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V.35 FOLD—ST
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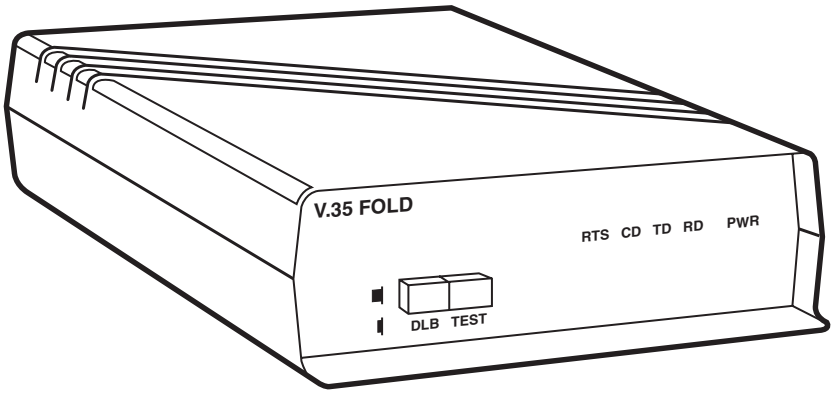

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FEDERAL COMMUNICATIONS COMMISSION AND INDUSTRY CANADA RADIO FREQUENCY INTERFERENCE STATEMENT

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 required 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 édicté par Industrie Canada.

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Contents

1. Specifications

Speed —	2.4 to 256 Kbps
Interface —	
Terminal:	V.35 DCE
Line:	Multimode fiberoptic, graded index
Pins Supported —	
V.35:	CTS, DCD, DSR, ETCA, ETCB, FG, RCA, RCB, RDA, RDB, RTS, SG, TCA, TCB, TDA, TDB
Fiberoptic:	TX, RX
Range —	2.3 km (1.4 miles) with 100µ, -5dB/km fiber optic cable; 1.5 km (0.9 miles) with 62.5µ , -5dB/km fiber optic cable;
Connectors —	(2) fiberoptic: SMA (905) female or ST female; (1) DB25S (25-pin sub D female) pinned per EIA530A. A DB25-to-V.35 (female M-block) adapter cable is included.
Fiber Optic Characteristics:	
Wavelength —	820nM
Receiver Sensitivity —	-21.7dB
Launch Power — (typical)	-10.1 dB into 100µ cable -14.1 dB into 62.5µ cable -19.6 dB into 50µ cable
Operation —	Point-to-point
Mode —	Full or half-duplex; synchronous
Clocking —	Internal, external, or recovered
Carrier —	Constant or Switched

Loopback —	Digital
RTS/CTS Delay —	0, 11, 50, or 175 ms
Protocol —	Transparent
Indicators —	5 LEDs (TX, RX, RTS, CD, and PWR)
Diagnostics —	DLB and Test Pattern Generator
Operating Temperature —	32° to 122°F (0° to 50°C)
Storage Temperature —	-4° to 158°F (-20° to 70°C)
Humidity —	15 to 90% relative humidity, noncondensing
Mean Time Between Failures —	approximately 100,000 hours
Power —	Wallmount transformer 115-VAC, 60 Hz, 8VA or 230-VAC, 50 Hz, 8VA
Size —	
Standalone:	1.8" H x 5.5"W x 8.5"D (4.6 cm x 14.0 cm x 21.6 cm);
Rackmount:	4.7"W x 7.4"D (11.9 x 18.8 cm)
Weight —	
Standalone:	1.5 lb. (0.7 kg);
Unit and transformer:	2.2 lb. (1.0 kg);
Rackmount:	0.5 lb. (0.2 kg)

2. Introduction

The V.35 FOLD (Fiber Optic Line Driver) provides short-haul synchronous data communication over your own fiberoptic cable in a point-to-point application. You must use these units in pairs.

The FOLD is equipped with two rear-panel adapters, either SMA or ST®.

The FOLD has two fiberoptic ports and a V.35 port (configured as DCE) that connects to a host computer or terminal (DTE).

Transmission can be half- or full-duplex. The switch-selectable baud rates range from 2400 to 256,000 bps.

LEDs on the front panel indicate flow control. TX, RX, and RTS indicate data activity on the V.35 interface only. CD indicates that there is a carrier signal on the RX fiberoptic connector.

Two pushbuttons on the front panel (TST and DLB) make diagnostics easy to use.

Internal switches or jumpers determine these characteristics:

- Speed
- Carrier: constant or switched with selectable RTS/CTS delay
- Operation: full- or half-duplex
- TX data clock select

Your FOLD package should include:

- the base unit with attached A/C cord and power transformer,
- a DB25-to-V.35 adapter, and
- this manual.

If any of these items are missing, check with your sales or technical representative to get replacements.

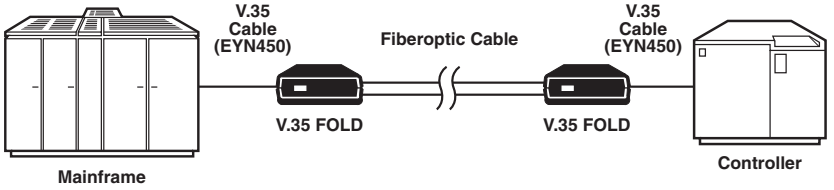

Figure 1. The V.35 FOLD is designed for a point-to-point application.

3. Installation and Configuration

3.1 Opening the V.35 FOLD

1. Remove the screw located at the center of the bottom cover.
2. Remove the top cover.

3.2 Speed

The ten standard available speeds are: 2.4, 4.8, 9.6, 19.2, 38.4, 56, 64, 112, 128, and 256 Kbps. The factory setting is 56 Kbps.

Set the speed of the V.35 FOLD by configuring DIP Switch banks S4 and S5. See Figure 2 for switch-bank locations. See Table 1 for how to set the switches.

NOTE: Off in Table 1 corresponds to Open on DIP switches S4 and S5.

If you are resetting the speed switch banks after the V.35 FOLD has been on, the heat sinks nearby might be quite warm. This is normal because of power dissipated in V.35 transmission.

Important

Both V.35 devices and both V.35 FOLDs *must* be set to the same speed.

Table 1. DIP Bank Speed Settings

Bank	Switch	Speed (in Kbps)									
		2.4	4.8	9.6	19.2	38.4	56	64	112	128	256
4	1	On	On	On	On	Off	Off	Off	Off	Off	Off
4	2	Off	On	On	Off	Off	Off	Off	Off	Off	Off
4	3	Off	On	Off	Off	Off	Off	Off	Off	Off	Off
4	4	On	Off	Off	Off	Off	Off	Off	Off	Off	Off
5	1	On	On	On	On	On	On	On	Off	Off	Off
5	2	Off	Off	Off	Off	Off	Off	Off	On	On	On
5	3	On	Off	Off	Off	Off	On	On	Off	Off	Off
5	4	On	On	On	On	On	Off	Off	Off	Off	Off
5	5	On	On	On	On	On	On	On	On	On	Off
5	6	On	Off	Off	Off	Off	On	Off	On	Off	On
5	7	On	On	On	On	On	On	On	On	On	On
5	8	On	On	On	On	On	On	On	On	On	Off

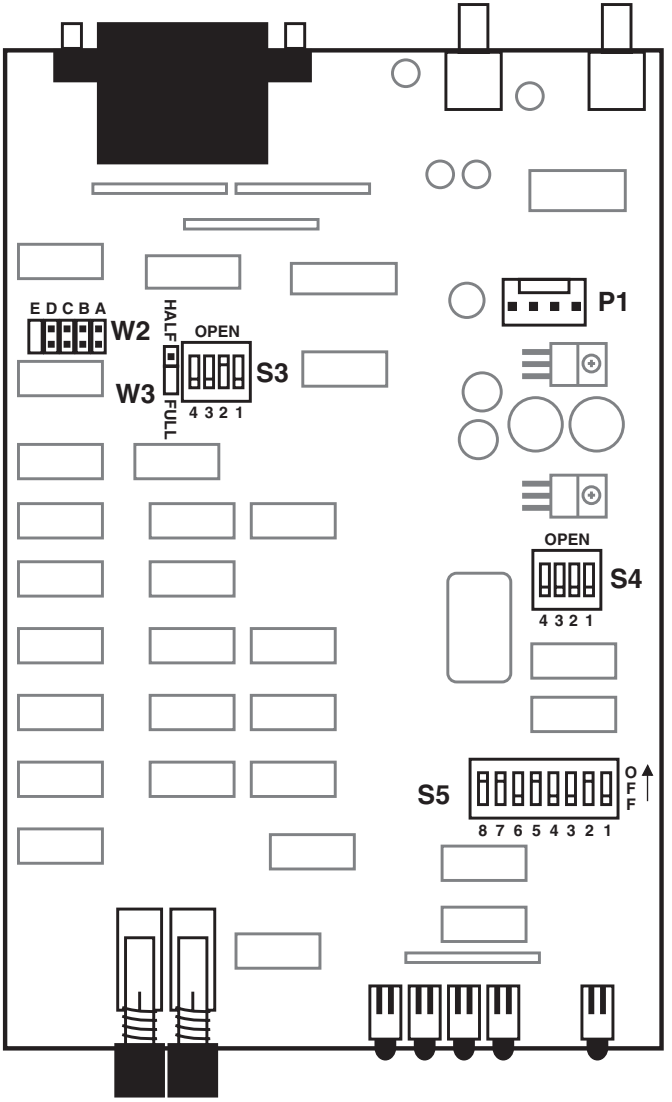

Figure 2. Circuit Board Layout for the V.35 FOLD.

3.3 Transmit Data Clock

Data timing is synchronized among all connected devices in one of three ways:

- Internal Clock (factory setting)
- Recovered Clock
- External Clock

DIP switch S3 controls the selection of the clock timing. See Table 2 for DIP switch settings. The fourth switch position on DIP switch S3 is unused. Figure 2 shows where the DIP switch is located on the ciruit board.

Table 2. Clock Settings

Data Clock	Switch			
	1	2	3	4
Recovered	On	Off	Off	On
Internal	Off	On	Off	On
External	Off	Off	On	On

Internal Clock

The FOLD generates Transmit Data clock and presents clock to the attached DTE on TCA and TCB. The DTE then presents synchronized data to the FOLD on pins TDA and TDB.

Recovered Clock

The Transmit data clock presented to the DTE is synchronized with the timing of data received from the remote device.

External Clock

The local DTE determines clocking. The clock is presented to the FOLD on Pins ETCA and ETCB, and returned as TCA and TCB.

Master Clock

To create a master clock, one of the FOLDs should be set to internal or external clocking and the other FOLD set to recovered clock.

3.4 Carrier—Constant/Switched

Jumper W2 is used to select Constant Carrier or Switched Mode. See Figure 2 for the jumper's location on the printed circuit board. This option determines how the FOLD reacts to an RTS signal from the local V.35 device. The FOLD is defaulted to Contant Carrier Mode.

Constant Carrier Mode

Place jumper W2 over position E. The FOLD functions as if the attached V.35 device is constantly asserting RTS:

- The fiberoptic transmitter is always on, and the FOLD's CTS signal remains high. Any data sent by the attached V.35 device is automatically transmitted by the FOLD.
- The RTS indicator on the FOLD's front panel will always be on, regardless of the data activity on the V.35 interface. The CD indicator on the remote FOLD will remain lit.

Warning

Constant Carrier Mode will work with full-duplex operation only, not half-duplex. In Constant Carrier mode the RTS signal is constantly held high, preventing any other signals from being raised in the sequential fashion required by half-duplex operation.

SWITCHED MODE

Set the jumper block over one of the four RTS/CTS delay positions. See **3.5 RTS/CTS Delay**.

The FOLD transmitter is not activated until the attached V.35 device asserts RTS. (Unlike Constant Carrier Mode, this mode does not always hold RTS high.)

When the attached V.35 device raises RTS, the RTS indicator on the local FOLD will light. The remote FOLD's CD indicator will also light, indicating that a transmission link has been established.

Once the local V.35 device drops RTS, the local RTS and remote CD indicators will go out.

3.5 RTS/CTS Delay

In Switched mode, you may insert a delay after the V.35 device raises RTS. This will delay the return of CTS from the FOLD to the V.35 device.

This feature is useful in applications that require time for the remote V.35 device to prepare to receive data. The local V.35 device should not attempt data transmission without sensing CTS.

In half-duplex operation, the RTS/CTS delay is useful because it allows time to establish which FOLD will have control of the line in order to transmit data.

RTS/CTS Delay Options (Jumper W2):

Position D: 0 msec (no delay)

Position C: 11-msec delay (factory setting)

Position B: 50-msec delay

Position A: 175-msec delay

3.6 Full or Half-Duplex Operation

Figure 2 shows the location of Jumper W3. This jumper allows you to select half-duplex or full-duplex operation. The factory setting is full duplex.

3.7 Final Installation Procedures

- Replace the top cover.
- Replace the screw.
- Connect your fiberoptic cable to the V.35 FOLD. When using SMA connectors, tighten the connection with your fingers and then stop. Do not over-tighten.
- Connect the DB25-to-female M-block connector to the V.35 FOLD. Connect the other end to your V.35 device.
- Plug the power supply into an AC outlet. The V.35 FOLD is now ready for operation.

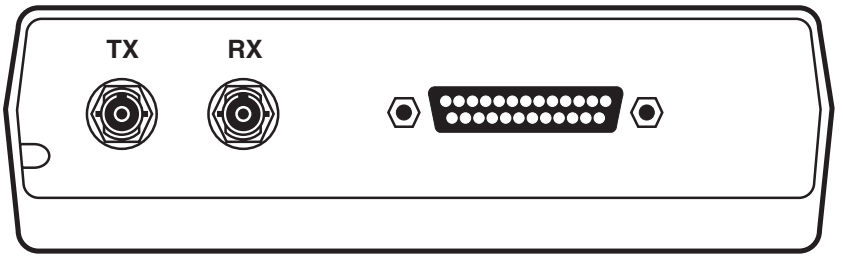

Figure 3. The rear panel of the V.35 FOLD.

4. Monitoring Operation

The front panel of the Line Driver has five status indicators (LEDs):

TD Lights when the TDA/TDB circuit pair is active on the FOLD's V.35 port.

RD Lights when the RDA/RDB circuit pair is active on the FOLD's V.35 port.

RTS Lights when V.35 device raises RTS to request data transmission.

In Constant Carrier mode the RTS LED will always be on.

In Switched mode the RTS LED will be on only if RTS is asserted.

CD Indicates the presence of carrier signal at the RX fiberoptic connector.

If the remote V.35 FOLD is in Constant Carrier Mode, the local V.35 FOLD's CD LED will always be on.

If the remote V.35 FOLD is in Switched Mode, the local V.35 FOLD's CD LED will light when the remote device asserts RTS.

PWR Shows that the FOLD is receiving AC power.

5. Diagnostics and Troubleshooting

5.1 Simple Problems

Check for the simple problems first: Are both FOLDs receiving AC power? (Check the PWR LED.) Are any there any cables that are not properly connected? These are obvious but often overlooked problems.

5.2 Diagnostic Tests

Test configurations are set up by using the front-panel pushbuttons. These tests should be performed when the FOLD is first installed or if a problem occurs.

TST

The TST pushbutton enables the V.35 FOLD's transmitter circuitry. The transmitter sends null data to the remote V.35 FOLD. If the link is operating properly, the RD indicator on the remote FOLD receiving this pattern will remain off. This indicates that the remote V.35 FOLD is correctly receiving and decoding the null data.

If you press the TST button on both the local and remote FOLDs, both RD indicators should go off. This ensures that both directions of the link are in working order.

The RD indicator may flash before switching off entirely. This is normal. If the RD indicator remains lit or flickers, see **Section 5.3, Troubleshooting**.

DLB

Press the DLB pushbutton to initiate digital loopback. Data received from the RX fiber port is decoded, re-encoded, and then transmitted back to the sending FOLD. (See Figure 4.)

If you put the local V.35 FOLD in TST and the remote FOLD in DLB, you can judge the integrity of the line by observing that the local RD indicator remains off.

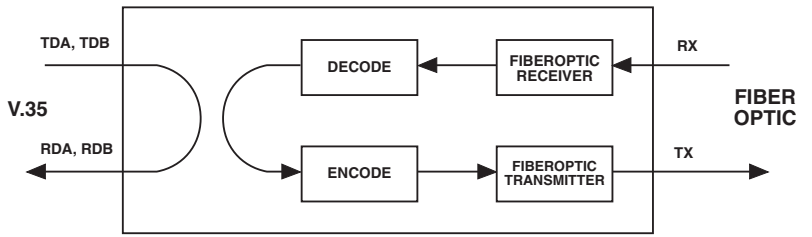

Figure 4. The DLB Test.

5.3 Troubleshooting

Here are some problems to look for:

- **Incompatible Baud Rates**. Remember that both V.35 FOLDs and their attached V.35 devices must all have the same baud rate. Any incompatibility will result in corrupt data transmission.
- **Incorrect V.35 Connections**. Use a BERT (Bit Error Rate Tester) to verify that your V.35 devices and the V.35 ports of the FOLDs are functioning properly.
- **Lead Mismatching**. The TX connector of the local FOLD should be attached to the RX connector of the remote FOLD. Conversely, the RX connector of the local FOLD should be attached to the TX connector of the remote FOLD.
- **Maximum Link Distance**. Check the specifications to make sure that the fiberoptic cable you are running between the two FOLDs has not exceeded the operating range.
- **Damaged Fiberoptic Cable**. If one direction of the link fails the TST test, try reversing the leads on *both ends* of the link. Repeat the TST test on both FOLDs. If the other direction of the link now fails the test, the problem is in the fiberoptic cable.

6. Fiberoptic Considerations

6.1 Link Distance

The maximum transmission distance is dependent on losses in the fiber lines. The typical range for data transmission is 1.4 mile (2.3 km) using 100µ fiberoptic cable. The distance with 62.5µ fiberoptic cable is 0.9 miles (1.5 km). Actual distances may be less and are affected by the quality of the fiber itself, connectors, and the terminus connections.

6.2 Handling Fiber Optic Cable

- Treat connectors the same as a fine camera lens.
- Clean the connectors with lens-cleaning tissue before installing them.
- Keep connectors covered with not installed.
- *Never* use the connectors to pull fiberoptic cable through conduits.
- Do not pull fiberoptic cable tightly around a corner. This can cut transmission by up to 50%.

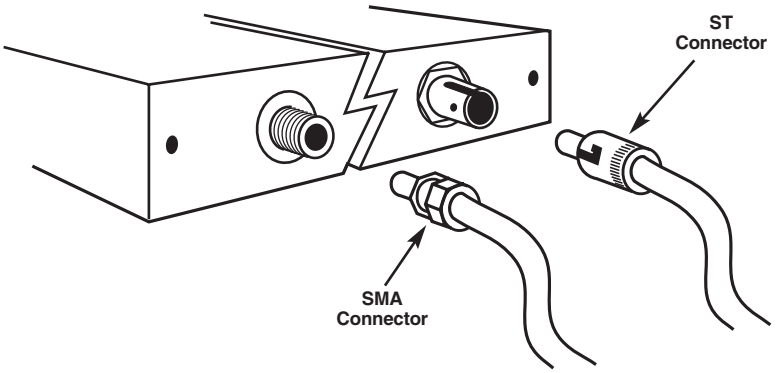

Figure 5. Fiber Optic Connectors

Appendix A
V.35 Pin Assignments

Lead	Flow	Name	DB25 Pin	M-block Pin
Transmitted data	In	TDA	2	P
		TDB	14	S
TX data clock	Out	TCA	15	Y
		TCB	12	AA
Received data	Out	RDA	3	R
		RDB	16	T
Remote TX clock	In	ETCA	24	U
		ETCB	11	W
Signal Detect	Out	DCD	8	F
Request to Send	In	RTS	4	C
Clear to Send	Out	CTS	5	D
Signal Ground	In/Out	SG	7 or 23	B
Protective Ground	In/Out	FG	1	A
Data Set Ready	Out	DSR	6	E
RX Data Clock	Out	RCA	17	V
		RCB	9	X
RX data clock	Out	RCA	17	V
		RCB	9	X

Appendix B
Tail-Circuit Applications

In a typical FOLD tail circuit, the FOLD will be connected back-to-back with another DCE device through the V.35 interface.

To create a tail circuit, set both FOLDs for external clocking. Then connect them with a cable that crosses the Receive clock outputs with the external clock inputs, and omits the Transmit clock lines (TCA and TCB). With TCA and TCB omitted, there is no danger of creating a short-circuit on those leads and, in turn, increasing the current that the unit will draw.

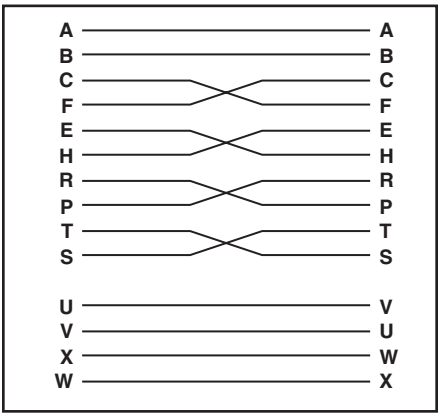

Figure 6. Cable pinouts for V.35 tail circuit applications.

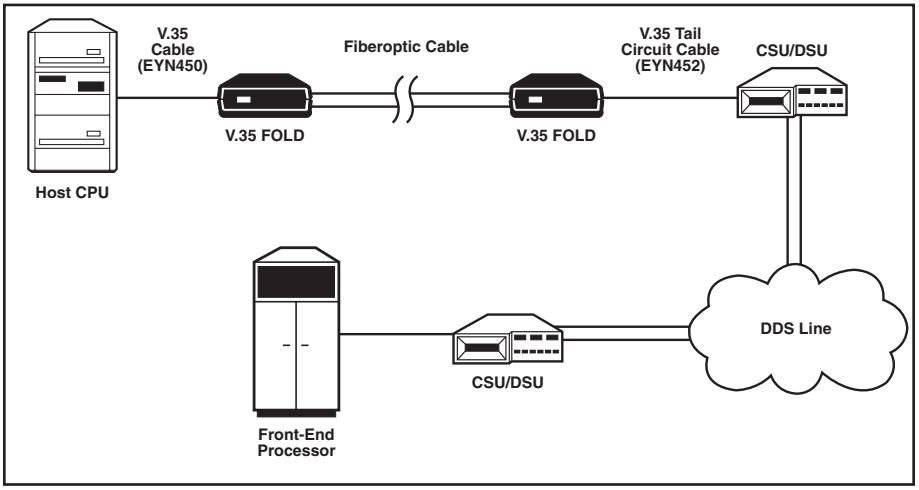

Figure 7. V.35 FOLD tail-circuit application.

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