

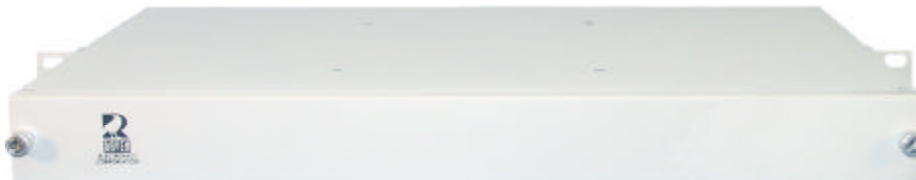


Raven Electronics Corporation

# Raven 40100D-AUX 40200D-AUX 41000D-AUX

## Wire-Wrap Bridge Shelves

40100D-AUX Shown



**Users Manual**

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### ***General Information***

Thank you for purchasing the Auxiliary Bridge Shelf from Raven Electronics Corporation. Please contact us if you have any questions, concerns, product ideas, or suggestions on how to improve this manual. We can be contacted at:

**Raven Electronics Corporation**  
400 Edison Way  
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### **Safety Warning**

***Please be Electro-Static Discharge (ESD) protected before starting any procedures contained in this manual.***

### **Raven Electronics' Warranty**

This warranty expressly precludes any liability by Raven for consequential damages however arising after delivery to the purchaser of the affected equipment, and is limited to the expressed warranty, excluding all implied warranties including merchantability. All equipment manufactured by Raven is warranted against defective materials and workmanship for a period of two (2) years from the date of delivery to the original purchaser or end-user. Liability under this warranty is limited to servicing, adjusting, repairing or replacing, as necessary, any equipment returned to the factory, transportation prepaid for that purpose. Factory examination must disclose a manufacturing defect. Repaired or replaced items will be returned to the purchaser surface freight prepaid within the continental U.S.A. This warranty does not extend to any equipment which has been subjected to transportation damage, misuse, neglect, accident, improper installation, or any other circumstances reasonably beyond the control of Raven.

Beyond the warranty period, repairs will be billed to the purchaser at cost. In such cases, an estimate will be submitted for approval before repair is initiated. Repaired equipment will be returned to the purchaser with transportation charges collect, unless agreed to between the purchaser and Raven.

## ***System Description***

### **40100D-AUX**

The 40100D-AUX Bridge Shelf provides four circuit card slots (J1 – J4) for the Raven 4-Way, 6-Way, or 8-Way Active Bridges. Position J6 is reserved for the power supply and the slot above it is left open to allow the power supply to dissipate heat. Connections to these modules are made via the wire-wrap pins on the rear of the shelf. The 40100D-AUX operates from a –24 to –56 VDC source. A 4-foot length of 18 AWG red wire is preinstalled for connecting to the DC input supply. A 4-foot length of 18 AWG black wire is preinstalled for connecting to ground.

The 40100D-AUX is used at repeater sites or as a hub site. The Bridges that can be installed in the shelf are the 41685 4Way Active Bridge, the 41685-01 6Way Active Bridge, and the 41688 8Way Active Bridge. Any combination of the bridge modules can be installed in the 40100D-AUX Bridge Shelf. Maximum capacity is four bridge modules per chassis. All of these Bridges are active conference bridges with +/- 25 dB of through path adjustment available. Amplifiers with potentiometer level adjustment are provided on each input and output for isolation, as well as, excellent common-mode rejection. All of these modules are removable for easy maintenance or replacement.

### **40200D-AUX**

The 40200D-AUX Bridge Shelf provides eight circuit card slots (J1 – J8) for the Raven 4-way, 6-way, or 8-way Active Bridges. Position J12 is reserved for the power supply and the slots above it are left open to allow the power supply to dissipate heat. Connections to these modules are made via the wire-wrap pins on the rear of the shelf. The 40200D-AUX operates from a –24 to –56 VDC source. A 4-foot length of 18 AWG red wire is preinstalled for connecting to the DC input supply. A 4-foot length of 18 AWG black wire is preinstalled for connecting to ground.

The 40200D-AUX is used at repeater sites or as a hub site. The Bridges that can be installed in the shelf are the 41685 4way Active Bridge, the 41685-01 6-way Active Bridge, and the 41688 8way Active Bridge. Any combination of the bridge modules can be installed in the 40200D-AUX Bridge Shelf. Maximum capacity is eight bridge modules per chassis. All of these Bridges are active conference bridges with +/- 25 dB of through path adjustment available. Amplifiers with potentiometer level adjustment are provided on each input and output for isolation, as well as, excellent common-mode rejection. All of these modules are removable for easy maintenance or replacement.

### **41000D-AUX**

The 41000D-AUX Bridge Shelf provides fourteen circuit card slots (J1 – J14) for the Raven 4-way, 6-way, or 8-way Active Bridges. Position J18 is reserved for the power supply and the slots above it are left open to allow the power supply to dissipate heat. Connections to these modules are made via the wire-wrap pins on the rear of the shelf. The 41000D-AUX operates from a –24 to –56 VDC source. A 4-foot length of 18 AWG red wire is preinstalled for connecting to the DC input supply. A 4-foot length of 18 AWG black wire is preinstalled for connecting to ground.

The 41000D-AUX is used at repeater sites or as a hub site. The Bridges that can be installed in the shelf are the 41685 4-way Active Bridge, the 41685-01 6-way Active Bridge, and the 41688 8-way Active Bridge. Any combination of the bridge modules can be installed in the 41000D-AUX Bridge

Shelf. Maximum capacity is fourteen bridge modules per chassis. All of these Bridges are active conference bridges with +/- 25 dB of through path adjustment available. Amplifiers with potentiometer level adjustment are provided on each input and output for isolation, as well as, excellent common-mode rejection. All of these modules are removable for easy maintenance or replacement.

#### **41620 Power Supply**

The Raven 41620 Regulated Power Supply provides a regulated -20 VDC output to power the Bridge(s). The 41620-01 regulates an input voltage ranging from -24 to -56 VDC. The 41620 provides foldback current limiting at an output current of approximately 1.2 amperes. Included on the 41620 is an ON/OFF power switch and a fuse in series with the input.

#### **41685 4-Way/4-Wire Bridge**

The Raven 41685 4-Way/4-Wire Active Bridge provides a multipath interface between four ports on a 4-wire basis. An input at one of the ports is routed through to the output of all other ports, with a minimum of interchannel crosstalk. All inputs and outputs are transformer coupled and are balanced. Potentiometer adjustments on all inputs and outputs allow input level coordination and through-path gain adjustments.

#### **41685-01 6-Way/4-Wire Bridge**

The Raven 41685-01 6-Way/4-Wire Active Bridge provides a multipath interface between six ports on a 4-wire basis. An input at one of the ports is routed through to the output of all other ports, with a minimum of interchannel crosstalk. All inputs and outputs are transformer coupled and are balanced. Potentiometer adjustments on all inputs and outputs allow input level coordination and through-path gain adjustments.

#### **41688 8-Way/4-Wire Bridge**

The Raven 41688 8-Way/4-Wire Active Bridge provides a multipath interface between eight ports on a 4-wire basis. An input at one of the ports is routed through to the output of all other ports, with a minimum of interchannel crosstalk. All inputs and outputs are transformer coupled and are balanced. Potentiometer adjustments on all inputs and outputs allow input level coordination and through-path gain adjustments.

### ***Equipment Needed for Installation***

**Rackmount Equipment** (to install unit in a rack):

- Screwdrivers (Flat blade and Phillips may be necessary)
- Screws
- Washers (optional)

**Miscellaneous Equipment:**

- Wire-Wrap Tool

**Audio Connections:**

- 24-Gauge Twisted Pair Wire

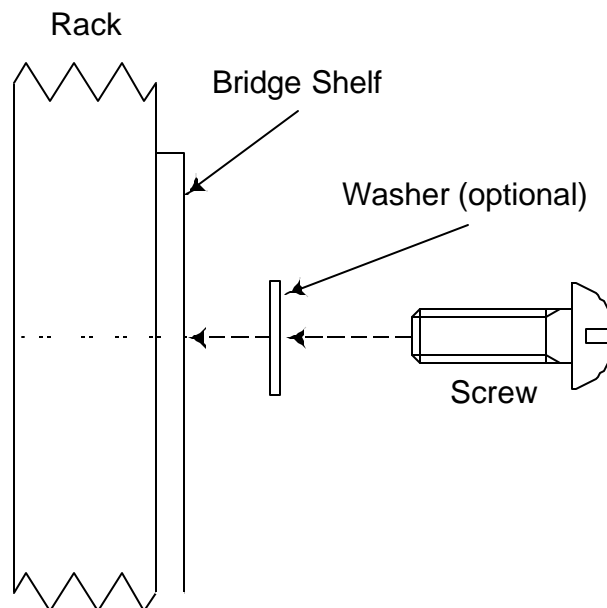
**Power Connections:**

- 18-Gauge Wire

### ***Mounting Unit in Rack***

*Please note that Raven supplies the hardware for mounting the flanges on the chassis, but not on the rack. Note also that the mounting flanges included with your Bridge Shelf are interchangeable between 19" and 23" except for the model 40100D-AUX. For this model a specific size flange is required for each. The default mounting flange included (unless specified differently at the time of order) is for 19-inch racks. If you require 23-inch flanges please contact Raven for a prompt replacement.*

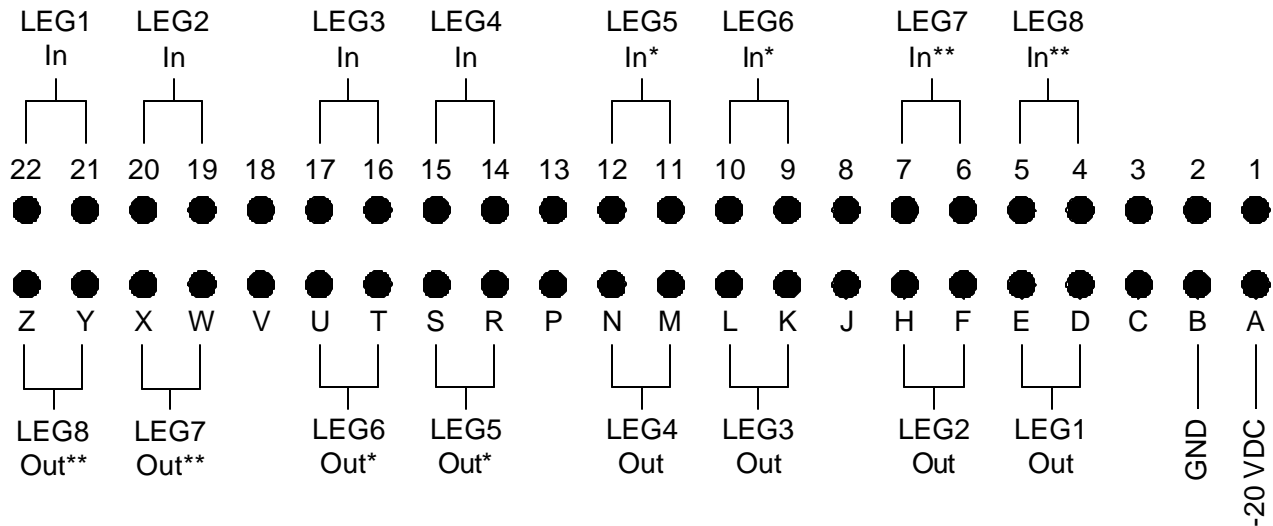
1. Hold unit in place in the rack.
2. Place a washer and screw in one of the four holes and tighten it to the rack. *(Please refer to the picture below.)*
3. Repeat Step 2 until all four screws are in place.



**Hooking Up Connections**

With the source power turned off, use the following diagram to hook up your 40100D-AUX Bridge Shelf. A wire-wrap tool is needed to make the connections shown below (*also found in Table B*).

**Be sure Power is turned OFF.**



With a regulated -20VDC input (example: The -20 VDC output from a Raven Orderwire):

48" Red 18 AWG Wire for -20 VDC Battery Connection (Pin A)

48" Black 18 AWG Wire for GND Connection (Pin B)

*Note: When 41620 Power Supply is not internal, J6 Position can be used for a 41685 bridge.*

With an internal Power Supply (in J6 Position):

48" Red 18 AWG Wire for -24 to -56 VDC Battery Connection (Pin R on Power Supply)

48" Black 18 AWG Wire for GND Connection

\* Optional 6-Way/4-Wire Active Bridge

\*\* Optional 8-Way/4-Wire Active Bridge

**40100, 40200 or 41000 Auxiliary Bridge Shelf**

Connector Pin Out for 41685 (4-Way), 41685-01 (6-Way),  
and 41688 (8-Way) Bridges  
(Rear View)

***Powering Up the Bridge shelf***

Reinstall the bridge card(s), if previously removed, before performing the following steps. Also, make sure the source power supply is turned off.

1. Open the front panel.
2. Verify the toggle switch is in the "off" position (to the right).
3. Turn on the external power source.
4. Flip the toggle switch to the "on" position (to the left).
5. The green light on the 41620 card (Power Supply) should be illuminated. If not, please refer to Chapter 4, Troubleshooting and Alignment.
6. Close the front panel.



### ***Troubleshooting and Alignment Procedures***

#### **Equipment Needed for Troubleshooting and Alignment:**

- 42067 Extender Card (optional, but easier to align with)
- AC Voltmeter
- DC Ammeter
- Alignment Tool
- Signal Generator

Every Bridge shelf has been carefully aligned and tested at the factory. Please try the unit first before attempting the alignment procedures. No adjustment should be necessary since levels are set at the factory per customer's specifications at time of order. If the unit is not working, it may need to be aligned. Attachment A lists all levels and impedances for the system. The Attachment A can be located inside the Bridge Shelf chassis.

Caution must be exercised during level alignment to insure that proper test levels and impedances are maintained.

A signal generator may double terminate a port causing a reduced signal level. When injecting a test tone into a port, bridge the port with an AC voltmeter and set the signal generator output according to the AC voltmeter reading.

When taking output level readings, the AC voltmeter will be either terminated or bridged. If it is unknown whether an output reading should be a terminated or bridged measurement, compare the two readings. If a 3.5 dBm difference is noted, the bridged measurement is correct. If a 6.0 dBm difference is noted, the terminated measurement is correct.

#### **41620 Power Supply Alignment Procedure**

1. Turn power ON and verify LED CR7 illuminates.
2. Connect a DC voltmeter to test points TP1 and GND on the 41620 Power Supply and read -20.0 VDC.
3. Adjust R15 on the 41620 module, if required.

***Troubleshooting and Alignment Procedures (cont.)***

**NOTE:** *This bridge shelf has already been aligned and tested in our factory per customer's specifications and it should function with little or no adjustments necessary. Please contact a Raven technician before making any adjustments suggested on this page.*

**41685 4-Way/4-Wire Bridge Level**

1. Turn power off. Remove the 41685 4W/4W Bridge module and insert a 42067 Extender Card into the module position. Insert the 41685 4W/4W Bridge into the Extender Card. Turn power on.
2. Connect the signal generator to pins 21 and 22 (LEG 1 IN) on the Extender Card. Set the signal generator frequency to 1 KHz at the level specified by Attachment A. Connect the AC voltmeter (terminate, if required) to pins F and H (LEG 2 OUT) on the Extender Card. Read the level specified by Attachment A. Adjust R2 on the 41685 4W/4W Active Bridge, if required.
3. Connect the AC voltmeter (terminate, if required) to pins K and L (LEG 3 OUT). Read the level specified by Attachment A. Adjust R3 on the 41685 4W/4W Active Bridge, if required.
4. Connect the AC voltmeter (terminate, if required) to pins M and N (LEG 4 OUT). Read the level specified by Attachment A. Adjust R4 on the 41685 4W/4W Active Bridge, if required.
5. Connect the signal generator to pins 19 and 20 (LEG 2 IN). Set the signal generator frequency to 1KHz at the level specified by Attachment A for LEG 2 IN.
6. With the AC voltmeter still connected to pins M and N, read the same level as in step 4. Adjust R8 on the 41685 4W/4W Active Bridge, if required.
7. Connect the AC voltmeter (bridging) to pins D and E (LEG 1 OUT). Read the level specified by Attachment A. Adjust R1 on the 41685 4W/4W Active Bridge, if required.
8. Connect the signal generator to pins 16 and 17 (LEG 3 IN). Set the signal generator level as specified by Attachment A. Read the same level on the AC voltmeter as in step 7. Adjust R9 on the 41685 4W/4W Active Bridge, if required.
9. Connect the signal generator to pins 14 and 15 (LEG 4 IN). Set the signal generator level as specified by Attachment A. Read the same level on the AC voltmeter as in step 7. Adjust R10 on the 41685 4W/4W Active Bridge, if required.
10. Disconnect all test equipment and turn power off. Remove the Extender Card and install the 41685 4W/4W Active Bridge in its position.

***Troubleshooting and Alignment Procedures (cont.)***

**NOTE:** *This bridge shelf has already been aligned and tested in our factory per customer's specifications and it should function with little or no adjustments necessary. Please contact a Raven technician before making any adjustments suggested on this page.*

**41685-01 6-Way/4-Wire Bridge Level**

1. Turn power off. Remove the 41685-01 6W/4W Bridge module and insert a 42067 Extender Card into the module position. Insert the 41685-01 6W/4W Bridge into the Extender Card. Turn power on.
2. Connect the signal generator to pins 21 and 22 (LEG 1 IN) on the Extender Card. Set the signal generator frequency to 1 KHz at the level specified by Attachment A. Connect the AC voltmeter (terminate, if required) to pins F and H (LEG 2 OUT) on the Extender Card. Read the level specified by Attachment A. Adjust R2 on the 41685-01 6W/4W Active Bridge, if required.
3. Connect the AC voltmeter (terminate, if required) to pins K and L (LEG 3 OUT). Read the level specified by Attachment A. Adjust R3 on the 41685-01 6W/4W Active Bridge, if required.
4. Connect the AC voltmeter (terminate, if required) to pins M and N (LEG 4 OUT). Read the level specified by Attachment A. Adjust R4 on the 41685-01 6W/4W Active Bridge, if required.
5. Connect the AC voltmeter (terminate, if required) to pins R and S (LEG 5 OUT). Read the level specified by Attachment A. Adjust R5 on the 41685-01 6W/4W Active Bridge, if required.
6. Connect the AC voltmeter (terminate, if required) to pins M and N (LEG 6 OUT). Read the level specified by Attachment A. Adjust R6 on the 41685-01 6W/4W Active Bridge, if required.
7. Connect the signal generator to pins 19 and 20 (LEG 2 IN). Set the signal generator frequency to 1KHz at the level specified by Attachment A for LEG 2 IN.
8. With the AC voltmeter still connected to pins M and N, read the same level as in step 4. Adjust R8 on the 41685-01 6W/4W Active Bridge, if required.
9. Connect the AC voltmeter (bridging) to pins D and E (LEG 1 OUT). Read the level specified by Attachment A. Adjust R1 on the 41685-01 6W/4W Active Bridge, if required.
10. Connect the signal generator to pins 16 and 17 (LEG 3 IN). Set the signal generator level as specified by Attachment A. Read the same level on the AC voltmeter as in step 7. Adjust R9 on the 41685-01 6W/4W Active Bridge, if required.
11. Connect the signal generator to pins 14 and 15 (LEG 4 IN). Set the signal generator level as specified by Attachment A. Read the same level on the AC voltmeter as in step 7. Adjust R10 on the 41685-01 6W/4W Active Bridge, if required.
12. Connect the signal generator to pins 11 and 12 (LEG 5 IN). Set the signal generator level as specified by Attachment A. Read the same level on the AC voltmeter as in step 11. Adjust R13 on the 41685-01 6W/4W Active Bridge, if required.
13. Connect the signal generator to pins 9 and 10 (LEG 6 IN). Set the signal generator level as specified by Attachment A. Read the same level on the AC voltmeter as in step 11. Adjust R14 on the 41685-01 6W/4W Active Bridge, if required.
14. Disconnect all test equipment and turn power off. Remove the Extender Card and install the 41685-01 6W/4W Active Bridge in its position.

***Troubleshooting and Alignment Procedures (cont.)***

**NOTE:** *This orderwire has already been aligned and tested in our factory per customer's specifications and it should function with little or no adjustments necessary. Please contact a Raven technician before making any adjustments suggested on this page.*

**41688 8-Way/4-Wire Bridge Level**

1. Turn power off. Remove the 41688 8W/4W Bridge module and insert a 42067 Extender Card into the module position. Insert the 41688 8W/4W Bridge into the Extender Card. Turn power on.
2. Connect the signal generator to pins 21 and 22 (LEG 1 IN) on the Extender Card. Set the signal generator frequency to 1KHz at the level specified by Attachment A. Connect the AC voltmeter (terminate, if required) to pins F and H (LEG 2 OUT) on the Extender Card. Read the level specified by Attachment A. Adjust R2 on the 41688 8W/4W Active Bridge, if required.
3. Connect the AC voltmeter (terminate, if required) to pins K and L (LEG 3 OUT). Read the level specified by Attachment A. Adjust R3 on the 41688 8W/4W Active Bridge, if required.
4. Connect the AC voltmeter (terminate, if required) to pins M and N (LEG 4 OUT). Read the level specified by Attachment A. Adjust R4 on the 41688 8W/4W Active Bridge, if required.
5. Connect the AC voltmeter (terminate, if required) to pins R and S (LEG 5 OUT). Read the level specified by Attachment A. Adjust R5 on the 41688 8W/4W Active Bridge, if required.
6. Connect the AC voltmeter (terminate, if required) to pins T and U (LEG 6 OUT). Read the level specified by Attachment A. Adjust R6 on the 41688 8W/4W Active Bridge, if required.
7. Connect the AC voltmeter (terminate, if required) to pins W and X (LEG 7 OUT). Read the level specified by Attachment A. Adjust R7 on the 41688 8W/4W Active Bridge, if required.
8. Connect the AC voltmeter (terminate, if required) to pins Y and Z (LEG 8 OUT). Read the level specified by Attachment A. Adjust R8 on the 41688 8W/4W Active Bridge, if required.
9. Connect the signal generator to pins 19 and 20 (LEG 2 IN). Set the signal generator frequency to 1KHz at the level specified by Attachment A for LEG 2 IN.
10. With the AC voltmeter still connected to pins Y and Z, read the same level as in step 8. Adjust R10 on the 41688 8W/4W Active Bridge, if required.
11. Connect the AC voltmeter (bridging) to pins D and E (LEG 1 OUT). Read the level specified by Attachment A. Adjust R1 on the 41688 8W/4W Active Bridge, if required.
12. Connect the signal generator to pins 16 and 17 (LEG 3 IN). Set the signal generator level as specified by Attachment A. Read the same level on the AC voltmeter as in step 11. Adjust R11 on the 41688 8W/4W Active Bridge, if required.
13. Connect the signal generator to pins 14 and 15 (LEG 4 IN). Set the signal generator level as specified by Attachment A. Read the same level on the AC voltmeter as in step 11. Adjust R12 on the 41688 8W/4W Active Bridge, if required.
14. Connect the signal generator to pins 11 and 12 (LEG 5 IN). Set the signal generator level as specified by Attachment A. Read the same level on the AC voltmeter as in step 11. Adjust R13 on the 41688 8W/4W Active Bridge, if required.

***Troubleshooting and Alignment Procedures (cont.)***

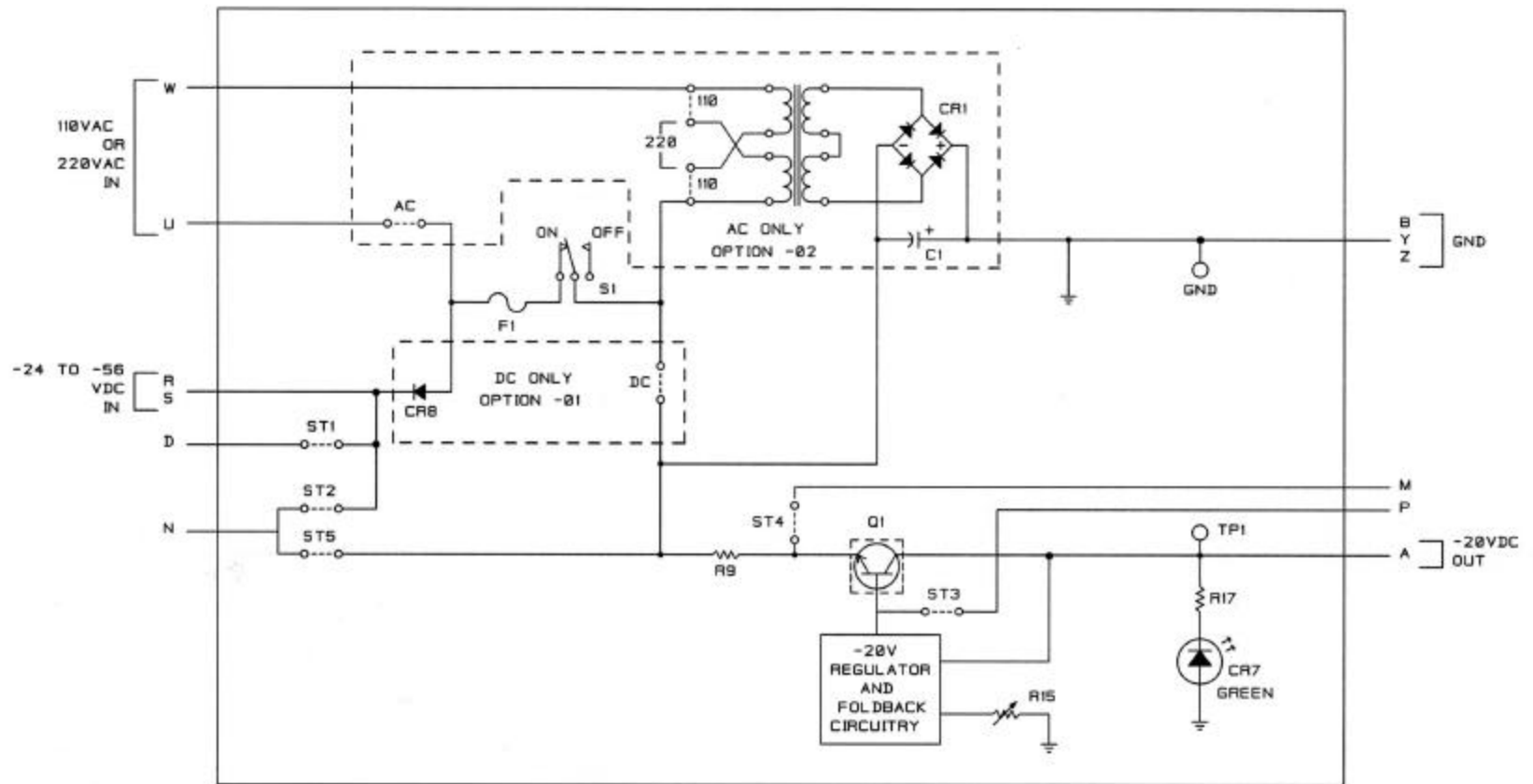
15. Connect the signal generator to pins 9 and 10 (LEG 6 IN). Set the signal generator level as specified by Attachment A. Read the same level on the AC voltmeter as in step 11. Adjust R14 on the 41688 8W/4W Active Bridge, if required.
16. Connect the signal generator to pins 6 and 7 (LEG 7 IN). Set the signal generator level as specified by Attachment A. Read the same level on the AC voltmeter as in step 11. Adjust R15 on the 41688 8W/4W Active Bridge, if required.
17. Connect the signal generator to pins 4 and 5 (LEG 8 IN). Set the signal generator level as specified by Attachment A. Read the same level on the AC voltmeter as in step 11. Adjust R16 on the 41688 8W/4W Active Bridge, if required.
18. Disconnect all test equipment and turn power off. Remove the Extender Card and install the 41688 8W/4W Active Bridge in its position.

**Specifications**

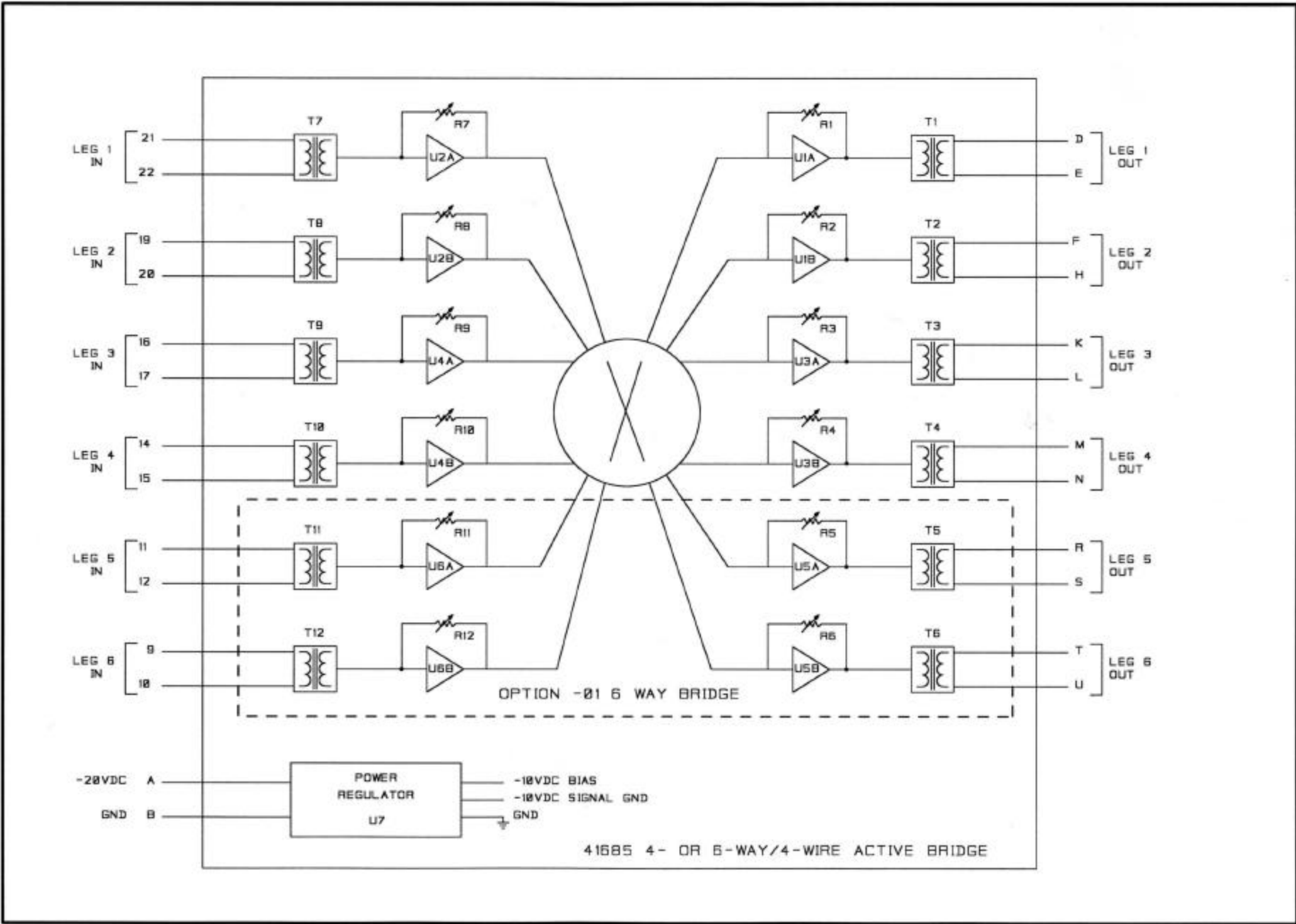
<b>POWER REQUIREMENT</b>	-24 to -56 VDC input power or 110/220 VAC, 47-63 Hz
<b>CURRENT DRAIN</b>	40100D-AUX 110 mA (max)
	40200D-AUX 220 mA (max)
	41000D-AUX 385 mA (max)
<b>4-WIRE INTERFACE</b>	
* <b>Line Impedance (XMT &amp; RCV)</b>	600, 75 ohms or customer specified
* <b>Levels (XMT &amp; RCV)</b>	-46 to +7 dBm, adjustable
† <b>Frequency Response</b>	+1, -3 dBm0 (300 Hz to 20 KHz)
† <b>Crosstalk (RCV &amp; XMT)</b>	Less than -50 dBm0 at unity gain (300 Hz to 20 KHz)
<b>ENVIRONMENTAL</b>	
<b>Operating Temperature</b>	0°C to +50°C
<b>Storage Temperature</b>	-50°C to +80°C
<b>Relative Humidity</b>	0 to 95% non-condensing
<b>Operating Altitude</b>	15,000 ft max (4572 meters)
<b>DIMENSIONS</b>	
<b>Width (Standard)</b>	19.00 inches rackmount (48.26 cm)
<b>(Optional)</b>	23.00 inches rackmount (58.42 cm)
<b>Depth</b>	14.75 inches (37.465 cm)
<b>Height</b>	40100D-AUX 1.75 inches (4.445 cm) (1 ru)
	40200D-AUX 3.50 inches (8.89 cm) (2 ru)
	41000D-AUX 5.25 inches (13.34 cm) (3 ru)
<b>WEIGHT (max)</b>	40100D-AUX 12 pounds max (5.44 kg)
	40200D-AUX 15 pounds max (6.53 kg)
	41000D-AUX 18 pounds max (8.16 kg)

\* *Customer Specified*

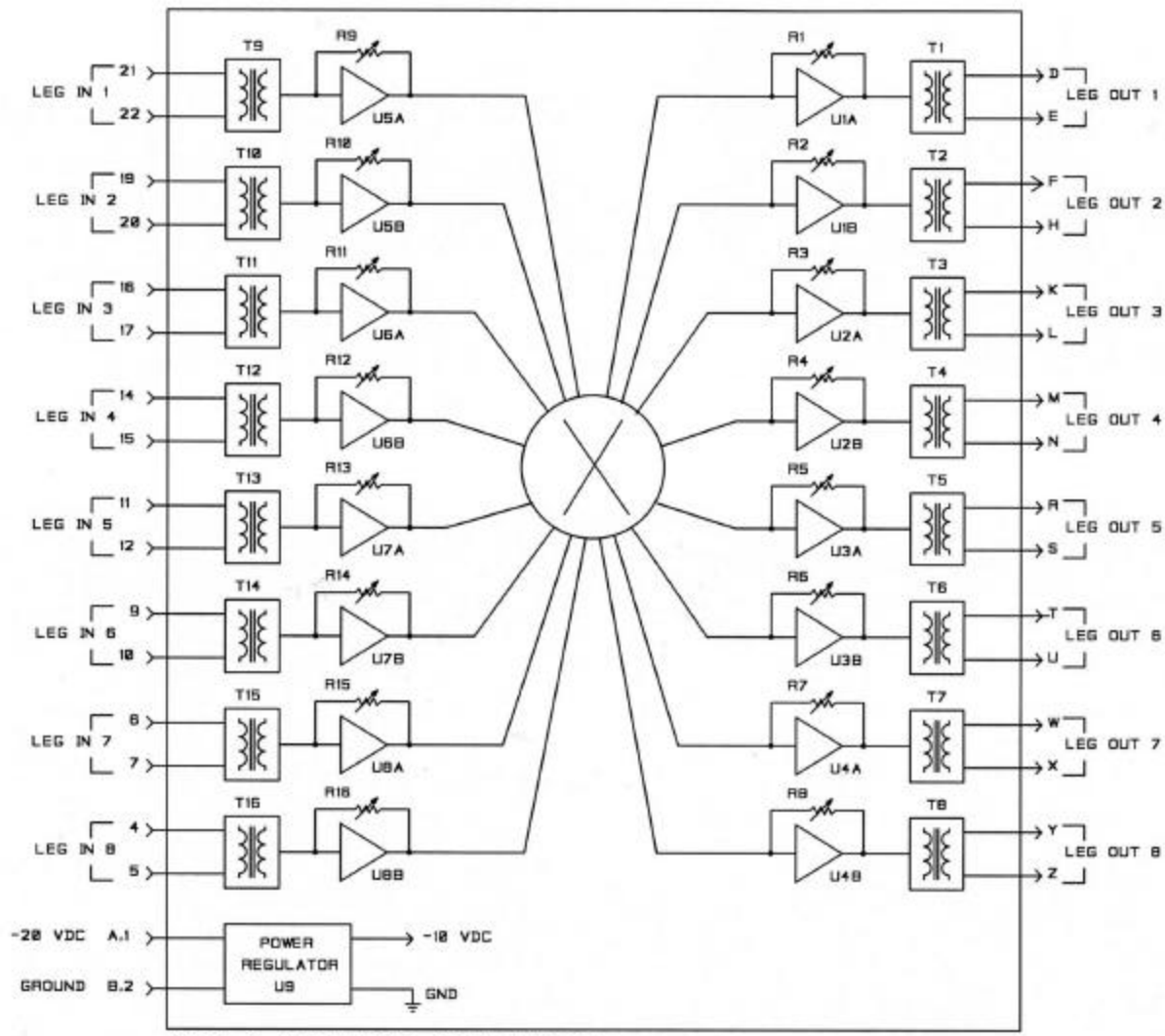
† *4-Wire and Data Interface set for 0 dBm 600 ohms IN and OUT @ 1 KHz*



41620 POWER SUPPLY  
BLOCK DIAGRAM



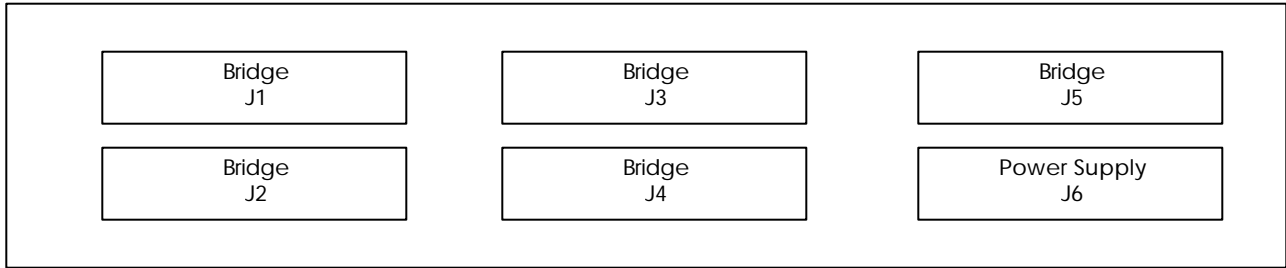




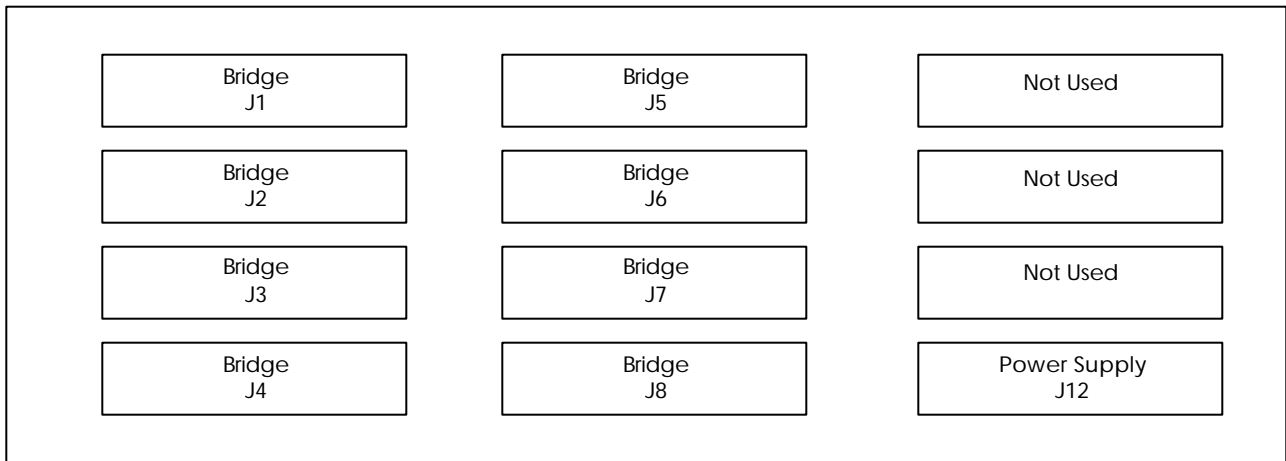
41688 8 WAY/4 WIRE ACTIVE BRIDGE  
ISSUE 04

41688 8 WAY/4 WIRE  
ACTIVE BRIDGE

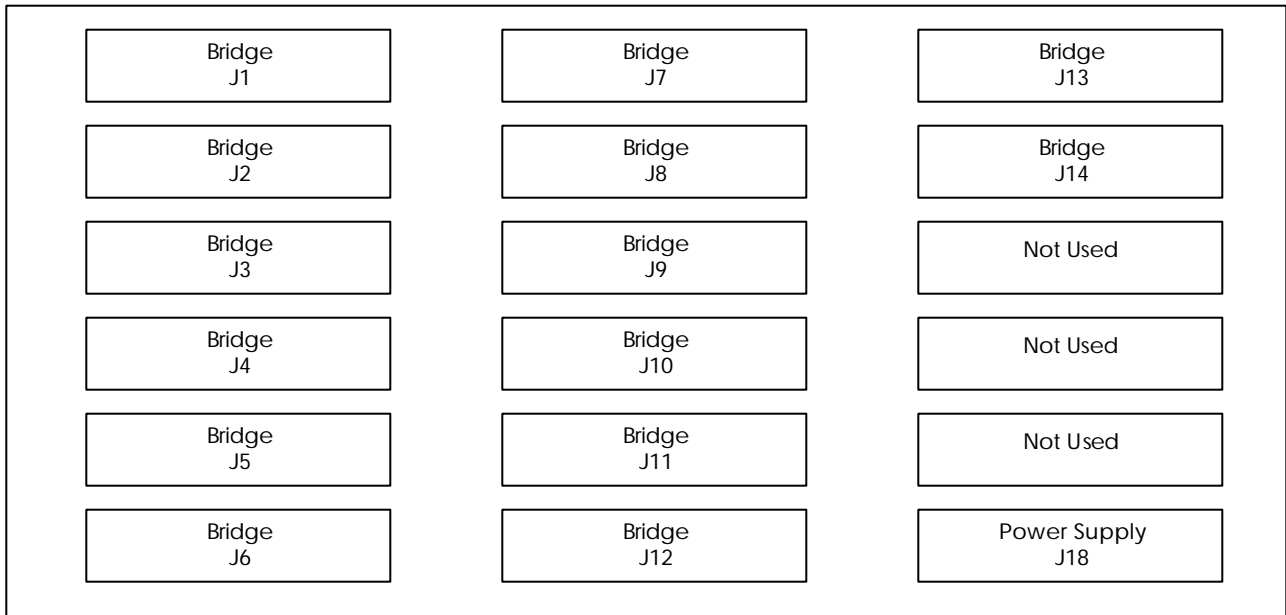
**40100D-AUX Front View**



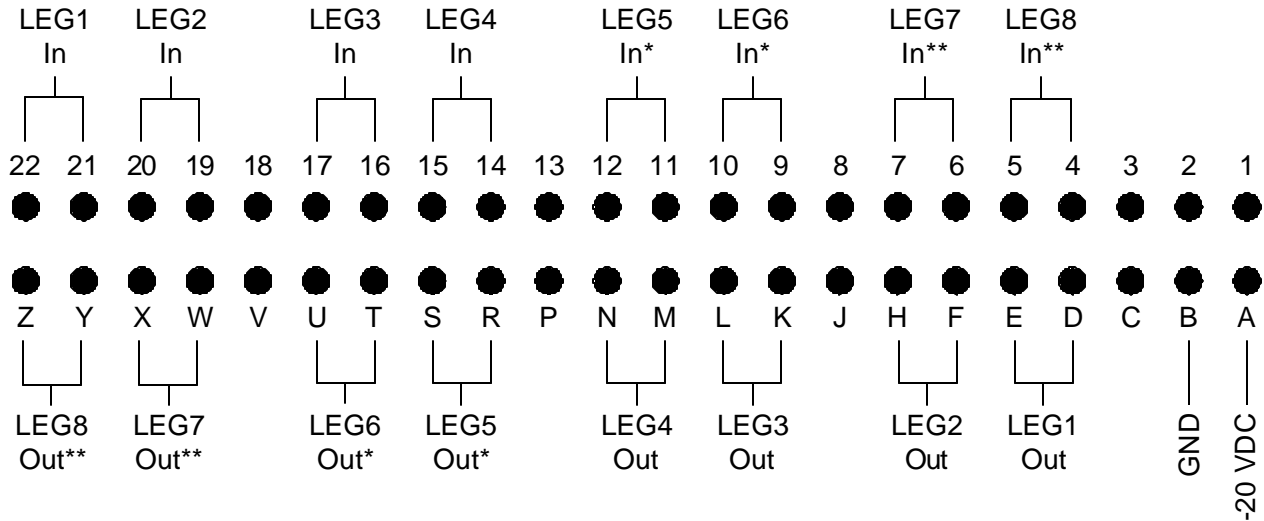
**40200D-AUX Front View**



**40200D-AUX Front View**



**Auxiliary Shelf Installer Connections**



With a regulated -20VDC input (example: The -20 VDC output from a Raven Orderwire):

48" Red 18 AWG Wire for -20 VDC Battery Connection (Pin A)

48" Black 18 AWG Wire for GND Connection (Pin B)

*Note: When 41620 Power Supply is not internal, J6 Position can be used for a 41685 bridge.*

With an internal Power Supply (in J6 Position):

48" Red 18 AWG Wire for -24 to -56 VDC Battery Connection (Pin R on Power Supply)

48" Black 18 AWG Wire for GND Connection

\* Optional 6-Way/4-Wire Active Bridge

\*\* Optional 8-Way/4-Wire Active Bridge

**40100, 40200 or 41000 Auxiliary Bridge Shelf**

Connector Pin Out for 41685 (4-Way), 41685-01 (6-Way),  
and 41688 (8-Way) Bridges  
(Rear View)

**General Conditions of Sales**  
**RAVEN ELECTRONICS CORPORATION**  
**400 EDISON WAY, RENO, NEVADA 89502**  
**TELEPHONE 775-858-2400 FAX: 775-858-2410**

**1. CONTRACT** – The following general conditions of sale apply to this contract and all purchases from Raven Electronics Corporation (hereinafter referred to as Raven). No changes, deletions or additions shall be binding on Raven, unless expressly agreed to in writing and signed by an authorized representative of Raven. Any terms or condition of the Purchaser inconsistent herewith, or in addition hereto, shall be of no force and effect, and Purchasers order shall be governed only by terms and conditions appearing herein. A definite and reasonable expression of acceptance or a written confirmation, which is sent within the time specified in the Raven proposal or sales order, operates as an acceptance of the terms specified herein, even though it states terms different from or additional to those specified herein.

**2. PROPOSALS** – Raven proposals, when accepted, and any subsequent orders placed as a result of such proposals, are not subject to cancellation changes, reduction in amount or suspension of deliveries except with Raven's written consent and upon terms which indemnify Raven against loss. Information contained in Raven's proposal is valid for a period of sixty (60) days from the date of proposal, unless specified to the contrary in the proposal. Stenographic and clerical errors are subject to correction. Verbal quotations expire, unless accepted, the same day they are made.

**3. PRICES (are in United States dollars)** – All prices and discounts are subject to change without notice. In the event of price change, the price of equipment on order but not shipped will be the price in effect at the time of acceptance of the order. Equipment already shipped is not subject to a price change. In addition to prices specified herein, purchaser shall pay for all extra components, parts, equipment, materials or services (each or all hereafter called "equipment") requested by the purchaser or made necessary by incompleteness or inaccuracy in plans, specifications, or other information submitted by the purchaser.

**4. TAXES AND TRANSPORTATION** – Unless otherwise specified, the prices do not include any applicable taxes (sales, use, ad valorem, property, etc.) for the sale, use, licenses, or delivery of the equipment, software, or services supplied. The purchaser agrees to pay all taxes, licenses and transportation charges.

**5. TERMS OF PAYMENT** – Terms of payment to Purchasers of satisfactory credit is thirty (30) days from the date of shipment. The same terms are applicable to partial shipment. If in the judgment of Raven, the financial conditions of the Purchaser at any time does not justify continuance of production or shipment on the terms of payment specified, the company may require full or partial payment in advance before shipment. Raven may ship the equipment in installments, and pro rata payments of purchase price are due as shipments are made. If shipments are delayed by Purchaser, payments shall be made based on the contract price and percent completed. Delinquent charges of 1½% per month (18% per annum) will be added to all past due invoices.

**6. DELIVERY** – Raven shall not be liable for any damages or penalty for delays in delivery and/or completion due to acts of God, acts of omissions of the Purchaser, acts of civil or military authorities, government regulations or priorities, fires, floods, epidemics, quarantine, inability to obtain necessary labor, war, riots, strikes, differences with workmen, accidents to machinery, delays in transportation, failure of or delay in furnishing correct or complete information by Purchaser, impossibility or impracticability of performance or any other cause or causes beyond the control of Raven.

**7. SHIPMENT** – Unless otherwise specified in this or other documents forming a part of this contract, all shipments will be F.O.B. Raven manufacturing facility. Property of and title to the equipment shall pass to the purchaser upon delivery thereof by Raven to the carrier, and risk of loss, damage or deterioration to the equipment shall thereafter be on the purchaser. If the purchaser requests Raven to postpone shipment beyond the time Raven would be required to ship in order to comply with the delivery dates agreed upon between Raven and the purchaser elsewhere in this or other documents forming a part of this contract, (a) the purchaser shall pay Raven for the expense of storing the equipment, (b) the risk of loss, damage or deterioration to the equipment shall be on the purchaser on and from the date Raven receives the purchasers request to postpone shipment.

**8. SHORTAGES** – Claims for shortages, damaged, or incorrect material must be made within ten (10) days after receipt of goods.

**9. MINIMUM BILLING CHARGE** – Orders amounting to less than \$50.00 will be billed at \$50.00.

**10. ACCEPTANCE OF ORDER** – All orders are subject to acceptance and approval by a principle officer of Raven.

**11. TITLE (Risk of loss)** – The purchaser agrees that Raven shall have a security interest in the equipment purchased until paid in full. The purchaser agrees to perform all acts necessary to protect the interests of Raven in the product until such interests are discharged by payment in full. Risk of loss of the equipment or any part of the same shall pass to the purchaser upon delivery of such equipment or parts, F.O.B. Raven's manufacturing facility.

**12. CANCELLATIONS** – An order once placed with and accepted by Raven can be canceled only with Raven's consent and upon terms which indemnify Raven against loss.

**13. WARRANTY** – This warranty expressly precludes any liability by Raven for consequential damages however arising after delivery to the purchaser of the affected equipment, and is limited to the expressed warranty, excluding all implied warranties including merchantability. All equipment manufactured by Raven is warranted against defective materials and workmanship for a period of two (2) years from the date of delivery to the original purchaser. Liability under this warranty is limited to servicing, adjusting, repairing or replacing, as necessary, any equipment returned to the factory, transportation prepaid for that purpose. Factory examination must disclose a manufacturing defect. Repaired or replaced items will be returned to the purchaser surface freight prepaid within the continental U.S.A.

This warranty does not extend to any equipment which has been subjected to transportation damage, misuse, neglect, accident, improper installation, or any other circumstances reasonably beyond the control of Raven. Repairs will be billed to the purchaser at cost. In such cases, an estimate will be submitted for approval before repair is initiated. Repaired equipment will be returned to the purchaser with transportation charges collect, unless otherwise agreed to between the purchaser and Raven.

**14. RETURN FOR CREDIT** – No equipment may be returned for credit until the company has obtained Raven's written approval for return authorization. Materials accepted for return is subject to a re-stocking charge of 15% of the current list price. All transportation charges will be borne by the purchaser. Orders for special non-stock equipment or items become non-cancelable upon initiation of production and are not returnable for credit.

**15. RETURNS FOR REPAIR** – Equipment returned for repair should be identified with a tag indicating the problem, and returned to Raven's repair service department. Special instructions, i.e., desired modifications, should be noted on the packing slip. Any equipment returned must be packaged to insure safe arrival at Raven. Items modified and/or programmed by customer for special features will be returned to standard Raven configuration, with time billed accordingly, unless modification and/or program instructions or documentation is provided and repairs have been agreed to by Raven.

**16. SERVICE** – Engineering assistance will be provided on request for permanently installed equipment, and billed at a nominal fee as agreed upon between Raven and the purchaser.

**17. APPLICABLE LAW** – The validity, performance, construction and interpretation of these terms and conditions shall be governed by the laws of the state of Nevada, United States of America and any litigation must take place in the state of Nevada.

**18. PROPRIETARY DATA** – Raven retains ownership and rights in all proprietary data disclosed to the purchaser by Raven in connection with this contract. Proprietary samples, software documents and/or drawings shall not be disclosed, reproduced, manufactured or made available to unauthorized persons in whole or in part or used to prepare the same or similar materials without the expressed written permission from Raven. Proprietary data includes all design, engineering, and technical information (whether patentable or not) and other information concerning Raven trade secrets not disclosed by inspection or analysis of the equipment itself.

**19. GOVERNMENT REQUIREMENTS** – Raven agrees to comply with all applicable state and federal laws, rules and regulations, and all obligations hereunder are subject to applicable government regulation, including those affecting or limiting prices (except price redetermination), production, purchases, sales, use or inventory of materials. If the equipment to be furnished is to the United States government, Raven agrees to comply with applicable requirements for such contracts, with respect to secrecy, use of convict labor, employment of aliens, non-discrimination, plant protection, espionage, sabotage, fair labor standards act of 1938, as amended, the service contract act of 1965 as amended and other provisions relative to hours and conditions of work, if and when applicable.

**20. MODIFICATION AND SUBSTITUTION** – Raven reserves the right to modify equipment of Raven design sold hereunder, and/or the drawings and specification related thereto, or to substitute equipment of later design to fulfill this contract, providing the modification or substitution will not materially affect the performance of the equipment or lessen in any way the utility of the equipment to the purchaser.

**21. DESIGN CHANGES** – Raven reserves the right to make design changes at any time without incurring any obligation to modify equipment previously sold.

**22. TERMS AND CONDITIONS** – The terms and conditions specified herein shall be in addition to those set out in the Raven proposal.



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