

VAC SD/HD SDI Switch Manual

(Rev C Manual)

VAC #18-111-102-B (Two input switch)
VAC #18-111-103-B (Three input switch)
VAC #18-111-104-B (Four input switch)

Video Accessory Corporation
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Two Year Limited Warranty

All Video Accessory Corporation (VAC) products have a full two year limited warranty. Exclusion to the warranty include but are not limited to damage to external components, power LED failure where the product continues to functions, electrical damage due to lightning or ESD, and minor cosmetic imperfections in the epoxy that do not affect the unit's performance. The warranty shall be void if any alteration or repair of the VAC product is attempted by anyone not authorized by VAC. This warranty is expressly in lieu of all other warranties expressed or implied, including warranties of merchantability and fitness for use, and of all other obligation 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 the 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, where 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 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. (REV 01-01-2018)

Document History

REV	Date	Action
A	Feb. 25, 2018	Original document
B	June 11, 2018	Added video present LED feature Revised Maintenance Mode commands
C	July 17, 2019	Added Option 35 Single push button control, rotates through active inputs.

1.0 Basic Operation

The SD/HD SDI switches included in this manual provide a way to switch between SDI data signals with several different control methods. A USB port is used to configure the control port. The units use an isolated power system so ground loops can be controlled. The unit also uses power and control connectors that have screw flange attachments for high vibration environments.

2.0 Basic Functions

The following SDI formats are supported:

SMPTE 292M	(1.48Gbit/s)
SMPTE 259M	(270/360Mbit/s)
SMPTE 424M	(2.97Gbit/s)

BNC connectors are used for the signal connectors. Depending on the unit there will be 2, 3, or 4 input signal connections and two (2 output DA) output connections. The unit has a built in 1X2 distribution amplifier that drives the two Outputs. Both Outputs have the same signal regardless of the control Option that is selected.

The units have a single bi-color power-on/signal LED. This LED displays the current Option and if video is present on the selected input. At power-up, the LED will be Yellow, then it will flash Green for the most significant digit of the current Option and then flash orange for the least significant Option digit. It will then turn Green if valid video is present on the selected input or orange if there is not video on the selected input.

A mini-USB connector is present to connect the units to a laptop computer for configuration. The user can also get unit information and manually select the input routed to the two outputs for overall system test/debug.

The following shows the control Options:

Option 12	2X1 switch (2 output DA)	Push button control (two buttons)
Option 13	3X1 switch (2 output DA)	Push button control (three buttons)
Option 14	4X1 switch (2 output DA)	Push button control (four buttons)
Option 22	2X1 switch (2 output DA)	Contact closure control (single contact)
Option 23	3X1 switch (2 output DA)	Contact closure control (two contacts)
Option 24	4X1 switch (2 output DA)	Contact closure control (two contacts)
Option 32	2X1 switch (2 output DA)	Push button control (single button)
Option 33	3X1 switch (2 output DA)	Push button control (single button)
Option 34	4X1 switch (2 output DA)	Push button control (single button)
Option 35	Active inputs	Push button control (single button)

Option 42	2X1 auto switch (2 output DA)	Video detect with priority selection
Option 43	3X1 auto switch (2 output DA)	Video detect with priority selection
Option 44	4X1 auto switch (2 output DA)	Video detect with priority selection
Option 52	2X1 timed switch (2 output DA)	Internal Timer control (all inputs)
Option 53	3X1 timed switch (2 output DA)	Internal Timer control (all inputs)
Option 54	4X1 timed switch (2 output DA)	Internal Timer control (all inputs)
Option 62	2X1 timed switch (2 output DA)	Internal Timer control (active inputs)
Option 63	3X1 timed switch (2 output DA)	Internal Timer control (active inputs)
Option 64	4X1 timed switch (2 output DA)	Internal Timer control (active inputs)

3.0 Power Requirements

These units have an internal switcher supply that provides fully isolated internal power. The units will operate correctly from 10-34 VDC. The power connector is a 4 pin 3.5mm center header (Phoenix Contact #1897267). The mating power plug (Phoenix Contact #1847071) is a 3.5mm center plug with screw flanges for vibration and shock resistance.

The power connector has four pins:	Pin 1	Power IN 1
	Pin 2	Power IN 2
	Pin 3	Chassis Ground
	Pin 4	Circuit Ground

The units have a full wave power rectifier on the power front end so power can be applied in either polarity. The chassis ground is connected to internal ESD protection devices. The chassis ground does not need to be connected for proper operation. There is secondary ESD protection connected between the output signals and the internal circuit ground. The circuit ground is the ground circuit for the internal circuits. The user has the option to not connect the circuit ground connection and float the internal circuits with respect to any system ground. 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.

4.0 USB Interface and Control

Each unit has a USB interface for configuring the unit. The USB port connects to a USB-UART bridge IC. HyperTerminal is used to enter configuration parameters. The configuration can be saved in FLASH memory so the unit enters the correct configuration at power-up.

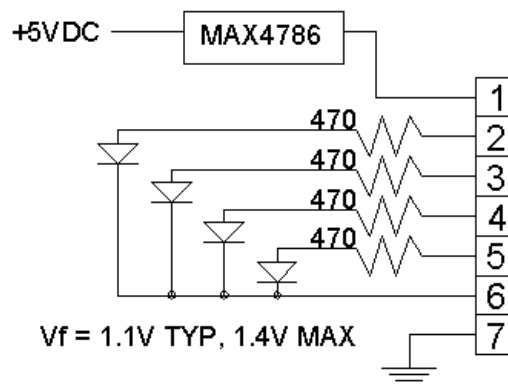
The user must power the SDI switch ON. The USB cable should then be plugged in and HyperTerminal started. HyperTerminal must be configured per the specification 6.0 section of this document.

5.0 Control Port and Control Modes

The control mode is configured using the USB and a terminal program like HyperTerminal. A user selected control Option number is loaded at the factory as the power up default control mode. The control port connector is a (Phoenix Contact #1897296) 3.5mm seven pin header. The mating control plug (Phoenix Contact #1847107) is a 3.5mm center plug with screw flanges for vibration and shock resistance.

The control connector has 7 pins:	Pin 1	Internal +2.5V (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 (not input Pwr Gnd)

The control inputs have opto-couplers so control signal grounds can be isolated from the power or signal grounds. The Control Input Gnd is the common cathode to the four control input opto-couplers. The diagram below shows the internal control port connections.



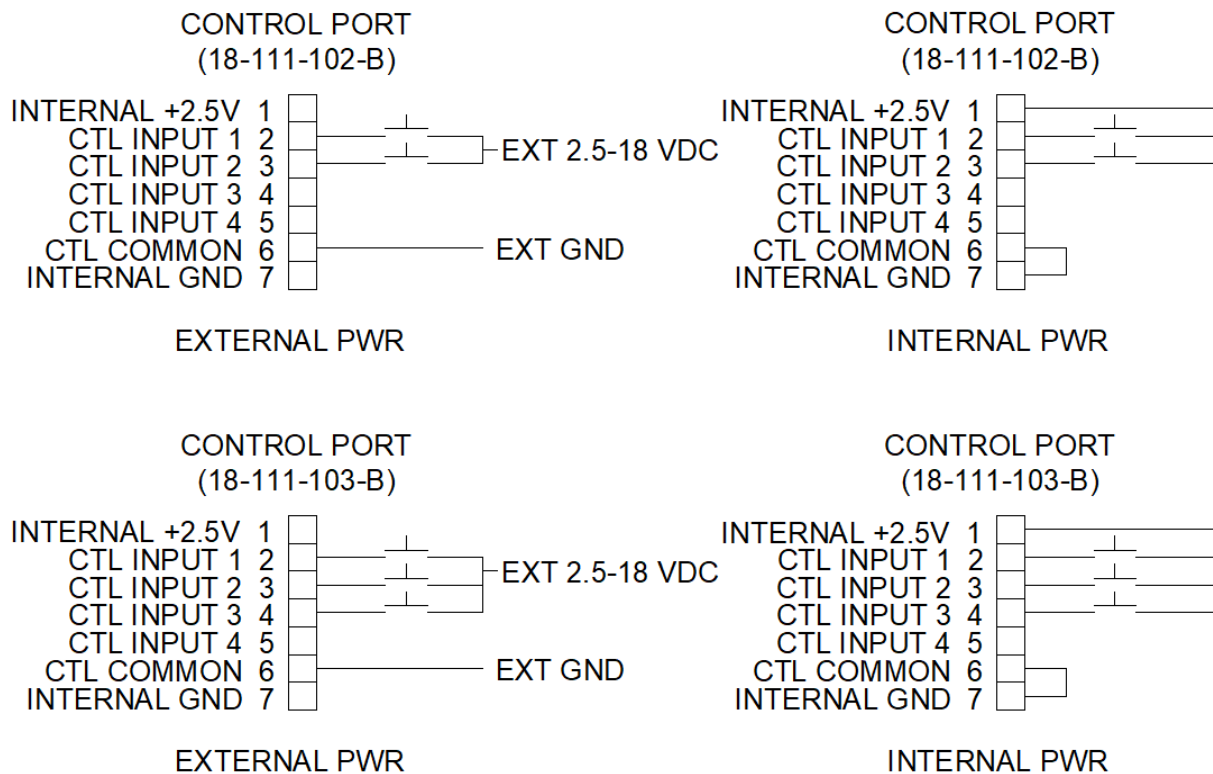
At power up, the unit will display the Option number being used by using the bi-color LED. The green LED is used to show the most significant digit of the Option number by flashing the corresponding number of times to the most significant Option number digit. The yellow LED will flash the corresponding 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.

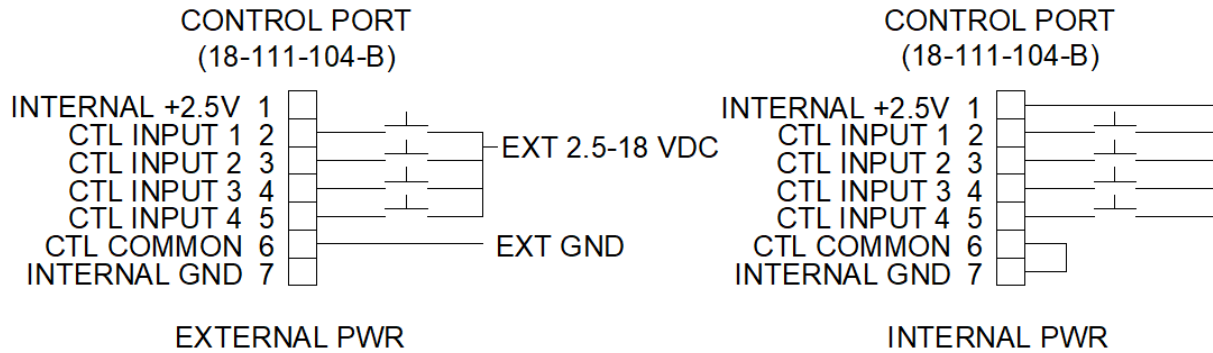
The following sections provide details on each of the Option modes.

5.10 Options 11, 12, 13 Push Button per Input

These three Options use a push button for each Input for Input selection. The unit functions as a 2X1, 3X1, or 4X1 (depending on the part number). If a control Option is selected that uses fewer Inputs than the unit has the switch will operate correctly but ignore the higher numbered Input(s). At power up, video Input 1 will be selected. The internal logic provides a de-bounce function for each of the control inputs on the control port. All control port control inputs must be inactive (no current) before the unit will look for a new Input selection. If the unit is being controlled by external electrical signals the signals must be between 2.5-18 VDC.

The following shows the external control circuits for the three different units:

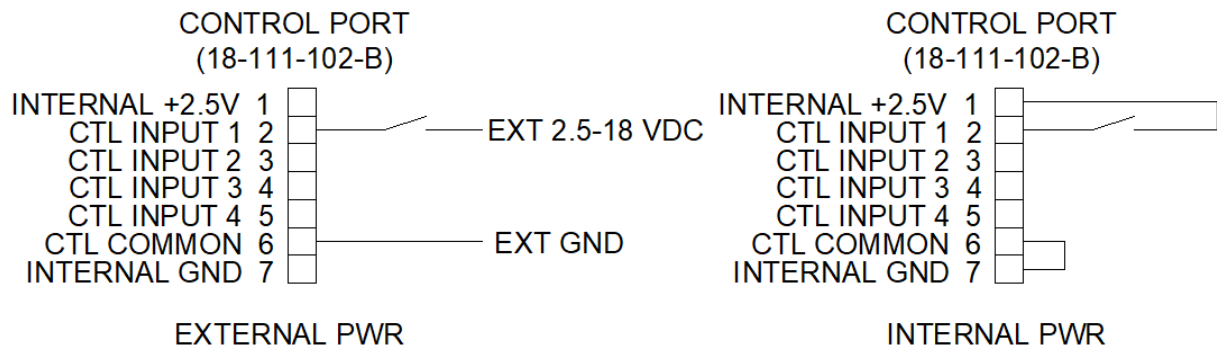




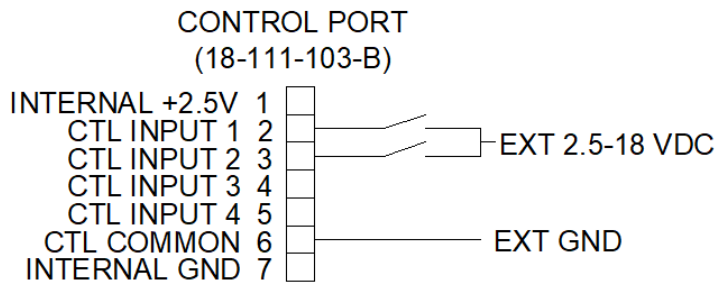
5.11 Options 22, 23, 24 Contact Closure Control (binary bits)

These three Options use contact closures in binary bit combinations for Input selection. The unit functions as a 2X1, 3X1, or 4X1 (depending on the part number). If a control Option is selected that uses fewer Inputs than the unit has the switch will operate correctly but ignore the higher numbered Input(s). At power up, the Input selected by the contacts will be selected. The internal logic provides a de-bounce function for each of the control inputs on the control port. The Input selection will trace the state of the control contacts. If the unit is being controlled by external electrical signals the signals must be between 2.5-18 VDC.

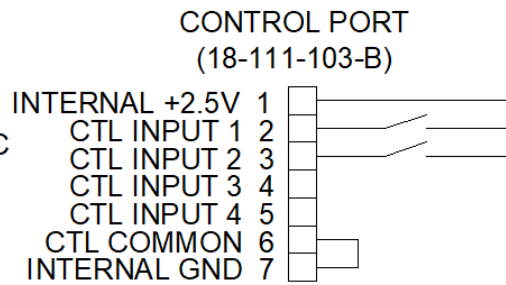
The following shows the external control circuits for the three different units:



- Select Video Input 1 Ctl IN 1 Open (no current)
- Select Video Input 2 Ctl IN 1 Closed (current flowing through opto)



EXTERNAL PWR



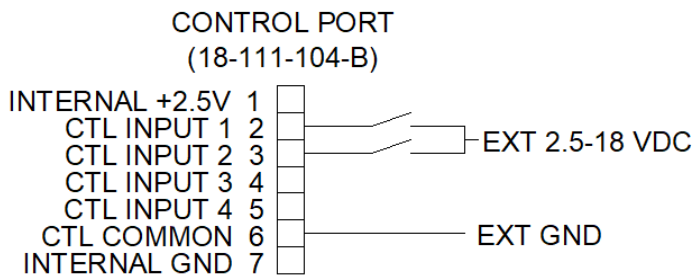
INTERNAL PWR

- Select Video Input 1 Ctl IN 1 Open (no current)
 Ctl IN 2 Open (no current)

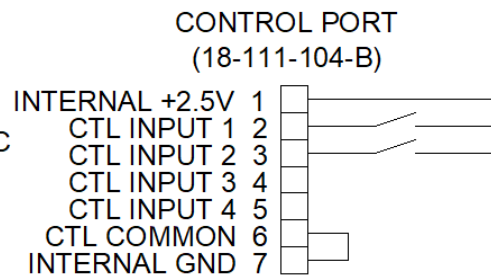
- Select Video Input 2 Ctl IN 1 has voltage applied (current through opto)
 Ctl IN 2 Open (no current)

- Select Video Input 3 Ctl IN 1 Open (no current)
 Ctl IN 2 has voltage applied (current through opto)

- Select Video Input 3 Ctl IN 1 has voltage applied (current through opto)
 Ctl IN 2 has voltage applied (current through opto)



EXTERNAL PWR



INTERNAL PWR

- Select Video Input 1 Ctl IN 1 Open (no current)
 Ctl IN 2 Open (no current)

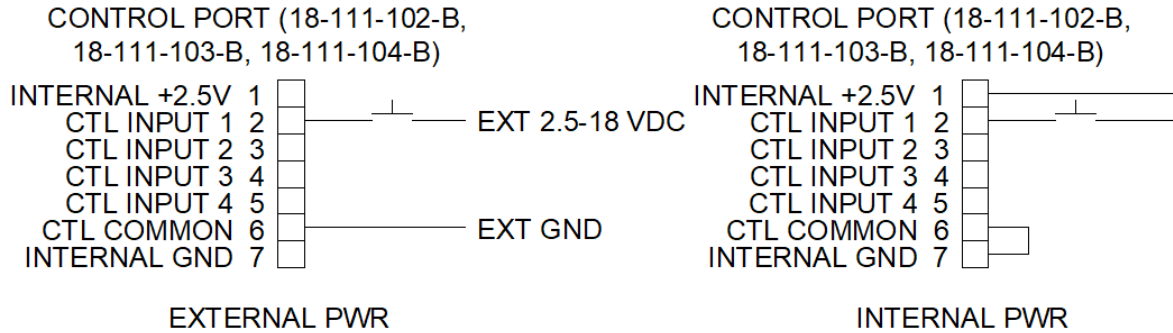
- Select Video Input 2 Ctl IN 1 has voltage applied (current through opto)
 Ctl IN 2 Open (no current)

- Select Video Input 3 Ctl IN 1 Open (no current)
 Ctl IN 2 has voltage applied (current through opto)

- Select Video Input 4 Ctl IN 1 has voltage applied (current through opto)
 Ctl IN 2 has voltage applied (current through opto)

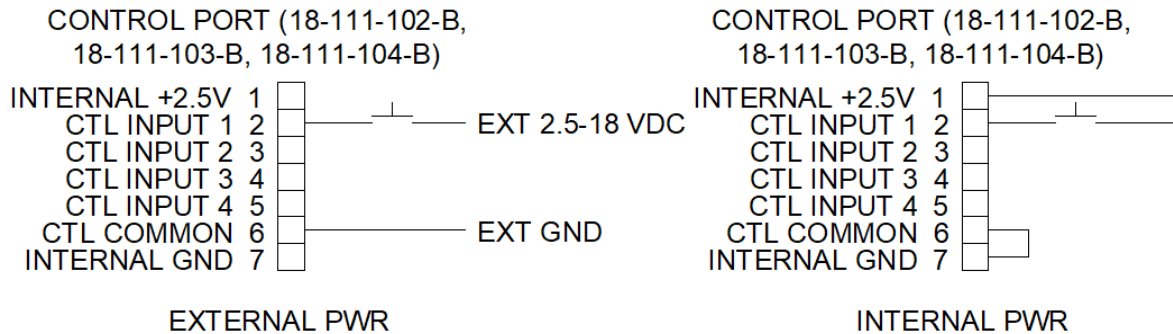
5.12 Option 32, 33, 34 Single Push Button Control

These three options use a single push button. At power up the unit will select Input 1. Each time the button is pressed the unit will select the next higher Input. When the highest Input is reached the unit will rotate back to Input 1. If a control Option is selected that uses fewer Inputs than the unit has, the higher Input will be ignored.



5.121 Option 35 Single Push Button Control

This option use a single push button. At power up the unit will select Input 1. Each time the button is pressed the unit will select the next active higher Input. When the highest Input is reached the unit will rotate back to the lowest active input.

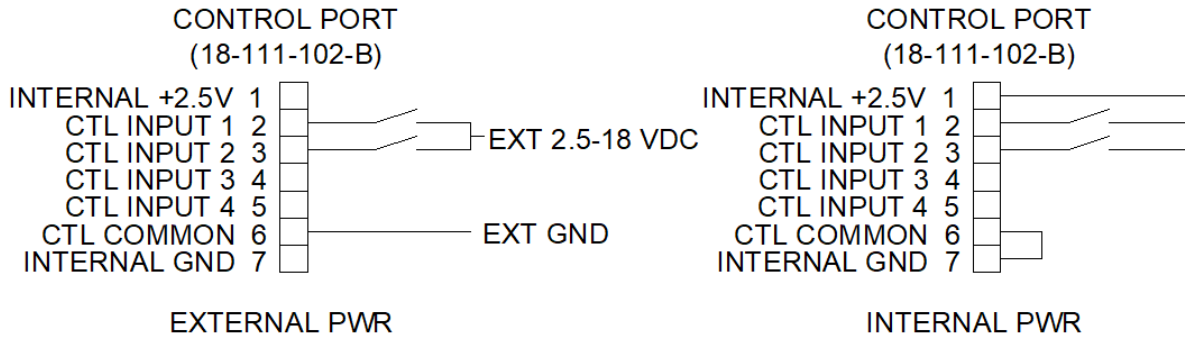


5.13 Option 42, 43 ,44 Automatic Switch

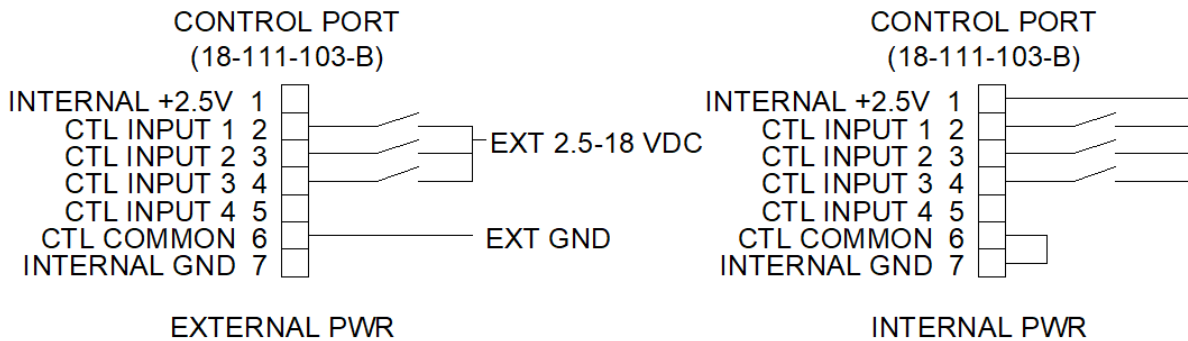
Option 42, 43, and 44 permit the units to operate in an automatic selection mode. Video Input 1 is the main input. If no active video is detected on Input 1, the unit automatically switches to

Input 2. The cycle continues until the highest Input for a given unit is selected. If active video is detected on a lower Input, the unit will automatically select that Input.

The control port permits the user to place the unit into manual mode and select any given Input. The internal logic has a de-bounce function for the control port inputs.



Control Input 1	Open Circuit (no opto current) Voltage applied (opto current)	Automatic mode Manual mode
Control Input 2	Open Circuit (no opto current) Voltage applied (opto current)	Video Input 1 selected (manual mode only) Video Input 2 selected (manual mode only)

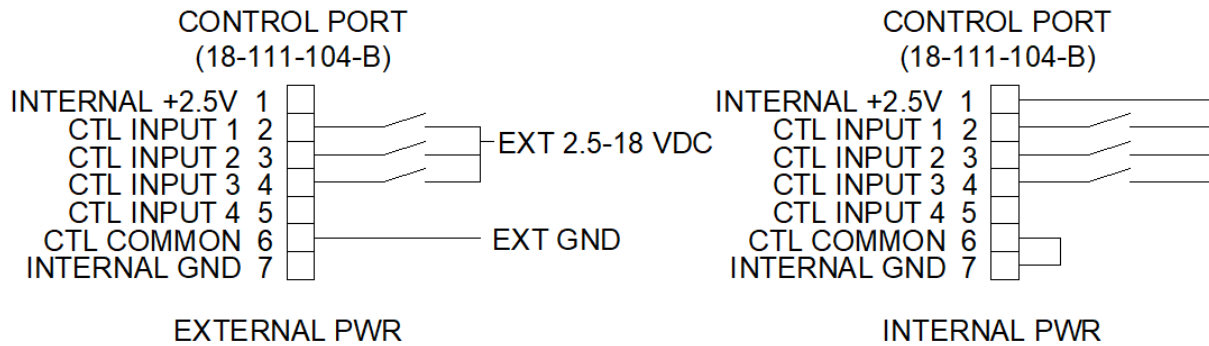


Control Input 1	Open Circuit (no opto current) Voltage applied (opto current)	Automatic mode Manual mode
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Manual Mode Only

Select Video Input 1	Ctl IN 2 Open (no current) Ctl IN 3 Open (no current)
Select Video Input 2	Ctl IN 2 has voltage applied (current through opto)

	Ctl IN 3 Open (no current)
Select Video Input 3	Ctl IN 2 Open (no current) Ctl IN 3 has voltage applied (current through opto)
Select Video Input 3	Ctl IN 2 has voltage applied (current through opto) Ctl IN 3 has voltage applied (current through opto)



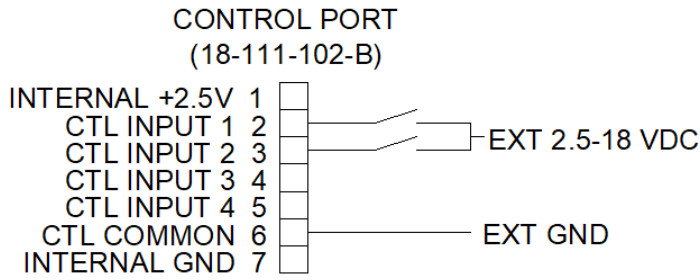
Control Input 1	Open Circuit (no opto current) Voltage applied (opto current)	Automatic mode Manual mode
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Manual Mode Only

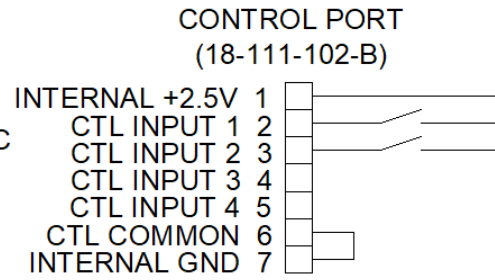
Select Video Input 1	Ctl IN 2 Open (no current) Ctl IN 3 Open (no current)
Select Video Input 2	Ctl IN 2 has voltage applied (current through opto) Ctl IN 3 Open (no current)
Select Video Input 3	Ctl IN 2 Open (no current) Ctl IN 3 has voltage applied (current through opto)
Select Video Input 4	Ctl IN 2 has voltage applied (current through opto) Ctl IN 3 has voltage applied (current through opto)

5.14 Option 52, 53,54 Timed Switching Cycles

These three Options permit the unit to automatically switch through the Inputs at a set time. The factory default time is 5 seconds, but this can be changed to 1-99 seconds through the Maintenance port. At power up the unit started by selecting Input 1. The control port permits the user to run in timed mode or manual mode.

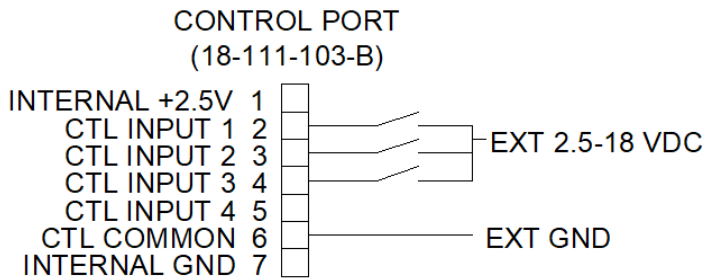


EXTERNAL PWR

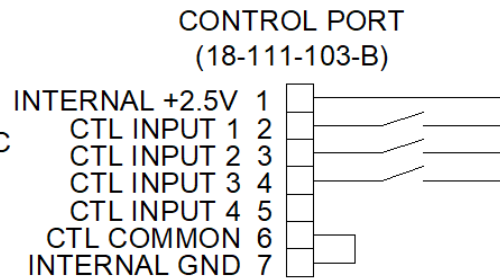


INTERNAL PWR

Control Input 1	Open Circuit (no opto current) Voltage applied (opto current)	Timer Switch mode Manual mode
Control Input 2	Open Circuit (no opto current) Voltage applied (opto current)	Video Input 1 selected (manual mode only) Video Input 2 selected (manual mode only)



EXTERNAL PWR



INTERNAL PWR

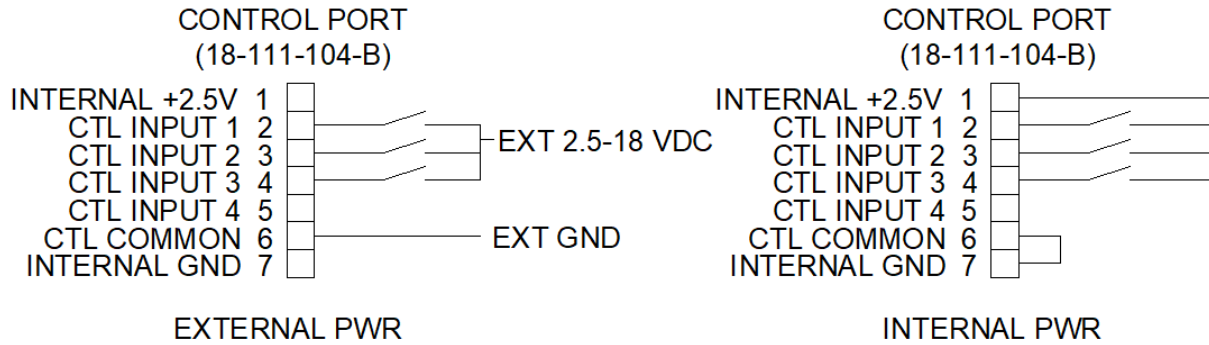
Control Input 1	Open Circuit (no opto current) Voltage applied (opto current)	Timed Switch mode Manual mode
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Manual Mode Only

Select Video Input 1	Ctl IN 2 Open (no current) Ctl IN 3 Open (no current)
Select Video Input 2	Ctl IN 2 has voltage applied (current through opto) Ctl IN 3 Open (no current)

Select Video Input 3 Ctl IN 2 Open (no current)
 Ctl IN 3 has voltage applied (current through opto)

Select Video Input 3 Ctl IN 2 has voltage applied (current through opto)
 Ctl IN 3 has voltage applied (current through opto)



Control Input 1 Open Circuit (no opto current) Timed Switch mode
 Voltage applied (opto current) Manual mode

Manual Mode Only

Select Video Input 1 Ctl IN 2 Open (no current)
 Ctl IN 3 Open (no current)

Select Video Input 2 Ctl IN 2 has voltage applied (current through opto)
 Ctl IN 3 Open (no current)

Select Video Input 3 Ctl IN 2 Open (no current)
 Ctl IN 3 has voltage applied (current through opto)

Select Video Input 4 Ctl IN 2 has voltage applied (current through opto)
 Ctl IN 3 has voltage applied (current through opto)

5.15 Option 62, 63, 64 Timed Switching Cycles (only active video)

These three modes operate like the Option 52, 53, 54 but only select Inputs that have active video. The control configuration are the same. In manual mode all Inputs can be selected, the Input does not need to have active video.

6.0 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 CP2102N USB-to-UART (RS232) bridge IC. HyperTerminal must be configured as shown below using the virtual Comm port formed by the CP2102N. The drivers for the CP2102N can be downloaded from the Silicon Labs web site.

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

The unit should be powered ON before the USB cable is plugged in. Once the laptop connects to the CP2102 HyperTerminal can be started and the comm port configured. At unit power up the user 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.

6.1 HELP Command Format > HELP<CR>

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

6.2 INFO Command Format > INFO<CR>

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

6.3 RUN Command Format > RUN<CR>

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

6.4 OPTION Command Format > 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.

6.4 TIMER Command Format > 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.

6.5 IN Command Format > IN<CR>

The IN command permits the user to select any of the Inputs and route it to Outputs. After the command is entered, the user must enter the Input number (1-4) followed by a <CR>.

6.6 STATUS Command Format > STATUS<CR>

The status command shows the currently selected Input and the video state on each Input.

7.0 Overall Specifications

Video Formats:	SMPTE 292M (1.48Gbit/s) SMPTE 259M (270/360Mbit/s) SMPTE 424M (2.97Gbit/s)
Input Connectors	BNC's (two, three, or four)
Input Termination	75 Ohms
Output Terminations:	75 Ohms (series), AC coupled
Output Connector:	Two BNC's
USB Interface (ASCII data)	8 bit 9600 baud 1 stop No parity <u>XON/XOFF flow control</u>

Power LED: Green (Indicates uP is running, selected Input has video)
Orange (Indicates uP is running, no active video on input)

Operating Temperature Range: -40C to +80C

Power: 10-34V DC (either polarity on PWR connector)

Supply Current: 200ma at 12 VDC
75ma at 28 VDC

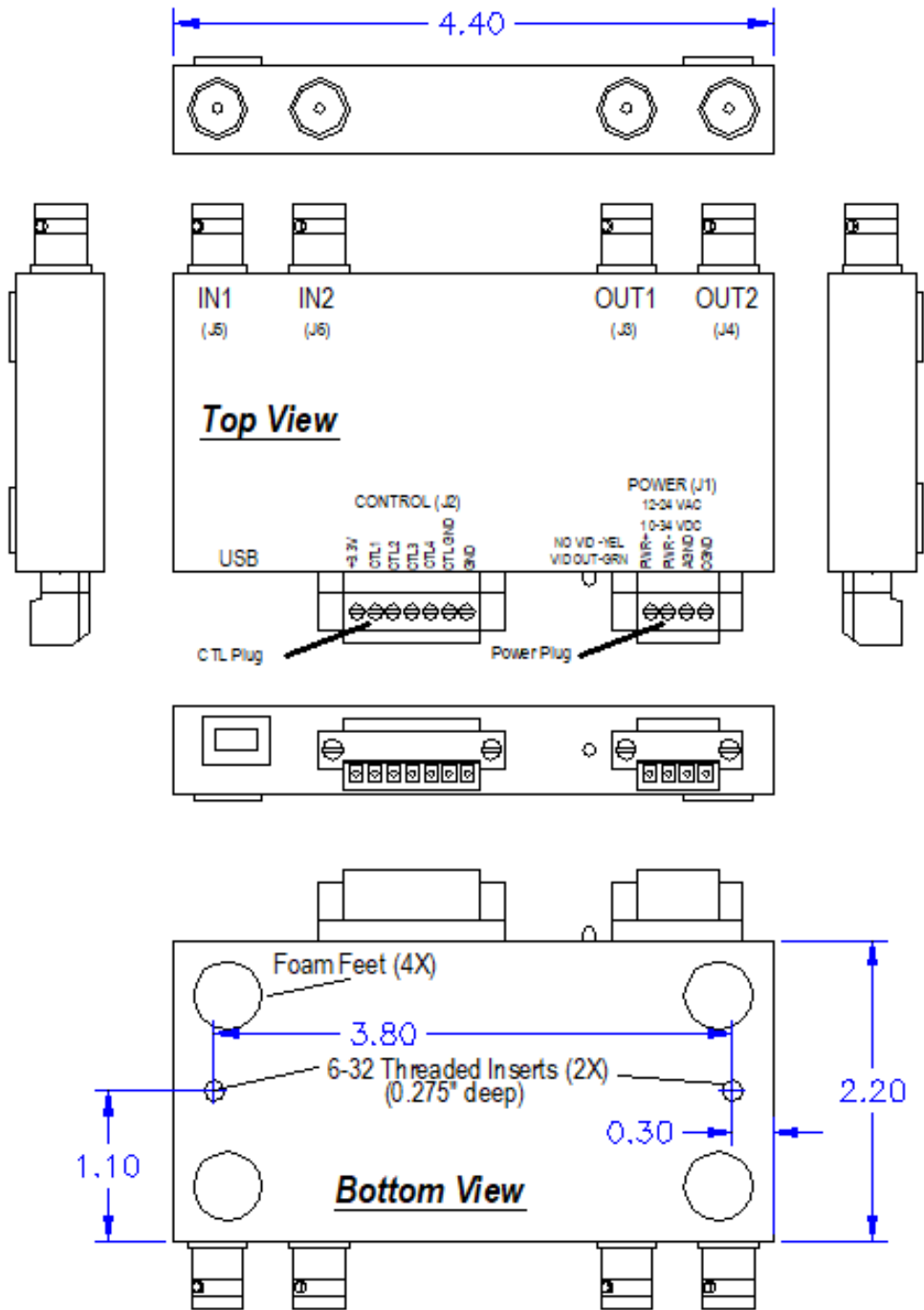
Power Connector: 3.5mm 4 pin terminal block (Phoenix Contact #1843813)
Mating plug (Phoenix Contact #1847071)

Control Connector: 3.5mm 7 pin terminal block (Phoenix Contact #1843842)
Mating plug (Phoenix Contact #1847107)

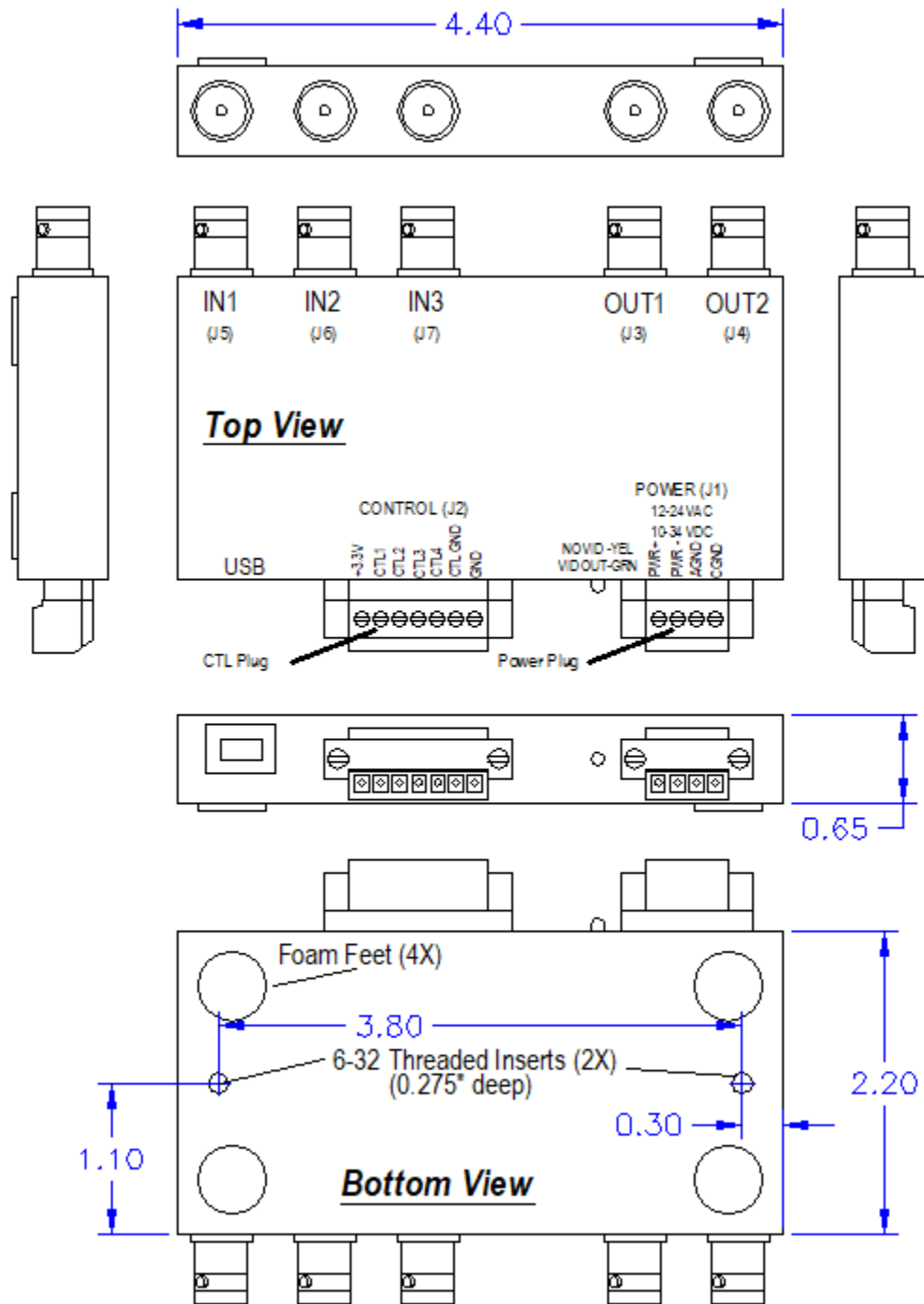
Package: 4.4" X 2.2" X 0.65"

Mounting: Two 6-32 threaded inserts

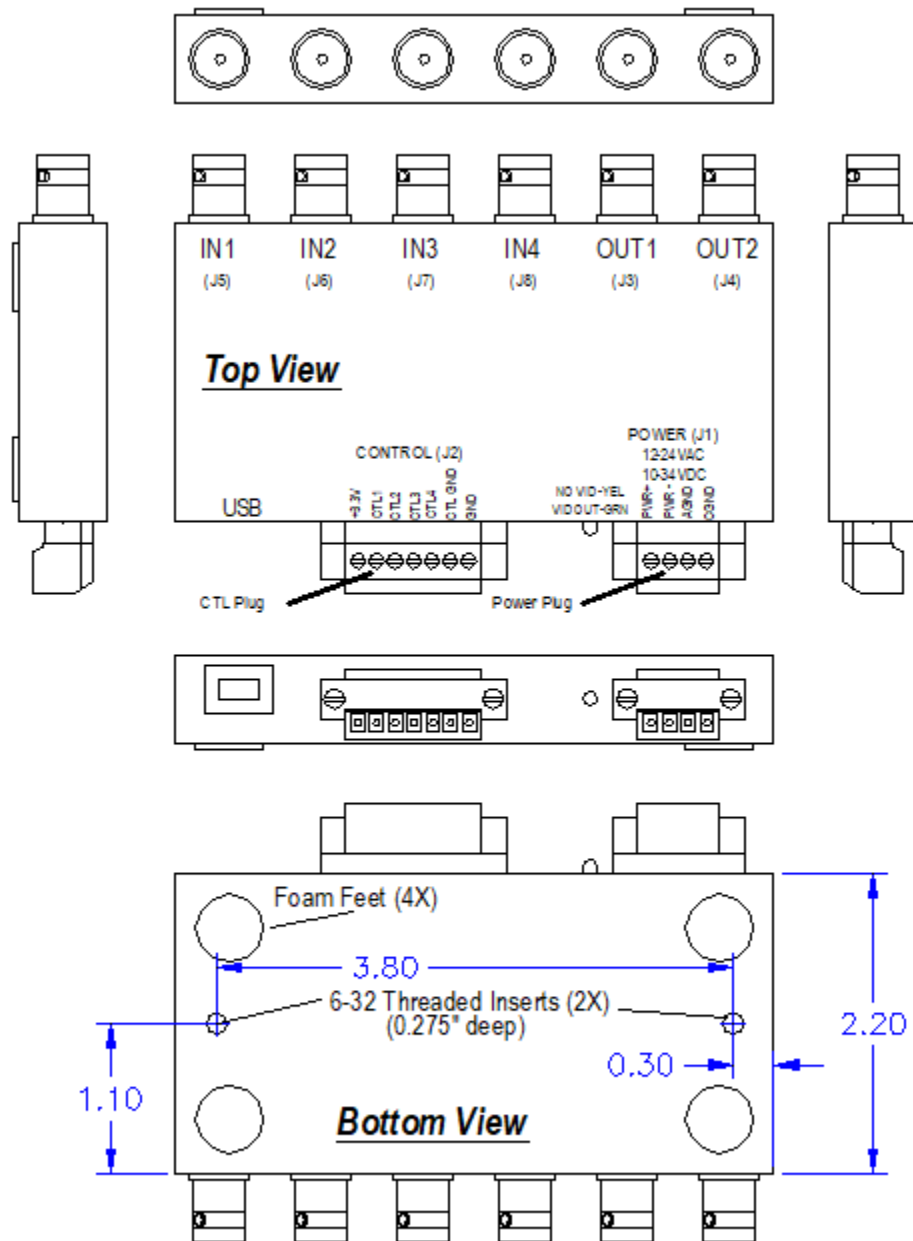
Weight: < 8 oz.



2 Input Switch (18-111-102-B)



3 Input Switch (18-111-103-B)



4 Input Switch (18-111-104-B)