# CalAmp HMU-3640 Location Messaging Unit Installation Guide



**9/28/23, 4:35 PM**
**HMU-3640 Hardware & Installation Guide – PULS Wiki**
**HMU-3640 Hardware & Installation Guide**
**HMU-3640™**
**Hardware and Installation**
**Guide**

**IMPORTANT:** DO NOT INSTALL OR USE THE SOFTWARE OR DOCUMENTATION UNTIL YOU HAVE READ AND AGREED TO THE LICENSE AGREEMENT AND REVIEWED THE LIMITED WARRANTY AND

REGULATORY INFORMATION.

Contents

1 Introduction
2 System Overview
3 Hardware Overview
4 Configuration and Activation
5 Documents / Resources
5.1 References

## Introduction

Welcome to the HMU-3640™ Hardware and Installation Guide. This manual is intended to give you information on the basic setup and installation of the CalAmp HMU-3640™ product(s) including hardware descriptions, environmental specifications, wireless network overviews and device installation.

### 1.1 About This Manual

The HMU-3640™ is a next generation telematics gateway that includes a range of wireless and peripheral connectivity options and is equipped with CalAmp's purpose built vehicle interface technologies for heavy duty vehicles. In order to accurately describe the functionality of these units we have broken this manual into the following sections:

System Overview – A basic description of a CalAmp HMU-3640™. This includes a description of roles and responsibilities of each of the CalAmp components as well as a brief overview of the wireless data technologies used by the HMU3640™.

Hardware Overview – Describes the physical characteristics and interfaces of the HMU-3640™.

Installation and Verification – Provides guidance for the installation of the HMU-3640™ versions in a vehicle and instructions on how to verify the installation is performing adequately.

### 1.2 About The Reader

In order to limit the size and scope of this manual, the following assumptions have been made about the reader.

1. You are familiar with GPS concepts and terminology
2. You have some experience with installing equipment in vehicles
3. You are familiar with the use of AT Commands
4. You are familiar with the use of terminal programs such as HyperTerminal or PuTTY

### 1.3 About CalAmp

CalAmp (NASDAQ: CAMP) is a telematics pioneer leading transformation in a global connected economy. We help reinvent businesses and improve lives around the globe with technology solutions that streamline complex IoT deployments and bring intelligence to the edge. Our software applications, scalable cloud services, and intelligent devices collect and assess business-critical data from mobile assets, cargo, companies, cities and people. We call this The New How, powering autonomous IoT interaction, facilitating efficient decision making, optimizing resource utilization, and improving road safety. CalAmp is headquartered in Irvine, California and has been publicly traded since 1983. LoJack is a wholly owned subsidiary of CalAmp. For more information, visit calamp.com, or LinkedIn, Twitter, YouTube or CalAmp Blog.

### 1.4 About the CalAmp Location Messaging Unit – HMU-3640™

The HMU-3640™ utilizes a ruggedized design to perform in arduous conditions and rugged construction equipment environment with extended temperature operation. Enhanced electrical interfaces give the HMU-3640™ a unique and versatile environment in heavy duty conditions, while delivering critical data to the end customer. The built-in ECU (Engine Control Unit) interface reads and transmits engine condition and performance data such as engine temperature and fault codes from heavy duty vehicle to provide the best possible real-time picture of vehicle health. In addition, it supports separate ARM (Advanced RISC Machine) cortex micro-controller to support hosted application features. The CalAmp HMU-3640™ is a mobile device that resides in private, commercial or government vehicles. The HMU-3640™ is a single box enclosure incorporating a processor, a GPS receiver, a wireless data modem, and a vehicle-rated power supply. The HMU-3640™ also supports inputs and

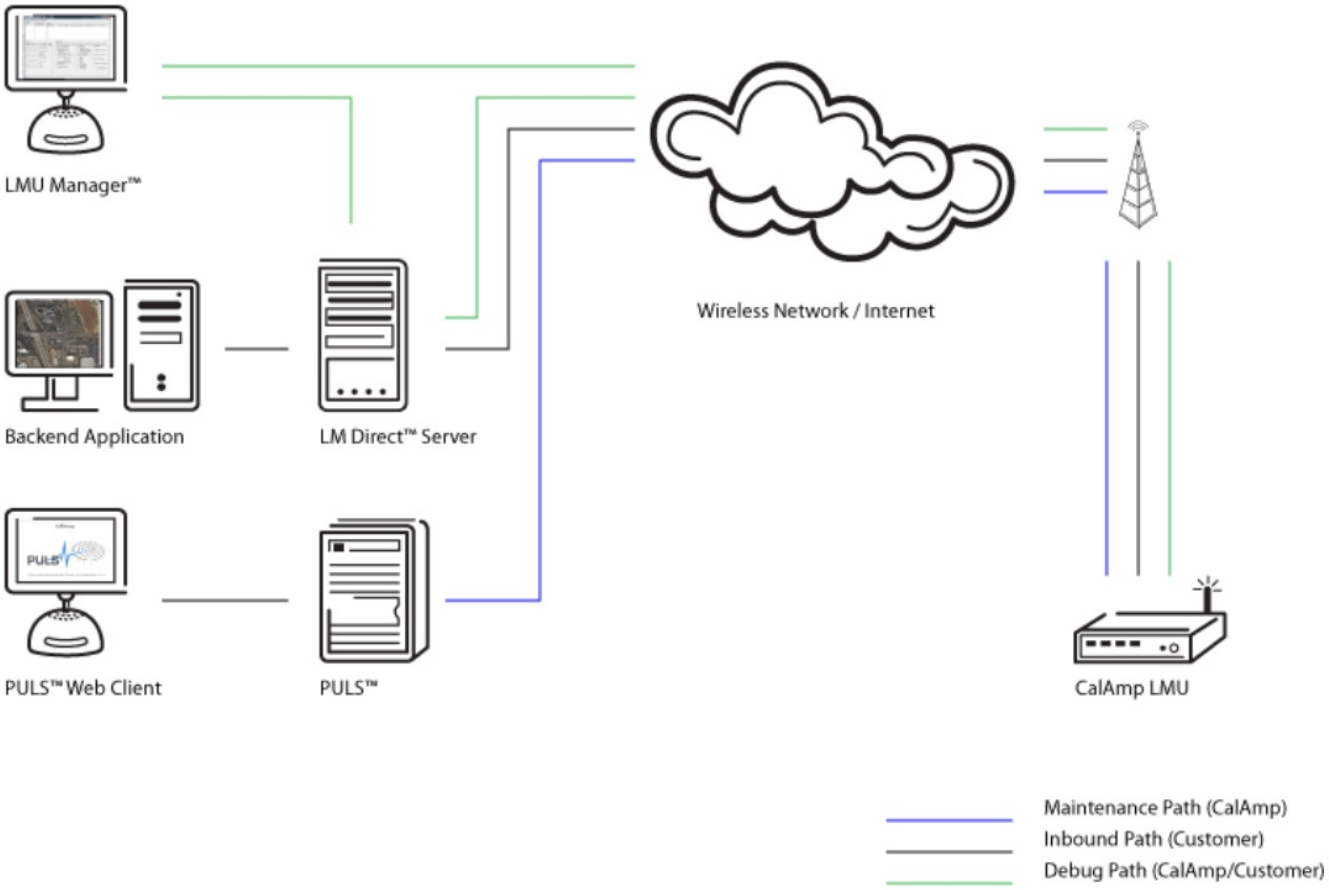
outputs to monitor and react to the vehicular environment and/or driver actions. The HMU-3640™ collects, stores and transmits vehicular and location data over a designated wireless network including LTE and HSPA. Vehicular and location data are transmitted to a customized software application that has been designed to receive, acknowledge, process, store, and respond to this data.
Unit location and vehicular information is sent at pre-determined intervals, on demand, or when pre-programmed vehicular conditions are met. Transmission of data are sent immediately when in wireless network coverage and stored for later transmission when out of the wireless coverage area. SMS messaging can be used as an alternative or redundant communication backup.
The HMU-3640™ is designed to support a variety of custom fleet applications starting with basic automatic vehicle location and including applications requiring more sophisticated features such as geo-fencing, speed and mileage monitoring, third party security monitoring, dynamic reporting routines, and an array of exception alerts.
HMU-3640™ are sold exclusively to authorized systems integrators, software firms, and service providers who have developed their offering around the capabilities of the HMU-3640™. Customers are trained by CalAmp to integrate the mobile device with their system and to assist in support and maintenance of the devices.
Installations of HMU-3640™ are performed by CalAmp customers or contracted installers. Typical installations include hook-up to power, ignition, and ground. HMU-3640™s and the corresponding wiring are almost always hidden from view and general access. Placement of the units is usually under dashboards, in trunks or in compartments.

## System Overview

### 2.1 Overview

The entire purpose behind a fleet management system is to be able to remotely contact a vehicle, determine its location or status, and do something meaningful with that information. This could include displaying the vehicle location on a map, performing an address look-up, providing real-time driving directions, updating the vehicles ETA, monitoring vehicle and driver status or dispatching the vehicle to its next pick up.
These functions, of course, are completely dependent on the capabilities of the vehicle management application. The role of the CalAmp HMU3640™ is to deliver the location information when and where it is needed.
A typical fleet management system based on a CalAmp device includes the following components:

- A wireless data network
- An HMU-3640™
- Host Device (GPS NMEA only)
- An LM Direct™ communications server
- Backend mapping and reporting software which typically includes mapping and fleet reporting functions
- PULS™
- LMU Manager™




**2.2 Component Descriptions**

**2.2.1 Backend Software**

Backend software is a customer provided software application. Regardless of its purpose one of its primary functions is to parse and present data obtained from the LM Direct server. This allows the application to do any of the following:

- Display location data base on reports received from the HMU-3640™ in a variety of formats.
- Present historic information received from the HMU-3640™ typically in a report/chart style format
- Request location updates from one or more HMU-3640™
- Update and change the configuration of one or more HMU-3640™

**2.2.2 LMU Manager**

LMU Manager is the primary support and configuration tool in the CalAmp system. It allows access to almost every feature available to the HMU-3640™. Unlike the backend software, it has the option of talking directly to an HMU-3640™ or making a request forwarded by the LM Direct server.

For further details on using LMU Manager, please refer to the LMU Manager Users Guide.

**2.2.3 LM Direct Server**

LM Direct is a message interface specification detailing the various messages and their contents the HMU-3640™ is capable of sending and receiving. This interface allows System Integrators to communicate directly with HMU-3640™s.

Sample code is available to system integrators upon request to aid in the development of an LM Direct Server.

**2.2.4 Wireless Data Network**

The Wireless Data Network provides the information bridge between the LM Direct server and the HMU-3640™s. Wireless data networks can take a variety of forms, such as cellular networks, satellite systems or local area networks. At this point in time, the networks available to the HMU-3640™ are: 4G LTE

**2.2.5 HMU-3640™**

The HMU-3640™ is responsible for delivering the location and status information when and where it is needed. Data requests can come from any of the following sources:

- PEG™ script within the HMU-3640™
- A location or status request from the LM Direct server
- A location or status request from LMU Manager
- A request made from a host device such as a laptop, PDA or MDT

**2.2.6 Host Device – Laptop/PDA or MDT**

In some cases, it is necessary to run an application in the vehicle while it is being tracked by the backend software. Such examples could include instant messaging between vehicles or a central office, in-vehicle mapping or driving directions, email or database access. In most of these cases you will be using the HMU-3640™ as a wireless modem as well as a vehicle-location device.

**2.3 Wireless Data Primer**

This section is meant to give an overview of the wireless data technologies employed by the CalAmp location products.

**2.3.1 SMS (Short Message Service)**

The Short Message Service (SMS) is the ability to send and receive text messages to and from mobile telephones. The text can comprise of words or numbers or an alphanumeric combination. SMS was created as part of the GSM Phase 1 standard.(Excerpt taken from the GSM World website (**http://www.gsmworld.com/technology/sms/intro.shtml#1)**)

SMS message are typically text based, though binary messages are possible and can range in size from 140 characters to 256 characters depending on the network being used.

**2.3.2 LTE (Long-Term Evolution)**

Long-term evolution (LTE) is the latest and rapidly growing global data transmission technology. Based on GSM and UMTS/HSPA standards, LTE is a standard of high-speed wireless data transmission and communication. Continuously evolving, LTE advancements continue to push data capacity and user experience on a global scale. With a peak downlink rate of 300 mbps, uplink rate of 75 mbps, LTE sits in 1.4 MHz to 20 MHz bands, while also supporting FDD, TDD, and not sacrificing data capability. “Both LTE FDD and TDD offer very high data rates, low latency, and seamless interworking with 3G, as well as between FDD and TDD networks. They also leverage common core network.” (Excerpt taken from the Qualcomm website (**https://www.qualcomm.com/invention/technologies/lte**))

LTE is the most current and advanced data technology network for MDT’s (mobile data terminals) and other mobile devices, and an upgrade over GSM/UMTS and CDMA. LTE frequency bands vary internationally, so it is important to note device configuration will dictate proper functionality.

## Hardware Overview

**3.1 Location Messaging Unit-HMU-3640™**

**3.1.1 Mechanical Drawing**

Media:HMU3640-ENVELOPE_REV_A.pdf

**3.1.2 Handling Precautions**

**Electrostatic Discharge (ESD)**

Electrostatic discharge (ESD) is the sudden and momentary electric current that flows between two objects at different electrical potentials caused by direct contact or induced by an electrostatic field. The term is usually used in the electronics and other industries to describe momentary unwanted currents that may cause damage to electronic equipment.

⚠ **WARNING:** This product can expose you to chemicals including carbon black, nickel, & bisphenol A, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to **https://www.P65Warnings.ca.gov**.

ESD prevention is based on establishing an Electrostatic Protective Area (EPA). The EPA can be a small working station or a large manufacturing area. The main principle of an EPA is that there are no highly charging materials in the vicinity of ESD sensitive electronics, all conductive materials are grounded, workers are grounded, and charge build-up on ESD sensitive electronics is prevented. International standards are used to define typical EPA and can be obtained for example from International Electro-technical Commission (IEC) or American National Standards Institute (ANSI).

This ESD classification of the sub assembly will be defined for the most sensitive component, therefore the following classifications apply:

- Class 1B – Human Model (< 1 kV)
- Class M1 – Machine Model (< 100V)

When handling the HMU-3640™'s™ main-board (i.e. sub assembly) by itself or in a partial housing proper ESD precautions should be taken.
The handler should be in an ESD safe area and be properly grounded.

**GPS Ceramic Patch Handling**

When handling the sub assembly it may be natural to pick it up by sides and make contact with the antenna boards. In an uncontrolled ESD environment contact with the center pin of ceramic patch antenna can create a path for electrostatic discharge directly to the GPS Module. The GPS Module is very sensitive to ESD and can be damaged and rendered non-functional at low levels of ESD. One should avoid contact with the center pin of the patch during handling.

**Packaging**

Anytime the sub assembly is shipped and it is not fully packaged in its final housing it must be sealed in an ESD safe bag.

**Electrical Over-Stress (EOS)**

The GPS receiver can be damaged if exposed to an RF level that exceeds its maximum input rating. Such exposure can happen if a nearby source transmits an RF signal at sufficiently high level to cause damage.

**Storage and Shipping**

One potential source of EOS is proximity of one HMU-3640™ GPS Antenna to another HMU-3640™ GSM Antenna. Should one of the units be in a transmit mode the potential exists for the other unit to become damaged. Therefore any HMU-3640™ GPS Antenna should be kept at least
four inches apart from any active HMU-3640™ GSM Antenna or any other active high power RF transmitter with power greater than 1 Watt.

**3.1.3 Battery Back-up devices**

Please properly dispose of the battery in any of the CalAmp products that utilize one, do not just throw used batteries, replaced batteries, or units containing a back-up battery into the trash. Consult your local waste management facility for proper disposal instructions.

**3.1.4 Physical and Environmental Specifications**

The HMU-3640™ is designed to operate in environments typically encountered by heavy duty fleet vehicles, including wide temperature extremes, voltage transients, and potential interference from other vehicle equipment.
To ensure proper operation in such an environment, HMU-3640™s were subjected to standard tests defined by the Society of Automotive Engineers (SAE). The specific tests included temperature, shock, vibration, and EMI/EMC. These tests were performed by independent labs and documented in a detailed test report.
The following shows the environmental conditions the HMU-3640™ is designed to operate in and the relevant SAE tests that were performed.
No formal altitude tests were conducted.

**Dimensions**

7.0"(L) x 3.0"(W) x 1.6"(H) 178mm (L) x 76mm (W) x 41mm (H) Weight 8.8oz (250g)
Ingress Protection Rating – IP66, IP67

**Temperature**

Operating Temperature Range: -30 o o C to 75 C oStorage Temperature Range: -40 o C to 85 C
https://puls.calamp.com/wiki/HMU-3640_Hardware_%26_Installation_Guide
Battery Charging Range: 0 o C to 40 C

**Humidity**

95% relative humidity, 50° non-condensing

**Altitude**

Operates at altitudes of up to 10,000 feet and can be stored safely up to 40,000 feet

**Shock and Vibration**

Ground vehicle environment with associated shock and vibration

**SAE Test: SAE J1455**

Mil Standard 202G, 810F

**Bench-Handling (Non-Operating)**

4 inch pivot drops on each of the faces on which it may be placed for servicing or installation.

**Electromagnetic Compatibility (EMC)**

EMC compliant for a ground vehicle environment

**Operating Voltage Range**

12/24 VDC Vehicle Systems

9-32 VDC (start-up, operating)
7-32 VDC (momentary)

**Battery Pack**

Battery Capacity: 500 mAh
Battery Technology: Nickel-Metal Hydride, NiMH
Charging Temperature: 0° to +40° C

**Transient Protection**

Input voltage transients typical of large trucks
Electrostatic Discharge (ESD)
No damage or performance degradation after the ESD disturbance.

**Power Consumption**

<350 uA @ 12V (deep sleep)
20 mA @ 12V (idle on network)
150 mA @ 12V (active tracking with VBUS active)

**GNSS**

55 channel GPS receiver (with SBAS; WAAS, EGNOS, MSAS)
GPS, GLONASS Capable (only two GNSS systems can run concurrently)
Tracking Sensitivity: -167dBm
Acquisition Sensitivity:
-148dBm Cold Start
-156dBm Hot Start
Location Accuracy: Up to 2.0 CEP Open Sky (24 hours static)
Anti-jamming
AGPS/Location assistance capable

**Cellular Communications (Comm)**

**North America Variant**

LTE Cat 1 – 1900 (B2)/AWS 1700 (B4)/850 (B5)/700 (B12) MHz
HSPA/UMTS – 850 (V)/1900 (II) MHz

**3.2 HMU-3640™ Connectors**

The HMU-3640™ offers connectors to access VBUS, I/O, other expansion capabilities. These connectors are:

- 12 Pin VBUS, I/F Power, I/O Mini-Deutsch Connector
- Battery Applicator
- SIM Card Port


**HMU-3640™ PCBA Top**


**HMU-3640™ PCBA Bottom**

### 3.2.1 I/O Connector

The HMU-3640™ features power, VBUS and I/O capabilities via its 12-Pin DTM15-12PA connector. Its pin-out is as follows:

| Pin | Signal Name | Description |
|---|---|---|
| 1 | CAN High | J1939 CAN communication |
| 2 | RS232 RTS | RS232 RTS Input to HMU3640 (not populated in standard product) |
| 3 | RS232 TX | RS232 Data Transmit from HMU3640 (not populated in standard prod uct) |
| 4 | INPUT 0 | Ignition Input |
| 5 | INPUT 1 | Digital Input |
| 6 | VIN | Main power input connected to positive terminal of vehicle battery. Op erating range of 9 to 32 VDC |
| 7 | GND | Main power input connected to negative terminal of vehicle battery. O perating range of 9 to 32 VDC. |
| 8 | ADC 1 | Analog Input |
| 9 | OUT 0 | Digital Output |
| 10 | RS232 RX | RS232 Data Input to HMU3640 (not populated in standard product) |
| 11 | RS232 CTS | RS232 CTS Output from HMU3640 (not populated in standard product ) |
| 12 | CAN Low | J1939 CAN communication |

Hardware options exist to swap in RS-485, K-line, or an additional general purpose input.

| CAN_H | RS232_RTS | RS232_TX | INPUT_0 | INPUT_1 | VIN1 |
|---|---|---|---|---|---|
| | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 12 | 11 | 10 | 9 | 8 | 7 |
| | | | | | |
| CAN_L | RS232_CTS | RS232_RX | OUT_0 | ADC_1 | GND |

**12 Pin Orientation**

**3.2.2 Accessories**

Breakout cables for the HMU3640 are not currently available from CalAmp. However, customers are encouraged to build their own custom wire harnesses using the 12 pin mating connector from Deutsch: DTM06-12SA with required wedge lock (WM-12S). Refer to Section 2.6of the Harness Diagrams page for more information on

appropriate accessories for the HMU-3640™.

**3.3 GPS Receiver**

56 channel GNSS receiver (with SBAS)
Accuracy: 2.0m CEP (50%)
Tracking Sensitivity: -162dBm
Acquisition Sensitivity: -147dBm
3.4 I/O Descriptions
The HMU-3640™ provides the following logical mapping of inputs and outputs (I/O):

**Digital Inputs**

Input 0: Ignition Sense (Always biased low)
Input 1: In-1 sel Generic Digital Input (Biased high or low/ S-158 Bit 1)

**Internal Inputs**

Input 8: Motion Sensor (low = no motion, high = motion)
Input 9: VBUS Active
Input 10: Pwr State (low = main power, high = battery power)
Input 11: Vbatt Low
Input 12: Not Used
Input 13: Batt Virt Ign
Input 14: Pure Virt Ign
Input 15: Radio Ring Wake
Input 16: DB Wake
Input 17: Vbus Wake
Input 18: Not Used
Input 19: Crank Detect

**Analog to Digital Inputs**

A/D 0: External Power Supply Monitor (VIN1)
A/D 1: Ext ADC1 Generic External Analog to Digital Input
A/D 2: Not Used
A/D 3: HW Config
A/D 4: Not Used
A/D 5: Not Used
A/D 6: GPS Antenna Monitor
A/D 7: µP Temperature (internal use only)
A/D 8: Vref
A/D 9: Battery

**Outputs:**

Output 0: Out-0

**Internal Outputs**

Output 8: Chrg Disable

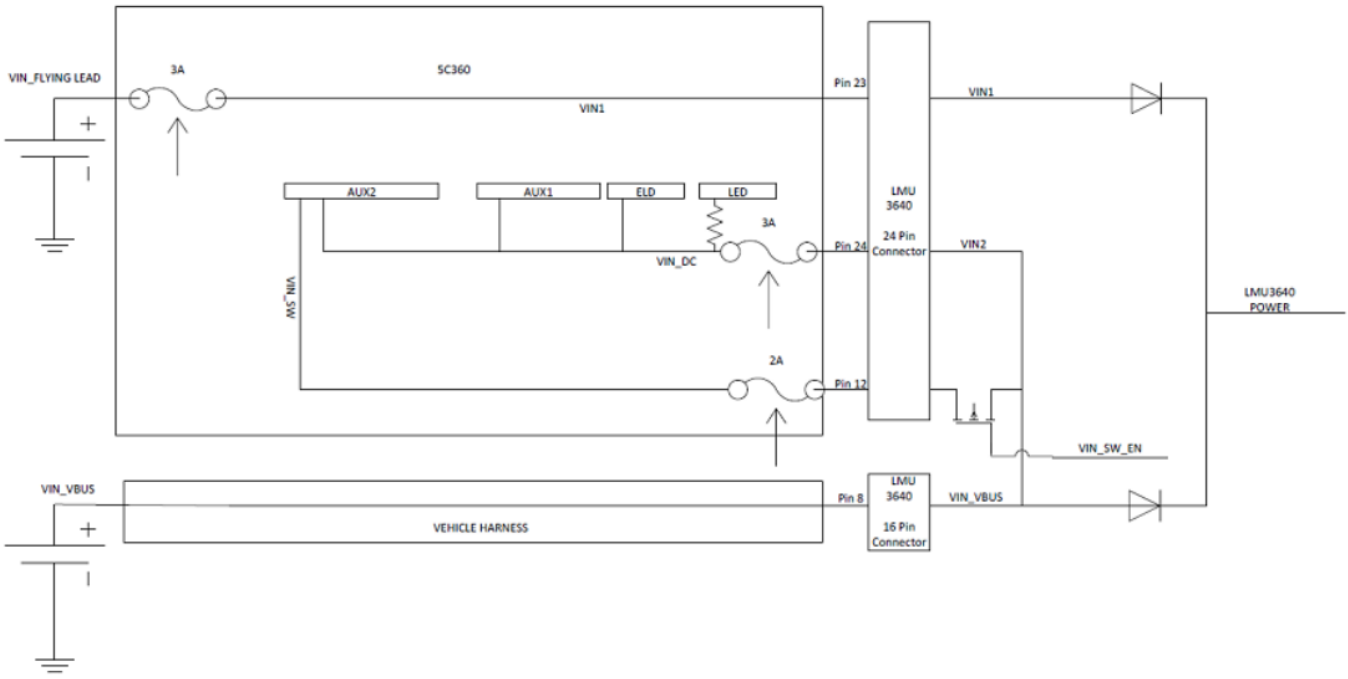
**3.4.1 3-Axis Accelerometer Input**

The HMU-3640™ supports an internal 3 Axis Precision Accelerometer as one of its discreet inputs. When the HMU is moved in any direction, the associated input will be in the High state. If the HMU's accelerometer does not detect motion, then the input will be in the Low state. No external connections are required for this functionality to be operational.

**3.4.2 Ignition and Inputs**

The HMU-3640™ provides up to 5 inputs. These inputs are protected from typical vehicle transients and can be directly connected to most vehicle level logical inputs from 0 volts up to the vehicle power input level (typically 12 VDC). One of these inputs is dedicated to sensing the vehicle's ignition status to provide for flexible power management. The other 4 inputs may be used to sense vehicle inputs such as cooling unit operation, a hidden driver "Panic" switch, taxi on-duty/off-duty meter status or many others.

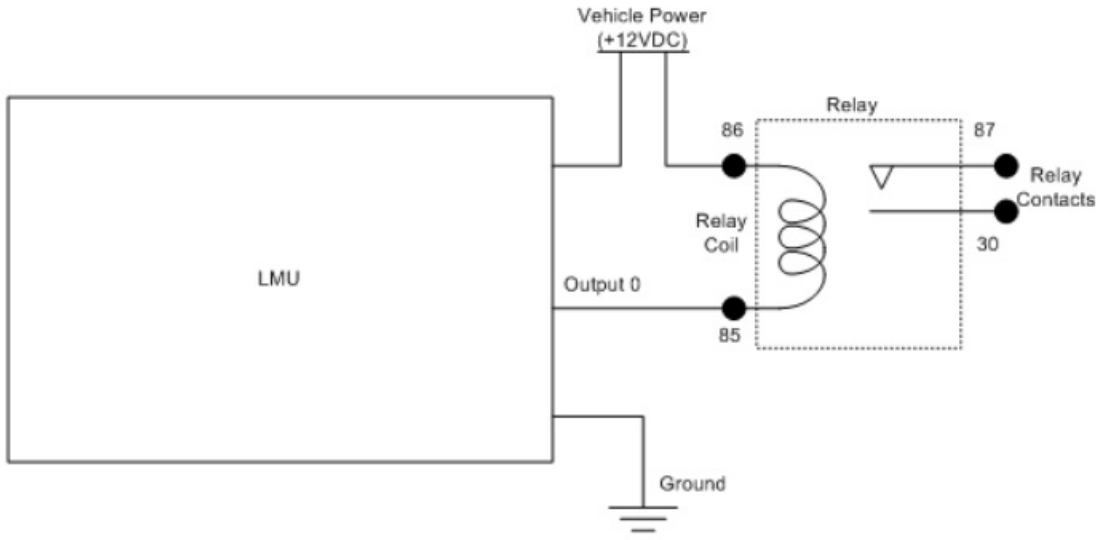
The ignition input is pulled to ground through the 268k resistance, where the other inputs can be configured to be normally High (i.e. pulled to +6v through a 210k resistor) or Low (i.e. pulled to ground through a 43k resistor). The diagrams below show how to connect the inputs in both a high- and low-biased configuration:




**HMU-3640™ Input Wiring**

### 3.4.3 Outputs

The HMU's outputs are designed to drive external relays. These outputs provide a high-current, open-collector driver that can sink up to 150 mA each. These drivers may be used to drive external relays that can then control vehicle functions such as door locks, fuel shut-off valves, sirens and lights. If additional current is required to drive the relays, external circuitry can be added to source the current. This diagram is a typical use of an output to drive a relay.




**Sample Relay Wiring**

### 3.4.4 Serial Streams

| Stream | Port | Rate | Word |
|---|---|---|---|
| 0:User0 | — | — | — |
| 1:Modem | 4:Radio | 460800 | 8/N/1 |
| 2:User 1 | — | — | — |
| 3:Debug | 0:Aux1 | 115200 | 8/N/1 |
| 4:NMEA Out | — | — | — |
| 5:DUN | — | — | — |
| 6:PEG Serial | — | — | — |
| 7:VBUS | 10:Aux3 | 115200 | 8/N/1 |
| 8:GPS Rcvr | 5:GPS | 115200 | 8/N/1 |
| 9:AltMdm | — | — | — |
| 10:HostApp0 | 1:Aux2 | 115200 | 8/N/1 |
| 11:HostAppl | — | — | — |
| 12:HostApp2 | — | — | — |
| 13:Undef. | — | — | — |
| 14:BlueTooth | — | — | — |
| 15:ATCmd-1 | — | — | — |
| 16:ATCmd-2 | — | — | — |
| 17:SatMdm | — | — | |
| 18:513B | — | — | — |
| 19:WSP | — | — | — |

**3.4.5 Status LEDs**
The HMU-3640™ is equipped with 4 Status LEDs; one for GPS, one for COMM (wireless network status), one for VBUS and one for WiFi. The LEDs use the following colors to indicate service:
**Status LEDs**

| LED | Status | Color |
|---|---|---|
| 1 | WiFi/BT | Blue |
| 2 | Comm | Orange |
| 3 | VBUS | Red |
| 4 | GPS | Green |

**LED #1 (BT – Blue) Definitions**
Controlled via PEG Script.
See PEG action 133 (AUX).
**LED #2 (Comm LED – Orange) Definitions**

| Condition | LED 2 |
|---|---|
| Modem Off | Off |
| Comm On – Searching | Slow Blinking |
| Network Available | Fast Blinking |
| Registered but no Inbound Acknowledgement | Alternates from Solid to Fast Blink every 1s |
| Registered and Received Inbound Acknowledgement | Solid |

**LED #3 (VBUS – Red) Definitions**
**Controlled via PEG Script.**
**See PEG Action 99.**
**LED #4 (GPS LED – Green) Definitions**

| Condition | LED 4 |
|---|---|
| GPS Off | Off |
| GPS On | Slow Blinking |
| GPS Time Sync | Fast Blinking |
| GPS Fix | Solid |


**4 Configuration of the Vehicle Bus Interface**
The VBU2 Vehicle Bus Interface embedded in the HMU-3640 is designed to support Heavy Duty (trucks and buses) vehicles. Detection of operating mode today is primarily based on the correct selection of the cable for the vehicle type.
In order to avoid vehicle interference from the device, ensure the correct cable is selected for the specific vehicle that the device is installed into
The Heavy Duty vehicle mode emulates the CalAmp JPOD2 accessory for vehicles with Heavy Duty vehicle bus interfaces. In this mode, the VBU2 interface will operate and communicate with heavy duty vehicles using the J1939 protocol. For detailed JPOD2 information, refer to the JPOD2 Tutorial.
Refer to the steps below to properly install, configure and run VBU2 interface of the HMU-3640.
**4.1 VBU2 Mode Configuration and Testing Instructions**

1. The HMU-3640 firmware with the correct app id should be preinstalled on the device.
2. To configure HMU in forced JPOD2 (Heavy Duty) configuration:

   ats178=13

   at$app param 3352,0,1

## Configuration and Activation

This section details how to quickly get an HMU-3640™ provisioned and configured to point at a specific server. It is assumed that a PEG script has already been created and is being managed through LMU Manager or PULS™, the CalAmp Maintenance System.
We are making three assumptions to simplify the setup process:
You have created, installed and configured an LM Direct™ Server to receive messages from the HMU-3640™. (See LM Direct™ Reference Guide for details)
You are using the standard wiring harness from CalAmp and the serial port expansion harness.
You have created a HyperTerminal or Putty session.
You have contacted the CalAmp sales team regarding the network availability of the HMU-3640™.
**5.1 Quick Start – General Config**
All HMU-3640™s must go through a common step during the configuration and provisioning process. Specifically, this is pointing the HMU to your LM Direct™ server, either via IP or a URL.
This configuration process is accomplished via a series of AT Commands:

1. Power up the HMU-3640™ and connect a serial cable from the HMUto your laptop
2. Open a terminal session to the HMU-3640™
3. Enter the address of the LM Direct™ server:

   AT$APP PARAM 2319,0,ddd.ddd.ddd.ddd

   AT$APP PARAM 768,0,ddd.ddd.ddd.ddd (32-bit products only)

   AT$APP PARAM 769,0,ppppp

   Where ddd.ddd.ddd.ddd is the publicly addressable IPV4 address of your LM Direct™ server and ppppp is the UDP port number.
4. Alternatively if a URL has been set up for your LM Direct™ server, the HMU may be programmed with:

   AT$APP PARAM 2319,0,myURL.MyCompany.Com

   Where myURL.MyCompany.com is the URL assigned to the server.
5. Enter ATIC to verify the correct settings are displayed for your Inbound Server.

This configuration process is accomplished via a series of SMS Commands:

1. Power up the HMU-3640™ and your handset
2. From the handset, send an SMS message to the HMU-3640™ phone number:

   !RP,2319,0,ddd.ddd.ddd.ddd

   !RP,768,0,ddd.ddd.ddd.ddd (32-bit products only)

   !RP,769,0,ppppp

   Where ddd.ddd.ddd.ddd is the publicly addressable IPV4 address of your LM Direct™ server and ppppp is the UDP port number
3. Alternatively if a URL has been set up for your LM Direct™ server, the HMU may be programmed with:

   !RP,2319,0,myURL. **MyCompany.Com**

   Where myURL.MyCompany.com is the URL assigned to the server
4. Verify your settings by sending the commands:

!RP?2319,0 !RP?769,0

**5.2 Activating LTE Using AT Commands**

There are two variants of LTE modems; LTE AT&T and LTE Verizon. Both variants require a SIM card to be inserted.

If you get an HMU without a SIM card (which is the typical case), the operator will simply ask for the IMEI of the HMU . The IMEI (International Mobile Equipment Identifier) is printed on the label of the HMU. Again, DO NOT give the operator the CalAmp ESN of the HMU.

The operator will provide you with a SIM card for each account activated. If they are especially nice (or you are especially persistent) they will also give you a list tying the IMSI (International Subscriber Identifier) of the SIM to the phone number assigned to it. Please note that the operator will likely tie the IMSI (i.e. the SIM) to a specific IMEI. Making sure the specific SIM matches to the right IMEI isn't strictly necessary, but it will keep everyone's book-keeping a little cleaner. You may also obtain this information by running a CSV report in PULS (after the devices have connected to the network and sent in their first ID Report). See the PULS Users Guide for more information. If you do happen to have a SIM card, the operator will ask for the IMSI and ICC-ID (Integrated Circuit Card Identifier) along with the IMEI of the HMU. Again, in return you should get a list of IMSIs and Phone Numbers.

The IMEI, IMSI and ICC-ID are all available through the ATI1 command. The IMEI should also be printed on the label of the HMU.

Operators can offer more than one type of APN and can even set up a custom APN just for your devices. The rates they charge will vary depending on the APN service you want. Operators may also request you use a blank APN. With the APN, you may also receive a username and password combination.

The last item an operator may provide is a SIM PIN. The PIN is effectively a password to the device. The main difference here is that the PIN will restrict all the capabilities of the device, where the SPC is used just for configuration.

The activation sequence for an LTE AT&T modem would therefore look as follows:

AT$APP PARAM 2306,0,“myAPN.myOperator.com”

AT$APP PARAM 2306,1,“myAPN.myOperator.com”

AT$APP PARAM 2314,0,“myUSername” (only if required by the carrier)

AT$APP PARAM 2315,0,“myPassword” (only if required by the carrier)

ATS155=1 (to disable APN auto-provisioning)

To clear the APN, the following command can be used:

AT$APP PARAM 2306,0,“”

AT$APP PARAM 2306,1,“”

Only enter this next command if you have been given a non-zero PIN as any errors may lock you out of the modem.

AT$APP PIN <SIM pin>

You can confirm activation by watching the Comm LED to see if it goes solid. You may also confirm activation by entering AT command

AT$APP COMM STATUS? or ATIC

The activation sequence for an LTE Verizon modem would therefore look as follows:

The HMU must be registered on the Verizon network. Having the device roaming or in poor Verizon coverage will not allow the execution of the activation process.

The activation is an automatic process where Verizon pushes the APN to the modem.

In some cases, there might be a delay up to 15 minutes until the unit gets activated and is able to make a data call.

For Verizon LTE, parameter 2306 (APN) is currently disabled.

AT$APP COMM STATUS? or ATIC

**5.3 Preparing for Installation**

Be sure you have received all the HMU components you need. This must include:

- The HMU to be installed
- A power harness
- 12 Pin deutch I/O connector
- Optional Components:

  Input and output cables

Relays

HMU peripherals (i.e. Serial adapter, jPOD, TetheredLocator)

Host serial devices (e.g. PDAs, laptops, other serial devices)

**5.4 Plan The Installation**

Verify Power, Ground and Ignition. Be sure to check each source (power, ground and ignition) to ensure that the proper signaling exists. This is typically accomplished with a multi-meter.

Before drilling any holes or running any wires, decide where each hardware component will be located (HMU, antennas, peripherals, etc.). Be sure that the cables to the HMU are not bent or constricted in any way. Also make sure that the HMU is kept free from direct exposure to the elements (sun, heat, rain, moisture etc…).

Be advised that an installation that violates the environmental specifications of the HMU will void the warranty.

The best way to ensure a trouble-free installation is to consider your options and make some decisions before you start. Take a look at the vehicle and determine how to best install the HMU for the following purposes:

Accurate data gathering and simulation of how customers actually use your solution

Ongoing monitoring and maintenance of HMU equipment Accidental or intentional alteration of the equipment or cable connections The following sections cover some of the issues to consider when planning your HMU installation.

**5.4.1 Size and Placement of LMU Unit**

The dimensions of the LMU should be taken into account, particularly when installing in a vehicle:

Whether you intend to place the LMU under a seat or into a cavity behind the vehicle's interior molded trim, be sure the LMU will fit before drilling any holes or running cable

Be certain that the cables running to the LMU will not be bent or constricted. Damage to the cables may impede the LMU's performance.

Be certain that the installation point will not violate any of the LMU's environmental specification (temperature, moisture, etc…) as improper installation of the LMU may void the warranty.

See the LMU Environmental Specifications for the exact measurements and specifications of the HMU-3640™.

Typical installations will place the LMU under the vehicle dash board, or in the trunk. Make sure you can get access to the unit afterwards as under some circumstances it may be necessary to add additional wiring or connections to the LMU.

**5.4.2 Access to the SIM (Subscriber Identity Module) Card**

When used in a LTE, each LMU uses a Subscriber Identity Module (SIM) card, which should be inserted before you install the LMU for the first time. The SIM card is attached to the main-board inside the housing of the LMU unit.

At some future time, you might need or want to replace the SIM card with a different one, so try to install the LMU in such a way that the cover can be removed to make the SIM card accessible.

**5.4.3 Protection from Heat**

It is best not to place the LMU unit in an unusually warm location such as directly near heater vents, near hot engine components or in direct sunlight. The maximum temperature that can be tolerated by the LMU is described in the LMU Environmental Specifications section.

**5.4.4 Visibility of Diagnostic LEDs**

Status LED lights on the front of the LMU unit can provide valuable information about the operation of the LMU. When feasible, attempt to install the LMU in such a way that these lights can be seen with reasonable ease.

You may find it useful to be able to view the LEDs periodically to make sure that the LMU is operating properly. If at any time you should encounter a problem with the LMU, you may need to read the LEDs in order to troubleshoot the problem. If you cannot fix the LMU yourself, you will need to provide the LED information to CalAmp customer support.

For information about how to interpret the LEDs, see the Status LED Behavior section.

**5.4.5 Cable Length**

Do not cut cables. Instead, coil any excess length, making sure not to crimp or flatten any cable.

**5.4.6 Moisture and Weather Protection**

The LMU unit must be located where it will not be exposed to moisture or water. In a typical installation inside a vehicle this is not commonly thought to be a concern; however, it might be best to avoid locating the LMU below a car's cup holders, or where rain might easily splash into the compartment when a door is opened.

**5.4.7 Preventing Accidental or Unauthorized Modification**

If you anticipate that fleet drivers or others might interfere with the LMUs once they are installed, take steps to be sure that it is not easy to remove the LMU from its power source, or disrupt internal antenna interference.

Two common methods are the use of Tamper Proof Sealant or creation of PEG Script to detect power loss or GPS antenna disconnections.

### 5.5 Installing the LMU in a Vehicle

This section provides instructions for installing an LMU in a vehicle.

Be sure to consider the design decisions described in the previous sections. When you are ready to begin installing the LMU, follow these steps:

#### 5.5.1 Place the HMU-3640 in the vehicle.

The HMU-3640 contains an internal battery, and thus should be oriented with the label facing upwards towards the sky. LMUs with internal antennas should be placed directly under a thick panel to maximize their performance and protect from external elements. A typical location include under the dash close to the front wind-shield.

Attach the LMU to the solid body of the vehicle, not to plastic panels. The LMU can be placed out of sight by removing interior trim and molding to expose available space, then replacing the trim once the LMU is in place.

#### 5.5.2 Connect power, ignition, and ground.

The power input (red wire) must be connected to a constant (un-switched) +12 VDC or +24 VDC supply; preferably, connected directly to the vehicle battery terminal or as close to it as possible. This connection point should be fuse protected to not more than 5 Amps.

The ignition input (white wire) must be connected to the vehicle ignition or another appropriate key operated line, such as ACCESSORY, ensuring that power to the ignition wire is available only when the vehicle ignition is on.

The ground line (black wire) must be connected to chassis ground.

Failure to connect these lines in the manner described may result in discharge of the vehicle battery.

For best results, it is strongly recommended that the LMU connection be on its own circuit. Connect the power input directly to the vehicle battery if possible and protect the circuit with an inline fuse. If you must connect through the fuse box, use standard commercial wiring practices to create a permanent installation rather than using press-in fuse clips or other temporary measures.

DO NOT connect the power cable to the LMU at this time.

#### 5.5.3 Typical Connection Sequence

- Connect any peripherals to the LMU
- Plug in the power harness.

The physical installation of the LMU hardware is now complete.

### 5.6 Installation Verification

In many cases it is desirable to verify that an installed HMU-3640™ is working properly. That is, installers should verify that the GPS and communications functions of the HMU-3640™ are working properly before departing the installation site. In more robust cases, some key configuration settings such as the Inbound Address and URL should also be verified.

Note that these processes are all based on issuing AT Commands to the HMU-3640™. It is expected that installers will have access to a serial port expansion cable and a laptop or PDA capable of a terminal connection. Alternatively, an SMS message can be sent to an HMU-3640™ to obtain its current status.

#### 5.6.1 Comm Verification

Installers should first verify that the HMU-3640™ has been acquired and has registered to the wireless network. This may be verified in one of two ways. First, installers may look at the Comm LED (i.e., the one closest to the SMC antenna connector). If this LED is solid, then the LMU has registered to the network and established a data session.

If the LED is not visible, then Comm may be verified using an AT Command:

ATIC

Depending on the wireless network being used something similar to what is shown below will be displayed. It is important to verify that ‘Yes’ values are displayed at the top for Data and Network registration and the correct APN is displayed.

```
        Radio Access     : GSM
        Network Reg.     : Yes, Home
        Data Reg.        : Yes, Home
        Connection       : Yes
        RSSI             :      -97 dBm
        BER              :       99
        Channel          :      737
        Cell ID          :     3441
        Base Station ID  :       40
        Local Area Code  :    31003
        Network Code     :      410
        Country Code     :      310
        IMEI (Modem S/N): 351802055396182
        IMSI (SIM ID)    : 310410202524377
        ICC-ID (SIM S/N): 89014102212025243778
        Phone Number     :
        GPRS APN         : ISP.CINGULAR
        Maint. Server    : maint.vehicle-location.com(216.177.93.246):20500
        Inbound Server   : (0.0.0.0):20500
        Dual Comm        : routing id=0, log cid=0, modem type=21, inbnd index=0

OK
```

If any of the responses return Not-Acquired or Not-Registered (and the APN is correct), the wireless network operator should be contacted for further troubleshooting.
Please note that it may take several seconds (or longer) for the HMU-3640™ to communicate with the modem and acquire the wireless network.

**5.6.2 GPS Verification**

The next step is to verify that the GPS receiver is seeing enough satellites to obtain a valid GPS position. Again, installers have two choices on how to perform this verification. First, like the Comm Verification, there is a GPS status LED (i.e., the one closest to the SMA connector). If this LED is solid, then the LMU has found GPS service. If the LED is not visible then GPS service may be verified using an AT Command:

**AT$APP GPS?**

The response should be similar to:
Lat=3304713, Lon=-11727730, Alt=0
Hdg=113 Spd=0 3D-RTIME HDOP=130 nSats=7
Installers are looking for the 3D-RTIME setting along with a valid Lat, Long pair (i.e. something other than 0). If the GPS receiver does not have a valid lock within 2-3 minutes.

**5.6.3 Inbound Verification**

The last item to verify is that the HMU-3640™ is sending data to the correct server. In general, this is a two-step process that will need the aid of an observer on the back end. That is, a technician will have to be logged in so they can monitor data coming into the backend mapping/vehicle management application.
First, verify that the HMU-3640™ is using the correct Inbound IP address by using:
AT$APP INBOUND?
The response should be similar to:
INBOUND LMD
INBOUND 0 ADDR ddd.ddd.ddd.ddd:ppppp *
INBOUND 0 URL myURL.myCompany.com
INBOUND 1 ADDR 0.0.0.0:20500
INBOUND 1 URL
INBOUND 2 ADDR 0.0.0.0:20500
INBOUND 3 ADDR 0.0.0.0:20500
The installer will need to verify with a backend technician that the, URL (myURL.myCompany.com ), IP address (ddd.ddd.ddd.ddd) and port (<ppppp>) are correct.
The second step is to verify that the HMU-3640™ is sending data. The best way to do this is to force the HMU-3640™ to send in an unacknowledged Event Report (i.e., its current GPS location) with the following command:
AT$APP PEG SUNRPT 255
The HMU-3640™ will respond with: OK
The backend monitor must then be contacted to confirm that they received an Event Report with Event Code 255. Assuming that all three sections have passed, the installation can be considered to be complete.

**5.6.4 Verification via SMS**

The current Comm, GPS and Inbound status of a GSM LMU can be obtained via SMS provided you have access to an SMS capable phone or PDA.

Using your handset, send the following SMS Message to the LMU: !R0
Within a few minutes, the LMU should return a response in the following format: APP: <App ID> <Firmware Version>
COM:<RSSI> [./d/D][./a/A][./L][IP address] [<APN>] GPS:[Antenna <Short/Open/Off>] | [No Time Sync] | [<FixStatus> <Sat Count>] INP:<inputs states> <vehicle voltage>
MID:<mobile ID> <mobile ID type>
INB:<inbound IP address>:<inbound port> <Inbound Protocol (LMD/LMX)>

- APP:

  o <App ID>:

  The Application ID value of the LMU indicating the host platform and the wireless networking technology of the LMU.

  o <Firmware Version>:

  The current firmware version in use by the LMU
- COM:

  o <RSSI>:

  This is the signal strength the wireless modem sees from the network. In general the LMU is at least scanning for the network if the RSSI is not -113.

  o [./d/D]:

  If the character ‘D’ is present, it indicates the LMU had a data session established when it responded to the status request. For the 8-Bit product line an upper case ‘D’ indicates both the Inbound and Maintenance sockets are ready. The lower case ‘d’ indicates that only the Maintenance socket is ready. A ‘.’ indicates no sockets are ready.

  o [./a/A]:

  This field indicates if the LMU has received an Acknowledgement from the Inbound server. This field will be empty if the LMU has never received an ACK. The lower case ‘a’ will be present if it has received an ACK since the last cold boot (i.e. power cycle) but not the last warm boot (App Restart or Sleep). The upper case ‘A’ will be present if the LMU has received an ACK since the last warm boot. A ‘.’ Indicates no acknowledgement has been received.

  o [./L]:

  This field indicates if the LMU’s log is currently active. An ‘L’ indicates that the log is currently in use (i.e. one or more records have been stored) where a ‘.’ indicates the log is inactive.

  o [IP Address]:

  This is an optional field if and is only present if the LMU has established a valid data session. This field will contain the current IP address of the LMU as assigned by the wireless network. Note that if you see a value of 192.168.0.0, this is an indication that the LMU has not been able to establish a data session.

  o [<APN>] The current Access Point Name in use by a GSM LMU.
- GPS:

  o [Antenna <Short/Open/Off>]:

  This field, if present, indicates a problem with the LMU’s GPS antenna. A value of Short indicates that the antenna cable has likely been crushed. A value of Open indicates that the antenna cable is either cut or disconnected. A value of Off indicates that the LMU’ GPS receiver is off.

  o [No Time Sync]:

  If this field is present, it indicates that the LMU’s GPS receiver has not been able to find even a single GPS satellite. This would likely been seen in conjunction with the above antenna error, or if the LMU GPS antenna is

otherwise blocked.

o [<FixStatus> <Sat Count>]:

If these fields are present it indicates that the LMU has, or had a valid GPS solution. The <Sat Count> field indicates how many GPS satellites are currently in use by the LMU. The <FixStatus> field indicates the type of fix. The Fix Status types are detailed in the LM Direct Reference Guide.

- INP:

o <input states>:

This field details the current state of each of the LMU's discreet inputs. This field is always 8 characters long. The left most character represents the state of input 7 where the right most represents the state of input 0 (i.e. the ignition). A value of 1 indicates the input is currently in the high state. A value of 0 indicates it is currently in the low state.

o <vehicle voltage>:

This field will contain the current reading of the LMU's internal A/D. This will be the supply voltage provided to the LMU in mV. MID:

o <mobile ID>:

This will be the current mobile ID in use by the LMU.

o <mobile ID type>:

This will be the type of Mobile ID in use by the LMU. The available types are, Off, ESN, IMEI, IMSI, USER, MIN and IP ADDRESS. INB:

o <inbound IP address>:

This is the current IP address in use by the LMU. This value should match the IP address of your LM Direct™ server.

o <inbound port>:

This is the current UDP port the LMU will use to deliver its LM Direct™ data. This value should match UDP port you are using on your LM Direct™ server. It is typically 20500.

o <Inbound Protocol (LMD/LMX)>:

This is the current UDP/IP messaging protocol in use by the LMU. In general it should be LMD.

https://puls.calamp.com/wiki/HMU-3640_Hardware_%26_Installation_Guide

---

## Documents / Resources

| | |
|---|---|
|  | CalAmp HMU-3640 Location Messaging Unit [pdf] Installation Guide<br>HMU3640, HMU-3640, HMU-3640 Location Messaging Unit, Location Messaging Unit, Messaging Unit, Unit |

## References

- Fleet Management Software Solutions | CalAmp
- GSMA | GSMA
- Log in - PULS Wiki
- Log in - PULS Wiki
- Log in - PULS Wiki
- Log in - PULS Wiki
- Log in - PULS Wiki
- P65Warnings.ca.gov
- p65warnings.ca.gov/
- 4G LTE | Carrier Aggregation | Qualcomm
- User Manual