SL869-3DR EVK User Guide

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Making machines talk.

APPLICABILITY TABLE

PRODUCT
SL869-3DR EVK

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Contents

Figures

Tables

1. Introduction

1.1. Scope

The scope of this document is to give an overview of:

- Operation of the SL869-3DR and its MEMS sensor related features
- Connections to a test vehicle

1.2. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit Technical Support Center (TTSC) at:

TS-EMEA@telit.com
TS-AMERICAS@telit.com
TS-APAC@telit.com

Alternatively, use:

http://www.telit.com/en/products/technical-support-center/contact.php

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

http://www.telit.com

To register for product news and announcements or for product questions contact Telit Technical Support Center (TTSC).

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

1.3. Text Conventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.4. Related Documents

- SL869-3DR Product User Guide
- SL869-3DR Software User Guide

1.5. Product Usage Notes

- To prevent ESD and EOS damage, a properly grounded ESD wrist strap should be worn when the EVK case is opened
- Do not alter jumpers while power is applied
- Do not short the RF signal to ground if antenna supply voltage is connected. Damage to the EVK or module may occur.

Always follow ESD safety precautions when utilizing the evaluation kit. For additional information, contact your local sales representative.

This module shall be supplied by a limited power source complying with clause 2.5 of EN 60950-1 and mounted on a V1 flammability class material or better.

2. Dead Reckoning Overview

Dead reckoning (DR) is the process of estimating one's current position based upon a previously determined position or "fix", and advancing that position from course and speed data (which could be either estimated or measured).
The SL869-3DR receiver provides the user with accurate estimates of a vehicle's position and speed, even during interruptions in GNSS information, combining the best features of GNSS and Sensor navigation.

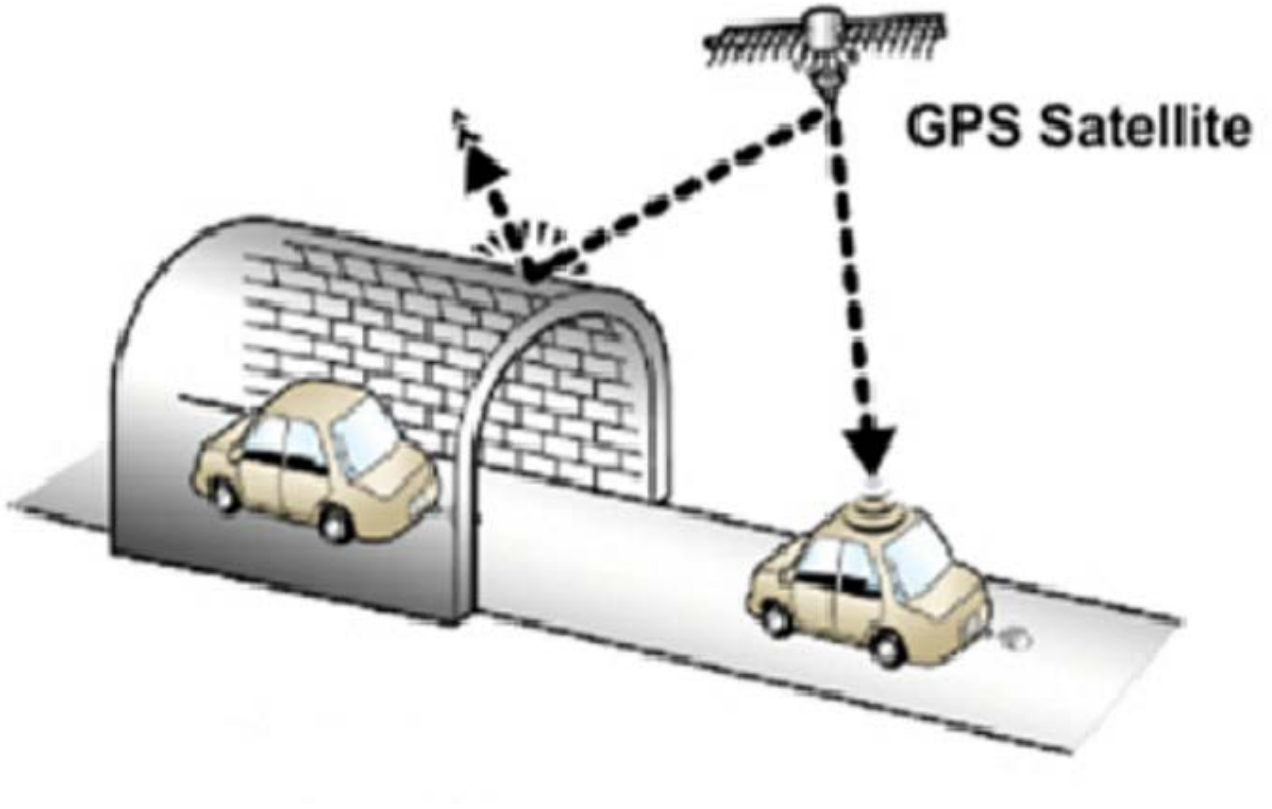


Figure 2-1 DR Operation in the absence of GNSS signals

When GNSS data is available, it provides navigation updates and corrections for sensor drift. When the GNSS signal is interrupted, sensor data (speed and heading) are used to compute the navigation solution.
The result is improved navigation in challenging environments such as urban canyons.

2.1. Classic Dead Reckoning (DR) Description

In a Classic DR configuration, a discrete odometer or wheel pulse signal is required to provide the unit with vehicle speed data. This signal may be obtained from various locations in the vehicle such as the transmission, speed display or ABS system.
Another option for supplying the odometer or wheel tick pulse is through the on-board diagnostics (OBDII) connector, which provides access to the vehicle's controller area network (CAN) bus. This can be achieved with the addition of an "OBD VSS Signal Generator" - a device that generates a wheel pulse from the vehicle CAN bus data. Telit does not sell these devices.

A forward-reverse signal, usually provided by the vehicle's transmission or a backup light circuit, supplies directional data to the DR module. For proper operation, the reverse signal should be stable when on and not be pulsed.

A DR module also includes a rate gyro that measures angular acceleration (rate of heading change), allowing the unit to maintain vehicle heading data.

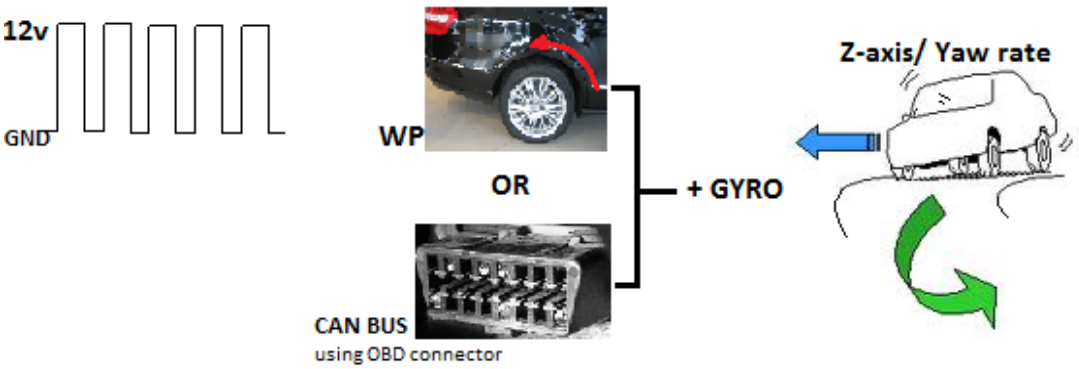


Figure 2-2 Classic DR Operation

Note that these connections to the vehicle systems are not required for MoDR operation, as described in the next section.

2.2. MEMS-only Dead Reckoning (MoDR) Description

The SL869-3DR module contains embedded sensors to eliminate the need for connections to vehicle sensor systems. These sensors include:

- 3-axis accelerometers
- 3-axis gyros (angular rate sensors)
- Barometric pressure sensor

The SL869-3DR is delivered with innovative Telit-developed MoDR firmware (FW) which calculates the vehicle speed and attitude (in 3 dimensions) for inclusion in the navigation solution.
Since the SL869-3DR does not require vehicle signals for speed or forward/reverse, installation is much simpler and less costly than the classic DR configuration.

MoDR has the advantage of reducing installation time, complexity and cost, but does not achieve the highest level of accuracy provided by vehicle sensors for wheel ticks and forward/reverse signal for direction. Thus, there is a trade-off of cost vs. performance between the two system designs.
Telit also has Classic DR products such as the SL869-ADR, which make use of vehicle sensor input to achieve the highest level of accuracy, which is particularly attractive for original installations.

3. Evaluation Kit Requirements

To use the SL869-3DR Evaluation Kit (EVK), you will need the following items:

1. An SL869-3DR Evaluation Unit
   (3DR programmed receiver is included in the kit)
2. GNSS antenna (included in the kit)
3. FTDI USB Drivers (included on the USB flash drive)
4. Current version of TelitView
   Note: There is a version of TelitView on the USB Drive supplied in the kit, however for full functionality, the latest version should be downloaded from the Telit Support Site.
5. A PC with a USB port and:
   - Windows 7 or later
   - .NET Framework 4.0
6. A test vehicle or test platform that can support MEMS testing.

4. Evaluation Kit Description

4.1. SL869-3DR EVK Contents

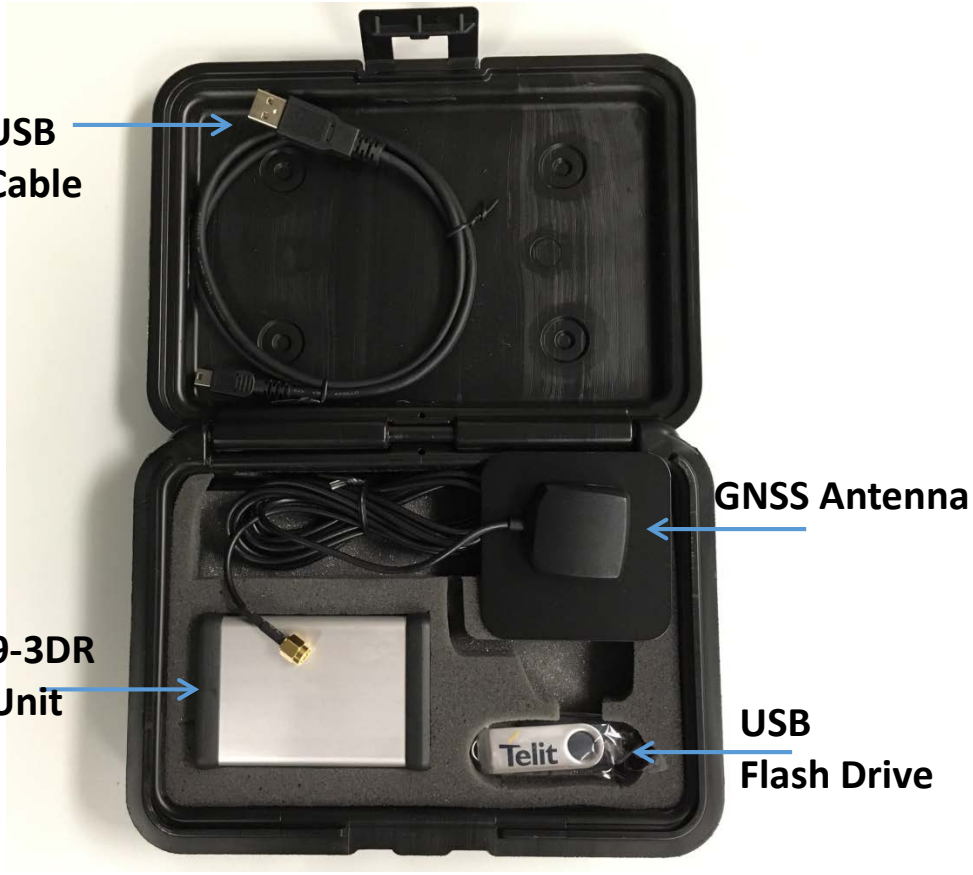


Figure 4-1 SL869-3DR EVK Contents

Contents Description

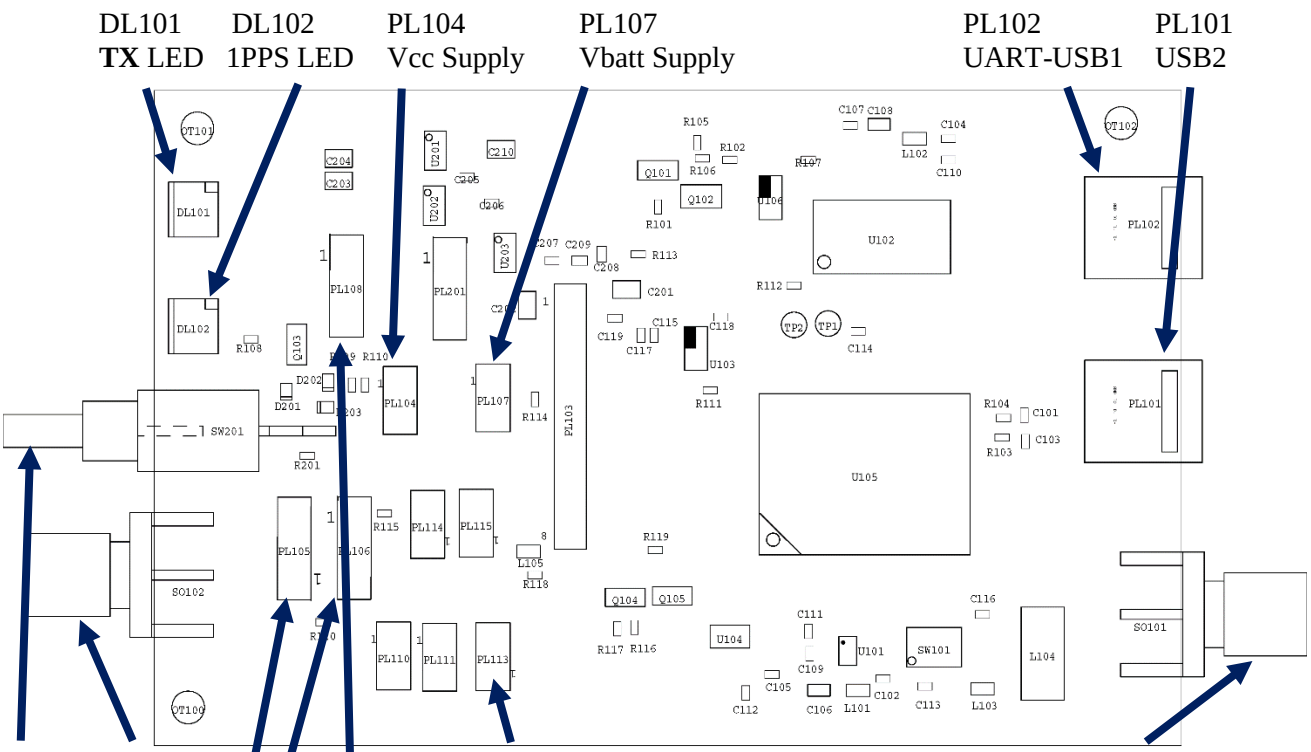
SL869-3DR Eval Unit: Evaluation Unit including the Telit SL869-3DR

GNSS Antenna: An active antenna powered by the EVK.
The antenna supports GPS/Glonass/Beidou with an LNA Gain 30 dB)

USB Cable: A 6ft mini USB cable used to supply power and communicate to the EVK

USB Flash Drive: Contains the tools and documentation for the SL869-3DR

4.2. SL869-3DR EVK Main Board Components



Note: PL105 and PL106 must be jumpered 1-2 to operate the on-board Teseo 3 Antenna Sense circuit.

Figure 4-2 SL869-3DR EVK Main Board Components

Required External Connections

Connect the PC to UART-USB (PL102)

Connect the GNSS antenna to RF-IN (SO101)

4.3. SL869-3DR EVK Main Board Component Identification

	SL869-3DR Main Board Components	
ID	**Name**	**Description**
DL101	TX LED	TX data display
DL102	1PPS LED	1PPS output display
SW 201	ON/OFF Switch	Applies power to the EVK.
SO 102	1PPS Output SMA	1PPS buffer output connector
PL 108	SL869 BOOT Pin	To place the module into BOOT mode, place a shunt jumper on pins 2 & 3 before powering the unit up. Not connected for normal operation.
PL 104	Vcc Supply	Place a shunt jumper to apply 3.3 V to the module Vcc. Required for normal operation.
PL105	Antenna Sense 2	Teseo 3 Antenna Sense 2 input
PL106	Anetnna Sense 1	Teseo 3 Antenna Sense 1 input
PL 107	Vbatt Supply	Place a shunt jumper to apply 3.3 V to the module Vbatt. Required if standby power is desired when Vcc is removed.
PL 102	UART-USB1	USB: DC, Ground, TX, RX. Connect to laptop.
PL 101	USB2	Reserved
PL 113	Vant Supply	Place a shunt jumper to apply 3.3 V to the SMA connector for an external active antenna.
PL 201	+3.3 V LDO Antenna supply	Pins 1 & 2: Power LDO_Enable with On/Off switch Pins 2 & 3: Power LDO_Enable with module Pin 4 output
SO 101	Antenna SMA	Antenna: RF Input + Vant

Table 4-1 SL869-3DR EVK Main Board Component Identification

4.4. SL869-3DR EVK Board Schematic Diagrams

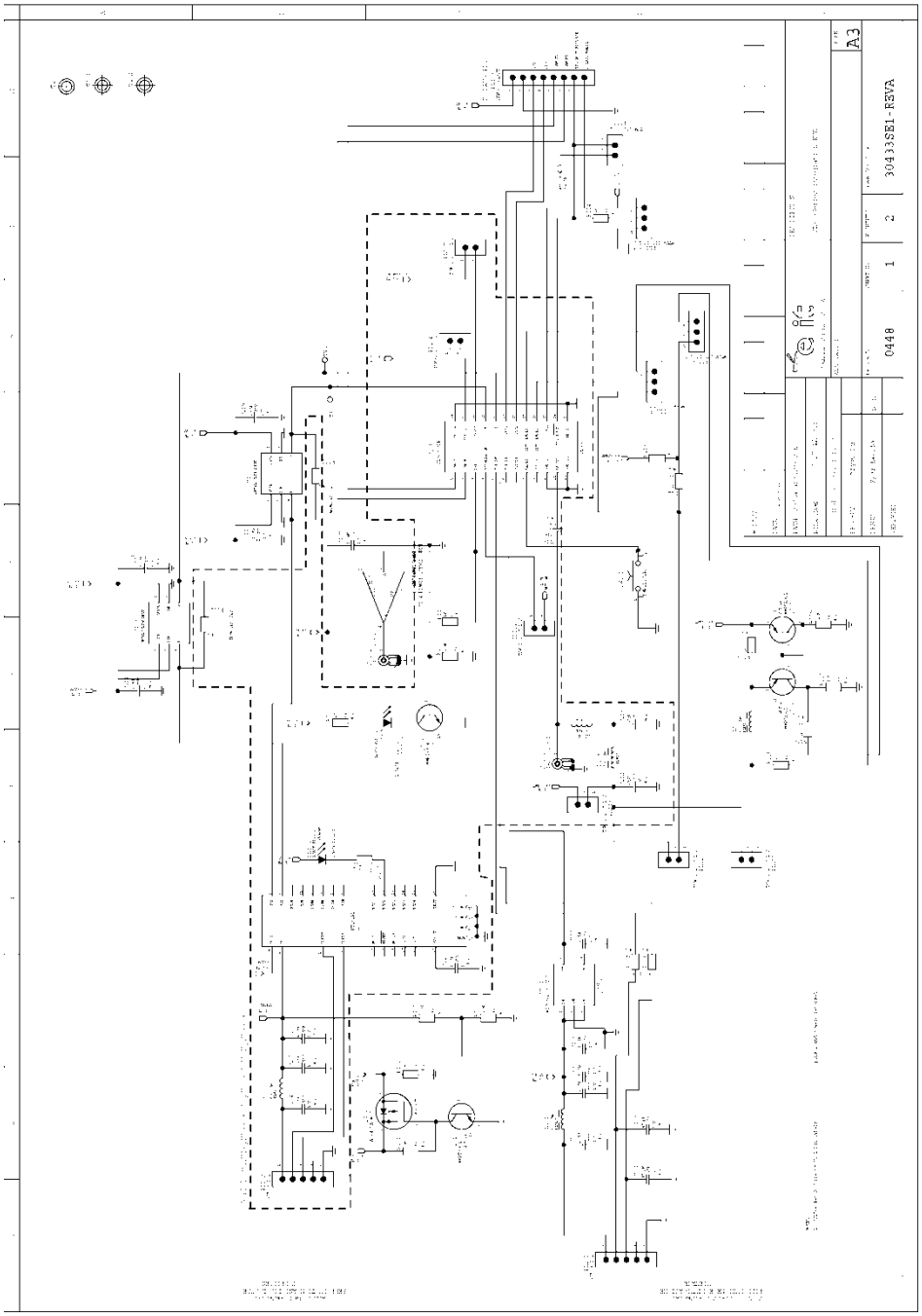


Figure 4-3 SL869-3DR EVK Board Schematic Diagram – Page 1 / 2

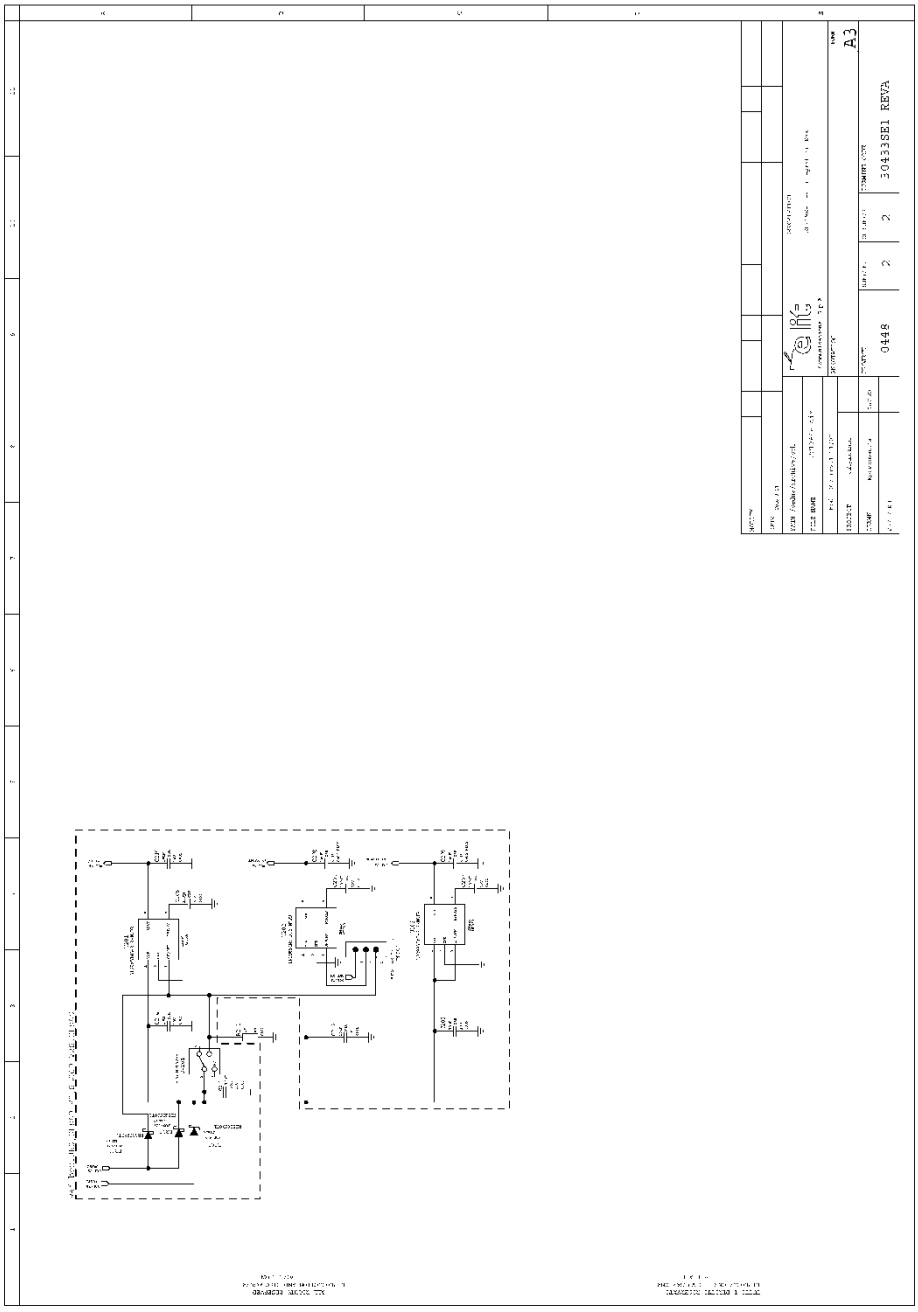


Figure 4-4 SL869-3DR EVK Board Schematic Diagram – Page 2 / 2

4.5. SL869-3DR EVK Unit connections

Figure 4-5 EVK Unit connections – rear panel

5. SL869-3DR EVK Setup Requirements

5.1. Installation and Calibration

1. Note: If NVRAM has been erased (e.g. during flashing), initialization will be required.

2. Place the EVK on a flat and secure surface with the power switch facing toward the front of the vehicle and as close as possible to the center of vehicle. This will allow the gyro to stabilize and the DR FW to store starting point parameters. Once oriented in this position, it should remain in same direction and location to keep results consistent.
   Insure a rigid mount.

3. Connect USB from the laptop PC to the EVK port USB1, located at opposite side from the SMA antenna connection.

4. Connect the GNSS antenna.

5. Turn on car and the power up the EVK.

6. Run Telit view and establish connection to the EVK.
   Note: Make sure to select correct COM port and set baud rate 115200.
   See **Section 5.2 Computer Setup and Connection** for examples.

7. Verify NMEA output activity from the EVK when powered on.
   TelitView will also allow you to see and record data from the EVK output.

8. Wait for a valid GNSS position fix.

9. Wait (stopped) for approximately 2 minutes on a flat and level surface with the EVK and vehicle on. Do not allow any vibration or movement during this time.
   This allows the unit to initialize the yaw rate offset with reliable values.

10. After the 2 minutes, SL869-3DR is calibrated and ready to run.

5.2. Computer Setup and Connection

Before operation, ensure that the EVK power switch is in the OFF (down) position and the USB drivers are installed by performing the following steps:

1. Insert the USB flash drive and connect the EVK to the PC via the USB-1 connector on the rear of the EVK. Then, turn the Power switch vertically UP to turn On the EVK.
2. As soon as the evaluation board is connected to the PC, it will be detected and the USB driver installed.
3. Note: If a software Installation warning appears select “Continue Anyway” option.

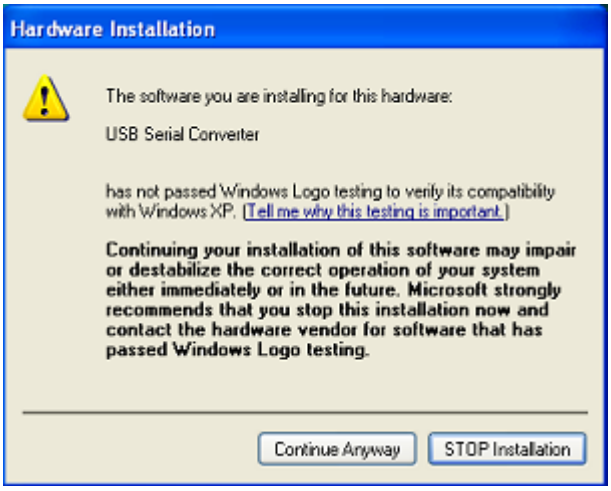


Figure 5-1 Hardware Installation Warning Screen

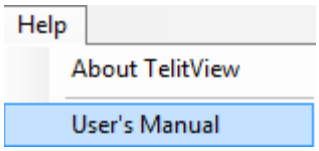
4. After the EVK is connected, check the “Device Manager” window for the evaluation board COM port number. This information is needed for use with the GPS tools.
5. Connect the provided Active Antenna to the SMA connector.

NOTE:

On some occasions, Windows will install a Microsoft Serial BallPoint mouse after connecting the USB. Uninstall the Microsoft Serial BallPoint mouse if Windows mistakenly installs it.

6. Using TelitView

- Please refer to TelitView user Manual located under the help tap on TelitView for more details.



Launch the TelitView application

Figure 6-1 TelitView Application Icon

6.1. Main Interface

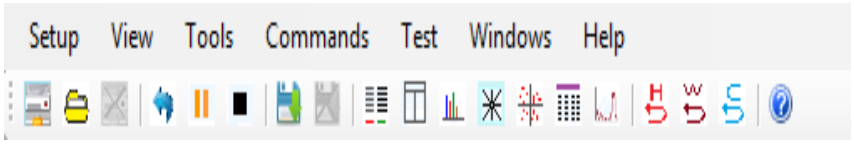


Figure 6-2 TelitView Main Tool Bar

6.2. Connecting to the EVK UART

➢ **Main Menu Bar**

Under the Main Menu Bar, click “Setup” and select “Comm Port”. A “connect to Receiver” window will open.

➢ **Main Tool Bar**

Select the “Connect to Receiver” icon under the Main Tool Bar and the ‘Connect to Receiver” window will open.

➢ **Connect to Receiver Window**

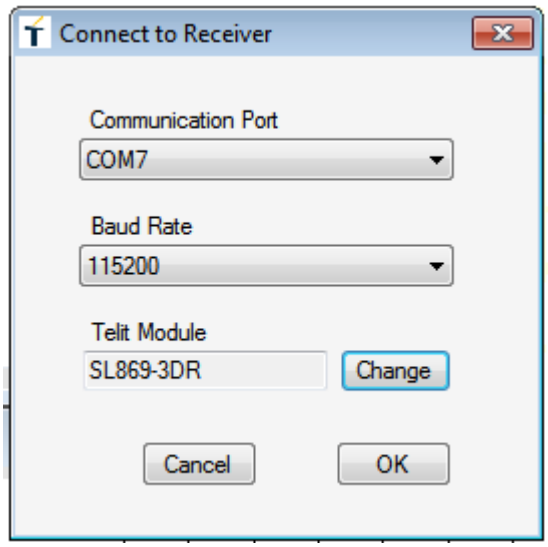


Figure 6-3 'Connect to Receiver" Window

1. Select the correct Communication Port.
2. Select the correct baud rate (SL869-3DR default = 115200).
3. Select "Change" and a "Product Selection" window will appear.
4. From the Products window, select "SL869-3DR" and click "OK".

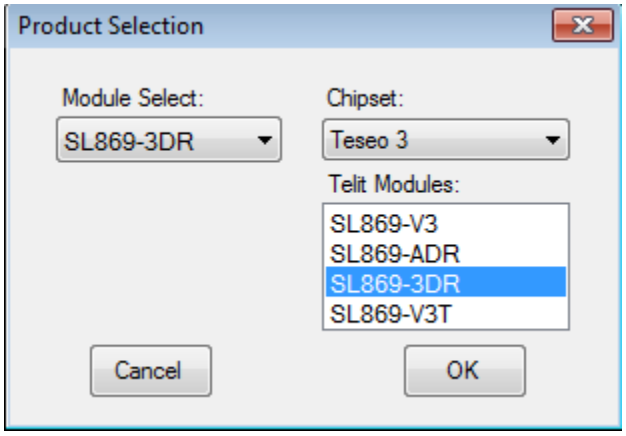


Figure 6-4 Select "SL869-3DR"

6.3. TelitView Tabular View

TelitView implements a tabular view. Switching between tabs displays different information parsed from the receiver.

- **Front Panel Status**

  The Front Panel Status Tab displays satellite information as well as position information.

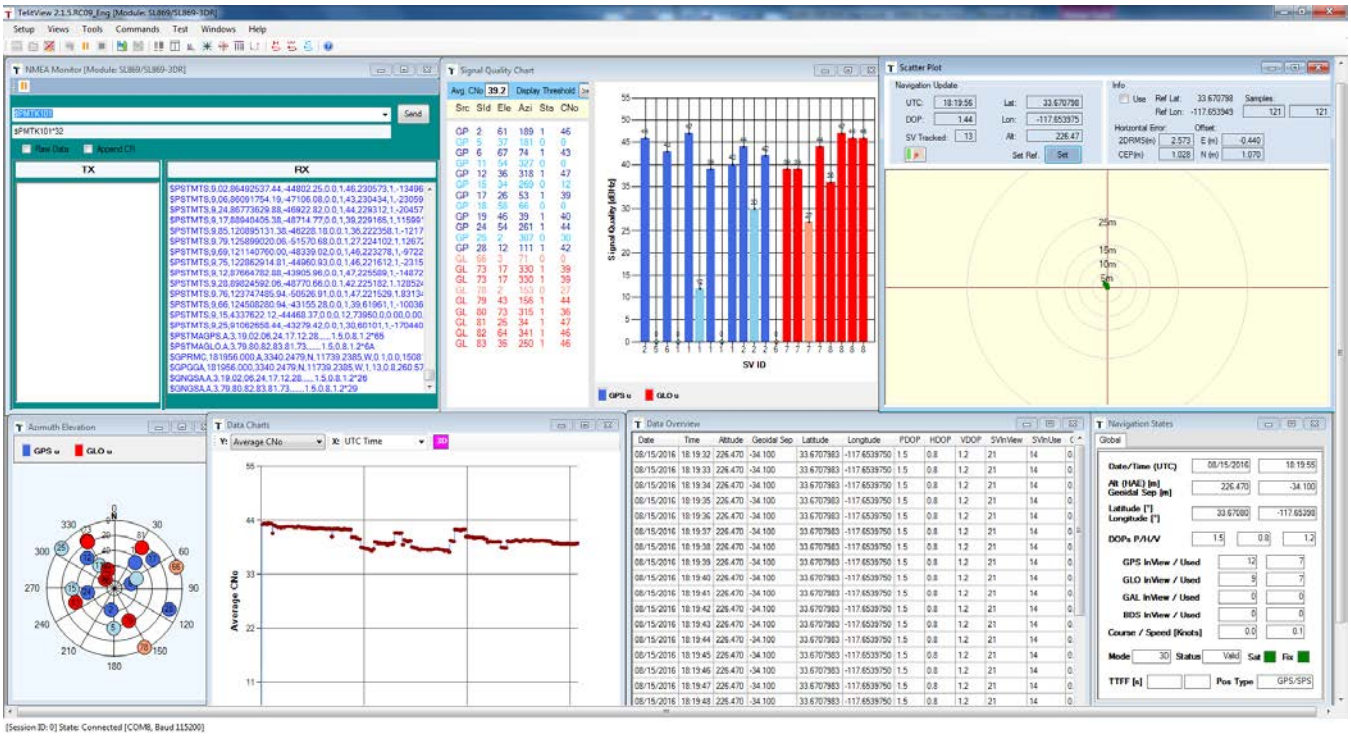


Figure 6-5 TelitView Front Panel Status Tab

➢ **Scatter Plot**

The Scatter Plot displays position points that are updated every second. The position points are compared to each other in an axis in meters.

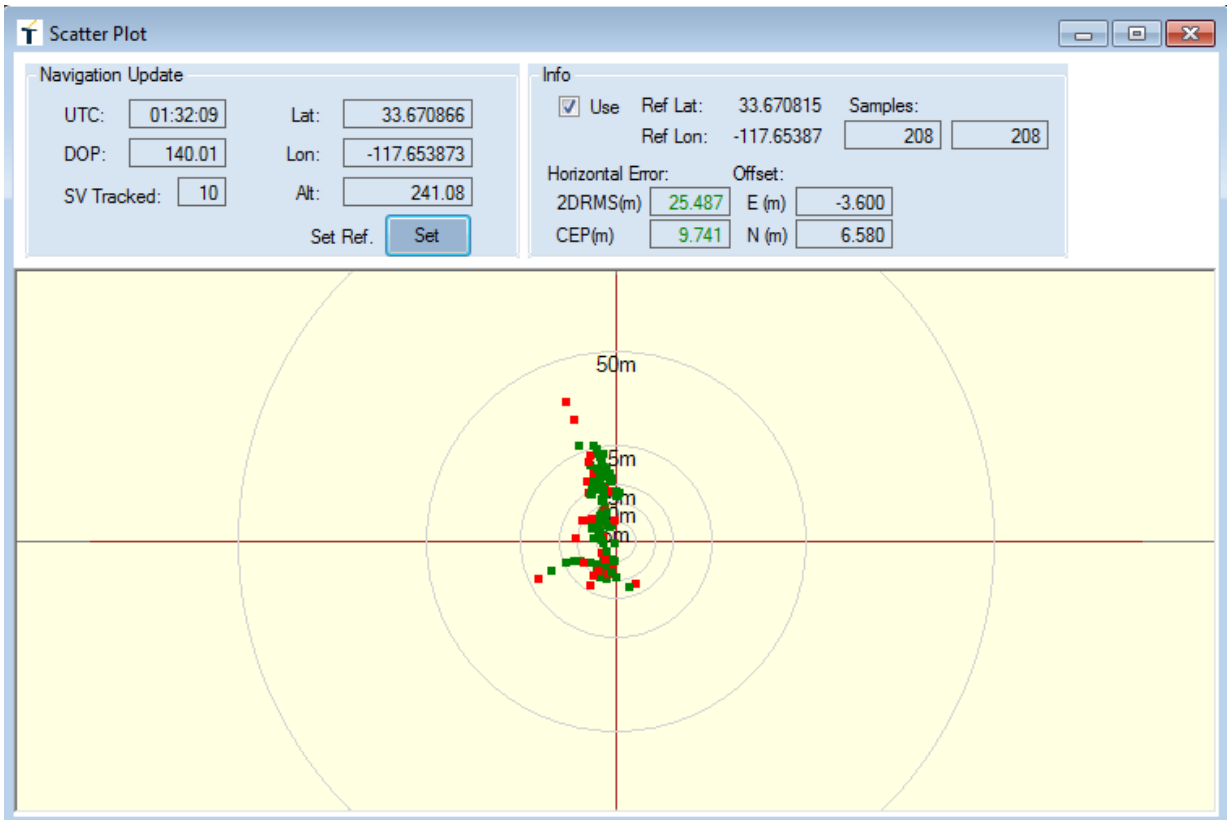


Figure 6-6 TelitView Scatter Plot Tab

➢ **NMEA Monitor**

The NMEA Monitor displays the NMEA output of the receiver. The user can also type in commands in the Transmit toolbar. In order to pause the "Receive" screen, right-click on the window and select "Pause receive"

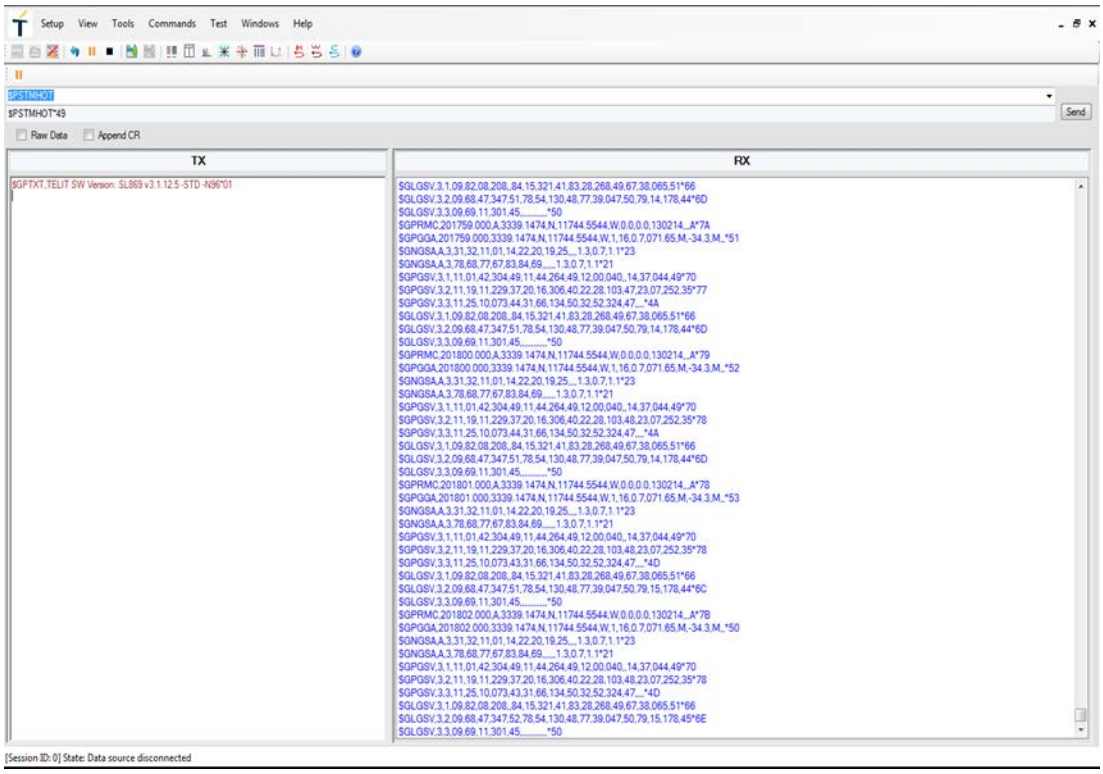


Figure 6-7 TelitView NMEA Monitor Tab

➢ **User Menu Command Manager**

The user has the option to enter basic commands by clicking on the “Commands Tab”. There are 18 available basic commands.

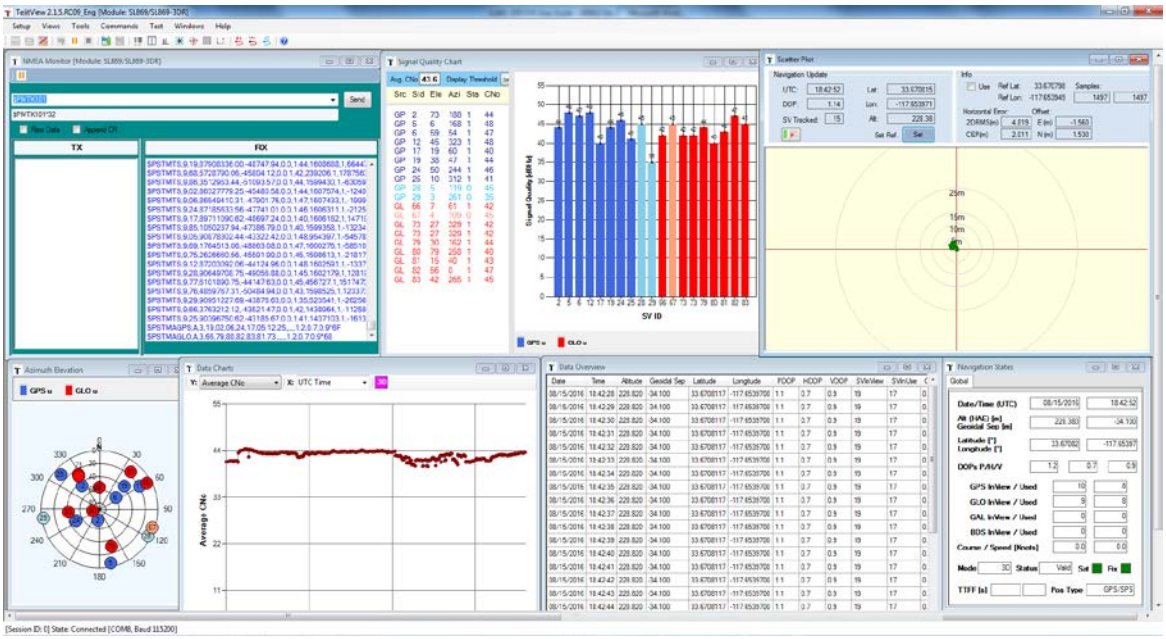
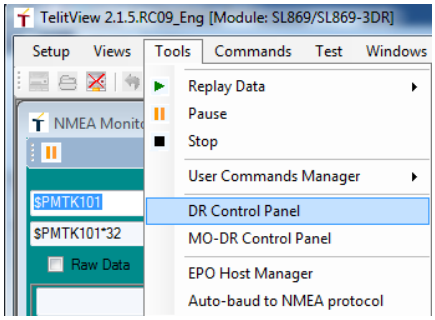


Figure 6-8 User Menu Command Manager

➢ **DR Control Panel and Data View**

To open the SL869-3DR Control panel click Tool > Mo-DR Control Panel



MEMS-Only DR control panel will open.

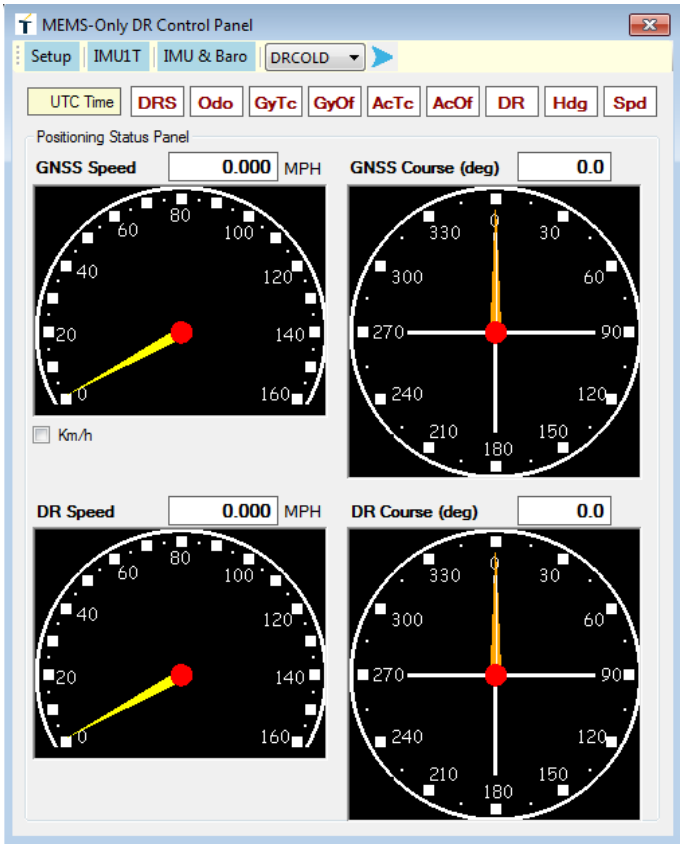


Figure 6-9 DR Control Panel View

MEMS-Only DR Menu Strip

This control panel Displayed at the top is the menu strip with selection buttons:

Figure 7-0 Menu strip on MEMS-Only DR Control Panel

These buttons perform the following functions:

☐"Setup" button

User can click this button to launch a MEMS-Only DR setup window, which has the capability to process relevant data to provide display that will help the installation – orientation and placement - of the sensor.

☐"IMU1T" button

IMU (Inertial Measurement Unit) that uses a combination of accelerometers and gyroscopes, and in some cases magnetometers.
User can click this button to launch a view window to display the data fields and the update of the Telit GNSS proprietary message "IMU1T".

☐"IMU & Baro" button

User can click this button to launch another view window to display the data fields and the update of the Telit GNSS proprietary messages "$PTWSIMU, RAW" and "$PTWSBARO, RAW". They are the raw output data of IMU unit and the barometer unit.

☐MODR Command selector

User may choose a command from the dropdown list to send to the receiver.
Currently supported commands include:

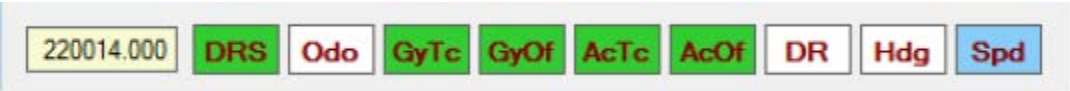
- DR Cold Restart: DRCOLD
- DR Factory Reset: FACTRST

☐Send Command Button

Right next to the DR command selector is the "send command" button. User clicks it to send the chosen command to the com port.

MEMS-Only DR Navigation State Flags

The row of flags, which is located below the tool bar strip, illustrates the navigation state of the MEMS-Only DR, based on the output NMEA Telit proprietary messages.



These status flags and their color codes follow:

☐ "220014.000" – the current UTC time tag.

☐**DRS – DR sensor calibration status**
- White: none of the DR sensors is calibrated
- Yellow: at least one sensor calibrated
- Green: Calibration complete

☐**Odo – Odometer calibration status**
- White: Odo scale is not calibrated
- Yellow: Calibration is progress
- Green: Calibration complete

☐**GyTc – Gyro temperature calibration status**
- White: Gyro temperature is not calibrated
- Yellow: Calibration is progress
- Green: Calibration complete

☐**GyOf – Gyro offset calibration status**
- White: Gyro offset is not calibrated
- Yellow: Calibration is progress
- Green: Calibration complete

☐**AcTc – Accelerator temperature calibration status**
- White: Accelerator temperature is not calibrated
- Yellow: Calibration is progress
- Green: Calibration complete

☐**AcOf – Accelerator offset calibration status**
- White: Accelerator offset is not calibrated
- Yellow: Calibration is progress
- Green: Calibration complete

☐**DR – GNSS compensated status**
- White: DR is not GNSS compensated

- Blue: DR is GNSS compensated

Hdg – DR Heading is GNSS compensated status

- White: DR Heading is not GNSS compensated
- Blue: DR Heading is GNSS compensated

Spd – DR Speed is GNSS compensated status

- White: DR Speed is not GNSS compensated
- Blue: DT Speed is GNSS compensated

Start Log

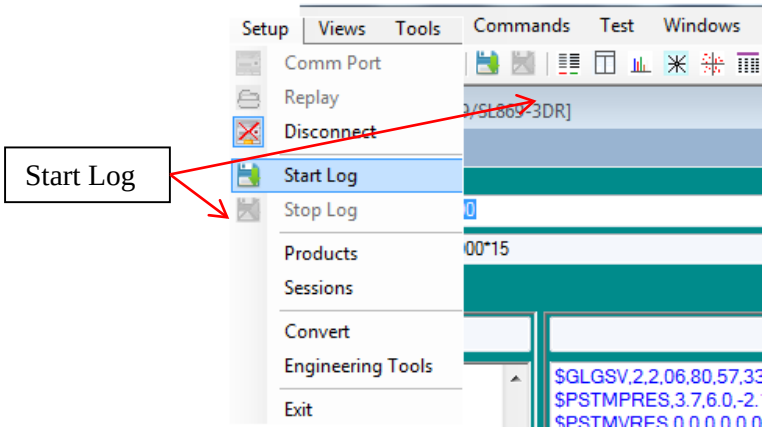


Figure 6-10 Start Log Button

User can click the “Start Log” button either from the “Setup” menu or the icon on the toolbar to start logging.

Stop Log

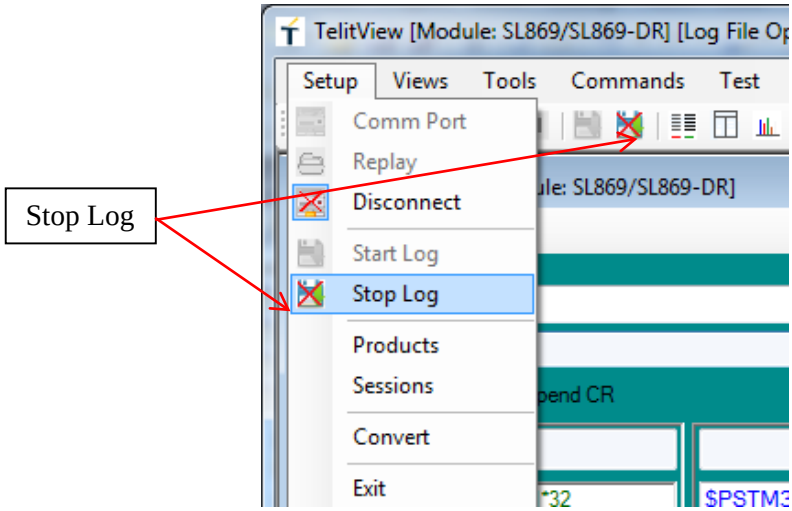


Figure 6-11 Stop Log Button

User can click the “Stop Log” button either from the “Setup” menu or the icon on the toolbar, to stop logging.

After data logging is stopped, the title bar in TelitView will display the updated logging status; showing that the log files are closed.

7. Flashing Firmware with TeseoIII X-Loader

Note that X-loader requires use of the BOOT pin. If this pin is not available in a user's design, you will need to run the FW Upgrade Tool (UPG).

The EVK will be preloaded with firmware, however if updates are required, perform the following steps:

7.1. Flashing Requirements

- SL869-3DR software from TELIT
- TESEOIII X-Loader v1.13 (or newer) from TELIT

7.2. Flashing Instructions

Note: Do not erase NVM, or the Initialization procedure will have to be performed.

1. Install a shunt jumper on Main Board SL869 BOOT (pins 2 & 3), shorting the pins together.
2. Connect the USB cable and let the Host PC machine enumerate the USB connection.
3. Set SW201 (Main Power) to ON (up) to power the SL869-3DR receiver.
4. Launch the TESEOIII X-Loader and set the selections as shown in the figure below.

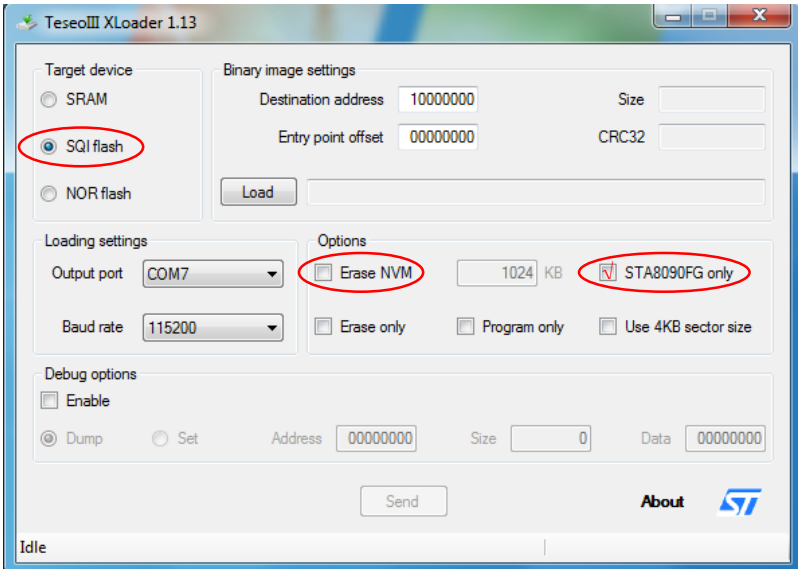


Figure 7-1 TESEOIII X-Loader

5. Click on the Load button, then locate and select the software provided by Telit.

6. Verify selections as follows:
   - "Target device" is SQI flash
   - "Erase NVM" is not selected
   - "STA8090FG Only" is selected
   - Output Port matched your configuration

7. After selecting the correct configuration and the selected COM port is properly identified (Look under Device Manager in Windows OS for COM port if cannot be identified/found), click on "Send" to program the device.
   When done, a pop up window will confirm, "Device successfully programmed".

8. Remove the shunt jumper from Step 1.

9. Cycle power to EVK. Verify NMEA data is streaming out with TelitView under the NMEA Monitor window.

8. Document History

Revision	Date	Changes
0	2016-09-15	Preliminary Issue