



Raven Electronics Corporation

Raven 61510-622-DB

Digital Orderwire



Users Manual

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General Information

Thank you for purchasing the 61510-622-DB Digital 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:

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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 61510-622-DB Digital Orderwire provides all necessary functions for voice communications through a 64 Kbps digital service channel by including voice codecs in the Orderwire Terminal. This system has the capability for selective station addressing using one to five-digit DTMF programming, with "All Call" and "Group Call", while on a common channel or party line. The 61510-622-DB also includes a 61584 4-Way Digital Bridge which provides four 64 Kbps RS-422 (V.11) ports for connection to the service channel equipment, as well as two analog VF ports, or one VF port and one or two RS-232 data ports, the drop to the Orderwire front panel and to the 61670-01 Telephone Interface (optional modules) for an extension telephone. The Digital Bridge performs the conference bridge function for all these signal paths digitally, eliminating additional quantizing units at repeater and hub sites. The 61510D-622-DB operates from a -24 to -56 VDC source, while the 61510A-622-DB operates from a 100 to 250 VAC source.

The RS-422 ports utilize an 8-wire interface, with balanced pairs for TX Data, RX Data, TX Clock, and RX Clock. Two relays are included to loop the Port 1 RX Data to the Port 2 TX Data and the Port 2 RX Data to Port 1 TX Data when the Orderwire is powered off. This feature allows the service channel on the main route (connected to Ports 1 and 2) to remain functional even if the Orderwire at a particular site is powered off or fails.

The 61510-622-DB can be used at repeater sites or can function as a 4-port hub site. It can also be used at the end of the line (a spur) where only one RS-422 port is used. The 61510-622-DB consists of the following modules: 61684 4-Way Digital Bridge, 61521 Power Supply, and 61670-01 Telephone Interface (optional modules). They are all removable for easy maintenance or replacement.

Front Panel

The front panel includes a handset with cradle and hookswitch, headset jacks, a one-watt speaker with volume control, a DTMF keypad, and LED indicators for power, off-hook, and incoming call. The voice codec and speaker amplifier are located inside the front panel on the 616-110 Front Motherboard. The Up and Down Volume buttons control the volume digitally through the micro-controller on the Digital Bridge such that the speaker (on-hook) and handset/headset (off-hook) volume are set independently. An Expansion bus interconnects the front panel, Telephone Interface and Digital Bridge to route control signals and digitized audio between the various circuits.

Transmit From the Front Panel

Voice signals are routed from the handset or headset microphone to a codec, which digitizes the voice. The digitized voice is then routed to a digital signal processor (DSP), which inserts the signal into the Expansion bus and routes it to the Digital Bridge.

DTMF encoding is performed digitally; the micro-controller on the Digital Bridge reads inputs from the DTMF keys via the Expansion bus and routes this information to the DSP. The DSP encodes the proper DTMF digit and the signal is routed to the appropriate Digital Bridge outputs.

System Description (cont.)

Receive To the Front Panel

Digitized voice frequency signals are routed from the Digital Bridge to the digital signal processor (DSP) via the Expansion bus. The signal is routed to the codec, which converts it to an analog voice frequency signal and routes it to the speaker when on-hook, or to the handset or headset earpiece when off-hook. The Up/Down Volume buttons are read by the micro-controller on the Digital Bridge to independently control the volume of the speaker and handset/headset earpiece.

The DTMF station call code is decoded by the micro-controller on the Digital Bridge, which asserts the audible call alert tone, transmits ringback, and flashes the ALERT indicator. The DTMF code assigned to the extension telephone is likewise decoded by the Digital Bridge, which asserts the ring generator. Ringback is generated on the Telephone Interface module. The Orderwire call code and the telephone call code can be identical (so that the Orderwire and telephone ring at the same time) or unique (the Orderwire and telephone ring independently, based on their assigned DTMF codes). The all call feature is decoded in a like manner, but the ringing cycle is twice as fast and no ringback is transmitted. The group call feature rings at the normal rate, and no ringback is transmitted. Programming and settings are stored in non-volatile RAM, so loss of power has no effect on the stored data. The micro-controller also controls the POWER and OFF-HOOK indicators.

61584 4-Way Digital Bridge

The 61584 Digital Bridge includes DSP circuitry, a micro-controller, and associated memory and buffers. Ringback and call alert tone generation, DTMF encoding and decoding, and volume control are performed digitally by the DSP circuitry, micro-controller, and other digital processing circuitry. The DTMF station call code, telephone extension call code, all call code, ring period, call alert tone volume and frequency, and the setup of the various ports is stored in non-volatile RAM, also located on this module.

In the **synchronous** mode of operation, a digital phase locked loop (PLL) circuit on the 61584 Digital Bridge synchronizes the Orderwire to an *external* clock source. This eliminates slip and skip problems since all internal clocks and counters are locked to the external clock source. NOTE: The synchronous mode of operation requires that the external receive and transmit clocks provided by the service channel equipment be identical. The PLL locks to the clock on Bridge Port 1 as the default. If valid clock is not found, or is lost, on Port 1, the PLL will "hunt" through Ports 2, 3, 4, and back to 1 until valid clock is found. If no external clock is found, the PLL locks to an internal clock to run the internal circuitry, but nothing will be transmitted on the four RS-422 ports. Synchronous mode should not be used when external receive and transmit clocks cannot be guaranteed to be identical.

In the **asynchronous** mode of operation (the default), a digital phase locked loop (PLL) circuit on the 61584 Digital Bridge synchronizes the Orderwire to an *internal* clock source. The **asynchronous** mode of operation allows for variation in external transmit and receive clocks from the service channel equipment for each individual port in use. Each RS-422 port can be independently clocked by the service channel equipment, tolerating up to a 5 Hz variation in the 64 KHz clock rate. Further, the transmit and receive functions of each RS-422 port can be independently clocked. The only drawback to asynchronous mode is a very slight drop in voice quality and a halving of the serial data rate when the Digital Bridge is provisioned to operate in one of the data modes.

System Description (cont.)

The 61584 Digital Bridge can be provisioned to operate in the following modes:

- Single Channel Voice
- Two Channel Voice
- One Channel Voice / One Channel Data
- One Channel Voice / Two Channel Data

In modes other than Single Channel Voice mode, the 61584 Digital Bridge splits the 64 Kbps data into two 32 Kbps paths. The Orderwire voice and VF Port 1 are digitized into a 14-bit format and then compressed to a 3-bit or 4-bit ADPCM signal. This 3-bit or 4-bit signal is inserted into the upper nibble of the 8-bit byte. If the second 32 Kbps path is used as an auxiliary VF path, it is likewise compressed and inserted into the lower nibble of the 8-bit byte. If the second 32 Kbps path is used for serial data, the serial data is inserted into the lower nibble with no compression.

If the second 32 Kbps path is used as an auxiliary talk path or for VF data, it is assigned to VF Port 2. Thus VF Port 1 is assigned to the Orderwire talk path for an analog extension, and VF Port 2 is assigned to the auxiliary path. These VF paths operate as two independent voice circuits.

If the second 32 Kbps path is used to transport digital data, it can be assigned to one or both of the RS-232 data ports. If both RS-232 ports are utilized, the maximum data rate is 9.6 Kbps in synchronous mode, and 4.8 Kbps in asynchronous mode. If only one of the RS-232 ports is utilized, the maximum data rate is 19.2 Kbps in synchronous mode, and 9.6 Kbps in asynchronous mode.

VF Port 2 and the RS-232 data are mutually exclusive. If the auxiliary path is provisioned to carry serial data, VF Port 2 is disabled. VF Port 1 is always associated with the Orderwire talk path and is not affected by the data selection. The Bridge can be re-provisioned with an ASCII terminal device to change the configuration of the VF and data ports.

61521 Power Supply

The 61521 Power Supply provides regulated +5 VDC and ± 12 VDC to power the Orderwire from a -24 to -56 VDC source. When the power source is AC, an external AC to DC converter is used to power the 61521 Module. The Power Supply Module includes a power good circuit, which activates an alarm if any of the three voltages go out of regulation. The watchdog on the Digital Bridge also activates the circuit for a micro-controller failure. This alarm is available on the rear panel terminals as a dry contact closure (POWER/CPU ALARM). The Power LED on the front panel also goes off if any of the voltages fail.

61670-01 Telephone Interface (optional modules)

The 61670-01 Telephone Interface provides talk battery, ring voltage, and the off-hook/on-hook controls to connect an analog 2-wire DTMF telephone instrument to the Orderwire. The extension telephone can be located up to 1,000 wire feet away from the Orderwire. Subscriber Line Interface Chips (SLICs) and DSP circuitry are utilized to convert the audio to and from the telephone to a digital signal suitable for communication through the Digital Bridge. The Telephone Interface communicates with the Digital Bridge via the Expansion bus, allowing the extension telephone to communicate with all the RS-422 ports, the VF1 port, as well as the Orderwire handset/headset. The CPU activates the ring generator on the Telephone Interface when the assigned DTMF code is detected.

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 (VF Port and Telephone Connections)

Digital Voice/Data Connections:

- 9-Pin D-Sub Connectors (Data Connections) (optional)
- 25-Pin D-Sub Female Connectors

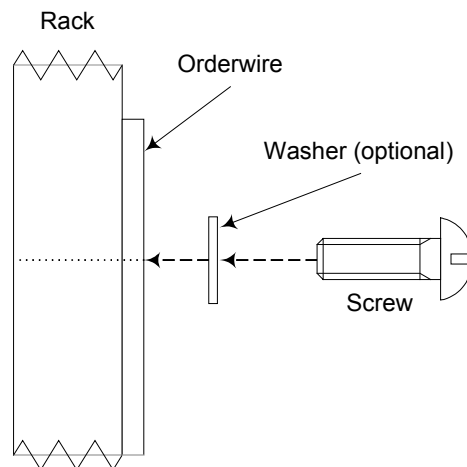
Power Connections:

- 18-Gauge Wire

Mounting Unit in Rack

Please note, Raven supplies the hardware for the mounting on the chassis, but not on the rack (except if ETSI flanges are requested). The flanges included with your Digital Orderwire are interchangeable between 19" and 23" (or ETSI flanges, if requested) 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.



For ETSI flanges (diagram not shown):

1. Insert clip nuts into rack.
2. Hold unit in place in the rack.
3. Run a bolt through the mounting brackets and in the clip nuts.
4. Repeat step 3 until all for bolts are in place.

Hooking Up Connections

With the source power turned off, use the following instructions to hook up your 61510-622-DB Orderwire. All wiring connections are made on the rear panel of the Orderwire. You may refer to the chart below (*also found in Table B*). The RS-422 ports are available on 25-Pin D-Sub Female Connectors. Screwlocks are included on the connectors to retain the mating connector.

DC power, telephone circuits, and the VF Ports are connected to the terminal strips. Text is screened on the rear panel to clearly identify each terminal's function. 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 (do not overtighten). The terminal strip is designed to make a crimp connection on the wire when the screw is tightened. To properly use this feature, be sure that the wire is slipped between the fixed and moveable portions of the terminal.

The RS-232 data ports are available on 9-Pin D-Sub Female Connectors. The connectors include threaded hex nuts, which accept 4-40 screws to retain the mating connector. The RS-232 ports are design to function as Data Communications Equipment (DCE), so most applications will use a standard (straight through) modem cable. If the Data Terminal Equipment (DTE) connected to the Orderwire doesn't use the control leads (DTR, DSR, RTS, & CTS), connect the DSR OUT (pin 6) to DTR IN (pin 4) in the modem cable at the Orderwire connector.

The extension telephone may be connected to either the RJ-11 modular telephone jack or the terminal strip.

DC power is connected to the unit at the terminal strips or SJ8, DC POWER INPUT jack. If AC power is utilized, an external power pack is connected between the AC line voltage and the DC Power Input of the Orderwire.

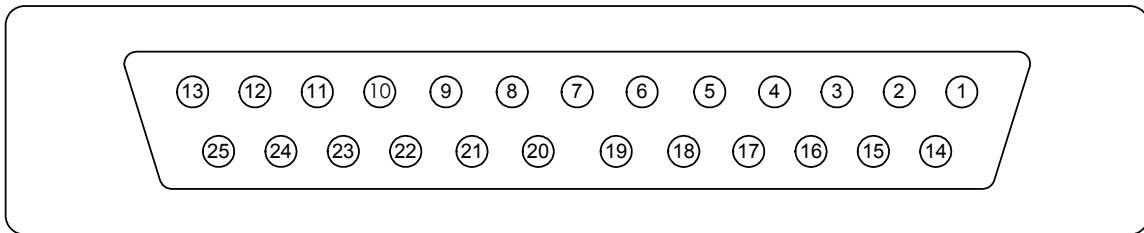
Be sure Power is turned OFF.

FUNCTION	REAR TERMINAL CONNECTIONS	SUGGESTED WIRE
VF Port 1 In (VF 1 IN)	B1, B2	24 GA
VF Port 1 Out (VF 1 OUT)	B3, B4	24 GA
VF Port 2 In (VF 2 IN)	B5, B6	24 GA
VF Port 2 Out (VF 2 OUT)	B7, B8	24 GA
Telephone Interface #1 (TELSET 1/ 2W LINE)	C1, C2	24 GA
Telephone Interface #1 Off Hook Relay (OFF HOOK RELAY)	C3, C4, C5	24 GA
Telephone Interface #1 Ring Relay (RING RELAY)	C6, C7, C8	24 GA
Telephone Interface #2 (TELSET 2/ 2W LINE)	D1, D2	24 GA
Telephone Interface #2 Off Hook Relay (OFF HOOK RELAY)	D3, D4, D5	24 GA
Telephone Interface #2 Ring Relay (RING RELAY)	D6, D7, D8	24 GA
Power / CPU Alarm (PWR GOOD/CPU FAIL RELAY)	A4, A5, A6	24 GA
Power (-24 TO -56 VDC)	A1 or SJ8 SLEEVE -24 TO -56 VDC A2, A3 or SJ9 CENTER GROUND	18 GA

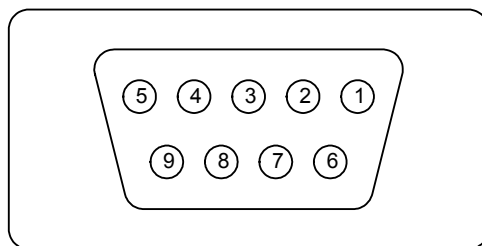
Hooking Up Connections (cont.)

PIN ASSIGNMENT				
1		NC		14
2		NC		15
3		NC		16
4		NC		17
5		NC		18
6	(+)	EXT TX CLK IN	(-)	19
7	(+)	EXT RX CLK IN	(-)	20
8		NC		21
9		NC		22
10	(+)	RX DATA IN	(-)	23
11	(+)	TX DATA OUT	(-)	24
12	NC		GND	25
13	NC			

25-Pin D-Sub Connector Pin Assignments



25-Pin D-Sub Connector
Digital Ports 1 - 4



9-Pin D-Sub Connector
Serial Data Ports 1 and 2

Hooking Up Connections (cont.)**Telephone Interface (TELSET 1/ 2 W LINE and TELSET 2/ 2 W LINE)** (Optional Module)

Signals are routed through the 61670-01 Telephone Interface module only when the telephone extension is off-hook. Expansion Bus signals are routed through a Subscriber Line Interface Chip (SLIC) set which provides impedance matching between the Orderwire system and the telephone set. Transmit and receive levels are fixed on the telephone. The SLIC chip set performs the functions of a codec and analog level translation to and from the telephone.

Ringing voltage is generated by the SLIC. The SLIC contains an on-board DC-DC converter circuit that generates the high voltage needed for ringing voltage. This voltage is modulated by digital steps to generate the roughly sine wave ringing voltage. The frequency of the ringing voltage is set in the Orderwire provisioning.

The extension telephone(s) may be connected to either the RJ-11 modular telephone jack(s) or the terminal strip(s).

RING RELAY

The Ring Relay follows the cadence of the telephone ringing. If a speaker, bell, light, or other external equipment is connected to the Ring Relay, that equipment will be turned on as well while the extension telephone is ringing.

Analog VF Ports 1 & 2 (VF1 IN and OUT & VF2 IN and OUT)

The analog VF Ports are set for transmit and receive levels of 0 dBm at the factory. These levels can be changed in the field through the provisioning routine using a handheld programmer or a computer running in the terminal mode, or by the manual adjustment *shown in the next section*.

OFF HOOK RELAY

This relay is energized when "off-hook" with the Extension Telset. The connections listed are: NO (normally open), C (common), and NC (normally closed). 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.

PWR/CPU ALARM

This connection allows the user to connect to an alarm and control device. This will alert the user if the power supply or DSP fails. The two connections listed are: C (common) and NO (normally open).

DIGITAL PORTS 1-4 (Digital Bridge)

The Digital Bridge provides the interface between the four 64 Kbps RS-422 ports, two analog VF ports, two RS-232 data ports, and the Expansion bus. VF Port 1 is always associated with the Orderwire talk path. VF Port 2 and the RS-232 data ports are mutually exclusive, such that only one or the other can be utilized. This means if VF Port 2 is enabled, both data ports are disabled. If one or both of the data ports are enabled, VF Port 2 is disabled. DSP circuitry performs the conference bridge function, combining and splitting signals and routing them to the appropriate ports. Return loss on the analog ports is greater than 60 dB, and on the RS-422 ports is essentially infinite.

Hooking Up Connections (cont.)

The RS-422 ports rely on the external clock source for the receive data and transmit data. If there is no external clock on a Bridge port, that port is muted and nothing is transmitted. In the **synchronous** mode, if clocks are present but there is no synchronization character received, only the synchronization character is transmitted. Communication is not possible until the Orderwire at both ends of the link have achieved synchronization. Other ports with clock and receive synchronization present will operate normally. Four "Digital Port Sync" LED indicators located on the front edge of the Digital Bridge module illuminate when synchronization is achieved on the associated RS-422 port.

The **asynchronous** (the default) mode of operation does not rely upon a synchronization character, as is the case in synchronous mode. The asynchronous mode of operation relies upon a start and a stop bit framing each data byte to provide for synchronization of data. The four "Digital Port Sync" LED indicators located on the front edge of the Digital Bridge module illuminate to show that data is successfully being received and transmitted on a particular RS-422 port.

The VF Analog Ports of the Bridge are 4-wire, 600 ohms balanced and provide transformer coupling for DC isolation and excellent common-mode rejection. Levels within a range of -16 to +7 dBm can be accommodated. The factory default levels are 0 dBm for transmit and receive. The DSP circuitry controls the signal level settings, and adjustments are performed through the provisioning routine using a handheld programmer or a computer running in the terminal mode. The levels of the two inputs and two outputs are independently adjustable.

The RS-232 Data Ports of the Bridge can be used for the transmission of one or two asynchronous data streams. If both data ports are utilized, the maximum data rate is 9.6 Kbps in *synchronous* mode, and 4.8 Kbps in *asynchronous* mode. If only one data port is utilized, the maximum data rate is 19.2 Kbps in synchronous mode, and 9.6 Kbps in asynchronous mode. Two RS-232 9-pin D-Sub female connectors are located on the rear panel for connecting the data terminal device(s). If the control leads are not utilized, the DTR IN pin must be pulled high externally.

Powering Up the Orderwire

Under normal circumstances, it should not be necessary to remove the Digital Bridge from the Orderwire. If for some reason the modules must be unplugged, be sure to turn power OFF when removing and replacing the modules.

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. If the unit powers up properly, a short beep is heard and the power indicator on the front panel illuminates.

If an error is detected, the power indicator will not illuminate. If the Bridge is faulty, the VF1 red LED will be illuminated and one (or more) of the green Digital Port Sync LEDs will be flashing. The following chart indicates the error based upon which green LED is flashing:

ERROR	LED RCV1	LED RCV2	LED RCV3	LED RCV4
Bridge Memory Error	Flashing	Off	Off	Off
1845 CODEC Error	Off	Flashing	Off	Off
ADPCM Processor Error	Off	Off	Flashing	Off
Framing Pulse Error	Off	Off	Off	Flashing
Processor Out of Time Error	Flashing	Flashing	Off	Off

If the Power Supply is faulty, one or more of the green power LEDs (+12 V LED, +5 V LED, -12 V LED) will be off. The green PWR GOOD LED on the Power Supply will be off if any of the power LEDs are off, or if the 61584 Digital Bridge DSP is in an error condition. The green front panel PWR LED mimics the operation of the PWR GOOD LED on the power supply.

6. Close the front panel.
7. The green light on the front panel should be illuminated while the unit is on.

Start-Up Diagnostics

If an ASCII device such as a handheld programmer or a computer running terminal software is connected to the craft port upon powering on the Orderwire, a series of characters will be displayed to the ASCII device. Each character represents a milestone being met during the initialization of hardware. Should the system “hang” before becoming operational, the following codes may help in determining where the problem resides.

Start-Up Diagnostic Codes Displayed to Handheld or Computer (via Craft Port)

- 1 – Initialized 188 registers
- 2 – Initialized global data
- 3 – Turned on 188 interrupts
- 4 – Setup PIO
- 5 – Initialized Dual Port RAM
- 6 – Setup DOW Parameters – Reads EEPROM or creates new EEPROM data structure
- 7 – Setup Function Pointers – Function handler for messages from 2181
- 8 – Test LEDs
- 9 – Inform 2181 that the 188 is ready
- A – Wait for 2181 to boot up
- B – Check 2181 Software Revision
- C – Check for modules in J slots
- D – Assign and connect timeslots

**** Report codes displayed to Tech Support ****

Manual Programming

Program / Verify Mode

The Orderwire is programmed for the site DTMF all call code, DTMF station code, 19 DTMF group call codes, telephone extension DTMF code, ring time period, interdigit time period, and the ringing tone volume and frequency through the front panel push buttons. When in the Program Mode, the DTMF encoder is disabled so no digits are transmitted when the keys are pressed.

To access the Program Mode:

1. Open the front panel.
2. Press the Program Mode switch (S1, near the craft port connectors) on the Digital Bridge.
3. A short beep will be heard and the front panel alert and off-hook indicators will be flashing simultaneously.

Programming entries are not saved to the non-volatile memory until the Program Mode is exited, so the Orderwire should not be powered off while in the Program Mode. If power is interrupted, all entries will be lost and must be performed again.

Once in Program Mode, the Orderwire must remain on-hook. When a valid programming entry is made, a short high-frequency beep is heard. If an invalid entry is made, a low-frequency tone is heard. The Orderwire automatically resets to the Operational Mode if there are no programming entries for five minutes.

Manual Programming (cont.)

All Call DTMF Code

The default for the all call feature is the “*” digit. To change this setting,

1. Press **0 0 #** (zero – zero – pound) on the DTMF keypad.
2. Enter the all call code (up to five digits can be entered).
3. Press **#** (pound).

Station DTMF Call Code

To program the station call code:

1. Press **0 1 #** (zero – one – pound) on the DTMF keypad.
2. Enter the call code (up to five digits can be entered).
3. Press **#** (pound).

*Nineteen (19) group call numbers may be programmed by following the above procedure using **0 2 #** thru **2 0 #**.*

Extension Telephone Code

To program the extension telephone call code:

1. Press **2 1 #** (two – one – pound) on the DTMF keypad for the telephone interface in slot 1 or press **2 2 #** (two – two – pound) for the telephone interface in slot 2.
2. Enter the call code (up to five digits can be entered). *(If the Orderwire and telephone are to ring simultaneously, enter the same call code that was used for **0 1 #**.)*
3. Press **#** (pound).

Inter-Digit Time Period

The default inter-digit time (period of time the Orderwire waits between DTMF digits) is 5 seconds. The minimum setting is 2 seconds and the maximum setting is 5 seconds. To change this setting:

1. Press **3 0 #** (three – zero – pound) on the DTMF keypad.
2. Enter the number of seconds the Orderwire should wait between digits before clearing the DTMF buffer (2 to 5 seconds).
3. Press **#** (pound).

Ring Tone Volume and Frequency

To set the volume and frequency of the ringing tone:

1. Press **4 0 #** (four – zero – pound) on the DTMF keypad. The ringing tone will be heard from the speaker.
2. Use the Up and Down Volume buttons to adjust the ringing volume.
3. Press the * button on the DTMF keypad to toggle the ringing frequency between the low tone and the high tone.
4. Press the **#** (pound) on the DTMF keypad when the desired volume and frequency are obtained.

The ringing volume is not affected by the Up and Down Volume buttons when the Orderwire is in the Operational Mode.

Ring Time Period

The default ring time (period of time the Orderwire rings when an incoming call is not answered) is 15 seconds. The minimum setting is 10 seconds and the maximum setting is 120 seconds. To change this setting:

1. Press **5 0 #** (five – zero – pound) on the DTMF keypad.
2. Enter the number of seconds the Orderwire should ring (10 to 120).
3. Press **#** (pound).

Manual Programming (cont.)**Verifying Programming Entries**

The Orderwire should still be in the Program Mode.

1. Go off-hook with the Orderwire handset.
2. Using the Orderwire keypad, dial the Station DTMF call code entered previously.
3. The alert indicator should flash and the ringing tone should be heard from the speaker at the volume and frequency selected in previously.
4. The call alerts should continue for the ring time entered previously, then automatically stop.

To Test All Call:

The all call audible alert cycles on and off at twice the rate as a normal station-to-station call.

To test the all call:

1. Go off-hook.
2. Dial the all call code.
3. The alert indicator should flash and the all call ringing should be heard from the speaker at the volume selected previously. The alerts should continue for the time entered previously, then automatically stop.

The call alerts and telephone ringing can be stopped immediately with a hook flash or the DTMF # (pound) key.

RAM Reset

If the memory becomes corrupted and cannot be corrected with routine programming, the RAM can be cleared and reset to factory default settings (including VF levels):

Port Configuration:	All Digital RS-422 ports enabled, set for 64 Kbps data rate and external clocks. VF Ports 1 & 2 set for 0 dBm TX & RX levels. Both RS-232 serial ports are disabled.
Operating Mode:	Two 32 Kbps voice channels, one for handset/speaker and VF Port 1, and one for VF Port 2 (VF 2 can be an auxiliary channel for FSK data, etc.)
DTMF Signaling:	Site code "1-5-9" (this must be re-programmed for the actual site code after a RAM reset is performed), and DTMF "*" digital for all call. The ringtime is 15 seconds, and the ringing is the low frequency tone at full volume.

A RAM reset is performed as follows:

1. Open front panel (keep handset on-hook).
2. Place Orderwire in the program mode.
3. Press **9 0 #** (nine – zero – pound) on the DTMF keypad while in the Program Mode.
4. Wait for an acknowledgement beep.
5. Exit the Program Mode.
6. Cycle Power OFF.
7. Power ON and reprogram the VF levels, DTMF codes, timers, etc. as described in this section.

Exiting the Program Mode

1. Go on-hook with the handset.
2. Press the Program Mode switch on the Digital Bridge again.
3. A short tone will be heard and the front panel and off-hook indicators will stop flashing, indicating the Orderwire has returned to the Operational Mode.

Provisioning by Handheld Programmer or Computer

The ASCII terminal device (handheld programmer or a computer) must be setup for serial communication as follows:

Baud Rate = 9600
Data Bits = 8
Parity = 0
Stop Bits = 1

1. Open the front panel of the Orderwire.
2. Connect the ASCII terminal device to the Craft Port located on the Digital Bridge. A 9-Pin D-Sub Connector is provided for computers and an RJ-11 jack is provided for handheld programmers. These two connectors operate in parallel, so only one at a time can be used.

Do NOT use both Craft Port connectors simultaneously.

3. Press the Enter key twice to launch the Program Mode. The following message should appear on the screen:

```
Raven Electronics
 61600
Digital Order Wire
Press Enter
```

4. Press the Enter key once to display the first programmable items.

Operation Setup

Selection 1 of the Main Menu is Operation Setup, which includes the DTMF dial code, all call code, audible call alert tone and volume, ring time, and inter-digit pause.

- Pressing the Backspace key will allow you to back up and re-enter a value if an error is made.
- Use the Space key for a null value if no value is desired for a particular entry (for example; a null value for the all call code would defeat the all call feature).
- If an invalid or out of range entry is made, the word "error" is displayed.

If the displayed value is not correct:

1. Enter new values (DTMF codes, time periods, etc.) by pressing the digit keys followed by the Enter key, or by selecting the No key when prompted for a Yes/No response (use the N key on a computer keyboard).
2. For the ringing tone, select Alert 1 for low tone or Alert 2 for high tone ringing.

If the displayed value is correct:

1. Press the Enter key to accept the displayed value or the Yes key when prompted for a Yes/No response (use the Y key on a computer keyboard).

Operation Setup (cont.)

Exiting Operation Setup:

The Operation Setup can be exited at any point in the sequence described on the previous page by:

1. Pressing the F4 key on a handheld or the D key on a computer. Or you can review all of the entries by pressing the Enter key to step through each selection.
2. Answer Yes/No when "Save changes...?" appears.
3. If the F4 or D key was pressed, the Program Mode is exited and a beep is heard when the Orderwire returns to the Operational Mode. If all the selections were reviewed using the Enter key, the Main Menu will appear. You can continue provisioning by selecting the Module Setup, or exit the Program Mode with the F4 or D key.

Module Setup

Selection 2 of the Main Menu is the Module Setup, which allows re-provisioning of the Modules in the Orderwire.

1. Press 4 to select the Digital Bridge.
 - a. The first provisioning choice in the Digital Bridge Setup is the compression for all of the RS-422 ports.
 - i. **"Single Channel Voice"** for one voice circuit (automatically disables both serial data ports and VF Port 2)
 - ii. **"Two Channel Voice"** for two voice circuits (automatically disables both serial data ports)
 - iii. **"One Channel Voice/One Channel Data"** for one voice circuit; one data circuit (automatically disables VF Port 2 and Serial Data Port 2)
 - iv. **"One Channel Voice/Two Channels Data"** for one voice circuit; two data circuits (automatically disables VF Port 2)
 - b. The next choice allows the user to select between **Asynchronous** or **Synchronous** modes of operation. Asynchronous mode provides the greatest amount of reliability in voice communications between sites, nearly eliminating residual effects of path fade and noise that normally cause loss of sync in the *synchronous* mode of operation. *Asynchronous* is the recommended mode of operation and is the default.
 - i. Select "1" on the sub-menu to set the TX and RX levels of the VF ports. When entering analog level values, the entire value can be typed in, or the left/right arrow keys can be used to place the cursor under the desired decimal place and type a new value for that digit only. The + and – keys on a computer keyboard set the value to a positive or negative number. On a handheld programmer, the "Yes" key is "positive", and the "No" key is "negative". The up/down arrow keys will also increment/decrement the entire displayed value. If an invalid or out of range entry is made (levels must be within +7 to –16 dBm), the word "error" is displayed.
 - ii. Select "2" on the sub-menu to re-provision the RS-232 serial ports.
 - a. The first selection is the baud rate, which is 0.3 to 4.8 Kbps max with two ports, and 9.6 Kbps max with one port while in *asynchronous* mode. If operating in *synchronous* mode rates up to 9.6 Kbps and 19.2 Kbps max, respectively, are allowed.
 - b. Then the stop bits are specified (1, 1.5, or 2), and finally the parity is selected (none, odd, or even).

Module Setup (cont.)

2. Press 1 to select the Telephone Interface Module (or Press 2 if there are more than one Telephone Interface modules installed).
 - a. The first item for the Telephone Interface Module provisioning is for the dial code of the telephone. If the dial code indicated is correct, press Enter. If a change is needed in the dial code, enter the new code then press Enter.

Recommendations for setting dial codes in systems with Telephone Interface Modules.

- Use the same number of digits (up to five) for the Orderwire front panel and the Telephone Interface Module.
 - If there is a different number of digits in the dial code for the Orderwire front panel and the Telephone Interface Module, use different first digits for the Orderwire front panel and the Telephone Interface Module.
- b. The next item sets the frequency of the ringing voltage. This setting will change for different types of telephone sets. The default is 20 Hz. If 20 Hz is correct, press Enter. If not, choose 25 Hz or 50 Hz and then press Enter.
 - c. The next item sets the type of telephone set. The default is 600 ohms. For other telephone sets, or for use with long wires between the Orderwire and the telephone set, choose one of the other settings and then press Enter. This setting interacts with the Hybrid Adjust Level.
 - d. The next item sets the Hybrid Adjust Level. This setting changes the amount of signal that is returned from a 2-wire telephone set. If the echo is too great, choose one of the settings that reduces the echo to an acceptable level. The default for this setting is 0 dBm. To make this adjustment,
 - i. Connect an oscillator to the VF1 IN terminals and set the output frequency to 1 KHz and the level to 0 dBm.
 - ii. Connect an AC Voltmeter to the VF1 OUT terminals.
 - iii. Take the phone off-hook. Note the AC Voltmeter reading.
 - iv. Make a change in the Hybrid Adjust Level and exit the Module Setup.
 - v. Note the AC Voltmeter reading again.
 - vi. Repeat this procedure and the previous procedure to obtain the lowest reading on the AC Voltmeter.

Exiting Module Setup

The Module Setup can be exited at any point in the sequence described above and on the previous page by:

1. Pressing the F4 key on a handheld or the D key on a computer. Or you can review all of the entries by pressing the Enter key (or answering Yes/No) to step through each selection.
2. Answer Yes/No when "Save changes...?" appears. If the F4 or D key was pressed, the Program Mode is exited and a beep is heard when the Orderwire returns to the Operational Mode. If all the selections were reviewed in sequence, the Main Menu will appear. Use the F4 or D key to exit the Program Mode and unplug the ASCII terminal device when finished.

If a conflict is detected when exiting, an error message will appear. Press the Enter key to continue. This will allow the provisioning routine to automatically correct any conflicts. After this process is completed, it should be possible to exit.

Group Dial Code Setup

Selection 3 of the Main Menu is the Group Call Dial Code Setup. Up to 19 Group Call numbers can be programmed.

If the displayed address is not correct:

1. Enter new Group Call Numbers by pressing the digit keys followed by the Enter key, or by selecting the No key when prompted for a Yes/No response (use the N key on a computer keyboard). Pressing the Backspace key will allow you to back up and re-enter a value if an error is made. Use the Space key for a null value if no value is desired for a particular entry.

Exiting Group Dial Code Setup

The Dial Code Setup can be exited at any point in the sequence described above and on the previous page by:

1. Pressing the F4 key on a handheld or the D key on a computer. Or you can review all of the entries by pressing the Enter key (or answering Yes/No) to step through each selection.
2. Answer Yes/No when "Save changes...?" appears. If the F4 or D key was pressed, the Program Mode is exited and a beep is heard when the Orderwire returns to the Operational Mode. If all the selections were reviewed in sequence, the Main Menu will appear. Use the F4 or D key to exit the Program Mode and unplug the ASCII terminal device when finished.

Self Test

Perform a Self Test to ensure the Orderwire has been programmed correctly.

1. Open the front panel and press the Program Mode switch on the Digital Bridge. A short acknowledgement tone will be heard and the front panel alert and off-hook indicators will be flashing simultaneously.
2. Go off-hook with the Orderwire handset and dial the DTMF call code entered with the ASCII terminal. The alert indicator should flash and the ringing tone should be heard from the speaker at the frequency selected. The call alerts should continue for the ring time entered and then automatically stop.

To adjust the ringing tone volume, go on-hook with the handset and dial 4 0 # (four-zero-pound). The ringing will start and the volume can be changed with the Up and Down Volume buttons. Press the # (pound) key when the desired volume is obtained.

3. The all call ringing tone cycles on and off at twice the rate as a normal station-to-station call. To test the all call:
 - a. Go off-hook
 - b. Press the * (asterisk or star key) digit (if the default setting was accepted). The alert indicator should flash and the all call ringing should be heard from the speaker at the frequency and volume selected. The all call alerts should continue for the ring time entered and then automatically stop.
4. The call alerts can be stopped immediately with a hook-flash or with the DTMF # (pound) key.

Self Test (cont.)

5. Go on-hook with the handset.
6. Press the Program Mode switch on the Digital Bridge again. The front panel alert and off-hook indicators will stop flashing, indicating the Orderwire has returned to the Operational Mode.

Verifying Channel and Data Modes

After initially powering on the Orderwire, it is good practice to verify that the system is operating in the correct channel and data modes.

1. Power-on the Orderwire.
2. Push the # (pound) button. (Note: Don't go off hook before pressing # otherwise these tones will not sound.)
3. A series of tones will be heard. The series is actually two "groups" of tones, the first indicating the mode, and the second "group" indicating the communications protocol (asynchronous or synchronous). Please see the chart below for the various tone descriptions.

First group – Channel Mode

Up to three high and/or low pitched beeps

High-Pitched Beeps	Low-Pitched Beeps	Channel Mode
1	0	Single Channel Voice (Default)
2	0	Two Channel Voice
1	1	One Channel Voice, One Channel Data
1	2	One Channel Voice, Two Channels Data

Second Group – Data Mode

Fast high-pitched beeps

Number of Beeps	Data Mode
2	Synchronous Data Mode
3	Asynchronous Data Mode (Default)

All Orderwires in the same network **MUST** be operating in the same channel and data mode.

Outgoing Calls

1. Verify that the Orderwire circuit is not in use. Lift the handset from the cradle (or take the extension phone off-hook). The "OFF HOOK" indicator will illuminate and the speaker will be muted (unless using the extension phone).
2. Dial (using the keypad) the one to five digit address code for the station desired and wait for an answer. (A ringback tone will be heard indicating the called station is ringing.) Call indications will cease when the call is answered or when the ring time period times out.
3. Upon completion of the call, place the handset on the cradle (or hang up the extension phone). 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, or the bell ringing on the extension phone.
2. Lift the handset from the cradle (or take the extension phone off-hook) and answer the calling party. The "OFF HOOK" indicator will light and the speaker will be muted (unless using the extension phone).
3. Upon completion of the call, place the handset on the cradle (or hang up the extension phone). The "OFF HOOK" indicator will go off.

Initiating an All Call

An All Call feature is provided on all Digital Orderwire Terminals, which alerts all stations in the network from any location. The following operating instructions apply.

1. Verify that the Orderwire circuit is not in use. Lift the handset from the cradle (or take the extension phone off-hook). The "OFF HOOK" indicator will light and the speaker will be muted (unless using the extension phone).
2. Depress the all call button (*) (or code previously setup for All Call) for approximately four (4) seconds. Make your announcement or request. No ringback is provided to the originating station.

All Clear Feature

The All Clear feature causes the Orderwire to clear digits previously entered upon the receipt of a DTMF All Clear tone. The All Clear tone is initiated by pressing the "#" button on the keypad. For example, while trying to dial station 1-3-5, the user accidentally dials 1-2 and realizes the mistake. The user needs to begin again, by pressing "#" and dialing 1-3-5 correctly.

Initiating a Group Call

The Group Call feature allows an Orderwire to call other Orderwire terminals within a specified group (programmed previously). The following steps will initiate the Group Call feature.

1. Verify that the Orderwire circuit is not in use. Lift the handset from the cradle (or take the extension phone off-hook). The "OFF HOOK" indicator will light and the speaker will be muted (unless using the extension phone).
2. Dial (using the keypad) the digits of the group call code (programmed previously) for the group of Orderwires desired and wait for an answer.
3. Upon completion of the call, place the handset on the cradle (or hang up the extension phone). 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".

Alignment Procedures

Equipment Needed for Alignment:

- AC Voltmeter
- DC Ammeter
- Alignment Tool
- Signal Generator

Every Orderwire has been carefully aligned and tested at the factory. Please try the unit first before attempting the alignment procedures. If the unit is not working, it may need to be aligned. Attachment A lists the RS-422 and VF Port and Data Port provisioning for the system. The Attachment A can be located inside the Orderwire chassis.

Routine Programming

When the installation is complete, the DTMF station code(s), extension telephone code, ring time period, and analog port levels (if used) should be verified. The programming and settings are stored in non-volatile RAM, so loss of power has no effect on the stored data. Routine programming of the DTMF station code, telephone extension code, all call code, ring time, interdigit time, and ringing tone volume and frequency are set with the front panel push buttons.

Please see the Programming section for directions on programming the Digital Orderwire.

Re-Provisioning

If more in-depth provisioning of the RS-422 ports or two VF Ports is required, the Orderwire must be re-provisioned in the field. This requires an ASCII terminal device, such as a handheld programmer or a computer running terminal software such as HyperTerminal. The programmer or computer is plugged into the Craft Port located on the Digital Bridge.

Analog VF Ports 1 and 2

The analog VF Ports are set for transmit and receive levels of 0 dBm at the factory. These levels can be changed in the field through the provisioning routine beginning on page 15 using a handheld programmer or a computer running in the terminal mode, or by the manual adjustment below.

VF1 and 2 OUT

1. Connect a signal level meter (terminate with 600 ohms, if required) to the VF1 OUT terminals on the rear panel.
2. Momentarily bridge the center and left pins of ST6 together. The Bridge will generate a 1 KHz tone and the level is indicated on the meter.
3. Short the OUT 1 "+" GAIN ADJUST pins together to increase the level, or short the "-" pins together to decrease the level. When the desired level is attained, momentarily bridge the center and left pins of ST6 again.
4. The 1 KHz tone will stop and a beep will be heard indicating the new level setting has been stored.
5. Repeat this process for VF2, using the VF2 OUT terminals on the rear panel and the center and right pins of ST6 and the OUT 2 GAIN ADJUST pins.

Alignment Procedures (cont.)**VF1 and VF2 IN**

1. Momentarily bridge the center and left pins of ST6.
2. Connect a signal generator to the VF1 IN terminals on the rear panel.
3. Set the generator to 1 KHz at the desired level.
4. Observe the VF1 INPUT OVERLOAD (red) indicator
 - a. If it's off, the gain must be increased
 - b. If it's flashing, the level is correct
 - c. If it's on, the gain must be decreased
5. Short the IN 1 "+" GAIN ADJUST pins to increase the gain, or short the "-" pins to decrease the gain.
6. When the VF1 indicator is flashing, momentarily bridge the center and left pins of ST6 again. A beep will be heard indicating the new level setting has been stored and the Bridge is in the operational mode again.
7. Repeat this process for VF2, using the VF2 IN terminals on the rear panel and the center and right pins of ST6 and the IN 2 GAIN ADJUST pins.

TELEPHONE INTERFACE (Optional Module)

No adjustments are available for the telephone levels. To verify proper operation of the telephone and Orderwire:

1. Connect a signal level meter (terminate with 600 ohms, if necessary) to the VF1 OUT terminals on the rear panel.
2. Go off hook with the telephone handset and press the "1" key on the keypad.
3. The level should be between -10 and 0 dBm.

Troubleshooting Procedures

Unlike traditional Analog Orderwire the Digital Orderwire requires a little more than simply connecting up a cable and turning the power on. Attention to detail in wiring, knowledge of clock references, and a thorough understanding of the transmission equipment being used will make the process of installation go much more smoothly. Technicians at Raven Electronics have found that over 90% of customer trouble calls are related to incorrect wiring of cables, errors in Orderwire programming, or improper transmission system provisioning.

The following pages have been added to the user's manual to help you get your Digital Orderwire up and running. Raven is always looking for ways to improve our documentation and would be happy to add section(s) related to your specific set up. If you require additional assistance, please don't hesitate to call our technical support group.

The following are common problems users experience during installation.

1. Check that there is DC voltage supplied to the Orderwire. Check fuses at power distribution boxes and verify that DC voltage is being supplied to the Orderwire. Use voltmeter to verify.
2. Check that the RS-422 cables are connected at the Orderwire and the transmission equipment. Some installations use a connector panel between the Orderwire and the transmission equipment and sometimes this connection is overlooked.
3. Check that the transmission equipment is in "local" mode rather than bypass mode. Some transmission systems (e.g. Alcatel 1640) can be put in a bypass mode that will break the Orderwire drop at that sight.
4. Check for broken wires in the RS-422 port connectors. All transmission systems have different cabling requirements and these cables are often made on sight by an installer. A broken or frayed wire will cause communication problems.
5. The power switch is located inside the Orderwire. A green "power good" light on the power supply should be illuminated when the switch is on.
6. Make sure both the power supply board and the bridge board are seated firmly in the chassis. Unpredictable Orderwire behavior can occur if these circuit boards are not seated properly.

RS-422 Connections

All is well if Sync light(s) are lit and steady. A sync light indicates that a downstream Orderwire is communicating with the local Orderwire.

Trouble indicator:

- Sync Light is blinking or not lit

Possible causes:

- 61684 or 61584 Bridge board not seated properly. Push hard!
- Transmission Medium Clock not stable.
- Cable connections not good.
- RS422 polarity reversed on TX or RX or TX Clock or RX Clock
- RS422 one leg on TX, RX, TX Clock, or RX Clock connection bad
- Program setup not consistent across all Orderwires
- Input power is not correct
- *A single common clock must be present at every site for operation*

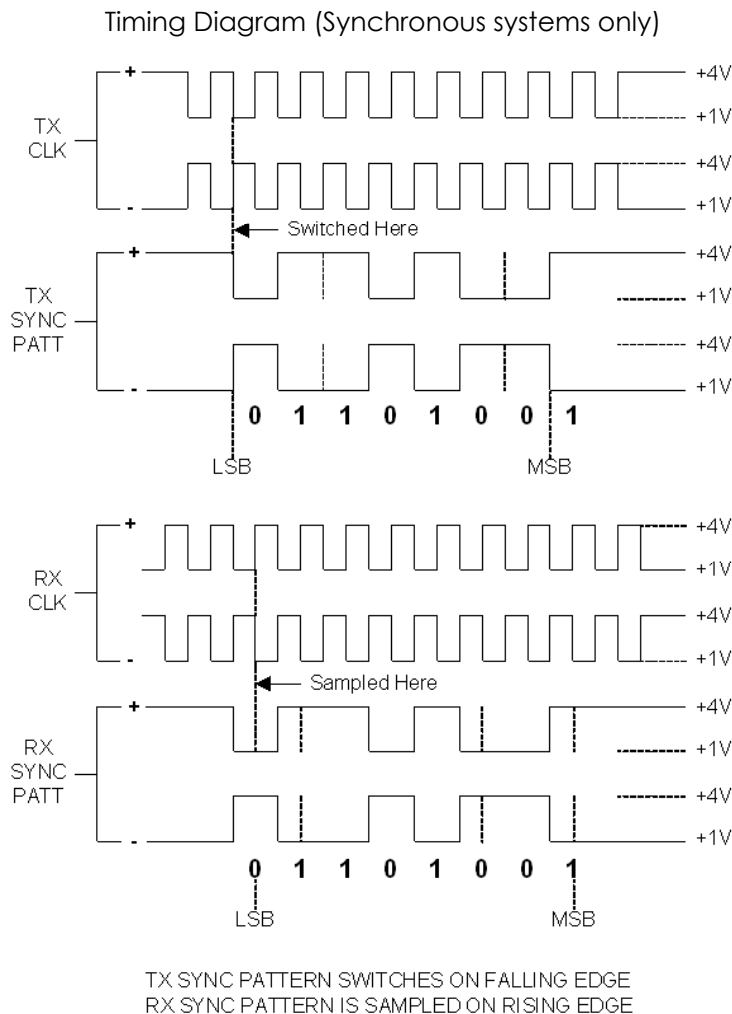
Troubleshooting Procedures (cont.)

Digital RS-422 Ports – Advanced Diagnostics Using Oscilloscope

The Orderwire should be powered off anytime the RS-422 cables are removed and replaced, or when the Orderwire’s plug-in modules are removed and replaced, or when the radio’s Overhead (OH) Interface is removed and replaced. Field experience with this equipment indicates hot swapping could damage or stress the RS-422 drivers and receivers in the OH Interface and Orderwire, leading to failures.

NOTE: THE following timing diagram pertains only to units operating in one of the synchronous modes of operation. The default mode of operation is asynchronous. You can skip this section unless you specifically require a synchronous mode of operation (this is very rare for units shipped after June 2000).

1. Set the oscilloscope timebase to 20 uSec. and the amplitude to 1V per division. The amplitude of all clock and sync pattern signals should be 2 to 3V peak to peak. Please refer to the following Timing Diagram.



Troubleshooting Procedures (cont.)**Digital RS-422 Ports – Advanced Diagnostics Using Oscilloscope** (cont.)

2. The TX CLK IN and RX CLK IN are generated by the local OH Interface card. All four CLK leads must be a clean signal and identical 64 KHz clocks for the Orderwire to operate properly. The clock signals will appear as a continuous 64 KHz square wave on the oscilloscope. Refer to the previous page for illustrations of the clock signal, sync pattern, and the connector pin assignments.

The only way to verify the clock signals are inverted from one another (plus and minus outputs of the RS-422 port) is to use two probes and monitor both sides of the clock output simultaneously. This typically is not necessary unless you suspect a wiring problem, such as the two leads are shorted together, or one lead is open (one signal will be lower in amplitude than the other if one side is open, since the signal path to the open lead is the terminating resistor).

3. If the clock inputs are identical and not too noisy, the Orderwire should generate the sync pattern on the TX DATA leads. The signal on one TX DATA lead must be inverted from the signal on the other TX DATA lead.

If the clock inputs are identical and not too noisy and the Orderwire is not transmitting the sync pattern, make sure there is no traffic on the circuit and that the handset is on the hook (the sync pattern is transmitted only during silent periods). Other possible causes are the RS-422 clock receiver chip, or the RS-422 data driver/receiver chip, has failed. Problems beyond these require more in-depth troubleshooting that is not practical in the field. If you get this far and the Orderwire is still not functional, Raven recommends replacing the 61684 Bridge.

NOTE: Item 4 only pertains to units operating in the synchronous mode of operation. The default mode of operation is asynchronous. You can skip this item unless you specifically require a synchronous mode of operation (this is very rare for units shipped after June 2000).

4. The sync pattern on the RX DATA leads is generated by the Orderwire at the far end of the link, and is passed through the OH Interfaces at the far and the local end before appearing at the RX DATA input of the local Orderwire.

If there is no receive sync pattern observe at the Orderwire connector, it is possible to observe this signal at the connectors in the radio bay. Alternately, the OH Interface could be replaced to verify the health of the local OH Interface card. Beyond this, a trip to the next site is required to check the Orderwire and OH Interface at the next or previous site.

The sync indicator illuminates when a valid receive sync pattern is received from the next or previous site and there is good RX CLK.

The quickest way to correct possible issues is to perform a RAM reset and provision the Orderwire according to your communication plan.

Specifications**61510-622-DB Digital Orderwire****POWER REQUIREMENT**

Input Power	-24 to -56 VDC input power or 95 to 250 VAC
Current Drain	800 mA @ -24 VDC or 200 mA @ 110 VAC maximum

RS-422 (V.11) PORTS

Input Voltage	
Differential Threshold	0.2 VDC
Common Mode	±7 VDC maximum
Output Voltage	
Differential Output	0 – 5 VDC (no load) 0 – 2 VDC min. (100 ohm load)
Short Circuit Current	150 mA maximum
Maximum Load	100 ohms
Data Rate	64 Kbps

ANALOG PORTS

* Levels	+7 to -16 dBm at 600 ohms, adjustable in 0.1 dB increments
† Frequency Response	300 to 3400 Hz ±0.5 dBm, ref. to 1 KHz
Isolation	Greater than 60 dB
Idle Noise	Less than 25 dbrnC0

TELEPHONE PORT

Microphone Input	0 dBm nominal
Receiver Output	0 dBm nominal
Hybrid Return Loss	Greater than 25 dB, 300 to 3400 Hz
2-Wire Longitudinal Balance	Greater than 45 dB

RS-232 (V.28) DATA PORT

Baud Rate	0.3 to 9.6 Kbps with two data ports (synchronous mode) 0.3 to 4.8 Kbps with two data ports (asynchronous mode) 0.3 to 19.2 Kbps with one data port (synchronous mode) 0.3 to 9.6 Kbps with one data port (asynchronous mode)
Input Voltage	± 12 VDC
Turn-On Threshold	1.8 V typ.
Turn-Off Threshold	1.0 V typ.
Output Voltage	± 9 V minimum
Short Circuit Current	25 mA maximum

DTMF SIGNALING

Addressable Site Codes	1 station address, 1 "All Call" and 19 "Group Call"
Number of Digits in Code	one to five
Ring Time	10 to 120 seconds, programmable in 1 second increments
Inter-Digit Time-Out	5 seconds
Minimum Tone Duration	40 mSeconds
Minimum Inter-Digit Pause	40 mSeconds

* Customer Specified

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

Specifications *(cont.)***61510-622-DB Digital Orderwire****ENVIRONMENTAL**

Operating Temperature	0 to 50°C
Storage Temperature	-40 to 80°C
Relative Humidity	0 to 95% non-condensing
Operating Altitude	15,000 ft max (4572 meters)

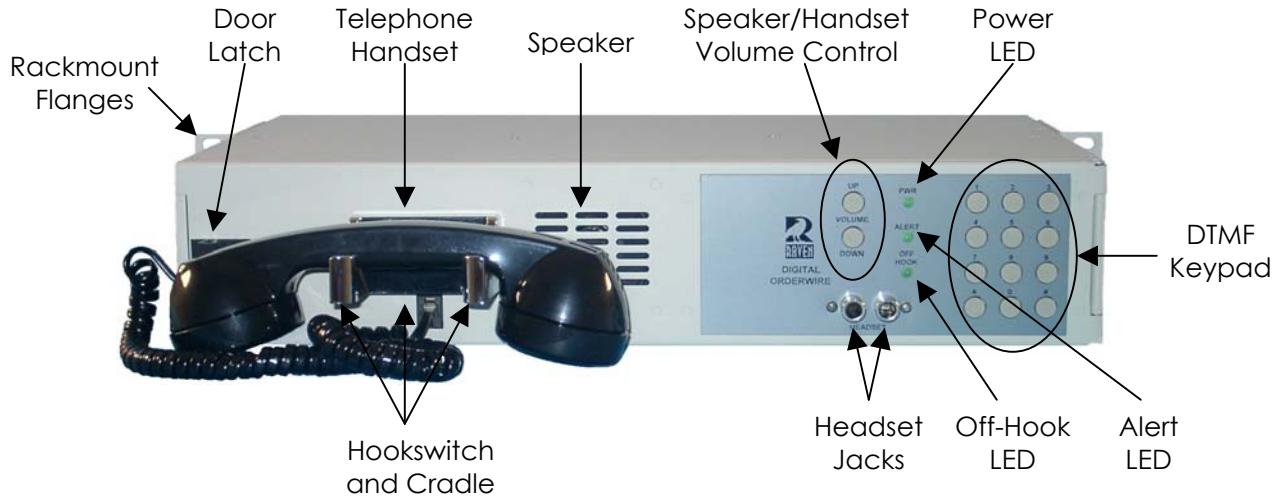
DIMENSIONS

Width	17.25 inches (43.80 cm)
Depth	7.8 inches (19.8 cm)
Height	3.50 inches (8.89 cm) (2 ru)
Mounting	19" or 23" Rack

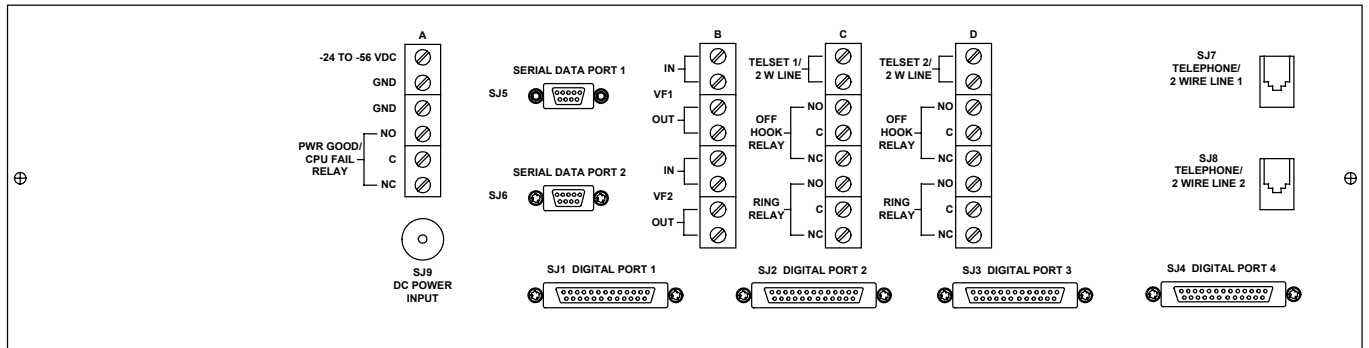
WEIGHT (max)

20 pounds	(9.1 kg)
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61510-622-DB Front Panel with Descriptions

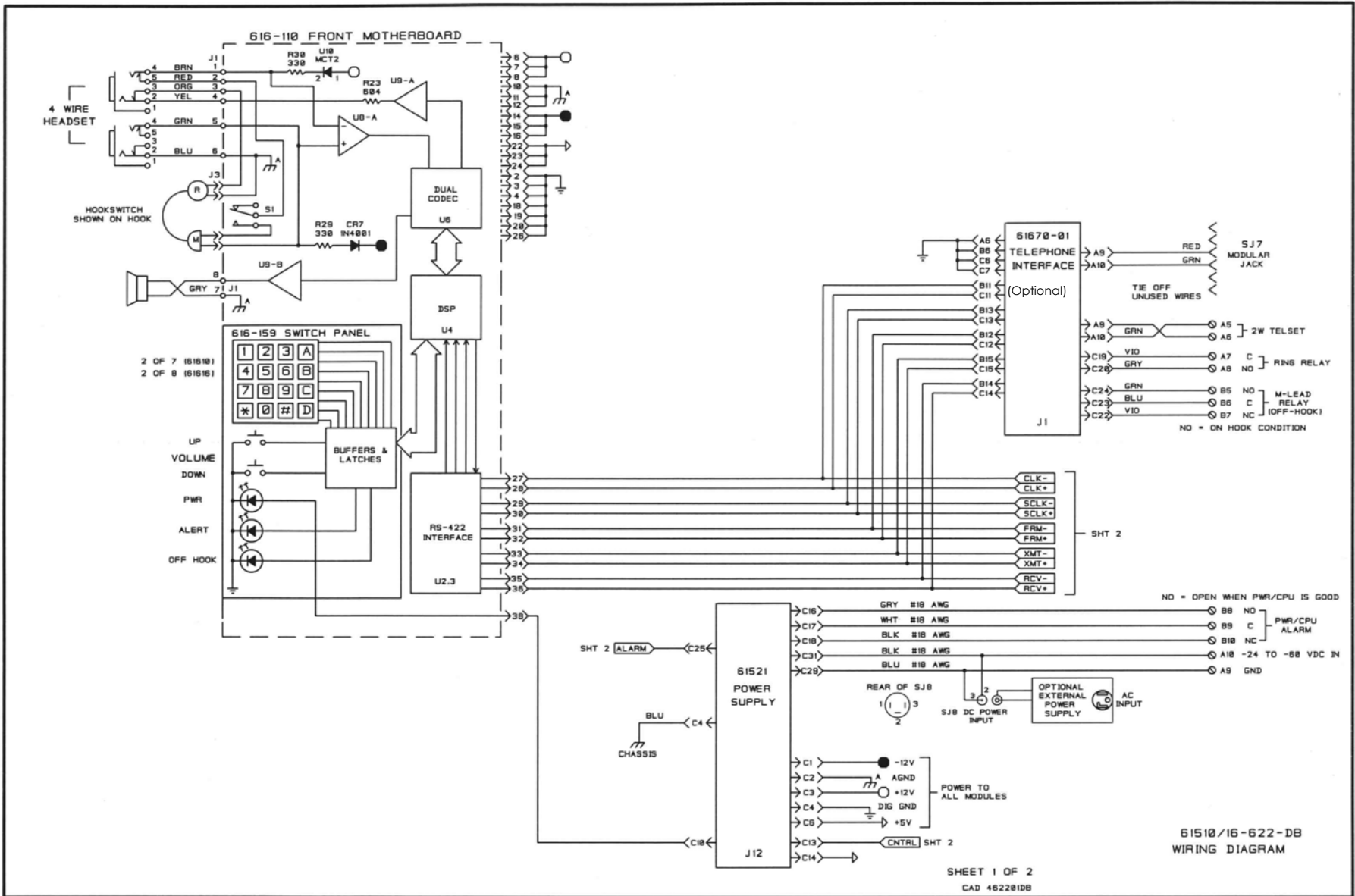


61510-622-DB Rear Panel Diagram



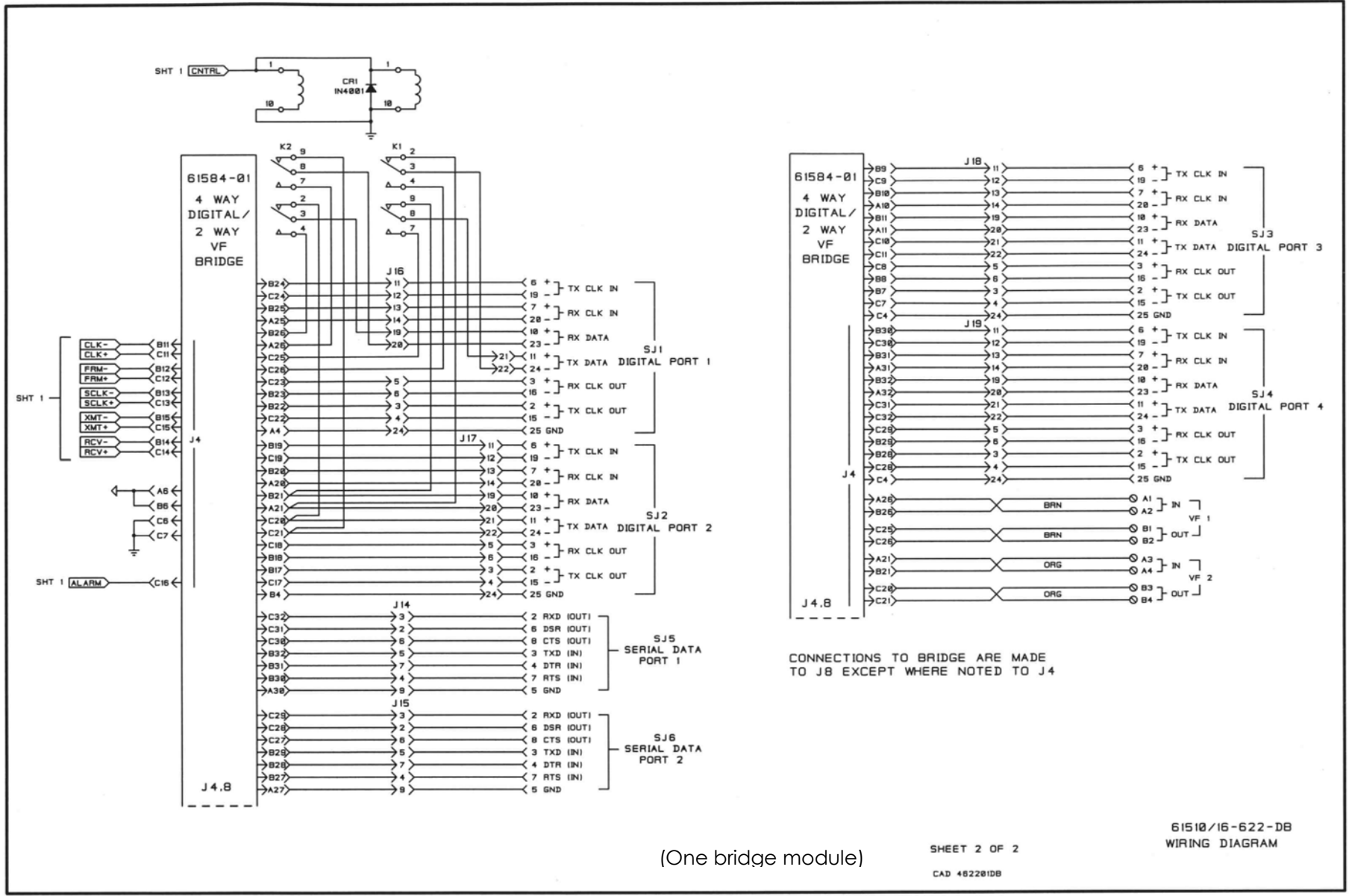
61510-622-DB Digital Orderwire
(Rear View)

Not drawn to scale.



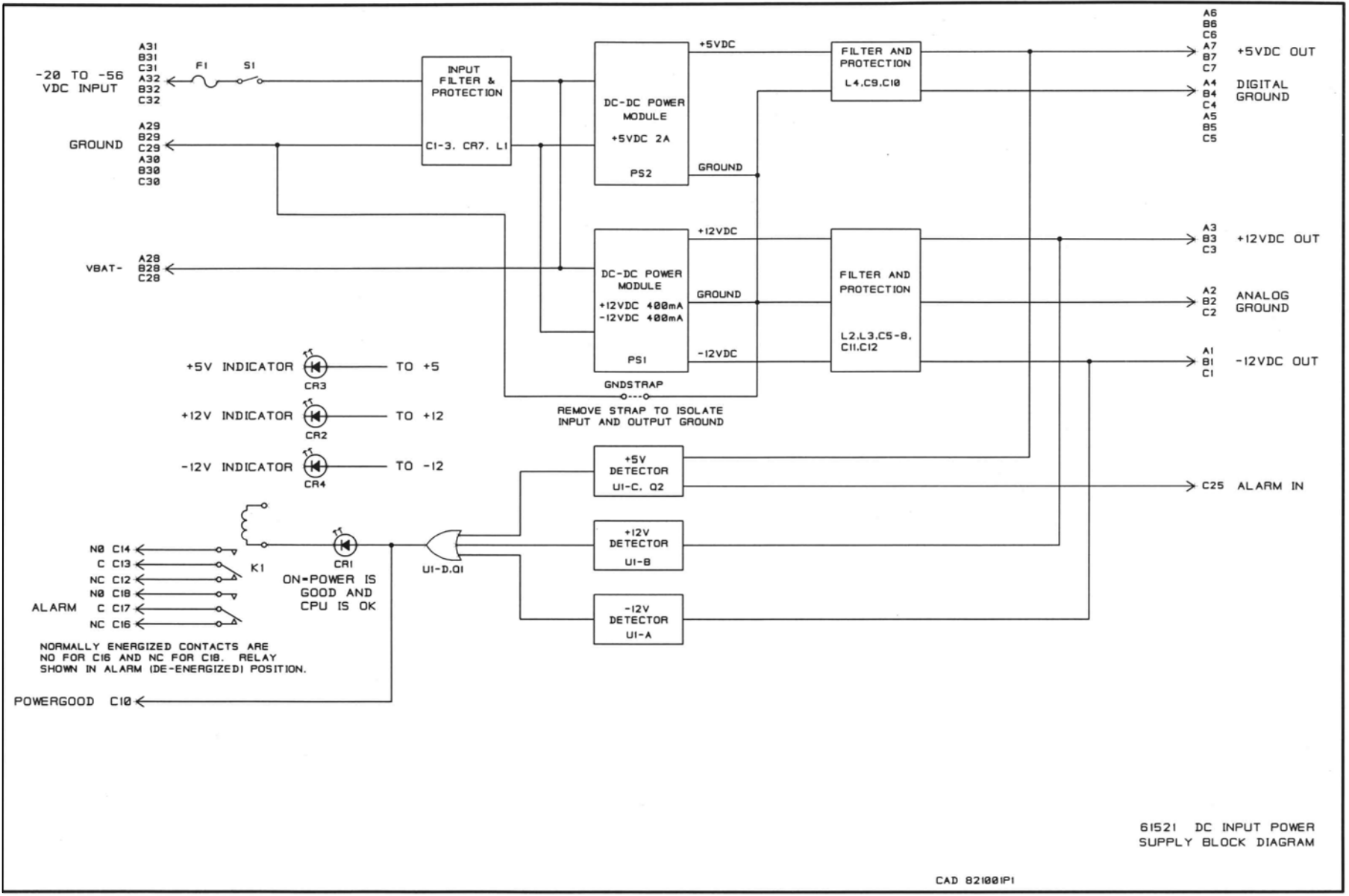
29

30



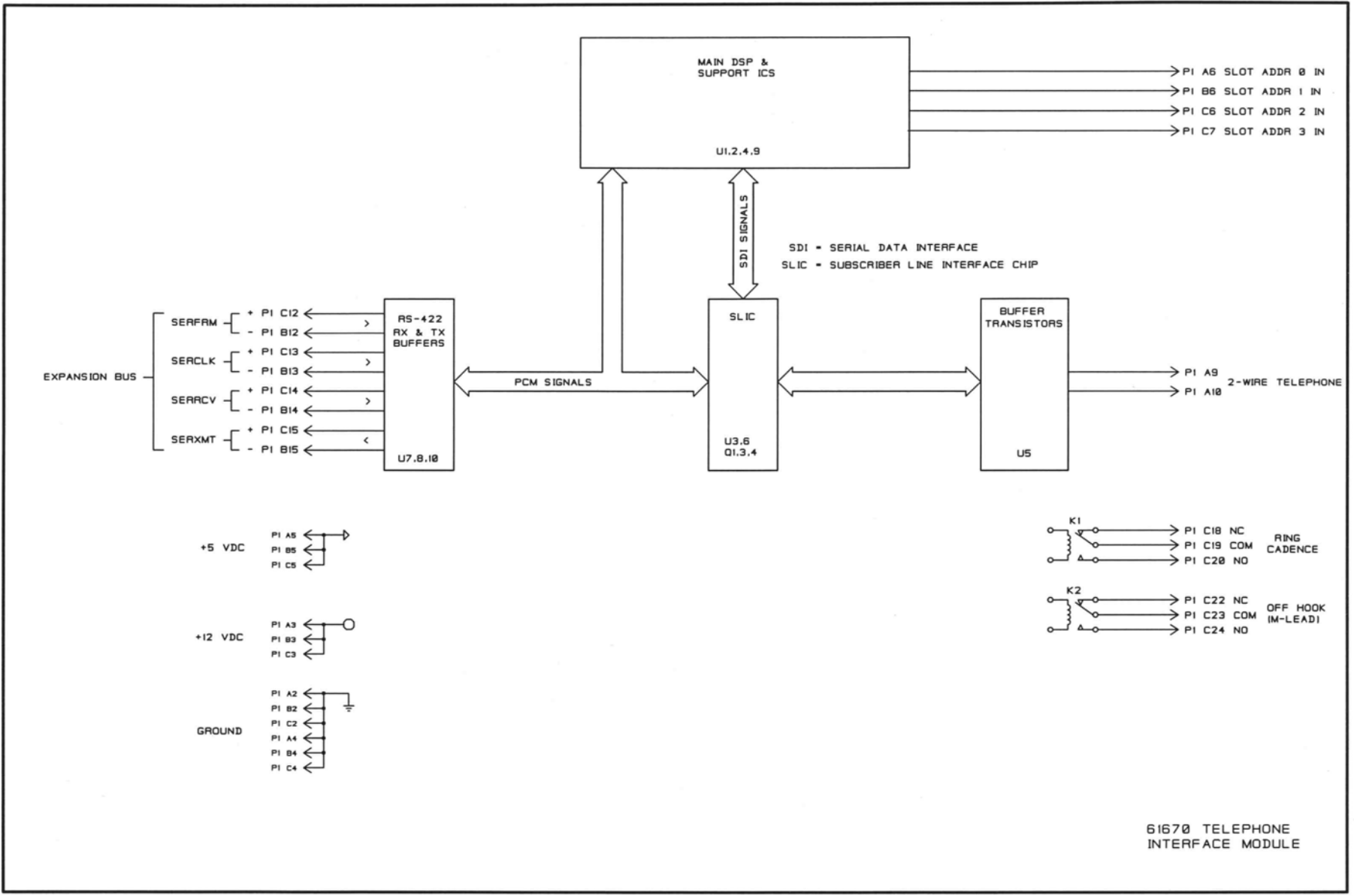
CONNECTIONS TO BRIDGE ARE MADE TO J8 EXCEPT WHERE NOTED TO J4

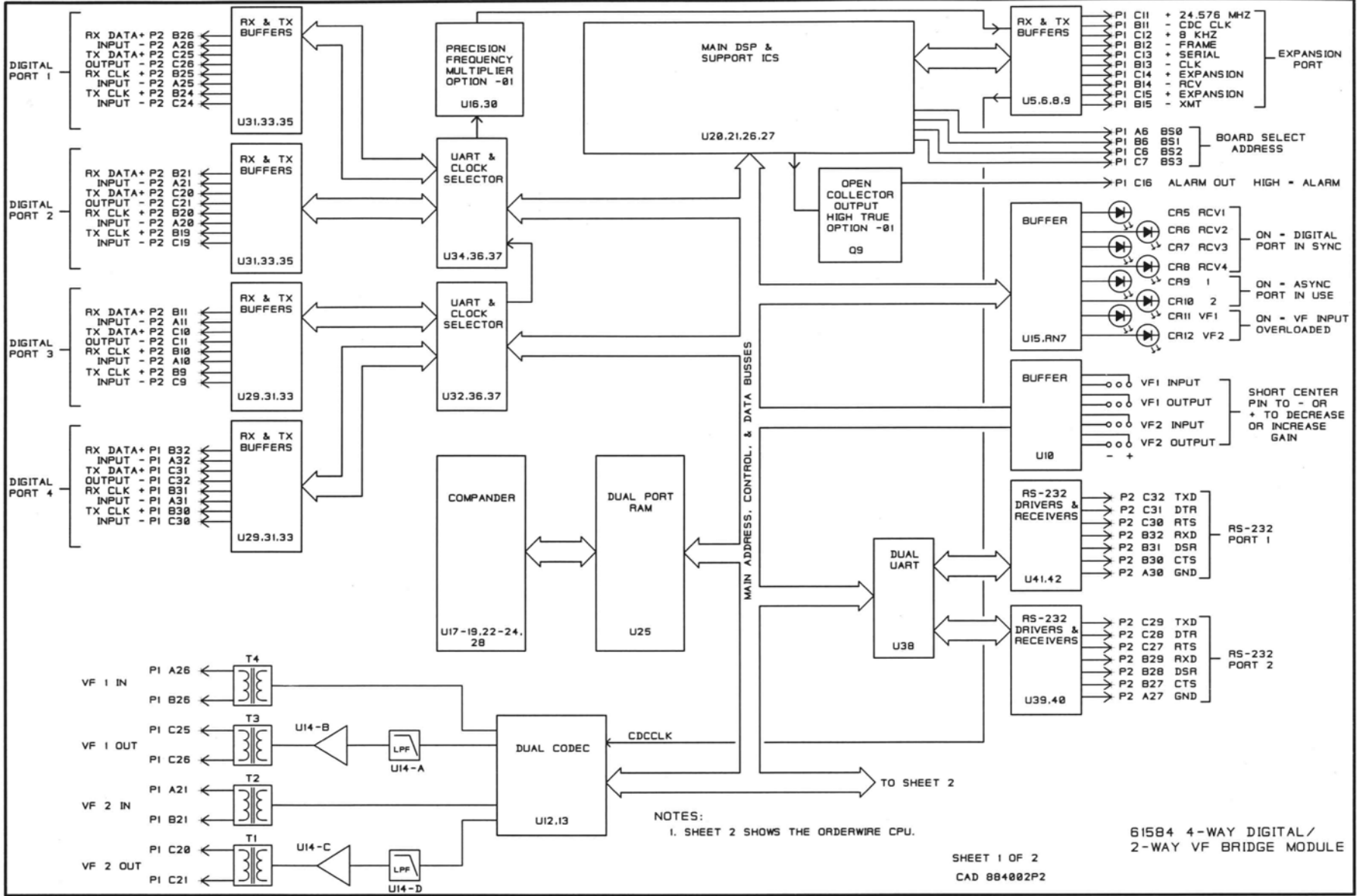
(One bridge module)



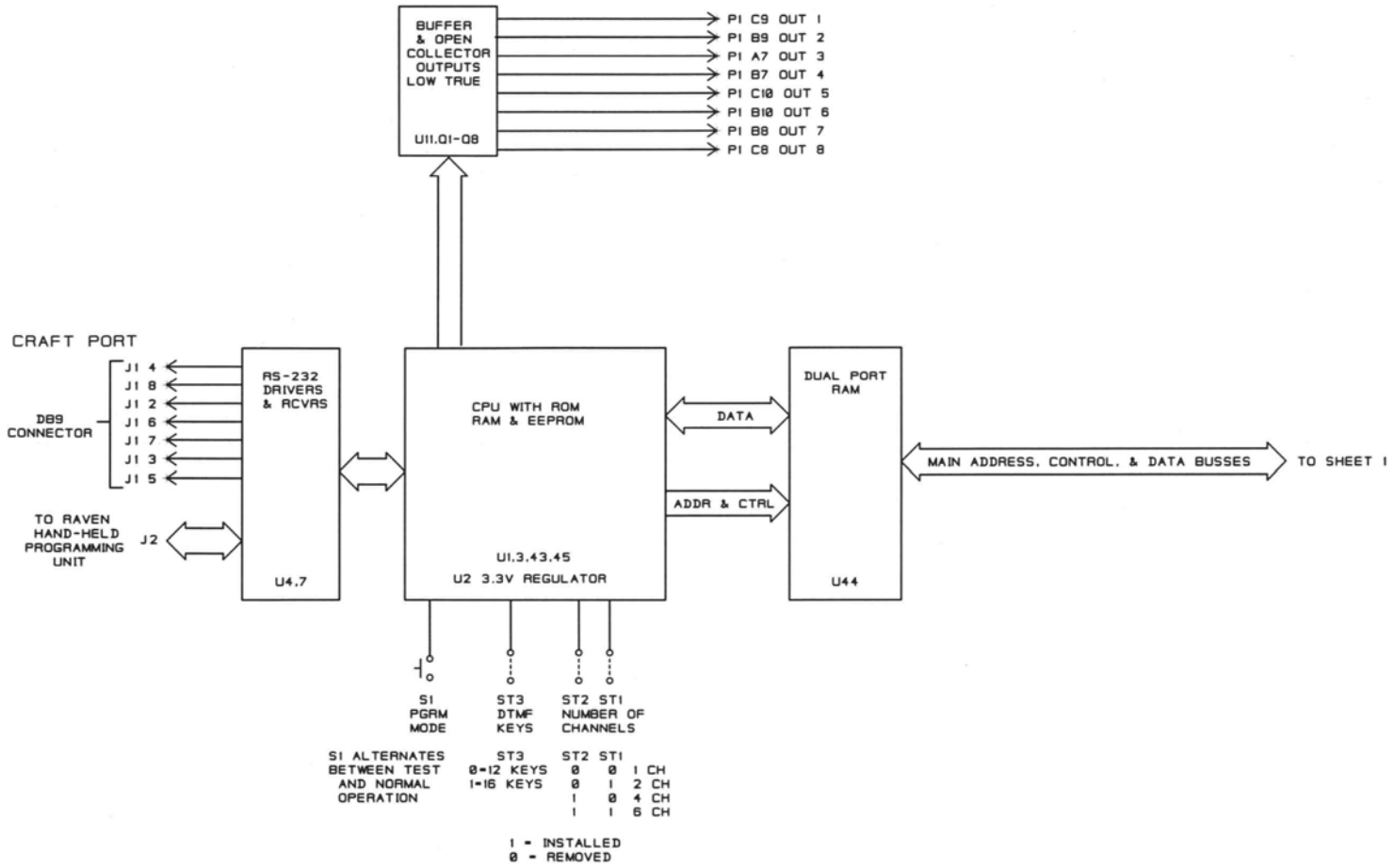
61521 DC INPUT POWER SUPPLY BLOCK DIAGRAM

CAD 82100 IPI





33



SHEET 2 OF 2
 CAD 884002P2

61584 4-WAY DIGITAL/
 2-WAY VF BRIDGE MODULE

TABLE B**INSTALLER CONNECTIONS****61510-622-DB Installer Connections**

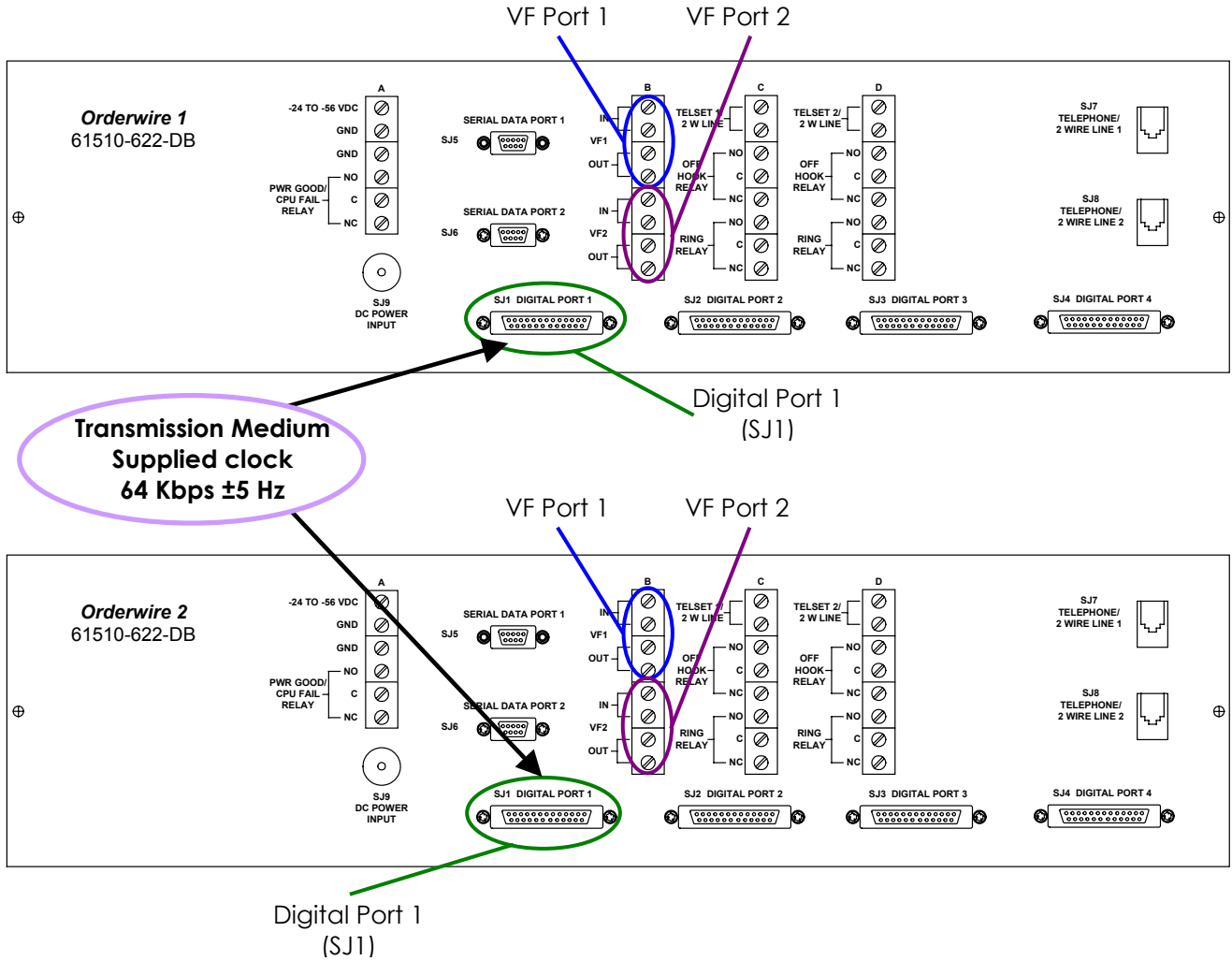
FUNCTION	REAR TERMINAL CONNECTIONS	SUGGESTED WIRE
VF Port 1 In (VF 1 IN)	B1, B2	24 GA
VF Port 1 Out (VF 1 OUT)	B3, B4	24 GA
VF Port 2 In (VF 2 IN)	B5, B6	24 GA
VF Port 2 Out (VF 2 OUT)	B7, B8	24 GA
Telephone Interface #1 (TELSET 1/ 2W LINE) *	C1, C2	24 GA
Telephone Interface #1 Off Hook Relay (OFF HOOK RELAY) *	C3, C4, C5	24 GA
Telephone Interface #1 Ring Relay (RING RELAY) *	C6, C7, C8	24 GA
Telephone Interface #2 (TELSET 2/ 2W LINE) *	D1, D2	24 GA
Telephone Interface #2 Off Hook Relay (OFF HOOK RELAY) *	D3, D4, D5	24 GA
Telephone Interface #2 Ring Relay (RING RELAY) *	D6, D7, D8	24 GA
Power / CPU Alarm (PWR GOOD/CPU FAIL RELAY)	A4, A5, A6	24 GA
Power (-24 TO -56 VDC)	A1 or SJ8 SLEEVE -24 TO -56 VDC A2, A3 or SJ9 CENTER GROUND	18 GA

* These connections are only used if the Telephone Interface Modules are installed.

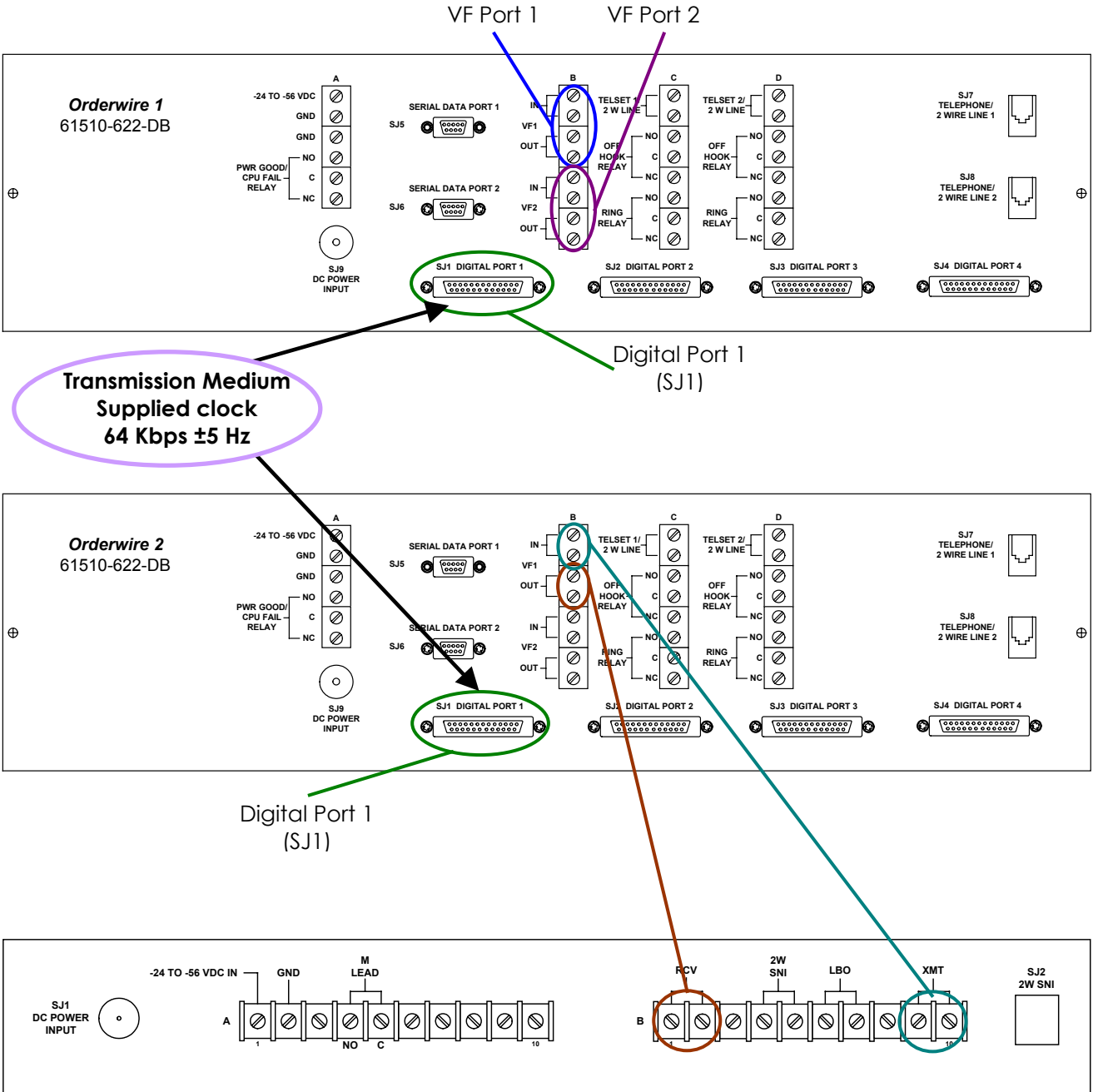
Orderwire Options

<u>Model #</u>	<u>Description</u>
61510D-622-DB	Digital Orderwire (DC Power) <i>Includes 3 or 4 modules:</i> 61670 Telephone Interface (1 or 2) (Optional Modules), 61584 4-Way Digital Bridge, 61521 DC Power Supply (-24 to -56 VDC input power)
61510A-622-DB	Digital Orderwire (AC Power) <i>Same as above, however the power supply is:</i> 61521 DC Power Supply with an AC External Power Pack (100 to 250 VAC input power)

Connections Using RS-422

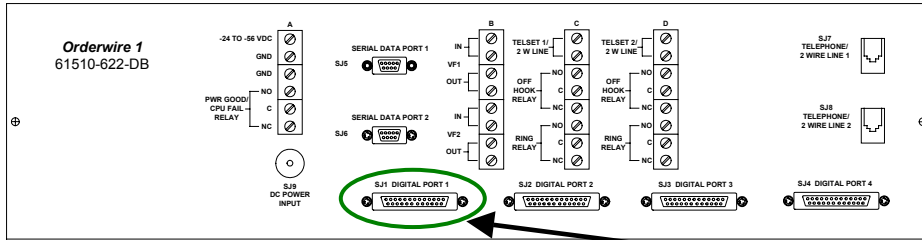


Connections to a Switched Network Interface Shelf

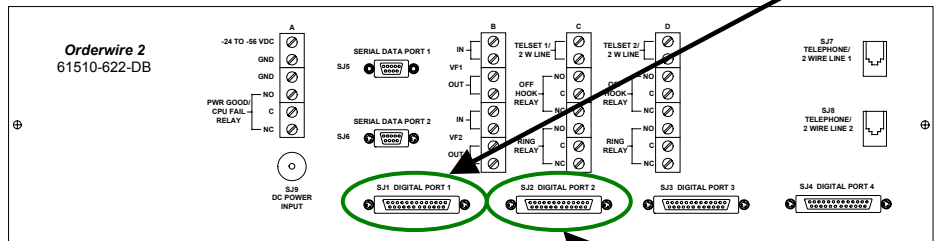


40710D-600 Switched Network Interface Shelf (Rear View)

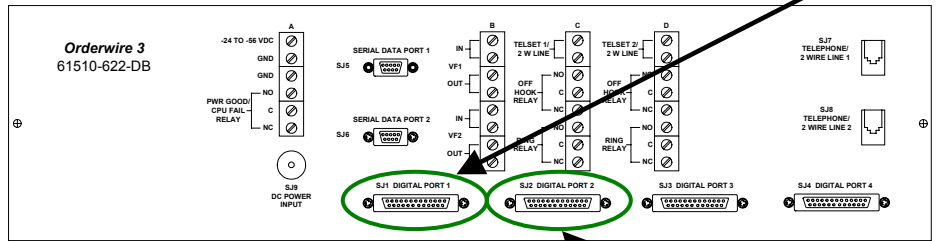
Multiple Connections Using RS-422



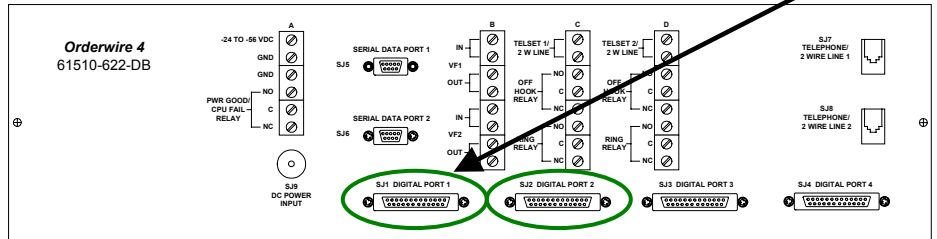
Transmission Medium
Supplied clock
64 Kbps ±5 Hz



Transmission Medium
Supplied clock
64 Kbps ±5 Hz



Transmission Medium
Supplied clock
64 Kbps ±5 Hz



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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