

LMU-3640 Hardware & Installation Guide

LMU-3640™

Hardware and Installation Guide



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1 Introduction

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

1.1 About This Manual

The LMU-3640™ is one of the most flexible economy mobile tracking hardware products available. 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 LMU-3640™ based tracking system. 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 LMU-3640™.
- **Hardware Overview** – Describes the physical characteristics and interfaces of the LMU-3640™.
- **Installation and Verification** – Provides guidance for the installation of the LMU-3640™ versions in a vehicle and instructions on how to verify the installation is performing adequately.

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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 is a leading provider of wireless communications products that enable anytime/anywhere access to critical information, data and entertainment content. With comprehensive capabilities ranging from product design and development through volume production, CalAmp delivers cost-effective high quality solutions to a broad array of customers and end markets. CalAmp is the leading supplier of Direct Broadcast Satellite (DBS) outdoor customer premise equipment to the U.S. satellite television market. The Company also provides wireless data communication solutions for the telemetry and asset tracking markets, private wireless networks, public safety communications and critical infrastructure and process control applications. For additional information, please visit the Company's website at www.calamp.com (<http://www.calamp.com/>) .

1.4 About the CalAmp Location Messaging Unit - LMU-3640™

The CalAmp Location and Messaging unit-LMU-3640™ is a mobile device that resides in private, commercial or government vehicles. The LMU-3640™ is a single box enclosure incorporating a processor, a GPS receiver, a wireless data modem, and a vehicle-rated power supply. The LMU-3640™ also supports inputs and outputs to monitor and react to the vehicular environment and/or driver actions..

The LMU-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 LMU-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.

LMU-3640™ are sold exclusively to authorized systems integrators, software firms, and service providers who have developed their offering around the capabilities of the LMU-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 LMU-3640™ are performed by CalAmp customers or contracted installers. Typical installations include hook-up to power, ignition, and ground. LMU-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.

2 System Overview

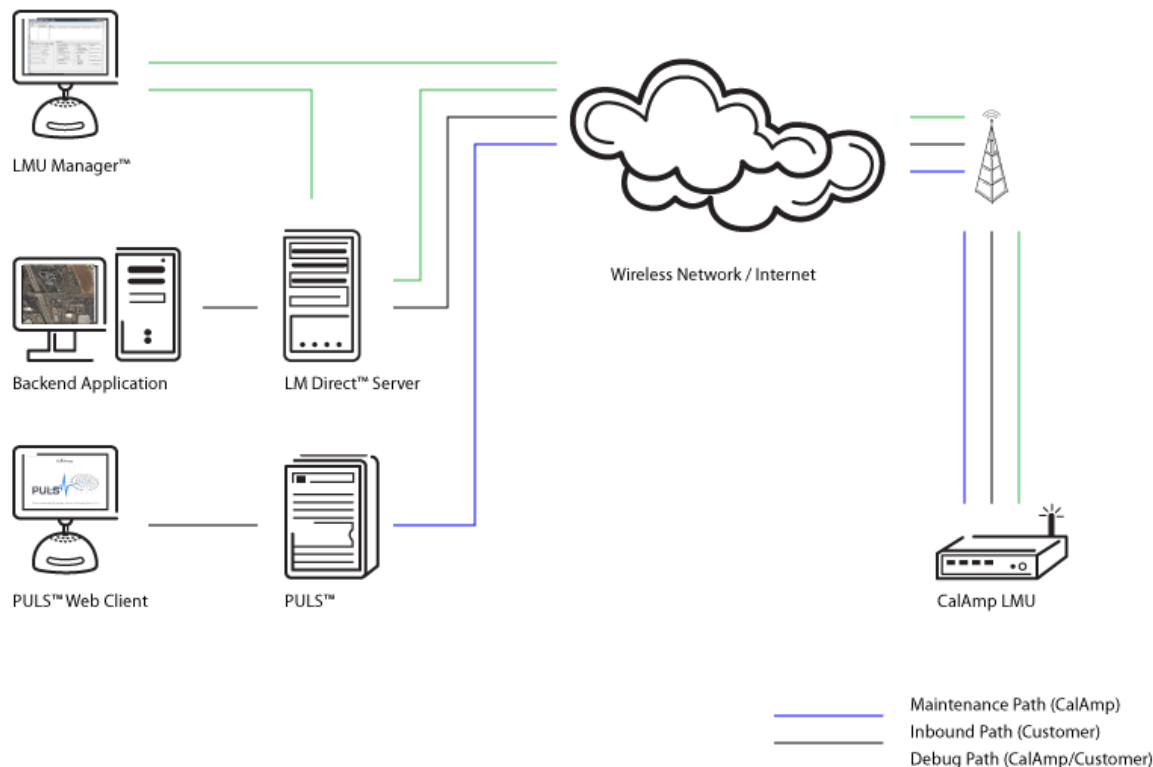
2.1 Overview

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 LMU-3640™ 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 LMU-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 LMU-3640™ in a variety of formats.
- Present historic information received from the LMU-3640™ typically in a report/chart style format
- Request location updates from one or more LMU-3640™
- Update and change the configuration of one or more LMU-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 LMU-3640™. Unlike the backend software, it has the option of talking directly to an LMU-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 LMU-3640™ is capable of sending and receiving. This interface allows System Integrators to communicate directly with LMU-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 LMU-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 LMU-3640™ are:

- HSPA

- LTE

2.2.5 LMU-3640™

The LMU-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 LMU-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 LMU-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.

3 Hardware Overview

3.1 LMU-3640™

3.1.1 Environmental Specifications

The LMU-3640™ is designed to operate in environments typically encountered by fleet vehicles, including wide temperature extremes, voltage transients, and potential interference from other vehicle equipment.

To ensure proper operation in such an environment, LMU-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. In accordance with Appendix A of SAE J1113 Part 1, the Unit is considered a “Functional Status Class B, Performance Region II” system that requires Threat Level 3 Testing.

The following shows the environmental conditions the LMU-3640™ is designed to operate in and the relevant SAE tests that were performed. No formal altitude tests were conducted.

Temperature

Operating Temperature Range: -30° C to 75° C

Storage Temperature Range: -40° C to 80° C

SAE Test: SAE J1455

Humidity

95% relative humidity, 50° non-condensing

SAE Test: SAE J1455

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 and 810F

Bench-Handling (Non-Operating)

4 inch pivot drops on each of the faces on which it may be placed for servicing or installation.
SAE Test: SAE J1455, SAE J1113
Mil Standard 810F

Electromagnetic Compatibility (EMC)

EMC compliant for a ground vehicle environment
SAE Test: SAE J1113 Parts 2, 12, 21 and 41

Operating Voltage Range

The LMU-3640™ supports vehicles with 12 or 24 VDC systems including transients and electrical system noise.; this includes ranges from 9 to 30 VDC.
SAE Test: SAE J1455, SAE J1113

Backup Battery

The LMU-3640™ supports a Lithium-Ion 1000 mAh backup battery input to be used when primary power is lost; the supported voltage range is 9 to 16 VDC

Transient Protection

Input voltage transients typical of large trucks
SAE Test: SAE J1113 Part 11

Electrostatic Discharge (ESD)

No damage or performance degradation after the ESD disturbance.
SAE Test: SAE J1113 Part 13

Power Consumption

Average: 100mA at 13.8 VDC
Peak: 200mA for 50ms transmit burst (0.1% transmit duty cycle typical)
Stand By 20mA

3.1.2 Physical Specifications**Dimensions**

5.7"(L) x 2.1"(W) x 1.3"(H)
145mm (L) x 53mm (W) x 33mm (H)

Weight

5oz (140g)

Operating Temperature

-30° C to +75° C (connected to primary power)
-10° C to +60° C (When using internal battery power)

Storage Temperature

-40° C to +85° C
0° C to +30° C (Long Term w/Internal Battery)

Internal Battery Charging Temperature

+5° C to +45° C

Humidity

0% to 95% relative humidity, at 50° C non-condensing

Shock and Vibration

Ground vehicle environment with associated shock and vibration

SAE Test: SAE J1455
Mil Standard 202G and 810F

Operating Voltage Range

The LMU-3640™ supports vehicles with 12 or 24 VDC systems including transients and electrical system noise; this includes ranges from 7 to 32 VDC.

Electrostatic Discharge (ESD)

No damage or performance degradation after the ESD disturbance.

Power Consumption

Average: 70mA at 13.8 VDC
Deep Sleep: 7mA @ 12V
Sleep on Network (SMS): 10mA

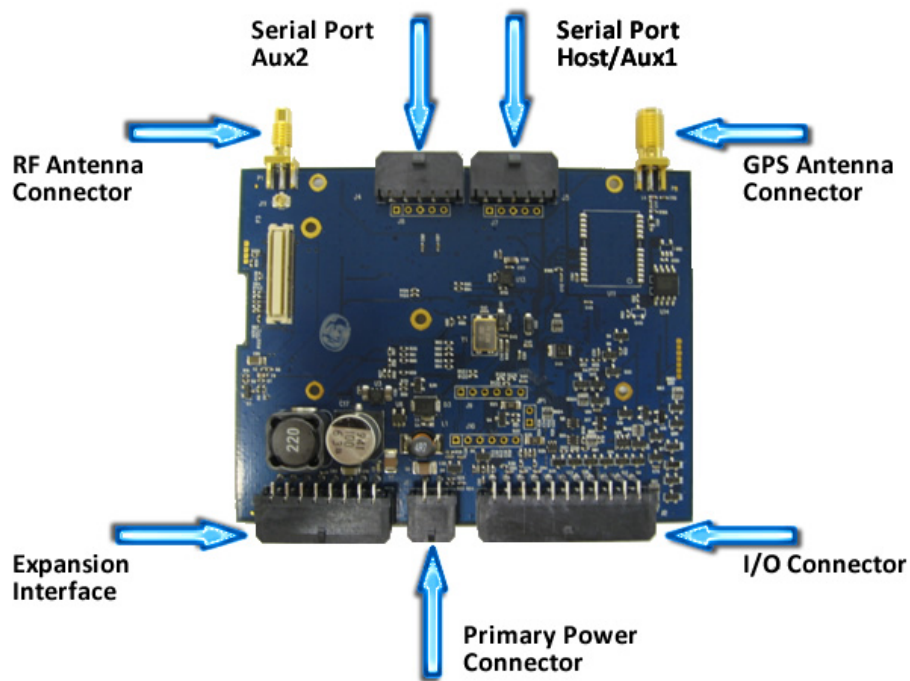
3.2 Location Messaging Unit - LMU-3640™

The block diagram has been removed LMU-3640™.

3.3 LMU-3640™ Connectors

The LMU-3640™ offers 5 connectors to access power, I/O, serial communications and other expansion capabilities. These connectors are:

- **Primary Power Connector**
- **I/O Connector**
- **Serial Port Connector – Host/Aux1**
- **Serial Port Connector – Aux 2**



LMU-3640™ Connectors

3.3.1 I/O Connector

The LMU-3640™ features expanded power and I/O capabilities via its 24-Pin Molex 43045-2202 connector. Its pin-out is as follows:

***Refer to the Harness Diagrams page for more information on appropriate accessories for the LMU-3640™.**

Pin	Signal Name	Description	Input or Output
1	Input 1	Input 1 – Digital Input	Input
2	Input 2	Input 2 – Digital Input	Input
3	Input 3	Input 3 – Digital Input	Input
4	Input 4	Input 4 – Digital Input	Input
5	ADC 1	Input 5 – Analog to Digital Input	Input
6	ADC 2	Input 6 – Analog Digital Input	Input
7	AUX1 TX	Input 7 – Digital Input	Input
8	AUX1 RX	1 Bit Bus Data (T)	Input
9	GND	1 Bit Bus Ground	Power
10	GND	1 Bit Bus Data (R)	Power
11	GND	1 Bit Bus Ground	Power
12	12V OUT SW	Output 0 - Starter Disable Relay Driver	Output
13	Input 0	Output 1 - Digital Output	Input
14	VCC 3V3 AUX1	Output 2 - Digital Output	
15	VCC 3V3 AUX2	Output 3 - Digital Output	
16	1BB T DATA	Output 4 - Digital Output	Input/Output
17	AUX2 RX	Output 5 - LED 1 Driver	Input
18	AUX2 TX	Output 6 - LED 2 Driver	Input
19	OUT 0	Analog to Digital Input 2	Output
20	OUT 1	Analog to Digital Input 3	Output
21	OUT 2	Analog to Digital Input 4	Output
22	GND	Analog to Digital Input 5	Power
23	VIN 1	Analog to Digital Input 4	
24	VIN 2	Analog to Digital Input 4	

3.3.2 VBUS Connector

The LMU-3640™s features a 16-Pin Molex 43045-1600 connector to the vehicle bus. Its pin-out is as follows:

Pin	Signal Name	Color
1	J1708H	Brown
2	J1850-	White
3	CAN2L-11	Grey
4	K-Line_12/HD	Black/Red
5	J1708L	Red
6	CAN1L	Green
7	K/L-Line	Violet
8	Vcc In	Orange
9	SWCAN	Pink
10	J1850+	Black/White
11	CAN2H	Blue
12	GND	Black
13	GND	Black/Green
14	CAN1H	Yellow
15	ISO/K-Line	Blue/White
16	CAN2L-8	Green/White

3.3.3 Accessories

See the Harness Diagrams page for more information on LMU accessories, and supported products table.

3.4 GPS Receiver

50+ channel GPS receiver (with SBAS, DGPS)

Accuracy: 2 meter CEP (with SBAS)
Tracking Sensitivity: -162dBm
Acquisition Sensitivity: -148dBm

3.5 I/O Descriptions

The LMU-3640™ provides the following inputs and outputs (I/O):

Digital Inputs

Input 0: Ignition Sense (Always biased low)
Input 1: In-1 sel
Input 2: In-2 sel
Input 3: In-3 sel
Input 4: In-4 sel

Internal Inputs

Input 8: Motion Sensor
Input 9: VBUS Active
Input 10: Pwr State
Input 11: Vbatt Low
Input 12: 1BB Detect
Input 13: Batt Virt Ign
Input 14: Pure Virt Ign
Input 15: Radio Wing Wake
Input 16: DB Wake
Input 17: Vbus Wake
Input 18: Pwr State 2
Input 19: Crank Detect

Analog to Digital Inputs

A/D 0: External Power Supply Monitor (VIN1)
A/D 1: Ext ADC1
A/D 2: EXT ADC2
A/D 3: HW Config
A/D 4: VIN2
A/D 5: VIN_VBUS
A/D 6: GPS Antenna Monitor
A/D 7: μ P Temperature
A/D 8: Vref
A/D 9: Battery

Outputs:

Output 0: Out-0
Output 1: Out-1
Output 2: Out-2

Internal Outputs

Output 7: Pwr Switch
Output 8: Chrg Disable
Output 13: 12Vout Enable

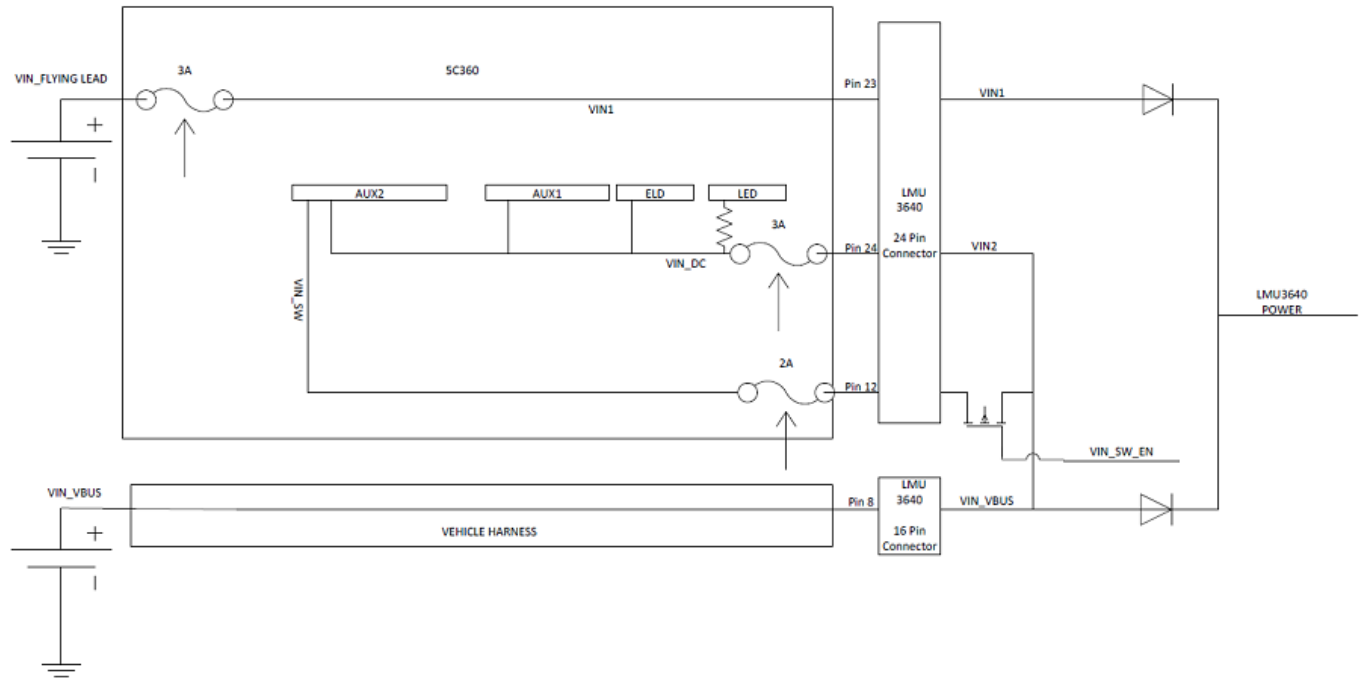
3.5.1 3-Axis Accelerometer Input

The LMU-3640™ supports an internal 3 Axis Precision Accelerometer as one of its discreet inputs. When the LMU is moved in any direction, the associated input will be in the High state. If the LMU'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.

3.5.2 Ignition and Inputs

The LMU-3640™ provides up to 7 inputs. These inputs are protected from typical vehicle transients and can be directly connected to most vehicle level logical inputs from 4 volts up to the vehicle power input level (typically 12 VDC). Their input impedance is approximately 10k Ω . One of these inputs is dedicated to sensing the vehicle's ignition status to provide for flexible power management. The other two 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.

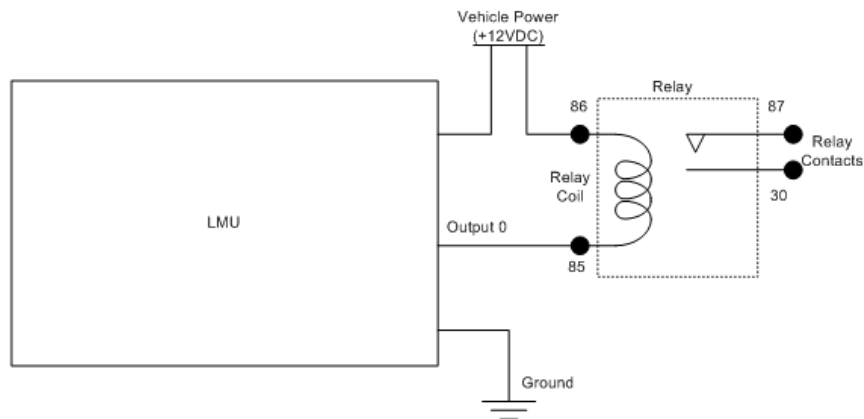
The ignition input is pulled to ground through the 10k resistance, where the other inputs can be configured to be normally High (i.e. pulled to +12v through a 10k resistor) or Low (i.e. pulled to ground through a 10k resistor). The diagrams below show how to connect the inputs in both a high- and low-biased configuration:



LMU-3640™ Input Wiring

3.5.3 Outputs

The LMU's and ioPOD'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

3.5.4 Status LEDs

The LMU-3640™ is equipped with 3 Status LEDs; one for GPS, one for COMM (wireless network status), one for GPS, and one for WiFi. The LEDs use the following colors to indicate service:

Status LEDs

Status	Color
GPS	Green
Comm	Orange
WiFi/BT	Blue

4 Configuration and Activation

This section details how to quickly get an LMU-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 LMU-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 LMU-3640™.** This device may not be supported for all the carriers or networks listed in this section (CDMA-Verizon, CDMA-Sprint, HSPA, GSM), for product availability consult the CalAmp sales team.

4.1 Quick Start - General Config

All LMU-3640™s must go through a common step during the configuration and provisioning process. Specifically, this is pointing the LMU 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 LMU-3640™ and connect a serial cable from the LMU to your laptop
2. Open a terminal session to the LMU-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 LMU 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 LMU-3640™ and your handset
2. From the handset, send an SMS message to the LMU-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 LMU 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
```

4.2 Activating LTE Using AT Commands

Check with the CalAmp Sales team for availability of the LMU-3640™ with GSM or HSPA modems.

If you get an LMU without a SIM (which is the typical case) the operator will simply ask for the IMEI of the LMU. The IMEI (International Mobile Equipment Identifier) is printed on the bottom of the LMU under the LMU's ESN. Again, DO NOT give the operator the ESN of the LMU.

The operator will provide you with a SIM 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, the operator will ask for the IMSI and ICC-ID (Integrated Circuit Card Identifier) along with the IMEI of the LMU. 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 bottom of the LMU.

You should also get an APN (Access Point Name) value. The APN is the device on the network that allows a GPRS device (i.e. the LMU) to get to the internet. They tend to look like a URL, for example:

myAPN.myOperator.com

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 should 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 a HSPA LMU would therefore look as follows:

```
AT$APP PARAM 2306,0,"myAPN.myOperator.com"
AT$APP PARAM 2306,1,"myAPN.myOperator.com"
AT$APP PARAM 2314,0,"myUsername"
AT$APP PARAM 2315,0,"myPassword"
```

For a blank APN the following command can be used:

```
AT$APP PARAM 2306,0,"" (for a blank APN)
```

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 using

```
AT$APP COMM STATUS?
```

A good response should look similar to the following:

```
AT$APP COMM STATUS?
```

```

GSM Registered:      Yes
GPRS Registered:     Yes
Connection:          Yes
RSSI:                -70 dBm
BER:                 0
Channel:              0
Cell ID:              0
Base Station ID:      0
Local Area Code:      0
Network Code:         38
Country Code:         310
IMEI (Modem S/N):     500167110060440
IMSI (SIM S/N):       310380100521849
Phone Number:
GPRS APN:             IP:Public
Quality of Srv:       1,0,0,3,0,0
GSM Class:            B

```

4.3 Auto provisioning of GSM or HSPA LMUs

For certain operators, the LMU can auto-populate the APN, username and password settings based on the Mobile Country Code (MCC) and the Mobile Network Code (MNC) of the SIM. Upon inserting a new SIM the APN, username and password will switch to the new SIM card's defaults if the MCC and MNC values change. The current list of supported MCC and MNC combinations are:

- AT&T – formerly AT&T Wireless or Cingular Blue (MCC 310, MNC 38)
 - o APN 0: PROXY
 - o APN 1: PUBLIC
- AT&T – formerly Cingular Wireless (MCC 310, MNC 17, 18, 41)
 - o APN 0 & 1: ISP.CINGULAR
 - o Username: ISP@CINGULARGPRS.COM
 - o Password: CINGULAR1
- Manxpronto (MCC 234, MCN 058)
 - o APN web.manxpronto.net
 - o Username: gprs
 - o Password: gprs
- O2 UK (MCC 234, MNC 02, 10, 11)
 - o APN 0 & 1: mobile.o2.co.uk
 - o Username: mobileweb
 - o Password: password
- O2 Ireland (MCC 272, MNC 02)
 - o APN 0 & 1: open.internet
 - o Username: gprs
 - o Password: gprs
- Orange UK (MCC 234, MNC 33, 34)
 - o APN 0 & 1: orangeinternet
 - o Username: user
 - o Password: pass
- T-Mobile (MCC 310, MNC 16, 20, 21, 22, 23, 24, 25, 26, 27, 31, 58, 66, 80)
 - o APN 0: INTERNET2.VOICESTREAM.COM
 - o APN 1: INTERNET3.VOICESTREAM.COM
- T-Mobile UK (MCC 234, MNC 30,31,32)
 - o APN 0 & 1: general.t-mobile.uk
 - o Username: user
 - o Password: wap
- TelCel Mexico (MCC 334 MNC 02)
 - o APN 0 & 1: INTERNET.ITELCEL.COM
 - o Username: webgprs
 - o Password: webgprs2002
- Telstra Australia (MCC 505, MNC 01, 11, 71, 72)

- o APN 0 & 1: telstra.internet
- Vodafone Ireland (MCC 272, MNC 01)
 - o APN 0 & 1: isp.vodafone.ie
 - o Username: vodafone
 - o Password: vodafone
- Vodafone New Zealand (MCC 530, MNC 01)
 - o APN 0 & 1: internet
 - o Username: guest
 - o Password: guest
- Vodafone UK (MCC 234, MNC 15)
 - o APN 0 & 1: internet
 - o Username: web
 - o Password: web

Unless otherwise stated, the username and password will be set to “dummy”.

This feature can be disabled by setting Bit 0 of S-Register 155.

```
AT$APP PARAM 1024,35,1,1
```

To re-enable auto-provisioning, use:

```
AT$APP PARAM 1024,35,1,0
```

Auto-provisioning occurs when the LMU detects a SIM with a new operator ID (i.e. the first 6 digits of the IMSI) or when Bit 0 of S155 is cleared and the GPRS context is blank (i.e. Parameter 2306,0).

4.4 Activating GSM or HSPA LMU using AT Commands

Check with the CalAmp Sales team for availability of the LMU-3640™ with GSM or HSPA modems. For a GSM/GPRS operator you will get the LMU in one of two varieties, one with a SIM and one without.

If you get an LMU without a SIM (which is the typical case) the operator will simply ask for the IMEI of the LMU. The IMEI (International Mobile Equipment Identifier) is printed on the bottom of the LMU under the LMU’s ESN. Again, DO NOT give the operator the ESN of the LMU.

The operator will provide you with a SIM 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, the operator will ask for the IMSI and ICC-ID (Integrated Circuit Card Identifier) along with the IMEI of the LMU. 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 bottom of the LMU.

You should also get an APN (Access Point Name) value. The APN is the device on the network that allows a GPRS device (i.e. the LMU) to get to the internet. They tend to look like a URL, for example:

myAPN.myOperator.com

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 should 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 GSM device, where the SPC is used just for configuration.

The activation sequence for a GSM LMU would therefore look as follows:

```
AT$APP PARAM 2306,0,"myAPN.myOperator.com"
AT$APP PARAM 2306,1,"myAPN.myOperator.com"
AT$APP PARAM 2314,0,"myUsername"
AT$APP PARAM 2315,0,"myPassword"
```

For a blank APN the following command can be used:

```
AT$APP PARAM 2306,0,"" (for a blank APN)
```

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 using

```
AT$APP COMM STATUS?
```

A good response should look similar to the following:

```
GSM Registered:      Yes
GPRS Registered:     Yes
Connection:          Yes
RSSI:                -70 dBm
BER:                 0
Channel:              0
Cell ID:              0
Base Station ID:      0
Local Area Code:      0
Network Code:         38
Country Code:         310
IMEI (Modem S/N):     500167110060440
IMSI (SIM S/N):       310380100521849
Phone Number:
GPRS APN:             IP:Public
Quality of Srv:       1,0,0,3,0,0
GSM Class:            B
```

4.5 Preparing for Installation

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

- The LMU to be installed
- A power harness
- GPS Antenna (for external devices)
- Comm Antenna (for external devices)
- Optional Components:
 - Input and output cables
 - Relays
 - LMU peripherals (i.e. Serial adapter, jPOD, TetheredLocator)
 - Host serial devices (e.g. PDAs, laptops, other serial devices)

4.6 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 (LMU, antennas, peripherals, etc.). Be sure that the cables to the LMU are not bent or constricted in any way. Also make sure that the LMU 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 LMU 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 LMU for the following purposes:

- Accurate data gathering and simulation of how customers actually use your solution
- Ongoing monitoring and maintenance of LMU equipment
- Accidental or intentional alteration of the equipment or cable connections

The following sections cover some of the issues to consider when planning your LMU installation.

4.6.1 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 LMU-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.

4.6.2 Access to the SIM (Subscriber Identity Module) Card

When used in a LTE or HSPA, 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.

4.6.3 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.

4.6.4 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.

4.6.5 Cable Length

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

4.6.6 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.

4.6.7 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.

4.7 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:

4.7.1 Place the LMU unit in the vehicle.

Typically, the LMU should be placed under the passenger seat or dashboard of the vehicle. LMUs with internal antennas should be placed to maximize their GPS performance. 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.

4.7.2 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.

4.7.3 Typical Connection Sequence

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

The physical installation of the LMU hardware is now complete.

4.8 Installation Verification

In many cases it is desirable to verify that an installed LMU-3640™ is working properly. That is, installers should verify that the GPS and communications functions of the LMU-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 LMU-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 LMU-3640™ to obtain its current status.

4.8.1 Comm Verification

Installers should first verify that the LMU-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:



```
AT+IC
```

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 LMU-3640™ to communicate with the modem and acquire the wireless network.

4.8.2 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.

4.8.3 Inbound Verification

The last item to verify is that the LMU-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 LMU-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 (<pppp>) are correct.

The second step is to verify that the LMU-3640™ is sending data. The best way to do this is to force the LMU-3640™ to send in an unacknowledged Event Report (i.e., its current GPS location) with the following command:

```
AT$APP PEG SUNRPT 255
```

The LMU-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.

4.8.4 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's 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 be 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.

Example GSM Response

```

APP:081 8.3d
COM:0
GPS:No Time Sync
INP:11100111 13.7V
MID:4141000100 ESN
INB:207.7.101.227:20500 LMD

```

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[edit]2 Limited Warranty

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[edit]3 Regulatory Information

Human Exposure Compliance Statement Pursuant to 47 CFR § 24.52 of the FCC Rules and Regulations, personal communications services (PCS) equipment is subject to the radio frequency radiation exposure requirements specified in § 1.1307(b), § 2.1091 and § 2.1093, as appropriate.

CalAmp DataCom Inc. certifies that it has determined that the LMU-3640™ complies with the RF hazard requirements applicable to broadband PCS equipment operating under the authority of 47 CFR Part 24, Subpart E of the FCC Rules and Regulations. This determination is dependent upon installation, operation and use of the equipment in accordance with all instructions provided.

The LMU-3640™ is designed for and intended to be used in fixed and mobile applications. “Fixed” means that the device is physically secured at one location and is not able to be easily moved to another location. “Mobile” means that the device is designed to be used in other than fixed locations and generally in such a way that a separation distance of at least 20 cm is normally maintained between the transmitter’s antenna and the body of the user or nearby persons. The LMU-3640™ is not designed for or intended to be used in mobile applications (within 20 cm of the body of the user) and such uses are strictly prohibited.

To ensure that the LMU-3640™ complies with current FCC regulations limiting both maximum RF output power and human exposure to radio frequency radiation, a separation distance of at least 20 cm must be maintained between the unit’s antenna and the body of the user and any nearby persons at all times and in all applications and uses. Additionally, in mobile applications, maximum antenna gain must not exceed 3.2 dBi.

FCC Rules and Industry Canada (IC) regulatory information Compliance Statement (Part 15.19) The equipment device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received including interference that may cause undesired operation. **Warning (Part 15.21)** Changes or modifications not expressly approved by TransCore Amtech Systems could void the user’s authority to operate the equipment. Manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. **Compliance Statement (Part 15.105(b))** Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: — Reorient or relocate the receiving antenna. —Increase the separation between the equipment and receiver. —Connect the equipment into an outlet on a circuit different from that to which the receiver is connected. —Consult the dealer or an experienced radio/TV technician for help. This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device. Le présent appareil est conforme aux CNR d’Industrie Canada applicables aux appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions suivantes : (1) l’appareil ne doit pas produire de brouillage, et (2) l’utilisateur de l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement. **Class B digital device notice “CAN ICES-3 (B)/NMB-3(B)”** RF Radiation Exposure Statement This equipment complies with the FCC/IC radiation exposure limits set fourth for mobile transmitting devices operation in an uncontrolled environment. End users must follow the specific operating instructions to satisfy RF exposure compliance. The equipment should only be used where there is normally at least 20cm separation between the antenna and all person/user. This transmitter must not be co-located or operation in conjunction with any other antenna or transmitter. Any changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate this equipment.