DATA CONNECT ENTERPRISE

User's Manual

For

IG192HFP & IG96HFP

Fast Poll Modem

Document Number 520-01014-101 Rev. A

Web site: www.data-connect.com

IG192HFP Fast Poll Modem User's Manual

520-01014-101 Rev. A

August, 2011

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Chapter 1
Introduction

Thank you for purchasing DCE's IG192HFP fast poll modem, the finest industrial-grade fast-poll modem available.

This manual covers the DCE IG192HFP, IG192HFP-RM, IG96HFP and IGHFP-RM standalone modems and Rack mount plug-in modules.

The DCE modem is a 19200/9600/4800/2400/1200 bps modem designed for 4-wire, full-duplex or 2-wire, half-duplex operation over a voice-band leased line or private line. The modem is designed utilizing the latest digital-signal processing (DSP) technology to achieve high performance. The modem employs efficient modulation and encoding scheme to achieve fast modem training time. The modem is also backward compatible with Bell 202 and ITU-T V.23 modems.

The IG192HFP is the most technologically advanced modem on the market. Boasting a fast DSP processor and automatic adaptive equalizer, the IG192HFP modem is ideally suited for multi-point communication systems that require fast response time, short training time, and low throughput delay.

This User's Guide describes the IG192HFP (AC-powered) and IG192HFP-LV (DC-powered) stand-alone modems, as well as the rack-mount IG192HFP-RM plug-in module for the Motorola/UDS RM16M. This manual is designed to get your modem "up and running" as quickly as possible. It contains all the information you need to configure and install your modem. It also contains troubleshooting information in the unlikely event you encounter a problem with your modem.

Features

The IG192HFP/IG96HFP modem is specifically designed for harsh environments typically associated in utility substations and industrial facilities. Though functionally similar to commercial modems, the IG192HFP/IG96HFP provides the following unique features that make it well suited for utility and industrial applications.

- Packaged in a rugged, compact enclosure for industrial applications.
- Leased-line interface protected with heavy-duty surge protection devices.
- Built-in hardware watchdog timer for software lock-up prevention without requiring human intervention, making it ideal for unmanned locations.
- Works within an extended temperature range of -40ºC to +85ºC.
- Designed with coupling transformers for high-voltage isolation and common mode noise rejection in industrial and commercial environments.
- Operate over voice-band conditioned or unconditioned leased-line and pilot wires.
- Accepts power from a wide range of AC and DC power supplies:
  - IG192HFP/IG96HFP: 90 to 265 VAC or 100 to 400 VDC
  - IG192HFP-LV/IG96HFP-/IG96HFP: 10 to 60 VDC
  - IG192HFP-RM: Plug-in module for the Motorola/UDS RM16M modem nest
- Standard industrial connectors for data, analog, and power interfaces allow reliable interconnection to other industrial equipment.
- Asynchronous data rates (selectable) of 19200, 9600, 4800, 2400, and 0-1800 bps.
- Easily accessible DIP switches for user configuration and option selection.
- DB9-F connector for RS-232/V.24 interface, and RJ-11 for RS-485.
- Local analog, local digital, and remote digital loopback diagnostics.
- Optional Wall-mount kit and DIN rail mounting kit for custom installations.

Wall-mount kit

DIN Rail mounting kit

Applications

The IG192HFP and IG96HFP modems are designed for point-to-point and multipoint data communications. Figure 1-1 shows a typical point-to-point configuration using the IG192HFP modem and Figure 1-2 shows a typical multipoint configuration using the IG192HFP modem.

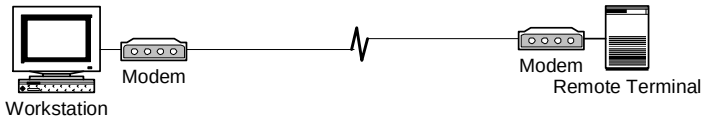


Figure 1-1. Point-to-Point Network Using the IG192HFP Modem

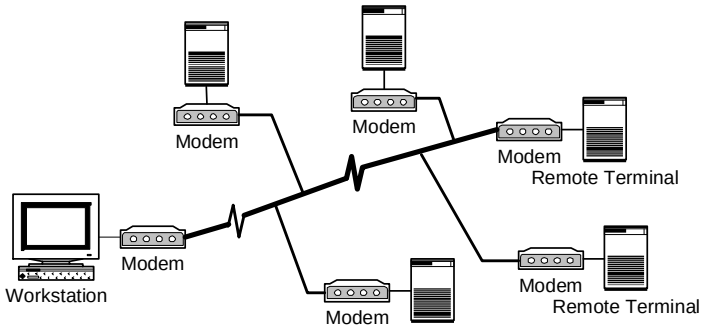


Figure 1-2. Multipoint Polling Network Using the IG192HFP Modem

There are a number of factors that can affect the modem's operation and performance. These include:

- Modem speed (i.e. bit error rate, transmission line distance)
- 2-wire or 4-wire configuration
- Transmission line characteristics, noise, and line impairments
- Network configuration (point-to-point or multipoint)

Chapter 2
Installation

This chapter describes how to configure and install the modem to maximize the performance and to match with your Data Terminal Equipment (DTE) or Remote Terminal Unit (RTU).

Unpacking Your Hardware

Your package should include:

- At least one of the following IG192HFP/IG96HFP modems:
  - Model IG192HFP or IG96HFP for 90 to 265 VAC
  - Model IG192HFP-LV or IG96HFP-LV for 10 to 60 VDC
  - Model IG192HFP-RM for RM16M plug-in module
- A switching power supply module for 90-265VAC input (model IG192HFP only)
- A leased-line cable with optional earth ground conductor (for stand-alone units only)
- A DC power cable (model IG192HFP-LV modem only)
- This User's Manual or CD-ROM

If your package contents are damaged or missing, contact your place of purchase.

Additional Items You Need to Complete Your Installation

To complete your installation and operate your modem, you need these additional items:

- Two- or four-wire transmission line or leased line
- A DB-9 data cable for your RS-232 interface Data Terminal Equipment (DTE) port, or a RJ-11C data cable for your RS-485 DTE.
- Power supply that provides either:
  - 90 to 265 Volts AC, 50 to 60 Hz, single phase or 100 to 400 VDC (if you have the model IG192HFP modem), or
  - 10 to 60 Volts DC (if you have the model IG192HFP-LV modem)
  - For the IG192HFP-RM, consult the documentation for your Motorola/UDS RM16M

Hardware Overview

Front View

Figure 2-1 shows the front view of the IG192HFP stand-alone modem. Starting from the left side, this view shows:

- A set of eight LEDs for modem interface status (see Table 2-6 on page 26)
- A loopback control push-button switch (see Loopback Control Switch on page 26)

Figure 2-1. Front View of the IG192HFP and IG96HFP Modems

Back View

Figure 2-2 shows the back view of the IG192HFP stand-alone modem. Starting from the left side, this view shows:

- A 4-wire/2-wire configuration block labeled **LEASED LINE**
- An RJ-11 modular jack labeled **RS-485** for connecting the modem to an RS-485 RTU
- A female, 9-pin RS-232 connector labeled **RS-232** for connecting the modem to a standard DTE (RTU)
- A power connector labeled **10-48V DC**

Figure 2-2. Back View of IG192HFP and IG96HFP Modems

Rack-Mount View

Figure 2-3 shows the rack-mount plug-in module.

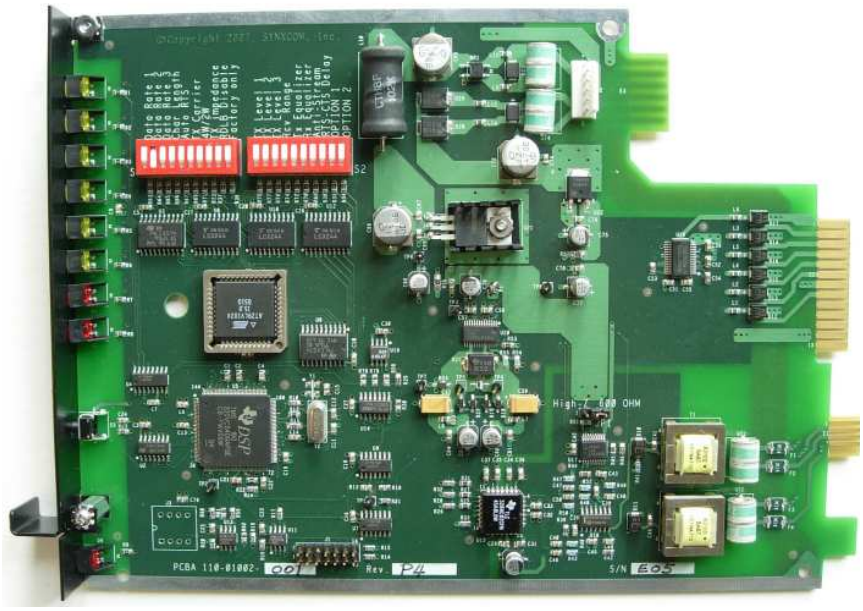


Figure 2-3. Rack-Mount Module for the IG192HFP-RM Modem Board

Installation Summary

This section describes the steps for installing the modem.

NOTE: It is important to follow the steps below to configure the modem's DIP switches to match your DTE/RTU interface requirement and the transmission line characteristics. If you are not certain about your system's parameters or the leased-line configuration, please contact your network administrator for assistance.

1. Configure the modem using the DIP switches and jumpers. See pages 14 and 19.
2. Connect to a transmission line. See page 21.
3. Connect to a voltage source. See page 23.
4. Connect a DTE device. See page 24.

Configuring the Modem

You configure the modem using the three sets of DIP switches located at the bottom of the modem box **S1** and **S2,** and **S3.**

Configuration DIP switches **S1** and **S2** for the stand-alone and rack-mount modems are identical. Their descriptions in this user's manual apply to both modem versions. Configuration jumper **JP1** for the rack-mount modem card is used to select receiver termination impedance.

It is important to follow the steps described below, in the order shown, to ensure that you configure your modem properly using the modem DIP switches:

1. Use DIP switch 1 (**S1**) to configure the modem for your host DTE interface and network topology. Using **S1**, you select the modem's operating speed to match you host computer or RTU devices, and other DTE specific operating parameters.
2. Use DIP switch 2 (**S2**) to select the modem's transmitter output level and receiver dynamic range specific leased line conditions. The **S2** settings apply for both high-speed fast-poll (QAM) and low-speed (FSK) modes.
3. After you change the DIP switch settings, recycle power to the modem to have the settings take effect.

NOTE: The DIP switch settings will not take effect until you recycle power to the modem.

To access the configuration DIP switches and jumpers on the stand-alone modem:

1. Ground yourself to discharge any ESD, which might cause damage to the sensitive devices on the modem board.
2. Disconnect and remove all the cables attached to the rear panel connectors.
3. Due to re-designing of the modem's main assembly circuit board and the chassis, you do not need to open the enclosure to get access to the DIP switches . Turn of the modem with the bottom up and the locations of the DIP switches for the stand-alone modem are shown in Figure 2-4. For DIP switches and jumpers on the rack-mount plug-in module, see Figure 2-5.
4. Carefully setting the DIP switches to the ON (close) or OFF (open) positions according to your requirements.

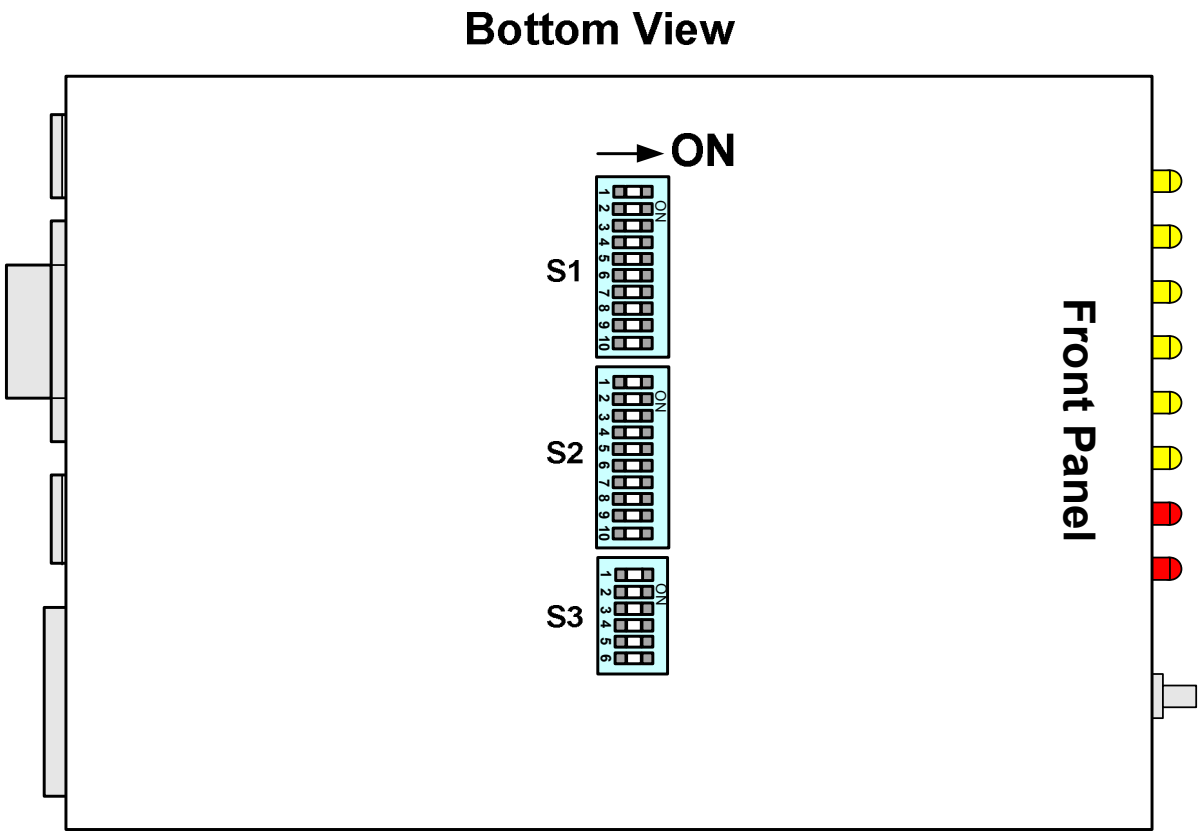


Figure 2-4. IG192HFP and IG96HFP Fast-Poll Stand-alone Modem

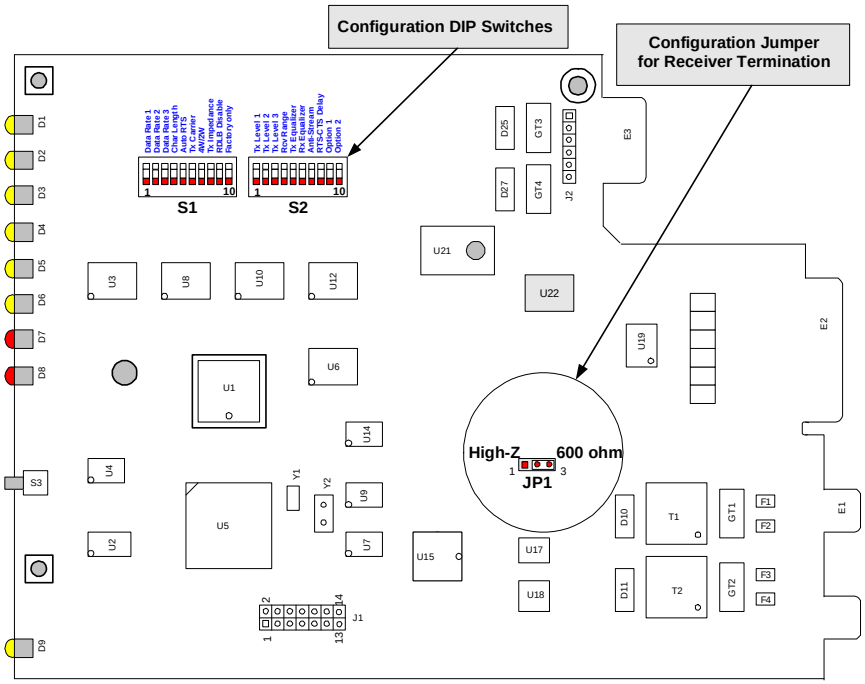


Figure 2-5. IG192HFP Fast-Poll Rack-mount Modem Board

Setting the DIP Switches

S1, **S2** and **S3** are miniature switches used to configure all the options and features of the modem. Table 2-1 shows the setting of the switches.

NOTE: Switches **S1** to **S3** are slide switches. To configure the switches, use a small sharp pin or small screw driver to push the handle to turn **ON** or to turn **OFF** each switch. Never leave any switch in half way ON or OFF. When the switch is slide to the **ON** position, it is referring to as **CLOSE** condition. When the switch is in the **OFF** position, it is in the **OPEN** state.

Table 2-1. Modem Switch Settings

DIP Switches	Switch Settings	
	ON	**OFF (Default)**
DIP Switch S1		
S1-1 to S1-3: Modem Data Rate	**19200**: SW1=OFF, SW2=OFF, SW3=OFF **9600**: SW1=**ON**, SW2=OFF, SW3=OFF **4800**: SW1=**ON**, SW2= **ON**, SW3=OFF **2400**: SW1=OFF, SW2=**ON**, SW3=OFF **Bell 202T**: SW1=OFF, SW2= OFF, SW3=**ON** **V.23**: SW1=**ON**, SW2=**ON**, SW3=**ON**	
S1-4: DTE Async Character	11 bit	10 bit
S1-5: Auto RTS	Enable	Disable
S1-6: Transmit Carrier Control	Constant On	Controlled by RTS
S1-7: 2- or 4-wire leased line	2-wire half duplex	4-wire full duplex
S1-8: Transmitter Impedance	Controlled by RTS	600 ohms
S1-9: Remote Digital Loopback	Enable	Disable
S1-10: Test Only (Reserved)	Test only	Normal
DIP Switch S2		
S2-1 to S2-3: Transmit Output Level	From -14 to 0 dBm (see Table 2-5)	
S2-4: Modem Receive Dynamic Range	-10 to -43dBm	+3 to -30dBm
S2-5: TX Cable Equalizer	Enabled	Disabled
S2-6: RX Cable Equalizer	Enabled	Disabled
S2-7: Anti-streaming	Active	Inactive
S2-8: RTS-CTS Delay (Bell 202T only)	33 msec	8 msec
S2-9: Forced RTS ON	Active	Inactive
S2-10: Re-Train Enabled (19200 bps only)	Enabled	Disabled
DIP Switch S3		
S3-1: RS-232 Port operation	Both S3-1 and S3-2 are set to **OFF**	
S3-2: RS-485, 4-wire interface 2-wire interface	S3-1 = ON, S3-2 = OFF S3-1 = OFF, S3-2 = ON	
S3-3: RS-485, Receiver Termination	High Impedance	120 Ohms

DIP Switches	Switch Settings	
	ON	OFF (Default)
S3-4: Not Used		
S3-5: Receiver Termination	600 Ohms (Default)	High Impedance
S3-6: Signal Ground and Chassis Ground	Connected Together	Open

S1-1, S1-2, S1-3 – Modem Data Rate

- S1-1, S1-2, S1-3: Select the modem speed per Table 2-2

Table 2-2. Modem Operating Speed

To Select…	Set Switch S1-1 to…	Set Switch S1-2 to…	Set Switch S1-3 to…
19,200 bps	OFF	OFF	OFF
9600 bps	**ON**	OFF	OFF
4800 bps	**ON**	**ON**	OFF
2400 bps	OFF	**ON**	OFF
Bell 202T	OFF	OFF	**ON**
V.23/1200	**ON**	**ON**	**ON**

For modem speeds of 2400 bps or higher, the modem uses QAM modulation automatically. When the modem is operating at 1200 bps either in Bell202T or ITU-V.23 mode, the modem uses FSK modulation.

Note: *Leased lines with a relatively flat 300-3400Hz bandwidth is required to support 19,200 bps operation*.

S1-4 – Async Character (Fast-Poll Mode Only)

- S1-4 ON = 11 bits
- S1-4 OFF = 10 bits (*default*)

Switch S1-4 selects whether the async character is 10 or 11 bits long. This switch setting is ignored when the modem uses FSK modulation.

S1-5 – Auto RTS

- S1-5 ON = Enable Auto RTS
- S1-5 OFF = Disable Auto RTS (*default*)

For data terminals that do not provide hardware Request To Send (RTS), i.e. only provide TXD, RXD, SG connections, set the modem's switch S1-5 to ON to enable auto RTS mode.

In this mode, the modem does not require RTS input. TXD is detected at the modem, internally, the modem turns on its internal RTS and carrier signals at the transmitter. After training completes, the TXD is transmitted to the remote modem. The transmitter turns itself off if no TXD is detected after some length of idle time (approx 2 characters).

S1-6 – Transmit Carrier Control

- S1-6 ON = Constant carrier
- S1-6 OFF = Controlled by RTS (*default*)

Switch S1-6 selects either the modem's transmit carrier to be constant ON or controlled by RTS. Constant carrier will force the modem to transmit a carrier signal to the remote modem instead of controlled by RTS. However, the modem will still required RTS from the RTU to transmit data to the remote modem. If you enable constant carrier (switch S1-6 = ON), the modem forces the transmit carrier active and the RTS-CTS delay is shortened to less than 0.5 ms. In constant carrier mode, CTS is ON only if RTS signal is ON.

In switched-carrier mode (switch S1-6 = OFF), the RTS-CTS delay is 23 ms for 2400 bps and above.

You can use constant carrier mode in 4-wire point-to-point connections, or at the master modem of a multi-point polling network to reduce modem RTS-CTS delay.

Note: Please refer to switch setting S2-9; forced RTS ON for other applications.

S1-7 – 2 or 4-Wire Leased Line Operation

- S1-7 ON = 2-Wire, Half-Duplex Mode
- S1-7 OFF = 4-Wire, Full-Duplex Mode (*default*)

Switch S1-7 configures the modem for either 4-wire full-duplex or 2-wire half-duplex operation.

S1-8 – Transmitter Impedance

- S1-8 ON = Transmitter termination is controlled by RTS
- S1-8 OFF = Transmitter always terminated with 600 Ω (*default*)

Switch S1-8 is used for multi-point configuration networks. When multiple modems are connected on the same metallic circuit:

- The transmitter termination should be of high impedance if the modem is not transmitting in order not to put a load on the transmission line.
- The transmitter is only terminated with 600 ohms when RTS is asserted.

This configuration should be used for all slave modems to prevent the transmitting modem from being unnecessarily burdened. To select this configuration, set switch S1-8 ON for the slave modems such that the slave modem is in high impedance when not transmitting.

If you use the modem with transmission lines that are transformer-coupled or with an impedance-isolated network (such as a transformer bridge), set switch S1-8 OFF for proper operation.

S1-9 – Remote Loopback Enable

- S1-9 ON = Loopback enabled
- S1-9 OFF = Loopback disabled (*default*)

During instances of channel noise, the modem may mistake a received preamble as a request to go into remote digital loopback. Setting switch S1-9 to OFF prevents the modem from participating in a remote digital loopback with another modem. Switch S1-9 does not prevent the modem from sending a remote digital loopback request to a remote modem.

S1-10 – Reserved (Test Only)

- S1-10 = must be OFF

Switch S1-10 must be in the OFF position for normal operation. It is reserved for factory testing only.

S2-1 through S2-3 – Transmit Level

Switches S2-1 through S2-3 adjust the modem's transmit level. Table 2-5 shows the transmit levels you can select using these switches.

Table 2-3. Transmit Levels

Transmit Level	S2-1 through S2-3 Switch Settings		
	S2-1	S2-2	S2-3
0 dBm	OFF	OFF	OFF
–2 dBm	OFF	OFF	ON
–4 dBm	OFF	ON	OFF
–6 dBm	OFF	ON	ON
–8 dBm	ON	OFF	OFF
–10 dBm	ON	OFF	ON
–12 dBm	ON	ON	OFF
–14 dBm	ON	ON	ON

S2-4 – Receiver Dynamic Range

- S2-4 ON = –10 to –43 dBm
- S2-4 OFF = +3 to –30 dBm (*default*)

For short distances or to select a strong receive signal, set S2-4 to OFF. For a long-distance cable or low receive signal level, set S2-4 to ON (–43 dBm).

S2-5 and S2-6 – Cable Equalizer (Fast-Poll Mode Only)

- S2-5 ON = Enable TX Cable Equalizer
  S2-5 OFF = Disable TX Cable Equalizer (*default*)
- S2-6 ON = Enable RX Cable Equalizer
  S2-6 OFF = Disable RX Cable Equalizer (*default*)

If you use the IG192HFP as a limited-distance modem over pilot wire or unloaded cables, you may need to improve or extend the modem's polling performance on long transmission lines by using the modem's internal fixed Compromise Cable Equalizer when polling on long metallic circuits when the cable exceeds 4 to 5 miles long. The cable equalizer is active only when the modem is in QAM fast-poll mode (2400 bps or higher).

S2-7 – Anti-streaming

- S2-7 ON = Anti-streaming is active
  S2-7 OFF = Anti-stream is inactive (*default*)

Typically, anti-streaming is used in multi-point applications to prevent a malfunctioning slave data terminal or RTU from occupying the line indefinitely. When anti-streaming is active, the modem can transmit data for a maximum of 27 seconds before the transmitter turns off automatically. The modem then looks for an ON-to-OFF RTS transition before proceeding with normal operation. Anti-streaming can be selected in either high-speed or low-speed mode.

S2-8 – RTS-CTS Delay (Bell 202 Mode Only)

- S2-8 ON = 33.0 ms delay
- S2-8 OFF = 8.0 ms delay (*default*)

Switches S2-8 determines the duration of the RTS-CTS delay in Bell 202 mode.
For V.23 mode, the RTS-CTS delay is fixed at 33 ms.

S2- 9– Forced RTS ON (Constant RTS)

- S2-9 ON = Force the modem's internal RTS to on. It also force the modem to turn on CTS and the transmit carrier.
- S2-9 OFF = Internal RTS is controlled by the RTU (*default*)

Switch 2-9 will force the modem to turn on its internal RTS, CTS and transmit carrier continuously, allowing the RTU and DTE to operate with the modem without supplying RTS signal. This is primary used by DTE's or RTU's that support only TD, RD and SG signals

S2- 10– Re-Train Request Enabled

When the IG192HFP modems are operating in high-speed polling modes, the modem's receivers require a special training pattern from the remote transmit modem to synchronize the receive timing before data can be received. The IG192HFP will only send out a training pattern when the transmit modem's RTS is raised from the OFF to ON state (i.e. Switched Carrier mode). However, if the modems are configured in Constant Carrier mode, or the RTS is ON continuously by the DIP switches, no training pattern will be sent from the transmit modems. When in configurations where constant carrier is received at the modem's receiver, there is a possibility that the modem might lose synchronization due to transmission line interferences such as line hits, line drop-outs, or power outage conditions. In order to regain synchronization at the receiver, the IG192HFP modem implements a re-train algorithm which allows the receiving modem to send out a re-train request to the remote modem for re-train and re-gain synchronization.

- S2-10 ON = Re-Train Request is Enabled (for 19,200 bps only)
- S2-10 OFF = Re-Train Request is Disabled (*default*)

S3-1 and S3-2– RS-232 or RS-485 Interface Select

The SM19202FP standalone modem support either RS-232/V24 or RS-485 4-wire or RS-485 2-wire operation. To select the interface standards to match you RTU, configure S1-2 and S3-2 as following:

- RS-232/V.24: S3-1 = OFF, S3-2 = OFF S3-3 = OFF
- RS=485, 4-wire: S3-1 = ON, S3-2 = OFF
- RS=485, 2-wire: S3-1 = OFF, S3-2 = ON

S3-3 RS-485 Receiver Termination

When RS-485 is used, a 120 ohm receiver termination may be used to terminate the receiver.

- S3-3 ON, a 120 ohms load is placed across the RX+ and RX- signal
- S3-3: OFF, no termination is connected to the receiver

S3-4- Not Used

S3-5 Leased Line Receiver Termination

- S3-5 ON = Leased line is terminated with 600 ohms (***default***)
- S3-5 OFF = Leased line is not terminated (for multi-drop applications)

S3-6- Common Signal Ground and Chassis Ground

- S3-6 ON = Signal ground and Chassis ground are connected
- S3-6 OFF = Signal ground and Chassis ground are isolated (***default***)

Configuring the Jumper Blocks

For Stand-alone Units

No jumper block is used in the standalone units

For Rack-Mount Plug-in Modules

Jumper block JP1 is used to set the modem's receiver termination impedance

- 600 ohms: A shorting jumper is placed over pin 2 & 3 (default)
- High impedance: A shorting jumper is placed over pin 1 & 2

Select high receiver impedance (Hi-Z) if multiple modems are connected in a multi-point configuration but without an impedance matching bridged such as private metallic circuit environment. In this configuration, only one receiver should be configured for 600 ohms.

Connecting to a Transmission Line

The modem has a transmission line interface that can be configured for 2- or 4-wire analog connection, where one pair (Tx-A and Tx-B) is used to transmit data and the other pair (Rx-A and Rx-B) is used to receive data. The transmit pair and receive pair are non-polarized. Table 2-4 shows the pin numbers and corresponding signals for the modem. Figure 2-6 shows the transmission line interface.

NOTE: For communication to occur, the Rx line of one modem must connect to the Tx line of the other modem. The modem's Tx/Rx pair are non-polarized.

NOTE: The modem does not support leased-line operation with DC shielding current. Leased-line connector pin assignments for the rack-mount module can be found in the documentation for your Motorola/UDS RM16M.

Table 2-4. Transmission Line Connector Pin Assignments

This Pin Number…	Corresponds to This Signal…
1	Rx
2	Rx
3	Tx (Tx/Rx)
4	Tx (Tx/Rx)
5	Earth Ground (optional)

NOTE: When 2-wire half duplex is used, the TX pair must be used for both transmit and receive.

Figure 2-6. IG192HFP Modem Transmission Line Interface

Connecting to a Voltage Source

The back panel of the modem provides a 2-position screw terminal power interface connector. For your convenience, the DC voltage of the input power is non-polarized. To meet your specific application, the modems can be powered from the following power sources:

- Model IG192HFP (with AC-DC power converter): 90 to 265 Volts AC, 50 to 60 Hz, single phase or 100 to 400 VDC. The output of the converter is a 12 VDC source that will power the modem.
- Model IG192HFP-LV (DC version): 10 to 60 Volts DC. The model IG192HFP-LV comes with a power cord for making this connection.

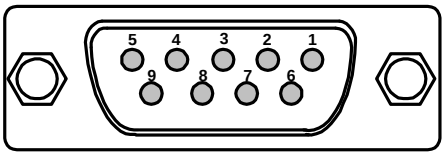
Figure 2-2 on page 10 shows the connection to the Model IG192HFPFP's power interface shows the connection to the Model IG192HFP-LV's power interface.

WARNING: Before you connect a voltage source, observe the following power supply voltage guidelines. Otherwise, you will void your warranty if the wrong voltage is applied.

- Be sure the voltage source is within the permitted ranges shown above. Otherwise, your modem and any attached devices may be damaged.
- Customer-supplied cables must be suitable for the site environmental conditions.
- Screw terminals on the power interface accept 24 to 16 AWG. However, surge protection is effective only if there is a solidly earthed ground connection greater than 18 AWG.
- Be sure the power source is not controlled by a wall switch, which can be inadvertently turned off, shutting off power to the modem.

Connecting to an RS-232 Device

The modem back panel provides a female, 9-pin RS-232 connector that accepts an attached RS-232 device (see Figure 2-2 on page 10). This connector accepts a standard connection to a DTE (RTU) that conforms to the pin assignments shown under Table B-2 "RS-232 (DTE) Interface" in Appendix B.



Connecting to an RS-485 Device

A RJ-11C modular jack is provided at the rear panel providing a 4-pin RS-485 or RS-422 interface in the event that your DTE or RTU does not support the RS-232 interface (see Figure 2-2 on page 10 and Figure 2-7). The RS-485 interface supports 4-wire full duplex or 2-wire half duplex.

NOTE: When RS-485 is used, configure the jumper blocks described on page 20 properly and enable either Auto-RTS or Constant RTS from the DIP switches S1 & S2.

The pin assignments for the RS-485 interface are listed in Table 2-5.

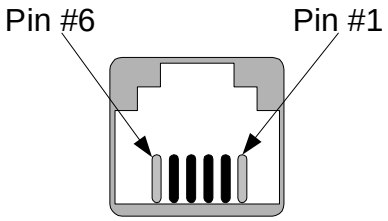
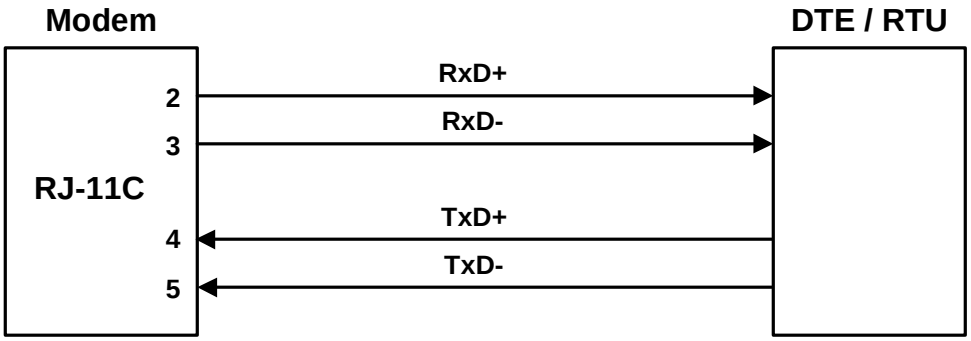


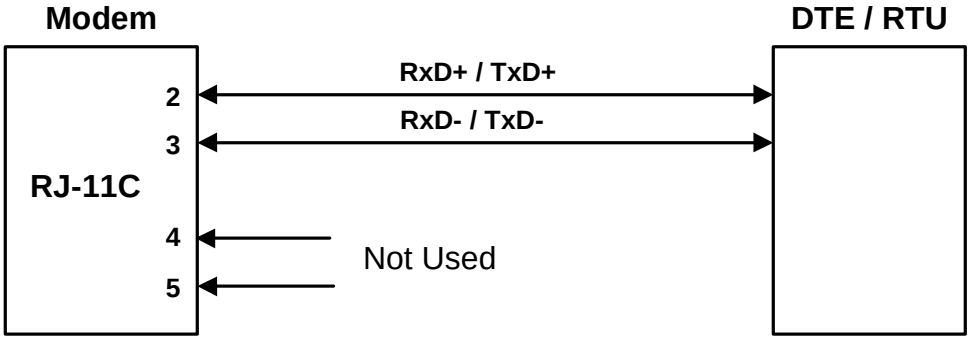
Figure 2-7. Pin Locations on the Modem's RJ-11C Jack

Table 2-5. RJ-11C Modular Jack Pin Assignments

RJ-11 Pin Number…	Corresponds to Signal Name	Modem Input or Output
1	Not Used	NA
2	RxD+	Output
3	RxD-	Output
4	TxD+	Input
5	TxD-	Input
6	Not Used	NA



4 wire RS-485 Connection



2 wire RS-485 Connection

LEDs

The front panel of the modem provides the LEDs shown in Table 2-5.

Table 2-6. Modem LEDs

LED	Color	Description
RTS	Yellow	Request To Send
CTS	Yellow	Clear To Send
TD	Yellow	Transmit Data
RD	Yellow	Receive Data
CD	Yellow	Carrier Detect
MR	Yellow	Modem Ready
ALB	Red*	Analog Loopback
DLB	Red*	Digital Loopback
* When the modem is in remote loopback, both the **ALB** and **DLB** LEDs go ON.		

Loopback Control Switch

The front panel of the modem has a push button for initiating the following loopback diagnostic tests:

- Local analog loopback — started by pressing the button one time. The **ALB** LED should be ON. When a DTE is connected to the RS-232 port of the modem, the transmit data is loop back to the DTE as receive data. This test will verify the modem transmitter, receiver, and its RS-232 interface along with the connecting cable.
- Local digital loopback — started by pressing the button two times. The **DLB** LED should be ON. When a DTE is connected to the RS-232 port of the modem, the transmit data is loop back to the DTE as receive data. This test will verify the modem's RS-232 interface along with the cable attached.
- Remote digital loopback — set the local modem's RTS signal to low. Press the local modem's diagnostics test button three times. Both the **ALB** and **DLB** LEDs should be ON. Then raise the local modem's RTS signal to start the test. The **ALB** and **DLB** LEDs of the remote modem should go ON when the modem is responded to remote digital loopback. This test will verify both modems' transmitters, receivers, and the leased line

NOTE: Be sure switch S1-9 is set to the ON position to enable the remote modem to respond to remote digital loopback requests. This test is only available in fast-poll mode at 2400 bps or higher.

Figure 2-8 shows these three loopback diagnostics.

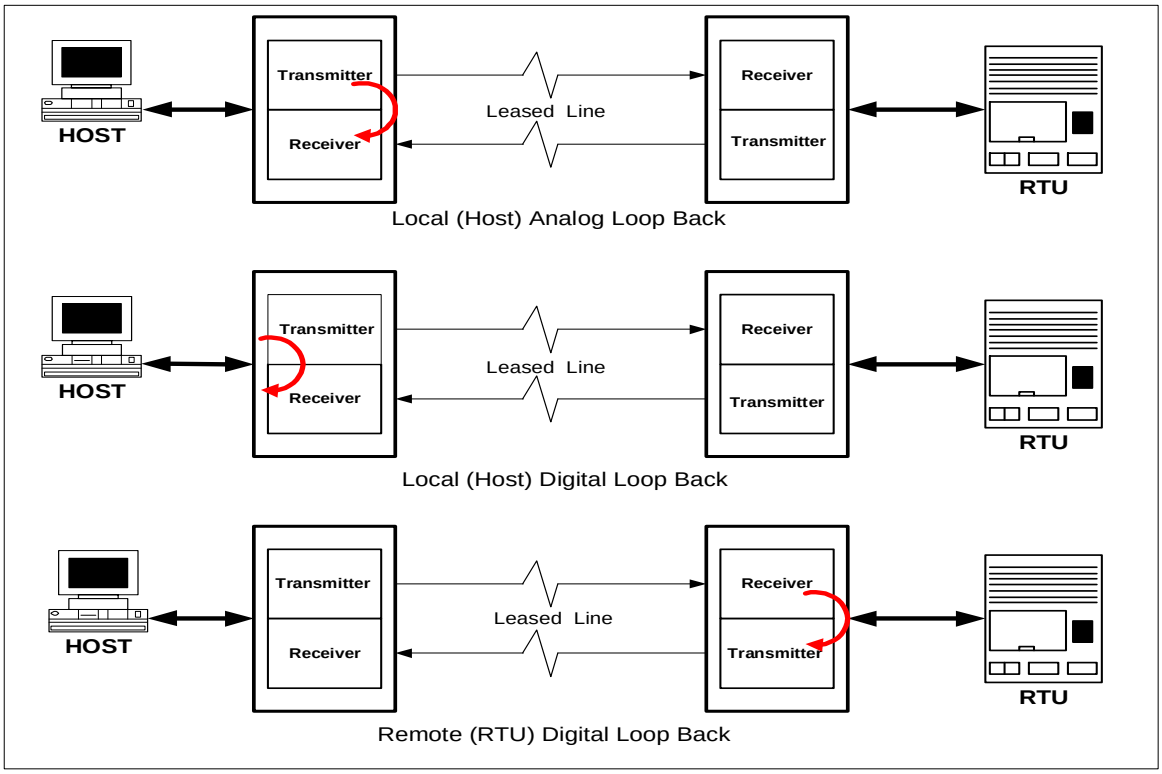


Figure 2-8. Loopback Diagnostic Modes

Appendix A
Troubleshooting

In the event you encounter a problem using your DCE modem, refer to the troubleshooting information in this appendix.

IMPORTANT: If you encounter a problem with your modem, be sure the switches on the modem are set to the appropriate positions (see Table 2-1 on page 14). If a switch is halfway between an on and off setting, the modem will not operate properly.

Problem Solving

Table A-1 offers troubleshooting solutions for modem problems.

Table A-1 Problem Solving

If…	Perform These Procedures…
No LEDs are ON at the front panel	Check the power supply source. Be sure the input power to the modem's power connector is between 10 to 60VDC
Modem does not respond to the attached DTE and the all LEDs are off.	Check the connecting RS-232 or RS-485 cable between the DTE and the modem. The MR LED (Modem Ready) on the front panel should be ON when the modem is idle.
Modem does not receive data, and the **DCD** and **RxD** LEDs are off.	Check the DIP switches of both modems to make sure that the same data rate and operating parameters are identical on both modems. The receive line pair may be disconnected from the modem. Make sure the transmission line connection to the modem is accurate and secure. The receive signal level may be below the CD threshold. Set switch S1-5 ON to see whether configuring the modem for a –43 dBm threshold resolves the problem. If this problem remains unresolved, perform a local ALB loopback test to determine if the modem's receiver is functioning correctly.
The **RTS**, **CTS**, and **TxD** LEDs do not blink.	The attached terminal or DTE may not be sending data to the modem. Verify that data is being transmitted. If data is being transmitted, make sure the RS-232 cable is sound and securely connected to the modem and terminal or DTE.

Appendix B
Specifications

General Specifications

Data rate:	19200, 9600, 4800, 2400, 0-1800 (Bell 202T), or 1-1200 bps (V.23) asynchronous
Data format:	8 or 9 data bits with 1 or more stop bits, or 7 data bit with parity bit
DTE interface:	EIA RS-232/V.24, or RS-485 (2-wire HD or 4-wire FD) compatible
Line conditions:	TELCO voice band 4- or 2-wire leased line, conditioned or unconditioned Private metallic circuits up to 9.5 miles at 9600 bps (24 AWG) without cable equalizer. Up to 15.0 miles (24 AWG) with TX and RX cable equalizer. Up to 25 miles for FSK modes.
Operating modes:	2-wire half-duplex or 4-wire full-duplex
Modulation:	QAM High-speed fast poll mode FSK, Bell 202T or V.23 compatible • Mark = 1200 Hz (1300 Hz, V.23) • Space = 2200 Hz (2100 Hz, V.23) • Soft Carrier = 900 Hz (Bell 202T only)
Equalizer	Automatic, adaptive
RTS-CTS Delay:	17.4 ms. (fast poll at 19200 bps) 23 ms. (fast poll at 2400/4800/9600 bps) 8 or 33 ms (Bell 202T) 33 ms (V.23)
Receiver dynamic range:	0 to –30 dBm or –10 to –43 dBm
Operating temperature:	-40°C to +85°C
Power supply:	Wide range switching power supply: • IG192HFP (AC version): 90 to 265 Volts AC, 50/60 Hz, single phase or 90 to 400 VDC • IG192HFP-LV (DC version):10 to 60 Volts DC
Surge protection:	Leased line, up to 15KV
Carrier control:	Constant or switched, DIP switch selectable
Carrier loss recovery:	Train on data automatically
Throughput delay:	Less than 10 milliseconds for fast polling
Auto RTS:	Support DTE without hardware RTS
Anti-streaming:	27-second timer to prevent transmitter lock-up network

Mechanical Specifications

Enclosure: Aluminum with removable front and rear panels

Dimensions: 5.0” wide x 6.5” long x 1.30” high

Weight: 1.0 lbs without AC to DC power converter module

Interface connectors

Leased Line: 5-position screw terminal (includes earth ground)

Data Terminal Equipment: DB-9 female connector (for RS-232)

RJ-11C module jack (for RS485)

Interface Connector Pin Assignments

Table B-1. Leased Line Terminal Block Pin Assignments

This Pin Number…	Corresponds to This Signal…
1	Rx
2	Rx
3	Tx
4	Tx
5	Earth Ground (optional)

NOTE: When 2-wire half-duplex is used, the TX pair must be used for both transmit and receive.

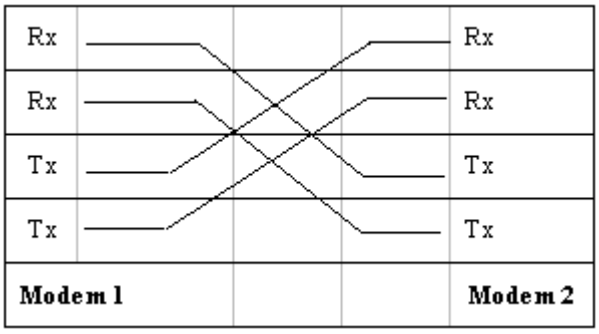


Figure 2-9. Back-to-Back Connection to a Second Modem

RS-232 (DTE) Interface

Table B-2. RS-232 (DTE) Interface

Signal Name	Modem Input/Output	DB-9 Pin	Description
DCD	Output	1	Data Carrier Detected
RXD	Output	2	Receive Data
TXD	Input	3	Transmit Data
SG	—	5	Signal Ground
DSR	Output	6	Data Set Ready (Modem Ready)
RTS	Input	7	Request To Send
CTS	Output	8	Clear To Send

RS-485 (DTE) Interface

Table B-3. RS-485 (DTE) Interface

RJ-11 Pin Number…	Corresponds to Signal Name	Modem Input or Output
1	Not Used	NA
2	RxD+	Output
3	RxD-	Output
4	TxD+	Input
5	TxD-	Input
6	Not Used	NA

Environmental Specifications

Operating temperature: -40 to + 85^{o} C

Storage temperature: -40 to + 85^{o} C

Operating humidity: 5 to 95 %, non-condensing

Surge protection: Leased line up to 15K VA

Appendix C
Limited Product Warranty

DCE warrants that the Product sold will be free from defects in material and workmanship and perform to DCE' applicable published specifications for a period of 24 months from the date of delivery to Customer. The liability of DCE hereunder shall be limited to replacing or repairing, at its option, any defective Products that are returned F.O.B. to DCE's Olney, Maryland facility (or, at DCE's option, refunding the purchase price of such products). In no case are Products to be returned without first obtaining permission and a customer return order number from DCE. In no event shall DCE be liable for any consequential or incidental damages.

Products that have been subject to abuse, misuse, accident, alteration, neglect, unauthorized repair or installation are not covered by the warranty. DCE shall make the final determination as to the existence and cause of any alleged defect. No liability is assumed for expendable items such as lamps and fuses. No warranty is made with respect to custom products or Products produced to Customer's specifications except as specifically stated in writing by DCE in the agreement for such custom products.

> **Warranty is voided if the serial number label on the printed circuit assembly of the returned modems is removed, defaced, or destroyed. This label contains the serial number that will provide proof of the date of manufacturing**.

This warranty is the only warranty made by DCE with respect to the goods delivered hereunder, and may be modified or amended only by a written instrument signed by a duly authorized officer or DCE and accepted by Customer.

This warranty and limitation extends to customer and to users of the product and is in lieu of all warranties with respect to the product whether express, implied, or statutory, including without limitation the implied warranties of merchantability and fitness for a particular purpose.

Appendix D
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 x 25 if you should have any questions.