DL-4

USER MANUAL

DL-4 User Manual

Publication Number: OM-20000063
Revision Level: 3
Revision Date: 2003/04/01

Proprietary Notice

Information in this document is subject to change without notice and does not represent a commitment on the part of NovAtel Inc. The software described in this document is furnished under a licence agreement or non-disclosure agreement. The software may be used or copied only in accordance with the terms of the agreement. It is against the law to copy the software on any medium except as specifically allowed in the license or non-disclosure agreement.

No part of this manual may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, for any purpose without the express written permission of a duly authorized representative of NovAtel Inc.

The information contained within this manual is believed to be true and correct at the time of publication.

NovAtel®, GPSolution®, RT-20® and RT-2® are registered trademarks of NovAtel Inc.

PAC™ is a trademark of NovAtel Inc.

All other brand names are trademarks of their respective holders.

Printed in Canada on recycled paper. Recyclable.

Table of Contents

Tables

Figures

Customer Service

OEM4 FIRMWARE UPDATES AND UPGRADES

Firmware *updates* are firmware revisions to an existing model, which improves basic functionality of the GPS receiver. During the one-year warranty coverage following initial purchase, firmware updates are supplied free of charge. After the warranty has expired, firmware updates and updated manuals may be subject to a nominal charge.

Firmware *upgrades* are firmware releases, which increase basic functionality of the receiver from one model to a higher level model type. When available, *upgrades* may be purchased at a price, which is the difference between the two model types on the current NovAtel GPS Price List plus a nominal service charge.

WINLOAD

Please see *Chapter 6, Software Programs on Page 57* for instructions on how to use the WinLoad program to upgrade/update your PDC, PIC or OEM4 card.

CONTACT INFORMATION

Firmware updates and upgrades are accomplished through NovAtel authorized dealers.

Contact your local NovAtel dealer first for more information. To locate a dealer in your area or if the problem is not resolved, contact NovAtel Inc. directly using one of the following methods:

Call the NovAtel GPS Hotline at 1-800-NOVATEL (U.S. & Canada), or 403-295-4900 (international)

Fax: 403-295-4901

E-mail: support@novatel.ca

Website: http://www.novatel.com

Write: NovAtel Inc., Customer Service Dept., 1120 - 68 Avenue NE, Calgary, AB., Canada, T2E 8S5

✉ Before contacting NovAtel Customer Service regarding software concerns, please do the following:

1. Issue a FRESET command
2. Log the following data to a file on your PC for 30 minutes

RXSTATUSB	once
RAWEPHEMB	onchanged
RANGEB	ontime 1
BESTPOSB	ontime 20
RXCONFIGA	once
VERSIONB	once

3. Send the file containing the logs to NovAtel Customer Service, using either the NovAtel ftp site at ftp://ftp.novatel.ca/incoming or the support@novatel.ca e-mail address.

Notices

Please refer to *Volume 1* of the *OEM4 Family Users' Guide* for software license and warranty information.

The following notices apply to DL-4.

FCC NOTICE

This equipment has been tested and found to comply with the radiated and conducted emission limits for a Class B digital device, for both CISPR 22 and Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Re-orient or relocate the receiving antenna
- Increase the separation between the equipment and the receiver
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

IMPORTANT: In order to maintain compliance with the limits of a Class B digital device, it is required to use properly shielded interface cables (such as Belden #9539 or equivalent) when using the serial data ports, and double-shielded cables (such as Belden #9945 or equivalent) when using the I/O strobe port.

WARNING: Changes or modifications to this equipment not expressly approved by NovAtel Inc. could result in violation of Part 15 of the FCC rules.

CE NOTICE

The enclosures carry the CE mark.

WARNING: This is a Class B product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

EMC

Common Regulatory Testing

• EN55022:	Radiated and Conducted Emissions
• CISPR 11/22	Class B
• EN 50081-1	Generic Emissions Class B
• EN 50082-1	Generic Immunity Class B
• EN 61000-4-2	Electrostatic Discharge Immunity
• EN 61000-4-3	Radiated RF EM Field Immunity Test
• EN 61000-4-4	Electrical Fast Transient/Burst Test
• EN 61000-4-6	Conducted Immunity
• EN 61000-4-8	Magnetic Field Immunity
• EN 61000-4-11	Voltage Dips and Interruptions

Compact Flash Memory Card Compatability

The DL-4 has been tested with SanDisk 4, 5, 20, 40, and 85 MB (binary-type) cards, and that while the receiver should work with Compact Flash Memory Cards from any manufacturer, minor variations between manufacturers' products may prevent a specific card from working properly. However, the card is working if it formats correctly, and is recognized correctly, when removed and reinserted. Please report any problems with Compact Flash Memory Cards to the NovAtel Customer Service Department. See *Page 11* for contact information.

CAUTION!

1. This device incorporates circuitry to absorb most static discharges. However, severe static shock may cause inaccurate operation of the unit. Use anti-static precautions where possible.
2. This device is a precision instrument. Although it is designed for rugged operating conditions, it performs best when handled with care.
3. When the access door for the Compact Flash Memory Card mass storage card (Compact Flash Card) is screwed closed, the enclosure is sealed to provide protection against adverse environmental conditions. To minimize the possibility of damage, always keep this access door closed except when exchanging Compact Flash Cards. Any attempt to remove this access door or the end-caps impairs the water-resistant qualities of the enclosure, and voids the warranty.
4. Before ejecting the Compact Flash Card, it is advisable to stop all logging to the flash card.
5. When a power interruption occurs during a data-logging session, allow for your data to be possibly reduced by several seconds up to a maximum of five minutes. When possible, error messages are generated to identify problems as they arise. See also the RXSTATUS log on *Page 171*.
6. The DL-4 can accept an input supply voltage in the range +7 to +18 V DC. This may not be the same range as other NovAtel products with which you are familiar. By default, operating the DL-4 below 6.5 V DC causes the unit to suspend operation. An input voltage above +18 V DC may physically damage the unit. The lower cutoff voltage can be adjusted using the BATTERY command on *Page 99*. A 12 V battery should not be allowed to discharge below 10.5 V.
7. Drawing more than the specified maximum current (1 amp) from COM2 will cause an internal fuse to interrupt the current. Restoring normal operation will require returning the unit to NovAtel.

Foreword

Congratulations!

Congratulations on your purchase of the DL-4, a GPS receiver with exceptional flexibility.

NovAtel is an industry leader in state-of-the-art GPS receiver design. We believe that our DL-4 will meet your high expectations, and are working hard to ensure that future products and enhancements will maintain that level of satisfaction.

This is your primary hardware and software reference.

Scope

This manual contains sufficient information on the installation and operation of the DL-4 and its software to allow you to effectively integrate and fully operate it. It is beyond the scope of this manual to provide details on service or repair. Contact your local NovAtel dealer for any customer-service related inquiries, see *Customer Service on Page 11*.

After the addition of accessories, an antenna and a power supply, the DL-4 will be ready to go.

The DL-4 incorporates an LCD display on its front panel and this manual will take you through its menus and features, see *LCD Menus on Page 39*. An LCD Menus Quick Look weatherproof guide is also provided to help you find the LCD windows you need in a hurry, using the navigation buttons on the DL-4.

The OEM4 in the DL-4 utilizes a comprehensive user-interface command structure, which requires communications through its communications (COM) ports. This manual also describes the DL-4-specific commands and logs, see *DL-4 Commands starting on Page 85* and *DL-4 Logs starting on Page 152*. Other supplementary manuals are included to aid you in using the other commands and logs available in the OEM4 family of receivers. It is recommended that these documents be kept together for easy reference.

DL4Tool, GPSolution, DL4Tool and Convert are also described, see *Software Programs* on *Page 57* and *DL4Tool starting on Page 66*. These programs provide graphical user interfaces to the DL-4 for logging, scheduling, planning, transferring data files from the Compact Flash Card to the PC, upgrading, and converting data types.

Prerequisites

The installation chapters of this document provide information concerning the installation requirements and considerations for DL-4. To run the PC software supplied, your personal computer must meet or exceed this minimum configuration:

- Windows compatible mouse or pointing device
- Pentium Microprocessor recommended
- Hard disk with 64 Mb free; extra space is required for data storage
- 16 Mb RAM memory
- VGA Display
- Microsoft Windows user interface

Although previous experience with Windows is not necessary to use the DL4Tool, familiarity with certain actions that are customary in Windows will assist in the usage of the program. This manual has been written with the expectation that you already have a basic familiarity with windows.

Chapter 1 Introduction

The DL-4 is a high performance, high accuracy, GPS receiver with fast data update rates and integrated memory (Compact Flash Card) for data logging. The DL-4's front panel also features a liquid crystal display (LCD) panel and keypad for on the fly observations.

Depending on which model you purchase, the DL-4 is capable of receiving and tracking the L1 C/A code, L1 and L2 carrier phase and L2 P-Code (or encrypted Y-Code) of up to 12 satellites. Patented Pulsed Aperture Correlator (PAC) technology combined with a powerful microprocessor make possible multipath-resistant processing and excellent acquisition and re-acquisition times.

Once you connect the DL-4 to an antenna and power supply, it begins operating as a fully functional GPS system (see *Chapter 2, Typical Setup on Page 19* and *Chapter 3, DL-4 Setup Considerations on Page 24*, for more information on this topic). *Figure 1* shows the DL-4 without an antenna or connecting cables.

Figure 1: DL-4 Receiver

1.1 Models and Features

The DL-4 is available in several different firmware models whose configurations may include other additional features. Some possible configurations can be seen in *Table 1*.

Table 1: DL-4 Controller Models

Model Name	Firmware Feature
DL-4-L1 [a]	L1-only
DL-4-L1L2 [a]	L1/L2
DL-4-RT20	L1 plus RT-20
DL-4-RT2	L1/L2 plus RT-2

a Also available with the SBAS option. Refer also to the *SBAS Overview* appendix in *Volume 1* of the *OEM4 Family Users' Guide*.

Table 2 lists the above models, each capable of multiple positioning modes of operation:

Table 2: GPS Positioning Modes of Operation

Modes of Operation [a]	DL-4 Model			
	L1	RT20	L2	RT2
Single point	✓	✓	✓	✓
Pseudorange differential corrections	✓	✓	✓	✓
RT20 pseudorange and carrier-phase double differencing	✗	✓	✗	✓
RT2 pseudorange and carrier-phase double differencing:	✗	✗	✗	✓
Post-processed RTK-type accuracy	✓	✓	✓	✓

a. For a discussion on GPS positioning, please refer to *Volume 1* of the *OEM4 Family Users' Guide.*

Each model has the following standard features:

- Rugged shock, water, and dust-resistant enclosure
- NovAtel's advanced OEM4 L1/L2 GPS technology
- Capability to log data to a removable Compact Flash Card (mass storage card).
- Capability to perform data collection
- LCD panel and keypad for on the fly data information
- Two bi-directional COM ports which support data transfer rates of up to 115,200 bit/second
- Field-upgradeable firmware (program software). What makes one model different from another is software, not hardware. This unique feature means that the firmware can be updated anytime, anywhere, without any mechanical procedures whatsoever. For example, a model with L1/L2-only capabilities can be upgraded to a model with L1/L2 RT-2 in only a few minutes in your office (instead of the days or weeks that would be required if the receiver had to be sent to a service depot). All that is required to unlock the additional features is a special authorization code. Please see *Chapter 6, Software Programs on Page 57* for details on the *WinLoad* utility used for updates and upgrades.

1.2 OPERATING MODES

Whenever the DL-4 is connected to a power source (regardless of whether the DL-4 is turned “on” or “off”), it detects whether there is a host computer connected to one of its serial ports. For example, this host computer could be a PC running NovAtel DL4Tool, or a data logger running suitable software. If a host computer is found, the DL-4 enters Manual mode and waits for a command; otherwise, the DL-4 enters Automatic mode and operates according to stored commands.

- *Manual Operation:* Among other things, a host computer can transmit scheduling and logging parameters, receive collected data, and turn the DL-4 on or off. In this mode, the DL-4 does not need to be tracking satellites, or even have an antenna connected to it.

- *Automatic Operation:* Once the DL-4 receives configuration commands from a host computer, it operates according to these parameters. Up to a week’s worth of data collection can be configured in advance.

1.3 ACCESSORIES AND OPTIONS

The DL-4 can be used with the following accessories:

- NovAtel *DL4Tool* and *GPSolution 4* – a suite of programs that allows you to plan your data collection trip, configure your DL-4 and archive your information sets
- Compact Flash Card for data storage
- Optional NovAtel GPSAntenna Model 601 – single frequency, active antenna designed for high-accuracy applications without the need for a choke ring
- An optional choke ring is available for the 501 antenna (model A031)
- Optional NovAtel GPSAntenna Model 600 - dual frequency, active antennas designed for high-accuracy applications without the need for a choke ring
- Optional NovAtel Model C006, C016, or C031 coaxial antenna cable in 5 m (16.4’), 15 m (49.2’), or 30 m (98.4') lengths
- Power cable (with automotive adapter) to connect the DL-4 to a power source or battery
- User-supplied power source or battery
- Bracket to allow the DL-4 to be mounted to a surface
- Y-type null modem serial cable for compatibility with certain data communications devices

Should you need to order an accessory or a replacement part, NovAtel part numbers are shown in *Appendix B on Page 184*. Not all of the above accessories are available from NovAtel.

Chapter 2 Typical Setup

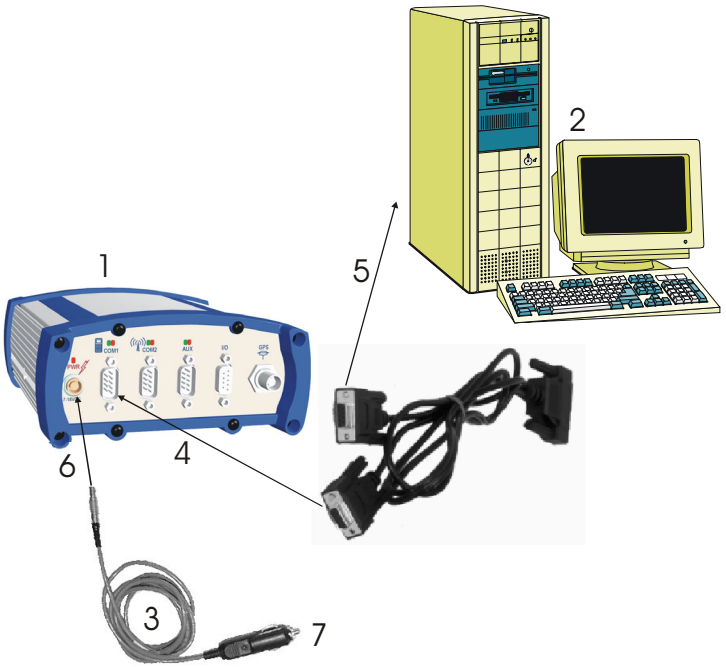
Setting up the DL-4 is a straightforward process, whether you are in the field (collecting data) or back at the office (configuring the DL-4, or transferring collected data to your PC for post-processing).

CAUTION!: See the cautions on *Page 13* of the *Notices* for a list of items you should be aware of as you set up and use the DL-4.

2.1 Set Up DL-4 at the Office

Figure 2 displays how you might typically set up the DL-4 at the office - for example, to load a schedule, or to transfer collected data to a PC. In this situation, the PC is connected to the COM1 port, and energy is supplied by means of a 12 V power supply.

Figure 2: Typical DL-4 Setup - Office



Reference	Description	Reference	Description
1	DL-4 with Compact Flash Card	5	Connect modem serial cable to PC COM port
2	Powered PC	6	Connect to PWR port
3	Power cable	7	Connect to 12 V power supply
4	Connect Y-type null modem serial cable to DL-4		

For office work, a typical configuration would result from the following steps:

1. Place the DL-4 on a desk or other suitable work surface.
2. Connect an RS232 communication terminal (e.g. PC, data logger) to one of the serial ports of the DL-4. The supplied null-modem cables are intended for RS232 communications only. See *Serial Ports & Cables on Page 25*.
3. Connect the output of a power source (e.g. AC/DC converter) to the input power port of the DL-4. See *Serial Ports & Cables on Page 25*.
4. Press the power button or, if you are connected to the DL-4 via a terminal, hit the <Enter> key and wait for an RXSTATUSA log with a BOOTOK message to appear, see *Page 171*. If you are you are using the *DL4Tool* to communicate with the DL-4, this initial communication is handled by the software.
5. Communicate with the DL-4, transfer data to the PC, *see DL4Tool on Page 66*, (if you have inserted a Compact Flash Card containing previously recorded data), or set up a data-collection schedule.
6. If you are using your DL-4 as a base or rover station to receive and transmit differential corrections, you will need to provide a data link between the base station and rover station (two NovAtel GPSCard receivers). Generally a data link capable of data throughput at a rate of 2400 bits per second or higher is sufficient for the examples shown below. Pre-configure the DL-4 as a base station as follows:

   ```
   interfacemode port rx_type tx_type
   fix position latitude longitude height
   log port message [trigger [period]]
   ```

   For example:

   RTCA
   ```
   interfacemode com2 none rtca
   fix position 51.11358042 -114.04358013 1059.4105
   log com2 rtcaobs ontime 2
   log com2 rtcaref ontime 10
   log com2 rtca1 ontime 10 3
   log com2 rtcaephem ontime 10 7
   ```

   RTCM
   ```
   interfacemode com2 none rtcm
   fix position 51.11358042 -114.04358013 1059.4105
   log com2 rtcm3 ontime 10
   log com2 rtcm22 ontime 10
   log com2 rtcm1819 ontime 2
   log com2 rtcm1 ontime 10 5
   ```

   CMR
   ```
   interfacemode com2 none cmr
   fix position 51.11358042 -114.04358013 1059.4105
   log com2 cmrobs ontime 2
   log com2 cmrref ontime 10
   log com2 cmrdesc ontime 10 5
   ```

✉ Remember, you can use your DL4Tool software to create a new group for your chosen configuration, see *Chapter 7, DL4Tool on Page 66*. Alternatively, you could also use the GROUP command to set up a group of commands and logs as detailed on *Page 105*.

Pre-configure the DL-4 as a rover station as follows:

```
interfacemode port rx_type tx_type
```

For example:

RTCA `interfacemode com2 rtca none`
RTCM `interfacemode com2 rtcm none`
CMR `interfacemode com2 cmr none`

For compatibility with other GPS receivers, and to minimize message size, it is recommended that you use the standard form of RTCA, RTCM or CMR corrections as shown in the examples above. This requires using the INTERFACEMODE command, please refer to *Volume 2* of the *OEM4 Family Users' Guide*, to dedicate one direction of a serial port to only that message type. Once the INTERFACEMODE command is used to change the mode from the default, NOVATEL, you can no longer use NovAtel format messages.

If you wish to mix NovAtel format messages and RTCA, RTCM or CMR messages on the same port, you can leave the INTERFACEMODE set to NOVATEL and log out variants of the standard messages with a NovAtel header. ASCII or binary variants can be requested by simply appending an "A" or "B" to the standard message name. For example on the base station:

```
interfacemode com2 novatel novatel
fix position 51.11358042 -114.04358013 1059.4105
log com2 rtcm1b ontime 2
```

At the rover station you can leave the INTERFACEMODE default settings (interfacemode com2 novatel novatel). The rover will recognize the default and use the corrections it receives with a NovAtel header.

At the base station it is also possible to log out the contents of the standard corrections in a form that is easier to read or process. These larger variants have the correction fields broken out into standard types within the log, rather than compressed into bit fields. This can be useful if you wish to modify the format of the corrections for a non-standard application, or if you wish to look at the corrections for system debugging purposes. These variants have "DATA" as part of their names (e.g. RTCADATA1, RTCMDATA1, CMRDATAOBS, and more). Refer to *Volume 2* of the *OEM4 Family Users' Guide* for details

The sections of *Chapter 3, DL-4 Setup Considerations starting on Page 24* give further details on Steps #2, #3 & #4, while *Chapter 4, Using DL-4 starting on Page 32* is devoted to Step #5.

Please refer to *Volume 1* of the *OEM4 Family Users' Guide* for more information on differential operation and message formats.

2.2 Set Up DL-4 as a Rover

Figure 3 displays how you might typically use the DL-4 in the field - for example, collecting data without the aid of base station corrections. In this situation, the GPS antenna is connected to the GPS port, and the power adapter is plugged into a 12 V power supply.

Figure 3: Typical DL-4 Setup - Field

Reference	Description
1	DL-4 with Compact Flash Card pre-installed
2	User-supplied antenna (GPS-600 shown)
3	User-supplied RF cable
4	Power cable
5	Connect, screw on and tighten antenna cable's RF connector to antenna
6	Connect, screw on and tighten other RF connector to GPS (antenna) port
7	Plug LEMO connection of power cable into the PWR port
8	Connect the power cable (with automotive adapter) into a 12V power supply

To collect data simply for post-processing, skip step #6.

For differential data collection in the field, a typical configuration is described below. This assumes that schedule and logging parameters have already been loaded to the DL-4 (see *Chapter 4, Using DL-4 starting on Page 32*), and that a portable terminal is not being used. If a portable terminal was being used, then at Step #7, when power was supplied, the DL-4 would accept configuration commands from the terminal.

1. Mount or place the DL-4 on a secure, stable structure that will not sway or topple. Although the unit has a moisture and dust-resistant enclosure, shelter it from adverse environmental conditions when possible.

2. Position the antenna over the desired location. The recommended antenna depends on which model of DL-4 you purchased (see *Choose the Right Antenna on Page 24*). For maximum positioning precision and accuracy, as well as to minimize the risk of damage, ensure that the antenna is securely mounted on a stable structure that will not sway or topple. Where possible, select a location with a clear view of the sky to the horizon so that each satellite above the horizon can be tracked without obstruction. The location should also be one that minimizes the effect of multipath interference. For a discussion on multipath, please refer to the *Multipath* appendix in *Volume 1* of the *OEM4 Family Users' Guide*.

3. Route and connect RF coaxial cable between the antenna and DL-4 (see *RF Port & Cables on Page 26*).

4. Connect an RS232 communication device to COM2 of the DL-4 (see *Serial Ports & Cables on Page 25*). For example, this might be a radio modem, for receiving differential GPS messages from a base station. The supplied null-modem cable is intended for RS232 communications only. See *Section 2.1, Set Up DL-4 at the Office on Page 21* for details on how to pre-configure the DL-4 as a rover.

5. Insert a Compact Flash Card into the DL-4 (see *Using the Removable Compact Flash Memory Card on Page 28*).

6. Connect the output of a power source (e.g. battery) to the input power port of the DL-4 (see *Power Port and Cable on Page 27*).

   The receiver provides battery power output (POUT) through the AUX port. It is possible to turn the supply On or Off using the VOUT command, see *Page 146*. The POUT output is the switched output of the input power supply so that 12V output requires 12V input.

7. Exit low power mode by pressing the power button, or if connected via a terminal, by hitting the <Enter> key. If you are going to configure the unit via DL-4 commands, wait for a RXSTATUSA log with a BOOTOK message to appear first. Otherwise, the DL-4 will begin logging based on the POWERUP configuration, if it exists.

8. Monitor the status indicators on the LCD display, see *Section 5.3.1, Status on Page 44*.

The chapters of this manual give further details on these steps.

Chapter 3 DL-4 Setup Considerations

3.1 Choose the Right Antenna

The recommended antenna depends on which model of the DL-4 you purchased. *Table 3* lists the allowable antenna types for each of the DL-4 models.

Table 3: Allowable Antenna Types

DL-4 Model	Allowable Antenna
DL-4-L1	L1-only or L1/L2
DL-4-RT20	L1-only or L1/L2
DL-4-L1L2	L1/L2
DL-4-RT2	L1/L2

The **GPS-600** series antennas are ideal for all applications. A Model 600 GPSAntenna provides comparable performance to a choke ring ground plane antenna while being much lighter and smaller.

Please see the GPS Antenna sections of the *Functional Overview,* and *Receiver Installation* chapters in *Volume 1* of the *OEM4 Family Users' Guide* for more information on NovAtel antennas and antenna considerations.

While there may be other antennas on the market that might also serve the purpose, please note that the performance specifications of the DL-4 are guaranteed only when it is used with a NovAtel GPSAntenna.

3.2 Connect Cables

As shown in *Figure 4,* on the back end-cap there are six labeled ports - PWR, COM1, COM2, AUX, I/O, and GPS.

Figure 4: Close-up of Ports on Back End-Cap

Each connector is keyed to ensure that the cable can be inserted in only one way, to prevent damage to both the DL-4 and the cables. Furthermore, the connectors that are used to mate the cables to the DL-4 require careful insertion and removal. Observe the following when handling the cables.

- To insert a cable, make certain you are using the appropriate cable for the port - the serial cable has a different connector (DE9S) than the I/O cable (DE9P), or the power cable (LEMO).

For the LEMO connector:

- Line up the red dot on the connector shell with the red index mark on the receptacle on the DL-4.
- Insert the connector until it seats with a click; it is now locked in place.
- To remove a cable, grasp the connector by the knurled ring and pull

WARNING: DO NOT PULL DIRECTLY ON THE CABLES.

3.2.1 I/O Port

DL-4 incorporates an input/output (I/O) port, which allows access to a mark input, VARF output, 1PPS output, and valid position output signal. These are specialized signals that are used when the DL-4 is part of an interconnected system composed of user devices that need to be synchronized with each other. For example, you could connect the DL-4 to an aerial camera in such a way that the DL-4 recorded its position whenever the shutter button was pressed. This port is not typically used for stand-alone applications. Refer to your user device's documentation for information on its connectors and cables.

The I/O strobe lines can be accessed by inserting the serial connector of a user-supplied I/O strobe port cable into the I/O port.

This port incorporates filters to suppress electromagnetic interference.

3.2.2 Serial Ports & Cables

The two serial ports (COM1 and COM2) are bi-directional. There are two color indicators above each of these serial ports. If the red one glows, data is being received on that port, while if the green one glows, data is being transmitted on that port. If they are both glowing, data is being received and transmitted simultaneously on that port.

These two serial ports are also factory configurable for RS232 or LVTTL operation, see *Section A.3, Port Pin-Outs on Page 179*.

For communication to occur, the DL-4 serial port configuration must match that of the external device's. The DL-4's default port settings are [RS232C, 9600 BPS, no parity, 8 data bits, 1 stop bit, no handshaking, and echo off]. Changing the default settings can be easily accomplished using DL4Tool, see *Chapter 7, DL4Tool on Page 66*, or by means of the COM command (which is described in *Volume 2* of the *OEM4 Family Users' Guide*).

The AUX serial port only accepts data input for the Compact Flash memory card. Peripheral power

output is also available on this port, see *Section 3.2.3* following.

On either the COM1 or COM2 serial port, only the RX, TX, and GND lines need to be used. Handshaking is not required, although it can optionally be used.

Cables are supplied to connect the receiver to a PC or modem. For further information on the signals, or connector pin-outs, for the serial ports or cables, please see *Appendix A starting on Page 179*.

See *Appendix B, Replacement Parts starting on Page 184*, if you need to consult a list of NovAtel part numbers.

3.2.3 Peripheral Power Supply Via the AUX Port

The receiver provides battery power output (POUT) through the AUX port. It is possible to turn the supply On or Off using the VOUT command, see *Page 146*. The POUT output is the switched output of the input power supply so that 12V output requires 12V input. See also *Appendix A, Peripheral Power Output on Page 178*.

✉ When using peripheral output, it is important to note that the POUT output has a 1-amp fuse. This fuse is non-user replaceable, and if you blow the fuse by trying to draw power greater than 1-amp, you will have to return the receiver to the factory for repair.

3.2.3.1 Power Control Operation

After initial connection of the power supply to the receiver, the POUT output is turned on.

When the power button is used to turn the receiver Off, the POUT output is turned on before going to sleep. This ensures that power is available to a potential host system for turning the receiver On again by starting communication with the receiver.

If the power input to the receiver falls below the minimum operating level (both batteries, in the case of a dual battery system), the POUT output is turned Off before the receiver goes to sleep. In this case, both COM activity or the power button will wake the receiver up and POUT remains Off. If the battery input from at least one battery recovers then POUT is turned On again and the unit wakes up as a result of COM activity or by pressing the power button.

3.2.4 RF Port & Cables

The radio frequency (RF) port is bi-directional in that it accepts RF signals from the antenna, and it supplies DC power to the low-noise amplifier (LNA) of an active antenna. It has a TNC female connector.

For further information on the signals or connector type for the RF port, please see *Appendix A, Input/ Output Connectors on Page 178*.

Please refer to the *Functional Overview* and *Receiver Installation* chapters in *Volume 1* of the *OEM4 Family Users' Guide* for more information on RF and antenna cable considerations.

While there may be other coaxial cables on the market that might also serve the purpose, please note that the performance specifications of the DL-4 are guaranteed only when it is used with NovAtel-supplied RF cables.

3.2.5 Power Port and Cable

The DL-4 requires an input supply voltage that can come from batteries, a wall outlet adapter (AC/DC converter), or an automotive power source. The DL-4 has an internal power module that does the following:

- filters and regulates the supply voltage
- protects against over-voltage, over-current, and high-temperature conditions
- provides automatic reset circuit protection

WARNING:

1. By default, supplying the DL-4 with an input voltage that is below +6.5 will cause the unit to suspend operation. An input voltage above +18 V DC may physically damage the unit. The lower cutoff voltage can be adjusted using the BATTERY command on *Page 99*.
2. A standard 12 V battery should not be discharged below 10.5 V. Use the BATTERY command on *Page 99* to set the cutoff voltage to 10.5 V.

The 4-pin power connector, with an appropriate cable, allows power to be supplied from two independent sources, although only one is used at a time. If two power sources are available, the DL-4 monitors their supply voltages independently, and on power-up, chooses the one with the higher voltage. If the current power source becomes unusable, the DL-4 then switches to the second one (if available) without any interruption in its logging activities.

Consider the case where the DL-4 is connected to two 12 V DC batteries. As described in the *Status* section of the *LCD Menus* chapter on *Page 44*, when the voltage drops on the first battery, the BATTERY status will change. Warning messages are sent on the serial port indicating that battery power is becoming exhausted. See the RXSTATUS and RXSTATUSEVENT logs on *Pages 171 and 173* respectively, if you require further information. Then, the DL-4 switches to the second battery. Once both batteries are depleted, the DL-4 shuts itself off. To maximize a battery's lifetime, the DL-4 does not use it once it is discharged.

As is also described in the *Status* section of the *LCD Menus* chapter on *Page 44*, the battery voltage screen provides the voltage of up to two connected batteries, or the voltage level of a connected DC supply.

The data logging mechanism is designed to be robust and to endure power interruptions (and similar disruptive events) with minimum loss of data. In this situation, or when ejecting the Compact Flash Card during a data-recording session, allow for your data to be possibly reduced by several seconds up to a maximum of five minutes. To the extent possible, error messages attempt to describe the problem. If you require further information on this topic, please see the description of the RXSTATUS log on *Page 171*.

There may be up to four power cables used with the DL-4. These cables allow you to energize the DL-4 by either an AC source or a DC source:

- 4-pin LEMO plug connector to automotive adapter plug, complete with a 3-amp slow-blow fuse, see *Page 180*
- optional 4-pin LEMO plug connector to autoranging AC/DC converter/battery charger, and AC power cord
- optional power cable connecting the DL-4 to a battery (33.5 cm or 75 cm lengths)
- optional Y-cable to power the DL-4 from two batteries

For further information on the following topics, see the following sections of this manual:

- For a listing of the required input supply voltages, and the typical power consumption in logging and "sleep" modes, see *Appendix A, Input/Output Connectors on Page 178*.
- For pin-out information on the 4-pin power connector, see *A.3, Port Pin-Outs on Page 179*.
- For operation with two batteries, see *Appendix A, Power Management on Page 178*.
- See *Appendix B, Replacement Parts starting on Page 184*, if you need to consult the list of NovAtel part numbers.

3.2.5.1 Using a Non-NovAtel Power Cable

If you decide to use a power cable that was not supplied by NovAtel, or make your own, there are a few things that you should keep in mind. There will always be a drop in voltage between the power source and the power port that is due to cable loss. Improper selection of wire gauge can lead to an unacceptable voltage drop at the DL-4. A paired wire run represents a feed and return line; therefore, a 2-m wire pair represents a total wire path of 4 m (13.1'). For a DL-4 operating from a 12 V DC battery system, a power cable longer than 2.1 m (7‘) should not use a wire diameter smaller than that of 24 AWG.

3.3 Using the Removable Compact Flash Memory Card

Data commands and logs can be input through the AUX port of the DL-4 to a Compact Flash Card, a flash-memory module which you can access, exchange and replace when needed. The need for a companion handheld data logger is avoided when continuous user interaction is not required, since DL-4 is capable of logging data according to pre-configured parameters without any user intervention. In applications when continuous user interaction is required, a simple handheld controller can be used with DL-4, as the controller does not require its own data logging memory. The reduced handheld data logger or controller requirements simplify your system and reduce its total cost and power consumption.

WARNING: To minimize the possibility of damage, always keep this cover closed and latched except when exchanging Compact Flash Cards.

Collected data can either be transmitted to a host computer over a serial port, or stored on the Compact Flash Card. If you choose to log data to the Compact Flash Card, each logging session is stored in a single, unique file. These files can then be transferred to a host computer, for data analysis or other types of post-processing, by one of two methods:

- transfer the data by means of serial communications, see *DL4Tool* on *Page 66*
- physically remove the Compact Flash Card from the DL-4 and insert it into the host computer, provided that it is also suitably equipped with a Compact Flash Card port

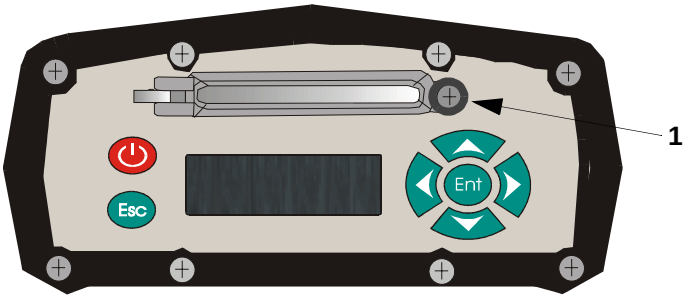
Refer to the DL-4 commands and logs detailed in *Chapter 8* and *Chapter 9* of this manual.

You have the flexibility of choosing the Compact Flash Card with the storage capacity that is the most appropriate for your needs, based on the selected logging rate. This is discussed in greater detail in *Chapter 4, Using DL-4 on Page 32*.

From *Figure 5*, you can see that the Compact Flash Card access door is closed with a captive screw (reference #1). As long as the captive screw is fully tightened in the clock wise direction, it provides a water and dust-resistant seal around the Compact Flash Card.

To open the Compact Flash Card access door, rotate the captive screw counter-clockwise, until it springs upward, to release the door. If the captive screw resists turning, do not force it; rather, turn the screw counter-clockwise one turn and then try again.

Figure 5: Opening the Compact Flash Card Door



To remove the Compact Flash Card unlock the access door. When the door is open you will see an eject button to the left of the card. You must push this button to partially eject the card; then grasp the card and pull it all the way out.

✉ It is recommended that you disable all logging to the Compact Flash Card before ejecting it.

To insert the card, ensure that it is correctly aligned before gently sliding it into the slot. When the card slides all the way in and locks in place, the eject button will extend. If you attempt to insert the card incorrectly, it will not go all the way in, and the eject button will not extend. In this case, do not force

the card! Remove it, orient it properly, and then insert it. After the card is locked in place, close the cover.

The data logging mechanism is designed to be robust and to endure power interruptions (and similar disruptive events) with minimum loss of data. In this situation, allow for your data to be possibly reduced by several seconds up to a maximum of five minutes. When possible, error messages are generated to identify problems as they arise; a description of the RXSTATUS log, see *Page 171*.

✉ It is not necessary to turn the DL-4 off before inserting or extracting a Compact Flash Card.

✉ Sandisk claim to have built-in, industry-standard compatibility in their 50-pin Compact Flash card because it can be easily slipped into a passive 68 pin Type II adapter card that fully meets PCMCIA electrical and mechanical interface specifications. Only Sandisk cards have been tested at NovAtel, see *Page 13*, but you may try other manufactures that meet the Compact Flash industrial standard. Please see also *Section 4.3.3, Data Storage Requirements* to help you determine the size of card (in Mb) that your application requires.

3.4 Front End-Cap Functionality

As shown in *Figure 6*, the DL-4's front end-cap has an LCD display with a keypad including an Ent and Esc button, see *Chapter 5, LCD Menus on Page 39*, and a power button, see *Sleep, Power Down and the Power Button* following.

Figure 6: DL-4 Front End-Cap

3.5 Sleep, Power Down and the Power Button

DL-4 incorporates a power button on its front end-cap, see *Figure 6, DL-4 Front End-Cap*. Pushing this switch sends a signal to the microprocessor to turn on or off the GPS receiver and system peripherals.

The DL-4 has two low-power modes: sleep mode and power-down mode. The modes do not differ in the amount of power consumed, but rather in the way in which the modes are entered into and terminated.

An internal clock, synchronized to GPS time, allows the DL-4 to go into “sleep mode” between scheduled data-collection sessions. This permits the DL-4 to operate reliably while using power sparingly. This is especially important when conducting scheduled data-collection sessions over a period of several days, while using a battery power source. The DL-4's GPS receiver will “wake” up early enough so that satellite tracking is established prior to the scheduled logging session. Note, however, that exceptional conditions may delay the acquisition of satellites beyond the start of the logging session. For more information on the clock, please see *Appendix A, Real-Time Clock on Page 178*.

Table 4: Power Modes

Mode	How to achieve mode	Outcome
Sleep	1. Once the DL-4 is powered on, it will go into sleep mode, if enabled, by itself between scheduled events, if a command is not received through either serial port for 5 minutes or a SLEEP command is issued, unless a scheduled event is about to take place. 2. When downloading files from the DL4Tool software, the unit goes into sleep mode, if enabled.	The DL-4 scheduler is still enabled and the DL-4 will wake up from sleep mode prior to a scheduled event.
Power-Down	To enter the low-power mode, press the button for at least three but no more than seven seconds, then release it. This is also the mode entered into after applying the power.	In the power down mode, all logging events are disabled. Note that while power consumption in power-down mode is minimal, the DL-4 is not completely off. If power conservation is very important, then disconnect the power source from the DL-4 when it is not in use.

In either the sleep mode or power-down mode, pressing the power button momentarily will “wake” up the DL-4. Also, the DL-4 monitors its serial ports, and becomes fully operational a short while after as serial port activity is detected - for example, if a key is pressed on a handheld data logger that is plugged into one of the DL-4's serial ports. The time required to wake up is only a few seconds, but it may require an additional few minutes to initialize the GPS receiver and allow it to establish an initial time and position. During the sleeping and wake-up time, the serial ports will not process data. You must wait until receiving the RXSTATUSA log with a BOOTOK message (see the RXSTATUS log on *Page 171*) before typing any commands.

The automatic power-down feature is disabled when logging is in progress. However, if the power button is pressed while the DL-4 is logging data autonomously, the DL-4 saves any open data files and then goes into power-down mode.

An additional function of the power button is that it resets the DL-4 if it is held depressed for at least 10 seconds. This 'system reset' clears stored logging parameters and reverts to a factory configuration when the power button is released.

Chapter 4 Using DL-4

Before using DL-4 for the first time, ensure that you have followed the installation instructions of *Chapter 2, Typical Setup* and *Chapter 3, DL-4 Setup Considerations, starting on Page 19*.

CAUTION!: See the cautions on *Page 13* of the *Notice* for a list of items you should be aware of as you set up and use the DL-4.

4.1 System Behavior

4.1.1 Self-Test

When the DL-4 is powered on by depressing the power button, a set of self-test functions are performed. Self-test failure of the power data card is indicated via the LCD panel status menu indicators and/or RXSTATUSA logs, see *Page 171*. Successful self-test of the power data card is indicated by a RXSTATUSA log with a BOOTOK message. Self-test status of the OEM4 GPSCard can then be examined via the self-status word in the RANGE and RXSTATUS data logs, refer to *Volume 2* of the *OEM4 Family Users' Guide*.

If the DL-4 fails its self-test, please refer the problem to your dealer or NovAtel Customer Service.

4.1.2 Default Schedule and Group Configuration

The default software configuration for the scheduling and group information includes only a group named "DEFAULT". The factory reset screen, see *Section 5.3.7, Commands on Page 53*, allows you to reset the DL-4 to its factory default settings.

4.1.3 Automatic Logging Upon Power Up

Upon acquisition of coarse time, if a group named "POWERUP" exists, the DL-4 will disable the scheduler and execute the group. If a POWERUP group does not exist, any manual logging will be stopped and the scheduler will be enabled. As mentioned previously, by default only a grouped name DEFAULT exists. A POWERUP group must be created manually to take advantage of this functionality.

4.1.4 Site Records in Scheduled Logging Operations

SITEDEF logs, see *Page 174*, contain site record information.

4.1.5 Monitoring Your System

After the initialization, you may find the following logs useful for observing the DL-4 activities. While using the DL4Tool software, see *Page 66*, is the easiest way to set up these logs, you can also use DOS or a Windows-based communications program (refer to the *Operations* chapter in *Volume 1*

of the *OEM4 Family Users' Guid*e). In the latter case, see *Chapter 9, DL-4 Logs on Page 152*, or refer to *Volume 2* of the *OEM4 Family Users' Guide*, for procedures and explanations related to data logging, and for further information on each of these logs.

- PSRDOP - reports the dilution of precision of the current satellite constellation
- TRACKSTAT - reports the GPS receiver's channel tracking status
- RXSTATUSEVENT - reports changes in the DL-4's status. For example, the DL-4 monitors the internal temperature of the receiver enclosure. A warning message is issued once per minute when the internal temperature is in excess of a preset threshold. If the internal temperature exceeds the design limit, the DL-4 shuts itself off and stays off until the internal temperature drops 10 degrees below the design limit.
- BESTPOS - reports the current computed position solutions
- RXCONFIG - lists the default command settings. After the DL-4 has been operational for a while, the RXCONFIG log is useful for indicating the status of all current command settings. Displaying the RXCONFIG log after a reset displays the saved configuration; refer to the description of SAVECONFIG in *Volume 2* of the *OEM4 Family Users' Guide.*
- RXSTATUS - reports the GPS receiver's status
- SATVIS - reports satellite-specific data

4.2 Communications with the DL-4

Communication with the DL-4 consists of issuing commands through the COM1 or COM2, serial ports from an external serial communications device. This could be either a terminal or an IBM-compatible PC that is directly connected to a DL-4 serial port using a null-modem cable.

For maximum ease, use a graphical interface program such as the accompanying DL4Tool, or GPSolution 4, to configure and communicate with your DL-4. However, you can also issue commands manually; refer to the *Operations* chapter in *Volume 1*of the *OEM4 Family Users' Guide.* For specific information about any of the DL-4's commands and logs, please see *Chapter 8, DL-4 Commands on Page 85* and *Chapter 9, DL-4 Logs on Page 152*.

4.3 Data Logging

The most basic activity is logging raw data. Each logging session (one uninterrupted period of time) is stored in a single, unique file on a Compact Flash Card. This file can subsequently be transferred to a PC for post-processing using the supplied DL4Tool software.

DL-4 records raw data in the form of logs, which are written to the data file on a periodic basis. If you wanted to analyze the data in these logs yourself, the details of the logs are documented in *Chapter 9, DL-4 Logs on Page 152*.

The best way to configure the DL-4 for data logging, or to manipulate log files (e.g. transfer or manage files), is using the *DL4Tool* software. This software, running on a PC, offers a user-friendly interface to your DL-4, and allows you to carry out typical activities without having to learn to use the OEM4's native-language commands and logs.

A file header is included with each logged data file. This header is designed to expedite post-processing when using a post-processor package. The data file's header consists of a GROUPDEFA log, see *Page 166*, and a FILEHDRA log, see *Page 164*, which includes the following:

- antenna height
- antenna serial number
- receiver serial numbers
- model numbers
- elevation cutoff
- minimum number of satellites
- start and end time
- log types and rates

Site record logs support kinematic surveying. The site record log (SITEDEFA, see *Page 174*) records this information at each occupation:

- site number, site name, attribute code
- antenna height
- antenna height measurement method code
- site start GPS time
- site end GPS time
- data logging flag

The meteorological log (METDEFA, see *Page 170*) records this information at each occupation:

- GPS time
- data flag
- temperature
- humidity
- pressure
- file offset to previous METDEF log

4.3.1 Schedule Logging Operation

Logging can be either immediate or delayed according to a pre-configured schedule which allows both daily events (for example, every day from 15:00 to 17:00) and weekly events (for example, Wednesdays from 10:00 to 11:00, and Fridays from 17:00 to 18:00). If a session is predefined or a manual session is started, a new file opens and the initial file closes.

You can schedule data logging on up to seven days in a one-week period, with up to 36 sessions per day. The scheduler operates perpetually; i.e. if an event is scheduled to occur on a Monday, this event is serviced every Monday that the system is in operation. Start and stop times must be provided with a resolution of 1 minute. The minimum time interval per logging session is 5 minutes. If you do not provide file names in advance, a unique file name is automatically generated for each set of recorded logs. Only one schedule can be active at any time. If there is sufficient time between sessions, the DL-4 will go into “sleep” mode to conserve power.

You may not specify overlapping time intervals. All scheduled entries rely on day of the week and UTC time references.

4.3.2 File Naming Conventions

You can either provide a name for each data file in advance, or allow DL-4 to generate them automatically.

You can only provide a file name when you are scheduling a single data collection event. If you are scheduling a series of events, you have to accept the DL-4's auto-generated names. An acceptable file name consists of a base of up to eight characters, followed by a .PDC extension. The first character of the name that you specify cannot be numeric; this prevents conflicts with auto-generated names, which always start with a number.

Auto-generated filenames consist of an eight-character base followed by a .PDC extension. The eight characters are derived as shown in *Table 5* on the following page:

Table 5: Auto-Generated File Name Convention

####$$$%.PDC	Comments
####	last 4 digits of the DL-4's serial number
$$$	UTC day of the year (001 - 366)
%	Session ID assigned in sequence (0 .. 9, A .. Z) based on the presence of files previously logged on a particular day.

For example, a DL-4 might have a serial number such as CGN95450087. A date such as January 25 has an UTC day-of-year representation of 025. The 15th schedule of the day would have an entry index of E. Thus, this file would have a name such as 0087025E.PDC.

Should a conflict occur between an auto-generated file name or a file name specified in a scheduled entry, the DL-4 will resolve the conflict by creating a file name whose first character is a tilde ("~"), followed by a 7-digit random number, and a .PDC extension (e.g. ~9368412.PDC).

4.3.3 Data Storage Requirements

Based on default settings (using RANGECMPB logs for observations, and BESTPOSB logs for positions), *Table 6* displays the amount of data storage required for a single data record for scenarios of 6, 8, or 10 satellites in view.

Table 6: Storage Requirements per Data Record

	L1-only		L1 & L2	
	Single-point Observations (Bytes)	Single-point or Differential Observations & Positions (Bytes)	Single-point Observations (Bytes)	Single-point or Differential Observations & Positions (Bytes)
6 SV	424	536	527	605
8 SV	451	560	536	647
10 SV	583	694	633	745

The number in a specific cell in this table represents the memory consumption (in bytes) per recorded GPS point, for a given number of visible satellites and a given recording mode. The following relationship, based on *Table 6*, yields an estimate of the data storage requirements for a data-recording session:

- Minimum file size (in bytes) ≈ (bytes per record) x (records per hour) x (number of hours)

This is an approximation - the actual file size will be a few kilobytes larger, due to file headers and other information (e.g. satellite ephemeris and almanac data). Also, feature tagging increases the file size by an amount that depends on the number of features tagged, and the number of attributes for each feature.

Example from *Table 6*:

You wish to record single-point observations, once every 2 seconds, for 8 hours, with 8 satellites visible, during L1/L2 operation. The file size will be no less than (536 bytes/record) x (1800 records/hour) x (8 hours) = 7 718 400 bytes = 7537.5 kBytes ≈ 7.36 MBytes. At this rate, an 8 MByte Compact Flash Card could hold approximately 8 hours of data.

Based on the values in *Table 6*, one can calculate how much data is generated in one hour if the RANGECMPB and BESTPOSB logs are collected every two seconds. This is the typical data-logging rate for real-time kinematic (RTK) survey applications. The cells of *Table 7* reflect the memory consumption, in kilobytes per hour, for scenarios of 6, 8, or 10 satellites in view.

Table 7: Memory Consumption - Typical Case for RTK Survey (2 Second Rate)

	L1-only		L1 & L2	
	Single-point Observations (kBytes/hour)	Single-point or Differential Observations & Positions (kBytes/hour)	Single-point Observations (kBytes/hour)	Single-point or Differential Observations & Positions (kBytes/hour)
6 SV	745	1884	926	2127
8 SV	793	1969	942	2275
10 SV	1025	2440	1113	2619

The following relationship, based on *Table 7*, yields an estimate of the data storage requirements for a typical RTK data-recording session:

- Minimum file size (in kilobytes) ≈ (kilobytes per hour) x (number of hours)

Example from *Table 7*:

You wish to record single-point observations, once every 2 seconds, for 8 hours, with 8 satellites visible, during L1/L2 operation. The file size will be no less than (942 kBytes/hour) x (8 hours) = 7536 kBytes = 7.36 MBytes. At this rate, an 8 MByte Compact Flash Card could hold approximately 8 hours of data.

Based on the values in *Table 6*, one can calculate how much data is generated in one hour if the RANGECMPB and BESTPOSB logs are collected every 15 seconds. This is the typical data-logging rate for static survey (post-processing) applications. The cells of *Table 8* reflect the memory consumption, in kilobytes per hour, for scenarios of 6, 8, or 10 satellites in view.

Table 8: Memory Consumption - Typical Case for Static Survey (15 Second Rate)

	L1-only		L1 & L2	
	Single-point Observations (kBytes/hour)	Single-point or Differential Observations & Positions (kBytes/hour)	Single-point Observations (kBytes/hour)	Single-point or Differential Observations & Positions (kBytes/hour)
6 SV	99	126	124	284
8 SV	106	263	126	303
10 SV	137	325	148	349

The following relationship, based on *Table 8*, yields an estimate of the data storage requirements for a typical data-recording session intended for post-processing:

- Minimum file size (in kilobytes) ≈ (kilobytes per hour) x (number of hours)

Example from *Table 8*:

You wish to record differential observations and positions, once every 15 seconds, for 8 hours, with 8 satellites visible, during L1/L2 operation. The file size will be no less than (303 kBytes/hour) x (8 hours) = 2424 kBytes ≈ 2.37 MBytes. At this rate, an 8 MByte Compact Flash Card could hold approximately 24 hours of data.

4.3.4 Errors

The data logging mechanism is designed to be robust and to endure power interruptions (and similar disruptive events) with minimum loss of data. In this situation, allow for your data to be possibly reduced by several seconds up to a maximum of five minutes. To the extent possible, error messages attempt to describe the problem. See the RXSTATUS log on *Page 171*.

Chapter 5 LCD Menus

The front panel of DL-4 has an LCD with 6 interaction keys. The panel consist of four navigational, a combination edit/enter, and an escape key.

The main functions of the LCD menu are:

- Status
- GPS Data
- Configure Base
- Configure Logging
- Configure Sites
- Configure Ports
- Commands
- File Operations

Accompanying the DL-4 is a water/tear proof LCD Menus Quick Look Guide for on the fly referencing of menu locations.

The current menu function being displayed is shown in the top left corner of the LCD screen. *Figure 7* shows the layout of the LCD area.

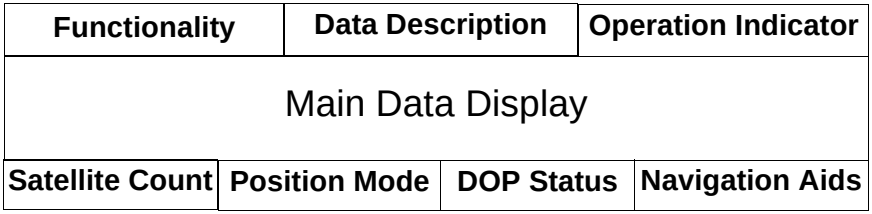


Figure 7: LCD Areas

The LCD areas are defined as:

- *Functionality:* The title of the current main function menu item
- *Data Description:* The title of the current sub-menu item
- *Operation Indicator:* Logging/schedule status information. Operation indicators and what their appearance signifies is shown in *Table 9, Operation Indicator Display on Page 40*.
- *Main Data Display*: Current data and depends on the active functionality.
- *Satellite Count*: The number of satellites being tracked.
- *Position Mode*: Current position mode:

- NONE: There is no current position mode.
- FIX: The position has been fixed.
- SING: The position is from single-point averaging.
- PSR: The position measurement is from pseudorandom code on the GPS signals.
- FLT: The position is from floating ambiguity estimates that converge over time.
- INT: The position is from carrier phase ambiguity estimates that are only allowed to take on integer values.

For a discussion on GPS positioning, please refer to the *GPS Overview* appendix in *Volume 1* of the *OEM4 Family User's Guide*.

- *DOP Status*: Current value of the position DOP (PDOP)
- *Navigation Aids*: Four directional arrows show you how you can proceed through the menu items for the current functionality.

Table 9: Operation Indicator Display

Indicator on Display	What functionality is available according to the indicator:			
	Logging	Group	Scheduler	Site
BLANK	-	-	-	-
LOGGING	✓	-	-	-
LOGGING / SITE	✓	-	-	✓
GROUP	-	✓	-	-
GROUP / LOGGING	✓	✓	-	-
GROUP / LOGGING / SITE	✓	✓	-	✓
SCHED	-	-	✓	-
SCHED / LOGGING	✓	-	✓	-
SCHED / LOGGING SITE	✓	-	✓	✓
SCHED / GROUP	-	✓	✓	-
SCHED / GROUP / LOGGING	-	✓	✓	✓
SCHED / GROUP / LOGGING / SITE	✓	✓	✓	✓

Figure 8 shows how the LCD appears when DL-4 is first powered up. This loading screen is then followed by the STATUS menu from where you can access any of the main functionality menus and their sub-menus.

Figure 8: LCD Loading Screen

5.1 Contrast

Pressing the <Ent> key while in the STATUS home screen, see *Page 44*, displays the CONTRAST screen. The contrast works as a type of EDIT BY GROUP, described in *Section 5.2.5, Edit Group Display on Page 43*, where the up and down arrows increase and decrease the contrast. Pressing the <Ent> key a second time returns you to the STATUS home screen.

5.2 Menu Access

Simple menu access is achieved by following the directional arrows in the bottom right of the LCD when they appear black on a white background (← ↑ → ↓). Arrows that appear in inverse (white on gray) show that special functionality is available, such as editing. See the display sections that follow for more information on this topic.

Pressing the <Esc> key continually will take you back through menu items until you return to the top of the menu where you started.

5.2.1 Normal Display

When the DL-4 LCD is in normal mode, it will display as described on *Pages 39 to 40*. An example of a screen in normal display mode is shown in *Figure 9*.

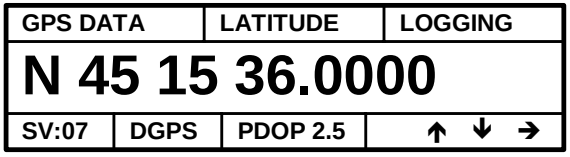


Figure 9: Normal Mode

5.2.2 Scroll Display

When the DL-4 LCD is in scroll display mode, the last screen of the GPS DATA menu displays the data normally displayed in the other sub-menus of that function. The upper middle box is shown in inverse video and a '>>' symbol appears in front of the value name currently being displayed. An

example of a screen in scroll display mode is shown in *Figure 10.*

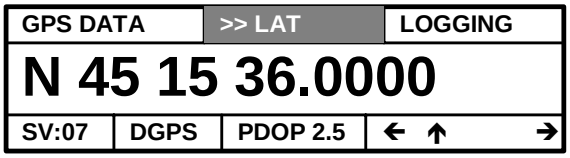


Figure 10: Scroll Mode

5.2.3 Scroll Pause Display

When the DL-4 LCD is in scroll display mode (see *Section 5.2.2, Scroll Display*, above), the upper middle box is displayed in inverse video to indicate that special functionality is available.

Press the <Ent> key to pause the scrolling display. The left and right navigation indicators appear in inverse video. Press the left or right arrow key to move the display one item at a time forward or backward through the list of display screens currently scrolling.

Press the <Ent> key again when the screen is in scroll pause mode to resume the scrolling action of the screen. An example of a screen in scroll pause display mode is shown in *Figure 11*.

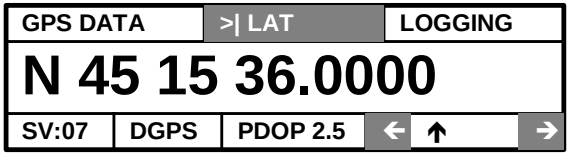


Figure 11: Scroll Pause Mode

5.2.4 Edit Digit Display

When the DL-4 LCD is in edit digit display mode, you are able to edit and set values in the screen. An editable screen has the upper middle box displayed in inverse video.

Press the <Ent> key to cause the navigation aid arrows to turn to inverse video and for a cursor to appear under the first digit of the data value. Cursor horizontally to the digit to be changed, then cursor up to increase its value or down to decrease its value. Press the <Ent> key again to save the new value.

An example of a screen in edit digit display mode is shown in *Figure 12.*

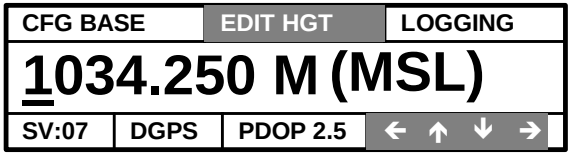


Figure 12: Edit Digit Mode

5.2.5 Edit Group Display

When the DL-4 LCD is in edit group display mode, it is possible to select screen values. An editable screen has the upper middle box displayed in inverse video.

Press the <Ent> key to cause the navigation aid arrows to turn to inverse video and for a cursor to appear under the first group. Cursor horizontally to move the cursor to the group value to change. An example of a group value that the cursor has been moved to, is the 9600 value shown in *Figure 13*.

Cursor up or down to cycle through a list of choices for that group value. Press the <Ent> key again to save the new group value.

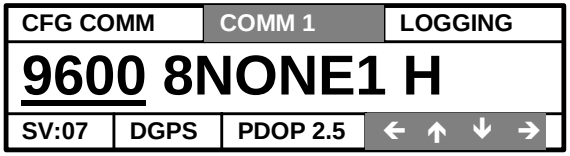


Figure 13: Edit Group Mode

5.3 Menus

This section describes, and graphically gives examples of, the main functionality menus and their sub-menus.

5.3.1 Status

The STATUS functionality group provides diagnostic information about the DL-4. Its home screen gives you DL-4's overall operational status and the current UTC time. *Figure 14* shows the STATUS menus.

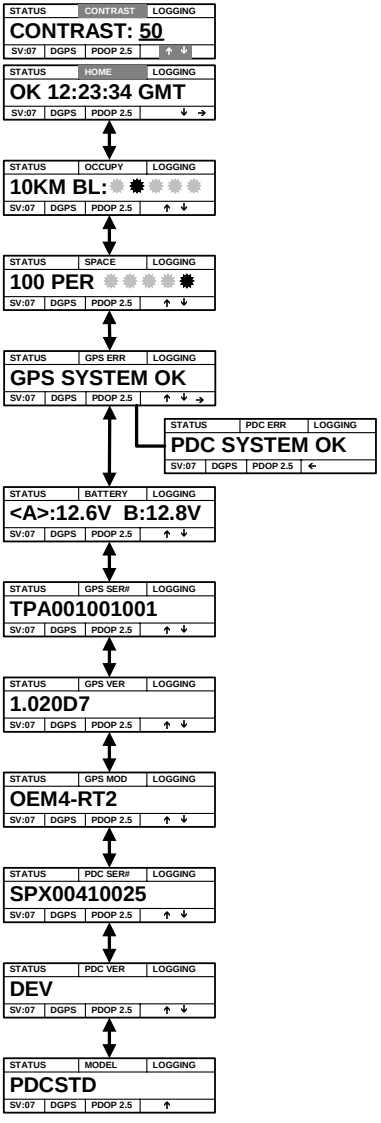


Figure 14: STATUS Menus

Pressing the <Ent> key while in the STATUS home screen displays the CONTRAST screen. The CONTRAST screen works as a special type of EDIT BY GROUP, see *Edit Group Display on Page 43*, where the up and down arrows increase and decrease the contrast. Pressing the <Ent> key a second time returns you to the STATUS home screen.

If the instrument's contrast is such that viewing is not possible, press the <Esc> key three times to bring you to the STATUS home screen where pressing the <Ent> key displays the CONTRAST screen. You can then press the up or down arrow until viewing is possible.

As seen from *Figure 14*, there are several STATUS data description categories:

- OCCUPY: The occupation timer screen provides an indication of whether sufficient data has been collected for successfully post processing data for the indicated baseline. For each sun-shaped icon that appears, you can process your data to the corresponding baseline. The occupation time gauge has the following values from left to right:

  ✹✳✳✳✳ 5 km baseline
  ✳✹✳✳✳ 10 km baseline
  ✳✳✹✳✳ 15 km baseline
  ✳✳✳✹✳ 20 km baseline
  ✳✳✳✳✹ 30 km baseline

- SPACE: The disk space screen provides the available space left on the compact flash card. The data card memory gauge displays the amount of memory or space used on your data card.

  When your data card has over 80% space available, the rightmost ✹ icon is displayed. As you use the space on your data card, the icon moves to the left. The leftmost icon indicates to you that the data card is almost completely filled. Once there is no icon displayed, you should consider replacing the current data card with an empty one or deleting the files.

  In normal operation, the data card memory gauge will have the following values, where S = space available:

  ✳✳✳✳✹ 100% ≥ S > 80%
  ✳✳✳✹✳ 80% ≥ S > 60%
  ✳✳✹✳✳ 60% ≥ S > 40%
  ✳✹✳✳✳ 40% ≥ S > 20%
  ✹✳✳✳✳ 20% ≥ S

- GPS ERR: The GPS status screen provides information on any GPS receiver system errors detected. When there are no errors, there is an 'OK' message.

- PDC ERR: The PDC status screen provides information on any PDC errors detected. When there are no errors, there is an 'OK' message.

- BATTERY: The battery voltage screen provides the voltage of up to two connected power sources. The active battery or DC power source is indicated by angled brackets, for example <A>.
- GPS SER#: The GPS serial number screen provides the GPS receiver card serial number.
- GPS VER: The GPS firmware version screen provides the GPS receiver firmware version and date.
- GPS MOD: The GPS model screen provides the GPS model number.
- PDC SER#: The PDC serial number screen provides the PDC controller serial number.
- PDC VER: The PDC firmware version screen provides the PDC controller firmware version and date.
- PDC MOD: The PDC firmware model screen provides the PDC controller firmware model.

5.3.2 View GPS Data

The VIEW GPS DATA functionality group allows you to view the position being determined by DL-4. Its home screen gives you information to indicate the content of this menu group. *Figure 15 on Page 47* shows the VIEW GPS DATA menus.

.

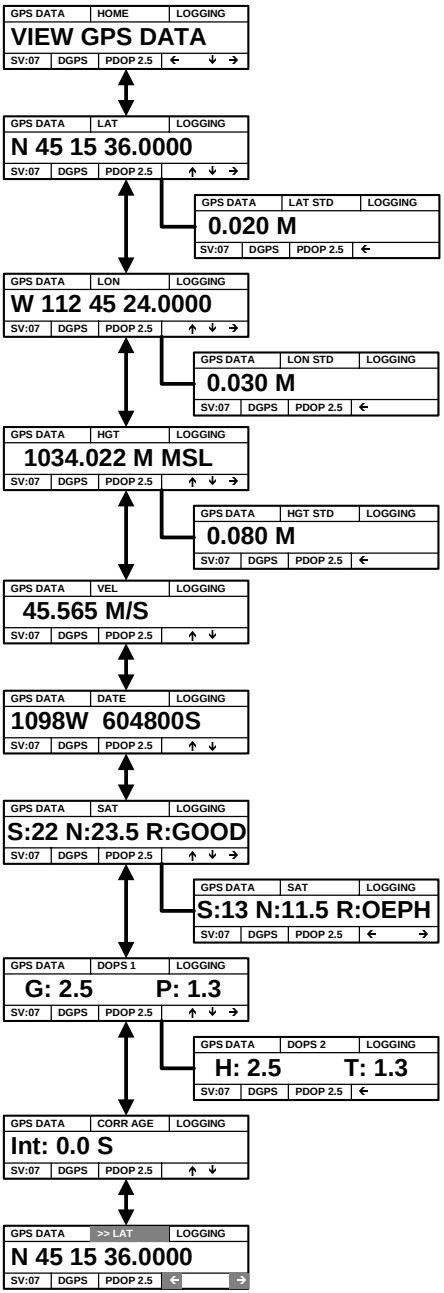


Figure 15: GPS Data Menus

As seen from *Figure 15*, there are several VIEW GPS DATA menu categories:

- LATTITUDE: The latitude screen provides the current latitude in degrees, minutes, seconds and decimal seconds to 4 decimal places. Arrow to the right to obtain the standard deviation (STD) of the latitude.
- LONGITUDE: The longitude screen provides the current longitude in degrees, minutes, seconds and decimal seconds to 4 decimal places. Arrow to the right to obtain the STD of the longitude.
- HEIGHT: The height screen provides the current height in meters to 3 decimal places. An indication of the height reference is also given, for example MSL (for Mean Sea Level). Arrow to the right to obtain the STD of the height.
- VEL: The velocity screen provides the current velocity in meters/second to 3 decimal places.
- DATE: The date screen provides the current date in GPS weeks and GPS seconds.
- SAT: The satellite information group of menus comprises of several screens, one screen for each satellite being used by the GPS receiver. Arrow right or left between satellites. Each satellite information screen provides:
    - The satellite vehicle (SV) number that the data on the screen belongs to.
    - The signal to noise ratio for that particular SV.
    - Reject code of the SV.
- DOPS 1: The dilution of precision or DOPS screens provide:
    - The current positional DOP.
    - The current horizontal DOP.
    - The current vertical DOP.
    - The current time DOP.
- CORR AGE: This screen provides the differential correction age in seconds if receiving differential corrections.
- >>LAT: The scrolling pause screen provides a display as described in *Section 5.2.3, Scroll Pause Display* on *Page 42*. The values are displayed for 2 seconds before switching to the next value.

5.3.3 Configure Base

The CONFIG BASE functionality group allows you to do simple base station configuration and identification. Its home screen gives you information to indicate the content of this menu group. *Figure 16* shows the CONFIG BASE menus.

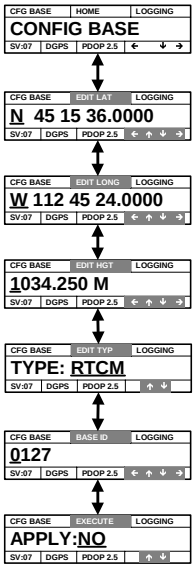


Figure 16: Configure Base Menus

As seen from *Figure 16*, there are several CONFIG BASE menu categories that allow you to fix the current position being solved by the GPS receiver as the base station co-ordinates:

- EDIT LAT: The edit latitude screen allows you to edit the current latitude co-ordinates so they can be used to fix the position of the base station. You can change parameters by using the "edit by digit" method, see *Section 5.2.4, Edit Digit Display* on *Page 42* for an explanation of the operation.
- EDIT LONG: The edit longitude screen allows you to edit the current longitude co-ordinates so they can be used to fix the position of the base station. You can change parameters by using the "edit by digit" method, see *Section 5.2.4, Edit Digit Display* on *Page 42* for an explanation of the operation.
- EDIT HGT: The edit height screen allows you to edit the current height value so that it can be used to fix the position of the base station. You can change parameters by using the "edit by digit" method, see *Section 5.2.4, Edit Digit Display* on *Page 42* for an explanation of the operation.
- EDIT TYP: The select format screen allows you to select what type of corrections are being sent according to the LOG group being executed. You can change the correction type by using the "edit by group" method, see *Section 5.2.5, Edit Group Display* on *Page 43* for an explanation of the operation. Example message formats are RTCM, RTCA, and CMR. Refer to *Volume 1* of the *OEM4 Family User's*

Guide for more information on *Message Formats*.

- BASE ID: The base ID screen allows you to enter an ID for the base station. You can change the ID by using the "edit by digit" method, see *Section 5.2.4, Edit Digit Display* on *Page 42* for an explanation of the operation. The base ID will be a digit or alpha numeric value depending on the message format being utilized, see EDIT TYP above.

  The following range values should be used when you are entering a BASE ID:

  RTCA ID: any four character string containing only alpha (a-z) or numerical (0-9) characters

  $0 \leq$ RTCM ID ≤ 1023

  $0 \leq$ CMR ID ≤ 31

  When the <Ent> key has been pressed for the second time, the receiver checks your BASE ID entry and if it does not fall within the ranges shown above, will force the BASE ID to revert to the 'ANY' option.

- APPLY: This screen allows you to apply the data entered in the preceding screens. A FIX POSITION command is issued along with a DGPSTXID command, using the information entered in the preceding screens. You can select YES or NO by using the "edit by group" method, see *Section 5.2.5, Edit Group Display* on *Page 43* for an explanation of the operation.

5.3.4 Config Logging

The CONFIG LOGGING functionality group provides information about the options which enable you to control logging to DL-4 using log groups or the scheduler. Its home screen gives you information to indicate the content of this menu group. *Figure 17* shows the CONFIG LOGGING menus.

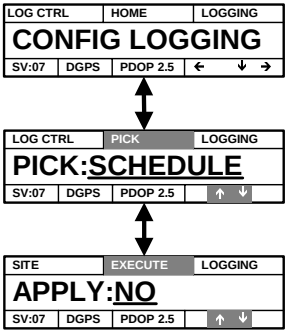


Figure 17: Config Logging Menus

There are two operational mode choices for logging data with the DL-4:

- Group, where a logging group downloaded from the DL4Tool software is executed.
- Schedule, where the logging schedule, downloaded from the DL4Tool is

executed.

See the PICK screen details below.

As seen from *Figure 17*, there are three CONFIG LOGGING menu categories that allow you to edit logging configurations:

- PICK: The pick screen allows you to select the schedule, which is always the first choice on the list, or one of the log groups installed on the DL-4. You can select SCHEDULE or a log group by using the "edit by group" method, see *Section 5.2.5, Edit Group Display* on *Page 43* for an explanation of the operation.
- APPLY: This screen allows you to apply choices from the preceding screens. You can select YES (enable) or NO (disable) by using the "edit by group" method, see *Section 5.2.5, Edit Group Display* on *Page 43* for an explanation of the operation.

5.3.5 Config Sites

The CONFIG SITES functionality group allows you to use the SITE ENTER and SITE LEAVE functionality. Its home screen gives you information to indicate the content of this menu group. *Figure 17* shows the CONFIG SITES menus.

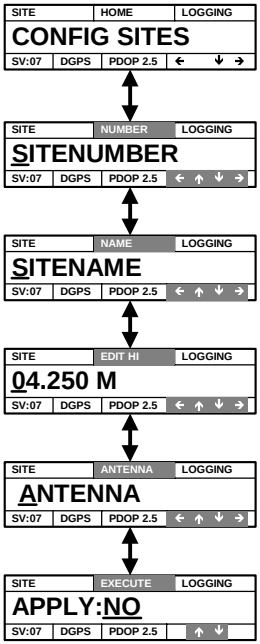


Figure 18: Site Menus

As seen from *Figure 17*, there are several CONFIG SITES menu categories that allow you to edit site parameters:

- NUMBER: The site number control screen provides you with a menu to enter an alphanumeric site number.

- NAME: The site name control screen provides you with a menu to enter an alphanumeric site name.
- EDIT HI: The height of instrument control screen provides you with a menu to enter the height of the antenna.
- ANTENNA: The antenna name control screen provides you with a menu to enter an alphanumeric antenna name.
- APPLY: This screen allows you to apply a YES or NO choice to enter or leave a site.
    - If YES (enter a site) is selected, you can enter the site number, name, antenna name and height. This information will be held until you select No (leave site).
    - If No (leave a site) is selected, the site information is written to the log file.

5.3.6 Configure Ports

The CONFIG PORTS functionality group allows you to configure the communication ports on DL-4. Its home screen gives you information to indicate the content of the functionality group. *Figure 19* shows the CONFIG PORTS menus.

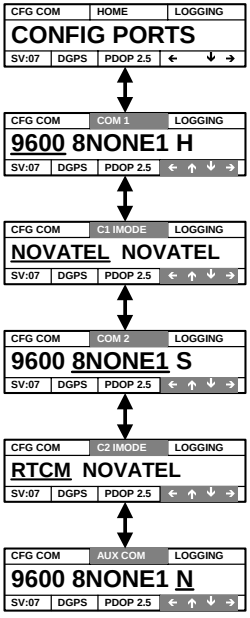


Figure 19: Configure Ports Menus

As seen from *Figure 19*, there are three CONFIG PORTS menu categories:

- COM1: The COM1 setup screen allows you to configure communication parameters for the COM1 serial port.
- C1 MODE: The first field in this screen tells the receiver what type of data to accept on the COM1 port. The second field then tells the receiver what kind of data the COM1 port can generate. See *Table 10 on Page 53* for a list of serial port interface modes available in this screen.
- COM2: The COM2 setup screen allows you to configure communication parameters for the COM2 serial port.
- C2 MODE: The first field in this screen tells the receiver what type of data to accept on the COM2 port. The second field then tells the receiver what kind of data the COM2 port can generate. See *Table 10 on Page 53* for a list of serial port interface modes available in this screen.
- AUX COM: The auxiliary I/O setup screen allows you to configure communication parameters for the auxiliary serial port.

You can change these parameters by using the "edit by group" method, see *Section 5.2.5, Edit Group Display* on *Page 43* for an explanation of the operation.

Table 10: Serial Port Interface Modes

ASCII Mode Name	Description
NONE	The port accepts/generates nothing
NOVATEL	The port accepts/generates NovAtel commands and logs
RTCM	The port accepts/generates RTCM corrections
RTCA	The port accepts/generates RTCA corrections
CMR	The port accepts/generates CMR corrections

5.3.7 Commands

The COMMANDS functionality group allows you to execute selected basic DL-4 commands. Its home screen gives you information to indicate the content of the functionality group. *Figure 20* shows the COMMANDS menus.

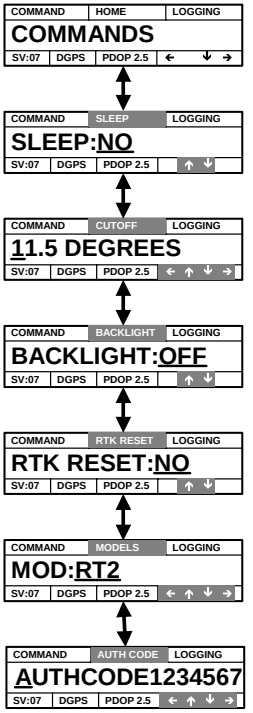


Figure 20: Commands Menus

As seen from *Figure 20*, there are four COMMANDS menu categories:

- SLEEP: The edit sleep screen gives you the option of allowing the DL-4 to go to sleep or not. This is especially useful when you are using the DL-4 for a longer period of time than it takes for the device to go into sleep mode.
- CUTOFF: The edit elevation screen provides easy access to edit the elevation cutoff angle. You can change the angle by using the "edit by digit" method, see *Section 5.2.4, Edit Digit Display* on *Page 42* for an explanation of the operation. See also the ECUTOFF command in *Volume 2* of the *OEM4 Family Users' Guide*.
- BACKLIGHT: The backlight screen provides menu access to commands to toggle the LCD's backlight. You can turn the backlight on or off by using the "edit by group" method, see *Section 5.2.5, Edit Group Display* on *Page 43* for an explanation of the operation.
- RTK RESET: This screen allows you to reset the RTK filter. If this screen is selected, a confirmation screen appears to ensure you want to do the reset.
- MODELS: This screen allows you to specify the DL-4 model. You can change the model by using the "edit by digit" method, see *Section 5.2.4, Edit Digit Display* on *Page 42* for an explanation of the operation.
- AUTH CODE: The auth code screen provides easy access to a command to issue the AUTH command. You can change the auth code by using the "edit by digit" method, see *Section 5.2.4, Edit Digit Display* on *Page 42* for an explanation of the operation.

  The auth code itself contains 5 sections followed by the model name and date. All three are editable by using the "edit by digit" method.

  If the model name is shorter than the space allowed, append the model name with the # symbol.

  The expiry date is optional and may be left as the default 00 00 00 or edited.

  See also the AUTH command in *Volume 2* of the *OEM4 Family Users' Guide*.

5.3.8 File Operations

The FILE OPERATIONS functionality allows you to do some basic data file management.Its home screen gives you information to indicate the content of the functionality group. *Figure 21* shows the FILE OPERATIONS menus.

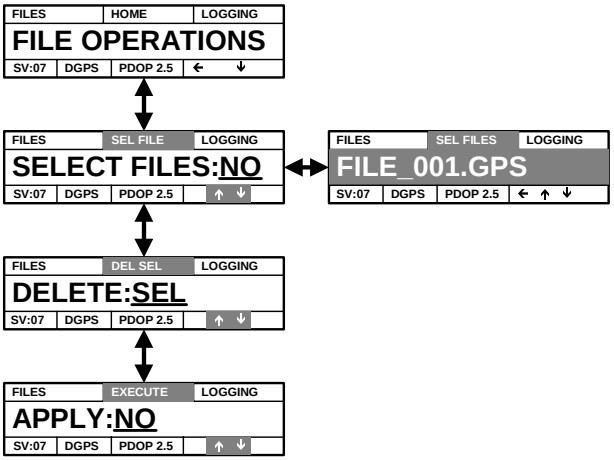


Figure 21: File Operations Menus

As seen from *Figure 21*, there are three FILE OPERATIONS menu categories:

- SEL FILES: The select files screen allows you to list all data files and mark files for deletion. You can choose YES or NO by using the "edit by group" method, see *Section 5.2.5, Edit Group Display* on *Page 43* for an explanation of the operation. If you select YES, a second screen appears to allow scrolling through the list of data files. Press the <Ent> key to toggle a file between marked (inverse video) or not marked. All files that have been marked (inverse video) are deleted if you decide to delete selected files from the DEL SEL menu (information following).
- DEL SEL: The delete selected files screen allows you to delete all files or files that have been marked in the SEL FILES menu (see above).
- APPLY: This screen allows you apply the choices in the preceding screens. You can choose YES or NO by using the "edit by group" method, see *Section 5.2.5, Edit Group Display* on *Page 43* for an explanation of the operation.

Chapter 6 Software Programs

The vinyl compact disc (CD) envelope accompanying this manual holds a CD that contains the windows applications, *DL4Tool, GPSolution 4,* and *Convert.* They are installed via a standard Install Shield set-up application, please refer to the *PC Software* chapter in *Volume 1* of the *OEM4 Family Users' Guide* for more information on installation, and the GPSolution 4 and Convert programs.

For more information on the DL4Tool software, see *Chapter 7, DL4Tool on Page 66.*

6.1 DL-4 Firmware Upgrades & Updates

The DL-4 includes two distinct processors in its enclosure:

- a GPS receiver (OEM4 family GPSCard)
- an integrated power supply and data card (PDC)

Each of these components has its own microprocessor, and each microprocessor has its own firmware (program software), which is stored in non-volatile memory. What makes one DL-4 model different from another is software, not hardware. This unique feature means that upgrading the firmware is equivalent to getting a DL-4 with an entirely different set of features. Upgrading can be done anytime, anywhere, without any mechanical procedures whatsoever. New firmware can be transferred to the DL-4 through a serial port, immediately making the unit ready for operation at a higher level of performance.

The following can be upgraded/updated on the DL-4:

- PIC firmware
- PDC (Power Data Card)
- Boot Firmware
- OEM4 Firmware

6.1.1 Updating/Upgrading DL-4 Firmware

WinLoad is required (instead of the $AUTH command) when updating previously released firmware with a newer version of program and model firmware (For example, updating an OEM4 Standard rev. 1.200 to a higher revision level of the same model). *WinLoad* is a Windows-based utility program designed to facilitate program and model updates. *WinLoad* enables you to select a host PC serial port, bit rate, and choose a script file that will automatically run the procedure to update/upgrade the firmware on your DL-4 receiver.

6.1.1.1 Install WinLoad and Acquire Firmware Files

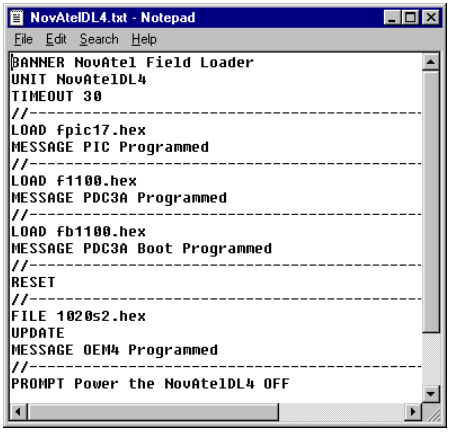
Before upgrading/updating, you must first acquire the latest firmware revision, which comes as a compressed file named NovAtelDL4XX.exe (where XX is the firmware revision level). At least 5MB of space should be available on the PC's hard drive.

The NovAtelDL4XX.exe file is password protected; but you will receive the required password. After copying the file to your computer, it must be decompressed. Simply double-click the file and choose a location on your PC to save the files.

Locate the directory on your PC and double-click the setup.exe file to install the *WinLoad* software and transfer the new firmware files. If you choose the default install locations, the *WinLoad* software will be stored at C:\Program Files\NovAtel Inc\WinLoad, and the firmware files will be stored at C:\Program Files\NovAtel Inc\WinLoad\Updates.

When updating firmware, it is not necessary for you to enter Auth codes. A data file (update.dat) is included in the WinLoad\Updates directory that contains a listing of all receiver Auth codes sorted by their corresponding OEM4 serial numbers. The software simply searches the file, finds the serial number that matches its OEM4 serial number and uses the corresponding Auth code. The Auth code is presented to you in the Auth code display box in the lower right hand corner of the *WinLoad* dialog.

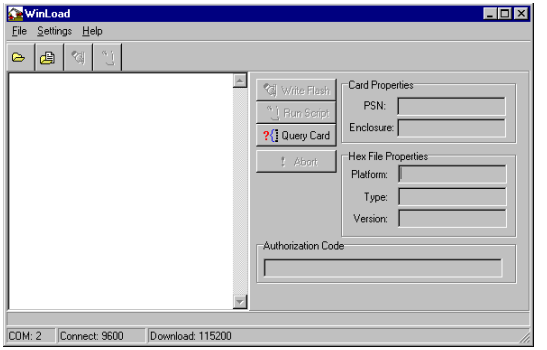
You have the option to load files individually or load multiple files at once using a script file, which will guide the software through the receiver firmware installation process or load individual files. The following is an example of a script file:



6.1.1.2 Updating Using WinLoad and a Script File

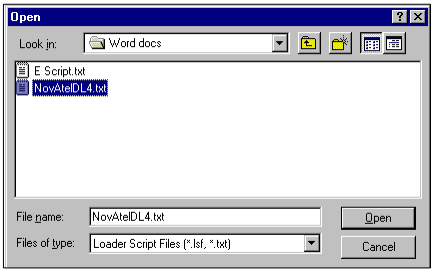
To update your DL-4 receivers to the latest firmware follow the steps below. You must install *WinLoad* to complete these instructions:

1. Connect your DL-4 to the COM1 port of your PC, but do NOT supply the receiver with power (do not install batteries or supply the receiver with external power).
2. Start *WinLoad*. An empty WinLoad dialog box will open.

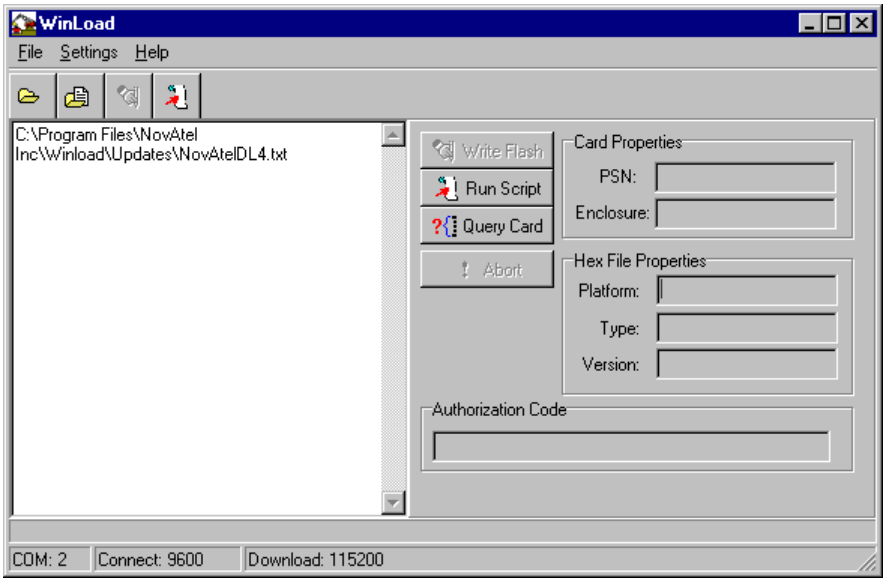


3. Click on File | Open Script File.

4. Use the Open dialog box to browse for and select the NovAtelDL4.txt file. If you used the default install path, this file will be located at `C:\Program Files\NovAtel Inc\WinLoad\Updates`.

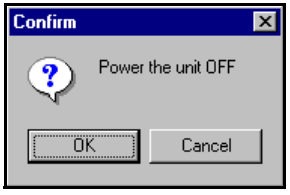


5. Click the <Open> button to open the file and return to the WinLoad dialog box.

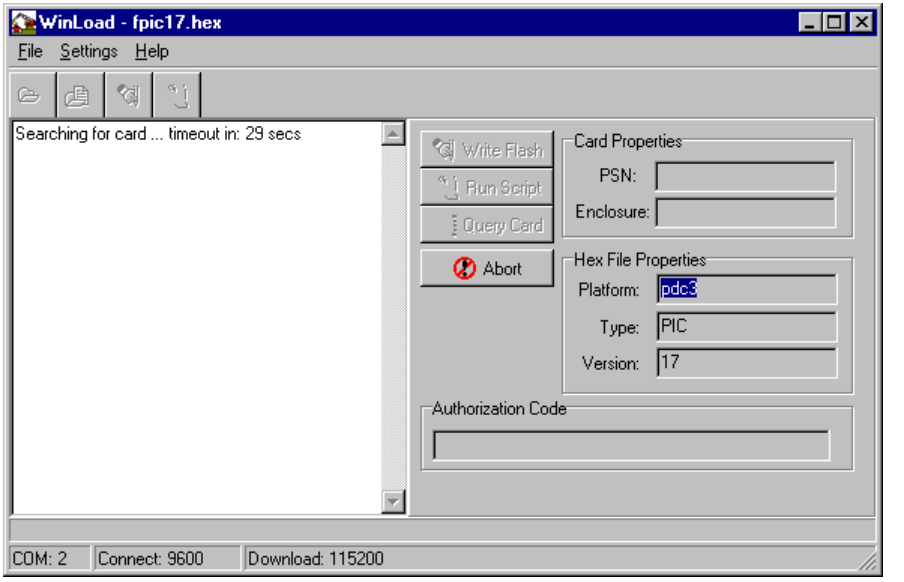


6. Click the <Run Script> button.

7. You will be prompted to make sure that the unit is powered off. At this point, make sure that the DL-4 is off and that you have not installed batteries or supplied the unit with external power. When you are sure the unit is not connected to a power supply, click <OK>.



8. A 30-second timer will begin to count down as *WinLoad* searches for the PDC card in the DL-4. Connect the DL-4 to a power supply BEFORE the 30 seconds expire.

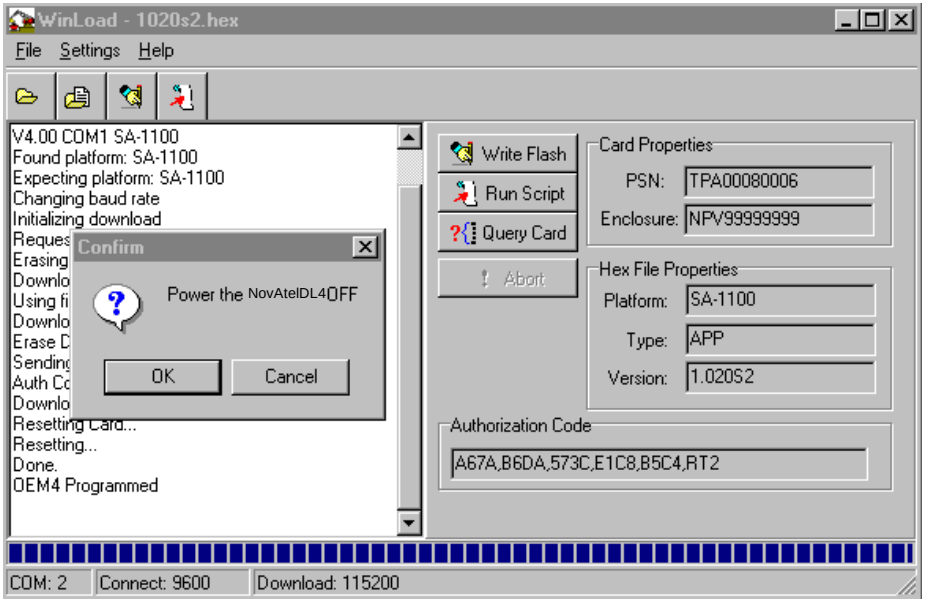


9. If using the NovAtelDL4.txt script, *WinLoad* will now update/upgrade the firmware specified in the script. The script could include one or all of the following:

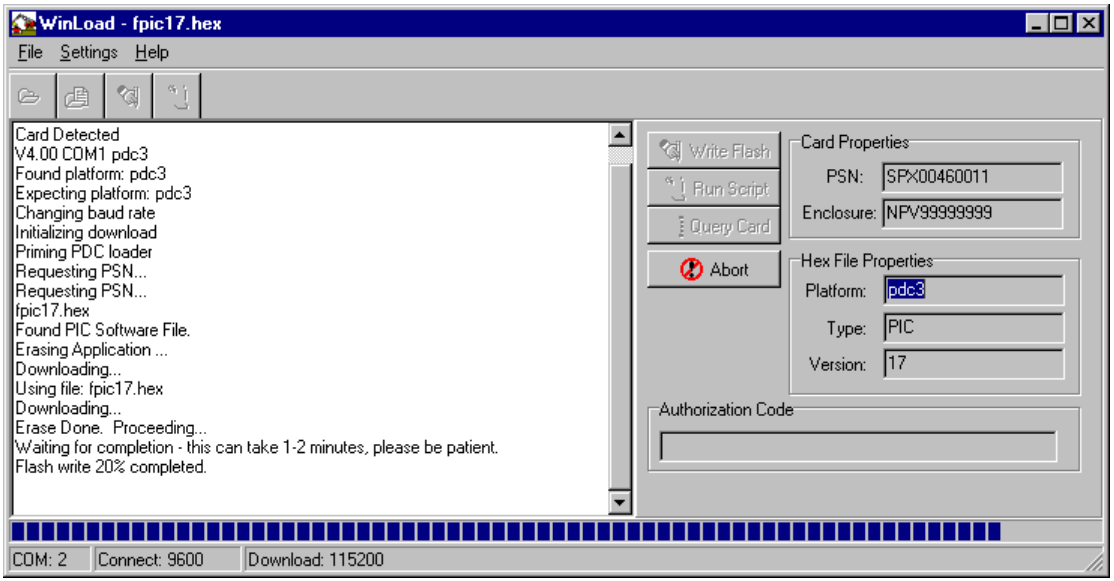
   – Pic
   – PDC (Power Data Card)
   – Boot firmware
   – OEM4 firmware

WARNING!: **Do not turn off power to the DL-4 or PC until the update/upgrade process is completed. If you do turn off power before *WinLoad* is finished, the DL-4 may need to be returned.**

When finished (approximately 5-6 minutes), you will once again be requested to power off the DL-4. Disconnect the power from the DL-4, then click <OK>.

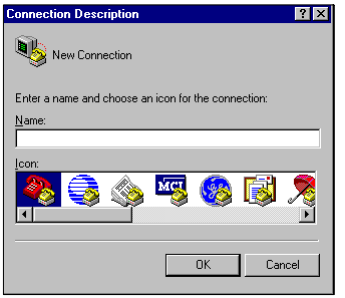


10. *WinLoad's* main window will read *Script Completed Successfully.* However, to ensure that the update/upgrade is complete, you should check the firmware version using the Windows *HyperTerminal* located on your PC. Proceed to the following section for instructions on using the *HyperTerminal*.



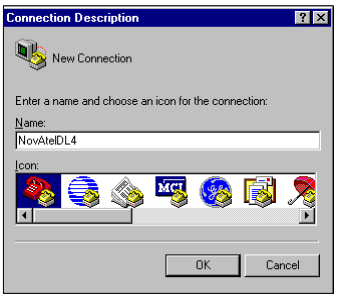
6.2 Using the HyperTerminal

1. From your Windows Start menu, choose Programs | Accessories | HyperTerminal | HyperTerminal.exe.

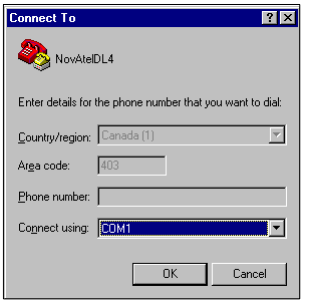


2. If prompted to install a modem, click <No>.

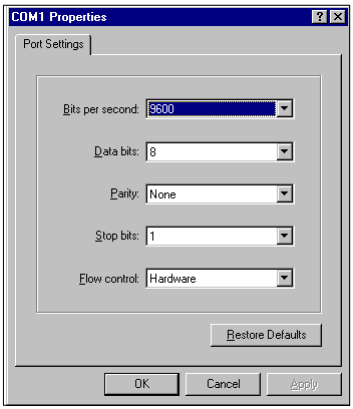
3. In the Connection Description dialog box (which displays automatically or can be opened from the *HyperTerminal* window by choosing File | New Connection), choose a name for your new connection. For example, NovAtelDL4. Click <OK>.



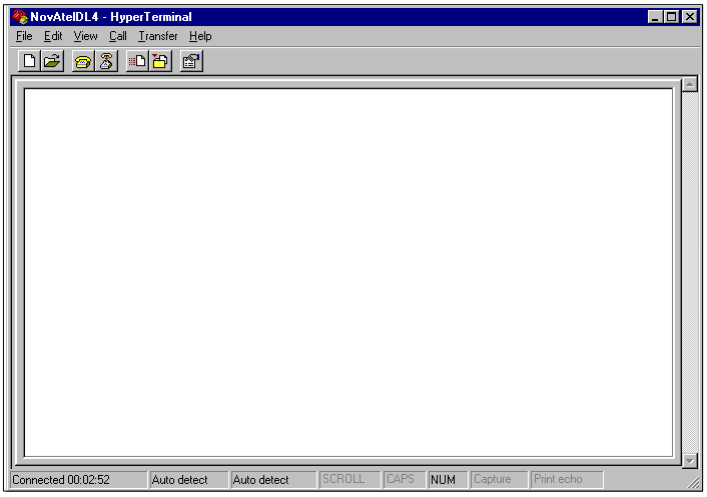
4. In the Connect To dialog box, choose COM1 from the Connect Using list. Click <OK>.



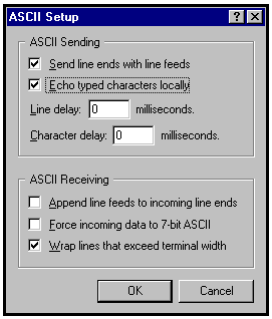
5. In the COM1 Properties dialog box, set the following: *Bits Per Second*: 9600, *Data Bits*: 8, *Parity*: None, *Stop Bits:* 1, *Flow Control*: Hardware. Click <OK>.



6. From the *HyperTerminal* window, open the *ASCII Setup* dialog box by selecting File | Properties | Settings tab| Terminal Setup | ASCII Setup. (Depending upon your version of *HyperTerminal*, you may have to select File | Properties | Settings tab | ASCII Setup)

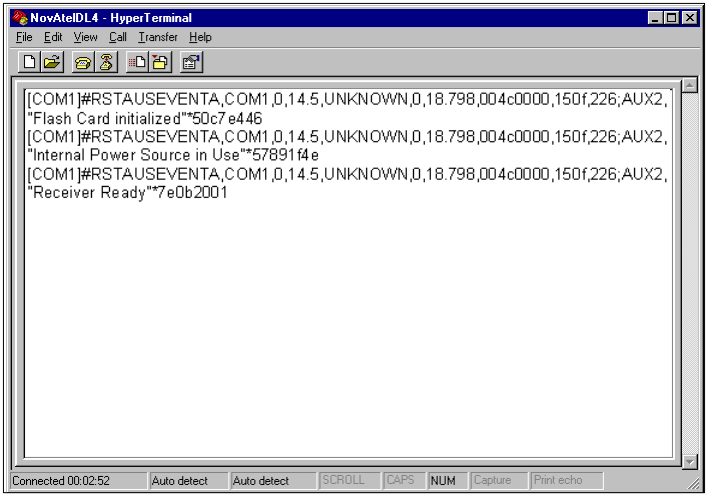


Click the *Send lines ends with line feeds* checkbox and the *Echo typed characters locally* checkbox. Click on the <OK> button at the bottom of the ASCII Setup dialog box. As well, click the <OK> button at the bottom of the New Connection Properties dialog box to return to the HyperTerminal window.

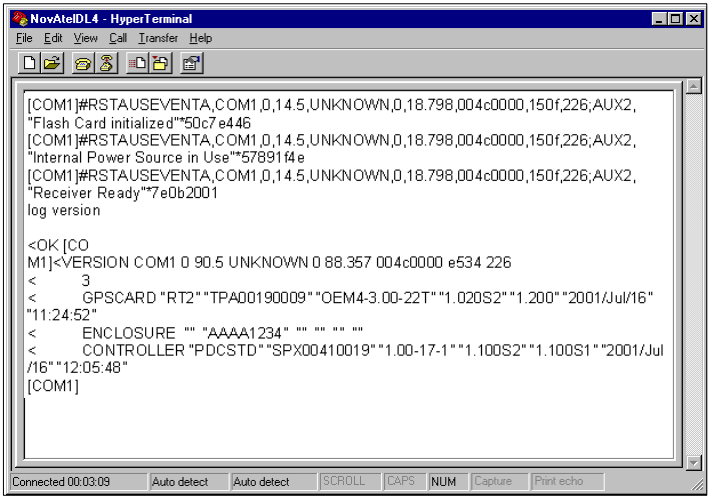


8. Connect a power supply to the DL-4 and power on the DL-4 using its power button.

9. After the DL-4 is powered on, the *HyperTerminal* window will display information as it communicates with the DL-4.



10. Once communication is established, type `Log Version` in the *HyperTerminal* window to display the version information for the DL-4.



11. Look at the version information to verify that the update is complete. To do this, check to see that the new firmware version numbers and names appear on your screen. If the updated information does not appear, try reinstalling the firmware again. If RT2 does not appear to the right of GPSCARD, print the contents of the LOG VERSION reply and call NovAtel (1-800-NOVATEL), see the *Customer Service* section in *Volume 1* of this manual for more ways of contacting NovAtel. For more information about the Version information below, refer to *Volume 2* of the *OEM4 Family Users' Guide*.

Example View:

```
log version
<OK
[COM1] <VERSION COM1 0 90.5 UNKNOWN 0 88.357 004c0000 e534 226 3
GPSCARD "RT2" "TPA00190009" "OEM4-3.00-22T" "1.020S2" "1.200" "2001/Jul/16" "11:24:52"
ENCLOSURE "" "AAAA1234" "" "" "" "" CONTROLLER "PDCSTD" "SPX00410019" "1.00-17-1"
"1.100S2" "1.100S1" "2001/Jul /16" "12:05:48"
```

Critical information that indicates your update has been successful:

a. You must see the most current LOG version numbers.

GPSCARD "RT2" "TPA00190009" "DL-44-3.00-22T" "1.020S2" "1.000" "2001/Jan/11" "11:27:54""
CONTROLLER "PDCSTD" "SPX00410019" "1.00-17-1" "1.100S2" "1.100S1" "2001/Jan/11" "12:10:48

b. The serial number of the update must appear in the VERSION body.

ENCLOSURE "" " NPV00450006" "" "" "" "" ""

12. Select Call | Disconnect to end your session in *HyperTerminal*, and select File | Exit to close *HyperTerminal*.

13. Disconnect the power supply from the DL-4.

Chapter 7 DL4Tool

DL4Tool is a powerful program which allows editing of schedules and log groups, uploading these to a DL-4 and downloading data from the Compact Flash Card to your PC. DL4Tool is easy to use and learn, while still providing a wide range of features and flexibility.

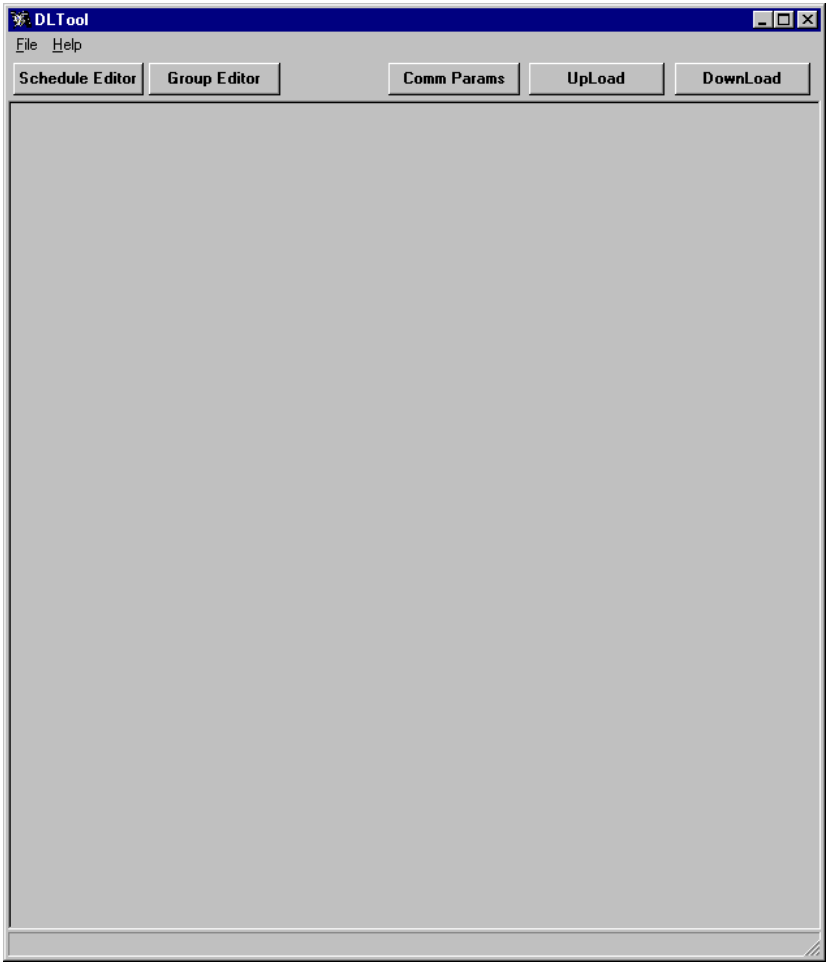
7.1 Basic Operations

7.1.1 Starting DL4Tool

If you accepted the default installation path, DL4Tool can be started from the Windows Start menu, by selecting Programs | NovAtel | DL4Tool. Otherwise, select the path where you installed DL4Tool.

You will be presented with the DL4Tool main window as seen in *Figure 22*.

Figure 22: DL4Tool Main Window



7.1.2 Exiting DL4Tool

To exit DL4Tool, choose one of the following methods:

- Click the <Exit> button  in the upper right-hand corner of the main window
- Select File | Exit from the main menu
- Press <Alt> + <F4>

7.2 Receiver Operations

DL4Tool can communicate with receivers, such as DL-4, to establish two types of data collection options:

Groups.....Receivers can collect several types of data. A group is a file that tells the receiver what type of data to collect, at what rate the data should be collected and where the data should be stored (for example the Compact Flash Card). Use the POWERUP group for manual data collection and other groups for associating with a schedule.

Schedules.....A schedule is user-defined settings that tells the receiver a specific time to start and end data collection. By associating a group with the schedule, you determine what types of data are collected during the scheduled time. This feature is helpful for collecting data even when you are absent.

These operations can be accessed from the DL4Tool Schedule Editor and Group Editor buttons. These operations, as well as receiver communications, are discussed in this chapter.

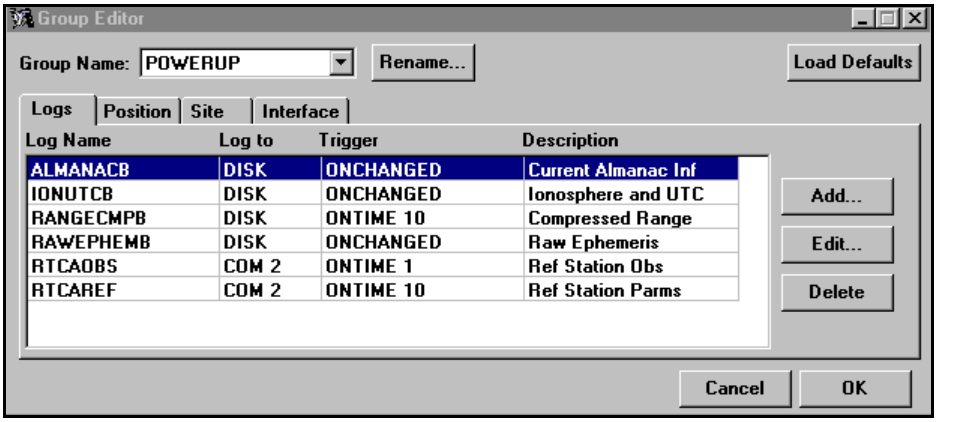
7.2.1 Receiver Groups

To schedule your DL-4 receiver to automatically start logging data at a specific time, you must create a receiver group, include it in a schedule and transfer it to the receiver. When configuring your receiver, you can define the groups settings to determine the type of information the receiver collects. These receiver groups consist of the log type, the data destination, the interval and a description for each log within the group.

Groups are used in schedules, see *Schedule Editor on Page 76*.

To edit receiver groups, click on the Group Editor button. The Group Editor dialog appears. An example is shown in *Figure 23*.

Figure 23: Group Editor Dialog



The Group Name field has a list box showing the names of all current groups including groups you defined, as well as default groups set up in the software. All preset groups can be modified from the software. For a list of default groups, see *Section 7.2.1.2, Preset Receiver groups on Page 71*.

From here you can create or edit receiver group names using the Rename... button. Group names will be converted to all uppercase lettering. Clicking on the Load Defaults button only changes the preset groups' configurations to its default settings. Your other groups will stay the same.

The default Group Name (other than the preset group names) is LOGGROUPX where X is the next possible number to make the name unique in the Group Editor dialog (For example, LOGGROUP1). The group name can be changed but must be unique. Group names can be up to eight characters long and the first character of the name can not be a number.

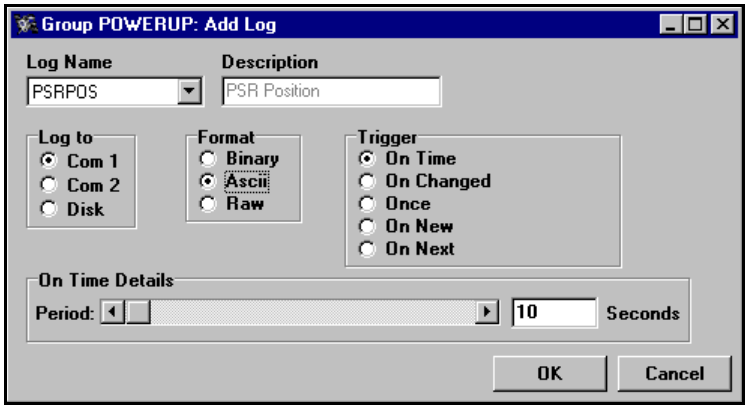
A receiver group consists of information in four tabs: Logs, see *Logs Tab on Page 69*, Position, see *Position Tab on Page 72*, Site, see *Site Tab on Page 73* and Interface, see *Interface Tab on Page 75*.

Click the OK button to save your changes or the Cancel button to discard your changes and return to the main DL4Tool window.

7.2.1.1 Logs Tab

To add a log to a receiver group, select the Logs tab and click on the Add... button. The Add Log dialog will appear as seen in *Figure 24.*

Figure 24: Add Log



Select a log from the Log Name drop down box.

Select a destination from the Log to list:

- COM1 Send this log through COM1 of the receiver
- COM2 Send this log through COM2 of the receiver
- Disk Save this log to the receiver's Compact Flash Card

If the group is intended for use with a stand-alone receiver, then Disk should be chosen so that data file information can be saved (see *Schedule Editor on Page 76*).

The trigger and interval settings can be edited by using the fields in the Trigger and On Time Details sections of the Add Log dialog.

Choose a log output format from the Format list. The Raw option should be chosen for transmitting differential corrections.

A log's interval information is what determines when and how often the DL-4 receiver will collect that log's information. For example, if the interval for the range measurements log (RANGECMP) is set to On Time 2, the receiver will log range measurements every two seconds.

To edit interval information in the Add Log dialog for a particular log, first select an interval by clicking on one of the Trigger radio buttons.

The On Time Details section appears dimmed unless the ON TIME radio button is selected. In this case you can enter or choose a time period. Use the Period scale bar to select a time interval in seconds. You can also use the Period edit box to edit the number of seconds directly. *Table 11, Log Intervals on Page 70* explains your choices.

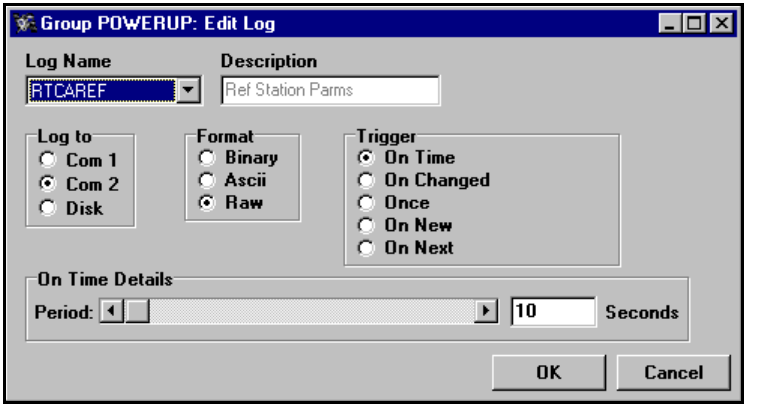
Table 11: Log Intervals

Interval	Description
On Time	You specify when the receiver should collect the information. For example, if you specify On Time 5, the information is collected every 5 seconds.
On Changed	Output only if the message changes. For example, if you select the almanac log (RAWALMB), you can choose the On Changed option so when the schedule is run, the receiver will collect almanac information once and not again unless the almanac information changes.
Once	Output only the current message.
On New	Output when the message is updated (not necessarily changed).
On Next	Output only the next message.

Click the OK button to save your changes or the Cancel button to discard your changes. Both buttons will return you to the Group Editor dialog where all logs you have selected are displayed along with their descriptions, default destination and interval settings.

To edit a log in a receiver group, click on the Edit... button and the Edit Log dialog will appear as seen in *Figure 25*.

Figure 25: Edit Log



The Edit Log dialog works in the same way as the Add Log dialog. Refer to the previous page for details.

To delete a selected log from the current group, click on the Delete button.

7.2.1.2 Preset Receiver groups

Your DL4Tool software is setup to include several preset receiver groups. The groups allow you to quickly and easily setup schedules without worrying about which logs to include in each group. Simply decide what type of logging session you want, and then choose the appropriate groups.

The list below outlines each of the preset groups. The group name, the logs within the group and the interval options are displayed (see details on editing trigger and interval information on *Page* 69).

POWERUP..... Use this group in a schedule when you are working with a receiver that is an RTK base and you want to post-process the data. This group may also be used for all manual data collection on the receiver.

Type of Information	Description
almanacb onchanged	current almanac
ionutcb onchanged	ionospheric and UTC clock parameters
rangecmpb ontime 10.0	compressed channel range measurements, revised
rawephemb onchanged	raw ephemeris
rtcaobs ontime 1.0	base station GPS data received every second
rtcaref ontime 10.0	base station position received every 10 seconds

The first four types of information (almanac, ionutc, rangecmp and rawephem) are typically used for post processing and are logged to the PCMCIA card. The last two (rtcaobs and rtcaref) are typically used for an RTK base station and are transmitted out of COM2.

STATIC ..... Use this group when collecting static and rapid static data. All data is stored on the Compact Flash Card.

Type of Information	Description
almanacb onchanged	current almanac
ionutcb onchanged	ionospheric and UTC clock parameters
rangecmpb ontime 10.0	compressed channel range measurements, revised
rawephemb onchanged	raw ephemeris

DGPS_BASE..... Use this group for a DGPS base receiver sending L1 code-only RTCM messages. All data is sent to COM port 2.

Type of Information	Description
RTCM1 ontime 1.0	RTK differential corrections received every second

CMR_BASE ..... Use this group when the receiver is an RTK base working with rover receivers that support the CMR format. All data is sent to the COM port 2[1].

Type of Information	Description
cmrobs ontime 1.0	Trimble format base station GPS data received every second
cmrref ontime 10.0	Trimble format base station position received every 10 seconds

RTCM_1819..... Use this group when the receiver is an RTK base working with rover receivers that support the RTCM1819 format, including OEM4 receivers. All data is sent to COM port 2[1, 2].

Type of Information	Description
RTCM1819 ontime 1.0	RTK differential observations and positions received every second
RTCM3 ontime 10.0	RTK differential observations and positions received every 10 seconds

RTK_BASE ..... Use this group when working with an RTK base receiver and post-processing is NOT required. All data is sent to COM port 2[1].

Type of Information	Description
rtcaobs ontime 1.0	base station GPS data received every second
rtcaref ontime 10.0	base station position received every 10 seconds

If these groups do not appear in the Group Name list, click on the Load Defaults button to return them to the list.

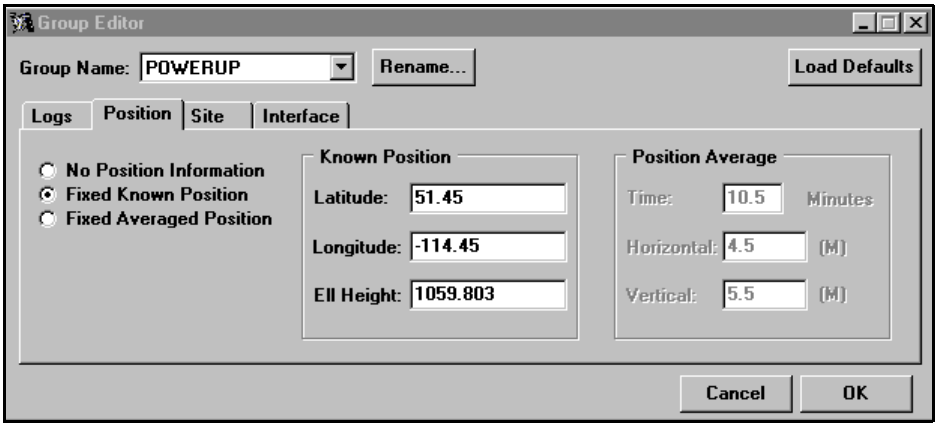
7.2.1.3 Position Tab

The second tab in the Group Editor dialog is the Position tab. Click in one of the radio buttons that give you the option of having no position information, known fixed position information (a static point) or single-point averaging information.

If you choose No Position Information then the Position tab's Known Position and Position Average edit boxes appear dimmed. If you choose Known Fixed Position then you **must** enter position information (latitude, longitude and ellipsoidal height) in the Known Position fields.

1. You may have to modify the version of RTCM used to either version 2.1 or 2.2. The RTCM version can be modified through a terminal mode.
2. The base station's coordinates must be entered or you must select the option for a base station's coordinates to be computed (based on meeting standard deviation or time interval criteria).

Figure 26: Position Tab



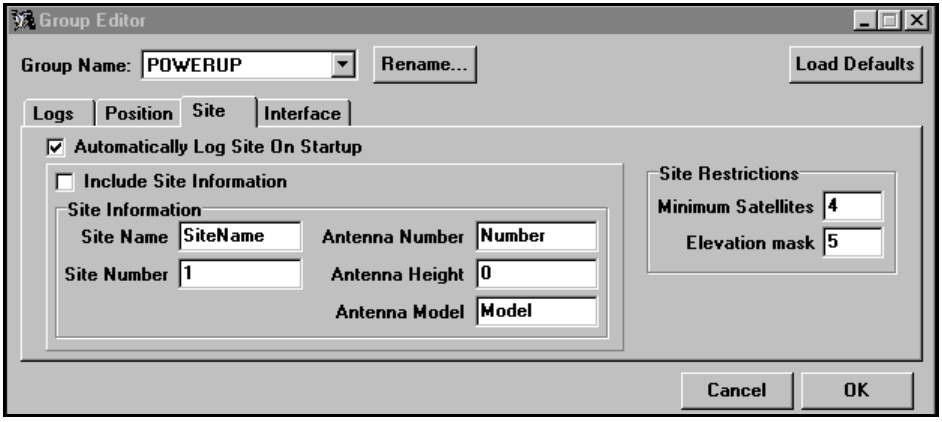
For the Fixed Averaged Position option, the Position Average fields become editable so you can enter the criteria by which you would like the position averaging to stop.

Position averaging will stop either before a certain time period in minutes (a maximum of 60 and a minimum of 1.5 minutes), if the standard deviation for the horizontal axis (in meters) has been met, or if the standard deviation for the vertical axis (in meters) has been met. The typical standard deviation range is from 10 cm (3.9") to 5 m (16.4'). The position will be fixed to the position averaged to that site.

7.2.1.4 Site Tab

The Site tab is the third tab available in the Group Editor dialog. It enables you to control whether site information is specified for sites automatically logged on startup.

Figure 27: Site Tab



If you check the Automatically Log Site On Startup check box, the group mode is set to static, a SITE ENTER command, see *Page 136*, is executed on startup, and the site is configured with parameters from the Site Information panel (if the Include Site Information check box is selected), or with a

default site name. If the Automatically Log Site On Startup check box is not checked, the group mode is set to kinematic.

- Static — A method of GPS data collection that involves simultaneous observations between stationary receivers. Post-processing computes the vector between sites.
- Kinematic — Your GPS antenna is moving. Kinematic data collection requires only short periods of data observations. Operational constraints include starting from, or determining, a known baseline and tracking a minimum of four satellites. One receiver is statically located at a control site, while others are moved between sites to be measured.

If do you wish to enter specific site information and have the information included in the group definition, check the Include Site Information check box. The editable fields are:

Antenna Model .....Enter the model number for your antenna.

Antenna Height .....Enter the vertical antenna height above ground.

Antenna Number .....Enter your antenna's serial number.

Site Number.....Enter a number for this site.

Site Name.....Enter a site name.

If the Site Name field is left blank, the log file name will be used as the site name.

The group definition that gets issued during the group upload includes the GROUPANTHEIGHT, GROUPANTSN, GROUPANTTYPE, GROUPSITENAME, and GROUPSITENUMBER. See *Pages 107, 108, 109, 119,* and *120* respectively for further details on these commands.

You may need to edit the following fields from their default values depending on your application:

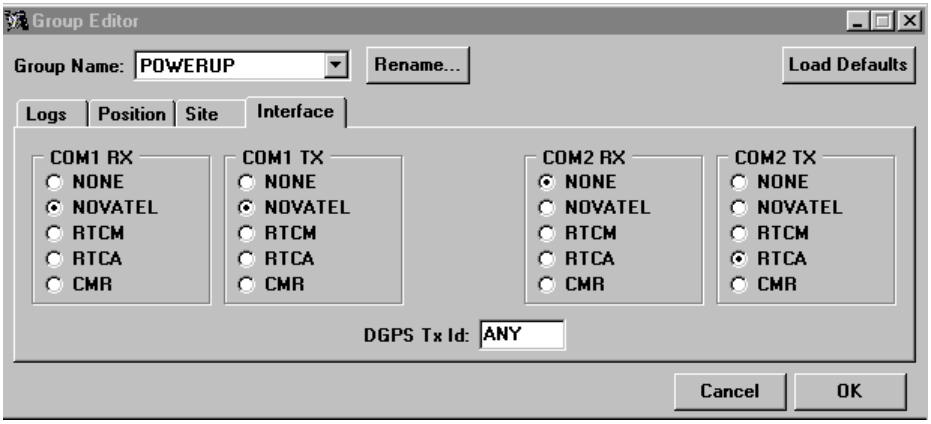
Minimum Satellites .....Select a number from 1 to 9 for the minimum number of satellites. The default is 4.

Elevation Mask .....Choose an integer value for the elevation mask angle between 0 and 90 degrees. The default is 0.

7.2.1.5 Interface Tab

The last tab in the Group Editor dialog is the Interface Tab as seen in *Figure 28 on Page 75*.

Figure 28: Interface Tab



This tab allows you to specify what type of data a particular port on the DL-4 can transmit and receive. The receive type (RX) tells the receiver what type of data to accept on the specified port. The transmit type (TX) tells the receiver what kind of data it can generate. For example, you would set the receive type on a port to RTCA in order to accept RTCA differential corrections.

You can set the base station ID, when it is transmitting corrections, in the DGPS Tx Id field. The following range values should be used when you are entering a base ID:

RTCA ID: any four character string containing only alpha (a-z) or numerical (0-9) characters

$0 \leq$ RTCM ID ≤ 1023

$0 \leq$ CMR ID ≤ 31

The default entry for the DGPS Tx Id field is ANY. The ANY option forces the message to revert to its default base ID. The ANY defaults are:

RTCM - 0
RTCA - AAAA
CMR - 0

It is also possible to disable or enable the generation or transmission of command responses for a particular port. Disabling of responses is important for applications where data is required in a specific form and the introduction of extra bytes may cause problems, for example RTCA, RTCM or CMR. Disabling a port prompt is also useful when the port is connected to a modem or other device that will respond with data the receiver does not recognize.

When NONE is chosen, the specified port will be disabled from interpreting any input or output data. Therefore, no commands or differential corrections will be decoded by the specified port.

7.2.2 Schedule Editor

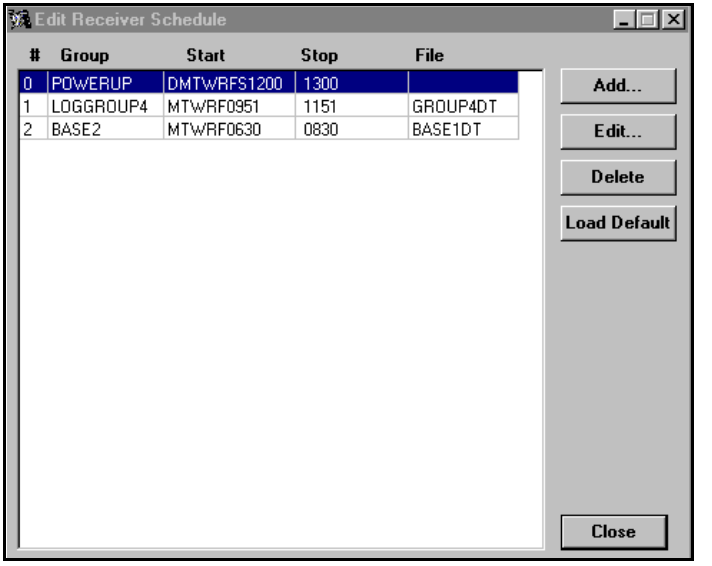
The Schedule Editor enables you to establish a data collection session on your receiver, much like scheduling a VCR to record when you are not there. After creating the schedule on the PC, you transfer it to the receiver. For more information, see *Section 7.3, DL4Tool Receiver Communications on Page 81*.

You can schedule up to seven days worth of data logging at a time, with up to 36 sessions per day. Start and stop times must be provided with a resolution of 1 minute. The minimum time interval per logging session is 5 minutes.

The scheduling feature is designed for use with receivers operating in stand-alone mode.

To schedule the logging of receiver groups, click on the Schedule Editor button. The Edit Receiver Schedule dialog appears as seen in *Figure 29*.

Figure 29: Schedule Editor



From the Edit Receiver Schedule dialog you have access to several buttons that, when pressed, do the following:

<Add>..... Add a schedule.

<Edit> ..... Edit a schedule.

<Delete> ..... Delete a schedule.

<Load Defaults>..... Schedule only the default POWERUP group.

<Close>..... Closes the Edit Receiver Schedule dialog and returns you to the main DL4Tool window.

The Edit Receiver Schedule dialog box has a window that is split into five columns. Following is an explanation of these columns:

#.....Automatically generated number. The number of sessions per day cannot exceed 36.

Days.....Displays the days of the week chosen (*See Table 13, Weekday Abbreviations*, on Page 80). For example, if you choose to schedule logging on Mondays and Fridays then MF will be displayed in this column.

Start .....Displays the start time of the session.

End .....Displays the end time of the session.

Group .....Displays the name of the group used in the session.

File.....Displays the file location where the data will be sent.

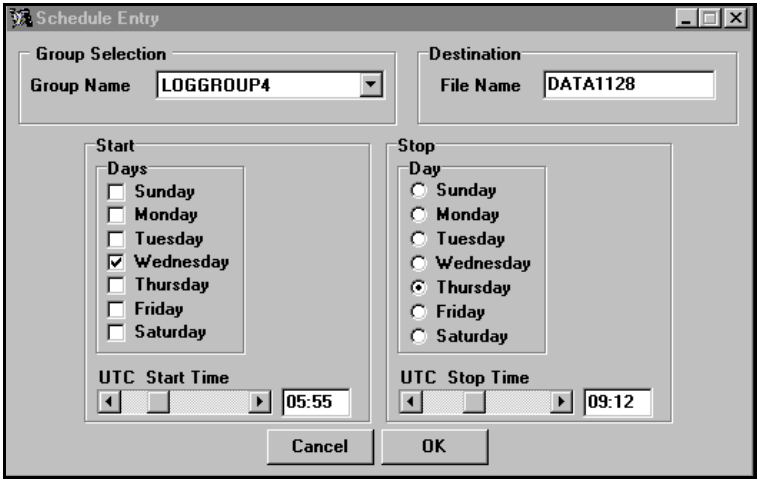
7.2.2.1 Add a Schedule

You can edit schedules in the Edit Receiver Schedule dialog box.

To add a new schedule, click on the Add... button. The Schedule Entry dialog appears as seen in *Figure 30 on Page 77*.

Choose a group for your session by selecting one of your previously created or software preset groups in the Group Name drop down box. For information on creating a group, see *Section 7.2.1, Receiver Groups on Page 67*.

Figure 30: Schedule Entry



The group Name edit box is not editable. To rename the group you must access it through the Group Editor dialog box (see *Section 7.2.1, Receiver Groups on Page 67*).

In the Schedule Entry dialog box, you are able to select Start Days, Stop Days, UTC Start Time and UTC Stop Time options.

Determine a start and stop time using the Start and Stop scale bars respectively. The Start and Stop edit boxes are for display purposes only and are not editable. The time system is based on UTC (Coordinated Universal Time). You can define the times more accurately by also using the ◀ and ▶ buttons on the ends of the scale bars.

In the Schedule Editor the Start and Stop times are specified in *ddddddhhmm* format, where *ddddddd* represents up to 7 days of the week, *hh* represents the hour (in 24-hour notation) and *mm* represents the minute. Multiple days of the week are allowed only in Start, and indicate that this schedule-table entry represents an event which repeats on the specified days of the week. Day of the week may not be specified in Stop for repeating events. If a day of the week is not specified in Start, the event repeats every day. If Stop is less than Start, the event wraps over to the next day. ddddddd consists of the combination of different character codes, each representing a day of the week as follows:

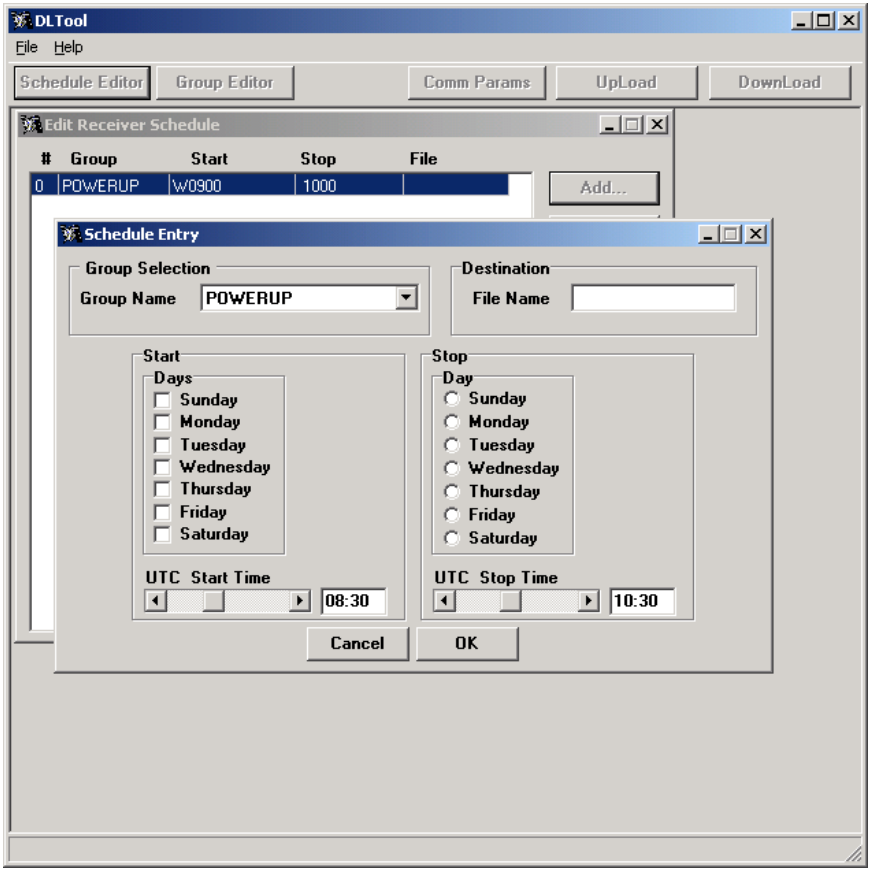
Sunday	D
Monday	M
Tuesday	T
Wednesday	W
Thursday	R
Friday	F
Saturday	S

The following are examples of valid Start and Stop times as seen in the Schedule Editor:

- 07:00 18:00 – event starts at 07:00 and ends at 18:00 every day
- MWRF10:00 11:00 – event starts at 10:00 and ends at 11:00 every Monday, Wednesday, Thursday and Friday
- M02:05 F12:15 – event starts at 02:05 on Monday and ends at 12:15 on Friday
- T14:00 13:00 – event starts at 14:00 every Tuesday and ends at 13:00 every Wednesday
- D18:30 D15:30 – event starts Sunday at 18:30 and continues until the next Sunday at 15:30

A conflict error message will appear if you choose a time span in the Start or Stop fields that conflicts with another schedule. An example is shown in *Figure 31, Conflict Example on Page 79*.

Figure 31: Conflict Example



You may give your session a filename in the File field. The name must begin with an alpha character (A-Z) and may be up to 8 characters long. The remaining characters may be digits (0-9) or alpha characters.

7.2.2.1.1 DL-4 Receiver Auto-Generated File Names

If you leave the File field blank in the Schedule Entry dialog of the DL4Tool, the DL-4 will give your session an auto-generated filename using the following convention (the DL-4 receiver does this but the DL4Tool software does not).

See also *Table 12, Auto-Generated File Name Conventions on Page 80*:

- The file name is composed of an eight-character base followed by a period and a three character extension on the DL-4 receiver.

- Characters 1 through 4 of the base is the last four digits of the DL-4 serial number.
- Characters 5 through 7 of the base is the UTC day-of-year (001 - 366).
- Character 8 of the base is the session id, an alphanumeric character in sequence 0, 1, 2, ..., 9, A, B, C, ..., Z, and starting with 0 for the first session of a UTC day.
- The file name extension will be “PDC”on the Compact Flash Card.

Character 8 (the last character in the file name) is selected when the session is started by the software looking at the files which are already on the Compact Flash Card and selecting the first character in sequence 0,1,2,...,9,A,B,C,...,Z that will produce a filename which does not already exist on the Compact Flash Card (For example, if there are 10 scheduled sessions on a particular day, but you turn the receiver ON during the 7th session with a blank Compact Flash Card, the last digit for the file created for this session will be 0.). If this procedure does not come up with an "available" file name, a completely random filename is generated.

Table 12: Auto-Generated File Name Conventions

Filename (####$$$%.PDC)	Comments
####	Last 4 digits of the DL-4 receiver’s serial number
$$$	UTC day of the year (001-366)
%	Log session index (0..9, A-Z)

For example, a DL-4 receiver might have a serial number such as CGN95450087. A date such as January 25 has a UTC day-of-year representation of 025. The 15th saved schedule on the Compact Flash Card would have an entry index of E. Thus, this file would have a name such as 0087025E.PDC.

In an exceptional case, a file-name conflict may occur that prevents the receiver from creating a file with the desired name. In that case, the receiver creates a file name whose first character is a tilde (“~”), followed by a 7-digit random number, and a *.PDC extension (For example, ~9368412.PDC).

You may not specify overlapping time intervals. All scheduled entries rely on day of the week and UTC time references. Schedule entries assign a one-character code to each of seven days, as shown in *Table 13, Weekday Abbreviations*.

Table 13: Weekday Abbreviations

Weekday	Abbreviation
Sunday	D
Monday	M
Tuesday	T
Wednesday	W
Thursday	R
Friday	F
Saturday	S

When you have selected valid start and stop times, click the OK button to save your changes or the Cancel button to discard your changes and return to the Edit Receiver Schedule dialog.

7.2.2.2 Edit a Session

To edit a session in the Edit Receiver Schedule dialog, highlight it and click on Edit... button. The Schedule Entry dialog appears. The details of the Session Entry dialog are described in *Add a Schedule on Page 77*.

7.2.2.3 Delete a Session

To delete a session, click on it to highlight it in the Edit Receiver Schedule dialog. Click on the Delete button.

7.2.2.4 Load Default

To ensure that only the default POWERUP schedule is active, click on the LOAD DEFAULT button.

7.3 DL4Tool Receiver Communications

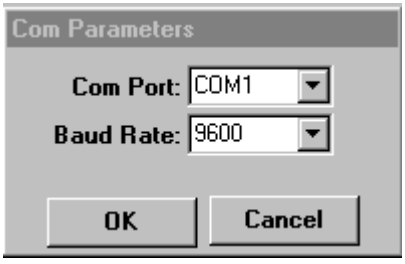
You can use the DL4Tool utility to manage and transfer files between the Compact Flash Card on the DL-4 and your PC.

Connect your DL-4 receiver to your PC (see *Section 2.1, Set Up DL-4 at the Office on Page 19* for instructions).

7.3.1 Communication Parameters

To transfer groups or a schedule table to the receiver, or files from the receiver, first click on the Coms Params button to select the communication parameters. The Com Parameters dialog appears as seen in *Figure 32*.

Figure 32: COM Parameters



Select your PC's communication port and baud rate (the defaults are COM1 and 9600 respectively) and click on the OK button. This will return you to the DL4Tool program window.

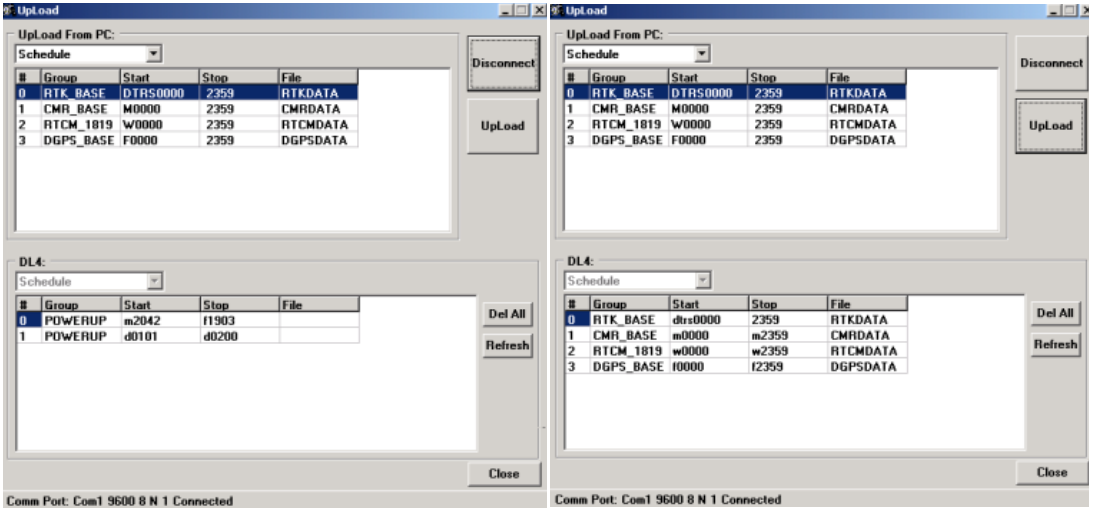
7.3.2 Upload Schedule or Group from the PC to the Receiver

Click on the Upload button in the main DL4Tool window. The Upload dialog will appear.

Click on the Connect button to establish a connection with the receiver. Once connected, this button

turns into a Disconnect button so you can close the current connection with the receiver. A status line at the bottom of the dialog displays the current state of the connection and/or transfer between the PC and the DL-4 receiver. An example of the Upload dialog once a connection has been established can be seen in *Figure 33* on the left. An example of the Upload dialog once the groups or schedule table are uploaded can also be seen in *Figure 33* on the right.

Figure 33: Upload Dialog Before (left) and After (right)



The Upload dialog box displays the current default schedule or group table on the PC in the UpLoad From PC top panel and the schedule table or groups stored on the connected receiver in the bottom DL4 panel. If the receiver is not connected, the DL4 panel is empty.

The schedules or groups displayed in the UpLoad From PC panel are dependant on the filter chosen in its drop down box. Its drop down box lists two choices: Schedules and Groups. The DL4 panel shows only the schedule table and groups stored on the connected receiver.

Up to five groups at a time can be selected for upload from your PC to the receiver. To transfer groups, highlight them from the UpLoad From PC panel and click on the Upload button.

Only one complete schedule table will be transferred and you can not select individual schedule entries. Any groups used in the schedule table must be uploaded first. To transfer a schedule, ensure you have chosen the Schedule filter and click on the Upload button.

The selected schedule table or groups are transferred to the receiver and may then be seen in the DL4 panel. Currently there is no mechanism for transferring files to the DL-4. If you transfer a new schedule from your PC to the receiver, the schedule currently on your receiver will be overwritten.

You may wish to refresh the data displayed in the DL4 panel. To do this, click on the Refresh button. Delete groups or the schedule table from the Compact Flash Card by clicking on the Delete button. Deletion of a group will fail if that group is used in the DL-4 current schedule. In this case, you can delete the DL-4 schedule first and then delete the DL-4 group(s).

To delete all the groups on the DL-4, click on the Delete All button. There is no need to highlight any groups in the DL4 panel in this case. The Delete All button appears dimmed when a schedule is being

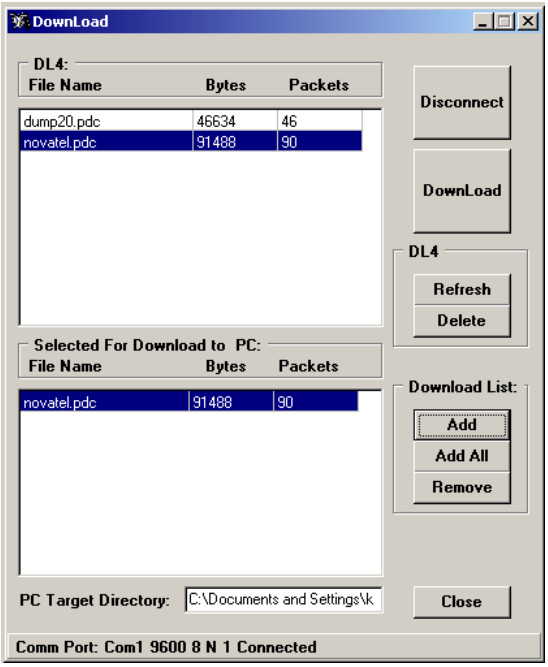
viewed.

The Close button disconnects the DL-4 (if connected), closes the Upload dialog and returns you to the main DL4Tool window.

7.3.3 Download File from the Receiver to the PC

Click on the Download button in the main DL4Tool window. The Download dialog will appear as seen in *Figure 34*.

Figure 34: Download Dialog



Click on the Connect button to establish a connection with the receiver. Once connected, this button turns into a Disconnect button so you can close the current connection with the receiver. A status line at the bottom of the dialog displays the current state of the connection and/or transfer between the DL-4 receiver and the PC. An example of the Download dialog once a connection has been established can be seen in *Figure 34*.

The Download dialog box displays the files stored on the connected receiver in the top DL4 panel and the current file directory location on the PC in the bottom UpLoad From PC panel. If the receiver is not connected, the DL4 panel is empty.

The DL4 panel shows all files stored on the connected receiver.

To transfer a file from the Compact Flash Card to your PC, first edit the destination in the PC Target Directory field at the bottom of the Download dialog. Select a file by highlighting it in the DL4 panel, and click on the Add button. The selected file is added to the lower panel labelled Selected For Download to PC panel.

You may wish to refresh the files on your Compact Flash Card. To do this, click on the Refresh button. Delete files from the Compact Flash Card by clicking on the Delete button. To select all the files on the Compact Flash Card for transfer to the PC, click on the Add All button. There is no need to highlight any files in the upper section in this case. Click on the Remove button to remove files from the Selected For Download to PC.

Click on the Download button to download selected files from the Compact Flash Card to the PC. The selected files are transferred to your PC. You can select one or multiple files at a time.

If, when you try to transfer a file to the PC, a filename already exists in the directory on the PC, you will be prompted with the dialog File Already Exists. This dialog enables you to reply with the following options:

<Overwrite> ..... this option enables you to replace the current file on the PC with the new file from the receiver

<Rename>..... this options enables you to give a different name to the file that you are transferring to the PC

<Cancel>..... this option cancels the file transfer to the PC

The Close button stops any current transfer or attempt to connect to the receiver, closes the Upload dialog and returns you to the main DL4Tool window.

Chapter 8 DL-4 Commands

The DL-4 firmware implements the commands in *Table 14* (repeated in *Table 15 on Page 87* in the order of their binary messages IDs), in addition to the OEM4 GPSCard command set.

Table 14: DL-4 Commands in Alphabetical Order

Message ID	ASCII Command	Description
208	audio	Control the audible annunciator
245	auxbuf	Specify the maximum auxcom data-packet size
24	auxcom	Specify settings for the auxiliary serial port
250	auxmark	Generate a MARK signal when AUX packet is produced
251	auxstart	Specify an AUX data-packet start sequence
252	auxstop	Specify and AUX data-packet stop sequence
253	auxtime	Specify the time out for the auxiliary serial port
52	battery	Control use of the power source(s)
185	currentfile	Specify a file for FILEHDR and FILEDUMP requests
186	currentgroup	Specify a group for GROUPDEF requests
53	del	Delete files from the compact flash card
284	disk	Carry out compact flash card maintenance
20	freset	Factory reset
54	group	Modify log group definitions
66	groupantheight	Edit the antenna height for the group
55	groupantsn	Edit the serial number for the group
65	groupanttype	Edit the antenna type for the group
271	groupdgpstxid	Edit the DGPS base ID configuration for the group
56	groupecutoff	Edit the elevation cut-off configuration for the group
58	groupfixpos	Fix the receiver position when the group is executed
318	groupinterfacemode	Edit the interface mode configuration for the group
64	grouplog	Modify message-logging specifications in a group
57	groupmode	Configure the survey type for a group survey
63	grouppossave	Configure position averaging when the group is executed
62	groupsatlimit	Edit the satellite limit configuration for the group
59	groupsitename	Edit the site name for the group
61	groupsitenumber	Edit the site number for the group

Message ID	ASCII Command	Description
149	groupuse	Group configuration macro to execute DL-4 commands
157	logfile	Manual file logging control
163	methumid	Specify air humidity
164	metpress	Specify air pressure
165	mettemp	Specify ambient temperature
211	project	Project-related parameters
201	rename	Rename a file stored in the compact flash card
18	reset	OEM4 reset with DL-4 features
212	satlimit	Specify number of satellites used in position solution
155	schedule	Modify the logging schedule
152	scheduleadd	Add schedule events to the schedule table
154	scheduledel	Delete individual event entries from the schedule table
166	site	Control site occupations
167	siteupdateantheight	Configure site antenna height information for an occupied site
168	siteupdateanttype	Configure site antenna type information for an occupied site
169	siteupdateattribute	Configure site attribute information for an occupied site
170	siteupdatename	Configure site name information for an occupied site
171	siteupdatenumber	Configure site number information for an occupied site
237	sleep	Enable low-power mode
238	sleepmask	Choose which activity sources prevent the receiver from timing out
213	softpower	Power-button OFF simulation
203	vout	Control peripheral power output
257	write	Create logs containing user data
204	writefile	Write data to a specified file on the compact flash card
240	writefilehex	Create files or append existing file on the compact flash card
205	writehex	Create logs containing user data

Table 15: DL-4 Commands in Order of their Message IDs

Message ID	ASCII Command	Description
18	reset	OEM4 reset with DL-4 features
20	freset	Factory reset
24	auxcom	Specify settings for the auxiliary serial port
52	battery	Control use of the power source(s)
53	del	Delete files from the compact flash card
54	group	Modify log group definitions
55	groupantsn	Edit the serial number for the group
56	groupecutoff	Edit the elevation cut-off configuration for the group
57	groupmode	Configure the survey type for a group survey
58	groupfixpos	Fix the receiver position when the group is executed
59	groupsitename	Edit the site name for the group
61	groupsitenumber	Edit the site number for the group
62	groupsatlimit	Edit the satellite limit configuration for the group
63	grouppossave	Configure position averaging when the group is executed
64	grouplog	Modify message-logging specifications in a group
65	groupanttype	Edit the antenna type for the group
66	groupantheight	Edit the antenna height for the group
149	groupuse	Group configuration macro to execute DL-4 commands
152	scheduleadd	Add schedule events to the schedule table
154	scheduledel	Delete individual event entries from the schedule table
155	schedule	Modify the logging schedule
157	logfile	Manual file logging control
163	methumid	Specify air humidity
164	metpress	Specify air pressure
165	mettemp	Specify ambient temperature
166	site	Control site occupations
167	siteupdateantheight	Configure site antenna height information for an occupied site
168	siteupdateanttype	Configure site antenna type information for an occupied site
169	siteupdateattribute	Configure site attribute information for an occupied site
170	siteupdatename	Configure site name information for an occupied site
171	siteupdatenumber	Configure site number information for an occupied site

Message ID	ASCII Command	Description
185	currentfile	Specify a file for FILEHDR and FILEDUMP requests
186	currentgroup	Specify a group for GROUPDEF requests
201	rename	Rename a file stored in the compact flash card
203	vout	Control peripheral power output
204	writefile	Write data to a specified file on the compact flash card
205	writehex	Create logs containing user data
208	audio	Control the audible annunciator
211	project	Project-related parameters
212	satlimit	Specify number of satellites used in position solution
213	softpower	Power-button OFF simulation
237	sleep	Enable low-power mode
238	sleepmask	Choose which activity sources prevent the receiver from timing out
240	writefilehex	Create files or append existing file on the compact flash card
245	auxbuf	Specify the maximum auxcom data-packet size
250	auxmark	Generate a MARK signal when AUX packet is produced
251	auxstart	Specify an AUX data-packet start sequence
252	auxstop	Specify and AUX data-packet stop sequence
253	auxtime	Specify the time out for the auxiliary serial port
257	write	Create logs containing user data
271	groupdgpstxid	Edit the DGPS base ID configuration for the group
284	disk	Carry out compact flash card maintenance
318	groupinterfacemode	Edit the interface mode configuration for the group

The arguments for each of these commands are described in the following sections.

For a complete listing and description of the other commands that the DL-4 is capable of processing, please consult *Volume 2* of the *OEM4 Family User's Guide*.

8.1 SYNTAX CONVENTIONS

The following rules apply when entering commands, at the command prompt, from a keyboard.

1. The commands are not case sensitive. For example, you could type either <BATTERY A> or <battery a>.
2. Except where noted, either a space or a comma can separate commands and their required entries. For example, you could type either <group del alpha p20a> or <group,del,alpha,p20a>.
3. At the end of a command, a carriage return is required. For example, press <Enter> or <Return>.
4. Responses will be provided to indicate whether or not an entered command was accepted. The format of the response depends on the format of the command. See *Volume 2* of the *OEM4 Family User Manual* for more information.
5. Optional parameters are indicated by square brackets ([ ]). For commands that contain optional parameters, the value used if the optional parameter is not specified is given in the syntax table for the command.
6. Courier font is used to illustrate program output or user input.
7. Data format definitions, as specified in the “Format” field, are detailed in *Volume 2* of the *OEM4 Family User Manual*. Note that all binary data is little-endian byte-ordered.

8.2 AUDIO

The `audio` command controls the audible annunciator.

The `audio default` command sets the audible annunciator parameters to default values (volume and pitch).

The `audio clear` command sets the audible annunciator volume level for all event types to 0 (i.e. disables the audible annunciator) until the next time the receiver is powered on.

The `audio set note|warning|error` *`volume [pitch]`* command configures the audible annunciator for the specified event type, see *Table 18 on Page 91*. *`volume`* is in the range 0-100%, with 0 indicating OFF, and a non-zero value indicating one of 7 volume levels, see *Table 17 on Page 91*. The optional *`pitch`* argument ranges from 1-255 and specifies audio frequency according to the following formula:

output frequency (Hz) = 175,000 / *`pitch`*

Specifying a value of 0 for the pitch indicates that the current value should be used.

Syntax

`audio default|clear`

`audio set [note|warning|error [`*`volume`* `[`*`pitch`*`]]]`

Message Id = 208

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Audio Event, see *Table 16*	NOTE	4	Enum	none	H+4
4	Volume	0	4	Ulong	none	H+8
5	Pitch	0 (no change)	4	Ulong	none	H+12

Table 16: Audio Event

Binary Value	ASCII Value	Description
1	NOTE	*note* event, 2 beeps
2	WARNING	*warning* event, 3 beeps
3	ERROR	*error* event, 4 beeps

Table 17: Audible Annunciator Volume Levels

Volume	Level
0	0
1-15	1
16-30	2
31-45	3
46-60	4
61-75	5
76-90	6
91-100	7

Table 18: Audible Annunciator Events

Event	Type	Duration[a]
Compact flash card error	error	periodic
Compact flash card capacity low	warning	periodic
Insufficient data quality	warning	single
Acceptable data quality	note	single
Battery life below 15 minutes	warning	periodic
Power-button power-down interval begin	note	single
Power-button flash card erase interval begin	note	single
Power-button factory reset interval begin	note	single
Power button stuck	error	periodic

a. Periodic duration means a beep pattern repeating itself for as long as the condition persists. Single duration means one beep pattern when the condition first occurs.

Table 19: AUDIO Default Configuration

Parameter	Power-On	Freset	Stored in NVM
NOTE Volume	100	100	NO
NOTE Pitch	65	65	NO
WARNING Volume	100	100	NO
WARNING Pitch	65	65	NO
ERROR Volume	100	100	NO
ERROR Pitch	65	65	NO

8.3 AUXBUF

The `auxbuf` command allows you to specify the maximum AUX data-packet size.

The `auxbuf set` *`size`* command sets the AUX maximum data-packet size to *`size`* bytes. *`size`* ranges from 0 to 1024.

✉ If 0 is specified then the maximum available size (currently 1024 bytes) is used.

The `auxbuf default` command configures the AUX maximum data-packet size to the factory default setting.

The `auxbuf clear` command configures the AUX maximum data-packet size to be the maximum available size.

Syntax

`auxbuf set [`*`size`*`]`

`auxbuf default|clear`

Message Id = 245

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Page 111*	-	4	Enum	none	H
3	Size	0	4	ULong	bytes	H+4

Table 20: AUXBUF Default Configuration

Parameter	Power-On	Freset	Stored in NVM
Maximum packet size	no change	0 (maximum)	YES

8.4 AUXCOM

The `auxcom` command allows you to specify settings for the auxiliary serial communication port.

The `auxcom set` command configures the auxiliary serial communication port to the specified settings. *`bps`* is one of `2400`, `9600`, `19200`, `38400`, `57600`, `115200`. *`parity`* is one of `n, e` or `o`, representing no parity, even parity or odd parity, respectively. *`databits`* is either `7` or `8`. *`stopbits`* is either `1` or `2`. *`handshake`* is either `n` or `cts`, representing no handshake or hardware handshaking, respectively. *`echo`* is either `off` or `on`.

Note that the DL-4 hardware supports only the RTS portion of hardware handshaking, i.e. the DL-4 is capable of controlling the RTS line to flow-control the device connected to AUX, but the device can not flow-control the DL-4.

The `auxcom default` command configures the auxiliary serial communication port to the factory default settings.

The `auxcom clear` command configures the auxiliary serial communication port settings to defaults.

Syntax

`auxcom set` *`bps`* [*`parity`* [*`databits`* [*`stopbits`* [*`handshake`*] [*`echo`*]]]]

`auxcom default|clear`

Message Id = 24

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Bps	-	4	ULong	baud	H+4
4	Parity, see *Table 21 on Page 94*	N	4	Enum	none	H+8
5	Data bits	8	4	ULong	bits	H+12
6	Stop Bits	1	4	ULong	bits	H+16
7	Handshake, see *Table 22 on Page 94*	N	4	Enum	none	H+20
8	Echo – OnOff, see *Table 81 on Page 147*	OFF	4	Enum	none	H+24

Table 21: Parity

Binary Value	ASCII Value	Description
0	N	No parity
1	E	Even parity
2	O	Odd parity

Table 22: Handshake

Binary Value	ASCII Value	Description
0	N	No handshaking
2	CTS	CTS/RTS hardware handshaking

Table 23: AUXCOM Default Configuration

Parameter	Power-On	Freset	Stored in NVM
baud rate	no change	9600	YES
parity	no change	N	YES
data bits	no change	8	YES
stop bits	no change	1	YES
handshake	no change	N	YES
echo	no change	OFF	YES

8.5 AUXMARK

The `auxmark` command allows you to request that a MARK signal be sent to the DL-4's internal OEM4 family card when an AUX packet is produced. A user can then trigger the generation of messages when the MARK signal is sent to the OEM4 (see the ONMARK trigger in the LOG command, *Volume 2* of the *OEM4 Family Users' Guide).*

The `auxmark set` command configures the DL-4 to generate a MARK signal when an AUX packet is produced. The MARK signal is generated upon detection of a valid packet:

If start-sequence detection is disabled, see *AUXSTART on Page 96,* the MARK is generated upon receipt of the first byte of the packet.

If start-sequence detection is enabled, the MARK is generated upon receipt of the last start-sequence byte of the packet.

The `auxmark default` command sets this feature to the factory default setting.

The `auxmark clear` command disables MARK generation.

Syntax

```
auxmark set|default|clear
```

Message Id = 250

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	4	Enum	none	H

Table 24: AUXMARK Default Configuration

Parameter	Power-On	Freset	Stored in NVM
MARK generation	no change	CLEAR	YES

8.6 AUXSTART

The `auxstart` command allows you to specify an AUX data-packet start sequence.

The `auxstart set` *`size sequence`* command sets the AUX start sequence to *`sequence`*. The *`size`* argument specifies the number of bytes in the start sequence. *`sequence`* is up to 3 concatenated pairs of hexadecimal characters representing up to 3 start-sequence bytes. The start sequence is not discarded, and is recorded in the data packet.

The `auxstart default` command configures the auxiliary serial communication port start sequence to the factory default setting.

The `auxstart clear` command disables AUX start-sequence detection. In this mode, any incoming data will initiate recording into a data packet.

Syntax

`auxstart set [`*`size`* `[`*`sequence`*`]]`

`auxstart default|clear`

Message Id = 251

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Size	0	4	ULong	bytes	H+4
4	Sequence	NUL	3	Hexbyte	none	H+8

Table 25: AUXSTART Default Configuration

Parameter	Power-On	Freset	Stored in NVM
start-sequence size	no change	0	YES
start sequence	no change	none	YES

8.7 AUXSTOP

The `auxstop` command allows you to specify an AUX data-packet stop sequence.

The `auxstop set` *`size sequence`* command sets the AUX packet-stop sequence to *`sequence`*. The *`size`* argument specifies the number of bytes in the stop sequence. *`sequence`* is up to 3 concatenated pairs of hexadecimal characters representing up to 3 bytes. The stop sequence is not discarded, and is recorded in the data packet.

The `auxstop default` command configures the AUX packet-stop sequence to the factory default setting.

The `auxstop clear` command disables AUX packet-stop-sequence detection.

Syntax

`auxstop set [`*`size`* `[`*`sequence`*`]]`

`auxstop default|clear`

Message Id = 252

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Size	0	4	ULong	bytes	H+4
4	Sequence	NUL	3	Hexbyte	none	H+8

Table 26: AUXSTOP Default Configuration

Parameter	Power-On	Freset	Stored in NVM
stop-sequence size	no change	0	YES
stop sequence	no change	none	YES

8.8 AUXTIME

The `auxtime` command allows you to specify the time out for the auxiliary communication port.

The `auxtime set` *`timeout`* command sets the AUX timeout to *`timeout`*, in milliseconds. The resolution of *`timeout`* is 100ms.

The `auxtime default` command sets the AUX timeout to the factory default setting.

The `auxtime clear` command disables the AUX timeout feature.

Syntax

`auxtime set [`*`timeout`*`]`

`auxtime default|clear`

Message Id = 253

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Timeout	0	4	ULong	ms	H+4

Table 27: AUXTIME Default Configuration

Parameter	Power-On	Freset	Stored in NVM
timeout	no change	1000 ms	YES

8.9 BATTERY

The `battery` command allows you to specify the battery or DC power supply that is to be used as the system power source and set battery-cutoff voltages. System settings configured with the `battery` command can be displayed with the `batstatus` log, see *Page 157*.

The `battery cutoff` command allows you to specify cutoff voltages. Specifying `a` or `b` indicates that the specified *`min_volt`* applies to power source A or B, respectively. Specifying `auto` will restore default cutoff voltages to all power sources. *`min_volt`* is specified in mV, and ranges between 6000 and 15000 mV. If the DL-4 is powered on and the power source goes below the cutoff voltage, the DL-4 will shut off. If the DL-4 is not powered on, the applied power source must be 0.5 V above the cutoff voltage before the DL-4 can turn on.

✉ If a 12 V battery is being used, the cutoff voltage should be set to 10.5 to protect the battery from over-discharge.

Specifying automatic battery selection (`auto`) causes the receiver to select the first available source, in the order: source A, and then source B. If no preference mode is specified, `auto` mode is assumed. The cutoff for `auto` mode is 6.5 V.

Table 28 summarizes the effect of certain actions on battery selection. In this table, “auto select” is equivalent to “`battery use auto`” command. In the OFF state, “no change” means that battery selection will be the same when the receiver is powered ON, as compared to when the receiver was last ON.

Syntax

`battery cutoff [{a` *`min_volt`*`}|{b` *`min_volt`*`}|auto]`

`battery use [a|b|auto]`

Message Id = 52

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Battery Actions, see *Table 29 on Page 100*	-	4	Enum	none	H
3	Battery Mode, see *Table 30 on Page 100*	AUTO	4	Enum	none	H+4
4	Cutoff voltage	6500	4	Ulong	mV	H+8

Table 28: Action Versus Power Source Selection

Action	OFF	ON, Using A	ON, Using B
All power sources removed	auto select	auto select	auto select
Unused source becomes unavailable	no change	no change	no change
Current source becomes unavailable[a]	no change	auto select	auto select
A becomes available	no change	N/A	no change
B becomes available	no change	no change	N/A
Factory Reset	N/A	auto select	auto select
User selects A, A is available	N/A	use A	use A
User selects B, B is available	N/A	use B	use B
User selects A, A is unavailable	N/A	N/A	no change
User selects B, B is unavailable	N/A	no change	N/A

a. Removal of the active power source is not supported in the current revision of hardware, and may result in undefined system behavior

Table 29: Power Source Action

Binary Value	ASCII Value	Description
1	USE	Use the source
2	CUTOFF	Set battery cutoff

Table 30: Power Source Mode

Binary Value	ASCII Value	Description
0	A	The A battery or DC supply
1	B	The B battery or DC supply
2	Reserved	
3	AUTO	Auto detect

Table 31: BATTERY Default Configuration

Parameter	Power-On	Freset	Stored in NVM
Power source A cutoff	no change	6.5V	YES
Power source B cutoff	no change	6.5V	YES
Power source use	no change	auto	YES

✉ A factory reset may result in inability to power the receiver ON when the receiver is used with batteries which use lower cutoff voltage than factory-reset defaults. After a factory reset, the receiver will shutdown immediately if all available power source levels are below factory defaults.

8.10 CURRENTFILE

The `currentfile` command allows you to specify a file to which subsequent requests for `filehdr` and `filedump` logs apply, see *Pages 163-164.*

Specified without arguments, the `currentfile` command clears any previously configured `currentfile` settings. The `currentfile` *`file`* command:

- Configures the *currentfile* to *`file`*. *`file`* is a name of a file on the flash card specified in a *base.ext* format, where *base* is maximum 8 characters and the optional *ext* is maximum 3 characters. Subsequent requests for the `filehdr` log, see *Page 164*, will display the `filehdr` log read from *`file`*. Subsequent requests for the `filedump` log, see *Page 163*, will transfer *`file`* in `filedump` log packets.
- Issued with the dump mode specified as `all`, causes the receiver to transfer the entire file on all subsequent requests for the `filedump` log.
- Issued with the transfer mode specified as `{single [`*`packet_id`*`]}`, causes the receiver to transfer only file packet number *`packet_id`* on all subsequent requests for the `filedump` log. *`packet_id`* ranges from 0 to SizePackets-1, see the `dirent` log on *Page 161*. The first packet is numbered 0. Packet size is defined in the `file` log definition.
- Issued without specifying the dump mode, defaults the dump mode to `all`.

Syntax

`currentfile`

`currentfile` *`file`* `[all|{single [`*`packet_id`*`]}]`

Message Id = 185

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	File	-	12	Char[]	none	H
3	Dump Mode, see *Table 32*	ALL	4	Enum	none	H+12
4	Packet Id	0	4	Ulong	none	H+16

Table 32: Dump Mode

Binary Value	ASCII Value	Description
0	ALL	Send all packets on dump
1	SINGLE	Send single packet on dump

Table 33: CURRENTFILE Default Configuration

Parameter	Power-On	Freset	Stored in NVM
currentfile	none	none	NO

8.11 CURRENTGROUP

The `currentgroup` command allows you to specify a group to which subsequent requests for `groupdef`, see *Page 166*, apply. If no group is specified, the currentgroup setting is cleared, and requests for `groupdef` logs list the entire group table.

Syntax

`currentgroup [`*`group`*`]`

Message Id = 186

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header			-	-	0
2	Group Name	NUL	12	Char[]	none	H

Table 34: CURRENTGROUP Default Configuration

Parameter	Power-On	Freset	Stored in NVM
currentgroup	none	none	NO

8.12 DEL

The `del` command allows you to delete files from the flash card.

The `del all` command deletes all files from the flash card. This operation is not reversible. The `del all` command fails if there are any open files.

The `del file file` command deletes the file named *`file`* from the flash card. *`file`* is a name of a file on the flash card specified in a *base.ext* format, where *base* is maximum 8 characters and the optional *ext* is maximum 3 characters. The `del file file` command fails if *`file`* is open.

Syntax

`del all|{file file}`

Message Id = 53

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Delete Target, see *Table 35*	4	Enum	none	H
3	File	12	Char[]	none	H+4

Table 35: Delete Target

Binary Value	ASCII Value	Description
0	ALL	Delete all files
1	FILE	Delete the filename specified

✉ A default configuration is not applicable to this command.

8.13 DISK

The `disk` command allows you to carry out flash-disk (compact flash) maintenance.

The `disk format` command formats the flash disk for use with DL-4. The format sequence erases all data previously stored on the disk. This operation is not reversible.

✉ Prior to issuing a `disk format` command, all logs being sent to file should be unlogged. If a group is being logged, the `groupuse stop` command should be issued.

Syntax

`disk format`

Message Id = 284

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Disk operation, see *Table 36*	4	Enum	-	H

Table 36: Disk Operation

Binary Value	ASCII Value	Description
1	FORMAT	Format the flash disk.

✉ A default configuration is not applicable to this command.

8.14 FRESET

The OEM-4 `freset` command is extended to include DL-4 features. An additional “target” field `controller` (value = 10), resets only the controller NVM, thereby resetting all parameters indicated in this document as “Stored in NVM” to factory defaults. Issuing the `freset` command with the “target” field set to `standard`, resets the controller NVM as well as OEM4 parameters as indicated in the *OEM4 Family User Manual*.

✉ A default configuration is not applicable to this command.

8.15 GROUP

A *group* is a set of log specifiers and configuration parameters that will normally be used together in a specific scenario. When a group is *executed*, the information contained in a group is mapped into a series of receiver commands which have the same effect as if you entered the commands individually. Thus, the group can be viewed as a “batch file” for configuration of a specific set of receiver parameters.

A maximum of five groups is supported. Upon creation, the group is added to the *group table* which is stored in non-volatile memory (NVM – which is preserved through a complete power failure). Any modifications to the group parameters are also immediately stored in the NVM.

If a group named "POWERUP" is defined, this group's log specification shall be executed with `groupuse start powerup file` upon first acquisition of time after a powerup with a power button or after powerup with a `freset` and exclude any other pending scheduler activity.

The `group` command allows you to create and manipulate groups. Configuration of group parameters is handled by commands described in *GROUP on Page 105* to *GROUPLOG on Page 114*.

The `group add` *`groupname1`* command creates a group named *`groupname1`* and add it to the group table. A maximum of ten groups is supported; the `group add` command will fail if a group needs to be added and ten groups already exist (i.e. the group table is full).

The `group del` *`groupname1`* command deletes the group named from the group table (and thus the NVM). This operation is not reversible.

The `group clear` command deletes all groups from the group table (and thus the NVM). This operation is not reversible.

The `group copy` *`groupname1 groupname2`* command copies group information from group *`groupname1`* to group *`groupname2`*. If a group named *`groupname2`* already exists, it is overwritten by *`groupname1`*. This operation is not reversible.

Syntax

`group add` *`groupname1`*

`group del` *`groupname1`*

`group clear`

`group copy` *`groupname1 groupname2`*

Message Id = 54

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Action, see *Table 37*	4	Enum	none	H
3	GroupName1	12	Char[]	none	H+4
4	GroupName2	12	Char[]	none	H+16

Table 37: Action

Binary Value	ASCII Value	Description
0	ADD	Add a group
1	DEL	Delete a group
2	CLEAR	Erase all groups
3	COPY	Copy one group to another

Table 38: GROUP Default Configuration

Parameter	Power-On	Freset	Stored in NVM
Group table	no change	Only DEFAULT group, see *Page 106*	YES

8.15.1 Factory-Reset DEFAULT Group

The factory-reset DEFAULT group is defined as follows:

- RANGECMPB ONTIME 10
- ALMANACB ONCHANGED
- RAWEPHEMB ONCHANGED
- IONUTCB ONCHANGED
- RTCAOBS ONTIME 1
- RTCAREF ONTIME 10
- RXSTATUSEVENTB ONNEW
- HWLEVELSB ONTIME 60
- POSAVE 0.01
- INTERFACEMODE COM2 NONE RTCA OFF

✉ You may edit or delete the factory-reset DEFAULT group.

8.16 GROUPANTHEIGHT

The `groupantheight` command allows you to edit the antenna height definition for the group.

The `groupantheight set` command sets the antenna height for the group named *`groupname`* to *`antheight`*.

The `groupantheight clear` command removes the antenna height setting from the group named *`groupname.`*

The `groupantheight default` command sets the antenna height for the group to `0.`

Syntax

`groupantheight set` *`groupname`* `[`*`antheight`*`]`

`groupantheight default|clear` *`groupname`*

8.16.1 Groupuse Translation

`groupuse start`

- The antenna height setting is reflected in the `groupdef` log.
- If an automatic site is being generated (see `groupmode`), the group antenna height is used in site configuration.

`groupuse stop`

- None.

Message Id = 66

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Group name	-	12	Char[]	none	H+4
4	AntHeight	0	4	Float	none	H+16

Table 39: GROUPANTHEIGHT Default Configuration

Parameter	Power-On	Freset	Stored in NVM
antheight	no change	0	YES

8.17 GROUPANTSN

The `groupantsn` command allows you to edit the antenna serial number definition for the group.

The `groupantsn set` command sets the antenna serial number for the group named *`groupname`* to *`antsn`*.

The `groupantsn clear` command removes the antenna serial number setting from the group named *`groupname.`*

The `groupantsn default` command removes the antenna serial number setting from the group named *`groupname.`*

Syntax

`groupantsn set` *`groupname`* [*`antsn`*]

`groupantsn default|clear` *`groupname`*

8.17.1 Groupuse Translation

`groupuse start`

- The antenna serial number setting is reflected in the `groupdefb` log.

`groupuse stop`

- None.

Message Id = 55

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Group name	-	12	Char[]	none	H+4
4	AntSn: Antenna Serial Number	NUL	16	Char[]	none	H+16

Table 40: GROUPANTSN Default Configuration

Parameter	Power-On	Freset	Stored in NVM
antsn	no change	NUL	YES

8.18 GROUPANTTYPE

The `groupanttype` command allows you to edit the antenna type definition for the group.

The `groupanttype set` command sets the antenna type for the group named *`groupname`* to *`anttype`*.

The `groupanttype clear` command removes the antenna type setting from the group named *`groupname.`*

The `groupanttype default` command removes the antenna type setting from the group named *`groupname.`*

Syntax

`groupanttype set` *`groupname`* [*`anttype`*]

`groupanttype default|clear` *`groupname`*

8.18.1 Groupuse Translation

`groupuse start`

- The antenna type is reflected in the `groupdef` log.
- If an automatic site is being generated (see `groupmode` on *Page 116*), the group antenna type is used in site configuration.

`groupuse stop`

- None.

Message Id = 65

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Group name	-	12	Char[]	none	H+4
4	AntType	NUL	16	Char[]	none	H+16

Table 41: GROUPANTTYPE Default Configuration

Parameter	Power-On	Freset	Stored in NVM
anttype	no change	NUL	YES

8.19 GROUPDGPSTXID

The `groupdgpstxid` command allows you to edit the DGPS base id configuration for the group. The group can be configured to store base id for one DGPS message type.

The `groupdgpstxid set` command sets the DGPS base id configuration for the group named *`groupname`* to *`type`* and *`id`* (refer to the OEM4 GPSCard documentation, DGPSTXID command, for further details on *`type`* and *`id`*).

The `groupdgpstxid clear` command removes the DGPS base id configuration from the group named *`groupname.`*

The `groupdgpstxid default` command removes the DGPS base id configuration from the group named *`groupname.`*

Syntax

`groupdgpstxid set` *`groupname type id`*

`groupdgpstxid default|clear` *`groupname`*

8.19.1 Groupuse Translation

`groupuse start`

- If set, the `dgpstxid` command is issued.

`groupuse stop`

- None.

Message Id = 271

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	4	Enum	none	H
3	Group name	12	Char[]	none	H+4
4	DGPS Type, see *Table 92 on Page 168*	4	Enum	none	H+16
5	ID	5	Char[]	none	H+20

Table 42: GROUPDGPSTXID Default Configuration

Parameter	Power-On	Freset	Stored in NVM
type	no change	AUTO	YES
id	no change	NUL	YES

8.20 GROUPECUTOFF

The `groupecutoff` command allows you to edit the elevation cut-off configuration for the group.

`groupecutoff set` sets cutoff for the group named *`groupname`* to *`ecutoff`*.
`groupecutoff clear` removes the cutoff setting from the group named *`groupname.`*
`groupecutoff default` sets the elevation cutoff for the group to 0.

Syntax

`groupecutoff set` *`groupname`* [*`ecutoff`*]

`groupecutoff default|clear` *`groupname`*

8.20.1 Groupuse Translation

`groupuse start`

- If set, the `ecutoff` command is issued.

`groupuse stop`

- None.

Message Id = 56

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Group name	-	12	Char[]	none	H+4
4	Ecutoff	0	4	Float	none	H+16

Table 43: Parameter Update

Binary Value	ASCII Value	Description
0	DEFAULT	Set the parameter for a group to the default
1	SET	Set the parameter for a group
2	CLEAR	Clear the parameter from a group

Table 44: GROUPECUTOFF Default Configuration

Parameter	Power-On	Freset	Stored in NVM
ecutoff	no change	0	YES

8.21 GROUPFIXPOS

The `groupfixpos` command allows you to configure the group to fix the receiver position when the group is executed. `groupfixpos` and `groupposave` configurations are mutually exclusive, and the last setting to be entered takes effect.

`groupfixpos set` configures the group to fix the position to *`lat long height.`* `groupfixpos clear` clears the group position-fix configuration. `groupfixpos default` clears the group position-fix configuration.

Syntax

`groupfixpos set` *`groupname`* [*`lat`* [*`long`* [*`height`*]]]

`groupfixpos default|clear` *`groupname`*

8.21.1 Groupuse Translation

`groupuse start`

- If position fixing is configured in the group, the `fix position` command is executed with the supplied parameters.

`groupuse stop`

- If position fixing is configured in the group, issues a `fix none` command.

Message Id = 58

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Group name	-	12	Char[]	none	H+4
4	Latitude	0	8	Double	degrees	H+16
5	Longitude	0	8	Double	degrees	H+24
6	Height	0	8	Double	degrees	H+32
7	Reserved for future use	-1	4	Int	none	H+40
8		-1	4	Int	none	H+44

Table 45: GROUPFIXPOS Default Configuration

Parameter	Power-On	Freset	Stored in NVM
Fixed Position Configuration	no change	CLEAR	YES

8.22 GROUPINTERFACEMODE

The `groupinterfacemode` command allows you to edit the interface mode configuration for the group. The group can be configured to issue the interfacemode command to COM1 and/or COM2.

The `groupinterfacemode set` command sets the interface mode configuration for the group named *`groupname`* and *`port`* to the specified parameters (refer to the OEM4 GPSCard documentation, `interfacemode` command, for further details on *`rx_type tx_type`* and *`responses`*). *`port`* can be `com1` or `com2`.

The `groupinterfacemode clear` command removes (disables) the interface mode configuration for all ports from the group named *`groupname.`*

The `groupinterfacemode default` command removes (disables) the interface mode configuration for all ports from the group named *`groupname.`*

Syntax

`groupinterfacemode set` *`groupname`* [*`port`*] [*`rx_type`* [*`tx_type`*]] [*`responses`*]

`groupinterfacemode default|clear` *`groupname`*

8.22.1 Groupuse Translation

`groupuse start`

- If set for the particular port, the `interfacemode` command is issued for the port.

`groupuse stop`

- None.

Message Id = 318

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Group name	-	12	Char[]	none	H+4
4	Serial Port Identifier, see *Chapter 9, Table 87 on Page 159*	NO_PORT	4	Enum	none	H+16
5	rx_type – Serial Port Interface Mode, see *Table 90 on Page 160*	NOVATEL	4	Enum	none	H+20
6	tx_type – Serial Port Interface Mode, see *Table 90 on Page 160*	NOVATEL	4	Enum	none	H+24
7	responses – OnOff, see *Table 81 on Page 147*	ON	4	Enum	none	H+28

Table 46: GROUPINTERFACEMODE Default Configuration

Parameter	Power-On	Freset	Stored in NVM
COM1 RX type	no change	NOVATEL	YES
COM1 TX type	no change	NOVATEL	YES
COM1 responses	no change	ON	YES
COM2 RX type	no change	NONE	YES
COM2 TX type	no change	RTCA	YES
COM2 responses	no change	OFF	YES

8.23 GROUPLOG

The `grouplog` command allows you to modify the message-logging specifications in a group. A maximum of 20 message-logging specifications is supported.

The `grouplog add` command allows you to add message-logging specifications to a group.

- The message-logging specification is added to a group named *`group`*. If a group named *`group`* does not exist, the group is created. The `grouplog add` command fails if a group needs to be created and the group table is full.
- *`dst`* specifies the destination to which the requested message is to be sent when the group is executed. If *`dst`* is not specified (or specified as `no_port`), the group-default destination is assumed (the destination which is specified at the time the group is executed). See *Table 87 on Page 159* for a list of valid port identifiers.
- *`message`* specifies a valid ASCII or binary DL-4 message (abbreviated-ASCII messages are not supported) which is to be requested when the group is executed.
- *`trigger`* specifies a valid OEM-4 message trigger which applies to this log specification (see the `log` command in *Volume 2* of the *OEM4 Family Users' Guide*).
- *`period`* specifies the repetition period for this message (see the `log` command).
- Within one group, the *`message-dst`* combination must be unique. The `grouplog add` command fails if an attempt is made to add a message-logging specification with a *message* and *dst* which are the same as a previously-entered specification in the same group.
- Message-logging specifications that are added are automatically saved to NVM.
- The `grouplog del` command allows you to delete message-logging specifications from a group.
- *`dst`* and *`message`* identify a unique message-logging specification to be deleted. If *`dst`* is not specified, the group-default destination is assumed.
- Message-logging specifications that are deleted are automatically deleted from NVM. This operation is not reversible.

Syntax

```
grouplog add group [dst] message [trigger [period]]
grouplog del group [dst] message
```

8.23.1 Groupuse Translation

`groupuse start`

- For each message-logging specification, a `log` command is issued.
- For each message-logging specification, *`dst`* is added to the groupuse destination list (see the `groupuse` command on *Page 121*)

`groupuse stop`

- For each message-logging specification, an `unlog` command is issued.
- For each message-logging specification, *`dst`* is added to the groupuse destination list (see the `groupuse` command)

✉ Action will be limited to ADD and DEL for this command.

Message Id = 64

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Action, see *Table 37 on Page 106*	-	4	Enum	none	H
3	Group Name	-	12	Char[]	none	H+4
4	Serial Port Identifier, see *Table 87 on Page 159*	NO_PORT	4	Enum	none	H+16
5	Message ID	-	4	Ulong	none	H+20
6	Trigger (see the LOG command in *Volume 2* of the *OEM4 Family Users' Guide*)	ONCE	4	Enum	none	H+24
7	Period	0	4	Float	seconds	H+28

Table 47: GROUPLOG Default Configuration

Parameter	Power-On	Freset	Stored in NVM
Log configuration	no change	See *Section 8.15.1, Factory-Reset DEFAULT Group* on *Page 106*	YES

8.24 GROUPMODE

The `groupmode` command configures the survey type for a survey carried out with the group.

The `groupmode set kinematic|static` command sets the survey type for the group named *`groupname`* to the specified mode. The `groupmode clear` command sets the survey type for the group to `static.` The `groupmode default` command sets the survey type for the group to `static`.

Syntax

`groupmode set` *`groupname`* `[kinematic|static]`

`groupmode default|clear` *`groupname`*

8.24.1 Groupuse Translation

`groupuse start`

- If the groupmode is set to `static`, a `site add` command is executed, and the site is configured with parameters defined by `groupantheight`, `groupsitenumber`, `groupsitename`, and `groupanttype` commands.

`groupuse stop`

- None.

Message Id = 57

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Group name	-	12	Char[]	none	H+4
4	Group Mode, see *Table 48*	STATIC	4	Enum	none	H+16

Table 48: Group Mode

Binary Value	ASCII Value	Description
0	STATIC	Set group mode to static
1	KINEMATIC	Set group mode to kinematic

Table 49: GROUPMODE Default Configuration

Parameter	Power-On	Freset	Stored in NVM
Group Mode	no change	KINEMATIC	YES

8.25 GROUPPOSAVE

The `groupposave` command allows you to configure position averaging to commence when the group is executed. `groupfixpos` and `groupposave` configurations are mutually exclusive, and the last setting to be entered takes effect.

The `groupposave set` command configures the group for position-averaging with parameters set to *`maxtime`*, *`maxhorstd`* and *`maxverstd`*.

The `groupposave clear` command clears the group position-average configuration.

The `groupposave default` command clears the group position-average configuration.

Syntax

`groupposave set` *`groupname`* [*`maxtime`* [*`maxhorstd maxverstd`*]]

`groupposave default|clear` *`groupname`*

8.25.1 Groupuse Translation

`groupuse start`

- If position averaging is configured in the group, the `posave` command is executed with averaging time, maximum horizontal and vertical standard deviation set to the configured values.

`groupuse stop`

- If position averaging is configured in the group, cancels position averaging and issues a `fix none` command.

Message Id = 63

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Group name	-	12	Char[]	none	H+4
4	MaxTime	0	8	Double	hours	H+16
5	MaxHorStd	0	8	Double	none	H+24
6	MaxVerStd	0	8	Double	none	H+32

Table 50: GROUPSAVE Default Configuration

Parameter	Power-On	Freset	Stored in NVM
maxtime	no change	0.01	YES
maxhorstd	no change	0	YES
maxverstd	no change	0	YES

8.26 GROUPSATLIMIT

The `groupsatlimit` command allows you to edit the satlimit configuration for the group. The `groupsatlimit set` command sets satlimit for the group named *`groupname`* to *`satlimit`*. The `groupsatlimit clear` command removes the satlimit setting from the group named *`groupname`*. The `groupsatlimit default` command sets the satlimit for the group to 0.

Syntax

`groupsatlimit set` *`groupname`* [*`satlimit`*]

`groupsatlimit default|clear` *`groupname`*

8.26.1 Groupuse Translation

`groupuse start`

- If set, the `satlimit` command, see *Page 129*, is issued for each virtual channel associated with a logfile by this `groupuse start` command.

`groupuse stop`

- None.

Message Id = 62

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Group name	-	12	Char[]	none	H+4
4	Satellite Limit	0	4	Int	none	H+16

Table 51: GROUPSATLIMIT Default Configuration

Parameter	Power-On	Freset	Stored in NVM
Satellite Limit	no change	0	YES

8.27 GROUPSITENAME

The `groupsitename` command allows you to edit the site name definition for the group.

The `groupsitename set` command sets the site name for the group named *`groupname`* to *`sitename`*.

The `groupsitename clear` command removes the site name setting from the group named *`groupname.`*

The `groupsitename default` command removes the site name setting from the group named *`groupname.`*

Syntax

`groupsitename set` *`groupname sitename`*

`groupsitename default|clear` *`groupname`*

8.27.1 Groupuse Translation

`groupuse start`

- The site name is reflected in the `groupdef` log.
- If an automatic site is being generated (see the `groupmode` command on *Page 116*), the group site name is used in site configuration. If the group site name is not specified and an automatic site is being generated, the log file name is used as the site name.

`groupuse stop`

- None.

Message Id = 59

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	4	Enum	none	H
3	Group name	12	Char[]	none	H+4
4	Site Name	32	Char[]	none	H+16

Table 52: GROUPSITENAME Default Configuration

Parameter	Power-On	Freset	Stored in NVM
sitename	no change	NUL	YES

8.28 GROUPSITENUMBER

The `groupsitenumber` command allows you to edit the site number definition for the group.

The `groupsitenumber set` command sets the site number for the group named *`groupname`* to *`sitenumber`*.

The `groupsitenumber clear` command removes the site number setting from the group named *`groupname.`*

The `groupsitenumber default` command removes the site number setting from the group named *`groupname.`*

Syntax

`groupsitenumber set` *`groupname`* [*`sitenumber`*]

`groupsitenumber default|clear` *`groupname`*

8.28.1 Groupuse Translation

Syntax

`groupuse start`

- The site number setting is reflected in the `groupdef` log.
- If an automatic site is being generated (see the `groupmode` command on *Page 116*), the group site number is used in site configuration.

`groupuse stop`

- None.

Message Id = 61

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Group name	-	12	Char[]	none	H+4
4	Site Number	NUL	8	Char[]	none	H+16

Table 53: GROUPSITENUMBER Default Configuration

Parameter	Power-On	Freset	Stored in NVM
sitenumber	no change	NUL	YES

8.29 GROUPUSE

The `groupuse` command is a macro which uses the group configuration to execute a set of DL-4 commands.

The `groupuse start` command executes the *start macro* for the group named *`groupname,`* with the default log destination set to *`dst`*. If *`dst`* is not specified, THISPORT is assumed. If any message-logging destinations are FILE_*n*, *`filename`* is associated with these destinations. If *`filename`* is not specified, it is automatically generated as per the `logfile` command.

The `groupuse start` command interprets the group configuration as follows:

- The *groupuse destination list* is assembled, representing all destinations to be used by the group.
- For each destination in the groupuse destination list, an `unlogall` command is issued.
- If the groupuse destination list contains any FILE_*n*, destinations, a `logfile close` command is issued, closing current logfile (if open).
- For each FILE_*n* destination in the groupuse destination list, a `logfile` command is issued, associating the destination with *`filename`*.
- The file-header destination, *`hdrdst`*, is selected as the first FILE_*n* destination in the destination list. If no FILE_*n* destination exists steps 6-11 are omitted.
- `log` *`hdrdst`* `versionb` command is issued.
- `log` *`hdrdst`* `timeb` command is issued.
- If a project has been defined, `log` *`hdrdst`* `projectdefb` command is issued.
- The `currentgroup` *`groupname`* command is issued.
- The `log` *`hdrdst`* `groupdefb` command is issued.
- The `currentgroup` command is issued.
- `groupinterfacemode` configuration is executed.
- `groupdgpstxid` configuration is executed
- `groupecutoff` configuration is executed.
- `groupsatlimit` configuration is executed.
- `groupposfix` or `groupposave` configuration is executed.
- If a file is opened in step 4, `groupmode` (in conjunction with `groupantheight`, `groupsitenumber`, `groupsitename`, and `groupanttype`) configuration is executed.
- `grouplog` configuration is executed.

The `groupuse stop` command executes the *stop macro* for the group named *`groupname,`* with the default log destination set to *`dst`*. If *`dst`* is not specified, THISPORT is assumed.

The `groupuse stop` command interprets the group configuration as follows:

- The *groupuse destination list* is assembled, representing all destinations to be used by the group.

- For each destination in the groupuse destination list, an `unlogall` command is issued (for the particular virtual channel).
- If the groupuse destination list contains any FILE_*n* destinations, and a site has been defined, a `site leave` command is issued.
- For each FILE_*n* destination in the groupuse destination list, a `logfile` command is issued, terminating the associating the destination with the logfile.
- `groupposfix` or `groupposave` configuration is executed.

✉ An OK response to the `groupuse` command does not guarantee that all steps in the `groupuse` sequence have completed successfully.

✉ A response to the `groupuse` command does not guarantee that the sequence has completed execution. If it is important to guarantee that a subsequent command is executed *after* the entire `groupuse` sequence has been completed, the "Groupuse execution in progress" bit in the Auxiliary 2 status word in the `rxstatus` log, see *Page 171*, should be used.

Syntax

`groupuse start|stop` *`groupname`* `[`*`dst`*`] [`*`filename`*`]`

Message Id = 149

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Group Action, see *Table 54 on Page 122*	-	4	Enum	none	H
3	Group name	-	12	Char[]	none	H+4
4	Serial Port Identifier, see *Chapter 9, Table 87 on Page 159*	THISPORT	4	Enum	none	H+16
5	Filename	NUL	12	Char[]	none	H+20

Table 54: Group Action

Binary Value	ASCII Value	Description
0	START	Start the specified group
1	STOP	Stop the specified group

✉ A default configuration is not applicable to this command.

8.30 LOGFILE

A *logfile* is a file on the compact flash disk with properties which are defined in *Section 9.1, PDC Files on Page 154*. The `logfile` command opens a logfile, associates a virtual channel with a logfile or closes a logfile. Only one logfile can be open at one time. A logfile cannot be reopened for further logging after it has been closed.

The `logfile open` command associates a virtual channel(s) with a logfile.

- If *`channel`* is specified, *channel* is associated with the logfile. If *channel* is not specified, all available virtual channels `FILE_`*`n`* are associated with the logfile.
- If *`file`* is specified, the virtual channel(s) is associated with a logfile named *`file`*. *`file`* is specified in a *base.ext* format, where *base* is maximum 8 characters and the optional *ext* is maximum 3 characters. Regardless of what extension is specified and if the extension is specified, the extension used for file creation is “pdc”. If *`file`* is not specified, a default filename is created for the logfile as follows:
    - The first four characters is taken from the last four digits of the DL-4 serial number.
    - The second three characters is three digits representing the UTC day-of-year (i.e. in the range 001-366).
    - The last character is an alphanumeric character denoting the session id, assigned in the sequence 0,…,9,A,…,Z. The first available session id is used (i.e. a session id which results in a filename which does not conflict with an existing file on the flash card.
- If no channel was previously associated with the logfile (i.e. the logfile has not been previously opened), the logfile is opened. If the logfile has been previously associated with a virtual channel(s) (i.e. the log file is open), the virtual channel(s) is associated with the already open logfile. This command fails if a logfile is already open and a new logfile needs to be opened in the course of execution of this command.
- You must specify *`channel`* if you wish to specify *`file`* which is a valid ASCII value in File Port Channel, see *Table 62 on Page 130*. This resolves the ambiguity as to which of the two fields has been entered.
- The `logfile close` terminates an association of a virtual channel(s) with a logfile.
- If *`channel`* is specified, association of virtual channel *`channel`* with the logfile is terminated. If *`channel`* is not specified, association of all virtual channels with the logfile is terminated, and the logfile is closed.
- If *`file`* is specified, the association(s) is terminated only if the association is with a logfile named *`file`*. If *`file`* is not specified, the association(s) is terminated for any logfile.
- If the association which has been terminated is the last one for the logfile, the logfile is closed.
- You must specify *`channel`* if you wish to specify *`file`* which is a valid ASCII value in File Port Channel, see *Table 62 on Page 130*. This resolves the ambiguity as to which of the two fields has been entered.

Syntax

`logfile open|close [channel file]`

Message Id = 157

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Log File Action, see *Table 55*	-	4	Enum	none	H
3	File Port Channel, see *Table 62 on Page 130*	FILE_ALL	4	Enum	none	H+16
4	Filename	NUL	12	Char[]	none	H+4

Table 55: Log File Action

Binary Value	ASCII Value	Description
0	OPEN	Associate the specified channel with a file.
1	CLOSE	Terminate the specified channel-file association.

Table 56: LOGFILE Default Configuration

Parameter	Power-On	Freset	Stored in NVM
logfile	none	none	NO

8.31 METHUMID

The `methumid` command allows you to specify air humidity. Humidity specified with the `methumid` command does not affect receiver operation. Rather, it allows you to create a record of atmospheric conditions for post-processing purposes.

The `methumid set` command specifies air humidity at *`humid`*. This command only stores the humidity value in volatile memory, and does not automatically generate a record. The humidity value can then be displayed/recorded by requesting the `met` log.

The `methumid clear` command clears the humidity setting.

The `methumid default` command clears the humidity setting.

Syntax

`methumid set [humid]`

`methumid default|clear`

Message Id = 163

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Humidity	0	4	Float	percent	H+4

Table 57: METHUMID Default Configuration

Parameter	Power-On	Freset	Stored in NVM
methumid	clear	clear	NO

8.32 METPRESS

The `metpress` command allows you to specify air pressure. Air pressure specified with the `metpress` command does not affect receiver operation. Rather, it allows you to create a record of atmospheric conditions for post-processing purposes.

The `metpress set` command specifies air pressure at *`press`*. This command only stores the pressure value in volatile memory, and does not automatically generate a record. The humidity value can then be displayed/recorded by requesting the `met` log.

The `metpress clear` command clears the air pressure setting.

The `metpress default` command clears the air pressure setting.

Syntax

`metpress set [press]`

`metpress default|clear`

Message Id = 164

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Pressure	0	4	Float	hPa	H+4

Table 58: METPRESS Default Configuration

Parameter	Power-On	Freset	Stored in NVM
metpress	clear	clear	NO

8.33 METTEMP

The `mettemp` command allows you to specify ambient temperature. Temperature specified with the `mettemp` command does not affect receiver operation. Rather, it allows you to create a record of atmospheric conditions for post-processing purposes.

The `mettemp set` command specifies air temperature at *`temp`*. This command only stores the temperature in volatile memory, and does not automatically generate a record. The temperature can then be displayed/recorded by requesting the `met` log.

The `mettemp clear` command clears the temperature setting.

The `mettemp default` command clears the temperature setting.

Syntax

`mettemp set [`*`temp`*`]`

`mettemp default|clear`

Message Id = 165

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header			-	-	0
2	Parameter Update, see *Table 43 on Page 111*		4	Enum	none	H
3	Temperature	0	4	Float	Celsius	H+4

Table 59: METTEMP Default Configuration

Parameter	Power-On	Freset	Stored in NVM
metpress	clear	clear	NO

8.34 PROJECT

The `project` command allows you to define or clear a project. If a project has been defined via the `project` command prior to issuing a `groupuse start` command, a `projectdefb` log is automatically logged to the default group destination by the `groupuse start` sequence.

`project add` defines a project with parameters *`project`*, *`agency`* and *`observer`*.

`project clear` undefines a project, and thus prevents the `projectdefb` log from being logged to the default group destination by the `groupuse start` sequence.

Syntax

`project add` *`project`* [*`agency`* [*`observer`*]]

`project clear`

Message Id = 211

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Project Action, see *Table 60*	-	4	Enum	none	H
3	Project	-	32	Char[]	none	H+4
4	Agency	NUL	32	Char[]	none	H+36
5	Observer	NUL	32	Char[]	none	H+68

Table 60: Project Action

Binary Value	ASCII Value	Description
0	ADD	Add a new project into the PDC (default)
1	CLEAR	Clear projects from the PDC

Table 61: PROJECT Default Configuration

Parameter	Power-On	Freset	Stored in NVM
project	clear	clear	NO

8.35 RENAME

The `rename` command allows you to rename a file on the flash card.

The `rename` command renames a file named *`filename`* to *`newfilename`*. The `rename` command will fail if *`newfilename`* already exists, or if *`filename`* is open.

Syntax

`rename` *`filename newfilename`*

Message Id = 201

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Source File Name	12	Char[]	none	H
3	Destination File Name	12	Char[]	none	H+12

✉ A default configuration is not applicable to this command.

8.36 RESET

The OEM-4 `reset` command is extended to include DL-4 features.

✉ A default configuration is not applicable to this command.

8.37 SATLIMIT

The `satlimit` command allows you to set the minimum number of SVs used in position solution, for a specific set of messages to be passed through a particular FILE_*n* virtual channel.

The following messages are affected by the satlimit filter:

- BESTPOS
- BESTVEL
- MATCHEDPOS
- MARKPOS
- PSRVEL
- RANGE
- RANGECMP
- RTKPOS
- RTKVEL

The satlimit filter does not guarantee that *every* message in the above list which passes through this filter is forwarded/rejected as desired. As the tracking environment changes on the GPS receiver, there is an approximately 2 second delay between the time that a change occurs in the number of SVs used n position solution and the time that the filter reflects this change. Consequently, during this short period messages may be incorrectly forwarded or rejected.

The `satlimit set` command sets the minimum number of SVs for the specified channel(s) to *`minsv`*. The satlimit configuration for a particular channel can be set before or while the channel is associated with a logfile. The satlimit configuration for a particular channel is cleared when that channel's association with a logfile is terminated via the `logfile` command.

The `satlimit default` command sets the satlimit value for the specified channel(s) to 0.

The `satlimit clear` command sets the satlimit value for the specified channel(s) to 0.

Syntax

`satlimit set file_all|file|file_`*`n`* *`minsv`*

`satlimit default|clear file_all|file|file_`*`n`*

Message Id = 212

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	4	Enum	None	H
3	File Port Channel, see *Table 62*	4	Enum	None	H+4
4	Sat Limit	4	Int	None	H+8

Table 62: File Port Channel

Binary Value	ASCII Value	Description
0	NO_PORT	No port specified
7	FILE_ALL	All virtual channels for file target
224	FILE	File target, virtual channel 0
…	…	...
255	FILE_31	File target, virtual channel 31

Table 63: SATLIMIT Default Configuration

Parameter	Power-On	Freset	Stored in NVM
satlimit	clear	clear	NO

8.38 SCHEDULE

The group scheduler is a facility which allows you to schedule autonomous executions of the `groupuse start/stop` commands. In order to use the group scheduler, you configure a *schedule table* which consists of up to 36 *schedule events* for each day of the week. Each schedule event defines the start time, the stop time and a group from the group table (see the `group` command on *Page 105*. When the group scheduler is enabled, scheduled events are started and stopped as per the schedule table by executing `groupuse start/stop` commands.

The following conditions apply to the scheduler:

- All day and time specifications is given and interpreted in universal time coordinates (UTC).
- The minimum schedule event interval is 5 minutes.
- Schedule event start and stop time resolution is 1 minute.
- Schedule events may not specify overlapping time intervals.
- The scheduler accommodates for seven days' operation.
- The scheduler operates perpetually; i.e. if an event is scheduled to occur on a Monday, this event is serviced every Monday that the system is in operation until the event is deleted from the schedule table.
- The scheduler enables the GPS engine prior to a schedule event such that satellite tracking is established prior to the scheduled logging session. This requirement is met with 90% statistical probability since exceptional conditions may delay the acquisition of satellites beyond the start of the logging session.
- System resources are disabled during events and idle periods as per the `sleep`, see *Page 143*, and `sleepmask`, see *Page 144*, configuration.

The group scheduler behavior is depicted below. Note that the scheduler executes configuration commands only when entering and leaving the "Session in progress" state; it does not monitor logging activity while it is in the "Session in progress" state.

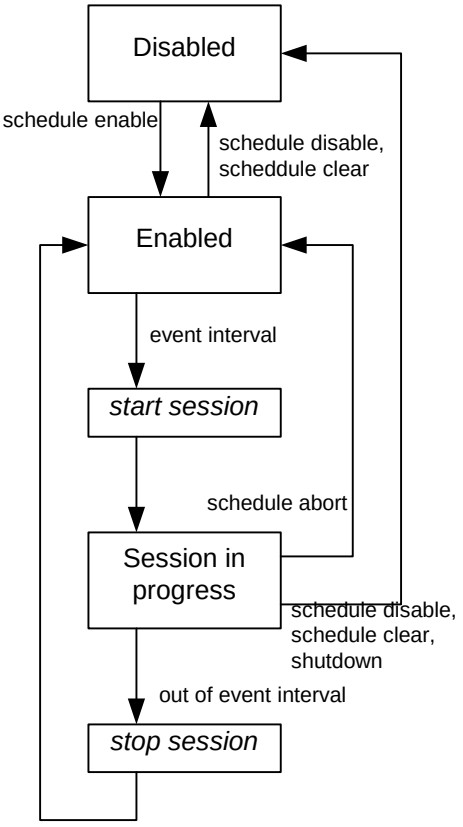
The `schedule enable` command enables the group scheduler. Execution of this command causes the scheduler to start executing `groupuse start`/`stop` commands as specified in the schedule table. Execution of this command within a schedule-event interval causes the immediate execution of the `groupuse start` command.

The `schedule disable` command disables the group scheduler. The schedule table remains unaffected by this command, but the group schedule does not execute any commands. Execution of this command within a schedule-event interval does not cause the execution of the `groupuse stop` command.

The `schedule clear` command disables the scheduler and clears all entries from the schedule table. This operation is not reversible. Execution of this command within a schedule-event interval does not cause the execution of the `groupuse stop` command.

The `schedule abort` command prevents the scheduled execution of the `groupuse stop` command for a schedule event in progress. Execution of this command does not cause the execution of the `groupuse stop` command. Normal group scheduler operation resumes at the end of the aborted event. This command fails if executed while a schedule event is not in progress.

Figure 35: DL-4 Group Scheduler Behavior



In the diagram above:

schedule enable – `schedule enable` command

schedule disable – `schedule disable` command

schedule clear – `schedule clear` command

shutdown – power-OFF sequence

event interval – current time is within boundaries of an event in the schedule table

schedule abort – `schedule abort` command

schedule clear – `schedule clear` command

start session – `groupuse start` command executed by the scheduler

stop session – `groupuse stop` command executed by the scheduler

The `schedule` command allows you to control the `groupuse` scheduler.

Syntax

```
schedule enable|disable|clear|abort
```

Message Id = 155

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Schedule Mode, see *Table 64*	4	Enum	none	H

Table 64: Schedule Mode

Binary Value	ASCII Value	Description
0	CLEAR	Clear schedules from PDC
1	ABORT	Abort scheduling on PDC
2	ENABLE	Enable scheduling on PDC
3	DISABLE	Disable scheduling on PDC

Table 65: SCHEDULE Default Configuration

Parameter	Power-On	Freset	Stored in NVM
schedule table	no change	clear	YES

8.39 SCHEDULEADD

The `scheduleadd` command allows you to add schedule events to the schedule table.

The `scheduleadd` command adds an event to the schedule table. The group scheduler executes a `groupuse start` *`groupname`* `file_0 [`*`filename`*`]` command at *`starttime`*, and execute a `groupuse stop` *`groupname`* `file_0` command at *`endtime`*.

`starttime` and *`endtime`* is specified in *ddddddhhmm* format, where *ddddddd* represents up to 7 days of the week, *hh* represents the hour (in 24-hour notation) and *mm* represents the minute. Multiple days of the week are allowed only in *`starttime`*, and indicate that this schedule-table entry represents an event which repeats on the specified days of the week. Day of the week may not be specified in *`endtime`* for repeating events. If a day of the week is not specified in *`starttime`*, the event repeats every day. *mm* and *dd* must contain two digits each; if necessary, a leading 0 should be inserted into the specification. If *`endtime`* is less than *`starttime`*, the event wraps over to the next day. ddddddd consists of the combination of different character codes, each representing a day of the week as follows:

Sunday	d
Monday	m
Tuesday	t
Wednesday	w
Thursday	r
Friday	f
Saturday	s

The following are examples of valid *`starttime`* and *`endtime`*:

- 0700 1800 – event starts at 07:00 and ends at 18:00 every day
- mwrf1000 1100 – event starts at 10:00 and ends at 11:00 every Monday, Wednesday, Thursday and Friday
- m0205 f1215 – event starts at 02:05 on Monday and ends at 12:15 on Friday
- t1400 1300 – event starts at 14:00 every Tuesday and ends at 13:00 every Wednesday

Syntax

`scheduleadd` *`groupname starttime endtime`* `[`*`filename`*`]`

Message Id = 152

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	GroupName	-	12	Char[]		H
3	StartTime	-	12	Char[]	(ddddddhhmm)	H+12
4	EndTime	-	12	Char[]	(ddddddhhmm)	H+24
5	FileName	NUL	12	Char[]		H+36

✉ A default configuration is not applicable to this command.

8.40 SCHEDULEDEL

The `scheduledel` command allows you to delete individual event entries from the schedule table.

The `scheduledel` command deletes entry number *`index`* from the schedule table. *`index`* corresponds to the *index* field in the `schdef` log, see *Page 173*, which lists the schedule table. This operation is not reversible.

Syntax

`scheduledel` *`index`*

Message Id = 154

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Index	4	Ulong		H

✉ A default configuration is not applicable to this command.

8.41 SITE

The `site` command allows you to control site occupations.

The `site enter` command defines the site-occupation start time for a site record *`name`*. This command does not result in a site record being entered into the logfile – the site record is written to the logfile when the `site leave` command is received.

The `site cancel` command cancels a previously-defined site. This command does not delete site records already written to a logfile with previous `site enter` and `site leave` commands. Rather, if at a site, as indicated by a preceding `site enter` command, the `site cancel` command terminates the site occupation without writing a site record to the logfile.

The `site leave` command ends occupation of a previously-defined site. If at a site, as indicated by a preceding `site enter` command, the `site leave` command terminates the site occupation and write a site record (`sitedefb`) to the logfile. There is no limit on the number of `sitedef` logs entered into a single log file.

- FirstGPSWeek/Sec fields of the `sitedef` record are set to correspond to time of the first *position* log (`bestpos`, `matchpos`, `range`, `rangec`, `rangedelta`, `rtkdata`) received with the number of SVs used in generation of these logs > 0, between `site enter` and `site leave` commands.
- LastGPSWeek/Sec fields of the `sitedef` log are set to correspond to time of the last *position* log received with the number of SVs used in generation of these logs > 0, between `site enter` and `site leave` commands.
- If no *position* logs are received with the number of SVs used in generation of these logs > 0 between `site enter` and `site leave` commands:
    - FirstGPSWeek/Sec and LastGPSWeek/Sec fields of the `sitedef` log is set to correspond to the times at which the `site enter` and `site leave` commands were issued, respectively,
    - the SITE_ST_INVALID bit (0x01) is set in the SiteStatus field of the `sitedef` log
- If no *position* logs are received with the number of SVs used in generation of these logs > 0 within 30 seconds after a `site enter` but such logs are received before a `site leave` command:
    - the SITE_ST_STARTTRUNCATE bit (0x02) is set in the SiteStatus field of the `sitedef` log
- If no *position* logs are received with the number of SVs used in generation of these logs > 0 within 30 seconds before a `site leave` but such logs are received at some time after a `site enter` command:
    - the SITE_ST_ENDTRUNCATE bit (0x04) is set in the SiteStatus field of the `sitedef` log
- If both of the above conditions apply, (i.e. If no *position* logs are received with the number of SVs used in generation of these logs > 0 within 30 seconds after a `site enter` but such logs are received before a `site leave` command and if no *position* logs are received with the number of SVs used in generation of these logs > 0 within 30 seconds before a `site leave` but such logs are received at some time after a `site enter` command):
    - both, the SITE_ST_STARTTRUNCATE and SITE_ST_ENDTRUNCATE bits is set in the SiteStatus field of the `sitedef` log

Syntax

`site enter` *`name`*

`site leave|cancel`

Message Id = 166

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Site Mode, see *Table 48 on Page 116*	4	Enum		H
3	Site Name	32	Char[]		H+4
4	Reserved for future use	12	Char[]		H+36
5		12	Char[]		H+48
6		12	Char[]		H+60
7		12	Char[]		H+72
8		12	Char[]		H+84

Table 66: Site Mode

Binary Value	ASCII Value	Description
0	ENTER	Enter a site into PDC (default)
1	LEAVE	Leaving site
2	CANCEL	Cancel this site from the PDC

Table 67: SITE Default Configuration

Parameter	Power-On	Freset	Stored in NVM
site	cancel	cancel	NO

8.42 SITEUPDATENUMBER

The `siteupdatenumber` command allows you to configure the site number information (SiteNumber field in the `sitedef` log) once the site has been occupied (by issuing a `site enter` command).

The `siteupdatenumber set` command sets the site number for an occupied site to *`sitenumber`*.

The `siteupdatenumber default` command clears the site number for an occupied site.

The `siteupdatenumber clear` command clears the site number for an occupied site.

Syntax

`siteupdatenumber set [`*`sitenumber`*`]`

`siteupdatenumber default|clear`

Message Id = 171

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Site Number	NUL	8	Char[]	none	H+4
4	Reserved for future use	NUL	12	Char[]	none	H+12

Table 68: SITEUPDATENUMBER Default Configuration

Parameter	Power-On	Freset	Stored in NVM
Site Number	clear	clear	NO

8.43 SITEUPDATENAME

The `siteupdatename` command allows you to configure the site name information (SiteName field in the `sitedef` log) once the site has been occupied (by issuing a `site enter` command).

The `siteupdatename set` command sets the site name for an occupied site to *`sitename`*.

The `siteupdatename default` command sets the name to "SITE".

The `siteupdatename clear` command has no effect.

Syntax

`siteupdatename set` *`sitename`*

`siteupdatename default|clear`

Message Id = 170

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Site Name	-	32	Char[]	none	H+4
4	Reserved for future use	NUL	12	Char[]	none	H+36

Table 69: SITEUPDATENAME Default Configuration

Parameter	Power-On	Freset	Stored in NVM
Site Name	clear	clear	NO

8.44 SITEUPDATEANTHEIGHT

The `siteupdateantheight` command allows you to configure the site antenna height information (AntHeight field in the `sitedef` log) once the site has been occupied (by issuing a `site enter` command).

The `siteupdateantheight set` command sets the site antenna height for an occupied site to *`antheight`*.

The `siteupdateantheight default` command clears the site antenna height for an occupied site.

The `siteupdateantheight clear` command clears the site antenna height for an occupied site.

Syntax

`siteupdateantheight set [`*`antheight`*`]`

`siteupdateantheight default|clear`

Message Id = 167

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	AntHeight	0	4	Float	none	H+4
4	Reserved for future use	NUL	12	Char[]	none	H+8

Table 70: SITEUPDATEANTHEIGHT Default Configuration

Parameter	Power-On	Freset	Stored in NVM
AntHeight	clear	clear	NO

8.45 SITEUPDATEANTTYPE

The `siteupdateanttype` command allows you to configure the site antenna type information (AntType field in the `sitedef` log) once the site has been occupied (by issuing a `site enter` command).

The `siteupdateanttype set` command sets the site antenna type for an occupied site to *`anttype`*.

The `siteupdateanttype default` command clears the site antenna type for an occupied site.

The `siteupdateanttype clear` command clears the site antenna type for an occupied site.

Syntax

`siteupdateanttype set [`*`anttype`*`]`

`siteupdateanttype default|clear`

Message Id = 168

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Antenna Type	NUL	16	Char[]	none	H+4
4	Reserved for future use	NUL	12	Char[]	none	H+20

Table 71: SITEUPDATEANTTYPE Default Configuration

Parameter	Power-On	Freset	Stored in NVM
AntType	clear	clear	NO

8.46 SITEUPDATEATTRIBUTE

The `siteupdateattribute` command allows you to configure the site attribute information (Attrib field in the `sitedef` log) once the site has been occupied (by issuing a `site enter` command).

The `siteupdateattribute set` command sets the site attribute for an occupied site to *`attrib`*.

The `siteupdateattribute default` command clears the site attribute for an occupied site.

The `siteupdateattribute clear` command clears the site attribute for an occupied site.

Syntax

`siteupdateattribute set [`*`attrib`*`]`

`siteupdateattribute default|clear`

Message Id = 169

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum	none	H
3	Attribute	0	4	Int	none	H+4
4	Reserved for future use	NUL	12	Char[]	none	H+8

Table 72: SITEUPDATEATTRIBUTE Default Configuration

Parameter	Power-On	Freset	Stored in NVM
Attribute	clear	clear	NO

8.47 SLEEP

The `sleep` command allows you to control automatic power-off of DL-4 subsystems for power-conservation purposes.

Specified without arguments, the `sleep` command enables sleep mode on the receiver and simulates a timeout on the receiver activity sources (see the `sleepmask` command on *Page 144*). If other conditions for turning the receiver off due to inactivity are satisfied (i.e. no log files are open and no imminent scheduler activity) this command causes the receiver to power off.

The `receiver` keyword has no effect on this command. It is supported for future expansion purposes.

Specified with `enable|disable|now`, the `sleep` command enables or disable sleep functionality, respectively. Specified with `now`, the `sleep` command enables sleep functionality and simulate a timeout. Specified with `timeout` *`timeout`*, the command sets the timeout period to *`timeout`* seconds. *`timeout`* must be greater than 1 second.

Syntax

`sleep [receiver] [enable|disable|now|{timeout` *`timeout`*`}]`

Message Id = 237

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Subsystem, see *Table 73*	RECEIVER	4	Enum		H+4
3	Sleep Action, see *Table 74 on Page 144*	NOW	4	Enum		H+8
4	Timeout period	-	4	Ulong	seconds	H+12

Table 73: Subsystem

Binary Value	ASCII Value	Description
0	NONE	No subsystem specified
1	RECEIVER	All subsystems except the low-power subsystem

Table 74: Sleep Action

Binary Value	ASCII Value	Description
0	DISABLE	Disable sleep
1	ENABLE	Enable sleep
2	NOW	Enable sleep and consider all activity sources inactive
3	TIMEOUT	Specify timeout period for the component

Table 75: SLEEP Default Configuration

Parameter	Power-On	Freset	Stored in NVM
Enable/Disable	DISABLE	DISABLE	NO
Timeout	no change	300 seconds	YES

8.48 SLEEPMASK

The `sleepmask` command allows you to configure which activity sources prevent the receiver from timing out (and turning OFF). The same configuration is used to determine which activity sources are used to turn ON the receiver when it is OFF.

The `sleepmask default` command restores default sleepmask settings for the receiver as per *Table 76:*

Table 76: Subsystem Sleep Mask

Subsystem	Sleep Mask
RECEIVER	COM1, COM2, AUX

The `sleepmask set|clear` command configures the receiver to use or ignore, respectively, activity on the specified activity source for time-out and turning ON. The `receiver` keyword has no effect on this command. It is supported for future expansion purposes.

Syntax

```
sleepmask default
sleepmask set|clear [receiver] com1|com2|aux|active|all
```

Message Id = 238

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Parameter Update, see *Table 43 on Page 111*	-	4	Enum		H+4
3	Subsystem, see *Table 73 on Page 143*	NONE	4	Enum		H+8
4	Activity Source, see *Table 77*	-	4	Enum		H+12

Table 77: Activity Sources

Binary Value	ASCII Value	Description
0	ALL	All activity sources.
1	UNKNOWN	Activity source not specified
2	ACTIVE	Simulated continuous activity source. If set in the sleepmask, the receiver never times out. [a]
3	COM1	COM1 receive or transmit activity.
4	COM2	COM2 receive or transmit activity.
5	AUX	AUX receive or transmit activity. [a]
6	Reserved for future use.	

a. This activity source is not monitored while the receiver is OFF.

Table 78: SLEEPMASK Default Configuration

Parameter	Power-On	Freset	Stored in NVM
Sleepmask	no change	Default, see *Table 76 on Page 144*	YES

8.49 SOFTPOWER

The `softpower` command allows you to simulate a power-button Off.

The `softpower now` command simulates a power-button Off. The `softpower now` command does not set the "power button pressed" bit in the receiver status word.

Syntax

`softpower now`

Message Id = 213

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Softpower, see *Table 79*	4	Enum	-	H

Table 79: Softpower

Binary Value	ASCII Value	Description
1	NOW	Simulate a power-button Off immediately.

✉ A default configuration is not applicable to this command.

8.50 VOUT

The `vout` command allows you to control the peripheral power supply on the AUX port.

The `vout` command enables (`on`) or disable (`off`) the supply of power to the power pin (POUT) on the AUX port. Specified without the optional *persist* argument (the second `on|off`), or with the *persist* argument specified as `on`, the requested configuration remains in effect while the receiver is OFF (i.e. if AUX power is enabled, AUX power remains available while the receiver is OFF). Specified with the *persist* argument as `off`, the port power is disabled while the receiver is OFF (i.e. if AUX power is enabled, AUX power is disabled while the receiver is OFF, and is re-enabled when the receiver is turned ON).

Syntax

```
vout com2 on|off [on|off]
```

Message Id = 203

Field	Data	Value Used if Not Specified	Bytes	Format	Units	Offset
1	Header	-		-	-	0
2	Peripheral Power, see *Table 80*	-	4	Enum		H
3	Enable – OnOff, see *Table 81*	-	4	Enum		H+4
4	Persist – OnOff, see *Table 81*	ON	4	Enum		H+8

Table 80: Peripheral Power

Binary Value	ASCII Value	Description
0	Reserved.	
1	COM2	Select AUX port[a]

a. Although the value entered is COM2, the AUX port provides the peripheral power output.

Table 81: On/Off

Binary Value	ASCII Value	Description
0	OFF	Set state to off
1	ON	Set state to on

Table 82: VOUT Default Configuration

Parameter	Power-On	Freset	Stored in NVM
Enable	no change	ON	YES
Persist	no change	OFF	YES

8.51 WRITE

The `write` command/log allows you to create logs which contain user data.

The `write` command allows you to supply user data for the `write` log. Upon receipt of the `write` command, the receiver generates a `write` log to all destinations which have been configured to send `write` logs with a `log write onnew` command.

All of the supplied arguments are echoed in the generated `write` log.

Data incoming on AUX is encapsulated via the `writehex` command with the *`type`* field set to 1.

If written to a logfile, the *`previous`* argument is overwritten to indicate the file offset (from the beginning of the file) of the previous `writeb` or `writehexb` log. The first record in a logfile has this field set to 0.

`length` specifies the number of bytes supplied as *`data`*.

`data` is up to 1024 bytes, and is ASCII data if the `write` command is issued in ASCII but can be binary in a binary `write` message.

Syntax

`write` *`previous type length data`*

Message Id = 257

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Previous	4	Ulong	Bytes	H
3	Type	4	Ulong		H+4
4	Length	4	Ulong	Bytes	H+8
5	Data	Max. 1024	Char[]		H+16

✉ A default configuration is not applicable to this command.

8.52 WRITEFILE

The `writefile` command allows you to create files on the flash card or append data to an existing file on the flash card.

The `writefile` command writes *`data`* to a file named *`filename`* on the flash card. If a file named *`filename`* does not exist, the file is created. If a file named *`filename`* already exists, data is appended to the end of the file. Only simple filenames (maximum 8 characters and an optional 3-character extension) are supported. *`data`* is up to 1024 bytes, and is ASCII data if the `writefile` command is issued in ASCII but can be binary in a binary `writefile` message.

`length` specifies the number of bytes supplied as *`data`*.

Syntax

`writefile` *`filename length data`*

Message Id = 204

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Filename	12	Char[]		H
3	Length	4	Ulong	Bytes	H+12
4	Data	Max. 1024	Char[]		H+16

✉ A default configuration is not applicable to this command.

8.53 WRITEFILEHEX

The `writefilehex` command allows you to create files on the flash card or append data to an existing file on the flash card.

The `writefilehex` command writes *`data`* to a file named *`filename`* on the flash card. If a file named *`filename`* does not exist, the file is created. If a file named *`filename`* already exists, data is appended to the end of the file. Only simple filenames (maximum 8 characters and an optional 3-character extension) are supported. *`data`* is up to 1024 concatenated hexadecimal pairs if the `writefilehex` command is issued in ASCII, and is 1024 bytes in a binary `writefilehex` message.

`length` specifies the number of bytes supplied as *`data`*.

Syntax

`writefilehex` *`filename length data`*

Message Id = 240

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Filename	12	Char[]		H
3	Length	4	Ulong	Bytes	H+12
4	Data	Max. 1024	Hexbyte		H+16

✉ A default configuration is not applicable to this command.

8.54 WRITEHEX

The `writehex` command/log allows you to create logs which contain user data.

The `writehex` command allows you to supply user data for the `writehex` log. Upon receipt of the `writehex` command, the receiver generates a `writehex` log to all destinations which have been configured to send `writehex` logs with a `log writehex onnew` command.

All of the supplied arguments are echoed in the generated `writehex` log.

Data incoming on AUX is encapsulated via the `writehex` command with the *`type`* field set to 1.

If written to a logfile, the *`previous`* argument is overwritten to indicate the file offset (from the beginning of the file) of the previous `writeb` or `writehexb` log. The first record in a logfile has this field set to 0.

`length` specifies the number of bytes supplied as *`data`*.

`data` is up to 1024 concatenated hexadecimal pairs if the `writehex` command is issued in ASCII, and is 1024 bytes in a binary `writehex` message.

Syntax

`writehex` *`previous type length data`*

Message Id = 205

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Previous	4	Ulong	Bytes	H
3	Type	4	Ulong		H+4
4	Length	4	Ulong	Bytes	H+8
5	Data	Max. 1024	Hexbyte		H+16

✉ A default configuration is not applicable to this command.

Chapter 9 DL-4 Logs

The DL-4 firmware generates the logs in *Table 83* (repeated in *Table 84 on Page 153* in the order of their binary messages IDs), in addition to those of the OEM4 GPSCard log set.

Table 83: DL-4 Logs in Alphabetical Order

Message ID	ASCII Log	Description
209	AUDIODEF	Audible annunciator settings
249	AUXDEF	Auxiliary communication channel configuration
254	BATSTATUS	Power supply information
317	COMCONFIG	COM port configuration
187	CURRENTSET	“CurrentX” command configuration
159	DIRENT	Compact flash card file list
158	FILECHANNEL	Log file channel configuration
146	FILEDUMP	File dump
147	FILEHDR	Log file header
148	GROUPDEF	Log group configuration
210	HWLEVELS	Hardware levels
150	METDEF	Meteorological parameters
156	PROJECTDEF	Project definition
93	RXSTATUS	DL-4 status
94	RXSTATUSEVENT	DL-4 status event notification
151	SCHDEF	Schedule table entry
153	SITEDEF	Site configuration
239	SLEEPMODE	Sleep configuration
37	VERSION	Hardware versions, software versions, and serial numbers
257	WRITE	User-generated information
205	WRITEHEX	User-generated information

Table 84: DL-4 Logs in Order of their Message IDs

Message ID	ASCII Log	Description
37	VERSION	Hardware versions, software versions, and serial numbers
93	RXSTATUS	DL-4 status
94	RXSTATUSEVENT	DL-4 status event notification
146	FILEDUMP	File dump
147	FILEHDR	Log file header
148	GROUPDEF	Log group configuration
150	METDEF	Meteorological parameters
151	SCHDEF	Schedule table entry
153	SITEDEF	Site configuration
156	PROJECTDEF	Project definition
158	FILECHANNEL	Log file channel configuration
159	DIRENT	Compact flash card file list
187	CURRENTSET	“CurrentX” command configuration
205	WRITEHEX	User-generated information
209	AUDIODEF	Audible annunciator settings
210	HWLEVELS	Hardware levels
239	SLEEPMODE	Sleep configuration
249	AUXDEF	Auxiliary communication channel configuration
254	BATSTATUS	Power supply information
257	WRITE	User-generated information
317	COMCONFIG	COM port configuration

For a complete listing and description of the other logs that the DL-4 is capable of generating, please consult *Volume 2* of the *OEM4 Family Users’ Guide*. It also contains procedures and explanations related to data logging.

Before proceeding to describe these logs, mention should be made of the DL-4 data file format (*.PDC). Please see *PDC Files on Page 154*.

9.1 PDC FILES

In a PDC file, the sequence of data exists in the following format:

Header
FILEHDRB
GPS Logs
SITELOGB #1
GPS Logs
: .
GPS Logs
SITELOGB #n
GPS Logs
EOF

Site records' meteorological logs (MET) may occur at arbitrary locations throughout the file. The records are linked to allow easy extraction. The file header information block consists of 128 bytes, see *Table 85*.

Table 85: PDC Log Header

Item	Type	Size	Description	Range	Offset
Description	char	60	File Description. ^Z can be included to indicate that the description is less than 60 characters.		0
EOF	byte	1	C:\ TYPE will not pass this point (artificial end of file)	^Z	60
Signature	char	7	"NOVATEL"		61
FileCode	byte	1	Indicates the type of file.		68
Version	byte	1	Version number	0+	69
Revision	byte	1	Revision number	0 to 99	70
Reserved	byte	57	Reserved for future use		71

The HDRB and GRPB logs are binary versions of the HDRA and GRPA logs described in the following sections.

9.2 AUDIODEF Audible Annunciator Settings

Structure: Message ID: 209
Log Type: Polled

Field	Data	Description	Bytes	Format	Units	Offset
1	Header			-	-	0
2	#Events	Number of audio events	4	Ulong		H+0
3	Audio Event	Audio event, see *Table 16 on Page 90*	4	Enum		H+4
4	Volume	Event volume as defined in *AUDIO on Page 90*	4	Ulong		H+8
5	Pitch	Event pitch as defined in *AUDIO on Page 90*	4	Ulong		H+12
	Next Audio Event, offset = H + 16 + (N*12)					

9.3 AUXDEF Auxiliary Communication Channel Configuration

Structure: Message ID = 249
Log Type: Polled

Field	Data	Description	Bytes	Format	Units	Offset
1	Header			-	-	0
2	Bps	Communication baud rate	4	Ulong	bytes	H
3	Parity	Parity, see *Table 88 on Page 159*	4	Enum		H+4
4	DataBits	Number of data bits (7 or 8)	4	Ulong		H+8
5	StopBits	Number of stop bits (1 or 2)	4	Ulong		H+12
6	Handshake	Handshaking mode, see *Table 89 on Page 159*	4	Enum		H+16
7	Echo	OnOff, see *Table 81 on Page 147*	4	Enum		H+20
8	StartSize	Start sequence length	1	Uchar	bytes	H+24
9	Start	Start sequence	3	Hexbyte		H+25
10	StopSize	Stop sequence length	1	Uchar	bytes	H+28
11	Stop	Stop sequence	3	Hexbyte		H+29
12	Time	Time out	4	Ulong		H+32
13	PacketSize	Maximum packet size	4	Ulong	bytes	H+36
14	Mark	OnOff, see *Table 81 on Page 147*	4	Enum		H+40

9.4 BATSTATUS Power Source Status

Structure: Message ID = 254
Log Type: Polled

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Peripheral power status, see *Table 86.*	4	Hexulong		H
3	Power source A voltage	4	Float	V	H+4
4	Power source B voltage	4	Float	V	H+8
5	Reserved, always set to 0	4	Float		H+12
6	Power source A remaining life	4	Float	min.	H+16
7	Power source B remaining life	4	Float	min.	H+20
8	rxstatus auxiliary 2, see *Table 95 on Page 171*	4	HexUlong		H+24
9	rxstatus auxiliary 3, see *Table 96 on Page 172*	4	HexUlong		H+28
10	Power source A cutoff voltage	4	Ulong	mV	H+32
11	Power source B cutoff voltage	4	Ulong	mV	H+36
12	Reserved, always set to 0	4	Ulong		H+40
13	Reserved for future use	4	Ulong		H+44
14	Reserved for future use	4	Ulong		H+48
15	Reserved for future use	4	Ulong		H+52

Table 86: Peripheral Power Status

Status (Bits)	Description	Bit = 0	Bit = 1
0x00000001	Reserved		
0x00000002	Peripheral power on AUX port flag	disabled	enabled
0x00000004	Reserved		
0x00000008	Peripheral power on AUX port persistent flag	not persistent	persistent

Unused bits are reserved for future use.

9.5 COMCONFIG COM Port Configuration

Structure: Message ID = 317
Log Type: Polled

Field	Data	Description	Bytes	Format	Units	Offset
1	Header			-	-	0
2	# ports	Number of ports	4	Long		H+0
3	port	Serial port identifier, see *Table 87, Serial Port Identifiers on Page 159*	4	Enum		H+4
4	bps/baud	Communication baud rate	4	ULong		H+8
5	parity	See *Table 88, Parity on Page 159*	4	Enum		H+12
6	databits	Number of data bits	4	ULong		H+16
7	stopbits	Number of stop bits	4	ULong		H+20
8	handshake	See *Table 89, Handshaking on Page 159*	4	Enum		H+24
9	echo	When echo is on, the port is transmitting any input characters as they are received. 0 = OFF 1 = ON	4	Enum		H+28
10	breaks	Breaks are turned on or off 0 = OFF 1 = ON	4	Enum		H+32
11	rx_type	The status of the receive interface mode, see *Table 90, Serial Port Interface Modes on Page 160*	4	Enum		H+36
12	tx_type	The status of the transmit interface mode, *Table 90, Serial Port Interface Modes on Page 160*	4	Enum		H+40
13	responses	Responses are turned on or off 0 = OFF 1 = ON	4	Enum		H+44
14…	Next port offset = H – 40 + (#port x 44)					

Table 87: Serial Port Identifiers

Port Identifier		Description
ASCII	Binary	
COM1	1	COM port 1
COM2	2	COM port 2
COM3	3	COM port 3
THISPORT	6	The current COM port
FILE_ALL	7	All virtual ports which may be associated with a file on the compact flash card
ALL	8	All COM ports
FILE_0	224	File on the compact flash card, virtual port 0
...		
FILE_31	255	File on the compact flash card, virtual port 31

Table 88: Parity

Binary	ASCII	Description
0	N	No parity
1	E	Even parity
2	O	Odd parity

Table 89: Handshaking

Binary	ASCII	Description
0	N	No handshaking
1	XON	XON/XOFF software handshaking
2	CTS	CTS/RTS hardware handshaking

Table 90: Serial Port Interface Modes

ASCII Mode Name	Binary Value	Description
NONE	0	The port accepts/generates nothing
NOVATEL	1	The port accepts/generates NovAtel commands and logs
RTCM	2	The port accepts/generates RTCM corrections
RTCA	3	The port accepts/generates RTCA corrections
CMR	4	The port accepts/generates CMR corrections

9.6 CURRENTSET "CurrentX" Command Configuration

Structure: Message ID = 187
Log Type: Polled

Field	Data	Description	Bytes	Format	Units	Offset
1	Header			-	-	0
2	File	Current file as set by the CURRENTFILE command, see *Page 101*	12	Char		H
3	FilePacket	Current packet as set by the CURRENTFILE command	4	Ulong		H+12
4	FileDumpMode	Dump mode as set by the CURRENTFILE command	4	Enum		H+16
5	Group	Current group as set by the CURRENTGROUP command, see *Page 102*.	12	Char		H+20

9.7 DIRENT PC Card File List

Structure: Message ID = 159
Log Type: Polled

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Filename	12	Char[]	none	H
3	SizeBytes	4	Ulong	bytes	H+12
4	SizePackets	4	Ulong	packets	H+16
5	Date of Last Change	4	Ulong	yyyymmdd	H+20
6	Time of Last Change	4	Ulong	hhmmss	H+24

✉ Up to 1000 files can be listed via this facility.

9.8 FILECHANNEL Log File Channel Configuration

Structure: Message ID = 158
Log Type: Polled

Field	Data	Description	Bytes	Format	Units	Offset
1	Header			-	-	0
2	DiskSpace	Number of free bytes on the flash card	4	Ulong	bytes	H
3	FCModel	Flash card model	40	Char[]		H+4
4	FCVersion	Flash card firmware version	8	Char[]		H+44
5	Reserved for future use		4	Ulong		H+52
6			16	Char[]		H+56
7	#Channels	Number of channels associated with files	4	Ulong		H+72
8	Channel	File port channel, see *Table 62 on Page 130*	4	Enum		H+76
9	SatLimit	Number of SV filter	4	Int		H+80
10	Reserved for future use		4	Ulong		H+84
11			4	Ulong		H+88
12	FileName	Name of open logfile	12	Char		H+92
	Next File Port offset = H + 76 + (N*28)					

9.9 FILEDUMP File Dump

Structure: Message ID = 146
Log Type: Polled

The “Packet ID” field range is from 0 to (SizePackets-1). The first packet is numbered 0. The “Sequence #” field in the header reflects the number of packets left in this dump sequence, with the last packet having “Sequence #” set to 0. If there are more packets left in the dump sequence than the capacity of the “Sequence #” field, the “Sequence #” field is set to its maximum value.

The “Data” field is variable in size. The last packet in the file normally contains fewer than 1024 bytes, and all previous packets contain 1024 bytes. The binary `filedump` message is also variable in size; you should check the header information to determine the message size and the “Length” field to determine the number of valid bytes in the “Data” field.

Field	Data	Bytes	Format	Units	Offset
1	Header		-	-	0
2	Packet ID	4	Ulong		H
3	Length	4	Ulong	Bytes	H+4
4	Data	Max. 1024	Hexbyte	none	H+8

9.10 FILEHDR Logfile Header

Structure: Message ID = 147
Log Type: Polled

Field	Data	Description	Bytes	Format	Units	Offset
1	Header			-	-	0
2	FileName	File name at creation	12	Char		H
3	FileSize	File size	4	Ulong	bytes	H+12
4	MinSats [a]	Minimum SVs used for pos logs	4	Ulong		H+16
5	StartGPSWeek [a]	GPS Week of first log	4	Ulong		H+20
6	EndGPSWeek [a]	GPS Week of last log	4	Ulong		H+24
7	StartGPSmSec [a]	GPS Seconds of first log	4	GPSs [b]	ms, s	H+28
8	EndGPSmSec [a]	GPS Seconds of last log	4	GPSs [b]	ms, s	H+32
9	Reserved for future use		4	Int		H+36
10			8	Double		H+40
11			4	Ulong		H+48
12			4	Ulong		H+52
13	FileStatus	File status information, see *Table 91 on Page 165*	4	Hexulong		H+56
14	VersionP	File position of the first `versionb` log	4	Ulong		H+60
15	TimeP	File position of the first `timeb` log	4	Ulong		H+64
16	ProjectP	File position of the first `projectdefb` log	4	Ulong		H+68
17	GroupP	File position of the first `groupdefb` log	4	Ulong		H+72

Field	Data	Description	Bytes	Format	Units	Offset
18	SiteP	File position of the last `sitedefb` log	4	Ulong		H+76
19	MetP	File position of the last `metdefb` log	4	Ulong		H+80
20	WriteP	File position of the last `writeb` or `writehexb` log.	4	Ulong		H+84
21	Reserved for future use		4	Ulong		H+88
22			4	Ulong		H+92
23			4	Ulong		H+96
23			4	Ulong		H+100

a. Affected only by the set of messages filtered by the satlimit filter (see the SATLIMIT command on *Page 129*).
b. GPSs format represents GPS time of the week (Ulong milliseconds in binary logs, floating-point seconds in ASCII logs).

Table 91: File Status

FileStatus Bit	Description	Bit=0	Bit=1
0x00000001	File access status	OK	error
0x00000002	Flag to indicate if `rangea/b` and/or `rangecmpa/b` logs are present in the file	absent	present
0x00000004	Flag to indicate if `rawephema/b` logs are present in the file	absent	present
0x00000008	Flag to indicate if `almanaca/b` logs are present in the file	absent	present
0x00000010	Flag to indicate if `ionutca/b` logs are present in the file	absent	present
0x00000020	Flag to indicate if `bestposa/b` and/or `rtkposa/b` logs are present in the file	absent	present

9.11 GROUPDEF Log Group Configuration

Structure: Message ID = 148
Log Type: Polled

Field	Data	Description	Bytes	Format	Units	Offset
1	Header			-	-	0
2	GroupName	Group name	12	Char		H
3	SessionName	Session name	8	Char		H+12
4	AntSN	Antenna serial number	16	Char		H+20
5	AntType	Antenna type	16	Char		H+36
6	AntHeight	Antenna height	4	Float	Metres	H+52
7	Ecutoff	Elevation cut-off angle	4	Float	Degrees	H+56
8	SatLimit	Number of SV filter	4	Integer		H+60
9	GroupStatus	Group status, see *Table 93 on Page 168*	4	HexUlong		H+64
10	Reserved for future use		4	Ulong		H+68
11	Lat	Latitude	8	Double	(Degrees) (s)	H+72
12	Lon	Longitude	8	Double	(Degrees) (s)	H+80
13	Ht	Height	8	Double	(m)	H+88
14	Site#	Site number	8	Char		H+96
15	SiteName	Site name	32	Char		H+104
16	DGPS Type	DGPS ID type, see *Table 92 on Page 168*	4	Enum		H+136

Field	Data	Description	Bytes	Format	Units	Offset
17	DGPS ID	5 char ID string or “ANY” ANY type defaults: RTCM - 0 RTCA - AAAA CMR - 0 The following range values are in affect: $0 \leq$ CMR ID ≤ 31 $0 \leq$ RTCM ID ≤ 1023 RTCA: any four character string containing only alpha (a-z) or numerical characters (0-9)	5	Char		H+140
18	Reserved for future use		1	UChar		H+145
19			2	UShort		H+146
20			4	ULong		H+148
21			8	Double		H+152
22			4	Int		H+160
23	#Specs	Number of log specifications to follow	4	Ulong		H+164
24	Message ID	Message ID of log	4	Ulong		H+168
26	Trigger	Log trigger, refer to the LOG command in *Volume 2* of the *OEM4 Family Users’ Guide*.	4	Enum		H+172
27	Rate	Log rate	4	Float	Seconds	H+176
28	Port	Serial port identifier, see *Table 87 on Page 159.*	4	Enum		H+180
29	Reserved for future use		4	Float		H+184
30			2	Ushort		H+188
31			1	Uchar		H+190
32			1	Uchar		H+191
	Next Log Spec Offset = H + 168 + (N * 24)					

Table 92: DGPS Type

DGPS Type Binary	ASCII	Description
0	RTCM	RTCM ID Type
1	RTCA	RTCA Id Type
2	CMR	CMR Id Type
10	AUTO	Automatic type

Table 93: Group Status

Group Status Bit	Description	Bit=0	Bit=1
0x01	Position fix flag	disabled	enabled
0x02	Position average enable flag	disabled	enabled
0x04	Survey type flag	static	kinematic
0x08	DGPSTxId configured flag	disabled	configured
0x10	Satlimit filter flag	not set	set
0x010000	COM1 interface mode flag	disabled	configured
0x020000	COM2 interface mode flag	disabled	configured
0x040000	COM1 responses flag	disabled	enabled
0x080000	COM2 responses flag	disabled	enabled
0x700000	COM1 Tx interface mode – the 3-bit binary value corresponds to the values in “Serial Port Interface Modes”, see *Table 90 on Page 160*	N/A	N/A
0x03800000	COM1 Rx interface mode – the 3-bit binary value corresponds to the values in “Serial Port Interface Modes”	N/A	N/A
0x1c000000	COM2 Tx interface mode – the 3-bit binary value corresponds to the values in “Serial Port Interface Modes”	N/A	N/A
0xe0000000	COM2 Rx interface mode – the 3-bit binary value corresponds to the values in “Serial Port Interface Modes”	N/A	N/A

9.12 HWLEVELS Hardware Levels

Structure: Message ID = 210
Log Type: Polled

Field	Data	Description	Bytes	Format	Units	Offset
1	Header			-	-	0
2	GPS temp	GPS subsystem temperature	4	Float	Celsius	H
3	ant current	Antenna current	4	Float	A	H+4
4	core volt	GPS subsystem CPU core voltage	4	Float	V	H+8
5	supply volt	GPS subsystem supply voltage	4	Float	V	H+12
6	rf volt	5V RF supply voltage	4	Float	V	H+16
7	int lna volt	Internal LNA voltage	4	Float	V	H+20
8	Reserved for future use		4	Float		H+24
9			4	Float		H+28
10			4	Float		H+32
11	lna volt	LNA voltage (internal or external)	4	Float	V	H+36
12	battAlife	Estimated power source A life	4	Float	min.	H+40
13	battBlife	Estimated power source B life	4	Float	min.	H+44
14	Reserved for future use		4	Float	V	H+48
15	ctrl temp	DL-4 temperature	4	Float	Celsius	H+52
16	disk space	Remaining space on the compact flash card	4	Ulong	bytes	H+56
17	Reserved for future use		4	Float		H+60
18			4	Float		H+64

9.13 METDEF Meteorological Parameters

Structure: Message ID = 150
Log Type: Polled

Field	Data	Description	Bytes	Format	Units	Offset
1	Header			-	-	0
2	MetP	File position of the previous `metdefb` log	4	Ulong	bytes	H
3	Met Status	Meteorological log status information, see *Table 94*	4	Hexulong		H+4
4	Temp	Temperature	4	Float	Celsius	H+8
5	Press	Pressure	4	Float	hPa	H+12
6	Humid	Relative humidity	4	Float	%	H+16

Table 94: Meteorological Log Status

Met Status Bit	Description	Bit=0	Bit=1
0x00000001	Temperature field flag	NOT VALID	VALID
0x00000002	Pressure field flag	NOT VALID	VALID
0x00000004	Humidity field flag	NOT VALID	VALID

9.14 PROJECTDEF Project Definition

Structure: Message ID = 156
Log Type: Polled

Field	Data	Description	Bytes	Format	Units	Offset
1	Header			-	-	0
2	Project	Project description	32	Char		H
3	Agency	Agency description	32	Char		H+32
4	Observer	Observer description	32	Char		H+64

9.15 RXSTATUS DL-4 Status

The AUXILIARY2 and AUXILIARY3 status words of the RXSTATUS log, refer *Volume 2* of the *OEM4 Family Users' Guide* for details on this log, are defined as in *Table 95 on Page 171* and *Table 96 on Page 172*, to indicate DL-4 functionality. The corresponding priority, set and clear masks can be defined via the STATUSCONFIG command, refer to *Volume 2* of the *OEM4 Family Users' Guide*.

Table 95: Auxiliary 2 Status Word

AUX2 Bit	Description	Bit=0	Bit=1
0x00000001	DL-4 status	not ready	ready
0x00000002	Shutdown indicator	no shutdown	shutting down
0x00000004	DL-4 boot status	boot in progress	boot done
0x00000008	Compact flash card status	not initialized	initialized
0x00000010	File(s) status	all files closed	file(s) open
0x00000020	Scheduler status	disabled	enabled
0x00000040	Flag to indicate if within schedule event interval (including 5 minutes pre-event).	outside of interval	inside of interval
0x00000080	Autonomous logging status	disabled	pending
0x00000100	Site status	not occupied	occupied
0x00000200	Power button status	not pressed	pressed
0x00000400	Wireless control session status	not established	established
0x00000800	Power source A status	not in use	in use
0x00001000	Power source B status	not in use	in use
0x00002000	Reserved for future use.		
0x00004000	COM1 activity (during the last second)	not active	active
0x00008000	COM2 activity (during the last second)	not active	active
0x00010000	AUX activity (during the last second)	not active	active
0x00020000	Reserved for future use.		
0x00040000	Flag to indicate if the DL-4 time is GPS-synchronized	no GPS sync	GPS sync

AUX2 Bit	Description	Bit=0	Bit=1
0x00080000	DL-4 time status	time not valid	time valid
0x00100000	Groupuse execution status	not in progress	in progress
0x00200000	Data quality status	not acceptable	acceptable

Table 96: Auxiliary 3 Status Word

AUX3 Bit	Description	Bit=0	Bit=1
0x00000001	Controller hardware status	OK	fail
0x00000002	Controller-GPSCard communication status	OK	fail
0x00000004	Reserved.		
0x00000008	Expected power source life flag (both sources combined)	OK	warning
0x00000010	Power source status (both sources combined)	OK	fail / source
0x00000020	Controller high-temperature warning flag	OK	warning
0x00000040	Controller temperature status	OK	fail
0x00000080	Controller NVM status	OK	fail
0x00000100	Compact flash card status	OK	error
0x00000200	Controller unrecoverable software flag	OK	error
0x00000400	Controller CPU status	OK	overload
0x00000800	Controller buffer overrun flag	OK	overrun
0x00001000	Wireless interface card status	OK	fail
0x00002000	Flag to indicate if a timer fail occurred on last powerup	OK	fail
0x00004000	DL-4 low-power subsystem flag	OK	fail
0x00008000	Peripheral power overload flag	OK	overload
0x00010000	Logfile name conflict flag	no conflict	conflict

9.16 RXSTATUSEVENT DL-4 Status Event Notification

The RXSTATUSEVENT log set, refer to the *Volume 2* of the *OEM4 Family Users' Guide*, is extended to indicate DL-4 functionality.

9.17 SCHDEF Schedule Table Entry

Structure: Message ID = 151
Log Type: Polled

Field	Data	Description	Bytes	Format	Units	Offset
1	Header			-	-	0
2	Index	Schedule table number	4	Ulong		H
3	Group	Group name	12	Char		H+4
4	StartTime	Time of week to start logging	12	Char		H+16
5	End Time	Time of week to end logging	12	Char		H+28
7	FileName	Log file name	12	Char		H+40

9.18 SITEDEF Site Configuration

Structure: Message ID = 153
Log Type: Polled

Field	Field Name	Description	Bytes	Format	Units	Offset
1	Header			-	-	0
2	SiteP	File position of the previous `sitedefb` log	4	Ulong	bytes	H
3	SiteNumber	Site number	8	Char		H+4
4	SiteName	Site name	32	Char		H+12
5	Attrib	Attribute code	4	Int		H+44
6	AntHeight	Antenna height	4	Float	m	H+48
7	AntType	Antenna type and measurement method	16	Char		H+52
8	FirstGPSWeek	Date of arrival	4	Ulong	GPS wk	H+68
9	LastGPSWeek	Date of departure	4	Ulong	GPS wk	H+72
10	FirstGPSSec	Time of arrival	4	GPSs [a]	ms, s	H+76
11	LastGPSSec	Time of departure	4	GPSs [a]	ms, s	H+80
12	SiteStatus	Site status, see *Table 97*	4	Hexulong		H+84
13	Reserved for future use		4	Ulong		H+88

a. GPSs format represents GPS time of the week (ULong milliseconds in binary logs, floating-point seconds in ASCII logs).

Table 97: Site Status

SiteStatus Bit	Bit Name	Description	Bit=0	Bit=1
0x00000001	SITE_ST_INVALID	No valid logs	logs received	no logs
0x00000002	SITE_ST_STARTTRUNCATE	Site occupation start time truncation flag	not truncated	truncated
0x00000004	SITE_ST_ENDTRUNCATE	Site occupation end time truncation flag	not truncated	truncated

9.19 SLEEPMODE Sleep Configuration

Structure: Message ID = 239
Log Type: Polled

Field	Field Name	Description	Bytes	Format	Units	Offset
1	Header			-	-	0
2	Subsystem	Subsystem, see *Table 73 on Page 143*	4	Enum		H+4
3	SleepStatus	Sleep action, see *Table 74 on Page 144* (ENABLE or DISABLE only)	4	Enum		H+8
4	Timeout	Feature timeout value	4	Ulong	seconds	H+12
5	ActSource	Activity source status, see *Table 98*	4	Hexulong		H+16

Table 98: Activity Source Status

Bit Mask	Description	Bit=0	Bit=1
0x00000001	ACTIVE – source of continuous activity	source masked	source used
0x00000002	COM1	source masked	source used
0x00000004	COM2	source masked	source used
0x00000008	AUX	source masked	source used
0x00000010	Reserved for future use.		
0x00000020	Power button	source masked	source used
0x00000040	Log file open	source masked	source used
0x00000080	Schedule activity in progress/pending	source masked	source used

9.20 VERSION HW & SW Versions and Serial Numbers

The Component Type of the VERSION log, refer to *Volume 2* of the *OEM4 Family Users' Guide*, is extended to include DL-4 information as in *Table 99*.

Table 99: Component Type

Binary Value	ASCII Value	Description
0	UNKNOWN	Unknown Component
1	GPSCARD	OEM-4 GPSCard Component
2	CONTROLLER	Controller Component
3	ENCLOSURE	DL-4 Receiver

Unused numbers are reserved for future use.

9.21 WRITE User-Generated Information

Please see the WRITE command on *Page 148*.

9.22 WRITEHEX User-Generated Information

Please see the WRITEHEX command on *Page 151*.

Appendix A Technical Specifications

A.1 Performance

Position Accuracy [a]	Standalone:	
	L1 only	1.8 m CEP
	L1/L2	1.5 m CEP
	WAAS:	
	L1 only	1.2 m CEP
	L1/L2	0.8 m CEP
	Code Differential	0.45 m CEP
	RT-20	0.20 m CEP
	RT-2	0.01 m + 1 ppm CEP
	Post Processed	5 mm + 1 ppm CEP
Time To First Fix	Hot 30 s	Warm 50 s Cold 60 s
Reacquisition	0.5 s L1 (typical) 1.5 s L2 (typical) (Requires OEM4 family firmware 2.100 or higher)	
Data Rates	Raw Measurements:	20 Hz
	Computed Position:	20 Hz
Time Accuracy [a b]	20 ns RMS	
Velocity Accuracy	0.03 m/s RMS	
Measurement Precision	C/A code phase	6 cm RMS
	L1 carrier phase:	
	Differential	0.75 mm RMS
	L2 P code	25 cm RMS
	L2 carrier phase:	
	Differential	2 mm RMS
Dynamics	Vibration	4 g
	Velocity	515 m/s [c]
	Height	18,288 m [c]

a. Typical values. Performance specifications are subject to GPS system characteristics, U.S. DOD operational degradation, ionospheric and tropospheric conditions, satellite geometry, baseline length and multipath effects. Assumes SA Off.

b. Time accuracy does not include biases due to RF or antenna delay.

c. In accordance with export licensing.

A.2 DL-4 Specifications

INPUT/OUTPUT CONNECTORS		
Antenna input	TNC female jack, 50 Ω nominal impedance +4.25 to +5.25 V DC, 90 mA max (output from DL-4 to antenna/LNA)	
Power	4-pin LEMO plug 4 W (typical while logging)	+7 to +18 V DC 0.2 W (sleep mode)
COM1 **COM2** **AUX** **Strobes**	DE9P connector DE9P connector DE9P connector DE9S connector	
PERIPHERAL POWER OUTPUT		
Voltage	≅ supplied voltage	
Current	≤ 1 A (internal fuse), non-user replaceable	
POWER MANAGEMENT		
If the DL-4 is connected to a 12 V battery, the lower cutoff voltage should be set to 10.5 V using the BATTERY command on *Page 99* as the battery should not be allowed to discharge lower than 10.5 V. If the DL-4 is connected to two batteries, it begins using the one with the higher voltage across its terminals. When this voltage drops the specified cutoff voltage, the DL-4 switches to the secondary battery (if available). Once the battery reserves are depleted, the DL-4 shuts itself off.		
ENVIRONMENTAL		
Operating Temperature	-40°C to +55°C (receiver)	-20°C to +55°C (display)
Storage Temperature	-40°C to +85°C	
Humidity	Not to exceed 90% non-condensing	
PHYSICAL		
Size	180 mm x 160 mm x 70 mm	
Weight	1.3 kg	
REAL-TIME CLOCK		
A real-time internal clock allows the DL-4 to go into low-power 'sleep mode' between scheduled data-collection sessions. When the DL-4 is turned on, this clock is initialized using the GPS time reference, and will indefinitely maintain an accuracy ±1 second and a resolution of 1 second. When the DL-4 is turned off, the clock begins to drift. To compensate for this, the DL-4 emerges from sleep mode in advance of the next scheduled data-collection session in order to re-initialize itself.		

A.3 Port Pin-Outs

Table 100: DL-4 Serial Port Pin-Out Descriptions

Connector Pin No.	COM1	COM2	AUX
1	N/C	N/C	N/C
2	RXD1	RXD2	RXD3
3	TXD1	TXD2	TXD3
4	N/C	N/C	POUT
5	GND	GND	GND
6	N/C	N/C	N/C
7	RTS1	RTS2	RTS3
8	CTS1	CTS2	CTS3
9	N/C	N/C	N/C

Table 101: DL-4 I/O Port Pin-Out Descriptions

Connector Pin No.	DL-4 Signal Name	Signal Descriptions
1	VARF	Variable frequency out
2	PPS	One pulse per second
3	Reserved	Reserved for future use
4	MK1I	Mark 1 input
5	PV	Valid position available
6	Reserved	Reserved for future use
7		
8	GND	Digital ground
9	GND	Digital ground

✉ For signal descriptions, please refer to the acronyms appendix in *Volume 1* of the *OEM4 Family Users' Guide.*

A.4 Cables

A.4.1 Power Cable with Automotive Adapter (NovAtel part number 01017023)

The power cable (with automotive adapter) is 2 meters (6.56 feet) long and has a 4-pin LEMO to automotive adapter socket (male plug) connector ends.

Use this power cable, in a base configuration, to connect your automobile power supply to the PWR port on your DL-4 receiver.

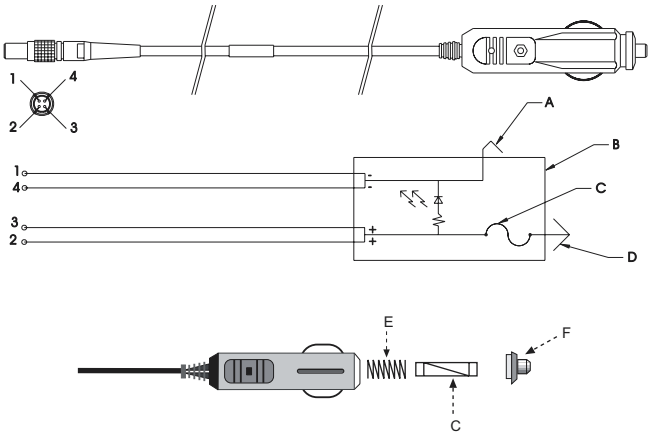


Figure 36: Power Cable - Illustration

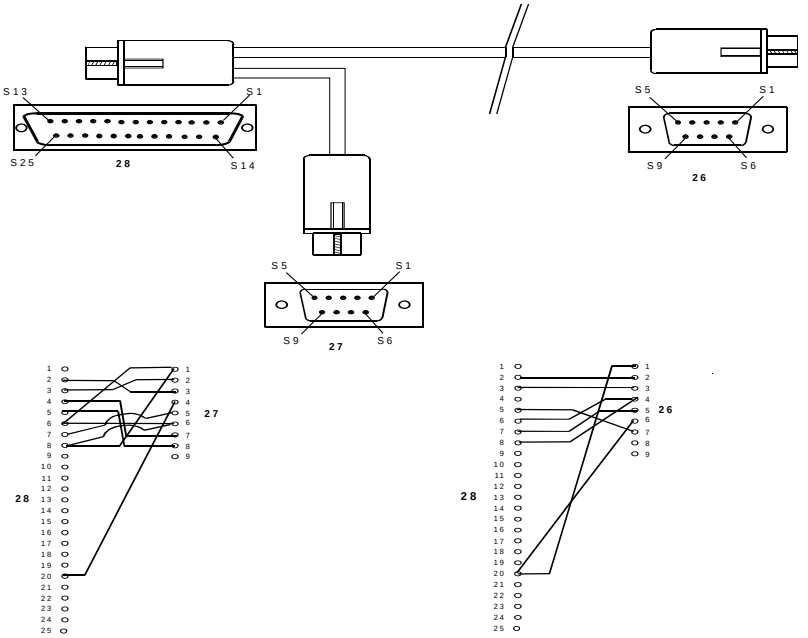
Reference	Description
A	Outer contacts
B	Automotive adapter
C	3-amp slow-blow fuse
D	Center contact
E	Spring
F	Universal tip

Table 102: Power Cable - Pin Configuration

Pin	Description	Color
1	Ground	Brown
2	Power source A	Orange
3	Power source B	Red
4	Ground	Black

A.4.2 Y-Type Null-Modem Cable (NovAtel part number 60715062)

This cable supplied with the DL-4, see *Figure 37*, provides an easy means of communications with the DL-4 from a PC. The cable is equipped with a 9-pin connector at the DL-4 end which can be plugged into either COM1, COM2 or AUX. At the PC end, both a 9-pin and a 25-pin connector are provided to accommodate most PC serial (RS232) communication ports.



Wiring Table:

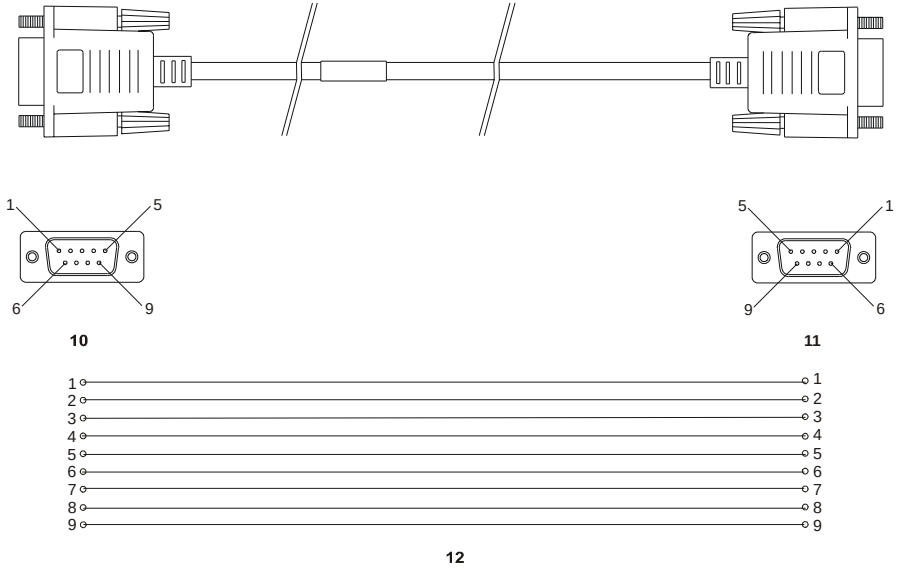
Connector	Pin Number						
From DB25S (28)	2	3	4	5	6 & 8	7	20
To DE9S (26)	2	3	8	7	4	5	1 & 6
To DE9S (27)	3	2	7	8	1 & 6	5	4

Reference	Description
26	DE9S (Female)
27	DE9S (Female)
28	DB25S (Female)

Figure 37: DL-4 Y-Type Null Modem Cable

A.4.3 Straight Serial Cable (NovAtel part number 60723066)

This cable can be used to connect the DL-4 to a modem or radio transmitter to propagate differential corrections. The cable is equipped with a male DB9 connector at the DL-4 end that should ideally be plugged into COM 2 on the receiver. The female DB9 connector at the other end is provided to plug into your user-supplied equipment (please refer to your modem or radio transmitter user guide for more information on its connectors). The cable is approximately 2 m in length. See *Figure 38*.

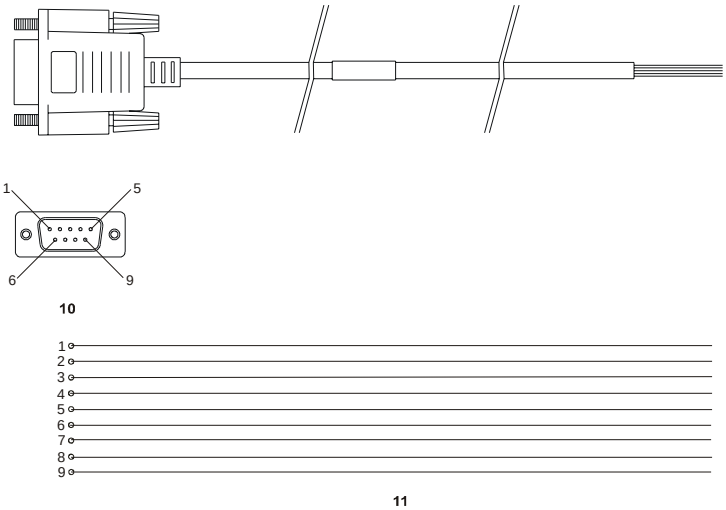


Reference	Description	Reference	Description
10	Male DB9 connector	12	9-conductor cable
11	Female DB9 connector		

Figure 38: DL-4 Straight Serial Cable

A.4.4 I/O Strobe Port Cable (NovAtel part number 60723065)

The DL-4 strobe lines can be accessed by inserting the male DB9 connector of the I/O strobe port cable into the I/O port. The other end of this cable is provided without a connector to provide flexibility. The jacket insulation is cut away slightly from the end but the insulation on each wire is intact. The cable is approximately 2 m in length. See *Figure 39*.



Wiring Table:

I/O Port Pin	I/O Port Signal	I/O Port Cable Wire Color	I/O Port Pin	I/O Port Signal	I/O Port Cable Wire Color
1	VARF	Black	6	Reserved	Green
2	PPS	Brown	7	Reserved	Blue
3	Reserved	Red	8	GND	Violet
4	MK1I	Orange	9	GND	White/Grey
5	PV	Yellow			

Reference	Description	Reference	Description
10	Male DB9 connector	11	9-conductor cable

Figure 39: DL-4 I/O Strobe Port Cable

Appendix B Replacement Parts

The following are a list of the replacement parts available for your NovAtel GPS receiver. Should you require assistance or need to order additional components, please contact your local NovAtel dealer or Customer Service representative.

B.1 DL-4 Cables

Part Description	NovAtel Part
Power cable assembly with to automotive adapter (see *Appendix A, Page 180*)	01017023
Y-type null modem cable (see *Appendix A, Page 181*)	60715062
Straight serial cable (see *Appendix A, Page 182*)	60723066
I/O strobe port cable (see *Appendix A, Page 183*)	60723065

B.2 Accessories and Options

Part Description		NovAtel Part
OEM4 Family User Manual Volume 1, Installation and Operation		OM-20000046
OEM4 Family User Manual Volume 2, Commands and Logs		OM-20000047
DL-4 User Manual		OM-20000063
Optional power assembly: autoranging AC/DC converter/battery charger to LEMO 4-pin socket and AC power cord.		GPS-ACDL-4
Optional Y power cable		01016690
Optional power cable: LEMO 4-pin plug to LEMO 4-pin plug available in two lengths:		
	33.5 cm (13.19”)	01016665
	75.0 cm (29.53”)	01016666
Optional NovAtel GPSAntennas:	**Model 600** (L1/L2 or L1-only)	GPS-600
	Model 501 (L1 only)	GPS-501
	Model 511 (L1 only)	GPS-511
	Model 521 (L1 only)	GPS-521
	Model 502 (L1/L2)	GPS-502
	Model 503 (L1/L2)	GPS-503
	Model 512 (L1/L2)	GPS-512
Optional RF Antenna Cable:	5 meters (16.4’)	C006
	15 meters (49.2’)	C016
	30 meters (98.4’)	C031
	22 cm (8.66”) interconnect adapter cable	GPS-C002

B.3 Manufacturer’s Part Numbers

The following original manufacturer’s part numbers are provided for information only and are not available from NovAtel as separate parts.

Part Description	LEMO Part
4-pin male plug connector on power cable (see *Appendix A, Page 180*), which mates with the PWR connector on the DL-4	FGG.0B.304.CLAD52Z

Index

T

U

V

W

Y


NovAtel