1200 BPS BELL 202T LEASED-LINE NETWORK MODEM G-9714A

GENERAL DESCRIPTION

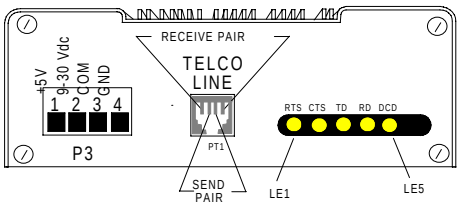
The Bell 202T Leased-Line Network Modem, the G-9714A, is designed for continuous monitoring of a device with either an RS-232 or RS-485 serial port. Powered from either regulated 5 Vdc or unregulated 9-15Vdc, the G-9714A takes 4-wire frequency-shift tones of the Bell 202T standard and creates a TTL send and receive signal. The user has the option of that signal being converted to either RS-232 signal levels or 4-wire RS-485 signals if the optional RS-485 port is ordered. The modem can also be configured for CCITT V.23 signalling if Bell 202T is not required. When the G-9714A is ordered with RS-485 port, the RS-232 port is not provided.

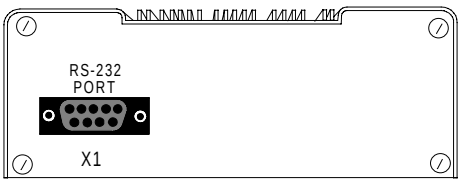
INSTALLATION

Power Connections:
For installations where regulated 5Vdc is available, connect the +5V to P3, terminal 1, and the power common to COM on P3, terminal 3. If only 9-15Vdc is available, typically 12Vdc or 24Vdc, an internal regulator will generate the 5Vdc. For this type of installation, connect the + to the 9-15Vdc, terminal 2, and the power common again to terminal 3, all of P3. For the internal protective circuitry to be active in protecting the line input and RS-485 lines, a good ground should be connected to P3 GND, terminal 4.

TELCO Line Connections:
The 4-wire communication pairs are terminated on an RJ-11 jack with the center pair for the send circuit (tones going to the other site) and the pins on either side for the receive pair (tones coming into this modem).

RS-232 Port Connections:
The RS-232 port exhibits ±10V levels for interfacing to the customer device. The modem has a 9-pin D-shell, female connector and, therefore, requires the device connection to be a 9-pin male-type connector. The signalling is as in Table 1. The RTS/CTS signalling does not affect the modem transmit in the sense of a dial-up modem. These signals help the device handshake data in and out of the modem. DCD does truly represent reception of tones at an acceptable level to the receiver section.





Note that the RD designation is for data flowing out of the modem and TD is for data flowing into the modem.

Optional RS-485 Port Connections:
The RS-485 4-wire port is an isolated 5V signalling system typically used on networked devices of up to 32 in number. P2 is the send port of the RS-485 and signals *to* the devices while P1 is the receiver port of the RS-485 and takes in signals *from* the devices. The receiver of the devices is connected to the send of the modem (P2) and the send of the devices is connected to the receive of the modem (P1). The polarity of the devices is usually opposing as in Table 2.

TABLE 1

9-PIN TERM.	DESCRIPTION
1	Data Carrier Detect
2	Received Data out of Modem
3	Transmit Data into Modem
4	N/C
5	Circuit Common
6	N/C
7	Request-to-Send
8	Clear-to-Send
9	N/C

TABLE 2

DEVICE		G-9714A RS-485 PORT	
SEND	+	–	P1
	–	+	
RECV	+	–	P2
	–	+	

The polarity can be the most confusing. If it is observed that the front panel LED for RD glows with no response from the device on TD, swap the polarity and try again.

Indicators:

LE1, RTS (Request-to-Send): signal from device to indicate wanting to send data, ON for RTS High, >3V.

LE2, CTS (Clear-to-Send): signal to device indicating modem okay to send data, ON for CTS High, >3V.

LE3, TD: Transmitted Data into modem to be sent over leased-line, ON for TD Data, >3V.

LE4, RD: Received Data out of modem from received tones on leased-line, ON for RD Data, >3V.

LE5, DCD (Data Carrier Detect): signal indicating received tones above -30dBm, ON for DCD High, >3V.

Jumper Settings:

The most common use of the G-9714A is for Bell 202T signalling with a 4-wire circuit; therefore, the jumpers are set for Bell 202T. Refer to the schematic for jumper settings for V.23. J3 and J6 are the only jumpers required for Bell 202T operation. J4 selects 100ms CTS delay when open and 10ms CTS delay when installed.

Mode:

When there is no RS-485 port installed, the RS-232 is always used.

SPECIFICATIONS

ENCLOSURE: 5.5"L x 3.95"W x 1.75"H extruded aluminum housing.

WEIGHT: 24 oz.

MOUNTING HOLE PATTERN:
4.75" x 5.5", 4 holes, 0.156" x 0.5" slots.

TEMPERATURE RANGE: 0° to +70°C.

SIGNALLING: Bell 202T or CCITT V.23.

BAUD RATE: 1200BPS maximum

COMMUNICATIONS LINE:
Connector: RJ-11-10
Send Level: -35 to 0dBm into 600W, factory set at 0dBm.
Receiver Sensitivity: -30dBm, min.

RS-232 INTERFACE:
±3V to ±10V levels, not isolated
9-pin DB-9S female D-shell
RTS, CTS, DCD, TD, RD, RI supported
Full-duplex, 1200BPS, maximum

RS-485 INTERFACE:
5V levels, 500V isolation
Transient protected
Two 3-wire removable screw connections
Full-duplex, 4-wire, 1200BPS, max.

CARRIER DETECTOR:
-34dBm
Loss detect speed less than 3 bits
Return delay 10-200ms, adjusted to maximum.

RTS-to-CTS DELAY: 100ms or 10ms.

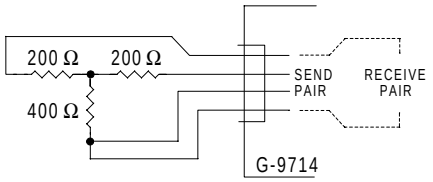
POWER REQUIREMENTS:
+5Vdc, 9-15Vdc, 1W, maximum

All specifications are subject to change.

TESTING AND CALIBRATION

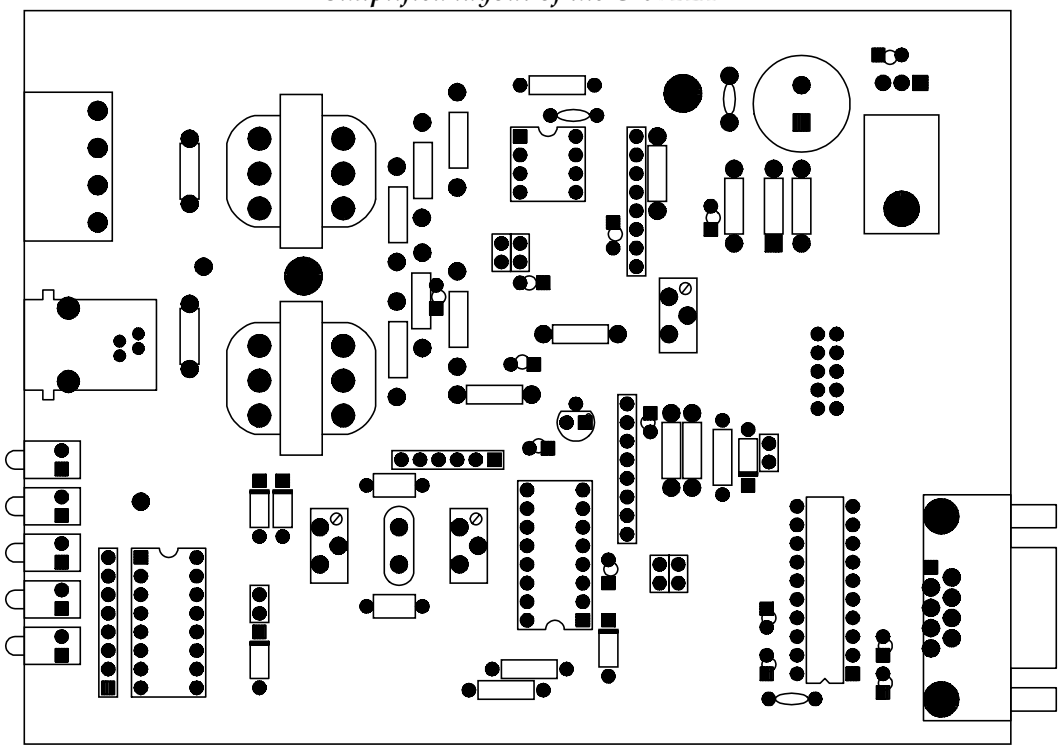
To test the modem place a T-pad between the send and receive pair of the RJ-11 as shown in the Figure 1. This T-pad provides approximately 16dB of attenuation of the send tones.

FIGURE 1



R8 adjusts the send tone level. Monitor the output of the send pair with a true rms ac voltmeter and make sure it will

Simplified layout of the G-9714A



adjust between -35dBm and 0dBm. Move the voltmeter to the receiver input pair and adjust the level for -30dBm. Adjust the carrier detector level with R10 until the DCD indicator toggles off. Monitor the DCD line on the 9-pin RS-232 and ensure that it toggles from >3V to <3V. Return the level of the receive pair to -20dBm to -15dBm. Adjust the CD delay trimmer R18 fully clockwise and short the receive pair and note the delay of the DCD lamp. With J4 open, assert RTS high (>3V) and note a delay in the CTS indicator lighting.

To set the bias, R12, connect a square-wave oscillator to the TD and COM pins of X1 at 150Hz, 10V peak-to-peak. Monitor the TD and RD pins with an oscilloscope and adjust R12 such that the duty cycle of the TD and RD lines are equal. Adjust the frequency of the oscillator to 600Hz and ensure that the duty cycle still matches.

To check the RS-485 port, data input on P1 (0 to +5V levels) should match that seen at P2. Use an oscilloscope and test similar to that done on the RS-232 above.

THEORY OF OPERATION

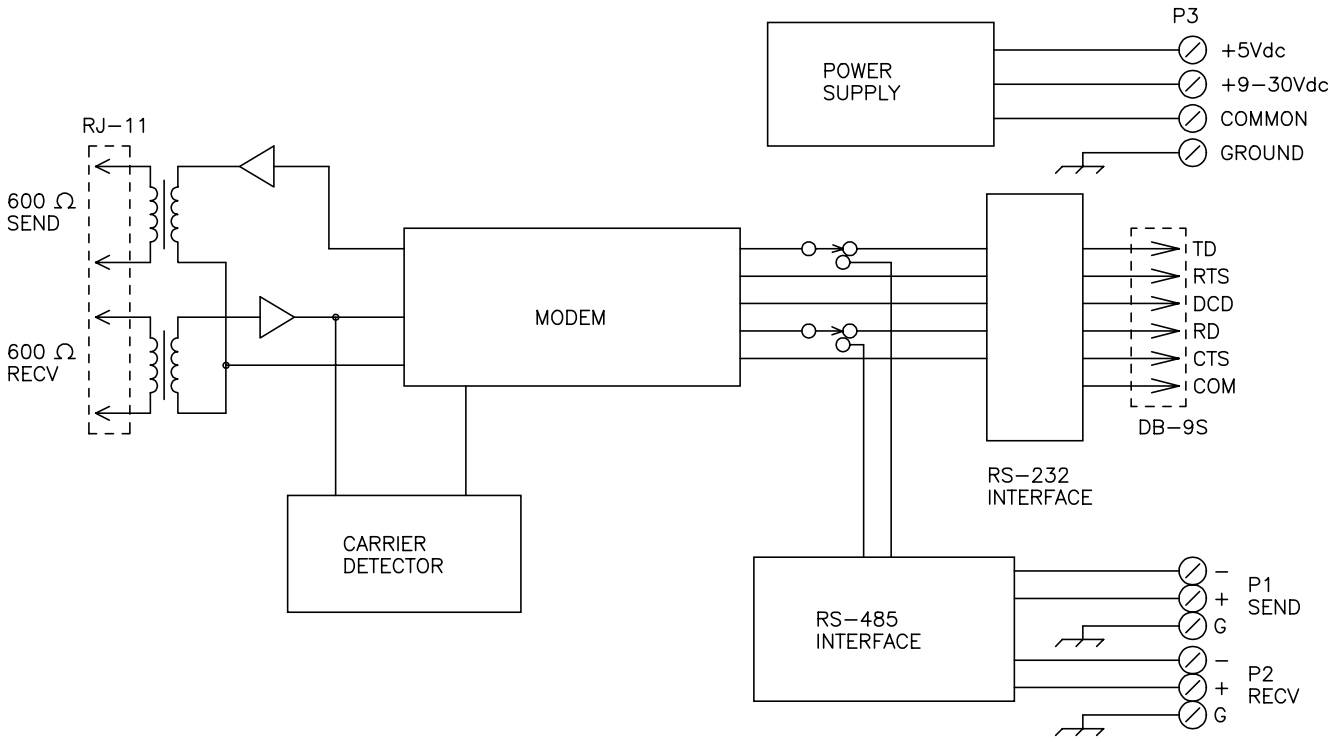
For full-duplex, 4-wire operation, serial information from either the TD line of the RS-232 port or the send port, P1, of the RS-485 port is presented to the TXD line of the TCM3105 single-chip modem. The TCM3105, U9, changes the serial data into FSK tones and sends them out the TXA pin. U8 forms an amplifier to drive the tones onto a 600-ohm line. RTS only affects the TCM3105 if J5 is installed. The CTS is wrapped back to the 9-pin through an R-C time delay that can be set to 100ms with J4 open and 10ms with J4 closed.

The receive section of the modem buffers the FSK tones with a section of U8 before they are presented to the RXF input of the TCM3105 chip. J3 terminated the receive line to 600 ohms and J1 reduces the gain of this buffer by 3dB for situations where the line level is too high. The TCM3105 chip uses the bias level set by R29 to slice the incoming discriminated tones into useable serial data. Received serial data is present at pin 8. The Mode switch again sends the serial data to the appropriate interface circuitry. The carrier detector circuit incorporating U7 is a full-wave bridge rectifier for higher speed level detection. R39 sets the level at which the last state determines carrier is present. R18 sets the delay for return-from-fail. When the carrier goes away, the diode, CR16, shorts R18 and affects an immediate carrier loss indication. When carrier is restored, the signal is built up through R18 and effectively a delay. The carrier detector output drives the RD output high during a fail by Q3 and drives its own DCD output.

U4 is an RS-232 to TTL converter that uses 5Vdc to chop the 4 10uf capacitors and makes ±10Vdc for the RS-232 levels. The RS-485 interfaces uses U3 and U5 to isolate the serial data and the VR2 dc-dc converter actually drives the 485 bus driven chips, U2 and U4.

Protection of the communication line and RS-485 lines is by the avalanche diodes and the MOVs on the TELCO line. The MOVs are directly against transients on the line; however, the avalanche diodes dissipate transients through the 10W resistors.

Simplified block diagram of the G-9714A



REPLACEABLE PARTS LIST, G-9714A

CIRCUIT SYMBOL	DESCRIPTION	STOCK #
LE1-LE5	LED, Red, 550-0406	010001
CR12	Diode, IN4004	010020
CR14-16,CR18-25	Diode, IN4148	010040
CR17	Diode, IN5228B	010290
CR1-CR11	Diode, P6KE10CA	010337
CR13	Diode, UF4002	010351
C9	Capacitor, EL., 330uf, 16V	020110
C6,C8	Capacitor, EL., 470uf, 50V	020111
C18,C19,C22,C25	Capacitor, TAN., 1uf, 35V TAP	030150
C1-C4	Capacitor, TAN., 10uf, 16V TAP	030152
C16	Capacitor, TAN., 3.3uf, 16V TAP	030153
C12	Capacitor, TAN., 33uf, 16V TAP	030154
C17	Capacitor, TAN., 4.7uf, 16V TAP	030160
C7	Capacitor, TAN., 6.8uf, 16V TAP	030161
C14, C14	Capacitor, TAN., .1uf, 35V TAP	030162
C15	Capacitor, CER., .05uf, 16V	040010
C5,10,11,20,21	Capacitor, CER., .1uf,50V	040080
C23,24	Capacitor, CER., 47pf, 50V	060060
U6	I.C., MC14049UBCP	080130
U9	I.C., TCM3105JL	080841
U1	I.C., MC145407P	081121
U7,8	I.C., TL064BCN	081172
VR1	I.C., LM2575T-5.0	081450
Q1,3,4	Transistor, 2N3903	090050
R28,29	POT, 67R10K	110300
R39	POT, 64Y502	110380
R18	POT, 64Y503	110400
R3,9,13,32	Resistor, COMP., 1/4W, 1K	130030
R6,17,31	Resistor, COMP., 1/4W, 10K	130040
R30	Resistor, COMP., 1/4W, 100K	130050
R15	Resistor, COMP., 1/4W, 220	130130
R16,22	Resistor, COMP., 1/4W, 2.2K	130140
R14	Resistor, COMP., 1/4W, 22K	130150
R21	Resistor, COMP., 1/4W, 2.2M	130170
R5,11,12,14,23,33	Resistor, COMP., 1/4W, 4.7K	130260
R20,26	Resistor, COMP., 1/4W, 47K	130270
R1,2,7,8,35-38	Resistor, COMP., 10W, 1/2W	130731
RN2-RN6	Resnet, 8-2-103 (ISO)	139940
RN1	Resnet, 8-1-102	139967
RN7	Resnet, 6-1-103	139970
R24,25	Resistor, PREC., 590.0 5900F	140860
R27	Resistor, PREC., 30.1K 3012F	141680
T1,2	Transformer, TY145P Microtran	150190
L2	Inductor, PE-52647 Pulse	150460
L1,L3	Inductor, Miller 77F100K	150461
P3	Phoenix, 1757491 (4P VRTCLS)	171200
P3	Phoenix, 1754481 (4P Plug)	171201
X1	AMP, 745395-2	171241
MO1,2	MOV, V150LA10A	250142
Y1	Crystal, NE18 4.4336	250460
	OPTIONAL RS485 INTERFACE	
U3,5	I.C., 4N35	080320
U2,4	I.C., MAX483CPA	081422
VR2	Voltage Regulator, 105S5FS CDI	081529
Q2	Transistor, 2N3905	090060
R10	Resistor, COMP., 1/4W, 100	130020
R4	Resistor, COMP., 1/4W, 470	130250
P1,2	Phoenix, 1754465 (3P Plug)	171217
P1,2	Phoenix, 1754452 (3P VRTOPN)	171219
S1	Switch, MTM206NRA AUGAT	180760

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NOTICE

As of the date of this printing, the specifications for the G-9714A in this Instruction Information sheet apply to all G-9714A 1200 BPS Bell 202T Leased-Line Network Modems, except as indicated. Because all Da-Tel products are continually being refined and improved, these specifications are subject to change without notice.