Data Flow Systems

TELEMETRY INTERFACE MODULE

INSTALLATION & OPERATION MANUAL

TELEMETRY INTERFACE MODULE INSTALLATION AND OPERATION MANUAL

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NOTICE

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PURPOSE OF THIS MANUAL

This manual is a reference guide for installing, programming, and operating the TIM007 Telemetry Interface Module. It contains information meant to guide and assist you through installation and configuration, including mounting and wiring instructions, product features and specifications, I/O listings, instructions for integrating with telemetry, and information on configuring communication and I/O properties.

DOCUMENT CONVENTIONS

The following conventions are used throughout this manual:

- Bulleted lists provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchal information.
- *Italic* type is used for emphasis

ABBREVIATIONS USED IN THIS MANUAL

ACM – Analog Control Module

AMM – Analog Monitor Module

ARC – Analog Radio Converter

I/O – Input/Output

BEM – Bus Extender Module

CIM – Computer Interface Module

CTU – Central Terminal Unit

DCM – Digital Control Module

DMM – Digital Monitor Module

FTU – Forward Terminal Unit

HMI – Human Machine Interface

MBP – Modular Backplane

NIM – Network Interface Module

PLC – Programmable Logic Controller

PSM – Power Supply Module

RIM – Radio Interface Module

RTU – Remote Terminal Unit

TIM – Telemetry Interface Module

VDR – Voyager Video and Data Radio

Notes

Chapter 1: PRODUCT OVERVIEW

DESCRIPTION

The Telemetry Interface Module (TIM) is a microprocessor-controlled module specifically designed for use with our TAC II Central Terminal Units (CTUs), Forwarding Terminal Units (FTUs), and 200 Series RTUs (AC powered and solar).

The TIM can be ordered with one of the following board-mounted serial digital radios:

- **Voyager Video and Data Radio (VDR)** – The Voyager radio supports three modes of operation:
  - *High-speed Mode* – A Voyager radio in High-speed Mode supports over-the-air data rates of 17 kbps or 34 kbps and accepts ASCII-formatted messages from the TIM through its serial port at 9600 bps.
  - *Medium-speed Mode* – A Voyager radio in Medium-speed Mode supports over-the-air data rates of 9 kbps and accepts ASCII-formatted messages from the TIM through its serial port at 9600 bps.
  - *Legacy Mode* – A Voyager radio in Legacy Mode supports an over-the-air data rate of 2.4 kbps and accepts Manchester-encoded data from the TIM through its serial port at 1200 bps.
- **T200 Radio** – This radio features an over-the-air data rate of 2.4 kbps and accepts Manchester-encoded data via the serial port at 1200 or 9600 bps. This radio is typically used to provide downward compatibility for existing systems with older model RIMs.

MODULE INTERFACE

The TIM can interface with up to 15 I/O modules of any combination, and supports Data Flow System's TAC II protocol and the new DFP protocol. The TIM's default speed for communicating with modules on the bus is 1200 bps, but it can be configured to communicate at 9600 bps (recommended for most applications). To increase the speed to 9600 bps, place a jumper across pins 15 and 23 on the TIM.

DIGIPEATING

Up to four levels of digipeating (store and forward) are supported by the TIM. Digipeating enables the radio signal from a distant RTU to be routed to the central site by passing its message through up to three RTUs. This is a powerful option for RTU locations that require short antenna heights or those with distance or terrain challenges.

DATA BUFFER

A data buffer on the TIM enables it to query its modules for status between radio polling loops and store that information until it is requested from the central site – a particularly useful feature for sites with long radio polling loops. The TIM stores any events that occur in its status and event tables and will reply to HT3 DFP queries with status changes and any history it accumulates between polling cycles. This feature requires that the TIM be polled using DFP protocol.

SOLAR MODE

The TIM features a wake up / report / sleep mode that aids in battery conservation in solar-powered applications. Solar mode requires that the TIM be polled using DFP protocol.

RIM FEATURES RETAINED

As with previous RIM versions, the TIM performs several functions regardless of mode (CTU or RTU).

- Installs in the RIM slot of the modular backplane
- Distributes power from the PSM or 12V battery to itself and the bus via the start up plate or DIN rail switch
- Charges the battery and connects the data bus to its attached radio.
- Turn off Power Supply Module (PSM) AC power
- Service port, used in conjunction with WinRTU Test, provides a mechanism for viewing radio traffic, polling modules, and configuring the TIM.

The only exception to these functions is when the TIM is installed as the second or third radio in an FTU. In these installations, the TIM's only function is to connect the data bus to the TIM's attached radio.

NEW FEATURES AND SUPPORTING HARDWARE

In addition to the standard features of the RIM006, the TIM adds several new features and supporting hardware:

- **Digital radio interface -** The RIM006 had many hardware versions to support numerous model radios. The TIM gets away from this approach and standardizes on the most common digital radio interface. Radios with different interfaces will require the Analog Radio Converter (ARC) module to work with the TIM.
- **Piezo speaker** – The Piezo speaker beeps to indicate that a good message was received from the central site. This can be used as a tool in antenna alignment.
- **2x8 LCD screen and configuration buttons** – The LCD displays information such as ROM version, serial number, and station number. The LCD has a radio test sub-menu that provides a counter for good and bad messages.

  Three buttons are used to navigate the LCD menus. The buttons are oriented vertically with the top and bottom buttons serving as up and down arrows and the center button serving as an Enter button. The center button has several additional functions: press and hold during power up to place the TIM in test mode; press the button while the TIM is in test mode to key the radio; press the center button to exit service mode.

- **Support for DFP protocol** – When the TIM has been configured to run DFP protocol (via an entry in HT3's Registry Editor) it essentially takes over the module bus communications and begins polling the modules on the bus independent of any radio communications it receives. The poll rate for a TIM running DFP protocol defaults to 15 seconds, but it can be increased or decreased on a per station basis through a configuration change in HT3. The TIM stores any events that occur in its status and event tables and will reply to HT3 DFP queries with status changes and any history it accumulates between polling cycles. With DFP protocol, HT3 no longer sends a change/no change query to TIM stations, but instead polls them for table information. In this mode, the overhead of asking for changes and then polling for status is eliminated.

FEATURES

- 505 addresses per communications link
- Board-mounted serial digital radio
- Supports Data Flow Systems' DFP protocol for faster communication
- Wake up / report / sleep operation for solar-powered applications
- Uses Piezo speaker to indicate signal from central site
- Digipeat (store and forward) up to four levels
- Data buffer stores status changes between polls and during communication failures
- 2x8 LCD display and 3-button user interface
- RS-232 serial port monitor
- Test mode switch for radio service
- Battery backup during a power supply failure
- Uses data-compression algorithm on radio link
- Monitors RTU power and DC bias
- Configurable over-the-air data rates: high-speed (17 or 34 kbps); medium-speed (9 kbps); and legacy mode (2.4 kbps)
- LEDs for TX, RX, Power, CPU Fault
- LCD display for field diagnostics and support data
- On-board communications and functional firmware
- On-board voltage regulation
- No on-board adjustments, switches, or straps (self-configuring)
- Fully downward compatible to RIM002 - RIM006
- Downward compatible with legacy T series radios (2.4 kbps over-the-air)

DOWNWARD COMPATIBILITY TO RIM

The TIM is backward compatible to RIM002 - RIM006 models. In this application, the TIM uses TAC II protocol. No configurations are required in the RTU. Simply remove the existing RIM and replace it with a TIM. Both T200 and Voyager radios can be used. For this application, the Voyager radio can be configured for Legacy Mode, which enables the Voyager to accept Manchester-encoded data through its serial port at 1200 bps and send data over the air at 2.4 kbps.

TECHNICAL SPECIFICATIONS

Board size	5.25" x 6.88"
Service Port	RS-232 (ASCII)
Power Requirements	12-14 VDC, 165 mA average, 1 amp peak
Radio Interface	Digital, High-speed digital, TTL
Status LEDs	Transmit Data (TX), Receive Data (RX), Power, CPU Fault
Environmental Conditions	Ambient Operating Temperature Range: • TIM with T200 radio: 0˚C (32˚F) to 60˚C (140˚F) • TIM with Voyager radio: 0˚C (32˚F) to 50˚C (122˚F)

INTERFACE

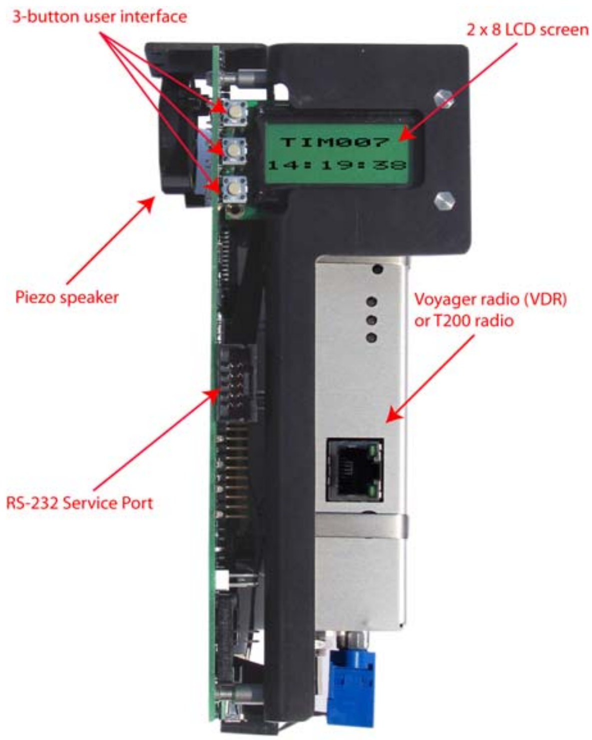


Figure 1-1, TIM007 Interface

PIN DESCRIPTIONS

ADDRESS GND	43		
		42	SYSTEM DC V+
ADDRESS BIT 7	41		
		40	SYSTEM GND
ADDRESS BIT 6	39		
		38	/POWER DOWN/
ADDRESS BIT 5	37		
		36	/RTS/
ADDRESS BIT 4	35		
		34	CTS/
ADDRESS BIT 3	33		
		32	/RX DATA/
ADDRESS BIT 2	31		
		30	/TX DATA/
ADDRESS BIT 1	29		
		28	P.S. V+
ADDRESS BIT 0	27		
		26	P.S. GND
/ADDRESS BIT 8/	25		
		24	P.S. CONTROL
/9600 BUS/	23		
		22	TGND (N/C)
/FUTURE CFG BIT/	21		
		20	/RTU POWER OK/
/SWAP/	19		
		18	/BIAS OK/
/INVERT/	17		
		16	MODBUS A 485
CFG GND	15		
		14	MODBUS B 485
	13		
		12	RADIO TXD 232
	11		
		10	MODBUS TXD 232
BATTERY GROUND	9		
		8	MODBUS RXD 232
BATTERY V+	7		
		6	RADIO RXD 232
POWER UP	5		
		4	
POWER SUPPLY GND	3		
		2	RADIO/MODBUS GND 232
POWER SUPPLY V+	1		

Notes

SAFETY PRECAUTIONS

Review the following statements before installing, servicing, or replacing the Telemetry Interface Module (TIM) or any of its components.

GENERAL PRECAUTIONS

Only trained and qualified personnel should install, service, or replace this equipment.

Carefully read the installation and wiring instructions before connecting the TIM to its power source.

Do not work on the TIM, or connect or disconnect any of its cables, during periods of lightning activity.

To prevent overheating the TIM, do not operate it in an area that exceeds the maximum recommended temperature range:

- TIM with T200 radio: 0˚C (32˚F) to 60˚C (140˚F)
- TIM with Voyager radio: 0˚C (32˚F) to 50˚C (122˚F)

Ensure that the unit is connected to earth ground during normal use.

Precautionary measures must be observed when installing, operating, and servicing the TIM in order to prevent shock from voltages present.

If the TIM is to be installed into an existing control panel, make sure that all breakers are shut off before starting the installation.

All wiring should conform to federal, state, and local electrical codes.

When using the TIM, observe the following safety guidelines:

- To help prevent electric shock, wire the TIM and peripheral power cables into properly grounded power sources.
- Ensure that nothing rests on the TIM’s cables and that the cables are located where they will not be stepped on or tripped over.

Working with the TIM

Before working with the TIM where the removal of components is necessary, perform the following steps in the sequence indicated:

1. Power down the unit.
2. Turn off all circuit breakers to the TIM.
3. Ensure that any cables connected to the TIM will not become entangled in or caught on anything in the surrounding area.

When disconnecting a cable, pull on its connector or on its strain-relief loop, not on the cable itself. Some cables have a connector with locking tabs; when disconnecting this type of cable, press in on the locking tabs before disconnecting the cable. When pulling connectors apart, you should keep them evenly aligned to avoid bending any connector pins. Also, before connecting a cable, make sure both connectors are correctly oriented and aligned.

Protecting Against Electrostatic Discharge

Static electricity can harm delicate components inside the TIM. To prevent static damage, put on an electrostatic discharge wrist strap before touching any of the TIM’s electronic components.

In addition to the preceding precautions, the following steps can be taken to prevent damage from electrostatic discharge (ESD):

- When unpacking a static-sensitive component from its shipping carton, do not remove the component's antistatic packing material until ready to install the component in the TIM. Be sure to put on an electrostatic discharge wrist strap before unwrapping the antistatic packaging.
- When transporting a sensitive component, first place it in an antistatic container or packaging.
- Handle all sensitive components in a static-safe area. Place the equipment on a grounded surface. If possible, use antistatic floor pads and workbench pads.

Note: Contact DFS if electrostatic discharge packaging is needed for return shipments. See “Return Authorization (RA) Procedure” beginning on page 83 for more information on returning equipment.

Receipt of Equipment

When equipment is received, examine the outside of the carton for any damage incurred during shipment. Remove the packing list and the equipment from the shipping carton. Carefully inspect the equipment for damage. Resolve any damage with the local carrier. Report damages to Data Flow Systems (321-259-5009). Include the serial number of the unit and the extent of damage in your report.

Chapter 3: PRINCIPLES OF OPERATION

The TIM is designed to provide radio communication in our TAC II Central Terminal Units (CTUs), Forwarding Terminal Units (FTUs), and 200 Series RTUs. The TIM is installed next to the Power Supply Module in the modular backplane of a CTU/RTU enclosure. The TIM monitors AC power on the PSM and provides power - through the module bus - for up to 15 I/O modules of any combination or to a PLC.

MODES OF OPERATION

The TIM has several modes of operation:

- **RTU mode** – Station addressed at 1-250; or 256*-511
- **CTU mode** – Station addressed at 0; or 251-254*
- **Solar mode –** Special DFP protocol configuration that has an added sleep function to conserve power in solar powered sites.
- **Test mode** – Temporary mode used for antenna alignment; temporarily changes the station address to 255 and keys the radio.
- **Service mode** – Temporary mode TIM enters when it detects communication on its service port, typically when connected to a laptop running WinRTU Test.
- **Flash Update mode** – Temporary mode TIM enters when its firmware is being updated.

** Station address 255 reserved for test mode.*

RTU MODE

In RTU Mode the TIM behaves the same as its predecessor RIM versions. When addressed as 1 to 250 or 256 to 511 the TIM boots up in slave mode to the radio port, waiting for over the air traffic from the CTU or FTU.

Until the TIM has been configured to run DFP, it will run TAC II protocol and operate the same as the RIM006 – take the data from the radio, decode it, alter the module address character if the station address does not match, and send it to the module bus at either 1200 or 9600 bps (depending on its configuration).

In RTU mode, the TIM acts as an interface between up to 15 I/O modules (or a PLC) and the CTU. Radio communication is through a Yagi antenna or rubber duck antenna depending on the distance between the RTU and CTU. The TIM monitors AC power and DC Bias on the PSM and provides power - through the module bus - for up to 15 I/O modules.

In RTU mode, communication is initiated from the radio side. The TIM receives messages from the CTU for ALL stations (every RTU receives every message sent by the CTU). The modules at the station determine if a response should be sent.

- The TIM examines the message to determine if the message is for its station. If the message isn't for the TIM's station, the TIM alters the module address part of the message before passing it on to the modules (the TIM sends all messages to its modules regardless).

- Each module examines the message to determine if the message is for it. If it is, the module asserts RTS and then transmits its reply (TXD). If the modules receive a message that has been altered by the TIM (because the TIM determined that the message wasn't for its station), the modules do not respond.

PROPERTIES OF RTU MODE

- Station Addresses 1-250 and 256-511
- Supports TAC II and DFP protocol
- Configurable for T200 radio or Voyager radio (requires WinRTU Test software to configure the TIM for the type of radio installed)
- Test mode temporarily changes station address to 255 for radio alignment
- Piezo beeps on good test mode send/reply
- LCD radio test sub-menus counts good/bad test mode messages
- Supports up to 15 function modules on the bus
- Supports group global polling
- Supports up to four (4) level digipeating

RTU MODE APPLICATIONS

- Standard Remote Terminal Unit (RTU) with DFP protocol
- Standard RTU with TAC II protocol
- “Receiving” radio in Forward Terminal Unit (FTU)
- Solar RTU
- RIM002 – RIM006 replacement
- Modbus Bridge (Legacy)

CTU MODE

In CTU mode, the TIM behaves the same as its predecessor RIM versions. The TIM boots up in slave mode to the module bus and waits for serial traffic from a FIM, a CIM, or another TIM (FTU application).

A TIM is placed in CTU mode by setting its address at 0 or 251-254.

The type of encoding used and the speed at which data is sent from the TIM to the attached radio is dependent on the type of radio installed and the application.

- T200 radio or Voyager radio in Legacy Mode – With either of these radios, the TIM takes the serial data, encodes it with Manchester encoding, and sends the data to the radio at 1200 bps.
- An exception to the above is a CTU application where a TIM in CTU mode is paired with a Voyager radio in High-speed or Medium-speed mode. In this application, there is no communication via the module bus. Network data from the HSS goes directly to the Voyager's Ethernet port. The TIM's function in this application is simply as a power source for the attached Voyager radio.

Properties of CTU Mode

- Station addresses 251-254 or 0
- Waits for data from the HSS
- Up to 9600 bps data rate over bus
- Transparently sends TAC II or DFP protocol
- Monitors RTU power and DC bias; supports power supply shutdown
- Second and/or third radio in an FTU
- Test mode keys radio for test purposes (initiate test mode by holding down center button while powering up TIM)
- Modbus to DFS conversion (with CIM instead of FIM) for third-party HMIs

CTU Mode Applications

- Central Terminal Unit (CTU)
- “Forwarding” radio in Forward Terminal Unit (FTU)
- Third-party Modbus CTU
- RIM002 – RIM006 replacement

Solar Mode

A solar-powered RTU uses a Solar Power Module (SPM), an 18 Ah battery, and a 43-watt solar panel to provide power to a Telemetry Interface Module (TIM), Analog Monitor Module (AMM), and Digital Monitor Module (DMM). The solar panels provide power to the RTU during the day; the battery takes over at night

A configuration setting in HT3 sets the DFP protocol to solar mode. Solar mode is essentially the same behavior as DFP with an added sleep function to conserve power.

For information on solar RTUs, see “Chapter 7: Solar RTU Application” beginning on page 45.

Test mode

Test mode is a temporary mode used for antenna alignment; temporarily changes the station address to 255 and keys the radio. While in test mode, the HSS sends a full status message to the station every other message.

For information on antenna alignment, see “Chapter 13: Using the TIM to Align the Antenna” beginning on page 67.

Service mode

Service mode is a temporary mode that the TIM enters when it detects communication on its service port, typically when connected to a laptop running WinRTU Test. WinRTU Test is software that is used to configure the TIM's radio parameters and can also be used for troubleshooting (Antenna and Inject forms).

For information on using WinRTU Test to configure the TIM's radio parameters, see "Chapter 12: Configuring Radio Parameters" beginning on page 61. Additional information on WinRTU Test can be found in the documentation supplied with the software.

FLASH UPDATE MODE

This is a temporary mode that the TIM enters when its firmware is being updated. Instructions for updating the TIM's firmware are supplied in "Chapter 14: Updating the TIM's Firmware" beginning on page 69.

RADIO OPTIONS

The TIM can be outfitted with one of two digital radios - either a Voyager radio or a T200 radio.

Instructions for configuring the TIM's radio are provided in "Chapter 12: Configuring Radio Parameters."

Other model radios require use of the ARC (Analog Radio Converter) board. For more information on this option, contact DFS.

Brief descriptions and specifications for the Voyager radio and the T200 radio are provided below.

VOYAGER VIDEO AND DATA RADIO (VDR)

DESCRIPTION

The Voyager radio is typically used for high speed (17 or 34 kbps over-the-air; 9600 bps ASCII messages to the TIM's radio port) or medium-speed (9 kbps over-the-air; 9600 bps ASCII messages to the TIM's radio port) communication. However, if required, the Voyager radio can operate in Legacy Mode (1200 bps Manchester encoded data to the TIM's radio port; 2.4 kbps over-the-air). Note that the 34 kbps option requires a 50KHz contiguous channel license.

SPECIFICATIONS

Frequency bands (factory selectable)	145 to 225MHz; 210 to 470MHz
RF transmit power	0.25 to 1.6 watts
RF output	Up to 2 watts
Noise figure	4dB
Data rates	2.4, 9, 17, or 34 kbps
Modulation	FSK, SOQPSK
Channel spacing	Part 90 operation (12.5, 25, 50 kHz); Part 15.709 operation (1, 2.5, 5.0 MHz); Max Tx duty cycle (100% with fan)

Tuning step size	12.5kHz
Operating mode	HDX or simplex
User ports	RS-232, Ethernet
Dimensions	3.5 x 5.0 x 1.4 inches
Enclosure material	Aluminum, anodized
Weight	0.7 lbs
Operating temperature range	-30 to 55 degrees C
Operating humidity	Up to 95%, non-condensing
Input voltage	9 to 14VDC
Current	Tx (1.5A); Rx (0.5A); Idle (0.2A)
Connector	2.5 mm jack
Certifications	FCC Part 15; FCC Part 90 (217 to 220MHz)

T200 RADIO

DESCRIPTION

The T200 radio supports 1200 bps Manchester encoded data to the TIM's radio port and 2.4 kbps over-the-air.

SPECIFICATIONS

Frequency band:	216 to 255MHz
Frequency control:	On-board PIC synthesizer; frequency programming via PC COM1/2
Channel spacing:	12.5 to 25KHz
Channel capacity:	16 pre-programmed channels
Switching bandwidth:	Maximum of 10MHz
RF output:	Up to 2 watts
Receiver sensitivity:	-115dBM at 12dB SINAD for all models
I/O:	Configurable as either digital (TTL) or analog (modem)
Frequency response:	9Hz to 3000Hz at -3dB
Type acceptance:	FCC Type Acceptance
DC supply:	10 to 14VDC; Nominal 12VDC; 500mA at 2W RF out and 50mA on receive
Connectors:	Antenna connector is BNC or SMB/C; DB9 for signal and DC
Operating temperature range:	-30 to +55 degrees C
Transmitter duty cycle:	50% at 2 watts

Transmitter switching time:	< 25mS
Receiver audio:	250mV p-p into 10L ohms for analog I/O; 5VDC TTL for digital I/O
Receiver squelch:	Noise operated; carrier detect on I/O connector (pin is active low when no signal)
Receiver RSSI:	+1 to +3VDC nominal; appears on I/O connector
Dimensions	4.5 x 2.0 x .75 inches including connectors
Enclosure material:	Metal with four-point chassis mounting

COMMUNICATION PROTOCOLS

The TIM can communicate with the HT3 server using either the standard TAC II protocol or the new DFP protocol. The TIM will automatically communicate using TAC II protocol until it has been sent the DFP station configuration by the HT3 server.

TAC II protocol is designed to maximize data gathering efficiency by only sending information that has changed (change/no-change – poll/reply). Once the driver in HT3 has obtained the status of a station it will begin to poll it for changes as opposed to requesting full status. For added efficiency it will poll groups of stations configured consecutively (up to 12) for changes.

With DFP protocol, HT3 no longer sends a change/no change query to DFP stations, but instead it polls them for table information. In this mode, the overhead of asking for changes and then polling for status is eliminated. The TIM polls the modules on the bus and stores the status and events that occur in tables. If no status changes have occurred, the TIM will send empty tables to HT3. If enough events have occurred that the data cannot be sent in a single reply message, the TIM will indicate to HT3 that there is more data to be sent. This behavior will continue until the TIM’s event table is empty.

TAC II PROTOCOL

DFS’ TAC II protocol maximizes data collection efficiency by only sending information that has changed. Once the driver in HT3 has obtained the status of a station it will begin to poll it for changes as opposed to requesting full status. For added efficiency the driver will poll groups of stations configured consecutively (up to 12) for changes.

Both the Voyager radio and the T200 radio support TAC II protocol.

When polling the TIM using TAC II protocol, the TIM’s role in data transfer is minimal. The TIM:

1. Decodes over-the-air traffic
2. Alters the module character of any messages that are not for its own station address.
3. Passes the messages to the modules on the bus.

When its own address is polled (either directly or within a group query), the TIM responds as module 'R' with its own I/O, and passes the full unaltered messages down the bus for the modules to reply to.

The modules on the bus contain the current status and a limited amount of status history for their own I/O.

POLLING SCHEME

1. HT3 sends a change / no change message to the station.
2. Each module responds to the change message with a “Y” or “N.”
3. HT3 polls each module for their current status.
4. Each module sends a reply:
   - Digital points provide their current status and a time tag (time since point changed) of 0-512 seconds.
   - Analog points provide their average change in value from the last poll.

The HT3 system uses station and group global messaging in order to communicate as efficiently as possible. Global messaging uses a change / no change methodology. Global messages don't poll for full status each time; they only ask if there has been a change since the last poll.

Global messaging limits the amount of radio traffic and provides for faster polling loops. The only times a station is asked for full status is the first time it comes online and following an offline condition. When a station goes offline, it is queried for full status when it comes back online. The query method then reverts to change / no change messaging.

STATION GLOBALS

Instead of sending a message to each module or each point, HT3 sends out a change / no change message to the station (station global). Each module replies at its assigned time – from Module A to Module O. If you were to look at the transmit LEDs on the modules in an RTU, you would see the transmit LED on each module light in sequence beginning with the module in slot A.

When the HT3 driver for a station sends a message, it knows (from the station's configuration) how many modules are installed at the station. When the driver receives the reply from the station, it knows how many responses to expect.

1. Driver sends out station global message asking for change / no change status for each module at the station.
2. Each module replies in time indicating if their status has changed from the last poll.
3. If a module reports a change in status, the driver sends a message to the module asking for the actual change.

If the driver doesn’t get the expected number of replies, either a radio error has occurred or the station’s configuration does not match the hardware in the field. Both of these conditions would generate an error in HT3.

If a module doesn’t send a response, the driver sends another message to that specific module. The module or modules at the station will be considered offline – and an offline alarm will be generated – when the total of non-responses reaches the Offline Count configured for the station in HT3.

GROUP GLOBALS

Stations can also be queried as a group (group global). One change/no change message is sent to the group. Modules at each station reply in sequence (module A at station 1; module B at station 1...; module A at station 2, module B at station 2...; module A at station 3, module B at station 3, etc.).

Stations are grouped logically by the HT3 system.

- Stations must be consecutively addressed to be in a group - for example, station 202, station 203, station 204, station 205, etc.
- A group can contain up to 12 and as few as four consecutively addressed stations.
- If there are any breaks in the addresses, for example if station 205 is followed by station 207, station 207 will either be part of the next group or will be polled by itself (if there are no other stations for that driver).
- If (for example) a driver had 11 stations, eight of which were addressed consecutively, the eight consecutive stations would be polled as a group, the remaining three would be polled individually.

DFP Protocol

In DFP Protocol, HT3 doesn't send change/no change queries to TIM stations, but instead polls them for table information. In this mode, the overhead of asking for changes and then polling for status is eliminated.

Both the Voyager radio and the T200 radio support TAC II protocol.

The TIM will not respond to HT3 using DFP protocol until it has been sent the station's configuration (via an entry in HT3's Registry Editor). Once configured for DFP protocol, the TIM polls the modules on the bus and stores the status and event data internally in a table-based format.

A TIM configured for DFP protocol essentially takes over the module bus communications. The TIM polls the modules on the bus independent of any radio communications it receives. The default poll rate for a TIM running DFP protocol is 15 seconds, but this can be increased or decreased on a per station basis through a configuration change in HT3.

All events that occur at the station are stored in the TIM's internal status and event tables.

Review the information provided in "Appendix C: DFP Protocol Operation Notes" before configuring a TIM for DFP protocol.

Status and Event Tables

There are three tables in the TIM: Config, Status, and Event.

- The Config table contains information regarding modules on the bus, points on each module, analog resolutions to record, alarms, module poll frequency, solar mode, etc.
- The Status table contains the current value of configured points.
- The Event table contains the events that occurred since the last poll of the station.

The TIM will reply to DFP queries from HT3 with status changes and any history it accumulates between polling cycles.

If no status changes have occurred since the last query, the TIM will send empty tables to HT3. If enough events have occurred that the data cannot be sent in a single reply message, the TIM will indicate to HT3 that there is more data to send. It will continue responding to HT3 this way until the TIM's event table is empty.

When HT3 receives an event message, it decodes the message and writes the data to HT3's journal tables.

POWER DISTRIBUTION

The TIM provides power distribution to the battery (except in solar power applications) and the modules through the backplane. A magnetic read switch / contact closures / starter plate on the TIM provide a path for power from the Power Supply Module (PSM) to the modules and the battery. When the starter plate is removed, power is removed from all modules (except the PSM).

COMMUNICATION (DATA) BUS

The data bus (comprised of the pins listed below) is shared by the TIM and the I/O modules. The TIM distributes power to and communicates with the modules via the data bus.

Pin 30 - TX Data

Pin 32 - RX Data

Pin 34 - CTS

Pin 36 - RTS

Pin 38 - Power Down

Pin 40 - System Ground

Pin 42 - System DC V+

INFORMATION AND STATUS SCREENS

The TIM’s LCD screen provides station configuration and status information. This information includes the station address, power supply voltage, AC and Bias status, TIM version number, and totals on the number of “good” and “bad” messages received.

For information on the TIM’s information and status screens, see “Chapter 10: TIM Information and Status Screens” beginning on page 55.

Notes

Chapter 4: RTU Application

Remote Terminal Units (RTU) are located at the well-fields, lift stations, pump stations, treatment plants, reuse ponds, storage tanks, and other various operations scattered throughout a utility's service area.

An RTU with a TIM installed communicates with the Central Terminal Unit (CTU) via a two-way radio link. The central site CTU sequentially polls each RTU to receive status from the attached equipment or transmit instructions to it.

Most RTU installations incorporate an enclosure, a tower assembly, and a Yagi antenna. DFS has several RTU antenna tower configurations, including assemblies certified to meet various wind load requirements.

More information on RTUs and their installation can be found in the *TAC II SCADA System Installation Planning Guide* and the *RTU Tower Installation Procedure*. Both of these documents are available for download from the DFS website at http://www.dataflowsys.com/support/literature.php

In RTU Mode, the TIM behaves the same as its predecessor RIM versions. Addressing the RTU as 1-250 or 256-511 causes the TIM to boot up in "slave mode" to the radio port and wait for over-the-air traffic from the CTU or FTU. The TIM supports up to 15 function modules on the bus and up to four levels of digipeating.

Both the Voyager radio and the T200 radio can be used in an RTU application. Additionally, TIM RTUs can use either TAC II or DFP protocol to communicate with the central site CTU as described in the sections that follow.

RTU with DFP Protocol

Note: Use of DFP protocol requires HT3. DFP protocol will work with both old and new versions of DFS' function modules (AMM, ACM, DMM, and DCM) without any changes.

DFP protocol is designed for stations where collecting highly granular data is important (e.g., analog data that changes many times during a polling loop). With DFP protocol all of the changes that occur during the polling loop are recorded and stored in the TIM's status and event tables and are transmitted to the Hyper SCADA Server (HSS) in one message (multiple messages may be required if there is a large amount of data).

The amount of data to be collected must be factored in when considering DFP protocol. If the messages become too large, the polling loop will be adversely affected and the granularity gains may be lost. This is because the TIM can store a finite amount of data.

If the TIM collects more data than it can store before being polled by HT3, the oldest data will be deleted from the status and event tables. If this occurs, the user should consider adjusting the resolution of analog points. Resolution is the threshold for recording changes in analog values; only changes that meet or exceed the threshold will be recorded. For example, increase the resolution of an elevated storage tank from 0.1 foot to 0.5 foot.

The TIM must be configured to run DFP protocol via an entry in HT3's Registry Editor. This information is transmitted to the TIM through a configuration download from HT3. Once it has been configured to run DFP, the TIM takes over the module bus communications and begins polling the modules on the bus independent of any radio communications it receives. Any events that occur are stored in the TIM's status and event tables. The TIM will reply to DFP queries from HT3 with status changes and any history it accumulates between polling cycles. It will continue to reply to queries from HT3 until the event table is empty.

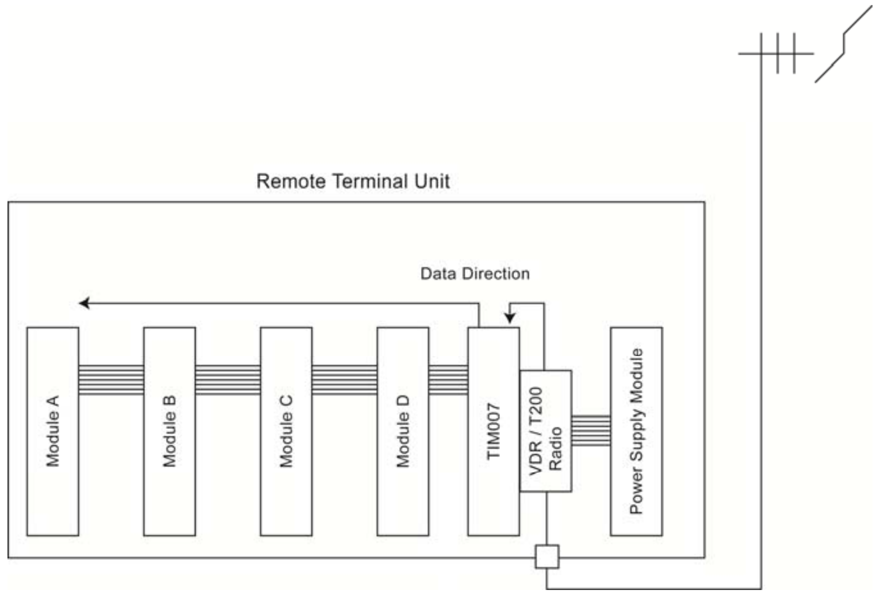


Figure 4-1, Typical DFP Protocol RTU Configuration

INSTALL AND CONFIGURE DFP PROTOCOL RTU

INSTALL TOWER AND RTU BOX

Install the RTU tower and the RTU box using the instructions provided in the *RTU Tower Installation Procedure* and the *TAC II SCADA System Installation Planning Guide*. Both of these documents are available for download from the DFS website at http://www.dataflowsys.com/support/literature.php

CONFIGURE BUS SPEED

By default, the TIM communicates with modules on the bus at 1200 bps. To increase the data rate to 9600 bps, place a jumper across pins 15 and 23 on the TIM.

ADDRESS STATION

Address the RTU station as 1-250 or 256-511 using the DIP switches on the modular backplane. See "Chapter 11: Module Addressing" beginning on page 59 for instructions on addressing a station.

Configure Radio Parameters

TIM configuration files define how the TIM communicates with its attached radios. This includes the structure of the messages sent via the TIM's radio port to the attached radio (Manchester encoded or ASCII formatted) and the speed at which data is transferred between the TIM's radio port and the radio (1200 bps or 9600 bps). The information in these files is transferred to the TIM using WinRTU Test.

A list of configurations and their definitions is maintained by the Product Engineering Department. After analyzing the specifications of the site the TIM is being installed in, refer to the list to find the correct configuration for the application.

For a T200 radio, the radio's frequency will be set in WinRTU Test. Refer to the site specifications when selecting the radio's frequency.

If a Voyager radio is being used at the site, you must use the Voyager configuration software to configure the radio's link configuration (over-the-air data rates and channel spacing), frequency, transmit power, and type (Remote or Hub). Refer to the specifications for the site when selecting the correct settings.

- For a Voyager radio in High-speed Mode, select one of the High-speed Mode link configurations (Link Configuration 2 or Link Configuration 4). For "Type," select "Remote."
- For a Voyager radio in Medium-speed Mode, select the Medium-speed Mode link configuration (Link Configuration 3). For "Type," select "Remote."
- For a Voyager radio in Legacy Mode, select one of the Legacy Mode link configurations (e.g., Link Configuration 1 or Link Configuration 5). A "Type" setting does not have to be selected for a Voyager in Legacy Mode (leave at default setting – "Remote").

For information on configuring these settings in WinRTU Test and the Voyager configuration software, see "Chapter 12: Configuring Radio Parameters" beginning on page 61.

Use Test Mode to Align Antenna

The TIM enters test mode when the center button on the LCD is held down while the TIM is being powered up. Test mode temporarily changes the TIM's station address to 255 for radio alignment.

When the TIM is in test mode, the Radio Test submenu provides a count of good and bad test mode messages, and the Piezo buzzer beeps on good test mode message send or reply.

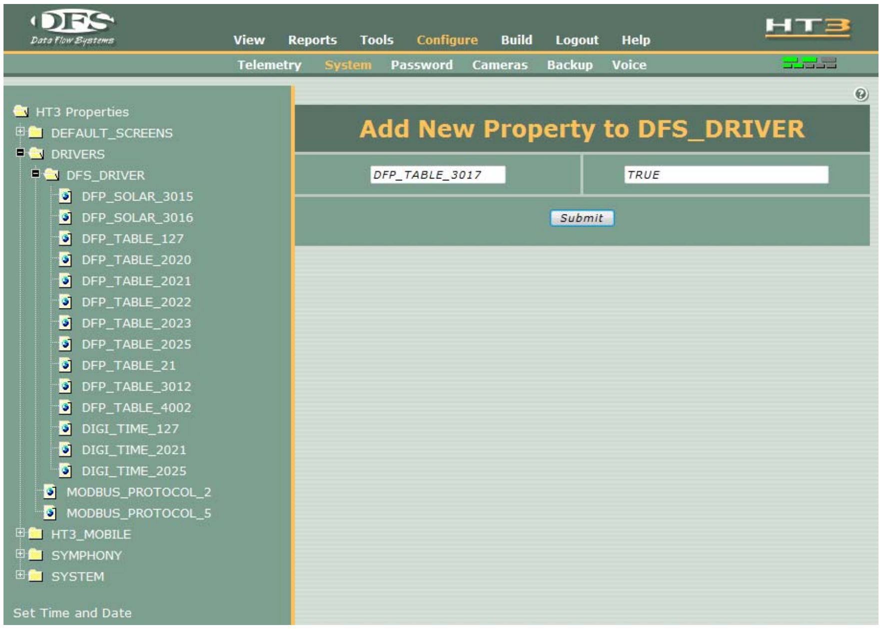
More information on using test mode to align the antenna can be found in "Chapter 13: Using the TIM to Align the Antenna."

CONFIGURE DFP STATION IN HT3

This is a two step process.

1. Add and configure the TIM station under a standard DFS driver in HT3's Configuration Editor. Detailed procedures can be found in the HT3 User Guide (an online user guide is available from within the HT3 user interface; a PDF version of the guide is available for download from the DFS website at http://www.dataflowsys.com/support/literature.php).
2. Configure the TIM station to use DFP protocol by configuring it in HT3's Registry Editor (requires DFS login; MGR login can view the Registry Editor but can't make changes to any setting other than server time and date).

Add DFP Station to Registry Editor



1. Open the Registry Editor (click Configure on HT3's main menu; click System on the Configure submenu.
2. Expand the Drivers branch and click DFS_DRIVER.
3. In the "Add New Property to DFS_DRIVER" form, enter DFP_TABLE_XXXX in the left form field (where XXXX is the station's address). The station's address is the driver number followed by three-digit station number. For example, 3017 for station 17 configured under driver number 3 (you must include a leading 0 for a station number that is less than 100).
4. In the form field on the right, enter the word TRUE.
5. Click Submit.
6. Return to Configuration Editor and perform "Update Polling."

Note: If for any reason you need the station to use TAC II protocol after it has been configured to use DFP protocol, select the station in the Registry Editor and enter the word FALSE in the station property field. "Update Polling" must be performed after changing the registry entry.

RTU WITH TAC II PROTOCOL

Unless the TIM has been configured to run DFP protocol, it will use TAC II protocol and will operate the same as the RIM006:

- Decode over the air CTU messages.
- Alter module address character unless the station address in the polling message matches its own.
- Pass data down the module bus at either 1200 or 9600 bps, depending on its configuration.
- Receive module replies, encode them, and send the responses to the radio.

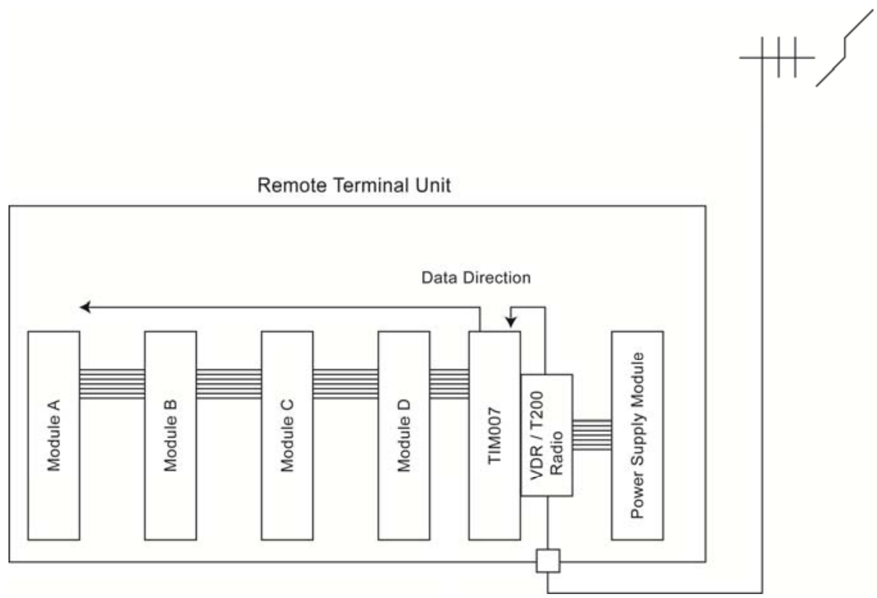


Figure 4-2, Typical TAC II Protocol RTU Configuration

INSTALL AND CONFIGURE TAC II PROTOCOL RTU

INSTALL TOWER AND RTU BOX

Install the RTU tower and the RTU box using the instructions provided in the *RTU Tower Installation Procedure* and the *TAC II SCADA System Installation Planning Guide*. Both of these documents are available for download from the DFS website at http://www.dataflowsys.com/support/literature.php

ADDRESS STATION

Address the RTU station as 1-250 or 256-511 using the DIP switches on the modular backplane. See “Chapter 11: Module Addressing” for instructions on addressing a station.

Configure Bus Speed

The default speed at which the TIM polls the modules on the bus is 1200 bps. To increase the bus speed to 9600 bps, place a jumper across pins 15 and 23 on the TIM. Note that the function modules themselves must be able to communicate at 9600 bps. All second generation and new modules (e.g., ACM002 and DMM002) are capable of 9600 bps.

Configure Radio Parameters

TIM configuration files define how the TIM communicates with its attached radios. This includes the structure of the messages sent via the TIM's radio port to the attached radio (Manchester encoded or ASCII formatted) and the speed at which data is transferred between the TIM's radio port and the radio (1200 bps or 9600 bps). The information in these files is transferred to the TIM using WinRTU Test.

A list of configurations and their definitions is maintained by the Product Engineering Department. After analyzing the specifications of the site the TIM is being installed in, refer to the list to find the correct configuration for the application.

For a T200 radio, the radio's frequency will be set in WinRTU Test. Refer to the site specifications when selecting the radio's frequency.

If a Voyager radio is being used at the site, you must use the Voyager configuration software to configure the radio's link configuration (over-the-air data rates and channel spacing), frequency, transmit power, and type (Remote or Hub). Refer to the specifications for the site when selecting the correct settings.

- For a Voyager radio in High-speed Mode, select one of the High-speed Mode link configurations (Link Configuration 2 or Link Configuration 4). For "Type," select "Remote."
- For a Voyager radio in Medium-speed Mode, select the Medium-speed Mode link configuration (Link Configuration 3). For "Type," select "Remote."
- For a Voyager radio in Legacy Mode, select one of the Legacy Mode link configurations (e.g., Link Configuration 1 or Link Configuration 5). A "Type" setting does not have to be selected for a Voyager in Legacy Mode (leave at default setting – "Remote").

For information on configuring these settings in WinRTU Test and the Voyager configuration software, see "Chapter 12: Configuring Radio Parameters" beginning on page 61.

Use Test Mode to Align Antenna

The TIM enters test mode when the center button on the LCD is held down while the TIM is being powered up. Test mode temporarily changes the TIM's station address to 255 for radio alignment.

When the TIM is in test mode, the Radio Test submenu provides a count of good and bad test mode messages, and the Piezo buzzer beeps on good test mode message send or reply.

More information on using test mode to align the antenna can be found in "Chapter 13: Using the TIM to Align the Antenna."

Configure Station in HT3

Add and configure the TIM station under a standard DFS driver in HT3's Configuration Editor.

Detailed procedures can be found in the HT3 User Guide (an online user guide is available from within the HT3 user interface; a PDF version of the guide is available for download from the DFS website at http://www.dataflowsys.com/support/literature.php).

Note: Using TAC II protocol at a TIM RTU station does *not* require any changes to HT3's Registry Editor. If for any reason you need the station to use DFP protocol, add the station to the Registry Editor using the steps provided in "Add DFP Station to Registry Editor" on page 26.

Notes

Chapter 5: CTU MASTER RADIO APPLICATION

The central terminal unit (CTU) houses the master radio (TIM with attached Voyager radio or T200 radio). In a CTU, the TIM is configured for CTU Mode and is used to interface communications between the Hyper SCADA Server (HSS) and the RTUs.

The CTU is typically mounted on the central site communications tower. The central antenna is typically a high gain, Omni-directional antenna selected specifically for the frequency of operation.

The data transmission connection between the Hyper SCADA Server and the CTU is by fiber optic cable. This isolates the server from high voltage spikes induced by nearby lightning strikes and negates the need for the HSS to be co-located with the CTU and tower.

Communication is initiated at the HSS. When a message is received, the TIM sends it out to the RTU stations via its attached radio. It then waits for replies from the stations and transmits them to the HSS.

Data conversion (network-to-serial and serial-to-network) is required in order for the HSS (a network device) to communicate with the RTUs (serial devices). This process – serial tunneling – is performed by a FIM installed in the CTU or by a Voyager radio configured for High-speed Mode.

- In a **CTU with a Voyager radio in High-speed or Medium-speed Mode**, a FIM is not required. The Voyager itself takes care of the data conversion. A Voyager radio in High-speed mode can function as both the radio and the serial tunneling device. The Voyager features an Ethernet port that can be used to provide an Ethernet connection between the HSS and the CTU.
- In a **CTU with a T200 radio or a Voyager radio in Legacy Mode**, serial tunneling is performed by the Fiber Interface Module (FIM). The FIM is a network-interface platform for use with TAC II telemetry systems. The FIM uses "serial tunneling" to convert the radio’s serial TTL data into network data for transmission over fiber optic cable to the Hyper SCADA Server. The FIM’s COM1 port (serial tunnel one) goes over the CTU’s bus to the TIM. This tunnel enables the transfer of data between the network and the radio.

TIM’S ROLE IN THE CTU

In a CTU application, the TIM is placed in CTU mode by addressing it at 0 or at an address between 251 and 254. A TIM in CTU mode typically causes the TIM to boot up in slave mode to the module bus and wait for serial traffic from a FIM.

An exception to this is when the TIM is paired with a Voyager radio in High-speed or Medium-speed mode. Additionally, the type of encoding used and the speed at which data is sent from the TIM to the attached radio is dependent on the type of radio installed and the application.

T200 RADIO OR VOYAGER RADIO IN LEGACY MODE

With either of these radios, the TIM behaves the same as its predecessor RIM versions. The TIM boots up in slave mode to the module bus and waits for serial traffic from the FIM. The TIM takes the serial data, encodes it with Manchester encoding, and sends the data out its radio port to the attached radio at 1200 bps. The radio then transmits the data to the RTUs.

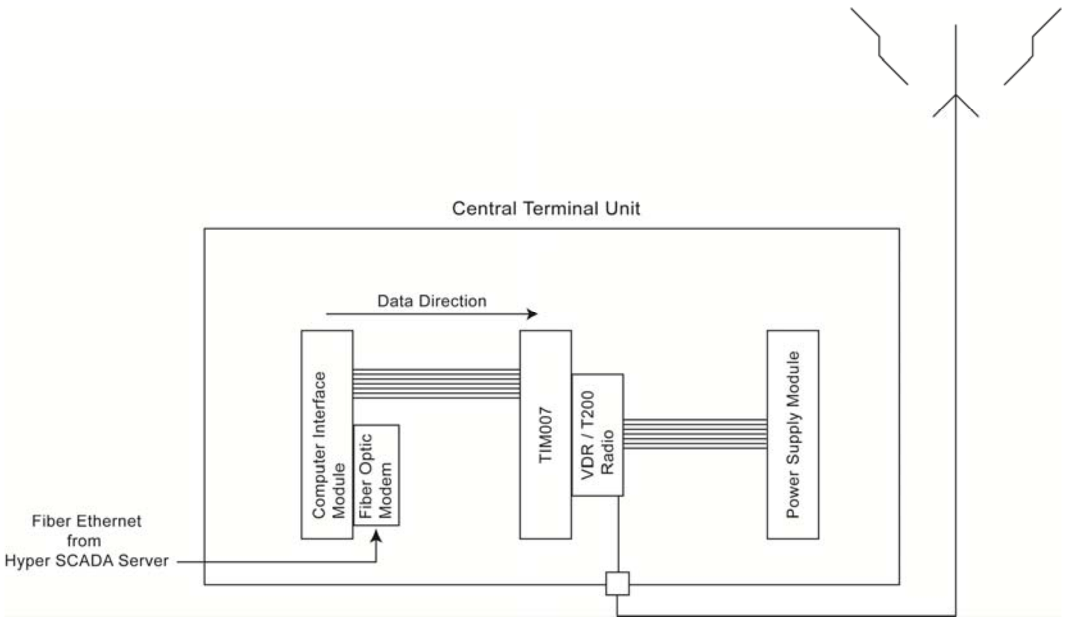


Figure 5-1, CTU with T200 or Voyager in Legacy Mode

VOYAGER RADIO IN HIGH-SPEED OR MEDIUM-SPEED MODE

With this radio, the TIM takes the serial data and simply passes the ASCII formatted message to the radio at 9600 bps. The Voyager radio then sends the data to the RTUs. In this application, there is no communication via the module bus. Network data from the HSS goes directly to the Voyager's Ethernet port. The TIM's function in this application is simply as a power source for the attached Voyager radio. For this reason, TAC II or DFP protocol is transparent.

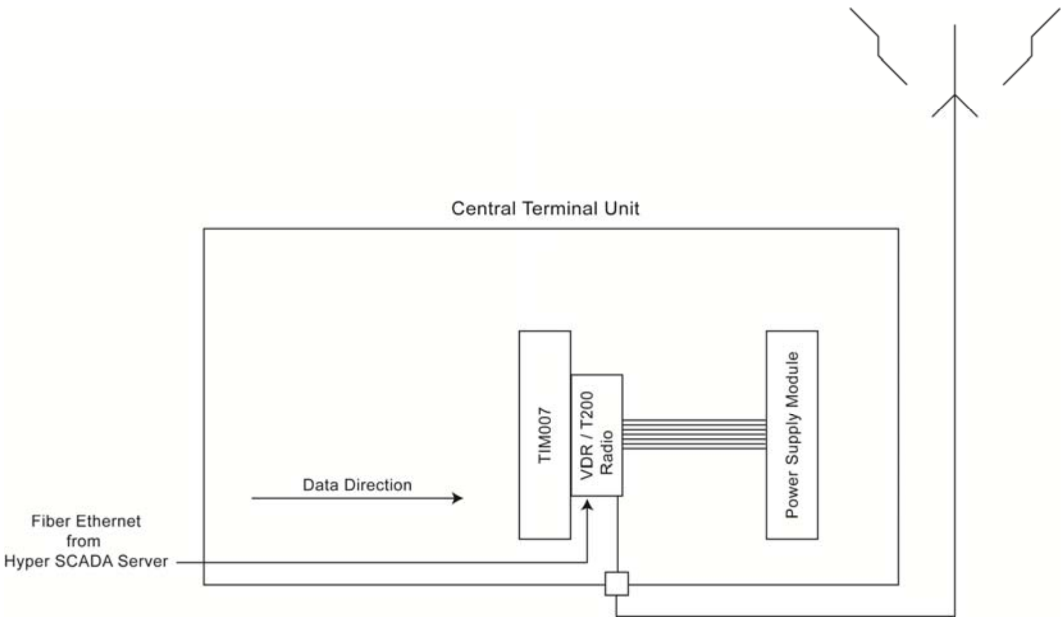


Figure 5-2, CTU with Voyager in High-speed Mode

INSTALL AND CONFIGURE CTU

INSTALL TOWER AND CTU BOX

Install the CTU tower and enclosure using the instructions provided in the *RTU Tower Installation Procedure* and the *TAC II SCADA System Installation Planning Guide*. Both of these documents are available for download from the DFS website at http://www.dataflowsys.com/support/literature.php

INSTALL MODULES AND MAKE CTU BOX MODIFICATIONS

Note: The instructions below apply only to a CTU with a T200 radio or a Voyager radio in Legacy Mode. A CTU with a High-speed or Medium-speed Mode Voyager radio does *not* require a FIM or any modifications to the CTU box.

- If the CTU is a 202 box, the FIM must be placed in the far left module slot (opposite end from the PSM); for a 204 box, place the FIM directly beside the TIM.
- Swap the bus to the TIM by placing a jumper across pins 15 and 21 of the FIM.
- Bypass the startup plate by placing a jumper across pins 3 and 5 on both the FIM and the TIM.
- By default, the TIM communicates with modules on the bus at 1200 bps. For this application, the data rate should be increased to 9600 bps. This is done by placing a jumper across pins 15 and 23 on the TIM.

CONFIGURE CTU IP ADDRESS

The CTU is a device on the same network as the Hyper SCADA Server or a device on a private network that communicates with the HSS through a gateway. As such, it requires a valid IP address: one not already in use by any other network device, including other network RTUs or CTUs.

CTU with T200 Radio or Voyager Radio in Legacy Mode

In a CTU with a T200 radio or a Voyager radio in Legacy Mode, the IP address is formed by combining the CTU's network address (first three octets of a Class C network IP address) with the FIM's configured station address. The station address becomes the host portion (fourth octet) of the IP address. Thus, a CTU on the 205.242.61 network with a FIM addressed at 247 would have an IP address of 205.242.61.247. To configure the FIM with a valid station address, place a jumper across the appropriate pins. See "Chapter 11: Module Addressing."

CTU with Voyager Radio in High-speed or Medium-speed Mode

In a CTU with a Voyager radio in High-speed Mode, the Voyager itself is configured with an IP address using the Voyager configuration software. For this application, set the Local IP and Radio IP settings to the same IP address (the Voyager configuration software has a "Copy from Local" button that copies the network settings of the Local section to the Radio section).

For information on configuring these settings in WinRTU Test and the Voyager configuration software, see "Chapter 12: Configuring Radio Parameters" beginning on page 61.

CONFIGURE TIM FOR CTU MODE

Set the TIM's CTU address at 0 or 251-254 to place it in CTU mode. Address the TIM using the DIP switches on the modular backplane. See "Chapter 11: Module Addressing."

Configure Radio Parameters

TIM configuration files define how the TIM communicates with its attached radios. This includes the structure of the messages sent via the TIM's radio port to the attached radio (Manchester encoded or ASCII formatted) and the speed at which data is transferred between the TIM's radio port and the radio (1200 bps or 9600 bps). The information in these files is transferred to the TIM using WinRTU Test.

A list of configurations and their definitions is maintained by the Product Engineering Department. After analyzing the specifications of the site the TIM is being installed in, refer to the list to find the correct configuration for the application.

For a T200 radio, the radio's frequency will be set in WinRTU Test. Refer to the site specifications when selecting the radio's frequency.

If a Voyager radio is being used at the site, you must use the Voyager configuration software to configure the radio's link configuration (over-the-air data rates and channel spacing), frequency, transmit power, and type (Remote or Hub). Refer to the specifications for the site when selecting the correct settings.

- For a Voyager radio in High-speed Mode, select one of the High-speed Mode link configurations (Link Configuration 2 or Link Configuration 4). For "Type," select "Hub."
- For a Voyager radio in Medium-speed Mode, select the Medium-speed Mode link configuration (Link Configuration 3). For "Type," select "Hub."
- For a Voyager radio in Legacy Mode, select the appropriate Legacy Mode link configuration (e.g., Link Configuration 1 or Link Configuration 5). A "Type" setting does not have to be selected for a Voyager in Legacy Mode (leave at default setting – "Remote").

For information on configuring these settings in WinRTU Test and the Voyager configuration software, see "Chapter 12: Configuring Radio Parameters" beginning on page 61.

Use Test Mode to Key Radio and Test SWR of the Antenna

The TIM enters test mode when the center button on the LCD is held down while the TIM is being powered up. In a CTU, Test Mode is used to key the radio and test the SWR of the CTU Antenna.

Configure Driver for CTU in HT3

Add and configure a standard DFS driver for the CTU in HT3's Configuration Editor.

The driver's Tunnel IP Address would be configured in HT3 as x.xxx.xxx.xxx.1, where:

- xxx.xxx.xxx is the CTU's IP address (see "Configure CTU IP Address" on previous page).
- The number 1 (one) at the end of the tunnel IP address represents the serial port of the FIM or the Voyager radio through which data is transferred between the network and the radio.

For example, a CTU with an IP address of 205.242.61.247, would have a Tunnel IP Address of 205.242.61.247.1

Detailed procedures can be found in the *HT3 User Guide* (an online user guide is available from within the HT3 user interface; a PDF version of the guide is available for download from the DFS website at http://www.dataflowsys.com/support/literature.php).

Note: Configuring a CTU does *not* require any changes to HT3's Registry Editor.

Notes

Chapter 6: FTU APPLICATION

An FTU (Forward Terminal Unit) provides a means to establish communications to a network of RTUs that are too far from the Central Terminal Unit master radio (CTU) or unable to communicate with the CTU because of terrain. The Forwarding Terminal Unit (FTU) is a type of RTU that is similar to a repeater and incorporates two or three TIMs.

- The first TIM (referred to here as the receiving TIM) is installed in the "radio" slot of the RTU and receives messages from the CTU Master Radio and passes them to the forwarding TIM.
- The second TIM (referred to here as the forwarding TIM) is typically installed in the far left slot of the RTU. This TIM communicates, or "forwards," the CTU's messages to the other RTUs in the system.

An FTU station is configured as a standard RTU in HT3. To HT3 and the rest of the telemetry system, an FTU will look like any other RTU.

IMPORTANT: An FTU can only use TAC II protocol, because the receiving and forwarding TIMs must be able to immediately pass data over the bus to each other. If the FTU was configured for DFP protocol, each TIM would accumulate the data in its event tables instead of sending it to the other TIM.

The module bus in an FTU must be modified to swap RTS, CTS, TXD, and RXD. The FTU utilizes one frequency for receive (RX) and transmit (TX) to communicate with the CTU and another frequency for RX and TX to communicate with the RTUs. This difference permits RTUs to act as digipeaters since they receive RX and TX on the same frequency. Continuous Differential Polling is used; RTU messaging incorporates two (2) second time-tagging accuracy.

The other module slots in an FTU may or may not contain I/O modules. Any I/O module placed in an FTU will be polled by the CTU Master Radio through the TIM that is installed in the "radio slot" of the RTU.

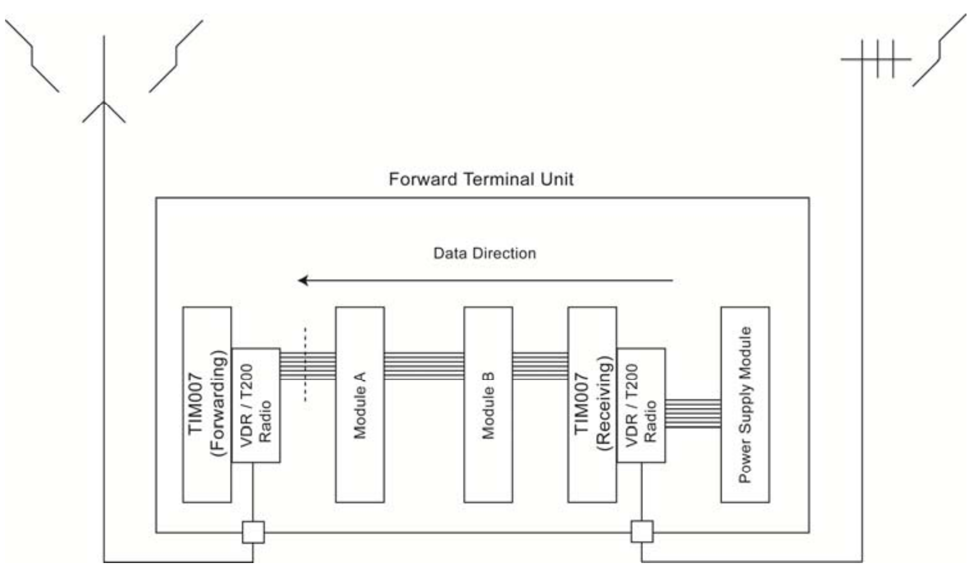


Figure 6-1, Example of FTU Configuration

Receiving TIM

The receiving TIM is installed in the “radio slot” of the RTU. It communicates in the direction of the Central Terminal Unit (CTU). It takes messages received from the CTU and passes them to the forwarding TIM, which sends them out to the system’s other RTUs. (Replies from the RTUs are handled in a similar manner but in reverse.)

The receiving TIM is configured and operates in RTU mode. It requires a valid RTU station address and configurations in HT3 just like any other RTU. The station address is typically 500-511, but any address between 1-250 or 256-511 is valid.

Forwarding TIM

The forwarding TIM is installed in the same RTU as the receiving TIM. The forwarding TIM takes messages from the receiving TIM and “forwards” them to the other RTUs in the system. (Replies from the RTUs are handled in a similar manner but in reverse)

- The forwarding TIM is typically installed in the RTU box in the furthest module slot on the left.
- The forwarding TIM is configured and operates in CTU mode.

The forwarding TIM must have a valid CTU address (251-254). We recommend that the forwarding TIM be configured at an unused CTU address, so it can be queried for firmware version and/or updated via the radio link. The forwarding TIM does *not* have to be configured in HT3.

Install and Configure FTU

Install Tower and FTU Box

Install the FTU tower and the FTU box using the instructions provided in the *RTU Tower Installation Procedure* and the *TAC II SCADA System Installation Planning Guide*. Both of these documents are available for download from the DFS website at http://www.dataflowsys.com/support/literature.php

Address Station

- **Receiving TIM**: Address as 1-250 or 256-511
- **Forwarding TIM**: Address as 251-254

Use the DIP switches on the modular backplane to address each TIM. See “Chapter 11: Module Addressing” for instructions on addressing a station.

Configure Radio Parameters

TIM configuration files define how the TIM communicates with its attached radios. This includes the structure of the messages sent via the TIM’s radio port to the attached radio (Manchester encoded or ASCII formatted) and the speed at which data is transferred between the TIM’s radio port and the radio (1200 bps or 9600 bps). The information in these files is transferred to the TIM using WinRTU Test.

A list of configurations and their definitions is maintained by the Product Engineering Department. After analyzing the specifications of the site the TIM is being installed in, refer to the list to find the correct configuration for the application.

For a T200 radio, each radio's frequency will be set in WinRTU Test. Refer to the site specifications when selecting the radio's frequency.

If a Voyager radio is being used at the site, you must use the Voyager configuration software to configure each radio's link configuration (over-the-air data rates and channel spacing), frequency, transmit power, and type (Remote or Hub). Refer to the specifications for the site when selecting the correct settings.

- For a Voyager radio in High-speed Mode, select one of the High-speed Mode link configurations (Link Configuration 2 or Link Configuration 4). For "Type," select "Remote" for each radio in the FTU.
- For a Voyager radio in Medium-speed Mode, select the Medium-speed Mode link configuration (Link Configuration 3). For "Type," select "Remote" for each radio in the FTU.
- For a Voyager radio in Legacy Mode, select one of the Legacy Mode link configurations (e.g., Link Configuration 1 or Link Configuration 5). A "Type" setting does not have to be selected for a Voyager in Legacy Mode (leave at default setting – "Remote").

For information on configuring these settings in WinRTU Test and the Voyager configuration software, see "Chapter 12: Configuring Radio Parameters" beginning on page 61.

USE TEST MODE TO ALIGN ANTENNA

The TIM enters test mode when the center button on the LCD is held down while the TIM is being powered up. Test mode temporarily changes the TIM's station address to 255 for radio alignment.

When the TIM is in test mode, the Radio Test submenu provides a count of good and bad test mode messages, and the Piezo buzzer beeps on good test mode message send or reply.

More information on using test mode to align the antenna can be found in "Chapter 13: Using the TIM to Align the Antenna" beginning on page 67

CONFIGURE FTU IN HT3

Note: An FTU can only use TAC II protocol, because the receiving and forwarding TIMs must be able to immediately pass data over the bus to each other. If the FTU was configured for DFP protocol, each TIM would accumulate the data in its event tables instead of sending it to the other TIM. Although the FTU cannot be configured for DFP protocol, the protocol it passes to the RTUs is transparent to it and therefore can be either TAC II or DFP.

- **Receiving TIM** – For the receiving TIM, add and configure a station under a standard DFS driver in HT3's Configuration Editor.
- **Forwarding TIM** – The forwarding TIM does *not* have to be configured in HT3.

Detailed procedures can be found in the *HT3 User Guide* (an online user guide is available from within the HT3 user interface; a PDF version of the guide is available for download from the DFS website at http://www.dataflowsys.com/support/literature.php).

Notes

Chapter 7: SOLAR RTU APPLICATION

A solar-powered site enables a utility to power a remote site when it is impractical and too expensive to run electrical power to the location. It is also useful for a utility that wants to take a site "off the grid."

A typical solar-powered RTU uses a Solar Power Module (SPM), an 18 Ah battery, and a 43-watt solar panel to provide power to a Telemetry Interface Module (TIM), Analog Monitor Module (AMM), and Digital Monitor Module (DMM). The solar panels provide power to the RTU during the day; the battery takes over at night.

The RTU does not contain a PSM but instead includes a Solar Power Module (SPM) that is wired to Photo Voltaic Modules (solar panels). There is no longer an applicable RTU power monitor point or power supply shutdown, because the RTU runs full time on the battery. The TIM monitors the SPM's DC bias, and also provides a DC voltage as an analog point in its event and status table.

A solar RTU can use either a Voyager radio or a T200 radio. The increased current that the Voyager draws during its idle and transmit states is not significant, because the TIM powers down the radio and the modules during its sleep cycles.

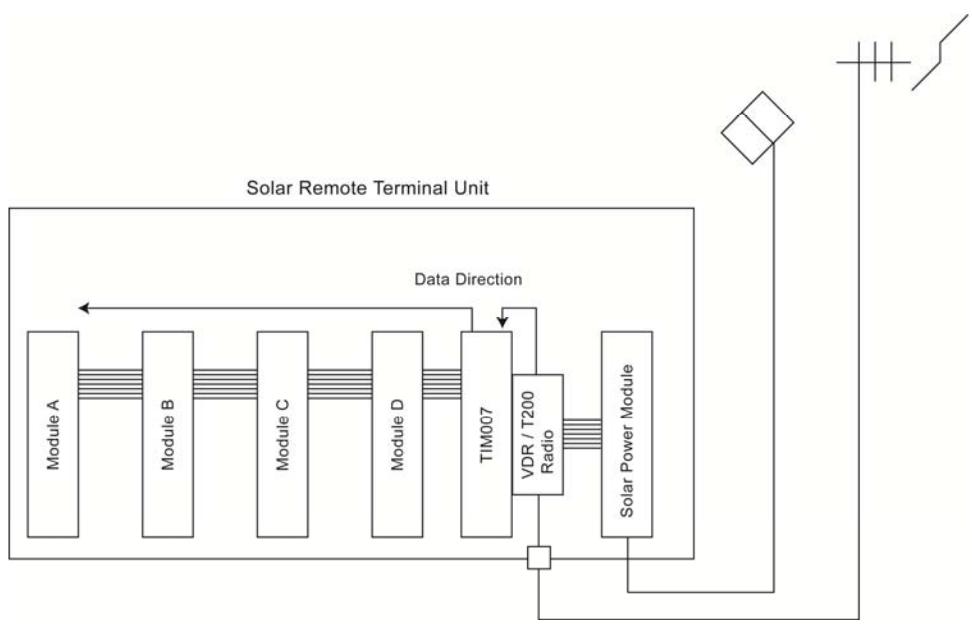


Figure 7-1, Typical Solar RTU Configuration

Solar Mode

DFP protocol is required for a solar RTU. A configuration setting in HT3 sets the DFP protocol to solar mode. Solar mode is essentially the same behavior as DFP with an added sleep function to conserve power.

- The TIM wakes 3 seconds before the top of each minute and polls the RTU's modules.
- The TIM waits up to 20 seconds after minute for HT3 query, then sleeps to next minute.
- The TIM responds every minute to HT3 if the battery voltage is greater than 13 volts.
- If the voltage is less than 13 volts, the TIM responds once every five minutes with the modulus 5 of its station address.
- In Sleep Mode the TIM powers down all but a clock component on its module, and also switches power off to the module bus.

Install and Configure Solar RTU

Install Tower and RTU Box

Install the RTU tower and the RTU box using the instructions provided in the *RTU Tower Installation Procedure* and the *TAC II SCADA System Installation Planning Guide*. Both of these documents are available for download from the DFS website at http://www.dataflowsys.com/support/literature.php

Address Station

Address the RTU station as 1-250 or 256-511 using the DIP switches on the modular backplane. See "Chapter 11: Module Addressing" for instructions on addressing a station.

Configure Radio Parameters

TIM configuration files define how the TIM communicates with its attached radios. This includes the structure of the messages sent via the TIM's radio port to the attached radio (Manchester encoded or ASCII formatted) and the speed at which data is transferred between the TIM's radio port and the radio (1200 bps or 9600 bps). The information in these files is transferred to the TIM using WinRTU Test.

A list of configurations and their definitions is maintained by the Product Engineering Department. After analyzing the specifications of the site the TIM is being installed in, refer to the list to find the correct configuration for the application.

For a T200 radio, the radio's frequency will be set in WinRTU Test. Refer to the site specifications when selecting the radio's frequency.

If a Voyager radio is being used at the site, you must use the Voyager configuration software to configure the radio's link configuration (over-the-air data rates and channel spacing), frequency, transmit power, and type (Remote or Hub). Refer to the specifications for the site when selecting the correct settings.

- For a Voyager radio in High-speed Mode, select one of the High-speed Mode link configurations (Link Configuration 2 or Link Configuration 4); for Type, select "Remote."

- For a Voyager radio in Medium-speed Mode, select the Medium-speed Mode link configuration (Link Configuration 3); for Type, select "Remote."
- For a Voyager radio in Legacy Mode, select one of the Legacy Mode link configurations (e.g., Link Configuration 1 or Link Configuration 5); a Type setting does not have to be selected for a Voyager in Legacy Mode (leave at default setting – "Remote").

For information on configuring these settings in WinRTU Test and the Voyager configuration software, see "Chapter 12: Configuring Radio Parameters" beginning on page 61.

USE TEST MODE TO ALIGN ANTENNA

The TIM enters test mode when the center button on the LCD is held down while the TIM is being powered up. Test mode temporarily changes the TIM's station address to 255 for radio alignment.

When the TIM is in test mode, the Radio Test submenu provides a count of good and bad test mode messages, and the Piezo buzzer beeps on good test mode message send or reply.

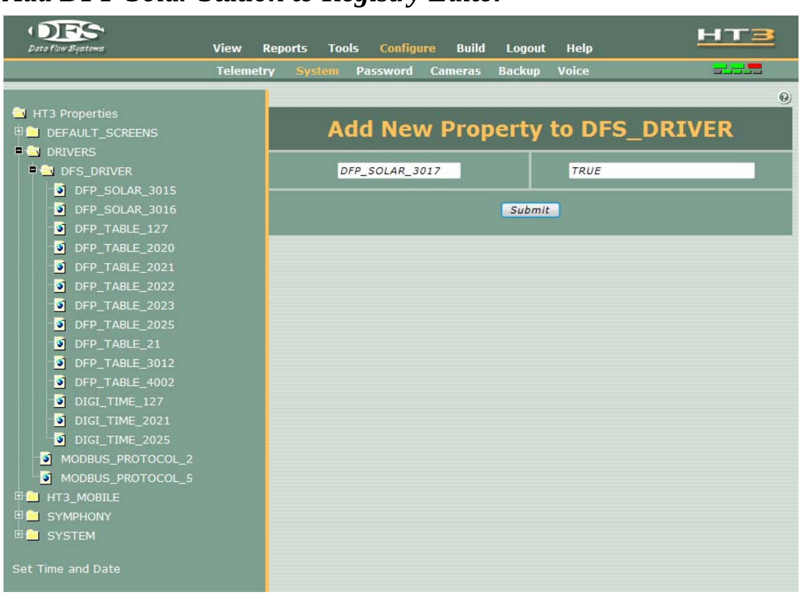
More information on using test mode to align the antenna can be found in "Chapter 13: Using the TIM to Align the Antenna."

CONFIGURE DFP SOLAR STATION IN HT3

This is a two step process.

1. Add and configure the TIM station under a standard DFS driver in HT3's Configuration Editor. Detailed procedures can be found in the HT3 User Guide (an online user guide is available from within the HT3 user interface; a PDF version of the guide is available for download from the DFS website at http://www.dataflowsys.com/support/literature.php).
2. Configure the TIM station to use DFP solar protocol by configuring it in HT3's Registry Editor (requires DFS login; MGR login can view the Registry Editor but can't make changes to any setting other than server time and date).

Add DFP Solar Station to Registry Editor



1. Open the Registry Editor (click Configure on HT3's main menu; click System on the Configure submenu.
2. Expand the Drivers branch and click DFS_DRIVER.
3. In the "Add New Property to DFS_DRIVER" form, enter DFP_SOLAR_XXXX in the left form field (where XXXX is the station's address). The station's address is the driver number followed by three-digit station number. For example, 3017 for station 17 configured under driver number 3 (you must include a leading 0 for a station number less than 100).
4. In the right form field, enter the word TRUE.
5. Click Submit.
6. Return to Configuration Editor and perform "Update Polling."

Note: If you need the station to use TAC II protocol for troubleshooting purposes, select the station in the Registry Editor and enter the word FALSE in the station property field. "Update Polling" must be performed after changing the registry entry.

Chapter 8: THIRD-PARTY MODBUS CTU APPLICATION

Third-party Modbus-based HMIs can poll DFS stations through a TIM-based CTU. The TIM translates Modbus messages received on the bus for its predetermined DFS station and module address (refer to "Appendix B: Module/Point to Register Address Map"). It then takes the DFS RTU reply and converts it back to Modbus protocol for the third-party software. For this application, the TIM is paired with a T200 radio.

A Computer Interface Module (CIM002-1) with attached fiber-optic modem is installed in the CTU and provides an RS-232 serial interface to a third-party Modbus HMI.

- The CIM takes messages directly from the third-party software's serial interface via its fiber optic modem and sends it down the bus to the TIM.
- For messages received by the radio, the CIM converts the TIM's TTL data into audio signals that can be transmitted over fiber optic cable via a fiber optic modem.

Note that this application, in which each module is queried for status every poll, does not take advantage of the functions – such as change / no change messaging and group global messaging – that were designed to enable quick and efficient polling of DFS RTUs. Also, because Modbus does not have a method to apply the change timers of our module responses, event time stamps will be when the Modbus driver *receives* the reply, not when the event actually occurred.

This CTU configuration should only be used on systems consisting of ten or fewer RTUs. Once a system grows larger, users should consider installing a Hyper SCADA Server (HSS) and using DFS protocols (either TAC II or DFP) for communications.

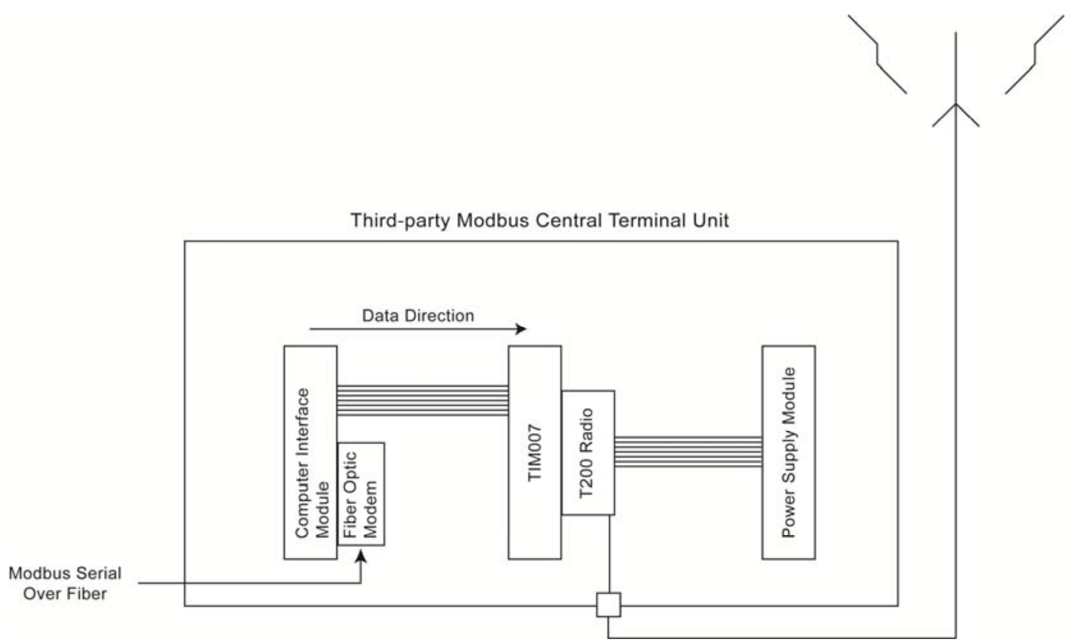


Figure 8-1, Typical Third-party Modbus CTU Configuration

Install and Configure CTU

Install Tower and CTU Box

Install the CTU tower and enclosure using the instructions provided in the *RTU Tower Installation Procedure* and the *TAC II SCADA System Installation Planning Guide*. Both of these documents are available for download from the DFS website at http://www.dataflowsys.com/support/literature.php

Install Modules and Make CTU Box Modifications

- If the CTU is a 202 box, the CIM must be placed in the far left module slot (opposite end from the PSM); for a 204 box, place the CIM directly beside the TIM.
- Bypass the startup plate by placing a jumper across pins 3 and 5 on both the CIM and the TIM.

Configure TIM for CTU Mode

Set the TIM's CTU address at 0 or 251-254 to place it in CTU mode. Address the TIM using the DIP switches on the modular backplane. See "Chapter 11: Module Addressing."

Configure Radio Parameters

TIM configuration files define how the TIM communicates with its attached radios. This includes the structure of the messages sent via the TIM's radio port to the attached radio (Manchester encoded or ASCII formatted) and the speed at which data is transferred between the TIM's radio port and the radio (1200 bps or 9600 bps). The information in these files is transferred to the TIM using WinRTU Test.

A list of configurations and their definitions is maintained by the Product Engineering Department. After analyzing the specifications of the site the TIM is being installed in, refer to the list to find the correct configuration for the application.

For a T200 radio, the radio's frequency will be set in WinRTU Test. Refer to the site specifications when selecting the radio's frequency.

Use WinRTU Test to configure the TIM for the T200 radio and to set the radio's frequency. For information on configuring these settings in WinRTU Test, see "Chapter 12: Configuring Radio Parameters" beginning on page 61.

Use Test Mode to Align Antenna

The TIM enters test mode when the center button on the LCD is held down while the TIM is being powered up. In a CTU, Test Mode is used to key the radio and test the SWR of the CTU Antenna.

Configure Driver in Third-party HMI

Configure the third-party HMI to poll this station using Modbus ASCII protocol.

Chapter 9: MODBUS BRIDGE APPLICATION

Modbus Bridge is no longer a recommended application. It is included in this manual only as a reference to support any existing installations.

Modbus Bridge is a method of bringing information from a Modbus serial slave device over an existing DFS radio network. In this application there can be no other modules on the bus. The RTU contains only a Power Supply Module (PSM), a Computer Interface Module (CIM), and a TIM.

The Modbus slave device is polled using Modbus ASCII 9600 7 O 2. The Modbus messages are encapsulated in a DFS message wrapper.

As occurs with the Third-party Modbus CTU application, all of the DFS driver efficiencies are lost when using this method.

If there is a significant amount of I/O in the Modbus device, the polling of this RTU can be detrimental to the performance of the radio network. The PLC033 was added to the DFS product line after this feature was implemented in the RIM006, and it offers a much better method to accomplish the same results.

When upgrading a Modbus Bridge RTU from a RIM to a TIM, the only configuration required is for radio selection. Use WinRTU Test to configure the TIM for the Voyager radio or the T200 radio. For information, see “Chapter 12: Configuring Radio Parameters.”

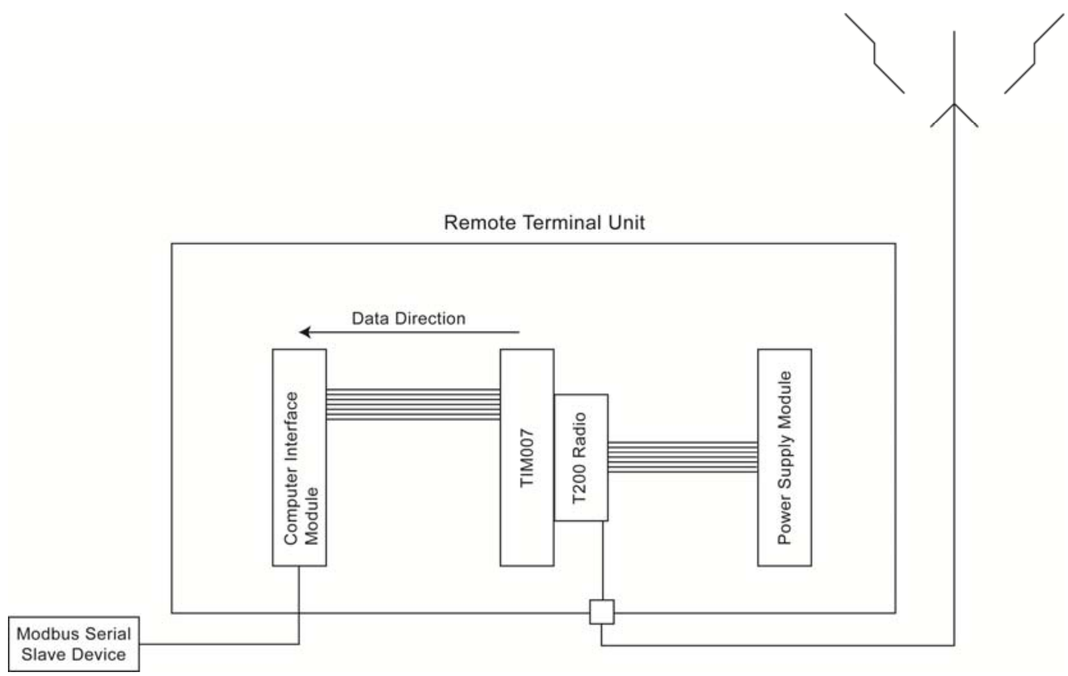


Figure 9-1, Typical Modbus Bridge Configuration

Notes

Chapter 10: TIM Information and Status Screens

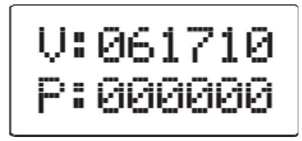
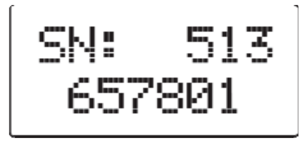
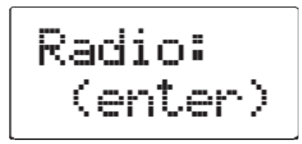
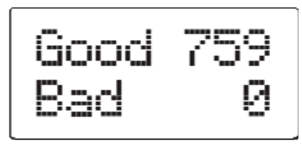
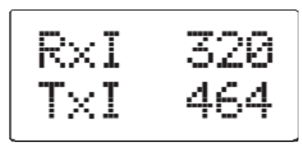
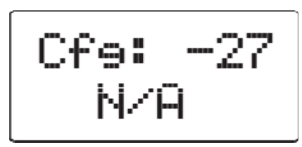
The TIM's LCD screen provides station configuration and status information. This information includes the station address, power supply voltage, AC power and DC Bias status, TIM version number, and totals on the number of "good" and "bad" messages received.

The TIM's "home" screen lists the module name (TIM007) and the current time. The three buttons located next to the LCD are used to navigate through the screens.

- Press the bottom navigation button to view the next screen.
- Press the top navigation button to view the previous screen.

When you reach the Radio section (seventh screen), you must press the middle navigation button to view the Radio information sub screens. When you reach the last screen in the Radio information section, you are prompted to press the middle button to return to the Main screen.

Main Screen The first screen displays the module name (TIM007) and the current time. When the TIM first boots up, it waits for a time message from the Hyper SCADA Server and updates the time when the message is received. For an AC-powered TIM, the time is updated once a polling loop. For a solar-powered TIM, the time is updated once a day.	TIM007 14:19:38
Address and Configuration The second screen displays the station's address and its configuration. **Cfg** indicates that status of the invert, swap, 9600, and factory reserved bit. • The first character will be either an I (data is inverted) or 0 (invert is off) • The second character will be either an S (nibble swapping is enabled) or 0 (swapping is disabled) • The third character will be either a 9 (bus data rate to modules set at 9600 bps) or 0 (bus data rate to modules set at 1200 bps) • The fourth character is a factory reserved bit and will either be a 0 (not being used) or an F (bit is being used)	Adr 18 Cfg I000
Temperature and Power Supply Voltage The third screen displays the internal temperature of the TIM and the power supply voltage.	Tem 107F PS 13.8V
AC Power and DC Bias Status The fourth screen displays the status of the AC power and the DC bias. For each item, either OK or Fail will be displayed next to the label.	AC: OK Bias: OK

Version and Patch The fifth screen displays the TIM’s current code version and patch level. This information is useful when servicing or troubleshooting the TIM.	
Serial Number The sixth screen displays the TIM’s serial number. This information is useful when servicing or troubleshooting the TIM.	
Radio Section When you reach the seventh screen, you are prompted to enter the radio test section. Press the TIM’s middle navigation button to view the radio status and information screens.	
Good and Bad Message Count The first screen of the radio section displays counts for “good” and “bad” messages received during the radio test session. These totals are reset when power is cycled.	
RxI and TxI The second screen of the radio section displays raw integer values that represent transmit and receive RF signal current measurements.	
Radio Configuration Setting The third screen of the radio section displays the name of the configuration file the TIM is currently using. This file name corresponds to the type of radio installed on the TIM (Voyager or T200) and its communication settings. This information is useful when servicing or troubleshooting the TIM. Refer to the radio configuration list provided by the Product Engineering Department.	

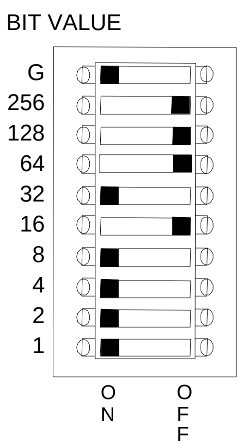
Instructions for addressing a TIM are provided below; instructions for addressing a FIM can be found on the next page.

ADDRESSING A TIM

A TIM is addressed using the DIP switches on the modular backplane. The DIP switch for the TIM is above and just to the left of the TIM's module slot.

Each DIP switch has an assigned bit value. The address is derived by totaling the values of the bits that are not grounded.

A DIP switch is grounded if it is in the CLOSED (or ON) position *except* for the 256-bit DIP switch, which is inverted. The 256-bit DIP switch is grounded if it is in the OPEN (or OFF) position.



The DIP switch example above shows a station address of 208.

We arrive at the station address by totaling the bit values of the switches that are OFF (or OPEN).

128 + 64 + 16 = 208

ADDRESSING A FIM

A FIM is addressed by placing a jumper across the ground pin (pin 43) and one of the address pins (odd numbered pins 27-41).

Each address pin has an assigned bit value. The address is derived by totaling the values of the bits that are *not* grounded. A pin is grounded if a jumper has been placed across it and pin 43 (ground).

PIN #	BIT VALUE
43	Ground
41	128
39	64
37	32
35	16
33	8
31	4
29	2
27	1
25	256

The example above shows a station address of 239. We arrive at the address by totaling the bit values of the pins that are not jumpered to Ground.

128 + 64 + 32 + 8 + 4 + 2 + 1 = 239

Chapter 12: Configuring Radio Parameters

The sections below provide instructions for configuring:

- **TIM's radio port settings** (speed the TIM communicates through its radio port to the attached radio and the format of the messages – ASCII or Manchester encoded). See "Use WinRTU Test to Configure TIM's Radio Port," (below)
- **T200 radio frequency**. See "Use WinRTU Test to Configure T200 radio Frequency" beginning on page 62.
- **Voyager radio settings**, such as frequency, transmit power, and IP address. See "Voyager Configuration Software" beginning on page 63.

Use WinRTU Test to Configure TIM's Radio Port

In the steps below, you select the appropriate radio port configuration for the type of radio attached to the TIM and the application:

- T200 radio – 1200 bps Manchester encoded
- Voyager radio in Legacy Mode – 1200 bps Manchester encoded
- Voyager radio in High-speed Mode – 9600 bps ASCII formatted

A list of configurations with corresponding dash numbers and their descriptions is maintained by the Product Engineering Department.

The following procedure requires software and cables that are included in the RTU Test Kit. Refer to Appendix A: Parts List for ordering information.

Note: You must be logged in as an authorized user to access the RIM Config Form referenced in step 5.

1. Verify that WinRTU Test is installed on the computer you will be using to configure the TIM.
2. Use the service cable included in the RTU Test Kit to connect the computer to the TIM. The service cable has a DB9 female connector on one end and a 10-pin dual row female connector on the other end.
    - Connect the DB9 female connector to a serial port on the computer. If the computer doesn't have a serial port, use the USB-to-serial adapter included in the RTU Test Kit.
    - Connect the 10-pin dual row female connector to the TIM's Service Port (located near the top of the module card).
3. Start WinRTU Test and login. (You must be logged into WinRTU Test to access the RIM tab of the Module Config form.)
4. Configure the parameters that WinRTU Test will use to communicate with the TIM.
    A. Select "Comm" from the "Config" menu.
    B. From the "Port" drop-down list, select the COM port on the computer that the service cable is plugged into. (If you are using the USB-to-serial adapter, you will need to open the

Windows Device Manager to determine the correct COM port. Refer to the documentation that came with the adapter for more information.)

C. The remaining parameters should be set as follows:
   - Baud – 9600
   - Bits – 7
   - Parity – Odd
   - Stop (bits) – 2

D. Click OK.

5. Open the RIM Module Config form by selecting “Module Config” from the “Form” menu and then selecting the “RIM” tab.
6. Verify communication with the TIM by clicking “Read” in the “Address & Config Strap” section and watching the Tx and Rx boxes for transmitted and received messages. After communication has been verified, click “Read” again to stop transmitting messages to the TIM.
7. In the “Configurations” section, select the correct configuration file for the radio (Voyager or T200) installed on the TIM and the application for which the TIM and radio will be used as stated in the site’s specifications. A list of configurations and their descriptions is maintained by the Product Engineering Department.

   After selecting the desired configuration, click “Write” to update the TIM.
8. Verify that the configuration was successfully installed by clicking “Read” in the “Configurations” section. This can also be done by viewing the “Radio Configuration Setting” screen on the TIM’s LCD screen (see Chapter 10: TIM Information and Status Screens for more information).

USE WINRTU TEST TO CONFIGURE T200 RADIO FREQUENCY

The frequency of a T200 radio is set using WinRTU Test. To set the frequency of a Voyager radio, use the Voyager configuration software.

The following procedure requires software and cables that are included in the RTU Test Kit. Refer to Appendix A: Parts List for ordering information.

Note: You must be logged in as an authorized user to access the RIM Config Form referenced in step 5.

1. Verify that WinRTU Test is installed on the computer you will be using to configure the TIM.
2. Use the service cable included in the RTU Test Kit to connect the computer to the TIM. The service cable has a DB9 female connector on one end and a 10-pin dual row female connector on the other end.
   - Connect the DB9 female connector to a serial port on the computer. If the computer doesn’t have a serial port, use the USB-to-serial adapter included in the RTU Test Kit.
   - Connect the 10-pin dual row female connector to the TIM’s Service Port (located near the top of the module card).
3. Start WinRTU Test and login. (You must be logged into WinRTU Test to access the RIM tab of the Module Config form.)

4. Configure the parameters that WinRTU Test will use to communicate with the TIM.
   A. Select “Comm” from the “Config” menu.
   B. From the “Port” drop-down list, select the COM port on the computer that the service cable is plugged into. (If you are using the USB-to-serial adapter, you will need to open the Windows Device Manager to determine the correct COM port. Refer to the documentation that came with the adapter for more information.)
   C. The remaining parameters should be set as follows:
      - Baud – 9600
      - Bits – 7
      - Parity – Odd
      - Stop (bits) – 2
   D. Click OK.
5. Open the RIM Module Config form by selecting “Module Config” from the “Form” menu and then selecting the “RIM” tab.
6. Verify communication with the TIM by clicking “Read” in the “Address & Config Strap” section and watching the Tx and Rx boxes for transmitted and received messages. After communication has been verified, click “Read” again to stop transmitting messages to the TIM. In the “Radio Freq” section of the RIM tab, select the desired frequency (value between 216.025 and 219.975) and click “Prog.”
7. Programming is complete when “Programming Sequence Completed” dialog box is displayed.

VOYAGER CONFIGURATION SOFTWARE

The Voyager configuration software is used to configure settings for the Voyager radio including the Voyager’s Link Configuration type, frequency, transmit power, radio type (remote or hub), IP address (CTU application only), and serial port settings.

The Voyager configuration software and the user manual are available from DFS.

The sections below give descriptions of the Voyager Link Configuration types and the applicable settings for each DFS application type.

Refer to the manual for the Voyager configuration software for the latest list of link configurations and for instructions on using the software.

LINK CONFIGURATIONS

The Voyager radio has three basic link configuration types: legacy mode, high-speed mode, and medium-speed mode. Within these three types are variations based on channel width (e.g., 12.5 kHz, 25 kHz, and 50 kHz) and over-the-air data rates.

Descriptions of the three types are discussed below. Refer to the Voyager configuration software manual for full descriptions.

LEGACY MODE

In this mode, the Voyager radio operates at an over-the-air data rate of 2.4 kbps and accepts 1200 bps Manchester-encoded messages from the TIM via the radio's serial port.

Legacy Mode link configurations include:

- Link configuration 1 – 2.4 kbps / 25 kHz (T200 compatible)
- Link configuration 5 – 2.4 kbps / 12.5 kHz (Maxon / Midland narrow band compatible)
- Link configuration 10 – 2.4 kbps / 25 kHz (Maxon / Midland wide band compatible)

Note: The Legacy Mode link configurations listed above are those available to date. Additional Legacy Mode link configurations may be added for other model radios in the future.

Legacy Mode would typically be used at a site in an existing system that is transitioning to High-speed Mode. During the transition, sites with Voyager radios would be configured for Legacy Mode to enable them to communicate with the system's other 2.4 kbps radios (e.g., T200, Maxon, and Midland radios). When all sites have been upgraded to the Voyager radio, they can be configured to run in High-speed Mode.

HIGH-SPEED MODE

In this mode, the Voyager radio operates at an over-the-air data rate of 17.kbps or 34 kbps depending on the link configuration selected. A Voyager radio in High-speed Mode can function as a hub (CTU) or a remote (RTU).

- As a hub, the Voyager radio accepts messages from HT3 through its Ethernet port, converts them to serial data, and transmits them over-the-air to the remote radios.
- As a remote, the Voyager radio accepts over-the-air serial data messages from the hub and passes them out its serial port to the TIM's radio port at 9600 bps. The messages sent to the TIM are ASCII formatted.

High-speed Mode link configurations include:

- Link configuration 2 – 17 kbps / 25 kHz
- Link configuration 4 – 34 kbps / 50 kHz

MEDIUM-SPEED MODE

In this mode, the Voyager radio operates at an over-the-air data rate of 9 kbps. A Voyager in Medium-speed Mode can function as a hub (CTU) or a remote (RTU).

- As a hub, the Voyager radio accepts messages from HT3 through its Ethernet port, converts them to serial data, and transmits them over-the-air to the remote radios.
- As a remote, the Voyager radio accepts over-the-air serial data messages from the hub and passes them out its serial port to the TIM's radio port at 9600 bps. The messages sent to the TIM are ASCII formatted.

For Medium-speed mode, select link configuration 3 – 9 kbps / 12.5 kHz

VOYAGER SETTINGS FOR DFS APPLICATIONS

Start the Voyager configuration software and login using the password supplied by DFS. For the applications below, configure only the settings listed. Leave all other settings at their default values.

The Voyager configuration software and user manual are available from DFS.

DFS RTU SETTINGS

Voyager radio in High-speed Mode

On the "Configuration" tab, configure the following based on the specifications for the site:

- Link Configuration – Select Link Configuration 2 or Link Configuration 4
- Frequency
- Transmit Power
- Radio Type – Leave at default value "Remote"

Voyager radio in Medium-speed Mode

On the "Configuration" tab, configure the following based on the specifications for the site:

- Link Configuration – Select Link Configuration 3
- Frequency
- Transmit Power
- Radio Type – Leave at default value "Remote"

Voyager radio in Legacy Mode

On the Configuration tab, configure the following based on the specifications for the site:

- Link Configuration – Select Link Configuration 1, Link Configuration 5, or Link Configuration 10
- Frequency
- Transmit Power
- Radio Type – Leave at default value "Remote"

DFS CTU SETTINGS

Voyager radio in High-speed Mode in DFS CTU

On the "Configuration" tab, configure the following based on the specifications for the site:

- Link Configuration – Select Link Configuration 2 or Link Configuration 4
- Frequency
- Transmit Power
- Radio Type – Select "Hub" from the drop-down list

On the "IP" tab, configure the following based on the specifications for the site:

- Local Address
- Local Subnet Mask
- Local Gateway

Click the “Copy from Local” button to copy these values to the Radio section. In a DFS CTU, these settings should always be the same.

Voyager radio in Medium-speed Mode in DFS CTU

On the “Configuration” tab, configure the following based on the specifications for the site:

- Link Configuration – Select Link Configuration 3
- Frequency
- Transmit Power
- Radio Type – Select “Hub” from the drop-down list

On the “IP” tab, configure the following based on the specifications for the site:

- Local Address
- Local Subnet Mask
- Local Gateway

Click the “Copy from Local” button to copy these values to the Radio section. In a DFS CTU, these settings should always be the same.

Voyager radio in Legacy Mode in DFS CTU

On the “Configuration” tab, configure the following based on the specifications for the site:

- Link Configuration – Select Link Configuration 1, Link Configuration 5, or Link Configuration 10
- Frequency
- Transmit Power
- Radio Type – Leave at default value “Remote”

Chapter 13: USING THE TIM TO ALIGN THE ANTENNA

Placing the TIM in Test Mode temporarily changes the RTU's station address to 255. When the central site detects that the RTU's station address is 255, it polls this RTU more frequently.

While in test mode, the TIM’s Piezo speaker beeps for each “good” message received. Additionally, the TIM’s LCD has a radio test sub-menu that provides a counter for “good” and “bad” messages. This allows you to monitor the ratio of “good” and “bad” responses and make changes to the antenna alignment.

The objective is to fine-tune the alignment of the remote site antenna to ensure an optimal communications path. Make your initial alignment with a hand compass. Use the radio study information for the proper bearing.

Once you complete the initial alignment:

1. Temporarily install additional attenuation, as needed, between the radio and the antenna to continue testing.
2. Power down the TIM.
3. Power up the TIM while holding down the TIM’s center button (the middle button next to the TIM’s LCD screen).
4. Listen for the Piezo beeps and monitor the “good” and “bad” responses.
5. Turn the antenna for optimal alignment. Swing the antenna one direction until communications degrade. Then swing it the other direction until communications equally degrade. Position the antenna half way between these points.

Be sure to remove the attenuation and take the TIM out of test mode when antenna alignment is complete.

Notes

Chapter 14: UPDATING THE TIM'S FIRMWARE

From time-to-time, we will make updates to the TIM's firmware (the ROM-based software that controls the device). These updates may add new features to the operation of the TIM or may fix bugs in the previous release.

To update the TIM's firmware, we utilize the ISP52 program, a computer, and a service port cable.

ISP52 and the service port cable are included in the RTU Test Kit. See Appendix A: Parts List for ordering information.

The TIM firmware file (TIM007.hex) can be obtained from the DFS Product Engineering Department. Contact DFS for more information.

1. Verify that ISP52 is installed on the computer you will be using to configure the TIM.
2. Use the service cable included in the RTU Test Kit to connect the computer to the TIM. The service cable has a DB9 female connector on one end and a 10-pin dual row female connector on the other end.
    - Connect the DB9 female connector to a serial port on the computer. If the computer doesn't have a serial port, use the USB-to-serial adapter included in the RTU Test Kit.
    - Connect the 10-pin dual row female connector to the TIM's Service Port (located near the top of the module card).
3. Start ISP52 and configure the communication parameters to match those of the port on the computer. The baud rate can be left at the default setting of 38400. (If you are using the USB-to-serial adapter, you will need to open the Windows Device Manager to determine the correct COM port. Refer to the documentation that came with the adapter for more information.)
4. Click "View" to place the TIM in Flash Update mode. The message "Flash Update" will be displayed on the TIM's LCD screen.

    The TIM's current firmware version will be displayed on the right side of the ISP52 interface (e.g., TIM007 11/23/10).
5. Click "Load" to browse to the TIM007.hex file.
6. Click "Program" to write the firmware update to the TIM. A progress bar on the bottom of the ISP52 interface indicates the update progress.
7. When the firmware update is complete, cycle power to the TIM.
8. Verify the TIM's firmware version by viewing the version displayed on the TIM's LCD splash screen.

Notes

FURNISHED PARTS

TELEMETRY INTERFACE MODULE (TIM007)

The TIM can be ordered with one of the following radios:

T200 Radio
Voyager Radio* in High-speed Mode 1 (17 kbps)
Voyager Radio* in High-speed Mode 2 (34 kbps; requires 50KHz contiguous channel license)
Voyager Radio* in Medium-speed Mode (9 kbps)
Voyager Radio* in Legacy Mode (2.4 kbps)

**The Voyager radio is available in the following frequency ranges (all are 2 watts):*
145 to 225 MHz
210 to 470 MHz

OPTIONAL PARTS

RTU TEST KIT

(Kit includes Service Cable, USB to Serial Adapter, Patch Cable, and DFS Resource CD)

Notes

The tables below provide register numbers to use when querying DFS modules using a third-party Modbus HMI. Register addresses are listed by module letter (corresponds to the slot the module is installed in the RTU). The TIM would typically be in the Module R slot.

For more information on any of the modules listed below, visit the Literature page of the DFS website at www.DataFlowSys.com/suport/literature.php

TIM MONITOR POINTS

Point Name	I/O Type	Register #
Bias Power	DI	12299
RTU Power	DI	12300

DMM001

Point #	I/O Type	Register # by Module Letter														
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	DI	12545	12801	13057	13313	13569	13825	14081	14337	14593	16385	16641	16897	17153	17409	17665
2	DI	12546	12802	13058	13314	13570	13826	14082	14338	14594	16386	16642	16898	17154	17410	17666
3	DI	12547	12803	13059	13315	13571	13571	14083	14339	14595	16387	16643	16899	17155	17411	17667
4	DI	12548	12804	13060	13316	13572	13828	14084	14340	14596	16388	16644	16900	17156	17412	17668
5	DI	12549	12805	13061	13317	13573	13829	14085	14341	14597	16389	16645	16901	17157	17413	17669
6	DI	12550	12806	13062	13318	13574	13830	14086	14342	14598	16390	16646	16902	17158	17414	17670
7	DI	12551	12807	13063	13319	13575	13831	14087	14343	14599	16391	16647	16903	17159	17415	17671
8	DI	12552	12808	13064	13320	13576	13832	14088	14344	14600	16392	16648	16904	17160	17416	17672
9	DI	12553	12809	13065	13321	13577	13833	14089	14345	14601	16393	16649	16905	17161	17417	17673
10	DI	12554	12810	13066	13322	13578	13834	14090	14346	14602	16394	16650	16906	17162	17418	17674
11	DI	12555	12811	13067	13323	13579	13835	14091	14347	14603	16395	16651	16907	17163	17419	17675
12	DI	12556	12812	13068	13324	13580	13836	14092	14348	14604	16396	16652	16908	17164	17420	17676

DMM002 (WITH PULSE POINTS*)

Point #	I/O Type	Register # by Module Letter														
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	DI	12561	12817	13073	13329	13585	13841	14097	14353	14609	16401	16657	16913	17169	17425	17681
2	DI	12562	12818	13074	13330	13586	13842	14098	14354	14610	16402	16658	16914	17170	17426	17682
3	DI	12563	12819	13075	13331	13587	13843	14099	14355	14611	16403	16659	16915	17171	17427	17683
4	DI	12564	12820	13076	13332	13588	13844	14100	14356	14612	16404	16660	16916	17172	17428	17684

Point #	I/O Type	Register # by Module Letter														
5	DI	12565	12821	13077	13333	13589	13845	14101	14357	14613	16405	16661	16917	17173	17429	17685
6	DI	12566	12822	13078	13334	13590	13846	14102	14358	14614	16406	16662	16918	17174	17430	17686
7	DI	12567	12823	13079	13335	13591	13847	14103	14359	14615	16407	16663	16919	17175	17431	17687
8	DI	12568	12824	13080	13336	13592	13848	14104	14360	14616	16408	16664	16920	17176	17432	17688
9	DI	12569	12825	13081	13337	13593	13849	14105	14361	14617	16409	16665	16921	17177	17433	17689
	DP	33097	33353	33609	33865	34121	34377	34633	34889	35145	36937	37193	37449	37705	37961	38217
10	DI	12570	12826	13082	13338	13594	13850	14106	14362	14618	16410	16666	16922	17178	17434	17690
	DP	33098	33354	33610	33866	34122	34378	34634	34890	35146	36938	37194	37450	37706	37962	38218
11	DI	12571	12827	13083	13339	13595	13851	14107	14363	14619	16411	16667	16923	17179	17435	17691
	DP	33099	33355	33611	33867	34123	34379	34635	34891	35147	36939	37195	37451	37707	37963	38219
12	DI	12572	12828	13084	13340	13596	13852	14108	14364	14620	16412	16668	16924	17180	17436	17692
	DP	33100	33356	33612	33868	34124	34380	34636	34892	35148	36940	37196	37452	37708	37964	38220

*Points 9-12 can be used as either digital input (DI) points or digital pulse (DP) points.

DCM001, DCM002, DCM003

Point #	I/O Type	Register # by Module Letter														
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	DI/DO	257	513	769	1025	1281	1537	1793	2049	2305	4097	4353	4609	4865	5121	5377
2	DI/DO	258	514	770	1026	1282	1538	1794	2050	2306	4098	4354	4610	4866	5122	5378
3	DI/DO	259	515	771	1027	1283	1539	1795	2051	2307	4099	4355	4611	4867	5123	5379
4	DI/DO	260	516	772	1028	1284	1540	1796	2052	2308	4100	4356	4612	4868	5124	5380
5	DI/DO	261	517	773	1029	1285	1541	1797	2053	2309	4101	4357	4613	4869	5125	5381
6	DI/DO	262	518	774	1030	1286	1542	1798	2054	2310	4102	4358	4614	4870	5126	5382
7	DI/DO	263	519	775	1031	1287	1543	1799	2055	2311	4103	4359	4615	4871	5127	5383
8	DI/DO	264	520	776	1032	1288	1544	1800	2056	2312	4104	4360	4616	4872	5128	5384
9	DI	265	521	777	1033	1289	1545	1801	2057	2313	4105	4361	4617	4873	5129	5385
10	DI	266	522	778	1034	1290	1546	1802	2058	2314	4106	4362	4618	4874	5130	5386
11	DI	267	523	779	1035	1291	1547	1803	2059	2315	4107	4363	4619	4875	5131	5387
12	DI	268	524	780	1036	1292	1548	1804	2060	2316	4108	4364	4620	4876	5132	5388

AMM001, AMM002

Point #	I/O Type	Register # by Module Letter														
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	AI	33201	33457	33713	33969	34225	34481	34737	34993	35249	35505	35761	36017	36273	36529	36785
2	AI	33202	33458	33714	33970	34226	34482	34738	34994	35250	35506	35762	36018	36274	36530	36786
3	AI	33203	33459	33715	33971	34227	34483	34739	34995	35251	35507	35763	36019	36275	36531	36787
4	AI	33204	33460	33716	33972	34228	34484	34740	34996	35252	35508	35764	36020	36276	36532	36788

Point #	I/O Type	Register # by Module Letter														
1	DI	12577	12833	13089	13345	13601	13857	14113	14369	14625	16417	16673	16929	17185	17441	17697
2	DI	12578	12834	13090	13346	13602	13858	14114	14370	14626	16418	16674	16930	17186	17442	17698
3	DI	12579	12835	13091	13347	13603	13859	14115	14371	14627	16419	16675	16931	17187	17443	17699
4	DI	12580	12836	13092	13348	13604	13860	14116	14372	14628	16420	16676	16932	17188	17444	17700

ACM001, ACM002

Point #	I/O Type	Register # by Module Letter														
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	AO	41249	41505	41761	42017	42273	42529	42785	43041	43297	45089	45345	45601	45857	46113	46369
2	AO	41250	41506	41762	42018	42274	42530	42786	43042	43298	45090	45346	45602	45858	46114	46370
3	AO	41251	41507	41763	42019	42275	42531	42787	43043	43299	45091	45347	45603	45859	46115	46371
4	AO	41252	41508	41764	42020	42276	42532	42788	43044	43300	45092	45348	45604	45860	46116	46372

PCU001

Bank 0

Point #	Point Name	State (0/1)	Register # by Module Letter														
			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Low Level	Off/On	12609	12865	13121	13377	13633	13889	14145	14401	14657	14913	15169	15425	15681	15937	16193
2	Off Level	Off/On	12610	12866	13122	13378	13634	13890	14146	14402	14658	14914	15170	15426	15682	15938	16194
3	Lead Level	Off/On	12611	12867	13123	13379	13635	13891	14147	14403	14659	14915	15171	15427	15683	15939	16195
4	Lag 1 Level	Off/On	12612	12868	13124	13380	13636	13892	14148	14404	14660	14916	15172	15428	15684	15940	16196
5	Lag 2 Level	Off/On	12613	12869	13125	13381	13637	13893	14149	14405	14661	14917	15173	15429	15685	15941	16197
6	High Level	Off/On	12614	12870	13126	13382	13638	13894	14150	14406	14662	14918	15174	15430	15686	15942	16198
7	Auxiliary Input	Off/On	12615	12871	13127	13383	13639	13895	14151	14407	14663	14919	15175	15431	15687	15943	16199
8	Alarm Horn	Enabled/ Silenced	12616	12872	13128	13384	13640	13896	14152	14408	14664	14920	15176	15432	15688	15944	16200
9	Pump 1	Off/ Running	12617	12873	13129	13385	13641	13897	14153	14409	14665	14921	15177	15433	15689	15945	16201
10	Pump 2	Off/ Running	12618	12874	13130	13386	13642	13898	14154	14410	14666	14922	15178	15434	15690	15946	16202
11	Pump 3	Off/ Running	12619	12875	13131	13387	13643	13899	14155	14411	14667	14923	15179	15435	15691	15947	16203
12	Phase Monitor	Enabled/ Bypassed	12620	12876	13132	13388	13644	13900	14156	14412	14668	14924	15180	15436	15692	15948	16204

BANK 1

Point #	Point Name	State (0/1)	Register # by Module Letter														
			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Phase Voltage	OK/ Fault	12657	12913	13169	13425	13681	13937	14193	14449	14705	14961	15217	15473	15729	15985	16241
2	Phase Sequence	OK/ Fault	12658	12914	13170	13426	13682	13938	14194	14450	14706	14962	15218	15474	15730	15986	16242
3	Pump 1 Starter	OK/ Fault	12659	12915	13171	13427	13683	13939	14195	14451	14707	14963	15219	15475	15731	15987	16243
4	Pump 2 Starter	OK/ Fault	12660	12916	13172	13428	13684	13940	14196	14452	14708	14964	15220	15476	15732	15988	16244
5	Pump 3 Starter	OK /Fault	12661	12917	13173	13429	13685	13941	14197	14453	14709	14965	15221	15477	15733	15989	16245
6	Pump 1 Stop	OK/ Fault	12662	12918	13174	13430	13686	13942	14198	14454	14710	14966	15222	15478	15734	15990	16246
7	Pump 2 Stop	OK/ Fault	12663	12919	13175	13431	13687	13943	14199	14455	14711	14967	15223	15479	15735	15991	16247
8	Pump 3 Stop	OK /Fault	12664	12920	13176	13432	13688	13944	14200	14456	14712	14968	15224	15480	15736	15992	16248
9	Float Sequence	OK/ Fault	12665	12921	13177	13433	13689	13945	14201	14457	14713	14969	15225	15481	15737	15993	16249
10	Transducer	OK/ Fault	12666	12922	13178	13434	13690	13946	14202	14458	14714	14970	15226	15482	15738	15994	16250
11	Backup Memory	OK/ Fault	12667	12923	13179	13435	13691	13947	14203	14459	14715	14971	15227	15483	15739	15995	16251
12	AC Power	OK/ Fault	12668	12924	13180	13436	13692	13948	14204	14460	14716	14972	15228	15484	15740	15996	1020
13	Isolated DC Bias	OK/ Fault	12669	12925	13181	13437	13693	13949	14205	14461	14717	14973	15229	15485	15741	15997	16253
14	Low Well	OK/ Low	12670	12926	13182	13438	13694	13950	14206	14462	14718	14974	15230	15486	15742	15998	16254
15	High Well	OK/ High	12671	12927	13183	13439	13695	13951	14207	14463	14719	14975	15231	15487	15743	15999	16255
16																	
17																	
18																	
19	HOA Switch 1	-/ Hand	12675	12931	13187	13443	13699	13955	14211	14467	14723	14979	15235	15491	15747	16003	16259
20	HOA Switch 1	-/ Off	12676	12932	13188	13444	13700	13956	14212	14468	14724	14980	15236	15492	15748	16004	16260
21	HOA Switch 1	-/ Auto	12677	12933	13189	13445	13701	13957	14213	14469	14725	14981	15237	15493	15749	16005	16261
22	HOA Switch 2	-/Hand	12678	12934	13190	13446	13702	13958	14214	14470	14726	14982	15238	15494	15750	16006	16262
23	HOA Switch 2	-/Off	12679	12935	13191	13447	13703	13959	14215	14471	14727	14983	15239	15495	15751	16007	16263

Point #	Point Name	State (0/1)	Register # by Module Letter														
			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
24	HOA Switch 2	-/Auto	12680	12936	13192	13448	13704	13960	14216	14472	14728	14984	15240	15496	15752	16008	16264
25	HOA Switch 3	-/Hand	12681	12937	13193	13449	13705	13961	14217	14473	14729	14985	15241	15497	15753	16009	16265
26	HOA Switch 3	-/Off	12682	12938	13194	13450	13706	13962	14218	14474	14730	14986	15242	15498	15754	16010	16266
27	HOA Switch 3	-/ Auto	12683	12939	13195	13451	13707	13963	14219	14475	14731	14987	15243	15499	15755	16011	16267
28	Auxiliary Output	Off/ On	12684	12940	13196	13452	13708	13964	14220	14476	14732	14988	15244	15500	15756	16012	16268
29	Alarm Horn	Off/ Ringing	12685	12941	13197	13453	13709	13965	14221	14477	14733	14989	15245	15501	15757	16013	16269
30	Alarm Light	Flashing/ Off	12686	12942	13198	13454	13710	13966	14222	14478	14734	14990	15246	15502	15758	16014	16270
31	Any Pump	Off/ Running	12687	12943	13199	13455	13711	13967	14223	14479	14735	14991	15247	15503	15759	16015	16271
32	Local Config	-/ Updated	12688	12944	13200	13456	13712	13968	14224	14480	14736	14992	15248	15504	15760	16016	16272

BANK 2

Point #	Point Name	Low Conversion	High Conversion	Register # by Module Letter														
				A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Analog Input	0=0mA or 0=0V	255=20mA or 255=5V	33153	33409	33665	33921	34177	34433	34689	34945	35201	35457	35713	35969	36225	36481	36737
2	Phase AB Voltage	0=151V	255=300V	33154	33410	33666	33922	34178	34434	34690	34946	35202	35458	35714	35970	36226	36482	36738
3	Phase AC Voltage	0=151 V	255=300V	33155	33411	33667	33923	34179	34435	34691	34947	35203	35459	35715	35971	36227	36483	36739
4	Well Level	0=0 ft	600=60 ft	33156	33412	33668	33924	34180	34436	34692	34948	35204	35460	35716	35972	36228	36484	36740

BANK 3

Point #	Point Name	State (0/1)	Register #														
			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Pump 1 Override	Auto/Override	321	577	833	1089	1345	1601	1857	2113	2369	2625	2881	3137	3393	3649	3905
2	Pump 2 Override	Auto/Override	322	578	834	1090	1346	1602	1858	2114	2370	2626	2882	3138	3394	3650	3906
3	Pump 3 Override	Auto/Override	323	579	835	1091	1347	1603	1859	2115	2371	2627	2883	3139	3395	3651	3907
4	Auxiliary Output	Auto/Override	324	580	836	1092	1348	1604	1860	2116	2372	2628	2884	3140	3396	3652	3908
5	Alarm Horn Override	Auto/Override	325	581	837	1093	1349	1605	1861	2117	2373	2629	2885	3141	3397	3653	3909
6	Alarm Light Override	Auto/Disabled	326	582	838	1094	1350	1606	1862	2118	2374	2630	2886	3142	3398	3654	3910

Point #	Point Name	State (0/1)	Register #														
			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
7	Station	Auto/Disabled	327	583	839	1095	1351	1607	1863	2119	2375	2631	2887	3143	3399	3655	3911
8	Pump 1	Auto/Disabled	328	584	840	1096	1352	1608	1864	2120	2376	2632	2888	3144	3400	3656	3912
9	Pump 2	Auto/Disabled	329	585	841	1097	1353	1609	1865	2121	2377	2633	2889	3145	3401	3657	3913
10	Pump 3	Auto/Disabled	330	586	842	1098	1354	1610	1866	2122	2378	2634	2890	3146	3402	3658	3914
11	Auxiliary Output	Auto/Disabled	331	587	843	1099	1355	1611	1867	2123	2379	2635	2891	3147	3403	3659	3915
12	Alarm Horn Disable	Auto/Disabled	332	588	844	1100	1356	1612	1868	2124	2380	2636	2892	3148	3404	3660	3916
13	Alarm Light Disable	Auto/Override	333	589	845	1101	1357	1613	1869	2125	2381	2637	2893	3149	3405	3661	3917
14	Flow Equalization	Disabled/Enabled	334	590	846	1102	1358	1614	1870	2126	2382	2638	2894	3150	3406	3662	3918
15	Override Reset	Disabled/Enabled	335	591	847	1103	1359	1615	1871	2127	2383	2639	2895	3151	3407	3663	3919
16	Analog Updates	Off/On	336	592	848	1104	1360	1616	1872	2128	2384	2640	2896	3152	3408	3664	3920

Appendix C: DFP Protocol Operation Notes

Applications where DFP protocol must not be used:

- TIMs in an FTU
- TIM communicating with a PLC that is emulating more than one station.

In both of these applications, the TIM must be able to immediately pass the data to the other device.

If the TIMs in an FTU were configured for DFP protocol, each TIM would accumulate the data in its event tables instead of sending it to the other TIM. The same is true for a TIM communicating with a PLC that is emulating more than one station. The TIM needs to be able to instantly send all communications it receives from the PLC to the central HT3 server.

Application where DFP protocol is required:

At this time, DFP protocol is *required* for a TIM communicating with a PLC033. The TIM cannot communicate with a PLC033 in TAC II protocol due to a hardware handshaking incompatibility. For this combination to work the TIM must be configured for DFP protocol.

Notes

September 2, 2010 Release

Initial release.

Firmware Version 021011 (February 10, 2011)

This firmware version addresses the following:

- Add RomUpdate feature – allow full firmware updates over the air (Requires HT3 version 3.0.7)
- Resolve bus incompatibility with the PLC033
- Add support for 15 modules in DFP protocol
- Extend test mode audio ‘beep’ time in high speed mode

Note: The RomUpdate feature will be available as a command line tool in HT3 version 3.0.7. Older versions of HyperTAC will not support RomUpdate. The TIM007 firmware can still be updated with ISP52.

Notes

Appendix E: Support, Service and Warranty

Support and Service

Data Flow Systems, Inc. offers support services nationwide from its home office and through authorized Value Added Resellers (VARs) and System Integrators. Contact your local Data Flow Systems, Inc. representative for:

- Sales and order support
- Product technical training
- Warranty support
- Support service agreements

If you are unsure who to contact, call DFS' Melbourne headquarters at 321-259-5009 and ask for the Sales Department. Alternatively, send email to sales@dataflowsys.com.

Technical Product Assistance

Please review the information in this manual before contacting Data Flow Systems, Inc. If you need further assistance, contact your local Data Flow Systems representative. If you are unsure who to contact, call DFS' Melbourne headquarters at 321-259-5009 and ask for the Service Department. Alternatively, send email to service@dataflowsys.com.

Return Authorization (RA) Procedure

Data Flow Systems' function modules are designed to be robust and highly reliable. We back this performance with a 3-year full warranty (see our warranty statement for details). In the event that a function module fails, during or after the warranty period, it may be returned to Data Flow Systems to be repaired or replaced.

All RA's will be subject to standard shipping and handling charges. Minimum handling charge will be assessed, in most cases, for work such as Radio Tuning, Backplanes, "No Problem Found," and other minor repairs. Handling charges will be waved on warranty equipment. Standard shipping and charges will be based on UPS ground, please advise if other arrangements are needed (UPS Red, FedEx, Pickup, Freight…). Standard cost of repairs and shipping charges can be obtained by contacting our RA Department by phone or e-mail.

STEP 1: Replace the failed module with a spare module of the same type, if one is available.

STEP 2: Contact Data Flow Systems Inc. in one of the following ways to receive RA #.

E-mail – RA # can be obtained by e-mailing DFS at rma@dataflowsys.com and must include the following information.

- Customer/Utility Name and Ship to Address
- Contact Name and Phone Number

- Products to be returned and Serial Numbers
- Detailed description of failure
- PO#

Phone – RA# will be issued over the phone by calling DFS at 321-259-5009 during normal operating hours. The following information will be needed.

- Customer/Utility Name and Ship to Address
- Contact Name and Phone Number
- Products to be returned and Serial Numbers
- Detailed description of failure
- PO#

Note: The lack of "Detailed description of failure" could result in the return of equipment due to the inability to properly determine the nature of the failure or testing resulting in "No Problem Found"

STEP 3: Place the function module(s) individually in an electrostatic discharge bag and then wrap with foam or bubble wrap. Pack the wrapped module(s) in a sturdy box filled with popcorn-type or bubble wrap packing material. Include a packing slip with the following information:

- Module(s) model, serial number, probable cause of failure, and the RA number
- Shipping address
- Shipping instructions (shipping costs greater than UPS ground are charged to the customer)

STEP 4: Address the box to:

RA Department # {the RA number you received here}
Data Flow Systems, Inc.
605 N John Rodes Blvd.
Melbourne, FL 32934-9105

STEP 5: Ship the box to DFS using any typical shipping carrier (for example, UPS, FedEx, etc.). If circumstances permit, have a DFS employee hand carry the package to the headquarters for you.

Note: DFS employees are not permitted to hand carry unpacked modules.

Modules are typically repaired and shipped back to the customer within a 2-week period starting at the time the module reaches the RA Department. If additional information is required during the repair of the module(s), the DFS service department will contact you.

To get information on the progress of any of your equipment in for repair, contact the DFS - RA Department at rma@dataflowsys.com or 321-259-5009.

Replacement of equipment may be necessary in the event that the equipment and/or parts are unrepairable. Warranty equipment will be replaced with out prior notification as warranty replacement. The customer will be notified by phone, if equipment not under warranty cannot be repaired, with information of available options.

DFS reserve the right to return any material received without RA # or not conforming to the requirements of this RA process.

WARRANTY

This product carries a one (1) year return-to-factory warranty against defects in material and workmanship. When installed with factory recommended surge protection, the return-to-factory warranty is extended to three (3) years and is also covered against damage due to lightning and surge. DFS will repair or replace at its option, F.O.B. Melbourne, Florida, any part or parts of this product during the warranty period. A Return Authorization (RA) must be obtained by contacting the DFS Factory Repair Center at 321-259-5009 or by email at rma@dataflowsys.com.

QUESTIONS OR COMMENTS ON THIS MANUAL

If you find a problem with any of the information in this manual or have suggestions on how it could be improved, please contact us at the address below:

Data Flow Systems, Inc.
Documentation Department
605 N. John Rodes Blvd.
Melbourne, FL 32934

Alternatively, e-mail us at:

documentation@dataflowsys.com

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