THALES NAVIGATION

POCKET GUIDE
for the
Z-MAX SURVEYING SYSTEM

Printed in France.
Part Number: 630881-01, Revision B
September 2003

CONTENTS

Introduction

This Pocket Guide is a quick reference guide to using the Z-Max Surveying System. The guide provides a short description of the modules and their functionality including using LEDs, front panel display menus. The Pocket guide also includes schematic diagrams of system hardware setup for static, kinematic and RTK surveys. This information does not contain complete explanations for operation and usage. More complete descriptions and additional information can be found in the Z-Max Operation and Applications manual.

Module Description & Connection

The Z-Max is a modular system that uses interconnecting components called modules. There are five important modules.

GPS Receiver Module

The GPS Receiver module, Figure 1, is essentially a specialized computer for processing and manipulating GPS measurements. The GPS receiver module has functionality similar to a personal computer including keypad, display, memory card, serial port, USB port, Bluetooth port and power port.

Figure 1 GPS Receiver Module

Front Panel

The Z-Max front panel allows you to power on/off the receiver, monitor basic receiver functions via the four LED status lights, and control receiver via the front panel LED Display.

SD Card Slot / USB Port

The SD Card slot and USB port are located behind a small door below the four control keys. Data recorded by the Z-Max is stored on an SD Memory card.

Rear Panel

The narrow rear panel of the Z-Max Main module, contains serial and external power ports for connection to peripheral equipment.

Serial Ports

The serial ports are used for communication between the Z-Max and external equipment.

Serial A: Serial A is a two-way serial port using RS-232 protocol, the protocol used by personal computers

Serial B: Serial B is a two-way serial port that can be toggled between RS-232 and RS-422 protocols. RS-422 is a specialized protocol for very long serial cables.

Power Port

The rear panel contains an external power connector that allows you to power the receiver externally with a DC power source. The input voltage must be 10-28 VDC. External sources of DC power include, battery, auto lighter or an AC/DC converter. Special cables are typically needed for external power sources.

GPS Antenna Module

The GPS antenna module, Figure 2, contains the Max-Trac GPS antenna. The GPS Antenna module connects to either the Receiver module, or to the top of the UHF Antenna module if the UHF

Communication module is used. The Antenna module fits into the antenna receptacle at the top of either the Main module or the UHF antenna module. Make sure the base of the Antenna module is oriented so that the flattened side is lined up with the flattened area of the receptacle, and the module will push easily into place. Once in place, twist the threaded collar on the Antenna module until the antenna is securely locked in place.

Figure 2 GPS Antenna Module

Power Module

The Power module, Figure 3, is the primary internal power source for the Z-Max. To plug in the module, insert the small ledge of the Power module into the rear of the GPS receiver module housing first. This will correctly align the module. Using the ledge like a hinge, swing the module closed until the latch on the Power module clicks into place. If you require additional or backup battery power, external power sources can be used in conjunction with the Power module.

Figure 3 Power Module and Charger

Communication Module

The Communication module, Figure 4, contains the data link(s) for transmitting or receiving data during DGPS and RTK applications. The Communication module can house a variety of wireless communication devices or combinations of devices. Communication devices will vary by application and geographic location. In case the receiver is not intended for real-time operation, an empty communication module, or V-module will be supplied in order to provide the moisture seal of the module bay. Refer to packing list to identify which communication device is being used.

Figure 4 Communication Module

To connect the Communication module, insert the small ledge of the Power module into the rear of the Main module housing first. This will correctly align the module. Using the ledge like a hinge, swing the module closed until the latch on the module clicks into place.

A Communication module that contains a GSM cellular modem has two additional features: a built-in GSM antenna, and a slot to hold the SIM card.

UHF Antenna Module

The UHF Antenna module, Figure 5, is the radio antenna for use with all UHF Communication modules. The UHF Antenna module, customized for UHF frequency band and in case the receiver is not intended for real-time operation, may be empty. The UHF Antenna module is connected between the GPS Antenna module and the Main Receiver module.

Figure 5 UHF Antenna Module

The UHF Antenna module connects to the Main module just like the GPS Antenna module.

LEDs

The Z-Max Main module has four LED indicator lights located on the front panel (Table 1). The 3-color LEDs allow the user to quickly monitor several receiver functions at a glance. From left to right, the four LEDs are RTK SOLUTION, COMMUNICATION, Data Log, and SV/Power.

Table 1 LED Indicator Functionality

LED	Color/Meaning	Frequency
RTK SOL	green = fixed solution orange = float solution red = no solution, autonomous	freq. of RTK output
COM	green = data quality good red = data quality bad	freq. of data output/input
DATA LOG	green = data recording solid red = data card full	recording interval
SV/Power	red = power is on green = SVs tracked	red: 1- 2 seconds green: # blinks = # SVs

The Power button located on the Z-Max Main module front panel will turn on/off the system, and can also be used to reset the receiver. Resetting the receiver

using the power button will also clear the data from the SD card (Table 2).

Front Panel Display

The Front Panel Display is an 8-character alphanumeric LED screen that is used to monitor receiver status, set receiver parameters and configure the receiver to perform different types of surveys. The display will also show warning messages and equipment status messages.

Control Keys

The display is accessed by using the four control keys. The control keys provide access to all the functionality of the display including moving within the menu tree, selecting available parameters, and entering letters or numbers like a keypad.

The keys will work differently depending upon if the screen is in Display mode (Table 2) or Edit mode (Table 3). In display mode, the keys are used only to scroll within a menu or move to another menu level. In Edit mode, the keys are used either to select a parameter or as a keypad to enter a parameter value.

Table 2 Control Keys in Display Mode

Key	Operation
UP arrow	Scroll menu forward
DOWN arrow	Scroll menu: backward
ENTER	Select and move down to next level
CANCEL	Return to upper level

Table 3 Control Keys in Edit Mode

Key	Operation
UP arrow	Parameter list: scroll parameters Keypad: scroll through characters
DOWN arrow	Fast scrolling forward or backward
ENTER	Keypad: accept character Parameter list: select parameter
CANCEL	Keypad: delete last edited character Parameter list: move from Edit mode to Display mode.

Display Menu Tree

Navigate through the front panel display by using the menu tree. Use the control keys described above to move around inside the menu tree and to set and enter parameters. Figure 6 depicts the main menu tree. Detailed menus for configuring the RTK Rover, and the data links (Thales/PDL radios, and GSM base and rover) are shown in Figures 12 through 16 beginning on page 30.

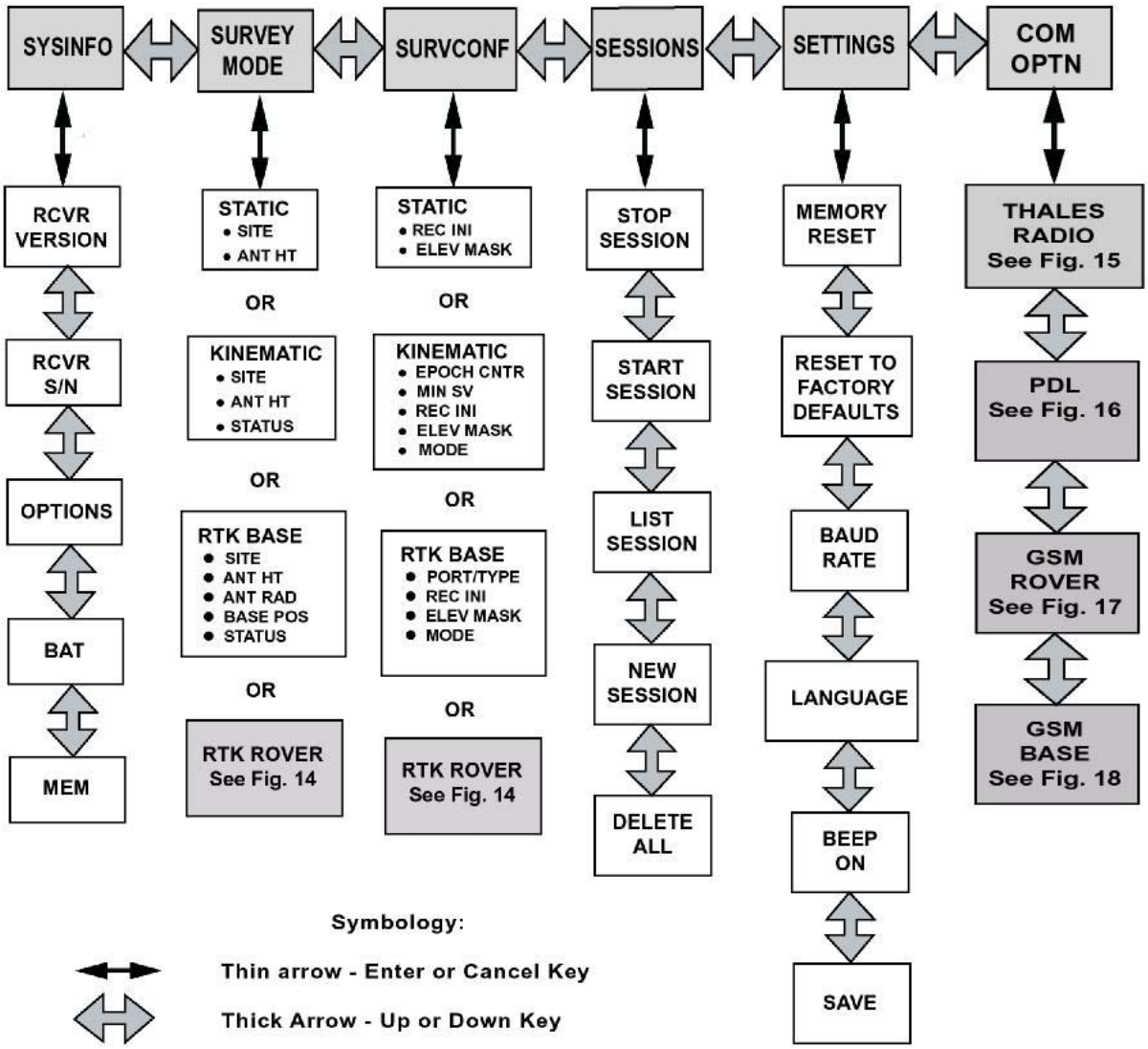

Figure 6 Display Main Menu

Checking Receiver Status

There are several operational status parameters to be aware of while performing a survey. Table 4 provides a list of the common ones along with where to monitor them. These parameters can also be monitored using field application software running on an external field computer.

Table 4 Common Status Parameters

Parameter	Location
Remaining battery life (Power module)	1. Power module push button 2. Front panel display (SYSINFO/BAT)
Number of SVs tracked	SV/Power LED
Remaining memory	Front panel display (SYSINFO/MEM)
Current position	Front panel display (SURVEY:mode/Status)
Data recording interval	1. Data Log LED (interval between blinks) 2. front panel display (SURVCONF/REC INT)
Files in memory	Front panel display (SESSIONS/LIST SESSION)
RTK Solution Status	RTK SOLUTION LED

Warning Messages

The receiver monitors a number of conditions that are of interest to the user. Whenever a problem is detected in one of these conditions, the LED display is interrupted to show a warning message stating the problem, and a beep will sound every 10 seconds. To acknowledge the message, press any key. Table 5 describes common warning messages and necessary action.

Table 5 Common Warning Messages

Warning	Definition	Action
Not Receiving (RTCM) Base Data	Not receiving base RTK/ RTCM data	Check data link. Check base receiver
Low Int. Battery: < 30 min	Remaining life of internal battery is < 30 minutes	Change Power module, or attach external battery
Data Card Full < 5 min	< less than 5 minutes of available memory on SD card	Delete data from the current card or replace current SD card
High Receiver Temperature	Internal receiver temperature is > 80 × C	Shield receiver from the sun or increase air flow

Table 5 Common Warning Messages

Warning	Definition	Action
Channel Not Programmed	Radio channel number has not been set	Set the radio channel number (CHN)
Wrong setting	A parameter conflict is preventing radio loading.	Check and reset radio parameters.
Communication Error	An error has occurred during setup or trying to power off external device	Resend the radio user parameters (PROGRAM submenu).
Not Loaded Yet	The radio LOAD function was not performed.	Load radio parameters (LOAD submenu).
MODEM Not Detected	GSM modem not detected	Verify a GSM modem is in the COMM module. Verify that the module is securely connected.
MODEM Not Responding	Can not communicate with GSM modem	Verify a GSM modem is in the COMM module, and verify that module is securely connected.
Enter Phone Number	Need to enter Base receiver phone number	Enter the correct base station GSM modem phone number.
MODEM No Carrier	Attempt to call Base receiver unsuccessful	Verify that the GSM base is operational.
MODEM Line Busy	Base receiver gives busy signal when called	Re-try later.

Table 5 Common Warning Messages

Warning	Definition	Action
MODEM Insert SIM Card	SIM card not detected	Insert SIM card into the COMM module
MODEM SIM Card Failure	SIM Card is not working.	Contact GSM Service Provider

Field Survey Setup

This section briefly lists the equipment setup required to perform a static, or RTK survey.

STATIC

In a static survey, all receivers are set up the same way. The typical steps to set up a static survey:

1. Determine if point location is suitable for GPS observations.
2. Connect system components.
   - GPS Antenna module ⇔ Main GPS receiver module
   - Power module ⇔ Main GPS receiver module
   - V-Module ⇔ Main GPS receiver module
   - External GPS receiver power ⇔ Main GPS receiver module (optional, not shown) (Figure 7)

Figure 7 Static Setup

3. Center and level tripod over point to be surveyed.
4. Attach HI Measurement Plate to tribrach adapter.
5. Securely thread tribrach adapter on to the Z-Max .
6. Place Z-Max onto the tripod.
7. Measure and record instrument height (HI) as shown in Figure 8.

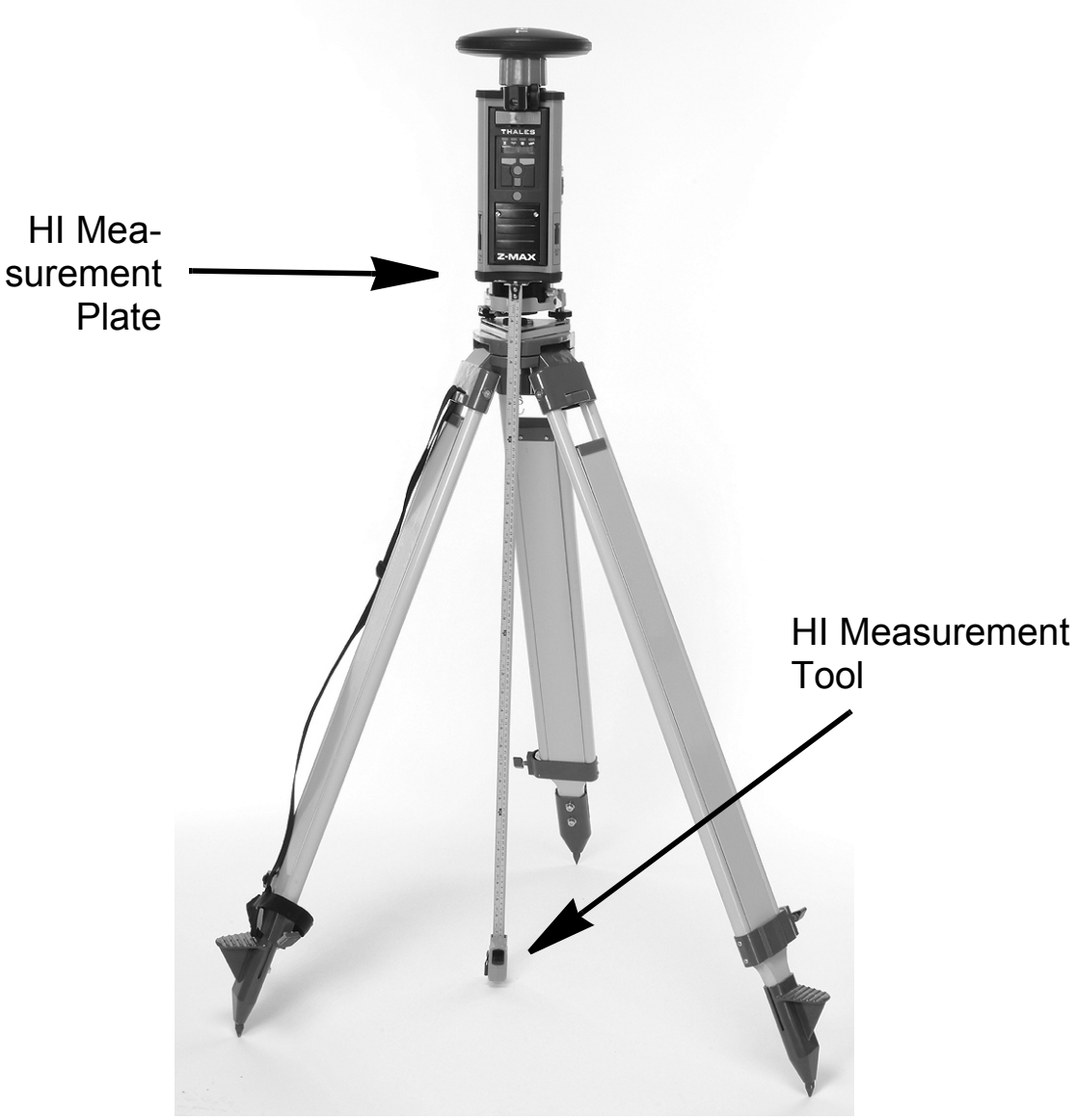

Figure 8 Measuring Instrument Height (HI)

8. Power-up the system.
9. Configure GPS receiver to perform a Static survey.

10. Enter the Site ID and Antenna HI in the front panel display Survey:Static submenu and in the observation log.

Figure 9 shows the front panel display.

Figure 9 Z-Max Front Panel Display

RTK BASE

The setup of an RTK base will differ depending upon the type of wireless communication system that is being used. The typical steps to set up an RTK base:

1. Select appropriate base system site .
2. Center and level tripod over base point .
3. Securely thread the Z-Max onto the tripod.
4. Mount base radio antenna and connect the base radio. UHF systems can be mounted on the same tripod as the Z-Max or on a different tripod. Cellular communications systems may have an antenna that is a part of the communications module itself.
5. Connect System Components.
6. Power module ⇔ Main GPS receiver module
7. GPS Antenna module ⇔ Main GPS receiver module
8. Communication module ⇔ Main GPS receiver module (if using GSM modem)
9. Radio ⇔ Radio Antenna (if using radio)
10. GPS Receiver ⇔ Radio (if using radio)
11. Radio ⇔ Radio Power System (if using radio)

12. External GPS receiver power ⇔ Main GPS receiver module (if needed)
13. Measure and record Instrument Height (HI) of GPS Antenna.
14. Power-up Base System.
15. Configure base wireless modem.
16. Configure the Z-Max Base to output RTK corrections.

Figure 10 shows the RTK Base configuration with a Thales U-Link radio. Figure 11 shows the RTK Base configuration with a PDL UHF radio.

Figure 10 RTK Base Setup with Thales U-Link Radio

Figure 11 RTK Base Setup with Pacific Crest PDL Radio

RTK ROVER

The setup of an RTK rover can be done in a variety of ways and with a variety of peripherals. The two primary ways of transporting an RTK rover are pole-mounting or backpack mounting. The wireless communication system used will dictate the wireless antenna that is used. Commonly, RTK is done with UHF radios. If this is the case, the UHF antenna module for the applicable radio frequency will be used. If cellular modems are used, the antenna is part of the Communication Module and the empty UHF Antenna Module may be used. The typical steps to set up an RTK rover:

1. **Connect Components**

   Pole-Mounted:

   - UHF Antenna module ⇔ GPS Receiver module
   - GPS Antenna module ⇔ UHF Antenna module
   - Communication module ⇔ GPS Receiver module
   - Power module ⇔ GPS Receiver module

Backpack-Mounted:

- Power module ⇔ GPS Receiver module
- Communication module ⇔ GPS Receiver module
- GPS receiver module ⇔ Backpack
- Pole Extension ⇔ Range Pole
- UHF Antenna module ⇔ Pole Extension
- GPS Antenna module ⇔ UHF Antenna module
- Max-RF adapter ⇔ Main GPS Receiver module
- Mount Z-Max into backpack
- Max-RF adapter ⇔ data/RF Cable ⇔ Pole Extension

2. Power-up Rover System
3. Configure wireless data link
4. Configure the Rover GPS Receiver to receive RTK corrections

Figure 12 shows the pole-mounted RTK Rover configuration. Figure 13 shows the backpack-mounted RTK Rover configuration Menu.

Figure 12 Pole-Mounted RTK Rover Setup

Figure 13 Backpack-Mounted RTK Rover Setup

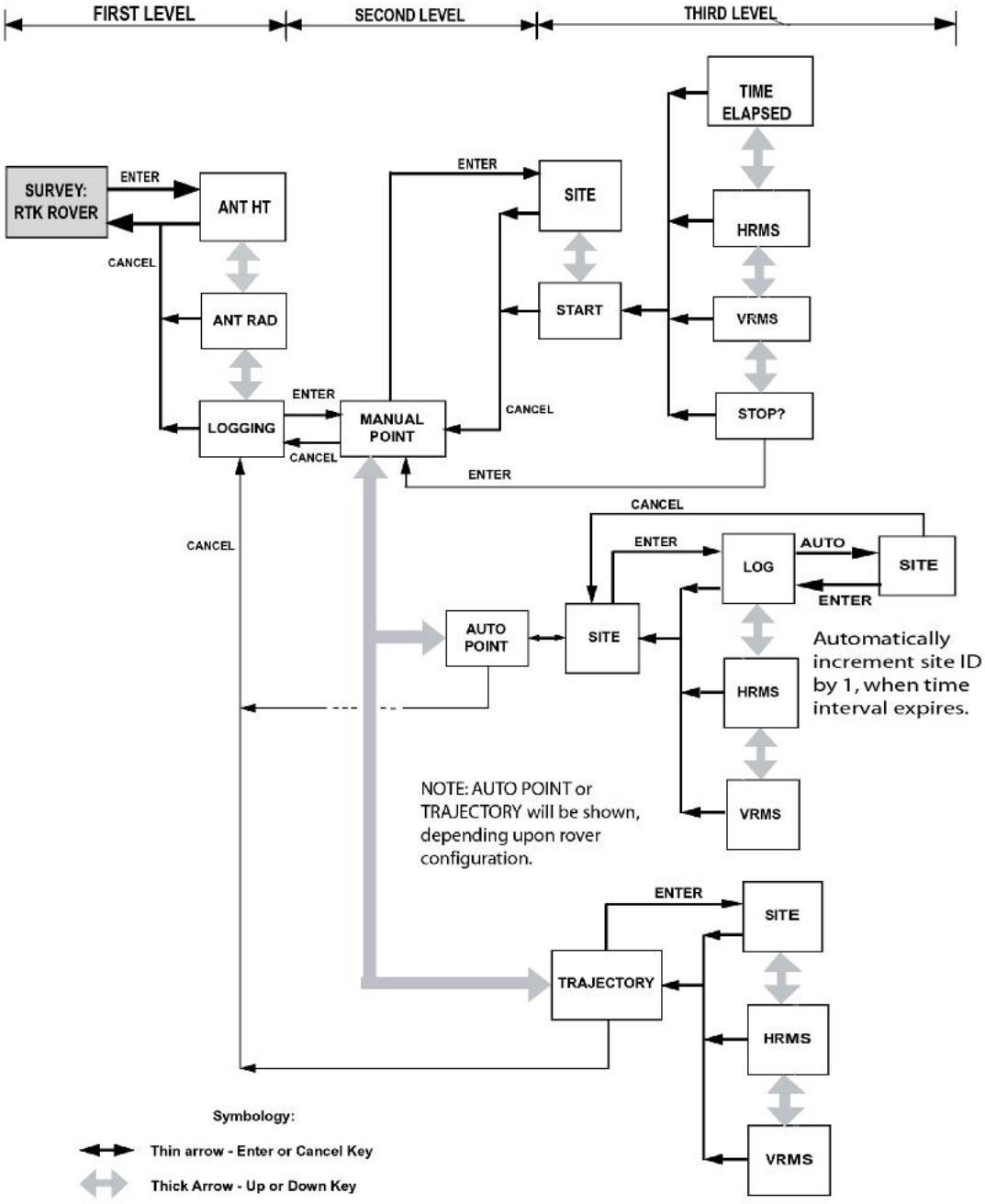

Figure 14 SURVEY: RTK Rover Menu

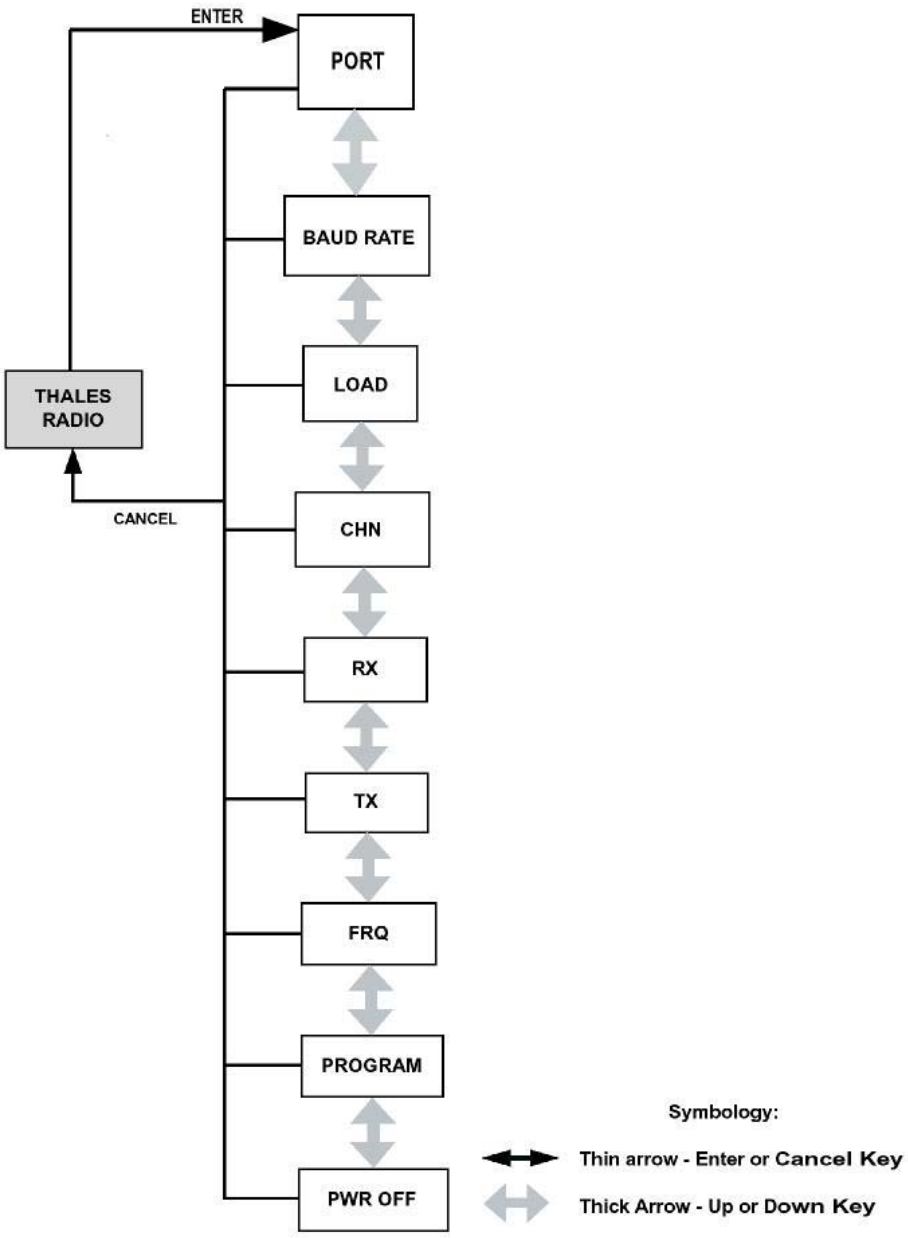

Figure 15 COM OPTN: THALES Radio Menu

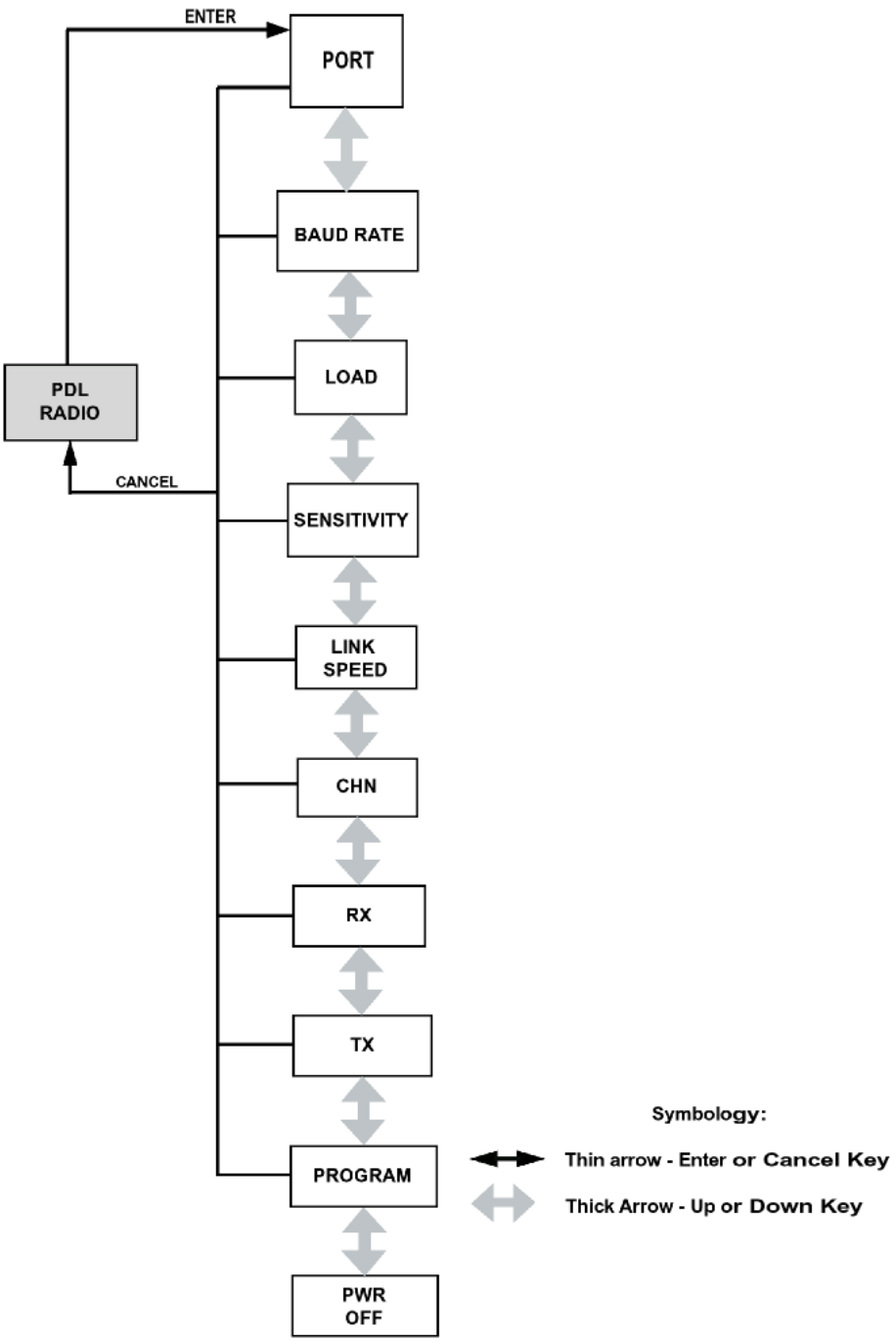

Figure 16 COM OPTN: PDL Radio Menu

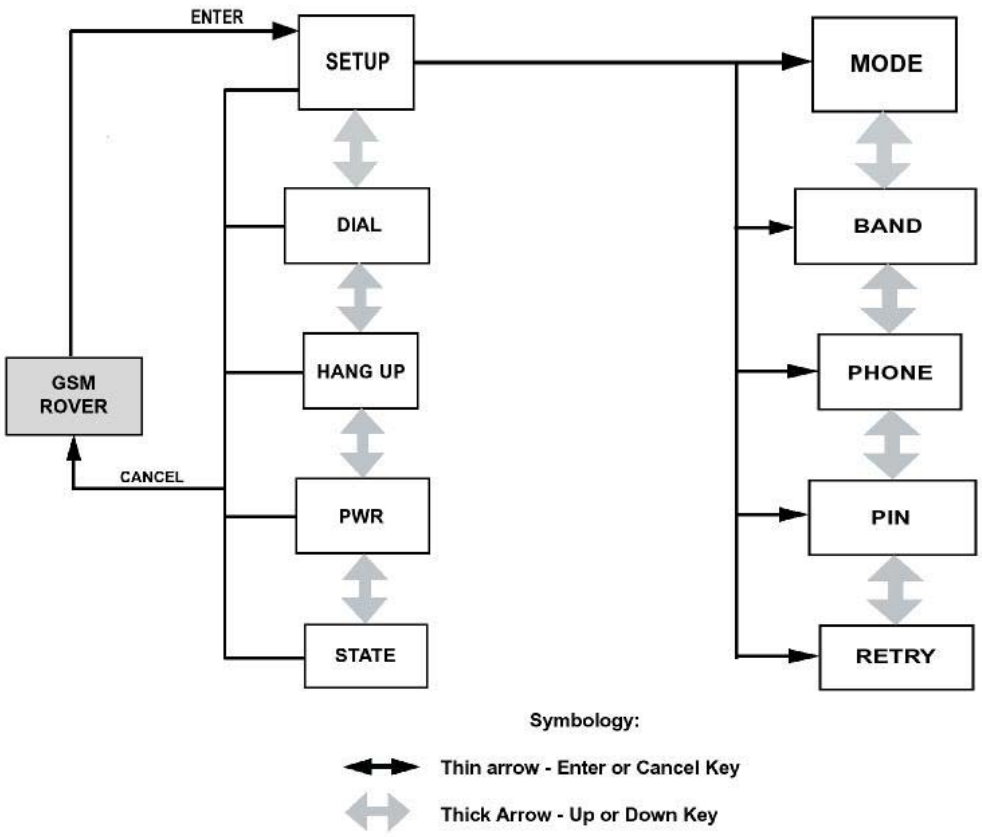

Figure 17 COM OPTN GSM Rover Menu

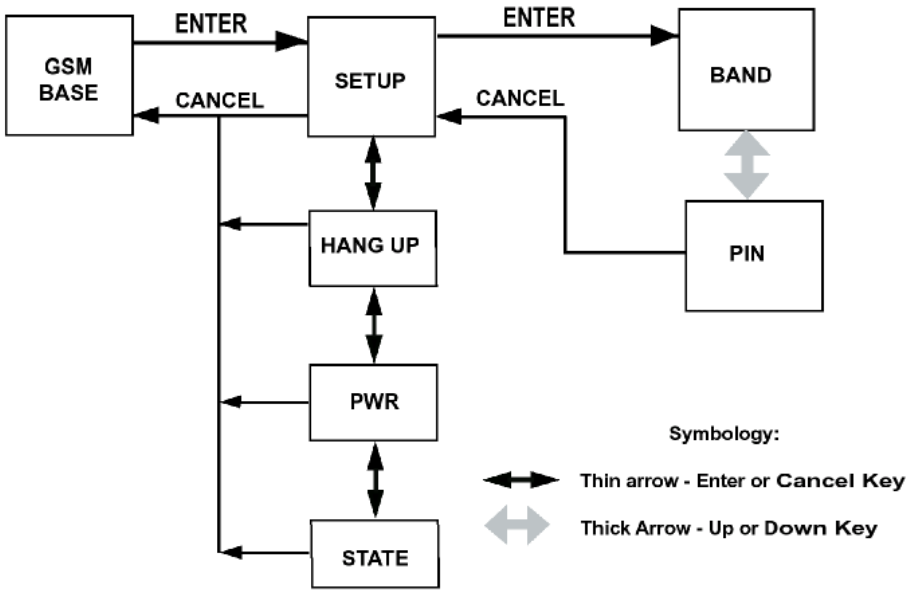

Figure 18 COM OPTN: GSM Base Menu