Gemini^{PD}
Mobile Radiomodem
Installation Guide
Version 1.46

Preliminary – For Internal Use Only

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What's New in this version

History

Version 1.46 (Preliminary), March 2002

Following sections are amended to show the capability of 25.6 and 19.2kb/s bitrates in channels spaced at 12.5 kHz (half band or NPSPAC)

- Section 1.2.1 Features
- Table 3 Carrier Modulation
- Table 4 Tests, Full & Half Channel Units
- Section 6 Specifications

Version 1.45b (Preliminary, January 2002

Section 4 “WinRIS” rewritten

Multiple minor changes to match revised Paragon and Paragon^{PD} technical manuals

Version 1.45a (Preliminary), December 2001

Removed IC class II permissive change note and updated data.

Section 1.2.1 Features

Table 3 Carrier Modulation

Table 4 TX Deviation

Version 1.44 (Preliminary), November 2001

Following sections are amended to show 32 kbps bitrates with RC4FSK modulation in 25kHz channel spacing bit rates for 800MHz band.

- Table 3 Carrier Modulation
- Table 5 Tests, Full & Half Channel Units
- Section 6 Specifications, emission designators

Version 1.43 (Preliminary), October 2001

Following sections are amended to show 32 kbps bitrates with RC4FSK modulation in 25kHz channel spacing bit rates.

- Section 1.2.1 Features
- Table 3 Carrier Modulation
- Table 5 Tests, Full & Half Channel Units
- Section 6 Specifications

Version 1.42 (Preliminary), April 2001

Following sections are amended to show SRRC4FSK 12.5kHz channel spacing bit rates.

- Section 1.2.1 Features
- Table 3 Carrier Modulation
- Table 5 Tests, Full & Half Channel Units
- Section 6 Specifications

Version 1.41, March 2001

- Section 2.5 “Antenna” and Figure 4 “Antenna spacing” amended to show FCC’s RF Exposure Guidelines for increased Duty Cycle.

Version 1.40, December 2000

- Supporting footnotes for Gemini/PD Lite model (No GPS option) added.
- Section 3.2, function of DE-9F pin 9 (Aux input) corrected and clarified.
- Section 4.0, re-written to support the WinRIS program.
- Section 5.0, Table 5, step 4, values revised.
- Section 6.0, MIL Specifications limitations note added.
- Appendix 1, clarification of “Officer Requires Assistance” alarm function added.

Version 1.32, October 2000

- Updated UHF units specifications:
  - Table 3 "Carrier Modulation"
  - Table 4 “Tests, Full & Half Channel Units”
  - Section 6 “Specifications”.

Version 1.31, August 2000

- Introduction of 25.6 Kbps model. Relevant changes made to:
  - Section 1.2.1 “Features”
  - Table 3 “Carrier Modulation"
  - Table 4 “Tests, Full & Half Channel Units”
  - Section 6 “Specifications”.
  - Emission designators table added to Section 6 “Specifications”.

Version 1.30, August 2000

- Power output specifications for 800MHz model added to section 1.2.1 “Features”.
- Main transceiver Output Power for 800MHz model added to: Table 4 “Tests, Full and Half Channel Units” and minimum value edited in the footnote.
- Title of section 4.4.4.2 edited to specify that RSSI Indicator also serves as power meter. Note added to establish that the internal wattmeter is not to be interpreted as a precision instrument.
- Section 4.4.4.3.1 “Unmodulated Carrier” edited to show 800MHz model power check nominal forward wattage.
- Section 2.4.2 “Routing of Power Cable”, step no. 7, clarification of negative wire connection.

Version 1.20, June 2000:

- LED indication explanation for the 800MHz (2% duty cycle limit) model added as a footnote to table 1 and to section 5.3 GPS Test.
- Section 2.5 “Antenna” rewritten and now including more details concerning “Planning” and has a new antenna spacing drawing.
- More details added to section 4.2 concerning starting of the WinRIS program from MS-Windows.
- Environmental MIL spec added
- FCC Certification number added to Specifications section.

Version 1.10, March 2000:

Addition of 800MHz specifications, revision to paragraph 2.2.1 - RF Radiation Warning and to paragraphs 2.5 through 2.5.3. – Antenna installation.

Version 1.0, January 2000:

First released version

Definitions

The following terms are used throughout this document.

Item	Definition
DCE	Data Communications Equipment. This designation defines the direction (input or output) of the various RS-232 interface signals. Modems are always wired as DCE.
DTE	Data Terminal Equipment. This designation defines the direction (input or output) of the various RS-232 interface signals. Most user equipment, as well as PCs, are wired as DTE.
GCU	Gemini^{PD} Control Unit board
Gemini^{PD}	High specs mobile radiomodem. PD = Parallel decode
Gemini^{PD} Lite	Gemini^{PD} without GPS feature
HDX	Half Duplex. A unit that uses separate transmit and receive frequencies, but which may not transmit and receive simultaneously.
RS-232	Industry–standard interface for data transfer.
Simplex	A unit which uses the same frequency for transmit and receive.
WinRIS	Windows © Radio Installation Software. This software allows basic tests and unit configuration.

1. PRODUCT OVERVIEW

This document provides the information required for the installation, operation and verification of the DATARADIO Gemini^{PD} mobile radiomodem.

1.1 Intended Audience

This document is designed for use by engineering design, installation, and maintenance personnel.

1.2 General Description

Gemini^{PD} is a mobile radiomodem aimed at the public safety and public utility markets to meet demand for high speed and high throughput. It integrates all the necessary hardware for data-only vehicular installations up to but not including the laptop PC and its application software.
Example of applications are:

1. Database inquiry systems.

   Small number of brief messages, (usually from the mobile station) with fairly long responses.

2. Computer-aided dispatch (CAD).

   Large number of messages, (usually from the base station) with very brief responses.

3. Automatic Vehicle Location (AVL).

   Using built-in GPS receiver, determines position, speed and direction of fleet members.

The Gemini^{PD} is made-up of:

- A main transceiver
- A auxiliary receiver for Parallel Decode (PD)
- A 40-Watt power amplifier (35-Watt for 800 MHz model),
- A Gemini^{PD} Control Unit (GCU) with DSP driven modem
- An optional integrated OEM GPS receiver.[1]

[1] The Gemini^{PD} Lite model has no GPS.

1.2.1 Features

- One-piece integrated design in a rugged die-cast aluminum chassis.
- Parallel Decode (PD) technology (patent pending) featuring dual receivers for added decode sensitivity in multi-path and fading environments.
- Sophisticated DSP-based modem design provides added system performance, fewer retries and more effective throughput.
- Automatic channel changing for improved roaming capabilities.
- Built–in, up to 16-channel flash – EEPROM programmable synthesized radio transceiver with automatic channel selection.
- Models with on-air data speeds and modulation types as follows:
  - DGFSK[2] modulation, rates of 9600 to 19200 b/s in 12.5 or 25 kHz channel spacing (9600 b/s maximum in half channels).

    or
  - xRC4FSK[2] modulation, rates of 32.0, 25.6, and 19.2 kb/s in 25 kHz or 25.6[3], 19.2, 16.0, and 14.4 kb/s in 12.5 kHz channel spacing.
- 3 available user ports using standard RS-232 interface via built-in multiplexer.
- Half-duplex or simplex operation.
- Out-of-band signaling enables transmission of GPS[1] reports with no effect on system performance.
- Back compatible with MobilPac/R (DGFSK)[2] at 9600 and 19200 b/s.

1.2.2 Configuration

Gemini^{PD} is factory configured based on each customer network system require-

2 Networks must use common modulation, bit and baud rates.

3 NPSPAC only

ments, usually by Dataradio System Engineering. Configuration is not changeable in the field without notifying Dataradio.

Factory Technical Support

The Technical Support departments of DATARADIO provide customer assistance on technical problems and serve as an interface with factory repair facilities. They can be reached in the following ways:

DATARADIO Inc.
5500 Royalmount Ave, suite 200
Town of Mount Royal
Quebec, Canada H4P 1H7

Technical support hours: Monday to Friday
9:00 AM to 5:00 PM, Eastern Time

phone: +1 514 737-0020
fax: +1 514 737-7883
Email address: support@dataradio.com

or

DATARADIO Corp.
6160 Peachtree Dunwoody RD., suite C-200
Atlanta, Georgia 30328

Technical support hours: Monday to Friday
8:30 AM to 5:30 PM, Eastern Time

phone: 1 770 392-0002
fax: 1 770 392-9199

Email address: drctech@dataradio.com

1.3 Product Warranty

Warranty information may be obtained by contacting your sales representative.

1.4 Replacement Parts

This product is not field serviceable, except by the replacement of a complete unit. Specialized equipment and training is required to repair the GCU board and radio modules.

Contact Technical Support for service information before returning equipment. A Technical Support representative may suggest a solution eliminating the need to return equipment.

1.4.1 Factory Repair

When returning equipment for repair, you must request an RMA (Returned Material Authorization) number. The Tech Support representative will ask you several questions to clearly identify the problem. Please give the representative the name of a contact person who is familiar with the problem, should questions arise during servicing of the unit.

Customers are responsible for shipping charges for returned units. Units in warranty will be repaired free of charge unless there is evidence of abuse or damage beyond the terms of the warranty. Units out of warranty will be subject to service charges. Information about these charges is available from Technical Support.

1.5 Unpacking

When ready for installation, carefully unpack your Gemini^{PD} kit (p/n 023 6000-001) shipping carton and identify each item as listed below:

- One Gemini^{PD}
- Installation mounting bracket
- Power cable – 22 feet (6.7 meters)
- Small parts kit

If damage has occurred to the equipment during shipment, file a claim with the carrier immediately.

2. Installation

2.1 Planning the Installation

2.1.1 Overview

To ensure trouble-free, efficient installation, start by inspecting the vehicle to determine the optimum position for Gemini^{PD} and its antennas as well as the routing of all associated cabling and wiring.

2.1.2 Location

Often, installations in cars are done in the trunk, underneath the back window ledge or on the trunk floor. In vans and small trucks, it is usually done in the back of the vehicle. In large vehicles, it is often done in the front cabin.

Be sure to place the Gemini^{PD} unit in such a way that:

- The LEDs can be seen (as an aid in troubleshooting)
- Access to the antenna DE-9 connectors is possible without removing the unit
- Sufficient air may flow around the unit to provide adequate cooling

Gemini^{PD} is not fully waterproof, therefore it should be mounted sufficiently away from an opened trunk lid or opened tailgate, windows or doors to avoid exposure to rain and/or snow. It also minimizes the chance that material can be accidentally thrown on the unit or of someone bumping against it.

2.1.3 Cable Path

Try to route the cables away from locations where they would be exposed to heat (exhaust pipes, mufflers, tailpipes, etc.), battery acid, sharp edges, mechanical damage or where they would be a nuisance to automobile mechanics, the driver or the passengers.
Keep wiring away from automotive computer modules, other electronic modules and ignition circuits to help prevent interference between these components and radio equipment.
Try using existing holes in firewall and trunk wall and the channels above and below or beneath the doors, channels through doors and window columns that are convenient to run cables and wires.
Whenever possible, install conduit in which to run the cables.

2.2 Warnings

Before starting installation, review all of the following warnings.

2.2.1 RF Radiation warning

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. Only proper installation of the transceiver antenna of Gemini^{PD} as summarized in section 2.5 will result in user exposure substantially below the FCC recommended limits.

Qualified personnel must do all antenna installations. See paragraph 2.5.2 for recommended antenna positioning.

Transmissions when persons or animals outside the vehicle are within two feet of the antenna may result in radio energy radiation burns or related injuries.

2.2.2 Interference with vehicular electronics

Certain vehicle electronic devices may be prone to malfunction due to lack of protection from radio frequency energy present when transmitting.
It includes, and is not limited to:

- Electronic fuel injection systems
- Electronic anti-skid braking systems
- Electronic cruise control systems

If the installation vehicle contains such equipment, consult the dealer for the make of vehicle and enlist his aid in determining if such electronic circuits will perform normally when the radio is transmitting.

2.2.3 Secure mounting

For vehicle occupant(s) safety, mount Gemini^{PD} securely so that the unit will not break loose in case of an accident or violent maneuvers.

2.2.4 Explosive environments

Operation of vehicular radio transmitters in explosive environments may be hazardous and conventional safety precautions must prevail. These include and are not limited to:

- Transmitting while fuelling the vehicle. Do not carry fuel containers in the same compartment as Gemini^{PD}.
- Dynamite blasting caps may explode when transmitting radio operation takes place within 500 feet. Always obey the ***"Turn Off Two-Way Radios"*** signs posted at sites where dynamite is being used.

If transporting blasting caps:

a) Carry the blasting caps in an appropriate metal container having a soft cushioning lining.
b) Suppress transmissions whenever the blasting caps container is being loaded or unloaded into or from the vehicle.

Check applicable local bylaws.

2.2.5 Installation in vehicles powered by liquefied gas.

Gemini^{PD} installations in vehicles powered by liquefied petroleum gas with the LP-gas container in the trunk or other sealed-off space within the interior of the vehicle must conform to the National Fire Protection Association Standard NFPA 58 which requires:

- Space containing radio equipment shall be isolated by a seal from the space containing the LP-gas container and its fittings.
- Outside filling connections shall be used for the LP-gas container.

The LP-gas container space shall be vented to the outside of the vehicle.

2.3 Physical Unit

2.3.1 Recommended tools and supplies

- Electric drill for mounting holes
- Hammer and center punch
- Tie-wraps
- Drills and circle cutters as needed according the size of screws (or nuts and bolts) used.
- In-line "Power meter" capable of measuring forward and reflected power at the operating frequency of the radio.

2.3.2 Physical mounting of Gemini^{PD}

Start by running all the cables (DC power, PC RS-232 as well as all antennas cabling) prior to mounting Gemini^{PD} to assure the feasibility of the planned cable routing. Be sure to leave sufficient slack in each cable so the Gemini^{PD} may be removed from the mounting bracket for servicing with the power applied and the antenna attached. Gemini^{PD} is ready for installation.

Cautions:

- *When drilling mounting holes, be careful to avoid damaging some vital part of the vehicle such as fuel tanks, transmission housing etc. Always check how far the mounting screws extend below the mounting surface prior to installation.*
- *Use of drill bit stops is highly recommended.*

- *After drilling, remove all metal shavings before installing screws.*
- *Do not overtighten self-tapping screws.*

1. Once you have found a suitable mounting position for Gemini^{PD}, hold the unit and the unattached mounting bracket in the proposed mounting position and check that there is clearance behind the unit for the heatsink, cables, etc. Check that the position provides a large enough flat surface that the bracket will not be distorted when installed.

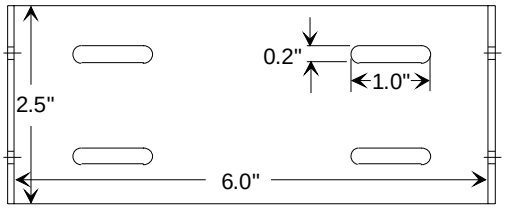

Figure 1 - Mounting plate and slot dimensions

2. Using the installation bracket as a template, mark the four locations for drilling (see Figure 1). Again, ensure that drilling at the selected points is safe and will not cause damage.
3. Indent the drilling positions with a center punch.
4. Drill holes sized for the self-tapping screws or for the nuts, bolts and lock washers used.

   Caution: *Slightly reduce the size of the drilled holes when using self-tapping screws in thin metal.*

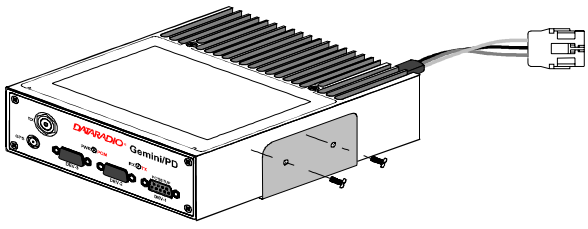

Figure 2 - Bracket installation

5. Install the bracket without distorting.

6. Securely mount Gemini^{PD} to the installed bracket using the four supplied 8x40 black machine screws.

7. Drill any additional holes as required for routing all cables and fit holes with suitable grommets or bushings whenever required.

2.4 Electrical installation

2.4.1 Electrical requirements

Gemini^{PD} is designed to operate from a 13.8Vdc nominal car battery (negative ground) and requires currents up to 15.0A. It will tolerate a supply voltage range of 10.9 volts to 16.3 volts.
In vehicles with a 24 VDC electrical system (mostly in trucks), it is essential to provide a suitably rated 24/12 VDC converter to isolate the unit from the battery and protect it against excessive voltage.

Warnings:

Application of more than 16.3 VDC will damage Gemini^{PD} and is not covered by the warranty.

Always disconnect GeminiPD's DC power lead before connecting a second battery, using power from another vehicle or power boosting (e.g. when "jump starting" the vehicle).

2.4.2 Routing of power cable

1. Start by disconnecting the vehicle's battery unless specifically prohibited from doing so by the customer, vehicle manufacturer, agent or supplier.

   Note:

   In this event, exercise extreme caution throughout the installation and fit the fuse only when the installation is complete.

2. The 22 feet (6.7 meters) long power cable consists of three wires attached to

a Packard Electric “Weather-Pack” connector (DC power Connector).

The DC Power connector has:

- At position “A”, the smaller red switch-sense wire (commonly to ignition)
- At position “B”, the blue ground wire
- At position “C”, a larger red B+ DC power wire (MUST be unswitched)

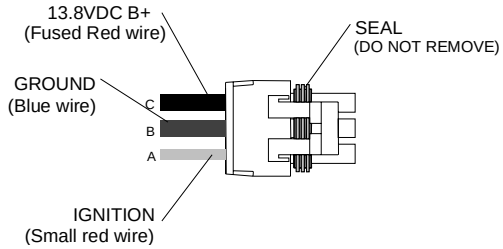

Figure 3 - DC Power Connector

3. Place this connector at Gemini^{PD}’s radio power input location. Do not connect at this time. See paragraph 2.6, “Completing the physical installation”.
4. Carefully route both the B and the C wires to where the in-line fuse holder will be installed, usually as close to the vehicle’s battery as practicable. Ensure that leads do not chafe on any metal part(s). Secure the wires at several locations along their length.

   Caution:

   Use proper crimping tool. Common pliers are NOT acceptable.

   Warning:

   The DC Power lead must be unswitched
5. Insert the negative (blue) lead into one of the appropriate connector lug and crimp solidly to force the metal contacts onto the wires.
6. Repeat the step above for connecting the red DC power lead.
7. Attach the positive lead at the battery positive terminal. Attach the negative wire at the vehicle end of the battery ground cable.

   If the negative cable is connected directly to the battery negative terminal, it should be fused in case of failure of the vehicle’s ground cable.

   Ensure tight and secure connections.
8. Fasten the fuse holder and leads.
9. Carefully route the A wire to where the connection will be made for switch sensing.
   - Connect to “Ignition” if you wish to have Gemini^{PD} turning ON and OFF dependent on the vehicle’s ignition key.
   - Connect to “Accessory” if you wish Gemini^{PD} to be available when the engine is not running, but still dependent on the ignition key.
   - Connect to a user-supplied control switch.
   - In installations equipped with a “ChargeGuard”, connect to the controlled-side of the ChargeGuard (remembering that the DC Power lead must NOT be switched).
10. Make appropriate connections.

    Cautions:

    Where scraping to bare metal was required, and at the battery posts where wire ends and lugs may be exposed, apply anti-corrosion compound.

    Insert the fuse only when installation is complete and ready to test.
11. At the Gemini^{PD} position, neatly coil cable slack and attach securely.

2.5 Antenna

To meet the FCC's RF Exposure Guidelines, the main transmitter antenna must be vehicle-mounted to provide a separation distance of 50 cm or more from all persons and the *antenna gain* must not exceed 5dB to satisfy RF exposure requirements.

2.5.1 Recommended tools and supplies

- circle cutter
- hole saw or
- socket punch for antenna
- Mini-UHF Crimp tool

2.5.2 Planning

Referring to Figure 4, Gemini^{PD} commonly uses three separate antennas:

- "T" - Main transceiver -

  Constraints are Maximum Permissive Exposure ("MPE" on the drawing) limits of 50 cm (as per see section 2.5 above) and omni-directional factors

- "R" - Auxiliary receiver –

  Constraints are the receiver spacing of at least 5/8 λ (wavelength) from transceiver antenna and omni-directional requirements

- "G" - Global Positioning System (GPS)*

  Constraints are TX spacing of at least 24-in/60.96 cm from all transmitting antennas and a clear view of the sky.

For the optimum antenna spacing at the frequency you are using, consult System Engineering.

For installation of ground-plane dependent antennas, the center of the metal surface used for mounting is preferable for best omni-directional pattern.

For ground-plane independent antennas, installation may be close to the edges of the surface.

* The Gemini^{PD} Lite model has no GPS.

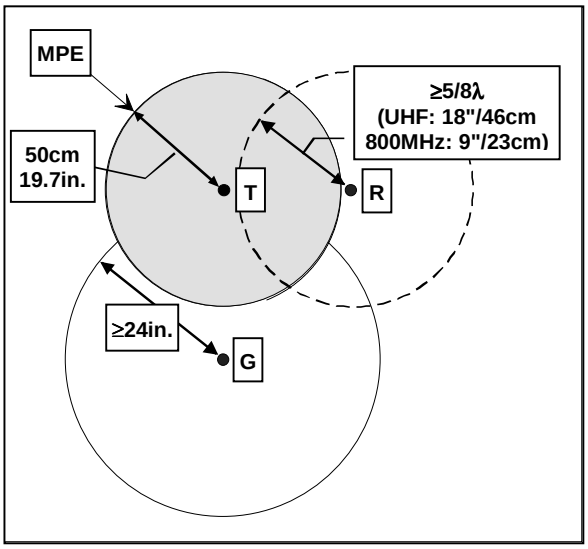

Figure 4 - Antenna spacing

Install the antennas in one of the following positions:

- Most preferred for all antennas: centerline of roof. For transmitter antenna, it is the ONLY acceptable position.
- Less preferred for receiver antenna: trunk lid, providing distance to transmitting antenna is respected whether lid is opened or closed.
- Much less preferred, but permissible for receiver antenna: left or right rear fenders, just in back of rear window
- Least preferred, but permissible for receiver antenna: left or right front fenders, ahead of windshield

Note:

Proximity to other vehicle-mounted antennas may cause mutual interference especially at higher frequencies.

2.5.3 Antenna Installation

1. Route good quality 50-ohm coaxial cables (e.g. RG-223) from each of the selected antenna positions to the position where the Gemini^{PD} unit is mounted.

2. Terminate the end at each of the antenna positions with the appropriate connector for the antenna used and make the connection.

3. At the Gemini^{PD} position, cut the three cables to length and terminate with the appropriate plug. For the transceiver and the auxiliary cables, use a Mini-UHF crimp plug using an appropriate crimping tool. For the GPS, use a SMA connector.

4. ***Positively identify*** the transceiver mini-UHF plug and connect to the left rear of Gemini^{PD}.

5. ***Positively identify*** the auxiliary receiver mini-UHF plug and connect to the front left of Gemini^{PD} to the RX position.

6. Connect the SMA connector to the GPS* position below the auxiliary connector position.

7. *Do not skip this last step, trust us; it is an important one.* To complete the installation, tie-wrap together the auxiliary and the GPS* antenna cables at a point about two inches in front of the unit. It will be much easier hereafter to correctly identify which mini-UHF plug goes where. You DO NOT want to cross the auxiliary plug with the transceiver plug.

2.6. Completing the physical Installation.

To complete the physical installation and prior to testing Gemini^{PD}:

- Connect DC Power cable's connector to Gemini^{PD}'s until you hear a click as the two parts snap together.
- Re-check that all other connections are secure (antennas, PC, etc.)
- Switch vehicle ignition ON.

You are now ready to check for normal operation and to run the Radio Installation Software (WinRIS) program for testing or trouble-shooting.

2.7. Checking out Normal operation

Check that the vehicle ignition is ON.

1. Check for proper operation of the Gemini^{PD}'s LEDs as per Table 1 in section 3.1

2. Using the WinRIS program (described in section 4) and an in-line wattmeter, check forward & reverse power to confirm main antenna installation.

3. Using the WinRIS, check the RF link with a base station that can be heard, see section 4.5.5 "Test Functions".

   If user application and its base station are available, test the installation by going through a normal sequence of transmitting and receiving messages.

* The Gemini^{PD} Lite model has no GPS.

3. Operating Description

3.1 Front & Rear Panels

The front panel includes:

- One mini-UHF type female antenna connector for the auxiliary receiver
- One SMA type female connector for the GPS receiver (not installed on Gemini^{PD} Lite model)
- Two LED indicators
- Three DE-9F RS232 ports

The rear panel includes:

- One mini-UHF type female antenna connector for the main transceiver
- One 3-pin pigtailed DC Power connector with ignition sense

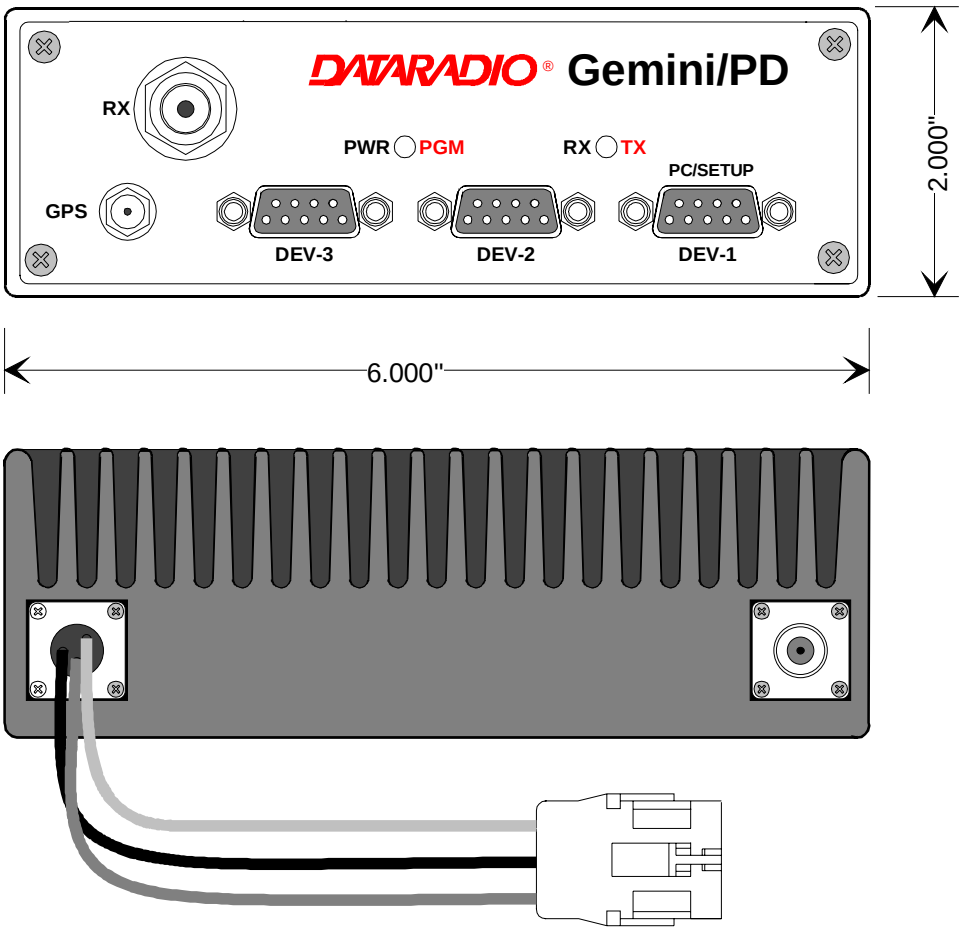

Figure 5 - Front and rear panels

Table 1 - Gemini^{PD} LEDs indications

Gemini^{PD} LEDs indications							
Power-on Sequence (LEDs are paired)				***Normal Operation (LEDs are independent)***			
	PWR	**RX / TX**	**Indication**	**PWR**	**Indication**	**RX / TX**	**Indication**
Normal	Red	Red	Normal boot-up start (10 to 27 sec.)	Green*	Normal ready state	Off	No network activity
	Amber	Off	Then 8 seconds to completing boot-up	Amber*	1 Pulse/sec. Sufficient satellites acquired by GPS	Green	Receiving packets "DBA sync" allows transmit
	Green	Off	Normal state				
Errors	Red	Off	Hardware failure			Amber	Receiving packets "DBA out-of-sync" prevents transmit
	Slow Red/Green	Red	Software failure (firmware erased)			Red	Transmitting
Special	Fast Red/Green	Red	Programming in progress	* For 800MHz model (using 25% duty cycle limit) PWR lit Green / Flashing Amber = normal indication (GPS 1pulse per sec.) PWR lit Amber / Flashing Green = exceeded duty cycle (GPS 1pps)			

3.2 DTE Port Interface

For all three ports:

DE-9 F pin #	Function
1	DCD – from Gemini^{PD}, normally asserted
2	RXD – data from Gemini^{PD}
3	TXD – data to Gemini^{PD}
4	DTR – to Gemini^{PD}, handshaking
5	Ground
6	DSR – from Gemini^{PD}, tied to VCC through current limiting resistor
7	RTS - to Gemini^{PD}, handshaking
8	CTS – from Gemini^{PD}, handshaking
9	AUX - auxiliary input to GeminiPD, (for port 2: **"Officer requires assistance"** Alarm input) It may be activated by (normally open) dry contact pull-up to the port's DSR output. It may also tolerate user pull-up to external +12 VDC (car battery), but an isolated dry contact is preferred due to the risk of noise-related false alarms caused by the vehicle's electrical system. A +3 to +12 V signal at this pin will send a DMP *"x"* (On) message to the base. An open or ground signal will send a DMP *"y"* (Off) message. Messages are only sent when a signal transition occurs. *See Appendix "A" on page 23 for further details.*

We recommend the use of a shielded 9-wire cable with all pins connected. These ports can be used for unit configuration, maintenance & adjustment as well to connect user applications.

3.2.1 RS-232 Interface Signal Levels

In the descriptions of data signals, the following conventions are used:

Table 2 - RS-232 Signal Levels

Term	Alternates	Signal level
1	asserted, spacing	+3 to +15 V
OFF	dropped, marking	-3 to -15 V

4. WinRIS program[1]

The Windows Radio Installation Software (WinRIS) program is used to:

- Check and troubleshoot Gemini^{PD}.
- Save an existing configuration.
- Upload files for field-configuring units (Requires intervention with technical support).

To run the program, you will need:
A PC or portable computer running a 32-bit MS-Windows application:
(Each program copyright © Microsoft Corporation. All rights reserved.)

Win ME
Win2000
Win NT
Win 9x

(For Win 95, if COMCTL32.DLL has been updated to the most recent version and copied to the \windows\system\ directory).

Note:

WinRIS does not operate under:
Win CE (embedded in PocketPC)
16-bit Windows 3.x

- A hard disk.
- An available COM port.
- A serial mouse, with its own driver installed is strongly recommend however most actions can also be done using keyboard command

4.1 Operation

This support program can be run in MS-Windows © mode.

DO NOT have more than one copy of this program loaded at any given time in separate windows. Doing so creates COM port sharing conflicts and failure to run the program alone results in unexpected transmissions.

Only left mouse button operation is supported.

Any command or selection shown in gray is either unavailable or is awaiting another action before activating.

Help in the program is available at all points by pressing the F1 key. If a subject is highlighted, the help displayed will be context sensitive.

4.2 To connect and start WinRIS

Connect a suitable 9-conductor straight RS-232 cable, between the unit's front-mounted PC/Setup port and the RS-232 port of the PC or portable computer that will be running Gemini.exe program.

All families of MobilPac, Gemini^{PD}'s, Paragon and Paragon^{PD} products share a common WinRIS program available on diskette, Dataradio p/n 980 03392-00*n*.

Refer to the WinRIS Readme.txt file for details on how to set the MS-Windows environment, and how to connect, install and run this program.

In summary, before starting the WinRIS when running MS-Windows, click on "Start", then on "Run". Type the relevant path and variables on the command line (or select by browsing) leading to:

WinRIS.EXE COM[x], [speed],8,n,1

(where x is the PC COM port to be used) Of course, the executable command may be used alone without any variable added.

Click on "OK".

It is also possible to create a PC desktop shortcut icon for WinRIS:

In MS-Windows 98

- Start by right clicking anywhere on the desktop,
- Select New,

[1] **For descriptions of features revised or added to WinRIS versions later than 3.xx, please refer to the program's context-sensitive help or type FI**

- Select Shortcut and type the path as detailed above directly on the command line (with or without variables).
- Click Next,
- Type in an applicable name for the shortcut icon,
- Click Next
- Select an icon (your choice) and
- Click on Finish.

In other MS-Windows Operating Systems, this procedure may vary slightly. If in doubt, check the manufacturer's documentation.
Command line settings override the environment variable, if any.
Command line settings override the environment variable, if any.

4.3 WinRIS Window

Refer to your version of WinRIS for its main screen appearance. WinRIS detects the product it is used with and the screen's design adjusts to the product's particular structure. Future versions will also introduce new features. The program's context-sensitive help (or accessible via the FI function key) is the best source of information on items not covered in this section.

Generally, this program uses only one main display screen. Placing the cursor over a Toolbar or Button generates a ScreenTip. Starting at the top, the screen display is made up of:

- A **Menu bar**, containing the menu names listed below. They give access to command options. Unavailable commands are shown in light gray color. ***Shortcut keys*** are listed whenever available.
  - ***File*** menu lists the:
    - ***Put From*** command (Ctrl+O)
    - ***Get*** command (Ctrl+S)
    - ***Get As*** command

    and below a command separator, the:
    - ***Exit*** command
  - ***Test*** menu lists the:
    - ***Stationreset*** command
    - ***Modulated*** command
    - ***UnModulated*** command
    - ***Square Wave*** command
    - ***Random Data*** command
  - ***View*** menu lists the:
    - ***Product ID*** command
    - ***Password*** command
    - ***Options*** command
    - ***Toolbar*** checked command
    - ***Status bar*** checked command
  - ***Help*** menu lists the:
    - ***Help Topics*** command

    and below a command separator, the:
    - ***About WinRIS*** command
- A **Toolbar** row, located immediately below the menu bar containing buttons (each bearing an icon) for commonly used tasks as follows:
  - ***Put From*** button
  - ***Get*** button

    Get As button

    and to the right of a bar separator, the:
  - ***About*** button and the
  - Context-sensitive ***Help*** button
- An **Indicator and Button bar,** located immediately below the Toolbar row, it contains two circular indicators
  - ***DSR signal is High*** indicator
  - ***CTS signal is High*** indicator

and buttons for commonly used tasks as follows.
  - ***Station Reset*** button
  - ***Product ID*** button
  - ***Modulated TXON*** button
  - ***Unmodulated TXON*** button
  - ***Square Wave*** button
  - ***Random Data*** button
- A **Product field**, displays product type being used after a connection to the product has been established
- A **Data section**, containing the Banner plus the Comments and Password fields and their related Put buttons.
- A **Channel(s) section**, to select and activate a channel.

- A **Test section**, with Address and Device fields, Send button and Chat window.
- A **Status bar,** for displaying standard user-messages. Other messages appear in dialog window boxes or warning windows.
- A **GPS Information** section, exclusive to Gemini^{PD}.
- An **RSSI Bar Graph** on the right side of the window is exclusive to Gemini^{PD}.

4.4 Port Configuration Window

At program's launch, WinRIS opens the "Port Configuration window".

Enter the COM port and speed that should be used. The program defaults to 8 bits, no parity and one stop bit. Make necessary modification(s) to entries if needed and click on Save to go to main screen (a delay of several seconds may occur). If COM port and speed are already saved, the program automatically goes to the main screen.

1. In the COM Port list box, select the COM port (1,2,3 or 4) to use for connection.

   Note: the COM Ports selections numbered 5 to 32 are used (at factory) to upgrade several units from the same computer USB port.
2. In the Baud rate list box, select the baud rate to use that matches your unit.
3. Bits options are 7 or 8 (default)
4. Parity options are None (default), odd or even
5. Stop bits options are 1 (default) or 2

   Note:
   Do not make any entry in the "Connection Type --- Base Only" box. *It only applies to Paragon or Paragon^{PD} base stations.*
6. Click the Save button to validate your choice(s) and start the connecting process that concludes with the Status bar reporting: "Stationreset is completed".

To exit the window without making any change, click on Cancel.

Notes:

Enable the "Always ask port configuration when WinRIS start" box to have the Port Configuration window always opening at start up.

Two instances of WinRIS may be run. One application runs on one COM port and the second on another port. This feature allows testing a mobile and a base station on one computer that has two COM ports.

Ensure that mobile unit is in DMP mode.

4.5 Functions

The WinRIS program is used to:

- Save an existing configuration from a unit to a file.
- Take a configuration from a file and upload it to a unit
- Check Gemini^{PD}
- Test and/or trouble-shoot installations

4.5.1 "Station Reset" button

On the menu bar, select "Test", then the "Stationreset" command or press the "Stationreset" button on the Toolbar to issue a stationreset command to the modem.

Stationreset is a last step after doing a "Put From". It causes downloaded parameters from a file or diskette to take effect in the connected unit.

Pressing Stationreset is not required after doing any Comments or Password configuration change as these have their own Put Comments and Put Password buttons.

StationReset does not break the connection.

4.5.2 Configuration to a file

Saving the unit's configuration to a file allows the user to:

- Subsequently restore the configuration.
- Safeguard a copy as documentation of the configuration.

Note: The configuration and status files are ASCII files and may be e-mailed or faxed to technical support when requested to do so.

Warning:

Do not make any changes to these files. Any changes made to the configurations MUST be done at factory or by Dataradio system engineering.

4.5.2.1 "Get" button

On the menu bar, select "File", then the "Get" command or press the "Get" button on the Toolbar to:

- Download and automatically save the connected unit's configuration setting to a file (in the current directory of WinRIS) named with the unit' serial number: The WinRIS status bar will then report *"All parameters are successfully retrieved and saved in file [unit' s/n].GM2.* Any previous configuration in the program is overwritten.

If you do not wish to overwrite an existing configuration or prefer to name the file yourself, use the "Get As" button.

4.5.2.2 "Get As" button

After communication is established using the Connect button, press the Get As button to:

- Open the "File, Save As" window with the ASCII file *.gm2 (already selected).
- Save the connected unit's operating characteristics (configuration setting) to a file, directory or drive of your choice.

  The program will ask before overwriting an existing file.

Status bar reports *"All parameters are successfully retrieved and saved in [filename]*.

4.5.3 Configuration from a File

Loading a configuration from a file to a unit is useful to:

- Restore the operating characteristics of a unit (Requires intervention with technical support.)
- Carry out field updates using Dataradio system engineering supplied diskette(s).

Warning:

Do not make any changes to these files. Any changes made to the configurations MUST be done at factory or by Dataradio system engineering.

4.5.3.1 "Put From" button

1- On the menu bar, select "File", then the "Put From" command or press the "Put From" button on the Toolbar.

2- In the "Open" window, locate the drive, directory and file name of the relevant file.

- This may be a configuration saved earlier from a unit.
- It can also be from a Dataradio (factory or system engineering) diskette.

4- Select the appropriate file

5- Press the "OK" button.
The status bar reports: "[filename] is downloading into unit" and up to 30 seconds later displays: "All parameters are saved. Apply Station Reset to take effect!" .

6- Press the "Station Reset" button. See section 4.5.1 for details.

4.5.4 Special Functions

The following WinRIS fields and buttons are used to gather specific information concerning the connected unit:

- ***Banner*** field
- ***Comments*** field and ***Put Comments*** button
- ***Password*** and ***Put Password*** button

4.5.4.1 Banner Field

This field displays a string made up of the serial number of the connected unit followed by the firmwares used and their version number.

Format is:

[serial number]:firmware 1 name, its version #, firmware 2 name, its version #.

The serial number portion uniquely identifies the unit. It is a variable length, maximum eight-character alphabetic string assigned at the time of manufacture. It is identical to the serial number printed on the label of the unit. This number cannot be changed and is used as part of the on-air protocol.

Gemini^{PD}'s firmwares resides in flash EPROM and are designed to allow field upgrades.

When contacting your supplier, give the full banner string and the version of the WinRIS used. You will find the version number by selecting the “Help” menu option, then “About WinRIS” command or pressing the “About” button on the Toolbar.

The “Banner” field is blank prior to doing a "Get", "Get As" or "Put From".

4.5.4.2 Comments

1- Type comments directly in the “Comments” field. These can be text up to 24 characters. Use this field to enter user-convenient description(s) (customer name, location, etc…).
2- Press the button “Put Comments” to make the entry permanent. This field may be left blank.

On subsequent “Get”, “Get As” or “Put From”, this field displays entered comments. If no comment was entered, the field will remain blank.

4.5.4.3 Password

The password feature is useful where two (or more) fleets share the same radio channel. Mobiles without the proper password would still receive the message but the contents would not be intelligible.

1- Type your password directly in the “Password” field. It is a string of 32 hexadecimal characters (exactly).

2- Press the button “Put Password” to make the entry permanent. This field may be left blank.

On subsequent “Get”, “Get As” or “Put From”, this field will require that the correct password be entered. If none was entered, the field will remain blank.

Password information is NOT retrieved and saved to a file, along with the configuration.

Clearing a Password is done by entering 32 zeros.

The Dataradio supplied password algorithm is designed to thwart the casual observer only. It provides a limited form of data privacy. Therefore, if your security requirements are high, Dataradio urges you to use external encryption technology (such as Data Encryption Standard (DES)) in the Host and Mobiles computers.

4.5.5 Test Functions

The following WinRIS functions and buttons are used to carry out testing or trouble-shooting on a connected unit:

- DSR signal is High indicator
- CTS signal is High indicator
- Channels select
- Show All Channel Frequencies
- RSSI Indicator
- TXON (Modulated)
- TXON (Unmodulated)
- Square Wave
- Random Data
- Addressing and Device fields

4.5.5.1 DSR signal is High indicator

The “Data Set Ready” (DSR) indicator light, located on the button bar (leftmost), is an RS-232 protocol port indication. When lit, it indicates proper connection and that the value is High. The DMP protocol used requires that DSR be normally asserted.

4.5.5.2 CTS signal is High indicator

The “Clear-to-Send” (CTS) indicator light, located on the button bar (second indicator from the left), is an RS-232 protocol port indication. When lit, it indicates proper connection and that the value is High. The DMP protocol used requires that CTS be normally asserted.

4.5.5.3 Channel Selection

Select the radio channel on which you wish to send a test transmission by clicking the relevant available option button.

The program automatically detects which of sixteen channels are present on the connected unit. For each factory-set channel available, the relevant round option button and channel number is enabled (black). For each unavailable channel, the round option button and channel number appears disabled (grayed-out). Only one channel at a time may be selected.

Pressing the “Show All Channel Frequencies” button opens a sub-window listing in tabular form the radio transmitting and receiving frequencies programmed for each available channel(s).

To exit this sub-window, press the upper right corner system box.

4.5.5.4 RSSI & Power Out Indicators

The Radio Signal Strength Indicator (RSSI) bar graph usually displays in twin-columns the relative strength (in dBm) of an incoming RF signal on the selected channel.
The left column indication, labeled "I", shows the transceiver RX signal (rear mini-UHF connector).
The right column indication, labeled "II", shows the auxiliary RX signal (front mini-UHF connector).
Meter precision is usually better than 3 dBm (see note at the end of this section).

This indicator functions as a single column "Power" (Watt) meter when using either of the test functions: "TXON (Modulated)", "TXON (Unmodulated)", “Square Wave” or “Random Data” with a range of 0 to 60 watts.
Precision is usually better than +/-3 watts.

Note:

These internal RSSI and wattmeter indicators are designed for use as convenient and general reference only (trend monitoring). Their readings are not to be considered a substitute for values obtained using a standard external precision measuring instrument.

Whenever faced with a pass/fail situation, always base a decision on an external RF instrument measurement.

It is good practice at the time of installation to record (for future reference) the WinRIS RF power meter reading as well as readings from a standard power meter (e.g. Bird, IFR COM120 etc.).

4.5.5.5 TXON tests

TXON test functions are selected by choosing “Test” from the file menu, then “Modulated”, “Unmodulated”, “Random” or “Square Wave” command or by pressing the relevant button on the Toolbar. *All other commands and buttons are inactive during test transmissions.*

4.5.5.5.1 Unmodulated Carrier

Unmodulated carrier gives a clear carrier and is frequently used for checking:

- Frequency error
- Forward and reverse power

Press the TXON (Unmodulated) button to transmit an unmodulated 20-seconds test signal on the channel selected or until the button is pressed again.

The functions of all the other buttons are inoperative during test transmissions.

Power check:

1- Connect an in-line power meter between the radio and the antenna.

Measure the forward and the reflected power levels by powering TX ON. Reflected power should be <5% of forward power (or as specified by System Eng.).

4.5.5.5.2 Modulated Carrier

Test transmission generates a carrier modulated with 1kHz sinewave, at deviation level that depends on model and network speed as indicated in Table 3 below.
This function is frequently used for checking frequency deviation.

Press the TXON (Modulated) button to begin transmitting a 20-seconds modulated test signal on the channel or until the button is pressed again.

Table 3 - Carrier Modulation

Carrier Modulation		
Full Channel		
Network Speed		*Typical Deviation*
RC4FSK	32000	± 4.0[1] / ± 3.6[2] kHz
SRRC 4FSK	25600	± 4.0[1] / ± 3.7[2] kHz
	19200	± 4.5[1] / ± 4.3[2] kHz
DGMSK	19200	± 4.0 kHz
	16000	± 4.0 kHz
	9600	± 3.0 kHz
Half Channel		
Network Speed		*Typical Deviation*
SRRC 4FSK	25600	± 2.1[2] kHz
	19200	± 1.5[1] / ± 2.2[2] kHz
	16000	± 1.6[1] / ± 2.4[2] kHz
	14400	± 2.0[1] / ± 2.8[2] kHz
DGMSK	9600	± 2.5 kHz

Different modulation types are not interoperable
[1] UHF model and Canada market [2] 800MHz model

4.5.5.6 Random Dataradio

Generates a 20-seconds random data signal. Pressing the ''Stop''' button halts the ongoing test.
This test function is used for checking low-frequency balance.

- Low-frequency balance check:
  Helps to determine if the radio transmitter is well balanced for data transmission.

Refer to Table 4 for values indicated in adjustment tables under "Low Frequency Balance" step.
Random data test requires the use of an IFR COM-120B service monitor with option 03: 30KHz IF filter and its DC coupled demodulator output selected.

4.5.5.7 Square Wave

Generates a 20-seconds 100 Hz square wave used for low-frequency balance adjustments.

4.5.5.8 Addressing and Test

The "Address" and "Device" fields, the "Send" button and the "Chat" message screen are used to send messages to specific mobile or base or to carry out RF test. Start by entering the address of the mobile (or base station) you wish to send a test message to or test:

1- Specify the address:

Addresses may be entered by typing directly in the "Address" field in two ways:

- Numerically, the valid address range is 1-126.
- As an "Alpha-Mapped-Nibble" (AMN) address, consisting of upper case letters in the range A-P. The valid address range is A to GN.
- The base address is usually: 1.
- The program may display one of the following messages on the status bar:
- **For Paragon products:**

  "address is not in AMN or number format"
- **For mobile products:**

  "address is not in the range A – GN"

In either case, check that the address entered is within the acceptable range, is of a valid format and correctly typed.

2- Enter the Device number for mobile (or base station).

3- Press the Send button.

The Chat window reports "Sent to xx mobile" *(where xx is mobile name).*

If test is successful:
Status line reports "Delivery confirmed.

If test unsuccessful:
Chat window reports "Waiting",
Then the Status line reports "Delivery Failed".

4.5.6 GPS Information

When connected to a Gemini/PD (except "Lite" model) and decoding a valid GPS input signal, this window presents global position in Latitude, Longitude and Altitude.

A green light indicates valid GPS data is displayed.

A red light indicates the GPS data is either old or not enough satellites signals are present to achieve valid location computation.

Position information is displayed in degrees, minutes and decimal fractions of a minute:

E.g. : Latitude of 45 degrees, 29 minutes and 15 seconds North would appear as:
4529.250 – N under DCF 1.0
4529.2500 – N under DCF 2.0

The "Altitude" field indicates height above the WGS-84 *[1] reference ellipsoid in meters with a range of –30000.00 to + 30000.00

Notes:
The "number of satellites" field indicates the number of satellite signals being received and used to calculate position.

When no GPS signal is present, the location indicators display the word "Invalid" and the # of Satellites indicates "0".

The Dataradio Compressed Format (DCF) for GPS messages (DCF v. 1.0 and 2.0 are supported) is used to transmit the GPS information along with the DMP data payload. Programmers who need to decode the compressed information for their applications may contact Dataradio System Engineering for further information.
Altitude is not displayed in DCF version 1.0

[1] WGS- 84 = World Geodetic System - 1984

4.5.7 Status Bar

The Status Bar is located along the bottom edge of the WinRIS window. To display or hide the bar, check or uncheck the command in the "View" menu.

The left area of the status bar describes actions of menu items as you navigate using the directional arrows. This area also shows messages describing actions of toolbar buttons as you depress them, before releasing them. If after viewing the description of the toolbar button command you wish not to execute the command, then release the mouse button while the pointer is off the toolbar button.

Warning and Caution messages appear in pop-up sub-windows. To close these message boxes, press the ESC key.

Three boxes on the right of the status bar indicate which of the following keys is latched down "CAP", "NUM" or "SCRL".

5. Trouble-Shooting and Testing

The checks described below should be done at annual intervals or whenever deterioration in performance is noted.

5.1 Equipment Required

- 13.8 VDC (nominal) car battery, or 13.8 VDC/20A regulated power supply (In the case the unit is not installed in a vehicle)
- In-line watt meter (50W range)
- Radio service monitor (IFR or equivalent).
- Cable with mini-UHF male connector to connect Gemini^{PD} to the service monitor.

5.2 Basic Tests

Recommended checks:

1. Transmit and Reverse power output
2. Carrier frequency error
3. Frequency deviation
4. Receivers RSSI Check
5. Link test between Gemini and the base station.
6. GPS test (not required on Gemini^{PD} Lite model).

Refer to Table 4 for checks 1 to 5.

Important note: Before proceeding make sure that the service monitor has been calibrated recently and has warmed up for at least the time specified by its manufacturer.

Some reported frequency and deviation problems have actually been erroneous indications from service monitors that have not adequately warmed up. This is particularly likely when field service is done during winter months

Refer to the WinRIS section for function details

5.3 GPS Test

About three minutes after ignition is turned-on, the PWR LED on the Gemini^{PD} front panel should flash in amber color at the rate of one pulse per second.[1] This indicates that the GPS has acquired the sky position of a sufficient number of satellites to arrive at a ground position solution.

If the GPS has a good view of the sky and still has not generated any position solution within three minutes (it may take up to 10 minutes or more if the sky view is partially blocked.), the following trouble-shooting procedures should be undertaken to isolate the fault:

1) Disconnect the GPS antenna cable connector from the Gemini radio and check for + 5 VDC on the center pin of the GPS antenna connector on the radio using a Digital voltmeter (DVM). If the voltage is present, do not reconnect the cable and proceed to step 2.

2) With the DVM, measure resistance between the shell and the center conductor of the GPS cable, resistance should be between 100 and 300 Ohms, if it measures open or short circuit the GPS antenna is either a passive antenna which is the WRONG type, or a defective active antenna, replace with a known good active antenna.

3) Connect the new antenna to Gemini and wait about three minutes for the POSITION ACQUIRED indicator to start flashing on Gemini^{PD}, if not, the Gemini radio or its GPS receiver is defective

[1] Lit green and flashing amber for the 800MHz model under 2% duty cycle limit.

Table 4 - Tests, Full & Half Channel Units

CHECKLIST				
STEP	**ACTION**	**EXPECTED RESULTS at 25ºC**	**MEASURE WITH**	**IF NOT?**
GeminiPD units are set and characterized at the factory to optimize performances. It is not recommended to try to readjust the units.				
1	**Power-up LED Sequence**	as per Table 1 - GeminiPD LEDs indications		
2	**Connect and save config** Press WinRIS *Get* button	as per section 4.5.2		
3	**Main transceiver Output Power** Press *TX (Unmod)*	**UHF**: 40 watts **800MHz**: 35 watts both +10%, -10% Factory-settable down to 10 watts (5 watts for 800MHz model) as per customer request	Service monitor set to read power or 50W in-line wattmeter	Refer to factory technical support.
4	**Main transceiver Reflected Power** Press *TXON (Unmod)*	<5% of forward power or as specified by System Eng.	10W in-line wattmeter	Check for bad connections, damaged coax cable, etc.
5	**Carrier Frequency Error** Press *TX (Unmod)*	±300 Hz	Service monitor set to read frequency error	Refer to factory technical support.
4	**TX Deviation (KHz)** Press *TXON (Modulated)* Carrier will be modulated with a 1 kHz tone.	**xRC4FSK** / UHF / 800 US / 800 CA **Speed** / ***Full channel unit*** /	Service monitor set to read deviation (IF filter set to Mid or 30 kHz position)	Refer to factory technical support.
		32.0 kb/s: ±4.0 / ±3.6 / ±3.6		
		25.6 kb/s: ±4.0 / ±3.7 / ±3.7		
		19.2 kb/s: ±4.5 / ±4.5 / ±4.5		
		Half channel unit		
		25.6 kb/s: - / ±2.1 / -		
		19.2 kb/s: ±1.5 / ±2.2 / ±1.5		
		16.0 kb/s: ±1.6 / ±2.4 / ±1.6		
		14.4 kb/s: ±2.0 / ±2.8 / ±2.0		
		DGFSK / ***Full channel unit***		
		19.2 kb/s: ±4.0 / ±4.0 / ±4.0		
		16.0 kb/s: ±4.0 / ±4.0 / ±4.0		
		Half channel unit		
		9.6 kb/s: ±2.5 / ±2.5 / ±2.5		
		Tolerance is +5%, -10% for all bit rates.		
5	**RF Link test** Use the addressing function's "Send" button to dynamically test transmissions	Look for "Delivery confirmed" on the Status bar	as per section 4.5.5.8	Check on the WinRIS RSSI bar graph if the base station is within range (i.e. better than -107dBm) or Refer to factory technical support.
6	Set the service monitor to generate at the levels mentioned below. The carrier generated should be modulated with a 1.0 kHz tone at deviation of +/- 4.0kHz (full ch.) or +/-2.5kHz (half ch.).			
7	**Main Rec. RSSI checks** -70dBm -110dBm -120dBm	- 70 dBm +/-3 -110 dBm +/-3 -120 dBm +/- 3	WinRIS bar graph	Refer to factory technical support. *The RSSI checks give a good indication of receivers' health.*
8	**Aux Receiver** repeat as per step 7	same as step 7	WinRIS bar graph	Refer to factory technical support.

1 (unless you have set a lower value). Note that readings less than 40 watts (UHF model) or 35 watts (800MHz model) may be due to losses in cables used for testing. Check also your wattmeter frequency calibration curve. Do not be too ready to condemn the transmitter.

6. Specifications

GENERAL

	UHF	800 MHz
Frequency Tx	403 - 512 MHz[1]	806 – 824 MHz (821-824)
Frequency Rx	403 - 512 MHz [1]	851 – 869 MHz (866-869)
Channel spacing	12.5 or 25 kHz	
Frequency Control	Digital Synthesizer / uController	
Frequency Stability	1.5 ppm	
Operating temperature	-30°C to +60°C (25°C nominal) @ 95% non-cond. RH	
Modes of Operation	Simplex or Half Duplex	
Number of channels	16 internally stored	
Supply voltage	13.6Vdc nominal (negative ground) 10.9 – 16.3 VDC	
Circuit Protection	15 Amp fuse external 2 & 4 Amp fuse internal	
RX Current at 13.6 VDC	< 550 mA Standby (with auxiliary receiver)	
TX Current at 13.6 VDC	< 15 A	
TX/RX separation	5 MHz typical	
Nominal Dimensions	7.050” D x 6.000” W x 2.0000” H	
Weight:	< 3.5 lbs.	
RF input/output Impedance	50 ohms nominal	
RF connector	Main TX/RX: mini-UHF female Auxiliary RX: mini-UHF female GPS RX: SMA female (Not installed for Gemini^{PD} Lite version)	
Interface connector	3x DE-9F D-subminiature	

RECEIVER

Sensitivity (12 dB SINAD)	< 0.35 µV *
Selectivity (25KHz)	75 dB typical 70 dB minimum
Selectivity (12.5)	65 dB typical 60 dB minimum
Intermodulation	75 dB typical 70 dB minimum
Spurious rejection	75 dB typical 70 dB minimum
FM hum & noise	-45 dB typical *
Conducted spurious	< -57 dBm

* psophometrically weighted filter

[1] **WARNING**: The frequency band 406 to 406.1 MHz is reserved for use by distress beacons and should not be programmed into the unit.

TRANSMITTER

Power output	UHF = 10-40 watts	800 MHz = 5-35 watts
Duty cycle	20% @ full power, 30 secs. max. TX time (subject to FCC MPE limit)	
Conducted Spurious	-75 dBc (-38 dBm @10 W) typical	
Frequency stability	1.5 ppm	
FM hum and noise	-45 dB max (25 kHz)	
Attack time	< 10 ms	

Operation	Simplex/half duplex
Data rates and Modulation type	DGFSK (9600 b/s), (19200 b/s) * SRRC4FSK (19200 b/s), (25600 b/s) *
Packet Error Rate (for < 1% error)	better than –112 dBm at 19200 b/s full channel, with P/D (DGFSK)*
	better than –110 dBm at 25600 b/s full channel, with P/D (SRRC4FSK - UHF)* better than –109 dBm at 25600 b/s full channel, with P/D (SRRC4FSK – 800MHz)*
Protocol	Dataradio Proprietary DBA

* Networks must use common modulation, bit and baud rates. Different types are not on-air compatible

DISPLAY and CONTROLS

2 status LEDs	RX/TX, PWR

Environmental MIL. spec.

Environment	Categories	MIL Spec. 810E		Other
		Method	*Procedure*	
Low Pressure	Operations	500.3	II	
High Temperature	Operations, Storage	501.3	I(A1), II	
Low Temperature	Operations, Storage	502.3	I(C3), II (C1)	
Temperature Shock	Transfer of equipment	503.3	I(AI,C2)	
Solar Radiation	Heat effects	505.3	I	
Rain[1]	Drip rain	506.3	II	IEC IP54 only II
Humidity[1]	Induced, Aggravated	507.3	II,III	
Dust[1]	Blowing dust	510.3	I	IEC IP54
Vibration	Ground Mobile	514.4	I(8)	EIA RS-204C Forestry
Shock	Functional, Bench handling	516.4	I,VI	EIA RS-204C

FCC / IC CERTIFICATIONS

	FCC	IC (DOC)
UHF	EOTGPDA	773195525A
800 MHz	EOTGPDB	773195643A

EMISSION DESIGNATORS

Bit rate	Baud rate	Modulation	UHF	800MHz
9600	9600	DGMSK	8K60FID	8K60FID
16000	16000	DGMSK	15K3FID	15K3FID
19200	19200	DGMSK	15K0FID	15K0FID
19200	9600	SRRC4FSK	16K0FID	16K0FID
			TBD	10K2F1D
25600	12800	SRRC4FSK	15K6F1D	15K6FID
			-	11K5F1D
16000	8000	SRRC4FSK	8K17F1D	10K0F1D
14400	7200	SRRC4FSK	8K67F1D	11K0F1D
32000	16000	RC4FSK	16K5F1D	15K6F1D

[1] MIL Specification not guaranteed with Gemini^{PD} Lite version.

Appendix 1 - "Officer Requires Assistance" alarm function

The contents of this appendix are also available as Technical Instruction Sheet 009 (TIS009), document part number 122 20110-009 dated December 20, 2000.

Overview

The DTE Port Interface pin 9 (AUX) on DEV-2 is used for the **"Officer Requires Assistance"** alarm function.

Intended Audience

This document is designed for use by System Integrators.

Physical Connection

This auxiliary input may be activated by (normally open) dry contact pull-up to the port's DSR output. It can also tolerate user pull-up to external +12 VDC (car battery), but an isolated dry contact is preferred due to the risk of noise-related false alarms caused by the vehicle's electrical system.

A +3 to +12 V signal at this pin will send a DMP *"x"* (On) message to the base.
An open or ground signal will send a DMP *"y"* (Off) message.

Messages are only sent when a signal transition occurs (debounced for approximately 100 ms).

Operation

When using Gemini^{PD} or Gemini^{PD} Lite products, activating the **"Officer Requires Assistance"** alarm input starts emergency communications:

- The modem creates DMP *"x"* or *"y"* messages.
- Any other pending message(s) will be failed to avoid delaying the alarm message on account of lower priority traffic and to remove non-emergency messages from duty-cycle management (if applicable). In the case of a "q" message, a D-NAK* will be immediately returned.
- Base and Channel hunt will take place for the usual number of retries per base (according to configuration) but will cycle forever until D-ACKed[1] or Reset[1.]
- Lack of base DBA synch will not prevent transmission to maximize the chance that a base gets the alarm signal. DBA "Freewheel" mode will be forced until the alarm is acknowledged.

1 For details on DMP terms, refer to DMP 1.5 manual, version 4.0