owa5X

Integrator's Manual

owasys®

HMS GROUP MEMBER

CE UKCA FC

The products described in this manual will conform to the essential Requirements in Radio Equipment Directive (RED) 2014/53/EU, covering requirements included in EMC directive 2014/30/EU Low Voltage Directive 2014/35/EU as well as any other applicable requirements as those from RoHS Directive 2011/65/EU as amended by 2015/863/EU.

The information contained in this document is the proprietary information of Owasys®.

The contents are confidential and any disclosure to persons other than the officers, employees, agents or subcontractors of the owner or licensee of this document, without the prior written consent of **Owasys**®, is strictly prohibited.

Declaration of conformity can be found at www.owasys.com

Edition 24/09/2025

Owasys® publishes this manual without making any warranty regarding the content contained herein. Further, **Owasys**® reserves the right to make modifications to this manual due to typographical errors, inaccurate information, or improvements to programs and/or equipment at any time and without notice. Such changes will, nevertheless, be incorporated into new editions of this manual.

Document number: BOK–000 5002
Document version: J

Trademarks

© ARM is a registered trademark of ARM Limited.
Linux is a registered trademark of Linus Torvalds.

DISPOSAL OF OLD ELECTRICAL & ELECTRONIC EQUIPMENT (APPLICABLE IN THE EUROPEAN UNION AND OTHER EUROPEAN COUNTRIES WITH SEPARATE COLLECTION SYSTEMS).

This product shall not be treated as household waste. Instead, it shall be handed over to the applicable collection point for the recycling of electrical and electronic equipment. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. The recycling of materials will help to conserve natural resources. For more detailed information about the recycling of this product, please contact your local council, your waste disposal service or the distributor where you purchased the product.

Index

Illustration Index

1 Safety and other precautions

1.1 General

IMPORTANT: FOR THE EFFICIENT AND SAFE OPERATION OF YOUR owa5X MODULE, READ THIS INFORMATION BEFORE USE!

Care must be taken when handling the unit. It must not be dropped or exposed to excessive heat.

Only authorized staff can disassemble the product. In case the product was disassembled by non-authorized people, the warranty is no longer valid.

Do not push objects into the openings of your device. Doing so can cause a fire or an electric shock by shorting out interior components.

The owa5X product has not been designed for outdoor conditions. If the product is exposed to severe conditions beyond the limits specified in Environmental Specifications, the product could be damaged.

Keep the device away from radiators and heat sources. Do not use the owa5X in wet or humid environments, for example, near the bathtub, sink, or swimming pool or in a damp basement.

The device may become hot during normal operation, so switch it off and wait for a while before handling it.

Do not clean the device when powered. Clean it with a soft cloth. Do not use liquid or aerosol cleaners, which may contain flammable substances.

1.2 owa5X connections

The highest internal voltage applied to the owa5X unit can be 36Vdc and complies with the low voltage European directive.

The power supply can be made with a battery or a continuous voltage supply with reinforced isolation.

Before you connect the device to a power supply, check the voltage and current rating to ensure that the required ones match the available power source. Exceeding the specified input range may cause unexpected operation and/or irreversible damage to owa5X.

To remove the device from all power sources, turn the device off and disconnect it from the power supply. Units with the internal back-up battery will keep powered until the battery is empty, or ON/OFF signal is held to GND connection.

Be sure that nothing rests on the connected cables and that the cables are not located where they can be tripped over or stepped on.

Applying loads outside of the range specified may result in unintended operation and/or possible permanent damage to owa5X. If there is any uncertainty, please contact
owasys Customer Support at customer_support@owasys.com.

1.3 owa5X protections

The owa5X inputs have some protections to avoid damage when erroneously connecting to a power supply, for example, or due to voltage peaks:

- Power supply input (V_IN) reverse voltage protection and overvoltage protection. An external fuse of 20 A should be added externally in the installation.
- Power output (V_OUT) overcurrent protection.
- DIOs' overcurrent protection.

1.4 EMC Instructions

Use shielded signal cables to ensure that you maintain the appropriate EMC classification for the intended environment.

Keep cables as short as possible.

1.5 Exposure to RF Energy

Minimize RF energy exposure by limiting the duration of GSM calls and operating the unit efficiently.

The antenna must be mounted in such a position that no part of the human body rests close to any part of the antenna. The product is intended to be used with an external GSM antenna, located at least 20 cm away from any part of the human body. Those installations not complying with this statement are responsible for providing SAR measurement reports and the corresponding declaration.

Do not hold the antenna during a call since it affects call quality and can cause the module to operate at a higher power level than needed.

1.6 Antenna care and replacement.

Do not use the product with a damaged antenna because when the antenna comes into contact with the skin, a minor burn may result. Replace the antenna immediately.

Use only antennas that are according to the technical specifications. Antennas that do not fulfil the specifications could damage the product and may contravene local RF emissions regulations or invalidate type approval.

1.7 Electronic devices

Most electronic devices are shielded from RF energy. However, RF energy may cause some malfunctioning of improperly shielded electronic devices.

When the product is mounted in a vehicle, check your vehicle to determine that all on-board electronic equipment is adequately shielded from RF energy.

In the same way, when the product is in the proximity of medical devices (hospitals, etc.), check with the manufacturer of medical equipment to determine if they are properly shielded.

This equipment should never be operated on an aircraft.

1.8 Blasting areas

To avoid interfering with blasting operations, turn the unit OFF in these kinds of areas or areas ported, "turn off your two-way radio".

Construction crew often uses remote control RF devices to set off explosives.

1.9 Children

Do not allow children to play with owa5X. It is not a toy, and they could hurt themselves or others. Children could also damage the unit.

1.10 Explosive atmospheres

Do not operate this product in environments containing explosive materials or vapour. This includes petrol service stations.

The unit accessories could generate sparks that can cause an explosion or fire, resulting in bodily injury or even death.

To avoid interfering with blasting operations, turn the unit off in areas posted "blasting area".

Do not transport or store flammable gas, liquid or explosives in the compartment of your vehicle which contains owa5X or its accessories.

1.11   Handling the device

Observe the following safe-handling guidelines to prevent damage to owa5X:

- When setting up the device for work, place it on a flat, level surface.

- Protect the device from environmental hazards such as dirt, dust, food, liquids, temperature extremes, and overexposure to sunlight.

- When you move your device between environments with very different temperature and/or humidity ranges, condensation may form on or within the device. To avoid damaging it, allow sufficient time for the moisture to evaporate before using the device.

- When taking the device from low-temperature conditions into a warmer environment or from high-temperature conditions into a cooler environment, allow the device to acclimate to room temperature before turning on power.

- When disconnecting a cable, pull on its connector or its strain-relief loop, not on the cable itself. As you pull out the connector, keep it evenly aligned to avoid bending any connector pins. Also, before you connect a cable, make sure both connectors are correctly oriented and aligned.

1.12   For owa5X with Back-up battery

These models include the optional lithium-ion battery backup. Do not dispose of the battery along with household waste. Contact your local waste disposal agency for the address of the nearest battery disposal site.

The battery poses a burn hazard if you handle it improperly. So do not disassemble or handle it. If the battery is damaged, electrolyte may leak from the cells and may cause personal injury.

Keep the battery away from children.

When the battery is heated to excessive temperatures, its cells could explode or vent, posing a risk of fire.

2   Introduction

2.1   Overview

The owa5X Integrators Manual describes how to install, set up, and configure owa5X Platform product.

The owa5X device can be provided with battery backup as an option.

This first section provides a brief overview of the product, followed by a "Getting Started" chapter. Further sections go into more detail on the hardware specifications and various firmware functions available for the development of the user application. Application notes, technical specifications, troubleshooting, and a peripheral devices reference complete this manual.

2.2   What is the owa5X Platform

The owa5X product provides a powerful platform for the management of geographically distributed equipment. The owa5X unit integrates a GSM/GPRS communication system with embedded IP functionality, allowing an efficient and bi-directional transmission of information across the cellular wireless network. Additionally, the owa5X unit includes a GNSS receiver for reception of positioning information.

The basic features of this product are:

- Cortex A53(x4) + M7 with 2 GB LPDDR4, 8 GB eMMC and 1 GB NAND Flash.

- Linux Kernel

- Debian Filesystem.

- User-friendly programming environment with a complete set of APIs.

- LTE-FDD: B1/B2/B3/B4/B5/B7/B8/B12/B13/B18/B19/B20/B25/B26/B28.

- LTE-TDD: B38/B39/B40/B41.

- UMTS: B1/B2/B4/B5/B6/B8/B19.

- GSM: 850/900/1800/1900 MHz.

- GNSS Receiver 72-channel with -160dBm tracking and navigation sensitivity.

- Interfaces, extensive range: RS-232, RS-485, iButton, digital and analog I/Os.

- CAN-FD, up to 4 interfaces.

- Accelerometer, programmable with 3-axis.

- USB 3.0 – Type A.

- MicroSD card holder – Hinge Type.

- SIM hinged card holder – Hinge Type.

- IP67 enclosure.

Optional features are:

- Single Pair Ethernet IEEE 802.3bw 100BASE-T1.

- 10/100BASE-TX

- Dead reckoning GNSS.

- Programmable 6-axis sensor (accelerometer, gyroscope).

- Wi-Fi 5 (802.11ac) & BT 5.2 module.

- Up to 4 CAN SIC-FD bus interfaces.

- RS-485 (1 Mbps).

- DRAM, 2 GB LPDDR4 as default and scalable on demand.

- eMMC, 8 GB as default and scalable on demand.

Check the data sheet and product variants for the exact features available in your device.

Abbreviations

API	Application Programming Interface
CAN	Controller Area Network
CEP	Circular Error Probability
CPU	Central Processing Unit
DTE	Data Terminal Equipment
EDGE	Enhanced Data GSM Environment
GPRS	General Packet Radio Service
GNSS	Global Navigation Satellite System
GSM	Global System Mobile
HSDPA	High-Speed Downlink Packet Access
HW	Hardware
LTE-FDD	Long-Term Evolution Frequency-Division Duplex
LTE-TDD	Long-Term Evolution Time-Division Duplex
MIPS	Millions of Instructions Per Second
MMU	Memory Management Unit
NC	Not Connected
O&M	Operation and Maintenance
OS	Operating system
PWM	Pulse Width Modulation
RTC	Real Time Clock
SAR	Specific Absorption Rate
SIM	Subscriber Identity Module
SMS	Short Message System
SW	Software
TTY	TeleType Writer
UMTS	Universal Mobile Telecommunications System
USB	Universal Serial Bus
VSWR	Voltage Standing Wave Ratio

2.1 Abbreviations list

2.3   Notes and Warnings

Note – Notes provide additional information about the products.

Cautions – Cautions alert you to situations that could cause hardware damage or software errors.

3 Getting started with the DK

3.1 Introduction

This section explains the steps to install and configure the owa5X UDK development kit to begin with the set–up of the customer application.

Starting with the list of components the development kit includes, the document follows with a physical description of the unit, the steps for mounting and connecting the components and then, the software set up procedure.

Finally, there is a description of the operating modes and the indicator lights of the unit.

3.2 Development Kit Contents

Refer to the documentation included with your Development Kit to know which the items are actually included in the package.

3.3 Block Diagram
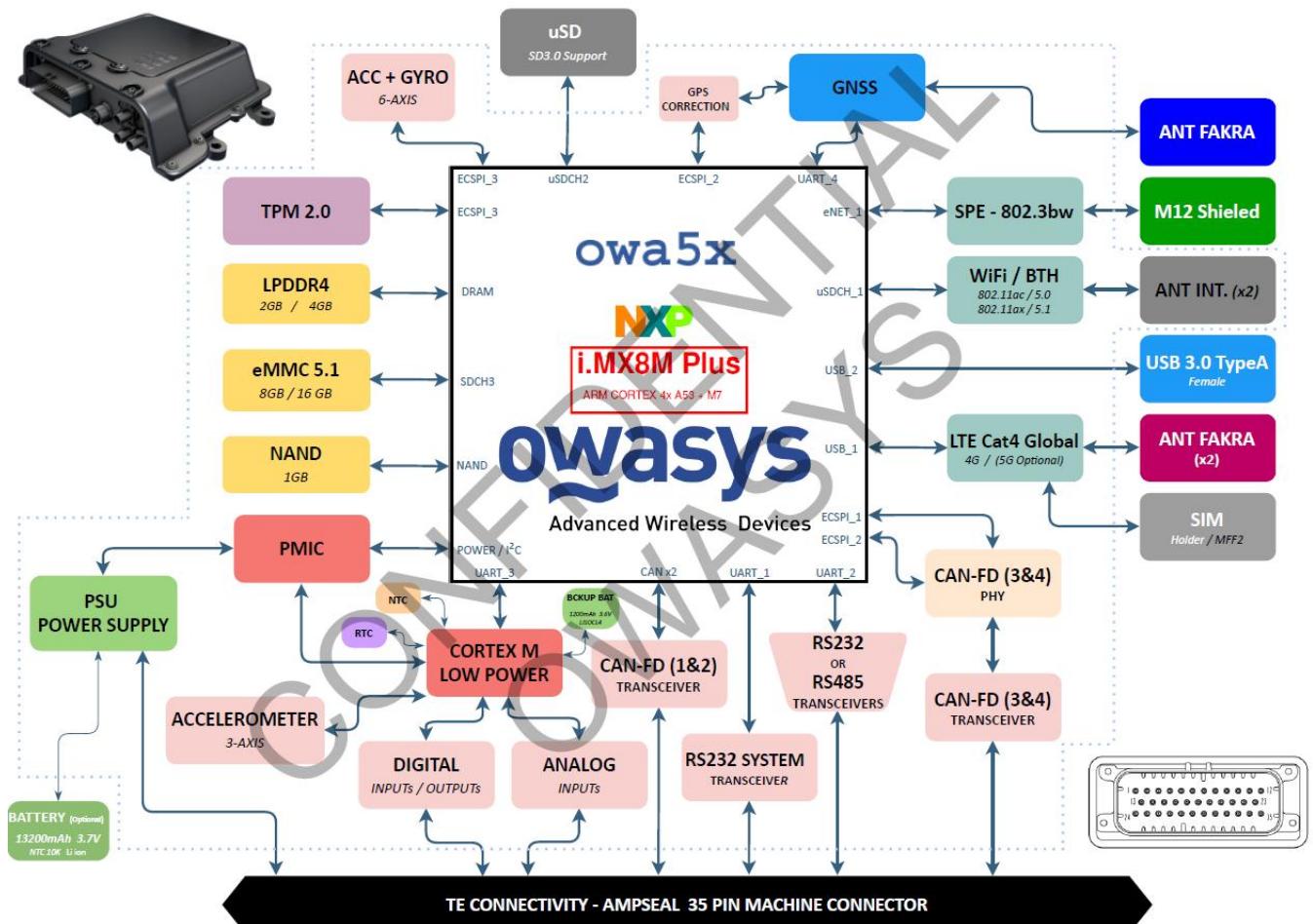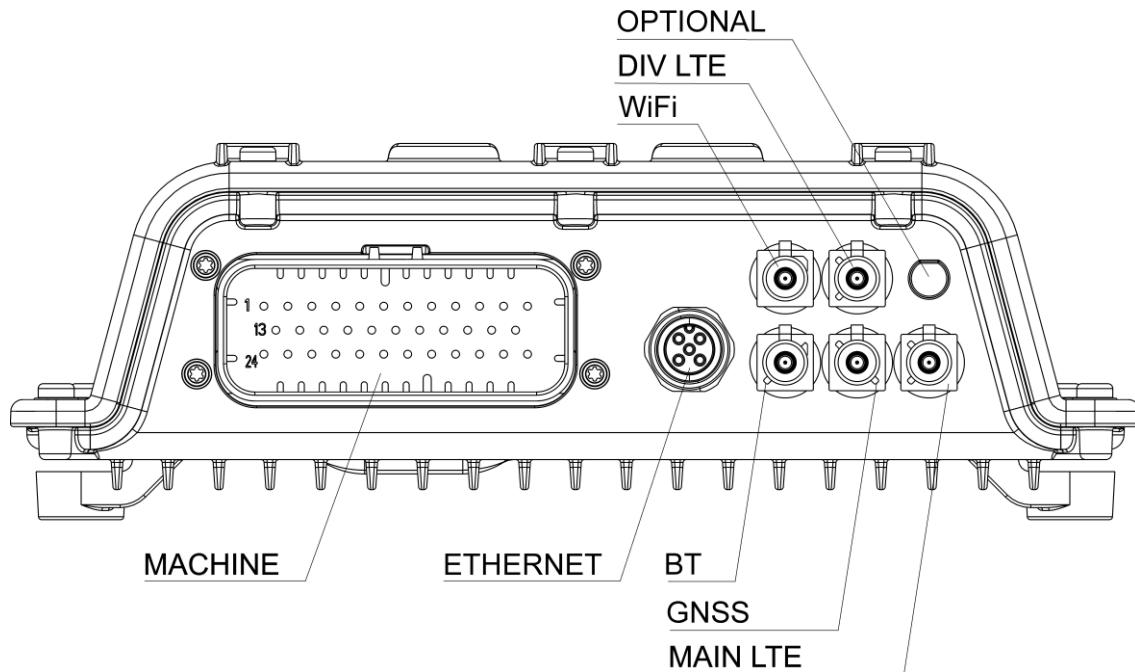
Illustration 1: owa5X block diagram

3.4 Physical Description

3.4.1 owa5X Physical Description - Front

Illustration 5: owa5X frontal view

The standard unit has GSM and GNSS external antenna connectors, while Bluetooth and Wi-Fi antennas are internal, as shown in illustration 4

Also, a connector with an M12 D-code gets out the Ethernet connection signal.

Two variants:
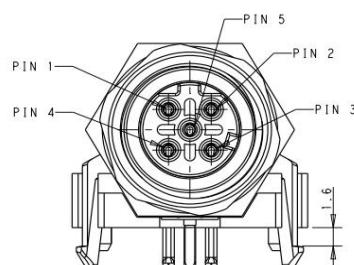
> Single Pair Ethernet (IEEE 802.3bw 100Base-T1).

> 10/100 Base TX (IEEE 802.3).

This is the pin-out of the M12 connector:

10/100 Base-T1 pinout

M12 D-code
1 TRX-P
2
3 TRX-N
4
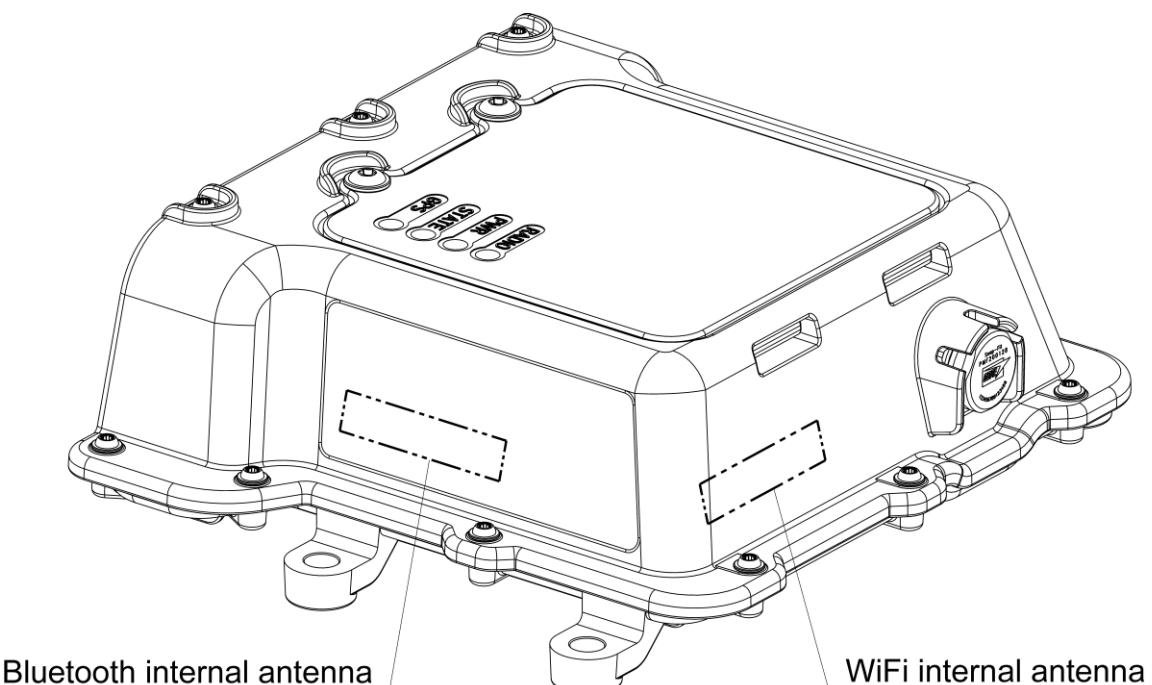
10/100 Base-TX pinout

M12 D-code
1 TX+
2 RX+
3 TX-
4 RX-

3.4.2 owa5X Physical Description – Wi-Fi/BTH Antenna Placement

When using either Wi–Fi or Bluetooth functionality, try to make sure that the installation allows a free view of these sides of the unit. The rectangles of the drawing indicate where the internal adhesive antennas are; try to keep these areas free and also not in contact with or very close to metallic surfaces.

Bluetooth internal antenna   WiFi internal antenna

Illustration 13: WiFi-BT antenna placement

3.4.3 owa5X Physical Description – Top
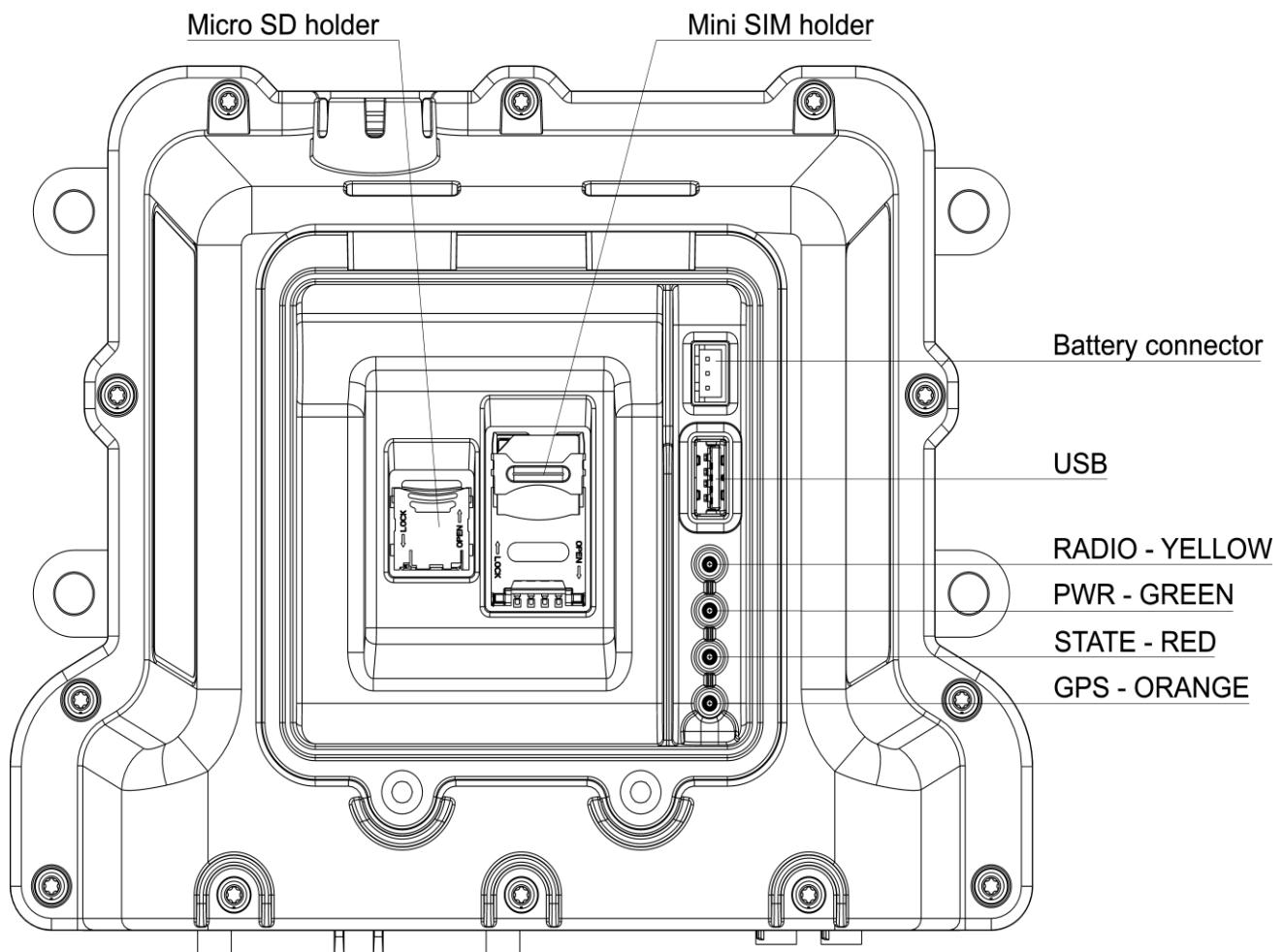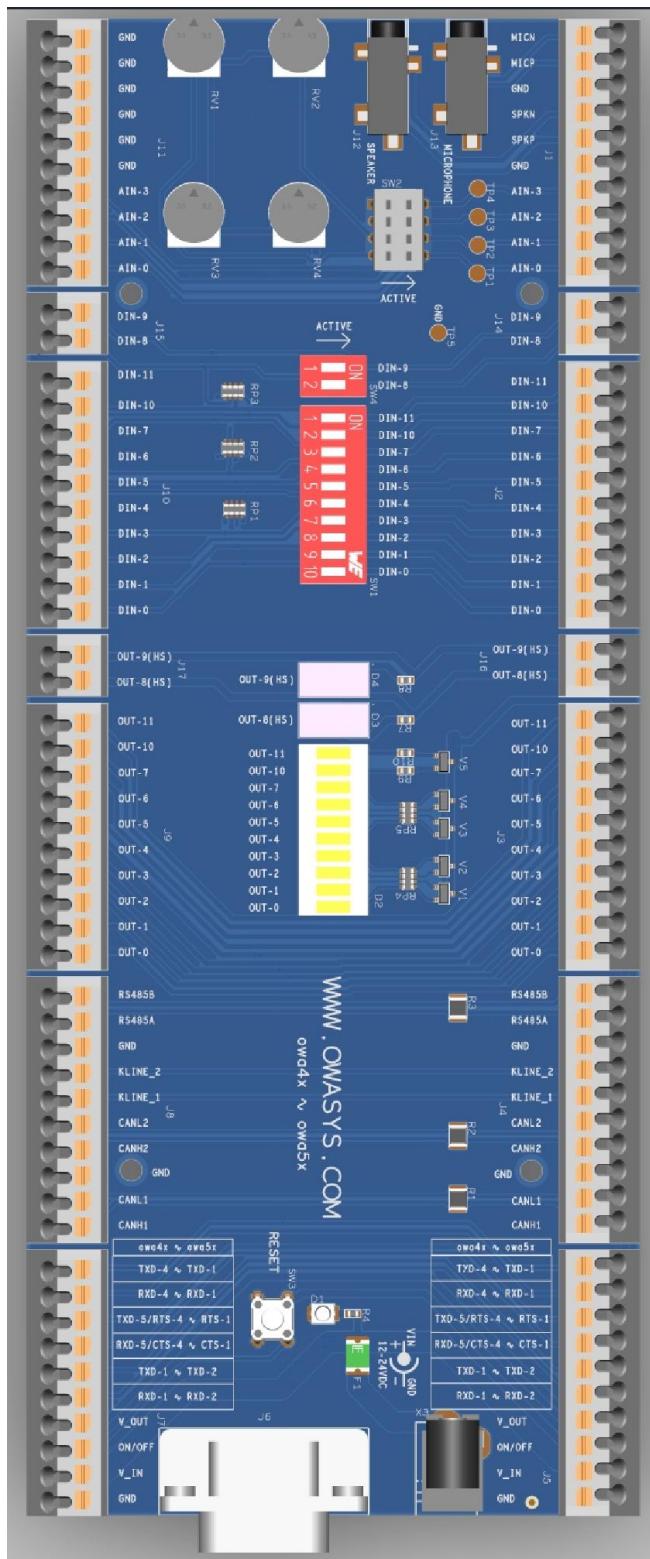
Illustration 14: owa5X Top View
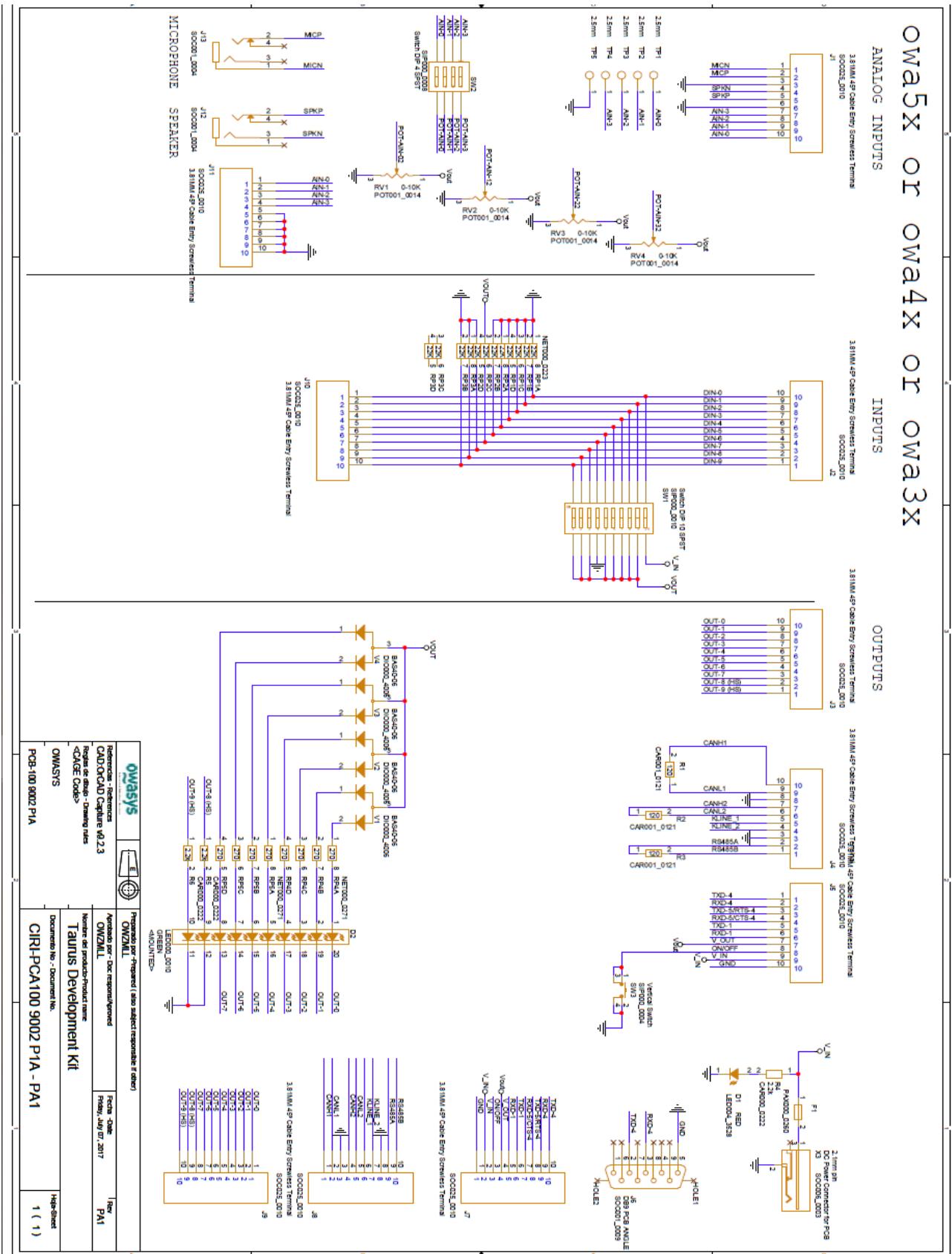
3.4.4   Developer's Board Physical Description

The following figure shows the layout of the Development Board connectors:

Illustration 18: Developers' board physical description

3.4.5 Schematic of Developer's Board

Illustration 20: Developers' board schematic

3.4.6 Connectors of the developers' kit.

Number	Connector
J1	Connector for audio and analog inputs from owa4x
J2	Connector for digital inputs from owa4x / owa5X
J3	Connector for digital outputs from owa4x / owa5X
J4	Connector for CAN KLINE and RS485 from owa4x / owa5X
J5	Connector for power, and RS232 interfaces from (owa4x / owa5X)
X3	Jack for DC power supply, 12V or 24V.
J6	DB9 for main uart, UART4 (owa4x) and UART1 (owa5X)
J7	Connector for external devices
J8	Connector for external devices
J9	Connector for external devices
J10	Connector for external devices
J11	Connector for external devices
J12	Jack speaker (owa4x)
J13	Jack microphone (owa4x)

3.1 Connectors of the developer kit

In the developer's zone of www.owasys.com there is available to download the schematics of the DK board in PDF format, which has better quality than the image in this document.

Power may be connected to either X3 or J7. The power input range is 9V – 36V, and a fuse F1 is mounted in the DK board to prevent damage to other components in case of over–voltage.

Connectors J1 to J5 are used to connect the necessary signals to the owa5X. All the signals are available in the connectors mounted in the front in case they have to be connected to external devices.

In order to test the analog inputs, potentiometers are provided. The switch may select the potentiometer or leave the signal open for an external signal source to be connected.

Digital inputs have switches to change the default status, in order to test the behaviour of all of them.

> Be careful when connecting the DIO cables to the DIN J2 connector. If instead of using them as inputs, are activated the outputs that are multiplexed on them, the unit may be damaged. Have special care with DIO8 and DIO9, activating their output while connected to the J2 connector and closed switch, will damage the device.

Digital outputs have led indicators to indicate when they have been activated.

Pin	Signal
J1–1	MICN (owa4x)
J1–2	MICP (owa4x)
J1–3	GND
J1–4	SPKN (owa4x)
J1–5	SPKP (owa4x)
J1–6	GND
J1–7	AIN–3
J1–8	AIN–2
J1–9	AIN–1
J1–10	AIN–0

3.2 Connector J1 of DK

Microphone and speaker signals are connected to Jacks for the microphone and speaker connection, which are valid to be used with the platform owa4X.

Analog inputs are connected to potentiometers through switches. The switches should be in the OFF position if external signal sources are to be applied.

Pin	Signal
J2-1	DIN-9
J2-2	DIN-8
J2-3	DIN-7
J2-4	DIN-6
J2-5	DIN-5
J2-6	DIN-4
J2-7	DIN-3
J2-8	DIN-2
J2-9	DIN-1
J2-10	DIN-0

3.3 Connector J2 of DK

Digital inputs have pull-downs in the Development kit and a switch to connect to a high level for the input testing.

Digital input 6 is inverted, so it has a pull-up by default, and the switch connects the input to GND.

If external signal sources are to be connected, the switches should be in the OFF state.

Pin	Signal
J3-1	OUT-9(HS)
J3-2	OUT-8(HS)
J3-3	OUT-7
J3-4	OUT-6
J3-5	OUT-5
J3-6	OUT-4
J3-7	OUT-3
J3-8	OUT-2
J3-9	OUT-1
J3-10	OUT-0

3.4 Connector J3 of DK

Digital outputs 0 to 7 and 10 to 11 are open drain, so they give a low value when active. Digital outputs 8 and 9 are High side, so they provide a high value (V_IN) when active. Output signals 0 to 7 have LEDs to provide a visual indication of the status of the output. The LED will be on when the output is activated.

Pin	Signal
J4–1	RS485B (owa4x) // (owa5X)
J4–2	RS485A (owa4x) // (owa5X)
J4–3	GND
J4–4	KLINE_2 (owa4x)
J4–5	KLINE_1 (owa4x) /
J4–6	CANL2
J4–7	CANH2
J4–8	GND
J4–9	CANL1
J4–10	CANH1

3.5 Connector J4 of DK

Note that to use RS–485 or CAN3, a 120 Ω termination resistor must be placed at each end of the network. In the development kit, there is a termination resistor of 120 Ω soldered for each of the buses. Also in CAN1, CAN2 and CAN4, there is a CANTERM (120 Ω) available that should be connected to CAN Low 4.1.4.5.5.

Pin	Signal	Function
J5–1	TXD–4	TX UART4 (Main uart owa4x) // TX UART1 (Main uart owa5X)
J5–2	RXD–4	RX UART4 (Main uart owa4x) // RX UART1 (Main uart owa5X)
J5–3	TXD–5/RTS–4	TX UART5 (owa4x) // RTS UART 1 (owa5X)
J5–4	RXD–5/CTS–4	RX UART5(owa4x) // CTS UART 1 (owa5X)
J5–5	TXD–1	TX UART1 (owa4x) // TX UART2 (owa5X)
J5–6	RXD–1	RX UART1 (owa4x) // RX UART2 (owa5X)
J5–7	V_OUT	+5V voltage output 500mA MAX
J5–8	ON/OFF	Connect to the ground to power down
J5–9	V_IN	Power input
J5–	GND	Ground

3.6 Connector J2 of UDK

J7, J8, J9, J10, J11 connectors are directly connected to signals coming from the owa5X connectors in order to connect external devices or signal sources.

3.5 Connecting the owa5X Development Kit

This section describes the owa5X development kit components and connections.

The steps for mounting the components in owa5X are the following:

Antennas: Connect the antennas used for the application, LTE, GNSS, etc.

DB9 RS-232 Serial connector: Connect an RS232 connector, or USB to RS232 connector to the PC to debug the unit.

owa5X Signals: Connect the signals needed to the development kit in the connectors J1 to J5. The development kit has a specific use for each of the signals in each of the connections. DIOs should be connected to the DIN or DOUT depending on which feature is to be tested.

mini SIM card: The mini-SIM card should be introduced in the SIM card compartment. The SIM card contacts shall be faced downwards. Close the SIM card following the arrow. A slight click will be felt once it is locked.

AC/DC Power supply: Provided AC/DC power supply adaptor can be connected to the developer's board, connector X3, and a suitable AC main outlet. Alternatively, a laboratory power supply can be connected to V_IN and GND at the J7 connector.

3.5.1 Connecting owa5X to a PC

3.5.1.1 Serial connection

Either Linux OS or Windows OS can be used to connect to the device from a Personal Computer (PC) through the serial port. The required configuration parameters are the following:

- Bit Rate: 115200 bps
- Data Bits: 8
- Parity: none
- Bit Stop: 1
- Flow Control: None

3.5.2 Windows Hyperterminal

Use Windows HyperTerminal to connect owa5X to the PC, configuring the serial port parameters to the values indicated in the previous section.

Switch on the owa5X. Once the Kernel is loaded in RAM memory and the system is up, the device waits for the user to enter a valid user name to log in. This user name is root, and the password is root. There is also another user, "*owasys*" and password "*temppwd*".

Once logged in, the user is in the owa5X file system, which has the directory structure of a usual Linux distro, in this case Debian.

To transfer a file from the PC to the owa5X, change to /home directory or to the directory where the file is to be stored (cd /home or cd /directory_name), type rz command and choose Transfer-> Send File... option of the HyperTerminal.

To transfer a file from the device to the PC, change to the directory where the file is, then type sz command indicating the name of the file (sz file_name) and choose the

Transfer -> Receive File… option of the HyperTerminal. File transfer protocol is **zmodem** in both cases.

3.5.3 Linux Minicom

Run the minicom program and configure the serial port parameters to the values indicated in the previous section. Minicom help is shown by typing Ctrl-A Z.

Serial port device files (/dev/ttyS0, /dev/ttyS1…) must have reading and writing permissions for all users. Log in as root and type chmod a+rw /dev/ttySx   to change permissions.

Switch on the owa5X and wait until the login prompt appears. Log in as root user with password "root" to enter into the device's Operating system.

To transfer a file from the local PC to the device, change to /home directory (or to the directory where the file is to be stored), type rz command in owa5X OS, type Control-A S so that the minicom knows the file that is to be transferred. The file transfer protocol is **zmodem**.

To transfer a file from the device to the local PC, change to the directory where the file to be transferred is stored, type sz command indicating the name of the file (sz file_name) and type Control-A R so that the minicom starts to receive the file. The file transfer protocol is also **zmodem**.

3.5.3.1 Ethernet connections

To communicate with the owa5X an SSH connection can be established too using the Ethernet interface, if the unit features this option.

For a variant with standard 100Base-T1, it is necessary to use an adapter to go from standard 100Base-T1 to 100Base-TX.

Once it is connected owa5X to the adapter, the system gets the SSH daemon up by default, and its configuration is:

IP: *192.168.10.1*

Port: *22* (default port of SSH)

In order to use this connection, connect to this IP using these credentials:

- user: *owasys*
- password: *temppwd*

SSH access is restricted for regular users, edit the file /etc/ssh/sshd_config to change this.

Authentication is only allowed using SSH keys without a passphrase by default.

If you need to use a password for authentication, you must explicitly specify it using the following SSH option:

ssh –o PreferredAuthentications=password owasys@hostname

M12 D-code connector is used to get out the Single Pair Ethernet (IEEE 802.3bw 100Base-T1) signals or 100Base-TX signals, depending of the owa5X option chosen.

4 owa5X Main Features

4.1 Hardware Features

4.1.1 Microprocessor and memory

Quad Cortex–A53 at 1600MHz clock speed + 800 MHz Cortex–M7 with 2 GB of LPDDR4, 8 GB of eMMC and 1 GB of non–volatile NAND FLASH. These provide, in terms of available user space, 7.8GB free RAM and 834 MB free Flash for the default configuration, with a basic Debian running in the system.

4.1.2 LTE, UMTS/HSPA+ and GSM/GPRS/EDGE coverage

owa5X provides LTE Cat4 (Long Term Evolution) Cellular communication (Quad band GSM 850/900+1800/1900 as the default configuration). Audio calls, data calls and Short Message Service are the features supported by GSM.

LTE can work as LTE–FDD and LTE–TDD, check the working bands in the table LTE/WCDMA/GSM/GPRS Specifications.

HSPA is an HSDPA Cat.8 / HSUPA Cat.6 data rates: DL 7.2 Mbps and UL 5.76 Mbps.

GPRS is a widely deployed value–added service of the cellular infrastructure that enables direct access to public and private data networks (Internet, corporate networks, private networks…). Using the owa5X GPRS service instead of simple GSM service significantly reduces traffic cost since resources are only allocated when data is to be sent/received.

GPRS service is class B and class 12. Four time–slots for the downlink and one for the uplink are available.

4.1.3 GNSS

GNSS (Global Navigation Satellite System) includes most of the available regional systems composed of a constellation of satellites orbiting the Earth, such as GPS, GLONASS, Galileo and Beidou, transmitting signals that allow the GNSS receivers to determine the receiver position (longitude, latitude and height) and time (Universal Time Coordinated, UTC).

With the GNSS module included in owa5X, accurate position and time information is provided for Location-Based Applications. The default datum used by the GNSS is WGS–84.

The GNSS can work in 2D navigation (viewing 3 satellites) or 3D navigation (viewing at least 4 satellites). When the GNSS starts up, it gives a valid position as soon as it sees 3 satellites, but it can only know the altitude once it sees 4 satellites. This is the reason why in the starting process, there is the possibility of a position jump. This position jump is more likely to happen the greater the altitude is.

The GNSS outputs the altitude as HAE ("Height Above Ellipsoid") (i.e. WGS–84). But since an ellipsoid cannot model the shape of the earth perfectly, one can see some deviation from the so-called "Mean Sea Level" altitude. MSL refers to the actual sea level. The difference between these two altitudes can exceed 100m.

The supported GNSS receivers are Ublox NEO–M8N (by default) or NEO–M8J.

4.1.4 Hardware Interfaces

owa5X is able to interface with many different devices through an extensive range of hardware signals, grouped into several connectors. Here, every connector pin-out is depicted together with a brief description of every signal and electrical specifications, and advice of use.

4.1.4.1 Battery Back-up

The owa5X is provided with a small dedicated internal battery for RTC and GNSS data retention. In addition to this, it is possible to install a high-capacity battery back-up to allow continuous operation of the owa5X without external power.

4.1.4.2 RTC and GNSS Data Battery

This is a small dedicated non-rechargeable battery which is supplied with all owa5X units to provide backup of the RTC and GNSS data. The RTC will be maintained for 10 years. The GNSS data is continuously backed up.
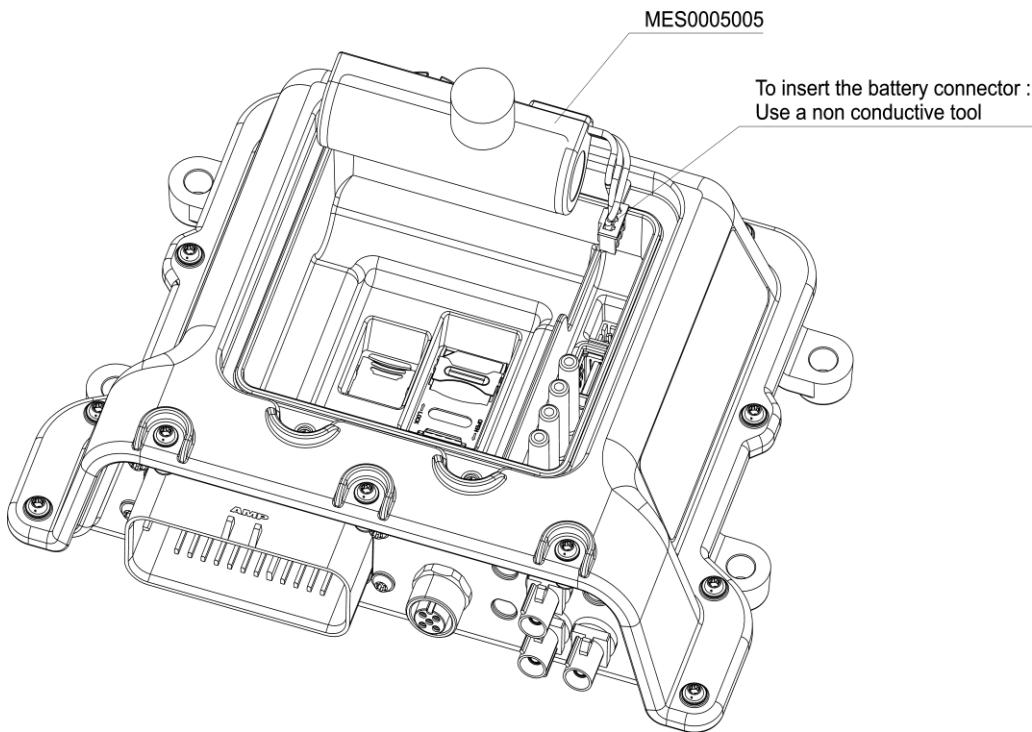
4.1.4.3 Optional High-Capacity Battery Back-up

Optional Li-ion batteries are available for the device. 3350mAh and 13400mAh high-capacity battery back-up can be installed, which allows continuous operation when the main power is lost. This enables the owa5X to, e.g. make a final call before going into low power mode, or a similar procedure, as defined by the customer application software.
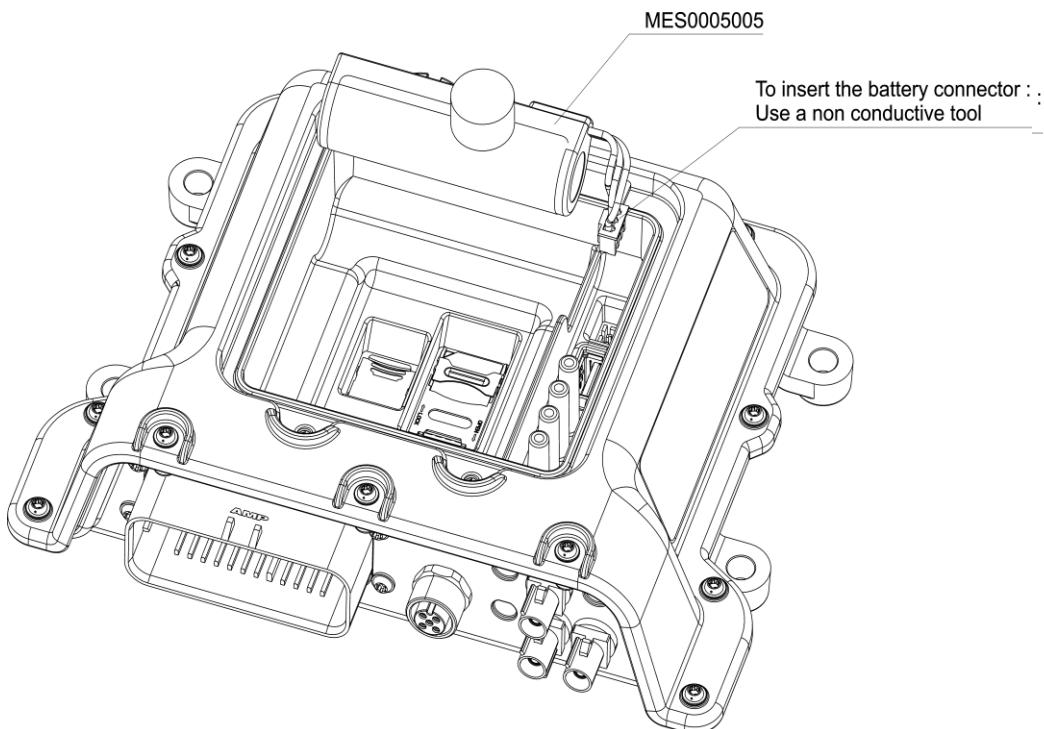
If the battery back-up is not pre-installed inside the unit, then insert it as it is shown in the figure below.

The hex key tool size needed for the 5x battery compartment is Torx–20.

The desired torque value for 5x battery compartment screws is 0.90 Nm.

MES0005005

To insert the battery connector :
Use a non conductive tool

Illustration 24: Insertion of BAT118 6500

MES0005005

To insert the battery connector : :
Use a non conductive tool
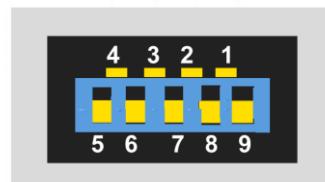
Illustration 26: Insertion of BAT 418 6500

**The connectors at the batteries may vary.

4.1.4.4   USB 3.0 typeA interface

USB connector with mass storage functionality.

SuperSpeed Standard A plug pinout
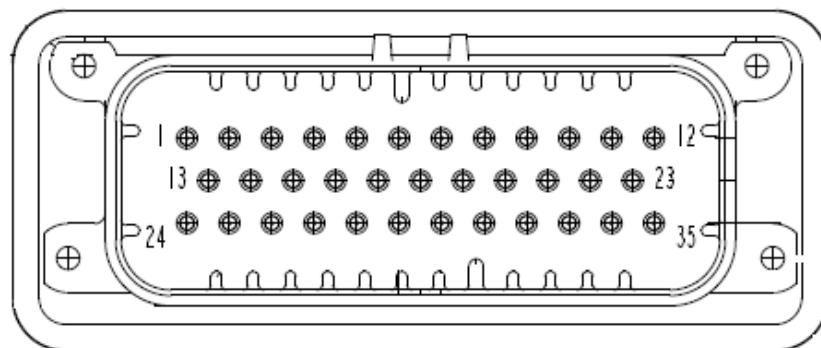
Illustration 30: USB pinout

Pin	Signal	Function	
1	VBUS	+5 V	Red
2	D–	Data –	White
3	D+	Data +	Green
4	GND	Ground	Black
5	StdA_SSRX–	SuperSpeed Receiver –	Blue
6	StdA_SSRX+	SuperSpeed Receiver +	Yellow
7	GND DRAIN	Ground for signal	
8	StdA_SSTX–	SuperSpeed Transmitter –	Purple
9	StdA_SSTX+	SuperSpeed Transmitter +	Orange
Connector type		USB type A	
Mating connector		Male A type	
Location		Top panel	

1 USB connector pins

4.1.4.5   Machine Connector

To provide maximum flexibility, a 35–pin TE automotive connector is provided with power input, several RS232 interfaces, digital and analog I/Os and a CAN bus connection. The connector reference is **TE 776164-1**.

Illustration 34: Main connector

| 1	2	3	4	5	6	7	8	9	10	11	12
V_OUT (5V)	ON/OFF	AIN2	AIN3	CANH1	CANL1	CAN2H	CAN2L	CAN1 TERM	CAN2 TERM	CAN4H	CAN4L

13	14	15	16	17	18	19	20	21	22	23
GND	GND	AIN0	DIO-0	DIO-1 / AIN1	DIO-2 / CAN3L	DIO-3 / CAN3H	DIO-4	DIO-5	DIO-6 (iButton)	DIO-7

24	25	26	27	28	29	30	31	32	33	34	35
V_IN	DIO-8 (high side)	DIO-9 (high side)	TXD-1	RXD-1	RTS-1	CTS-1	TXD-2 / RS485A	RXD-2 / RS485B	DIO-10	DIO-11	CAN4 TERM

2 Main connector pinout

Pin	Signal	Type	Low Level	High Level	Max Range
1	V_OUT 5V	Power output	4.5V	5.2V	5.2V@900mA
2	ON/OFF	Input	OFF 0V	ON Open	
3	AIN2	Input. Imp range: 110K – 200K	0V	5.12V or 30.72V	0 to 50V
4	AIN3	IInput. Imp range: 110K – 200K	0V	5.12V or 30.72V	0 to 50V
5	CANH1	BUS			–36V to 36V
6	CANL1	BUS			–36V to 36V
7	CANH2	BUS			–36V to 36V
8	CANL2	BUS			–36V to 36V
9	CAN1 TERM	120R 1/4W			–36V to 36V
10	CAN2 TERM	120R 1/4W			–36V to 36V
11	CANH4	BUS			–36V to 36V
12	CANL4	BUS			–36V to 36V
13	GND	POWER			
14	GND	POWER			
15	AIN0	IInput. Imp range: 110K – 200K	0V	5.12V or 30.72V	0 to 50V
16	DIO-0	Input impedance range: 220K– 360K	0–6V	9V –50V	0 to 50V
	DIO-0	Output Open Drain	0,6V@200mA (Vol max)		
17	DIO-1	Input impedance range: 64K– 129K	0–2V	3.3V –50V	0 to 50V
	DIO-1	Output Open Drain	0,6V@200mA (Vol max)		
	AIN1	Input impedance range: 64K– 129K	0V	5.12V or 30.72V	0 to 50V
18	DIO-2	Input impedance range: 180K– 360K	0–2V	3.3V –50V	0 to 50V
	DIO-2	Output Open Drain	0,6V@200mA (Vol max)		
	CAN3L	BUS			–36V to 36V
19	DIO-3	Input impedance range: 180K– 360K	0–2V	3.3V –50V	0 to 50V
	DIO-3	Output Open Drain	0,6V@200mA (Vol max)		

	CAN3H	BUS			–36V to 36V
20	DIO-4	Input impedance range: 180K– 360K	0-2V	3.3V –50V	0 to 50V
	DIO-4	Output Open Drain	0,6V@200mA (Vol max)		
21	DIO-5	Input impedance range: 180K– 360K	0-2V	3.3V –50V	0 to 50V
	DIO-5	Output Open Drain	0,6V@200mA (Vol max)		
22	DIO-6	Input 1K Pull-ip to +5V	0-1V	1.6V –50V	0V to 50V
	DIO-6	Output Open Drain	0,6V@200mA (Vol max)		
	iButton	BUS			0V to 50V
23	DIO-7	Input impedance range: 180K– 360K	0-2V	3.3V –50V	0 to 50V
	DIO-7	Output Open Drain	0,6V@200mA (Vol max)		
24	V_IN	POWER			9V to 36V
25	DIO-8 (highside)	Input impedance range: 180K– 360K	0-2V	3.3V –50V	0V to Vin
	DIO-8 (highside)	Output 1A High Side		VIN	
26	DIO-9 (highside)	Input impedance range: 180K– 360K	0-2V	3.3V –50V	0V to Vin
	DIO-9 (highside)	Output 1A High Side		VIN	
27	TXD-1	RS232			
28	RXD-1	RS232			
29	RTS-1	RS232			
30	CTS-1	RS232			
31	TXD-2	RS232			
	RS485A	RS485			–70V to 70V
32	RXD-2	RS232			
	RS485B	RS485			–70V to 70V
33	DIO-10	Input impedance range: 180K– 360K	0-2V	3.3V –50V	0 to 50V
	DIO-10	Output Open Drain	0,6V@200mA (Vol max)		
34	DIO-11	Input impedance range: 180K– 360K	0-2V	3.3V –50V	0 to 50V
	DIO-11	Output Open Drain	0,6V@200mA (Vol max)		
35	CAN4 TERM	120R 1/4W			–36V to 36V
Mating connector manufacturer part number: TE 776164-1 // Crimps: TE 770520-1					

3 Machine connector pinout

Illustration 38: Digital output typical loads

DIO8 and DIO9 are high-side switched digital outputs with Vin as input voltage, and with a maximum of 1A current that can be drawn from them. If loads with higher power are required, the user can connect them to these outputs. The maximum inductive load is 100 mH.

4.1.4.5.3   Analog Inputs

The 4 analog inputs AIN0 to AIN3 present the following characteristics:

Resolution	12 bits
Input range	0–5.12V (1.25mV per bit) or 0–30.72V (7.5mV per bit)
Accuracy	±1% typ. @ 25ºC
Input impedance	110K (AIN1 68K)

5. Characteristics of analog inputs
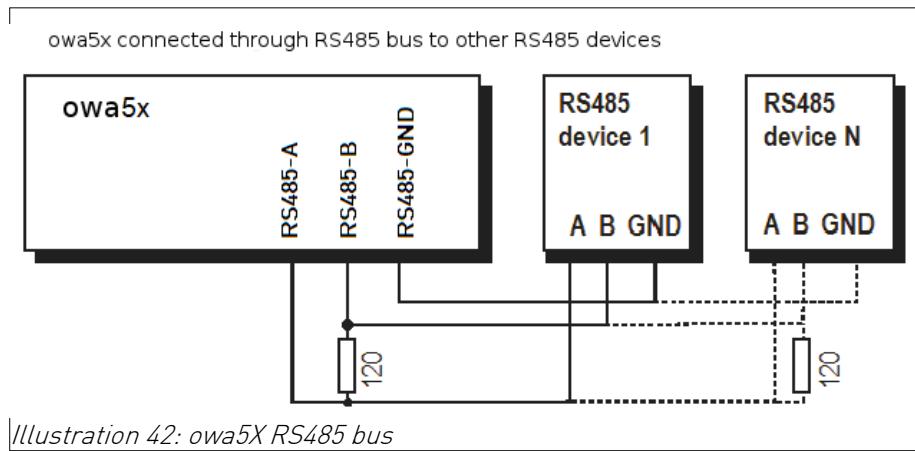
4.1.4.5.4   RS485

The owa5X has the option to include an RS-485 bus driver (replacing the 2nd-RS232).

The number of devices that can be connected in parallel to this interface is 32.

In the following diagram, an example of a set of devices connected to the owa5X through an RS-485 bus is shown.

First and last devices in the bus should be equipped with terminating resistors of 120 ohms. owa5X does not have this terminating resistor internally, so it must be added externally as depicted in the next figure.

Illustration 42: owa5X RS485 bus

4.1.4.5.5   CAN
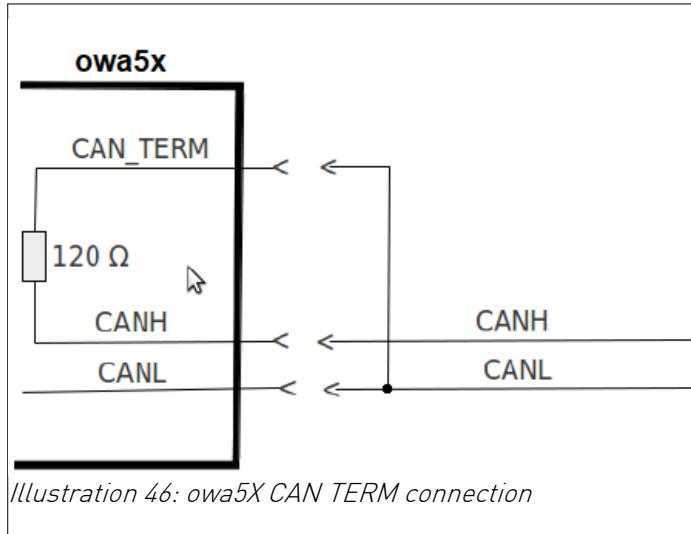
The owa5X includes two CAN SIC-FD transceivers at 1 Mbaud arbitration and 8 Mbaud for data phase.

For more detailed information, see owa5X Programming Guide.

Optionally, two more CAN SIC-FD transceivers at 1 Mbaud and 5 Mbaud for data can be mounted in owa5X to have two different physical CAN drivers available simultaneously.

In a CAN bus network, a terminating resistor should be integrated between CAN High and CAN Low to avoid signal reflections. These resistors must take the value of the natural resistance of the circuit itself, which is usually 120 ohms. owa5X gives the option of integrating this resistor internally in the unit end using the CAN1_TERM, CAN2_TERM and CAN4_TERM pins of the machine connector.

When the owa5X is connected at the end of the CAN bus, CANL should be connected to CAN_TERM too, to integrate the terminating resistor in the bus, due to the 120-ohm resistor is connected internally to CANH.

Illustration 46: owa5X CAN TERM connection

4.1.4.5.6   Ground

owa5X provides a ground connection for all interfaces, digital I/Os, RS485, CAN and analog inputs.

4.1.4.6   mini-SIM Card Holder

The SIM Card Holder is a push-push connector, and it is for the GSM/GPRS service.

Connector type	mini-SIM hinged type holder
Card type supported	3V and 1.8V
Location	Upper panel

6. SIM card holder characteristics

The mini-SIM Card Holder provided is for the LTE/UMTS/GSM/GPRS service. Both 3V and 1.8V mini-SIMs are supported. Insert the mini-SIM card with the connectors facing downwards in its slot, as shown in illustration 5.

Be careful when extracting the mini-SIM card; pulling out the card holder itself can damage the connection pads on the board.

Check out this short video to see how to insert the SIM card correctly into its holder:

https://youtu.be/ozfRjG64EyY

4.1.4.7   LTE Antenna

Connector type	FAKRA Plug male type D(Bordeaux)
Mating connector	FAKRA jack female type D(Bordeaux)
Location	Front panel

7. LTE antenna connector characteristics

To keep the IP67 waterproof features, a special Fakra cap connection is needed, with code AIMMET 3659NTG14D1. Please contact Owasys* to get more information on this connector.

4.1.4.8 GNSS Antenna

owa5X products have a built-in GNSS module. Use only the external GNSS active antenna connected to the GNSS connector provided in the front panel.

Connector type	FAKRA Plug male type C(blue)
Mating connector	FAKRA jack female type C(blue)
Location	Front panel

8. GNSS antenna connector characteristics

By means of internal circuitry, the owa5X is able to detect if the GNSS antenna is operating correctly, if there is an open circuit or a short circuit.

To keep the IP67 waterproof features, a special Fakra Cap connection is needed, with code AIMMET 3659NTG14C1. Please contact Owasys® to get more information on this connector.

4.1.4.9 LEDs

There are 4 LEDs at the top of the owa5X, see illustration 5 of this document.

These are the LEDs' colours and functions:

Name	Colour	Indication	Comment
GNSS	Orange	GNSS activity	Can be controlled by user
STATE	Red	As defined by application	Controlled by user
PWR	Green	As defined by application	Controlled by user
RADIO	Yellow	GSM activity	Can be controlled by user

9. LEDs description

The green LED on owa5X is user programmable. For more information about the control of the Red LED, see *owa5X Family Programming Guide*.

The yellow LED is used to indicate the status of the GSM Module as shown in the table below (It is connected to the NET_STATUS pin of the module):

GSM Module State	Yellow LED
Flicker slowly (200ms High / 1800ms Low)	Network searching
Flicker slowly (1800ms High / 200ms Low)	Idle
Flicker quickly (125ms High / 125ms Low)	Data transfer is ongoing
Always High	Voice calling

10. owa5X Yellow LED indications

The yellow LED is off until the device is switched ON and the GSM module is powered on and registered to the network.

This yellow LED may be configured by the user to follow its own state code. However, the user must enable it explicitly first, as by default is controlled by the user application and this has preference over the usage from the GSM module.

The orange LED on owa5X is controlled by the GNSS module and gives one pulse per second when the GNSS module has coverage.

GNSS Module State	Orange LED
OFF	Off
ON without a valid fix	Off
ON with a valid fix	One pulse per second

11. owa5X Orange LED indications
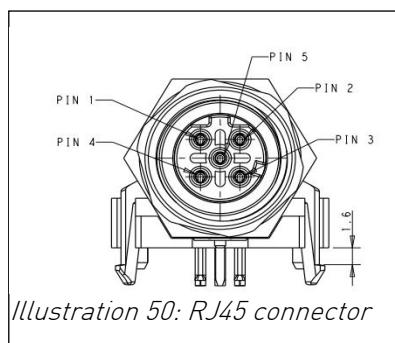
The orange LED may also be configured by the user to follow its own state code. However, the user must enable it explicitly first, as by default is controlled by the user application and this has preference over the usage from the GNSS module.

The red LED on owa5X is user programmable. For more information about the control of the Red LED, see the *owa5X Family Programming Guide*.

4.1.4.10 M12 D-Code for ETHERNET

Illustration 50: RJ45 connector

This optional connector at the front of the owa5X, is intended for Ethernet communication.

Pin	10/100Base-T1 Signal	Function	10/100Base-TX Signal
1	TX+P	Transmission Positive	TX+
2	N.C.	Receive Data +	RX+
3	TX–N	Transmission Negative	TX–
4	N.C.	Receive Data –	RX–
Connector type	M12 Female D-Code, 4-pin socket		
Main connector	M12 D-Code jack		
Location	Front Panel		

12. owa5X Ethernet connector

4.1.4.11 Bluetooth/Wi-Fi Antennas

The antennas of Bluetooth and Wi-Fi are internal, as shown in this illustration 4.

4.1.4.12 uSD Card

The microSD card is inserted into its slot. This holder is also under the cover at the top of the owa5X, below the optional main battery, as shown in illustration 5.

This short video shows how the SD card is inserted it its holder:

https://youtu.be/atYj6DmMJng

4.1.5 Internal Temperature

The owa5X has an internal sensor to measure its internal temperature.

This temperature sensor cannot be used to measure external environment temperature due to the difference between this temperature and the owa5X internal temperature.

The temperature sensor is connected to an internal analog input. See the Programming Guide to get further info on this input and how to read it.

- Temperature range: –40ºC to +75ºC   (Accuracy: ±5ºC)

4.1.6 System Time and HW time

The owa5X unit is provided with two different clocks:

- The **CPU system time**: This clock is able to maintain system time in normal operation, but loses the time when owa5X is powered off or is put into a low power mode.

- The **RTC module:** This is a dedicated Real Time Clock (RTC) module, which is battery backed up so that the time remains correct even when power is removed. The duration of the internal battery is 10 years.

When the owa5X returns from OFF or STANDBY modes, the CPU system time is automatically updated with the value in the RTC time. Hence, any changes to the time should be performed on the RTC time as this is the 'master'.

owa5X models have an additional and more precise time reference that is obtained from GNSS data.   When available, use this as a reference to set the RTC value.
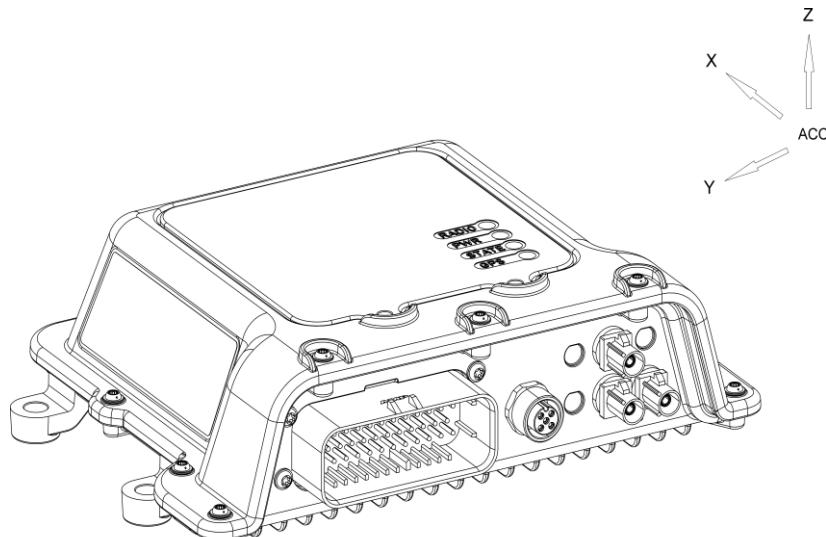
4.1.7 Accelerometer

The owa5X carries by default a 3-axis accelerometer with ±2g/±4g/±8g/±16g configurable ranges and 1mg/2mg/4mg/12mg sensitivity, respectively.

The accelerometer can be set in the wake-up mask of Standby or OFF mode, in order to wake up when there is a movement bigger than the preconfigured one.

The data from the axis registers can also be obtained using a function of the RTU library, with or without a gravity acceleration filter, which can be of use to get the inclination of the device. See API for more information on these functions.

Illustration 54: Accelerometer axis

4.1.8 Watchdog

4.1.8.1 HW watchdog

There is a HW watchdog available under /dev/watchdog and a SW watchdog that can be controlled via systemd. You can get more information on how to use them in the Programming Guide (BOK 000 5006).

4.1.8.2 pmsrv

There is also a service that controls the low power modes and communication with the IOs, **pmsrv**, that must be always running. When for whatever reason this service is down for longer than one minute, the system will reboot.

4.1.9 Optional Features

The non-standard owa5X may be provided with a number of optional features, which can customize the product to the user's needs in a higher degree.

4.1.9.1 3rd and 4th CAN

A third and fourth CAN-FD bus can be provided optionally in pins 18 and 19 for CAN3 and pins 11 and 12 for CAN4.

owa5X supports CAN-FD for all its CAN interfaces, including the optional 3rd and 4th CAN interfaces.

4.1.9.2 Wi-Fi / Bluetooth / BLE

A Wi-Fi / Bluetooth / BLE module can be integrated as an option.

4.1.9.3 Ethernet
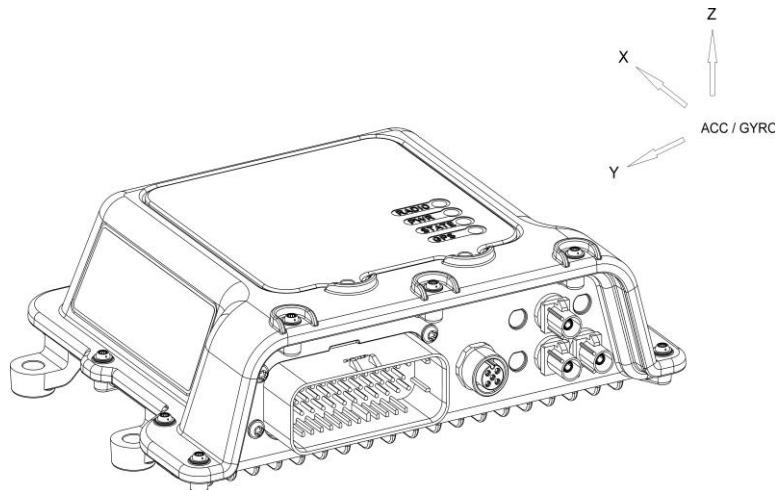
10/100 Ethernet Base T1 (IEEE 802.3bw) or 10/100 Base TX can be provided with a M12 D-Code Female connector at the front side of the owa5X.

4.1.9.4 Gyro/accelerometer

The optional gyroscope/accelerometer works with the IIO drivers of the Linux kernel. Check the "Programming guide" to get more information on the usage of this module.

- 3D accelerometer with selectable full scale: ±2/±4/±8/±16 g

- 3D gyroscope with selectable full scale: ±125/±250/±500/±1000/±2000 dps

The data rate for the owa5X is up to 416 Hz.

Illustration 58: Accelerometer / Gyroscope axis

4.1.9.5   Trusted Platform Module (TPM)

The owa5X has the option to mount a TPM2.0 (ISO/IEC 11889).

This TPM is tamper resistant against invasive silicon, fault injection and side channel attacks, and provides protected storage, device hardware identity, secure generation of cryptographic keys and a random number generator.

See document BOK–000_5016–A–TPM_Reference_Guide to get more information and use examples on this option.

Also, the manufacturer Infineon has its own Application Note with a step–by–step guide to set up the Open Source Software Stack 2.0 (TSS 2.0) and related software on a Raspberry Pi® 3 and software usage and programming examples, which are also valid for the owa5X platform.

4.1.10   IP67 / IP6K9K

In order to maintain the owa5X's IP rating, **all cables must be connected**.

A tap cover must be installed if a cable is not in use. Please consult your Owasys sales contact for options regarding Fakra caps and M12 tap covers (MEC 005 5119).

C. Seal Plug

All circuits are sealed by a diaphragm in the rubber wire seal. During plug assembly, the diaphragm is pierced as the contact passes through it. Unused circuit cavities, unless accidentally perforated, will remain sealed.

Standard Wire Size - Seal plug is 770678-1 is designed to keep out contaminants if diaphragm is pierced. Insert seal plug, **large end first**, into the circuit cavity as far as it will go. An insertion tool is not required for this procedure, See Figure 8a.

Reduced Wire Size – AMPSEAL 16 Size 20 seal plug 776364-1 is designed to keep out contaminants if diaphragm is pierced. Insert seal plug into the circuit cavity as far as it will go. An insertion tool is not required for this procedure. See Figure 8b
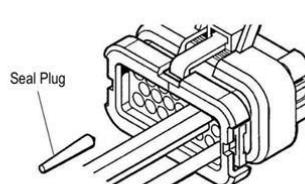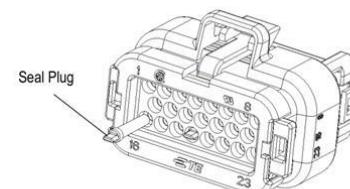
Figure 9a   **Figure 8b**

5   Power management

5.1   Functional states

From the functional point of view, owa5X can work in one of the following functional modes:

State	Short Description	Available Circuits	Wake-up sources	Wake-up time	Power sources
No Power	No power supply available.	RTC.	V_IN.	N/A.	N/A.
OFF	Minimal power. Main CPU shut down (without power).	RTC Dig inputs Movement RS232-RX1 ETH CAN BTH GSM	RTC DIN[0-8] Movement RX1 CANFD[1-4] ETH(T1) BTH GSM	Slow (complete boot).	V_IN, Optional External Battery.
STANDBY	Low power with fast response to wake-up events. Linux operating system suspended.	RTC Movement Dig inputs CPU (halt) RAM (refresh) GSM RS232 CAN ETH BTH GSM	RTC DIN[0-8] Movement RX1 CANFD[1-4] ETH(T1) BTH GSM	Fast (next instruction executed).	V_IN, Optional External Battery.
RUN	Linux operating system running.	All.	N/A.	N/A.	V_IN, Optional External Battery.

5.1 owa5X functional modes

If the unit is not powered and it is not in OFF, STANDBY or RUN, the only way to switch the unit ON will be with Vin; the optional battery cannot be used to power ON the unit.
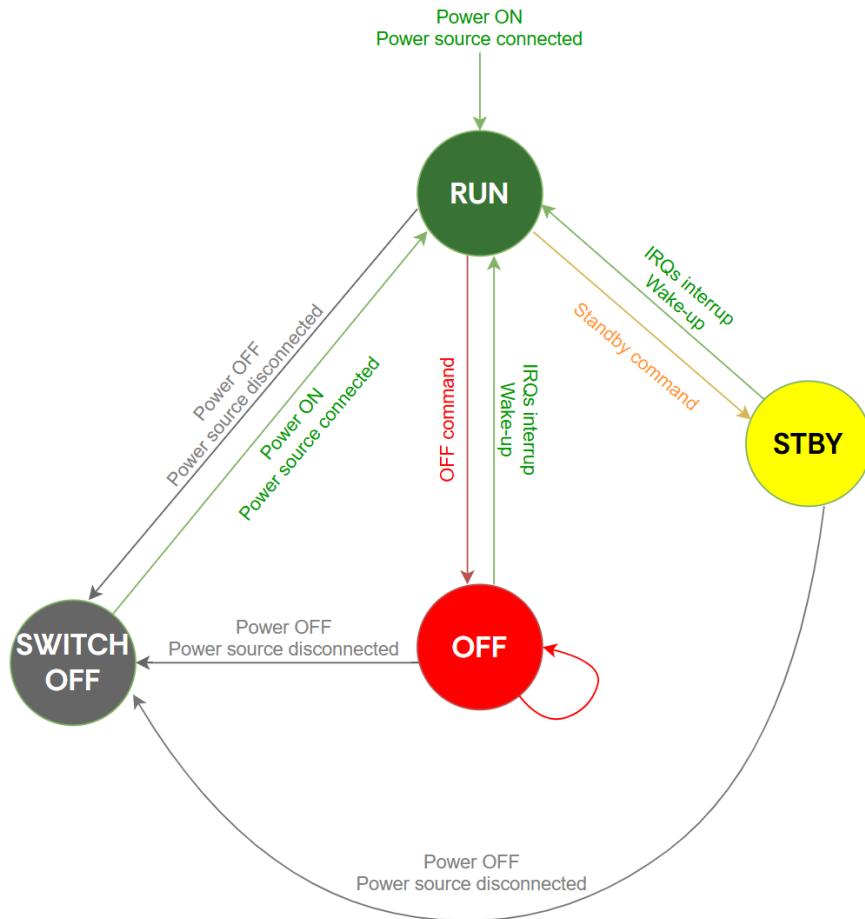
Once the owa5X is switched on, it starts executing the boot loader. Then, if the user stops the process, the owa5X will remain in Service Mode. Otherwise, the owa5X continues loading the kernel and the file system.

The customer application is able to select the desired mode, usually based on the current consumption.

In Run mode, the microprocessor is running at 1600 MHz. If the customer application wants or needs lower speed, it can send the owa5X to either Standby or Off mode (see owa5X Programming Reference Manual and Programming Guide).

From Standby and Off modes, the customer application can wake up the owa5X to Run mode with an event preconfigured with a mask. The difference between Standby and Off modes is the possible events that will be listened for as trigger conditions. For further information about the trigger possibilities, see the Programming guide.

These modes offer the possibility to build powerful and flexible applications that can handle situations where the power supply can be constrained.

5.2 owa5X state functional modes

RUN: Linux OS is running, CAN is on, and Ethernet is ON. The consumption in the table refers to the default status of the modules; by default, GNSS, LTE, Wi-Fi-BT are not powered, the V_OUT signal has no load, high side outputs have no load, and the USB peripheral is not installed. All these modules represent extra power consumption.

STANDBY: The main processor is set into its Standby mode, but its power is kept on, and memory is in self-refresh. The auxiliary microcontroller is set in low power mode, monitoring the wake-up sources too.

When there is a trigger for wake-up, the main processor keeps running the OS where it was, so there is no system boot. The total consumption will be determined by the Standby consumption of the system plus the peripheral components that are left ON (GSM, GNSS, CAN, Ethernet…).

OFF: Main processor power regulators and DC-DC converters are switched off. The system has to be halted in the process of going off in order to make a proper closing of all the services and system.

The auxiliary microcontroller is left powered in low power mode, monitoring the wake-up sources (such as digital inputs, RTC, accelerometer and other signals) in order to wake up the system, powering the main processor and generating a new system boot.

5.2   System halt

The owa5X is a unit designed to run at all times, as it will be installed in remote places. As such, the power management will reset the unit whenever the main system is not running, and that means that the standard "poweroff –halt" or "reboot –halt" will not work as expected, and in less than 3 minutes, the system will be rebooted.

In case the user wants to halt the system, a custom command, **owasys-off**, must be used instead. This command makes use of the power management functionality to set the unit in STOP mode.

These are the options that can be passed to this command:

–t <secs>   (CPU is powered off after <secs>

–m <mask>   (<mask> selects events to return from OFF state)

> <mask> is the sum of the desired values
>
> 1: moving
>
> 2: power on
>
> 4: console
>
> 128: IO 0
>
> 256: IO 1
>
> 512: IO 2
>
> 1024: IO 3
>
> 2048: IO 4
>
> 4096: IO 5
>
> 8192: IO 6
>
> 16384: IO 7
>
> 32768: IO 8
>
> 65536: IO 9
>
> 524288: Remove VOUT in OFF state

–h   (show this help)

---

6   Backup FS

A backup FS is included that can be used to recover the system, either locally or remotely, as this small FS has all the libraries needed to open a data session with the LTE module and use the owasys GSM library.

7 Installation

7.1 owa5X dimensions
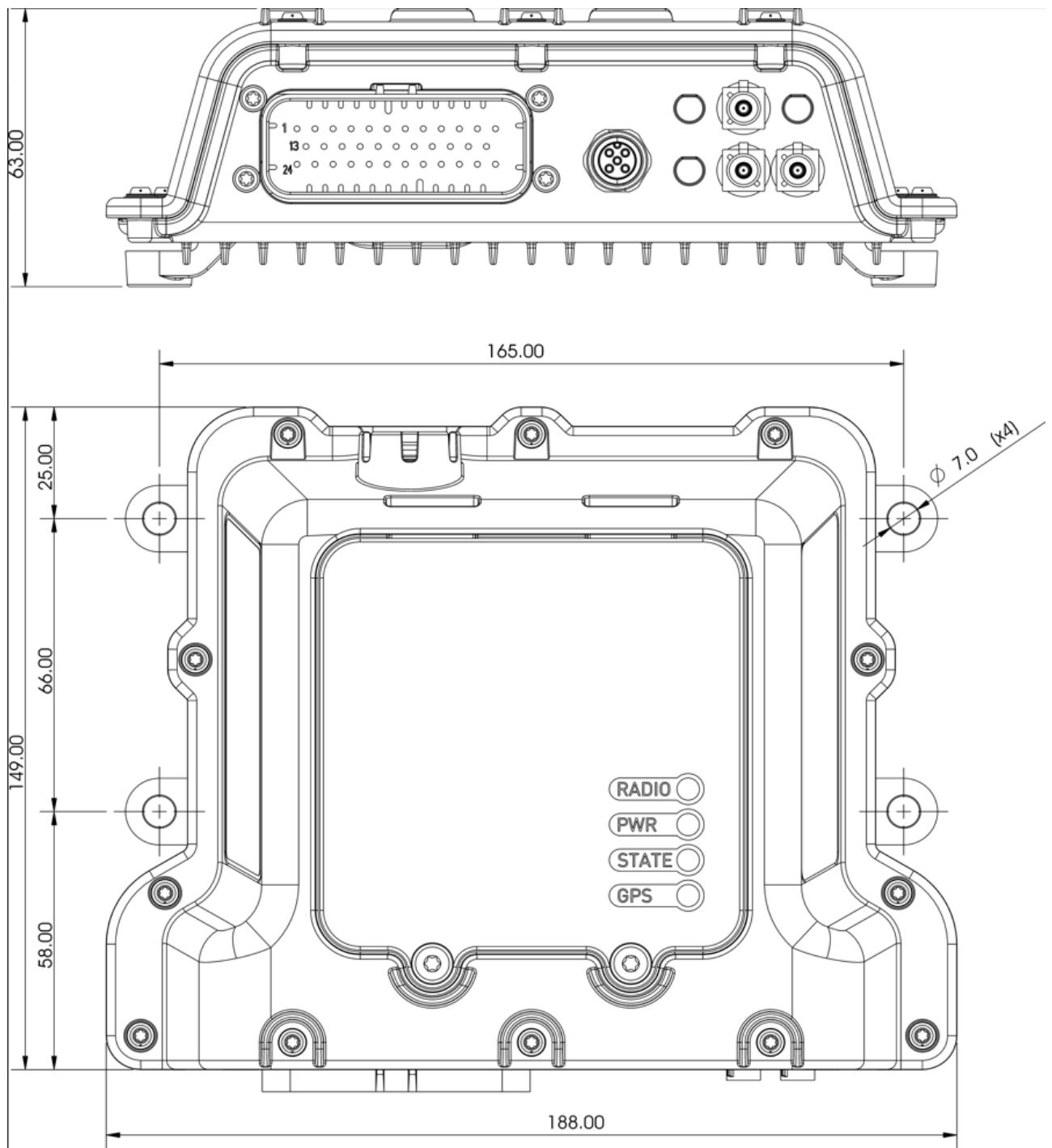
Illustration 60: owa5X dimensions

7.2 Mounting the unit

7.2.1 Antenna Location and Installation

Permanently installed antennas are preferred over magnetic, glass or body lip mounts for anything other than low power or temporary installations. However, a magnetic mount antenna is a good tool for checking the proposed fixed antenna location for unwanted effects.

Glass-mounted antennas are suitable for mounting on vehicles. In this case they should be kept as high as possible in the centre of the rear window or windshield. Some vehicles use glass that contains a thin metallic coating for defrosting or to control solar gain; glass mount antennas may NOT function properly when mounted on this type of glass.

If a magnetically mounted antenna is used, take care to locate the magnetic base in a location which avoids interference to the compass mechanism, since magnets may affect the accuracy or operation of the compass. If metallic panels are used, do not block the reception paths for installed antennas such as Global Position Satellite Receivers, if so equipped.

For optimum performance of antennas, consider these aspects:

- The antennas should have an unobstructed view of the sky, especially for GNSS receivers. The antennas should not be shielded by any metal object or other impenetrable material.

- The antennas have to be safe from damage during normal vehicle operation and maintenance.

- GNSS antenna should not be shielded from satellite signals by metal objects or other impenetrable materials.

- Choose a location with access both above and below the antenna-mounting surface. This access is required for installing fasteners and for routing the antenna cable.

- Keep the antenna as separate as possible from the microphone and loudspeaker when hands-free option is used.

- The max. torque value for screw mount antenna (ANT 100 9000) is 5 Nm.

7.2.2 Antenna Tuning

It is important that the antenna is properly tuned and Voltage Standing Wave Ratio (VSWR) less than 2.0:1, and to avoid RF current on the antenna cable shield.

7.2.3 Antenna Cable Routing

Always use a high quality, one-piece coaxial cable. Connector quality and termination techniques are quite important.

The antenna cables should be treated in the same way as the control and power cables. Avoid sharp edges and pinches and keep the cable as short as possible. Also avoid routing the antenna cable in parallel with other control or power wiring over long distances. If it is necessary to cross over wiring, cross at right angles.

7.3 Power connection

To connect owa5X cables follow these instructions:

- Allow enough cabling to enable the removal of the equipment.

- Ensure cables are not corrupted or rubbing against sharp objects.

7.4   Choosing a location

Choose a location for owa5X which allows for convenient routing and connection of the antenna and interface cables, and which has access to the power source and status LEDs. When selecting a mounting location, avoid the following hazards:

- Direct exposure to weather.

- Excessive heat or cold.

- Excessive humidity.

- High vibration areas.

- Corrosive fluids and gases.

- Direct exposure to water.

- Direct exposure to solar radiation.

- Do not obstruct drivers view or impede operation.
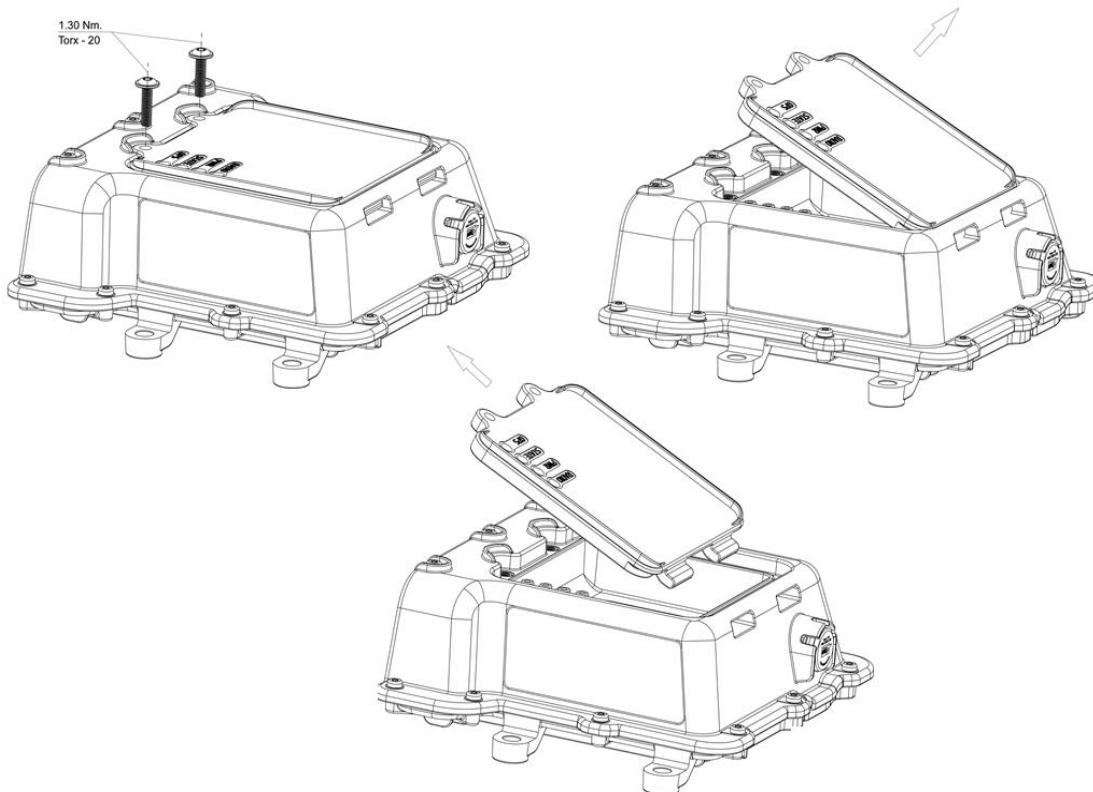
7.5   Opening the unit to access miniSIM, USB and microSD

owa5X mini–SIM Card holder and uSD Card holder are a hinged connector type.

In order to insert the mini–SIM card and the microSD card, the small translucent top cover must be opened. There are 2 screws that must be unscrewed.

For the opening process, a Torx T–20 tool is needed, 1,3 Nm torque.

Then, insert mini-SIM card and microSD with contacts facing downwards as in the figure below. If necessary, connect/disconnect external optional Battery using its one-position connector.

Take a look to these videos for further detail:
https://youtu.be/ozfRjG64EyY (miniSIM card)

https://youtu.be/atYj6DmMJng (uSD card)

Check carefully lock-unlock marking direction.
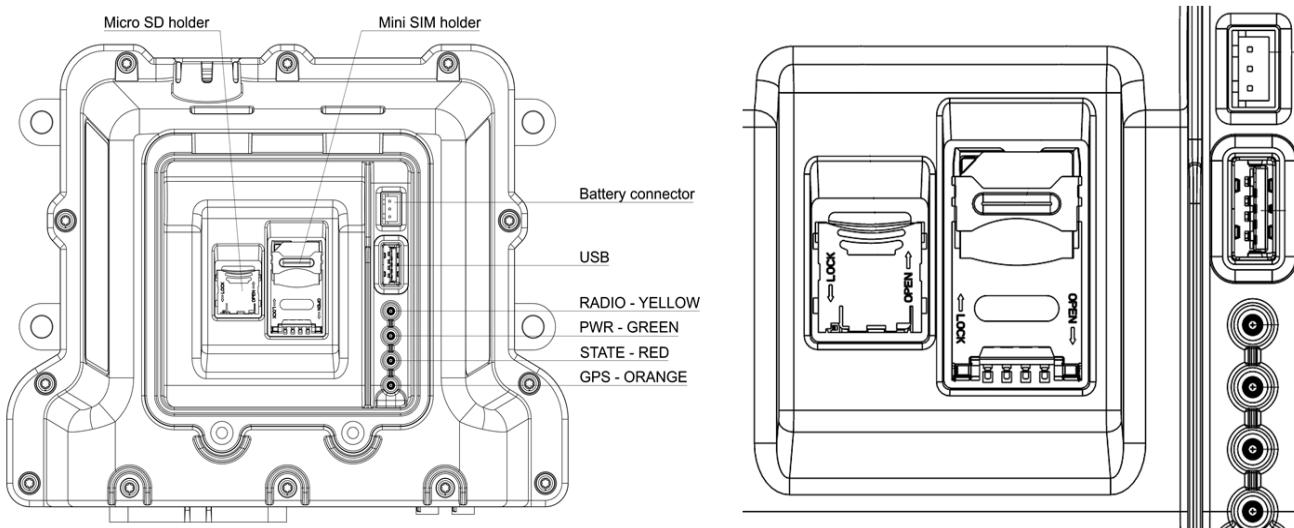
Illustration 68:   mini-SIM Card holder and uSD Card holder detailed access.

Before mounting the cover, make sure that there is no dust and impurities in the cover gasket, the gasket itself and all sealing area that could affect device IP sealing.

Then do the reverse process to unmounting cover.

7.6   Mounting and fixing the unit
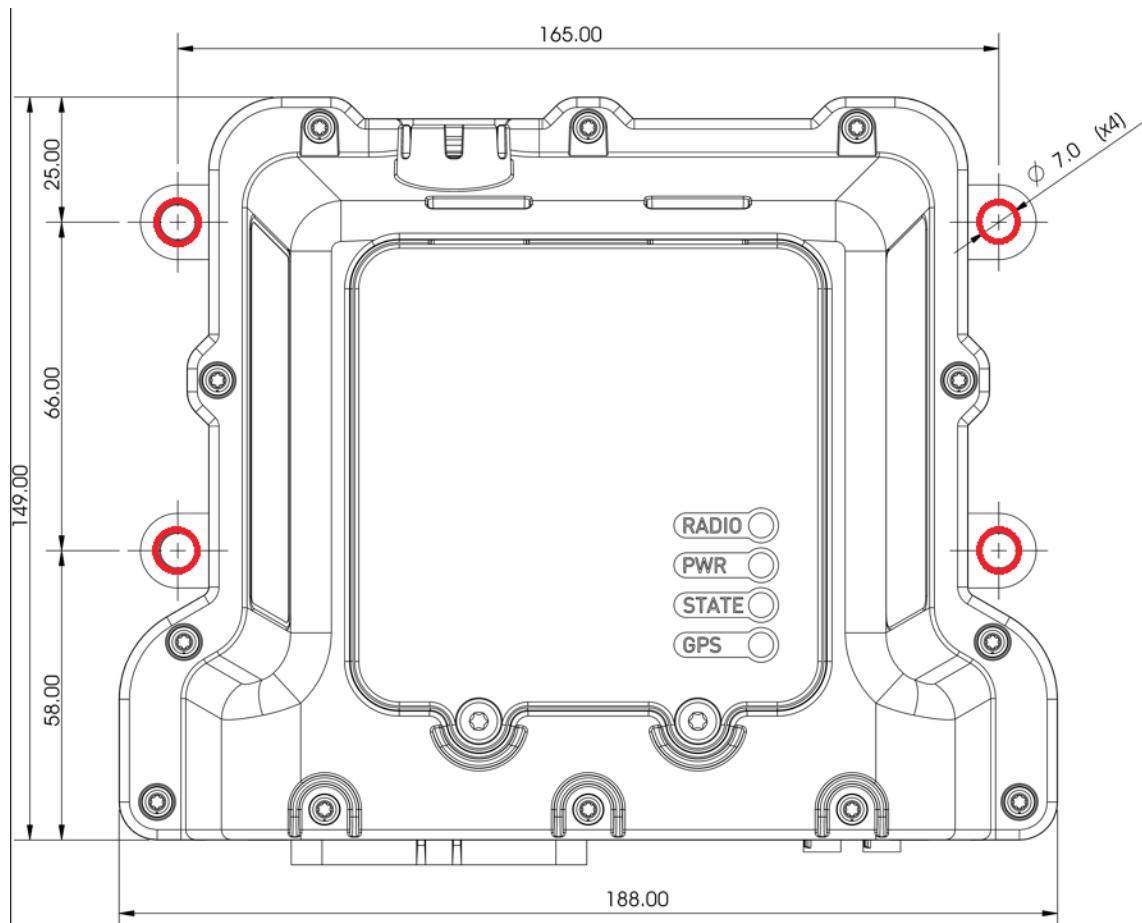
Always keep cabling as short as possible.

The owa5X can be mounted horizontally, vertically, or in any convenient orientation, but it is advisable to maintain the indicator lights in sight, since that come as an advantage when troubleshooting the unit.

The 4 holes at the ends of the aluminium radiator of the owa5X are always available, and the screws to mount it are not provided, as the installation scenario can vary significantly.

For the Wi-Fi/BT option, take care not to blind the internal antennas, placing the unit getting free or as much separate of metal objects as possible from those areas of owa5X, so that the antenna has an open view.

Illustration 72: Assembly wall/panel holes

Mounting holes are compatible with owa4x-4G thanks to its new fixing unit (MEC 100 9006#2), keeping the 66.00 x 165.00 distances.

8 Technical data summary

8.1 General Specification

Item	Specification
Processing Capacity	64 bits Quad CORTEX A53 core at 1600MHz + M7
Available Space for user	About 800 MB Flash (NAND) About 5.1 GB (ext4) for eMMC of 8 GB About 13.5 GB (ext4) for eMMC of 16 GB
Available Memory for user	About 950 MB RAM

General Specification

8.2 Mechanical Description

| Item	Specification
Dimensions (mm.)	188(W) x 63(H) x 149(L)
Weight	878 gr ±5gr with back-upbattery 699 gr ±5gr without back-up battery
Material	Glass reinforced plastic and anodized aluminum
Connectors	Machine Connector USB 3.0 M12 D-Code as Ehernet *(100Base T1 or TX)* Mini-SIM Card Holder (Hinged) Optional main battery connector µSD card holder (Hinged)

Mechanical description

8.3 Power Interface

Item	Specification	
Power supply	9 to 36 Vdc	
Power Consumption (Typical average)	**Mode**	**Consumption @ 24V (mA)**
	RUN	51.95 mA
	RUN + ETH connected	72.40 mA
	RUN + GNSS + ETH	80.30 mA
	RUN + GSM + ETH	92.60 mA
	RUN + GSM + GNSS	100.80 mA
	RUN + GSM on call + ETH	145 mA
	STANDBY	14.20 mA *
	OFF	0.67 mA

** If the ETH Interface is configured down before going to Standby, power consumption levels are much lower → **5.6mA @24Vdc** for TX variant // **4.2mA @24Vdc** for T1 variant*

Power Interface

8.4 LTE/WCDMA/GSM/GPRS Specifications

Item	Specification
Frequency bands	**LTE-FDD**: B1/B2/B3/B4/B5/B7/B8/B12/B13/B18/B19/B20/B25/B26/B28 **LTE-TDD**: B38/B39/B40/B41 **WCDMA**: B1/B2/B4/B5/B6/B8/B19 **GSM**: 850/900/1800/1900MHz

Item	Specification
Power (max ratings)	2.5 Watt at GSM850/EGSM900 1.8 Watt at GSM1800/GSM 1900 2.1 Watt at WCDMA 2.8 Watt at LTE
GPRS	multi-slot class 33
UMTS	DC-HSDPA: Max 42Mbps (DL) HSUPA: Max 5.76Mbps (UL) WCDMA: Max 384Kbps (DL), Max 384Kbps (UL)
LTE	LTE-FDD: Max 150Mbps (DL), Max 50Mbps (UL) LTE-TDD: Max 130Mbps (DL), Max 30Mbps (UL)
Operations	Audio calls, Short Message Service, data session
SIM	Integrated mini-SIM holder, 3 V. Do not user pre-cut mini/micro/nano-SIM cards, use true miniSIM cards.
Antenna Connector	2 x Fakra plug Male type D

GSM/GPRS specifications

8.5 GNSS Specifications

Item	Specification
Receiver	72-channel GPS L1C/A SBAS L1C/A QZSS L1C/A GLONASS L1C BeiDou B1 GALILEO E1B/C SBAS: WAAS, EGNOS, MSAS, GAGAN
Update Rate	10Hz or 5Hz if received more than one satellite system
Accuracy	2 meters CEP
Signal Acquisition	Cold Start: 26 sec Hot Start: 1.5 s Signal Reacquisition: < 1 sec
Datum	WGS-84
Sensitivity	Tracking & reacquisition: -167 dBm Cold start: -148 dBm
Operational limits	Speed: 500 m/s (972 knots) Altitude: 50,000 m
Antenna Connector	FAKRA plug Male Type C
Antenna Requirements	1 Active antenna. Impedance: 50Ω Active Antenna recommended gain:15 dB Frequency: 1575.42 MHz VSWR: Max 2.0:1
Active antenna detection circuitry	Active Antenna Power Supply: +3.0V @ 30mA current • open circuit detection: < 0.5 mA • short-circuit detection: > 100 mA

GNSS specifications

1

The use of a passive antenna would require connecting a DC block between the OWA connector and GNSS antenna.

8.6 Environmental Specifications

Item	Specification
Operating Temperature	–40ºC to +75ºC /GSM off –30ºC to +75ºC /GSM on –20ºC to +53ºC /from optional Li-ion battery +0ºC to +45ºC /optional Li-ion battery charge
Storage Temperature	–40ºC to +85ºC

Environmental specifications

8.7 Battery Back-up

Only for the owa5X with optional 3350 mAh Li-ion rechargeable battery back-up.

Item	Specification
Time to recharge	3.5 hours
Charging temperature range	0 ºC to 45 ºC
Duration @ 25ºC	Run Mode: 8.5 Deep Sleep Mode: 8K
Cell type	Lithium Ion 3350mAh and 13400mAh
Discharging temperature range	–20 ºC to+ 60 ºC

Only for the owa5X with optional 13400 mAh Li-ion rechargeable battery.

Item	Specification
Time to recharge	12 hours
Charging temperature range	0 ºC to 45 ºC
Duration @ 25ºC	Run Mode: 47.5 hours Deep Sleep Mode: 32k hours
Cell type	Lithium Ion 13400mAh
Discharging temperature range	–20 ºC to+ 60 ºC

(*) Based on characterization, not tested in production.

8.8 Incompatibilities

owa5x	AIN_1	DIO_1	CAN_3	DIO_2 & DIO_3	DIO_6	UART_2	RS485
iBUTTON						(2)	
RS485						(4)	
UART_2							
DIO_6							
DIO_2 & DIO_3			(3)				
CAN_3							
DIO_1	(1)						

(1) AIN1 is multiplexed with DIO_1, can be used one or the other, but not both at the same time.

(2) iButton is multiplexed with DIO_6, can be used one or the other, but not both at the same time.

(3) Devices with CAN3 will not mount DIO_2 and DIO_3.

(4) Devices with rs485 will not mount UART_2 (TX2 – RX2).

8.9 Compliance Regulations in different countries

Serbia

Wi-Fi/BT functionality

Frequency band 5150-5350 MHz [B1 (5150-5250) and B2 (5250-5350)] must be disabled for units of this device shipped to Serbia when the device is not used indoors (the interior of the vehicle is considered indoors). When Wi-Fi/BT functionality is not activated, the device can work both indoors and outdoors.

The frequency band and output power of the device cannot be reconfigured by the user.

Chile

Wi-Fi/BT functionality

This device must operate in indoor areas (the interior of the vehicle is considered indoor). Also, in the 5150-5250 MHz frequency band [B1], the maximum radiated power density shall not exceed 17 mW/MHz in any 1 MHz band.

The frequency band and output power of the device cannot be reconfigured by the user.

When Wi-Fi/BT functionality is not activated, the device can work both indoors and outdoors.

Brazil

Wi-Fi/BT functionality

Frequency band 5150-5350 MHz [B1 (5150-5250) and B2 (5250-5350)] is allowed for only Indoor use in Brazil. Only if the device works as a Slave, this frequency band could be activated.

The frequency band and output power of the device cannot be reconfigured by the user.

When Wi-Fi/BT functionality is not activated, the device can work both indoors and outdoors.

LTE functionality

LTE B40 was not approved for the EG25-G module.

Frequency band B40 must be disabled for units of this device shipped to Brazil.

Canada

Wi-Fi/BT functionality

The 5150-5250 MHz frequency band [B1] is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems. Operation in the 5600-5650 MHz band is not allowed in Canada. High-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350 MHz and 5650-5850 MHz, and these radars could cause interference and/or damage to LE-LAN devices.

EN50155

Railway Application Standard (EN50155) with isolation requirements.

EN50155: For Railway Application Standard (EN50155) compliance with Isolation requirements, the owa5X device must be mounted on an insulated panel (no train chassis connected). The ground (negative) of the owa5X is connected to the owa5X chassis.

8.10 VERIZON

The owa5X remains certified for the applicable category mentioned below, provided it continues to satisfy the terms of the Certification Agreement between Verizon and OWASYS ADVANCED WIRELESS DEVICES SL. The terms of validity for device certification are as follows.

Conditions:

'LTE' capable device: Certification lasts five years from 3rd May 2023 if each device complies with a Firmware Over The Air (FOTA) upgrade.

'Multimode' device: A multimode device that supports HD voice over LTE and complies with a FOTA upgrade will remain certified for five years from 3rd May 2023. Certification for a multimode device (LTE with CDMA) supporting CDMA Voice expires on December 31, 2019.

A 'CDMA only' (1xRTT and/or 1xEvDO) device and its maintenance releases (MR) certifications expire December 31, 2019. Once the term expires, the device will receive no re-certification or (MR) certification. In addition, effective July 1st, 2018, Verizon will no longer accept uploads or activations for any new CDMA-only MEID/ESN on our network, unless the devices are capable of 4G LTE.

owa5X is certified via Verizon Wireless' Open Development program.

9   References

Ref.	Doc. Number	Description
[1]	BOK_000_5000	owa5X platform data sheet
[2]	Systemd	https://www.freedesktop.org/software/systemd/man/systemd.target.html
[3]	BOK_000_5009	owa5X_API
[4]	BOK_000_5006	owa5X programming guide
[5]	ubifs	http://www.linux-mtd.infradead.org/doc/ubifs.html
[6]	BOK-000_5016	TPM reference guide
[7]	infineon.com	https://www.infineon.com/dgdl/Infineon-TPM20_Embedded_RPi_TSS_SLx_9670-ApplicationNotes-v02_00-EN.zip?fileId=5546d4626eab8fbf016f13f1c3ff4c50
[8]	BOK-000_5007	owa5X HW Block Diagram
[9]	BOK-000_5008	owa5X main System Cable

10   History

Rev.	Changes
PA1	– First release.
PA2	– Updating measures, images and completing information.
B	– CANTerm explanation, format corrections.29.
C	– Added 6-axis features explanation 34. – Mounting compatibility with owa4X. – Pinout ref error correction in 4.1.4.5.2. – Max current added for Vout pin – Main connector pinout. – Torque and screws for external battery cover 4.1.4.3. – Antenna screw torque. – Compliance Regulations in different countries (Serbia,Chile,Brasil,Canada). – Added SIM card insertion video 30. – Added SD card insertion video 32. – Added 100BASE-TX variant 32. – CAN-FD Datarate error correction and update 4.1.4.5.5. – CAN4 pin-out text error correction 4.1.9.1. – miniSIM, uSD and USB access info updated.
D	– Updated Functional States table.
E	– Illustration 6 updated 6. – Added Verizon certification condition. – Optional gyroscope/accelerometer data rate update 4.1.9.4

F	– Incompatibilities table error correction.	
	– EN50155 compliance requirements.	50
	– Consumption table update.	
G	– Power Interface table updated.	
H	– Functional states table updated.	
I	– Debian user replaced with "owasys".	
J	– Naming of owasys turn off binary replaced. 5.2.	