INTERFACE CONTROL DOCUMENT

SKG417 GATEWAY

INTERFACE SPECIFICATION

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Change History

Revision	Date	Description of Change
00	2020/10/23	First document issue
01	2020/07/16	Table 4: changed note description of data_field[4] and data_field[5..6]. Table 5: changed vbatt note from bin to hex value. Table 5, 6, 8: changed data_field numeration. Table 5, 6, 8: added column for RSSI data_field[7]. Table 7: changed PGN number in caption. Table 8: deleted ID description, changed Values description, added IDs 129 and 130, added data byte, minor Note description change. Changed values @ par. 3.3.1.3.3. General minor typo fixing.
02	2020/10/20	Introduced some applicable documents in section 1.4.2 Removed current consumption in table 1 Changed “vbatt” with “battery indicator” in table 3 and 5 Modified table 9 with average power consumption Added Test mode at pin 9 in table 10 Added Test mode brief description
03	2021/02/01	Added guidelines and best practices in chapter 2.1

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1 Introduction

1.1 Purpose and Scope

The aim of this document is to define all interfaces of SKG417, a Micro.sp® gateway designed and produced by Ste Industries S.r.l.

This document describes all logical and physical interfaces of the product: protocols, connectors, shape and dimensions.

1.2 Acronyms and Abbreviations

Acronyms, terms, symbols and abbreviations are here defined in the context of this document.

ADR	Address
CAN	Controller Area Network
COM	COMmmunication
Hz	Hertz
ICD	Interface Control Document
ID	Identifier
DEVID	Device Identifier
PDU	Protocol Data Unit
PGN	Parameter Group Number

RAM	Random Access Memory
RTC	Real Time Clock
SD	Secure Digital
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver-Transmitter
SW	Software

1.3 Definitions

The definitions provided here are intended to clarify the meaning of the terms used within this document. They can refer to those defined in the glossary of applicable standards, possibly specifying their meaning where necessary.

The order of the definitions is not alphabetical, but thematic in order to facilitate the comparison of terms that can create ambiguity.

ISO	common short name for the International Organization for Standardization

1.4 References and Applicability

1.4.1 Reference Documents

The following documents will be taken as reference.

[MICRO.SP]	ICD-EN000007 - MicroSP frame encoding description
[2.4_ANT]	Design Note DN004 – Folded Dipole Antenna for CC25xx

1.4.2 Applicable Documents

The following documents have to be considered as applicable.

[SPEC]	Rev 00 –	PDD-SKG417
[TPMS-DS]	Rev.00	PDD-VEX1712

[Air-DS]	Rev.xx	Donaldson Air Filter datasheet
[AUTX-DS]	Rev.xx	Donaldson Analog Universal Transmitter datasheet
[DUTX]	Rev.xx	Donaldson Digital Universal Transmitter datasheet
[TEST-MODE]	Rev.00	PRS-EN000002_SKG417_test_software_requirements
[PTR]	Rev.00	PTR-EN000005-01 SKG417BSCAN Test Report

2 Product Overview

Due to the great number of telematics solution available at truck and fleet level, SKG417 has been designed as "add-on" to on board telematics and featuring tasks related to the data collection only. Similarly, to building monitoring gateway, the SKG417 is capable to cover full range of application in truck monitoring and assist fleet management devices with full blend of data collected for example from chassis and tire.

The target application scenario of this product version is:

a) Direct connection to CAN inputs of telematic unit (Master Gateway): data received from sensors are delivered through standard CAN bus protocol with proprietary objects towards on board telematics.

b) Trailer system (Slave Gateway): data are delivered on demand from Slave Gateway to Master Gateway via a RF 2.4GHz link and a proprietary protocol. Sensors' data received by Master Gateway via this link are managed exactly as case a) but the Unit ID will indicate the origin.

The wireless interface guarantees capability to tailor the application according to specific requirements without the complete device to be engineered case to case: a tractor gateway will integrate CAN bus line to gather data through a dedicated bus to the on-board telematics. A suitable radio link between tractor and trailer allows the trailer's sensors to reach the truck gateway. The gateway implements Micro.sp® receiver interface to collect data from sensors deployed in chassis such as temperature in cabin, pressure in tire, humidity in container, door security locking and other foreseeable implementation of wireless sensors to remove cables, with exception to "security and ADAS driven sensor applications.

The gateway is integrated in a waterproof IP69K enclosure.

The installation of the gateway is as easy as possible and does not foresee any configuration, on the truck version; it just sends through the CAN bus line any sensor it receives, identifying itself on the CAN message, as described later on.

The Trailer version requires to be identified, since more than one trailer could be attached to the Truck; this implies a very simple configuration of the Trailer SKG417 that could be done via Ground contacts.

The association of the valves to the truck or to the trailer is made by a separate App that will send all this information on the CLOUD.

Truck-trailer configuration:

a) Data are collected from Truck SKG417 device via Micro.sp® and delivered via CAN to on board telematics

b) Data are collected from Trailer SKG417 device via Micro.sp® and delivered via RF link to the Truck SKG417

c) Data collected by Truck SKG417 via radio link from Trailer are delivered via CAN to on board telematics

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At present, two variants of SKG417 family are produced: SKG417ST1 and SKG417BSCAN.

The two variants are identical on radio, electrical and mechanical point of view and have only two small functional differences:

- SKG417BSCAN has the ability to select the CAN bus speed at 250kbps or 500kbps and enable or disable the CAN bus load resistor. These features are selectable by setting the external connector pins as in the table below.

Configuration	Required settings
CAN speed = 500 kbps, CAN load	Leave pins 11 and 12 unconnected
CAN speed = 250 kbps, CAN load	Set pin 11 to GND, leave pin 12 unconnected
CAN speed = 500 kbps, CAN load disabled	Leave pin 11 unconnected, set pin 12 to GND. Apply a 120Ω resistor between signals CAN-L and CAN-H (pins 7 and 8).
CAN speed = 250 kbps, CAN load disabled	Set pins 11 and 12 to GND, apply a 120Ω resistor between signals CAN-L and CAN-H (pins 7 and 8).

- SKG417ST1 has CAN bus speed fixed at 500kbps and the load resistance is always enabled.

2.1 Guidelines and best practices for installation

Installation shall be performed by authorized personnel only, with skills on electrical side and full knowledge of the product documentation.

The product can be installed in any location, provided that there are no reflecting surfaces (e.g. metal sheets, large metal walls) near the vehicle, which may affect signal propagation.

The first step is to find the best positioning for the units to be installed. Theoretically, best radio performance is achieved when there is line of sight between Master and Slave. In practice, considering the structure of the vehicle, device positions must have as much free air and visibility as possible, to optimize sensor reception and Master-Slave link quality.

If the product shall be fixed to the vehicle using a metal sheet, keep it small as possible, otherwise it may affect radio propagation. In the example of the figure below, the upper part of the device (where 434MHz antenna is located) is free from the influence of the metal sheet.

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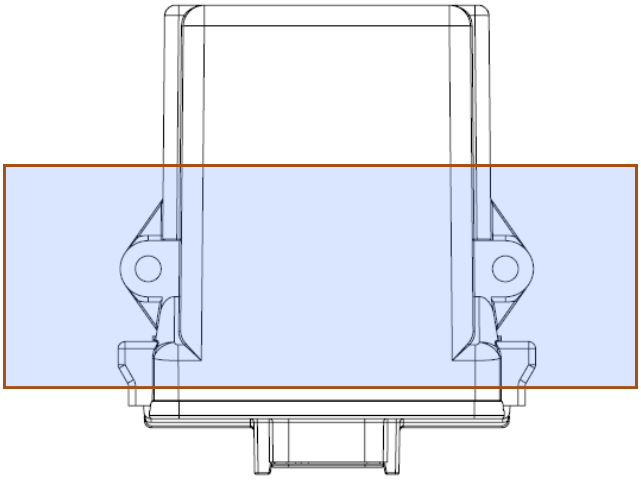


Fig. 1 - Metal sheet for fixing the device to the vehicle

For reliable radio performance, Master and Slave shall not be installed at a distance ≥ 20m from each other.

The following additional precautions must be taken:

- Make sure that the vehicle is stationary when the product is installed.
- Make sure to position the device so that it does not obstruct the view of the road, vehicle controls or rear-view mirrors.
- Make sure not to drill into parts of the frame that have structural or safety-related functions.
- Make sure not to drill into electrical wiring, fuel lines or similar components. Drilling these can cause fires.
- Do not place the product near electromagnetic fields, high bitrate cables or other radio devices that could disturb its correct functioning.
- Do not place the product inside the vehicle cab.
- The product should be mounted on a plain flat surface on the vehicle frame.

The location of the two antennas of the device is shown in the figure below.

Due to the radiation pattern of the antenna (see reference document [2.4_ANT] for more information), 2.4GHz Master-Slave link has slightly better performances when the 2.4GHz antennas of Master and Slave are facing each other (i.e. when one of the two devices is as in the picture below, and the other is turned by 180°) and both devices are installed in horizontal position (i.e. parallel to the ground plane).

Good results are also obtained on the perpendicular direction, as described in the reference document [PTR].

Concerning 434MHz receiver antenna, according to [PTR], best directions are along the longitudinal axis, as shown in the figure below.

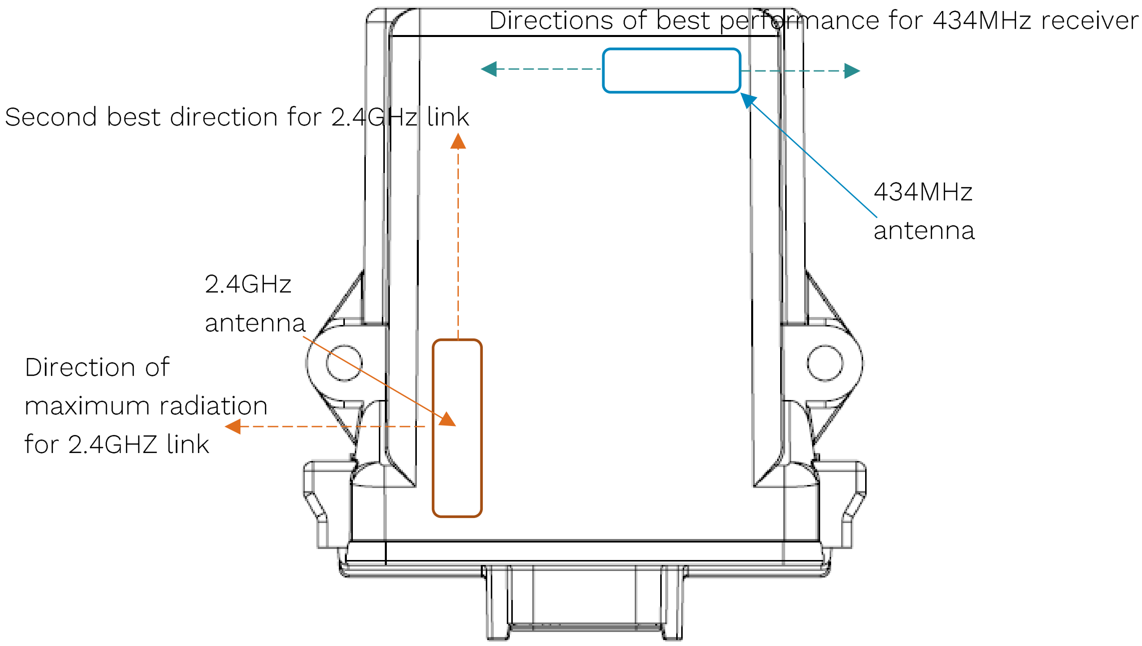
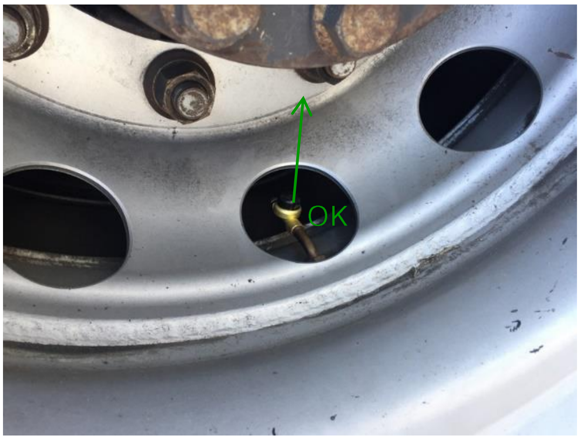


Fig. 2 - Location of the antennas

For 434MHz link, also the positions of the transmitters must be taken into account to determine system performance. Best results are obtained when the sensors on the tires are placed with the plastic cap facing the exterior of the tire rim (see pictures below for an example).



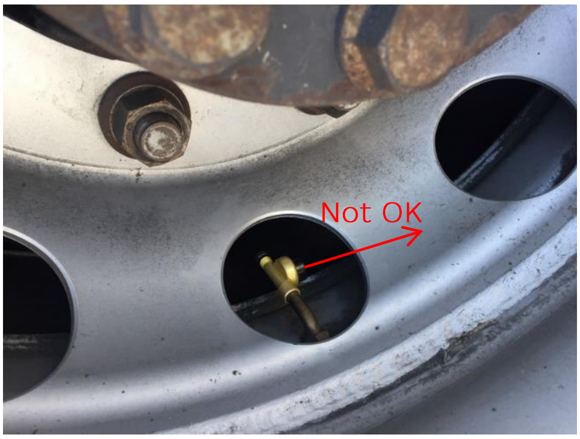


Fig. 3 – Examples of sensor orientation with high (left) and low (right) signal strength

Also notice that system performance is affected by the position of the sensor above the ground: RF signal is usually maximum when the sensor is in its upmost position and minimum in its lowest position. So, if a particular sensor is received poorly, it may be useful to move the vehicle 1-2m forward to see if the reception improves.

The product shall be installed on the vehicle and connected to Power Supply and CAN bus interface through the connector on the box.

Connection cabling shall leave ADR 1 and ADR 2 pins unconnected to configure the SKG417 as Master unit. When the SKG417 is installed on a trailer, it has to be connected to Power Supply. Connection cabling shall either connect ADR 1 and/or ADR 2 pins to Ground or leave them unconnected to configure the SKG417 as Slave unit with Unit ID as specified in Table 12 – Pin function for Unit ID setting.

2.2 Operating mode

Once switched on, a Slave unit begins to collect data from TPMS sensors received via Micro.sp®, stores each record in a memory buffer and then sends these Micro.sp® records every 9 seconds via radio link message 2.4GHz. To prevent more than one Slave unit from transmitting a message on the 2.4GHz link synchronously, a delay of t = 3 * n is added to the start of Slave # n (with n from 1 to 3). The maximum payload capacity of the data message is fixed in two Micro.sp® records.

Once powered on, the Master unit starts collecting data from TPMS sensors received via Micro.sp® and sends each record to telematics device via CAN bus using object PGN 61646 and from Slave units (up to 3 units) over 2.4GHz radio link.Every time a message is received from one Slave unit containing TPMS records, an object PGN 61646 is sent throughout the CAN bus towards the on-board telematic unit. The Master unit sends a Keep-Alive message every 180 seconds to the on-board telematic unit using object PGN 61647.

2.3 Regulatory and Safety

The design of SKG417 satisfies the following regulations and standards:

1. Europe: RED directive including:
    a) EMC
    b) LVD
    c) UL 60950-22 (for Outdoor)
2. IP69K
3. Safety: IECEE Certification Bodies Scheme (CB Scheme).
4. Vehicle Usage: E-Mark (72/245/EEC, 2009/19/EC), ISO7637-2, SAE J1455 (Shock & Vibration)
5. Environmental: RoHS2, REACH, WEEE.
6. USA: FCC

3 Communication Interfaces

The SKG417 is equipped with:

- Micro.sp® receiver with integrated antenna.
- A 2.4 GHz proprietary radio interface for Truck Trailer communication with integrated antenna
- CAN controller for data communication with on board telematics

The microcontroller is an ARM Cortex M3.

3.1 Micro.sp® Receiver Interface

An advanced highly integrated Micro.SP® radio receiver module is used to interface the Micro.SP® sensors.
The communication link is mono directional from the sensor to the gateway.
This radio interface must be able to manage messages coming from Micro.SP® sensors, there is no filtering options available, meaning that any valid frame received by a Micro.SP® sensor is routed to the CAN interface.
The supported protocol is a proprietary as specified in [MICRO.SP].
The antenna is an internal vertical loop antenna.

The following table synthetizes the electrical parameters of the Micro.SP® radio interface

Table 1 – Micro.SP® Electrical Parameters

Operating values	
Operating frequency	434.4 MHz
Selectivity	300KHz
Sensitivity	-96dBm
Modulation	Pulse Peak Modulation

3.2 Truck Trailer Radio Link Interface

This Radio interface is used to convey data from trailer to the tractor master unit and therefore helps the connection between a slave module placed on the trailer and a master module placed on the truck.

The adopted Radio frequency is the 2.4GHz that is a worldwide free band.

The chip used to support this interface is the Texas CC2500.

3.3 CAN bus Interface

Controller Area Network (CAN) is the definition of a high-performance communication protocol for serial data communication.

The CAN controller of the SKG417 is integrated into the main controller.

The CAN Controller is designed to provide a full implementation of the CAN-Protocol according to the CAN Specification Version 2.0B.

General CAN features:

- Compatible with CAN specification 2.0B
- port ISO 11898-2-5-6 (HS CAN)
- Multi-master architecture with nondestructive bit-wise arbitration.
- Bus access priority determined by the message identifier (11-bit or 29-bit).

The CAN used on the master SKG417 fitted on the tractor, adopts a proprietary scheme and is a bus mainly designed to interface the on-board telematics, as described in the next paragraph.

3.3.1 CAN Protocol

Due to the nature of wireless sub-networks, there are some objective limitations on the J1939 messages that suggest using a proprietary protocol in order to ease the installation and the configuration of the SKG417, as following defined.

3.3.1.1 Keep Alive message

The purpose of this message is to help to locate and diagnose any communication problem to a missing link between the Telematics and the SKG417 and to provide the firmware version installed on the device.

This message is sent by the SKG417 over the CAN bus every 180 seconds and contains the DEVID of the Gateway (8 byte).

A very simple logic on the Telematics can be implemented so that if this message is missed for x times, a communication alarm can be raised.

The Proprietary J1939 message for this purpose is PGN 61647 (0xF0CF) described as follows:

Table 2 – PGN 61647 (0xF0CF) message

CAN ID 0x18F0CF33		
Field Name	Value	Note
numbytes	8	8 bytes message
pdu_format	240	format: 0xF0
pdu_specific	207	spc: 0xCF
priority	6	priority: 6
src_address	51	CAN address: 51 (0x33, address tires)
DP	0	
R	0	
Data		
data_field[0]	(MSB)	DEVID
data_field[1]		
data_field[2]		
data_field[3]		
data_field[4]		
data_field[5]	(LSB)	
data_field[6]	FW Major	FW version Major
data_field[7]	FW Minor	FW version Minor

3.3.1.2 TPMS message

Tire pressure monitoring systems sends data about pressure and temperature of the tire where it is mounted on.

The Proprietary J1939 message sent by the Master Unit is PGN 61646 (0xF0CE), which is 8 byte long with following data:

Unit ID + TPMS ID + Pressure + Temperature + Battery Status.

Where Unit ID (2 bit) represents a Type indicator to identify the receiver of the Micro.sp® message coming from the sensor (0 for Master, 1/2/3 for Slaves/Trailers)

The Micro.sp® message has to be sent as soon as such message is received on one of the two available radio interfaces (Micro.sp® or the 2.4Ghz links).

The Proprietary J1939 message for this purpose is PGN 61646 (0xF0CE) described as follows:

Table 3 – PGN 61646 (0xF0CE) message

CAN ID 0x18F0CE33		
Field Name	Value	Note
numbytes	8	8 bytes message
pdu_format	240	format: 0xF0
pdu_specific	207	spc: 0xCE
priority	6	priority: 6
src_address	51	CAN address: 51 (0x33, address tires)
DP	0	
R	0	
Data		
data_field[0]	bitfield	Bit 0..1: reserved Bit 2..3: battery indicator Bit 4..5: reserved Bit 6..7: Unit ID = 0 – 3 Example: 0x30 battery indicator = 11 (fully charged battery) unit id = 0 (master)
data_field[1..4]	32 bit value	TPMS UID sensor (MSB to LSB)
data_field[5]	8 bit value	tire pressure SPN241 (refers to J1939)
data_field[6-7]	16 bit value	tire temperature SPN242 (refers to J1939)

NOTE!

Plese refer to [TPMS-DS] document in par.1.4.2

Example CAN message for TPMS record received by Master Unit:

CAN Raw Message:

18 F0 CE 33 30 01 02 4c 23 00 24 A9 (little endian)

Decoded message fields:

CAN ID = 0x18F0CE33

battery indicator = 3 (fully charged battery); Unit ID = 0 (Master)

TPMS ID = 0x01024c23

Pres = 0 -> 0*6 (Kpa) = 0 kPa

Temp = 0x24A9 -> 9385*0.03125 – 273 = 20.28 C

See [TPMS-DS] reference document for more information on conversion formulas.

Example CAN message for TPMS record received by Slave Unit #2:

CAN Raw Message:

18 F0 CE 33 32 01 02 4c 23 00 24 A9 (little endian)

Decoded message fields:

CAN ID = 0x18F0CE33

battery indicator = 11 (fully charged battery); Unit ID = 2 (Slave #2)

TPMS ID = 0x01024c23

Pres = 0 -> 0*6 (Kpa) = 0 kPa

Temp = 0x24A9 -> 9385*0.03125 – 273 = 20.28 C

See [TPMS-DS] reference document for more information on conversion formulas.

3.3.1.3 General STE message

The SKG417 device is designed to manage a variety of different Micro.SP® devices, known as the Micro.SP® hyper low power sensors vehicle sub-network, such as TPMS, Air Filter, Universal Transmitters, liquid , light monitoring, axis sensors and additional sensor types as they will become available in future development of the Micro.SP® hyper low power sensors vehicle sub-network ecosystem.

For this reason, a general STE message is defined so that the message structure will be the same for all the present and future supported sensors, while the “specialization” of the message for each sensor is based on the content of the ”pdu_special_data_fields”.

The message sent by the Master Unit is 8 byte long => Sensor ID + Measurement ID + Measurement Value.

Multiple general STE messages will be transmitted for the sensors that will be able to transmit multiple measurements values.

This message has to be sent as soon as a message is received on a radio interface, either the Micro.sp® or the 2.4Ghz.

Table 4 – PGN 61244 (0xEF3C) message

CAN ID 0x18EF3C33		
Field Name	Value	Note
numbytes	8	8 bytes message
pdu_format	239	format: 0xEF
pdu_specific	60	spc: 0x3C
priority	6	priority: 6
src_address	51	CAN address: 51 (0x33, address tires)
DP	0	
R	0	
Data		
data_field[0..3]	32 bit value	Sensor UID (MSB to LSB)
data_field[4]	8 bit value	Measurement ID (see tables 5, 6 and 8)
data_field[5..6]	Bitfield	Measurement values (see tables 5, 6 and 8)
data_field[7]	Reserved	

The following paragraphs summarize the different kind of measurements carried by the PGN 61244 (0xEF3C) messages.

3.3.1.3.1 Air Filter messages

In case of the Air Filter sensor the four General STE messages are transmitted by the SKG417 device to the J1939 CAN bus, as detailed below:

Table 5 – PGN 61244 (0xEF3C) message: Air Filter measures

ID	**Values**	

data_field[4]	data_field[5]	data_field[6]	data_field[7]	Note
5 ID & vbatt	Unit ID: 0 Master 1..3 Slaves/Trailers	vbatt: Bit 0..5: reserved Bit 6..7: vbatt	Reserved	Example: data_field[5..6] = 0x0003 Unit ID: = 0 (master) battery indicator = 11 (fully charged battery)
1 Pressure	Pressure value: Data Length: 2 bytes Resolution: 0.374 mBar/bit Data Range: 0 to -382 mBar		Reserved	Please refer to [Air-DS] document in section 1.4.2
2 Temperature	Temperature value: Data Length: 1 byte Resolution: 1.65°C/bit Data Range: -46°C to +150°C		Reserved	Please refer to [Air-DS] document in section 1.4.2
23 RSSI	Noise: 12 bits: data_field[5] & data_field[6][0-3]; RSSI: 12 bits: data_field[6][4-7] & data_field[7].			

3.3.1.3.2 Analogue Universal Transmitter message

In case of the Analogue Universal Transmitter the message is used to transport the raw data (voltage) acquired from the two analogue channels available for the sensors' connection.

The information related to the Unit ID and the battery level are not managed for this type of device due to the fact that the Universal Transmitter will be always installed on the Truck and not on the Trailers and that it will be powered by the vehicle battery and not from an internal battery (as for TPMS or Air Filter sensors).

The data acquired by the analogue Universal Transmitter are transferred to CAN bus via two General STE messages plus one for radio connection noise and RSSI:

Table 6 – PGN 61244 (0xEF3C) message: Analogue Universal Transmitter measures

ID data_field[4]	Values data_field[5]	data_field[6]	data_field[7]	Note
21 voltage ch1	Voltage value: Data Length: 2 bytes Resolution: see note Data Range: 0 to 1024 raw value		Reserved	Please refer to [AUTX-DS] document in section 1.4.2
22 voltage ch2	Voltage value: Data Length: 2 bytes Resolution: see note Data Range: 0 to 1024 raw value		Reserved	
23 RSSI	Noise: 12 bits: data_field[5] & data_field[6][0-3]; RSSI: 12 bits: data_field[6][4-7] & data_field[7].			

3.3.1.3.3 Digital Universal Transmitter

This message is used to transport the data acquired by the Universal Transmitter device from external digital sensors (physically connected via the Digital Universal Transmitter CAN Bus interface).

The message content is dependent from the connected sensor, typically a digital sensor is able to transmit multiple PGN objects, thus requiring SKG417 firmware to remaps each received PGN into multiple proprietary J1939 messages.

Due to the fact that the Universal Transmitter will be always installed on the Truck and not on the Trailers and that it will be powered by the vehicle battery and not from an internal battery (as for TPMS or Air Filter sensors), the information related to the Unit ID and the battery level are not managed for this type of device.

The data acquired by the digital Universal Transmitter are transferred to CAN bus via multiple General STE messages, each one corresponding to a STN field, as represented in the following example:

One of the standard PGNs transmitted by the digital sensor is the PGN 61244 - 0xEF3C Engine Oil is defined as follows:

- Transmission Repetition Rate: 30 seconds
- Source address: 0x33
- Data Length: 8 bytes
- Data Page: 0
- PDU Format: 239 (0xEF)
- PDU Specific: 60 (0x3C)
- Default Priority: 6
- Parameter Group Number: 61244

And the Data field is structured as summarized in the following table:

Table 7 – PGN 61244 (0xEF3C) Engine data fields

Bytes	Bytes length	SPN	SPN description
1-2	2 bytes	5055	Engine Oil Viscosity
3-4	2 bytes	5056	Engine Oil Density
5-6	2 bytes	-	Reserved - 0xFFFF
7-8	2 bytes	5068	Engine Oil Dielectric constant

The above PGN is received via CAN Bus from the Digital Universal Transmitter and then transferred to Micro.sp®. The SKG417 receives the Micro.sp® frame and transforms the received data to a sequence of three General STE messages plus one for radio connection noise and RSSI, as detailed below:

Table 8 – PGN 61244 (0xEF3C) message: Digital Universal Transmitter measures

<table>
<tr><th>ID
data_field[4]</th><th colspan="3">Values
data_field[5] data_field[6] data_field[7]</th><th rowspan="1">Note</th></tr>
<tr><td>126</td><td colspan="2">CAN PGN
Data Length: 2 bytes</td><td>Reserved</td><td rowspan="4">The values and meanings assumed by the Measurement Value fields are dependent on the Digital sensor and can be decoded by referring to the [DUTX-</td></tr>
<tr><td rowspan="2">127</td><td colspan="2">CAN Data bytes
Data Length: 2 bytes</td><td rowspan="2">Reserved</td></tr>
<tr><td>D1</td><td>D0</td></tr>
<tr><td>128</td><td colspan="2">CAN Data bytes
Data Length: 2 bytes</td><td>Reserved</td></tr>
</table>

<table>
<tr><td rowspan="2"></td><td colspan="2"></td><td rowspan="2"></td><td rowspan="7">DS] document in section 1.4.2</td></tr>
<tr><td>D3</td><td>D2</td></tr>
<tr><td rowspan="2">129</td><td colspan="2">CAN Data bytes
Data Length: 2 bytes</td><td rowspan="2">Reserved</td></tr>
<tr><td>D5</td><td>D4</td></tr>
<tr><td rowspan="2">130</td><td colspan="2">CAN Data bytes
Data Length: 2 bytes</td><td rowspan="2">Reserved</td></tr>
<tr><td>D7</td><td>D6</td></tr>
<tr><td>23
RSSI</td><td colspan="3">Noise: 12 bits: data_field[5] & data_field[6][0-3];
RSSI: 12 bits: data_field[6][4-7] & data_field[7].</td></tr>
</table>

3.4 Radio link RSSI Monitor message

The purpose of this message is to evaluate the power strength of the radio link at 2,4GHz between Master and Slave units.

This message is sent by the Master SKG417 over the CAN bus every 5 minutes, and contains the RSSI level in dBm (one byte in two's complement) of the Master side Rx and Slave side Rx respectively for the three Master/Slaves links.

Table 9 – PGN 61652 (0xF0D4) message

CAN ID 0x18F0D433		
Field Name	Value	Note
numbytes	8	8 bytes message
pdu_format	240	format: 0xF0
pdu_specific	212	spc: 0xD4
priority	6	priority: 6
src_address	51	CAN address: 51 (0x33, address tires)
DP	0	
R	0	
Data		
data_field[0]	8 bit value	Master/Slave #1 RSSI on Rx Master
data_field[1]	8 bit value	0
data_field[2]	8 bit value	Master/Slave #2 RSSI on Rx Master

data_field[3]	8 bit value	0
data_field[4]	8 bit value	Master/Slave #3 RSSI on Rx Master
data_field[5-7]	24 bit value	0

Example CAN message for RSSI monitor message:

18 F0 D4 33 AB 00 B3 00 00 00 00 00

- CAN ID = 0x18F0D433
- Master/Slave #3 RSSI on Rx Master = 0 (Slave #3 not present)
- Master/Slave #2 RSSI on Rx Master = -85 dBm
- Master/Slave #1 RSSI on Rx Master = -77 dBm

3.5 Electrical Interfaces

The main input power supply comes from the truck battery, and ranges from 8 to 32 Vdc.

Low voltage disconnects to prevent battery drain.

Built-in protection against voltage transients according to the standard mentioned in chapter 6.

The following table summarizes the power inputs of the SKG417 device.

Table 10 – Electrical Characteristics

Parameter	Value	Note
Input Voltage	8-32 Vdc	
Average Power consumption	1 W	

3.6 Mechanical Interfaces

SKG417 device is made of a mechanical layout box type TE EEC-325X4B with the following dimensions:

PCBA 135 x 117 x 36 (L x W x H)

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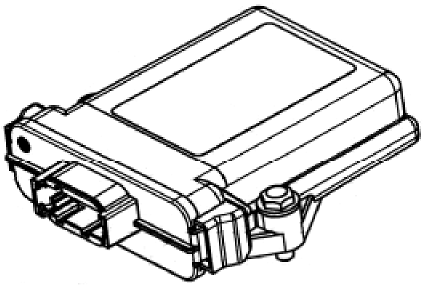

Fig. 4 - SKG417 with a vehicular box configuration

3.6.1 Connectors

A suitable connector, type DTM06-12SA from TE Connectivity is provided on the SKG417, it features connections for CAN lines, as well as Power and generic I/O (NC = Not Connected).

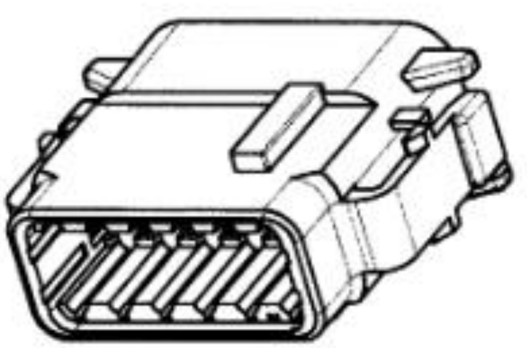

Fig. 5 - DTM06-12SA connector

Table 11 – DTM06-12SA connector pinout

Pinout					
7. CAN-H	8. CAN-L	9. TEST MODE	10. NC	11. CAN SPEED	12. CAN LOAD
6. ADR2	5. ADR1	4. NC	3. GND	2. NC	1. VIN

Test Mode

Device enters in test mode only if, at a power on, the related pin is connected to ground.

The test mode is used in the manufacturing and installation procedure to verify the correct behavior of a device. For a more detailed explanation see the [TEST-MODE] document in section 1.4.2.

the configurations that can be implemented are:

Table 12 – Pin function for Unit ID setting

ADR2	ADR1	Unit ID
NC	NC	0 - Master
NC	GND	1 - Slave #1
GND	NC	2 - Slave #2
GND	GND	3 - Slave #3

Table 13 – Pin function for CAN bus setting

CAN SPEED	
NC	500Kbit/s
GND	205Kbit/s

CAN LOAD	
NC	120Ω load on CAN bus
GND	no load

A “back shell” type 1028-015-1205 from TE Connectivity is provided to comply with the IP69K specification.

A custom cable to interface the box to the vehicle cabling system has to be defined time by time.