Raven Electronics Corporation

Raven 60100-400

VOX Shelf

Users Manual

Rev. 01A

Table of Contents

CHAPTER 1 INTRODUCTION

General Information

Thank you for purchasing the 60100-400 VOX Shelf from Raven Electronics Corporation. Please contact us if you have any questions, concerns, product ideas, or ideas to improve this manual. We can be contact at:

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Reno, Nevada 89502
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(775) 858-2410 Fax
info@ravencomm.com
sales@ravencomm.com

Safety Warning

Please be 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 60100-400 VOX Shelf provides a way of interconnecting various types of mobile radio equipment at the voice level without having to miss part of the conversation. The shelf is configured to accommodate up to four 61649 VOX Modules, each module is capable of two VOX circuits, for a total capacity of eight independent VOX circuits. Push-to-talk (PTT) relay outputs and audio delay are provided on each VOX circuit. The VOX/Delay Module digitally delays the audio while the transmitter is keying up to prevent speech clipping.

Screw lug terminal strips are provided for DC input power, circuit ground, and power good relay (which closes if any of the Power Supply's three output voltages fail). Voice inputs and outputs, PTT relay outputs, and COR (carrier operated relay) inputs are connected through 50-pin Telco type connectors, SJ1 for VOX circuits 1 – 4 and SJ2 for VOX circuits 5 – 8.

The 60100-400 VOX Shelf is capable of operating with redundant power supplies, where both power supply assemblies are turned on. If either power supply fails, the other supply will continue to supply power through diode logic. Redundant supplies are optional; if a single supply is specified, the diodes are not used.

COR inputs for each VOX channel can be programmed for active low (GND) or active high (+5VDC) by a jumper strap. If the COR input is active low (GND), the jumper should be in the GND position. If the COR input is active high (+5VDC), then the jumper should be in the +5 position. (For active low (GND) inputs, a ground terminal is available for each circuit in the SJ1 and SJ2 cable connectors.)

61620 Power Supply

The Raven 61620 Power Supply provides three regulated DC voltage outputs required to power the 60100-400 VOX Shelf and associated plug-in modules. The input has a very wide range, automatically accommodating input voltages from –20 VDC to –70 VDC. 61620-01 is also used in AC applications with an external AC/DC converter pack.

System Description (cont.)

61649 VOX Module

The Raven 61649 VOX Module provides the detection and delaying of voice frequencies (0.2 to 3.4 KHz). When voice frequencies are detected, a relay contact closure is provided. The 61649 uses CMOS and microcomputer technology to digitally convert, detect, delay, and reconstruct analog signals. Switches are provided to set the amount of time delay (up to 1 second) and to set the analog detect level. The input can provide gain and the output amplifier provides gain or attenuation. LEDs are provided to give a visual indication of which channels are active. Additional circuitry is provided to allow for a COR (carrier operated relay) input. Each COR input can be individually programmed as active high or active low. The 61649 VOX module can use this signal to provide additional input (TTL) to determine how the keying relay operates. The 61649 VOX Module provides two VOX circuits.

CHAPTER 2 INSTALLING and SETTING UP THE VOX SHELF

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

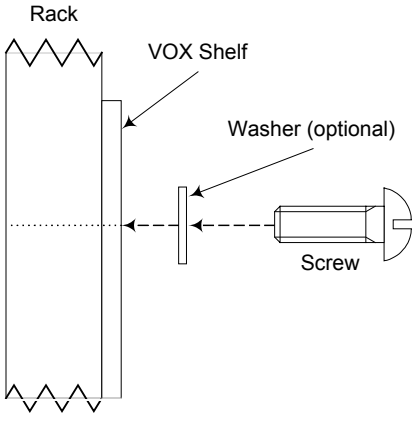
Power Connections:

- 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 VOX Shelf are not interchangeable between 19" and 23". Please specify the flange size needed when ordering. The factory default is for the 19" rack.

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.



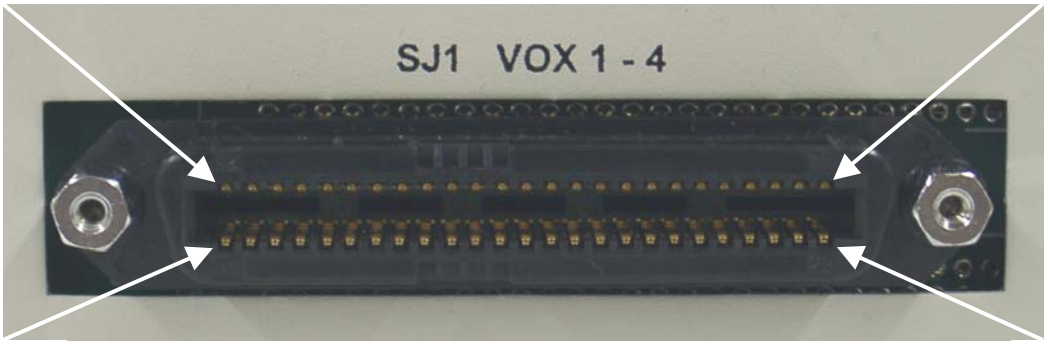
Hooking Up Connections

With the source power turned off, use the following instructions to hook up your 60100-400 VOX Shelf. A 50-pin connector is needed to connect to these female 50 pin "Telco" connectors. You may refer to the chart found in Table B. Below is a pin out diagram. All VOX Modules (SJ1 and SJ2) are the same as below. The following page shows an example of a configuration and its wiring.

Be sure Power is turned OFF.

FUNCTION	PINS	FUNCTION	PINS
VOX 1 RCV	1, 26	VOX 3 RCV	11, 36
VOX 1 XMT	2, 27	VOX 3 XMT	12, 37
VOX 1 PTT RELAY	3, 28	VOX 3 PTT RELAY	13, 38
VOX 1 COR INPUT	4, GND PIN 29	VOX 3 COR INPUT	14, GND PIN 39
VOX 2 RCV	6, 31	VOX 4 RCV	16, 41
VOX 2 XMT	7, 32	VOX 4 XMT	17, 42
VOX 2 PTT RELAY	8, 33	VOX 4 PTT RELAY	18, 43
VOX 2 COR INPUT	9, GND PIN 34	VOX 4 COR INPUT	19, GND PIN 44

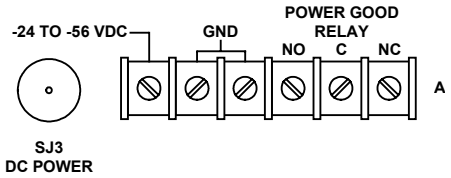
PIN 25 PIN 1



PIN 50 PIN 26

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.

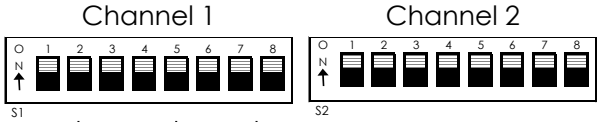
The SJ3 DC Power Input is used with an external AC Power Pack for the 60100A-400.



Programming the Delay and Detect Levels

To program the Delay and Detect Levels, perform the following steps.

1. Switches S1 and S2 correspond to Channel 1 and 2, respectively.

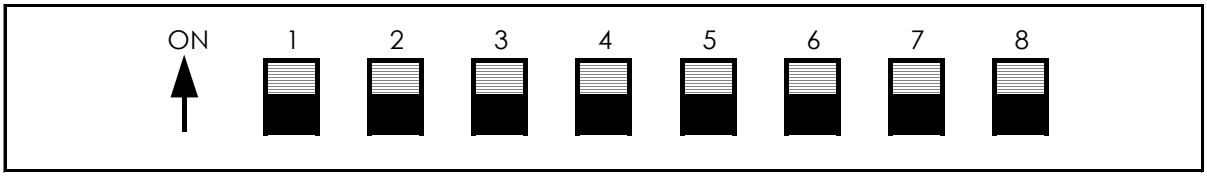


2. S1 and S2 are found on the module from left to right, when viewing the board from the front. You will need to refer to the chart below to program the correct codes. Please also see the example on the following page.

Signal Delay: The amount of time required to delay the signal before transmitting to equipment.

Key Relay Release Delay: The amount of time desired before disconnecting the connection after the detector threshold level is no longer exceeded.

Detector Level Sensitivity: The level necessary to detect a signal to confirm communication is still taking place.



Switch Positions												
Signal Delay	**Delay**	**1**	**2**	**3**	**Key Relay Release Delay**	**PTT Release**	**4**	**5**	**6**	**Detector Level Sensitivity**	**Level**	**7**	**8**
	125 milliseconds	Off	Off	Off		0.5 seconds	Off	Off	Off		-5dBm0	Off	Off
	250 milliseconds	On	Off	Off		1.0 seconds	On	Off	Off				
	375 milliseconds	Off	On	Off		1.5 seconds	Off	On	Off		-10dBm0	On	Off
	500 milliseconds	On	On	Off		2.0 seconds	On	On	Off				
	625 milliseconds	Off	Off	On		2.5 seconds	Off	Off	On		-15dBm0	Off	On
	750 milliseconds	On	Off	On		3.0 seconds	On	Off	On				
	875 milliseconds	Off	On	On		3.5 seconds	Off	On	On		-20dBm0	On	On
	1000 milliseconds	On	On	On		4.0 seconds	On	On	On				

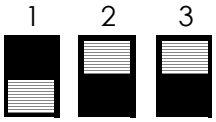
Programming the Delay and Detect Levels (cont.)

Example:

The Signal Delay needs to be 875 milliseconds, the Keying Relay Release Delay needs to be set to 2.5 seconds, and the Detector Level Sensitivity has to be programmed to –10dBm0. For additional channels, please repeat on S2, depending on application.

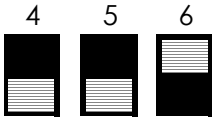
Signal Delay (875 milliseconds):

1. Set Position 1 – off
2. Set Position 2 – on
3. Set Position 3 – on



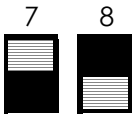
Keying Relay Release Delay (2.5 seconds):

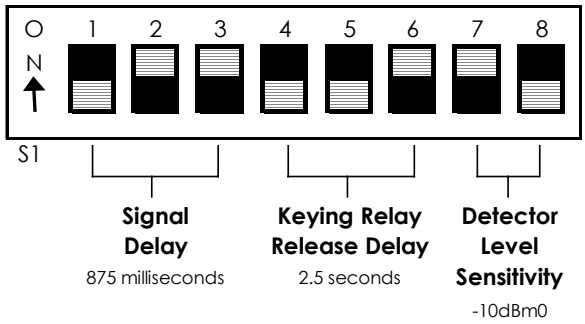
1. Set Position 4 – off
2. Set Position 5 – off
3. Set Position 6 – on



Detector Level Sensitivity (-10dBm0):

4. Set Position 7 – on
5. Set Position 8 – off





Programming the COR Functions and Alignment Switch (S3)

The S3 Switch controls the operation of the VOX module. To program the COR functions and Turn Off and On the Test Alignment (S3) Switch, perform the following steps.

1. Position 1 determines the following:

   OFF COR inputs are inactive. VOX is operated by level only.

   ON COR inputs are activated. VOX & COR determines operation.

2. Position 2 determines the COR operation:

   OFF COR input AND VOX input control keying relay.
   The COR input must be active (see S3, position 1) AND the VOX level (see S1 and S2; positions 7 & 8) must meet or exceed the programmed value in order for the keying relay to activate. Keying Relay Release timer starts when COR or VOX becomes inactive.

   ON COR input OR VOX input control keying relay.
   The COR input must be active OR the VOX level meets the programmed level in order for the keying relay to energize. Keying Relay Release timer start when COR and VOX become inactive.

3. Position 3 determines the VOX operation:

   OFF VOX circuits are enabled, audio is delayed and is used to control the keying relay.

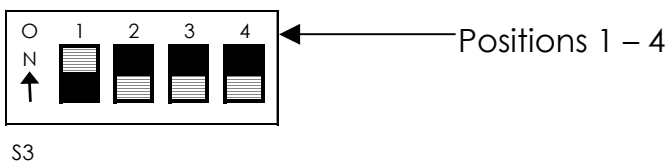
   ON VOX circuits are disabled, audio is delayed, but does NOT control the keying relay.

4. Position 4 is used during testing and alignment, otherwise, be sure it is switched to the Off position.

   OFF Normal Operation

   ON Test and Alignment position

Switch S3 Example:

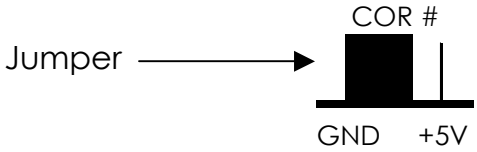


S3

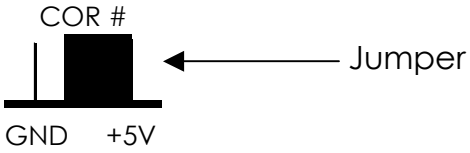
Setting the COR Inputs

If the COR inputs are enabled, the MPU uses these inputs to determine how the keying relay operates. Each COR input can be programmed for active low (GND) or active high (+5 VDC). Set the corresponding jumper as needed. COR1 and COR 2 correspond to Channel 1 and 2, respectively.

If the COR input is active low (GND), then the jumper should be in the GND position:



If the COR input is active high (+5VDC), then the jumper should be in the +5V position:



Powering Up the VOX Shelf

Make sure the source power supply is turned off before performing the following steps.

1. Remove the front panel.
2. Verify the toggle switches are in the "off" position (to the right).
3. Turn on the external power source(s).
4. Flip the toggle switches to the "on" position (to the left).
5. Four green lights on the power supply module(s) should be illuminated. There are three lights, one for each supply voltage, and one light for Power Good. (Power Good is the most important light.) If these lights are not illuminated, please refer to Chapter 4, Troubleshooting and Alignment.
6. Replace the front panel.

Troubleshooting and Alignment Procedures

Equipment Needed for Troubleshooting and Alignment:

- 61667 Extender Card (optional, but easier to align with)
- AC Voltmeter
- Alignment Tool
- Signal Generator

Alignment of the system has been performed 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 VOX Shelf chassis.

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

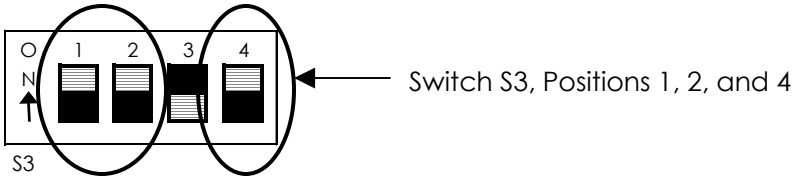
A signal generator may double terminate a port causing a reduced signal level. When injecting a test tone into a port, bridge the port with an AC voltmeter and set the signal generator output according to the AC voltmeter reading.

When an output reading is taken, the AC voltmeter will be either terminated or bridged. If it is unknown whether an output reading should be 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.

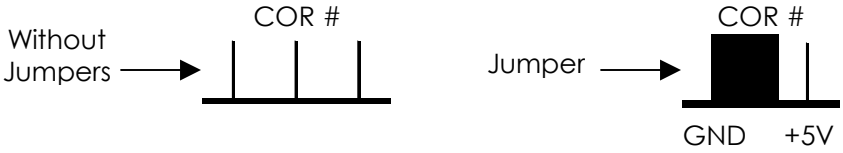
Troubleshooting and Alignment Procedures (cont.)

61649 VOX Module Alignment Procedure

1. Remove front panel.
2. Turn power OFF (flip the toggle switch to the right).
3. Remove the 61649 VOX Module from module position J1 in the Shelf.
4. Turn on positions 1, 2, and 4 of Switch S3 to activate the alignment mode and the COR inputs.



5. Place jumpers on the COR1 and COR2 stik-pins in the GND position.



6. Place a 61667 Extender Card into the module position and insert the 61649 Module into the Extender Card.
7. Turn Power ON (flip the toggle switch to the left).
8. Connect a signal generator to pins A10 and C10 on the Extender Card.
9. Set the signal generator frequency to 1KHz at the level specified by Attachment A.
10. Observe the CH1 activity LED (CR1).
11. If it is illuminated, the level is correct. If it is off, the level is either too high or too low for proper codec operation. Adjust R20 until CR1 illuminates, then fine-tune R20 for the brightest illumination from CR1.
12. Connect the AC voltmeter to pins A12 and C12 on the Extender Card. Terminate the AC voltmeter, if required. Read the level specified by Attachment A. Adjust R17 on the 61649 Module, if required. Turn off position 4 on switch S3.

Troubleshooting and Alignment Procedures (cont.)

61649 VOX Module Alignment Procedure *(cont.)*

13. Verify a low resistance between pins A20 and C20 on the Extender Card. Disconnect the signal generator. Verify that these pins are open after the relay release delay time.
14. Short pins A32 and A4 on the Extender Card if the COR inputs are strapped for GND enable, or short pins A32 and A5 on the Extender Card if the COR inputs are strapped for +5 V enable.
15. Verify a low resistance between pins A20 and C20 on the Extender Card. Remove the short, and verify that pins A20 and C20 are open after the relay release delay time. Turn on position 4 of switch S3.
16. Connect a signal generator to pins A14 and C14 on the Extender Card. Set the signal generator frequency to 1 KHz at the level specified by Attachment A.
17. Observe the CH2 activity LED (CR2).
18. If it is illuminated, the level is correct. If it is off, the level is either too high or too low for proper codec operation. Adjust R32 until CR2 illuminates, then fine-tune R32 for the brightest illumination from CR2.
19. Connect the AC voltmeter to pins A16 and C16 on the Extender Card. Terminate the AC voltmeter, if required. Read the level specified by Attachment A. Adjust R29 on the 61649 Module, if required. Turn off position 4 on switch S3.
20. Verify a low resistance between pins A26 and C26 on the Extender Card. Disconnect the signal generator. Verify that these pins are open after the relay release delay time.
21. Short pins C32 and A4 on the Extender Card if the COR inputs are strapped for GND enable, or short pins C32 and A5 on the Extender Card if the COR inputs are strapped for +5 V enable.
22. Verify a low resistance between pins A26 and C26 on the Extender Card. Remove the short, and verify that pins A26 and C26 are open after the relay release delay time.
23. Turn the power OFF (flip toggle switch to the right).
24. Put Switch S3 back to the original settings.

Troubleshooting and Alignment Procedures (cont.)

61649 VOX Module Alignment Procedure *(cont.)*

25. Remove the 61667 Extender Card and re-install the 61649 Module in the Shelf.
26. Repeat steps 3-25 for the VOX Modules in slots J2-J4, if installed.

61620 Power Supply

With power on, verify that the Power Good LED on the front of the power supply module(s) is on. This verifies that all three supply voltages are normal.

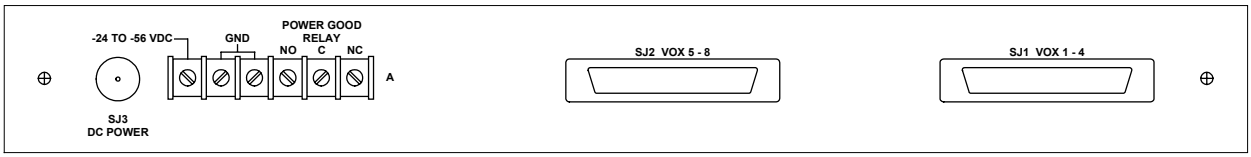
Symptoms	Possible Causes	Remedy
Power LED Off	1. Toggle switch on 61620 Power Supply in "OFF" position.	1. Switch to "ON" position.
	2. Fuse blown on 61620 Power Supply.	2. Replace fuse.
	3. 61620 Power Supply not firmly seated in the chassis.	3. Re-seat power supply module in its slot. *Note: Make sure toggle switch on the 61620 power supply module is in the "OFF" position before removing and re-inserting the power supply.*
	4. Unit not connected to Power Source or user's power source is down.	4. Confirm unit is connected properly to the power source and that the power source is functioning.
	5. Failed power supply.	5. Replace with a spare or return for repair.

Specifications

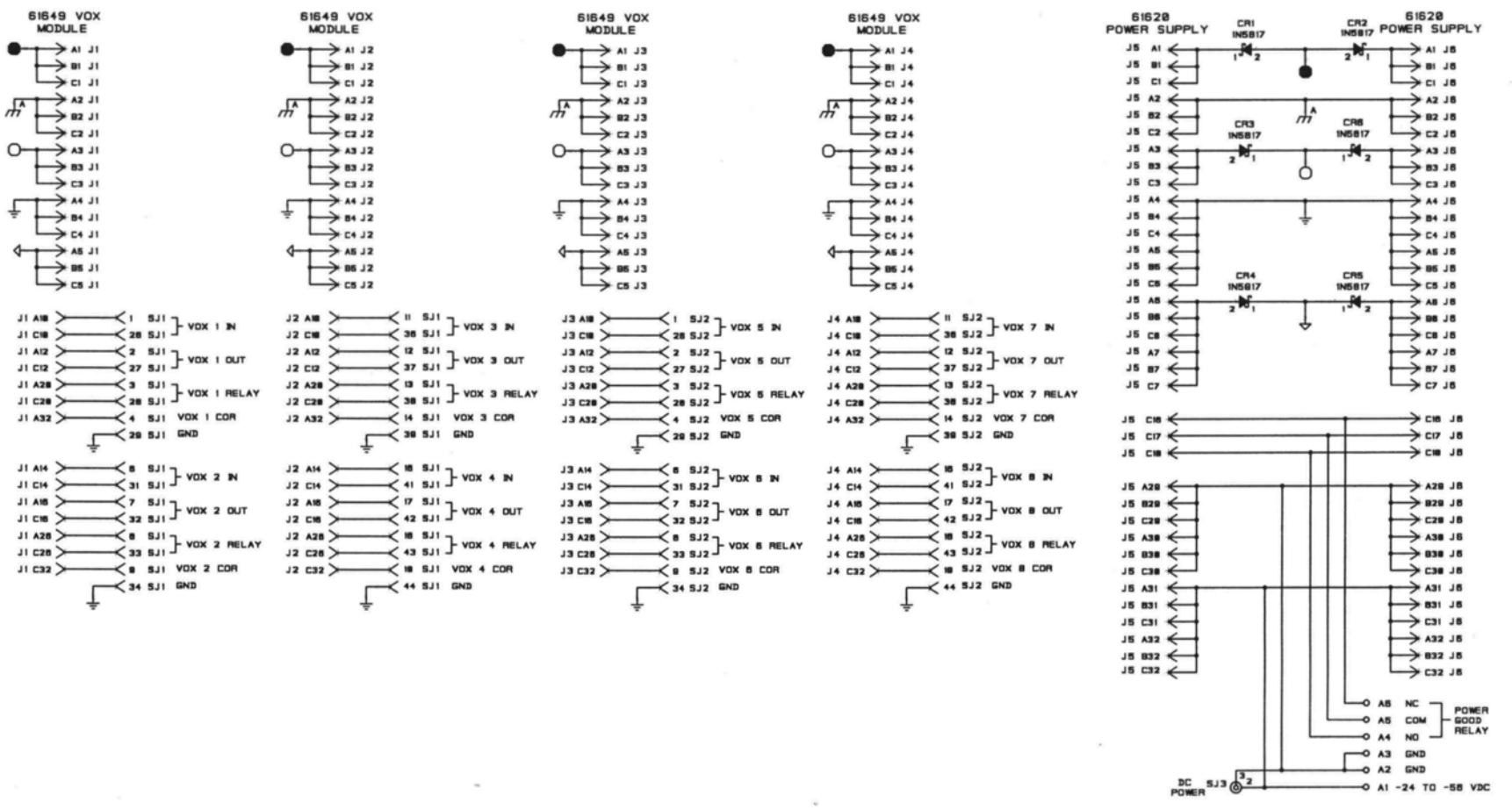
60100-400 VOX Shelf

POWER REQUIREMENT	
Input Voltage	-24 to –60 VDC input power or 100 to 250 VAC, 47-63 Hz
AC Power Safety Approvals	UL1950, CSA950, TUV/IEC950, Approved for Australia, MITI *(when the external AC-DC adapter is used)*
Current Drain (maximum)	0.6 A @ 24 VDC 0.4 A @ 48 VDC
AUDIO INTERFACE	up to 8 VOX inputs and outputs
Input/Output Impedance	600 ohms balanced, transformer isolated
Input/Output Level	+3 to –16 dBm, continuously adjustable
Frequency Response	+1, -3 dB from 200 to 3400 Hz
Signal to Noise Ratio	Greater than 65 dB (at 0 dBm transmit level)
Signal Detect Level	-20, -15, -10, or –5 dBm0
PTT RELAY CONTACTS	
Maximum Current	50 mA. max
ENVIRONMENTAL	
Ambient Temperature	0°C to +50°C
Storage Temperature	-50°C to +80°C
Relative Humidity	95% max, 0 to 40°C non-condensing
Operating Altitude	15,000 ft max (4,572 meters)
DIMENSIONS	
Width	19.0 inches (483.0 mm)
Depth	12.0 inches (304.8 mm)
Height	1.75 inches (44.5 mm) (1 ru/EIA mps)
WEIGHT (fully loaded)	20 pounds (9.1 kg)

60100-400 Back Panel Diagram



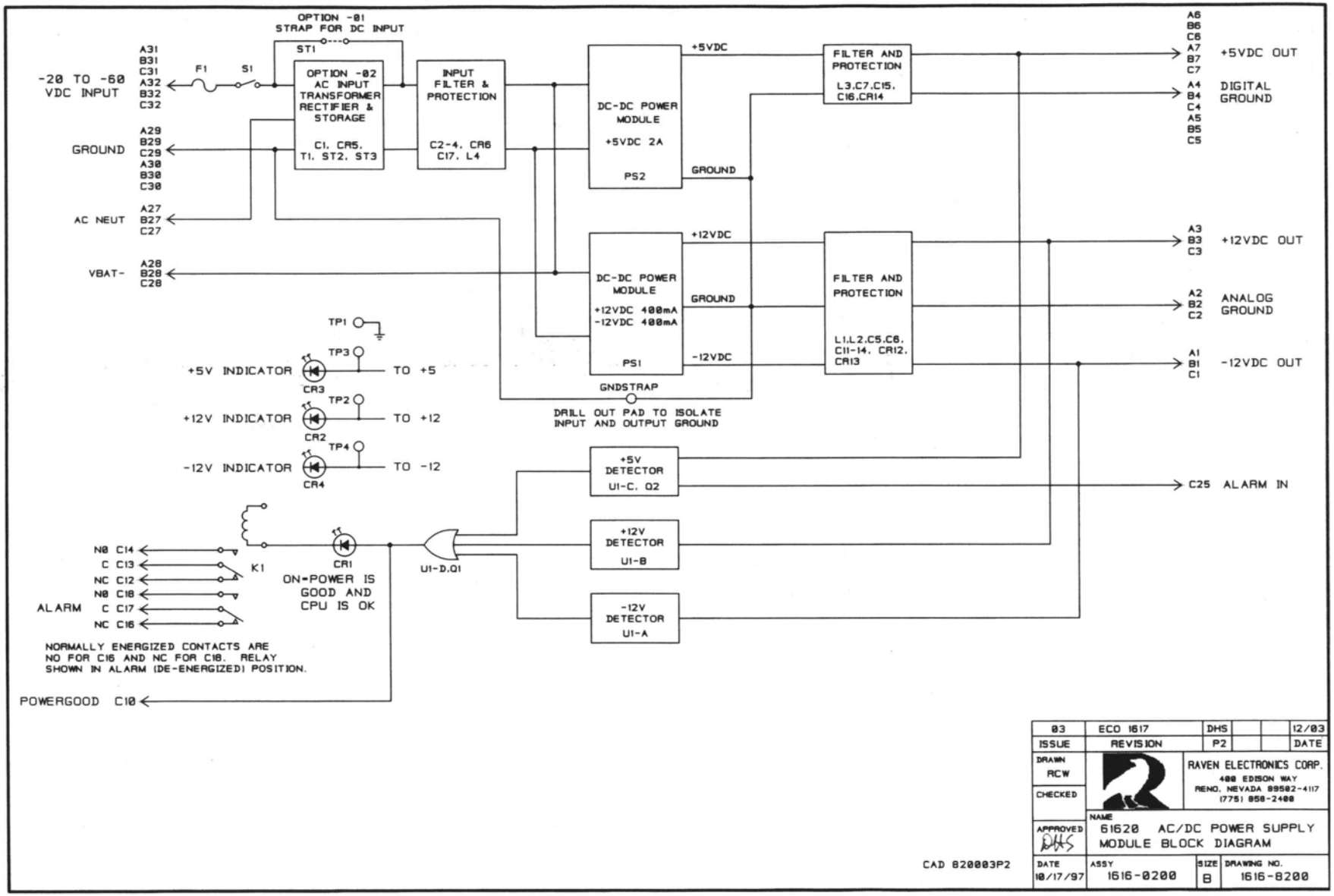
REAR PANEL VIEW

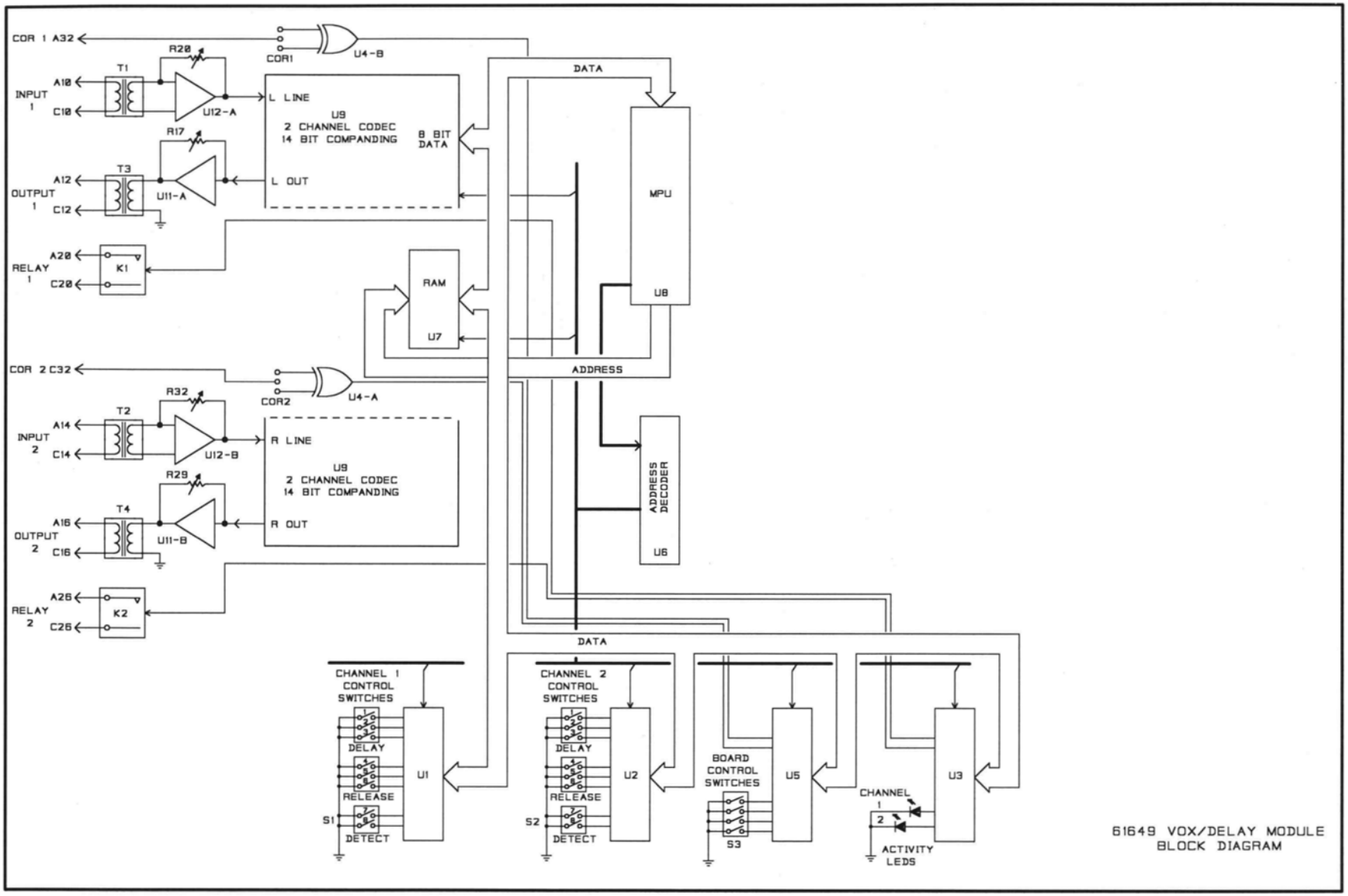


NOTES: (UNLESS OTHERWISE SPECIFIED)

1. WHEN OPTION -01 IS SPECIFIED INSTALL 61620 IN J6 AND DELETE DIODES CR1-6. STRAP OUT CR2, CR5 & CR6 WITH 24AWG INSULATED WIRE.
2. SQUARE PAD INDICATES PIN A1 ON 96 PIN CONNECTORS OR CATHODE ON DIODES.
3. WITH NORMAL OPERATION TERMINAL A4 IS N.C. AND TERMINAL A6 IS N.O.

601-100 REAR MOTHERBOARD
VOX/DELAY SLIMLINE SHELF


OPTION -01
STRAP FOR DC INPUT
ST1
-20 TO -60
VDC INPUT
A31
B31
C31
A32
B32
C32
F1
S1
OPTION -02
AC INPUT
TRANSFORMER
RECTIFIER &
STORAGE
C1, CR5,
T1, ST2, ST3
INPUT
FILTER &
PROTECTION
C2-4, CR6
C17, L4
DC-DC POWER
MODULE
+5VDC 2A
PS2
+5VDC
GROUND
FILTER AND
PROTECTION
L3,C7,C15,
C16,CR14
A6
B6
C6
A7
B7
C7
+5VDC OUT
A4
B4
C4
A5
B5
C5
DIGITAL
GROUND
GROUND
A29
B29
C29
A30
B30
C30
AC NEUT
A27
B27
C27
VBAT-
A28
B28
C28
DC-DC POWER
MODULE
+12VDC 400mA
-12VDC 400mA
PS1
+12VDC
GROUND
-12VDC
FILTER AND
PROTECTION
L1,L2,C5,C8,
C11-14, CR12,
CR13
A3
B3
C3
+12VDC OUT
A2
B2
C2
ANALOG
GROUND
A1
B1
C1
-12VDC OUT
GNDSTRAP
DRILL OUT PAD TO ISOLATE
INPUT AND OUTPUT GROUND
TP1
TP3
+5V INDICATOR
CR3
TO +5
TP2
+12V INDICATOR
CR2
TO +12
TP4
-12V INDICATOR
CR4
TO -12
+5V
DETECTOR
U1-C, Q2
+12V
DETECTOR
U1-B
-12V
DETECTOR
U1-A
C25 ALARM IN
NO C14
C C13
NC C12
NO C18
ALARM C C17
NC C16
K1
CR1
ON=POWER IS
GOOD AND
CPU IS OK
U1-D,Q1
NORMALLY ENERGIZED CONTACTS ARE
NO FOR C16 AND NC FOR C18. RELAY
SHOWN IN ALARM (DE-ENERGIZED) POSITION.
POWERGOOD C10
CAD 820003P2
03
ECO 1617
DHS
12/03
ISSUE
REVISION
P2
DATE
DRAWN
RCW
CHECKED
APPROVED
DHS
DATE
10/17/97
RAVEN ELECTRONICS CORP.
400 EDISON WAY
RENO, NEVADA 89502-4117
(775) 858-2400
NAME
61620 AC/DC POWER SUPPLY
MODULE BLOCK DIAGRAM
ASSY
1616-0200
SIZE
B
DRAWING NO.
1616-8200


COR 1 A32
COR1
U4-B
R20
T1
A10
INPUT 1
C10
U12-A
L LINE
U9
2 CHANNEL CODEC
14 BIT COMPANDING
8 BIT DATA
R17
T3
A12
OUTPUT 1
C12
U11-A
L OUT
A20
RELAY 1
C20
K1
RAM
U7
DATA
MPU
U8
ADDRESS
COR 2 C32
COR2
U4-A
R32
T2
A14
INPUT 2
C14
U12-B
R LINE
U9
2 CHANNEL CODEC
14 BIT COMPANDING
R29
T4
A16
OUTPUT 2
C16
U11-B
R OUT
A26
RELAY 2
C26
K2
ADDRESS DECODER
U6
DATA
CHANNEL 1 CONTROL SWITCHES
DELAY
RELEASE
S1
DETECT
U1
CHANNEL 2 CONTROL SWITCHES
DELAY
RELEASE
S2
DETECT
U2
BOARD CONTROL SWITCHES
S3
U5
CHANNEL
1
2
ACTIVITY LEDS
U3
61649 VOX/DELAY MODULE
BLOCK DIAGRAM

60100-400 Installer Connections

FUNCTION	REAR TERMINAL CONNECTIONS	SUGGESTED WIRE
Power	A1 or SJ3 Sleeve -24 to -56VDC A2 or SJ3 Center GND	18 GA
Power Good (Alarm) Relay	A4 ALARM NC	24 GA
	A5 ALARM C	24 GA
	A6 ALARM NO	24 GA
VOX 1 RCV	SJ1 pins 1 & 26	24 GA Twisted
VOX 2 RCV	SJ1 pins 6 & 31	24 GA Twisted
VOX 3 RCV	SJ1 pins 11 & 36	24 GA Twisted
VOX 4 RCV	SJ1 pins 16 & 41	24 GA Twisted
VOX 1 XMT	SJ1 pins 2 & 27	24 GA Twisted
VOX 2 XMT	SJ1 pins 7 & 32	24 GA Twisted
VOX 3 XMT	SJ1 pins 12 & 37	24 GA Twisted
VOX 4 XMT	SJ1 pins 17 & 42	24 GA Twisted
VOX 1 COR INPUT	SJ1 pin 4 & GND pin 29	24 GA
VOX 2 COR INPUT	SJ1 pin 9 & GND pin 34	24 GA
VOX 3 COR INPUT	SJ1 pin 14 & GND pin 39	24 GA
VOX 4 COR INPUT	SJ1 pin 19 & GND pin 44	24 GA
VOX 1 PTT RELAY	SJ1 pins 3 & 28	24 GA
VOX 2 PTT RELAY	SJ1 pins 8 & 33	24 GA
VOX 3 PTT RELAY	SJ1 pins 13 & 38	24 GA
VOX 4 PTT RELAY	SJ1 pins 18 & 43	24 GA
VOX 5 RCV	SJ1 pins 1 & 26	24 GA Twisted
VOX 6 RCV	SJ1 pins 6 & 31	24 GA Twisted
VOX 7 RCV	SJ1 pins 11 & 36	24 GA Twisted
VOX 8 RCV	SJ1 pins 16 & 41	24 GA Twisted
VOX 5 XMT	SJ1 pins 2 & 27	24 GA Twisted
VOX 6 XMT	SJ1 pins 7 & 32	24 GA Twisted
VOX 7 XMT	SJ1 pins 12 & 37	24 GA Twisted
VOX 8 XMT	SJ1 pins 17 & 42	24 GA Twisted
VOX 5 COR INPUT	SJ1 pin 4 & GND pin 29	24 GA
VOX 6 COR INPUT	SJ1 pin 9 & GND pin 34	24 GA
VOX 7 COR INPUT	SJ1 pin 14 & GND pin 39	24 GA
VOX 8 COR INPUT	SJ1 pin 19 & GND pin 44	24 GA
VOX 5 PTT RELAY	SJ1 pins 3 & 28	24 GA
VOX 6 PTT RELAY	SJ1 pins 8 & 33	24 GA
VOX 7 PTT RELAY	SJ1 pins 13 & 38	24 GA
VOX 8 PTT RELAY	SJ1 pins 18 & 43	24 GA

General Conditions of Sales

RAVEN ELECTRONICS CORPORATION
400 EDISON WAY, RENO, NEVADA 89502
TELEPHONE 775-858-2400 FAX: 775-858-2410

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

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

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

Raven Electronics Corporation
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775.858.2400 Phone
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Web site: www.ravencomm.com