RTCU CX1 warp series

Technical Manual

Version 1.02

The M2M Enabler

Introduction

This manual contains technical documentation which allows for easy installation and use of the **RTCU CX1 warp** series. For information on the programming and software configuration of the **RTCU CX1 warp** series please refer to the RTCU IDE documentation.

The RTCU CX1 warp series are compact, waterproof and ruggedized telematics tracking and control devices, based on the powerful X32-architecture. The series sports a long list of standard features and can be further upgraded when required with powerful ***on-demand hardware*** options.

The RTCU CX1 warp series are available in two versions:

- **RTCU CX1 warp**
  With RS232/FMI and 1-wire, but no CAN bus.
- **RTCU CX1 warp-c**
  With CAN bus, but no RS232/FMI or 1-wire.

Except for the differences list above the two RTCU CX1 warp variants are identical, and any reference to RTCU CX1 warp refers to both variants unless otherwise noted.

The RTCU CX1 warp is designed for a broad variety of advanced telemetry / telematics applications and has been manufactured according to the highest technical standards for professional automotive and industrial use. The product has all necessary regulatory approvals – including 2004/104/EC / UN ECE R10 and CE mark.

The RTCU CX1 warp includes many sophisticated standard features and can be further upgraded as required with the following on-demand hardware features:

I/O:	**2 x digital inputs, 2 x digital outputs and 1 x analog input (total).**
RF:	**Medium range ISM band RF transceiver with on-board antenna.**
FLASH:	**Micro-SD card reader and 3 MB extended flash.**[1]
COM:	**RS232/FMI and 1-Wire bus (warp) or CAN (warp-c).**

Options can be applied on-demand even remotely by the unit already installed in the field.

The RTCU CX1 warp rests on the **RTCU M2M Platform** that brings all the necessary tools together to develop, implement and maintain today's sophisticated M2M/IoT applications.

For detailed information on the powerful RTCU M2M Platform, please refer to the ***RTCU M2M Platform datasheet***.

1 The FLASH on-demand option is FREE of charge and just requires activation.

The technical highlights of the RTCU CX1 warp:

- Based on the **RTCU M2M Platform**[2]
- **X32 execution architecture**.
  - RTCU IDE development tool with a full featured device simulator.
  - Huge standard API with more than 800+ functions.
  - Comprehensive protocol support, including:
    TCP-UDP/IP, FTP, SMTP, RACP, MQTT, FMS/J1939, Garmin FMI.
- World-wide **Quad-band GSM engine**.
- Internal SIM-card reader.
- State-of-the art **SuperGPS positioning engine**.
- High-performance **3-axis accelerometer** with 16g scale.
- Large data-flash/logger memory with a capacity **up to 4.5 MB**.
- Internal **4 MB FAT32 flash drive**.
- **1 x digital inputs** and **1 x high-power** solid-state **digital output** (upgradeable).
- Wide operating range from **8..36 VDC.**
- On-board **Li-Ion battery**.
- Advanced **power-management** with wake-up on a wide range of events.
- High-speed **Mini-USB programming** connector.
- Support the **Garmin Fleet Management Interface**.
- Fully supported by the **RTCU Gateway 2** and the **RTCU Deployment Server**.
- Available in two powerful hardware versions:
  CX1 warp (RS232/1-wire)
  CX1 warp-c (CAN)
- **Ruggedized IP66** plastic encapsulation.
- Delivered a 50 cm interface cable.
- **Powerful on-demand hardware options:**
  I/O: **2 x digital inputs, 2 x digital outputs and 1 x analog input (total).**
  RF: **Medium range ISM band RF transceiver with on-board antenna.**
  FLASH: **Micro SD card reader and 3 MB extended flash.** ***FREE!***
  COM: **RS232/FMI and 1-Wire bus (warp) or CAN (warp-c).**
- **On-demand options** can be applied **anytime** — even remotely after installation.

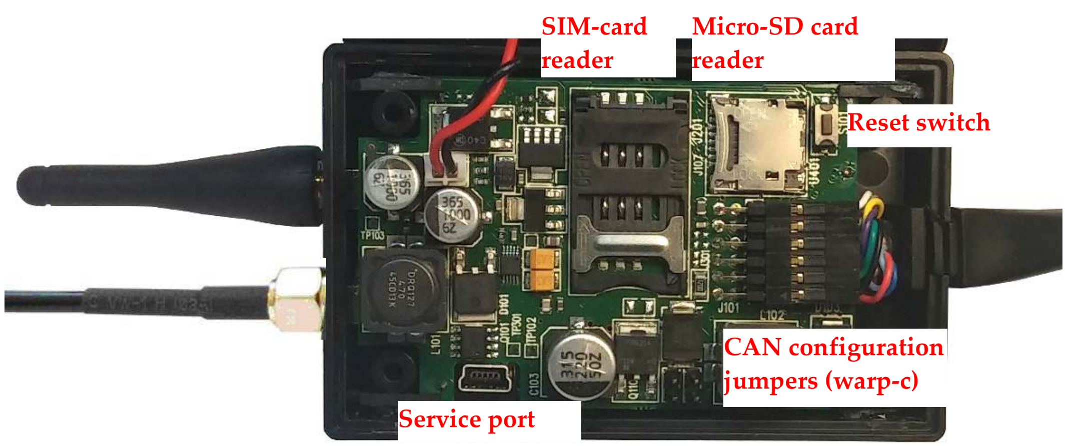
2 Please see "The **RTCU M2M Platform**" data sheet for more information.

* * * * THIS PAGE IS INTENTIONALLY LEFT BLANK * * *

Table of Contents

Graphical view

(Note: Please remove the protective foil on the surface of the unit before use)



Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark
Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: support@logicio.com
www.logicio.com

External connections

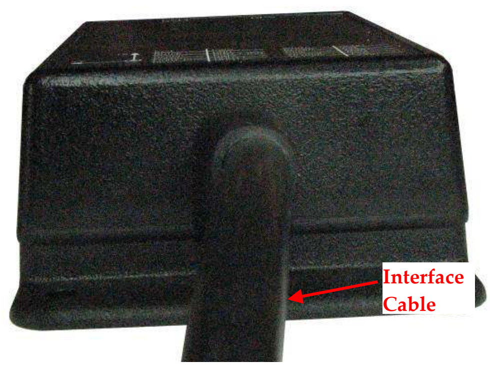
Overview

Connections to external equipment are done via the connectors/cables located back and forth on the product.

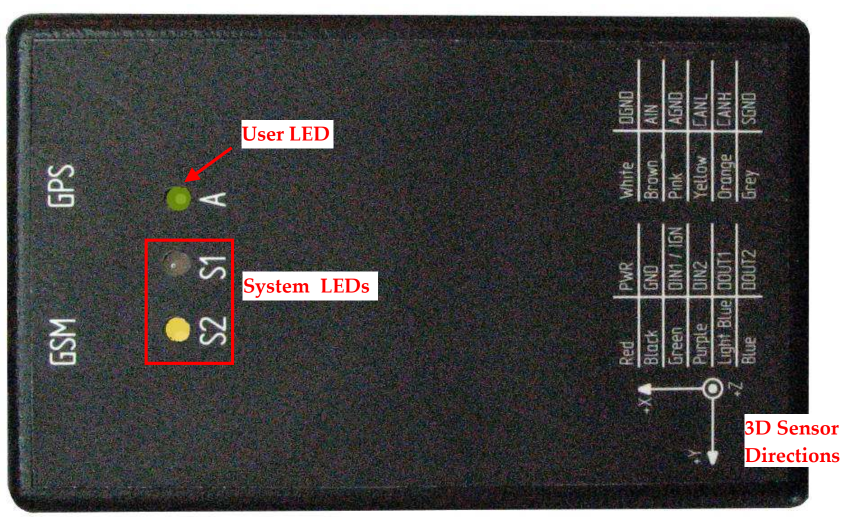
The front side is equipped with a SMA female Quad-band GSM antenna connector, and a SMA female GPS antenna connector. In the back side the interface cable to the unit is located. The interface cable is color coded and includes power supply, digital input/output interfaces, analog input interface and CAN-bus communication interface.

A graphical overview of the front, back and top side is shown below:

Front-side view



Back-side view



Top-side view

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark
Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: support@logicio.com
www.logicio.com

Interface cable overview (CX1 warp)

Color	Name	Description
Red	PWR	Power supply, positive (+) connection
Black	PGND	Power supply, negative (-) connection
Green	DIN1 / IGN	Digital input 1, ignition input
Purple	DIN2	Digital input 2 (*enabled with I/O option*)
Light Blue	DOUT1	Digital output 1
Blue	DOUT2	Digital output 2 (*enabled with I/O option*)
Brown	AIN	Analog input (*enabled with I/O option*)
Pink	1WIRE	1-Wire bus (*enabled with COM option*)
White	GND	Digital/analog ground
Yellow	RXD	Receive Data for RS232 port (*enabled with COM option*)
Orange	TXD	Transmit Data from RS232 port (*enabled with COM option*)
Grey	SGND	Signal ground

Interface cable overview (CX1 warp-c)

Color	Name	Description
Red	PWR	Power supply, positive (+) connection
Black	GND	Power supply, negative (-) connection
Green	DIN1 / IGN	Digital input 1, ignition input
Purple	DIN2	Digital input 2 (*enabled with I/O option*)
Light Blue	DOUT1	Digital output 1
Blue	DOUT2	Digital output 2 (*enabled with I/O option*)
White	DGND	Digital ground
Brown	AIN	Analog input (*enabled with I/O option*)
Pink	AGND	Analog ground
Yellow	CANL	CAN-bus L-signal (*enabled with COM option*)
Orange	CANH	CAN-bus H-signal (*enabled with COM option*)
Grey	SGND	Signal ground

Power supply

The RTCU CX1 warp are to be supplied with 8..36 VDC from an external DC power source connected to the power cables in the interface cable. Positive power is applied to the **red** colored cable and ground is connected to the **black** colored cable.

There are four different labels for the ground connections:

- Power Ground (PGND on CX1 warp, and GND on CX1 warp-c)
- Signal Ground (SGND)
- Digital Ground (GND on CX1 warp, and DGND on CX1 warp-c)
- Analog Ground (AGND, only on CX1 warp-c).

The signal, digital and analog grounds are filtered from the power ground. Power ground must only be used as power supply return path. The signal ground is used as ground reference for RS232/CAN-bus interface, and digital ground for digital I/O's. The analog ground is used as a low noise analog ground reference for the analog inputs.

The RTCU CX1 warp has a protection circuit on the supply lines which includes protection against wrong polarity, electrical disturbances, conducted transients and load-dumps that can occur in a vehicle.

The RTCU CX1 warp also contains an internal high capacity backup battery that will supply the unit, if the external power supply should fail or be disconnected. By default the unit is powered down, when a power fail occur. This setting however can be changed. Please consult the RTCU IDE documentation for additional information.

When the ignition input is activated with a logical high, the unit will wake-up if it was in power down mode.

Digital Outputs

The RTCU CX1 warp offers as standard 1 digital output, but additional 1 digital output can be enabled with the I/O on-demand option.

The digital outputs control two "high-side" switches. They function like a contact, where one side is connected to the positive supply of the RTCU unit and the other is the output. The switches are protected against short circuit, ESD and electronic kickback from inductive loads such as relays etc. The maximum switchable inductance is 20mH and must not be exceeded.

The digital outputs are supplied through the power cable in the interface cable that also supplies the rest of the RTCU unit. As the power is also the RTCU CX1 warp main power, a power-fail would also affect the digital outputs.

The RTCU CX1 warp offers very advanced power management which makes it possible to have one or more outputs enabled while the RTCU is in low-power mode. Please consult the RTCU IDE on-line help for more information.

Please note: Special attention to wiring must be taken; if the total current consumption of the digital outputs exceeds 1A then power ground must be used as return path for the output(s) in order to avoid temperature increasing in the enclosure.

Digital Inputs / Ignition Input

The RTCU CX1 warp offers as standard 1 digital input, but additional 1 digital input can be enabled with the I/O on-demand option.

The digital inputs are all low-pass filtered and transient protected. To activate the inputs, connect a positive voltage between the input and the GND (DGND on the CX1 warp-c) connector.

Please note: The DIN 1 / IGN input is a special input as it also functions as the ignition input. If the ignition input is activated with a logical high or low (Wait For Event mode only) when the RTCU is in low power mode, it will wake-up the unit. A power apply will also wake-up the unit if it is in power-down mode or WaitForEvent mode with power Apply and/or ignition selected for wake-up. The ignition is de-bounced with a period between 1-2 ms when used as a digital input. So any logical level applied to this input must be longer than 2 ms to be valid.

The power management allows the possibility to configure a wake-up on one or more digital inputs with individually configured falling- or rising edge detection. Please consult the RTCU IDE online help for more information.

To support compatibility with other RTCU devices the digital input 1/ignition can also be addressed as digital input 5 from the VPL application.

Analog input

The RTCU CX1 warp has by standard no analog input, but 1 analog input can be enabled with the I/O on-demand option.

The analog input is voltage input with a range from 0V to 10V DC. The analog voltage is converted to a digital value with a resolution of 10bit or 1024 in decimal. The decimal value with 10V applied to the input is 1023 and 511 for 5V.

The input signal is connected between AIN and AGND (GND on CX1 warp). AGND must be connected to the reference of the connected equipment. Please be aware that deviations may occur, as the system is very noise sensitive. Avoid long unshielded wires and large fast-changing signals routed parallel to the analog signals.

The inputs are low-pass filtered, ESD- and transient protected.

RS232 port 1 (CX1 warp only)

This port is a general-purpose RS232 serial port and does not support handshaking. The serial port is available on the interface cable and can be activated with the communication on-demand option.

1-Wire bus (CX1 warp only)

The 1-Wire bus is available on the interface cable and can be activated with the communication on-demand option.

All 1-Wire communication goes through a single connection, and all 1-Wire devices connected to this connection retrieves its power directly from the bus (called parasitic power). For this only two wires are needed – the 1-wire signal and the ground reference – allowing minimal cable installations.

Please Note: 1-Wire ID-Button reader is supported by the CX1 warp except for the LED.

Further information regarding 1-wire networks, topology and limitations can be found in the application note area on the Logic IO webpage.

CAN (CX1 warp-c only)

The CAN interface is available on the interface cable and can be activated with the communications on-demand option

The RTCU CX1 warp-c provides the physical layer for the CAN (Controller Area Network) serial communication interface in accordance with the ISO 11898 standard. The CAN bus is designed for high-speed (up to 1Mbit) robust communication in especially harsh environments like those found in the automotive industry.

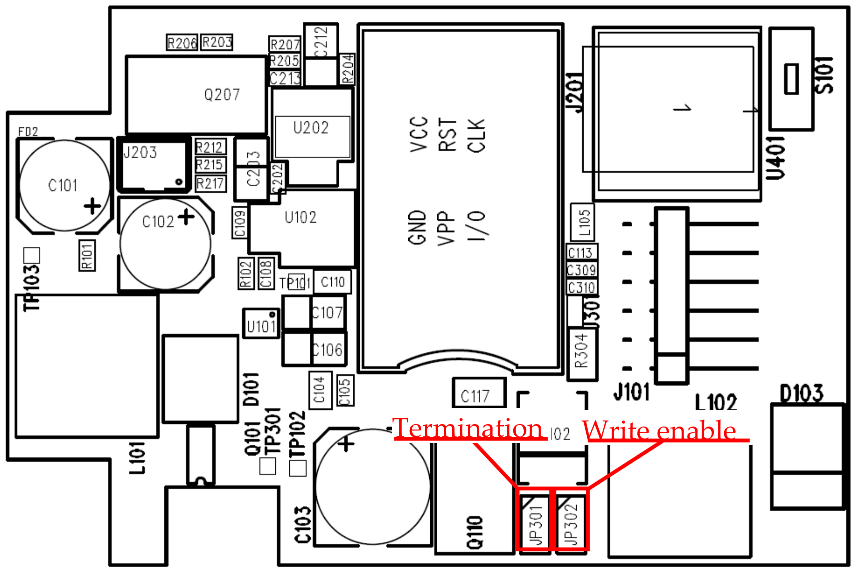
The CAN interface can be connected to an existing CAN network with a common protocol like the J1939 standard, to retrieve information for surveillance or information purposes. The interface can also be used as a robust serial data link with a non-standard protocol. Please consult the RTCU IDE documentation for more information.

The physical layer consists of a two wire (CAN-H and CAN-L) differential bus and a signal ground for reference.

Be aware that connecting the RTCU to a CAN network can be dangerous. If the RTCU is not configured with the correct network parameters, it will lead to network corruption and may interfere with other connected equipment on the bus. Especially in vehicles great precautions must be observed to prevent interruption of the communication.

On the RTCU CX1 warp-c write capability on the CAN bus is disabled by default, this can be enabled by installing the hardware jumper JP302 inside the unit.

If the RTCU CX1 warp-c is connected to a “non-existing” network, a 120[3] ohm resistor must be connected between CAN-H and CAN-L at each end of the transmission-line to terminate it and avoid signal reflections. This resistor can be connected by installing the hardware jumper JP301 inside the unit. Please refer to Appendix A for assembling/disassembling the unit for jumper installation. The following picture illustrates the location of the termination resistor jumper, and write enable jumper:



Jumper	Name	Status	Description
JP301	CAN-bus termination	Installed	120 ohm termination enabled
		Not installed	120 ohm termination disabled
JP302	CAN-bus write enable	Installed	CAN-bus write enabled
		Not installed	CAN-bus write disabled

A wide range of software functions is available for easy access to the network. Please consult the RTCU IDE online help for further information.

USB programming port

The USB port is for programming and communicating with the RTCU IDE (or other RACP compliant applications). A standard mini-USB cable can be used between the unit and the PC. For location of the service port connector please refer to Appendix A

3 Assuming use of a CAT5 twisted pair cable

3D-movement Sensor

The RTCU CX1 warp has an on-board 3D-movement and vibration sensor. It makes it possible to detect movement and position change in all three directions, X-Y-Z, and vibration through the power management when for example the vehicle is moved. The sensitivity and thresholds for different directions can be altered from within the VPL program - making it suitable for various applications. Please consult the RTCU IDE online manual for more information.

Specification

		Unit	
Resolution	±16	g	The acceleration can be set as relative to motion,
Precision	12	bit	or relative to earth gravity

LED Indicators

Two bi-colored (red and green) and a single yellow LED indicators are present on the top side of the unit (see graphical view).

One bi-colored LED (A) are available to the user and the remaining two LED's (S1 and S2) are signaling the status and possible errors of the RTCU unit.

User LED A

LED A are composed of two individually controllable LEDs:

- LED named A on the front, consists of LED 1 (green) and LED 2 (red).

They are easily accessed from within the application program, and it is possible to mix the LED's to obtain a third color: yellow. Please consult the RTCU IDE documentation for more information.

System LED S1 and S2

The RTCU is equipped with two system LED's which shows the status and possible errors of the RTCU unit.

The different patterns are listed in the table below. If the color of the system LED S1 is yellow, the unit is actively communicating with the RTCU IDE (or another program, supporting the RTCU RACP protocol).

The single yellow LED is signaling either the GSM module activity, or if all other LED's are off, that the RTCU is in the "wait for event" low power state.

S1: System LED1 pattern overview

Pattern	Description
Fastest blinking, green	The unit is initializing, preparing to start the application.
Fast blinking, green[4]	The unit has been forced into recovery mode with the use of the system switch. The application is not executing.
500ms On / 500ms Off green[4]	The unit is executing the application program
1.5s On / 0.5s Off. green[4]	The unit is executing the application program, while charging the internal back-up battery.
Fast blinking, red[4]	A runtime error has been detected in the program. Use the RTCU IDE to obtain the fault log.
Alternating Fast/Slow, red[4]	The unit has lost its firmware! This can only happen if, during a firmware upgrade, the RTCU unit loses power or the communication is lost completely. In this case, simply upload the firmware to the unit again.
75ms On / 925ms Off, green	Execution speed is different from full-speed.

S2: System LED2 pattern overview (GSM activity and "Wait For Event")

Pattern	Operating Status
Off	The GSM module is turned off
600 ms On / 600 ms Off	Missing SIM card or PIN code. Network search and logon in progress.
75 ms On / 3 s Off	Logged on to the network.
75 ms On / 75 ms Off / 75 ms On / 3 s OFF	A GPRS session is active.
Flashing	Indicates GPRS data transfer.
On	A voice or CSD session is active.
8 s OFF / 10 ms ON (and all other LED's OFF)	The RTCU unit is in low-power "Wait For Event" state.

4 Or yellow when communicating with the RTCU IDE or another program, supporting the RTCU RACP protocol).

System switch (RST)

The RTCU CX1 warp contains a combined reset/diagnostic switch. This switch is located inside of the RTCU unit (see the graphical view).

By activating the switch shortly the RTCU unit will do a complete reset, as if the power was removed and reapplied.

If the reset switch is held down for approx. 3 seconds[5] the unit will enter recovery mode[6] where the application will not be started. In recovery mode the system will automatically turn on the GSM module to establish a connection to the GSM network and RTCU Gateway (if configured). This method will also activate the unit when the unit is in power-down mode.

5 System LED S2 will flash three times when this state is entered.

6 System LED S1 will indicates this state by fast blinking green or yellow.

Internal Li-Ion battery

The RTCU contains an internal Li-Ion battery for operation even when the external power is absent making it possible to report power loss etc. Please note that when external power is removed, the unit will be powered down by default. This setting can be changed as documented in the RTCU IDE documentation.

The digital outputs will be disabled when a power fail occurs as the internal battery cannot provide the supply voltage needed.

The battery charging is completely automated and handled internally by the RTCU unit – leaving no need for user interaction. Different kinds of functions (Battery low, Charger enable, Charging status, etc.) are available to the user application.

The charge current is relatively high, for a shorter charge time, as specified in the technical specification. Make sure both power supply and cables can handle the high current.

The battery will be charged whenever a power fail has occurred to establish the capacity thus making the battery ready for the next power fail. A maintenance charge will start every 20 days after the last charge. This is to compensate for the battery self-discharge etc.

By default the battery cannot be charged above 45°C or below 0°C. The RTCU offers charging down to -10 ˚C using a specialized algorithm to protect the battery.

If the temperature is above 45°C the charging will not start and will be postponed until it is below this threshold.

The temperature has a very high influence on the battery capacity. At 0°C the capacity has dropped to 60% of the initial capacity and it falls dramatically at lower temperatures.

The battery cycle (numbers of charges and discharges) also influences the capacity. After 300 cycles the capacity has dropped to approximately 80% of the initial capacity.

Warning
Misusing the RTCU unit may cause the built-in battery security circuit to be damaged.

- *Do not place the RTCU unit in high temperature locations such as in direct sunlight or near engines. Using the RTCU unit in this environment may result in loss of battery performance and a shortened life expectancy.*
- *Do not expose the unit to water, salt water or allow the battery to get wet.*
- *Avoid strong impacts and shocks.*

For more information regarding the environmental limitations see “Specifications for RTCU CX1 warp series” below or consult the RTCU CX1 warp series Datasheet.

Micro SD card reader

The RTCU CX1 warp has an on-board Micro SD card reader, with FAT32 file-system support for standard PC-compatibility, with up to 32 GB capacity support.

The Micro SD card reader is a lid based system with mechanical lock for reliable insertion and operation, and is located inside the unit (see graphical view)

NOTE:
The Micro SD card reader is an on-demand option that can be enabled with the FLASH option.

Approved Micro SD-cards

To ensure the highest performance and compatibility it is important to use SD-CARDs that has been approved and tested by Logic IO.

The following **Commercial Grade** Micro SD card's from Sandisk has been approved for use:

Capacity	Sandisk SKU
4GB	SDSDQM-004G-B35
8GB	SDSDQM-008G-B35
16GB	SDSDQM-016G-B35
32GB	SDSDQM-032G-B35

Commercial grade SD-CARDs can be used in applications where the limited write endurance is acceptable - for example if the SD-CARD is often replaced. Commercial grade SD-CARDs should ***not*** be used in applications where a potential failure on the media is considered mission critical.

For applications that uses the SD-CARD media extensively and where a failure is critical, it is recommended to use approved **Industrial Grade** SD-CARDs.

Logic IO has approved and recommends industrial grade SD-CARDs from **ATP** that is available in capacities from 512 MB to 32 GB.

ATP Industrial Grade SD/SDHC Cards are optimized for demanding industrial applications with consistent performance in all conditions. ATP uses reliable SLC flash technology with a flash endurance more than 20 times higher than commercial grade products with MLC flash.

The differences in write endurance between commercial grade MLC flash and ATP Industrial grade SLC flash is quite remarkable for write-intensive applications:

Product Line	Details	Total Writeable Data Prediction @ 1GB	Time Prediction @ 500 writes a day (1GB)
ATP Industrial Grade	Industrial SLC Flash + Advanced Wear Leveling	80,000 GB or 2,800,000 writes	**5,740 days** or **15.7 years**
Commercial Grade	Grade A MLC (2 bits per cell) + Advanced Wear Leveling	4,000 GB or 140,000 writes	**280 days**

ISM RF

The RTCU CX1 warp is provided with an ISM band RF module, which gives the unit ability of communicating with other devices wireless. The unit communicates in the 868 MHz frequency band. The RF module hardware is setup to comply with the European EN 300 220 requirements. Please consult the RTCU IDE on-line help for more information on how to configure the RF module.

The ISM RF is an on-demand option that can be enabled with the RF option.

Specifications of the RF module

Data	Value
Max. Output Power	+10 dBm
Frequency	869,4 MHz
Modulation	GFSK
Max. Baud Rate	38,4 kbaud

Please Note: Listen **B**efore **T**alk (LBT)[7] functionality to comply with EN 300 220 is implemented in the RF module. If the unit is installed in an environment with disturbance in the same frequency band, difficulties in RF transmission will be observed.

7 LBT is a term used in radio communication whereby a radio transmitter senses its radio environment before it starts a transmission

Antennas

GSM

The RTCU CX1 warp contains an SMA Female connector for connection of a suitable GSM quad band antenna (850/900/1800/1900 MHz). When installing the antenna, please make sure that the antenna is not in close proximity of metallic parts or anything else that can influence the efficiency of the GSM antenna.

GPS

The RTCU CX1 warp contains an SMA Female connector for connection of a suitable GPS antenna. The GPS antenna must be a 3V active GPS antenna mounted with a SMA Male connector.

When installing the antenna, please make sure that the antenna has a reasonable view of the sky so that it can receive the weak signals from the satellites.

Barcode

The barcode found on the CX1 warp includes the serial number. A short format with total length of 9 digits is used. The 9 digits of the barcode are equal to the unit serial-number. The first three digits in the short format serial-number identify the unit type, and the unique code for the RTCU CX1 warp series are as following:

- **255:** RTCU CX1 warp
- **256:** RTCU CX1 warp-c

The barcode format used: 2/5 Interleaved with Check Digit

Power consumption

Detailed information on the maximum power consumption of the CX1 warp in different states and at different supply voltages is listed below.

Maximum power consumption: Unit running on external supply

	8V	12V	36V		
Unit Active	70	50	20	mA	
Unit Active with RF On	85	60	25	mA	RF idle
Unit Active with GSM On	90	60	25	mA	GSM idle @ -63dBm
Unit active with GPS On	90	60	25	mA	
Unit Active with GSM/GPS On	110	75	35	mA	GSM idle @ -63dBm
Unit Active while charging	520	500	190	mA	
Unit in power-down	0.9	0.6	0.3	mA	Restart on Ignition, RTC
Unit in "wait for event"	0.9	0.6	0.3	mA	Resume on DI, Vibration, RTC
Unit in "wait for event"	20	10	5	mA	Resume on CAN **(CX1 warp-c)**
Unit in "wait for event"	11	7	3	mA	Resume on RS232 **(CX1 warp)**
Unit in "wait for event"	25	20	7	mA	Resume on GSM activity

If the external power source is removed and the internal battery is enabled the power consumption from the battery will be as listed below.

Maximum power consumption: Unit running on internal battery

	BAT		
Unit Active	90	mA	
Unit Active with RF On	110	mA	RF Idle
Unit Active with GSM On	110	mA	GSM idle @ -63dBm
Unit active with GPS On	110	mA	
Unit Active with GSM/GPS On	130	mA	GSM idle @ -63dBm
Unit in power-down	1	mA	Restart on Ignition, RTC
Unit in "wait for event"	1	mA	Resume on DI, Vibration, RTC
Unit in "wait for event"	25	mA	Resume on CAN **(CX1 warp-c)**
Unit in "wait for event"	15	mA	Resume on RS232 **(CX1 warp)**
Unit in "wait for event"	35	mA	Resume on GSM activity

Note: Power consumption from a fully charged battery.

Specifications for the 66-channels SuperGPS receiver

	MediaTek MT3329 Single Chip SuperGPS	
General:	66 Channels simultaneous operation.	
	A-GPS capable	
	L1 frequency (1575.42MHz), C/A code	
	Continuous tracking receiver	
Update Rate:	NMEA @ up-to 1 Hz	
Accuracy:	Position	<2.5m CEP
	DGPS/SBAS	<2.5m CEP[8]
Sensitivity:	Tracking/navigation	-165 dBm
	Reacquisition	-160 dBm
	Cold Start (Autonomous)	-148 dBm
	(GPS chipset reference parameters)	
Time-To-First-Fix[9]:	Autonomous Operation in Standard Sensitivity Mode	
	Reacquisition[10]	< 1 sec.
	Hot Start[11]	< 1 sec.
	Aided start[12]	< 3 sec.
	Warm start[13]	< 32 sec.
	Cold start[14]	< 32 sec.
Interface protocol:	NMEA 0183 v3.0 with GGA, VTG, GLL, GSA, GSV and RMC	

8 Depends on accuracy of correction data provided by the SBAS service.

9 All satellites at -130 dBm.

10 Time to get a fix when signal has been blocked for a short period of time.

11 The GPS has been powered down for less than 2 hours and the stored position and time are valid.

12 The GPS has valid A-GPS information. A-GPS is currently unsupported in the standard firmware.

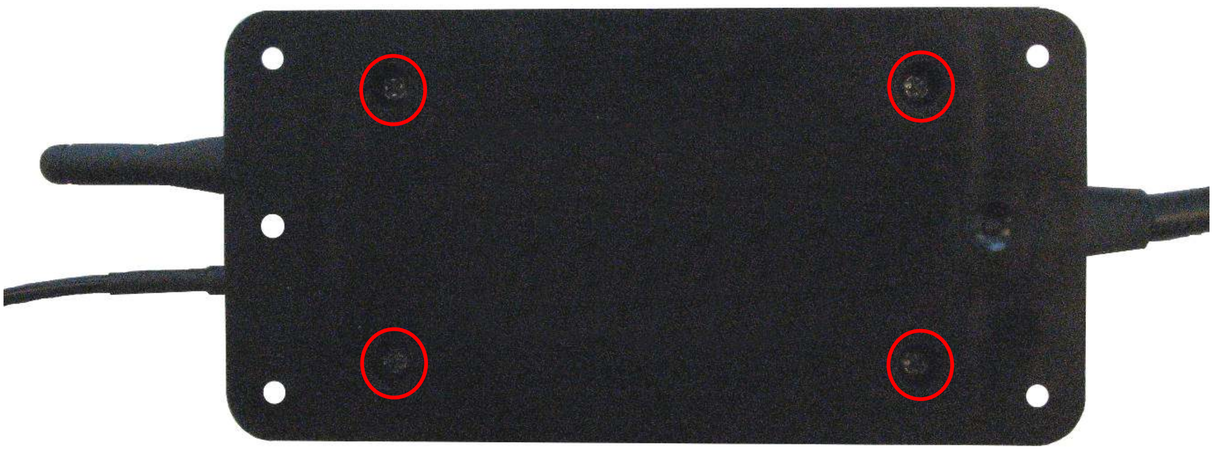
13 The GPS has been powered down for more than one hour, but has stored information about its current position and time.

14 The GPS has no valid navigation data.

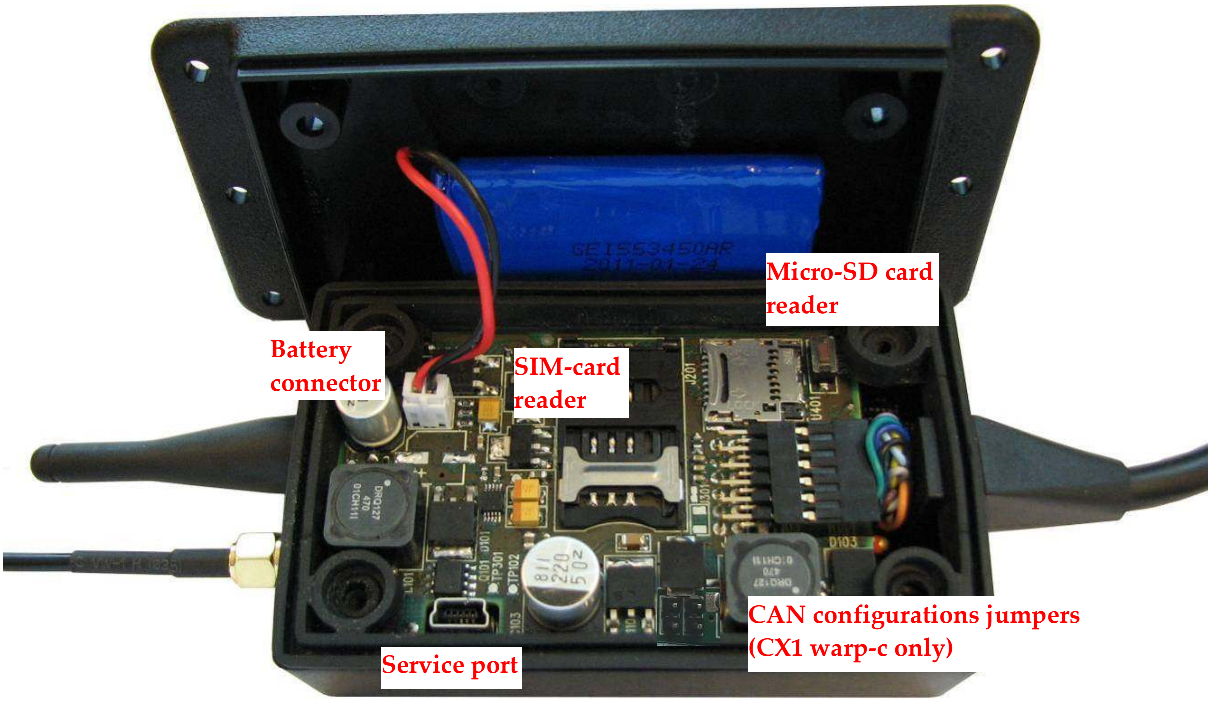
Appendix A – Assembling/Disassembling of the Unit

In order to comply with IP-66 the SIM-Card reader, Micro-SD card reader, Service port connector (mini-USB) and CAN configuration jumpers (CX1 warp-c only) are mounted inside the enclosure. User may need to open the enclosure in order to get access to these connectors and jumpers. The following steps describe assembling and disassembling the enclosure:

1. Remove the bottom part of the RTCU CX1 warp unit. The four screws are located at the corners of the bottom part as shown below:



2. Gently lift the bottom part. Please note, that the internal backup battery is mounted on the bottom part and connected to the unit with short cables. If the necessary precaution is not taken when removing the bottom part the battery, battery cable or the unit may be damaged. The open enclosure should look like this:



3. To avoid damaging the battery cable or connector it is advised to detach the battery cable.

Assembling of the enclosure is the opposite order of disassembling.

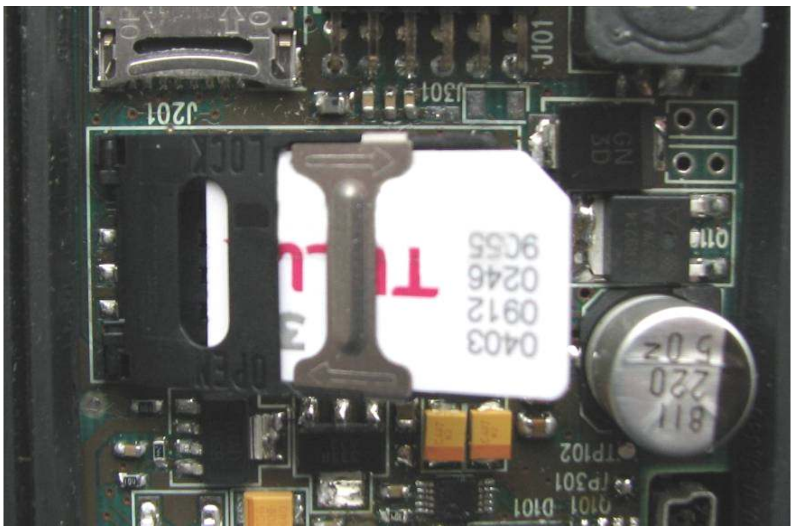
Please note: *The rubber seal* ***must*** *be mounted and aligned correctly before closing the enclosure. The interface cable mould has a cut-out for the sealing rubber. The rubber must be fitted properly in it in order to maintain IP-66.*

Appendix B – Installing the SIM card

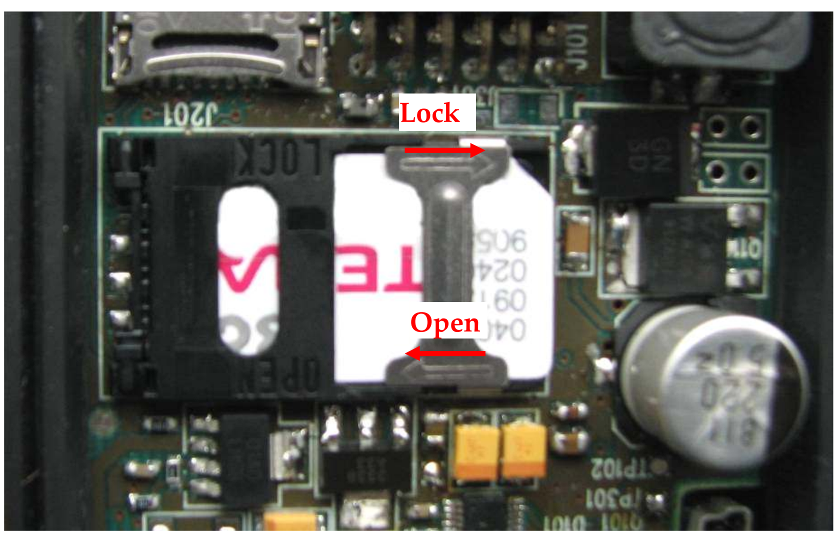
The SIM card reader is a lid based type with a mechanical lock for secure installation of the SIM card.

Open the hinged lid of the SIM card reader, orientate the card as showed below, and insert it into the lid of the card reader. Close the lid, and slide the metal locking mechanism to the locked position as shown with an arrow and text on the lid, until a click is heard.

To remove the card slide the metal locking mechanism to the unlocked position as shown with an arrow and text on the lid, and open the lid. The SIM card can now be removed.



SIM card orientation.



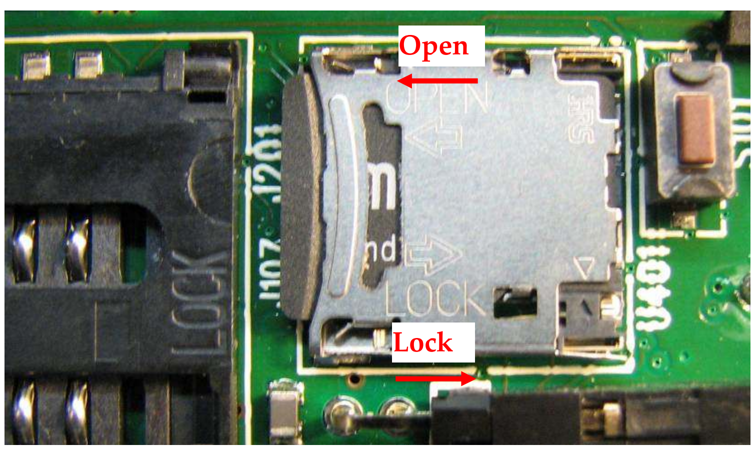
SIM inserted and locked

Appendix C – Installing the Micro SD card

To insert a Micro SD card into the reader open the hinged lid of the card reader, orientate it as shown below, and push the card into the lid. Close the lid, and slide the metal lid in the direction that is shown with an arrow on the lid, until a click is heard.

Remove the card by sliding the lid in the direction that is shown with an arrow on the lid, and then open the lid. Avoid removing the Micro SD card during access to the card.

Micro SD card orientation



Micro SD card inserted and locked

NOTE:
The Micro SD card reader is an on-demand option that can be enabled with the FLASH option.

Appendix D – Unpacking of the RTCU CX1 warp

The RTCU CX1 warp unit is delivered as a boxed product with or without GSM/GPS antennas included in a carton box, as shown below:

1. To unpack the box open the carton and remove the unit



2. Remove the unit from the bubble plastic bag


3. To prepare the unit for SIM card and SD-Card follow the guides:
   - Appendix A – Assembling/Disassembling of the unit.
     (Please notice the screw has been replaced by the rubber band)
   - Appendix B – Installing the SIM card
   - Appendix C – Installing the Micro SD

4. Optional connect the unit to the PC using a USB cable, and transfer an application.
5. Insert the screws from the plastic pack at the back of the unit and fasten tight.

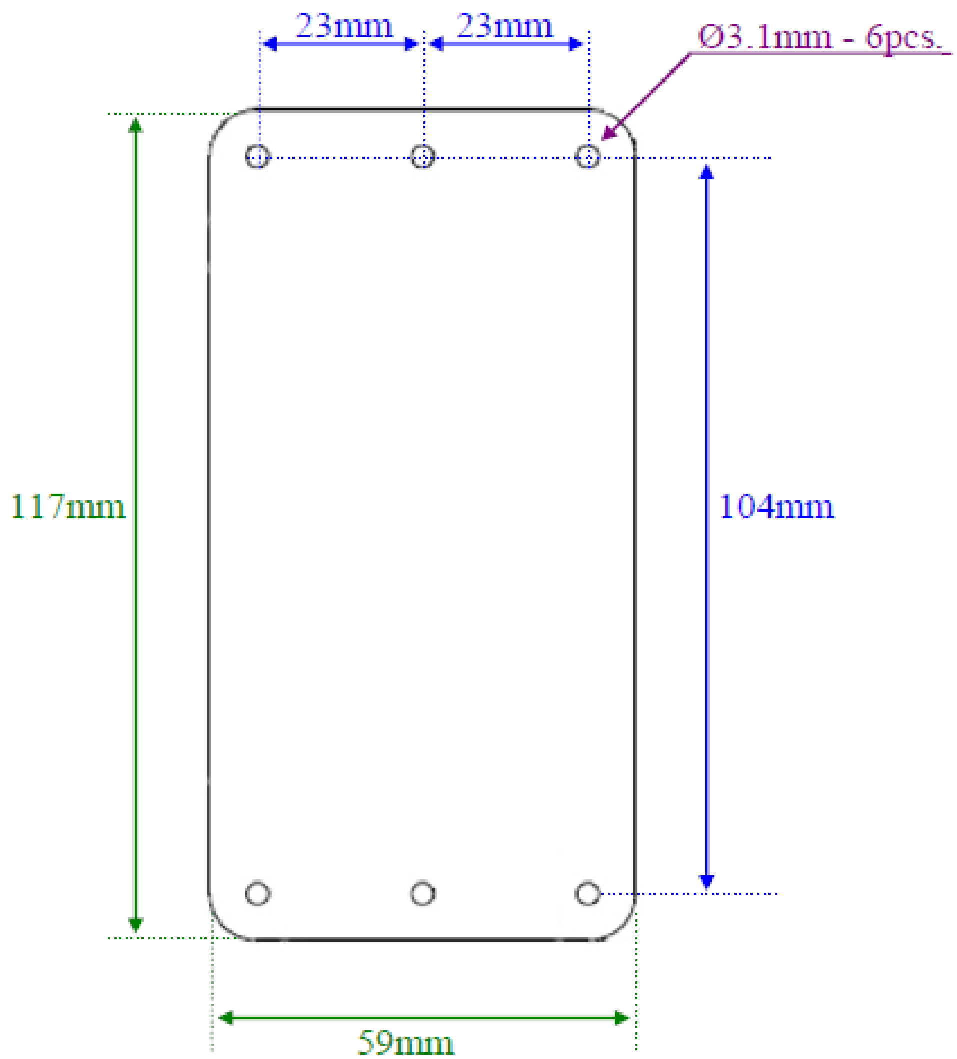
6. Remove the rubber band.
7. Remove the protective foil from the front label.

8. The unit is now ready for use.

The GPS or GSM antennas delivered may be different from the versions shown in this section.

Appendix E – RTCU CX1 warp mounting drawing

Below drawing shows the placement of the mounting holes on the bottom part of the unit:



Appendix F – On-demand hardware options

The RTCU CX1 warp utilizes a state of the art on-demand option concept allowing actual hardware options to be applied to the unit at any time - even over the air after installation.
The following upgrade options are currently available:

I/O option
The RTCU CX1 warp has by standard 1 x digital input, 1 x digital output, and no analog inputs. Applying the I/O option will expand the available I/O to 2 x digital inputs, 2 x digital outputs and 1 x analog input.

Communication option
The RTCU CX1 warp does not by standard support RS232/FMI, 1-Wire or the CAN bus.
By applying the Communication option the RTCU CX1 warp-c will get the CAN-bus interface enabled and the RTCU CX1 warp will get RS232/FMI and the 1-wire bus enabled.

RF option
The RTCU CX1 warp series does not by standard support the RF interface.
By applying the RF option the RF interface will be enabled.

Flash option
The RTCU CX1 warp series does not by standard support the SD-CARD interface, nor the extended flash (XF3). By applying the Flash option both the extended flash and SD-CARD reader will be available. This option is free of charge and just requires activation.

From within the RTCU IDE on-demand options can be requested and applied to the RTCU CX1 warp connected. When a unit option is requested the option server at Logic IO is contacted over the Internet using the supplied account credentials. If there is sufficient credits for the requested option(s) the transaction will be made and the unit options activated.
To use the request unit option functionality it is therefore necessary to have an account with a positive credit established at Logic IO with a given username/password.

By using the boardRequestOption() the RTCU CX1 warp unit can also request on-demand options directly with no user intervention.

Please see the RTCU IDE on-line help for additional information.

RTCU CX1 warp series Specifications

Processor and Main-memory
- Powerful 32-bit ST ARM7 processor.
- 1088 KB fast execution RAM.
- 2304 KB Flash for firmware/application.

Storage
- 3.5 MB persistent data flash.
- 4 MB internal FAT32 flash drive.
- 1 MB circular automatic datalogger.
- 8 KB Virtual FRAM with fast access / unlimited write endurance.
- Micro SD-CARD reader. Up to 32 GB.

GSM
- Quad-band GSM engine. 850/900/1800/1900 MHz.
- GPRS Class B, Multislot 10.
- CSD with up to 19 Kbps.
- SMS / PDU.
- Micro-SIM 1.8/3 volt.
- Optional Gemalto SIM-on-chip.
- Delivered with 'thumb' antenna.

SuperGPS
- Mediatek MT3329 Single Chip.
- 66 acquisition / 22 tracking channels.
- SBAS (WAAS,EGNOS,MSAS).
- Prepared for A-GPS.
- Position update with up to 4 hz.
- Sensitivity.
  Tracking: -165 dBm
  Reacquisition: -160 dBm
  Cold start: -148 dBm.
- Accuracy: < 2.5m CEP.
- Active 3 volt GNSS antenna.
- Delivered with a tiny magnet antenna with 2 meter cable.

Battery and Charger
- On-board 900mA (nom.) Li-Ion battery.
- Intelligent charger with temperature throttle and sub-zero degrees support.
- On-board temperature sensor.

Electrical Specification.
- Operating voltage is 8 to 36 VDC.
- Short and reverse power protected.

Digital/Analog Interface
- 2 x digital solid-state digital output.
  Max. 36 volt / 0.75 A per. channel.
  Short-circuit, ESD, Inductive kick-back protected up to 20 mH.
- 2 x digital inputs.
  Logic high: 8 to 40 VDC.
  Logic low: -5 to 3 VDC.
- Digital input #1 can be used as ignition.
- 1 x analog input.
  Range is 0..10V.
  Resolution: 10 bit
  Precision: ±1.5% FSR @ 25°C

Communication
- **Warp-c:** Full CAN2.0B with hardware filtering and multi-speed support.
- **Warp:** RS232 and 1-Wire bus.
- On-board 868 Mhz ISM RF
  Up to 15 meter indoor /
  Up to 50 meter outdoor.

Power Management
- 5 execution speeds.
- Wait for Event: Timer, Digital input, RS232, CAN, GSM, Accelerometer and power change state.
- Wait for event, from: 600 uA@12V.
- Supervision of supply voltage / type.

Accelerometer
- 3-axis digital acceleormeter.
- Resolution: 12 bit @ ±16g.
- Low-power mode.

Internal Interface
- Mini-USB connector for service port.
- SIM-card slot for micro-SIM.
- Micro SD-CARD slot.
- Reset/recovery switch,

External Interface
- 2 x bi-color LED indicators.
- Yellow LED for status.
- SMA female connector for GSM antenna.
- SMA female connector for GPS antenna.

On-Demand Hardware Options
- Applied "*any-time*" - locally or remotely.
- Over-the-air hardware upgrade.

Physical Characteristics
- Encapsulation: Black UL94 plastic.
- Sealing membrane.
- 50 cm open-ended interface cable.
- Approx. 250 gram without accessories.
- W 92 x H 30 x D 58 mm. (without mounting flanges).

Environmental Specification
- Operating temperature: -30 to 55°C.
- Battery charge temperature: -10 to 45 °C
- Recommended storage temperature: 0 to 45 °C.
- Humidity: 5..90% (non condensing).
- IP-66 ingress protected.

Approvals
- E1 type approval: 2004/104/EC UN ECE R10.
- CE mark / Applied R&TTE directive.
- GSM engine: CE/GCF/FCC/PTCRB.

Warranty
- Two-years return to factory parts and labor.
- Optional warranty up to 5 years. (restrictions apply).

Technical data are subject to changes.

* * * * END OF DOCUMENT * * * *