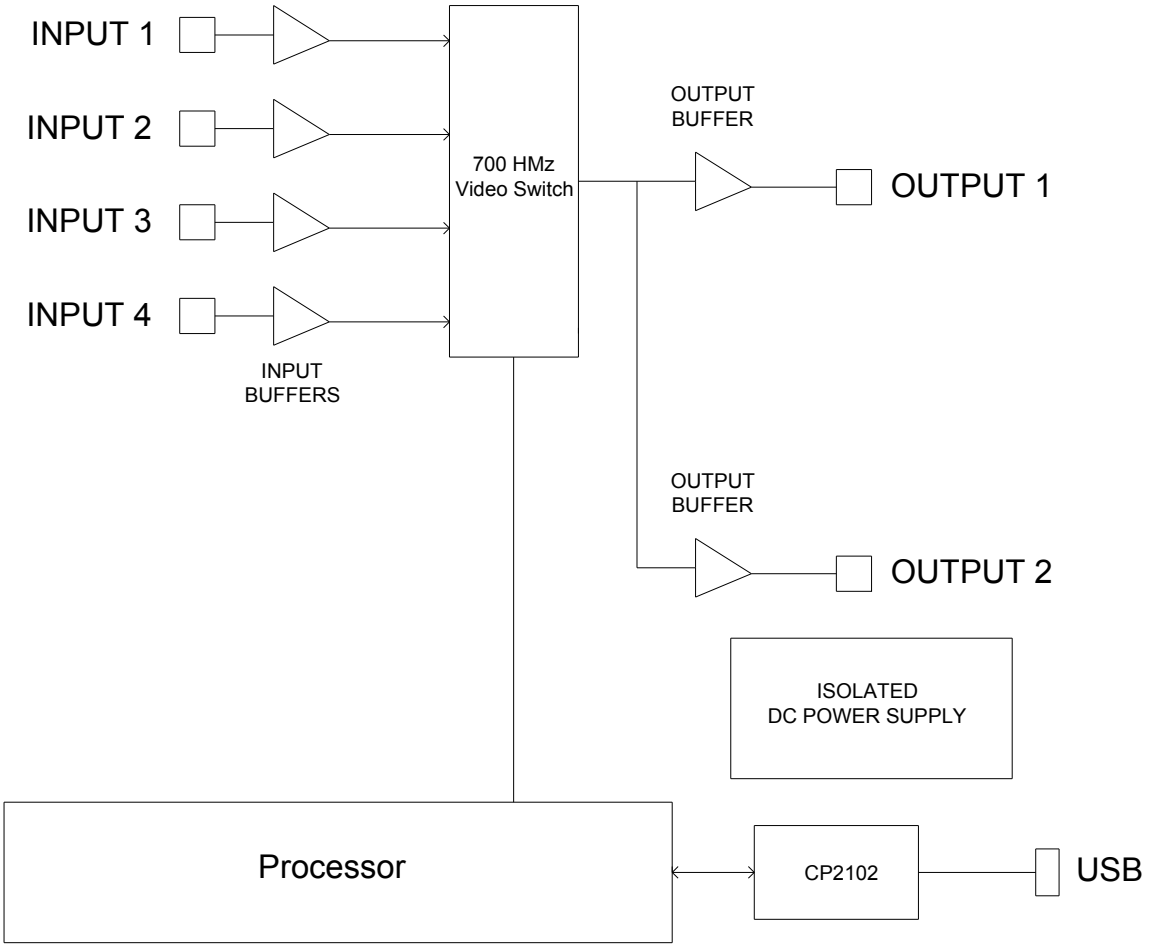


Figure 1: Block Diagram (4x1 shown)

2 Basic Functions

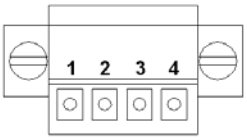
Switching behavior is controlled according to the selected or specified Option Number.

It is recommended customers specify the desired default control option when ordering. This eliminates the need for the user to connect each unit to a laptop in order to set the desired default power up option before use. If another option is required, the default Option number may be changed via the USB port and the change stored in FLASH memory as the new power up default value.

Each control port provides an internal +5V current limited voltage source, ground, four control inputs, and control input ground. The user may use an external voltage source to drive control port inputs to further isolate grounds. Each of the sections explaining the different control modes provide electrical connection information for both contact closures and external voltage controls.

3 Power Requirements

These units have an internal switching supply that isolates supply power from the internal power and I/O. Units will operate correctly when powered by 12-24 VAC or 10-34 VDC. Units are equipped with full wave rectification, so power may be applied between Pins 1 & 2 using either polarity.



Pin 1	**PWR+ (10-34V Supply Connection +V)**
Pin 2	**PWR- (10-34V Return Connection –V/GND)**
Pin 3	**AGND/Circuit Ground (Same as Input BNC/USB Shields)**
Pin 4	**CGND/Chassis Ground (ESD Protection Ground)**

Internal Circuit ground (AGND/Pin-3) is the ground reference for the internal circuits and input BNC shields. It is NOT the input voltage return path of pins 1 and 2. The user has the option of floating internal circuits, with respect to any system ground, by not connecting to this pin. The user also has the option to connect the circuit ground to the chassis ground or the input power ground (or both). This power connector pin-out permits the user to define the grounding environment the unit is used in.

Chassis ground (CGND/Pin-4) is connected to internal ESD protection devices. The chassis ground does not need to be connected for proper operation. Secondary ESD protection connections exist between the input and output video signals and internal circuit ground.

The power connector (J7) is a 4 pin 3.5mm center header (Phoenix Contact #1897267) and mating power plug (Phoenix Contact #1847071) with screw flanges for vibration and shock resistance.

The unit has a multi-color LED (green/orange/yellow) to indicate power is connected and the internal uP is running.

4 Universal Serial Bus (USB) Maintenance Interface

The Universal Serial Bus (USB) maintenance interface provides a terminal interface that permits the user to perform several functions: Selection of the control mode, setting configuration

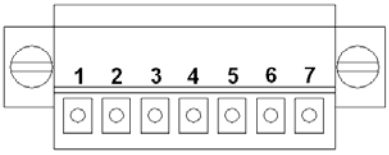
parameters, displaying status, and performing debug/maintenance. **Maintenance commands and functions are described at greater detail in *Section 7.***

The mini-USB port connects through a Silicon Labs CP2102 USB-UART bridge IC to communicate with the processor. A laptop and HyperTerminal[1] is used to view, enter, or modify configuration parameters. The configuration can be saved in non-volatile FLASH memory so the unit enters the correct configuration at power-up.

NOTE: USB shield is referenced to internal Circuit Ground. It is therefore possible for a ground "Sneak Path" to be created through the connected laptop computer. This will typically occur when the laptop or peripherals are connected to an external power source.

5 Control Port

Control Port operation is determined by the functionality or Option number specified by the user. The Option number is pre-loaded at the factory as the power-up default control mode. The default power-up Option and parameter values may be modified by the user. The modified values may then be stored into non-volatile memory (via the maintenance interface defined in *Section 4)* as the new power-up default.
Control port connectors are 3.5mm seven pin header (Phoenix Contact #1897296) and mating control plug (Phoenix Contact #1847107) with screw flanges for vibration and shock resistance.



Pin 1 Internal +5V (50mA limit)
Pin 2 Control Input 1
Pin 3 Control Input 2
Pin 4 Control Input 3
Pin 5 Control Input 4
Pin 6 Control Input Gnd
Pin 7 Internal Circuit Gnd (Same as BNC Shield)

Control inputs are optically-isolated from internal circuit ground. This permits control signals to be isolated from power and signal grounds. The Control port interface is a common cathode configuration. Control Input Ground (Pin-7) is common to the four control inputs of each control port. Voltage is applied or asserted onto the control input to generate an active input. Internal control port connections are shown in *Figure* 2.

[1] HyperTerminal is no longer a software component of post Windows-XP operating systems. Alternate terminal programs such as Hercules Setup may be considered.

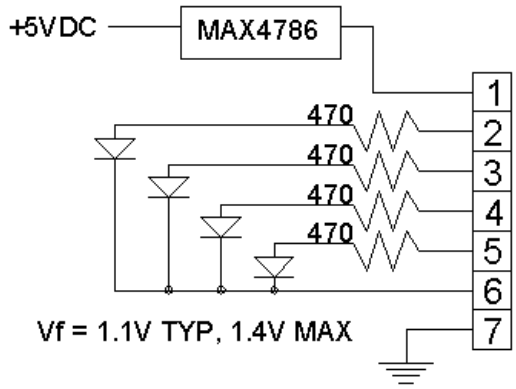


Figure 2: Control Port Electrical

Either the internal current limited voltage source or an external voltage source may be used for control input activation. If the unit is being controlled by external electrical signals the signals must be between 3-18 VDC. Unused, open, or unconnected control input connections default to an OFF or logic '0' level. An ON or logic '1' level is made when the internal processor detects current through the corresponding control input pin. The internal processor code also contains a de-bounce routine to remove contact noise and prevent false switching.

At power up, the unit will display the option number by using the bi-color LED. The green LED is used to show the most significant digit of the Option number by flashing the corresponding number of times to the most significant Option number digit. The yellow LED will flash the corresponding number of times to the least significant Option number digit. This provides a way for the user to know the Option number for the control mode at unit power up without the need to attach a laptop computer.

One control port is present for each brick layer and/or multiple of four Video Inputs. The control port residing at the top layer or same level as the power connector is considered the Primary Control Port or Control Port A. The mode of operation that is selected will determine which control ports and associated connections are required for that given mode of operation. Modes are described in *Section 6 and Section 1*.

6 Basic Switch Control Modes

Models with 8 inputs or more include a 1x2 DA on the output. Either output BNC connector will produce the selected input signal.

Basic Switch Control Options Include:

Option 11: One-to-One Button/Contact per Input Control
Option 12: Sequential Up/Down Two Button Control
Option 13: Encoded (BCD) Contact Control
Option 15: Timed Switching

6.1 Option 11: One-To-One Control (Button/Contact per input)

One-To-One control mode uses individual control signals (one control signal input for each Video Input) to select the video to the output. Multiple momentary (*Figure 3)* or static contact

closures, typical of an interlocked button switch, or control voltages, are connected to each control port input. Each control input is mapped to and will select a single video input.

At power up, video Input 1 is selected.
Control Port A / Input 1 is used to select video Input 1
Control Port A / Input 2 is used to select video Input 2
Control Port A / Input 3 is used to select video Input 3
Control Port A / Input 4 is used to select video Input 4
(For inputs 5-8 Port B, 9-12 Port C, and 13-16 Port D are used)
Control Port B / Input 1 is used to select video Input 5
…..
Control Port D / Input 4 is used to select video Input 16

Video input/source selection is made when the internal processor detects current through the corresponding control input pin. Only one control contact closure may be active at a time for selection. Between selection cycles the internal processor must see; all control inputs as an open circuit (not active) **or** that only the control input of the currently selected video input is active.

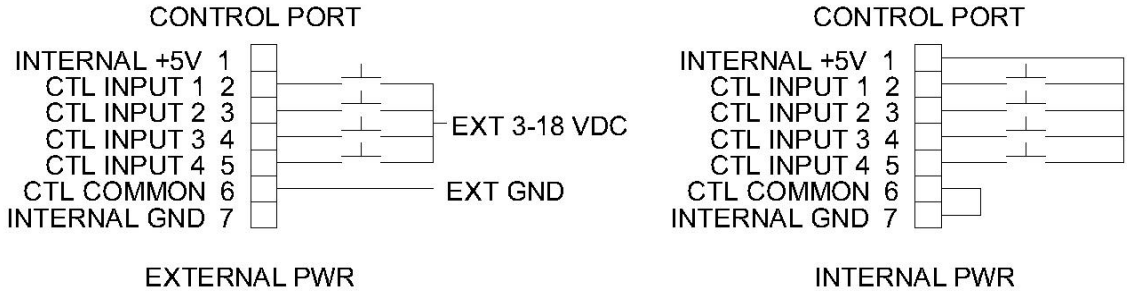


Figure 3: Button per Input Connection

6.2 Option 12: Pushbutton Control (Sequential Up/Down)

This control mode is used to sequentially select video inputs to the output each time a control signal is detected. A momentary contact closure, such as a pushbutton, or control voltage is connected to a single Up or Down control port input. Upon assertion of the “Up” or “Down” signal the output video is switched to the next sequential input (*Figure 4*).

The “Inputs” parameter (configured with the USB port: *Section 7*) permits the user to set the number of active inputs to less than the total number available on the unit. This can avoid the need for additional button presses to skip past unused Video Input channels.

Two pushbuttons are connected to control Port A (*Figure* 4) as a means of generating the desired momentary contact closures for switching. Port A/CTL1 when asserted will select the next sequential video input. Port A/CTL2 when asserted will select the last/previous sequential video input. The following describes how a 4x1 switch would operate:

At power up, video Input 1 is selected
Button Press #1(UP): Selects Video Input 2
Button Press #2(UP): Selects Video Input 3
Button Press #3(UP): Selects Video Input 4

Button Press #4(DN): Selects Video Input 3
Button Press #5(UP): Selects Video Input 4
Button Press #6(UP): Selects Video Input 1
Button Press #7(DN): Selects Video Input 4

Video input/source selection is made when the internal processor detects current through the corresponding control input pin (*Figure* 4). Between selection cycles the internal processor must see all control inputs as an open circuit (not active) before another selection is made.

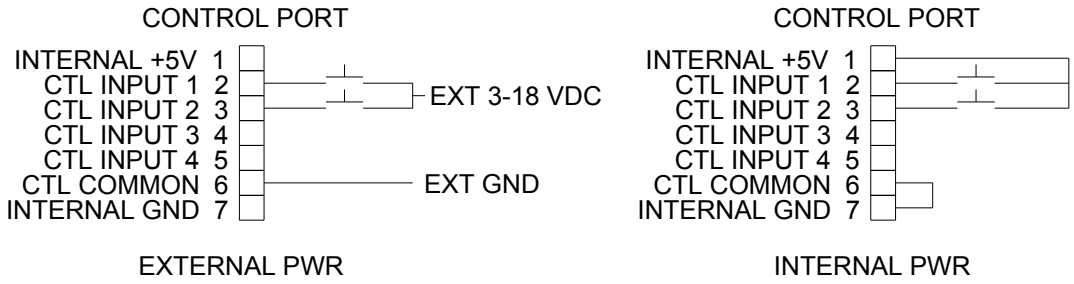


Figure 4: Pushbutton Sequential Up/Down Control

6.3 Option 13: Contact Closure (BCD)

Contact Closure control mode uses a binary coded decimal (BCD) value applied to the Primary control port (Port A) to select the desired video input for routing to the output. Control values are typical of those used by rotary encoding switches.

Video Input	CTL4	CTL3	CTL2	CTL1
1	0	0	0	0
2	0	0	0	1
3	0	0	1	0
4	0	0	1	1
5	0	1	0	0
6	0	1	0	1
7	0	1	1	0
8	0	1	1	1
9	1	0	0	0
10	1	0	0	1
11	1	0	1	0
12	1	0	1	1
13	1	1	0	0
14	1	1	0	1
15	1	1	1	0
16	1	1	1	1
CTL Connections default to '0' if unconnected '0' = CTL input is Not-Active/No current flow '1' = CTL input is Active/Current flow.				

Table 1: BCD Control/Select Values

Video input/source selection is made when the internal processor detects current through the corresponding control input pins (*Figure* 5). Selection of a new video input requires only that the BCD value applied to the control input be changed to that of the desired input (*Table* 1).

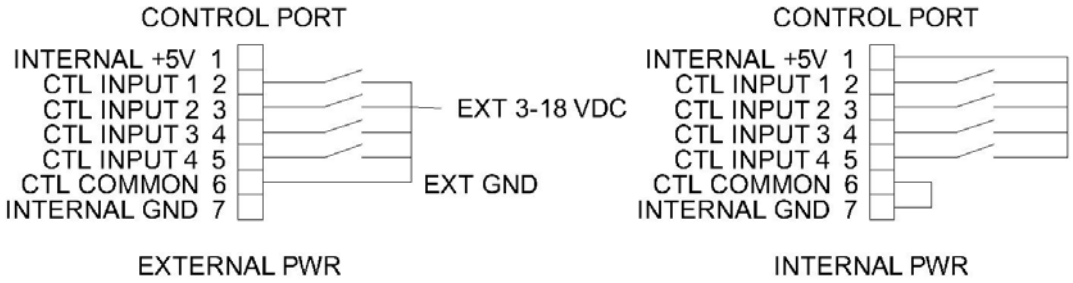


Figure 5: Control Port (Contact Closure) connections

Type of Switch	Control Port A			
	CTL1	CTL2	CTL3	CTL4
2x1	Yes	No	No	No
4x1	Yes	Yes	No	No
8x1	Yes	Yes	Yes	No
12x1 or 16x1	Yes	Yes	Yes	Yes
Least Significant BCD bit is CTL1				

Table 2: Port-A Control Line Use per type of Switch

6.4 Option 15: Timed Switching Cycles (Auto Sequencing)

This control mode switches between video Inputs at a timed interval. Switching interval is set by the **"Time"** parameter (5 second factory default). The **"Inputs"** parameter permits the user to set the number of active inputs to less than the total number available on the unit. This provides the ability to skip past unused Video Input channels. Both "Time" and "Inputs" parameters may be accessed and configured with the USB port; see *Section 7*.

The control port permits the user to override Timed Switching selection and place the unit into manual mode. Control Port A/CTL4 provides override control by assertion of logic '1' to the control input. In the override state the unit will operate in the same manner as described in *Section 6.3* using the same control connections as described in ***Error! Reference source not found.*** *&* ***Error! Reference source not found.***.

6.5 Other Control Modes

Don't see the control mode you're looking for, or need something a little different? Contact VAC.

7 Maintenance Mode Commands

These units have a USB port to permit the user to; retrieve information, change parameters, and select specific inputs for system debug. The intent of this port is for it to be connected to a laptop computer and use HyperTerminal to communicate with the internal processor. The USB port uses a Silicon Labs CP2102 USB-to-UART (RS232) bridge IC. HyperTerminal must be configured as shown below using the virtual Com port formed by the CP2102.
Drivers for the CP2102 can be downloaded from the Silicon Labs web site.

8 bit data
9600 baud
1 stop
No parity
XON/OFF flow control

The XON/XOFF flow control is used during the download of new code so the data transfer can be stopped while the processor internal FLASH memory to loaded.

The unit should be powered up before the USB cable is plugged in. Once the laptop connects to the CP2102 HyperTerminal can be started and the com port configured. At unit power up the used can enter the Maintenance Mode by entering NO when asked if the user wants to download new code. Once the unit is up and running, any key will indicate to the code that the user wants to enter Maintenance Mode. Two CR characters are required to enter the Maintenance Mode. If the two characters are not received within 30 sec., the unit will time out and jump back to the RUN mode. While in the Maintenance Mode, if no key activity is detected for 30 sec., the code will jump to the RUN mode.

The following shows the different commands available in Maintenance Mode. The commands are not case sensitive.

7.1 HELP: “HELP<CR>”

The Help command provides a list of the valid Maintenance Mode Commands.

7.2 INFO: “INFO<CR>”

The INFO commands provides the user with unit information like part number, serial number, code revision level, default Option number, default Timer number, and code CRC values.

7.3 RUN: “RUN<CR>”

The RUN command causes the code to jump to the main application and exit the Maintenance Mode.

7.4 OPTION: “OPTION<CR>”

The OPTION command permits the user to change the default Option Mode number. The units are shipped from the factory with the default Option number set to the customer’s request (part of the original order to VAC). When the Option number is changed, it is changed in the internal

FLASH as the new power up Option default. After the Option command is entered the user must enter a valid Option number (two numbers followed by <CR>) as defined in the product manual. The Option number is confirmed by printing out the new default number.

7.5 INPUTS "INPUTS<CR>"

The INPUTS command permits the user to change the default number of video inputs for the timed and automatic control modes. The units are shipped from the factory with the default set to the number of actual inputs. After the INPUTS command is entered the user must enter a valid inputs number, 02 – 16 (two digits followed by <CR>). Inputs number is validated to be equal to or less than the total number of available video inputs present on the model of switch. Updated Inputs number is also confirmed by printing out the new default number on the maintenance terminal. Whenever the INPUTS number is changed, it is changed in the internal FLASH as the new power up Option default.

7.6 TIMER "TIMER<CR>"

The TIMER command permits the user to change the default timeout number for the timed control modes. The units are shipped from the factory with the default Timer number set to 5 seconds. When the Timer number is changed, it is changed in the internal FLASH as the new power up Option default. After the Timer command is entered the user must enter a valid Timer number, 01 – 99 seconds (two numbers followed by <CR>). The Timer number is confirmed by printing out the new default number.

7.7 OUT<#> "OUT1<CR>" & "OUT2<CR>"

The OUT1 and OUT2 commands permit the user to select any Input and route it to the specified output (Output1/"OUT1" and Output2/"OUT2). After the command is entered, the user must enter the Input number (1-4, 1-8, etc.. depending on switch model) followed by a <CR>.

7.8 LOAD NEW CODE "LOAD NEW CODE<CR>"

The LOAD NEW CODE command permits the user to load a new revision of processor code. The user **must** contact the factory for changes to the code and receive the required TXT file.

NOTE: Care must be taken when loading new code. Once the user answers YES to both questions the application FLASH is erased, new code must be loaded.

It is the responsibility of the user to contact the factory before attempting to load new code.

8 Overall Specifications

Video Formats:	NTSC or PAL
Input Connectors:	BNC, High Precision 75 Ω
Input Termination:	75 Ohms, DC coupled
Output Connector:	BNC, High Precision 75 Ω
Output Terminations:	75 Ω (series), DC coupled
USB Interface (ASCII data):	8 bit 9600 baud 1 stop No parity XON/OFF flow control
Control Port Vout:	+5V @ up to 50mA (per Port)
Control Port V_{ih} Range:	3-18 VDC
Power LED:	Green (Indicates uP is running)
Operating Temperature Range:	-40C to +85C
Power:	12-24V AC, 10-34V DC (either polarity on PWR connector)
Supply Current:	<300mA at 12 VDC (actual TBD)
Power Connector:	3.5mm 4 pin terminal block (Phoenix Contact #1843813) Mating plug (Phoenix Contact #1847071)
Control Connector:	3.5mm 7 pin terminal block (Phoenix Contact #1843842) Mating plug (Phoenix Contact #1847107)
Dimensions:	4.4" x 2.2" x 0.65” (4x1*: Figure* 6) 4.4” x 2.2” x 1.40” (8x1: *Figure* 7) 4.4” x 2.2” x 2.15” (12x1: *Figure* 8) 4.4” x 2.2” x 2.90” (16x1: *Figure* 9)
Mounting:	Two 6-32 threaded inserts
Weight:	7 oz (one layer) 14 oz (two layer) actual TBD

9 Packages

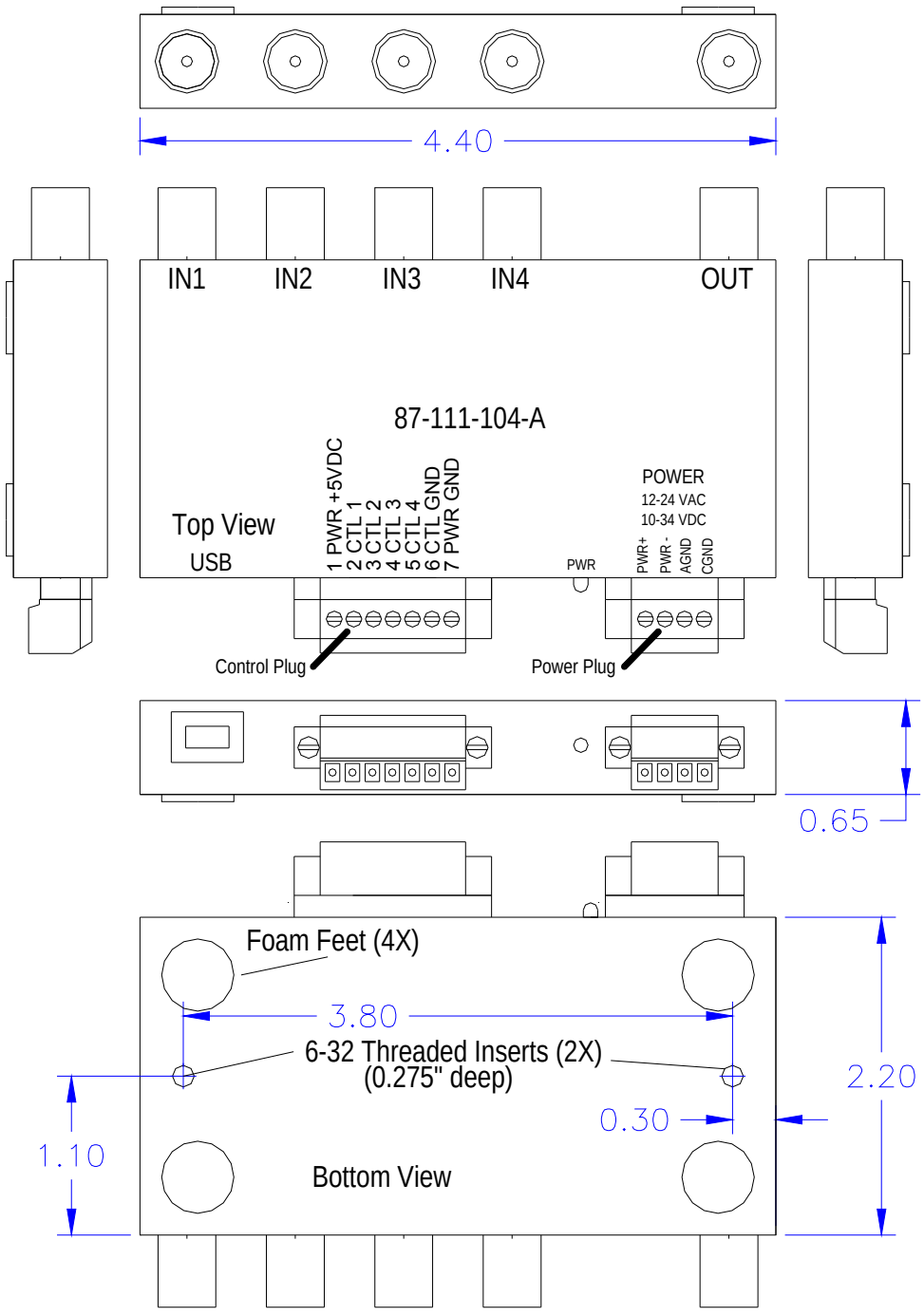


Figure 6: Basic 4x1 Switch

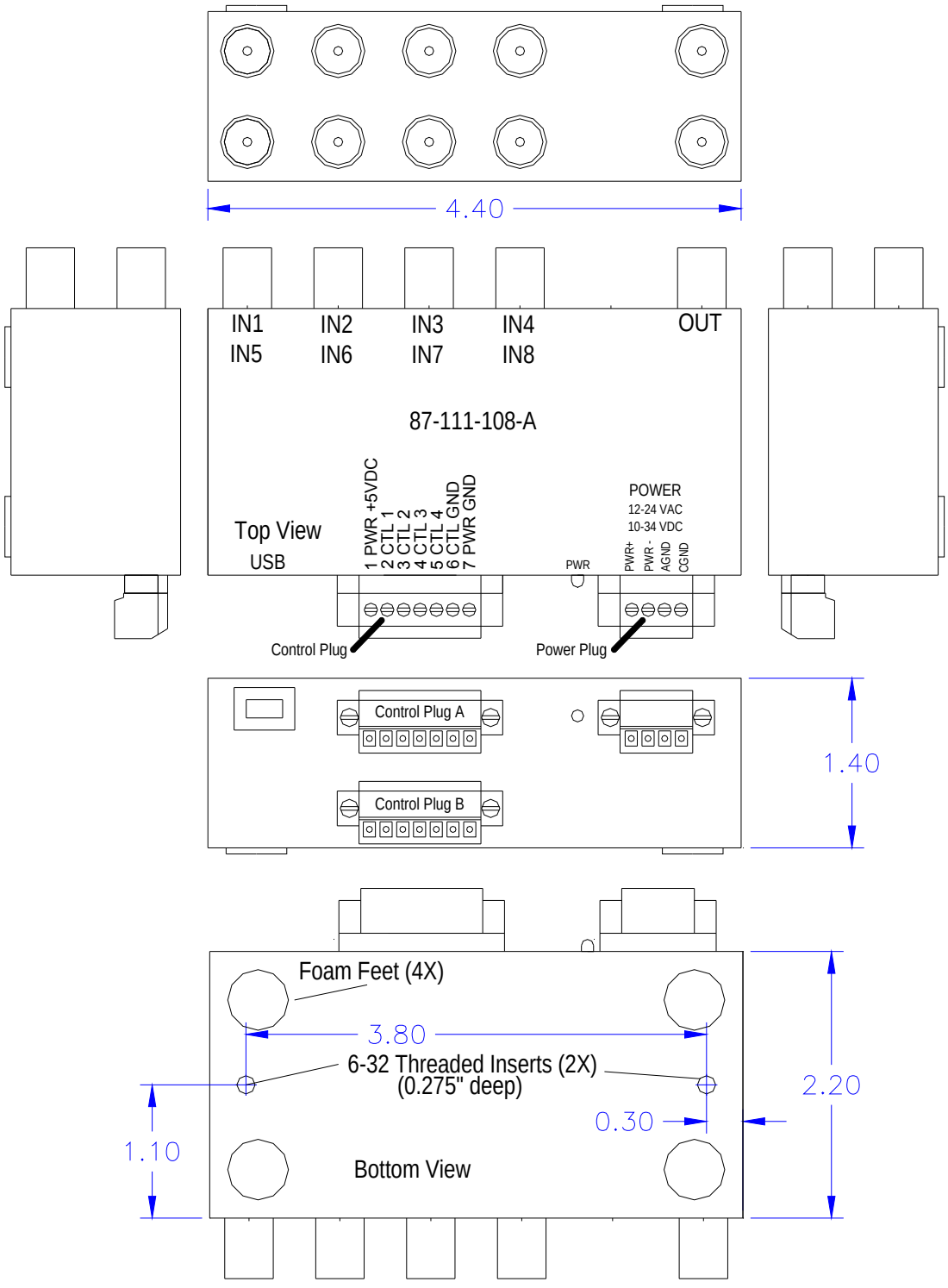


Figure 7: Basic 8x1 Switch

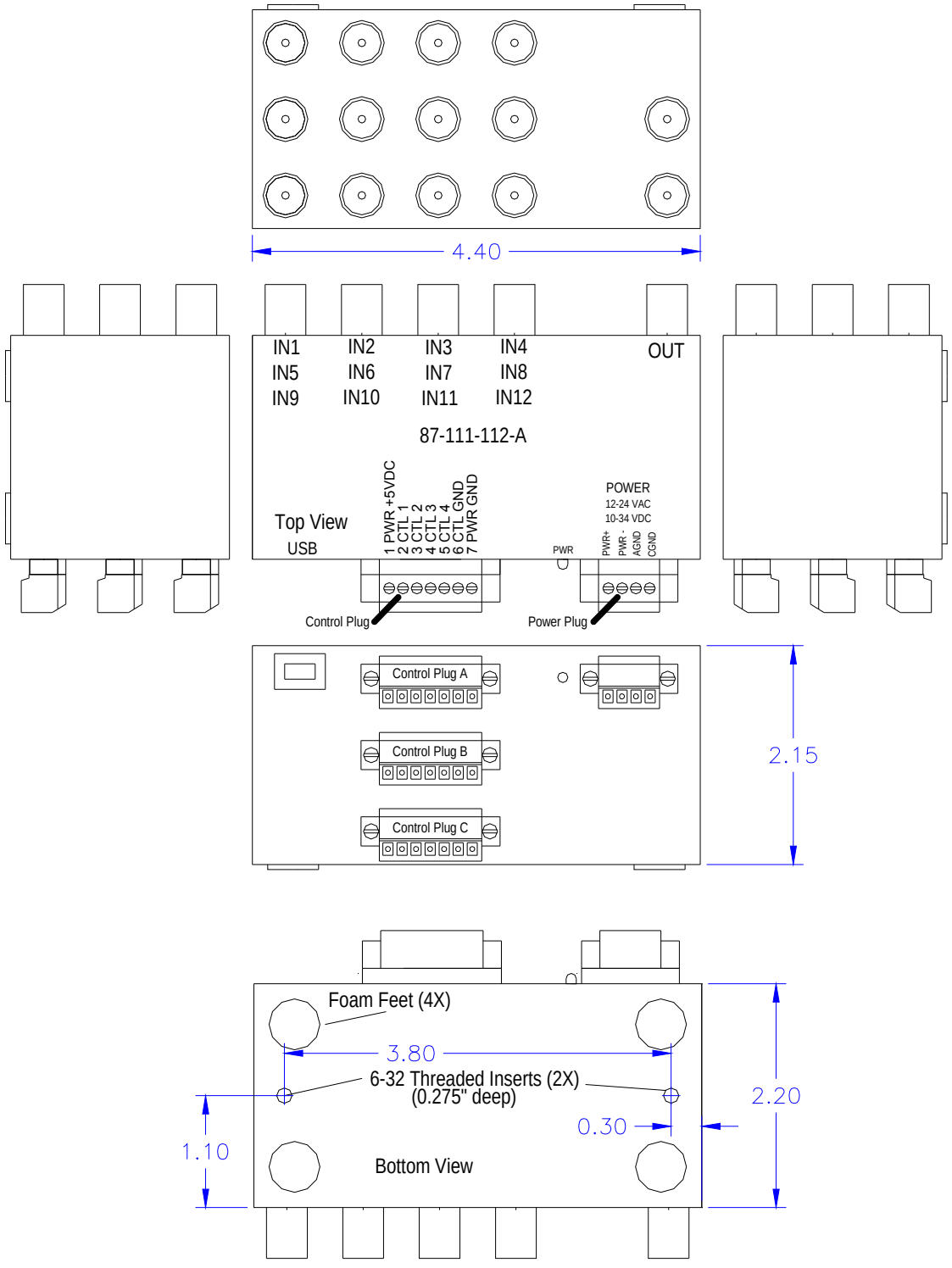


Figure 8: Basic 12x1 Switch

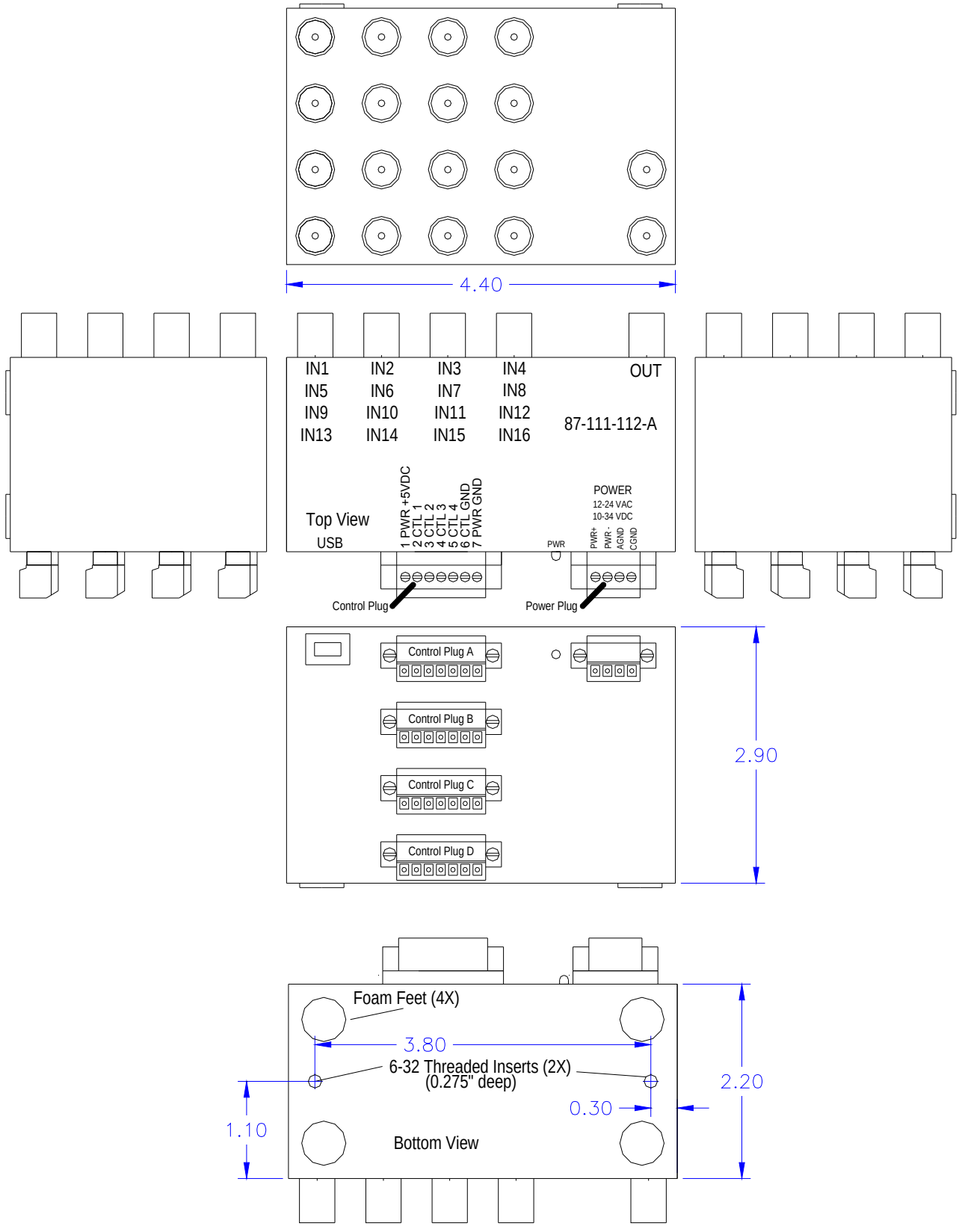


Figure 9: Basic 16x1 Switch