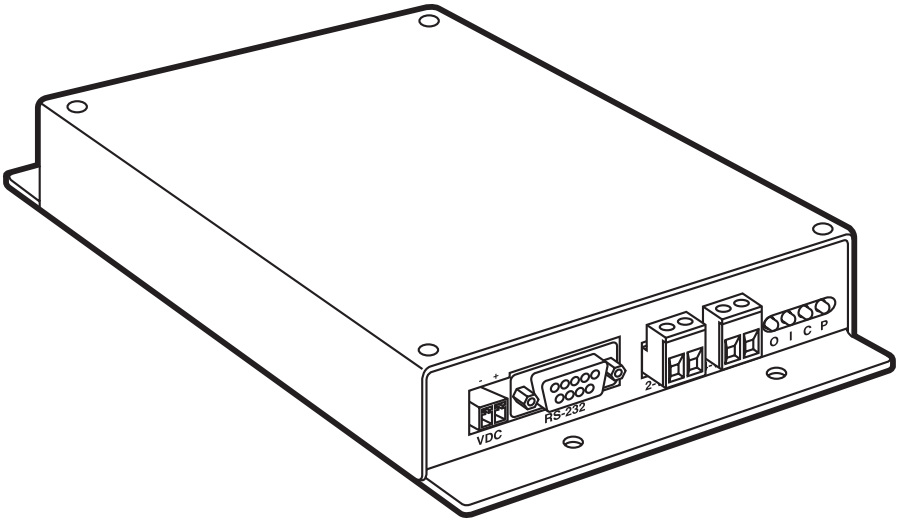
BLACK BOX®
NETWORK SERVICES

MAY 2001
MD845A-R2

Modem 202T



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FEDERAL COMMUNICATIONS COMMISSION
AND
INDUSTRY CANADA
RADIO FREQUENCY INTERFERENCE STATEMENTS

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

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This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

FCC REQUIREMENTS FOR TELEPHONE-LINE EQUIPMENT

1. The Federal Communications Commission (FCC) has established rules which permit this device to be directly connected to the telephone network with standardized jacks. This equipment is designed to operate only on dedicated phone lines or wires. Do not connect to dial-up lines, coin lines, party lines, or lines with dial tones.

2. If this device is malfunctioning, it may also be causing harm to the telephone network; this device should be disconnected until the source of the problem can be determined and until the repair has been made. If this is not done, the telephone company may temporarily disconnect service.

3. If you have problems with your telephone equipment after installing this device, disconnect this device from the line to see if it is causing the problem. If it is, contact your supplier or an authorized agent.

4. The telephone company may make changes in its technical operations and procedures. If any such changes affect the compatibility or use of this device, the telephone company is required to give adequate notice of the changes.

5. If the telephone company requests information on what equipment is connected to their lines, inform them of:

   a. The telephone number that this unit is connected to.

   b. The FCC registration number.

   Item (b) can be found on the unit's FCC label.

6. In the event of an equipment malfunction, all repairs should be performed by your supplier or an authorized agent. It is the responsibility of users requiring service to report the need for service to the supplier or to an authorized agent.

CERTIFICATION NOTICE FOR EQUIPMENT USED IN CANADA

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications-network protective, operation, and safety requirements. Industry Canada does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single-line individual service may be extended by means of a certified connector assembly (extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized maintenance facility—in this case, Black Box. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION:

Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

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ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.

2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.

3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.

4. Todas las instrucciones de operación y uso deben ser seguidas.

5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..

6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.

7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.

8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.

9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.

10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.

13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.

14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.

15. En caso de existir, una antena externa deberá ser localizada lejos de las lineas de energia.

16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.

17. Cuidado debe ser tomado de tal manera que objectos liquidos no sean derramados sobre la cubierta u orificios de ventilación.

18. Servicio por personal calificado deberá ser provisto cuando:

    A: El cable de poder o el contacto ha sido dañado; u

    B: Objectos han caído o líquido ha sido derramado dentro del aparato; o

    C: El aparato ha sido expuesto a la lluvia; o

    D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o

    E: El aparato ha sido tirado o su cubierta ha sido dañada.

TRADEMARKS USED IN THIS MANUAL

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1. Specifications

Range: Up to 20 miles on unloaded lines, depending upon line characteristics. Unlimited on loaded lines.

Operating Frequency: 1200/2200 Hz (Bell 202 or 1300/2100 CCITT V.35) FSK (Frequency Shift Key)

Data Rates: 300, 600, or 1200 baud half- or full duplex up to 1200 baud simplex

Handshake Modes: DataSense (DSCC) or RTS line

Enclosure: Standard NEMA 1; 18-gauge steel with mounting flanges

Temperature Tolerance: -4 to +158°F (-20 to +70°C)

Indicators: (4) LEDs: Data Out, Data In, Carrier, Power

Connectors: (2) terminal blocks, (1) DB9 female

Power required: Input: 11 to 18 volts DC at a minimum of 200 ma. External wallmount power supply provided for 110 VAC nominal.

Size: 1.5"H x 5"W x 9"D (3.8 x 12.7 x 22.9 cm) over mounting flanges

Mounting: Hole pattern ¼ inch diameter located on rectangle 8.3 by 2.8 inches

2. Introduction

The Modem 202T is a Bell 202 (CCITT V.23 optional) voice-band, 1200-baud modem. Use it on private, leased, un-switched telephone lines or any dedicated 2- or 4-conductor wire (twisted or untwisted, shielded or unshielded). The Modem has a range of up to 20 miles (32.2 km) on any ordinary wire pairs or unlimited on "loaded" telephone company voice-grade (VG-6) leased lines.

The Modem 202T can operate without handshake lines using the proprietary DataSense (DSCC) microprocessor firmware. This feature detects and buffers incoming RS-232 data to allow the assertion and stabilization of the FSK carrier before transmitting the buffered characters.

The nominal operating supply voltage for the Modem 202T is 12 VDC via a 2-conductor screw terminal power connector.

3. Modem Configurations

3.1 Full Duplex 4-Wire Mode

To operate in full duplex, the Modem 202T must use a 4-wire connection and can have only two units in a point-to-point connection. In full duplex, the Modem does not use carrier control since both modems will have their carriers transmitting at all times. No handshake signals are used by the modems, but the signals can be asserted by the users' equipment and fed back to the connecting equipment if needed.

When operating, the Carrier Detect LED of both modems should be on at all times. The carrier reflects the presence of the FSK frequency on the connecting wires. The Data In LED (Yellow) and the Data Out LED (Green) of the modem will follow the data at the RS-232 9-pin connector. The two modems are cross-connected via the "2-wire" and "4-wire" connectors.

3.2 Half-Duplex 2-Wire Mode

The Modem 202T can operate in half-duplex 2-wire mode with one master and one or more remote modems. The setup configuration is the same for the master and remote modems. The user's systems equipment must provide a timing delay between a received message and a transmitted answer to allow the FSK carrier time to switch directions.

The data flow control can be either DataSense (DSCC) or the RTS line from the connected equipment.

In DSCC mode, the modem senses the characters from the user's equipment, turns on the FSK carrier, and then sends the buffered characters. All receiving modems detect the carrier, then send the received data out the RS-232 port to the user's equipment. In DSCC mode, a minimum line turnaround delay of 40 milliseconds is required.

With RTS control, the assertion of the RTS line by the user's equipment tells the modem to turn on the transmission carrier. Only the carrier at one modem can be on at any time in a half-duplex system, or carrier collision will occur and no data can be transferred. The minimum RTS timings are 20 milliseconds pre-transmit delay, 60 milliseconds RTS to data, and zero milliseconds RTS off delay at the end of the data. If you are adding the Modem 202T to an existing system with previous models of Modem 202Ts, a minimum of 100 milliseconds RTS to data delay is required.

In a half-duplex system, the higher level equipment is responsible for recognizing that the incoming data is valid and responds with return data. Either time delays (DSCC mode) or handshake signals (RTS mode) must be provided to allow line carrier turn around.

In a two-wire system, only the left connector marked "2-wire" is used to interconnect all the modems in the system.

NOTE

These modems also use audio frequency tones and the connections to the phone wires do not have a polarity.

The LEDs on a modem reflect the status of the lines at the 9-pin RS-232 connector. When a modem is transmitting, the Data In (Yellow) LED will flash, and at the remote modem the Carrier Detect (Amber) and Data Out (Green) LEDs will flash as data is received.

3.3 Half-Duplex 4-Wire Mode

The Modem 202T will operate in half-duplex 4-wire mode with one master and one or more remote modems.

The master's carrier transmitter "4-wire" line must be connected to the remote's receiver line "2-wire" and vice versa. The master modem's carrier is being transmitted at all times so the remote's carrier (Amber) LED will always be on. The remote modem's carrier is only transmitted when a remote modem is actively sending data to the master.

No data flow control is needed at the master since its carrier is always on and ready to transfer data. The data flow control at the remotes can be either DataSense or the RTS line from the connected equipment.

In DSCC mode, the modem senses the RS-232 characters from your equipment, turns on the FSK carrier, and then sends the characters. The master modem detects the carrier, then the data, and and sends the received data out its RS-232 port to your equipment.

With RTS control, the assertion of the RTS line by your equipment tells the remote modem to turn on the transmission carrier. Only one remote carrier can be on at any time in a half duplex system or carrier collision will occur and no data can be transferred. At a remote modem, your system must recognize that incoming data is for the unit and must respond with data (DSCC) or RTS handshake line to provide the correct timing delays to prevent carrier collisions. The minimum RTS timings

are 20 milliseconds pre-transmit delay, 60 milliseconds RTS to data, and zero milliseconds RTS off delay at the end of the data. If adding Modem 202Ts to an existing system with Modem 202Ts, a minimum of 100 milliseconds RTS to data delay is required.

The Carrier Detect (Amber) LED on all remote modems in the system should be on at all times. FSK data received at the remote will flash the Out (Green) LED when data is sent out its RS-232 port. When a remote modem is transmitting, the Data In (Yellow) LED will flash, and at the master modem the Carrier Detect (Amber) and Data Out (Green) LEDs will flash.

3.4 Simplex or Bits Mode

In Bits mode, the Modem 202T sends data from a master to a remote(s) in one direction only. In this mode, the modem is protocol- or format transparent and will only operate in 2-wire mode. The data line is either a binary 1 or 0, producing a 1 or 0 at the receiving modem(s).

When connecting the modems to each other, use only the "2-Wire" connector terminal block on all modems in the system.

With the Modems connected, the Carrier detect LED on the remote modem(s) should be on at all times. The Carrier LED on the master will never be on. When data is moving from the master to the remote modem(s), the Data In (Yellow) LED on the master and the Data Out (Green) LED on the remote(s) will flash with the data.

3.5 Default Configuration

The default configuration for the modem is:

Character Size: 10 bis/character (N, 8, 1)

Baud Rate: 1200

Carrier Frequency: Normal

Carrier On Select: DataSense

Modem Connection: 2-wire half-duplex

4. Making Connections

The Modem 202T has four connection points. (See Figure 4-1.) On the left is the DC power connection. The standard modem has a two-position terminal block connector for use with the supplied wallmount power supply. The DB9 connector is the RS-232 interface. To the right of the DB9 connector are two connections for the carrier wire pairs marked "2-Wire" and "4-Wire." These are two-position removable terminal block connectors. In 2-wire mode, the left connector acts as both the transmitter and receiver connector. In 4-wire mode, the unit sends audio tones out the 4-wire connector (transmit) and receives tones on the 2-wire connector (receive). All connections to the phone lines are through 600-ohm transformers.

NOTE

When using the Modem 202T in a 4-wire configuration, the transmitter of the master "4-wire" must be connected to the "2-wire" of the remote(s) and all remote transmitter "4-wires" are wired in parallel to the master's receiver connector "2-wire."

4.1 Connections Diagram

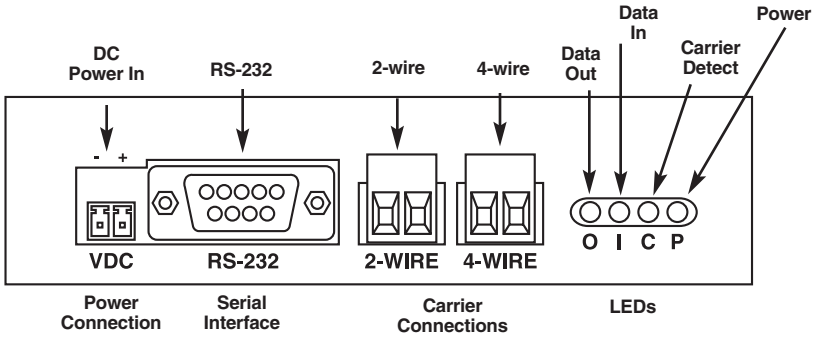

Figure 4-1. Connections.

LEDs

- Power (P), red
- Carrier Detect (C), amber
- RS-232 In (I), yellow
- RS-232 Out (O), green

4.2 Power Connector

The two-position screw terminal connector is left pin negative (-) and right pin positive (+). DC negative is not connected to the chassis.

4.3 RS-232 Serial Connector

Table 4-1. RS-232 serial connector.

Pin Number	Name	Function
1	DCD*	Received carrier detect out
2	TX	RS-232 Data Out of Modem
3	RX	RS-232 Data In to Modem
4	DTR	Not connected in unit
5	Gnd	Signal Ground
6	DSR*	Data Set Ready (connected to CTS)
7	RTS*	Ready to Send (transmit enable)
8	CTS	Clear to Send [may be connected to RTS or DCD] (connected to DSR)
9	RI	Not connected in unit

*DCD via factory jumper to pin 1.

4.4 Operating Mode Selection and Wiring

Table 4-2. Operating mode selection and wiring.

Wire	Mode	Use Connectors	SW3	SW2-5	SW2-6	Notes
2 wire	Half-Duplex Master or remote(s)	2 wire to 2 wire parallel all units.	2 wire	OFF	OFF	One master with 1 or more remotes. Carriers flash.
2 wire	Simplex (Bits) Master	2 wire is out.	2 wire	ON	ON	Data flows from master to remote(s) only. No carrier.
2 wire	Simplex (Bits) Remote	2 wire is in.	2 wire	ON	OFF	Data flows from master to remote(s) only. Carrier on.
4 wire	Half-Duplex Master	Cross wire 4 wire to all remote 2 wire and 2 wire from all remote 4 wire.	4 wire	ON	ON	One master with 1 or more remotes.
4 wire	Half-Duplex Remote	Same as 4-wire Master. Cross wire.	4 wire	ON	OFF	Remote carrier LED always on.
4 wire	Full Duplex	Cross connect 2 wire to 4 wire between both units.	4 wire	OFF	ON	2 Modem 202Ts only. Both carrier LEDs on.

NOTE

SW3 2-wire with SW2-5 off and SW2-6 on will enter self-test display.
SW3 4-wire with SW2-5 off and SW2-6 off is an invalid combination.

5. Operation

5.1 Component Locator Diagram

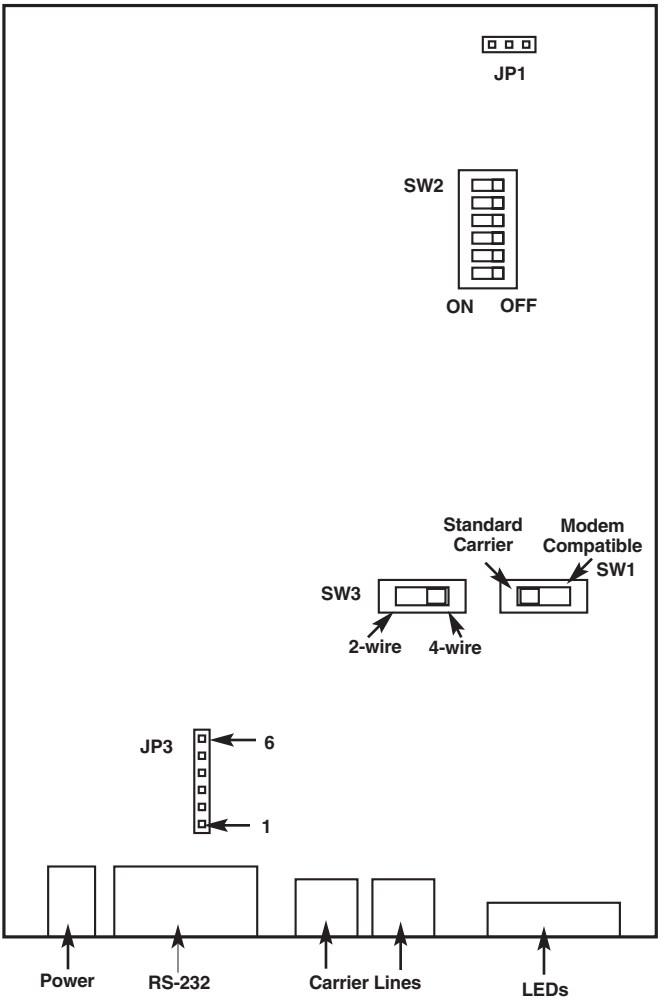

Figure 5-1. Component locator.

If the Modem 202T will be used with existing Modem 202Ts, you must set SW1 for Modem 202T mode (SW1 set away from SW3) to maintain frequency compatibility.

NOTE

The default setting for SW2 is positions 1–5 OFF and position 6 ON.

If you need to field configure a Modem 202T, you will need the following information.

1. Baud rate of the serial device you are connecting with (unless using simplex).
2. Character format (1 start bit + # data bits + parity + 1 stop bit). This must add to 10 or 11 bits.

   Set SW2-3 ON = 11 bits, or OFF = 10 bits.
3. Use of RTS line from your equipment to control the flow of data into and between modems. If RTS use is unknown, set the unit for DSCC DataSense mode.

   Set SW2-4 OFF = DSCC DataSense ON = RTS
4. Either 1 wire pair (2-wire mode) or 2 wire pairs (4-wire mode). Set SW3.
5. Half or full duplex data transmission method, bi-directional or one-way data flow (simplex). Set SW2-5 and SW2-6 using the information in Table 4-2.

NOTE

After changing any switches, remove DC power and reapply to memorize the changes. Switches are only read during power on.

5.2 Baud Rate Selection

The Modem 202T will operate at 300, 600, and 1200 baud in a 10- or 11-bit word format. The modem is parity transparent; however, it must know if there are 8 or 9 bits of data/parity. In Simplex mode, the Modem is baud-rate and protocol transparent and the baud switches are ignored. The Baud rate is set using switches SW2-1 and SW2-2.

Table 5-1. Selecting the baud rate.

Baud Rate	SW2-1	SW2-2
*1200	OFF	OFF
600	ON	OFF
300	ON	ON
Not Used	OFF	ON

*Default

5.3 Character Format

To find the character format of your equipment, take the number of data bits in a character. If parity is used (odd, even, mark, space), add one (1). If parity is not used, don't add anything. Add two for one start bit and one stop bit. The result must be 10 or 11. Use SW2-3 to set the length. SW2-3 is OFF for 10 bits, and ON for 11 bits. This switch is ignored in simplex mode.

5.4 Handshake Lines

If RTS handshaking mode is set, the Modem 202T needs the RTS asserted when it is time to transmit data onto the FSK carrier from the equipment. Depending upon how the modem is configured, it can provide DCD, CTS, and DSR signaling back to your equipment. JP3 is used to configure these lines.

If these lines are needed, note that:

- Shorting pins 1 and 2 will pull DCD (pin 1) logic high at the DB9 connector.
- Shorting pins 2 and 3 will pass carrier status to DCD (pin 1) at the DB9 connector.
- Shorting pins 4 and 5 will route incoming RTS (pin 7) to outgoing CTS (pin 8) and outgoing DSR (pin 6) at the DB9 connector.
- Shorting pins 5 and 6 will route DSR and CTS to pin 1. Also, shorting pins 2 and 3 will connect DCD (pin 1) to outgoing CTS (pin 8) and outgoing DSR (pin 6) at the DB9 connector.

NOTE

DSR (pin 6) and CTS (pin 8) are always connected to DTR.

5.5 Self-Test

The Modem 202T has a built-in test mode that verifies whether the processor is operating normally. It displays the operating configuration as set by the SW2 switches and the 2-/4-wire mode switch SW3.

To conduct the self-test:

1. Remove DC power.
2. Remove the cover.

3. Temporarily short together the JP1 header pins 1 and 3 and re-apply DC power.

4. A repeating sequence will occur. First, the Green LED (O) will flash, followed by seven (7) flashes of the Amber LED ("C").

5. The Green LED is the processor outputting the switch setup and operating mode as serial data at 1200 baud, formatted as 8 data, no parity, 1 stop bit. To view this data, connect a PC to the 9-pin D sub connector using 3 wires (pins 2, 3, 5) or a straight-through serial cable. Start a communications program such as Procomm or HyperTerminal set to 1200, n, 8, 1. The next set of Green flashes will put the modem configuration on the PC display.

6. The Amber LED flashes are the 6 positions of SW2 and the position of SW3. A short flash means the switch is in the OFF position. A long flash means it is in the ON position. For SW3, OFF is towards SW1 (4-wire) and ON is away from SW1 (2-wire).

7. Compare the ON/OFF pattern to the setup tables for baud, handshake, # of bits, and user operating mode.

8. Remove DC power and any JP1 connections.

9. Reapply DC power to enter your selected operating setup mode.

Appendix. Troubleshooting

A.1 Calling Black Box

If you determine that your Modem 202T is malfunctioning, do not attempt to alter or repair the unit. It contains no user-serviceable parts. Contact Black Box at 724-746-5500.

Before you do, make a record of the history of the problem. We will be able to provide more efficient and accurate assistance if you have a complete description, including:

- the nature and duration of the problem.
- when the problem occurs.
- the components involved in the problem.
- any particular application that, when used, appears to create the problem or make it worse.

A.2 Shipping and Packaging

If you need to transport or ship your Modem 202T:

- Package it carefully. We recommend that you use the original container.
- If you are shipping the Modem 202T for repair, make sure you include everything that came in the original package. Before you ship, contact Black Box to get a Return Authorization (RA) number.

1000 Park Drive • Lawrence, PA 15055-1018 • 724-746-5500 • Fax 724-746-0746