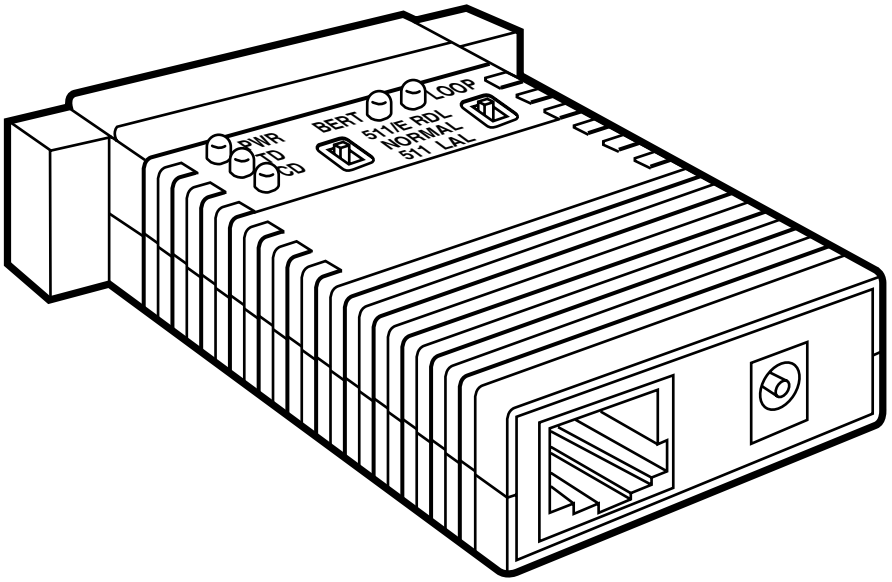
BLACK BOX®
NETWORK SERVICES

MAY 1997

ME350A-F	ME350AE-F	ME350A-M	ME350AE-M
ME351A-F	ME351AE-F	ME351A-M	ME351AE-M
ME352A-F	ME352AE-F	ME352A-M	ME352AE-M
ME353A-F	ME353AE-F	ME353A-M	ME353AE-M

Async/Sync Line Drivers 56/64



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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 B 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 la 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 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.

Contents

1. Specifications

Cable Required — For modem-to-modem line: Four-wire unconditioned twisted-pair, 19 to 26 AWG (see **Appendix A**), pinned as shown in Table 4-1 on page12

Compliance — FCC Part 15 Class A, DOC Class/MDC classe A

Interfaces — Serial:
ME350, ME351 units: EIA RS-232/ITU-TSS [CCITT] V.24;
ME352, ME353 units: ITU-TSS V.35 pinned to EIA RS-530;
Line: Two- or four-wire telco

Protocol — Synchronous or asynchronous

Clock Source — Internal, external (from DTE), or received (from other unit) (user-selectable)

Data Format — Word length (including start bit, data bits, stop bits, and parity bit) must equal 8, 9, 10, or 11 bits (user-selectable)

Flow Control — Transparent to all types of software (X-ON/X-OFF, robust X-ON/X-OFF, etc.) flow control; can be set to support hardware flow control

Operating Mode — 4-wire full-duplex, point-to-point or multipoint (user-selectable)

Data Rates — 64, 56, or 32 kbps (user-selectable)

Maximum Distance — 6 miles (9.7 km), but see **Appendix A**

Isolation — 1500 volts RMS minimum using custom transformers

Surge-Protection Method — Silicon Avalanche Diodes

Surge-Response Time — 1 ps

Maximum Surge Protection — 600 watts dissipated after 1 ms

User Controls —
(2) Top-mounted toggle switches:
LOOP (Remote Digital or Local Analog loopback),
BERT (511 or 511/E V.52 diagnostics);
(2) Internal 8-position DIP switches:
(1) for DTE loopback control, protocol, signaling-rate range, word length, and diagnostics;
(1) for data rate, clock source, carrier control, and RTS/CTS delay

Indicators — (5) Top-mounted LEDs: PWR (Power), TD, CD, BERT, and LOOP

Diagnostics — ITU-TSS V.54 remote digital and local analog loopbacks; ITU-TSS V.52 BERT testing

Connectors —
ME350A-F, ME350AE-F, ME352A-F, ME352AE-F:
(1) RJ-11 female for modem-to-modem line,
(1) DB25 female for serial connection;
ME350A-M, ME350AE-M, ME352A-M, ME352AE-M:
(1) RJ-11 female for modem-to-modem line,
(1) DB25 male for serial connection;
ME351A-F, ME351AE-F, ME353A-F, ME353AE-F:
(1) RJ-45 female for modem-to-modem line,
(1) DB25 female for serial connection;
ME351A-M, ME351AE-M, ME353A-M, ME353AE-M:
(1) RJ-45 female for modem-to-modem line,
(1) DB25 male for serial connection

Power —

ME350A, ME351A models:
From wallmount power supply:
Input: 115 VAC, 47-63 Hz;
Output: 9 VDC, 500 mA;
Consumption: 17 mA @ 7 V (119 mW)
ME350AE, ME351AE models:
From desktop power supply:
Input: 230 VAC, 47-63 Hz;
Output: 9 VDC, 1 A;
Consumption: 17 mA @ 7 V (119 mW)
ME352A, ME353A models:
From wallmount power supply:
Input: 115 VAC, 47-63 Hz;
Output: 7.5 VDC, 100 mA;
Consumption: 60 mA @ 5 V (300 mW)
ME352AE, ME353AE models:
From desktop power supply:
Input: 230 VAC, 47-63 Hz;
Output: 9 VDC, 1 A;
Consumption: 60 mA @ 5 V (300 mW)

Temperature — 32 to 140˚F (0 to 60˚C)

Humidity — Up to 95% noncondensing

Maximum Altitude — 15,000 ft. (4572 m)

Size — 0.8"H x 2.1"W x 3.6"D (2 x 5.3 x 9 cm)

Weight — 2 oz. (56.8 g)

2. Introduction

2.1 Overview

The Async/Sync Line Driver 56/64 (A/SLD) is a high-speed short-range modem that supports synchronous and asynchronous data rates of 32, 56, and 64 kbps. It also supports internal, external, or received synchronous clocking. Since it has a 7.5-volt power supply, it can drive data up to a maximum range of 6 miles (9.7 km) over unconditioned twisted pair.

The Async/Sync Line Driver 56/64 has several features that enhance its overall performance, including transformer isolation and Silicon Avalanche Diode surge protection. The A/SLD also has strong diagnostics: It features V.52-compliant bit-error-rate (BERT) pattern tests and two V.54 test modes.

The Async/Sync Line Driver 56/64 comes in RS-232 and V.35 versions. It is housed in an ABS plastic case and comes with either a male or a female DB25 serial connector and either an RJ-11 or RJ-45 line jack.

2.2 Features

- Synchronous or asynchronous communication
- Data rates of 32, 56, or 64 kbps, distances up to 6 miles (9.7 km)
- User-selectable internal, external, or received loopback clocking
- Hardware or software flow control
- AC power to drive signals strongly
- Built-in transformer isolation and high-speed surge protection
- V.52 and V.54 test modes

3. Configuration

This chapter describes the locations and posssible settings of the Async/Sync Line Driver 56/64's DIP configuration switches, and provides detailed instructions for setting them. Once you've configured the Async/Sync Line Driver 56/64, it is designed to operate reliably and transparently, without needing to be frequently reconfigured. Just set it and forget it!

3.1 Where the Switches Are

The Async/Sync Line Driver 56/64 has two 8-position DIP switches—SW1 and SW2—mounted inside, as shown in Figure 3-1 below. These configuration switches allow you to select data rates, clocking methods, V.52 and V.54 tests, word lengths, extended signaling rates, sync or async protocol, and other options. As shown in Figure 3-2 on the next page, the "ON" and "OFF" points are the same for all of the switch positions.

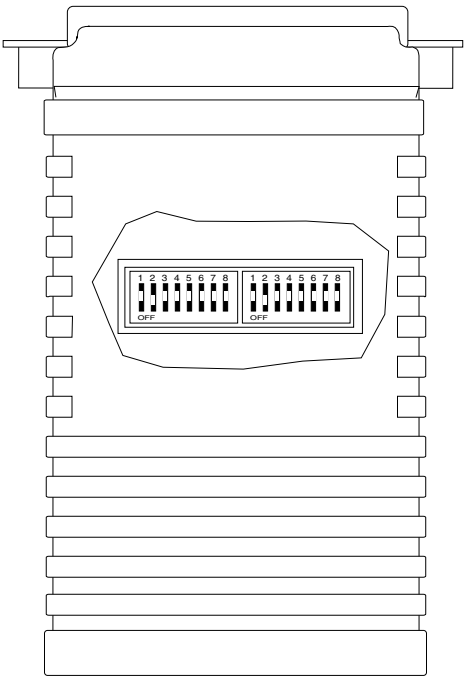


Figure 3-1. The A/SLD's internal configuration switches.

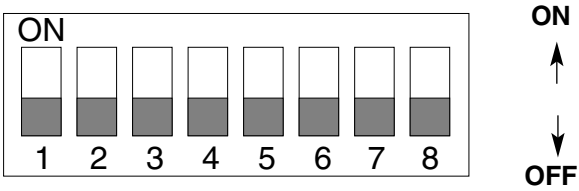


Figure 3-2. The ON and OFF settings of the DIP switches.

3.2 Opening the Case

To set the configuration switches inside a Async/Sync Line Driver 56/64, you must open the unit. Do so by gently inserting a screwdriver into the special pry slot on the plastic case, as shown in Figure 3-3 below. Don't worry about breaking the plastic, but make sure you don't insert the screwdriver more than ¼" (0.6 cm) into the enclosure, because you might damage the circuitry inside the unit.

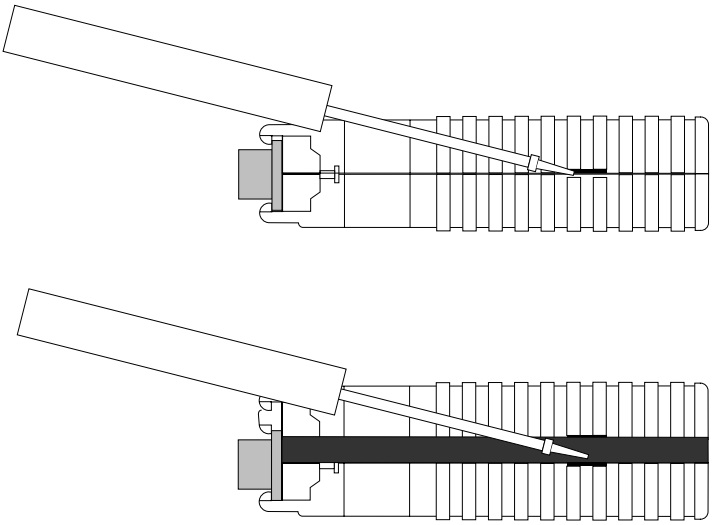


Figure 3-3. Using a screwdriver to open the case.

3.3 Configuration Switch "SW1"

Use the individual positions on DIP switch SW1 to set data rate, clock source, sync vs. async protocol, and carrier-control method. The factory-default settings are summarized in Table 3-1 below.

Table 3-1. Switch SW1 Summary

Position	Function	Default Setting	
SW1-1	DTE Ctrl. of Analog Loopback	On	Enabled
SW1-2	DTE Ctrl. of Digital Loopback	On	Enabled
SW1-3	Not Used	N/A	
SW1-4	Protocol	Off	Synchronous
SW1-5	Signaling-Rate Range	Off	–2.5% to +1%
SW1-6 SW1-7	Word Length Word Length	Off Off	10 bits
SW1-8	V.52, V.54 Tests	Off	Tests Enabled

SW1 Position 1: DTE Initiation of Local Analog Loopback Test
Set position 1 of switch SW1 to determine whether the Async/Sync Line Driver 56/64's local analog loopback (LAL) test (see **Section 5.3.1**) can be initiated by raising the signal on Pin 18 at the DTE.

SW1-1	Pin 18 Test Initiation
On	Enabled (default)
Off	Disabled

SW1 Position 2: DTE Initiation of Remote Digital Loopback Test
Set position 2 of switch SW1 to determine whether the Async/Sync Line Driver 56/64's remote digital loopback (RDL) test (see **Section 5.3.2**) can be initiated by raising the signal on Pin 21 at the DTE.

SW1-2	Pin 21 Test Initiation
On	Enabled (default)
Off	Disabled

SW1 Position 3: Not Used

SW1 Position 4: Protocol
Set position 4 of switch SW1 to determine whether the Async/Sync Line Driver 56/64 operates synchronously or asynchronously.

SW1-4	Protocol
On	Asynchronous
Off	Synchronous (default)

SW1 Position 5: Signaling-Rate Range
Set position 5 of switch SW1 to determine the degree of asynchronous data-rate fluctuation that the Async/Sync Line Driver 56/64 will accept (that is, how much variance from a given frequency level the A/SLD will tolerate).

S1-5	Signaling-Rate Range
Off	–2.5% to +1% (default)
On	–2.5% to +2.3%

SW1 Positions 6 and 7: Word Length
Set positions 6 and 7 of switch SW1 to determine the word length that the Async/Sync Line Driver 56/64 will expect for synchronous or asynchronous data. For example, if you are using the most common data format (1 start bit, 8 data bits, 1 stop bit, and no parity), you would use the factory-default word-length setting (10 bits).

SW1-6	SW1-7	Word Length
Off	On	8 bits
On	On	9 bits
Off	Off	10 bits (default)
On	Off	11 bits

SW1 Position 8: V.52 and V.54 Diagnostic Testing
Set position 8 of switch SW1 to determine whether the Async/Sync Line Driver 56/64's diagnostic tests are enabled or disabled.

SW1-8	Test Mode
Off	Tests Enabled (default)
On	Tests Disabled

3.4 Configuration Switch "SW2"

Use the individual positions on DIP switch S2 to set data rate, clock source, carrier control, and RTS/CTS delay, or 2- or 4-wire operation, as well as to control diagnostic testing. The factory-default settings are summarized in Table 3-2 below.

Table 3-2. Switch SW2 Summary

Position	Function	Default Setting
SW2-1	Data Rate	Off
SW2-2	Data Rate	On > 56 kbps
SW2-3	Data Rate	Off
SW2-4	Clock Source	On > Internal
SW2-5	Clock Source	On
SW2-6	Carrier Control	Off — Constantly ON
SW2-7	RTS/CTS Delay	On > 7 ms
SW2-8	RTS/CTS Delay	On

SW2 Positions 1 through 3: Data Rate
Set positions 1 through 3 of switch SW2 to determine the data rate (valid for both synchronous and asynchronous protocols) of the Async/Sync Line Driver 56/64.

SW2-1	SW2-2	SW2-3	Data Rate
On	Off	Off	64 kbps
Off	On	Off	56 kbps (default)
Off	Off	On	32 kbps

SW2 Positions 4 and 5: Clock Source
Set positions 4 and 5 of switch SW2 to determine which transmit-clock source the Async/Sync Line Driver 56/64 uses.

SW2-4	SW2-5	Clock Source
On	On	Internal transmit clock (default)
Off	On	Receive-recover clock
On	Off	External transmit clock

SW2 Position 6: Carrier-Control Method
Set position 6 of switch SW2 to determine whether the carrier is "constantly ON" or "controlled by RTS." In the "controlled by RTS" setting, the Switch can support switched-carrier, multipoint, or hardware flow-control applications.

SW2-6	Carrier
Off	Constantly ON (default)
On	Controlled by RTS

SW2 Positions 7 and 8: RTS/CTS Delay
Set positions 7 and 8 of switch SW2 to determine the amount of time the Async/Sync Line Driver 56/64 waits after it "sees" RTS before it sends CTS. Possible settings are no delay, 7 ms, or 53 ms.

SW2-7	SW2-8	RTS/CTS Delay
On	On	7 ms (default)
On	Off	53 ms
Off	On	No delay
Off	Off	No delay

4. Installation

Once the Async/Sync Line Driver 56/64 is properly configured, you can connect it to your system. This chapter describes how to run twisted-pair cable between your A/SLDs and how to connect A/SLDs to RS-232 or V.35 equipment.

4.1 The Modem-to-Modem Line Cables and Connectors

The Async/Sync Line Driver 56/64 supports data-only communication between two RS-232 devices at distances to 6 miles (9.7 km) and data rates to 64 kbps. There are two essential requirements for installing A/SLDs:

1. They work in pairs; you must have one at each end of the twisted-pair cable.
2. The Async/Sync Line Driver 56/64 operates half-duplex over two twisted pairs of wire. In all applications, the twisted-pair wire must be between 19 and 26 AWG (higher gauges might limit the distance that can be run), unconditioned, dry, and metallic. Both shielded and unshielded cable yield favorable results.

NOTE

The Async/Sync Line Driver 56/64 can only communicate in a closed data circuit with another Async/Sync Line Driver 56/64. It will not work with dialup analog circuits, such as those used with standard modems. For further information about acceptable wire grades, refer to the recommendations in Appendix A.

For your convenience, two types of twisted-pair connectors are available for the Async/Sync Line Driver 56/64: RJ-11 female and RJ-45 female. The modem-to-modem cable must be specially cross-pinned, as shown in Table 4-1 and Figure 4-1 on the next page. If your cabling includes punchdown blocks, you can easily do the cross-pinning at a punchdown block. If you'll be running cable directly between two A/SLDs, you can get a custom cable from Black Box as a special quote, or you can use regular straight-through-pinned cable and repin one of the RJ connectors (that is, rearrange the wiring connections between the terminal block and the actual contacts). You might need special crimping tools or new connectors; call Black Box for these items, or for technical support if you have difficulty.

Table 4-1. Line-Cable Pinouts

RJ-11

SIGNAL	PIN#	COLOR*	COLOR*	PIN#	SIGNAL
GND**	1	Blue	White	6	GND**
RCV†	2	Yellow	Red	4	XMT
XMT	3	Green	Black	5	RCV
XMT	4	Red	Yellow	2	RCV
RCV	5	Black	Green	3	XMT
GND**	6	White	Blue	1	GND**

RJ-45

SIGNAL	PIN#	COLOR*	COLOR*	PIN#	SIGNAL
GND**	2	Orange	Brown	7	GND**
RCV†	3	Black	Green	5	XMT
XMT	4	Red	Yellow	6	RCV
XMT	5	Green	Black	3	RCV
RCV	6	Yellow	Red	4	XMT
GND**	7	Brown	Orange	2	GND**

*Standard color codes—wire colors in your cable might be different
**Connection to ground is optional
†The Async/Sync Line Driver 56/64 is not sensitive to polarity

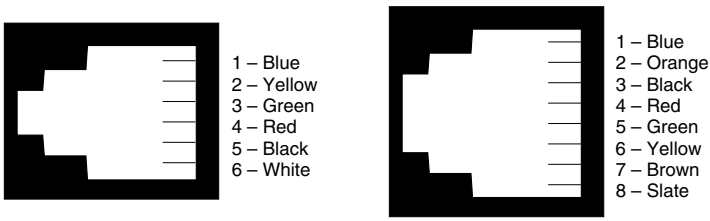


Figure 4-1. AT&T® standard modular color codes.

4.2 RS-232 and V.35 Serial Connections

The DB25 connectors of the ME350 and ME351 models of the Async/Sync Line Driver 56/64 are standard RS-232 ports (pinout shown in Table 4-2 below). The DB25 connectors of the ME352 and ME353 models serve as V.35 ports; the pinout (shown in Table 4-3 below) follows the most widely used adaptation of V.35 to DB25. See **Section 4.2.1** if you want to connect the A/SLD to a DTE (PC or printer) device. See **Section 4.2.2** if you want to connect the A/SLD to an RS-232 DCE (modem) device. If you want to connect the A/SLD to a V.35 DCE device, you will need a special cable whose pinning will depend on your application; call Black Box for technical support.

Table 4-2. Pinout of the RS-232 Interface

DIRECTION	STANDARD RS-232/V.24 DCE PINNING	DIRECTION
	1 Protective Ground (PGND)	
From A/SLD	Transmit Clock DCE (TCC) 15 — 2 Transmit Data (TD)	To A/SLD
	3 Receive Data (RD)	From A/SLD
From A/SLD	Receive Clock DCE (RCC) 17 — 4 Request to Send (RTS)	To A/SLD
To A/SLD	Local Loopback (LL) 18 — 5 Clear to Send (CTS)	From A/SLD
	6 Data Set Ready (DSR)	From A/SLD
	7 Signal Ground (SGND)	
To A/SLD	Data Terminal Ready (DTR) 20 — 8 Carrier Detect (CD)	From A/SLD
To A/SLD	Remote Loopback (RL) 21	
To A/SLD	Transmit Clock DTE (TCT) 24	
From A/SLD	Test Mode (TM) 25	

Table 4-3. Pinout of the V.35 Interface

DIRECTION	V.35 DCE PINNING ON DB25 (AS PER EIA RS-530)	DIRECTION
	1 Frame Ground (FGND)	Common
To A/SLD	Send Data B (TD B) 14 — 2 Send Data A (TD A)	To A/SLD
From A/SLD	Srl. Clock Trans. A (SCT A) 15 — 3 Receive Data (RD A)	From A/SLD
From A/SLD	Receive Data B (RD B) 16 — 4 Request to Send (RTS)	To A/SLD
From A/SLD	Srl. Clock Rcv. A (SCR A) 17 — 5 Clear to Send (CTS)	From A/SLD
To A/SLD	Local Loopback (LL) 18 — 6 Data Set Ready (DSR)	From A/SLD
	7 Signal Ground (SGND)	Common
To A/SLD	Data Terminal Ready (DTR) 20 — 8 Carrier Detect (CD)	From A/SLD
To A/SLD	Remote Loopback (RL) 21 — 9 Srl. Clock Rcv. B (SCR B)	To A/SLD
	11 S. Clock Tr. Ext. B (SCTE B)	To A/SLD
To A/SLD	S. Clock Tr. Ext. A (SCTE A) 24 — 12 Srl. Clock Trans. B (SCT B)	From A/SLD
From A/SLD	Test Mode (TM) 25	

4.2.1 Connecting the A/SLD to a DTE Device

This is the normal application for the Async/Sync Line Driver 56/64, which is wired as a DCE. Connect it to a DTE (PC, printer, terminal, etc.) by plugging it right into the DTE's DB25 male RS-232 or V.35 port. (After doing so, remember to insert and tighten the A/SLD's two captive connector screws.) If the DTE has a DB9 male serial port, use a DB9-female-to-DB25-male adapter (our product code FA520). If you must use a cable to connect the A/SLD to a DTE, make sure that the cable is pinned *straight through* and that it is as short as possible (we recommend 6 ft. [1.8 m] or less).

4.2.2 Connecting the A/SLD to an RS-232 DCE Device

Because the Async/Sync Line Driver 56/64 is wired as a DCE device, you can't plug it directly into another RS-232 DCE (modem, multiplexor, etc.) device. If you must make such a connection, use a *null-modem cable* pinned according to Table 4-4 below. This cable should be as short as possible (we recommend 6 ft. [1.8 m] or less).

NOTE

When you connect the Async/Sync Line Driver 56/64 to another DCE device, you should configure the A/SLD for the "external" clock source (see the entry for SW2 Positions 4 and 5 in Section 3.4).

Table 4-4. Pinout for a Null-Modem Cable Conecting the A/SLD to Another DCE

A/SLD End: DB25 Male Pin No.	DCE End: DB25 Male Pin No.
1	1
2	3
3	2
4	8
6	20
7	7
8	4
17	24
20	6
24	17

4.3 Multipoint Applications

The Async/Sync Line Driver 56/64 supports multipoint applications if position 6 of switch SW2 is turned On (moved to the "controlled by RTS" setting). Maximum distance between the units will vary based on the number of drops, data rate, wire gauge, etc. Call Black Box Technical Support for distance estimates more specific to your application.

Figure 4-3 below shows how to wire two-pair cables for a Async/Sync Line Driver 56/64 network. (We do not recommend arranging multipoint equipment in a star topology.)

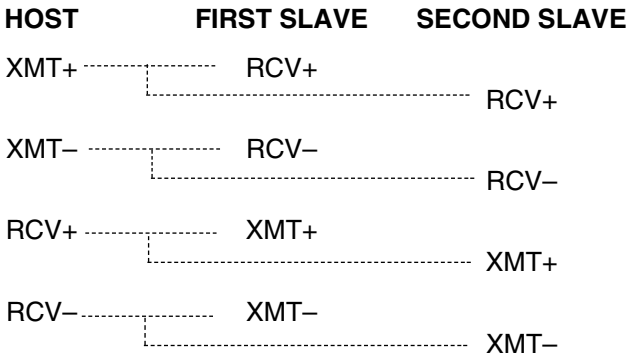


Figure 4-2. Two-pair wiring for host and slave A/SLDs.

5. Operation and Diagnostics

Once you have configured each Async/Sync Line Driver 56/64 and connected the cables, you are ready to operate the units. They should operate transparently, as if there were a standard cable connection between the two destination devices.

Depending on whether the interface is RS-232 or V.35, the A/SLD draws its power from a 9-VDC or 7.5-VDC power-supply transformer. It has no "ON/OFF" switch; to power up the unit, plug the power supply's output cord into the A/SLD, then plug the power supply into an outlet. The A/SLD will stay on until the power supply is unplugged.

The rest of this chapter describes the A/SLD's top-panel LEDs and switches and how to perform diagnostic testing.

5.1 Status LEDs

The Async/Sync Line Driver 56/64 has five top-panel status LEDs (shown in Figure 5-1 below). “PWR” stays lit while the unit is receiving power. “TD” flickers while the unit is receiving data. “CD” stays lit while the unit detects carrier. “LOOP” stays lit while the unit is in a loopback test mode (see Section 5.3). “BERT” lights whenever bit errors occur in 511 testing; it stays lit for the duration of 511/E testing.

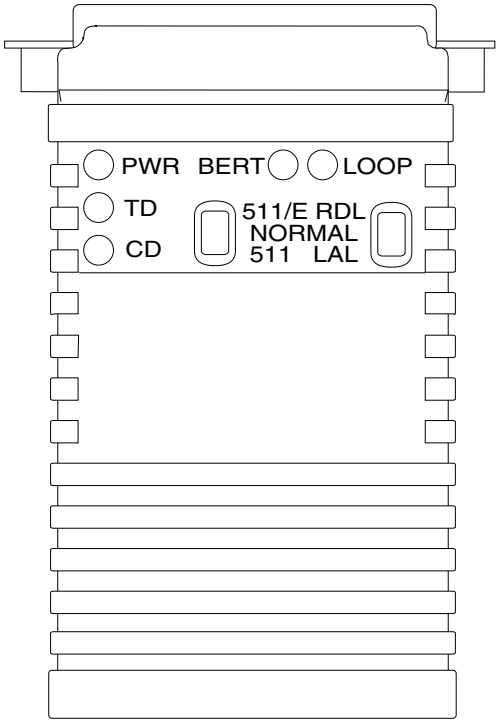


Figure 5-1. The A/SLD’s top panel.

5.2 Test Switches

The Async/Sync Line Driver 56/64 has two top-panel slide switches (shown in Figure 5-1 on the previous page). During normal operation, these switches should be in the center (“NORMAL”) position. You can move them to different positions to trigger various tests (see **Section 5.3**).

5.3 V.54 and V.52 Diagnostic Tests

The Async/Sync Line Driver 56/64 offers two V.54 test modes and two V.52 test modes to evaluate the condition of the A/SLDs and the communication link. Both sets of tests can be activated physically from the top panel. The V.54 test can also be activated from the RS-232 or V.35 interface.

NOTE

V.54 and V.52 test modes on the Async/Sync Line Driver 56/64 are available for point-to-point applications only.

5.3.1 Local Analog Loopback (LAL)

The Local Analog Loopback (LAL) test checks the operation of the local Async/Sync Line Driver 56/64, and is performed separately on each unit. Any data sent to the local Async/Sync Line Driver 56/64 in this test mode will be echoed back (returned) to the user device. For example, characters typed on the keyboard of a terminal will appear on the terminal's screen. To perform an LAL test, follow these steps:

1. Activate LAL. You can do this in either of two ways. One is to move the right-hand top-panel slide switch (the one under the "LOOP" LED) to the "LAL" (down) position. The other is to raise the signal on Pin 18 of the RS-232 or V.35 interface (switch SW1 position 1 must be "On" and switch SW1 position 8 must be "Off"—see **Section 3.3**). Once LAL is activated, the A/SLD's transmit output is connected to its own receiver. The LOOP LED should light.

2. Verify that the attached DTE is operating properly and can be used for a test.

3. Move the left-hand top-panel slide switch (the one under the "BERT" LED) to the "511" (down) position. This will activate the V.52 BERT test mode and inject a 511 test pattern into the local loop. If any errors are present in the loop, the BERT LED will blink *sporadically*.

4. If the BERT test indicates *no errors* are present, move the BERT switch to the "up" position to activate the "511/E" test with periodic errors. If this test is working properly, the BERT LED will blink *regularly*. A successful 511/E test will confirm that the loop is in place, and that the Async/Sync Line Driver 56/64's built-in 511 generator and detector are working properly.

5. If the BERT test indicates that errors *are* present, make sure that the Async/Sync Line Driver 56/64 is plugged into the DTE properly. (If the A/SLD is connected to a DTE across a length of cable, make sure the cable is pinned straight through, is properly plugged in on both ends, and is not longer than 6 ft. [1.8 m]. If the A/SLD is connected to an RS-232 DCE, make sure that the connecting cable is properly cross-pinned according to Table 4-3 on 19, is properly plugged in on both ends, and is not longer than 6 ft. [1.8 m].) Also, make sure that the A/SLD is configured properly. Then recheck your DTE equipment. If you still get errors and can't find the cause, call Black Box for technical support (see **Section 6.1**).

5.3.2 Remote Digital Loopback (RDL)

The Remote Digital Loopback (RDL) test checks the performance of both the local and remote Async/Sync Line Drivers 56/64, and the communication link between them. Any characters sent to the remote A/SLD in this test mode will be echoed (returned) back to the originating device. For example, characters typed on the keyboard of the local terminal will appear on the local terminal's screen after having been passed to the remote Async/Sync Line Driver 56/64 and looped back. To perform an RDL test, follow these steps:

1. Activate RDL. You can do this in either of two ways. One is to move the local unit's right-hand front-panel slide switch (the one under the "LOOP" LED) to the "RDL" (up) position. The other is to raise the signal on Pin 21 of the RS-232 or V.35 interface (positions 2 and 8 of switch SW1 must be "On"—see **Section 3.3**). Once RDL is activated, the remote A/SLD's receive input is connected to its own transmitter. The LOOP LED should light on both A/SLDs.

2. Verify that the DTE attached to the local A/SLD is operating properly and can be used for a test.

3. Move the left-hand top-panel slide switch (the one under the "BERT" LED) to the "511" (down) position. This will activate the V.52 BERT test mode and inject a 511 test pattern into the local loop. If any errors are present in the loop, the BERT LED will blink *sporadically*.

4. If the BERT test indicates *no errors* are present, move the BERT switch to the "up" position to activate the "511/E" test with periodic errors. If this test is working properly, the BERT LED will blink *regularly*. A successful 511/E test will confirm that the loop is in place, and that the Async/Sync Line Driver 56/64's built-in 511 generator and detector are working properly.

5. If the remote BERT test indicates that errors *are* present, but the local analog loopback BERT tests showed that both Async/Sync Line Drivers 56/64 were functioning properly, there is probably a problem with the twisted-pair communication line connecting the two modems. A common problem is improper crossing of the pairs. Also, check the cable's pinning (see Table 4-1 on page 18) and continuity. If you still get errors and can't find the cause, call Black Box for technical support (see **Section 6.1**).

5.3.3 Using the V.52 BERT Test Independently

The Async/Sync Line Driver 56/64 can perform its V.52 BERT test independently of the V.54 loopback tests. This requires two operators: one to initiate and monitor the test at the local A/SLD, and one to do the same at the remote A/SLD. To use the V.52 BERT test by itself, both operators should simultaneously follow these steps:

1. Move the left-hand top-panel slide switch (the one under the "BERT" LED) to the "511" (down) position. This will activate the V.52 BERT test mode and transmit a 511 test pattern to the other unit. If any errors are present, the receiving modem's BERT LED will blink *sporadically*.

NOTE

For this independent test to work properly, the "BERT" switch on both Async/Sync Line Drivers 56/64 must be set the same way (that is, moved to the "511" position for this step and to the "511/E" position for the next step).

2. If the BERT test indicates *no errors* are present, move the BERT switch to the "up" position to activate the "511/E" test with periodic errors. If this test is working properly, the receiving modem's BERT LED will blink *regularly*. A successful 511/E test will confirm that the link is in place, and that the built-in 511 generators and detectors of the Async/Sync Line Drivers 56/64 are working properly.

6. Troubleshooting

6.1 Contacting Black Box

If you determine that your Async/Sync Line Driver 56/64 is malfunctioning, *do not attempt to alter or repair it.* It contains no user-serviceable parts. Call Black Box Technical Support at (724) 746-5500. The problem might be solvable over the phone.

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.

6.2 Shipping and Packaging

If you need to transport or ship your Async/Sync Line Driver 56/64:

- Package it carefully. We recommend that you use the original container.
- Before you ship a unit for repair or return, contact Black Box to get a Return Authorization (RA) number, and make sure you include everything you received with the unit when you ship it.

Appendix A: Cable Recommendations

The Async/Sync Line Driver 56/64 has been performance-tested using twisted-pair cable with these characteristics:

Wire Gauge	Capacitance	Resistance
19 AWG	83 nf/mi. or 15.72 pf/ft.*	16.3 Ω/1000 ft. (53.5 Ω/km)
22 AWG	83 nf/mi. or 15.72 pf/ft.*	32.6 Ω/1000 ft. (107 Ω/km)
24 AWG	83 nf/mi. or 15.72 pf/ft.*	51.65 Ω/1000 ft. (169.5 Ω/km)
26 AWG	83 nf/mi. or 15.72 pf/ft.*	82.35 Ω/1000 ft. (270.2 Ω/km)

*Alternatively, 51.6 nf/km or 51.6 pf/m

If you use the Async/Sync Line Driver 56/64 with a different type of twisted-pair cable, make sure that the cable has characteristics similar to, or better than, those listed above (for example, lower capacitance or lower resistance).

Bench tests yield the following data-rate/maximum-distance results:

Data Rate in bps	Absolute Maximum Distance in miles (km)			
	19 AWG	**22 AWG**	**24 AWG**	**26 AWG**
32,000	9.1 (14.6)	6.3 (10)	4.7 (7.6)	3 (4.9)
56,000	6.8 (11)	5.1 (8.2)	4.2 (6.7)	2.7 (4.3)
64,000	5.3 (8.5)	4.9 (7.9)	3.8 (6.1)	2.5 (4)

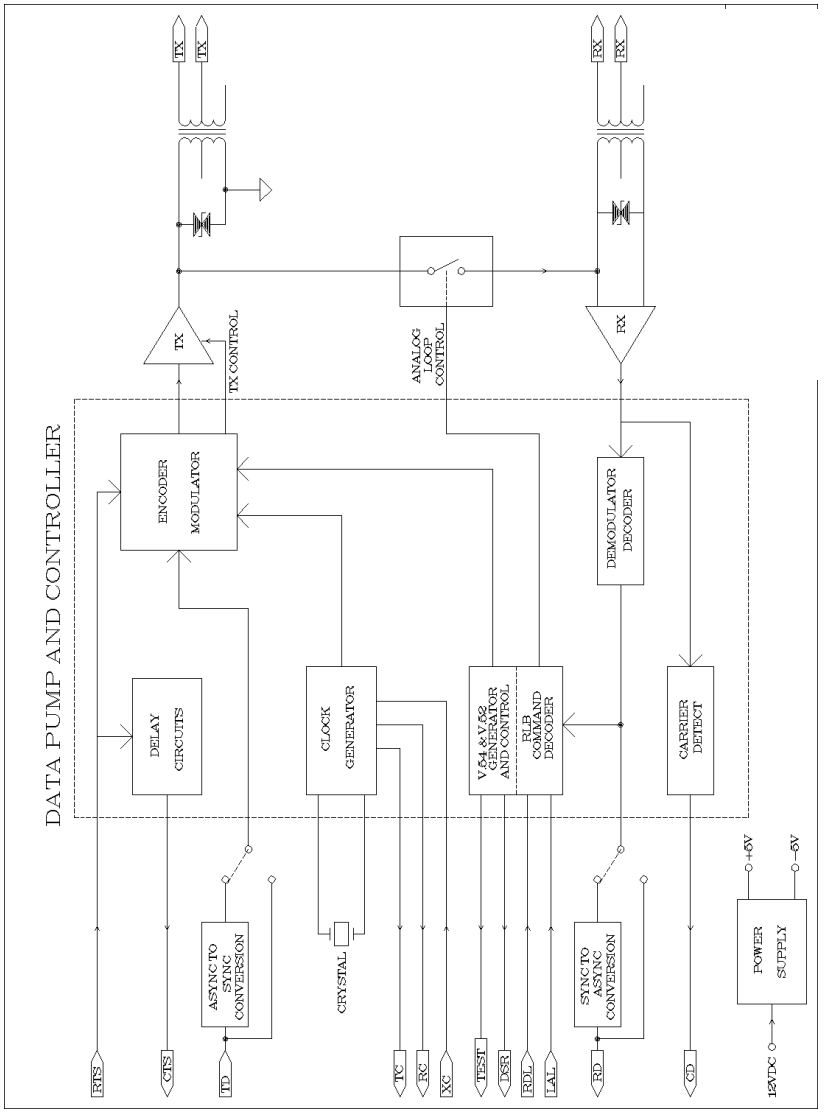
Note that these distances are absolute maxima for constant-carrier performance between two A/SLDs under ideal conditions. Many environmental factors can affect transmission distance, so the distances you can attain at your site might vary, and in fact will probably be less. Also, the absolute maximum distance at which remote digital loopback will be successful for any given data rate and wire gauge will be as much as a mile (1.6 km) less than the constant-carrier figure shown above. For these reasons, we do not recommend running more than 6 miles (9.7 km) of cable between two A/SLDs.

To get optimum performance from your Async/Sync Line Driver, please keep these other guidelines in mind:

- Always use twisted-pair cable—this is *not* an option.

- Use twisted-pair cable with a capacitance of 20 pf/ft. (65.6 pf/m) or less.
- Avoid twisted-pair cable thinner than 26 AWG (that is, avoid higher AWG numbers than 26).
- Using twisted-pair cable with a resistance greater than that listed at the beginning of this appendix might reduce the maximum distance you can run the cable, but should not otherwise affect your system.

Appendix B: Block Diagram



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