ORBCOMM®

CONNECTING THE WORLD'S ASSETS

PT 6000

Hardware Guide

PT117, Version 01

Oct 2020

© ORBCOMM®

LEGAL NOTICE

This documentation is owned by ORBCOMM® and protected by applicable copyright laws and international treaty provisions. Other copyrighted names used are the property of their respective owners. Therefore, you must treat this documentation like any other copyrighted material. This publication, or any part thereof, may not be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, storage in an information retrieval system, or otherwise, without prior written permission by ORBCOMM, Inc. 395 W Passaic Street, Suite 325, Rochelle Park, NJ 07662 USA Phone 703-433-6325. The information in this document is for information purposes only and contains technical information and descriptions of the ORBCOMM product(s) and is subject to change without notice. No warranty or representation, express or implied, is made with respect to its contents.

TRADEMARK NOTICE

The ORBCOMM name and the ORBCOMM logo are registered trademarks of ORBCOMM.

The Bluetooth® word mark and logos are registered trademarks owned by the Bluetooth SIG, Inc.

Mi-Jack Products, the Mi-Jack Products logo, are trademarks and/or service marks of Mi-Jack Products, Inc.

Other trademarks, trade names, and logos are those of their respective owners.

EXPORT CONTROL STATEMENT

The contents of this document, in whole or in part, shall not be exported from the United States, which export shall include, but not be limited to, transmittal to any non-U.S. citizen wherever said person is located, except in accordance with all United States laws and regulations relating to exports and to all administrative acts of the U.S. Government pursuant to such laws and regulations. Diversion, re-export or transshipment of the contents of this document, in whole or in part, contrary to U.S. law is also strictly prohibited.

CONTACT INFORMATION

Visit ORBCOMM Online

www.ORBCOMM.com

Contact Customer Care

customer.care@orbcomm.com

(International) +1-703-433-6300

(North America) 1.800.ORBCOMM (1-800-672-2666

Headquarters

395 W Passaic Street, Suite 325

Rochelle Park, NJ 07662 USA

Tel: +1-703-433-6300

Fax: 1-703-433-6400

Email: sales@orbcomm.com

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

TABLE OF CONTENTS

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

LIST OF FIGURES

LIST OF TABLES

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

PREFACE

Purpose

This document is an overview of the hardware characteristics and specifications for the PT 6000 terminal.

Notation

Hardware components and hardware labels in this document might not be exactly as shown and are subject to change without notice.

CAUTION: This safety symbol warns of possible hazards to personnel, equipment, or both. It includes hazards that will or can cause personal injury, property damage, or death if the hazard is not avoided.

Note: A note indicates information with no potential hazard. A note indicates points of interest or provides supplementary information about a feature or task.

Numbered lists indicate a series of steps required to complete a task or function.

Bulleted lists highlight information where order or sequence is not crucial.

Battery Warnings

CAUTION: Always follow local disposal guidelines to properly dispose of the Lithium-ion battery and the device.

CAUTION: Store in a cool, well ventilated area. Elevated temperatures can result in shortened battery life.

CAUTION: DO NOT replace the battery. Changing the battery without ORBCOMM's permission could violate regulatory conformity.

CAUTION: DO NOT throw the internal battery or the device into fire.

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

1 PRODUCT OVERVIEW

The PT 6000 is a low cost, versatile tracking and monitoring terminal capable of cellular communications over various cellular networks using multiband radios and nested module footprints as well as optional satellite communications through the ORBCOMM OGx interface. It is primarily targeted towards the refrigerated transportation market. Two RS-232 ports are available to control and monitor equipment controllers. In addition, the PT 6000 includes interfaces to external wired sensors and peripherals.

The PT 6000 utilizes a rugged, IP67 enclosures that house all electronics and power control. External antennas interface through IP67 RF connectors providing cellular, GNSS, and optional satellite connections.

The PT 6000 can be powered externally through the main connector or through the internal rechargeable battery.

The following configurations are available (refer to APPENDIX 1 for part numbers):

- PT 6000 cellular terminal (p/n - SM202323-0xx)*
- PT 6000 cellular-satellite terminal (p/n - SM202334-0xx)*

  * -0xx indicates variants

1.1 Features and Benefits

The PT 6000 offers the following features and benefits:

- Configurable for specific customer requirements
- Single or dual-mode module models to communicate with the network
- Remote firmware updates over-the-air via cellular or locally via diagnostic port
- Remote terminal configuration updates via cellular/satellite
- Wide operational temperature range
- Accelerometer
- Rugged, compact, and easy to install
- Powerful web applications and third-party integration
- Factory installed SIM card

1.2 Sensors

Add powerful ORBCOMM sensors for added visibility and reporting (APPENDIX A).

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

Contact your ORBCOMM Account Manager to discuss the features and options available to suit your business requirements.

1.3 Peripherals

The following options are supported based on the model of PT 6000:

- OGi Satellite Antenna

- GSM/GPS Cellular Antenna

- ST 2100

1.4 Web Platform

- ORBCOMM Platform is a single, unified, next-generation analytics and reporting cloud-based platform that puts everything in one place with intuitive icons to distinguish asset types, reports by asset type and customizable

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

workspaces and access control so that each user gets the data they need quickly and easily.

- ORBCOMM DeviceCloud (ODC) is a single interface for managing multiple networks and devices, where connectivity and device-specific messaging is abstracted to a common interface and messaging API.
- CargoWatch® is a web application that delivers near-real-time alerts on trailer status, location, history, as well as arrival and departure, providing greater visibility and utilization for fleet managers.

1.5 Bluetooth®

The Bluetooth (BLE) wireless module in each PT 6000 allows wireless communication with select ORBCOMM sensors. Bluetooth wireless technology allows dual-mode devices to share a single radio antenna.

1.6 Programmability

The terminal can be upgraded through the RS-232 port and over-the-air.

1.7 Installation

This terminal was specifically designed for flexible, quick and easy installation.

Refer to the various PT 6000 installation guides available from you ORBCOMM Account Manager or ORBCOMM Customer Care.

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

2 SPECIFICATIONS

2.1 Temperature

2.1.1 Terminal

Parameter	Value
Operating Temperature Range using external power	-40° to +75°C (-40°F to +167°F)
Storage Temperature Range	-40° to +60°C (-40°F to +140°F)

2.1.2 Internal Battery

Parameter	Value
Operating Temperature Range	-20°C to +60°C (-4°F to +140°F)
Charging Temperature Range	0°C to +40°C (32°F to +104°F)

2.2 Electrical

2.2.1 Input Range

Parameter	Value
Power Supply Voltage	9 to 16 V DC (The terminal can measure its main input supply voltage over the range 6-32 V, to an accuracy of at least ±3.8%)

2.2.2 Power Consumption

The typical input currents in each operating mode are detailed below, for an external supply of 12V.

Mode of Operation	Current
Sleep + Power Save	200 µA
Cellular Transmit (see Note)	2000 mA
Cellular Receive	80 mA
Normal (Reefer Comms)	35 mA
Battery Charging	750 mA
Maximum Continuous	1750 mA

Note: Maximum pulsed current during transmit. Maximum duty cycle is 50%.

Apart from the sleep mode current, the current consumption is inversely proportional to the input voltage.

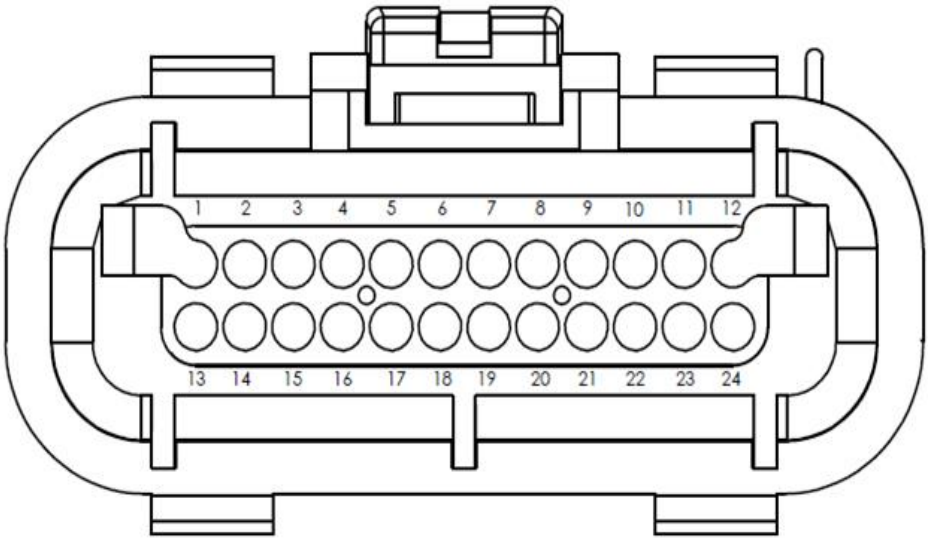
ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

2.3 Connectors

2.3.1 Connector Pin Assignment

This, 24-pin Delphi, connector is IP67 rated when mated. Many of the signals have dedicated functions, but some have alternate uses. The signals available on the connector are shown below. The electrical specification describes the functions in more detail.

Figure 1: Connector (View on Terminal)



2.3.2 Pin Assignment

Table 1 maps to the layout shown in Figure 1.

Table 1: Electrical Pin Assignment

J2 Pin	Signal	Primary Function	Secondary Function
1	GND	Ground from the asset	-
2	GND	Ground from the asset	-
3	GND	Ground from the asset	-
4	OFF_KEY	External reset	-
5	PWR_BOX_RST	Power control clock	Reefer Power Input
6	TEMP_SENSOR_1	Temperature sensor input	Tire Inflation Input
7	SPARE_RS232_TX	Auxiliary RS232 transmit (output)	-
8	REEFER_TX_RS	Reefer RS232 transmit (output)	Mi-Jack RS232 transmit (output)
9	REEFER_RX_RS	Reefer RS232 receive (input)	Mi-Jack RS232 receive (input)

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

J2 Pin	Signal	Primary Function	Secondary Function
10	PWR_BOX_MUX_CTRL	Power control data	IBOX power input
11	DOOR(BKR1)	Door sensor input	Reefer RS-232 external mux control
12	TEMP_SENSOR_3	Temperature sensor input	Humidity input
13	TEMP_SENSOR_2	Temperature sensor input	Humidity input
14	FUEL_PWR	12V output for fuel sensor	12 V output for humidity sensor
15	TRAILER_HOOK(ACV)	Trailer hook input	-
16	FUEL_IN	Fuel sensor analog input	Flow meter input
17	GND	Ground from the asset	-
18	SPARE_RS232_RX	Auxiliary RS232 receive (input)	-
19	GND	Ground from the asset	-
20	CONSOLE_RX_RS	Console RS232 receive (input)	-
21	CONSOLE_TX_RS	Console RS232 transmit (output)	-
22	GND	Ground from the asset	-
23	GND	Ground from the asset	-
24	REEFER_12V	12V input from reefer	-

2.4 I/O Descriptions

2.4.1 Power Control Interface

The terminal includes an interface to communicate with an ORBCOMM power control device. The clock line is an open drain output tied directly to reefer voltage. The data line is internally pulled up to reefer voltage. Logic low is a short to ground.

The power control devices are accessories that allow remote and local control of the reefer microcontroller power supply.

Specifications for the power control interface are below:

Parameter	Min.	Typical	Max.	Units
Clock Output High	9	-	16	V
Clock Maximum Current	-	-	0.5	A
Data Output High	9	-	16	V
Data Output Low	-	0	-	V
Data Pull-up Resistance	-	10		kΩ
Data Input Low	-	-	1.1	V

The power control interface signals are multiplexed with other functions. The clock input is multiplexed with IBOX wake-up output and 12 V reefer power indicator. The data I/O is multiplexed with the IBOX power control input

2.4.2 Reefer Power Indicator

The terminal includes an input to sense the presence of power to the reefer microcontroller. This input would expect a 12 V input from the reefer to determine if the microcontroller is powered.

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

Specifications for the reefer power indicator are below.

Parameter	Min.	Typical	Max.	Units
Input High	7.7	-	16.5	V
Input Low	-	-	0.4	V

The reefer power indicator is multiplexed with the IBOX wake-up output and power control clock output.

2.4.3 IBOX Wake-up Output

The terminal includes an output to control an IBOX wake-up signal. The output is an 12V open drain output.

Specifications for the reefer power indicator are below.

Parameter	Min.	Typical	Max.	Units
Output High	9	-	16	V
Output Maximum Current	-	-	0.5	A

The reefer power indicator is multiplexed with the reefer power indicator and power control clock output.

2.4.4 IBOX Power Control Input

The terminal includes an input to sense the status of the IBOX power controller. This input would expect a 12 V input from the reefer to determine if the IBOX is powered. It is internally pulled down.

Specifications for the reefer power indicator are below.

Parameter	Min.	Typical	Max.	Units
Input High	8.8	-	20	V
Input Low	-	-	0.4	V
Pull-down Resistance	-	12	-	kΩ

The IBOX power control input is multiplexed with the power control data I/O.

2.4.5 Door Input

The terminal includes a low voltage digital input for use with a contact closure switch. The door sensor is weakly pulled up inside the PT 6000 to conserve current when the switch is closed. The door input can accept normally open or normally closed switches. Switch type must be configured in the firmware.

The door input specifications are below:

Parameter	Min.	Typical	Max.	Units
Pull-up Voltage	-	3.3	-	V
Pull-up Resistance	-	1	-	MΩ
Voltage Input	-0.3	-	5.5	V

This interface is multiplexed with Mi-Jack multiplexer control.

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

2.4.6 Mi-Jack Multiplexer Control

The terminal includes a low voltage digital output used to control a serial port multiplexer. The serial port multiplexer allows the PT 6000 to share a single RS-232 port to interface with two devices, the reefer microcontroller and Mi-Jack door lock.

The Mi-Jack multiplexer control specifications are below:

Parameter	Min.	Typical	Max.	Units
Output High	2.6	-	-	V
Output Low	-	-	0.4	V
Drive Strength	-	8	-	mA

This interface is multiplexed with the door input.

2.4.7 Temperature Sensor Inputs

The terminal includes three temperature inputs to interface with thermistors. The input is specifically designed for the ORBCOMM thermistor temperature probe.

The temperature sensor specifications are below:

Parameter	Min.	Typical	Max.	Units
Pull-up Resistance	-	7.5	-	kΩ
Pull-up Voltage	-	3	-	V
Input Impedance	10	-	-	MΩ
Measurement Accuracy	0.2	-	-	%

Temperature sensor inputs are multiplexed with the humidity sensor inputs.

2.4.8 Humidity Sensor Inputs

The terminal includes three analog inputs to interface to ORBCOMM humidity sensors.

The humidity sensor input specifications are below:

Parameter	Min.	Typical	Max.	Units
Maximum Voltage Range	-0.3	-	5.5	V
Measurement Voltage Range	0	-	3	V
Expected Humidity Sensor Voltage Range	0	-	1	V
Measurement Accuracy	0.2	-	-	%

Humidity sensor inputs are multiplexed with the temperature sensor inputs.

2.4.9 12 V Power Output

The terminal includes a switched power output for external sensor power. The power output is unregulated but protected from transients. The output is internally fused to protect from overcurrent.

The 12 V power output specifications are below:

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

Parameter	Min.	Typical	Max.	Units
Voltage Output (enabled)	9	-	16	V
Voltage Output (disabled)	-	-	0	V
Current Output	-	-	500	mA

2.4.10 Fuel Sensor Input

The terminal includes an analog input to interface to the ORBCOMM fuel sensor.

The fuel sensor input specifications are below:

Parameter	Min.	Typical	Max.	Units
Maximum Voltage Range	-0.6	-	11	V
Measurement Voltage Range	0	-	6	V
Expected Humidity Sensor voltage Range	0	-	5	V
Measurement Accuracy	1.04	-	-	%

The fuel sensor input is multiplexed with the flow meter input.

2.4.11 Flow Meter Input

The terminal includes a digital input for interfacing to the ORBCOMM flow meter. The flow meter output is a 20 Hz pulse with modulated signal with a voltage range of 0 to 6 V.

The flow meter input specifications are below:

Parameter	Min.	Typical	Max.	Units
Maximum Voltage Range	-0.6	-	11	V
Expected Frequency	-	20	-	Hz

The flow meter input is multiplexed with the fuel sensor input.

2.4.12 Trailer Hook Input

The terminal includes an analog input for detecting the presence of a trailer and measuring the trailer voltage.

The trailer hook specifications are below:

Parameter	Min.	Typical	Max.	Units
Maximum Voltage Range	-1.5	-	27.5	V
Measurement Voltage Range	0	-	15	V
Frequency	-	20	-	Hz
Accuracy	1.64	-	-	%

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

2.5 Serial Interfaces

2.5.1 Off Key

The PT 6000 includes an input to allow a local hard reset of the terminal. This interface is an open circuit during normal operation. When a reset is required, a low pulse on the OFF_KEY performs a hard reset.

Specifications for OFF_KEY are below

Parameter	Min.	Typical	Max.	Units
Reset Voltage	0	-	0.9	V
Run Voltage	1.06	-	40	V
Pull-up Resistance	-	49.9	-	kΩ

2.5.2 Console RS-232

The Console RS-232 interface defaults to the following settings: 9600 bit/s, 1 start, 8 data, 1 stop bit, and no parity. The baud rate is configurable up to 115,200 bps.

The console serial interface is intended for control, configuration, and monitoring of the PT 6000. It is typically disconnected during normal operation.

The processor wakes on RS-232 activity based on the status signal from the RS-232 driver. This status signal is shared with the reefer RS-232 interface.

The electrical characteristics of the console RS-232 interface are:

Parameter	Min.	Typical	Max.	Units
Rx input lower threshold for DTE connected	-	-	-2.7	V
Rx input upper threshold for DTE connected	2.7	-	-	V
Rx input threshold for DTE disconnected	-0.3	-	0.3	V
Serial Rx input low threshold	0.6	-	-	V
Serial Rx input high threshold	-	-	2.4	V
Serial Tx low output (3 kΩ load)	-	-5.4	-	V
Serial Tx high output (3 kΩ load)	-	5.4	-	V

2.5.3 Reefer RS-232

The reefer RS-232 interface defaults to the following settings: 9600 bit/s, 1 start, 8 data, 1 stop bit, and no parity. The baud rate is configurable up to 115,200 bps.

It is designed for communication with the reefer microcontroller. In some applications this serial interface can be externally multiplexed to communicate with other accessories, such as the Mi-Jack lock.

The processor wakes on RS-232 activity based on the status signal from the RS-232 driver. This status signal is shared with the console RS-232 interface.

The electrical characteristics of the reefer RS-232 interface are the same as the console RS-232 interface.

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

2.5.4 Spare RS-232

The spare RS-232 interface defaults to the following settings: 9600 bit/s, 1 start, 8 data, 1 stop bit, and no parity. The baud rate is configurable up to 115,200 bps.

The spare serial interface is intended for communication with other devices such as the AG400 or the ST 2100. Contract your Account Manager or ORBCOMM Customer Care for product guides.

The electrical characteristics of the spare RS-232 interface are the same as the console RS-232 interface.

2.6 RF Specifications

2.6.1 Satellite Performance

The terminal complies with the ORBCOMM Subscriber Communicator Specifications.

2.6.2 Cellular Performance

The terminal uses a PTCRB certified cellular module.

2.6.3 GPS Performance

The GPS has an un-aided cold start of less than 35 seconds and an un-aided hot start in less than 1 second.

The 2D position accuracy is less than 10 m CEP.

2.7 Internal Battery

2.7.1 Battery Supply Voltage Measurement

The PT 6000 can measure its main input supply voltage over the range 5-8.4 V, to an accuracy of ±55 mV.

2.7.2 Battery Controller

The battery system includes hardware battery control that monitors and controls the charge and discharge of the terminal battery pack.

Discharge is controlled such that no battery discharge is allowed over the battery pack maximum discharge temperature. Temperature is monitored using a thermistor placed on the PCA nearest to the battery pack. The high temperature cutoff requirement is to ensure CE safety compliance.

Discharge can also be separately enabled by the processor. The processor can disconnect the battery, effectively cutting power completely if no external power is present. When external power is reapplied, the processor shall have the ability to enable the battery

Charging is limited to between the minimum and maximum charging temperature of the battery pack. Temperature is monitored using the thermistor internal to the battery pack.

The battery charger automatically shuts down when the charge voltage drops below the minimum value.

The charge controller electrical specifications are below:

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

Parameter	Min.	Typical	Max.	Units
External Charge Voltage	10.65	-	32	V
Charge Current	-	-	400	mA
Charge temperature - Low Cost Battery	0 (32)	-	40 (104)	°C (°F)
Float Voltage	-	8.0	-	V
Charge Time	-	-	4	Hours
Battery Chemistry	Lithium-ion Cell			

The terminal includes a rechargeable 7.4V nominal battery pack able to supply the current necessary for all operational modes. The battery pack includes a protection circuit with internal NTC sensor that provides all required UN 38.3 protection, including over discharge, overcharge, and over current protections. The battery pack meets UN 38.3 and IEC62133.

The electrical specifications of the battery pack are:

Parameter	Min.	Typical	Max.	Units
Capacity	1200	-	-	mAh
Voltage (nominal)	-	7.4	-	V
Maximum Current Output	3	-	-	A
Over Discharge Limit	-	5.5	-	V
Temperature	-30 (-22)	-	+60 (+140)	°C (°F)

2.7.3 Battery Life Expectancy

If the terminal is disconnected from the external reefer battery, it can use its internal battery to report two (2) messages per day for at least 10 days. In some conditions, battery life expectancy may be longer, and can also vary depending on whether the terminal is single or dual mode.

2.7.4 Battery Dimensions

The dimensions of the battery are:

Parameter	Value
Dimensions	6.7 L x 3.2 W x 1.2 H cm (2.64 x 1.26 x 0.48 in)

2.8 GNSS

Table 2: GNSS Specifications

Parameter	GPS	GLONASS	BeiDou
Time to First Fix[1]			
Cold Start	29 s	30 s	34 s

[1] All satellites at -130 dBm

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

Parameter	GPS	GLONASS	BeiDou
Aided Start	2 s	2 s	3 s
Hot Start	1 s	1 s	1 s
Sensitivity			
Tracking	-166 dBm	-166 dBm	-160 dBm
Hot Start	-157 dBm	-156 dBm	-155 dBm
Cold Start	-148 dBm	-145 dBm	-143 dBm
Accuracy			
Horizontal Position (CEP) [1]	2.5 m	4.0 m	3.0 m
Velocity	0.05 m/s	-	-
Heading	0.3 degrees	-	-

2.9 Memory

Parameter	Value
Nonvolatile On-board Flash	8 MB
Write-Erase Cycles (over operating life)	100 000
External Flash	4 KB
Internal SRAM	96 kB (All retained in sleep)
Internal Flash	512 MB
BLE Flash	1 MB, 100,000 write-erase cycles over its operating life.

2.10 Sensors

Refer to APPENDIX A for a list of PT 6000 supported ORBCOMM sensors and peripherals.

2.11 Accelerometer

The accelerometer is important in low power applications where it is critical to save power while the asset is stationary.

To minimize false motion detects and excess power usage, the internal motion thresholds are configurable.

Accelerometer Minimum Specifications:

Parameter	Condition	Min.	Typical	Max.	Units
Acceleration Range	software selectable	-	±2	-	g
		-	±4	-	g
		-	±8	-	g
Bandwidth Filtering	Selectable via digital interface	0.78	-	400	Hz

[1] CEP, 50%, 24 hours static, -130 dBm

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

Parameter	Condition	Min.	Typical	Max.	Units
Sensitivity	2 g	-	4096	-	LSB/g
	4 g	-	2048	-	LSB/g
	8 g	-	1024	-	LSB/g

2.12 Communications

The terminal allows for multiple cellular modules.

Power to the cellular module is processor controlled, which allows you to completely power off the cellular module to save energy.

The terminal can trigger a Firmware Over-the-Air update and allow the cellular module to update its internal firmware.

The cellular module operates with a single external antenna covering all known cellular bands.

The cellular RF interface is an RF cable to a panel mount IP67 FAKRA connector.

2.12.1 Cat 1 North American LTE with Global Fallback

This optional cellular module covers North American LTE bands and falls back to global 3G and 2G bands.

The specifications for this module are below:

Table 3: Cat 1 NA LTE Module

Parameter	Minimum Specification
LTE Category	Cat 1
LTE Bands	2, 4, 5, 12
UMTS/HSPA+ Bands	1, 2, 5, 8
GSM Bands	2, 3, 5, 8

2.13 Bluetooth Module

The terminal includes a dedicated serial link to a Bluetooth Smart module (also known as Bluetooth Low Energy or BLE).

The BLE Module is a low power short range wireless protocol using the 2.4 GHz frequency band. BLE is not compatible with standard Bluetooth.

The BLE allows the terminal to communicate as a peripheral with a mobile phone or other BLE enabled host for configuration and some debug logging. It allows the terminal to communicate as a host to local wireless sensors. The BLE system is capable of operating in both the host and peripheral modes at the same time.

The BLE characteristics are below.

Parameter	Min.	Typical	Max.	Units
Frequency	2360	-	2500	MHz
Bluetooth version compliance	-	4.2	-	version
Receive sensitivity	-97	-	-	dBm
TX Power	-	-	4	dBm

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

Parameter	Min.	Typical	Max.	Units
Available RAM	-	64	-	kB
Available Flash	-	512	-	kB
Maximum Peripherals Available	4	-	-	

2.13.1 BLE External Memory

The terminal includes 1 MB of nonvolatile onboard flash storage for data for use with the Bluetooth Low Energy subsystem. The flash is capable of 100,000 write-erase cycles over its operating life.

2.13.2 BLE RF Interface

The BLE includes an internal BLE antenna.

2.14 PT 6000 LEDs

To help diagnose performance, the PT 6000 incorporates a series of LEDs on its top cover, which provides visual feedback. Refer to Table 4 to determine whether the PT 6000 is operating correctly.

Table 4: PT 6000 LED Description

Event	Green	Duration (sec)	Frequency (Hz)	Yellow	Duration (sec)	Frequency (Hz)	Red	Duration (sec)	Frequency (Hz)
Startup	ON	20	-	ON	20	-	OFF	OFF	OFF
Micro Comm	Blink 3x	1.2	2	OFF	OFF	OFF	OFF	OFF	OFF
Micro OFF/Not Detected	Blink 7x	0.7	10	OFF	OFF	OFF	OFF	OFF	OFF
Micro Read Error	OFF	OFF	OFF	OFF	OFF	OFF	Blink 7x	0.7	10
U-blox Comm/Antenna Error	OFF	OFF	OFF	OFF	OFF	OFF	Blink 3x	1.2	2
GSM Error: No Comm	OFF	OFF	OFF	Blink 3x	1.2	2	OFF	OFF	OFF
GSM Warning: No Service	OFF	OFF	OFF	Blink 7x	0.7	10	OFF	OFF	OFF

2.15 Mechanical

Parameter	Value
Dimensions (excludes connector body)	19 L x 11 W x 4 H cm (7.5 x 4.3 x 1.5 in)

2.16 Environmental

Parameter	Description
Humidity	The terminal meets all its specifications during exposure to 90% relative humidity at +85°C (185°F), per the test methodology of SAE J1455, section 4.2.3 (8-hour humidity cycle per figure 4a).
Vibration	The terminal meets all its specifications during exposure to random vehicular vibration levels per SAE J1455, section 4.9.4.2 figures 6, 7, and 8, and MIL-STD-810G, section 514.6, figure 514.6C-1.

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

Parameter	Description
Mechanical Shock	The terminal meets all its specifications after exposure to positive and negative saw tooth shock pulses with peaks of 20 G and durations of 11 ms as specified in MIL-STD-810G, section 516.6, Procedure I, section 2.3.2c.
Altitude	The terminal meets all specifications after a nonoperating 12.2 km (7.6 miles) altitude test as detailed in SAE J1455, section 4.9.3, except with an ambient temperature of -40°C (-40°F).
Thermal Shock	The terminal meets all of its specifications after a thermal shock test as detailed in SAE J1455, section 4.1.3.2
Drop Test	The terminal meets all its specifications after a handling drop test as specified in SAE J1455, section 4.11.3.1
Salt Spray Atmosphere	The terminal meets all of its specifications after a salt spray test as detailed in SAE J1455, section 4.3.3.1.
Immersion	The terminal meets all of its specifications after a 6-hour alternating hot/cold salt water immersion test as detailed in SAE J1455, section 4.3.3.2.
Steam Cleaning and Pressure Washing	The terminal meets all of its specifications after a pressure wash test as detailed in SAE J1455, section 4.5.3.
Fungus	The terminal meets all of its specifications after a fungus test as detailed in SAE J1455, section 4.6.3.
Dust and Sand Bombardment	The terminal meets all of its specifications after a dust and sand bombardment test as detailed in SAE J1455, section 4.7.3.
ESD	All electrical interfaces shall operate normally after being subjected to 8 kV ESD contact discharge per IEC 61000-4-2 human body model, level 3. (Enclosure) The terminal meets all its specifications after exposure of the enclosure to 6 kV ESD contact discharge per IEC 61000-4-2, level 3.
Ingress Protection	IP67
Exposure to Chemicals and Oils	The terminal meets all of its specifications after a light to moderate splash test as detailed in SAE J1455 section 4.4.3.2, for the following chemicals: Window Washer Solvent Gasoline Diesel Fuel Fuel Additives Alcohol Anti-Freeze Water Mixture Degreasers Soap and Detergents Steam Waxes Kerosene Freon Spray Paint Paint Strippers Ether Dust Control Agents (magnesium chloride) Moisture Control Agents (calcium chloride) Ammonia Aluminum brightener (acid wash)

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

3 COMPLIANCE

The PT 6000 has the following certifications:

EU RED 2014/53/EU

- PT 6000 3G
- PT 6000 4G cell only single mode

RoHS

- Restriction of Hazardous Substances (RoHS) [1]

[1] European Union's (EU) Directive 2015/863/EU "Restriction of Hazardous Substances" (RoHS) in Electronic and Electrical Equipment.

ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

APPENDIX A SUPPORTED SENSORS

Refer to the appropriate datasheet or contact your ORBCOMM Account Manager for additional details or information about possible additional sensors.

	Product Name	Product Description
	Wired Door Sensor	The door sensor (wired) can detect if a trailer or container door is open or closed, or while on route, providing enhanced security and operational efficiency. The magnetic door sensor monitors the status of the trailer door. The door sensor features an interrupt-driven digital interface that minimizes power draw from the sensor.
	Wired Temperature Sensors	ORBCOMM's proven temperature sensors (LK4048 (6 m/20 ft.), LK4049 (15 m/49 ft.) or L4050 (22 m/72 ft.)) help to ensure the integrity of perishable and temperature-sensitive products. This technology enables the collection and analysis of in-transit cargo temperature data for the entire trip to maximize compliance, help prevent loss of loads and improve customer satisfaction. Specific temperatures or ranges can be set and verified for the duration of the trip. The sensor can also send near-real-time alerts if the temperature deviates from the set range.
	Fuel Sensor (FS 210)	The FS 210 fuel sensor accurately monitors fuel volume, providing valuable operational and management data. The fuel sensor can immediately detect and report rapid loss of fuel to provide a significant deterrent against fuel theft.

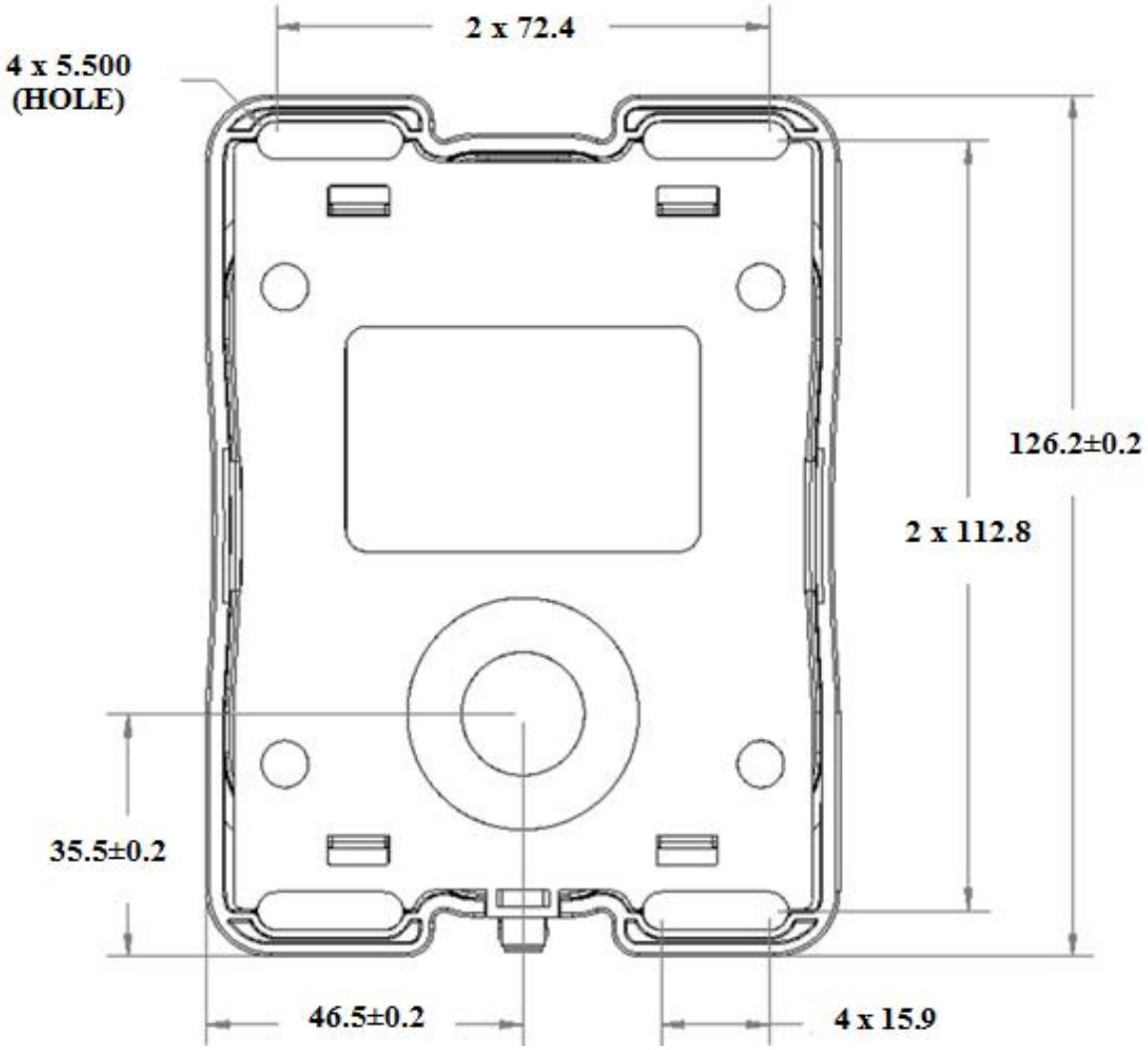
ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020

APPENDIX B OGI ANTENNA DIMENSIONS

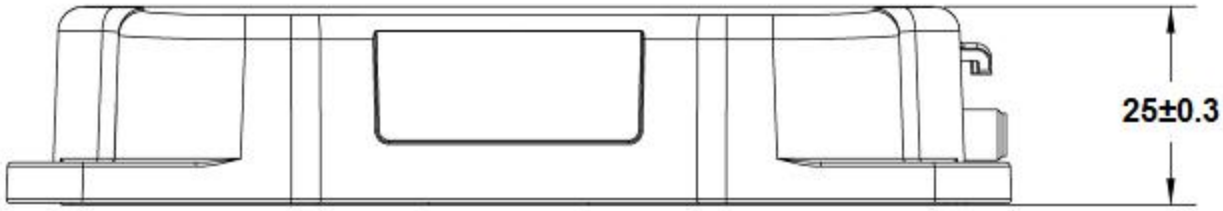
CAUTION: Before drilling check the template against actual hardware for dimensional accuracy. If it is not correct, DO NOT USE THIS TEMPLATE. Use the physical antenna hardware as a template.

CAUTION: Cable management and connector strain relief must be incorporated in the installation. Secure the cable no more than 15 cm (6 in.) from the antenna enclosure and at regular intervals along its length as part of the installation to prevent cable wear and eliminate strain on the connector. Damage to the connector interface or cable may otherwise result and lead to hardware failure.

Figure 2: OGi Antenna Dimensions (shown in mm)



ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020



ORBCOMM® PROPRIETARY AND CONFIDENTIAL MATERIAL © Oct 2020