Installation and Operation

Metroplex™ 6000

Flexi-Data
Model MP 6441

d **General DataComm**

Manual Revision History

Shown below is a chronological listing of revisions to this manual. The issue number, date, and synopsis of revised materials are included to provide the reader with a comprehensive manual history.

Issue	Date	Description
1	Nov/96	First Issue
2	Oct/97	General updates and added E1 updates and data rates - 2.4, 4.8, 19.2k
3	Mar/98	Added 232 Asyc Option Card

Compatibility

Check that you have the required revision of Platform Card firmware and Flexi-Data card firmware to support the cards in your system. See Compatibility on page 8.

Flexi-Data

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Flexi-Data Card

The MP 6441 Flexi-Data Card provides up to four DS0A compatible data channels. Each channel occupies one timeslot and may be assigned to either LIU A or LIU B. Various data interfaces are supported using option cards which plug into the basecard.

Features

- Supports up to four data channels.

- Supports a single timeslot per channel at 56k or 64k - DS0A format.

- Supports synchronous DTE data rates of 2.4, 4.8, 9.6, 19.2, 56, or 64 kbps.

- Supports asynchronous DTE data rates at 1.2, 1.8, 2.4, 4.8, 9.6, or 19.2 kbps.

- Compatible with standard Digital Data Service (DDS) and Switched 56 Service

- Supports clear channel applications.

Note   *Flexi-Data Card Model MP6441 (086P072-001) is identical to an earlier version, Model MP6440 (086P070-001), except for the front panel connectors.*

Configuration

- Interface Type

     EIA/TIA-232-E

     V.35

     X.21 (byte timing is not supported)

     EIA-530-A

     V.36

- LIU Assignment

     any channel can be assigned to either LIU A or B

- Timeslot

     any channel can be assigned to any unused timeslot on either LIU

- Service

     DDS or Switched 56 service

- Data Rates

     Synchronous - 2.4 kbps, 4.8 kbps, 9.6 kbps, 19.2 kbps, 56 kbps, or 64 kbps

     Asynchronous - 1.2 kbps, 1.8 kbps, 2.4 kbps, 4.8 kbps, 9.6 kbps, or 19.2 kbps.

- Control Leads

     DCD, CTS, DSR

- Control of Latching Loopback Detection

     control whether channel responds to latching loopbacks or not
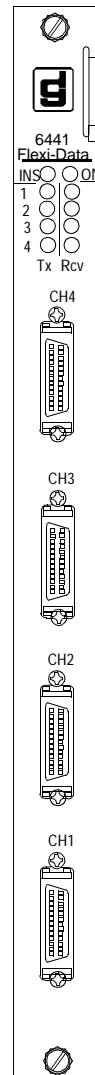
Diagnostics

- Supports a Card Self-Test

   Initiated from Manager:

- supports loopback to the network

- supports loopback to the customer

   Initiated from Network:

- supports DDS latching and non-latching loopbacks

Status

Front panel Indication:

- Tx status per channel

      channel LED is off for Control Mode in the transmit direction

      channel LED lights green for Data Mode in the transmit direction

- Rcv status per channel

      channel LED is off for Control Mode in the receive direction

      channel LED lights green for Data Mode in the receive direction

- Diagnostic status per channel

      Tx and Rcv channel LEDs light red when in a diagnostic condition

- In Service status

      INS (in service) LED lights green when any channel is assigned to a timeslot

Displayed on Local Management screen:

- Control Leads

      DTR

      RTS

      DCD

- Out of Service Status from the network

Alarms

- The Flexi-Data Card does not generate any alarms. It responds to network alarms (LOS, OOF, RAI, AIS) and network loopbacks by conditioning the receive data and control leads.

Front Panel Indicators and Connections

Table 1 describes the front panel indicators and electrical connections, and *Table 2* through *Table 5* describe the front panel pinouts.

Table 1   Front Panel Indicators and Connectors

Indicators	
Led	**Use**
ON	Power on. Off = No power received by the card. Green = Card has power, and passed its own self-test. Red = Card has power but failed its own self-test.
INS	In Service. Off = Card not in service. Green = Card in service. One or more channels assigned to timeslots.
Tx 1-4	Transmit 1 through 4. Off = Channel not configured or transmit channel in control mode (RTS Off). Green = Transmit channel in data mode (RTS On). Red = Channel in test mode.
Rcv 1-4	Receive 1 through 4. Off = Channel not configured or receive channel is in control mode (DCD Off). Green = Receive channel in data mode (DCD On). Red = Channel in test mode.
Connections	
Connector	**Description**
CH1, CH2, CH3, CH4	Four 26-pin Alt A connectors. Refer to *Table 2* through *Table 5*.

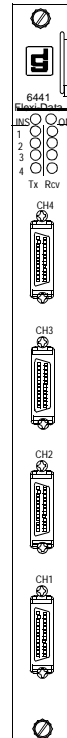**Table 2**   EIA/TIA-232-E Front Panel Connector and Adapter Cable Pinouts

26-Pin Pin No.	DB-25 Pin No.	Signal	Direction	Description
2	2	TXD	to Flexi-Data Card	Transmit Data to the network
3	3	RXD	from Flexi-Data Card	Receive Data from the network
4	4	RTS	to Flexi-Data Card	Request to Send - On = local DTE sending data.
5	5	CTS	from Flexi-Data Card	Clear to Send - can be forced On or follow RTS
6	6	DSR	from Flexi-Data Card	Data Set Ready - Normally On. Can be forced Off.
20	20	DTR	to Flexi-Data Card	Data Terminal Ready
8	8	DCD	from Flexi-Data Card	Data Carrier Detect - Follows far-end RTS at sub-rates and normally On at 64 kbps. Can be forced On.
15	15	TXCLK	from Flexi-Data Card	Transmit Clock - interface clock at configured data rate, used to clock data from DTE when configured for internal timing
17	17	RXCLK	from Flexi-Data Card	Receive Clock - interface clock at configured data rate, used to clock data to DTE
24	24	EXTCLK	to Flexi-Data Card	External Clock - interface clock at configured data rate, used to clock data from DTE when configured for external timing.
7	7	GND		Ground
22	22	RI	from Flexi-Data Card	Ring Indicator - always Off
18	18	LL	to Flexi-Data Card	Local Loopback - not used by Flexi-Data Card
21	21	RL	to Flexi-Data Card	Remote Loopback - not used by Flexi-Data Card
25		TM	from Flexi-Data Card	Test Mode - always Off
Note:				
1 - No connection to pins 1, 9, 10, 11, 12, 13, 14, 16, 19, 23 or 26.				
2 - Use adapter cable No. 027H900. See *Figure 8*.				

Table 3   V.35 Front Panel Connector and Adapter Cable Pinouts

26-Pin Pin No.	V.35 Pin No.	Signal	Direction	Description
2	P	TXD-A	to Flexi-Data Card	Transmit Data to the network
14	S	TXD-B		
3	R	RXD-A	from Flexi-Data Card	Receive Data from the network
16	T	RXD-B		
4	C	RTS	to Flexi-Data Card	Request to Send - On = local DTE sending data.
5	D	CTS	from Flexi-Data Card	Clear to Send - can be forced On or follow RTS
6	E	DSR	from Flexi-Data Card	Data Set Ready - Normally On. Can be forced Off.
20	H	DTR	to Flexi-Data Card	Data Terminal Ready
8	F	DCD	from Flexi-Data Card	Data Carrier Detect - Follows far-end RTS at subrates and normally On at 64 kbps. Can be forced On.
15	Y	TXCLK-A	from Flexi-Data Card	Transmit Clock - interface clock at configured data rate, used to clock data from DTE when configured
12	AA	TXCLK-B		for internal timing.
17	V	RXCLK-A	from Flexi-Data Card	Receive Clock - interface clock at configured data
9	X	RXCLK-B		rate, used to clock data to DTE.
24	U	EXTCLK-A	to Flexi-Data Card	External Clock - interface clock at configured data rate, used to clock data from DTE when configured
11	W	EXTCLK-B		for external timing.
7	B	GND		Ground
22	J	RI	from Flexi-Data Card	Ring Indicator - always Off
18	L	LL	to Flexi-Data Card	Local Loopback - not used by Flexi-Data Card
21	N	RL	to Flexi-Data Card	Remote Loopback - not used by Flexi-Data Card
25	NN	TM	from Flexi-Data Card	Test Mode - always Off

Notes:

1 - No connection to pins 1, 10, 13, 19, 23 or 26.

2 - Use adapter cable No. 027H437. See *Figure 6*.

Table 4   EIA-530-A Front Panel Connector and Adapter Cable Pinouts

26-Pin Pin No.	DB-25 Pin No.	Signal	Direction	Description
2	2	TXD-A	to Flexi-Data Card	Transmit Data to the network
14	14	TXD-B		
3	3	RXD-A	from Flexi-Data Card	Receive Data from the network
16	16	RXD-B		
4	4	RTS-A	to Flexi-Data Card	Request to Send - On = local DTE sending data.
19	19	RTS-B		
5	5	CTS-A	from Flexi-Data Card	Clear to Send - can be forced On or follow RTS
13	13	CTS-B		
6	6	DSR	from Flexi-Data Card	Data Set Ready - Normally On. Can be forced Off.
20	20	DTR	to Flexi-Data Card	Data Terminal Ready
8	8	DCD-A	from Flexi-Data Card	Data Carrier Detect - Follows far-end RTS at subrates and normally On at 64 kbps. Can be forced On.
10	10	DCD-B		
15	15	TXCLK-A	from Flexi-Data Card	Transmit Clock - interface clock at configured data rate, used to clock data from DTE when configured for
12	12	TXCLK-B		internal timing.
17	17	RXCLK-A	from Flexi-Data Card	Receive Clock - interface clock at configured data rate,
9	9	RXCLK-B		used to clock data to DTE.
24	24	EXTCLK-A	to Flexi-Data Card	External Clock - interface clock at configured data rate, used to clock data from DTE when configured for
11	11	EXTCLK-B		external timing.
23	23	DCECOM		Ground (AC, 102b), grounded in 422/V.11 card.
7	7	GND		Ground (AB, 102)
22	22	RI	from Flexi-Data Card	Ring Indicator - always Off
18	18	LL	to Flexi-Data Card	Local Loopback - not used by Flexi-Data Card
21	21	RL	to Flexi-Data Card	Remote Loopback - not used by Flexi-Data Card
25	25	TM	from Flexi-Data Card	Test Mode - always Off

Notes:

1 - No connection to pins 1 or 26

2 - Use adapter cable No. 027H900. See *Figure 8*.

Table 5   X.21 Front Panel Connector and Adapter Cable Pinouts

26-Pin Pin No.	DB-15 Pin No.	X.21 Signal	Signal	Direction	Description
2	2	T(A)	TXD-A	to Flexi-Data Card	Transmit Data to the network
14	9	T(B)	TXD-B		
3	4	R(A)	RXD-A	from Flexi-Data Card	Receive Data from the network
16	11	R(B)	RXD-B		
4	3	C(A)	RTS-A	to Flexi-Data Card	Request to Send - On = local DTE sending data.
19	10	C(B)	RTS-B		
5			CTS-A	from Flexi-Data Card	Clear to Send. Not used for X.21.
13			CTS-B		
6			DSR	from Flexi-Data Card	Data Set Ready. Not used for X.21.
20			DTR	to Flexi-Data Card	Data Terminal Ready. Not used for X.21
8	5	I(A)	DCD-A	from Flexi-Data Card	Data Carrier Detect - Follows far-end RTS at subrates and normally On at 64 kbps. Can be forced On.
10	12	I(B)	DCD-B		
15			TXCLK-A	from Flexi-Data Card	Transmit Clock - interface clock at configured data rate. Not used for X.21.
12			TXCLK-B		
17	6	S(A)	RXCLK-A	from Flexi-Data Card	Receive Clock - interface clock at configured data rate, used to clock data to DTE, and to clock data
9	13	S(B)	RXCLK-B		from the DTE when configured for internal timing.
24	7	X(A)	EXTCLK-A	to Flexi-Data Card	External Clock - interface clock at configured data rate, used to clock data from DTE when configured
11	14	X(B)	EXTCLK-B		for external timing.
23			DCECOM		Ground (AC, 102b), grounded in 422/V.11 card.
7	8	G	GND		Ground (AB, 102)
22			RI	from Flexi-Data Card	Ring Indicator - always Off. Not used for X.21.
18			LL	to Flexi-Data Card	Local Loopback. Not used for X.21.
21			RL	to Flexi-Data Card	Remote Loopback. Not used for X.21.
25			TM	from Flexi-Data Card	Test Mode - always Off. Not used for X.21.

Notes:

1 - No connection to pin 1 or 26. No connection to DB15 pin 1 or 15.

2 - Use adapter cable No. 027H438. See *Figure 7*.

Compatibility

Flexi-Data option cards require a certain revision level of firmware on both the Flexi-Data basecard and on the Platform Card for correct operation. To check the firmware revision levels, go to the System Utilities screen on the Local Manager. Select `Card Revisions`. Read the firmware revision level of the Platform Card and the Flexi-Data Card under the `F/W` column. The revision level starts at -- and proceeds in the order A-, B-, C-, etc.

If a basecard is not in a slot, or an option card is not populated on a basecard, the card name will appear as `None` in the `Card Type` or `OptCrd` headings on the Card Revisions screen. If a basecard or option card is populated, but not supported by your Platform Card firmware, the card name will appear as `Unknown`.

If the firmware revision level of the Flexi-Data Card is not compatible with the Platform Card firmware revision level, a "`Communication Error`" message may appear. If this occurs, check that the Platform Card and/or the Flexi-Data Card have up-to-date firmware.

The Flexi-Data Card (MP6440 or MP6441) -- firmware is compatible with Platform Card -- firmware or later.

The Flexi-Data Card (MP6441) A- firmware or later (which is required to support 2.4, 4.8, 19.2 kbps data rates), requires Platform Card G- or later firmware.

The Flexi-Data Card (MP6441) B- firmware or later (which is required to support the 232 Async option card), requires Platform Card H- or later firmware.

Option Cards

422/V.11 Option Card

The 422/V.11 option card provides a single interface for connection to a customer DTE. This card supports synchronous data rates of 2.4, 4.8, 9.6, 19.2, 56, or 64 kbps.

The interfaces that are supported are X.21, EIA-530-A, and V.36. Different cables are used.

V.35 Option card

The V.35 option card (MP6440/V.35-1 or MP6441/V.35-2) provides a single interface for connection to a customer DTE. This card supports synchronous data rates of 2.4, 4.8, 9.6, 19.2, 56, or 64 kbps. The V.35 interface is supported.

Note   *The MP6440/V.35-1 and MP6441/V.35-2 are identical in functionality.*

EIA/TIA-232-E Async Option Card

The 232 Async Option Card provides a single interface for connection to a customer DTE. This card supports synchronous data rates of 2.4, 4.8, 9.6, 19.2, 56, or 64 kbps. This card also supports asynchronous data rates of 1.2, 1.8, 2.4, 4.8, 9.6, or 19.2 kbps. The 232 Async Option Card supports asynchronous character lengths (including start or stop bits) of 8, 9, 10, or 11 bits. When operating in asynchronous mode the interface is V.14 compliant.

Due to proprietary rate adaption of 1.2 kbps and 1.8 kbps to 2.4 kbps, another Metroplex FlexiData with 232 Async Option Card or 500A DSU is required at the receiving end to insure compatibility.

EIA/TIA-232-E Option Card

The EIA 232 option card (MP64401/232-1) is a previous version of the 232 Async Option Card that only supports synchronous data rates of 2.4, 4.8, 9.6, 19.2, 56, or 64 kbps.

Notes About Cable Length and Timing

Note that the EIA/TIA-232-E specifies rates up to only 20 kbps. To use the 232 Async card at 56 or 64 kbps, there are special considerations to take into account to ensure error-free data. You must keep the interconnecting cable between the DTE and the Flexi-Data Card short to minimize the cable capacitance. Cable capacitance causes extra delay in signal transitions, which is more important at higher data rates. This extra delay can cause data to be sampled at the wrong instant, causing data errors. The longest 027H900 (*Figure 8*) cable should be no more than 15 feet at 56 or 64 kbps.

Another consideration when operating at 56 or 64 kbps is to select the correct timing option for transmit data. You should set the `External Transmit Timing` selection to `On` in the Manager's Flexi-Data Configuration screen. Refer to Timing Options.

Refer to Local Management - 6 for Flexi-Data configuration options and default settings.

Installation of Option Cards

You can install one, two, three or four option cards. Option cards should be added starting at the bottom with Channel 1. This makes cabling easier.

Option cards plug onto the basecard using one or more connectors. The basecard connectors have socket (female) contacts and the option card connectors have pin (male) contacts. The connector housing has a small key located at pin 1 to prevent incorrect mating. These surface-mount, high-density connectors have fragile pins, so they must be handled carefully. Each option card also has four plastic snap-in standoffs which secure the card mechanically to the basecard. The standoffs have a locking end which remains in the option card, and a non-locking end which allows removal of the option card from the basecard. You must make sure that the option card is oriented and located correctly before attempting installation. One corner of each option card is notched to help in orientation, and also one standoff is offset to prevent incorrect installation.

Before handling a card, make sure that you are grounded with an ESD wriststrap, to prevent ESD damage to the card.

Orient the option card so that the notched corner is at the bottom right as shown in *Figure 1*. The basecard silkscreen has a notched outline of the option card to help in location and orientation. Place the option card over the basecard, locating the four standoffs over the corresponding holes in the basecard. Press the four corners of the option card firmly into place until the four standoffs snap into the holes.

To remove an option card, turn the basecard over and press down on each of the option cards standoffs to push the standoffs through the basecard holes. You can use a blunt object such as the end of a plastic screwdriver handle. Never use a sharp object or a metal object to do this, in order to avoid damage to circuit traces or components. When all four standoffs are free, the connectors unmate, allowing the option card to be lifted off easily.
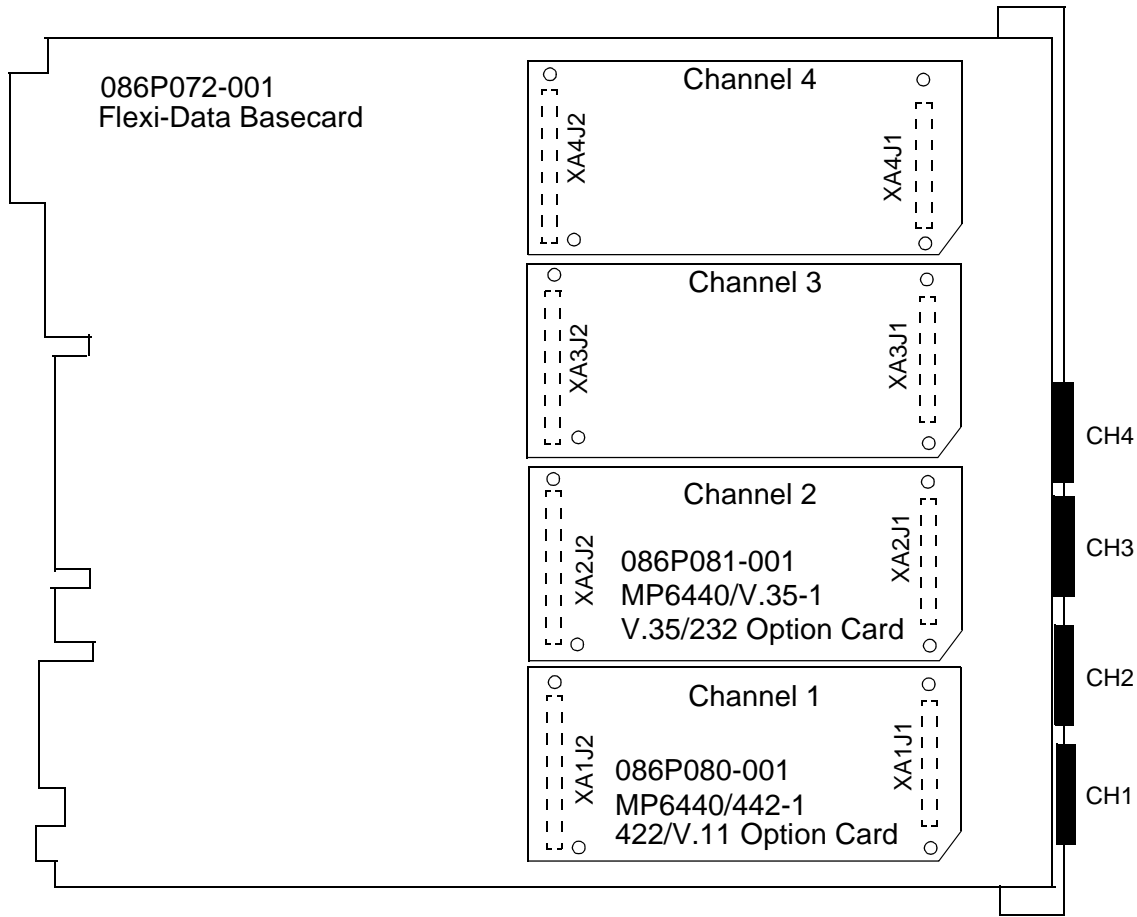
Figure 1   Flexi-Data Card

Installation of Basecard

Insert basecard (see *Figure 1*) into the card guides, pushing on the front panel until the backplane connector mates. Tighten the two captive screws at the top and bottom of the front panel.

To remove a card, loosen the top and bottom captive screws and pull the ring located near the top of the front panel.

Once you insert a card into a powered system (or when you first power the system up), the card will automatically perform a simple power-on self-test (POST). This test allows you to check the front panel LEDs by turning them red and then green; and it checks that the card's firmware checksum is correct. If the self-test passes, the ON LED is turned green; if the test fails, it remains red. The status is also reported in the Status column of the Manager's Monitor, Diagnostic, and Configuration Slot Selection screens. Since a channel card cannot access the backplane unless configured by the Platform Card, the power-on self-test does not check the data path through the card.

If you are installing a new card in a system, perform a complete self-test on the card by going to the Manager's Diagnostics screen for that card and selecting Card Selftest. The Platform Card then configures the card with a test configuration, performs a ToNet loopback on the card, and sends a test pattern across the backplane to the card, where it is looped back to the Platform Card and checked for errors.   Both the data and signaling paths are tested. The result of the self-test is reported on the Diagnostics screen.

Note that you can run a self-test on all of the cards in the system by selecting `Shelf Self-Test` in the Diagnostic Slot Selection screen.

Connect a terminal to the TERM port of the Platform Card and configure the Flexi-Data Card. Refer to *Local Management - 6*.

Application Information

The Flexi-Data Card along with its option cards is fully compatible with North American T1 and DDS standards. It may also be used in a E1 environment for 64 kbps clear channel data, or for DDS-formatted sub rate data. DDS loopback codes are not available from an E1 network. Note that Flexi-Data A- firmware or later is required for correct operation of 9.6 kbps in an E1 environment.

DDS Data Transport and Loopbacks

2.4, 4.8, 9.6, 19.2, and 56 kbps

At 2.4, 4.8, 9.6 19.2, and 56 kbps, the data channel is either in data mode or control mode. The 'C' bit (LSB of the timeslot) is used to determine the mode. In data mode, the 'C' bit is set to 1 and the other bits are used for customer data. In control mode, the 'C' bit is set to 0 and the other bits are used to convey control codes or control information.

At 2.4, 4.8, 9.6. 19.2, and 56 kbps, the 'C' bit is used to map the status of the local RTS control lead to the remote DCD control lead. When the local RTS control lead is On, the local channel is put into data mode and the 'C' bit = 1. The Tx LED is Green on the local channel. At the remote end, 'C' bit = 1 turns DCD On and the Rcv LED of the remote channel is Green. When RTS is turned Off, the local channel is put into control mode and transmits all one's in the data bits with the 'C' bit = 0. The Tx LED is turned Off on the local channel. At the remote end, 'C' bit = 0 turns DCD Off and the Rcv LED of the remote channel is turned Off.

At 2.4, 4.8, 9.6, 19.2, and 56 kbps, the network can perform a loopback by setting the 'C' bit = 0 and sending a loopback code in place of the data. These are called non-latching loopbacks. The loopback code is repeated and once the minimum amount of codes are detected on the Flexi-Data channel, the loopback is started. Then the network switches from sending repetitive control codes to sending alternate test pattern/control code. To terminate the loopback, the network drops the control code, and the loopback is taken down.

Switched 56 kbps service operates by using the 'C' bit in a similar manner to a voice channel's robbed-bit signaling. The 'C' bit is used to indicate the busy/idle status of a channel and to dial the number of the destination. Dial pulses on the RTS control lead are used to control dial pulsing on the 'C' bit.

64 kbps Rate

At 64 kbps the channel is a clear channel and there is no distinction between data mode or control mode. All eight bits of the timeslot are used to transmit customer data. The state of RTS is not used to control DCD at the remote end. The Rcv/Tx LEDs correspond simply to the channel's online/ offline status. The network can perform a loopback by sending a pseudo-random pattern in place of the serial data to the channel. The Flexi-Data channel detects the codes in the data and latches or starts the loopback. This is called latching loopback. With the loopback active, the network switches to test pattern data to test the channel. To terminate the loopback, the network sends another pseudo-random pattern which the Flexi-Data channel detects and unlatches or stops the loopback.

You can disable latching loopbacks in the Flexi-Data configuration screen.This will prevent the accidental occurrence of a loopback in the unlikely event of the loopback code being imitated by customer data.

Control Leads

RTS - Request To Send - Input from DTE. When RTS is On, the DTE is sending data. The state of RTS is passed over the channel as the DDS C-bit and is used to control the state of DCD at the far end, at all rates except for 64 kbps, when there is no C-bit and DCD is normally Off.

CTS - Clear To Send - Output to DTE. Normally follows the state of RTS. CTS is turned Off during a ToNet loopback on the channel card. Can be forced On, in which case RTS is ignored and the C-bit is set to 1, turning On DCD at the far end, at all rates except 64 kbps.

DSR - Data Set Ready - Output to DTE. Normally On, except when during a ToNet loopback on the channel card. Can be forced On so that it remains on even during the loopback.

DCD - Data Carrier Detect - Output to DTE.

At 1.2, 1.8, 2.4, 4.8, 9.6, 19.2, and 56 kbps rates (synchronous or asynchronous): DCD normally follows the state of the far end's RTS control. If the far end's CTS control is forced On, then DCD will be On. DCD is turned Off during a ToNet loopback or during a network alarm. DCD can be forced On.

At 64 kbps rate: DCD is normally On except during a ToNet loopback or during a network alarm. DCD can be forced On.

Timing

There is one timing option for the Flexi-Data Card. In the Flexi-Data configuration screen, you can turn `External Transmit Timing Off` or On. See *Figure 2*.

`Off` (default): When `External Transmit Timing` is set to `Off`, Transmit Data (TXD) from the DTE is clocked into the Flexi-Data Card using the Flexi-Data's own Transmit Clock (TXC) signal. TXC is derived from the Metroplex™ 6000 system (or backplane) timing.

`On`: When `External Transmit Timing` is set to `On`, Transmit Data from the DTE is clocked into the Flexi-Data Card using the External Timing signal from the DTE. The DTE must provide a timing signal on the External Timing lead, and this signal must be loop timed from the Transmit Clock from the Flexi-Data Card. You cannot use an External Timing lead from DTE equipment as a source of timing for the Metroplex™ 6000. When you select `External Timing On`, the DTE must be loop timed, and not act as a source of timing. Note that some DTE equipment does not provide an External Timing lead. Also, external timing is not supported in asynchronous mode.
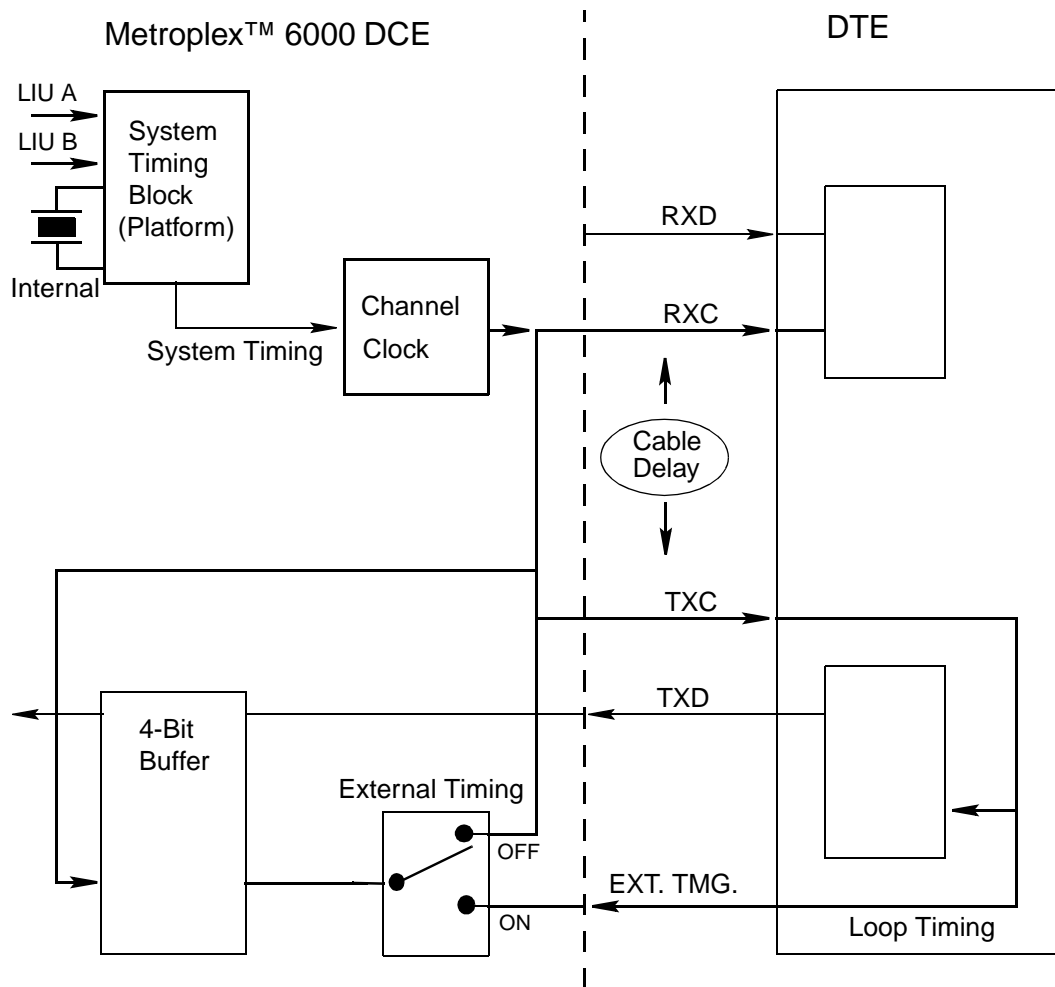
Figure 2   Flexi-Data Timing

Receive Timing

Receive data (RXD) from the network is synchronously clocked out of the Flexi-Data Card towards the attached DTE using Receive Clock (RXC). RXC is always derived from the Metroplex™ 6000 system (backplane) timing, which in turn is derived from the network timing on LIU A or LIU B, or from an internal clock on the Platform Card. See *Figure 2*. The DTE clocks in Receive Data using RXC.   Note that RXD and RXC travel in the same direction in the cable. All DTE equipment that follows the EIA-530A, V.35 or X.21 standards operates this way with receive timing.

Transmit Timing

Timing for Transmit Data is a little more complex. Since the timing for a DCE/DTE interface generally comes from the DCE (Data Communications Equipment) side, Transmit Clock (from the DCE) and Transmit Data (from the DTE) are going in opposite directions. See *Figure 2*.

The DCE equipment outputs a Transmit Clock (TXC), one edge of which tells the DTE to send a new data bit.   The Flexi-Data Card's TXC is always derived from the system timing, similar to RXC. The other edge of TXC is normally used to clock Transmit Data in to the DCE (internal transmit timing). However, this sometimes causes problems.   At high data rates (more than 64kb/s) and/or with long cables (which introduce propagation delay, and for EIA/TIA-232-E causes

slower signal transitions), the round-trip delay of TXC and TXD can approach half of a bit period, which may cause incorrect sampling of TXD, causing bit errors.   One solution for this problem is to have the DTE loop the TXC signal from the DCE and send it back to the DCE as External Timing. The DCE, optioned for External Timing, then uses the External Timing signal to clock in the transmit data. Since data and timing are now travelling in the same direction between equipments, this is similar to a co-directional interface and propagation delays in the cable are cancelled out. This timing method is sometimes referred to as 306 or Station Timing.

Equipment Limitations

Some DTE equipment does not provide an External Timing lead. Since the V.35 specification did not specify an External Timing Lead, some V.35 implementations do not provide it. When it is provided, it is provided on pins U and W according to ISO 2593, the V.35 connector specification. Also, the X.21 specification specified the DTE Signal Timing Element lead as optional, so it may not always be provided.

Crossover Cable

If a crossover cable is used to connect the Flexi-Data Card to a tail-circuit modem, External Timing should be selected for both the Flexi-Data Card and the near end modem, and the far-end modem must be loop timed.   The crossover cable crosses over the RXC and External Timing leads, as well as the Transmit and Receive Data leads and various control leads. The Transmit Clock lead is not used.

Diagnostics

Figure 3 through *Figure 4* illustrates loopback tests that you may perform from the Manager or the Network.

Card Self-test

Select `Card Selftest` on the Manager's Flexi-Data Diagnostics screen. The Platform Card generates a test pattern which it sends in turn to each channel of the Flexi-Data Card.   Each channel is looped back and the Platform Card checks for the correct return of the pattern. This self-test tests the data and signaling paths and verifies the integrity of the Flexi-Data Card and backplane. The pass or fail results are displayed on the screen.

Manager-Initiated - ToDTE Loopback

1.   Connect external test equipment (to generate and detect the test pattern) at the 26-pin front panel connector (for the desired channel). See *Figure 3*.

2.   From the Manager, select `ToDTE` on the Flexi-Data Diagnostics screen. This loops the signal from the test equipment back to the test equipment.

3.   The front panel transmit and receive LEDs lights red for the channel under test indicating the loopback. This loopback test verifies the integrity of the option card and the cable.

DCD, and DSR on the channel interface are forced on by this loopback, CTS is not affected. The transmit data to the network is marked.
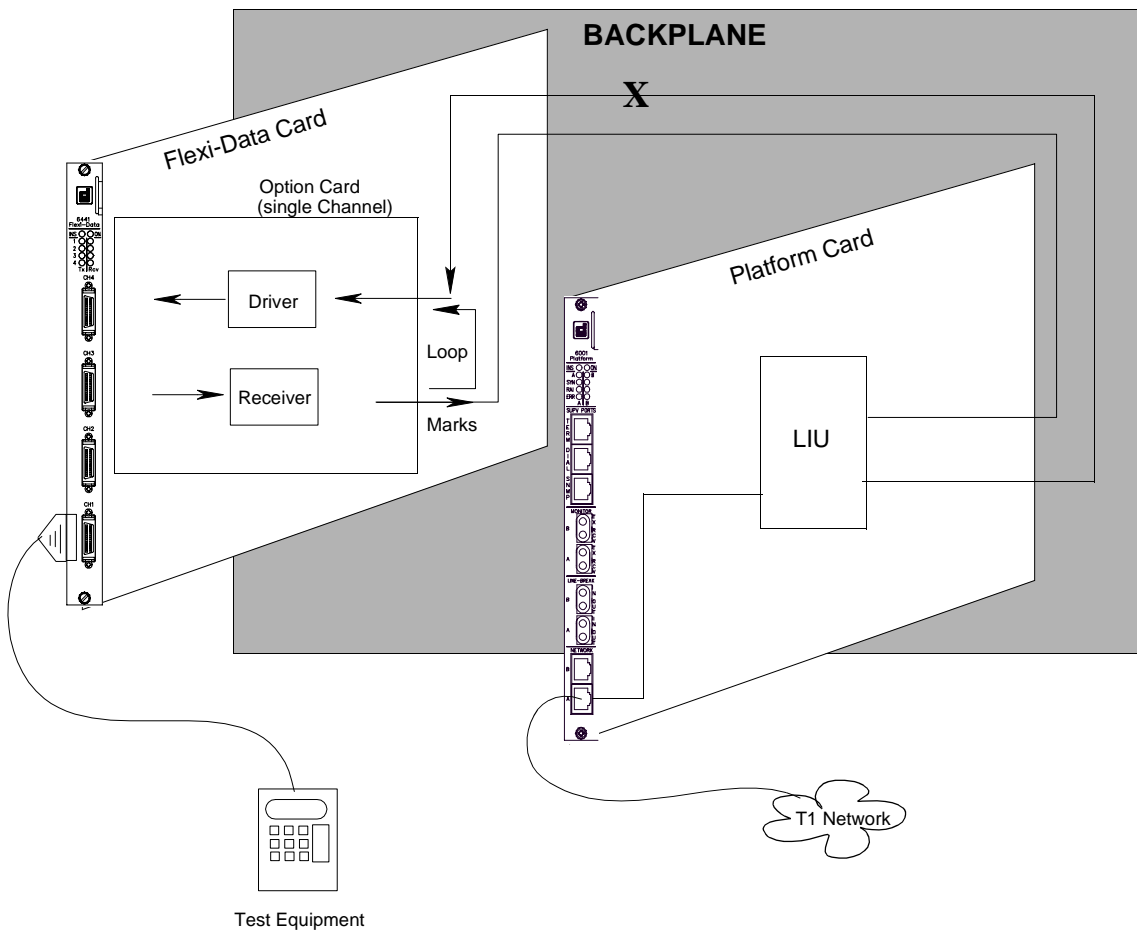
Figure 3   Manager-initiated ToDTE Loopback (Any of 4 Channels)

Manager-Initiated - ToNet Loopback

1. Connect external test equipment (to generate and detect the test pattern) at the Platform Card NETWORK jack. See *Figure 4*.

2. From the Manager, select `ToNet` on the Flexi-Data Diagnostics screen. This loops the signal from the test equipment back to the test equipment.

3. The front panel transmit and receive LEDs lights red for the channel under test indicating the loopback. This loopback verifies the integrity of the Platform Card, LIU, backplane and Flexi-Data basecard, but not the option card or the Flexi-Data cables.

DCD, CTS, and DSR on the channel interface are all set to Off during this loopback when the channel is configured for DCD: Normal, CTS: Switched, DSR: Normal. The receive data to the DTE is marked.
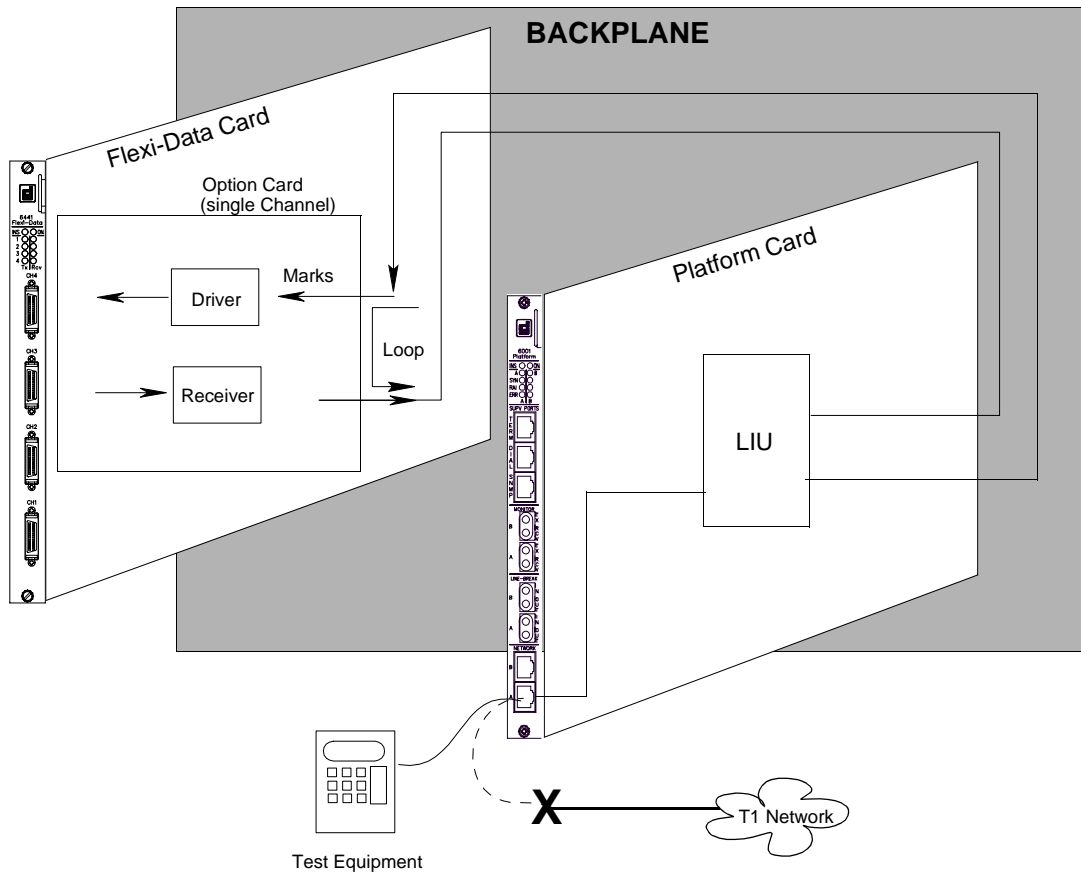
Figure 4   Loopback Towards Network (Any of 4 Channels)

Network-Initiated Loopback

The Flexi-Data Card responds to all standard DDS loopback codes, according to AT&T Pub. 62310. The loopback is performed at the same location as for the ToNet manager-initiated loopback. See *Figure 5*.

Test equipment at the Serving Test Center (STC) will send the correct codes.

At 2.4, 4.8, 9.6, 19.2, or 56 kbps, the Flexi-Data Card responds to non-latching OCU, CSU and DSU loopback codes.

At 64 kbps, the Flexi-Data Card responds to latching OCU, CSU and DSU loopback codes.

DCD, CTS, and DSR on the channel interface are all set to Off during these loopbacks when the channel is configured for DCD: Normal, CTS: Switched, DSR: Normal. The receive data to the DTE is marked.
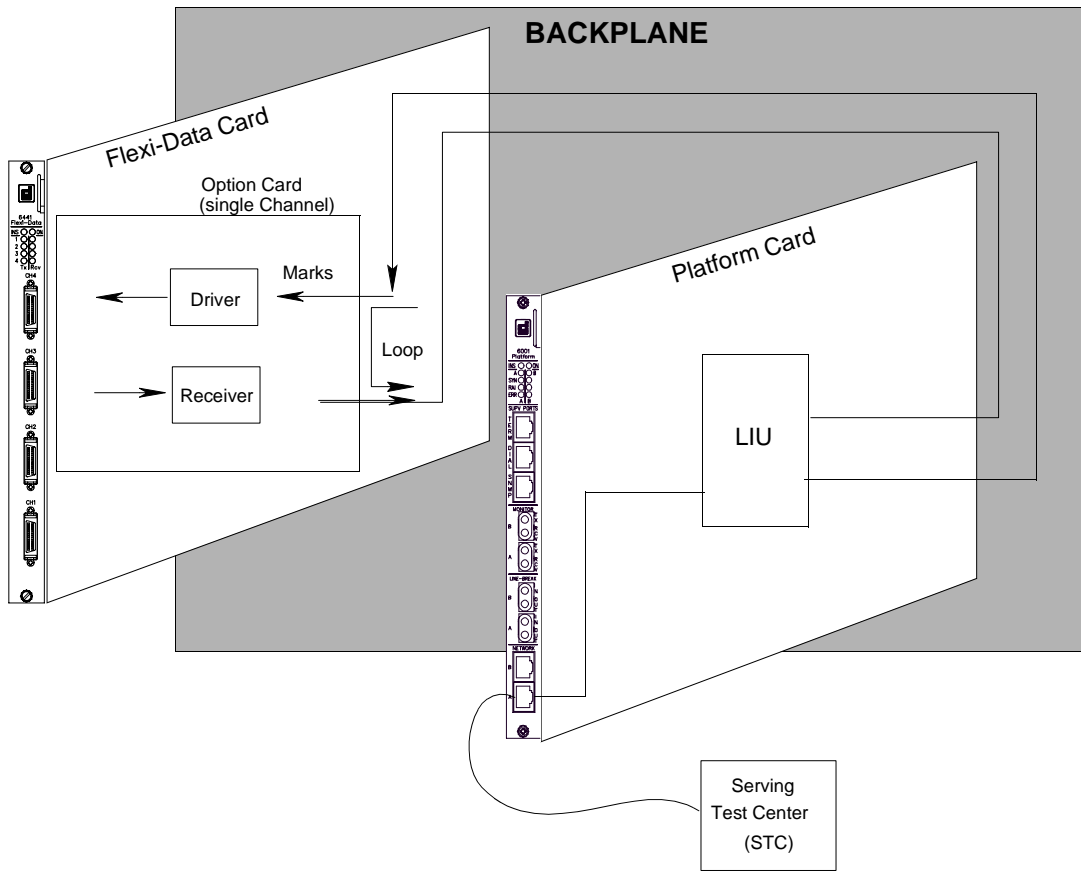
Figure 5   Network-Initiated Loopback

Pinouts

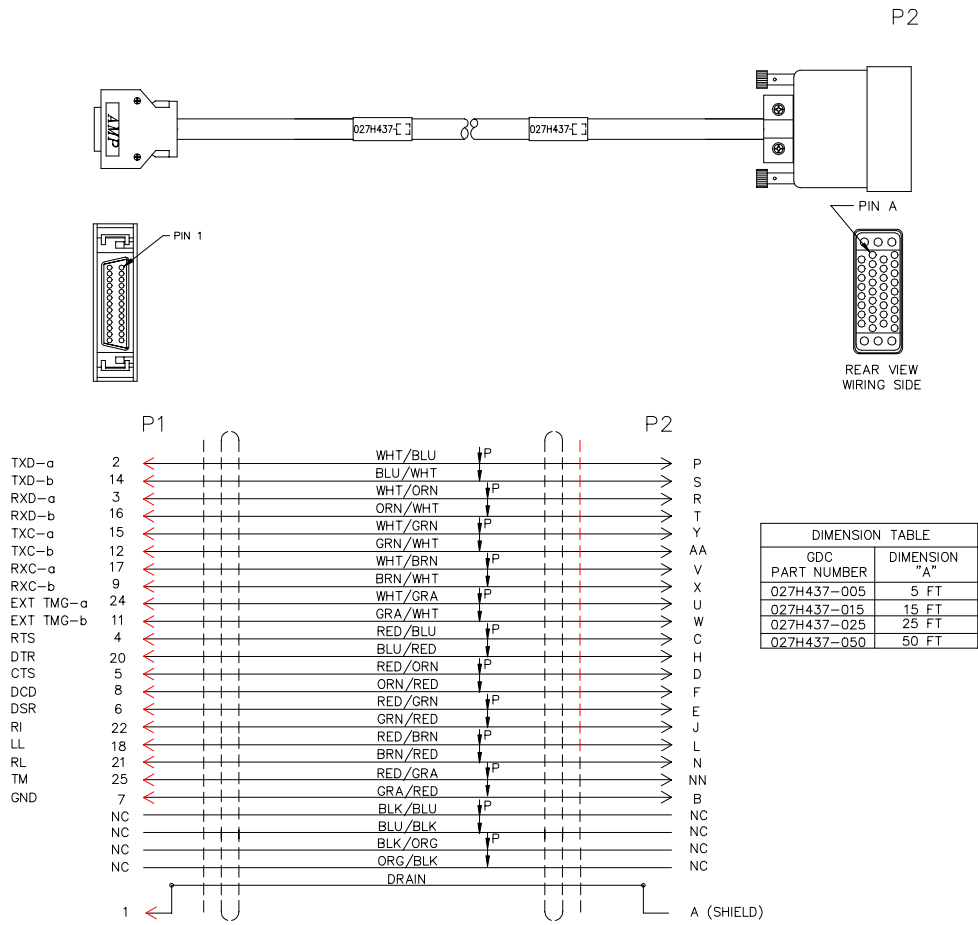*Figure 6 through 8* illustrates and describes the cables and associated pinouts used with the Flexi-Data Card.

Figure 6   Cable No. 027H437 - 26-Pin Male to V.35 Male (use with V.35 option card)
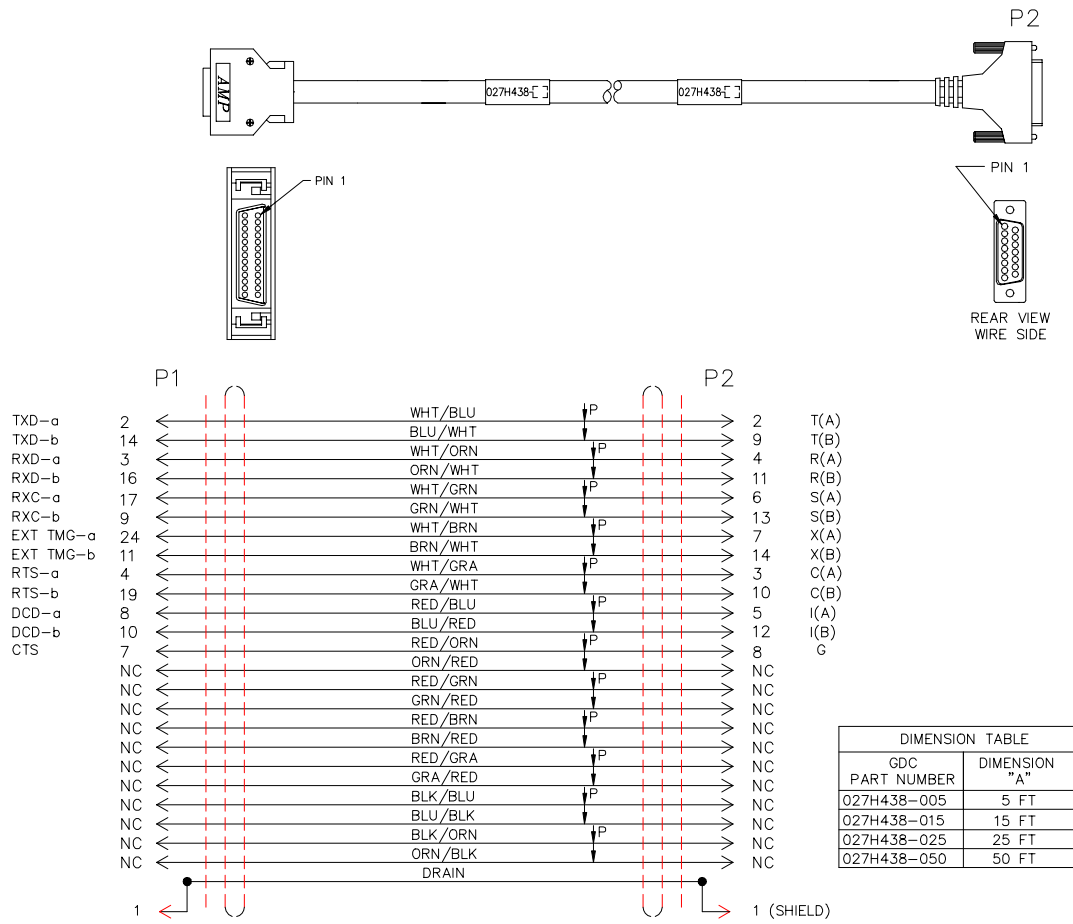
Figure 7   Cable No. 027H438 - 26-Pin Male to DB15 Male (use with 422/V.11 option card
for X.21 Interface)

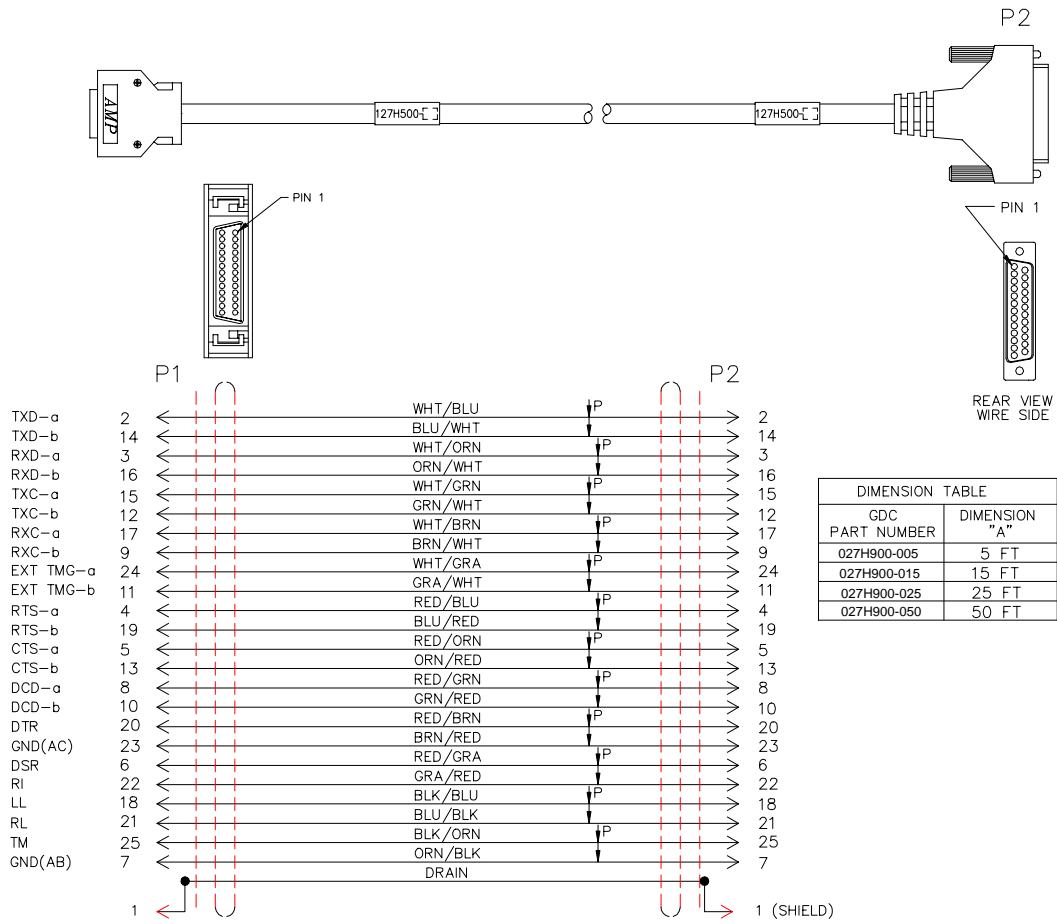| DIMENSION TABLE	
GDC PART NUMBER	DIMENSION "A"
027H900-005	5 FT
027H900-015	15 FT
027H900-025	25 FT
027H900-050	50 FT

Figure 8   Cable No. 027H900 - 26-Pin Male to DB25 Male (use with EIA232 or 232 async option cards for EIA/TIA-232-E or with 422/V.11 option card for EIA/TIA-530-A)
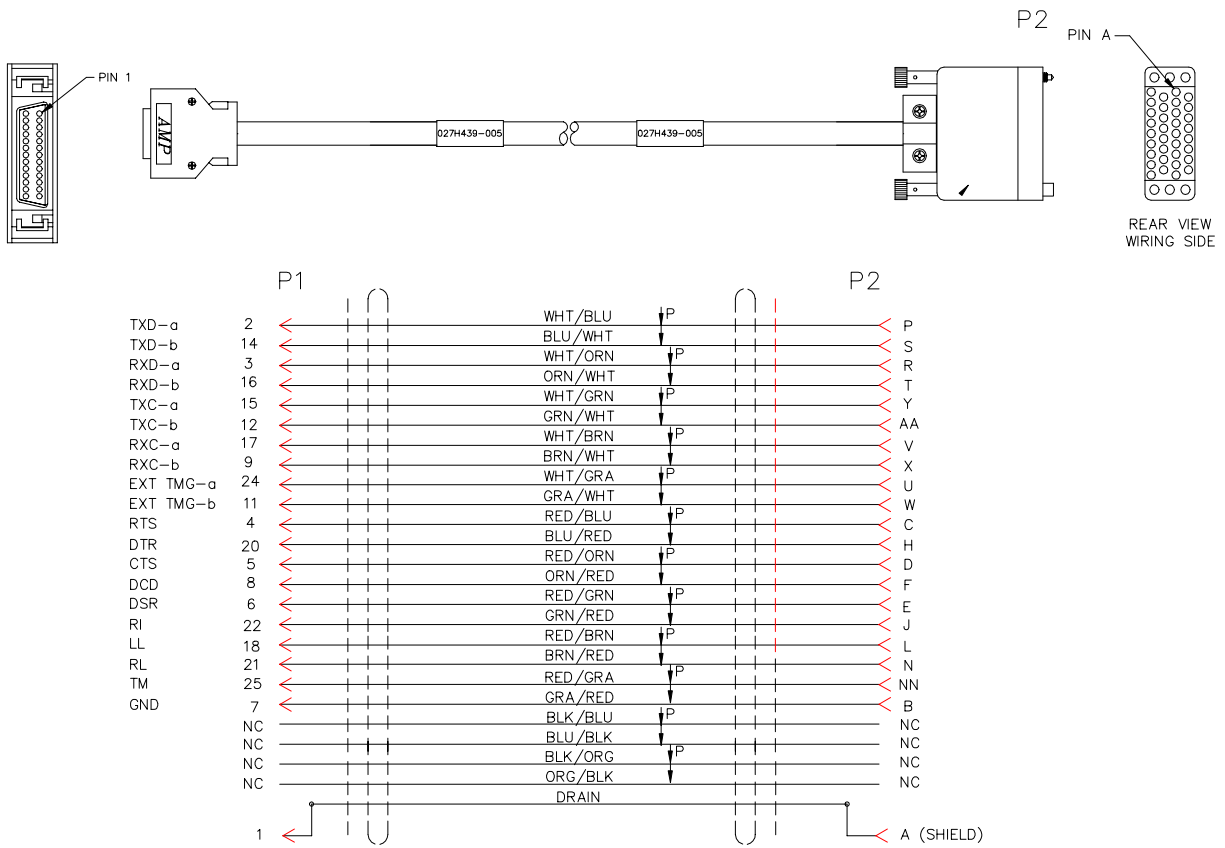
P2

PIN A

PIN 1

AMP

027H439-005   027H439-005

REAR VIEW
WIRING SIDE

P1   P2

Signal	Pin	Wire		Pin
TXD-a	2	WHT/BLU	P	P
TXD-b	14	BLU/WHT		S
RXD-a	3	WHT/ORN	P	R
RXD-b	16	ORN/WHT		T
TXC-a	15	WHT/GRN	P	Y
TXC-b	12	GRN/WHT		AA
RXC-a	17	WHT/BRN	P	V
RXC-b	9	BRN/WHT		X
EXT TMG-a	24	WHT/GRA	P	U
EXT TMG-b	11	GRA/WHT		W
RTS	4	RED/BLU	P	C
DTR	20	BLU/RED		H
CTS	5	RED/ORN	P	D
DCD	8	ORN/RED		F
DSR	6	RED/GRN	P	E
RI	22	GRN/RED		J
LL	18	RED/BRN	P	L
RL	21	BRN/RED		N
TM	25	RED/GRA	P	NN
GND	7	GRA/RED		B
NC		BLK/BLU	P	NC
NC		BLU/BLK		NC
NC		BLK/ORG	P	NC
NC		ORG/BLK		NC
		DRAIN		
	1			A (SHIELD)

Figure 9   Cable No. 027H439-005 - 5 foot - 26-Pin Male to V.35 Female (use with V.35 option card)
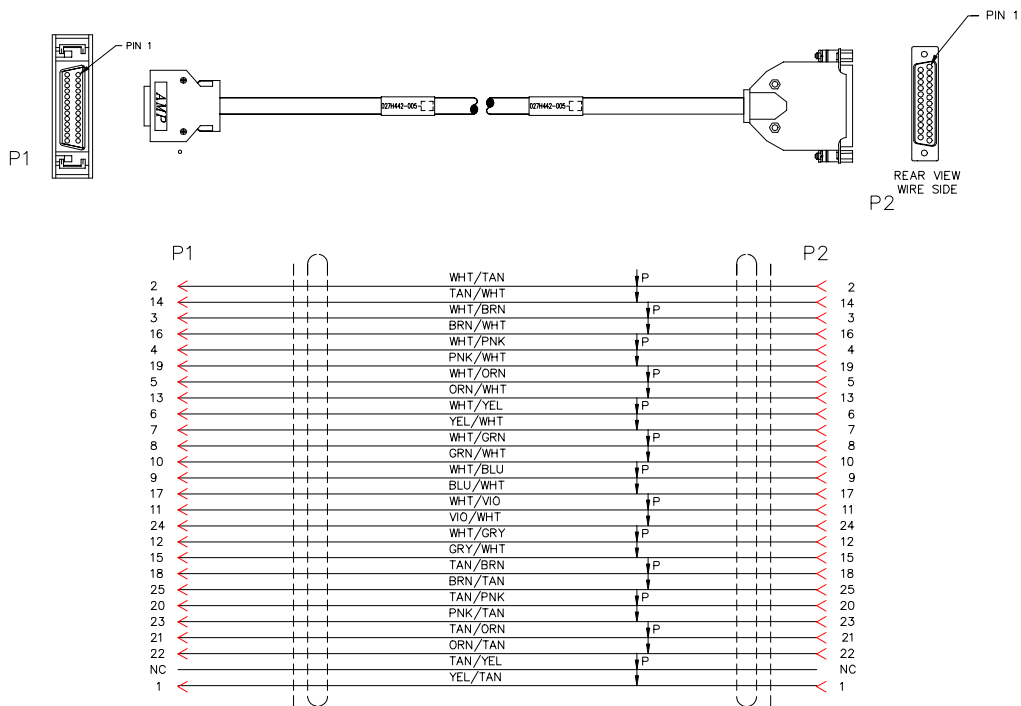
Figure 10   Cable No. 027H442 - 26-pin male Alt to DB25 female, shielded

Specifications and Parts List

The specifications and parts list for the Flexi-Data Card are found in *Table 6*.

Table 6   Specifications and Parts List

Physical	
Card Assembly	
Height	10.4 in. (264 mm)
Width	0.85 in. (22 mm)
Depth	10.75 in. (273 mm)
Weight	1 lb. (0.54 kg)
Temperature	
Operating	0-50 °C (32 to 122 °F) (derate by 1 C/1000 ft above sea level)
Non-operating	-40 to 85 °C (-40 to 185°F)
Humidity	
Operating	0% to 95%, without condensation
Altitude	
Operating	0 to 10,000 ft (0 to 3,048 m)
Non-operating	0 to 40,000 ft (0 to 12,192 m)
Electrical	
Power Requirements	Power may be either 22 VAC, -24 VDC, or -48VDC
Power Dissipation	10W maximum
Fusing	One 3.0A, 125V, SB (GDC Part No. 215-311W300)
Channel Interface	
Optional	EIA/TIA-232-E
Optional	V.35
Optional	X.21, EIA-530A, V.36
Data Rates	Synchronous - 64, 56, 19.2, 9.6, 4.8, or 2.4 kbps
	Asynchronous - 19.2, 9.6, 4.8. 2.4, 1.8, or 1.2 kbps.
Diagnostics	
Manager-initiated	ToDTE loop or ToNet loop
network-initiated	OCU, CSU and DSU non-latching loop (at 2.4/4.8/9.6/19.2/56 kbps), OCU, CSU and DSU latching loop (at 64 kbps)
Physical Interface	26-pin high-density (CH1 - CH4)
Item	**Part No.**
Flexi-Data Basecard MP6441	086P072-001
422/V.11 Option Card MP6440/422-1	086P080-001
V.35 Option Card MP6440/V.35-1	086P081-001
V.35 Option Card MP6441/V.35-2	086P082-001
EIA 232 Option Card MP6440/232-1	086P081-002
232 Async Option Card MP6441/232-2	086P082-002
Cables	
26-pin male Alt A to V.35 male, shielded (use for V.35)	027H437-005, -015, -025, -050

Table 6   Specifications and Parts List (Continued)

26-pin male Alt A to V.35 female, shielded	027H439-005
26-pin male Alt A to DB25 female, shielded	027H442-005
26-pin male Alt A to DB15 male, shielded (use for X.21)	027H438-005, -015, -025, -050
26-pin male Alt A to DB25 male, shielded (use for EIA232, EIA530-A)	027H900-005, -015, -025, -050