

# 87 Series Composite Video Two Output Matrix Switch

Rev B

<u>Part Number</u>	
<u>With Sync Detect</u>	<u>Standard</u>
87-112-202-A (2x2)	87-111-202-A (2x2)
87-112-204-A (4x2)	87-111-204-A (4x2)
87-112-208-A (8x2)	87-111-208-A (8x2)
87-112-212-A (12x2)	87-111-212-A (12x2)
87-112-216-A (16x2)	87-111-216-A (16x2)

Video Accessory Corporation  
1243 Sherman Drive, Suite 8  
Longmont, Colorado 80501  
303-443-1319

[www.vac-brick.com](http://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

87 Series Composite Video Two Output Matrix Switch .....	i
<b>Table of Contents</b> .....	i
<b>Document History</b> .....	ii
1 Overview .....	1
2 Power Requirements .....	3
3 Universal Serial Bus (USB) Maintenance Interface .....	4
4 Control Port.....	4
5 Control Port Control Types .....	5
5.1 Pushbutton Control (Button-per-Input) .....	6
5.2 Pushbutton Control (Sequential) .....	7
5.3 Rotary Encoder/BCD Contact Closure .....	8
6 Intelligent Control Functions .....	10
6.1 Auto/Timed Switching.....	11
6.2 Automatic/Priority Switching.....	11
6.3 Other Control Modes .....	12
7 Maintenance Mode Commands (USB) .....	13
8 Specifications:.....	15
9 Mechanical.....	16
Alternate Terminal Programs.....	1

### **Copyright © 2014 Video Accessory Corporation (VAC)**

All rights reserved. No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of the publisher, except in the case of brief quotations embodied in critical reviews and certain other noncommercial uses permitted by copyright law. For permission requests, write or email us, addressed "Attention: Permissions Coordinator," at the address below.

#### **Video Accessory Corporation (VAC)**

1243 Sherman Drive, Suite 8  
Longmont, Colorado 80501  
303-443-1319

[www.vac-brick.com](http://www.vac-brick.com)

## *Document History*

<u>REV</u>	<u>Date</u>	<u>Action</u>
A	Dec 19, 2013	Initial release
B	Mar 26, 2014	Updated feature-set

## 1 Overview

The 87-Series switch models are Two, Four, Eight, Twelve, or Sixteen Input, Two Output, non-blocking composite video (CVBS) matrix switches. Units are feature rich devices that allow the user to configure each unit to the specific demands of the installation. Video/signal interface consists of two-to-sixteen composite video inputs, and two composite video output channels. Models with 8, 12, or 16 inputs feature an extra output for each channel (integrated 1x2 DA). Signal routing is non-blocking, permitting any input to be routed to any output or outputs without signal degradation. Video inputs are 75Ω terminated. Video outputs are buffered with 75Ω series termination.

Control inputs are optically-isolated and in conjunction with control mode parameters permit use of common signaling methods: Momentary pushbutton, interlocked pushbutton contact closure, Standard static switch contact closures, and Rotary encoders. Each control port provides an internal +5V current limited voltage source or the user may use an external voltage source to drive control port inputs. Each of the sections explaining the different control modes provides electrical connection information for use of internal and external control voltages.

Each matrix output may be linked, as a “by-one” basic switch, or controlled independently. When outputs are linked the selected input is routed to both output channels. (All 4 outputs for models with 8, 12, and 16 inputs)

Additional parameters control unit functionality and switching behavior. This permits the user to tailor unit functionality to the specific demands of the installation. (See *Section 5*)

Parameters include:

- NTSC/PAL select
- Timed/Automatic switching functionality
- Priority Input select.
- Max Inputs control
- Sync Detection\*

\* Models equipped with sync detection examine each video input channel for signal presence and analyze sync timing. Sync detection is required for Automatic-Priority Switching functions.

A Universal Serial Bus (USB) port/interface provides the unit maintenance interface. This permits the user to view and change the default configuration parameters. Internal non-volatile memory is used to hold the power up default settings.

A multi-color LED provides power and operational status.

Power input and video input/output ports are all fully isolated to assist the user in ground loop prevention. Power and control connectors have an integrated threaded/screw flange for shock and high vibration environments.

It is recommended customers review and specify the desired default control parameters 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 other parameter settings are required, they may be changed via the Maintenance interface (USB port) and new values stored as the new power up default values.

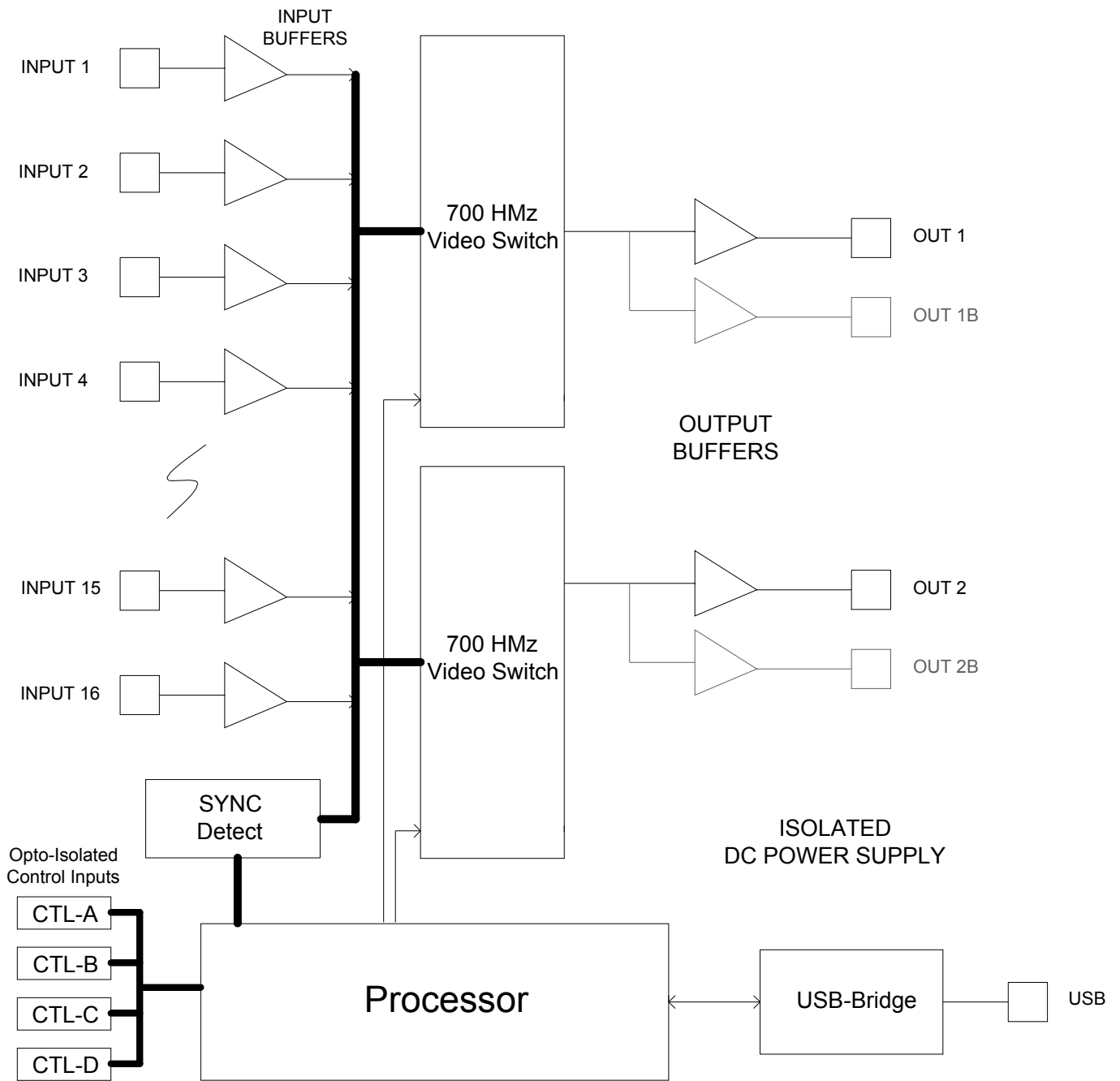


Figure 1: Block Diagram

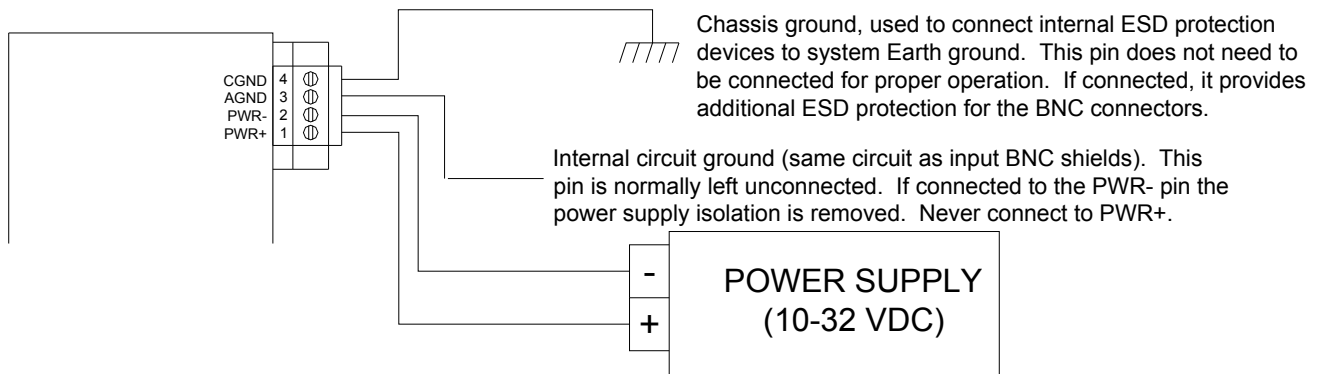
## 2 Power Requirements

This unit has an internal switching supply that isolates supply power from the internal power. The units will operate correctly from 10-24 VAC or 10-32 VDC. Units are equipped with full wave rectification on the power front end, so power may be applied to Pin 1 & 2 using either polarity.



- Pin 1** Power IN1 (Supply Connection +V)
- Pin 2** Power IN2 (Supply Connection -V)
- Pin 3** AGND/Circuit Ground (**Same as BNC Shields**)
- Pin 4** CGND/Chassis Ground (Ground for ESD Protection)

**Figure 2: Power Connector**



**Figure 3: Power Connection**

Internal Circuit ground (AGND/Pin-3) is the ground reference for the internal circuits. **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 and operational status.

### 3 Universal Serial Bus (USB) Maintenance Interface

The Universal Serial Bus (USB) maintenance port 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 to the unit processor to form via a virtual serial communication channel. A terminal program such as HyperTerminal<sup>1</sup> is used to view, enter, and modify configuration parameters. The configuration is saved in non-volatile memory so the unit initializes with the correct configuration at power-up.

Xon/Xoff flow control is used during the download of new code so the data transfer is held while the processor updates internal FLASH memory.

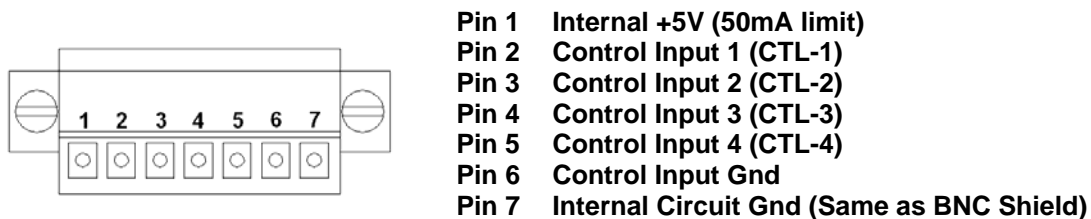
The USB cable may be plugged into the unit at any time. The computer then enumerates the USB-to-UART bridge interface and establishes the Serial communication port number. The “port” should now be visible when configuring the terminal program. USB port configuration parameters should be: 9600bps 8-N-1. (8bit, No parity, 1Stop). Loading of the CP2102 USB-bridge driver (available from Silicon Labs web site) may also be required.

**NOTE:** USB shield is referenced to Chassis 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.

### 4 Control Port

One control port is present for each brick layer (Multiple of four Video Inputs). The control port residing closest to the top layer is the Primary Control Port (Port A). The control type parameter (Ctl\_Type) mode of operation selected will determine which control signals and associated connections are required for that given mode of operation. These are described at a greater detail in *Section 5*.

Each control port combines a current limited voltage source, four optically isolated control inputs, control input return, and a circuit ground connection into a seven pin connector. The mating seven pin, terminal-block (28-16AWG), 3.5mm pitch, and threaded flange plug is manufactured by Phoenix Contact (#1847107). This connector has shown excellent performance in high-vibration environments.



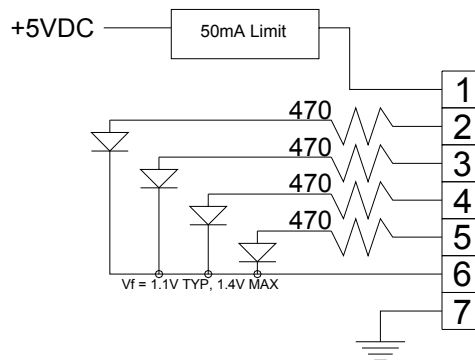
**Figure 4: Control Port Connector**

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

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



or asserted onto the control input to generate an active input. Internal control port connections are shown in *Figure 5*.



**Figure 5: 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.

## 5 Control Port Control Types

Control Port operation is determined by the functionality desired and corresponding parameter specified by the user. Operational parameters are pre-loaded at the factory as the power-up default control mode. The default power-up settings may be modified by the user and stored into non-volatile memory (via the maintenance interface defined in *Section 7*) as the new power-up default if desired.

This section describes each of the control types associated with the Output Control Type parameter (*Table 1*), and the electrical connections required. Control mode types permit the unit to be controlled using many methods: Pushbutton, Interlocked pushbutton, contact closure, standard static switch contact closures, and rotary encoders.

Parameter	Value	Description
Option1 Option2	11	<b>Button-Per-Input:</b> Each control 'Port' CTL input is mapped 1-to-1 with a video input. Selection of video input is accomplished when the control input of the associated video input is active. (Only one CTL signal may be active)
	21*	<b>Button-Sequential:</b> This control type sequentially selects the Next/UP, Previous/DN, or Home/Pri video input channel to the output each time a momentary contact closure or signal is applied to the control port.
Manual1* Manual2*	31*	<b>Rotary Encoder/BCD:</b> This control type selects the desired input to output routing based on the binary coded decimal (BCD) value applied to the control port. BCD is the typical output of rotary encoders.
	41	<b>Auto/Timed:</b> Setting the Option1/2 parameter value to 41 enables automatic/timed sequential switching/selection of video inputs. In this mode the Manual1/2 parameters define control port type and/or operation.

**Table 1: Option1/2 Parameter Values**

**NOTE:** There are 4 contact points within each 7-pin control connector "port". Each control port is typically associated with the control of one output. Certain configuration or control types such as one-to-one pushbutton control on a two output matrix switch may not be available.

## 5.1 Pushbutton Control (Button-per-Input)

Pushbutton control mode is available on 2x2 Matrix model or when configured as a basic switch. (2x1, 4x1, 8x1, 12x1, and 16x1) Each control port and inputs (*Table 2 & Table 3*) are used to select one corresponding video input to the output. In the “basic switch” configuration; the unit functions as if it were a standard 2X1, 4x1, 8x1, 12x1 or 16x1 switch with integrated distribution amplifier(DA). All outputs produce the same selected input signal. (Two outputs on 2x2/4x2, four outputs on 8x2/12x2/16x2)

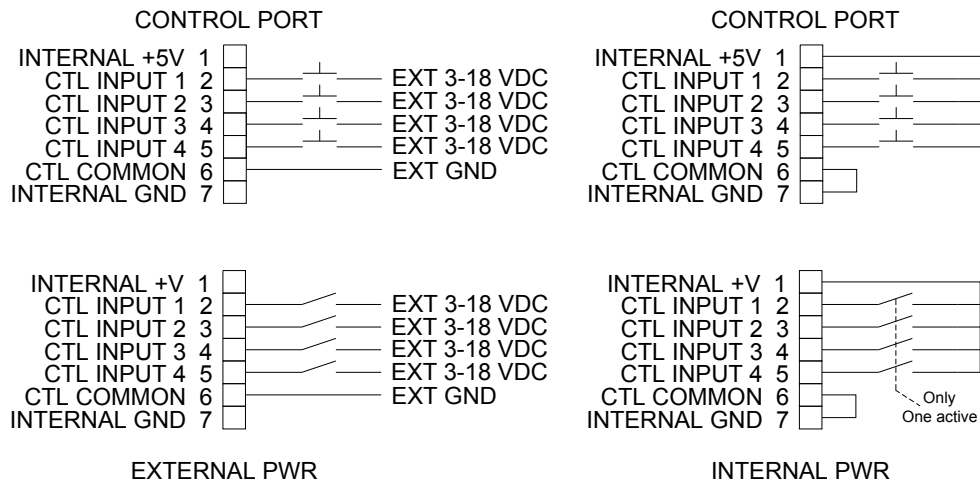
	CTL4	CTL3	CTL2	CTL1
PORTA	IN4	IN3	IN2	IN1
PORTB	IN8	IN7	IN6	IN5
PORTC	IN12	IN11	IN10	IN9
PORTD	IN16	IN15	IN14	IN13

**Table 2: Input Selection for 4/8/12/16 Input Models**

PORTA	CTL4	CTL3	CTL2	CTL1
OUT1			IN2	IN1
OUT2	IN2	IN1		

**Table 3: Input Selection for 2 Input Model**

Video selection is made when the internal processor detects a change on any of the control port inputs. Internal or external voltage sources (as described in *Section 4*) using either momentary contact pushbutton switches, or interlocked pushbutton switches having a static contact closure. The internal processor contains contact de-bounce and filtering routines to remove contact noise and filter transition. Proper Video input selection is determined by only one control port or ports inputs being active at a given time. No other function parameters or override control are utilized for this control type.



**Figure 6: Button-per-Input Connections**

**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**

**Figure 7: Example - Pushbutton Control**

NOTE: Due to the number of available control inputs this control type limits the unit to a by-one switch. Selection of this control option supersedes the Output Mode parameter.

## 5.2 Pushbutton Control (Sequential)

This control type sequentially selects the Next/UP, Previous/DN, or Home/Pri video input channel to the output each time a momentary contact closure, such as a pushbutton, or control voltage control signal is detected. Sequential pushbutton control type is available on all switch models. When configured as a basic switch only Control Port-A is required. When configured as a matrix switch control Port-A and Port-B are required for control each output.

Video selection is made when the internal processor detects the momentary active signal on the control port input. Internal or external voltage sources (as described in *Section 4*) using momentary contact closure or signaling may be used. The internal processor contains contact de-bounce and filtering routines to remove contact noise.

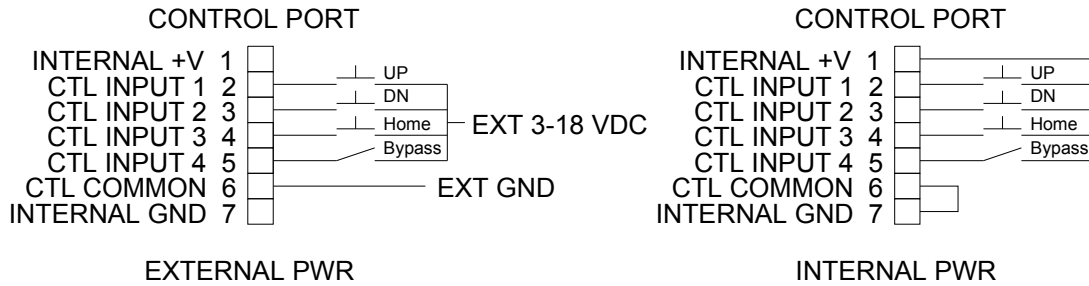
Three momentary control signals are used to change the input video sequentially to the; Next/UP, Previous/DN, or Home/Priority input. Control input (CTL-4) is used with timed or auto-switching modes as an override to hold or prevent automatic switching when those functions are enabled. Override condition requires that the (CTL-4) control input remain at an active control level. CTL-4 may be left unconnected/floating if desired, as the default level indicates “normal operation”

- **CTL1:(UP) Advance to next/Select next sequential video input to output**
- **CTL2:(DN) Select previous/last sequential video input to output**
- **CTL3:(PR) Switch the priority video input. (pre-selected ‘Home’ input)**
- **CTL4:(BP) Bypass/Hold (Used with Auto/Timed Switching modes)**

Switch Type	Control Port A				Control Port B				Control Port C			
	CTL1	CTL2	CTL3	CTL4	CTL1	CTL2	CTL3	CTL4	CTL1	CTL2	CTL3	CTL4
2x1	UP1	DN1	No	No	Port B Not Present				Port C Not Present			
2x2	UP1	DN1	UP2	DN2								
4x1	UP1	DN1	No	No								
4x2	UP1	DN1	UP2	DN2								
8x1	UP1	DN1	PRI1	BP1	No	No	No	No	BP1			
8x2	UP1	DN1	PRI1	BP1	UP2	DN2	PRI2	BP2				
12x1	UP1	DN1	PRI1	No	No	No	No	No	No	No	No	No
12x2	UP1	DN1	PRI1	No	UP2	DN2	PRI2	No	BP1	BP2	No	No
16x1	UP1	DN1	PRI1	No	No	No	No	No	BP1	No	No	No
16x2	UP1	DN1	PRI1	No	UP2	DN2	PRI2	No	BP1	BP2	No	No

Least Significant BCD bit is CTL1 for all Control Ports  
UP, DN, PRI = Used as a Up, Down, Priority Control signal input  
NO = Not Used as a Control signal input  
BP, BP1, BP2 = Used as the Bypass/Override Control input (BP1=Output 1, BP2=Output 2)  
Control Port D is not used.

**Table 4: Input Selection for 4/8/12/16 Input Models**



**Figure 8: Pushbutton Sequential Control connections**

**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**

**Figure 9: Example - Sequential UP/DN Control**

The “Inputs” parameter (*Section 4*) permits the user to reduce the number of selectable inputs to less than the total number available on the unit. Typical use would be the need for additional button presses to skip past unused video input channels.

### 5.3 Rotary Encoder/BCD Contact Closure

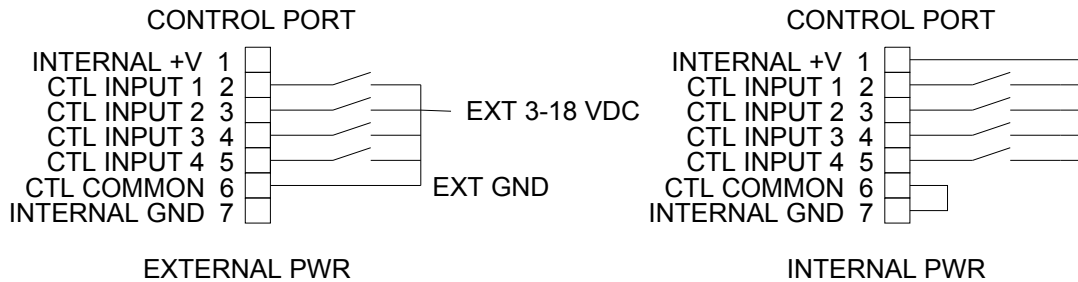
This control type selects the desired input to output routing based on the binary coded decimal (BCD) value applied to the control port. BCD is the typical output of rotary encoders. Rotary Encoder/BCD contact closure control type is available on all switch models. When configured as a basic switch only Control Port-A is required. When configured as a matrix switch control Port-A and Port-B are required for control of each output (*Table 6*).

Switch Type	Control Port A				Control Port B				Control Port C							
	CTL1	CTL2	CTL3	CTL4	CTL1	CTL2	CTL3	CTL4	CTL1	CTL2	CTL3	CTL4				
2x1	Yes	No	No	No	Port B Not Present				Port C Not Present							
2x2	Yes	No	Yes	No												
4x1	Yes	Yes	Yes	Yes												
4x2	Yes	Yes	Yes	Yes												
8x1	Yes	Yes	Yes	BP	No	No	No	No	Port C Not Present							
8x2	Yes	Yes	Yes	BP1	Yes	Yes	Yes	BP2								
12x1	Yes	Yes	Yes	Yes	No	No	No	No					BP	No	No	No
12x2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes					BP1	BP2	No	No
16x1	Yes	Yes	Yes	Yes	No	No	No	No	BP	No	No	No				
16x2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	BP1	BP2	No	No				

Least Significant BCD/Hex bit is CTL1 for all Control Ports  
 YES = Used as a BCD Control signal input  
 NO = Not Used as BCD Control signal input  
 BP, BP1, BP2 = Used as the Bypass/Override Control input (BP1=Output 1, BP2=Output 2)  
 Control Port D is not used.

**Table 5: Port Control Input Use Matrix**

Video selection is made when the internal processor detects a change of the BCD control signal on the control port inputs. The least significant bit is CTL1. Internal or external voltage sources (as described in *Section 4*) using steady-state control levels may be used. Only the control inputs necessary to select the total number of video inputs are used (*Table 6*). The internal processor contains contact de-bounce and filtering routines to remove contact noise and filtering to identify a new control value.



**Figure 10: BCD Control Electrical Connections**

The Override or Bypass control inputs are used only when Priority-Select and Auto-switching modes or parameters are enabled (*Section 6*) otherwise BP control lines are ignored. When it is necessary to override or temporarily suspend Priority-Select or Auto-switching modes; users may utilize Port A CTL-4, Port B CTL-4 or Port-C CTL-1 & 2 control inputs. Upon activation of BP, automatic and/or timed functions are suspended and the control inputs become active in the manner defined by the Manual1/2 parameters. The two control modes supported are BCD and Pushbutton Sequential. Override condition requires that the “BP” control input remain at a steady-state level while active. BP may be left unconnected or floating if desired, as the default level indicates “normal operation”.

**NOTE:** Due to Control Port I/O constraints Bypass (BP) is not available on 2x1, 2x2, and 4x2 modes.

Video Input	CTL1	CTL2	CTL3	CTL4
1	0	0	0	0
2	1	0	0	0
3	0	1	0	0
4	1	1	0	0
5	0	0	1	0
6	1	0	1	0
7	0	1	1	0
8	1	1	1	0
9	0	0	0	1
10	1	0	0	1
11	0	1	0	1
12	1	1	0	1
13	0	0	1	1
14	1	0	1	1
15	0	1	1	1
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 6: BCD Control/Select Values**

Control Port A				Selected Input	
CTL1	CTL2	CTL3	CTL4	OUT1	OUT2
0	0			#1	
1	0			#2	
0	1			#3	
1	1			#4	
		0	0		#1
		1	0		#2
		0	1		#3
		1	1		#4

CTL Connections default to '0' if unconnected  
'0' = CTL input is Not-Active/No current flow  
'1' = CTL input is Active/Current flow.

**Table 7 BCD Control/Select Values (2x2 & 4x2 Models)**

Control Port A				Control Port B				Selected Input	
CTL1	CTL2	CTL3	CTL4	CTL1	CTL2	CTL3	CTL4	OUT1	OUT2
0	0	0	BP1	Port B has no effect on A				#1	
1	0	0						#2	
0	1	0						#3	
1	1	0						#4	
0	0	1						#5	
1	0	1						#6	
0	1	1						#7	
1	1	1						#8	
Port A has no effect on B				0	0	0	BP2		#1
				1	0	0			#2
				0	1	0			#3
				1	1	0			#4
				0	0	1			#5
				1	0	1			#6
				0	1	1			#7
				1	1	1			#8

CTL Connections default to '0' if unconnected  
BP = Bypass/Override Control  
'0' = CTL input is Not-Active/No current flow  
'1' = CTL input is Active/Current flow.

**Table 8 BCD Control/Select Values**

## 6 Intelligent Control Functions

This section describes background task type functionality and parameter settings specific to each mode. There are several important global parameter settings that users should be aware of.

Parameter	Value	Description
Vid_Std	NTSC PAL	Sync detection filtering is configured for NTSC video standard Sync detection filtering is configured for PAL video standard
Ctl_Type	X	Configures the control port signaling type:
time	5-xx sec	"Time on Picture" or Dwell time setting. (Default is 5 sec)

## 6.1 Auto/Timed Switching

Auto/Timed Switching operation sequentially switches between video Inputs at a timed interval. This feature is enabled by setting the OPTION parameter for one or both outputs to 41. Time on picture or “Dwell Time” interval is set by the “TIME” parameter. The “MAX” parameter permits the user to set the number of active vs unused inputs to less than the total number available on the unit if desired. The SyncDetect parameter when enabled, only selects inputs with active video.

Parameter	Value	Description
OPTION = 41	ON	Enables Auto-Timed switching mode.
MANUAL	21 or 31	Sets the control type used while the bypass/suspend BP# is active. 21 – Pushbutton Sequential 31 – BCD/Hex Control
PrioritySelect	OFF	Priority Select function supersedes Auto-Switching function and must be disabled when using Auto-Timed mode.
Syncdet	OFF ON	Switches video to next video input, with or without video being present Searches for next video input with active video and selects it to output <a href="#">NOTE: Model with sync detection is required to use this parameter.</a>
MAX = N	N	Set the number of inputs for sequencing: Inputs 1 to N (default N value is the total number of inputs available on the switch model purchased)
TIME = T	5,T sec	“Time on Picture” or Dwell time setting. (Default is 5 sec)

Automatic/Timed Switching may be temporarily suspended or held, and video selection controlled manually via the control port or ports according to the desired control method specified by the MANUAL parameter. Control port signal mapping (inclusive of the bypass BP signal), Control port types, and output type parameter are described in *Section 5*.

All parameters may be accessed and configured with the USB port; see *Section 4*.

## 6.2 Automatic/Priority Switching

Automatic/Priority Switching is enabled via the Pri\_sel parameter and available only on models enabled for video and sync detection. This mode scans all video input channels and selects the input channel using the following criteria:

- Video is Present
- Sync Timing is Valid
- It is the lowest physically numbered input.

Parameter	Value	Description
Pri_Sel	ON	Priority Select function supersedes all other Auto-Switching functions <a href="#">NOTE: Model with sync detection is required to use this parameter.</a>

Video selection is determined by the internal processor scanning all inputs for active video, validating NTSC/PAL sync timing, and selecting the input that corresponds to the lowest physical input number. Video input 1 has a higher priority than 2, 3, and so on, to the maximum number of inputs. If video is not detected on any input, video Input 1 is selected by default. If the video signal of the currently selected lower numbered input is removed, the next highest numbered active and validated Video Input is selected. If active and valid video is detected on an input with a lower physical input number, than is currently selected, that input will be selected to the output.

Video Input Channel																Selected Output	
#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	#16		
No Active Inputs																#1 (Default)	
A																	#1
X	A																#2
X	X	A															#3
X	X	X	A														#4
X	X	X	X	A													#5
X	X	X	X	X	A												#6
X	X	X	X	X	X	A											#7
X	X	X	X	X	X	X	A										#8
X	X	X	X	X	X	X	X	A									#9
X	X	X	X	X	X	X	X	X	A								#10
X	X	X	X	X	X	X	X	X	X	A							#11
X	X	X	X	X	X	X	X	X	X	X	A						#12
X	X	X	X	X	X	X	X	X	X	X	X	A					#13
X	X	X	X	X	X	X	X	X	X	X	X	X	A				#14
X	X	X	X	X	X	X	X	X	X	X	X	X	X	A			#15
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	A		#16

'A' = Active Video Detected on Input  
'X' = Don't Care (May be Active or Not)

**Table 9: Auto-Priority Output Select Matrix**

Automatic/Priority Switching may be temporarily suspended and video selection controlled manually via the control port or ports using the parameter specified control port type. Control port signal mapping (inclusive of the bypass BP signal), Control port types, and output type parameter are described in *Section 5*.

All parameters may be accessed and configured with the USB port; see *Section 4*.

**NOTE:**  
This feature is specific to units with Video/sync detection hardware option.  
Video detection option must be specified when ordering.  
Model part numbers 87-xx2-xxx-x include this option.

**6.3 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 (USB)

This unit has a USB port permitting the user to retrieve information, change parameters, and system debug. The intent of this port is for it to be connected to a laptop computer and use a terminal program to communicate with the internal processor.

At unit power up the user may 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 signal code that the user wants to enter Maintenance Mode. Two carriage return (↵) characters are required to enter Maintenance Mode. If the two carriage return characters, or if no key activity is detected for 30 sec, the code will return to the RUN/Application mode.

Depending on the selected option it may be necessary to change or configure additional parameters. Some parameter value changes may not be available or take effect until the next system reset or power-up is performed. All parameters are retained in non-volatile memory

### Symbols:

↵ = Carriage Return (0x0D)      X1 = One Character X decimal number  
● = Space Character (0x0A)      X2 = Two Character XX decimal number

The following shows the different commands available in Maintenance Mode<sup>2</sup>.

### Commands:

- HELP↵      Responds with the list of valid Maintenance mode commands.
- INFO↵      Displays the unit information such as: Part Number, Serial Number, Revision level, and currently selected options and parameters.
- RUN↵      Exits Maintenance mode and returns/jumps to main application.
- CONFIG↵      Configures the unit to operate as a “by-1” or “by-2” switch. Entry of the next field is dependent on the switch type. The display output defines the available values. Example 12x1 or 12x2, one of these values is entered.
- OPTIONX1↵      Defines the control method by which inputs are selected to each output. X1 defines the output to configure followed by return. The list of valid options is displayed, and entry of the next field X2↵ which is the desired control option. X2 defines the desired interaction and format of control port signals in the selection of video inputs to the output. Timed/Auto switching mode is also available with selection of option number 41. Each output control option is independent of the other output, thus may be different.
- MANUALX1↵      Similar to the OPTION command, this command defines the control method by which inputs are selected to each output when bypass/override is active. X1 defines the output to configure followed by return. The list of valid options is displayed, and entry of the next field X2↵ which is the desired control option. (21 or 31) X2 defines the desired interaction and format of control port signals in the selection of video inputs to the output. Timed/Auto switching control option makes use of this parameter.

---

<sup>2</sup> Maintenance Mode commands are not case sensitive.

- MAX[X1]← Permits the number of selectable inputs to be reduced. [X1] defines the output to configure followed by return and entry of the next field [X2]←. [X2] defines the highest video input in use. This is especially useful when the Timed/Auto option is selected.
- HOMEX1← Set's the "Home/Priority" input, and initial power-on input. [X1] defines the output to configure followed by return and entry of the next field [X2]←. [X2] defines the "Go To" input or "Home/Priority" input when in Pushbutton sequential option is selected for the primary or override input control.
- OUT[X1]← When in Maintenance Mode, permits selection of video inputs to each output. [X1] defines the output to configure followed by return and entry of the next field [X2]←. [X2] indicates the desired input to route to that output.
- TIMER[X1]← Sets the dwell timer used in the Timed/Auto advance function. [X1] defines the output to configure followed by return and entry of the timer value in seconds into next field [X2]←.
- LOAD●NEW●CODE← Permits the user to load a new revision of processor code.

**NOTE:**

Care must be taken any time a new revision is to be loaded.  
It is the responsibility of the user to contact the factory before attempting to use this function.

## 8 Specifications:

Video Formats: NTSC or PAL

Video/Signal Connections:  
Input Connector BNC  
Input Termination 75  $\Omega$  (DC Coupled)  
Output Connector BNC  
Output Termination 75  $\Omega$  (Series)

USB/Maintenance Interface:  
Data Type ASCII/Text  
Data Format 9600bps, 8bit, 1 Stop, No Parity  
Flow Control XON/XOFF (Required for Firmware Update)

Control Port:  
Supply Voltage( $V_{out}$ ) +5V  
Current limited source( $I_{out}$ ) 50mA  
Active Control Range( $V_{ih}$ ) 3-18 Vdc  
Mating Plug Phoenix Contact #1847107  
Wire Range 28-16 AWG

Environmental:  
Operating Temperature -40°C to +85°C

Power:  
Supply Input 10-28VAC, 10-32VDC (either polarity on PWR connector)  
Mating Plug Phoenix Contact #1843813  
Wire Range 28-16 AWG

Current:  
87-111-108-A <300mA (Actual TBD)  
87-111-212-A 4.6W (390mA@12VDC, 150mA@28VDC)

Specified Torque<sup>3</sup>  
3.5mm Plug Terminal/M2: 0.22-0.25Nm  
3.5mm Plug Flange/M2.5: 0.40-0.50Nm  
Two Mounting 6-32 Inserts TBD

Dimensions:  
Unit: 2x2, 4x1, 4x2 4.4"x2.2"x0.65" (Single Layer) 7oz  
Unit: 8x1, 8x2 4.4"x2.2"x1.40" (Two Layer) 14oz  
Unit: 12x1, 12x2 4.4"x2.2"x2.15" (Three Layer) 20oz  
Unit: 16x1, 16x2 4.4"x2.2"x2.90" (Four Layer) 26oz

---

<sup>3</sup> Phoenix Contact indicates that Torque specified under DIN EN 60947-1 is sufficient to secure connections, however recommended those listed.

## 9 Configuration Worksheet:

Use this sheet to select how you wish the unit to operate, so we know how to best configure your unit.

Video Format: NTSC or PAL

Switch type: (Config1 parameter)  
Outputs are the same (by-1) ##x1 (Ex: 12x1 or 12x2)  
Outputs are Independent (by-2) ##x2 (Default is ##x2)

Control type: (Option1 & Option2 parameters)  
Pushbutton (11) Output 1: 11 21 31 41 (Default is 31)  
Up/Down/Home (21)  
Hex/Binary/BCD (31) Output 2: 11 21 31 41  
Auto/Timed (41)

If the Control type above is 41, What control option when override/bypass is active:

Override/Bypass Control type: (Manual1 & Manual2 parameters)  
Up/Down/Home (21) Output 1: 21 31 (Default is 31)  
Hex/Binary/BCD (31) Output 2: 21 31

Switching Dwell/Interval time: (Timer1 & Timer2 parameters)  
Time in Seconds Output 1: \_\_\_\_\_ (Default is 5 sec)  
Output 2: \_\_\_\_\_

If you anticipate using fewer video inputs or want to limit number of inputs to less than the total number available on the unit. (Max1 & Max2 parameters)

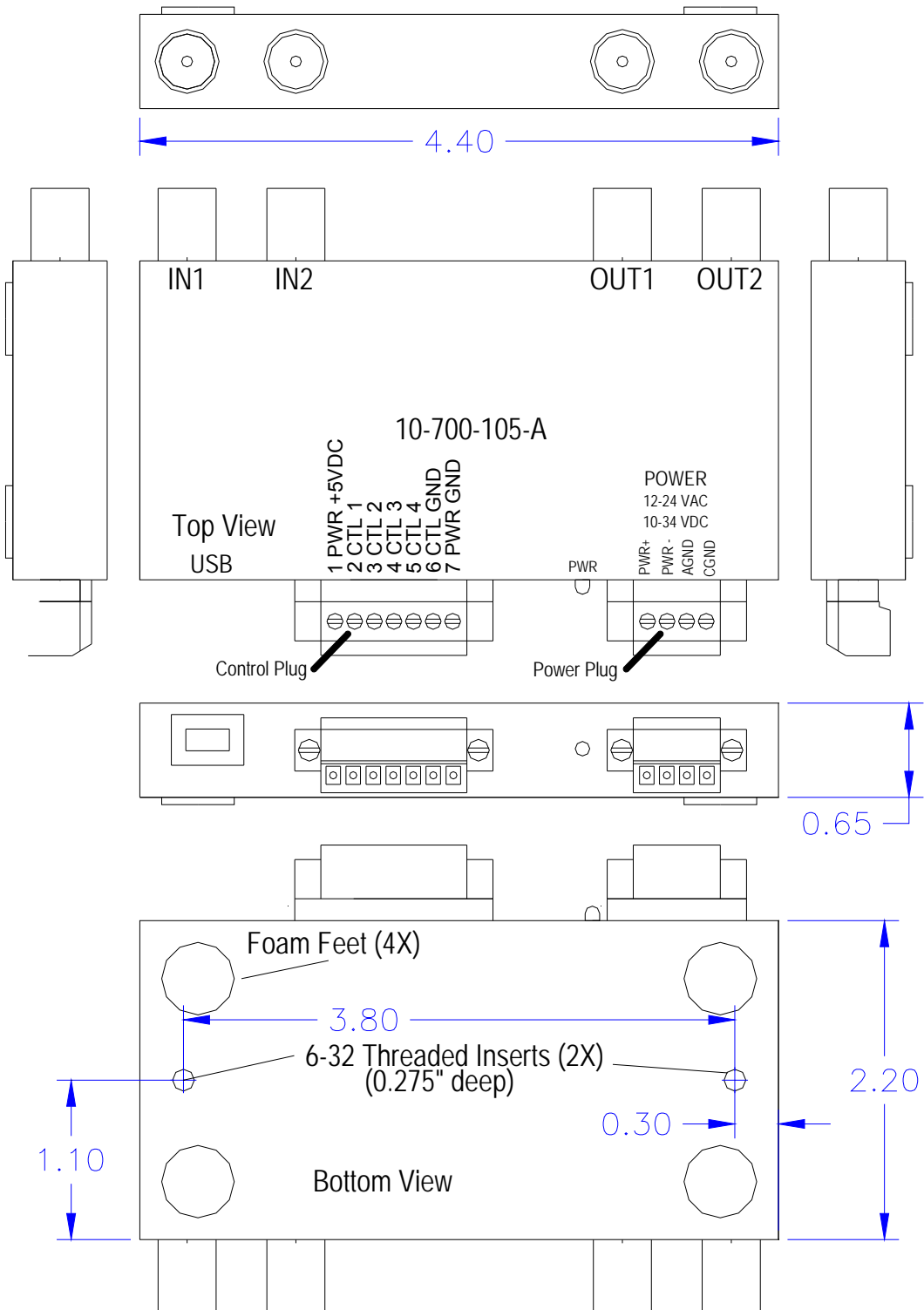
Highest input for Output1 Max1: \_\_\_\_\_ (Default is total number of unit inputs)  
Highest input for Output2 Max2: \_\_\_\_\_

What is the power-up and/or Priority/Home input you would like for each output?

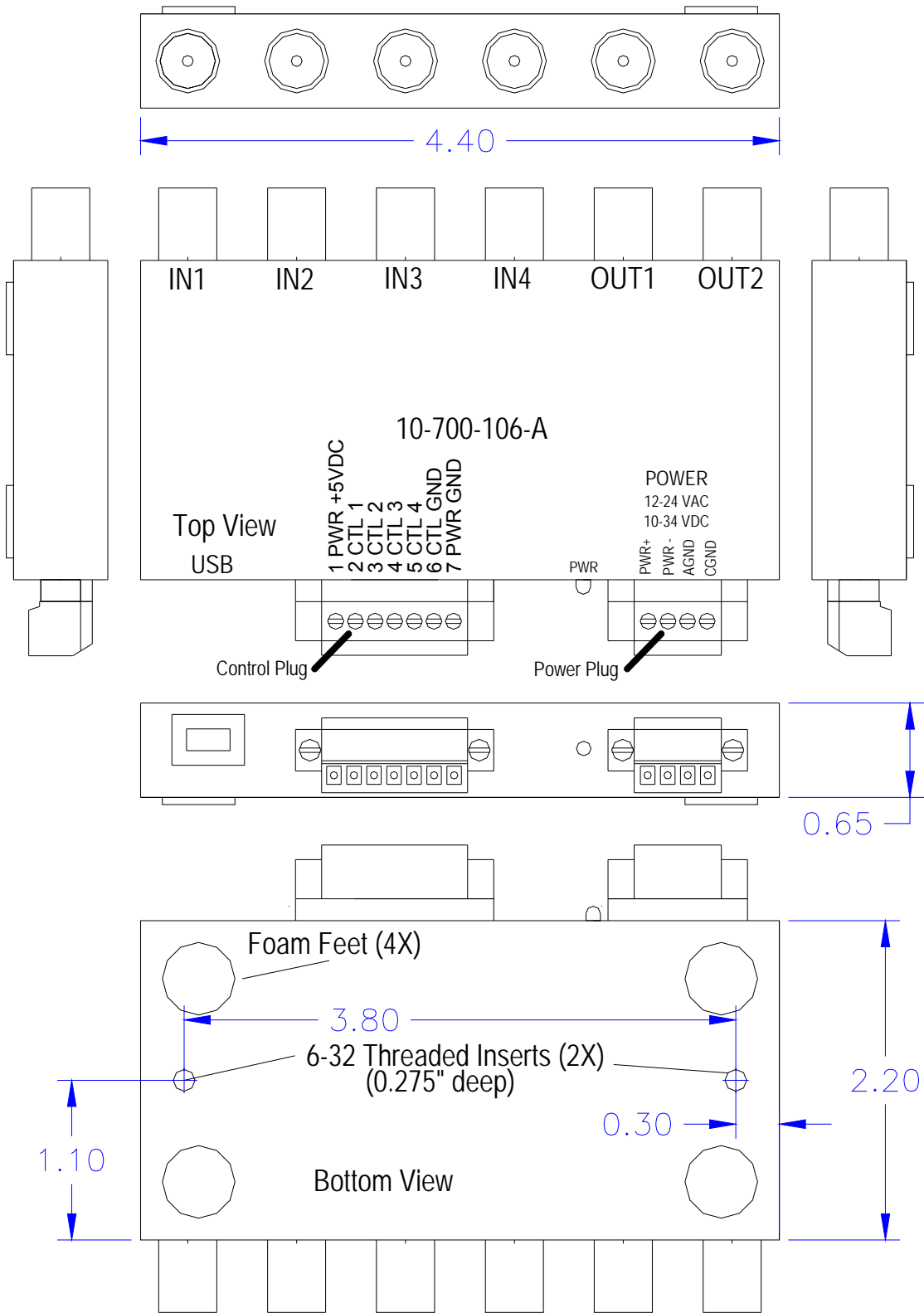
(Home1 & Home2 parameters)  
Priority/Home video input for Output 1: \_\_\_\_\_ (Default is #1)  
Priority/Home video input for Output 2: \_\_\_\_\_

Parameters can always be changed or modified using the Maintenance Interface/USB port. We use this worksheet to help configure the product so it works just the way you like it off the shelf and from the factory.

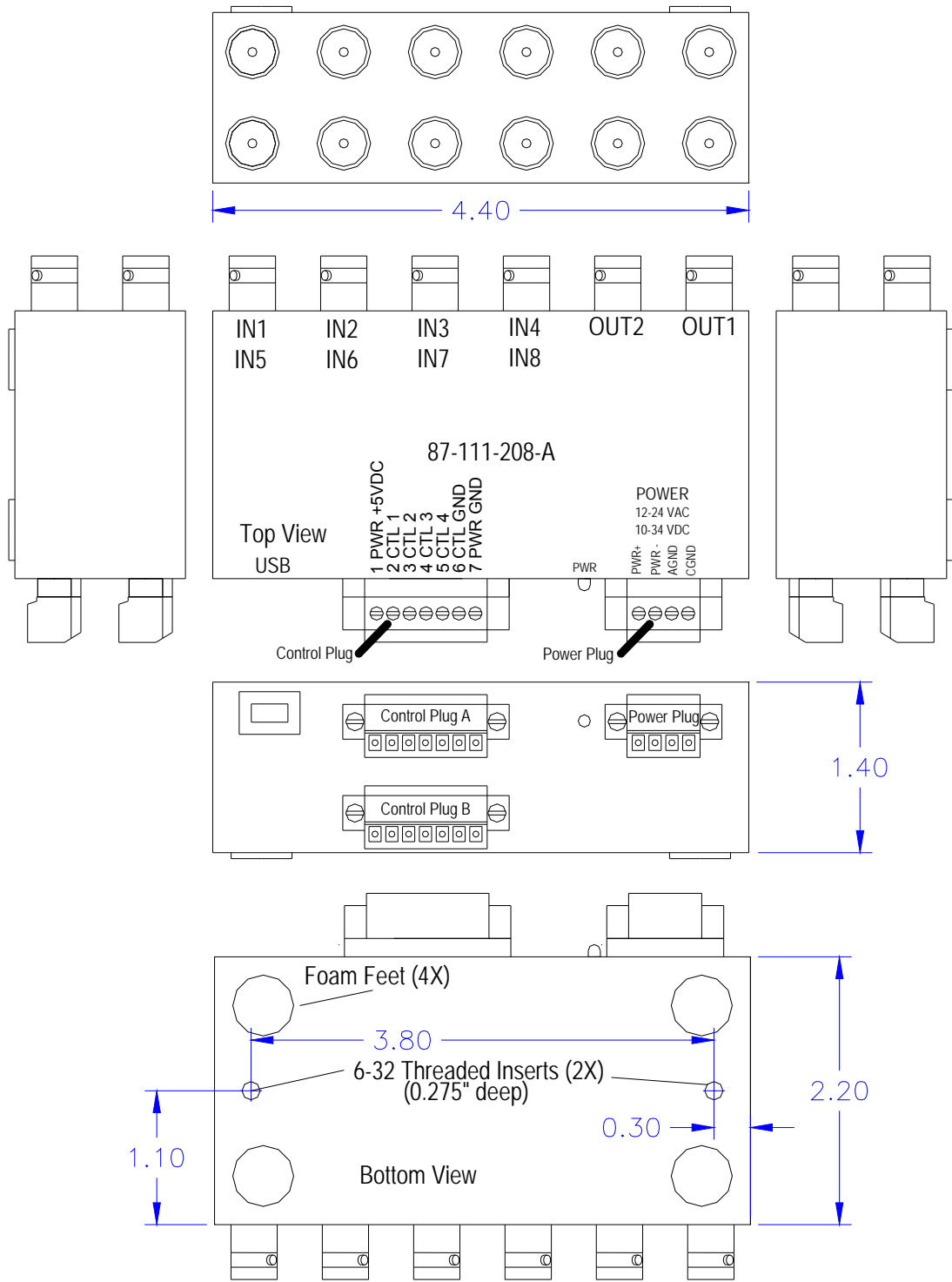
## 10 Mechanical



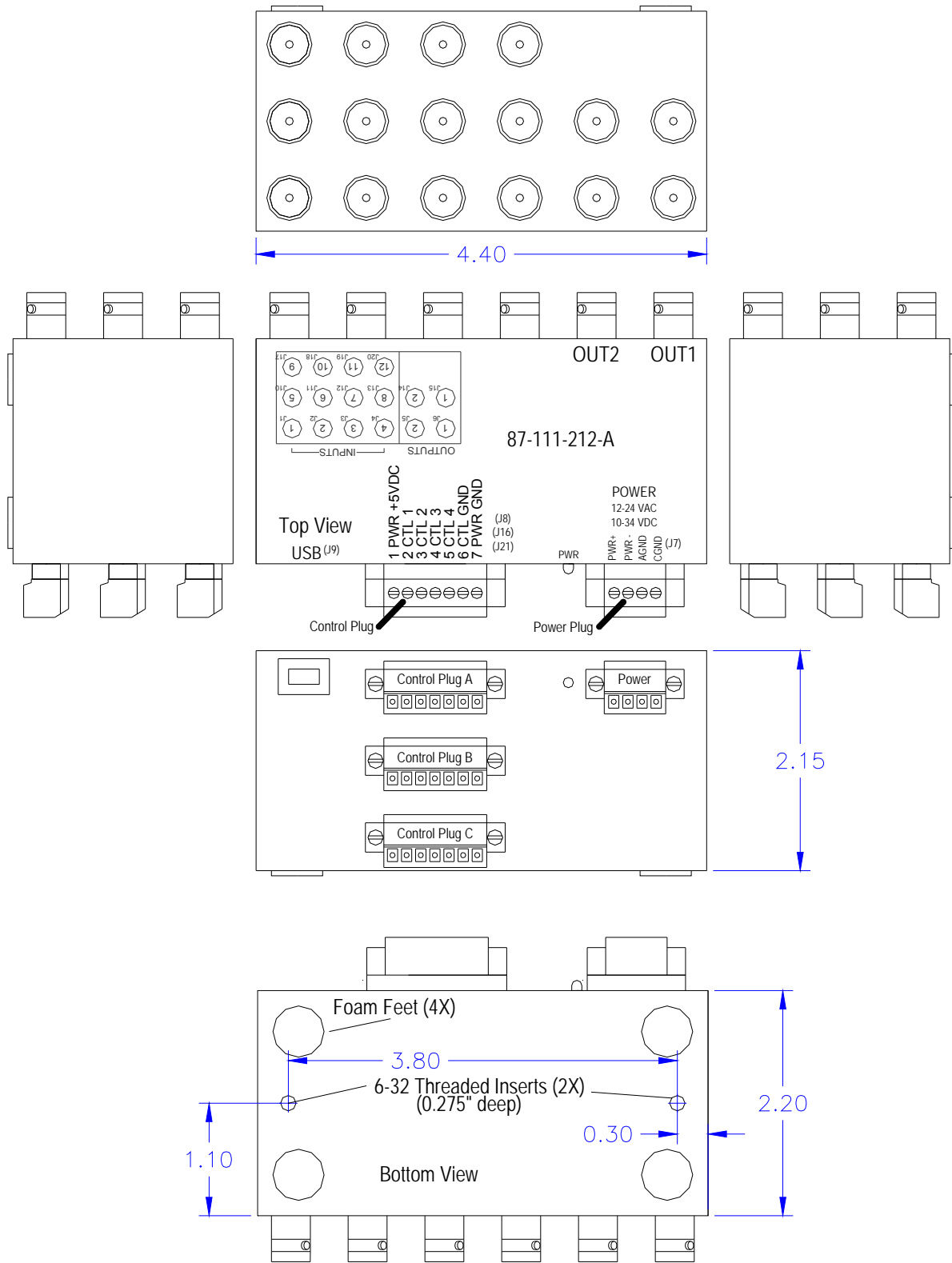
**Figure 11: 2x2 Matrix Switch**



**Figure 12: 4x2 Matrix Switch**

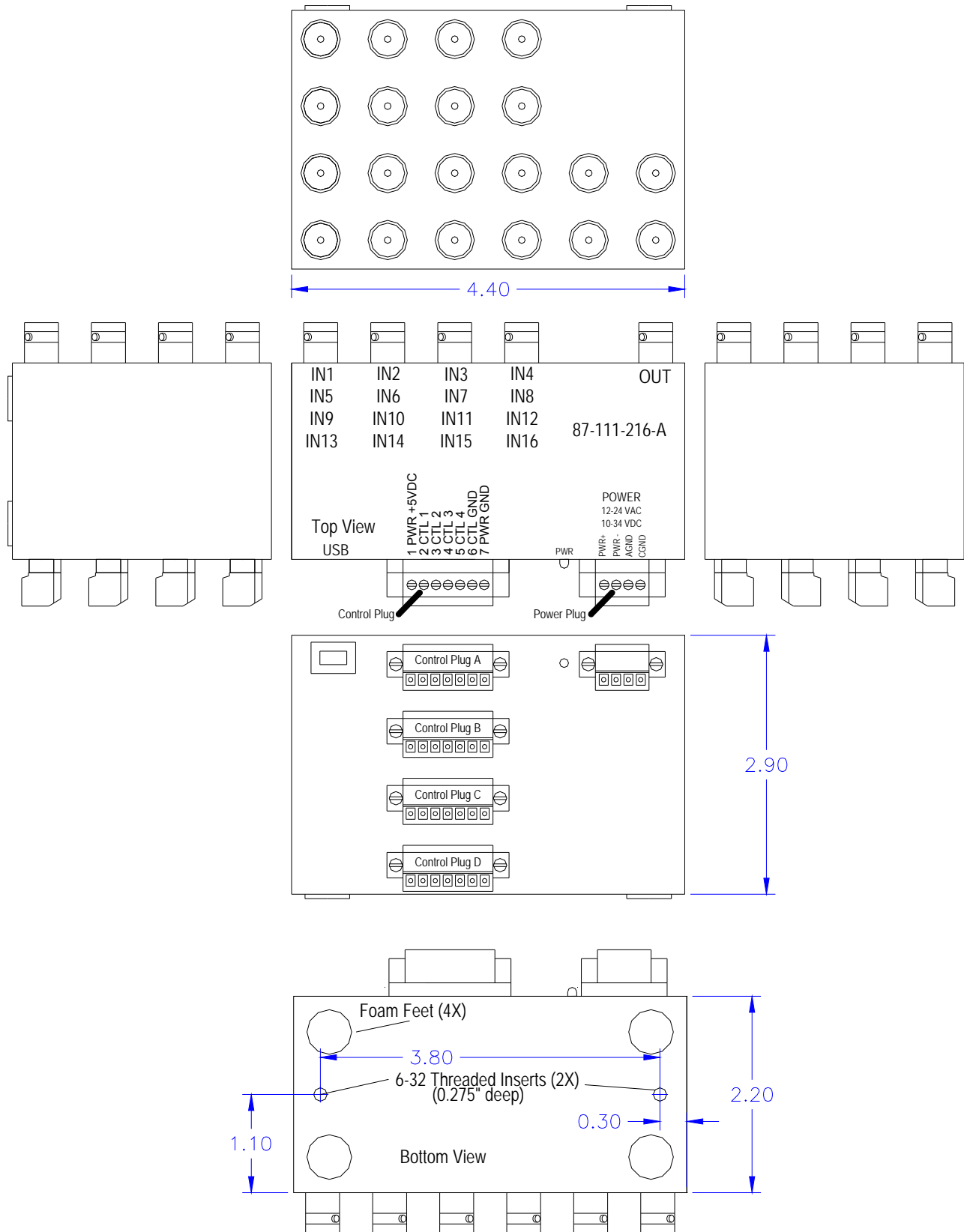


**Figure 13: 8x2 Matrix Switch**



**Figure 14: 12x2 Matrix Switch**





**Figure 15: 16x2 Matrix Switch**

# Alternate Terminal Programs

Post Windows-XP operating systems no longer include HyperTerminal. The majority of alternative serial terminal emulation programs are sufficient in supporting basic configuration of the option and parameters on VAC product. However in order to support field upgrade of firmware, the terminal emulator must be capable of ASCII file transfer and Xon/Xoff flow control.

Be sure that the appropriate x64/x86/Unix Silicon Lab's CP2102 driver is installed. Windows based operating systems should identify the "COM" port associated with the unit in the "Device Manager" of the Computer Management screen as "Silicon Labs CP210x USB to UART Bridge". Unit communication parameters are set for 9600, 8N1, and Xon/Xoff flow control.

While no warranty or guarantee is implied, NetBurner Inc has a handy terminal program "Multi-threaded TTY" they distribute in support of their product offerings. ([www.netburner.com/support/resources/cb34-ex](http://www.netburner.com/support/resources/cb34-ex))

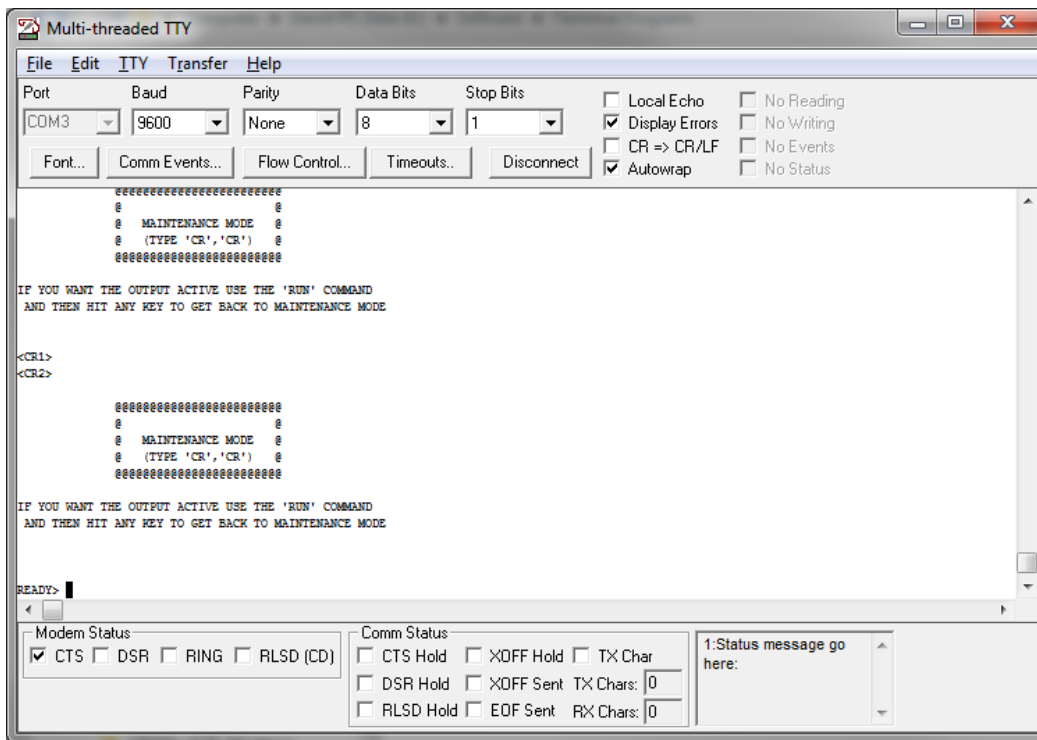
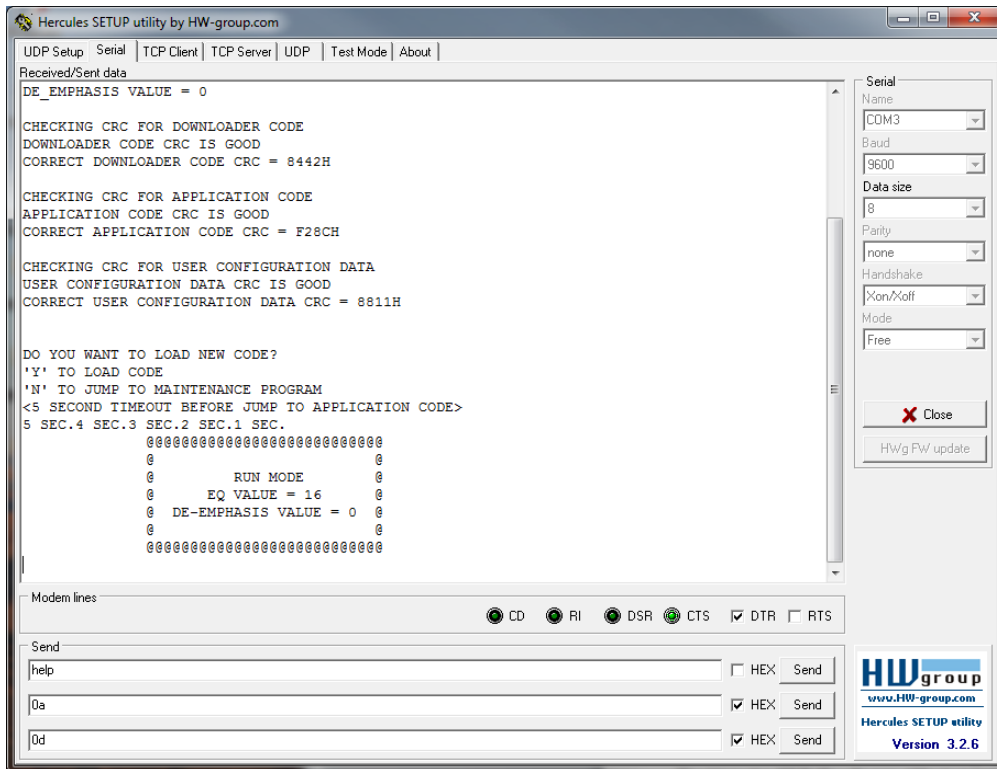


Figure 16: MTTY Serial Terminal Interface

Mtty.exe is a single executable. The example screen above shows the USB Bridge connection as COM3. Configure your "Port" setting to the port your computer has associated with the unit. Set communication parameters for 9600 8N1. Xon/Xoff flow control is configured under the "Flow Control" tab. ASCII file transfer is under the "Transfer" menu pull-down. Don't forget about the "Connect" button.

The Hercules SETUP software utility is a very powerful Serial port terminal, UDP/IP terminal, and TCP/IP Client Server terminal. This software may be downloaded free from [www.hw-group.com](http://www.hw-group.com). HWgroup should be commended for making this excellent software available as Freeware and are indeed worthy of financial support. While functional for unit configuration, serial emulation supports only binary and not ASCII file transfer (required for firmware update).



**Figure 17: Serial Terminal Tab/Window**

Hercules SETUP is a single executable. Some changes from the default configuration settings are required. Click on the “Serial” Tab and the window should appear similar to that of Figure 17. Set “Name” for the units associated “COM” port. For the screen above it just so happened to be COM3. Configure the remaining items for 9600 8N1, Xon/Xoff, and Mode = Free. There is no box for the stop bit ‘1’.

The next step is VERY important. There are additional settings accessed by clicking the right mouse button.

**Un-Check most everything**  
**Change Transmit EOL to “CR (Mac)”**

Use the Open/Close button to connect/disconnect to/from the “COM” port.

