



Raven Electronics Corporation

Raven 41611-640-CSI

Analog Orderwire



Users Manual

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General Information

Thank you for purchasing the 41611-640-CSI Analog Orderwire(s) 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

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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

The orderwire is a voice communication device used by technicians and engineers during installation of new communication equipment and during maintenance and troubleshooting of existing equipment.

The 41611-640-CSI Analog Orderwire provides all necessary functions for voice communications on a network. The 41611-640-CSI also includes an internally wired 41685 4-Way/4-Wire Active Bridge in the transmit and receive paths providing three 4-wire external repeater ports wired out to the rear panel. The 41611A-640-CSI operates from a 110 or 220 VAC source.

The 41611-640-CSI is used at repeater sites or can function as a 3-port hub site. The 41611-640-CSI consists of the following modules: 41685 4-Way/4-Wire Active Bridge, 41650 Receive Module, 41651 Transmit Module, and the 41620-02 Power Supply. They are all removable for easy maintenance or replacement.

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.

41650 Receive Module

The Raven 41650 Receive Module provides conditioning required to derive a wideband (data) port, a voice frequency output and a balanced input. Amplifiers are provided on the inputs and outputs for isolation and level control. A 3-stage low-pass filter attenuates frequencies above the voice band for the voice and speaker paths. A call alert generator provides an audible call indication through the speaker output when enabled. Relay contacts (one Form C) are available for an E-Lead indicator.

41651 Transmit Module

The Raven 41651 Transmit Module provides the conditioning required to combine a wideband (data) port and multiple voice frequency inputs into a balanced output. Amplifiers are provided on the inputs and outputs for isolation and level control. A 3-stage low-pass filter attenuates frequencies above the voice band in the voice path.

41620-02 Power Supply

The Raven 41620-02 Regulated Power Supply provides a regulated -20 Volt DC output from an AC supply. The 41620-02 provides foldback current limiting at an output current of approximately 1.2 amperes. Included on the 41620-02 is an ON/OFF power switch and a fuse in series with the input.

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

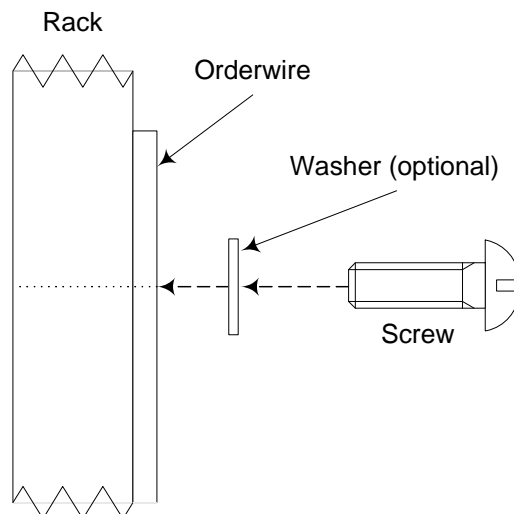
Power Connections:

- 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 Analog Orderwire are interchangeable between 19" and 23" as well as flush mount and offset mount.

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.

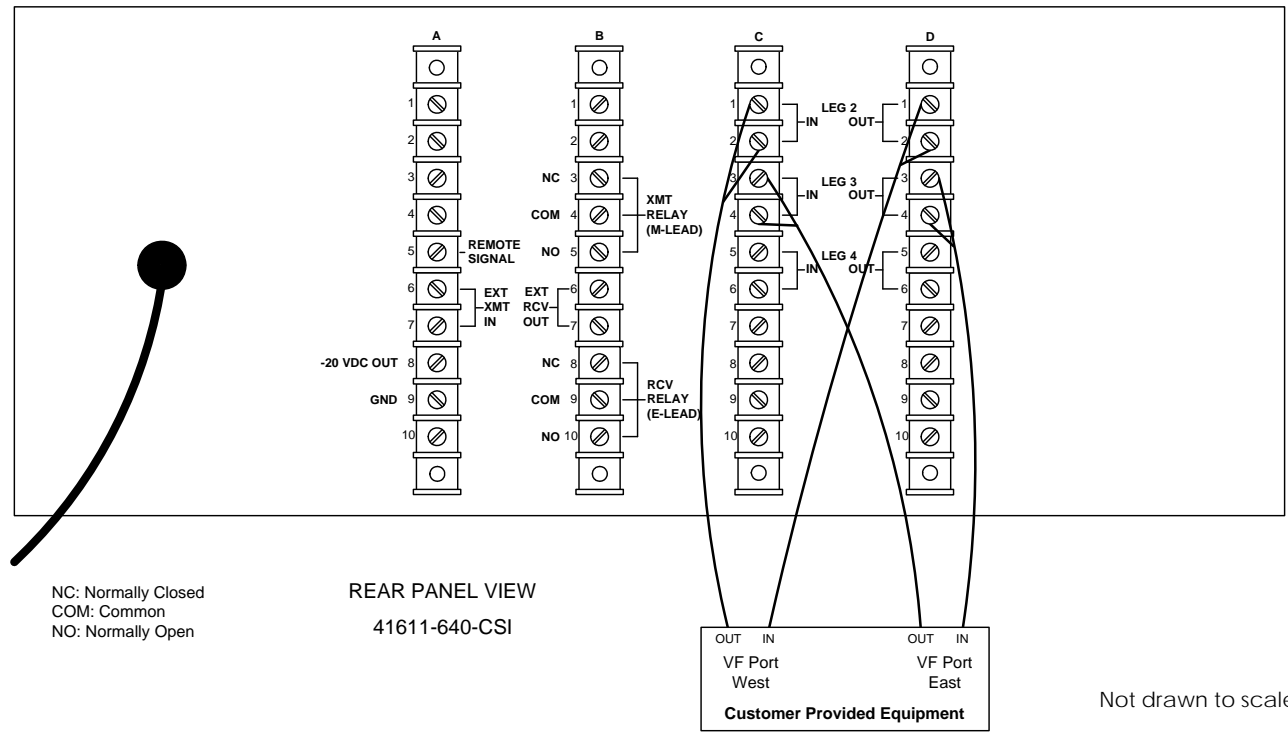


Hooking Up Connections

With the source power turned off, use the following instructions to hook up your 41611-640-CSI Orderwire. 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 chart below (*also found in Table B*). The Remote Signal, EXT XMT IN, EXT RCV OUT, M-LEAD, and E-LEAD are not necessary to operate the orderwire.

Be sure Power is turned OFF.

FUNCTION	REAR TERMINAL CONNECTIONS	SUGGESTED WIRE
Leg 2 In Leg 2 Out	C1, C2 D1, D2	24 GA
Leg 3 In Leg 3 Out	C3, C4 D3, D4	24 GA
Leg 4 In Leg 4 Out	C5, C6 D5, D6	24 GA
Power (PWR)	3-WIRE POWER CORD	18 GA
Remote Signal	A5	24 GA
External Transmit In (EXT XMT IN)	A6, A7	24 GA
External Receive Out (EXT RCV OUT)	B6, B7	24 GA
XMT RELAY (M-LEAD)	B3, B4, B5	24 GA
RCV RELAY (E-LEAD)	B8, B9, B10	24 GA



Hooking Up Connections (cont.)

Remote Signal

The Remote Signal is typically used on the 41611 E&M Orderwire model for signaling or calling other 41611 orderwires. The signal can be either Ground referenced or -20 VDC referenced.

EXT XMT IN and EXT RCV OUT

These functions are used to send FSK data to and from external customer provided equipment. Any kind of data above the voice range or frequency can be used. RS-232 data will not work. If used, the EXT XMT IN would need to connect to the FSK Transmit connector and the EXT RCV OUT would need to connect to the FSK Receive connector. Sample Applications: low-rate, voice frequency data; FSK data; cable break locator equipment.

-20 VDC OUT

This connection allows the user to power equipment via this unit as long as no more than -20 VDC is required. Example: the Raven 40100 Bridge Shelf can run off of the -20 VDC OUT from this unit. ***Please do NOT hook up power to the unit via this connection!***

XMT Relay (M-LEAD)

This relay is energized when "off-hook". The three connections listed are: NC (normally closed), COM (common), and NO (normally open). Example: While communicating with a microwave network, it may be necessary to use this connection. When making an outgoing call to a microwave network, this connection will turn on a channel to provide a ringback tone so the user knows the call made it through, even if the end-user does not answer.

RCV Relay (E-LEAD)

The RCV Relay is turned on while alerting the user of the call when the unit receives its own signaling frequency. The three connections listed are NC (normally closed), COM (common), and NO (normally open). Example: if a speaker, bell, light, or other external equipment is connected to the RCV Relay, that equipment will be turned on as well.

Powering Up the Orderwire

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 41620-02 card (Power Supply) should be illuminated. If not, please refer to Chapter 5, Troubleshooting and Alignment.
6. Close the front panel.
7. The green light on the front panel should be illuminated while the unit is on.

Outgoing Calls

1. Set volume control to approximately mid-range. Verify that the orderwire circuit is not in use. Lift the handset from the cradle. The "OFF HOOK" indicator will illuminate and the speaker will be muted.
2. Press the call button on the front panel and wait for an answer. (The signal is received by all stations for the period the call button is pressed.) When the system detects the incoming signaling frequency, a visual alert is provided by the LED indicator and an audible alert through the speaker (when on-hook).
3. Upon completion of the call, place the handset on the cradle. The "OFF HOOK" indicator will go off.

Incoming Calls

1. Incoming calls are indicated by an audible alert through the speaker (not affected by the volume control), and by the "ALERT" indicator being lit.
2. When the call alert tone is heard, set the volume control to approximately mid-range. Lift the handset from the cradle and answer the calling party. The "OFF HOOK" indicator will light and the speaker will be muted.
3. Upon completion of the call, place the handset on the cradle. The "OFF HOOK" indicator will go off.

NOTE: When a headset is plugged in to the jacks on the front panel, the unit is always "Off-Hook".

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
- Frequency Counter

Every Orderwire 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 Orderwire 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 dBm difference is noted, the terminated measurement is correct.

41620-02 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 41620-02 Power Supply and read -20.0 VDC.
3. Adjust R15 on the 41620-02 module, if required.

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 try and operate the Orderwire before making any adjustments suggested on this page.*

41650 Receive Module**VF Receive Level**

1. Insert a 1KHz test tone from a signal generator into the RCV jacks. Set the level as specified by Attachment A.
2. Connect an AC voltmeter (terminate with 600 ohms) to the 4W OUT jacks. Read a level of +7 dBm. Adjust R40 on the 41650 Receive, if required.

Data Receive Level

1. Insert a 1KHz test tone from a signal generator into the RCV jacks. Set the level as specified by Attachment A.
2. Connect an AC voltmeter (terminate, if required) to the EXT RCV OUT jacks. Read the level specified by Attachment A. Adjust R43 on the 41650 Receive, if required.

41651 Transmit Module**VF Transmit Level**

1. Insert a 1KHz test tone from a signal generator into the TEST TONE jacks at a level of -16 dBm.
2. Connect an AC voltmeter to the XMT jacks. Read the level specified by Attachment A. Adjust R58 (coarse) or R59 (fine) on the 41651 Transmit, if required.

Data Transmit Level

1. Insert a 1KHz test tone from a signal generator into the EXT XMT IN jacks. Set the level as specified by Attachment A.
2. Connect an AC voltmeter to the XMT jacks. Read the level specified by Attachment A. Adjust R65 on the 41651 Transmit, if required.

Transmit Signaling Level

1. Connect an AC voltmeter (terminate, if required) and frequency counter to the XMT jacks.
2. Go off-hook and press the CALL button. Read the level specified on Attachment A. Adjust R35 (coarse) or R36 (fine) on the 41651 Transmit, if required.
3. Read the signaling tone frequency as specified on Attachment A. Adjust R24 on the 41651 Transmit, if required. (The 41651 module will need to be on the Extender Card to make this adjustment.)

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. The 41650 and 41651 are internally wired and aligned to the bridge. Please contact a Raven technician before making any adjustments suggested on this page.*

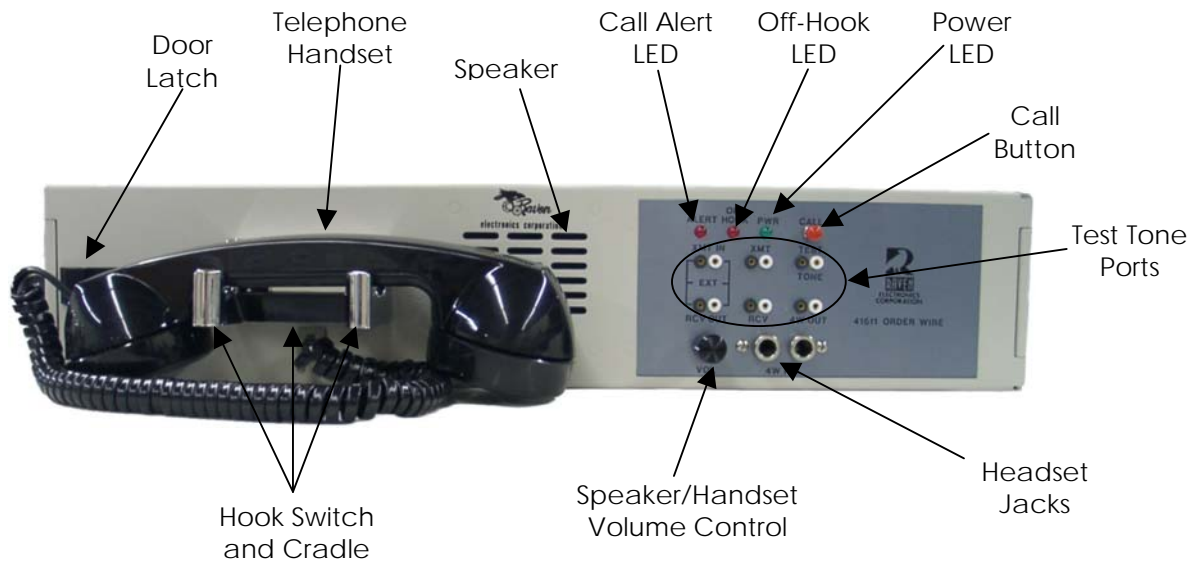
41685 4W/4W Bridge Level

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 Bridge in its position.

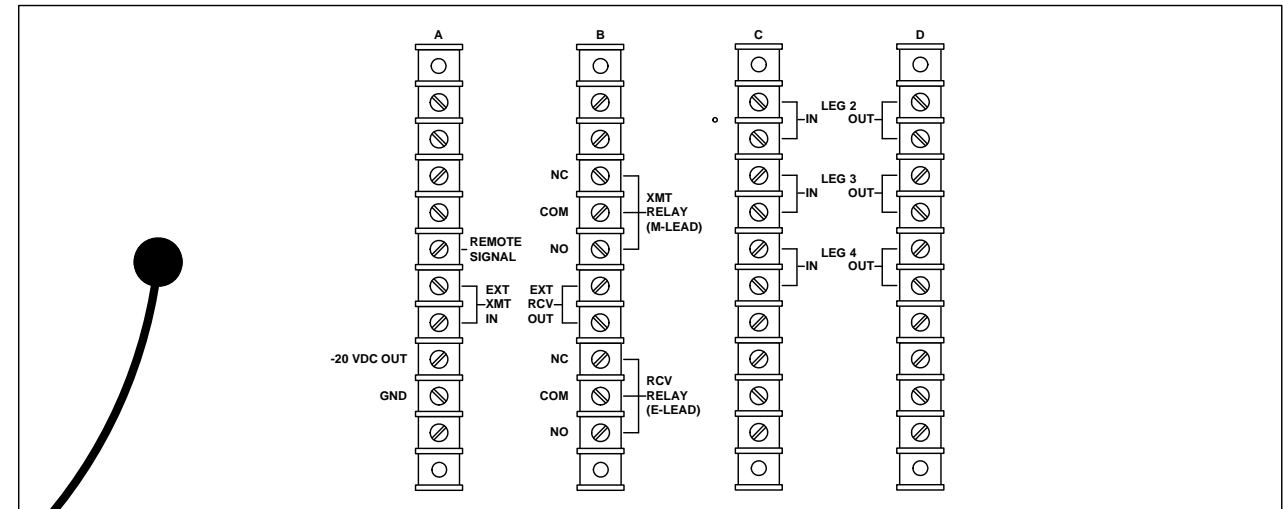
Troubleshooting and Alignment Procedures (cont.)

Symptoms	Possible Causes	Remedy
Power LED Off	<ol style="list-style-type: none"> 1. Toggle switch on 41620-02 Power Supply in "OFF" position. 2. Fuse blown on 41620-02 Power Supply. 3. 41620-02 Power Supply not firmly seated in the chassis. 4. Unit not connected to Power Source or user's power source is down. 5. Failed power supply. 	<ol style="list-style-type: none"> 1. Switch to "ON" position. 2. Replace fuse. 3. Re-seat power supply module in its slot. <i>Note: Make sure toggle switch on the 41620-02 power supply module is in the "OFF" position before removing and re-inserting the power supply.</i> 4. Confirm unit is connected properly to the power source and that the power source is functioning. 5. Replace with a spare or return for repair.
Alert tone will not sound when called.	<ol style="list-style-type: none"> 1. Audio paths not wired correctly. 2. Improper audio levels. 3. Failure of user's transmission equipment (e.g. modem). 	<ol style="list-style-type: none"> 1. Refer to Chapter 2 "Hooking up Connections" and Table B. Check the integrity of the wiring and cables. 2. Refer to Chapter 5 "Troubleshooting and Alignment". 3. Check and repair.
Other problems, e.g., degraded or complete loss of audio (transmit or receive)	<ol style="list-style-type: none"> 1. Audio paths not wired correctly or wiring/cables are faulty. 2. Improper audio levels. 3. Failed 41650 Receive Module. 4. Failed 41651 Transmit Module. 5. Failure of user's transmission equipment (e.g. modem). 	<ol style="list-style-type: none"> 1. Refer to Chapter 2 "Hooking up Connections" and Table B. Check the integrity of the wiring and cables. 2. Refer to Chapter 5 "Troubleshooting and Alignment" 3. Replace with a spare or return for repair. 4. Replace with a spare or return for repair. 5. Check and repair.

41611-640-CSI Front Panel with Descriptions



41611-640-CSI Back Panel Diagram



41611-640-CSI Analog Orderwire (Rear View)

Not drawn to scale.

TABLE B**INSTALLER CONNECTIONS***41611-640-CSI Installer Connections*

FUNCTION	REAR TERMINAL CONNECTIONS	SUGGESTED WIRE
Leg 2 In	C1, C2	24 GA
Leg 2 Out	D1, D2	
Leg 3 In	C3, C4	24 GA
Leg 3 Out	D3, D4	
Leg 4 In	C5, C6	24 GA
Leg 4 Out	D5, D6	
Power (PWR)	3-WIRE POWER CORD	18 GA
Remote Signal	A5	24 GA
External Transmit In (EXT XMT IN)	A6, A7	24 GA
External Receive Out (EXT RCV OUT)	B6, B7	24 GA
XMT RELAY (M-LEAD)	B3, B4, B5	24 GA
RCV RELAY (E-LEAD)	B8, B9, B10	24 GA

Orderwire Options

<u>Model #</u>	<u>Description</u>
41611A-640-CSI	E&M Orderwire (AC Power) <i>Includes 4 modules:</i> <i>41650 Receive Module,</i> <i>41651 Transmit Module,</i> <i>41685 4-Way/4-Wire Active Bridge,</i> <i>41620-02 AC Power Supply (110 or 220 VAC input power)</i>

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 Purchaser's 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 Purchaser 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 purchaser's 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 restocking 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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