

Intertek Testing Services NA Inc.

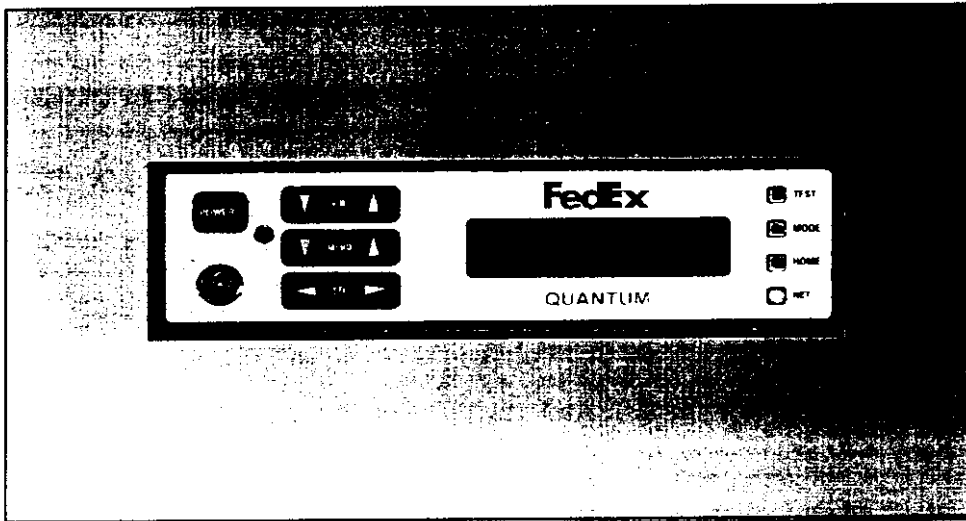
~~6.4~~ User Manual

6.5

FedEx

Quantum

Multi-Mode Radio
Operating Instructions



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List of Acronyms

DADS	Digitally Assisted Dispatch System
FCC	Federal Communications Commission
FMT	FedEx Mobile Terminal
RF	Radio Frequency
RSSI	Receive Strength Signal Indicator
SMR	Special Mobile Radio
MMP	Motorola Mobile Protocol
FMP	FedEx Mobile Protocol
MD-IS	Mobile Data Intermediate System

Referenced Trade Marks

Motorola MMP-30™	Motorola Mobile Protocol - Registered Trade Mark Motorola Corporation.
AMBE®	Voice Compression Hardware and Software - Registered Trade Mark of DVSI Inc.

FedEx *Quantum*

Multi-Mode Radio

Operating Instructions

November 6th 1997

Quantum Software Revisions
FMP 9.03 to 9.06
MMP 3.03 to 3.07

Company Proprietary

FedEx Quantum Multi-Mode Radio

1 FCC Regulations

The Federal Communications Commission (FCC) requires the user to obtain a station license for this radio equipment before operating it in transmit mode. It does not require an operating license or permit. FedEx is responsible for ensuring that the transmitter power, frequency, and deviation are within maximum limits allowed by the station license.

FedEx is at all times responsible for the proper operation and maintenance of the equipment. No FCC license is required for personally maintaining the equipment.

IMPORTANT

FCC regulations state that:

The grantee of a license has the responsibility of ensuring that all equipment operated under that license conforms to the specifications of the license.

The frequency, deviation, and power of a radio transmitter must be maintained within specified limits. It is recommended, therefore, that these three parameters be checked before the station is placed in service.

2 General Safety Information

The Federal Communications Commission (FCC), with its action in the General Docket, 79-144, March 13, 1985, has adopted a safety standard for the human exposure to radio frequency electromagnetic energy emitted by FCC-regulated equipment. Proper operation of this radio as summarized below will result in user exposure substantially below the FCC recommended limits.

- Do not operate this radio when someone outside the vehicle is within two feet (approximately 0.6 meters) of the antenna.
- Do not operate this radio if any of the RF connectors are not secure or if open connections are not properly terminated.

The following general safety guidelines should also be followed:

- Do not operate this radio near electrical blasting caps or in an explosive atmosphere.
- The radio must be properly grounded according to the installation instructions.
- The radio must be serviced only by a qualified technician.

3 System Overview

The FedEx Quantum is a multi-mode radio which provides mobile voice and data communication using the FedEx Digitally Assisted Dispatch System (DADS). The Quantum is a "soft" radio; its function is determined by software applications in much the same way that computer programs are used for different functions on a personal computer.

The Quantum comes with two applications for use as a mobile radio, one to emulate the existing Motorola MMP-30 DADS architecture, the second to support the new FedEx Mobile Protocol, FMP. The desired mode of operation may be changed directly from an FMT or other data terminal connected to the serial port of the Quantum.

The MMP-30 operating mode functions in exactly the same way as with other compatible radios and provides voice and data communication.

The FMP system uses digital techniques and a new packet communications protocol based on TCP/IP. It connects seamlessly with existing DADS applications and provides many added features such as:

- faster data download
- greater system throughput for improved peak traffic operation
- network support for simultaneous data and voice operation
- improved coverage area using roaming between different base stations

The FMP system transfers data at least four times faster than the MMP-30 system; under heavy load conditions the increased throughput can be as much as ten times that of MMP.

Concurrent voice and data transmissions over a single channel are possible as the FMP protocol allows half of the channel capacity to be given to supporting a single voice call whilst the remainder continues to carry data transmissions from other users. Two simultaneous voice transmissions are not permitted ensuring the availability of channel bandwidth for data transmission. Voice communication is handled digitally; this provides noise-free audio reception and allows for added features such as voice grouping to be supported.

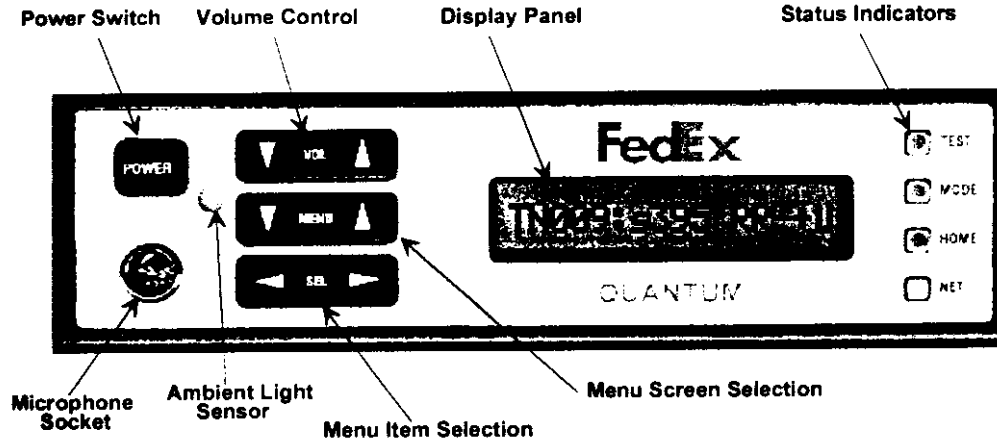
Operation with FMP requires the serving base station or repeater to be upgraded with FMP compatible equipment. The upgrade consists of replacing the existing receiver and controller units with FMP compatible devices. Additional equipment is installed in each dispatch area but the data interface to both couriers and dispatchers remains unchanged. A Quantum unit is also provided for each dispatcher but runs different software than the mobile radio. This provides the means for voice communication to the fleet and is referred to as a Digital Voice Unit, or DVU. Its operation is covered in a separate manual.

In locations where multiple basestations on different channels are available, the Quantum radio may be configured to roam between coverage areas in much the same way as a cell phone operates. This allows for increased coverage area without user intervention; it also allows for automatic system recovery in the event of a basestation failure.

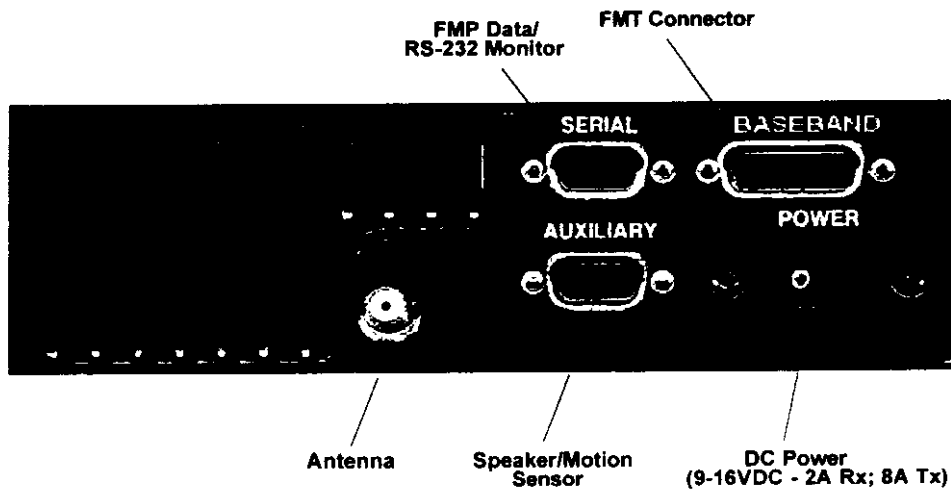
Note:

Most of the functions within the Quantum radio are implemented in embedded firmware. Therefore, particular menus and options may vary from one version of firmware to the next. Please confirm that this manual corresponds to the firmware version which is displayed on the alphanumeric display during the power-on cycle. Consult your local depot configuration personnel for further assistance.

4 Front Panel Layout



5 Rear Panel Layout



6 Controls and Indicators

6.1 General

Four front panel switches provide user control of major radio functions. The switches and display panel are back-lit for ease of use in low light conditions. The amount of applied back-lighting is a function of the ambient light level and is regulated by a sensor located on the front panel of the radio. As the ambient light level decreases, so does the amount of applied back-lighting.

6.2 Power

The POWER switch controls application of power to major radio functions as well as to a connected FMT. With power connected, pressing the power button once will cause the radio to power up; pressing it again will cause the radio to power down and will save the active configuration. This will be recalled automatically at the next power-up.

If power is removed from the radio by disconnection rather than pressing the power button, the active configuration will not be saved and the radio will subsequently power up with its previously saved configuration. Re-application of power will not cause the radio to power up until the power switch is pressed.

NOTE: With later versions, the radio will automatically power-up when the DC supply is initially connected. This allows automatic recovery from a battery brown-out during vehicle starting. Radios with this feature are identified as MOD-3.

The Quantum radio should be attached directly to the vehicle battery terminals. This enables operation with the ignition turned off. In order to prevent draining the vehicle battery, the Quantum will automatically power down itself and a connected FMT after a time-out period of 2 hours if (1) no vehicle motion is sensed; (2) no voice or data is transmitted; or (3) no front panel button is pressed during the time out period. If this occurs, the radio may be powered up as normal and will recover all previously used mode settings.

After being powered up for even a short time, it is normal for the case of the radio to become warm.

6.3 Volume

The VOLume control is a dedicated rocker switch for user adjustment of received audio level. It has no effect on the level of transmitted voice. Pushing the left side of the rocker, (downward arrow), will reduce the audio volume level, pushing the right side, (upward arrow), will increase volume. If a large adjustment is required, pushing and holding either side of the volume rocker will automatically increase or decrease volume level through its valid range of 0 to 31. A volume setting of "0" will mute the speaker output.

When either side of the VOL control is pressed, the display panel will indicate the chosen volume setting. It will revert to displaying channel information approximately 2 seconds after the VOL button is released.

Depending on the operating mode of the radio, the volume setting may not be the only control affecting audio output. In certain modes, Audio Squelch Enable, Audio Squelch Threshold and Monitor Enable functions may also disable the audio output.

6.4 Menu and SEL Controls

All user controllable functions can be accessed using the MENU and SElect buttons. Pressing either the left or right MENU button cycles through a menu of functions. The selected function is displayed in the alphanumeric display. Options within a menu are viewed and selected by pressing the left or right SEL button. Details of available menus and associated options are given later in this manual as the types of available control functions depend on the active mode of the radio.

6.5 Display

The display panel normally provides channel and status information to the user. When any of the rocker switches are pushed, the left side of the display temporarily changes to show information relevant to the selected menu screen. The right side of the display continues to show mode dependent transceiver status, such as received signal strength, transmit/receive mode.

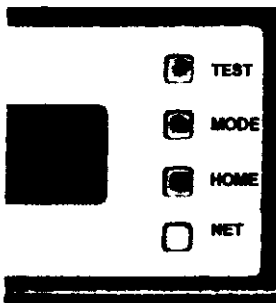
Menu Display & Control Area



Transceiver Status Area

As different menu screens are selected using the MENU and SEL buttons, context relevant information is displayed in the Menu Display and Control Area. The Transceiver Status Area will either be blank or will display transceiver status relevant to the current operating mode. The figure above shows the Default Display typical of an MMP-30 configured radio. Detailed descriptions of all displays which cover the various operating modes of the radio are given in later sections of this manual.

6.6 LED Indicators



The LED indicators provide additional status and configuration information to the user. Each LED is a tri-color device capable of glowing red, yellow or green.

During normal operation, correct function of the radio is indicated by the TEST LED glowing green. Red indicates a fault condition.

When receiving, the MODE indicator will glow green; when transmitting it will glow red.

The color of the HOME and NET LEDs depends on the operating mode of the radio. This is discussed in detail later.

8.3 FMT Power/Analog Data

The FMT Power/ Analog Data connection requires the use of the supplied heavy duty 15-pin D-type male to female cable between the BASEBAND connector on the rear panel of the QUANTUM and the 15-pin D-type connector on the rear of the FMT. As D.C. power for the FMT is supplied through this connection, use of a standard cable may cause risk of severe cable damage and possible fire.

8.4 Speaker and Motion Sensor Connection

The Speaker and Motion Sensor connection requires the use of a special purpose cable connected to the AUX connector on the rear panel of the QUANTUM. This connector has three rows of pins but is the same form factor as a 9 pin D-type shell. **Do not** connect this to the SERIAL connector on the rear panel of the QUANTUM; this will result in damage to the plug assembly.

The cable has three conductors; a pair terminated by a white Molex connector, which connects to the speaker, and a single unterminated red cable which must be connected to the vehicle motion sensor. The motion sensor is used for FMT blanking and also as a control input for the QUANTUM auto-shutoff timer.

8.5 DC Power

DC power should be provided to the radio by direct connection to the vehicle battery using the cable provided. An external fuse or circuit breaker rated at 15 Amps is required to be placed in line. The ground of this cable must be securely attached to a clean vehicle ground.

8.6 Microphone

The microphone connector is located on the QUANTUM front panel. The plug will lock in place when inserted into the connector. A small black button on top of the microphone plug must be pressed to release it for removal.

The supplied microphone has an acoustic noise cancellation sensor located on its rear face above the circular mic clip. Care must be taken to avoid covering this sensor or exposing it to excessive wind noise for optimum microphone operation in locations with high levels of background noise.

9 Changing Modes

The QUANTUM is a *Soft Radio*; this means that its functional operation is dependent upon the type of software running on its internal computers.

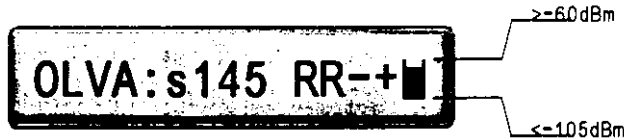
The QUANTUM is capable of storing a number of user applications, (software programs), in its memory. At power-up, the active application is de-compressed from flash memory and loaded into application space. The power-on delay of between 5 and 10 seconds is due to this file de-compression process.

Mode changes are performed using an FMT connected to the radio with both the MMP-30 and Serial cables. Entering either "MMP" or "FMP" in the password field of the "Forms-F" screen of an FMT display will cause the radio to change to the appropriate mode. This feature is enabled on all FMT units with a firmware revision later than 3.2.6; this version number may be checked on the FMT Sign-On screen. Version 4.0.2 and later FMT software allows user configuration of

10.5 RSSI Indication

The RSSI Indicator, located on the right-hand side of the QUANTUM display panel, provides a measure of the received signal level. In a mobile environment, received signal level is not only a function of range but also of blockage, due to natural terrain or man-made obstacles such as buildings.

At full scale, the indicator is calibrated for a received signal level in excess of -60dBm; with no RSSI indication, the received signal level will be less than -105dBm. Under these conditions, the FMT response time to a message transmission may be longer than typical.

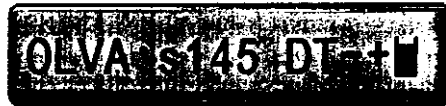


10.6 MMP-30 Data Transmission

Data transmission requires the use of an FMT connected to the BASEBAND port of the QUANTUM radio as previously described.

In MMP-30 mode, data transmission using a connected FMT remains unchanged from existing FedEx procedures.

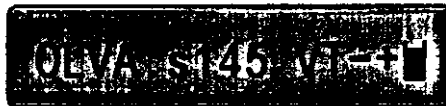
During data transmission, the Quantum front panel display will show the following transceiver status, (Note, the channel name and number and RSSI level may differ) :



10.7 Voice Transmission

Voice transmission functions on a push to talk basis and operates in line with existing FedEx procedures.

During voice transmission, the Quantum front panel display will show the following transceiver status:



11 FedEx Mobile Protocol (FMP) - System Overview

The FMP system has been specially designed to support existing FedEx end-system applications such as the FMT and DADS system yet provide a dramatic improvement to radio network efficiency, throughput and available features.

The main system benefits are:

- Greater system throughput,
- Improved system performance under high load conditions,
- Simultaneous transmission of voice and data from different users.
- Automatic roaming between base-stations for improved coverage.

The system operates using a timeslot reservation process where a mobile requests access to one of two reverse-channel, (mobile to base station), timeslots. The Base Station Controller, located at the repeater, arbitrates which requesting mobiles are granted timeslot access. This process ensures that channel contention is minimized allowing graceful handling of high traffic volume.

The FMP system operates at a higher data rate than that of the existing MMP-30 system. This, together with improved network management algorithms, yields an improvement in system throughput of at least four times the total throughput capability of MMP, and under extreme traffic levels, up to ten times.

The timeslotted nature of the FMP protocol allows support for simultaneous voice and data. When a voice transmission is occurring, FMP still provides at least twice the total capacity of MMP-30 for simultaneous data from another user. The BSC-1000 ensures that only one of the timeslots is allocated to voice at any one time guaranteeing that system capacity is always reserved for data transmission.

FMP voice is transmitted digitally using a process called Advanced Multiband Excitation, AMBE, a method of digital voice compression licensed from DVSI. With conventional FM voice transmission, poor reception results in noise at the speaker output. Under marginal signal conditions with FMP, no noise is heard but the received audio will be automatically squelched, i.e. may contain gaps. Once adequate signal level is recovered, the system will automatically recover.

The FMP system also supports automatic roaming between basestations. This allows the radio coverage area to be designed around the constraints of local terrain yet still provide seamless coverage to users.

Roaming operates in three depot selectable modes:

- **Receive:** Roaming is determined by the radio based on the number of sync errors received in the forward channel transmission.
- **Transmit:** Roaming is determined by the base station based on the number of errors received from the mobile. The base station sends a message to the mobile instructing it to roam.
- **Advanced:** Roaming is determined by an algorithm which considers both transmit and receive error levels and network congestion. Using advanced roaming, a radio may be told by a base station to retune to another base station if, for instance, its utilization exceeds a preset threshold. Advanced roaming also supports automatic load leveling in the event of a repeater failure and consequent recovery.

The default mode of operation is Advanced Roaming.

12 FMP Operation

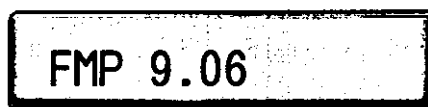
12.1 Power-up.

To turn the radio on: press the power button.

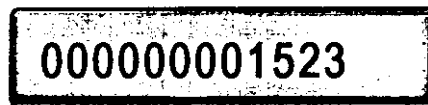
To adjust the volume: press the left or right volume button.

On power-up, the radio loads the FMP application into its operational memory. Due to the greater size of this application, this process takes approximately 12 seconds, slightly longer than loading MMP-30. On completion, the alphanumeric display will show the application name and version number and finally revert to the FMP Default Display. Samples of displays are shown below:

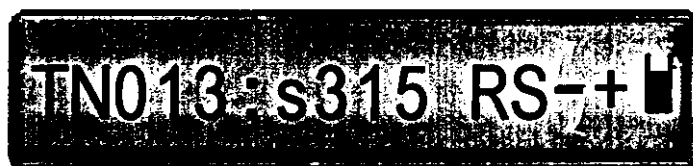
Mode Type & Software Revision



Radio Serial Number



Default Channel Display



Received Signal Strength

Channel Name SMR Channel Number

Transceiver Mode

- = Not connected to network
- t = Awaiting TEI assignment
- T = TEI assigned
- E = Acknowledged mode established
- p = MDIS registration pending
- R = MDIS registration established
- r = Releasing connection
- d = De-registration pending
- 1 = Network Access denied - no reason given
- 2 = Network ID unsupported
- 3 = Network ID not authorized
- 4 = Bad authentication
- 5 = Unsupported authentication
- 6 = MDIS fully loaded
- 7 = Service denied

Transceiver Status

- + = OK
- P = PLL Error
- O = Over Temperature
- A = Transmission Aborted

Watchdog Timer

The Watchdog indicator will spin during correct operation.

Transmit/ Receive Status

- * = Out of Sync
- = Offline
- p or P = Persistently out of Sync
- s or S = In Sync

When the application fully boots the Quantum will enable DC power to the FMT. The Default Display will appear showing the selected channel and transceiver status information. At this time, if there is an FMT connected to the QUANTUM and a receivable FMP base station signal is present, the QUANTUM will indicate the following display stating that:

- no network connection has been established, but,
- the radio is in sync with the base station and has adequate received signal level.

TN013:s315 -S--+

If there is no signal present, the asterisk *Out of Sync* indicator will be displayed as shown. There will also be no RSSI indication.

TN013:s315 -*--+

At this time the QUANTUM will attempt to communicate with the FMP system by transmitting a request for a temporary equipment identifier, TEI, and ultimately receiving FMP system registration. During this process, the MODE LED will toggle between green and red, as the QUANTUM transmits. The transceiver status display will cycle through the screens as shown as assignment and registration is negotiated.

TN013:s315 tS--+

Once registration is successfully complete, the transceiver status will be shown as "RS"; data transmission can proceed in the same way as used for MMP-30 operation.

TN013:s315 RS--+

NOTE:

The FMP protocol makes use of sophisticated error detection and correction algorithms to ensure correct delivery of data over the AirLink. Use of this technique makes it undesirable for the FMT to perform retries. Therefore, under certain circumstances, it may be necessary for the user to retransmit a message if an ACKnowledgement is not received by the FMT.

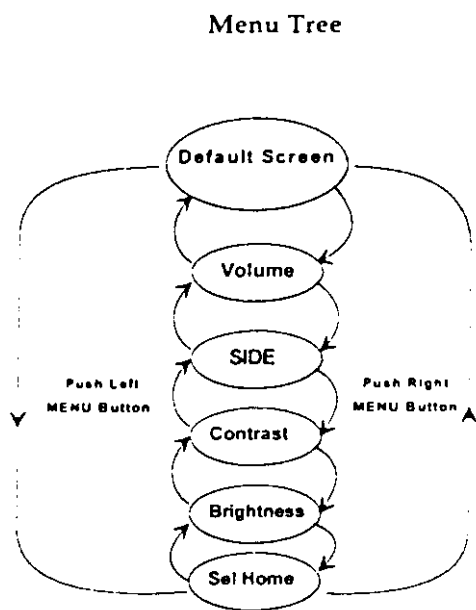
12.2 General Configuration

The table below shows available menu options for FMP operation. Available choices may differ by software revision number. Check that the documentation set matches the revision number in use.

QUANTUM radios are shipped with the defaults shown below in brackets. Personal changes may be entered using the MENU and SEL buttons as previously described. Changes are retained by the radio when powered down using the POWER button.

To adjust a particular parameter, use the MENU buttons to select the appropriate menu option then use the SEL buttons to effect the change. The display will revert to the default setting of displaying channel information after 10 seconds.

12.3 FMP Menu Options - Software Revision FMP 9.06



MENU Options	SEL Options (Defaults)	Description
Default Screen	Scan Channel List	Channel Name and Number; Transceiver Status
VOL	Range 0 - 31 (15)	Replicates the function of the dedicated VOL control.
SIDE	On / Off (On)	Enables or disables sidetone or audio beep.
CON:	Range 1 - 3 (2)	Adjusts display contrast.
BRIGHT:	Range 1 - 3 (2)	Adjusts display brightness.
SEL→HOME	No Options	Causes the radio to tune to the defined HOME station.

12.4 FMP LED Indicators

The following table defines the meaning of LED status indicators for FMP mode.

LED			Yellow	OFF
TEST	Failed Diagnostics	Normal Operation		Power-up
MODE	Transmitting	Receiving		Power-up
HOME	Fault Condition	Home Channel	Roaming Channel	Power-up
NET	N/A	FMP	N/A	

12.5 Data Transmission

Data transmission in FMP mode is handled in exactly the same way as with MMP. Ensure that the FMT is connected to the QUANTUM, as previously described, and verify that both units are in FMP mode.

- The QUANTUM operating mode may be checked during the power-up process;
- The FMT mode may be checked after power-up by selecting the "Forms-F" screen. The display should be similar to that shown in Figure 1, noting that specific values for parameters will differ from those shown.

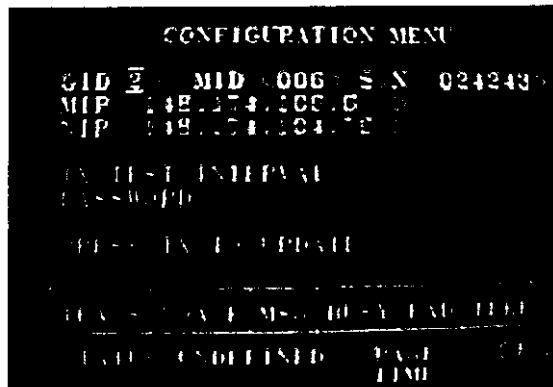


Figure 1: FMP FORMS-F Screen

NOTE: All of these parameters should be set through Depot configuration. Unauthorized change will likely cause the terminal to cease functioning in FMP mode.

If the mode needs to be reset, this can be done by entering "FMP" in the password field of the Forms-F screen and pressing the Tx button.

The various parameters are defined below.

GID - Group ID.

This field has no function in FMP.

MID - Mobile ID

The Mobile ID uniquely identifies an individual FMT to the dispatch center WDM, Wireless Data Manager. Each mobile must have a corresponding account on the WDM in order to gain access to the network.

S/N - Serial Number

This is the serial number of the FMT.

MIP - Mobile I/P Address

The mobile I/P address uniquely identifies the data terminal to the FMP data network. This address is also used by the QUANTUM radio and must be identified as an authorized user in the MDIS.

NIP - Network Interface I/P Address

The Network interface I/P address defines the I/P address of the WDM.

12.6 Voice Communication

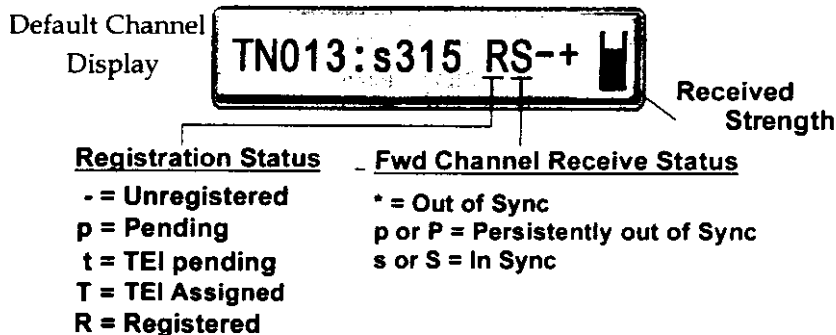
Voice transmission from an FMP QUANTUM is supported from a user perspective in much the same way as a conventional mobile radio. As the transmission process is digital, the system offers several features not available in a conventional analog system:

- **Secure voice communication:**
QUANTUM FMP voice is transmitted digitally. This makes it impossible for non authorized users to eavesdrop on voice communication without the use of sophisticated equipment.
- **Simultaneous transmission of voice and data from different users:**
The FMP protocol is engineered to partition channel capacity so that simultaneous voice and data communication can be supported. In this mode, approximately half of the system capacity is allocated to voice, the remainder, which is still at least twice the capacity of MMP-30, to data.
- **Depot configurable voice groups:**
Each truck radio is allocated a voice group corresponding to the dispatch center that the truck operates from. Voice communication is automatically received only by trucks sharing the same voice group.
- **Private communication with dispatch:**
A courier may communicate privately with the serving dispatch operator without other couriers hearing the conversation.
- **Automatic voice patching to assigned dispatch operator:**
The FMP system allows couriers to automatically roam between different base stations. When communicating via a base station other than the HOME base station, the system will automatically route all voice and data transmissions to the correct dispatch center.
- **Noise-free operation:**
Digitization of voice information results in essentially no background noise being apparent in received voice; although users may notice a change in the tonal qualities of received voice.

Basic Operation

Ensure that a microphone and speaker are connected to the radio, it is powered on, and that the audio volume level is adjusted to a comfortable level.

For voice communication to be available, the Transmit/Receive Status Indicator on the radio display must indicate "In Sync". The figure below refers.



FMP voice uses three audio tones to signify the status of a voice access request. The tones are identifiable by their pitch or frequency.

- Medium pitch tone : Channel access was granted, user may begin to speak
- Low pitch tone : Channel was released by user. (Heard by transmitting user)
- High pitch tone : Received audio transmission has ended.
- Three bursts of medium pitch tone : Channel access was denied, try again.

Voice Transmission

To communicate with other users in the same voice group, hold the microphone approximately three inches from the mouth and press and hold the "push-to-talk" button on the side of the microphone. The radio will respond with a medium tone as follows:

- A single burst if channel access was granted,
- Three bursts of medium pitch tone if denied.

Once channel access has been granted, normal voice communication may proceed for a period of up to 30 seconds, after which time the radio will automatically terminate the transmission. At this time a low tone will be given indicating that channel access has been terminated.

To end a voice transmission, release the push-to-talk button. The radio will respond with a low and a high pitch tone. The low tone indicates that channel access has been terminated; the high pitch tone indicates that the voice transmission has ended. This high tone will also be generated by receiving radios to indicate to users that a voice segment has ended.

Voice Reception

Receiving a voice transmission requires no user intervention, only that the audio volume is suitably adjusted. For a vehicle environment, this level will be typically set between 18 and 26.

At the end of a received voice transmission, a high pitch tone is given indicating the end of a received speech segment. As no background or "squelch" noise is audible, the high pitch tone is the only indication that another user has finished speaking.

Changing the Voice Group

The receive voice group of a mobile may be changed via the FORMS-F screen of the FMT. The transmit voice group of a particular mobile may only be configured by Depot Staff.

Private Voice Communication (FMP 9.03 - 9.04)

A private voice transmission to a dispatch operator may be made by double-clicking and holding the push-to-talk button on the microphone. In this mode, the mobile to dispatch voice transmission will not be overheard by other couriers; the dispatch to mobile voice transmission will, however, continue to be broadcast to all users on the same voice group. This feature is not supported in FMP software revisions later than 9.04.

Return to Home (FMP 9.05 and later)

By keying and releasing the microphone push-to-talk button, a user can force the Quantum radio to return to its HOME channel.

13 Extended Radio Functions

13.1 Basic Capabilities

The Quantum radio supports a conventional Serial Line IP interface on its serial port. This means that with suitable interface software running on a portable computer, the FMT may be replaced by a PC and the Quantum may be used as a remote network interface which supports many features of the Internet Protocol.

The Quantum, as currently configured, is a half duplex radio; i.e. it can transmit and receive but not simultaneously. In FMP mode, the transition between transmit and receive occurs in milliseconds, however, this can add latency for services such as FTP which ideally require full duplex transmit & receive paths for the acknowledgement process of the packet protocol to function efficiently.

The FMP system is optimized for regular DADS message transfer in either direction and for download of file based information from the fixed system to the mobile. This allows for routing tables, maps and other information to be pulled from a master server to mobiles with latency effects predominating on the low data volume reverse channel.

13.2 Connection and Connectivity

A portable computer may be connected to the Quantum serial port in place of the FMT. The cable supplied for the FMT connection may be used for this purpose.

The serial port operates in two modes:

- **Control Mode:** This uses the conventional asynchronous serial data mode of the physical RS-232 interface and transfers unformatted ASCII text. This mode is used for controlling, configuring and monitoring the status of the Quantum radio.
- **Data Mode:** This mode uses the Serial Line Internet Protocol, SLIP, which is a packet communications protocol designed for use over a serial

communications circuit. This mode is used for transferring SLIP formatted data between a connected terminal and Quantum. The terminal may either be dedicated to the application, such as the FMT, or a connected PC running a SLIP compliant interface application such as the Reflections IP stack. This can be used to support generic IP applications such as Rlogon, Telnet, Ping, FTP, e-mail etc.

Control mode capabilities are detailed in Appendix A to this manual. They consist of a number of commands which are invoked using an extended set of the AT modem commands. These commands may either be issued to the Quantum from a program application running on a dedicated terminal such as the FMT or by a generic communications application, such as Microsoft Windows Terminal, running on a personal computer connected to the Quantum Serial port.

In order for a PC to communicate through the IP stack with a remote host, the local communications application must be configured with a valid IP address which must be registered with the MDIS. It must also command the Quantum to go Online and attempt to register with the MDIS. SLIP applications will not function unless the Transmit/Receive Status indicator shows the radio to be In Sync and the Transceiver mode is Registered.

Appendix 1- Quantum AT Command Set

14 MMP Operation

14.1 MMP - Basic Commands & Registers

Command	Function
ATEn	echo character control - n = 0-disable echo back; n = 1-enable echo back
ATIn	report radio id - n = 0-returns radio equipment code; n = 1-returns the checksum computed on F/W ROM n = 2-performs a checksum on the F/W ROM, compares it with the value stored in ROM and indicates O
ATLn	set speaker volume - n = 0...31 n = 0-speaker off; n = 31-speaker max volume
ATSnATSn?ATSn = x	select register n; n = 0...208 read register specified by n. Write value specified in x to register specified in n. Only timer, operating mode, current profile and ROM checksum registers may be written to. all others are read only

Register	Description	Mode	Value	Default
S0	ROM checksum	write/read		
S1-S13	not used			
S14	command status (echo in bit 1, result mode in bit 3)	read only	0..80	80
S15-S17	not used			
S18	test timer	write/read	0..60	0
S19	contrast control	read only	0..2	1
S20-S22	not used			
S23	equipment status (serial port) bit 0/data bits, 0 = 7, 8 = 1: bits 1, 2, 3/ baud rate, 0 = 1200, 2 = 2400, 3 = 9600 4 = 19200: bit 4, 5/ stop bits, 0, 1: bit 6, 7/ parity, 0 = even, 1 = none,	read only	0..246	128
S24-S45	not used			
S46	operating mode (protocol)	write/read	1..3	2(MMP)
S47-S59	not used			
S60	current profile	read/write	1..3	3

Register	Description	Mode	Value	Default
S61	side tone on/off - MSB speaker volume - LSB 5 bits	read only	0,10..31	115
S62	RSSI squelch on/off RSSI squelch volume - LSB 5 bits	read only	0,1670..2510	1670
S63	voice leveling on/off - MSB voice leveling point - LSB 7 bits	read only	0,10..32767	116000
S64	voice squelch on/off - MSB bit voice squelch level - LSB 7 bits	read only	0,10..32767	116000
S65	tone coded squelch on/off - MSB bit tone coded squelch level - LSB 7 bits	read only	0,10..32767	116000
S66	tone coded squelch detection threshold	read only	0..32767	16000
S67	brightness control	read only	0..2	1
S68	voice transmission timeout	read/write	1..20 secs	1 second
S69	data transmission timeout	read/write	30..60 secs	30 secs
S70	shutdown timeout	read/write	0..120 mins	30 mins
S71	user ID	read only	8 characters	
S72	equipment code	read only	12 characters	
S73	firmware revision	read only	8 characters	
S78	home channel parameters	read only	14 characters	
S79	current channel parameters	read only	14 characters	
S80-S208	channel parameter list	read only	14 characters	
ATVn	result code form - n = 0-short (numeric) result codes; 0 = OK, 1 = connect, 2 = ring, 3 = no carrier, 4 = error n = 1-verbose result codes; get text results, e.g. "connect" instead of "1"			
ATZn	n = -1 : depot configuration; n = 0: Reset Mode; n = 1: set to FMP; n = 2: set to COPD; n = 3 :set to MMP			

14.2 MMP Extended Command Set

Command	Function
AT&F	restore factory defaults
AT&V	display current profile
AT&Wn	save active profile - n = 0-store as profile 0 (depot) ; n = 1-store as user profile 1; n = 2-resets depot profile store flag; n = 3-resets user profile store flag
AT@An	tone coded squelch detection threshold - n = 0.. 32767; default 16000
AT@Bn	side tone on/off - n = 0-side tone off; n = 1-side tone on
AT@C	select channel parameters - < name > , < tone coded squelch freq > , < band type > , < channel number > 5char 670-2503 Hz 0 = AMP, 1 = SMR channel number.
AT@Dn	select data transmission time-out - n = 30..60 (in seconds)
AT@G	change channel - AT@G < channel name >
AT@H	specify home channel - AT@H < channel name >
AT@In	increment channel - n = 0-next channel down; n = 1-next channel up
AT@In	voice leveling on/off - n = 0-voice leveling off; n = 1-voice leveling on
AT@Kn	tone coded squelch on/off - n = 0-squelch off; n = 1-squelch on
AT@Ln	select voice squelch level - n = 0...32767; default 16000
AT@On	voice squelch on/off - n = 0-squelch off; n = 1-squelch on
AT@Pn	voice leveling point - n = 0...32767; default 16000
AT@Qn	set shutdown timer duration - n = 0...120 (in minutes)
AT@R	remove channel - AT@R < channel name >
AT@Sn	RSSI squelch on/off - n = 0-squelch off; n = 1-squelch on
AT@Tn	select tone coded squelch - 0...32767; default 16000
AT@Vn	set RSSI squelch level - n = 0...32767; default 16000
AT@Wn	brightness control - n = 0-low; n = 1-medium; n = 2-bright
AT@Xn	select voice transmission time-out - n = 1...30 (in seconds)
AT@Yn	contrast control - n = 0-low; n = 1-medium; n = 2-high
ATEn	0 = disable echo back, 1 = enable echo back
ATL < 0...31 >	gain range 0 to 31
ATVn	0 = short result codes, 1 = verbose result codes
ATZn	0 = reset to depot config., 1 = set to FMP, 2 = set to CDPD, 3 = set to MMP
at**ptd	manually enable push-to-data - 0 = off / 1 = on
at**ptt	manually enable push-to-talk - 0 = off / 1 = on
at**dev	alter maximum deviation - an at**dev ? will result in present value being displayed
at**mod	alter modulation index - an at**mod ? will result in present value being displayed
at**vco	carrier tracking control - 0 = disables / 1 = enables / -1 = reset VCTCXO / ? = VCTCXO offset in Hz

15 FMP Commands

Command	Meaning	Class	Format/Ranges
AT@C	Change Active Channel	Channel	AT@Cname
AT@R	Remove Channel	Channel	AT@R[name *]
AT@R*	Remove all channels	Channel	AT@R*
AT@C	Specify Channel Parameters	Channel	AT@C[name_].amps [0] or smr[1].[channel number] (Name_ must be 5 characters)
AT@H	Specify Home Channel	Channel	AT@Hname
AT@T	Specify Tuner Control (0 - Manual, 1 - Rx only, 2 - Tx only, 3 - Adv roam)	Channel	AT@T??[0 1]
AT*****n	Specify Transmit Power (Where n = nominal dBm)	Channel	AT*****[0-45]
AT@W	Brightness Control	Comfort	AT@W
AT@Y	Contrast Control	Comfort	AT@Yn
ATL	Set Speaker Volume	Comfort	ATLn, n = 0..31
AT@B	Side Tone On/Off	Comfort	AT@B[0 1]
ATH	Disconnect from Network	Connection	ATH[0 1]
ATO	Enter On-line Mode	Connection	ATO
ATD	Go on-line and connect to network (using specified I/P Address)	Connection	ATD[www.xxx.yyy.zzz]
ATI	Report Identifying Information	Identity	ATI[0 1 2 3]
ATU	Specify I/P Cheater Address and Port	Identity	ATU[www.xxx.yyy.zzz].[p]
ATS	Specify Operational I/P Address	Identity	ATS[www.xxx.yyy.zzz]
AT@V	Specify Receive Voice Group	Identity	AT@Vg
AT@P	Specify Transmit Voice Group	Identity	AT@Pg
ATE	Command Mode Echo (On/Off)	Misc.	ATE[0 1]
AT&F	Restore Factory Defaults	Misc.	AT&F
AT&V	Return Current Profile	Misc.	AT&V
AT&W	Set Configuration Save Flags	Misc.	AT&W[0 1 2]
ATV	Set Result Code Format (0 - Short, 1 - Verbose)	Misc.	ATV[0 1]

Command	Meaning	Class	Format/Ranges
ATZ	Soft Reset, 0 - Same Mode, 1 - FMP, 2 - CDPD, 3 - MMIP	Misc.	ATZ[0; 1 2; 3]
AT@Q	Specify Shutdown Time-out (Minutes)	Time-out	AT@Qtime
AT@X	Voice Transmission Time-out (Seconds)	Time-out	AT@Xn
AT@V	Add Voice Group	Voice	AT@Vn
AT@A	Increment(1) or Decrement (0) Voice Group	Voice	AT@A[0 1]
AT@K	Remove Voice Group	Voice	AT@K[n *]
AT@D	Select Home Voice Group	Voice	AT@Dn
AT@P	Select Transmit Voice Group	Voice	AT@Pn