



**Data Connect - Installation, Operation**

**for the**

**MIU202T**

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

**ARC Electronics**  
**800-926-0226**

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## **1. STANDARDS**

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

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## 2. PRODUCT OVERVIEW

The **MIU202T** is an industrial grade Bell202T 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 deg C.

Internally, the MIU202T 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 MIU202T is packaged specifically for the harsh environments found in utility substations and industrial facilities. Though functionally similar to commercial modems, the MIU202T includes special features that make it particularly well suited for utility and industrial applications:

**Environment:** The MIU202T has been designed specifically for use in harsh environments. In addition to an extended temperature range (-40 to +85° C), the MIU202T includes surge, shock, vibration, and safety features superior to those of conventional commercial modems.

**Power Supply:** The MIU202T can be powered from a broad range of AC and DC power supplies, such as an auxiliary supply (eg; 12VDC) from another piece of equipment, 125VDC from a station battery or a standard 120VAC.

**Industrial:** The MIU is packaged in a rugged, compact, non-metallic (ABS) enclosure. Designed for unmanned locations, the MIUs do not include the array of pushbuttons and LEDs normally associated with consumer-type modems. Configuration is by dip switches. Standard industrial connectors for data, analog and power interfaces allow reliable interconnection to other industrial components.

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### 3. GENERAL PRODUCT SPECIFICATIONS

**Dimensions:** 5.3 x 4.0 x 1.375 inches

**Weight:** 1 lb

**Voltage Supply:** Standard Model: 40 to 270VDC  
40 to 270VAC, 50/60Hz  
LV Model (Suffix “-LV”): 9 to 36VDC

**Current Requirements:**

12VDC	24VDC	125VDC	120VAC	220VAC
65mA	27mA	7.5mA	6.5mA	5.5mA

**Surge Protection:** Power Supply: 8kVrms  
Analog Line: 3.75kVac  
Digital Line: ESD  $\pm$  10kV

**Operating Temperature:** -40 to +85 deg C

**Operating Humidity:** 0 to 90% (non-condensing.)

**Storage Temperature:** -55 to 100 deg C

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## 4. MODEM SPECIFICATIONS

<b>Modulation:</b>	Bell202T
<b>Modulation Type:</b>	FSK
<b>Synch/Async:</b>	Asynchronous Only
<b>Data Rate:</b>	0 – 1200bps
<b>Transmit Frequency:</b>	Mark: 1200Hz Space: 2200Hz
<b>Error Correction:</b>	None
<b>Data Compression:</b>	None
<b>Data Modulation Connectivity:</b>	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 *

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## 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 ( $\pm 5$ 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 $\pm 0.5$ ms

\* Dip Switch Selectable ~ See Section 9



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## 5. ANALOG LINE SPECIFICATIONS

The MIU202T 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 MIU202T will also interface to Power Line Carrier or Microwave radio voice channel networks.

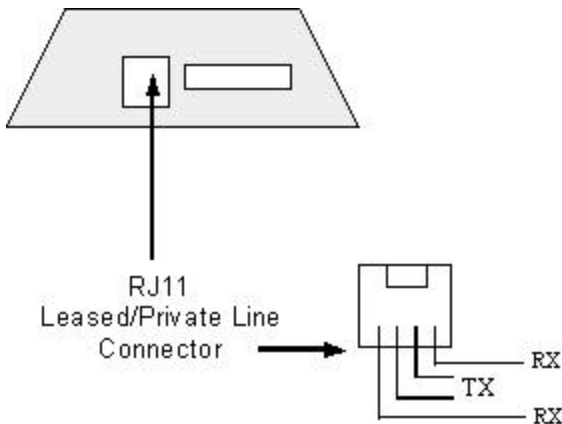
The MIU202T has an RJ-11 terminated connector. The following lists the MIU202T analog interfaces

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



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## 6. ANALOG MICROWAVE INTERFACE

The MIU202T 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  $\mu$ sec, maximum  
   Option – 002:            1900  $\mu$ sec, maximum

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

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

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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

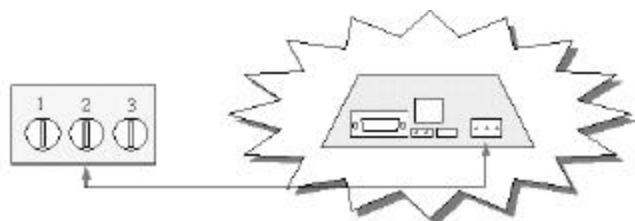
Level -20 dBmO

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

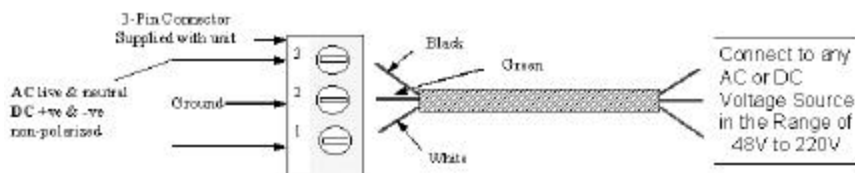
Pulse distortion  $\pm 3$  dB, level var. 3% max.

Signaling leak -60 dBmO, maximum

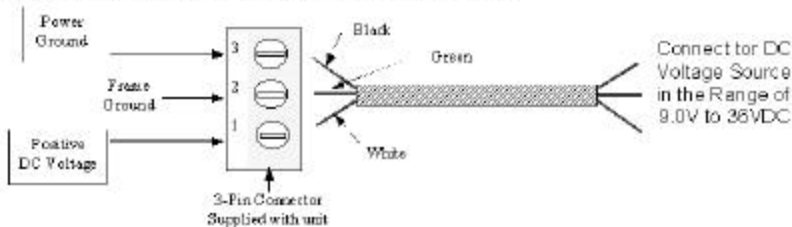
## 7. POWER CONNECTIONS



MIU2.4, MIU9.6, MIU9.6L, MIU14.4, MIU14.4L, MIU28.8, MIU202T, MIU9.6FP, MIU9.6FPD



MIU Models as above, but with suffix "-LV" (eg; MIU2.4-LV)



### IMPORTANT NOTES

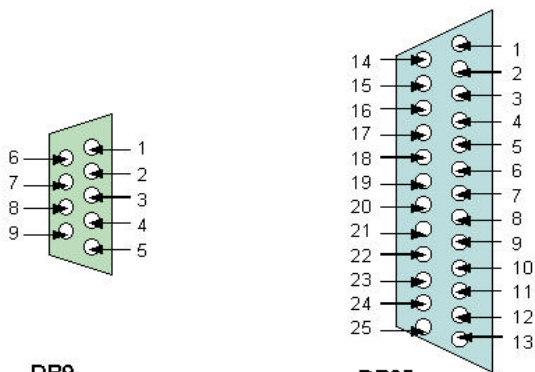
1. Wire colors shown are for optional Telenetics cable, if ordered.
2. Customer supplied cable must be suitable for site environmental conditions.
3. Surge protection only guaranteed if ground wire >18 AWG
4. Solidly earthed ground connection required to guarantee surge protection
5. Screw terminals accept 28 to 16 AWG.

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## 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**

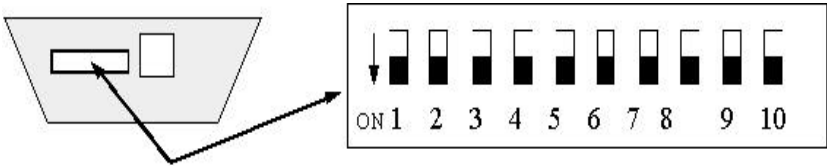
Pin	Signal
1	CD - Carrier Detect
2	RXD - Receive Data
3	TXD - Transmit Data
4	DTR - Data Term'I Ready
5	Signal Ground
6	DSR - Data Set Ready
7	RTS - Ready to Send
8	CTS - Clear to Send
9	RI - Ring Indication (Dial Modems Only)

**DB25**

Pin	Source
8	MODEM
3	MODEM
2	TERMINAL
20	TERMINAL
7	N/A
6	MODEM
4	TERMINAL
5	MODEM
22	MODEM

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## 9. DIP SWITCH FUNCTIONS



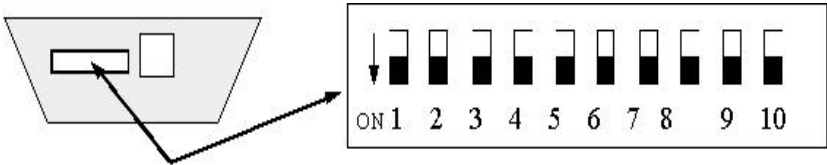
IMPORTANT NOTE: Invert modem to view dip switches as shown above

**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

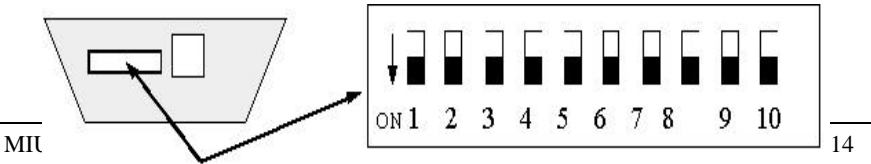


# 10. MODEM CONFIGURATION

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

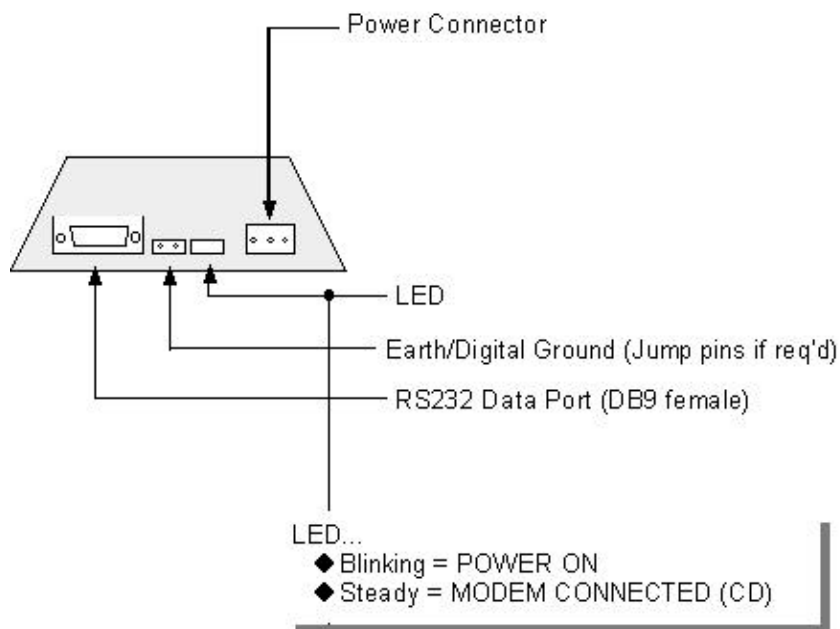
For clarity, a blank space = OFF



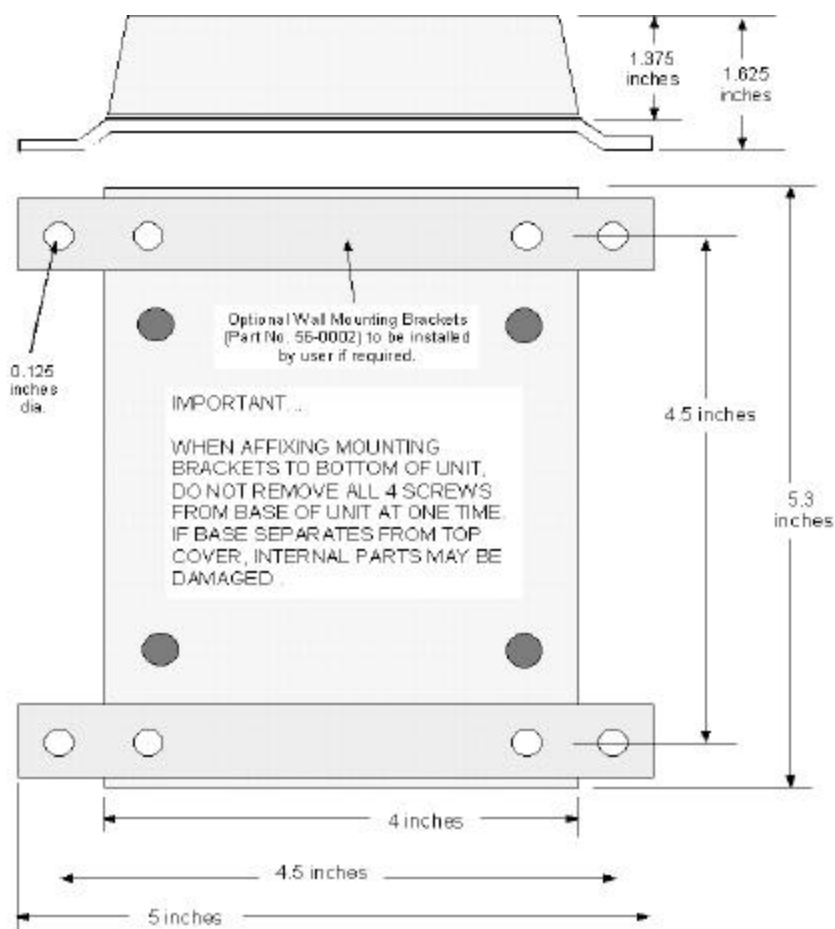


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## 11. LED INDICATOR



## 12. OUTLINE DRAWING & MOUNTING



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## 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.

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### **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.

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**(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.

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## (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)

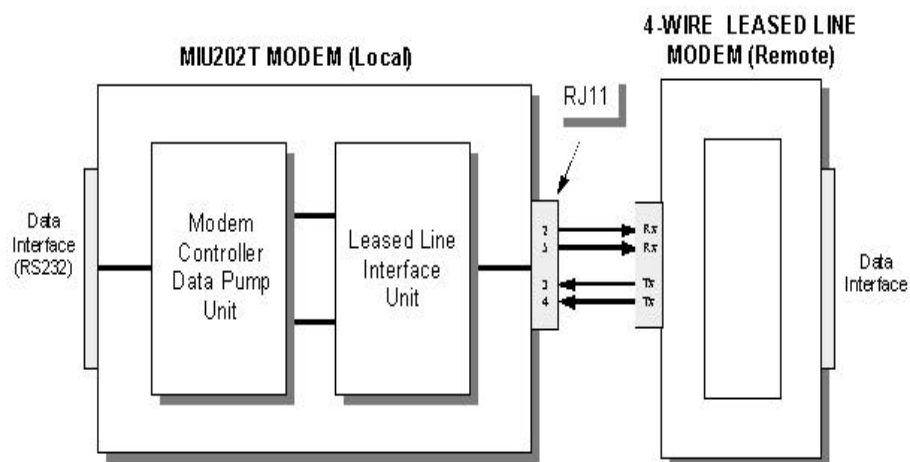


Figure 1 **TYPICAL 4-WIRE LEASED LINE MODEM CONFIGURATION**

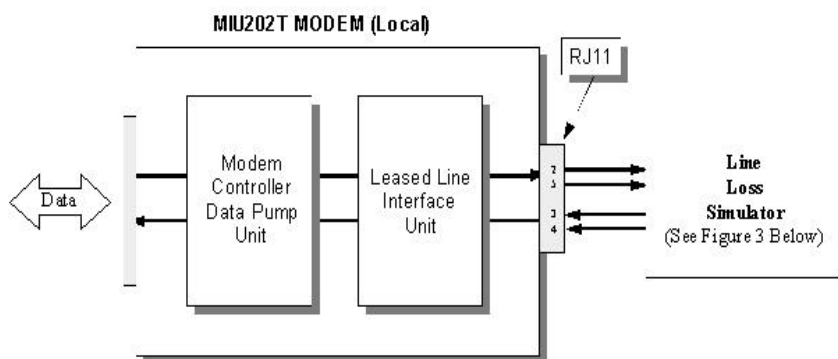


Figure 2 **LOCAL ANALOG LOOPBACK**

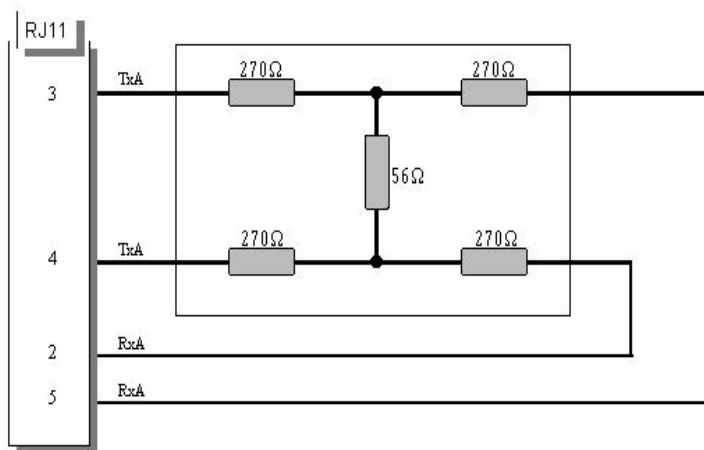


Figure 3 **LINE LOSS SIMULATOR (Approx. .26dB)**



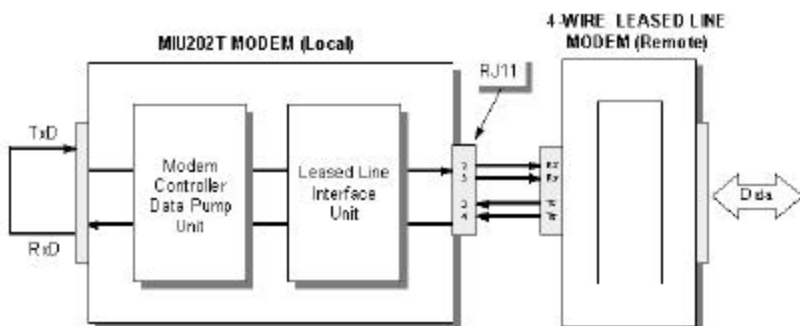


Figure 4 LOCAL DIGITAL LOOPBACK

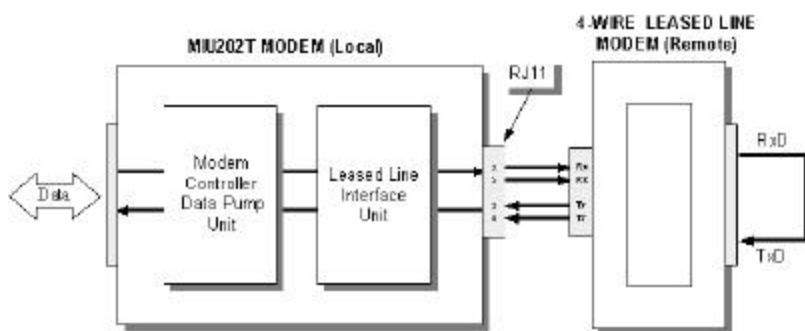


Figure 5 REMOTE DIGITAL LOOPBACK

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NOTES: