Raven Electronics Corporation

Raven 40100-4082
40200-208
41000-204
41000D-224

4-Wire Bridge,
2-Wire to 4-Wire Hybrid, and/or
Notch Filter Shelf

40200 (2ru) Model Shown

Users Manual

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CHAPTER 1 INTRODUCTION

General Information

Thank you for purchasing a Bridge/Hybrid/Notch Filter 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:

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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

40100-4082

The 40100-4082 Bridge/Hybrid/Notch Filter Shelf provides two mounting positions for the Raven 4-Wire/4-Way, 6-Way, 8-Way Active Bridges, 2-Wire to 4-Wire Hybrids, and/or Notch Filters. The 4-Way and 6-Way Bridges are pin compatible with the 8-Way Bridge so that the shelf is wired for the 8-Way capacity, yet is still compatible with the smaller Bridges. The two mounting positions are stand-alone except for power, which maintains isolation between the audio circuits routed through the two Bridges. Alternatively, two 8-Way Bridges could be "daisy chained" to one another to form a single bridge function of greater capacity (up to a fourteen-way conference bridge). This is done by wiring the external Leg Out/Leg In port of one bridge to the Leg In/Leg Out port of the other bridge. In a similar manner, the 4-wire side of the 2-Wire/4-Wire Hybrids or Notch Filters can be connected to a 4-wire port of a bridge externally. The 40100D-4082 operates from a –24 to –56 VDC source, while the 40100A-4082 operates from a 110 or 220 VAC source.

The modules that can be installed in the shelf are the 41685 4-Wire/4-Way Active Bridge, the 41685-01 4-Wire/6-Way Active Bridge, the 41688 4-Wire/8-Way Active Bridge, the 41690 2-Wire to 4-Wire Hybrid, or the 41667 Notch Filters. Any combination of these modules can be installed in the 40100-4082 Bridge/Hybrid/Notch Filter Shelf. Maximum capacity is two modules per chassis. 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.

40100-4082-40X and -44X

Options -40X and -44X are the same as the 40100-4082 with set options. The -40X has one 41685 Active Bridge Module installed. It also includes a 42067 Extender Board. The -44X has two 41685 Active Bridge Modules installed. It too includes a 42067 Extender Board.

40200-208

The model 40200-208 Bridge/Hybrid Shelf has eight mounting positions for the Raven 4-Wire/4-Way, 6-Way, 8-Way Active Bridges, 2-Wire to 4-Wire Hybrids, and Notch Filters. The 4-Way and 6-Way Bridges are pin compatible with the 8-Way Bridge so that the shelf is wired for the 8-Way capacity, yet is still compatible with the smaller Bridges. The eight mounting positions are stand-alone except for power, which maintains isolation between the audio circuits routed through the eight Bridges. Alternatively, eight 8-Way Bridges could be "daisy chained" to one another to form a single bridge function of greater capacity (up to a 50-way conference bridge). This is done by wiring the external Leg Out/Leg In port of one bridge to the Leg In/Leg Out port of the next bridge and so on until all eight bridges (or however many are installed in the shelf). In a similar manner, the 4-wire side of the 2-Wire/4-Wire hybrids can be connected to a 4-wire port of a bridge externally. The 40200D-208 operates from a –24 to –56 VDC source, while the 40200A-208 operates from a 100 to 250 VAC source.

Any combination of the above mentioned modules can be installed in the 40200-208 shelf. Maximum capacity is eight modules per chassis. All of these are active modules 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.

41000-204
The 41000-204 Bridge/Hybrid/Notch Filter Shelf provides interface between the Raven 4-wire/4-Way, 6-Way, 8-Way Active Bridges, 2-Wire to 4-Wire Hybrid modules, or 4-Wire Notch Filter modules for fifteen individual circuits. Each module is wired to rear panel connectors, with only the power source being shared by the individual modules. Thus isolation is maintained between the circuits. Bridges may be connected together externally to form longer bridges where necessary.

All inputs and outputs are transformer coupled for maximum isolation and common mode rejection. Amplifiers with potentiometer level adjustment are provided on each input and output for easy level coordination between ports. For 4-Way or 6-Way Bridges, 2-Wire/4-Way Hybrid modules, and Notch filters there are unused pins on the rear panel connectors.

The modules that can be installed in the shelf are the 41685 4-Wire/4-Way Active Bridge, the 41685-01 4-Wire/6-Way Active Bridge, the 41688 4-Wire/8-Way Active Bridge, the 41690 2-Wire to 4-Wire Hybrid, or the 41667 Notch Filters. Any combination of these modules can be installed in the 41000-204 Bridge/Hybrid/Notch Filter Shelf. Maximum capacity is fifteen modules per chassis. 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-224
The 41000D-224 Bridge/Hybrid/Notch Filter Shelf provides interface between the Raven 4-Wire/4-Way, 6-Way, 8-Way Active Bridges, 2-Wire to 4-Wire Hybrid modules, or 4-Wire Notch Filter modules for eleven individual circuits. Each module is wired to rear panel connectors, with only the power source being shared by the individual modules. Thus isolation is maintained between the circuits. Bridges may be connected together externally to form longer bridges where necessary. This Shelf also provides redundant power supplies with an internal 41678 Relay module to monitor the status of the power supplies and will give a relay closure should one of the power supplies fail.

All inputs and outputs are transformer coupled for maximum isolation and common mode rejection. Amplifiers with potentiometer level adjustment are provided on each input and output for easy level coordination between ports. For 4-Way or 6-Way Bridges, Hybrid modules, and Notch filters there are unused pins on the rear panel connectors. ***Note: All unused ports for the 41688 with MOD 169 must be terminated.***

The modules that can be installed in the shelf are the 41685 4-Wire/4-Way Active Bridge, the 41685-01 4-Wire/6-Way Active Bridge, the 41688 4-Wire/8-Way Active Bridge, the 41690 2-Wire to 4-Wire Hybrid, or the 41667 Notch Filters. Any combination of these modules can be installed in the 41000-224 Bridge/Hybrid/Notch Filter Shelf. Maximum capacity is eleven modules per chassis. 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 Module(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.

41667 Notch Filter
The Raven 41667 Quad Notch Filter module can remove a single frequency within the normal pass baud. For frequencies outside the notch frequency, the level is adjustable over a 23dB range. The notch frequency is customer specified. The notch will be at least 50 dB down. The module is provided with one, two, three, or four filter circuits.

41678 Relay
The Raven 41678 Relay module provides relay contact closures for use by external equipment.

41685 4-Wire/4-Way 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 4-Wire/6-Way 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 4-Wire/8-Way 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.

41688 MOD 169 4-Wire/8-Way Bridge with MOD 169 (Removes Input Load Resistors)
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. ***Note: All unused ports for this module must be terminated.***

41690 2-Wire to 4-Wire Hybrid
The Raven 41690 Quad 2-Wire to 4-Wire Hybrid module provides bi-directional access between a 2-wire line and a 4-wire network. The levels of the transmit and receive paths are each adjustable over a 23 dB range. The 41690 module is always ON, passing signals between the 2-wire line and the 4-wire circuits. The module is provided with one, two, three, or four 2-wire to 4-wire hybrid circuits.

Equipment Needed for Installation

Rackmount Equipment (to install unit in a rack):

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

Audio Connections:

- 24-Gauge Twisted Pair Wire

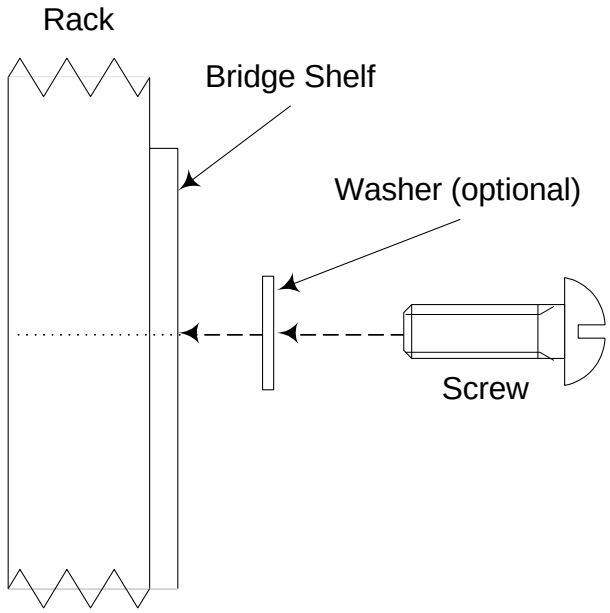
Power Connections:

- 18-Gauge Wire

Mounting Unit in Rack

Please note, Raven supplies the hardware for the mounting on the chassis, but not on the rack. The flanges included with your 40100-4082 Bridge Shelf are not interchangeable between 19" and 23". The flanges included with your 40200-208 and/or 41000-204 are interchangeable between 19" and 23". Please specify the flange size needed when ordering a 40100-4082 shelf.

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.) It is best to start at the bottom of the unit.*
3. Repeat Step 2 until all four screws are in place.



Hooking Up Connections

With the source power turned off, use the following instructions to hook up your Bridge/Hybrid/Notch Filter Shelf. A small (1/8" blade) flat blade screwdriver is needed to loosen and tighten the terminal screws. It is not necessary to use lugs on the wires. Strip the wire(s) about 3/8", loosen the terminal screw, insert the wire, then tighten the screw. You may refer to the charts below (*also found in Table B*).

Be sure Power is turned OFF.

Quad Notch Filter Connections

FUNCTION	50-PIN TELCO or R250-0020 or R250-0021	R250-0023 WIRES	40100-4082 TERMINALS MODULE 1	S66 PUNCH BLOCK PIN NUMBERS
Filter 1 Inputs	2, 27	WHT/ORG & ORG/WHT	B1, B2	3, 4
Filter 1 Outputs	1, 26	WHT/BLU & BLU/WHT	C1, C2	1, 2
Filter 2 Inputs	5, 30	WHT/GRY & GRY/WHT	B3, B4	9, 10
Filter 2 Outputs	4, 29	WHT/BRN & BRN/WHT	C3, C4	7, 8
Filter 3 Inputs	8, 33	RED/GRN & GRN/RED	B5, B6	15, 16
Filter 3 Outputs	7, 32	RED/ORG & ORG/RED	C5, C6	13, 14
Filter 4 Inputs	11, 36	BLK/BLU & BLU/BLK	B7, B8	21, 22
Filter 4 Outputs	10, 35	RED/GRY & GRY/RED	C7, C8	19, 20

POWER

FUNCTION	REAR TERMINAL CONNECTIONS	REAR TERMINAL CONNECTIONS	REAR TERMINAL CONNECTIONS	SUGGESTED WIRE
GND	A1 or SJ1 Center	A1 or SJ9 Center	A1 or SJ16 Center	18 GA
-VDC In	A2 or SJ1 Sleeve	A2 or SJ9 Sleeve	A2 or SJ16 Sleeve	

50-PIN TELCO, R250-0020, and R250-0021 are connections on 40200-208 or 41000-204 shelves.

R250-0023 are connections at the wire-end of a cable plugged into 40200-208 or 41000-204 shelves.

40100-4082 connections are to screw terminals on the rear panel.

S66 Punch Blocks are pre-wired for use with R250-0021 Male-Male cables. Pins are counted from the top when the block is mounted with the UP sign pointing at the top.

For connections to Filter Module 2 on the 40100-4082, use terminal blocks D and E with the same terminal numbers.

Please see pages 24-27 for rear panel diagrams.

Note: Only relays 1, 2, and 5 are available on Bridge Shelf connections. Relay 1 is normally open only. Relay 2 is normally closed only. Relay 5 has both normally open and normally closed contacts available. Two poles are available on all three relays labeled "A" and "B".

RELAY CONNECTIONS

(For Model 41000D-224 Only)

FUNCTION	50-PIN TELCO or R250-0020 or R250-0021	R250-0023 WIRES	S66 PUNCH BLOCK PIN NUMBERS
A N.O.	23, 48	GRN/VIO & VIO/GRN	46, 45
B N.O.	1, 26	WHT/BLU & BLU/WHT	2, 1
RELAY 1 COIL	4	BRN/WHT	8
A N.C.	17, 45	ORG/YEL & YEL/GRY	39, 34
B N.C.	7, 29	ORG/RED & WHT/BRN	14, 7
RELAY 2 COIL	32	RED/ORG	13
A N.C.	5	GRY/WHT	10
A N.O.	30	WHT/GRY	9
A COM	2	ORG/WHT	4
B N.C.	19	BRN/YEL	38
B N.O.	44	YEL/BRN	37
B COM	22	ORG/VIO	44
RELAY 5 COIL	47	VIO/ORG	43

Note: In the 41000D-224, the 41678 Relay module is installed in Slot 12.

50-PIN TELCO, R250-0020 Male-Female cable, and R250-0021 Male-Male cable are connections on the 41000D-224 shelf.

R250-0023 are connections at the wire end of a cable plugged into the 41000D-224 shelf.

S66 Punch Blocks are pre-wired for use with R250-0021 Male-Male cable, pins are counted from the top when the block is mounted with the UP sign pointing at the top.

Please see page 27 for a rear panel diagram.

4-, 6-, or 8-Way Bridge Connections

FUNCTION	50-PIN TELCO or R250-0020 or R250-0021	R250-0023 WIRES	40100-4082 TERMINALS MODULE 1	S66 PUNCH BLOCK PIN NUMBERS
Port 1 Inputs	2, 27	WHT/ORG & ORG/WHT	B1, B2	3, 4
Port 1 Outputs	1, 26	WHT/BLU & BLU/WHT	C1, C2	1, 2
Port 2 Inputs	5, 30	WHT/GRY & GRY/WHT	B3, B4	9, 10
Port 2 Outputs	4, 29	WHT/BRN & BRN/WHT	C3, C4	7, 8
Port 3 Inputs	8, 33	RED/GRN & GRN/RED	B5, B6	15, 16
Port 3 Outputs	7, 32	RED/ORG & ORG/RED	C5, C6	13, 14
Port 4 Inputs	11, 36	BLK/BLU & BLU/BLK	B7, B8	21, 22
Port 4 Outputs	10, 35	RED/GRY & GRY/RED	C7, C8	19, 20
Port 5 Inputs	14, 39	BLK/BRN & BRN/BLK	B9, B10	27, 28
Port 5 Outputs	13, 38	BLK/GRN & GRN/BLK	C9, C10	25, 26
Port 6 Inputs	17, 42	YEL/ORG & ORG/YEL	B11, B12	33, 34
Port 6 Outputs	16, 41	YEL/BLU & BLU/YEL	C11, C12	31, 32
Port 7 Inputs	20, 45	YEL/GRY & GRY/YEL	B13, B14	39, 40
Port 7 Outputs	19, 44	YEL/BRN & BRN/YEL	C13, C14	37, 38
Port 8 Inputs	23, 48	VIO/GRN & GRN/VIO	B15, B16	45, 46
Port 8 Outputs	22, 47	VIO/ORG & ORG/VIO	C15, C16	43, 44

POWER

FUNCTION	REAR TERMINAL CONNECTIONS	REAR TERMINAL CONNECTIONS	REAR TERMINAL CONNECTIONS	SUGGESTED WIRE
GND	A1 or SJ1 Center	A1 or SJ9 Center	A1 or SJ16 Center	18 GA
-VDC In	A2 or SJ1 Sleeve	A2 or SJ9 Sleeve	A2 or SJ16 Sleeve	

50-PIN TELCO, R250-0020, and R250-0021 are connections on 40200-208 or 41000-204 shelves.

R250-0023 are connections at the wire-end of a cable plugged into 40200-208 or 41000-204 shelves.

40100-4082 connections are to screw terminals on the rear panel.

S66 Punch Blocks are pre-wired for use with R250-0021 Male-Male cables. Pins are counted from the top when the block is mounted with the UP sign pointing at the top.

For connections to Bridge Module 2 on the 40100-4082, use terminal blocks D and E with the same terminal numbers.

Please see pages 24-27 for rear panel diagrams.

Quad 2-Wire to 4-Wire Hybrid Connections

FUNCTION	50-PIN TELCO or R250-0020 or R250-0021	R250-0023 WIRES	40100-4082 TERMINALS MODULE 1	S66 PUNCH BLOCK PIN NUMBERS
Hybrid 1 Inputs	2, 27	WHT/ORG & ORG/WHT	B1, B2	3, 4
Hybrid 1 Outputs	1, 26	WHT/BLU & BLU/WHT	C1, C2	1, 2
2-Wire Line 1	22, 47	VIO/ORG & ORG/VIO	C15, C16	43, 44
Hybrid 1 LBO	14, 39	BLK/BRN & BRN/BLK	B9, B10	27, 28
Hybrid 2 Inputs	5, 30	WHT/GRY & GRY/WHT	B3, B4	9, 10
Hybrid 2 Outputs	4, 29	WHT/BRN & BRN/WHT	C3, C4	7, 8
2-Wire Line 2	19, 44	YEL/BRN & BRN/YEL	C13, C14	37, 38
Hybrid 2 LBO	17, 42	YEL/ORG & ORG/YEL	B11, B12	33, 34
Hybrid 3 Inputs	8, 33	RED/GRN & GRN/RED	B5, B6	15, 16
Hybrid 3 Outputs	7, 32	RED/ORG & ORG/RED	C5, C6	13, 14
2-Wire Line 3	16, 41	YEL/BLU & BLU/YEL	C11, C12	31, 32
Hybrid 3 LBO	20, 45	YEL/GRY & GRY/YEL	B13, B14	39, 40
Hybrid 4 Inputs	11, 36	BLK/BLU & BLU/BLK	B7, B8	21, 22
Hybrid 4 Outputs	10, 35	RED/GRY & GRY/RED	C7, C8	19, 20
2-Wire Line 4	13, 38	BLK/GRN & GRN/BLK	C9, C10	25, 26
Hybrid 4 LBO	23, 48	VIO/GRN & GRN/VIO	B15, B16	45, 46

POWER

FUNCTION	REAR TERMINAL CONNECTIONS	REAR TERMINAL CONNECTIONS	REAR TERMINAL CONNECTIONS	SUGGESTED WIRE
GND -VDC In	A1 or SJ1 Center A2 or SJ1 Sleeve	A1 or SJ9 Center A2 or SJ9 Sleeve	A1 or SJ16 Center A2 or SJ16 Sleeve	18 GA

50-PIN TELCO, R250-0020, and R250-0021 are connections on 40200-208 or 41000-204 shelves.

R250-0023 are connections at the wire-end of a cable plugged into 40200-208 or 41000-204 shelves.

40100-4082 connections are to screw terminals on the rear panel.

S66 Punch Blocks are pre-wired for use with R250-0021 Male-Male cables. Pins are counted from the top when the block is mounted with the UP sign pointing at the top.

For connections to Hybrid Module 2 on the 40100-4082, use terminal blocks D and E with the same terminal numbers.

Please see pages 24-27 for rear panel diagrams.

Powering Up the Shelf

Reinstall the module(s), if previously removed, before performing the following steps. Also, make sure the source power supply is turned off. Steps 1-6 apply to the DC powered model only. If using AC power, skip to step 7.

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.
7. If using AC powered version, plug the DC jack of the external power supply in to SJ1 (40100-4082), SJ9 (40200-208), or SJ16 (41000-204) on the rear panel. Refer to pages 22-24 for a rear panel view.

Troubleshooting and Alignment Procedures

Equipment Needed for Troubleshooting and Alignment:

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

Every 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 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 unit 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 unit 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 T and U (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 unit 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 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 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 41685 8W/4W Active Bridge in its position.

Troubleshooting and Alignment Procedures (cont.)

NOTE: This unit 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.

41667 Notch Filter Level

1. Turn power off. Remove the 41667 Notch Filter module and insert a 42067 Extender Card into the module position. Insert the 41667 Notch Filter 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 700 Hz or another frequency well away from the notch frequency. Set the signal generator frequency to the level specified by Attachment A. Connect the AC voltmeter (terminate with 600 ohms, if required) to pins D and E (LEG 1 OUT) on the Extender Card. Read the level specified by Attachment A. Adjust R15 on the 41667 Notch Filter for the output level indicated in Attachment A, if required.
3. Set the signal generator frequency to the notch frequency specified by Attachment A. (A frequency counter will be useful here as the notch is very narrow and the generator frequency must be set to the notch frequency within less than 1 Hz.)
4. Adjust R47 for a minimum output. Then adjust R19 for a minimum output. (It will be necessary to adjust the AC voltmeter to lower levels so that the notch level will be easily seen.) These controls do not interact. The final filter rejection at the notch frequency should be greater than 50 dB.
5. For the other Notch Filters on this module, consult Table 1 for pins to connect to and the controls to adjust.
6. Disconnect all test equipment and turn power off. Remove the Extender Card and install the 41667 Notch Filter in its position.

Table 1

Filter Sections

FILTER	INPUT PIN #	NOTCH ADJUST POT	NOTCH ADJUST POT
1	21, 22	R47	R19
2	19, 20	R50	R22
3	16, 17	R53	R29
4	14, 15	R56	R36

Output Amplifier

FILTER	OUTPUT PIN #	ADJUST POT
1	D, E	R15
2	F, H	R22
3	K, L	R29
4	M, N	R36

Troubleshooting and Alignment Procedures *(cont.)*

NOTE: ***This unit 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.***

41690 2-Wire to 4-Wire Hybrid Level

1. Turn power off. Remove the 41690 Hybrid module and insert a 42067 Extender Card into the module position. Insert the 41690 Hybrid into the Extender Card. Turn power on.
2. Connect the signal generator to pins 21 and 22 (Hybrid 1) on the Extender Card. Set the signal generator frequency to 1 KHz at the level specified by Attachment A for input. Connect the AC voltmeter (terminate with 600 ohms, if required) to pins Y and Z.
3. Read the level specified by Attachment A for Hybrid 1 2-Wire line output. Adjust R7 for a level of 0 dBm. Remove the signal generator from pins 21 and 22.
4. Connect the signal generator to pins Y and Z. Set the signal generator frequency to 1 KHz at a level of 0 dBm. Connect the AC voltmeter (terminate with 600 ohms, if required) to pins D and E.
5. Read the level specified by Attachment A for Hybrid 1 4-Wire Output. Adjust R2, if required.
6. Connect the signal generator to pins 21 and 22 (Hybrid 1) on the Extender Card. Set the signal generator frequency to 1 KHz at the level specified by Attachment A for 4-Wire line Input. Make sure there is a single 600 ohm load on the 2-wire line. Adjust R11 for a minimum reading on the AC Voltmeter. The reading obtained should be greater than 25 dB down from the output level specified by Attachment A.

   In some cases, hybrid balance will be improved by switching in capacitors in the balance circuit. Start by turning on Position 1 of SW1 and readjust R11 for a minimum reading. Additional capacitors may be switched on as needed. Always adjust the hybrid balance pot for minimum reading on the output meter.
7. For the other Hybrids on this module, consult Table 2 for pins to connect to and the controls to adjust.
8. Disconnect all test equipment and turn power off. Remove the Extender Card and install the 41690 Hybrid in its position.

Table 2

HYBRID	RCV IN	POT	XMT OUT	POT	2-WIRE LINE	HYBRID POT	SWITCH
1	21, 22	R7	D, E	R2	Y, Z	R11	SW1
2	19, 20	R19	F, H	R14	W, X	R23	SW2
3	16, 17	R31	K, L	R26	T, U	R35	SW3
4	14, 15	R43	M, N	R38	R, S	R47	SW4

Specifications

40100-4082 Bridge/Hybrid/Notch Filter Shelf

POWER REQUIREMENT	-24 to -56 VDC input power or 110/220 VAC, 47-63 Hz
CURRENT DRAIN	110 mA (max) with DC power 10 watts max with AC power
4-WIRE INTERFACE	
* **Line Impedance (XMT & RCV)**	600, 75 ohms or customer specified
* **Levels (XMT & RCV)**	-46 to +7 dBm, adjustable
Frequency Response	+1, -3 dBm0 (300 Hz to 20 KHz, bridges only)
† **Crosstalk (RCV & XMT)**	Less than –50 dBm0 at unity gain (300 Hz to 20 KHz, bridges only)
2-WIRE LEVEL	0 dBm (nominal) @ 600Ω
Hybrid	
Trans-Hybrid Loss	>30 dB
Longitudinal Balance	>60 dB
Notch Filter	
* **Notch Frequency**	Customer Specified
Notch Depth	>50 dB
ENVIRONMENTAL	
Operating Temperature	0°C to +50°C
Storage Temperature	-50°C to +80°C
Relative Humidity	0 to 95% non-condensing
Operating Altitude	15,000 ft max (4572 meters)
DIMENSIONS	
Width (Standard)	19.00 inches rackmount (48.26 cm)
(Optional)	23.00 inches rackmount (58.42 cm)
Depth	14.75 inches (37.465 cm)
Height	1.75 inches (4.445 cm) (1 ru)
WEIGHT (max)	12 pounds max. (5.44 kg)

* *Customer Specified*

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

Specifications

40200-208 Bridge/Hybrid/Notch Filter Shelf

POWER REQUIREMENT	-24 to -56 VDC input power or 110/220 VAC, 47-63 Hz
CURRENT DRAIN	500 mA max for DC input 25 watts max for AC input
4-WIRE INTERFACE	
* **Line Impedance (XMT & RCV)**	600, 75 ohms or customer specified
* **Levels (XMT & RCV)**	-46 to +7 dBm, adjustable
Frequency Response	+1, -3 dBm0 (300 Hz to 20 KHz, bridges only)
† **Crosstalk (RCV & XMT)**	Less than –50 dBm0 at unity gain (300 Hz to 20 KHz, bridges only)
2-WIRE LEVEL	0 dBm (nominal) @ 600Ω
Hybrid	
Trans-Hybrid Loss	>30 dB
Longitudinal Balance	>60 dB
Notch Filter	
* **Notch Frequency**	Customer Specified
Notch Depth	>50 dB
ENVIRONMENTAL	
Operating Temperature	0°C to +50°C
Storage Temperature	-50°C to +80°C
Relative Humidity	0 to 95% non-condensing
Operating Altitude	15,000 ft max (4572 meters)
DIMENSIONS	
Width (Standard)	19.00 inches rackmount (48.26 cm)
(Optional)	23.00 inches rackmount (58.42 cm)
Depth	14.75 inches (37.465 cm)
Height	3.5 inches (8.9 cm) (2 ru)
WEIGHT (max)	14 pounds max. (6.36 kg)

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

Specifications

41000-204 Bridge/Hybrid/Notch Filter Shelf

POWER REQUIREMENT	-24 to -56 VDC input power or 110/220 VAC, 47-63 Hz
CURRENT DRAIN	1.00 Amp max for DC input 25 watts max for AC input
4-WIRE INTERFACE	
* **Line Impedance (XMT & RCV)**	600, 75 ohms or customer specified
* **Levels (XMT & RCV)**	-46 to +7 dBm, adjustable
Frequency Response	+1, -3 dBm0 (300 Hz to 20 KHz, bridges only)
† **Crosstalk (RCV & XMT)**	Less than –50 dBm0 at unity gain (300 Hz to 20 KHz, bridges only)
2-WIRE LEVEL	0 dBm (nominal) @ 600Ω
Hybrid	
Trans-Hybrid Loss	>30 dB
Longitudinal Balance	>60 dB
Notch Filter	
* **Notch Frequency**	Customer Specified
Notch Depth	>50 dB
ENVIRONMENTAL	
Operating Temperature	0°C to +50°C
Storage Temperature	-50°C to +80°C
Relative Humidity	0 to 95% non-condensing
Operating Altitude	15,000 ft max (4572 meters)
DIMENSIONS	
Width (Standard)	19.00 inches rackmount (48.26 cm)
(Optional)	23.00 inches rackmount (58.42 cm)
Depth	14.75 inches (37.465 cm)
Height	5.25 inches (13.335 cm) (3 ru)
WEIGHT (max)	25 pounds max. (11.34 kg)

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

Specifications

41000-224 Bridge/Hybrid/Notch Filter Shelf

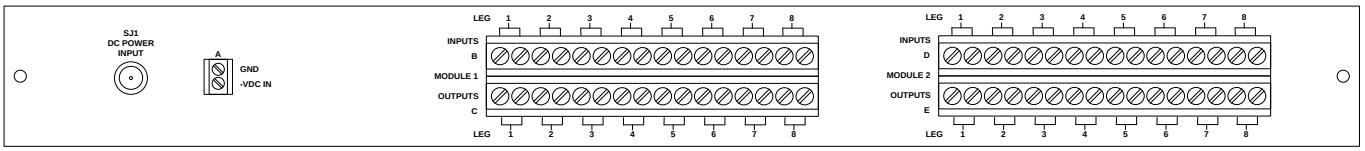
POWER REQUIREMENT	-24 to -56 VDC input power or 110/220 VAC, 47-63 Hz
CURRENT DRAIN	1.00 Amp max for DC input 25 watts max for AC input
4-WIRE INTERFACE	
* **Line Impedance (XMT & RCV)**	600, 75 ohms or customer specified
* **Levels (XMT & RCV)**	-46 to +7 dBm, adjustable
Frequency Response	+1, -3 dBm0 (300 Hz to 20 KHz, bridges only)
† **Crosstalk (RCV & XMT)**	Less than –50 dBm0 at unity gain (300 Hz to 20 KHz, bridges only)
2-WIRE LEVEL	0 dBm (nominal) @ 600Ω
Hybrid	
Trans-Hybrid Loss	>30 dB
Longitudinal Balance	>60 dB
Notch Filter	
* **Notch Frequency**	Customer Specified
Notch Depth	>50 dB
ENVIRONMENTAL	
Operating Temperature	0°C to +50°C
Storage Temperature	-50°C to +80°C
Relative Humidity	0 to 95% non-condensing
Operating Altitude	15,000 ft max (4572 meters)
DIMENSIONS	
Width (Standard)	19.00 inches rackmount (48.26 cm)
(Optional)	23.00 inches rackmount (58.42 cm)
Depth	14.75 inches (37.465 cm)
Height	5.25 inches (13.335 cm) (3 ru)
WEIGHT (max)	25 pounds max. (11.34 kg)

* *Customer Specified*

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

40100-4082 Front Panel

40100-4082 Back Panel Diagram

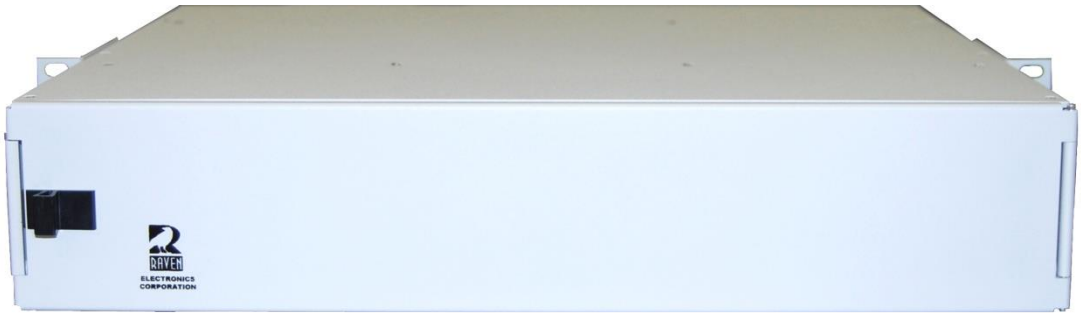


REAR PANEL VIEW

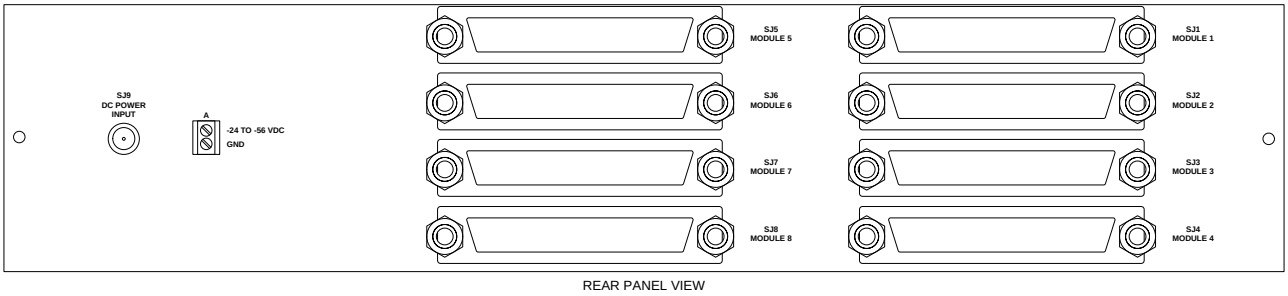
40100-4082 Bridge/Hybrid/Notch Filter Shelf
(Rear View)

Not drawn to scale.

40200-208 Front Panel



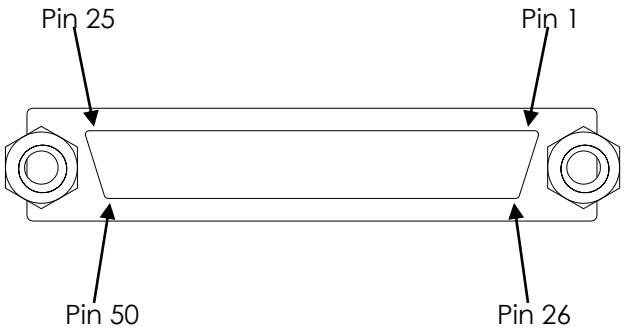
40200-208 Back Panel Diagram



40200-208 Bridge/Hybrid/Notch Filter Shelf
(Rear View)

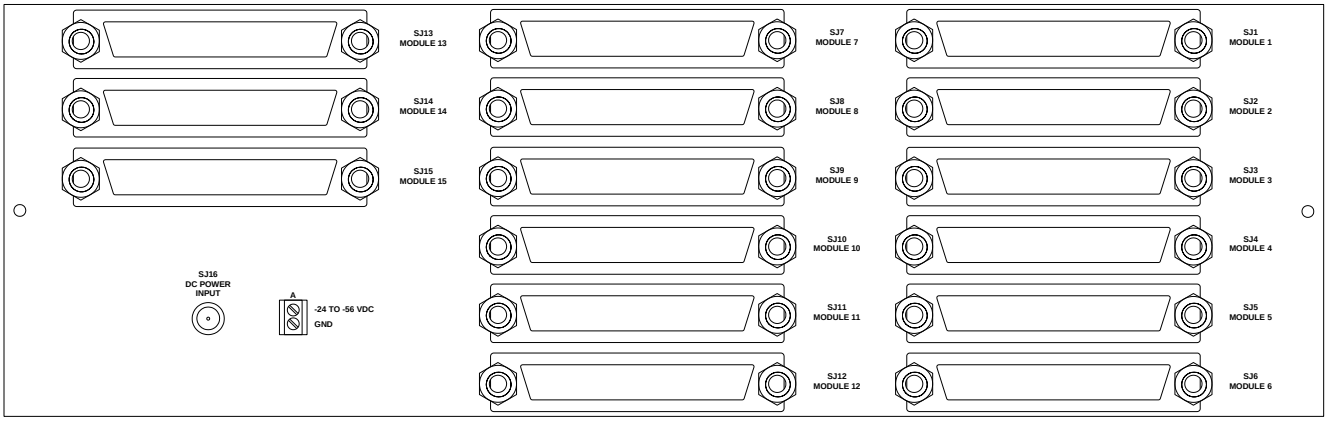
Not drawn to scale.

50-Pin Connector Pin-Out Diagram



41000-204 Front Panel

41000-204 Back Panel Diagram

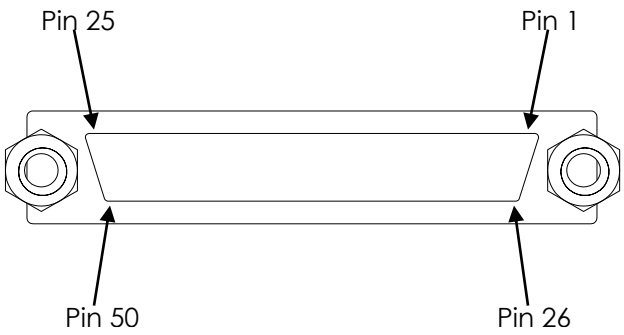


REAR PANEL VIEW

41000-204 Bridge/Hybrid/Notch Filter Shelf
(Rear View)

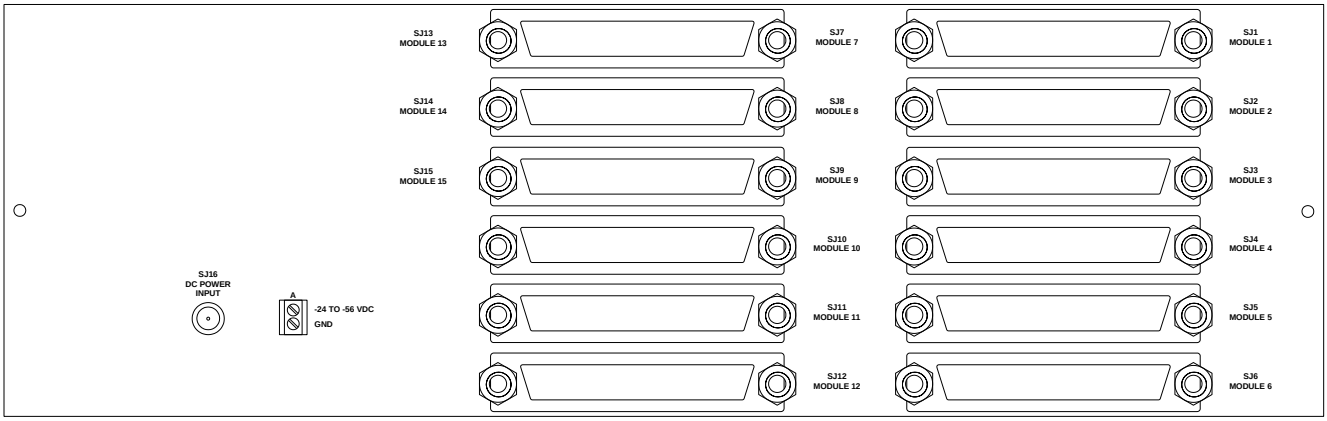
Not drawn to scale.

50-Pin Connector Pin-Out Diagram



41000-224 Front Panel

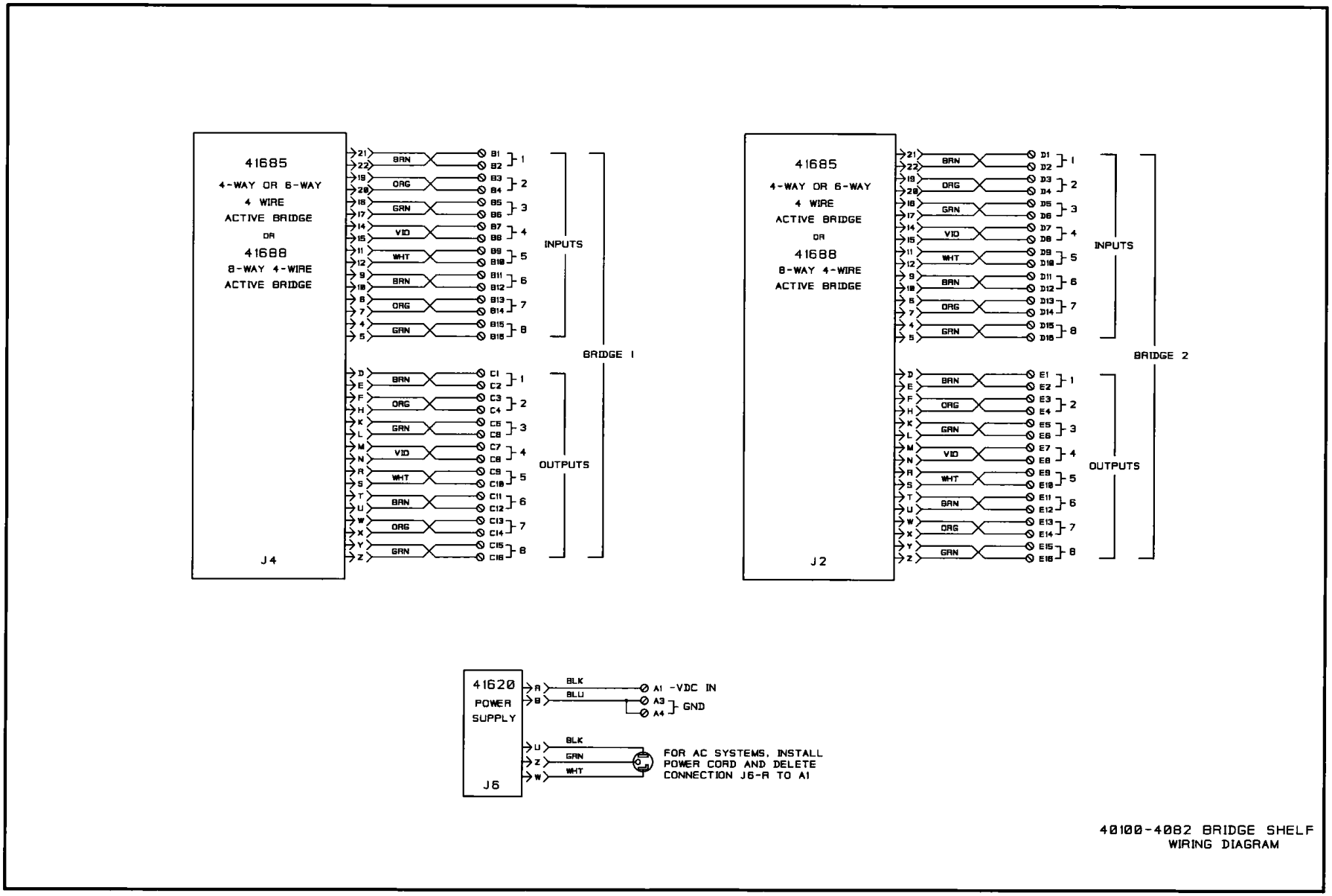
41000-224 Back Panel Diagram

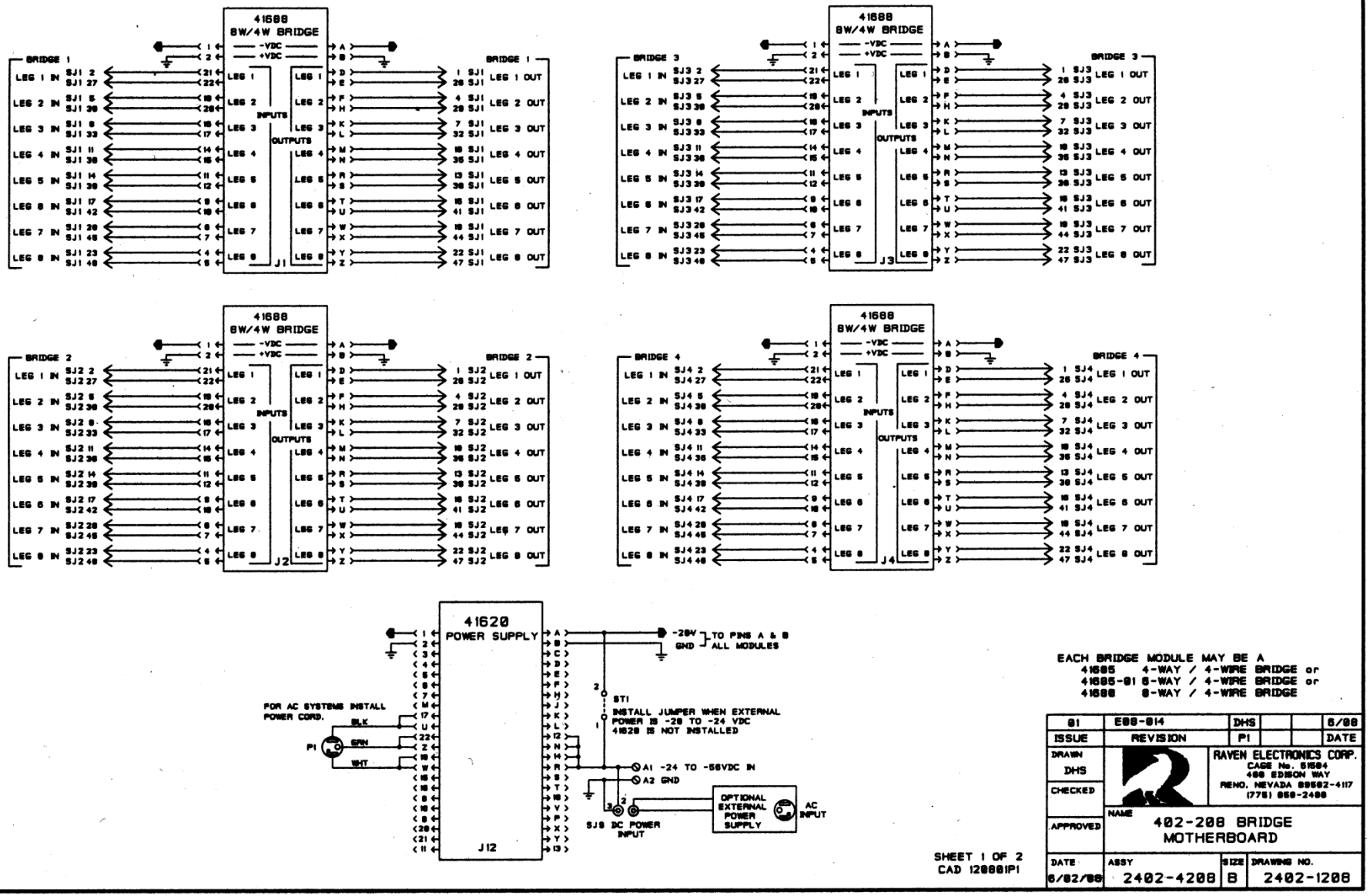


REAR PANEL VIEW

41000-224 Bridge/Hybrid/Notch Filter Shelf with Redundant Power Supplies
(Rear View) Not drawn to scale.

50-Pin Connector Pin-Out Diagram


41685
4-WAY OR 6-WAY
4 WIRE
ACTIVE BRIDGE
OR
41688
8-WAY 4-WIRE
ACTIVE BRIDGE
J4
INPUTS
OUTPUTS
BRIDGE 1
41685
4-WAY OR 6-WAY
4 WIRE
ACTIVE BRIDGE
OR
41688
8-WAY 4-WIRE
ACTIVE BRIDGE
J2
INPUTS
OUTPUTS
BRIDGE 2
41620
POWER
SUPPLY
J6
-VDC IN
GND
FOR AC SYSTEMS, INSTALL
POWER CORD AND DELETE
CONNECTION J6-R TO A1
40100-4082 BRIDGE SHELF
WIRING DIAGRAM



EACH BRIDGE MODULE MAY BE A
41685 4-WAY / 4-WIRE BRIDGE or
41685-01 8-WAY / 4-WIRE BRIDGE or
41688 8-WAY / 4-WIRE BRIDGE

01	E88-814	DHS			6/88
ISSUE	REVISION	PI			DATE

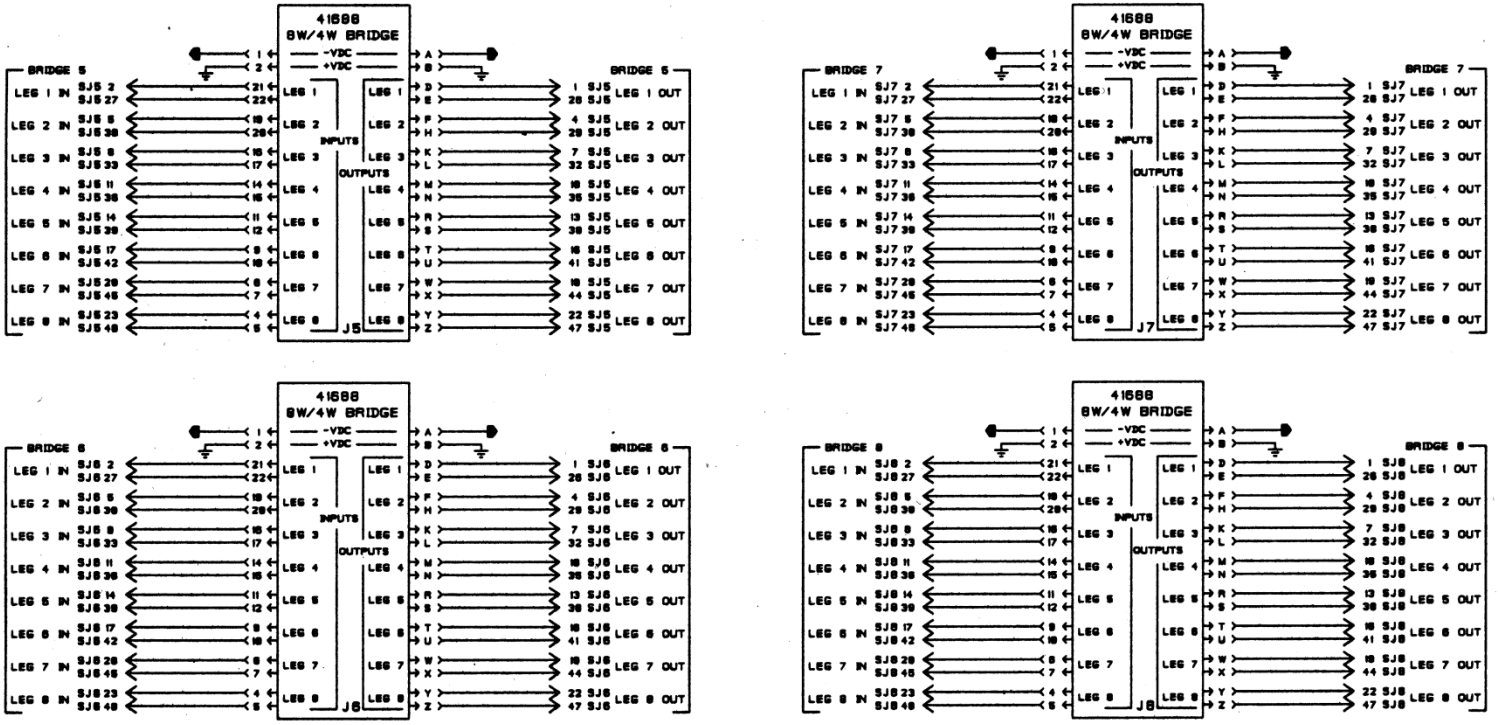
DRAWN: DHS
CHECKED:
APPROVED:
DATE: 6/02/88

RAVEN ELECTRONICS CORP.
CAGE No. 51584
496 EDISON WAY
RENO, NEVADA 89502-4117
(775) 858-2488

NAME: 402-208 BRIDGE MOTHERBOARD

ASSY: 2402-4208 | SIZE: B | DRAWING NO.: 2402-1208

SHEET 1 OF 2
CAD 12888IP1

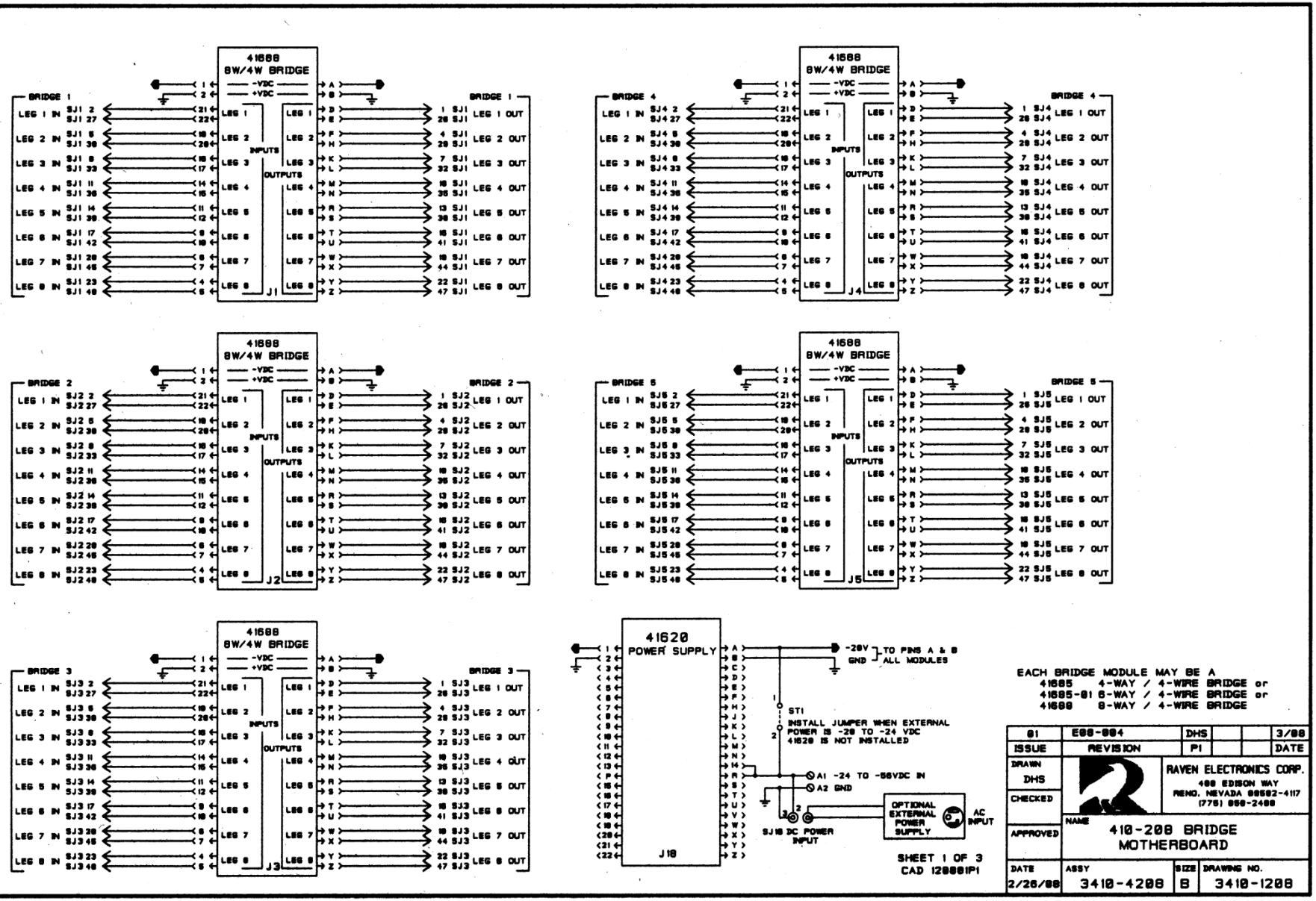


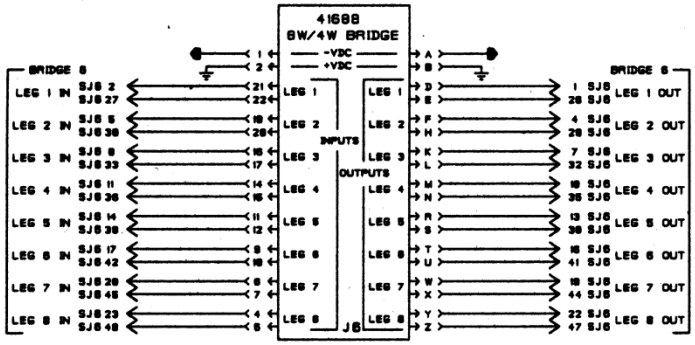
EACH BRIDGE MODULE MAY BE A
41685 4-WAY / 4-WIRE BRIDGE or
41685-01 6-WAY / 4-WIRE BRIDGE or
41688 8-WAY / 4-WIRE BRIDGE

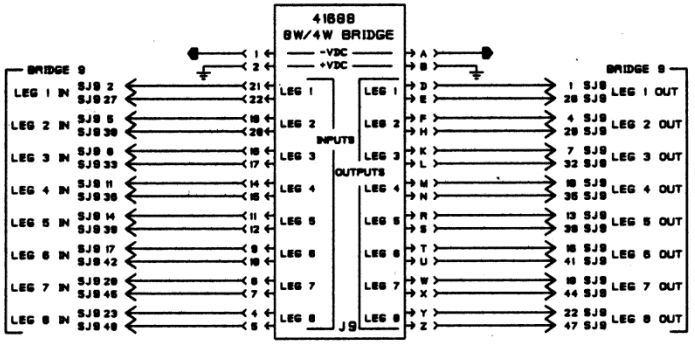
01	E88-814	DHS			6/88
ISSUE	REVISION	PI			DATE
DRAWN DHS	RAVEN ELECTRONICS CORP. CAGE No. 51904 400 EDISON WAY RENO, NEVADA 89502-4117 (775) 858-2400				
CHECKED					
APPROVED	NAME 402-208 BRIDGE MOTHERBOARD				
DATE 6/02/88	ASSY 2402-4208	SIZE B	DRAWING NO. 2402-1208		

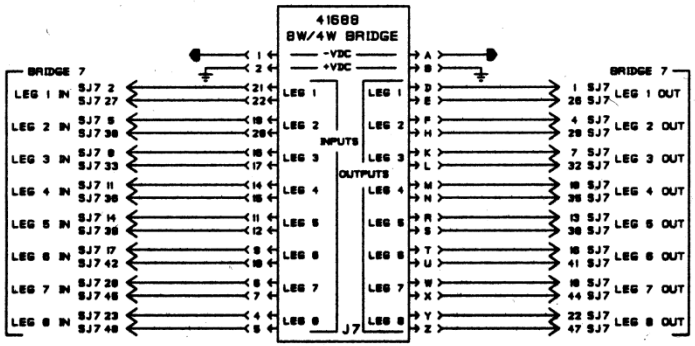
SHEET 2 OF 2

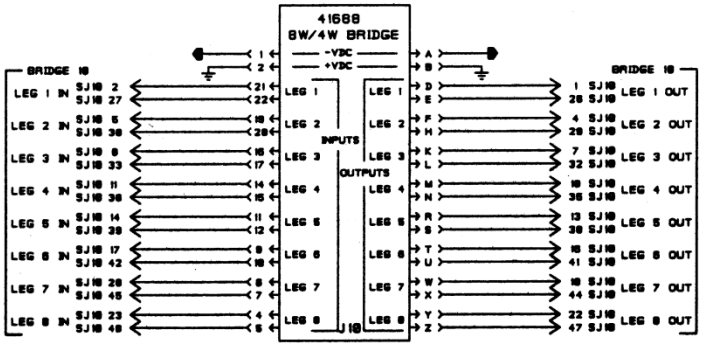
CAD 12888IP1

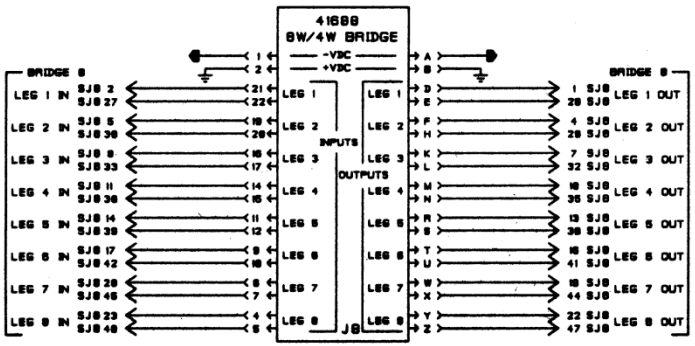

41688
8W/4W BRIDGE
-VDC
+VDC
INPUTS
OUTPUTS
BRIDGE 1
LEG 1 IN
LEG 2 IN
LEG 3 IN
LEG 4 IN
LEG 5 IN
LEG 6 IN
LEG 7 IN
LEG 8 IN
LEG 1 OUT
LEG 2 OUT
LEG 3 OUT
LEG 4 OUT
LEG 5 OUT
LEG 6 OUT
LEG 7 OUT
LEG 8 OUT
J1
BRIDGE 4
J4
BRIDGE 2
J2
BRIDGE 5
J5
BRIDGE 3
J3
41620
POWER SUPPLY
J18
-28V
GND
TO PINS A & B
ALL MODULES
STI
INSTALL JUMPER WHEN EXTERNAL
POWER IS -28 TO -24 VDC
41620 IS NOT INSTALLED
A1 -24 TO -56VDC IN
A2 GND
OPTIONAL
EXTERNAL
POWER
SUPPLY
AC
INPUT
SJ18 DC POWER
INPUT
SHEET 1 OF 3
CAD 12888IP1
EACH BRIDGE MODULE MAY BE A
41685 4-WAY / 4-WIRE BRIDGE or
41685-81 6-WAY / 4-WIRE BRIDGE or
41688 8-WAY / 4-WIRE BRIDGE
01
E88-884
DHS
3/88
ISSUE
REVISION
PI
DATE
DRAWN
DHS
CHECKED
APPROVED
DATE
2/26/88
RAVEN ELECTRONICS CORP.
488 EDISON WAY
RENO, NEVADA 89502-4117
(775) 856-2488
NAME
410-208 BRIDGE
MOTHERBOARD
ASSY
3410-4208
SIZE
B
DRAWING NO.
3410-1208











EACH BRIDGE MODULE MAY BE A
41685 4-WAY / 4-WIRE BRIDGE or
41685-01 6-WAY / 4-WIRE BRIDGE or
41688 8-WAY / 4-WIRE BRIDGE

SHEET 2 OF 3

CAD 12888IP1

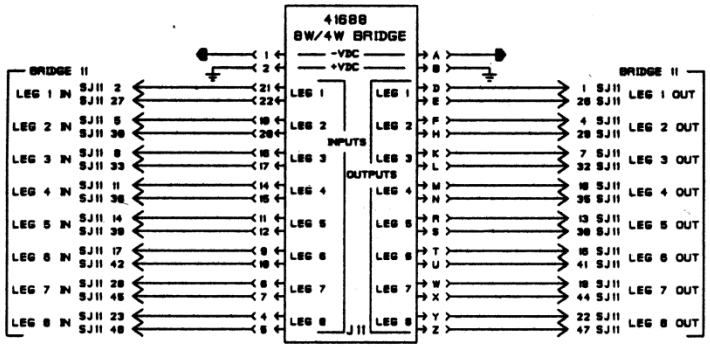
01	E88-884	DHS			3/88
ISSUE	REVISION	PI			DATE

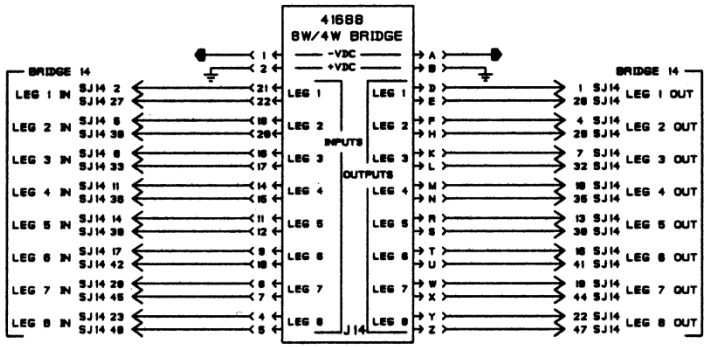
DRAWN: DHS
CHECKED:
APPROVED:
DATE: 2/26/88

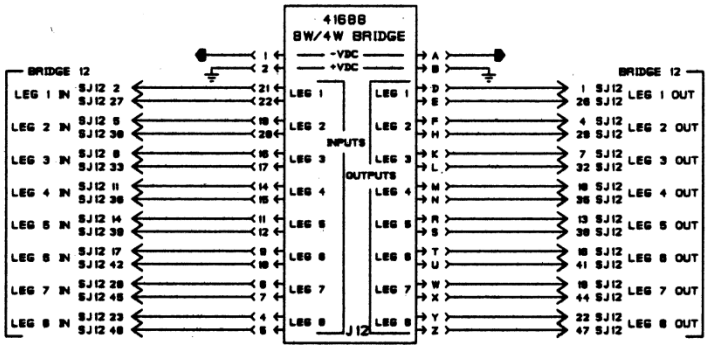
RAVEN ELECTRONICS CORP.
488 EDISON WAY
RENO, NEVADA 89502-4117
(775) 856-2488

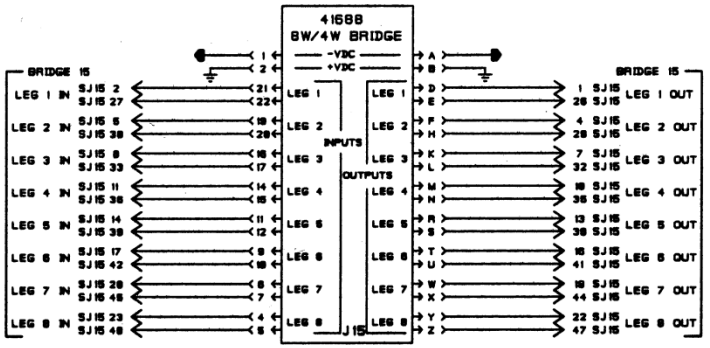
NAME: 410-208 BRIDGE MOTHERBOARD

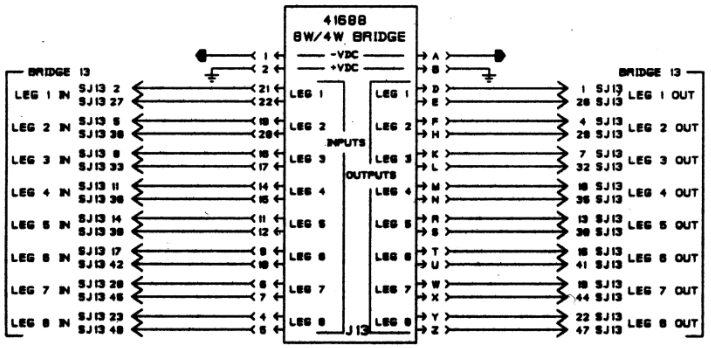
ASSY: 3410-4208
SIZE: B
DRAWING NO.: 3410-1208











EACH BRIDGE MODULE MAY BE A
41685 4-WAY / 4-WIRE BRIDGE or
41685-01 6-WAY / 4-WIRE BRIDGE or
41688 8-WAY / 4-WIRE BRIDGE

SHEET 3 OF 3

CAD 12888IP1

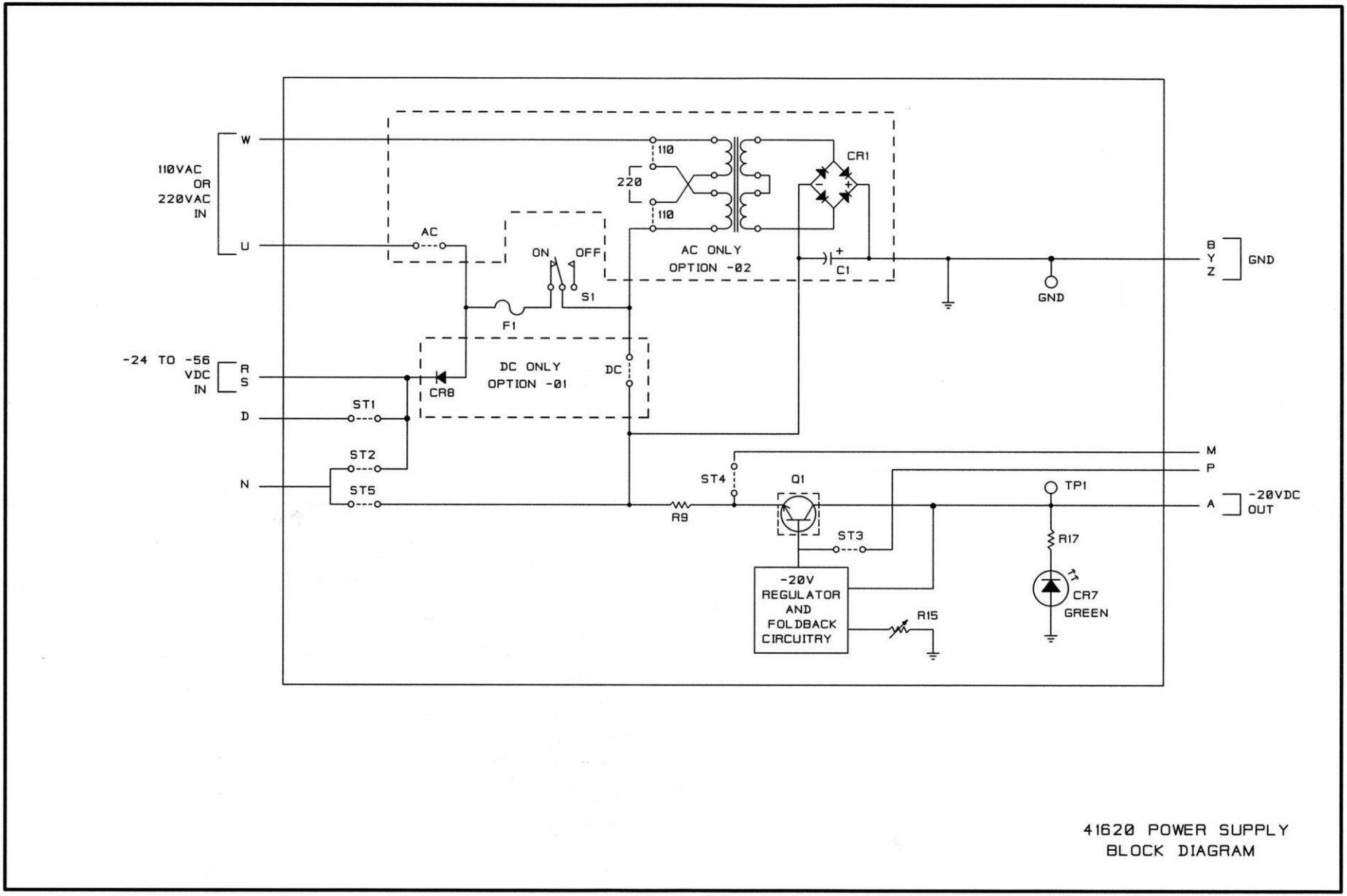
01	E88-884	DHS			3/88
ISSUE	REVISION	PI			DATE

DRAWN: DHS
CHECKED:
APPROVED:
DATE: 2/26/88

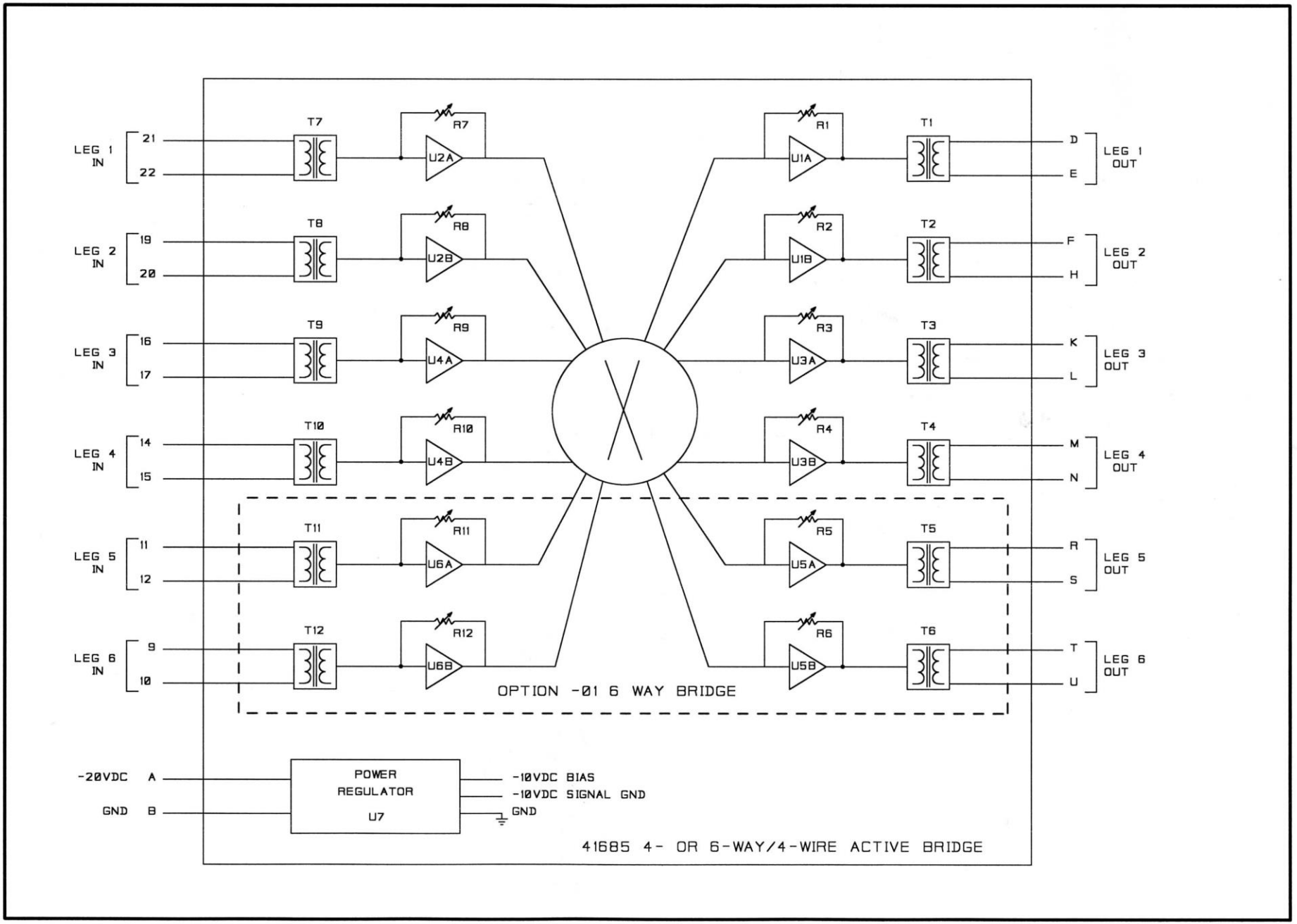
RAVEN ELECTRONICS CORP.
488 EDISON WAY
RENO, NEVADA 89502-4117
(775) 858-2488

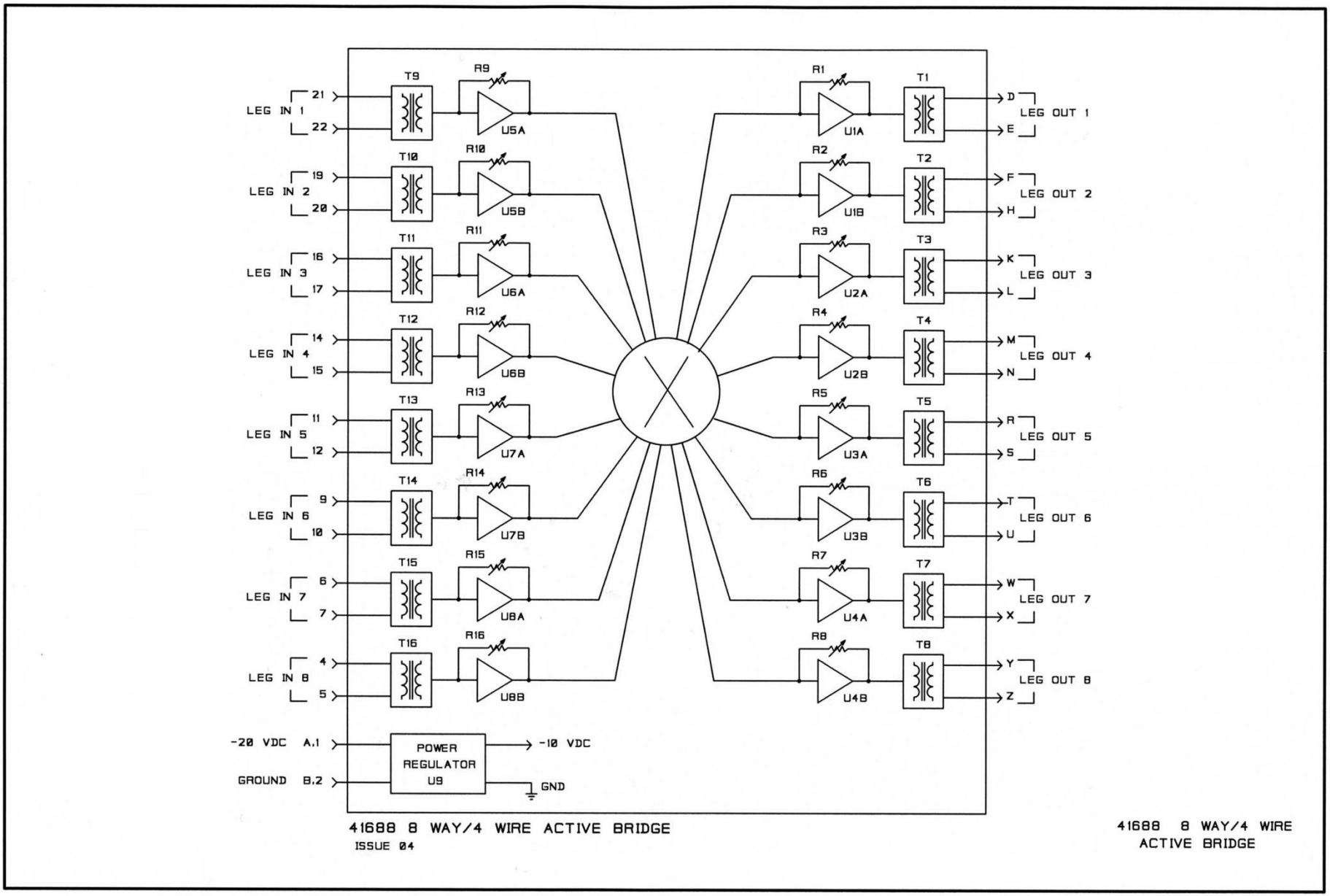
NAME: 410-208 BRIDGE MOTHERBOARD

ASSY: 3410-4208 | SIZE: B | DRAWING NO.: 3410-1208



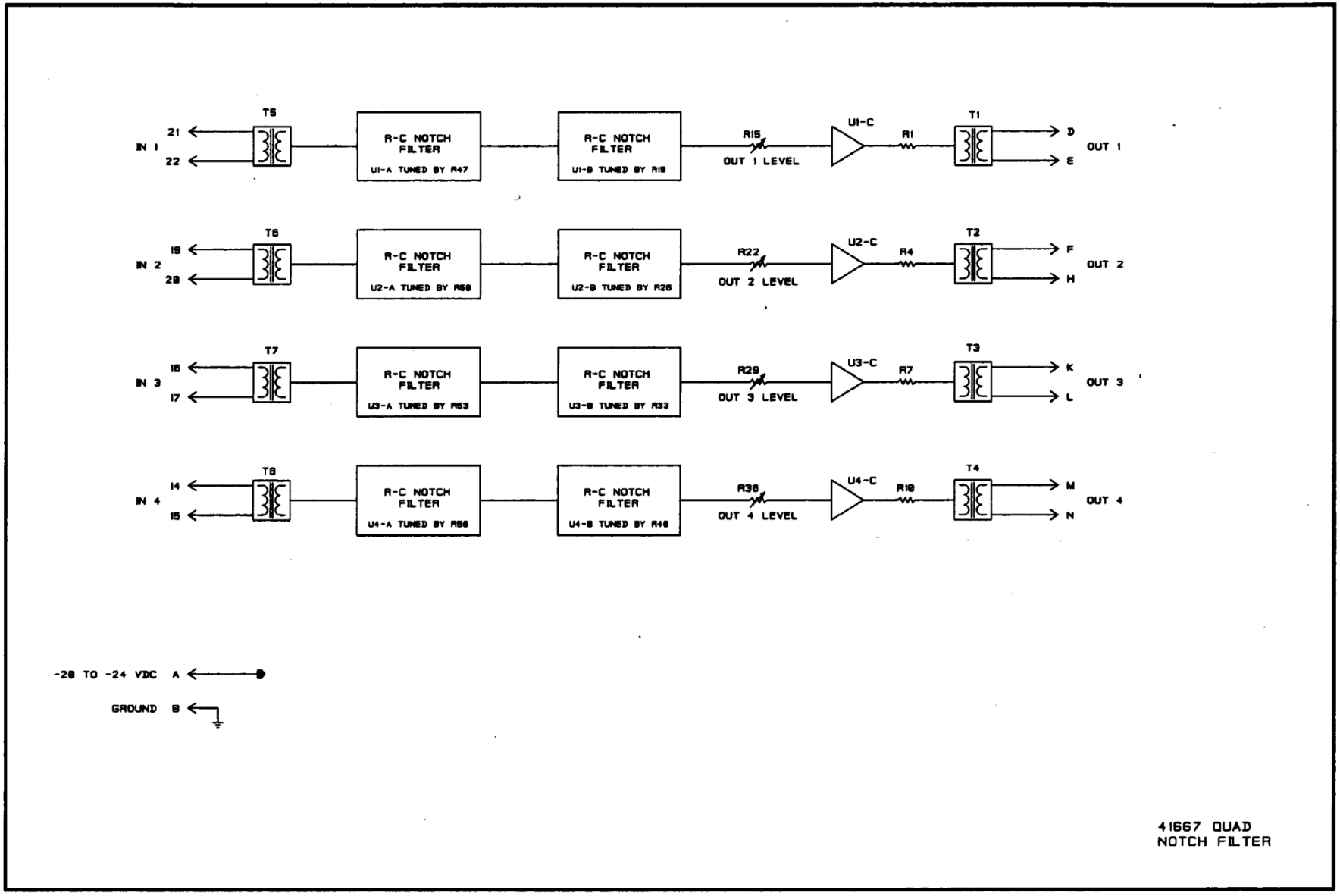
41620 POWER SUPPLY
BLOCK DIAGRAM

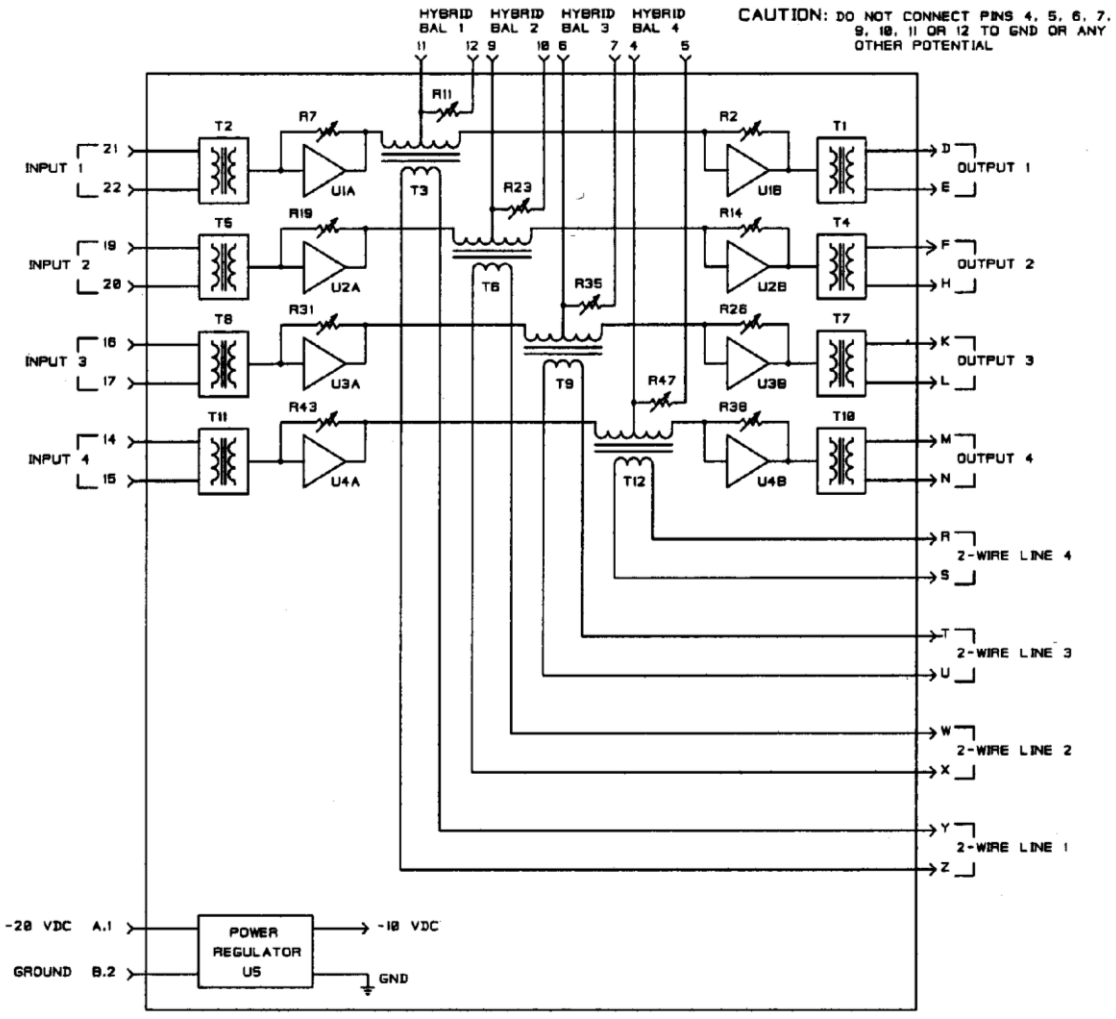

LEG 1 IN
21
22
LEG 2 IN
19
20
LEG 3 IN
16
17
LEG 4 IN
14
15
LEG 5 IN
11
12
LEG 6 IN
9
10
T7
T8
T9
T10
T11
T12
R7
R8
R9
R10
R11
R12
U2A
U2B
U4A
U4B
U6A
U6B
R1
R2
R3
R4
R5
R6
U1A
U1B
U3A
U3B
U5A
U5B
T1
T2
T3
T4
T5
T6
D
E
F
H
K
L
M
N
R
S
T
U
LEG 1 OUT
LEG 2 OUT
LEG 3 OUT
LEG 4 OUT
LEG 5 OUT
LEG 6 OUT
OPTION -01 6 WAY BRIDGE
-20VDC A
GND B
POWER REGULATOR U7
-10VDC BIAS
-10VDC SIGNAL GND
GND
41685 4- OR 6-WAY/4-WIRE ACTIVE BRIDGE



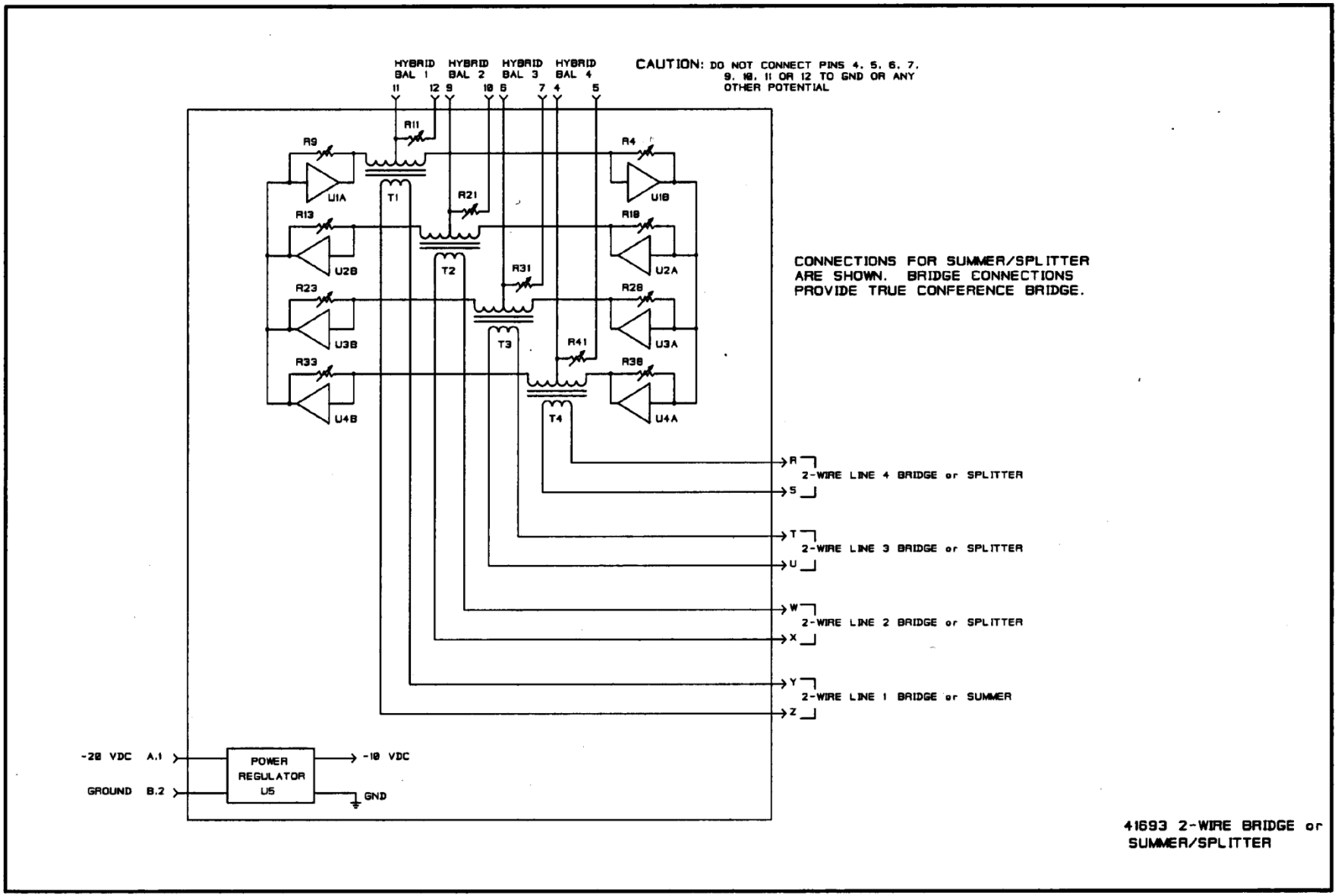
41688 8 WAY/4 WIRE ACTIVE BRIDGE
ISSUE 04

41688 8 WAY/4 WIRE
ACTIVE BRIDGE


IN 1
21
22
T5
R-C NOTCH FILTER
U1-A TUNED BY R47
R-C NOTCH FILTER
U1-B TUNED BY R19
R15
OUT 1 LEVEL
U1-C
R1
T1
D
E
OUT 1
IN 2
19
28
T6
R-C NOTCH FILTER
U2-A TUNED BY R59
R-C NOTCH FILTER
U2-B TUNED BY R26
R22
OUT 2 LEVEL
U2-C
R4
T2
F
H
OUT 2
IN 3
16
17
T7
R-C NOTCH FILTER
U3-A TUNED BY R53
R-C NOTCH FILTER
U3-B TUNED BY R33
R29
OUT 3 LEVEL
U3-C
R7
T3
K
L
OUT 3
IN 4
14
15
T8
R-C NOTCH FILTER
U4-A TUNED BY R56
R-C NOTCH FILTER
U4-B TUNED BY R46
R36
OUT 4 LEVEL
U4-C
R10
T4
M
N
OUT 4
-28 TO -24 VDC A
GROUND B
41667 QUAD
NOTCH FILTER



41690 QUAD 2-WIRE TO 4-WIRE HYBRID


HYBRID BAL 1
HYBRID BAL 2
HYBRID BAL 3
HYBRID BAL 4
11 12 9 10 6 7 4 5
CAUTION: DO NOT CONNECT PINS 4, 5, 6, 7, 9, 10, 11 OR 12 TO GND OR ANY OTHER POTENTIAL
R11
R9
R4
U1A
T1
R21
U1B
R13
R18
U2B
T2
R31
U2A
R23
R28
U3B
T3
R41
U3A
R33
R38
U4B
T4
U4A
CONNECTIONS FOR SUMMER/SPLITTER ARE SHOWN. BRIDGE CONNECTIONS PROVIDE TRUE CONFERENCE BRIDGE.
R
S
2-WIRE LINE 4 BRIDGE or SPLITTER
T
U
2-WIRE LINE 3 BRIDGE or SPLITTER
W
X
2-WIRE LINE 2 BRIDGE or SPLITTER
Y
Z
2-WIRE LINE 1 BRIDGE or SUMMER
-28 VDC A.1
GROUND B.2
POWER REGULATOR U5
-10 VDC
GND
41693 2-WIRE BRIDGE or SUMMER/SPLITTER

41667 Notch Filter Installer Connections

Quad Notch Filter Connections

FUNCTION	50-PIN TELCO or R250-0020 or R250-0021	R250-0023 WIRES	40100-4082 TERMINALS MODULE 1	S66 PUNCH BLOCK PIN NUMBERS
Filter 1 Inputs	2, 27	WHT/ORG & ORG/WHT	B1, B2	3, 4
Filter 1 Outputs	1, 26	WHT/BLU & BLU/WHT	C1, C2	1, 2
Filter 2 Inputs	5, 30	WHT/GRY & GRY/WHT	B3, B4	9, 10
Filter 2 Outputs	4, 29	WHT/BRN & BRN/WHT	C3, C4	7, 8
Filter 3 Inputs	8, 33	RED/GRN & GRN/RED	B5, B6	15, 16
Filter 3 Outputs	7, 32	RED/ORG & ORG/RED	C5, C6	13, 14
Filter 4 Inputs	11, 36	BLK/BLU & BLU/BLK	B7, B8	21, 22
Filter 4 Outputs	10, 35	RED/GRY & GRY/RED	C7, C8	19, 20

POWER

FUNCTION	REAR TERMINAL CONNECTIONS	REAR TERMINAL CONNECTIONS	REAR TERMINAL CONNECTIONS	SUGGESTED WIRE
GND -VDC In	A1 or SJ1 Center A2 or SJ1 Sleeve	A1 or SJ9 Center A2 or SJ9 Sleeve	A1 or SJ16 Center A2 or SJ16 Sleeve	18 GA

50-PIN TELCO, R250-0020, and R250-0021 are connections on 40200-208 or 41000-204 shelves.

R250-0023 are connections at the wire-end of a cable plugged into 40200-208 or 41000-204 shelves.

40100-4082 connections are to screw terminals on the rear panel.

S66 Punch Blocks are pre-wired for use with R250-0021 Male-Male cables. Pins are counted from the top when the block is mounted with the UP sign pointing at the top.

For connections to Filter Module 2 on the 40100-4082, use terminal blocks D and E with the same terminal numbers.

41678 Relay Module Installer Connections

Note: Only relays 1, 2, and 5 are available on Bridge Shelf connections. Relay 1 is normally open only. Relay 2 is normally closed only. Relay 5 has both normally open and normally closed contacts available. Two poles are available on all three relays labeled "A" and "B".

RELAY CONNECTIONS
(For Model 41000D-224 Only)

FUNCTION	50-PIN TELCO or R250-0020 or R250-0021	R250-0023 WIRES	S66 PUNCH BLOCK PIN NUMBERS
A N.O.	23, 48	GRN/VIO & VIO/GRN	45, 46
B N.O.	1, 26	WHT/BLU & BLU/WHT	1, 2
RELAY 1 COIL	4	BRN/WHT	7
A N.C.	17, 45	ORG/YEL & YEL/GRY	34, 40
B N.C.	7, 29	ORG/RED & WHT/BRN	13, 8
RELAY 2 COIL	32	RED/ORG	14
A N.C.	5	GRY/WHT	9
A N.O.	30	WHT/GRY	10
A COM	2	ORG/WHT	3
B N.C.	19	BRN/YEL	37
B N.O.	44	YEL/BRN	38
B COM	22	ORG/VIO	43
RELAY 5 COIL	47	VIO/ORG	44

Note: In the 41000D-224, the 41678 Relay module is installed in Slot 12.

50-PIN TELCO, R250-0020 Male-Female cable, and R250-0021 Male-Male cable are connections on the 41000D-224 shelf.

R250-0023 are connections at the wire end of a cable plugged into the 41000D-224 shelf.

S66 Punch Blocks are pre-wired for use with R250-0021 Male-Male cable, pins are counted from the top when the block is mounted with the UP sign pointing at the top.

41685, 41685-01, and 41688 Bridge Module Installer Connections

4-, 6-, or 8-Way Bridge Connections

FUNCTION	50-PIN TELCO or R250-0020 or R250-0021	R250-0023 WIRES	40100-4082 TERMINALS MODULE 1	S66 PUNCH BLOCK PIN NUMBERS
Port 1 Inputs	2, 27	WHT/ORG & ORG/WHT	B1, B2	3, 4
Port 1 Outputs	1, 26	WHT/BLU & BLU/WHT	C1, C2	1, 2
Port 2 Inputs	5, 30	WHT/GRY & GRY/WHT	B3, B4	9, 10
Port 2 Outputs	4, 29	WHT/BRN & BRN/WHT	C3, C4	7, 8
Port 3 Inputs	8, 33	RED/GRN & GRN/RED	B5, B6	15, 16
Port 3 Outputs	7, 32	RED/ORG & ORG/RED	C5, C6	13, 14
Port 4 Inputs	11, 36	BLK/BLU & BLU/BLK	B7, B8	21, 22
Port 4 Outputs	10, 35	RED/GRY & GRY/RED	C7, C8	19, 20
Port 5 Inputs	14, 39	BLK/BRN & BRN/BLK	B9, B10	27, 28
Port 5 Outputs	13, 38	BLK/GRN & GRN/BLK	C9, C10	25, 26
Port 6 Inputs	17, 42	YEL/ORG & ORG/YEL	B11, B12	33, 34
Port 6 Outputs	16, 41	YEL/BLU & BLU/YEL	C11, C12	31, 32
Port 7 Inputs	20, 45	YEL/GRY & GRY/YEL	B13, B14	39, 40
Port 7 Outputs	19, 44	YEL/BRN & BRN/YEL	C13, C14	37, 38
Port 8 Inputs	23, 48	VIO/GRN & GRN/VIO	B15, B16	45, 46
Port 8 Outputs	22, 47	VIO/ORG & ORG/VIO	C15, C16	43, 44

POWER

FUNCTION	REAR TERMINAL CONNECTIONS	REAR TERMINAL CONNECTIONS	REAR TERMINAL CONNECTIONS	SUGGESTED WIRE
GND	A1 or SJ1 Center	A1 or SJ9 Center	A1 or SJ16 Center	18 GA
-VDC In	A2 or SJ1 Sleeve	A2 or SJ9 Sleeve	A2 or SJ16 Sleeve	

50-PIN TELCO, R250-0020, and R250-0021 are connections on 40200-208 or 41000-204 shelves.

R250-0023 are connections at the wire-end of a cable plugged into 40200-208 or 41000-204 shelves.

40100-4082 connections are to screw terminals on the rear panel.

S66 Punch Blocks are pre-wired for use with R250-0021 Male-Male cables. Pins are counted from the top when the block is mounted with the UP sign pointing at the top.

For connections to Bridge Module 2 on the 40100-4082, use terminal blocks D and E with the same terminal numbers.

41690 Hybrid Installer Connections

Quad 2-Wire to 4-Wire Hybrid Connections

FUNCTION	50-PIN TELCO or R250-0020 or R250-0021	R250-0023 WIRES	40100-4082 TERMINALS MODULE 1	S66 PUNCH BLOCK PIN NUMBERS
Hybrid 1 Inputs	2, 27	WHT/ORG & ORG/WHT	B1, B2	3, 4
Hybrid 1 Outputs	1, 26	WHT/BLU & BLU/WHT	C1, C2	1, 2
2-Wire Line 1	22, 47	VIO/ORG & ORG/VIO	C15, C16	43, 44
Hybrid 1 LBO	14, 39	BLK/BRN & BRN/BLK	B9, B10	27, 28
Hybrid 2 Inputs	5, 30	WHT/GRY & GRY/WHT	B3, B4	9, 10
Hybrid 2 Outputs	4, 29	WHT/BRN & BRN/WHT	C3, C4	7, 8
2-Wire Line 2	19, 44	YEL/BRN & BRN/YEL	C13, C14	37, 38
Hybrid 2 LBO	17, 42	YEL/ORG & ORG/YEL	B11, B12	33, 34
Hybrid 3 Inputs	8, 33	RED/GRN & GRN/RED	B5, B6	15, 16
Hybrid 3 Outputs	7, 32	RED/ORG & ORG/RED	C5, C6	13, 14
2-Wire Line 3	16, 41	YEL/BLU & BLU/YEL	C11, C12	31, 32
Hybrid 3 LBO	20, 45	YEL/GRY & GRY/YEL	B13, B14	39, 40
Hybrid 4 Inputs	11, 36	BLK/BLU & BLU/BLK	B7, B8	21, 22
Hybrid 4 Outputs	10, 35	RED/GRY & GRY/RED	C7, C8	19, 20
2-Wire Line 4	13, 38	BLK/GRN & GRN/BLK	C9, C10	25, 26
Hybrid 4 LBO	23, 48	VIO/GRN & GRN/VIO	B15, B16	45, 46

POWER

FUNCTION	REAR TERMINAL CONNECTIONS	REAR TERMINAL CONNECTIONS	REAR TERMINAL CONNECTIONS	SUGGESTED WIRE
GND -VDC In	A1 or SJ1 Center A2 or SJ1 Sleeve	A1 or SJ9 Center A2 or SJ9 Sleeve	A1 or SJ16 Center A2 or SJ16 Sleeve	18 GA

50-PIN TELCO, R250-0020, and R250-0021 are connections on 40200-208 or 41000-204 shelves.

R250-0023 are connections at the wire-end of a cable plugged into 40200-208 or 41000-204 shelves.

40100-4082 connections are to screw terminals on the rear panel.

S66 Punch Blocks are pre-wired for use with R250-0021 Male-Male cables. Pins are counted from the top when the block is mounted with the UP sign pointing at the top.

For connections to Hybrid Module 2 on the 40100-4082, use terminal blocks D and E with the same terminal numbers.

Bridge shelf Options

Model #	**Description**
40100D-4082	**Bridge/Hybrid/Notch Filter Shelf (DC Power)** *Includes 2-3 modules:* *1-2 Active Bridge, Notch Filter, and/or Hybrid Modules,* *(41685 4-Way/4-Wire Active Bridge, and/or* *41685-01 6-Way/4-Wire Active Bridge, and/or* *41688 8-Way/4-Wire Active Bridge, and/or* *41667 Notch Filter, and/or* *41690 2-Wire to 4-Wire Hybrid, and/or* *41693 4-Way /2-Wire Active Bridge)* *41620-01 DC Power Supply (-24 to -56 VDC input power)*
40100A-4082	**Bridge/Hybrid/Notch Filter Shelf (AC Power)** *Same as above, however the 41620-01 power supply is not installed and the unit is powered from an external AC power supply (100 to 250 VAC input).*
40200D-208	**Bridge/Hybrid/Notch Filter Shelf (DC Power)** *Includes 2-9 modules:* *1-8 Active Bridge, Notch Filter, and/or Hybrid Modules,* *(41685 4-Way/4-Wire Active Bridge, and/or* *41685-01 6-Way/4-Wire Active Bridge, and/or* *41688 8-Way/4-Wire Active Bridge and/or* *41667 Notch Filter, and/or* *41690 2-Wire to 4-Wire Hybrid, and/or* *41693 4-Way /2-Wire Active Bridge)* *41620-01 DC Power Supply (-24 to -56 VDC input power)*
40200A-208	**Bridge/Hybrid/Notch Filter Shelf (AC Power)** *Same as above, the unit is powered from an external AC power supply (100 to 250 VAC input).*
41000D-204	**Bridge/Hybrid/Notch Filter Shelf (DC Power)** *Includes 2-15 modules:* *1-14 Active Bridge, Notch Filter, and/or Hybrid Modules,* *(41685 4-Way/4-Wire Active Bridge, and/or* *41685-01 6-Way/4-Wire Active Bridge, and/or* *41688 8-Way/4-Wire Active Bridge and/or* *41667 Notch Filter, and/or* *41690 2-Wire to 4-Wire Hybrid, and/or* *41693 4-Way /2-Wire Active Bridge)* *41620-01 DC Power Supply (-24 to -56 VDC input power)*
41000A-204	**Bridge/Hybrid/Notch Filter Shelf (AC Power)** *Same as above, the unit is powered from an external AC power supply (100 to 250 VAC input).*

General Conditions of Sales

RAVEN ELECTRONICS CORPORATION
4655 LONGLEY LANE, #106, 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 of 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 25% 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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