



ORBCOMM®

CONNECTING THE
WORLD'S ASSETS



FM 5000

User Guide

GJD105-ECert, Version .05

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ABOUT THIS USER GUIDE

Purpose

This guide contains product information for the FM 5000. The intended audiences for this guide include field support personnel, product evaluators, and certified third-party personnel. It is particularly intended for personnel who are responsible for system installation and activation. In addition, and as is appropriate, this guide may be used for customer training.

Cautions Concerning Servicing the Device

CAUTION: The asset must be turned off when service work is required, and there may be a temperature change within the refrigerated compartment that may lead to the loss of the load. ORBCOMM is not liable for lost loads. Be aware of the temperature within the refrigerated compartment during servicing.

CAUTION: Remove the cable from the negative terminal of the asset battery and secure the cable to prevent accidental contact before performing any installation or service procedure. Only trained service personnel should perform the procedures outlined in this installation manual. These procedures may allow exposure to high electrical energy that could result in electric shock and injury to untrained personnel during servicing, maintenance, and installation of the unit.

CAUTION: To avoid personal injury, the asset battery should be disabled by disconnecting the negative terminal cable prior to installation or servicing.

CAUTION: Be aware of your working environment. Take appropriate steps to ensure that the device cable and especially its connectors are not exposed to soil, water, or other contaminants that may be present at the installation site.

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 will 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.

WEEE Statement

Disposal of this product should be handled according to all national laws and regulations.

The mark shown to the right is in compliance with Waste Electrical and Electronic Equipment Directive 2002/96/EC (WEEE). The mark indicates the requirement NOT to dispose the equipment as unsorted municipal waste, but use the return and collection systems according to local law.



1 OVERVIEW

ORBCOMM's FM 5000 is a cellular-based telematics device for driver safety and fleet management applications.



The FM 5000 monitors driver behavior and alerts drivers and managers when actions that may compromise safety are detected. With state-of-the-art coaching technology, the FM 5000 informs drivers when they are speeding, driving aggressively, or not wearing a seat belt.

The FM 5000 is used with a mobile app and a cloud-based application as part of a comprehensive solution. In addition to in-cab coaching, the solution sends data to the application, allowing managers to receive alerts and generate reports to track driver performance, fleet status and productivity, as well as to ensure compliance with regulations. The FM 5000 is third-party certified for compliance with the Federal Motor Carrier Safety Administration's and Transport Canada ELD rules.

1.1 Assembly

The FM 5000 consists of the base unit plus a windshield mounting bracket that also acts as a shield to solar radiation. A [cable harness](#) completes the overall assembly.

The mounting bracket is designed to accept double-sided adhesive glue dots in six locations. That allows the mounting bracket to be adhered to the inside of a vehicle windshield. Slots in the mounting bracket allow the cable harness to be zip tied to the bracket.

1.2 Cable Harness

Below is a list of recommended cable harnesses. PRO-400 cable harnesses are compatible with the FM 5000. *{{not sure we should mention another product in the certification guide - remove this statement?}}*. Additional ancillary cables may be required to complete an installation and allow access to certain interfaces. *{{will cert house want details about these cables? they are not referenced in install section and there are no cable drawings/photos - remove this chapter section?}}*

Description	ORBCOMM Part Number
Vehicle Bus OBD Cable	840-00277
FFBO Cable Assembly	840-00280

Description	ORBCOMM Part Number
Vehicle Bus ODB Breakout Cable	840-00282
{{NOT IN AGILE}}	CA301363-000-A

{{What's FFBO? Difference between the two ODB cables? }}



2 SPECIFICATIONS

{{overall this section contains more information and detail than we normally submit for certification - perhaps some of this information should not be removed to reduce the risk that our competitors may see it if it is made public}}

2.1 Temperature

Parameter	Value
Operating Temperature	-20° to +85°C (-4° to +185°F)
Storage Temperature	-40° to +85°C (-40° to +185°F)

2.2 Power

2.2.1 Power Supply Input

Parameter	Value
Power Supply Voltage	9 to 36 V DC
Reverse Polarity Protection	Yes

2.2.2 Power Consumption

Typical power consumption values at VIN=12 V and at room temperature (23°C/73°F).

Table 1: Power Consumption

State of Operation	Current
Normal State	350 mA to 2 A
Low Power Mode	<1 mA typical

2.2.3 Fuse

An internal PTC type fuse is installed on the circuit card assembly.{{remove previous statement?}}The fuse is a slow blow type rated to 2.5 A. When a short circuit condition is detected, the PTC becomes open circuit until the short circuit condition is removed. {{remove previous statement?-keep only slow blow fuse and not replaceable}}It is not user replaceable.

Note: For further protection, it is recommended that an external 2.5 A, 48 V fuse be installed on all vehicle power lines connecting to the FM 5000.

2.2.4 Inrush Current

Input voltage value at VIN=12 V and at room temperature (23°C/73°F).

State of Operation	Current
Application of Input	<500 mA is typical

2.2.5 Supercapacitor

Allows for 20 seconds of full operation at full charge plus low vehicle voltage / brown-out protection.

2.3 General Purpose Input-Output (GPIO)

The FM 5000 has seven pre-configured GPIO inputs, plus two spare GPIO inputs. A pre-configured GPIO output and three spare GPIO outputs. The inputs and outputs are not configurable.

GPIO Inputs:

- Ignition Sense
- Ignition Cable Detect
- Vehicle Bus Cable Type Detect
- Seat Belt
- Seat Belt Cable Detect
- Panic Button
- Kill Switch
- GPIO_SPARE1
- GPIO_SPARE2

GPIO Outputs:

- Accessory Power Control
- GPIO_OUT1
- GPIO_OUT2
- GPIO_OUT4

2.4 Serial Interfaces

The FM 5000 has the following UART-based interfaces:

- Five RS-232 compliant interfaces
- Two USB connections (USB 2.0)
- CAN Bus - Two channels supporting SAE J1939, ISO15765 CAN protocols
- CAN Bus - Single Wire CAN (SWC) uses CAN Bus channel 2
- J1708 - One channel

2.4.1 RS-232

The RS-232 interfaces default to the following settings: 115.2 kbps, 1 start, 8 data, 1 stop bit, no parity. The baud rate is configurable up to 115.2 kbps. One RS-232 interface is a dedicated CONSOLE or DEBUG port. RS-232 ports are not user accessible. There is one RS-232 interface with full flow control. The remainder are typical 3-wire types (TX, RX, and GND).

- Rx is protected up to ± 25 V
- Tx is protected up to ± 13.2 V
- Rx and Tx have ± 15 kV ESD protection

2.4.2 USB

The FM 5000 has two USB 2.0 compatible interfaces. The primary interface for programming the FM 5000 is the USB On-The-Go (USB-OTG) interface. That interface is not user accessible. The other USB 2.0 interface allows for connection of an external keyboard or mouse though currently there is no software support. *{{delete all but first statement? User can't do anything with these USBs. As a minimum the last statement should be removed, "no support" now is like a future promise or shortcoming and shouldn't be included.}}*

2.4.3 CAN Bus

The transceiver provides two CAN Bus interfaces for sending and receiving frames. *{{keep "transceiver" term?}}*

The transceiver incorporates a controller area network interface with signaling rates up to 1 Mbps.

A Single Wire CAN (SWC) is also available on the second CAN Bus interface.

2.4.4 J1708

The transceiver provides a half-duplex J1708 interface as an accessory bus interfacing with signaling rates up to 250 kbps.

2.4.5 1-Wire

A 1-wire interface is available for use of logging in or out via an ancillary iButton tag. This is a legacy interface that has been largely superseded by the NFC one. *{{not sure this second statement should be in the customer-facing docs - do we need details about iButton??}}*

2.5 Vehicle Connections

- CAN: 2 channels supporting SAE J1939, ISO15765 high, medium, and single wire CAN protocols
- SAE J1708: 1 channel
- Supported vehicle connections:

Note: These require interface specific cable harnesses.

- OBDII (J1962)
- Volvo J1939 16 pin connection (purple)
- J1939 Type II connector (green)
- RP1226
- J-Bus Deutsch 9-pin and 6-pin connectors
- 3-wire install (power, ground, and ignition)
- 2-wire install (power and ground)

2.6 Operation Frequency Band

Parameter	Value
Cellular	LTE 4G, 3G/2G



Parameter	Value
GPS	72 channel GPS/AGPS
Wi-Fi	802.11 b/g/n Wi-Fi Dual Mode
NFC	RFID ISO 15693, ISO 18000-3 support

2.7 Antennas

Antenna Type	Description
Cell	The FM 5000 contains two multi-band cellular internal antennas, one providing both transmit and receive functions, the other providing LTE diversity reception for enhanced CAT 1 downloads. The two antennas are surface mounted (surface-mount technology - SMT) to the electronics PCA. {{remove last statement}}
GNSS	A single SMT, edge mounted chip antenna for GNSS reception.
Wi-Fi	A single SMT edge mounted chip antenna for transmission and reception of Wi-Fi signals.
NFC	An NFC coil is mounted in the lower, plastic enclosure and via a twisted pair cable assembly is connected to the main electronics PCA. {{reword to simply - "An NCF located on the main PCA?"}}

2.7.1 Cellular

Type	u-blox TOBY-R200-42B
LTE Module	LTE bands: 1, 2, 4, 5, 8, and 12 UMTS bands: 850, 900, 1900, 2100 MHz GSM 850/900/1800/1900 MHz
Output Power	LTE power Class 3 (23dBm) UMTS/HSDPA/HSUPA power Class 3 (24dBm) GSM/GPRS Power Class: *Class 4 (33 dBm) for GSM/E-GSM band *Class 1 (30 dBm) for DCSPCS band EDGE(8-PSK) Power Class: *Class E2 (27 dBm) for GSM/E-GSM band *Class E2 (26 dBm) for DCS/PCS band
Input Power	Peak currents of 1.5 A typical, 1.9 A maximum. Module supply peak current consumption: peak of current consumption through the VCC pins during a GSM 1-slot Tx burst at maximum Tx power, with a matched antenna
Data Transfer	LTE Category 1: up to 10.3 Mb/s DL, 5.2 Mb/s UL HSDPA category 8: up to 7.2 Mb/s DL, HSUPA category 6: up to 5.76 Mb/s UL GPRS multi-slot class 33, CS1-CS4, up to 107 kb/s DL, up to 85.6 kb/s UL EDGE multi-slot class 33, MCS1-MCS9, up to 296 kb/s DL, up to 236.8 kb/s UL

The u-blox module meets regulatory requirements of FCC, ICES, CE, and other countries.

2.8 GNSS

The GNSS engine used in the FM 5000 is the u-blox EVA-M8M. Aided GPS or AGPS is used to improve cold start capability. The manufacturer's specifications are given in the table below.

Table 2: Multi-GNSS Specifications

Parameter	GPS	GLONASS	GPS/GLONASS
Time to First Fix¹			
Cold Start	29 s	31 s	26 s
AGPS	3 s	3 s	3 s
Hot Start	1 s	1 s	1 s
Sensitivity			
Tracking	-164 dBm	-163 dBm	-164 dBm
Hot Start	-156 dBm	-155 dBm	-156 dBm
Cold Start	-148 dBm	-145 dBm	-148 dBm
Accuracy			
Horizontal Position (CEP) ²	2.5/2.0 m	4.0 m	2.5/2.0 m
Velocity	0.05 m/s	0.1 m/s	0.05 m/s
Heading	0.3 degrees	0.4 degrees	0.3 degrees

2.9 Wi-Fi

The FM 5000 contains a 802.11 b/g/n dual mode module capable of operating in both STATION and ACCESS POINT modes. The module is a Microchip ATWILC3000-MR110UA. Typical RF output power is less than +18.5 dBm. The module meets regulatory requirements of FCC, ICES, CE, and other countries. *{{is this too much detail?}}*

Wi-Fi communication is used between the FM 5000 and local cell phones/tablets or yard access points. External cameras with Wi-Fi can also be connected to the FM 5000 via the Wi-Fi interface.

2.10 Near Field Communication (NFC)

The FM 5000 contains a Texas Instruments integrated circuit TRF7970A. This is a multi-protocol 13.56 MHz RFID and NFC device. An internal NFC coil is mounted in the FM 5000 enclosure allowing you to log in or log out of the device using an RFID card. The chip supports several ISO protocols including ISO 14443A/B, ISO 15693, ISO 18000-3.

2.11 Accelerometer

The FM 5000 has an internal 3D accelerometer to detect motion in any axis. The FM 5000 uses Bosch accelerometer model BMI160. *{{remove the previous statement?}}* The primary use for the accelerometer is to wake the FM 5000 upon driver entry into the vehicle. The secondary use is to sense hard acceleration/deacceleration forces and high cornering forces. That information is used to actively monitor and modify driver behavior. Finally, the accelerometer detects impact events such as those encountered during a vehicle crash.

¹All satellites at -130 dBm

²CEP, 50%, 24 hours static, -130 dBm

2.12 Mechanical

Figure 1: FM 5000 Front / Face View

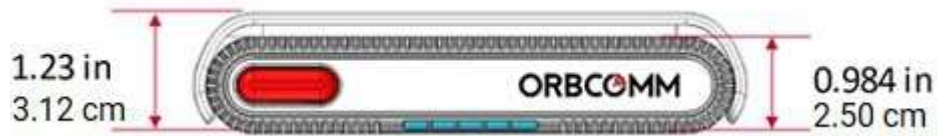


Figure 2: FM 5000 Side View

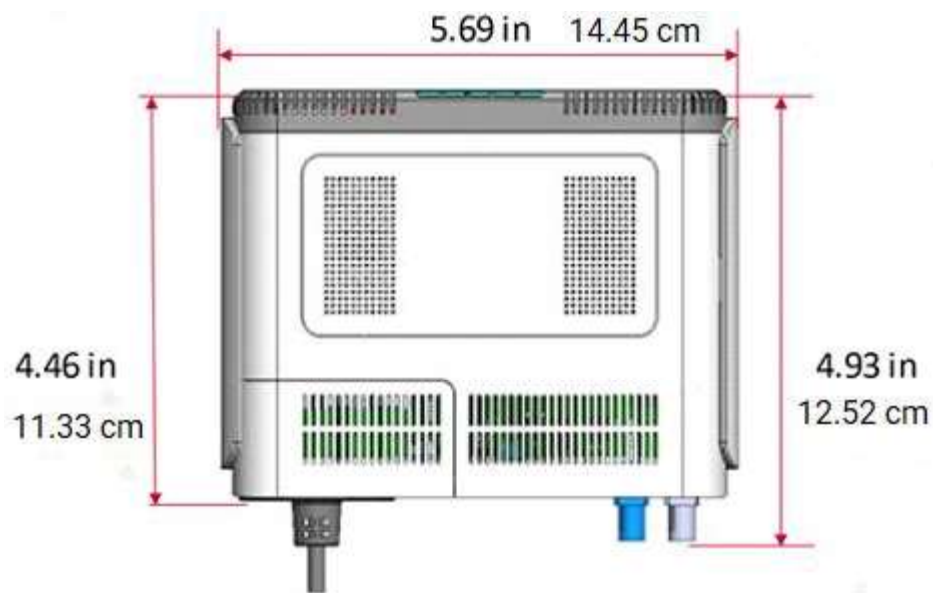


Table 3: Mass and Total Dimensions

Parameter	Value
Dimensions (Includes mounting bracket, cover shield, and mounting pads)	5.69 x 4.46 x 1.31 inches (14.5 x 11.3 x 3.3 cm)
Weight	
Assembly	0.55 lbs. (249 g)
Approximate Cable Harness	1.30 lbs. (590 g) <i>{{earlier we gave a list of 4 cable harnesses - do they all weigh the same??}}</i>
Total Weight	1.85 lbs. (839 g)

2.13 Environmental

Parameter	Description
Thermal Shock	The device meets all of its specifications after a thermal shock test as detailed in SAE J1455 (2017), section 4.1.3.2
Humidity	The device meets all its specifications during exposure as per the test methodology of SAE J1455 (2017), section 4.2.3 fig 4A
Mechanical Vibration	The device meets all its specifications during exposure to random vehicular vibration levels per SAE J1455 (2017), section 4.10.4.2 figures 6 and 8, and MIL-STD-810G (2019), section 514.8 Annex C, Category 4, US Highway Transportation, Unknown Orientation
Mechanical Shock	The device meets all its specifications as specified in MIL-STD-810H (2019), section 516.8, Procedure I Functional Shock, section 2.3.2c Fig 516.8-10 and Table 516.8-IV Ground Material
Ingress Protection	IEC 60529 (2001), sections 14.2.7 and ISO 20653 (2013) Table 7 and Figure 7.

3 COMPLIANCE

Certifications for the following are pending, unless noted otherwise.

FCC / Industry Canada

- CFR 47 Part 15
- CONTAINS FCC ID: XPY1 EHM44NN; 2ADHKWILC3000U
- CONTAINS IC ID: 8595A-1 EHM44NN; 20266-WILC3000UA
- ICES-003

CE RED 2014/53/EU

RoHS

- Restriction of Hazardous Substances (RoHS) ¹

PTCRB

WARNING:

- The minimum 10 in. (25 cm) separation distance from the device is required for RF exposure safety for all persons.
- La distance de séparation minimale de 10 pouces (25 cm) de l'appareil est requise pour la sécurité de l'exposition aux RF pour toutes les personnes.
- Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- This 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.
- This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions: (1) This device may not cause interference. (2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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;
- 2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

¹European Union's (EU) Directive 2002/95/EEC "Restriction of Hazardous Substances" (RoHS) in Electronic and Electrical Equipment.

4 INSTALLATION

IMPORTANT

READ ALL INSTRUCTIONS CAREFULLY BEFORE INSTALLING. FAILURE TO DO SO MAY CAUSE PERSONAL INJURY OR DAMAGE TO PRODUCT AND/OR PROPERTY. •

• Review the product package and contents prior to beginning the installation. Take care when opening the packaging and removing items. If a return is needed you will want to return the product in its original packaging if possible. • This instruction guide is provided as a GENERAL installation guide, some assets vary dimensionally and may require additional steps. • The manufacturer and / or distributors do not accept responsibility for third party charges, labor, and or third part replacement modifications. Some modifications may void the factory warranty. • Exercise due diligence when installing this product. ORBCOMM does not accept any responsibility for asset damage or personal injury resulting from the installation of this product. Careless installation and operation can result in serious injury or equipment damage. • All liability for installation and use rests with the owner / operator. • Always make sure you have a clean, dry, and well-lit work area. • Always ensure products are secure during disassembly and installation. • Always take steps to protect yourself when drilling, cutting, and grinding because this may create flying particles that can cause injury. • Thoroughly inspect the area to be drilled, on both sides of material, prior to modification, and relocate any objects that may become damaged. • Always route electrical cables carefully. Avoid moving parts, parts that may become hot and rough, or sharp edges. • Make sure to fully understand the product, its intended use, and operation prior to use.

4.1 Prepare the Windshield

Preparing the windshield prior to installation is extremely important. If the windshield is not thoroughly clean and dry, the device will lose adhesion over time. Follow the instructions below to clean and prepare the windshield properly for installation.

1. Ensure that the interior windshield surface is dry by operating the vehicle windshield defrost, with the air conditioning on, in a neutral temperature range.
2. Determine the appropriate location on the interior vehicle windshield (ORBCOMM recommends the right-side of the rear-view mirror).

Note: The area must be clear of any labels or stickers.

Note: It is the responsibility of the installer to check local, state, and federal guidelines regarding the attachment of objects to a vehicle windshield.

3. Use glass cleaner and clean towels or rags to thoroughly clean the interior surface of the windshield.
4. Use alcohol wipes to prepare a 6" x 6" (15 x 15 cm) area of the windshield in the location where the device will be installed.

4.2 Mix and Apply the Adhesive

1. Thoroughly mix the 2-part adhesive by squeezing all of the liquid from one end to the other while kneading the packet.
2. Remove the backing from the device's adhesive pads, pay careful attention not to touch the pad surface.
3. Cut a small corner of the 2-part mix adhesive packet.
4. Apply one drop of the mixed adhesive to the center of two adhesive pads.

Note: DO NOT apply the mixed adhesive to more than two round adhesive pads.

4.3 Mount the FM 5000

1. Mount the device on the windshield in the prepared and cleaned location.

CAUTION: Mount the device to the windshield so that the cable points downward from the device.

2. Apply sufficient pressure to adequately secure the device in place (approximately 60 seconds).

4.4 Route and Connect the Cable

1. Route the cable from the mounted device to the vehicle's diagnostic port, likely the roof liner above the driver.

CAUTION: Pay special attention when routing cables near airbags. DO NOT route the cable in a manner that will interfere with the deployment of your vehicle's airbags. Never allow the device cable to cross over or obstruct an airbag system.

2. Connect the device's cable to the vehicle's diagnostic port.
3. Secure the remaining cable using the provided cable ties away from moving parts or that would otherwise interfere with normal vehicle operation.

