



INVENTURE
AUTOMOTIVE
SIGNALS • DATA • ANALYTICS



Reeper Interface G2
based on
FMS Gateway G2™

User's Manual

Inventure

FMS Gateway G2™ –

Reefer interface

Legal Notice

Information furnished in this publication is believed to be accurate and reliable. However, Inventure assumes no responsibility for the consequences of use. Information contained in this publication regarding the device applications and the like is intended through suggestion only. Product specifications are subject to change or modification without notice.

This document is for use by the intended recipient and contains confidential information under applicable law. You are hereby formally notified that any use, copying or distribution of the document, in whole or in part, is strictly prohibited.

This publication supersedes and replaces all information previously supplied.

Trademarks

The Inventure logo and product names are trademarks of Inventure, Inc. and are protected by copyright law.

All rights reserved.

Copyright Notice

© Copyright 2020, Inventure, Inc.

Revision

D01-018-09-04-08-03EN

Contact

INVENTURE Automotive Electronics R&D, Plc.
11 Tarcali Strret
H-1113 Budapest
HUNGARY
Phone: +36 1 381-0970
E-mail: support@inventure-automotive.com
URL: www.inventure-automotive.com

Table of contents

1	INTRODUCTION	5
2	THE FMS GATEWAY G2 REEFER INTERFACE	5
2.1	MAIN FEATURES.....	5
2.2	ADDITIONAL FEATURES.....	5
2.3	HOW TO USE INVENTURE FMS GATEWAY G2 REEFER INTERFACE	6
3	SAFETY NOTICES	7
4	PACKAGE CONTENTS	8
5	CONNECTION OVERVIEW.....	9
5.1	V_CAN 1 CONNECTOR.....	10
5.2	MAIN CONNECTOR	10
5.3	USB MINI CONNECTOR	11
6	INSTALLATION TO VEHICLE	12
7	TROUBLESHOOTING, LED STATUS	13
7.1	PROPER OPERATION	13
7.2	V_CAN 1 ERROR	14
7.3	V_CAN 1 IDLE.....	14
7.4	DIAG IDLE	14
7.5	UNKNOWN VEHICLE.....	14
7.6	V_CAN 2 ERROR	14
7.7	FMS CAN OUTPUT ERROR.....	14
7.8	BOOTLOADER STATE (USB CONNECTED).....	15
8	INVENTURE SUPPORT INFORMATION	15
9	SYSTEM CHARACTERISTICS	16
10	WARRANTY.....	17
11	HOW TO CONTACT INVENTURE?	18
12	LIST OF FIGURES	19
13	LIST OF TABLES.....	19

1 Introduction

Thank you for purchasing an Inventure product. Your new FMS Gateway G2™ interface is a carefully engineered, high quality durable product with intelligent features and robust styling. It is designed to give you the quality and convenience you expect from an automotive measuring instrument.

To familiarize yourself with all the features of your unit please read the following instructions carefully. Retain this guide for future reference.

2 The FMS Gateway G2 Reefer Interface

The interface connects to Thermo King Smart Reefer controller electronic communication channel, acquires and transfers real time sensor data on its output. The output format can be compliance with standard FMS CAN, and/or RS232. The output data can be transferred via hardwire (FMS Gateway output cable – FMS CAN and/or RS232) method.

The **FMS Gateway G2™ basically has only one firmware for each manufacturing group** and it uses **Automatic Vehicle Detection** which means that after installing the device will detect your vehicle by itself. To use the standard FMS Gateway G2 as Reefer Interface you need to use the General Truck firmware and upload it by using the proper Device Database (the method is detailed in this document)

2.1 Main features

This intelligent interface provides contactless and safety solution for Thermo King refrigerators with comprehensive measurement as listed below:

- ❖ **High-Speed CAN and/or RS232 output**
- ❖ **Multiple zone temperature** up to three separated zones¹
- ❖ **No need for OEM translator interface**
- ❖ **FMS compatible** (CAN output compliance with FMS CAN bus)
- ❖ **Easy integration with any telematics systems**

The Reefer Interface solution can be used as extra feature² on reefer equipped rigid trucks to acquire vehicle related FMS data and reefer related data with one device at once.

2.2 Additional features

The FMS Gateway G2 interface has advantageous features that are accessible via mini USB connector, such as:

- ❖ **Vehicle measurement:** If the vehicle is not supported, then you can easily make a CAN measurement using FMS Gateway G2. You just send this measurement to Inventure Support (support@inventure.hu), we analyze the files and update new firmware as soon as possible

¹ if the Thermo King unit is able to handle multiple zones

² Extra feature: please contact Inventure Automotive for details

- ❖ Troubleshooting: should you need further assistance during installation, measurements can be recorded from the Support Tool PC software. The measurement can be analyzed by Inventure experts and effective support can be provided.

Explanation:

- ❖ Firmware Update
 - *An option to update the firmware of the device so it is usable in other vehicles*

2.3 How to use Inventure FMS Gateway G2 Reefer Interface

- ❖ Identify your Reefer controller module
 - *Supported Thermo King units:*
 - All Thermo King units equipped with SR2 controller
 - All Thermo King units equipped with SR3 controller
- ❖ Firmware update process (skip if you ordered with updated firmware)
 - *Install **FMS Gateway Support Tool** PC Software*
 - *See further details in the **FMS Gateway Support Tool User's manual***
 - *Acquire and refresh the Device Database in FMS Gateway Support Tool*
 - *Update the latest Truck firmware via FMS Gateway Support Tool*
 - *Enable the related output messages in G2 Configuration menu via FMS Gateway Support Tool*
- ❖ On site installation process
 - *During installation please refer to the Reefer specific Installation guide. Please contact Inventure Support (support@inventure.hu) for the install guide.
*E.g.: ThermoKing_SR3_Reefer_IF_G2_Installation_Guide_v01.pdf**
 - *Install the CL-CAN sensor according to the guide, connect its cable to the V_CAN 1 slot.*
 - *Connect the power supply wires of the Main cable to the proper points*
 - *After device installation, please connect input cables (Power, Ground, Vehicle CAN input and other inputs when needed). See Section 5 for more details.*
 - *Connect the FMS Gateway G2 output to the input of your AVL device.*
- ❖ After successful installation and power-up, the device testing can be started.
 - *The FMS Gateway G2 has an in-built Status LED that indicates its operating status. If everything works as it should, the LED flashes green once in every 5 seconds. If not, please check Section 7 for further information.*

- *The complete Reefer tracking system can be tested online by visiting your fleet tracking system's website, where you are able to see the Reefer data beside the GPS position.*

3 Safety notices



Please read the following safety instructions carefully. Inventure Automotive accepts no liability for damage that results from disregarding the safety instructions.

- ❖ Usage of the interface is permitted for industrial purposes only.
- ❖ The interface must not be used in situations in which human lives depend upon the operation of this equipment.
- ❖ Product must be installed by professional and this fact should be recorded legally
- ❖ The interface may be damaged by contact with water or any liquids. Use and store the interface in an area protected from water
- ❖ Do not expose the interface to direct sunlight or high temperature (see section 11 for reference) to ensure proper operation

4 Package Contents

Please make sure that the package contains the items listed below.

- ❖ FMS Gateway G2 Reefer Interface



- ❖ CL-CAN (contactless CAN) sensor
- ❖ Cable set (optional)
- ❖ User's Manual (this guide)
- ❖ Installation guide on the specific Reefer model

INVENTURE AUTOMOTIVE ELECTRONICS R&D LTD. H-1124 Budapest, XII. Fűző str. 2. B. Ép. Tel.: +36 (1) 381-0970

Installation Guide

For Inventure Reefer Interface G2 device
Type: Thermoking SmartReefer 3
Version 001_190213

INPUT

LED STATUS

OUTPUT

Installation steps:

1. Connect FMS Gateway G2 Reefer Interface input cables to the wires shown in the installation guide.
2. Recommended: Inventure CL-CAN sensor blue (V CAN_H) and yellow (V CAN_L) wires.
3. Connect the configured AVL device to output of the FMS Gateway G2 Reefer Interface.
 - FMS CAN: active communication, 250kb/s. Acknowledgement must be enabled!
 - RS-232: default baudrate: 115200b/s. Can be modified in FMS Gateway Support Tool.
4. Connect the Power and GND to the wires shown in the installation guide.

Troubleshooting
Please contact Inventure Support with the following information:

- Vehicle manufacturer
- Vehicle type
- Vehicle model year
- VIN

Copyright © Inventure R&D LTD. All rights reserved. 12 www.inventure-automotive.com

INVENTURE AUTOMOTIVE ELECTRONICS R&D LTD. H-1124 Budapest, XII. Fűző str. 2. B. Ép. Tel.: +36 (1) 381-0970

<p>Access to the connection points</p> <p>Remove covers to access the SmartReefer3 controller board.</p>	
<p>Access to the connection points</p> <p>Device MUST NOT be installed when refrigerator is in operation!!!</p>	
<p>CAN bus connections</p> <p>Install CL-CAN device to CAN wires coming from one of the fitted CAN connectors (CAN1, CAN2, CAN3).</p> <p>CANL = Black, CAN connector pin #1 CANH = Red, CAN connector pin #2</p>	
<p>Power connections</p> <p>Connect device</p> <p>IGNITION (Red) wire to White wire, CAN connector pin #6. GND (Black) wire to Green wire, CAN connector pin #8.</p>	

Copyright © Inventure R&D LTD. All rights reserved. 22 www.inventure-automotive.com

5 Connection overview

INPUT DESCRIPTION	CONNECTOR
Vehicle CAN 1 channel – Default input for Reefer	V_CAN 1
Vehicle CAN 2 channel ³	V_CAN 2
Diagnostics channel ⁴	DIAG
Tachograph connection ⁵	TACHO
Main harness (Power, FMS CAN, RS232, Analog)	MAIN
Programming / Configuring / Measuring channel	mini USB B

Table 1: Input description

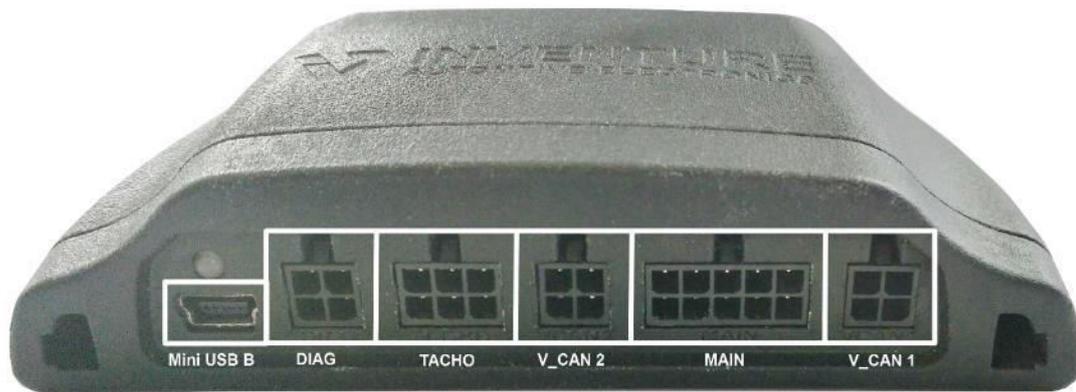


Figure 1: Device connectors

For the device proper functioning, please make sure to connect only to the following points according to the charts. The rest should be left as is (DNC - Do Not Connect).

³ Not used for Reefer Interface

⁴ Not used for Reefer Interface

⁵ Not used for Reefer Interface

5.1 V_CAN 1 connector

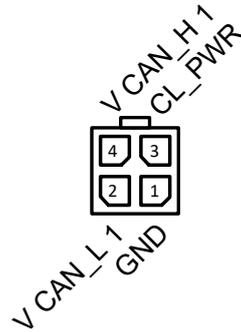


Figure 2: Micro Fit 4-pin (V_CAN 1) assignment

Pin Nr.	Designation	Description
1	GND	Ground
2	V CAN_L 1	Vehicle CAN 1 bus CAN Low line
3	CL_PWR	Power output for CL-CAN sensor
4	V CAN_H 1	Vehicle CAN 1 bus CAN High line

Table 2: Micro Fit 4-pin (V_CAN 1) assignment

5.2 MAIN connector

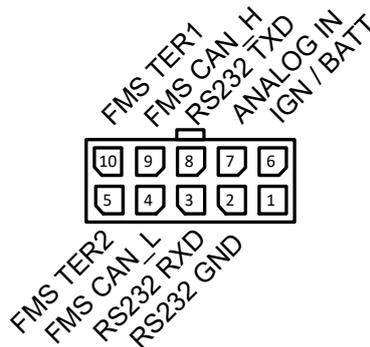


Figure 3: Micro Fit 10-pin (MAIN) assignment

Pin Nr.	Designation	Description
1	GND	Ground
2	RS232 GND	RS232 Ground
3	RS232 RXD	RS232 channel receive data line
4	FMS CAN_L	FMS CAN bus CAN Low line
5	FMS TER 2	FMS CAN bus terminating resistor activation loop 2
6	IGN / BATT	Ignition / Battery + input
7	ANALOG IN	Analog sensor input (e.g.: fuel level sensor)
8	RS232 TXD	RS232 channel transmit data line
9	FMS CAN_H	FMS CAN bus CAN High line
10	FMS TER 1	FMS CAN bus terminating resistor activation loop 1

Table 3: Micro Fit 10-pin (MAIN) assignment

5.3 USB Mini connector

Please make sure to follow the below steps:

- ❖ Connect FMS Gateway to computer (use Mini USB – USB cable)



Figure 4: USB Mini B to USB A cable

- ❖ Install device driver
- ❖ Install FMS Gateway Support Tool software
- ❖ Activate FMS Gateway Support Tool software using license file (Send the activation request file in e-mail to Inventure Automotive support)

6 Installation to vehicle

In order to avoid damaging the vehicle or the device the installation must be performed by professional, skilled person.

During installation please consider safety instructions (see Section 3) and follow the instructions below:

1. Make sure that the FMS Gateway G2 Reefer Interface device has the latest firmware installed, and it is appropriately configure for the Reefer model (check firmware version and configuration by using FMS Gateway Support Tool)
2. Update the appropriate firmware and configuration to the device if necessary (by using FMS Gateway Support Tool)
3. Update the settings if you need specific configuration (by using FMS Gateway Support Tool)
4. Connect the vehicle communication bus wires to the interface input connectors by using vehicle specific Installation guide
 - *Connect CL-CAN sensor to V_CAN 1*
5. Connect device output to the telematics device
 - *FMS CAN and/or*
 - *RS232*
6. Turn vehicle ignition ON, and check FMS Gateway device LED status. LED should be flashing green once in every 5 seconds. Should it be different, please see Troubleshooting on Section 9.
7. Check telematics device's operating status (LED indicator if available) then verify the dataflow from vehicle on remote server database.

7 Troubleshooting, LED status

The FMS Gateway has a status LED on the face of the enclosure which indicates the current operational mode.

When ignition turns ON the status LED lights RED for 5s (initialization process), after this the status LED indicates the current operation state. The status LED flashes 1-5 times in 5s period with different color, see attached table.

Status LED flashing states:

State	Status LED	Flashing / 5s
Proper operation	Green	1
No communication on device input	Not flashing	0
V_CAN 1 input Error	Red	2
V_CAN 1 input Idle	Red	3
DIAG input Idle	Red	4
Unknown Vehicle	Red	6
V_CAN 2 input Error	Red	7
V_CAN 2 input Idle	Red	8
K-Line input Idle	Red	9
FMS CAN output Error	Yellow	5
Bootloader state (USB Connected)	Yellow	rapid

Table 4: Device working status

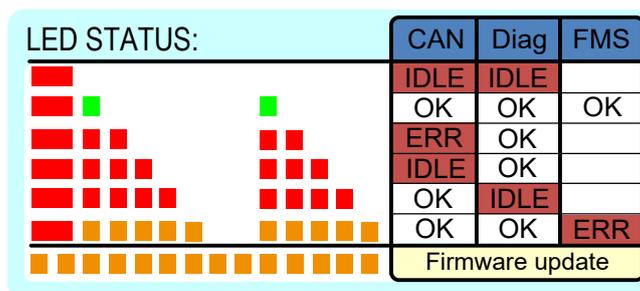


Figure 5: Status LED flashing

7.1 Proper operation

Device works correctly, LED flashes GREEN 1 time in 5s period.

In this working state the device gets power supply (voltage and current OK) and detects the input CAN and/or DIAG communication channels' messages.

In this operating state the device and the GPS device connection are correct, the GPS device sends CAN acknowledges (in case of FMS CAN connection).

7.2 V_CAN 1 Error

In case of the status LED flashes RED 2 times in 5s period the FMS Gateway detects error on V_CAN 1 input channel. The device detects CAN errors on vehicle CAN communication bus.

Possible Faults:

- ❖ **FMS Gateway Firmware does not fit for this vehicle model**
 - *Check the updated firmware version, use FMS Gateway Support Tool to read firmware version. Update firmware if necessary.*
- ❖ **V_CAN 1 bus connection wrong:**
 - *Check V_CAN 1 connections (CAN Low ~2,3V, CAN High 2,7V DC)*
- ❖ **V_CAN 1 bus lines reverse connection:**
 - *Check V_CAN 1 connections reverse polarity (CAN Low ~2,3V, CAN High 2,7V DC)*

7.3 V_CAN 1 Idle

This state is not relevant on Reefer Interface.

7.4 DIAG Idle

This state is not relevant on Reefer Interface.

7.5 Unknown vehicle

This state is not relevant on Reefer Interface.

7.6 V_CAN 2 Error

This state is not relevant on Reefer Interface.

7.7 FMS CAN Output Error

In case of the status LED flashes YELLOW 5 times in 5s period the connection between the FMS Gateway device and the GPS device is not working properly. Check connections!

Possible Faults:

- ❖ **FMS CAN bus connection is wrong:**
 - *Check FMS CAN connections (CAN Low ~2,3V, CAN High 2,7V DC)*
- ❖ **FMS CAN bus lines have reverse connection:**
 - *Check FMS CAN connections for reverse polarity (CAN Low ~2,3V, CAN High 2,7V DC)*
- ❖ **No CAN acknowledge from GPS device:**
 - *If there is no acknowledge on FMS CAN bus then FMS Gateway cannot transfer CAN messages to GPS device.*

- *Set GPS device CAN settings Normal or turn on CAN acknowledge.*
- ❖ **No CAN terminating resistor:**
 - *Check 120Ohm terminating resistors on CAN bus according ISO11898-2 standard.*
- ❖ **FMS CAN bus baudrate is wrong:**
 - *The FMS CAN output baudrate is 250kb/s according to FMS Standard. Set this baudrate in GPS device settings.*

7.8 Bootloader state (USB Connected)

In case of the status LED flashes YELLOW rapidly the FMS Gateway is in firmware update mode. In this mode you can easily update the firmware of the FMS gateway device, change device settings and make measurement from the vehicle's input communication channels.

Possible Faults:

- ❖ **USB cable is connected:**
 - *If USB cable is connected to the device the FMS Gateway is in firmware update mode. Disconnect USB Cable from the device.*

8 Inventure Support information

In case of any problem with device installation, firmware upgrade or any questions please contact Inventure Automotive support team (support@inventure-automotive.com). To get the fastest answer please describe the problem as detailed as possible.

Please provide the following information in case of any problem:

- ❖ Vehicle Type, model year, VIN, Engine code
- ❖ Short description of the problem
- ❖ Company name
- ❖ Device serial number
- ❖ LED status (which color and how often it flashes)
- ❖ Firmware name
- ❖ If you can connect to the device, the whole device information screen content (use FMS Gateway Support Tool)
 - *Bootloader version*
 - *Last update was successful or not*
 - *Update trial counter*
 - *Last update trial date*
 - *Firmware description*

❖ FMS Gateway Support Tool Error message

9 System Characteristics

Parameter	Symbol	Min.	Tip.	Max.	Unit
Power Supply					
Voltage supply	VIGN	8		32	V
Operating current (12V)	I_op		50	70	mA
Operating current (24V)	I_op		30	50	mA
Operating current (Sleep)	I_op		3	4	mA
Environmental characteristics					
Storage temperature		-40		85	°C
Operating temperature		-20		75	°C
Humidity		0		70	%
FMS CAN output interface					
Baud rate			250		Kbaud
FMS CAN terminating resistor			120		Ohm
CAN mode			Normal		
CAN 2.0B ID			29		bit
Box parameters					
Length			110		mm
Width			50		mm
Height			30		mm
Mass			75		g

Table 5: System characteristics

10 Warranty

There is a one-year warranty on FMS GATEWAY G2™ starting from the date of the original purchase. The warranty covers any defect in materials or workmanship. The warranty is valid only if FMS GATEWAY G2™ was operated under normal circumstances in regular use. The warranty does not include damage from misuse or neglect.

As FMS GATEWAY G2™ has a well thought design, it is thoroughly tested before release and it is composed of high quality parts, there should be no need for maintenance of any parts of FMS GATEWAY G2™ during normal operation. If the box was damaged the warranty for FMS GATEWAY G2™ is no longer valid.

Remember to save your sales receipt in case of you ever need warranty service. Please refer to the serial number of your FMS GATEWAY G2™ in case of any problems. The serial number can be found on a label outside the box. In case of warranty claims contact your local dealer or directly Inventure, Inc.

11 How to contact Inventure?

Inventure provides customer support via its World Wide Web (WWW) site. The Inventure website is available by using from your favorite Internet browser at:

www.inventure-automotive.com

Our website provides a variety of services. Read up-to-date information about the company, the products, application possibilities and the services. Frequently asked questions and the corresponding answers are also available on the Inventure site.

If you have problems, questions, suggestions, or you just want to express your opinion about us or our products, please feel free to write an email to us, and we will surely find a way to the solution.

support@inventure-automotive.com

Come and visit our website, tell us your experience concerning our product, fill out the registration form to be able to inform you directly about the latest results of research and development and the continuously improving customer services.

Your comments are also welcome under the following address:

**Inventure Automotive Electronics R&D, Inc.
H-1124 Budapest
Fürj Street 2.
HUNGARY**

Phone: (+36) 1 381-0970

12 List of figures

Figure 1: Device connectors 9
Figure 2: Micro Fit 4-pin (V_CAN 1) assignment..... 10
Figure 3: Micro Fit 10-pin (MAIN) assignment 10
Figure 4: USB Mini B to USB A cable 11
Figure 5: Status LED flashing 13

13 List of Tables

Table 1: Input description 9
Table 2: Micro Fit 4-pin (V_CAN 1) assignment..... 10
Table 3: Micro Fit 10-pin (MAIN) assignment..... 10
Table 5: Device working status 13
Table 6: System characteristics 16



<http://www.inventure-automotive.com>