

Z-Xtreme™ GPS Receiver

Operations & Reference Manual

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Introduction

The Z-Xtreme GPS receiver, Figure 1.1, presents a powerful and economical alternative to conventional surveying equipment for the GPS community. Designed to support an expanding variety of surveying applications, including land/boundary/cadastral surveys, route surveys, construction, and as-built surveys, the 12-channel, dual-frequency receiver integrates technological advances in microprocessor design, data storage, and power management. Retaining the functionality of a complete surveying system, the Z-Xtreme fits into an improved, lighter, and more ergonomic enclosure. Incorporating Ashtech's patented Z-Tracking™ technology to mitigate the effects of Anti-Spoofing (AS), the Z-Xtreme provides increased tracking ability under adverse satellite visibility conditions such as under tree canopy, in canyons, or between buildings.



Figure 1.1 Z-Xtreme GPS Receiver

The Z-Xtreme operates on just 6 watts and includes an internal battery capable of 10 hours of continuous operation. For longer operations, the Z-Xtreme offers an external power input. The receiver also includes internal memory in the form of a removable standard 16Mb PCMCIA card expandable up to 85 Mb. Due to performance and popularity, many third-party application software companies have developed their

application-specific packages to work directly with the receiver. The Z-Xtreme receiver works with a wide choice of controller software and data collectors, and provides a full range of accessories to make surveying simple and efficient.

Incorporating an integrated, optimized keyboard/display, the system supports collection and post-processing of static, rapid static, and kinematic data without the need for an external handheld display/controller. The unit functions as a base station and/or rover for real-time code and code/carrier RTCM differential GPS usage. To support the requirement for real-time centimeter-level surveying solutions, an optional UHF or spread spectrum radio is incorporated into the receiver, providing a configured portable and integrated real-time GPS surveying system. The receiver can be configured as a continuous operating reference station (CORS) for surveying, GIS, geological, or other scientific monitoring applications.

Overview

The Z-Xtreme processes signals from the GPS satellite constellation, deriving real-time position, velocity, and time measurements. Twelve dedicated separate and parallel channels extract Coarse/Acquisition (C/A) code-phase, and carrier-phase measurement on the L1 (1575 MHz) band, and Precise (P) code phase and carrier phase measurement on the L1 and L2 (1227 MHz) bands.

The Z-Xtreme receives satellite signals via an L-band antenna and low-noise amplifier (LNA). The receiver operates stand-alone and as a base (reference) station or remote (rover) station providing real-time differential GPS operation for code, and real-time kinematic (RTK) operation for carrier phase. The unit implements the RTCM SC 104 V2.2 standard for differential and RTK operation. These features allow the Z-Xtreme to achieve centimeter accuracy while being compatible for differential and RTK operation with any other receiver that implements the RTCM standard.

Functional Description

The receiver is activated when either an internal battery has been inserted, or an external power supply has been connected to the power connector, and the power push-button is pushed to ON. After self-test, the receiver initializes its 12 channels and begins searching for all space vehicles (SV) within the field of view of the antenna. The receiver can track all Block I and Block II GPS SVs. All 32 PRN numbers as specified in Navstar GPS Space Segment/Navigation User Interfaces, ICD-GPS-200, Revision B are internally coded. As the receiver acquires (locks onto) each SV, it notes the time and collects the ephemeris data about the orbit of that SV, and almanac data about the orbits of all the SVs in the constellation.

The receiver features 12-parallel channel/12-SV all-in-view operation; each of up to 12 visible SVs can be assigned to a channel and then continuously tracked. Each SV broadcasts almanac and ephemeris information every 30 seconds, and the unit automatically records this information in its non-volatile memory. The unit has an L1/L2-band radio frequency (RF) port and four RS-232 serial input/output (I/O) ports. Ports A, B, and C are capable of two-way communication with external equipment. Port D is capable of RTCM operation when using the optional internal radio link.

The RF circuitry receives satellite data from a GPS antenna and LNA via a coaxial cable, and can supply +5V to the antenna/LNA by means of that cable. No separate antenna power cable is required. Typical power consumption is approximately 6.0 watts even when powering an LNA.

The receiver incorporates three multi-colored LEDs. A radio data status LED blinks green when valid radio data has been received. A memory storage status LED blinks green when data is stored to the memory card. A satellite/power status LED blinks green for each satellite tracked, and blinks red between satellites tracked count to depict power-on status.

The receiver collects Coarse Acquisition (C/A) code-phase (pseudo-range) and full wavelength carrier phase measurement on L1 frequency (1575 MHz), Precise (P) code phase (pseudo-range) and full wavelength carrier phase on L1 and L2 frequency (1227 MHz). All data can be stored on the internal PCMCIA card. The receiver permits uninterrupted use even when Anti-Spoofing (AS) is turned on. When AS is on, the receiver automatically activates Ashtech's patented Z-tracking mode that mitigates the effects of AS. The accuracy when AS is on is the same as when AS is off.

Memory Options

The amount of data the Z-Xtreme can retain depends upon the PCMCIA card and the recording interval. You can verify the amount of memory by going to the Memory Status (**MEM:***%**) menu under the **SYSINFO** menu displayed on the front panel. You can also verify the amount of memory by sending the `$PASHQ,FLS,0` command (for more information on commands, refer to the *Z-Xtreme Technical Reference Manual*).

Technical Specifications

Table 1.1 lists the technical specifications of the Z-Xtreme.

Table 1.1 Technical Specifications

Characteristic	Specifications
Tracking	12 channels L1 CA/PL1 and PL2
Size	3."H x 7.75"W x 8.75"D
Weight	3.5 lb
Operating temperature	-20° to +55°C (without internal battery)
Storage temperature	-30° to +75°C (without internal battery)
Humidity	100%
Environment	Resistant to wind-driven rain and dust to MIL-STD-810E
Power consumption, operating with internal battery, at room temperature (25° C), display disabled	6.0 watts
Power input	10 - 28VDC
Data storage	From 16Mb up to 85 MB dependent upon PCMCIA card
Interface	<ul style="list-style-type: none"> • Eight-character alphanumeric LED display • Three dual-color LED • Three external RS-232 ports via Fischer connectors • One antenna connector • Event marker and 1PPS via serial port connector • Optional radio antenna connector
MEASUREMENT PRECISION	
C/A (>10° elevation) <ul style="list-style-type: none"> • Pseudo-range (raw/smooth) • Carrier Phase 	<ul style="list-style-type: none"> • 25cm/3.6cm • 0.9mm
P-Code AS off (>10° elevation) <ul style="list-style-type: none"> • L1 Pseudo-range (raw/smooth) • L1 Carrier Phase • L2 Pseudo-range (raw/smooth) • L2 Carrier Phase 	<ul style="list-style-type: none"> • 15cm/0.9cm • 0.9mm • 21cm/1.3cm • 0.9mm

Performance Specifications

One of the most important functions of the receiver is providing real-time position with accuracy ranging from less than 10 meters to centimeter level. Table 1.2 summarizes the positioning modes and expected accuracy.

Table 1.2 Accuracy as Function of Mode

Positioning Mode	Typical Horizontal Accuracy (2drms), 5 SVs, PDOP<4	Maximum Update Rate	Maximum Operating Range
Static, Rapid Static	Horizontal: 5mm + 1 ppm Vertical: 10 mm + 1 ppm	5Hz (10 Hz optional)	Several hundred kilometers depending upon satellite geometry.
Post-Processed Kinematic	Horizontal: 1 cm + 1 ppm Vertical: 2 cm + 1 ppm	5 Hz (10 Hz optional)	Several hundred kilometers depending upon satellite geometry.
Real-Time Code Differential	< 1 m	5 Hz (10 Hz optional)	Several hundred kilometers depending upon data link.
Real-time Z Kinematic (Fine Mode)	Horizontal: 1 cm + 2 ppm Vertical: 2 cm + 2 ppm Azimuth (arc sec): 0.4 + 2.0/baseline (km)	5 Hz (10 Hz optional)	Recommended: < 10 km Maximum: 40 km



Specifications assume operation follows all the procedures recommended in the product manuals utilizing Instant-RTK, post processing with Ashtech Solutions or Ashtech Office Suite for Survey. High-multipath areas, high PDOP values, low satellite visibility, and periods of adverse atmospheric conditions and/or other adverse circumstances will degrade system performance. All accuracy specifications are RMS values.

Receiver Options

Table 1.3 lists the available options.

Table 1.3 Z-Extreme Options

Option	Description
B	RTCM differential base
U	RTCM differential remote
E	Event Marker

Table 1.3 Z-Extreme Options (continued)

Option	Description
X	External Frequency
M	Remote monitor option
F	Fast Data Output
T	Point Positioning
1,2,3	Observables
J	RTK Rover
K	RTK Base
I	Instant RTK

Each option is represented by a letter or number presented in a certain order. You can verify the installed options by going to the options table under the System Information (SYSINFO) menu on the front panel. You can also verify the installed options by issuing the **\$PASHQ,RID** command to the receiver using an external handheld controller or PC, as described in the *Z-Xtreme Technical Reference Manual*. The **\$PASHQ,RID** command displays the options on the external handheld controller or PC. For example:

\$PASHR,RID,UZ,30,UC00,BUEXMFT3JK,0A13*75

If the letter or number is displayed in the response message, the option is installed. If the letter/number is not displayed, the option is not installed.

Option B - RTCM Base

The receiver can set as an RTCM differential base station and can output real-time differential corrections when this option is enabled. The output will be in RTCM-104, Version 2.2 format message types 1, 3, 6, 16, and 22, as well as RTCM Carrier Differential 18, 19, 20, and 21. For messages 18, 19, 20, and 21, the K option is also required.

Option U - RTCM Remote

The real-time differential corrections are available when this option is enabled. The receiver will decode the RTCM-104, Version 2.2 format message types 1, 3, 6, 9, 16, and 22 as well as types 18, 19, 20 and 21. For messages 18, 19, 20, and 21, the J option is also required.

Option E - Event Marker

The E option enables the storage of event times created from a trigger signal. The receiver measures and records event times with high accuracy (down to one microsecond). The receiver stores an event time at the rising edge of the trigger signal (or the falling edge on command) and the time is recorded in the receiver's PC memory card and/or output through the TTT NMEA message.

Option X - External Frequency Reference

The external frequency option X allows you to input an external frequency so you can synchronize receiver data to an external clock. When enabled, its installation disables the internal oscillator and uses the external frequency input only.

Option M - Remote Monitoring

The remote monitoring option allows you to use the **REMOTE.EXE** utility to access and control the receiver via a modem from a remote location.

Option F - Fast Data Output

This option enables the receiver to be programmed to output both raw position data and NMEA messages or record data (if a PCMCIA card is present in the receiver) at user-selectable frequencies up to 10Hz. Without this option, only frequencies up to 5Hz are available.

Option T - Point Positioning

The T option allows you to put the receiver into point positioning mode using the \$PASHS,PPO command. Point positioning mode improves the accuracy of an autonomous position of a static point.

Option 3 - Observables—1, 2, 3

This option determines the observables available in the receiver where:

- 1—CA code and P-code on L1/L2 (no carrier)
- 2—CA code and carrier, P-code on L1/L2 (no carrier)
- 3—CA code and carrier, P-code on L1/L2 and carrier

Option J - RTK Rover

The J option allows the receiver to act as a rover station that utilizes the carrier phase differential (both DBEN and RTCM message 18, 19, 20, and 21) data transmitted from the base to compute differentially corrected positions. This option requires the observables option to be 3. For RTCM messages type 18, 19, 20, and 21, the U option is required in addition to the J option.

Option K - RTK Base

The K option allows the receiver to act as a real-time Z base station which will output carrier phase differential data. This option requires the observables option to be 3. For RTCM 18/19 or 21/22, the B option is also required.

Option I - Instant RTK

The I option, an extension of the J option, allows the receiver to use the new RTK system - Instant RTK™ which uses a new data processing strategy for integer ambiguity initialization. The initialization time using Instant RTK typically requires a single epoch of data if there are 6 or more satellites available with reasonable open sky and low multipath. The baseline length should be 7 km or less.

Equipment Description

This chapter provides a detailed description of the internal features of the Z-Xtreme.

Z-Xtreme Front Panel

The Z-Xtreme front panel, Figure 2.1 and Figure 2.2, allows you to control basic receiver options as well as perform Static, Rapid Static, and Kinematic surveys. Table 2.1 describes the functions of the front-panel controls and indicators.



Figure 2.1 Z-Xtreme Front Panel Closed



Figure 2.2 Z-Xtreme Front Panel Open

Table 2.1 Controls and Indicators

Number	Component	Function
1	LED Display	Display and input screen for receiver. Displays messages, parameters, equipment status, and warning messages. The screen displays eight characters at one time, while scrolling messages larger than eight characters from right to left.
2	Up/Down/Enter buttons	Operate these buttons for use with the LED display.
3	LED Indicators <ul style="list-style-type: none"> • UHF/SS Radio Indicator • Memory Storage Indicator • Satellite Tracking/Power Indicator 	<ul style="list-style-type: none"> • Flashing green light indicates radio activity. • Flashing green light indicates data stored to memory activity; flashing red indicates data card full. • Flashing green indicates satellites tracked; flashing red indicates power applied to receiver.
4	On/Off Power button	Turns unit on and off. Press and hold for 3 seconds to turn off receiver.
5	Memory/Battery door	Allows access to the memory card and battery.
6	Battery Eject button	Ejects battery from internal battery connector.
7	Memory Card Eject button	Ejects memory card from the memory card connector.

Table 2.1 Controls and Indicators (continued)

Number	Component	Function
8	Internal battery	Internal removable battery.
9	Memory card	Internal removable memory card.

Rear Panel

The rear panel of the Z-Xtreme, Figure 2.3, contains all the connectors for connection to external equipment. Table 2.2 describes the rear panel components.

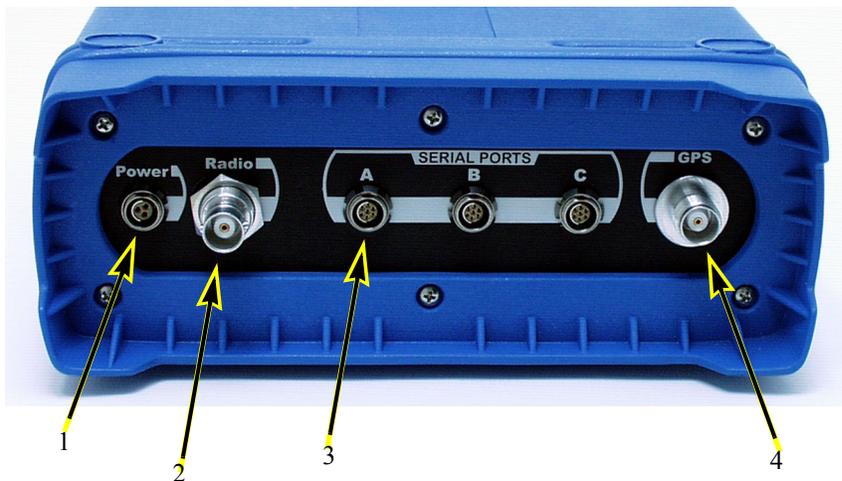


Figure 2.3 Z-Xtreme Rear Panel

Table 2.2 Z-Xtreme Rear Panel Description

Number	Component	Function
1	Power connector	Allows connection to external power source (refer to Table 2.3).
2	Radio connector	Allows RF connection of the embedded radio modem. <ul style="list-style-type: none"> • BNC for UHF radio modems • Reverse polarity TNC for spread spectrum radio modems

Table 2.2 Z-Xtreme Rear Panel Description

Number	Component	Function
3	Serial Ports •A •B •C •D	<p>Each port delivers a 12V output on pin 1 for radio modem power up. The total power delivered by all connectors is 1A, at 50% duty cycle, 250ms duration. In case of a short-circuit, the power is internally fused—the fuse has been tripped requiring the removal of the short-circuit prior to activation of this power.</p> <ul style="list-style-type: none"> • A complete RS-232 port with full-handshaking. Port A can be used for communications with a hand-held computer, an IBM compatible PC, or a radio. Port A is used for transferring data from the receiver to a computer, from a receiver to a receiver, and all other communications to and from the receiver. • A complete RS-232 port with full-handshaking. Port B can be used for communication with the hand-held computer, an IBM compatible PC, or a radio. Port B is used for transferring data from the receiver to a computer, from a receiver to a receiver, and all other communications to and from the receiver. This port also carries an event marker input on pin 7. • A complete RS-232 port with full-handshaking. Port C can be used for communication with the hand-held computer, an IBM compatible PC, or a radio. Port C is used for transferring data from the receiver to a computer, from a receiver to a receiver, and all other communications to and from the receiver. This port also carries a 1PPS output on pin 7. • A complete RS-232 port with full-handshaking. Port D is used internally for communication with the optional internal radio modem.
4	GPS antenna connector	<p>The RF connector is a standard TNC female receptacle wired for connection via 50-ohm coaxial cabling to a GPS antenna with an integral LNA. The connector shell is connected to the Z-Xtreme common ground. The TNC connector center pin provides +5VDC (to power the LNA) and accepts 1227 and 1575.42 MHz RF input from the antenna; the RF and DC signals share the same path.</p>

CAUTION

The current for the GPS antenna connector is limited to 150mA out of the RF center conductor. It is short-circuit protected. If using a splitter or other RF network, use an inner DC block suitable for 1-2 GHz, 50 ohms; maximum voltage back to the Z-Xtreme cannot exceed 15V.

Pinouts

Power

The voltage input range is 10-28 volts, with a power rating of 10 watts. One 3-pin Fischer connector provides the power input interface. Figure 2.4 shows the pin layout of the power connector. Table 2.3 defines the pinout of the power connector.

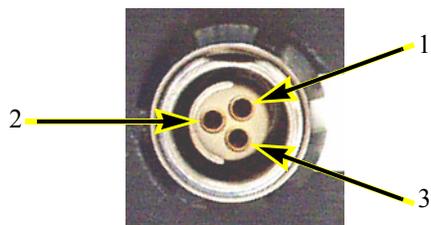


Figure 2.4 Power Connector Pin Layout

Table 2.3 Power Connector Pinouts

Pin	Signal	Description
1	EXT_GND	External Ground
2	EXT_INP	Power input 10-28 Vdc
3	NA	Not connected



Chassis ground and external ground are not the same for EMI purposes.

Port (Fischer) Connectors

Figure 2.5 shows the pin layout for all the serial ports.

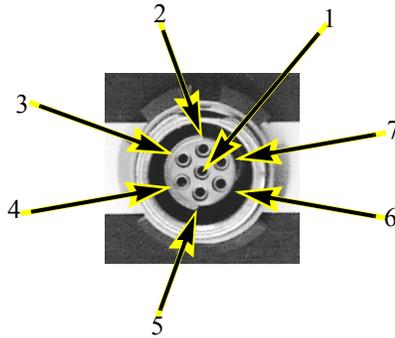


Figure 2.5 Serial Port Pin Layout

Figure 2.1. Table 2.4 provides the serial port pinout description.

Table 2.4 Serial Port Pinout Description

Pin	Description
1	12 volts output
2	Ground
3	Clear To Send input
4	Request To Send Output
5	Receive Data input
6	Transmit Data output
7	This pin has the one-pulse-per-second output and the event marker input for ports B and C respectively. For port A, do not connect any signals; this pins is for factory use only.

CAUTION

Do not connect or disconnect power or signal cables from the Z-Xtreme while power is applied. Possible injury and/or equipment damage may occur.

PCMCIA Card

The PCMCIA card, Figure 2.6, can be accessed through the front panel door of the Z-Xtreme.

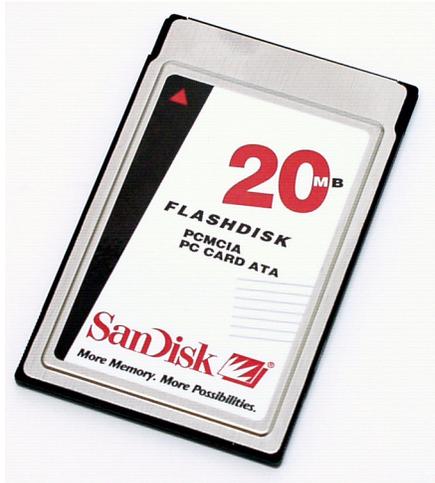


Figure 2.6 PCMCIA Card

The PCMCIA card is a high-capacity, solid-state, non-volatile flash memory device which complies with PC Card ATA and IDE standards. It provides plug-and-play compatibility with IDE rotating disk drives. Table 2.5 lists the specifications for the card.

Table 2.5 PCMCIA Specifications

Characteristic	Specification
Type	PCMCIA Type II
Electrical: <ul style="list-style-type: none">• Interface• Capacity	<ul style="list-style-type: none">• ATA True IDE Mode• 16MB, 32Mb, 85Mb

Table 2.5 PCMCIA Specifications (continued)

Characteristic	Specification
Physical: <ul style="list-style-type: none">• Length• Width• Depth• Weight	<ul style="list-style-type: none">• 3.370 in (85.6mm)• 2.126 in (54.0 mm)• 0.1968 in (5.0 mm) Max• 1.52 oz. (43g) Max
Environment: <ul style="list-style-type: none">• Temperature (operating)• Temperature (storage)• Vibration (operating)• Vibration (storage)• Shock	<ul style="list-style-type: none">• -25 C to +75 C• -40 C to +85 C• 15G peak-to-peak (max)• 15G peak-to-peak(max)• 1000G max



The PC card can be used inside the receiver without restrictions, over the receiver's full operating and non-operating temperature range.



When using a new PCMCIA card, make sure to reformat it within the receiver. This optimal formatting can be done through the "DELETE ALL" command under the "SESSIONS" menu of the front panel display, or by sending the \$PASHS,CLM command on one of the serial ports.

Battery/Charger

The Z-Xtreme uses a 10.8Vdc lithium-ion rechargeable battery, similar to the one shown in Figure 2.7.



Figure 2.7 Lithium-ion Battery

This battery has a push button on the top which indicates percent of power remaining. Table 2.6 lists percentage indicators and their corresponding power remaining.

Table 2.6 Battery Indications

Indication	Power Remaining
Red 25	<25%
Green 50	<50%
Green 75	<75%
Green 100	<100%



For a more accurate representation of the power remaining in an internal battery, use the front panel interface.

CAUTION

Operation of the battery above 50°C can cause leakage of hazardous materials as well as permanent damage to the battery.



Before using the battery for the first time, it needs a full charge followed by a full discharge and full charge again. This conditioning is necessary to ensure proper calibration of the power remaining in the battery.

Conditioning

When you charge your battery for the first time, your charger may indicate that charging is complete after just 10 to 15 minutes. This is normal and can happen with all rechargeable batteries when first charged. To condition a new battery, remove the battery and then repeat the charging procedure.



Unless conditioning is performed, the power remaining percentages given through the front panel and through the serial ports will be inaccurate.

CAUTION

Do not disassemble or attempt to open the battery under any circumstances. The battery can explode, leak or catch on fire if heated or exposed to fire or high temperatures. When discarding the battery, be sure to follow the battery manufacturer's disposal procedures. Do not short circuit the battery by directly connecting the metal terminals. Be certain that no metal objects such as coins, paper clips, etc., touch the terminals.

Upon first use, or after prolonged periods of storage, you need to completely charge and discharge your battery two or three times before obtaining optimum performance. It is best to charge the battery at room temperature between 59° F (15° C) and 85° F (30° C). It is normal for the battery to become warm during charging or after use. It is not necessary to fully discharge your battery before charging. You can top-off the charge at any time. A charged battery will gradually lose its charge if left in storage. Deep discharge of the battery causes permanent damage resulting in a shorter life.



Remove your battery from the receiver, charger, or AC adapter when not in use. Store at room temperature in a dry place.

The battery charger is a dual-slot, sequential smart charger for both dumb and smart battery applications. The input voltage is 24 Vdc. The AC/DC adapter delivers 24 Vdc

for the charger from a power source 100-240 Vac. Figure 2.8 shows an internal battery placed in the battery charger.



Figure 2.8 Battery in Battery Charger with AC Adapter

Charging

Charging of an internal battery takes about four hours. Remove battery from receiver and place battery(s) in charger bay(s), plug charger into AC adapter, and then plug AC adapter into 100-240VAC, 3-prong AC source. The status lights on the charger indicate the following:

- Yellow—Standby
- Red—Charging
- Green—Charged
- Blinking Red - Error



The charger and battery communicate capacity and charge level information. The charger will terminate the charge cycle when the calculated charge time has expired to protect the battery from being over-charged. The battery memory and the actual charge state of the battery do not match. The battery needs to be calibrated.

Calibration

The battery circuitry stores and communicates charge capacity and charge level information. The accuracy of the charge level indicator relative to the actual charge level of the battery will degrade over time. The charger supports the ability to calibrate the battery to the actual charge level. Calibration is a three-step process. The first

step charges the battery to capacity. The second step discharges the battery at a 1-A rate. The third step charges the battery to capacity. This process may take over 12 hours to complete. Calibrating the battery is recommended after 10 charge/discharge cycles. The status lights on the charger indicate the following:

- Blinking Yellow -- Calibrate mode is in progress
- Blinking Green -- Calibration completed

Disposition

Dispose of the internal batteries in accordance with manufacturer's directions. These batteries are recyclable.

3

Getting Started

This chapter describes receiver operations controllable through the front panel.

Memory Card

While you may use the Z-Xtreme without a memory card, one is required for internal data storage.

Installation

Perform the following steps to properly insert the PCMCIA card.

1. Orient the Z-Xtreme so that you are looking at the front panel.
2. Open the memory/battery door (Figure 3.1).



Figure 3.1 Memory/Battery Door

3. Orient the PCMCIA card so the arrow on the label is on the bottom side of the card and pointing towards the memory card slot.

4. Insert the card (side with insertion arrow face down) into the memory slot.
5. Slide the PCMCIA card all the way into the memory slot of the Z-Xtreme.

CAUTION

All PCMCIA cards are keyed so they only seat into the card connector one way. While this feature assists in the insertion of the card, it is possible to force the card into the connector improperly. Improper installation of the PCMCIA card may damage the Z-Xtreme.

6. Ensure the PCMCIA card properly seated.
7. Close and latch the memory/battery door.

Removal

Perform the following steps to remove the PCMCIA card.

1. Ensure recording has stopped (either issue a “stop session” through the front panel, or issue a \$PASHS,REC,S command, or turn the receiver off).
2. Orient the Z-Xtreme so that you are looking at the front panel.
3. Open the memory/battery door on the front of the Z-Xtreme.

CAUTION

Attempting to extract a PCMCIA card while the receiver is recording might result in loss of up to five minutes of recorded data. Disable data recording or power the receiver off prior to removing the card.



Whenever you stop data recording to insert a new PCMCIA card, data recording will resume as soon as the new card has been inserted, recognized as valid, and the system has verified there is enough memory to continue data recording.

4. Depress the PCMCIA ejection button to eject the card from its slot.
5. Grasp the PCMCIA card and remove it.
6. Close and latch the memory/battery door.

Internal Battery

Using the Z-Xtreme in a field environment requires a battery (internal and external models are available—the receiver will default to the external battery if it is connected). This section covers only the internal battery.

Installation

1. Orient the Z-Xtreme so that you are looking at the front panel.
2. Open the memory/battery door (Figure 3.2).



Figure 3.2 Installing an Internal Battery

3. Orient the battery so the connector is on the right side while pointing towards the battery bay.
4. Slide the battery into the battery slot until it seats into the battery connector.

CAUTION

The battery connector is keyed so it only seats into the battery bay connector one way. While this feature assists in the insertion of the battery, it is possible to force the battery into the bay improperly. Improper installation of the battery may damage the Z-Xtreme.

5. Close the memory/battery door.

CAUTION

Operation of the receiver on internal battery, with the radio or other peripheral device connected to the external 12V on the serial ports, will shorten battery life.

Avoid a deep discharge of the battery below 9V as permanent damage to the battery can result.

Removal

Perform the following steps to remove the battery from the Z-Xtreme.

1. Orient the Z-Xtreme so you are looking at the front panel.
2. Open the memory/battery door on the front of the Z-Xtreme.
3. Push the battery eject button. The battery will unseat from the battery connector.
4. Grasp and pull the battery pull-tab and remove the battery (Figure 3.3).



Figure 3.3 Removing an Internal Battery

5. Close the memory/battery door.

Hardware Setup

Perform the following steps before turning on the receiver:

1. Connect the antenna cable from the GPS antenna to the antenna connector on the rear of the receiver.
2. Verify that a memory card has been correctly inserted.
3. Ensure that a fully charged battery (internal or external) is connected to the receiver. If operating with an external battery, connect the battery to the PWR connector on the rear panel of the receiver.

The receiver is internally protected in case the battery connections are unintentionally reversed.



Applying Power

After your equipment has been properly cabled and a memory card correctly inserted, press the **On/Off** button to apply power.

Receiver Initialization

It is good practice to reset the receiver prior to operating it for the first time or when a system malfunction occurs. A reset of the internal memory clears the memory and restores the factory defaults. This reset does not affect data stored on the PCMCIA card.

- **Front Panel**

You can reset the receiver one of two ways:

- With the receiver powered off, hold down the **ENTER** button while depressing the power button.
- Performing a Memory Reset from the SETTINGS menu of the LED interface.

- **Using Ports**

Send this command to execute the initialization:

```
$PASHS,INI,5,5,5,5,1,0
```

For more information about this command, refer to the *Z-Xtreme Technical Reference Manual*.

PCMCIA Card

When using the PCMCIA card, be sure to reformat the card consistently (biweekly for receivers used regularly). Reformatting can be done through the DELETE ALL command under the SESSIONS menu of the front panel display or by sending \$PASHS,CLM command to one of the serial ports. This allows the receiver to format the card using a special File Allocation Table algorithm that allows recovery of data from a corrupted card.

Monitoring

Monitoring via the Front Panel

Apply power to the receiver by pressing the **On/Off** button. The unit displays

```
CHECK
```

and then the main menu:

```
SYSINFO
```

With this message displayed, press \uparrow for less than two seconds. Every time you press \uparrow , the unit displays a different main menu in the following order:

- SYSINFO
- SURVEY: mode
- SURVCONF
- SESSIONS
- SETTINGS

If the display is in one of the submenus and you press the \uparrow arrow button for more than two seconds, the display returns to the top level parent menu. The receiver can monitor activity while collecting data. The following paragraphs present step-by-step instructions regarding access to important receiver status information such as:

Satellite Tracking
Position
Remaining Memory
Remaining Power

Satellite Tracking

If you wish to monitor the satellites that the receiver is tracking, perform the following steps:

1. From the main menu, press \uparrow < 2 seconds until SURVEY: MODE is selected (mode can be static, kinematic, or RTK Base).
2. With SURVEY: MODE selected, press \downarrow >2 seconds.
3. Within the SURVEY: MODE submenu, press \uparrow < 2 seconds repeatedly until STATUS appears on the screen.
4. With STATUS selected, press \downarrow >2 seconds.
5. Within the STATUS submenu, press \uparrow < 2 seconds repeatedly until #USED:** appears on the screen.

Position

If you wish to view the current position of the receiver, perform the following steps:

1. From the main menu, press \uparrow < 2 seconds until SURVEY: MODE is selected.
2. With SURVEY: MODE selected, press \downarrow >2 seconds.
3. Within the SURVEY: MODE submenu, press \uparrow < 2 seconds repeatedly until STATUS appears on the screen.
4. With STATUS selected, press \downarrow >2 seconds.
5. Within the STATUS submenu, press \uparrow < 2 seconds repeatedly until
LAT:N/S**0**'*** .*****" LON:E/W**0**'*** .*****" ALT:***** ***
scrolls across the screen.

Remaining Memory

The receiver can check the amount of memory remaining on the PCMCIA card. To view the remaining memory, perform the following steps:

1. From the main menu, press \uparrow < 2 seconds until SYSINFO is selected.
2. With SYSINFO selected, press \downarrow >2 seconds.
3. Within the SYSINFO submenu, press \uparrow < 2 seconds repeatedly until
MEM:xxx%
appears on the screen.

Remaining Power

To view the remaining power of the internal battery, perform the following steps:

1. From the main menu, press \uparrow < 2 seconds until SYSINFO is selected.
2. With SYSINFO selected, press \downarrow >2 seconds.
3. Within the SYSINFO submenu, press \uparrow < 2 seconds repeatedly until
BAT:**MIN
is selected.



This display, exclusively used for an internal battery, is only accurate when battery conditioning has been performed.

Monitoring via the Serial Ports

Receiver status may also be monitored through the serial ports. To communicate with the receiver via the serial ports, the receiver must be correctly connected to a PC running communication software such as Magellan's RCS or commercial PROCOMM. Set and query commands can then be sent to the receiver, and the receiver responds with data or status messages. Refer to the *Z-Xtreme Technical Reference Manual* for more details about serial port communication and for command descriptions and formats. The following is a partial list of commands that return information on the receiver status.

Satellite Monitoring

The following commands return information on satellite tracking and status:

```
$PASHQ,SAT  
$PASHQ,STA
```

Position

The following commands return information on the current receiver position:

```
$PASHQ,POS  
$PASHQ,GGA
```

Available Memory

The following command will return information on the amount of available memory and the files stored on the PC card:

```
$PASHQ,FLS
```

Remaining Power

The following command will return information amount of power remaining in the internal battery:

```
$PASHQ,POW
```

Setting Receiver Parameters

You can find many of the receiver parameters accessible by the front panel. You can modify any of these parameters. Additional parameters can be set using the serial port commands (Refer to the *Z-Xtreme Technical Reference Manual*).

Saving Parameter Settings

Ordinarily, receiver parameters that have been changed will return to their default status after a power cycle. The receiver allows you to save changed receiver settings

so they will be saved through a power cycle. Perform the following steps to save receiver settings:

1. From the main menu, press \uparrow < 2 seconds repeatedly until **SETTINGS** is selected.
2. With **SETTINGS** selected, press \downarrow >2 seconds.
3. Within the **SETTINGS** submenu, press \uparrow < 2 seconds repeatedly until **SAVE** is selected.
4. Press \downarrow <2 seconds and the message "Save settings?" is displayed.
5. Press **ENTER** <2 seconds to save the receiver settings.
6. Receiver displays "Done."

4

Operations

LED Display Interface

General

The LED interface allows you to monitor, query, and control several receiver surveying functions. All functions are organized in a menu tree which is accessed by using the up/down/enter buttons. Table 4.1 describes the basic functions of the up, down, and Enter buttons on the front panel.

Table 4.1 Control Buttons

Mode	Button Combination	Function
Display	↑ arrow pressed <2 seconds	Scrolls through the submenu options
	↑ arrow pressed >2 seconds	Returns display to upper level menu
	↓ arrow pressed <2 seconds	Places display in edit mode
	↓ arrow pressed >2 seconds	Sends display to lower level menu
	Enter key pressed <2 seconds	No action
	Enter key pressed >2 seconds	Cancels and exits.
Edit	↑ arrow pressed <2 seconds	Scrolls display upward through available values
	↑ arrow pressed >2 seconds	Scrolls display upward quickly
	↓ arrow pressed <2 seconds	Scrolls display downward through available values
	↓ arrow pressed >2 seconds	Scrolls display downward quickly
	Enter key pressed <2 seconds	Accepts parameter setting
	Enter key pressed >2 seconds	Cancels parameter setting

If the display is inactive for more than 20 seconds, the display enters sleep mode to save power. Press any key to restore the display to its original state prior to sleep mode.

Menus

Figure 4.1 depicts the menu tree for the front panel display.

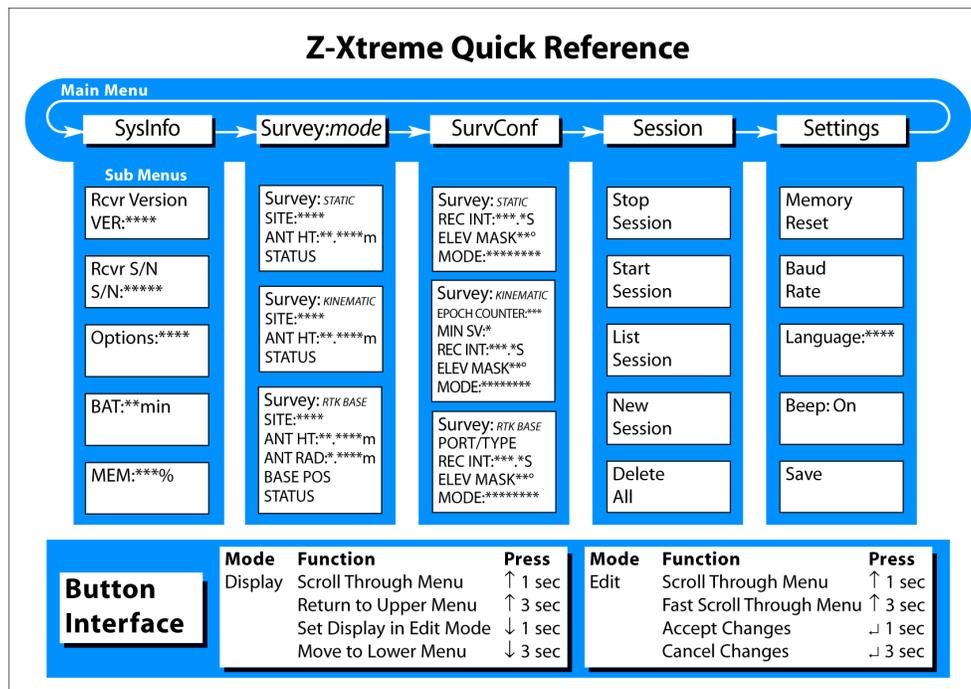


Figure 4.1 Display Menu Tree

Table 4.2 describes the five main menus.

Table 4.2 Main Menu Description

Category	Menu Name	Description
System Information	SYSINFO	Information about the receiver
Survey parameters and status	SURVEY: <i>mode</i>	Parameters that may need to be changed several times per survey type and current status: Coordinate, time, and satellite information (mode dependent)
Survey configuration	SURVCONF	Operational settings users need to modify only once per survey type (mode dependent)
File management	SESSIONS	File management/data recording functions
Receiver control parameters	SETTINGS	Receiver settings that users can modify

The following sections describe each menu. The text within the parentheses matches the text on the display.

System Information (SysInfo)

This menu lets you obtain basic receiver information such as serial number, options currently loaded, power and memory status, etc.

- **Receiver software version number (VER:****)**
Version of firmware installed within the receiver. Record this information in case you need to contact Customer Support.
- **Receiver serial number (S/N:*****)**
This is the serial number of the receiver. Record this information in case you need to contact Customer Support.
- **Options table (Options:*****)**
This string of letters/numbers represents the receiver options loaded in the receiver (refer to Table 1.3). Record this information in case you need to contact Customer Support.
- **Power Status (BAT:**min)**
Indicates the amount of power left in the internal battery, expressed in remaining time (minutes) based on the current power consumption.
- **Memory Status (MEM:***%)**
Indicates the percentage of memory left on the PCMCIA card.

Receiver Status (Survey:mode)

This menu allows you to set receiver parameters and obtain basic receiver status such as current position, number of satellites locked, PDOP, current time, etc.

dependent on the type of survey being conducted. There are three modes:

- STATIC**
- KINEMATIC**
- RTK BASE**

The display shows only the items that are significant for the mode selected. The mode is selected through the **SURVCONF** main menu.

STATIC

- **SITE (SITE:****)**
Sets the four-character SITE name.
- **Antenna Height (ANT HT:**.****m)**
Sets the height of the GPS antenna
- **Survey Status (STATUS)**
STATUS is a submenu with the information described in Table 4.3.

Table 4.3 Survey Status Information

Menu Item	Indication	Description
Current Position	LAT:N/S**O***.****" LON:E/W**O***.****" ALT:****.***m	The position displayed is the autonomous position or the RTCM code differential position, but not the RTK or CPD position.
Position Dilution of Precision	PDOP: **.*	Displays PDOP of current constellation used for position solution.
#Satellites recorded (on L1 and L2)	#USED: **	Number of satellites being recorded on PCMCIA card (healthy and above the recording elevation mask).
Time	CNT/GPS/UTC **.***	Displays current time. Table 4.4 describes the different types of time the receiver can display.

Table 4.4 Time Parameters

Time	Description
CNT	Time of the receiver's internal clock. Displayed until receiver locks to first satellite.
GPS	Time displayed after receiver locks to first satellite.
UTC	Time displayed after receiver collects UTC corrections from satellite.

KINEMATIC

- **SITE (SITE:****)**
Sets the four character SITE name.
- **Epoch Log counter (LOG #:***)**
If the epoch counter in the SURVCONF menu has been set to a value other than 0 and the SITE has been entered (which must be done after you have set the antenna on the desired point), the display enters the LOG # screen and the log counter begins decrementing starting from the epoch counter value (at the rate of the recording interval set in the SURVCONF menu).
- **Incremented SITE (Site:****?)**
Once the log counter reaches 0 (when enough epochs have been recorded for the current site), the receiver beeps and the B-file reverts to ????. The display automatically increments the SITE while waiting for the user to set up at the new point. You can then accept or reject the proposed SITE.
The SITE is automatically incremented only if the last character (on the right) is a number. When this number reaches 9, it rolls back to 0. If the character on the left is also a number, it gets incremented, and so on. The characters which are not incremented and the ones on the left of the first character which are not numbers, are ignored (the same SITE is used for the new point).



Even if all the SITE characters are letters, the display will still go to the accept/refuse menu. You will need to refuse before being able to enter a new SITE. If you accept, the same SITE will be used for the new point.

- **Antenna Height (ANT HT:**.****m)**
Sets the height of the GPS antenna
- **Survey Status (STATUS)**
STATUS is a submenu with information listed in Table 4.3.

RTK BASE

- **SITE (SITE:****)**
Sets the four-character SITE name.
- **Antenna Height (ANT HT:**.****m)**
Sets the height of the GPS antenna
- **Antenna Radius (ANT RAD:*.****m)**
Sets the radius of the GPS antenna.
- **Base Position (BASE POS) (submenu)**
The base position is associated with the following information:
 - **Latitude (LAT:N/S**0***'**. *****)**

- **Longitude (LON:E/W****0****.*****)**
- **Altitude (ALT:****.***m)**
- **Set to current position (HERE)**
Sets the base position to the position currently computed by the receiver (the stand-alone position).
- **Survey Status (STATUS)**
STATUS is a submenu with information listed in Table 4.3.

Survey Configuration (SURVCONF)

This menu lets you set or change the display item while conducting specific surveys, dependent on the type of survey being conducted (e.g. the epoch counter in kinematic mode). There are three modes:

STATIC
KINEMATIC
RTK BASE

The display shows only the items that are significant for the mode selected.

STATIC

- **Recording Interval (REC INT:***.s)**

Table 4.5 lists the values for which you can set the second and subsecond recording intervals.

Table 4.5 Selectable Recording Intervals

Subsecond	Second*
0.1†	1
0.2	2
0.3	3
0.4	4
0.5	5
0.6	6
N/A‡	7
0.8	8
0.9	9—999 (default is 20)

*Only integer number of seconds are allowed (e.g. 1.5 is rejected).
†Only accepted if the fast output option is enabled (F option).
‡0.7 is not accepted because the resulting time tag will not be aligned with the GPS hour.

- **Recording Elevation Mask (ELEV MASK**0)**

Data from satellites under the elevation mask will not be recorded to the PCMCIA card.

- **Display Mode (MODE:***** STATIC/KINEMATIC/RTK BASE)**

Receiver displays the parameters relevant to the survey mode selected.

KINEMATIC

- **Epoch Counter (EPOCH COUNTER:***)**

Number of epochs to record on each point.

- **Minimum SV required for Kinematic Operation (MIN SV:*)**

Receiver beeps indicating there are not enough satellites to continue a

kinematic survey; independent from the minimum number of SVs required to record any data.

- **Recording Interval (REC INT:***.s)**
Refer to Table 4.5 for information on available recording intervals.
- **Recording Elevation Mask (ELEV MASK**°)**
Data from satellites under the elevation mask will not be recorded to the PCMCIA card.
- **Display Mode (MODE:***** STATIC/KINEMATIC/RTK BASE)**
Receiver displays the parameters relevant to survey mode selected.

RTK BASE

- **Base Port and Data Type (PORT/TYPE) submenu**
This submenu displays/sets the RTK data type sent by the RTK Base on each of the four ports available.

Table 4.6 lists the possible data types.

Table 4.6 Selectable Data Types

Data Type	Description
DBEN	Ashtech RTK base compact binary format
RTCM	RTCM type 18/19 and 3/22 are enabled
OFF	No RTK base data sent on that port

- **Recording Interval (REC INT:***.s)**
Refer to Table 4.5 for information on available recording intervals.
- **Recording Elevation Mask (ELEV MASK**°)**
Data from satellites under the elevation mask will not be recorded to the PCMCIA card.
- **Display Mode (MODE:***** STATIC/KINEMATIC/RTK BASE)**
Receiver displays the parameters relevant to survey mode selected.

Data Recording (Sessions)

This menu lets you control the data recording sessions.

- **Stop Session**
Closes the session and stops recording (this function is performed automatically when the receiver is powered off). This command must be entered prior to extracting the PCMCIA card if the receiver is recording data. Failure to do so may cause loss of data and card corruption.
- **Start Session**
Opens session and begins recording (the action is performed automatically when inserting a new PCMCIA card or applying power to the

receiver). This command must be entered if a session was stopped and the PCMCIA card was not removed.

- **List Sessions**
Lists all of the data recording sessions on the PCMCIA card in the order of recording up to 100. If the data recording sessions exceed 100, the receiver lists the first 99 as well as the most recent session. If in the “edit” mode (i.e., the ↓ button was pressed for <2 seconds), the receiver deletes the session. Pressing “enter” (i.e., pressing the enter button <2 seconds) confirms the deletion while pressing “cancel” (i.e., pressing the enter button >2 seconds) cancels the deletion.
- **New Session**
Closes current data file and opens a new one (data recording does not stop during this operation).
- **Delete all**
Deletes all data on the PC card by formatting the FAT directory area.

Miscellaneous Parameter (Settings)

These are receiver settings that you are able to set.

- **Memory Reset**
Resets internal memory and user parameters back to default (does not affect PC card).
- **Baud Rate**
Displays the baud rate submenu allowing you to select a baud rate for each port. Default is 9600. Table 4.7 lists the selectable baud rates.

Table 4.7 Selectable Baud Rates

300	600	1200	2400	4800	9600	19.2K	38.4K	57.6K	115.2K
-----	-----	------	------	------	------	-------	-------	-------	--------

Language

Allows you to select the language of the screen messages. Table 4.8 lists the available languages.

Table 4.8 Selectable Languages

Language	Display
English	ENGLISH
French	FRANCAIS
German	DEUTSCH
Italian	ITALIANO
Spanish	ESPANOL



If warnings were generated before changing the language, they will remain in the original language even after the language is changed. Only new warnings will be displayed in the selected language.

- **Beep**
Allows you to turn the beeper on or off (default is on).
- **Save**
Saves the current values of the user parameters to the battery backed-up memory so they can be restored when powering the receiver back on.

Warning Messages

The receiver checks a number of conditions that are of interest to the user. Whenever one of these conditions is true, the display is interrupted to show a message, called a warning, stating what the condition is. The warning message flashes to distinguish it from a regular menu, and the beep comes on for 1 second every 10 seconds (unless disabled). When you have acknowledged the warning (by pressing any key), the display returns to whatever it was displaying before being interrupted, and the beep stops. At times, the receiver can generate several warnings at once. In this case, the receiver displays the highest priority warning until it is acknowledged. The receiver then displays the remaining warnings in sequence, according to their priority.

Table 4.9 describes the possible warnings the receiver may issue.

Table 4.9 Front Panel Warnings

Warning	Definition	Action
Int. Battery Error : SMBus	The SMBus controller (for the internal battery communication) is not working	Remove battery and reinsert it. If problem persists, insert a different battery. If problem still persists, contact customer support.
Int. Battery Error : Access	Can't access the internal battery	Remove battery and reinsert it. If problem persists, insert a different battery. If problem still persists, contact customer support.
Battery Conditioning Required	Internal battery efficiency is down, it requires a conditioning cycle.	Perform battery reconditioning (depends on the battery, but typically means full charge, full discharge and full charge again)
Low Int. Battery: < 10 min	Internal battery remaining life is < 10 min, the battery needs to be changed	Replace battery with a charged one.
Low Ext. Battery : < 30 min	External battery remaining life is < 30 min, the battery needs to be changed. This is only available if you have entered the parameters of the external battery via the \$PASHS,POW command.	Replace battery with a charged one.
†Memory Test Error : RAM	RAM error	Perform a receiver initialization. If problem persists, contact customer support.
†Memory Test Error : BBRAM	Battery backed	Perform a receiver initialization. If problem persists, contact customer support.
†Memory Test Error : ROM	ROM, i.e. Flash	Perform a receiver initialization. If problem persists, contact customer support.
†Memory Test Error : BOOT	Boot section of the flash	Perform a receiver initialization. If problem persists, contact customer support.
No Data Card Detected	There is no card in the PCMCIA drive or it cannot be detected; no recording will be done	Insert or reinsert data card in slot.
Data Card Full	No space left on the PC card, therefore data recording is stopped	Replace current data card with a card containing available memory, or delete some older sessions.

Table 4.9 Front Panel Warnings (continued)

Warning	Definition	Action
†Data Card Full <5 min	Not enough space on the PC card to record more than five minutes of data under current conditions (satellite number, recording period, output information).	Replace data card with one containing available memory or delete older sessions.
Data Card Error : Access	Can't read or write to the PC card	Power cycle the receiver. If problem persists, issue command \$PASHS,CLM (card will be reformatted and all data erased, so download data prior to issuing the CLM command). If problem persists, replace the PC card.
Data Card Error : Update	Can't update the FAT (file allocation table)	Power cycle the receiver. If problem persists, issue command \$PASHS,CLM (card will be reformatted and all data erased, so download data prior to issuing the CLM command). If problem persists, replace the PC card.
Data Card Error : Create	Can't create the files for new session, can not record data	Power cycle the receiver. If problem persists, issue command \$PASHS,CLM (card will be reformatted and all data erased, so download data prior to issuing the CLM command). If problem persists, replace the PC card.
Data Card Error : Rename	Can't rename the files of session	Power cycle the receiver. If problem persists, issue command \$PASHS,CLM (card will be reformatted and all data erased, so download data prior to issuing the CLM command). If the problem persists, replace the PC card.
Data Card Error: Corrupted FAT	File Allocation Table on PCMCIA card has been corrupted and could not be recovered by the receiver.	Issue command \$PASHS,CLM to reformat the card. If critical data is on the PC card, call Customer Support before issuing the CLM command to recover data.
Not Receiving Base Data	Not receiving RTK Carrier Phase measurements from the base receiver	Check serial/radio link with the base. Ensure base is computing a position. Ensure a valid position was entered into the base.
Not Receiving RTCM Base Data	Not receiving RTCM code phase corrections from the base receiver	Check serial/radio link with the base. Ensure a valid position was entered in the base. Verify that base is computing a position.

Table 4.9 Front Panel Warnings (continued)

Warning	Definition	Action
Bad Base Coordinates	The position entered in the base receiver for CPD operation is not correct (too far from computed position)	<ul style="list-style-type: none"> • Base position was entered wrong on the rover side. Reenter it. • The mode in the base receiver was set to not send BPS, set base to send BPS (\$PASHS, CPD,UBP,1). • If rover is in "entered base station" (\$PASH,CPD,UBP,O). Enter the base position in the rover via \$PASHS,BPS,POS. • If rover is in "receiver base position" mode (default or \$PASHS,CPD,UBP,1), check link with base. • Make sure the base sends base coordinates (\$PASHS,BPS,PER,O)
Bad RTCM Base Position	The position entered in the base receiver for RTCM code operation is not correct (too far from computed position)	Enter correct base position.
†‡Not Enough Satellites	Tracking fewer than the minimum number of satellites required for kinematic survey	The kinematic survey must be reinitialized on last point.
Low Backup Battery	The battery powering the non-volatile memory and the real-time clock is low and needs to be changed	Contact Customer Support. Back-up battery must be replaced.
Antenna Overload	Antenna installation problems, i.e. the setup is drawing more than 150 milliamps (short on antenna cable or LNA drawing too much current)	Check antenna connection for bad cable or bad LNA.
No Antenna Detected	Does not sense any antenna: WARNING, this will be the case if a DC block is installed somewhere between the receiver and the antenna	Check antenna connection for bad cable or bad LNA. There may be another receiver connected to the same antenna with no DC block, or this receiver is connected to the antenna via a DC block.
MODEM Communication Error	Cannot communicate with the modem	Check serial connection to the modem. Check power on modem. Check baud rate of modem-it should match baud rate of receiver. Reinitialize modem.

Table 4.9 Front Panel Warnings (continued)

Warning	Definition	Action
MODEM Initialization Error	Cannot initialize the modem	Check serial connection to the modem. Check power on modem. Check baud rate of modem-it should match baud rate of receiver. Reinitialize modem.
High Receiver Temperature	Inside receiver temperature > 80 deg Celsius: the receiver will turn off automatically at 82 deg Celsius (this message might be seen when the external ambient temperature is >55 degrees Celsius)	Shield the receiver from the sun. Increase air flow around receiver. NOTE: If the receiver's temperature is still going up, the receiver automatically switches to the sleep mode, in reduced power consumption mode as a safety measure. To recover, cycle the Power, after having eliminated the source of overheating.
Download in Progress	Receiver is currently downloading data from the PCMCIA card to a PC. No session management operations can be conducted at this time.	Wait for Download to complete operation before performing the command. If Download is not running, run Download again, perform proper shutdown routine. Do not disconnect serial link to PC before exiting Download.
† Indicates warning is permanent (the warning will NOT go away if the condition disappears, but only if it is acknowledged). ‡ Indicates error will only display if antenna is present.		

Data Recording

Reformatting the PC Card

PC cards are normally pre-formatted. If the card is not pre-formatted, it may be formatted through a PCMCIA drive in the PC, using the DOS format command. In addition, prior to initial use in the receiver, the PC card must be reformatted inside the receiver using the \$PASHS,CLM (clear external memory) command. This allows the receiver to optimally format the card using a special File Allocation Table (FAT) algorithm. PC cards should also be reformatted regularly (bi-weekly for receivers in constant use) inside the receiver to ensure minimum fragmentation of the card.

The receiver can reformat the card using one of two methods:

- Via the serial command \$PASHS,CLM, which formats all tracks in the card. This includes the FAT area, directory area, and data area. This

process, requiring approximately 5 seconds per MB, is the optimum and recommended method.

- Via the serial command \$PASHS,FIL,D,999, or via the DELETE ALL option under the SESSION menu from the front panel display, which formats only the FAT and directory areas. The data area is not physically cleared. This process takes one or two seconds, and is independent of the card size.

PCMCIA File Structure and File Names

The PC card is formatted as a standard DOS drive and can be accessed using any DOS-compatible computer with a PCMCIA card drive. The receiver stores files in the root directory and it creates a single file per session. Sessions are created after:

- cycling the receiver power
- by selecting the NEW SESSION option in the SESSIONS menu of the front panel display
- issuing the \$PASHS,FIL,C command
- by selecting the STOP/START option in the SESSIONS menu of the front panel display
- issuing the \$PASHS,REC,S/R command

Although the receiver is capable of creating a number of different records that cover a wide variety of information, the session file, called the U-file, contains all available types of data records (almanac records, ephemeris records, raw data records, position records, site information records, site attribute records, event marker records). The U-file is decoded into different files during the download process. See “*Downloading Data*” on page 47 for more information.

The U-file is automatically named according to a naming convention that includes the site name, session, and day of the year. Figure 4.2 outlines the file naming convention.

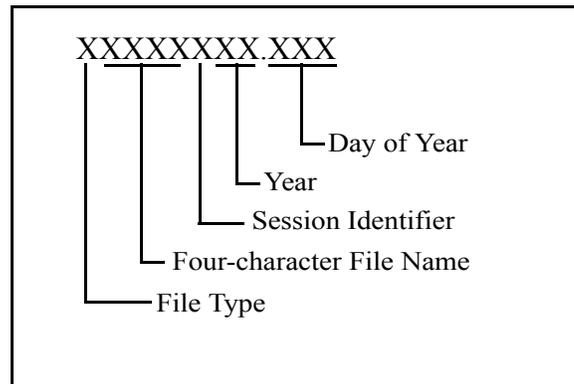


Figure 4.2 File Naming Convention

- The first letter is the file type.
- The next four characters indicate the site information. If you have not entered a site, then these four characters are replaced by underscores ("_____"). If you have not entered a site during the course of the session, the last site information entered in the previous session is used. If the site has been entered several times during the course of the session, the last entered site information is used.
- The next character is the session identifier. This field automatically increments from A with each new session, ending with Z. After 26 sessions are created, the session identifier resets to A, and the first character of the year changes to A. Then, once again the session identifier increments one letter with each new session.
- The next two characters indicate the last two digits of the year when the session was terminated (e.g., 00).
- The file extension indicates the day of the year when the session was terminated (e.g. Jan. 1 is day 001; Dec. 31 is day 365).

Data Modes

The receiver can record data in three different modes, called data modes or data types. Each mode records different combinations of data records and can only be

changed using the serial port command \$PASHS,RNG. Table 4.10 describes these modes. The default is mode 0.

Table 4.10 Z-Family Recording Modes

Recording Mode	Typical Application	Records Created	File Type After Conversion
0	Raw data, full code and carrier phase	Raw data records Ephemeris records Session Information records Almanac records	B-file E-filet S-file ALMyy.ddd
2	Position data only	Position records Session information records Almanac records	C-file S-file ALMyy.ddd
4	Raw data, full code and carrier phase, position data file	Raw data records Position records Ephemeris records Session Information records Almanac records	B-file C-file E-file S-file ALMyy.ddd

Downloading Data

GPS data stored on the PC card can be transferred to a computer for post-processing using three different methods. In all cases, the **Download** program is required.

- Data can be downloaded directly through one of the serial ports on the receiver into any destination directory in the PC. **Download** handles the protocol required to transfer data from the receiver via the serial port into the PC.
- With the PC card installed in a PCMCIA card drive, data can be downloaded from the PCMCIA drive into any destination directory in the PC.
- The PC card is a standard DOS storage device, therefore files can be transferred directly from the PC card in a PC card reading drive to a computer using the standard DOS commands or the Windows file manager. Then files need to be downloaded from the source directory (C:\Data) into any destination directory in the PC.



Files copied from the PC card reader into the computer are in a compressed format and will NOT be usable until downloaded using the Download software.

When transferring PC data from the receiver or the PCMCIA drive into the PC, **Download** reads the U-files records from the PC card and converts them into different data files, creating one set of data files per each session. Data files are

named using the U-file name for that session, however the first letter corresponds to the file type. The one exception is the almanac file, which is named ALMyy.ddd where yy represents the last two digits of the year and ddd represents the day of the year. Table 4.11 lists the file types.

Table 4.11 File Types

File Type	Description	Format
B-file	Generated from raw data - generally code and carrier phase data	Binary
E-file	Generated from satellite ephemeris data	Binary
S-file	Generated from site information data	ASCII
C-file	Generated from position data	ASCII
M-file	Generated from event marker files (photogrammetry)	ASCII
D-file	Generated from site attribute files	ASCII
ALMyy.ddd	Generated from almanac data	Binary

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