



Data Connect - Installation, Operation

for the

MD202T

**Industrial Grade, Bell 202T
Rackmount Modem**

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1. STANDARDS

Meets FCC Rules Part J, Subpart 15, Class A for radiated emissions.

2. PRODUCT OVERVIEW

The DCE **MD202T** is an industrial grade Bell 202T modem for connection to unconditioned and conditioned, voice grade, type 3002 two or four-wire leased lines and metallic lines (eg: pilot wires). It can be powered from a wide range of AC and DC power supplies, it is internally surge protected on both the power and analog lines, and it will operate in temperatures from -40 to +85 °C.

Internally, the MD 202T consists of a **baseboard** and a **communication module**. The **baseboard** includes the power supply regulation and surge protection. The **communication module** is a Telenetics **Pony Express PE202T** Modem Module.

The MD202T is packaged specifically for the harsh environments found in utility substations and industrial facilities. Though functionally similar to commercial modems, the MD202T includes special features that make it particularly well suited for utility and industrial applications:

Environment: The MD202T has been designed specifically for use in harsh environments. In addition to an extended temperature range (-40 to +85° C), the MD202T includes surge, shock, vibration, and safety features superior to those of conventional commercial modems.

Power Supply: The MD202T is powered by a 5V logic power supply through a Data Connect MDR chassis.

3. GENERAL PRODUCT SPECIFICATIONS

Surge Protection:	Power Supply:	8kVrms
	Analog Line:	3.75kVac
	Digital Line:	ESD \pm 10kV
Operating Temperature:		-40 to +85 °C
Operating Humidity:		0 to 90% (non-condensing.)
Storage Temperature:		-55 to 100 °C

4. MODEM SPECIFICATIONS

Modulation:	Bell 202T
Modulation Type:	FSK
Synch/Async:	Asynchronous Only
Data Rate:	0 – 1200bps
Transmit Frequency:	Mark: 1200Hz Space: 2200Hz
Error Correction:	None
Data Compression:	None
Data Modulation Connectivity:	Using 16ms Polling Test
	99.999% or better at -37dBm
	99.5% or better at -40dBm
	95% or better at -43dBm

Serial Formats and Flow Control:

Asynchronous and RTS/CTS flow control

Analog Interface

Tx Output Level:	-0 dBm or -10 dBm *
Rx Sensitivity:	-43dBm or -33dBm *
	-43dBm for constant carrier
	-40dBm for polling carrier
Line Termination:	Dip Switch Selectable *
Line Impedance:	600 ohms balanced
2 or 4 Wire Configuration:	Dip Switch Selectable *

Other Features

Receiver Equalization:	Compromise Equalization
Self Test Diagnostics:	None
Local Analog Loopback:	See Section 13
Local Digital Loopback:	See Section 13
Remote Analog Loopback	See Section 13
Remote Digital Loopback	See Section 13
Anti-Streaming:	OFF or 45 Seconds (± 5 sec) *
RTS/CTS delay:	1ms, 12ms, 35ms or 50ms ($\pm 5\%$) *
	Note: Soft Carrier will effect RTS/CTS delay time (see Dip Switch Settings ~ Section 8)
Constant Carrier	Switch Selectable ON or OFF
Soft Carrier Turn Off	20ms of 900Hz after RTS is turned Off
Carrier Turn ON/OFF	8ms ± 0.5 ms

* Dip Switch Selectable ~ See Section 9

5. ANALOG LINE SPECIFICATIONS

The MD202T contains analog circuitry for connection to the public conditioned or unconditioned, Bell type 3002, 2 or 4-wire, full duplex voice grade leased lines or metallic lines (eg; pilot wires). The MD202T will also interface to Power Line Carrier or Microwave radio voice channel networks.

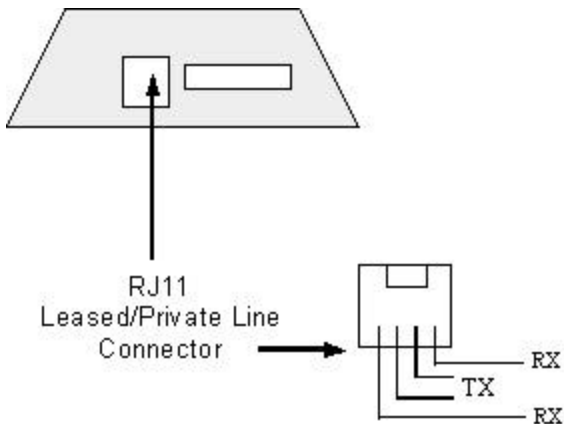
The MD202T has an RJ-11 terminated connector. The following lists the MD202T analog interfaces

Analog Line Type:

Conditioned or unconditioned, Bell type 3002, 2 or 4-wire, full duplex voice grade or metallic lines or better.

Analog Line Specifications:

Bandwidth	300 Hz to 3400 Hz (± 3 dB)
Impedance	600 / 900 ohms , balanced
Frequency Response	400 to 3000Hz (± 2 dB)
Receiver Input Level	-16dBm max.
Output Level	+7 dBm
Noise Signal Level	-48 dBmO



6. ANALOG MICROWAVE INTERFACE

The MD202T is designed to interface to a Microwave radio voice channel network with the following specifications:

Phase Jitter (10 to 300Hz) 1 degree peak-to-peak, max.

Frequency Response: 300 - 3400Hz -3, +0.7 dB
 400 - 3000Hz -1, +0.7 dB
 600 - 2400Hz \pm 0.7 dB

Frequency Stability: With Synchronization 0.1 Hz
 Without Synchronization 0.5 Hz / month

Level Stability (w/o regulation): \pm 0.5 dB (6 months)

Harmonic Distortion: 1% max, 0.3 % typical
 (1Khz, 0 dBmO test tone)

Absolute Delay: Option – 001: 1500 μ sec, maximum
 Option – 002: 1900 μ sec, maximum

Group Delay (option - 001): 600 - 3200 Hz 1200 μ sec, maximum
 800 - 2800 Hz 550 μ sec, maximum
 1000-2600 Hz 350 μ sec, maximum

Group Delay (option - 002): 600 - 3200 Hz with 1000 μ sec, maximum
 800 - 2800 Hz with 400 μ sec, maximum
 1000-2600 Hz with 180 μ sec, maximum

Linearity: 0.3 dB +3.5 dBmO

Limiting: +7.5dBmO, max (+6.5 dBmO typical)
 for +20dBmO input

Crosstalk (intelligible)(1KHz test tone at 0 dBmO):

Inter-channel 65 dBmO maximum, 80 dBmO typical
Intra-channel 70 dBmO maximum

Crosstalk (unintelligible):

Adjacent channel 28dBmC0 maximum (24 455B weighted noise at 0 dBmO dBmC0 typical).

Intra-channel 28 dBmC0, maximum (18 dBmC0, typical)
(1KHz test tone at 0 dBmO)

Out of Band Signalling: Frequency 3825 Hz

Level -20 dBmO

Pulse speed (30 to 80% break) 8 to 14 pps

Pulse distortion ± 3 dB, level var. 3% max.

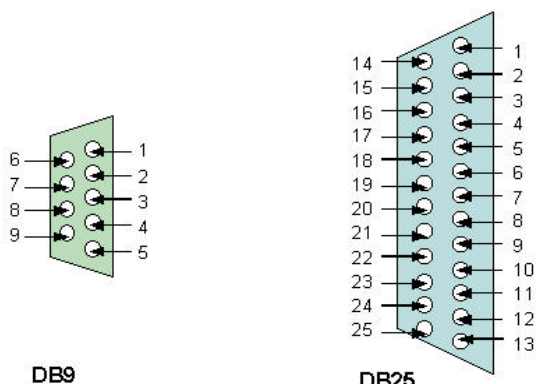
Signaling leak -60 dBmO, maximum

8. SERIAL DATA PORT PIN-OUTS

RS232C is the most commonly used serial data interface and defines the Physical, Functional and Electrical boundaries between two or more communicating devices

~ D-SHAPED SERIAL PORT CONNECTORS ~

are usually used to interconnect DTEs (computers, controllers, etc.) and DCEs (modems, converters, etc.)

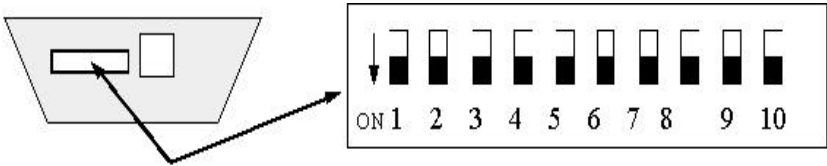


DB9

Pin	Signal	Pin	Source
1	CD - Carrier Detect	8	MODEM
2	RXD - Receive Data	3	MODEM
3	TXD - Transmit Data	2	TERMINAL
4	DTR - Data Term'I Ready	20	TERMINAL
5	Signal Ground	7	N/A
6	DSR - Data Set Ready	6	MODEM
7	RTS - Ready to Send	4	TERMINAL
8	CTS - Clear to Send	5	MODEM
9	RI - Ring Indication (Dial Modems Only)	22	MODEM

DB25

9. DIP SWITCH FUNCTIONS



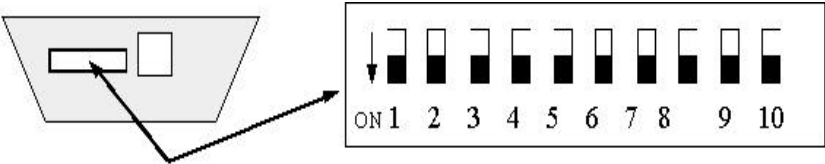
IMPORTANT NOTE: Invert modem to view dip switches as shown above

Table 1

Switch	Function	ON	OFF
Switch 1	Transmit Analog (TxA) Signal Level	0 dBm	-10 dBm
Switch 2	Anti-Streaming	45 secs	OFF
Switch 3	Received Analog (RxA) Signal Level	-33 dBm	-43 dBm
Switch 4	RTS/CTS Delay	See Table 2	
Switch 5	RTS/CTS Delay	See Table 2	
Switch 6	Switched/Constant Carrier	Constant Carrier	Switched Carrier (Follows RTS State)
Switch 7	2 or 4- Wire Selection	2-Wire	4-Wire
Switch 8	Line Termination	600 ohms	None
Switch 9	Soft Carrier (900Hz) Turn Off	ON	OFF
Switch 10	Spare		

Table 2: RTS/CTS Delay Time

2 Wire	4 Wire	Switched Carrier	Constant Carrier	Switch 4	Switch 5	Switch 9 Soft Carrier	RTS/CTS Delay Time
NO	YES	YES	YES	ON	ON	OFF	50 ms
YES	NO	YES	NO	ON	ON	ON	50 ms
NO	YES	YES	NO	ON	ON	ON	50 ms
YES	NO	YES	NO	ON	ON	OFF	50 ms
NO	YES	YES	YES	OFF	ON	OFF	35 ms
NO	YES	YES	NO	OFF	ON	ON	55 ms
YES	NO	YES	NO	OFF	ON	ON	35 ms
YES	NO	YES	NO	OFF	ON	OFF	35 ms
NO	YES	YES	YES	ON	OFF	OFF	12 ms
NO	YES	YES	NO	ON	OFF	ON	35 ms
YES	NO	YES	NO	ON	OFF	ON	12 ms
YES	NO	YES	NO	ON	OFF	OFF	12 ms
NO	YES	NO	YES	OFF	OFF	OFF	1 ms
NO	YES	YES	NO	OFF	OFF	OFF	12 ms
NO	YES	YES	NO	OFF	OFF	ON	32 ms
YES	NO	YES	NO	OFF	OFF	OFF	1 ms
YES	NO	YES	NO	OFF	OFF	ON	1 ms



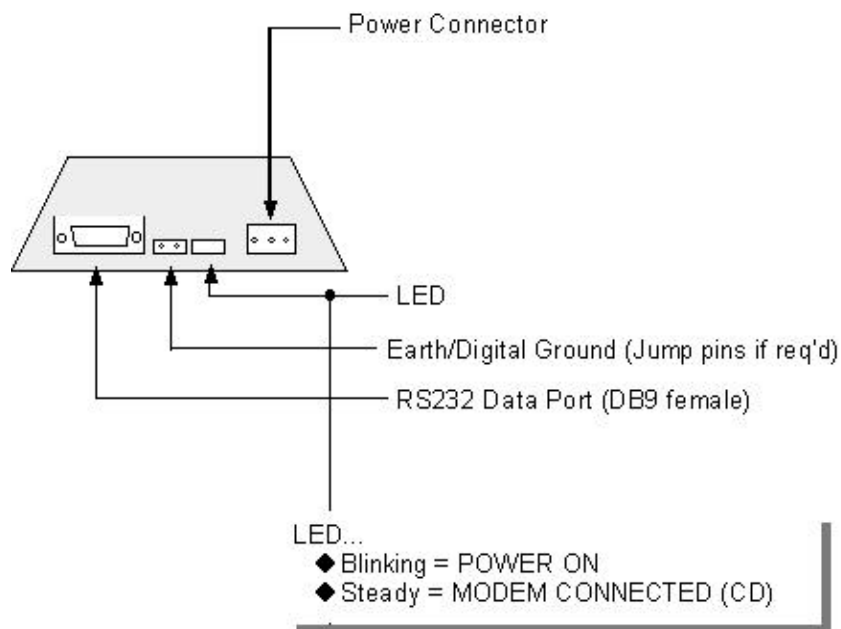
10. MODEM CONFIGURATION

The following table provides the Dip Switch settings required for most modem application configurations:

	Dip Switch Setting								
	1	2	3	4	5	6	7	8	9
4-Wire Point-to-Point	ON		ON			ON		ON	
4-Wire Multi-Point Master	ON		ON			ON		ON	
4-Wire Multi-Point Slave Rx Term. OFF	ON	ON	ON	ON					ON
4-Wire Multi-Point Slave Rx Term. ON	ON	ON	ON	ON				ON	ON
2-Wire Point-to-Point	ON	ON	ON	ON			ON	ON	ON
2-Wire Multi-Point Master Line Term. ON	ON	ON	ON		ON		ON	ON	ON
2-Wire Multi-Point Slave Line Term. ON	ON	ON	ON		ON		ON	ON	ON
2-Wire Multi-Point Slave Line Term. OFF	ON	ON	ON		ON		ON		ON

For clarity, a blank space = OFF

11. LED INDICATOR



13. DIAGNOSTICS

The following pages provide hardware techniques for diagnosing communication problems and thereby isolating the problem at the local modem, the remote modem or the interconnecting line.

(a) LOCAL ANALOG LOOPBACK (Figure 2)

Requires a loop back cable with a built-in circuit for line loss to simulate a typical leased line condition (See Figure 3).

Connect the loop back cable to the RJ11 connector on the modem under test.

Set Dip Switches as follows...

Switch 7 = OFF 4-Wire

Switch 9 = ON Soft Carrier Turn Off Enabled

Switch 1 = ON Transmit (TxA) Signal Level = 0dBm

Switch 3 = ON Receive (RxA) Signal Level = -33dBm

Switch 6 = OFF Switched Carrier

Switch 4&5 = ON RTS/CTS Delay = 50ms

Test 1: RTS/CTS Analog Control

Set RTS "ON" and check that CD (Carrier Detect) turns "ON".

Turn RTS "OFF" and ensure that CD turns "OFF"

With RTS "ON", run a test message at TxD and verify that the same message is received at RxD with no data errors.

Test 2: Transmit Signal Power & Receive Levels

Set Dip Switch 1 OFF (TxA = -10dBm)

CD will be OFF.

Change Dip Switch 1 to ON (TxA = 0dBm)

CD should now be ON.

Test 3: Received Signal Level

Set Dip Switch 1 OFF (TxA = -10dBm) and Dip Switch 3 OFF (RxA = -43dBm).

CD will be ON.

Run a test message at TxD and verify that the same message is received at RxD with no data errors.

Test 4: Repeat Test 3 for various RTS/CTS delay times and with soft carrier ON and OFF.

(b) LOCAL DIGITAL LOOPBACK – 4-Wire Network (Figure 4)

On the modem under test, connect TxD to RxD

Switch 1 = ON (TxA = 0dBm)

Switch 3 = ON (RxA = -33dBm)

Switch 4 = OFF (RTS/CTS = 35ms)

Switch 5 = ON (RTS/CTS = 35ms)

Switch 6 = ON (Constant Carrier mode).

Switch 7 = OFF (4-Wire)

Switch 8 = ON (Line Termination = 600 ohms)

Switch 9 = ON (Soft Carrier = ON)

Transmit a test message from a remote modem and confirm that the same message is received back at RxD on the remote modem with no data errors.

(c) REMOTE DIGITAL LOOPBACK – 4-Wire Network (Figure 5)

Configure both the local and remote modems as follows:

Switch 1 = ON (TxA = 0dBm)
Switch 3 = ON (RxA = -33dBm)
Switch 4 = OFF (RTS/CTS = 35ms)
Switch 5 = ON (RTS/CTS = 35ms)
Switch 6 = ON (Constant Carrier mode).
Switch 7 = OFF (4-Wire)
Switch 8 = ON (Line Termination = 600 ohms)
Switch 9 = ON (Soft Carrier Turn Off = ON)

Connect TxD to RxD at the remote modem.

Transmit a test message from the local modem and confirm that the same message is received back at RxD on the local modem with no data errors.

(d) LINE DIAGNOSTICS

(i) Typical modem configuration for **4-wire Point-to-Point** system...

Switch 1 = ON (TxA = 0dBm)
Switch 3 = ON (RxA = -33dBm)
Switch 4 = OFF (RTS/CTS = 1ms)
Switch 5 = OFF (RTS/CTS = 1ms)
Switch 6 = ON (Constant Carrier mode).
Switch 7 = OFF (4-Wire)
Switch 8 = ON (Line Termination = 600 ohms)
Switch 9 = OFF (Soft Carrier = OFF)

(ii) Typical modem configuration for **4-wire Multi-Point** system...

Switch 1 = ON (TxA = 0dBm)
Switch 3 = ON (RxA = -33dBm)
Switch 4 = OFF (RTS/CTS = 1ms)
Switch 5 = OFF (RTS/CTS = 1ms)
Switch 6 = ON (Constant Carrier mode).
Switch 7 = OFF (4-Wire)
Switch 8 = ON (Line Termination = 600 ohms)
Switch 9 = OFF (Soft Carrier = OFF)

Adjustments...

In a network with high line loss (greater than 16dB) change Switch 3 (RxA) to OFF (-43dBm).

If there are conditions that can cause cross-talk (TxA leaking into RxA path) set Switch 1 (TxA) to OFF (-10dBm).

Note that noise level should be -50dBm or lower for most FSK operation (signal-to-noise ratio of 15dB or higher)

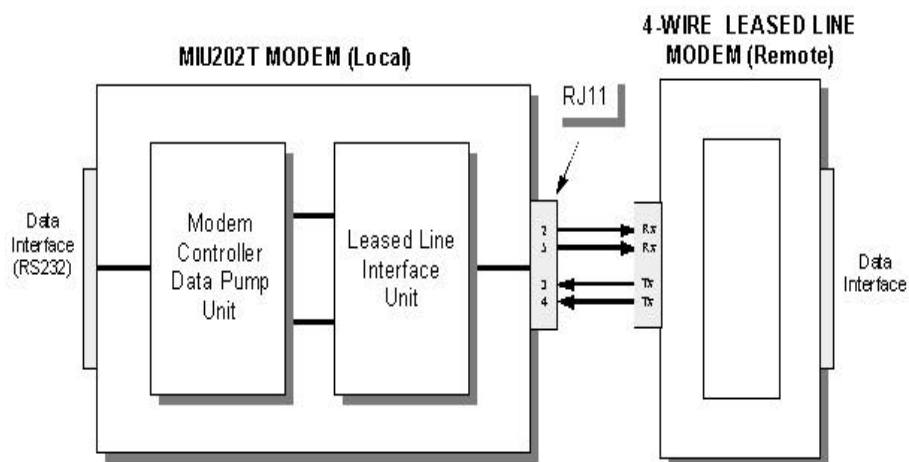


Figure 1 **TYPICAL 4-WIRE LEASED LINE MODEM CONFIGURATION**

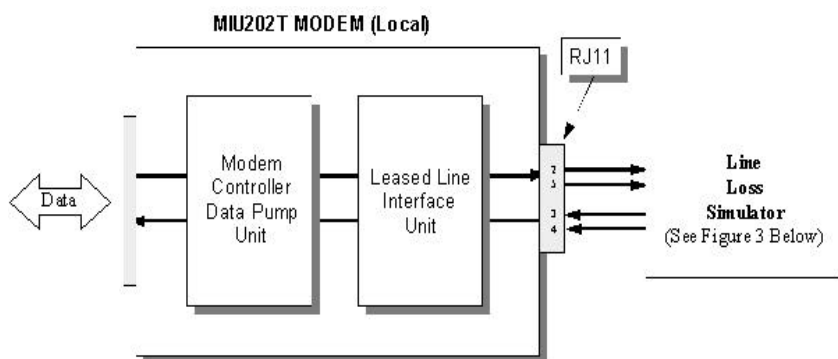


Figure 2 LOCAL ANALOG LOOPBACK

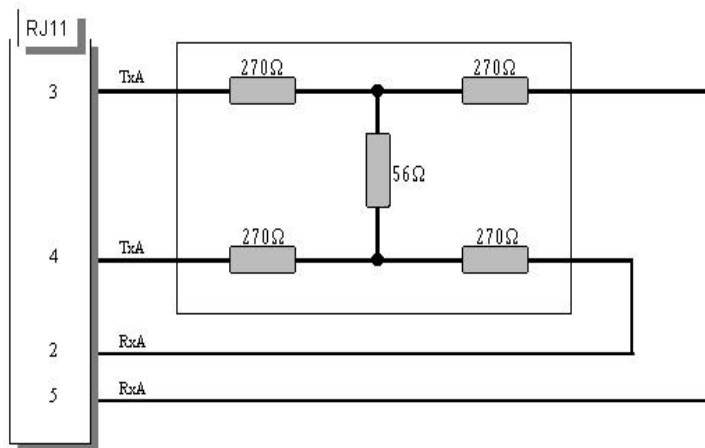


Figure 3 LINE LOSS SIMULATOR (Approx. -26dB)

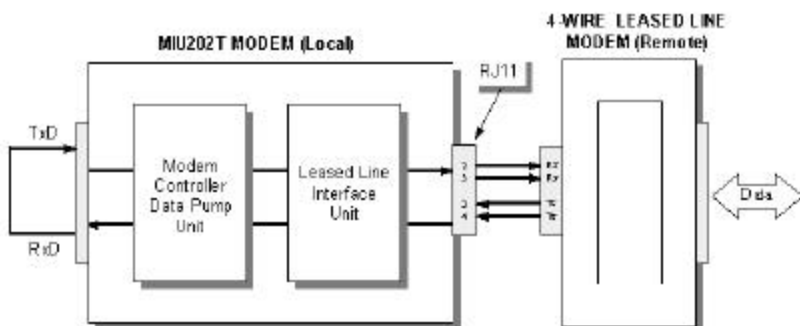


Figure 4 LOCAL DIGITAL LOOPBACK

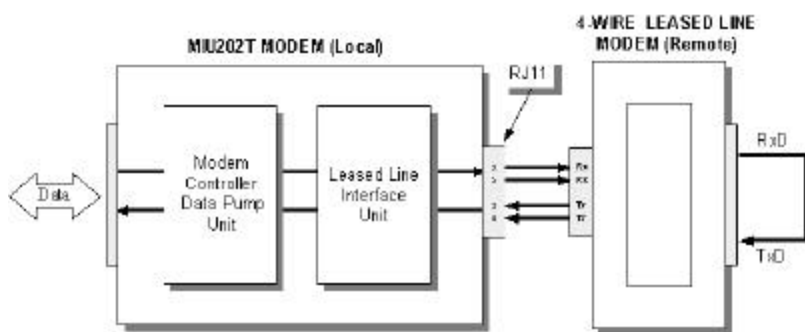


Figure 5 REMOTE DIGITAL LOOPBACK

CERTIFICATIONS

FCC Part 68

This equipment complies with U.S. Code of Federal Regulations, Title 47, FCC Rules and Regulations Part 68. Located on the equipment is the FCC Registration Number and Ringer Equivalence Number (REN). You must provide this information to the telephone company if requested.

The Registration Number and REN will be on a label attached to the unit. The FCC requires these numbers be prominently displayed on an outside surface of the equipment.

The REN is used to determine the number of devices you may legally connect to your telephone line. In most areas, the sum of the REN of all devices connected to one line must not exceed five (5.0). You should contact your telephone company to determine the maximum REN for your calling area. The telephone company may change technical operations or procedures affecting your equipment. You will be notified of changes in advance to give you ample time to maintain uninterrupted telephone service.

If you experience trouble with this telephone equipment, please contact Data Connect Enterprise at (301) 924 - 7400 x17 for information on obtaining service or repairs. The telephone company may ask that you disconnect this equipment from the network until the problem has been resolved. If your equipment continues to disrupt the network, the telephone company may temporarily disconnect service. If this occurs, you will be informed of your right to file a complaint with the FCC.

This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

FCC Part 15

This equipment has been tested and complies with the limits for a Class A computing device according to U.S. Code of Federal Regulations, Title 47, FCC Rules and Regulations Part 15. Operation is subject to the following two conditions:

- (1) This device may cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

RMA PROCEDURE

Before returning any DCE product, an RMA number must be obtained. Before asking for an RMA number, ascertain that the product was purchased from DCE. If you bought the product from a Distributor or Systems Integrator, the product should be returned to that vendor.

The most convenient method to obtain an RMA authorization for a product purchased from DCE is to submit a request by fill in the form from www.data-connect/returns.htm. Information required must include

- Company name
- Address (including any Mail Stop or specific delivery information)
- Name, contact information, and e-mail address for the technical contact(s) at your company

If the above information is on your letterhead, that format is acceptable.

For each item you wish to return, please include:

- The product model number (usually found on the serial number tag)
- The serial number for each item you wish to return
- A description of the problem you are encountering
- The cause of the problem (if known)

A product support specialist may call to verify that the product is properly installed or may ask you to perform tests to insure that the product has actually failed. After reviewing the problem, DCE will assign an RMA number and you will be notified by email or FAX.

The product must be properly packed and returned to:

Data Connect Enterprise.
3405 Olandwood Court,
Olney, MD 20832
Attn: RMA Technical Support

The RMA number must be legibly displayed on the shipping carton. No RMAs will be issued without a product review. DCE will not be responsible for any product returned without an RMA number.

If you believe the product may be out of warranty, include a method of payment for repairs (either a Purchase Order number or credit card number), card holder name, date of expiration on the RMA request. Repairs currently require 5 working days and are returned UPS second day air.

Contact us by e-mail mspellerberg@data-connect.com or call 301.924.7400 x25 if you should have any questions.

NOTES: