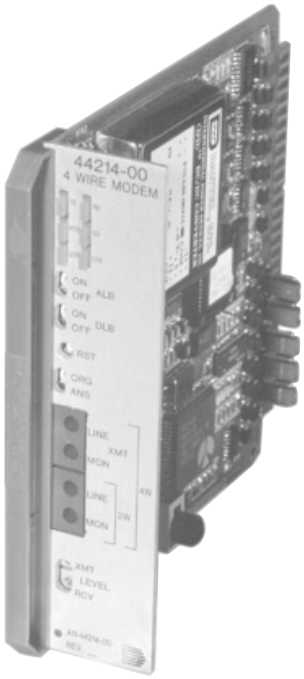
44214
9600 BPS MODEM



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About this Practice:

This practice has been reissued to:

- Update Figs. 1 and 3.

Reissued Practices: Updated and new content can be identified by a banner in the right margin.

UPDATED

Issue date: August 1998

CAUTION

- Install or remove modules from the shelf only when the power is off. If you install a module in the shelf with the power on, the internal circuitry may suffer damage and the product warranty will be void.
- Remove and install circuit boards only in a static-safe environment (use antistatic wrist straps, smocks, footwear, etc.).
- Keep circuit boards in their antistatic bags when they are not in use.
- Do not ship or store circuit boards near strong electrostatic, electromagnetic, magnetic, or radioactive fields.
- For more complete information on electrostatic discharge safety precautions, refer to Bellcore™ Technical Reference # TR-NWT-000870.

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ORDERING INFORMATION

NOTE: This section lists the different options available for this product. To order any of the available options, contact Dantel Inside Sales through our toll-free number, **1-800-432-6835.**

OPTION NUMBER	FEATURES
A11-44214-00	9600 bps Tone Modem

GENERAL DESCRIPTION

NOTE:
The 44214 must communicate with another 44214. Using on-board switches, set the baud rate of both modules the same.

NOTE:
Only one interface may be enabled at a time.

NOTE:
The A11-44214-00 4-Wire Modem is not Bell 202 compatible.

The A11-44214-00 9600 bps Modem is a 400-type module used in applications where a tone modem is required. This module provides an interface between Data Terminal Equipment (such as a computer or terminal) and a 4-wire voice channel (such as a mux channel or a satellite link). Capable of transmitting and receiving data at 1200, 2400, 4800, or 9600 bps, this module converts asynchronous data from a serial bit stream into voice-frequency tone in one direction and tone to serial data in the other direction.

On the data side of the 44214 there are input/output ports available for interfacing to Data Terminal Equipment. Available interfaces are:

- TTL/CMOS
- RS232
- RS422
- RS485

An on-board switch (S6) selects which interface is enabled.

The front panel provides:

- Four mini jacks for 4-wire level adjustments and testing.
- Six green LEDs that indicate communication status.
- Switches for testing the modem, and selecting the mode of operation.
- Potentiometers for adjusting the transmit and receive levels.

CIRCUIT DESCRIPTION

Fig. 1 shows the 44214 9600 bps Modem functional schematic.

The circuit contains:

- ♦ 87C51 Microcontroller
- ♦ Loopback capability
- ♦ Modem Controller
- ♦ Reset circuitry
- ♦ Asynchronous Serial Interface
- ♦ Analog Interface

NOTE:

Upon power-up, the modem configured for answer-mode will transmit a continuous answer tone and will respond if an originate tone is detected. If an originate tone is not detected within 10 seconds of power-up, it will stop transmitting the answer tone and will wait. Upon receiving an originate tone, it wil start transmitting an answer tone again.

87C51 Microcontroller

The microcontroller is used to configure and operate the modem controller and operates at 12 Megahertz. This processor contains a one-time programmable ROM and 128 bytes of data RAM. A two-position switch (S4) configures the microprocessor to operate in either originate or answer mode. When configured in originate mode, the modem constantly transmits an origination tone on the analog line. When in answer mode, it continually monitors the line for an origination tone and responds if one is detected. For two modems to communicate over the orderwire, one device must be in originate and the other in answer mode.

Loopback

Both the analog and digital sides of the 44214 can be set to loopback. A two-position switch (S3) is used to enable or disable the analog side. A second two-position switch (S5) is used to enable or disable the digital side.

Modem Controller

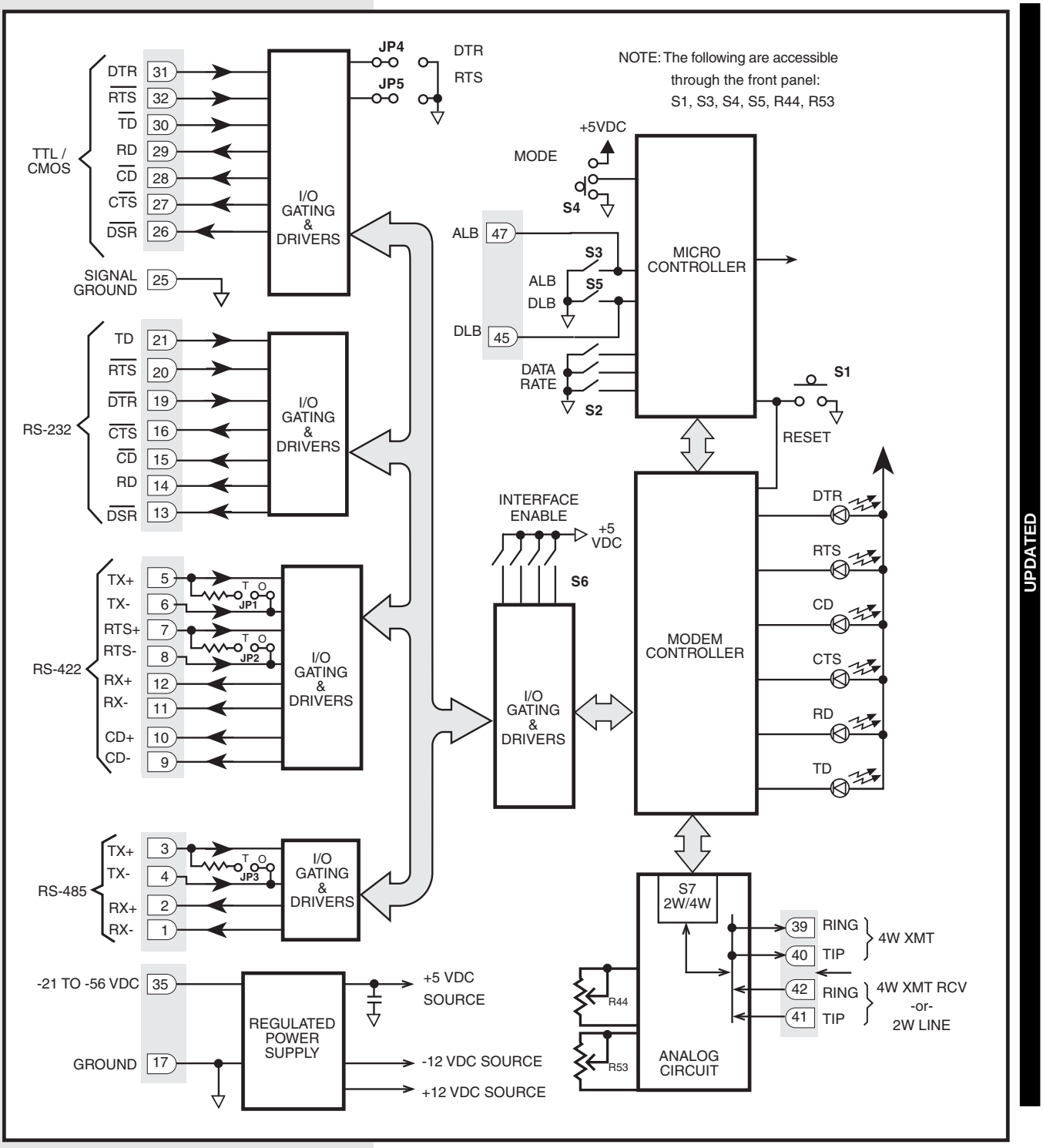
The modem controller provides all the modem functions. It includes the analog modulation/demodulation, analog to digital conversion, asynchronous serial data signal control, and configuration. Receiving configuration information from the microcontroller, the modem controller drives the asynch digital interface as well as the analog line interface. The transformers are 600-to-442 ohm and provide facility-side to circuit isolation.

Reset Circuit

The modem can be reset by a push button (S1), which can be accessed through the front panel. There is also a watchdog circuit that will reset the modem if there is no activity from the microprocessor for 1.2 seconds.

CIRCUIT DESCRIPTION

FIG. 1 - FUNCTIONAL SCHEMATIC; 44214 4-WIRE MODEM



CIRCUIT DESCRIPTION

Asynchronous Serial Interface

The asynchronous serial interface provides the drivers and switching capability to support RS232, RS422, RS485, or TTL communication. The selection of interface is accomplished using S6. There is an LED display which indicates activity on the TXD, RXD, CTS, RTS, DTR, and CD lines.

NOTE:

For 2-Wire operation, the transmit level will adjust itself to the best level between -30dBm and 0dBm.

Analog Interface

The analog interface provides the 2 or 4-wire circuitry necessary to communicate with the modem controller. A two-position switch (S7) selects 2-wire or 4-wire operation. Transmit and receive levels are independently adjustable from the front panel. XMT and RCV levels are adjustable from -40dBm to 0dBm.

INSTALLATION

Installation consists of setting the switch and strap settings, wiring the pin connectors, installing the module in the shelf, and checking out the module.

1. Set the switch and strap settings

Set switches with the on-board slide switches, mini-DIPs or recessed front panel slide switches. Refer to Fig. 2, Fig. 3, and Table A.

Set straps with the on-board mini-jumpers. Refer to Fig. 3 and Table B.

2. Install the module in the shelf

Install the module in the proper slot by sliding the module along the guide slots, then firmly seating the edge connector in its receptacle.

ALIGNMENT PROCEDURE

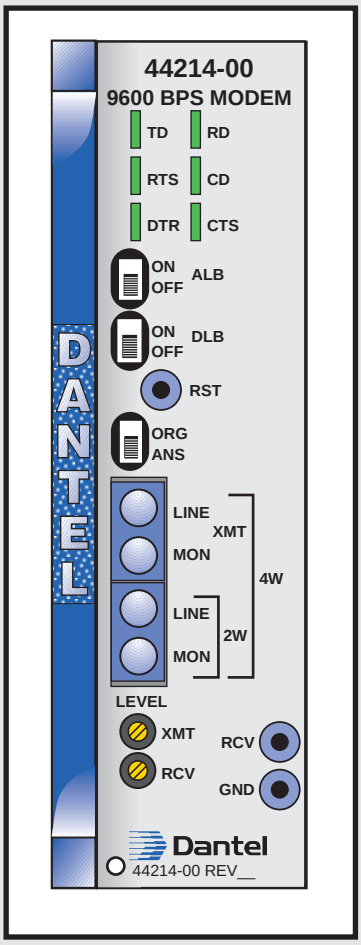
Set modem to Originate Mode

Set Switch 4, accessible through the front panel, to ORG.

Adjust transmit level

Connect a 600 ohm terminated dB meter to the module. Connection can be made at either of two places. A mini-plug can be inserted into the front panel jack labeled 4W MON or the meter can be connected to the 44214's edge connector at pins 40 and 39.

FIG. 2 - FRONT PANEL VIEW



Adjust the XMT LEVEL, at the bottom of the front panel, until the meter reads -6dBm.

Adjust the receive level

Connect a 600 ohm load across the output of a signal generator. With a 600 dB meter across those same outputs, adjust the output level of the generator until the meter reads -29 dBm, at 1004 Hz.

Remove the meter and the 600 ohm load from the generator. Connect the generator to the 44214. Connection can be made at either of two places. A mini-plug can be inserted into the front panel jack labeled 2W LINE or the meter can be connected to the 44214's edge connector at pins 41 and 42.

Connect the dB meter, unterminated, to the pinjacks on the front panel. These are labeled RCV and GND.

Adjust the RCV LEVEL, at the bottom of the front panel, until the meter reads -20 dBm.

Remove the meter and the generator.

CHECKOUT PROCEDURE

Follow the Alignment Procedure to set the levels. If, at any point in the alignment, the unit fails, the module should be replaced. When performing the checkout procedure described below, take appropriate precautions to avoid damaging the unit. Wear an ESD wriststrap, and make sure it is grounded. Every time the procedure requires that the module be removed from the shelf or replaced in the shelf, remove power from the entire shelf.

RTS/DTR

Remove power and set JP4 to ACT. Replace the module and restore power. The front panel DTR LED will illuminate. Replace JP4 to position NA. The DTR LED will remain off.

Remove power and set JP5 to ACT. Replace the module and restore power. The front panel RTS LED will illuminate. Replace JP5 to position NA. The RTS LED will remain off.

Analog Loopback (ALB)

Set S6-1 on, and the rest off. This enables the RS232 portion of the modem. Connect a dumb terminal to the RS232 port. Refer to Figure 1. Edge connector pin 21 is the transmit into the 44214. Pin 14 is the receive back to the dumb terminal. Use pin 17 or 25 for signal ground.

Set ALB, on the front panel, to ON. After a delay of 5 seconds, the front panel RTS, DTR, CD, and CTS LEDs will come on. Typing on the keyboard will cause the TD and RD LEDs to blink and the characters to be echoed back on the screen.

NOTE:

During normal operation, the analog loopback function is used to test the facility between the modem and the DTE device connected to the modem. The ALB function can also be activated by applying a signal ground to edge connector pin 47.

CONTINUED . . .

Set ALB to OFF.

Return S6 to the setting required by the application in use.

NOTE:
During normal operation, the digital loopback function is used to test the facility between the modems. The DLB function can also be activated by applying a signal ground to edge connector pin 45.

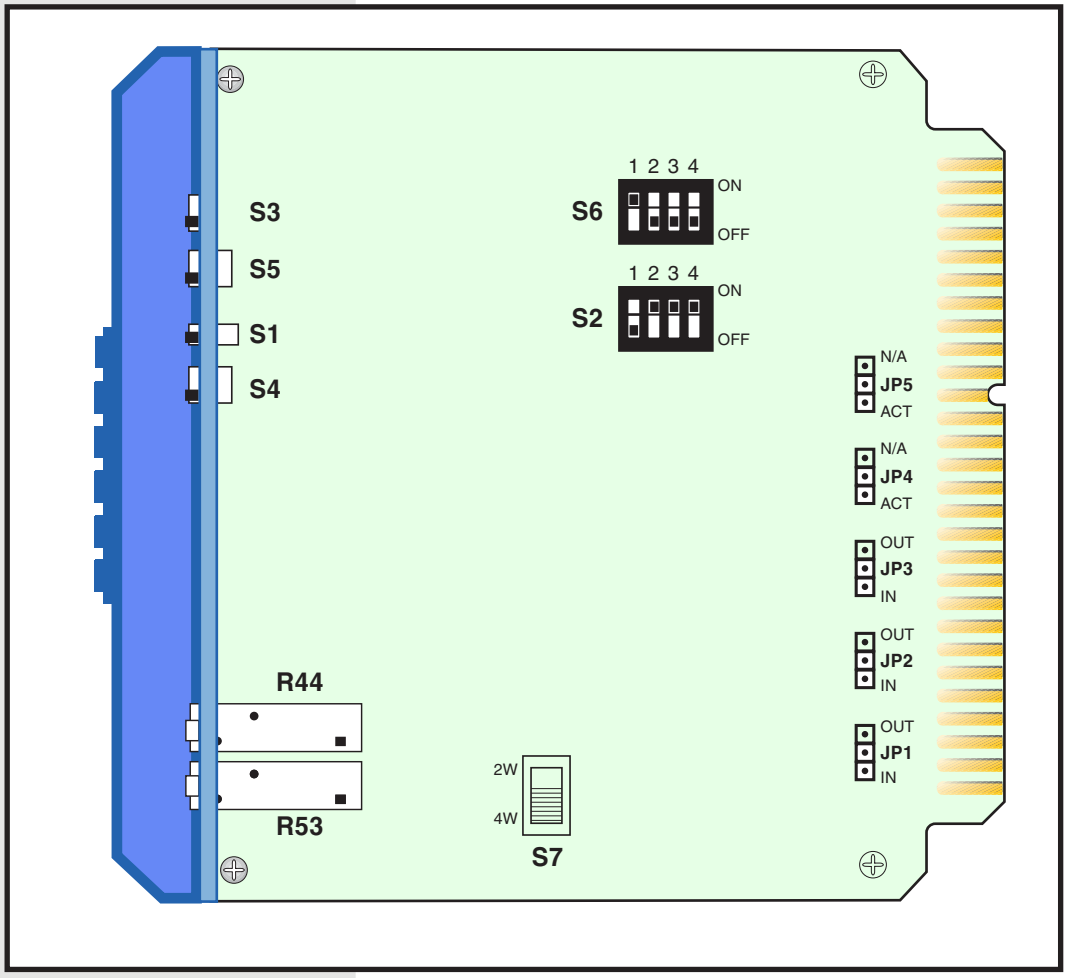
Digital Loopback (DLB)

Connect a remote modem to the analog side. Set DLB, on the front panel, to ON. After a delay of 5 seconds, the remote modem's front panel RTS, DTR, CD, and CTS LEDs will come on. Type any character on the remote terminal. The remote modem's TD and RD LEDs will blink and the remote terminal will receive its character back.

FINAL CHECK-OUT

For the two modems to communicate with each other, one must be set to ORG mode and the other to ANS. These switches are on the front panel of each unit. Make sure that the 2W/4W switch (S7) is set per the application.

FIG. 3 - STRAP AND SWITCH LOCATIONS



UPDATED

TABLE A - SWITCH SETTINGS

SWITCH	POSITION	DESCRIPTION
S1	Momentary	Momentary reset button
S2	Bit 1 Bit 2 Bit 3	
	ON ON ON	Non-functional
	OFF ON ON	9600 baud operation
	ON OFF ON	7200 baud operation
	OFF OFF ON	4800 baud operation
	ON ON OFF	2400 baud operation
	OFF ON OFF	1200 baud operation
	ON OFF OFF	Non-functional
	OFF OFF OFF	Non-functional
S2	Bit 4 ON	No parity
	Bit 4 OFF	Even parity
S3	ON	Enable analog loopback
	OFF	Disable analog loopback
S4	ORG	Set modem to Originate Mode
	OFF	Set modem to Answer Mode
S5	ON	Enable digital loopback
	OFF	Disable digital loopback
S6*	Bit 1 ON	RS-232 I/O Port enabled
	Bit 2 ON	TTL/CMOS I/O Port enabled
	Bit 3 ON	RS-422 I/O Port enabled *
	Bit 4 ON	RS-485 I/O Port enabled *
S7	4W	4-Wire operation
	2W	2-Wire operation

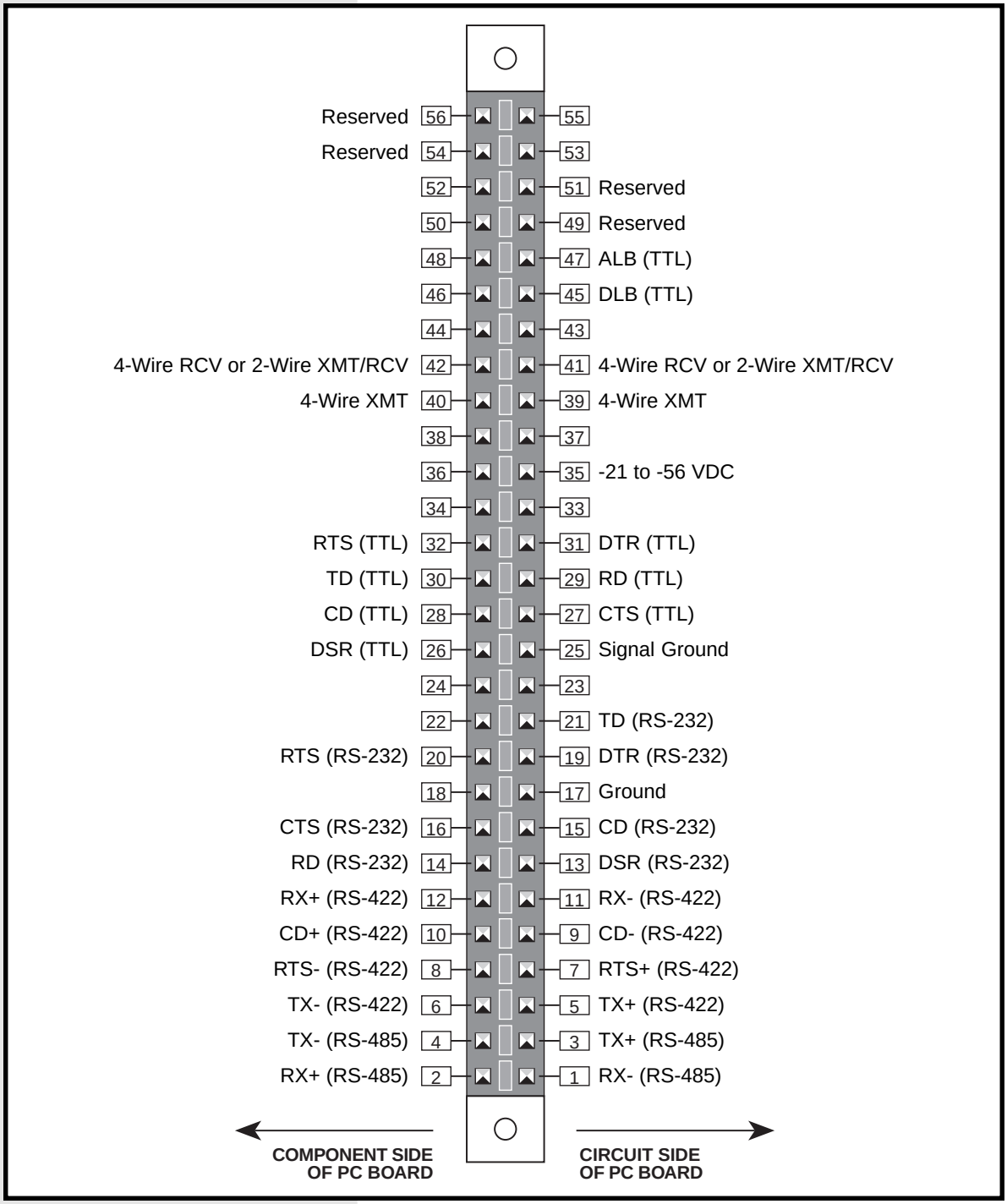
** **NOTE**: Enable only one I/O port at a time. JP4 and JP5 must be strapped to ACT if RS-422 or RS-485 is enabled.*

TABLE B - STRAP OPTIONS

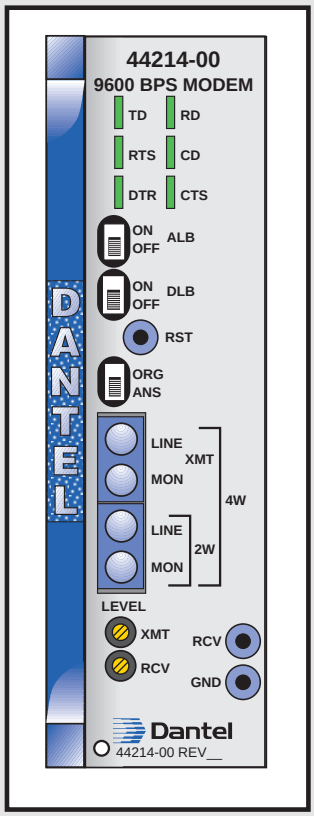
STRAP	POSITION	DESCRIPTION
JP1	OUT	No termination at RS-422 Transmit Data Input
	IN	180 ohm termination at RS-422 Transmit Data Input
JP2	OUT	No termination at RS-422 RTS Input
	IN	180 ohm termination at RS-422 RTS Input
JP3	OUT	No termination at RS-485 Transmit Data Input
	IN	180 ohm termination at RS-485 Transmit Data Input
JP4	1 & 2	Activated / DTR (*required for RS-422 or RS-485)
	2 & 3	Not activated
JP5	1 & 2	Activated / RTS (*required for RS-422 or RS-485)
	2 & 3	Not activated

When it is necessary to wire directly to the 44214 4-Wire Modem, refer to Fig. 4 for the pin designation.

FIG. 4 - PIN DESIGNATIONS



OPERATION



For the most part, once the switches, straps, and levels have been set, operation of the 44214 9600 bps Modem consists of observing the front panel LEDs.

Six green LEDs on the 44214 front panel indicate:

- TD (Transmit Data)
- RD (Receive Data)
- RTS (Request To Send)
- CD (Carrier Detect)
- DTR (Data Terminal Ready)
- CTS (Clear To Send)

There are two recessed switches labeled ALB-ON/OFF and DLB-ON/OFF. These switches test the modem's operation.

There is one recessed switch labeled ORG-ANS. This switch sets the mode of operation for the modem.

Two normal-through mini jacks, labeled 4W LINE (transmit line) and 2W LINE (receive line), provide facility connection. Two jacks, labeled 4W MON (transmit monitor jack) and 2W MON (receive monitor jack), monitor facility-side transmit and receive.

The RCV level potentiometer adjusts the modem IC receive level. The XMT LEVEL potentiometer sets the transmit level at the XMT LINE jacks.

APPLICATION INFORMATION

IMPORTANT NOTE:

When used in alarm applications, as depicted in Fig. 5, the 44214 has specific limitations.

- The 44214 may only be used at 9600 baud.
- The 44214 modem may only be used on point-to-point (not bridged) circuits.

The 44214 modem may only be used with one other 44214 modem operating at 9600 baud.

Applications for the 44214 9600 bps Modem consist of digital data transmission service between distant equipment sites. Use the 44214 with equipment from other manufacturers (for example, alarm and control) to transmit and receive data between a remote location and central location.

Fig. 5 shows a 44214 Modem application. A 44214 Modem at a remote location transmits 460 Alarm and Control System data to a 44214 Modem at a central data processing location. The 44214 Modem provides stable operation because its battery, a DC power source, is free of AC power interruptions.

Fig. 6 shows a 44214 Modem used in the 05547 DTSS3A Orderwire\Data Interface. In this application the 44214 provides a 9600 bps interface between a piece of Data Termination Equipment and Dantel's DTSS3A Orderwire. The 05547 then provides two-way voice and/or data communication over a 64-Kilobit Channel. At the far end is another 05547 equipped with another 44214 9600 bps Modem.

APPLICATION INFORMATION

FIG. 5 - EXAMPLE APPLICATION 1

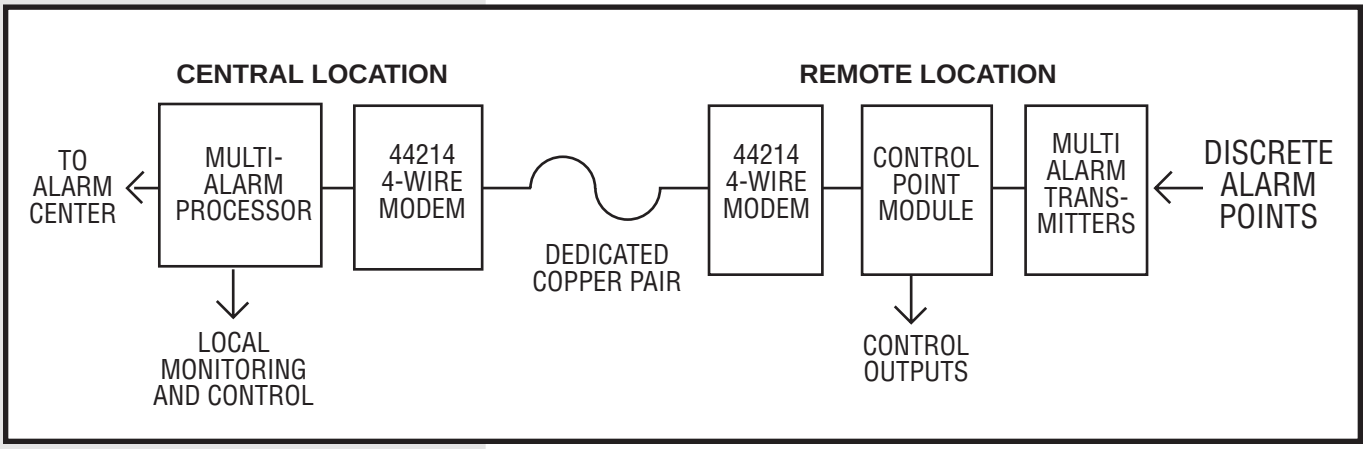
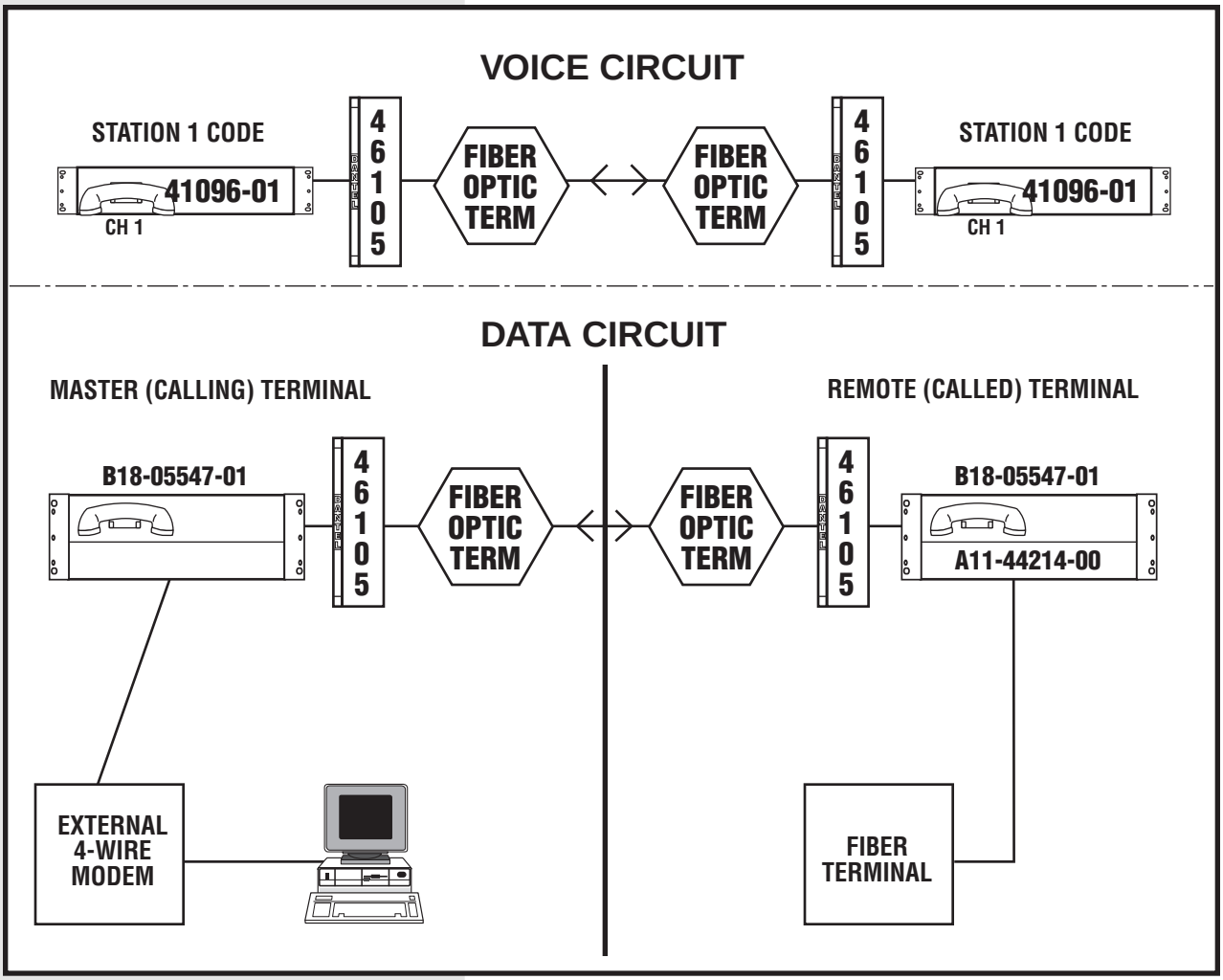


FIG. 6 - EXAMPLE APPLICATION 2



TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS; 44214 4-WIRE MODEM

DESCRIPTION	VALUE
POWER REQUIREMENTS	
Input Voltage	-21 to -56 VDC
Input Current	
@ -21 VDC	114 mA
@ -24 VDC	100 mA
@ -48 VDC	48 mA
@ -56 VDC	45 mA
Maximum Heat Dissipation	
@ -21 VDC	8.9 Btu/Hr
@ -24 VDC	8.9 Btu/Hr
@ -48 VDC	9.0 Btu/Hr
@ -56 VDC	9.4 Btu/Hr
HARDWARE STANDARDS	
Physical Size	1.4"H x 6.0"L x 5.6"W
Weight	8.14 ounces
Operating Temperature	0° to 55° C.
AUDIO PORT LEVELS (600 OHM)	
XMT Carrier Level	-40 dBm min. to 0 dBm max.
RCV Carrier Level	-40 dBm min. to 0 dBm max.
DIGITAL INTERFACES	
TTL/CMOS	
Input Voltage	0 to +1V = Low; +3.4 to +5V = High
Output Current	6mA Sink
RS-232	
Receivers	
Input High Voltage	+3 to +25V
Input Low Voltage	-3 to -25V
Drivers	
Output High Voltage	+10.5V typ.; +5V min. (3K ohm load)
Output Low Voltage	-9.5V typ. (no load); -5V min. (3K ohm load)
Short Circuit Current	±30 mA max.
Output Resistance	300 ohms min.
Maximum Load Resistance	3K ohms
RS-422 & RS-485	
Receivers	
Differential Input	±0.2V threshold; voltage ref. to inverting input
Common Mode Input	±12V max.; voltage ref. to ground
Drivers	
Differential Output	±4V max. (no load) ±1.5V min. (54 ohm load at inverting output)
Short Circuit Current	180 mA V54 = VCC -180 mA Vo = -7V 500 mA Vo = +17V
ALB & DLB Inputs	
Operating Voltage	0 to +1V
Usable Voltage	+3.4 to +5V

CONTINUED . . .

TECHNICAL SPECIFICATIONS (CONTINUED); 44214 4-WIRE MODEM

	9600	7200	4800	2400	1200
Configuration Mode	V.32 9600	V.32 TCM	V.32 4800	V.22 BIS 2400	V.22 BIS 1200
Modulation	QAM	TCM	QAM	QAM	KPSK
Carrier Frequency ±0.01	1800	1800	1800	1200/2400	1200/2400
Baud (Symbol/Sec.)	2400	2400	2400	600	600
Bits Per Symbol Data/TCM	4/0	3/1	2/1	4/0	2/0
Constellation Points	16	16	4	16	4

WARRANTY

LIMITED WARRANTY

The Seller warrants that the standard hardware products sold will be free from defects in material and workmanship and perform to the Seller's applicable published specifications for a period of 18 months for hardware, and 3 months for software, from the date of the original invoice. The liability of the Seller hereunder shall be limited to replacing or repairing, at its option, any defective products which are returned F.O.B. to the Seller's plant, (or, at the Seller's option, refunding the purchase price of such products). In no case are products to be returned without first obtaining permission and a customer return authorization number from the Seller. In no event shall the Seller be liable for any consequential or incidental damages.

Equipment or parts which have been subject to abuse, misuse, accident, alteration, neglect, unauthorized repair or installation are not covered by warranty. The Seller shall make the final determination as to the existence and cause of any alleged defect. No warranty is made with respect to custom equipment or products produced to the Buyer's specifications except as specifically stated in writing by the Seller in the contract for such custom equipment.

This warranty is the only warranty made by the Seller with respect to the goods delivered hereunder, and may be modified or amended only by a written instrument signed by a duly authorized officer of the Seller and accepted by the Buyer.

Warranty and remedies on products not manufactured by the Seller are in accordance with warranty of the respective manufacturer. THE SELLER MAKES NO OTHER WARRANTY OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED; AND ALL IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEEDS THE AFORESAID OBLIGATIONS IS HEREBY DISCLAIMED BY THE SELLER.

IN CASE OF DIFFICULTY

If you experience difficulty with this equipment, check the following, as appropriate:

1. **Switch settings**
2. **Signal levels**
3. **Software configuration**
4. **Connections between Dantel's equipment and your equipment.**

If there is still a problem, substitute equipment that is known to be good. For additional assistance, call Dantel's Technical Field Service Department weekdays, 6 A.M. to 5 P.M. pacific time:

1-800-4DANTEL (1-800-432-6835).

If a thorough checkout shows a piece of equipment has malfunctioned, you may return it to the factory. For repairs and emergency replacements, obtain a Return Material Authorization (RMA) number from the Customer Service Representative at **1-800-4DANTEL** (1-800-432-6835).

To ensure expedient processing of your order, provide a purchase order number and shipping and billing information when requesting an RMA number. Also, when the units are returned to Dantel, include a description of the failure symptoms for each unit returned. Send defective equipment to:

Dantel, Inc. • 2991 North Argyle Avenue • Fresno, California 93727-1388