



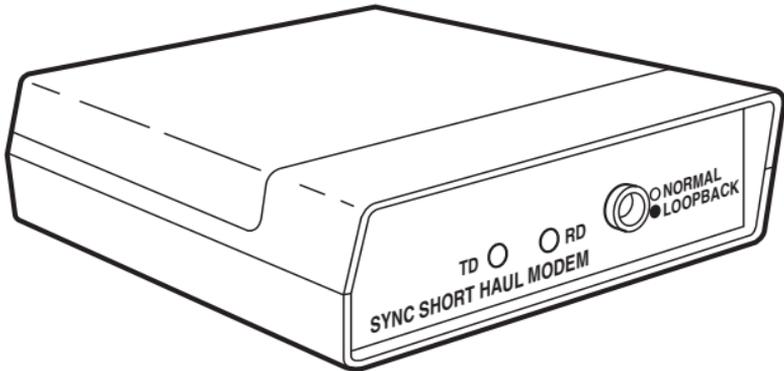
DECEMBER 1999

ME801A

ME801A-E

ME801-C

Short-Haul Modem-B Sync (SHM-B Sync)



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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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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 classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

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NORMAS OFICIALES MEXICANAS (NOM) 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 líneas 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 objetos 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: Objetos 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.

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1. Specifications

Compliance —	FCC Part 15 Subpart J Class A, IC Class/class A
Interfaces —	RS-232-C (DCE) to attached local device; Proprietary balanced 4-wire to line
Protocol —	Synchronous
Clock Source —	Local internal (each SHM-B Sync unit independently generates its own clock)
Operation —	4-wire full-duplex
Flow Control —	Hardware (RTS and/or DTR), local only (control signals are not passed across the 4-wire line—see Section 5.2); transparent to software (X-ON/X-OFF, etc.)
Data Rate —	19,200, 9600, 4800, 2400, 1200, or 600 bps (user-selectable)
Maximum Distance —	See the table in Appendix A
Loopback —	Simultaneous local loopback to attached RS-232 device and remote loopback to remote SHM-B Sync (user-controllable)

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User Controls — (1) Front-mounted pushbutton to turn loopback ON and OFF;
(6) Internal pairs of jumper posts for setting the data rate;
(3) Internal pairs of jumper posts for setting CTS delay

Indicators — (2) Front-mounted bicolor LEDs for transmit status and receive status; these light green for a “low” logic level (–3 to –25 V) or red for a “high” logic level (+3 to +25 V)

Connectors — RS-232: (1) Rear-mounted DB25 female;
Line: (1) Internal 4-position screw-terminal block

Leads/Signals Supported — RS-232: Transmit Data (TD), Receive Data (RD), Request to Send (RTS), Clear to Send (CTS), Data Set Ready (DSR), Signal Ground (SGND), Carrier Detect (CD), Transmit Clock (TC), Receive Clock (RC), and Data Terminal Ready (DTR)—
Pins 1 through 8, 15, 17, and 20 respectively;
Line: TX+, TX–, RX+, and RX–

Power —	ME801A: From utility-power (mains) outlet through wallmount transformer: Input: 108 to 132 VAC, 60 Hz, at ~160 mA (20 watts); Output: 17 VAC CT at 700 mA; ME801A-E: From utility-power (mains) outlet through desktop transformer: Input: 198 to 242 VAC, 50 or 60 Hz, at ~90 mA (20 watts); Output: 17 VAC CT at 700 mA; ME801-C: 17 VAC CT at 700 mA from rack's electrical-power bus
Surge Protection —	Internal opto-isolators (effective up to 20 VDC) on transmit and receive lines
Temperature Tolerance —	32 to 122°F (0 to 50°C)
Humidity Tolerance —	Up to 95% noncondensing
Enclosure —	ME801A, ME801A-E: High-impact plastic
Size —	ME801A, ME801A-E: 1.4"H x 4.3"W x 4.5"D (3.6 x 10.9 x 11.5 cm); ME801-C: 4"H x 0.5"W x 4.5"D (10.2 x 1.3 x 11.5 cm)
Weight —	ME801A, ME801A-E: 1.3 lb. (0.6 kg) including power supply; ME801-C: ~3 oz. (~85 g)

2. Introduction

The Short-Haul Modem-B Sync (SHM-B Sync for short) is a synchronous full-duplex 4-wire line driver and receiver that makes it possible for two RS-232-C devices to communicate across distances up to 5 miles (8 km), at data rates up to 19,200 bps. In addition to its transmitter and receiver circuits, the SHM-B Sync also features status LEDs, a loopback switch, and support for RS-232 clock and control signals.

The SHM-B Sync is designed to operate with 4-wire cable. See **Appendix A** for optimum cable specifications and supported distances/data rates.

The SHM-B Sync is also designed for maximum operator safety. There are no voltages greater than 12 VDC or 17 VAC present on the unit's circuit board. Opto-isolation circuits protect both the transmit and receive lines against voltage surges (up to 20 VDC) such as those caused by lightning.

The SHM-B Sync is available in either a 120-VAC (ME801A) or 220-VAC (ME801A-E) standalone version or a card version (ME801-C) that will fit in our ME810 or RM007 card chassis.

3. Configuration

Before you install a pair of SHM-B Sync units, you should set their configuration jumpers as necessary.

CAUTION!

If you have the card version, make very sure that the SHM-B Sync card is not installed in a powered chassis when you configure it. If you have the standalone version, make sure that it is unplugged and is disconnected from any other devices. No voltages greater than 17 VAC are ever present on the board even when it is powered, but the possibility of electric shock should always be avoided.

When you handle the SHM-B Sync's circuit board, take every reasonable precaution against damaging the board with static electricity. At the very least, discharge yourself by touching a fixed metal surface before handling the board; if possible, stand on an anti-static mat and wear a grounding strap or anti-static gloves.

There are two sets of jumper posts mounted on the SHM-B Sync's circuit board:

- Six pairs of posts are used to set the SHM-B Sync's data rate. They're at the front of the left-hand side of the board (the ones labeled "DATA-RATE SELECTION" in Figure 3-1). The six possible data-rate settings are 600, 1200, 2400, 4800, 9600, and 19,200 bps. The factory-default value is 9600 bps; if your RS-232 equipment is using one of the other data rates, set the jumpers in both units accordingly by moving the jumper to the appropriate pair of

posts. (The SHM-B Sync units must both be set to the same data rate, which they will generate internally; the attached devices must be set to accept clock from them.)

- Three pairs of posts are used to set the SHM-B Sync's CTS delay. They're at the rear of the right-hand side of the board (the ones labeled "CTS-DELAY SELECTION" in Figure 3-1). The CTS delay is the amount of time that the SHM-B Sync waits after detecting that the attached device has raised RTS before it responds by raising CTS. The possible settings are LONG (53 ms), SHORT (7 ms), or NONE. Factory default is NONE, but if your RS-232 device needs to see a CTS delay in order to function properly, move the jumper to the appropriate post *in that SHM-B Sync only*.

Standalone units only: To open the unit's case, push in on either side of the top half of the case, close to the front of the unit, then pry the top of the case away from the bottom half. (If your hand is large enough, you can squeeze both sides of the case's top half toward each other at the same time, then pry it upward.) The halves of the case are hinged at the back, so the unit swings open like a compact or a makeup case.

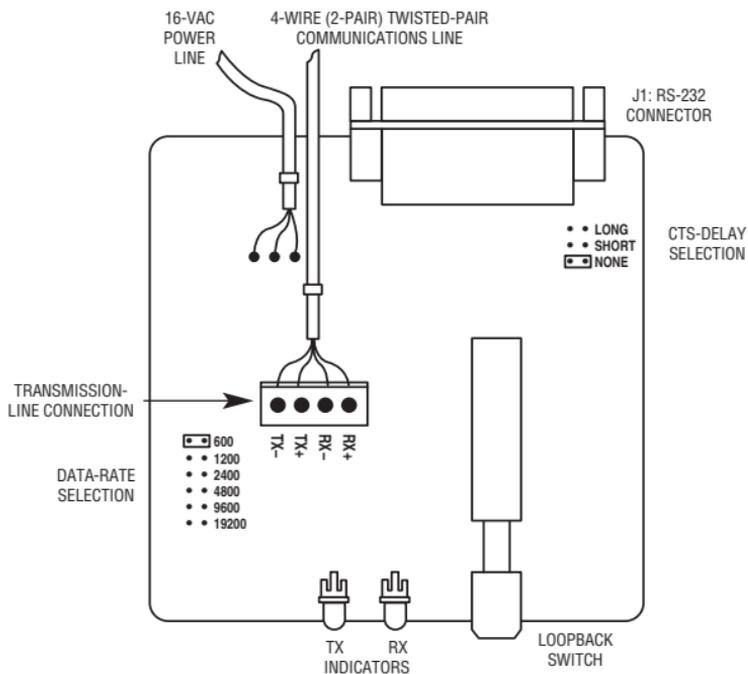


Figure 3-1. The SHM-B Sync's circuit board. (Standalone board shown; card version will not have power-line connection.)

4. Installation

4.1 Installing Standalone Units

Take these steps to install a pair of standalone SHM-B Sync units (ME801A or ME801A-E):

1. Open the case of one of the SHM-B Sync units. Refer to **Chapter 3** for how to do this (and for precautions you should take when you do).
2. Feed the 4-wire twisted-pair cable that will run between your SHM-B Sync units through the appropriate hole in the back of the case (refer to Figure 3-1 on the previous page). Refer to **Appendix A** for maximum-length guidelines for this cable.
3. Take the end of this cable and remove the outer jacket and insulation from the last half-inch (1.3 cm) or so of it, exposing the ends of the four individual wires. Strip the insulation from the last $\frac{1}{8}$ to $\frac{3}{16}$ of an inch (0.3 to 0.5 cm) of each wire.

- Thread the bare ends of the four wires into the four screw terminals on the SHM-B Sync's board marked RX+, RX-, TX+, and TX-. Refer to Figure 3-1 on page 11 for the location of these terminals. Bear in mind as you do this that the wires must run from TX+ in one SHM-B Sync to RX+ in the other, and from TX- to RX-, RX+ to TX+, and RX- to TX-, as shown in Figure 4-1 below.

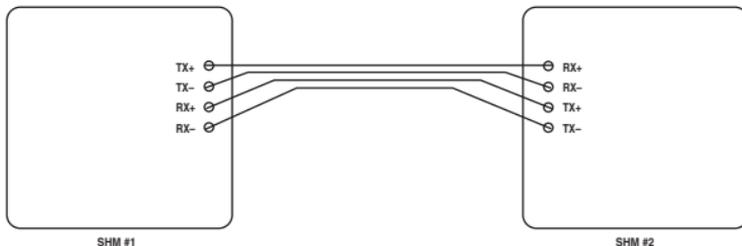


Figure 4-1. Cable wiring between SHM-B Sync units.

- Wrap the nylon cable tie provided with the SHM-B Sync around the four wires, threading it through the two holes in the circuit board just behind the terminal block. Pull it tight to secure the wires in place against the board. Remove the excess nylon tie with a pair of scissors or wire cutters.
- Close the unit's case.

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7. Plug one end of an RS-232 cable into the DB25 female connector on the rear of the unit. Avoid running this cable farther than 50 ft. (15.2 m). Refer to **Section 5.2** for information about supported RS-232 signals and about how this cable should be pinned.
8. Plug the other end of the RS-232 cable into a powered-down device whose serial communication you want to extend.
9. Repeat steps 1 through 8 with the remote site's SHM-B Sync unit.
10. Plug in both SHM-B Sync units and power up the attached RS-232 devices. Your SHM-B Sync system should begin operating right away. If the LEDs on the units' front panels light up, go on to **Section 4.3**. If not, refer to the first item in **Section 6.2**.

4.2 Installing Card Units

Take these steps to install a set of SHM-B Sync cards (ME801-C):

1. Remove the front panel of the powered-down ME810 or RM007 card chassis in which you'll be installing a SHM-B Sync card. If you're unsure how to do this, refer to the chassis' manual.
2. Feed both (a) the 4-wire twisted-pair cable that will run between your SHM-B Sync units and (b) the RS-232 cable that will run from the SHM-B Sync to the attached device through the back of a vacant slot in the card chassis. Refer to **Appendix A** for maximum-length guidelines for the 4-wire cable.
3. Take the end of the 4-wire cable and remove the outer jacket and insulation from the last half-inch (1.3 cm) or so of it, exposing the ends of the four individual wires. Strip the insulation from the last $\frac{1}{8}$ to $\frac{3}{16}$ of an inch (0.3 to 0.5 cm) of each wire.
4. Thread the bare ends of the four wires into the four screw terminals on the SHM-B Sync's board marked RX+, RX-, TX+, and TX-. Refer to Figure 3-1 on page 11 for the location of these terminals. Bear in mind as you do this that the

wires must run from TX+ in one SHM-B Sync to RX+ in the other, and from TX- to RX-, RX+ to TX+, and RX- to TX-, as shown in Figure 4-1 on page 14.

5. Wrap the nylon cable tie provided with the SHM-B Sync around the four wires, threading it through the two holes in the circuit board just behind the terminal block. Pull it tight to secure the wires in place against the board. Remove the excess nylon tie with a pair of scissors or wire cutters.
6. Plug one end of an RS-232 cable into the DB25 female connector on the back of the card. Avoid running this cable farther than 50 ft. (15.2 m). Refer to **Section 5.2** for information about supported RS-232 signals and about how this cable should be pinned.
7. Slide the card into the front of the chosen vacant slot in the card chassis: Slide it carefully along the grooved tracks at the top and bottom of the slot until it reaches the three “power pins” at the back of the chassis. Make sure that the card’s three power sockets have mated with these pins before applying force to fully seat the card; otherwise, when you push the card into the back of the chassis, you might damage the card and the chassis.

8. Plug the other end of the RS-232 cable into a powered-down device whose serial communication you want to extend.
9. Repeat steps 1 through 8 with the remote site's SHM-B Sync card.
10. Plug in both chassis and power up the RS-232 devices attached to each card. Your SHM-B Sync system should begin operating right away. If the LEDs on the cards' front panels light up, do the tests described in **Section 4.3**. If not, refer to the first item in **Section 6.2**.
11. Repeat steps 1 through 10 for any other communicating pairs of SHM-B Sync cards you want to install in this pair of card chassis.
12. If all of your cards and attached devices seem to be operating correctly, put the front panels of both card chassis back on.

4.3 Initial Testing

When you have installed and powered up a pair of SHM-B Sync units and the attached RS-232 devices, test your system by sending data from one RS-232 device to the other (and vice versa if the link is meant to be bidirectional). If this works, go on to **Section 5.1**. If it doesn't, perform loopback testing as described in **Section 6.1** and refer to the problem descriptions in **Section 6.2** as necessary.

5. Operation

5.1 Normal Operation and LED Functions

While the SHM-B Sync and its attached devices are plugged in and the attached devices are plugged in and turned on, the system should operate continuously without requiring human intervention. You can, however, monitor the unit's status at any time by looking at the LEDs marked "TD" and "RD" on the unit's front panel. These will indicate the logic status of the transmitter and receiver circuitry, respectively: They will light green for a "high" logic level or red for a "low" logic level, and will flicker as data is transmitted and received. (These LEDs respond to the *actual* transmitted and received signals, *not* the TD and RD lines of the RS-232 interface.)

Refer to the next section for a description of how the RS-232 interface operates, and to **Appendix B** for a block diagram of how the SHM-B Sync works at a circuit level.

If you ever have difficulty, you can do loopback testing as described in the next section and/or refer to the problem descriptions in **Section 6.1**.

5.2 The RS-232 Signals, Flow Control, and Synchronous Timing

The SHM-B Sync should be connected to your RS-232 device with a standard RS-232 cable. The cable must have a DB25 male connector at the SHM-B Sync's end. The type of connector at the other end will depend on what type of RS-232 device you're attaching, and the pinning of the cable will depend on whether the device is a DTE or DCE:

- To connect a sync terminal, a PC running a sync protocol, or another DB25 male sync-DTE serial port, use a straight-through-pinned DB25 male-to-female RS-232 cable such as our product code ECN25C-MF.
- To connect a mux's composite port or another DB25 female sync-DTE serial port, use a straight-through-pinned DB25 male-to-male RS-232 cable such as our product code ECN25C-MM.
- To connect a sync modem, a mux's channel port, or another DB25 female sync-DCE serial port, use cross-pinned DB25 male-to-male tail-circuit cable such as our product code EYN255C.

Refer to your devices' manuals if you need information about which RS-232 signals they require. Often, it's best to use only the Transmit Data (TD), Receive Data (RD), and Signal Ground (SGND) lines—plus either Transmit Clock (TC) or Receive Clock (RC)—if the devices don't need control signals such as Ready to Send (RTS) and Clear to Send (CTS). (Be aware that some devices, even if they don't technically support control signals, draw power from the control-signal leads.) Table 5-1 below shows the RS-232 pins and signals that the SHM-B Sync supports.

Table 5-1. Supported RS-232 Leads/Signals

DB25 Pin	Signal Name (Abbreviation)
2	Transmit Data (TD)
3	Receive Data (RD)
4	Request to Send (RTS)
5	Clear to Send (CTS)
6	Data Set Ready (DSR)
7	Signal Ground (SGND)
8	Carrier Detect (CD)
15	Transmit Clock (TC)
17	Receive Clock (RC)
20	Data Terminal Ready (DTR)

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Here is how the SHM-B Sync implements flow control: As soon as the system begins operating, each SHM-B Sync unit forces its own RTS, CTS, DSR (Data Set Ready), and DTR (Data Terminal Ready) signals “high” (above +3V), and as soon as each unit detects the presence of the one at the far end, it also raises CD (Carrier Detect) in order to signal the attached device to expect data. If the cables are correctly wired and attached, the system is ready for continuous data transmission.

The control signals will stay in this state unless:

- One of the SHM-B Sync units is powered down (all signal transmission at its end will cease and the other SHM-B Sync will lower CD);
- The 4-wire cable is broken or detached (both SHM-B Sync units will lower CD);
- An attached device is powered down or lowers DTR or RTS (its attached SHM-B Sync unit will drop carrier and the other unit will lower CD).

As far as the synchronous clock signals go, each SHM-B Sync will generate its own internal clock and continuously transmit it to the attached device on both the Transmit Clock (TC) and Receive Clock (RC) leads while the system is operating. The SHM-B Sync cannot accept clock from the attached device; it also cannot buffer signals, so it's very important that the two SHM-B Sync units are set to the same data rate.

NOTE

Always keep in mind that both clocking and flow control operate locally only—the data signals are the only signals passed across the 4-wire line. For more detail on the electronic operation of the RS-232 interface (and of the SHM-B Sync as a whole), see **Appendix B**.

6. Troubleshooting

6.1 Loopback Mode

The SHM-B Sync has a built-in loopback test that can help you isolate and diagnose problems. If you press the “LOOPBACK” button on a SHM-B Sync unit’s front panel, that unit will go into “loopback mode”: Data from the attached device will be echoed back to it rather than transmitted across the link, and data from the other SHM-B Sync unit will be echoed back to it across the 4-wire link rather than forwarded on to the attached device. Figure 6-1 on the next page shows how data flows in loopback mode vs. normal operation. (While a unit is in loopback mode, the front of the button will look white; while it’s operating normally, the front of the button will look black.)

During loopback mode, make sure you have a terminal or a PC running terminal emulation attached to the RS-232 port of either SHM-B Sync: You will be able to type in characters at your keyboard and receive them back at your screen. When loopback is active at the local SHM-B Sync, your typed characters pass through only the local cable and the SHM-B Sync unit; when

loopback is active at the remote SHM-B Sync, the characters pass through the 4-wire cable as well. (Do *not* turn loopback mode on at *both* SHM-B Sync units at the same time.) If some component of the data loop is broken, improperly installed, etc., characters will come back garbled or not at all. So type in characters at either end, with loopback mode active at either unit, and use a process of elimination (when does transmission succeed and when does it fail?) to find the point of failure.

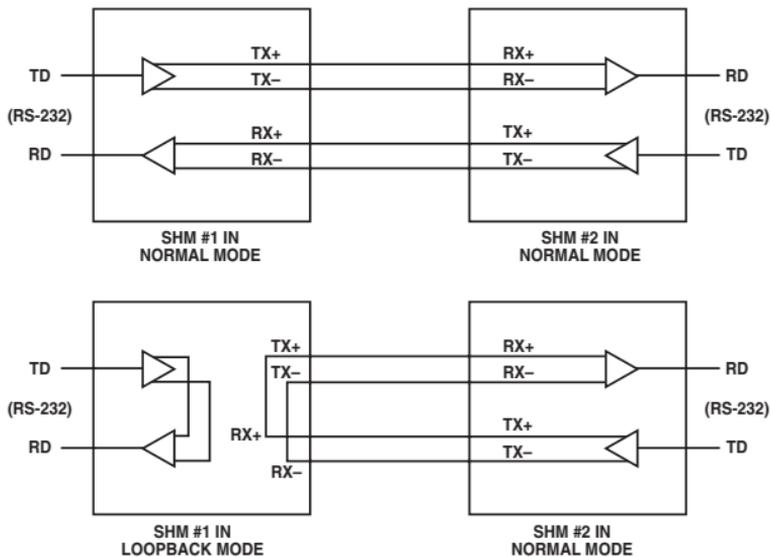


Figure 6-1. Data flow in normal vs. loopback operation.

6.2 Common Problems

Here are a few problems that people sometimes have with the SHM-B Sync and a few suggestions for possible causes and things to do about them.

The LEDs don't light when the SHM-B Sync is plugged in.

1. Loose power connection or non-working outlet? If your SHM-B Sync is a standalone model, try moving or wiggling the wallmount transformer. If it's a card model, make sure the card is properly seated in its chassis.
2. Broken power leads? If your SHM-B Sync is a standalone model, open its case (careful—see **Chapter 3!**) and inspect the three leads from the transformer for continuity. If it's a card model, remove the card from the chassis and make sure the power pins in the chassis slot aren't bent or broken.
3. The SHM-B Sync or its power supply might be defective. Call Black Box Technical Support as described in **Section 6.3**.

The LEDs indicate data activity, but data communication isn't really happening.

1. Check the pinning of your RS-232 cable and of your device's RS-232 port.
2. Check the data-rate settings of both SHM-B Sync units; they must be set to the same data rate. And both of the attached devices must be set to receive clock from the SHM-B Sync.
3. Are any of the cables too long? RS-232 cables shouldn't be longer than 50 ft. (15.2 m); see **Appendix A** for distance guidelines for the 4-wire twisted-pair cable.

No data is being transferred in either direction.

1. Make sure the RS-232 cables are securely connected at both ends.
2. Is the 4-wire cable connected and wired properly? Make sure the four wires are securely connected to the proper terminals on your SHM-B Sync; refer to Figure 4-1 on page 14 for end-to-end pinning. If the wires are connected properly, check the data-rate settings of your SHM-B Sync units and make sure that the attached devices are set to receive clock from them. (If your SHM-B Sync units are standalone models, these inspections will require that you carefully open their cases—see **Chapter 3**.)

3. Are any of the cables too long? RS-232 cables shouldn't be longer than 50 ft. (15.2 m); see **Appendix A** for distance guidelines for the 4-wire twisted-pair cable.
4. Check the pinning of your RS-232 cable and of your device's RS-232 port.
5. Do a loopback test (see **Section 6.1**). If local loopback fails, the RS-232 cable is probably miswired, broken, or defective. If local loopback succeeds but remote loopback fails, the 4-wire cable is probably broken or defective.
6. Test each SHM-B Sync's RS-232 interface with a breakout box. Pins 4, 5, 6, 8, and 20 all have to be "high" (above +3V) in order to enable data communication. In particular, if Pin 8 (Carrier Detect) is low, the local SHM-B Sync is not receiving a carrier signal from the remote unit.

Data is being transferred, but it's all garbled.

Is the 4-wire cable connected and wired properly? Make sure the four wires are securely connected to the proper terminals; refer to Figure 4-1 on page 14 for end-to-end pinning. If the wires are connected properly, check the data-rate settings of your SHM-B Sync units and make sure that the attached devices are set to receive clock from them. (If your SHM-B Sync units are standalone models, these inspections will require that you carefully open their cases—see **Chapter 3**.)

Data is being transferred, but there are an unacceptable number of errors.

1. Are any of the cables too long? RS-232 cables shouldn't be longer than 50 ft. (15.2 m); see **Appendix A** for distance guidelines for the 4-wire twisted-pair cable.
2. Is the 4-wire cable wired properly? Make sure the four wires are connected to the proper terminals on your SHM-B Sync units; refer to Figure 4-1 on page 14 for end-to-end pinning. (If your SHM-B Sync units are standalone models, these inspections will require that you carefully open their cases—see **Chapter 3**.)

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3. Is your cable routed too close to any sources of electrical interference, such as motors, generators, compressors, elevators, or fluorescent lights? If so, reroute it.
4. Is the 4-wire cable high quality? If not, try swapping in a better one.
5. You might be having AC-power trouble. Try plugging the SHM-B Sync standalone unit or the card's chassis into a different outlet or a different power circuit entirely. If that doesn't work, try installing a surge protector or uninterruptible power supply. (Call Black Box Technical Support for help in selecting the proper power protection for your application.)

6.3 Calling Black Box

If you determine that your SHM-B Sync system is malfunctioning, *do not attempt to alter or repair the units*. They contain no user-serviceable parts. Contact Black Box Technical Support 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; and
- the results of any testing you've already done.

6.4 Shipping and Packaging

If you need to transport or ship a SHM-B Sync:

- Package it carefully. We recommend that you use the original container.
- Before you ship the unit back to Black Box for repair or return, contact us to get a Return Authorization (RA) number.

Appendix A: Distances, Data Rates, and Cable Specifications

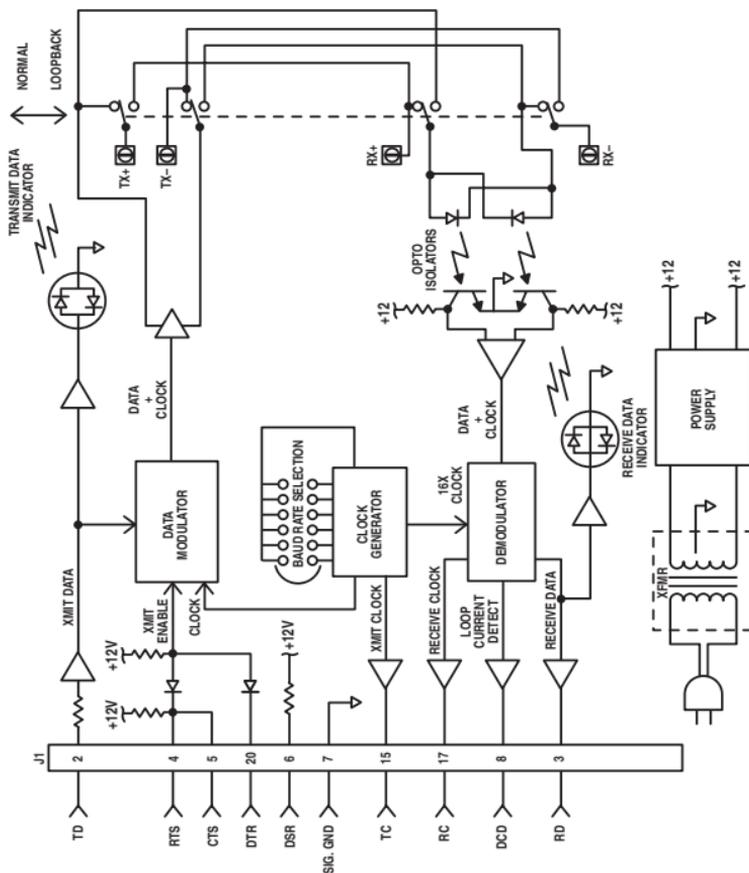
For the best performance, use 22- or 24-AWG unshielded twisted-pair (UTP) cable with a mutual capacitance of 15.7 pF/ft. (51.6 pF/m) or less with the SHM-B Sync. The table below shows the distances and data rates attainable with this type of cable.

CAUTION!

Most types of UTP cable can be used with the SHM-B Sync without having much adverse effect on its performance. But, because it has much higher capacitance, shielded twisted-pair (STP) cable will reduce the distance you can run between SHM-B Sync units to as little as one-third of the normal values shown below.

Data rate in bps	Distance in miles (km)
19,200	0.75 (1.2)
9600	0.9 (1.4)
4800	1 (1.6)
2400	2 (3.2)
1200	3.5 (5.6)
600	5 (8)

Appendix B: Block Diagram



NOTES



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