logic IO
The M2M Enabler

Technical Manual for the RTCU CX1 pro-c

Version 1.22

Introduction

This manual contains technical documentation allowing easy installation and use of the RTCU CX1 pro-c unit. For information on the programming and software configuration of the RTCU CX1 pro-c please refer to the RTCU IDE documentation.

The RTCU CX1 pro-c is a compact, waterproof and ruggedized telematic tracking and control platform, based on the powerful X32-architecture also found in the popular MX2i Series. In addition to a long list of standard features the RTCU CX1 pro-c sports a state of the art 66-channels SuperGPS receiver with unprecedented performance. In addition the device offers an on-board advanced 3D-movement sensor and wireless RF transceiver.

The product is especially suited for mobile tracking applications with its on-board GPS-receiver and advanced power-management features. The unit is fully supported by the RTCU IDE development tool and is fully back-ward compatible with previous generation of RTCU units.

The RTCU CX1 pro-c includes many sophisticated features, including Micro SD-CARD with up to 32 GB capacity and 512 KByte internal flash drive with a FAT32 compatible file-system for easy sharing of files with a PC.

As a powerful feature the RTCU CX1 pro-c incorporates a full CAN 2.0B controller with hardware filtering and multi speed support.

The advanced power-management features on the RTCU CX1 pro-c combined with the on-board high capacity Li-Ion battery allows the unit to stay in power-saving mode for a longer period of time still being connected to the GSM network and capable of waking up on for example GSM activity, change of digital inputs or the 3D-movement sensor. These features open up for the use of the RTCU CX1 pro-c in exciting new application areas where extremely low power consumption and flexible wake-up conditions are crucial parameters for successful product integration.

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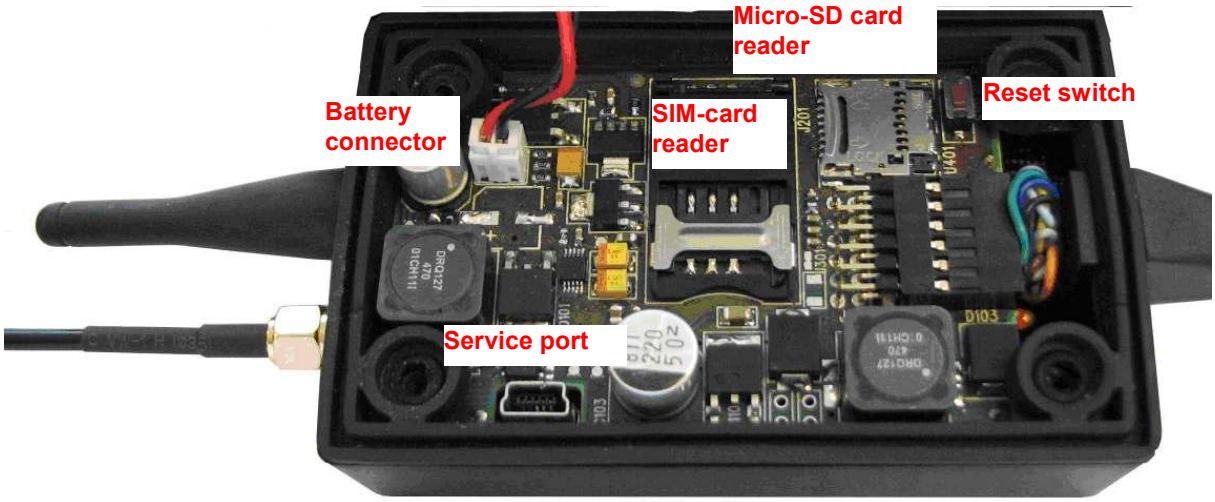
Graphical view

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



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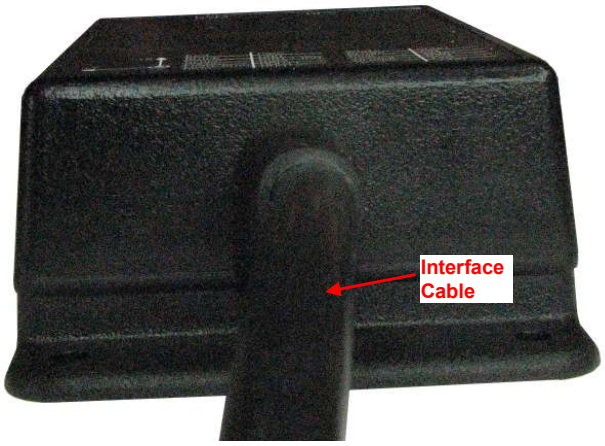
External connections

Overview

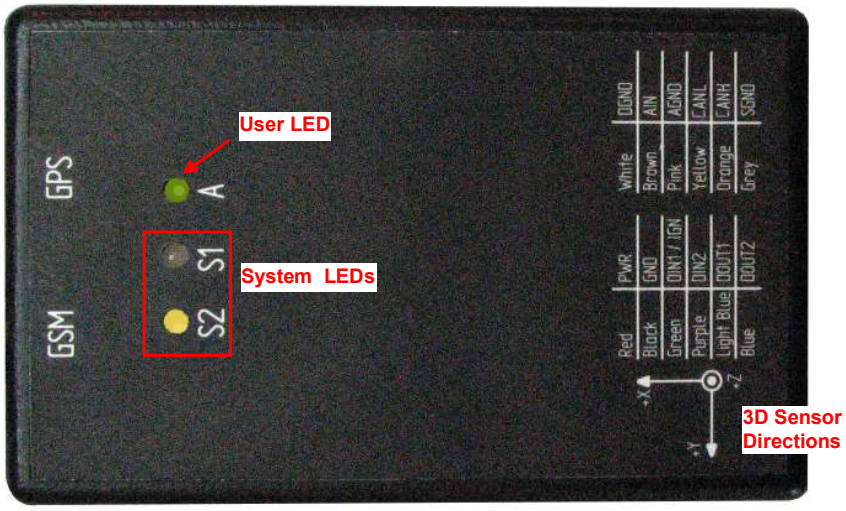
Connections to external equipment are done via the connectors/cables located back and forth on the product. All connections are available externally for easy access.
The front side is equipped with a SMA female Quad-band GSM antenna connector, and a SMA female GPS antenna connector. In the back side 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

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Interface cable overview.

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
Light Blue	DOUT1	Digital output 1
Blue	DOUT2	Digital output 2
White	DGND	Digital ground
Brown	AIN	Analog input
Pink	AGND	Analog ground
Yellow	CANL	CAN-bus L-signal.
Orange	CANH	CAN-bus H-signal.
Grey	SGND	Signal ground

Power supply

The RTCU CX1 pro-c unit is 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 (GND), Signal Ground (SGND), Digital Ground (DGND) and Analog Ground (AGND). 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 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 pro-c 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 pro-c also contains an internal high capacity backup battery, which will supply the RTCU if the external power supply should fail or be disconnected. By default the RTCU is powered down when a power fail occur. This setting however can be changed. Please consult the RTCU-IDE online help for more information.

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

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Digital Outputs

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 switch-able inductance is 20mH and must not be exceeded.

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

The RTCU unit offers a 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 online 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 supply ground (GND) must be used as return path for the output(s) in order to avoid temperature increasing in the enclosure.

Digital Inputs / Ignition Input

The digital inputs are all low-pass filtered and transient protected. To activate the inputs, connect a positive voltage between the input and the DGND 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 backward compatibility with the RTCU MX2i series DIN 1 / IGN can also be addressed as DIN 5 from the VPL application.

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Analog Input

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. 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.

CAN

The RTCU CX1 pro-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 either be connected to an existing CAN network with a common protocol like the J1939 standard to retrieve information for surveillance or information purposes. Or the interface can be used as a robust serial data link with a non-standard protocol. Please consult the RTCU-IDE online help 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 pro-c unit writing 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 pro-c unit is connected to a “non-existing” network, a 120[1] 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:

[1] Assuming use of a CAT5 twisted pair cable

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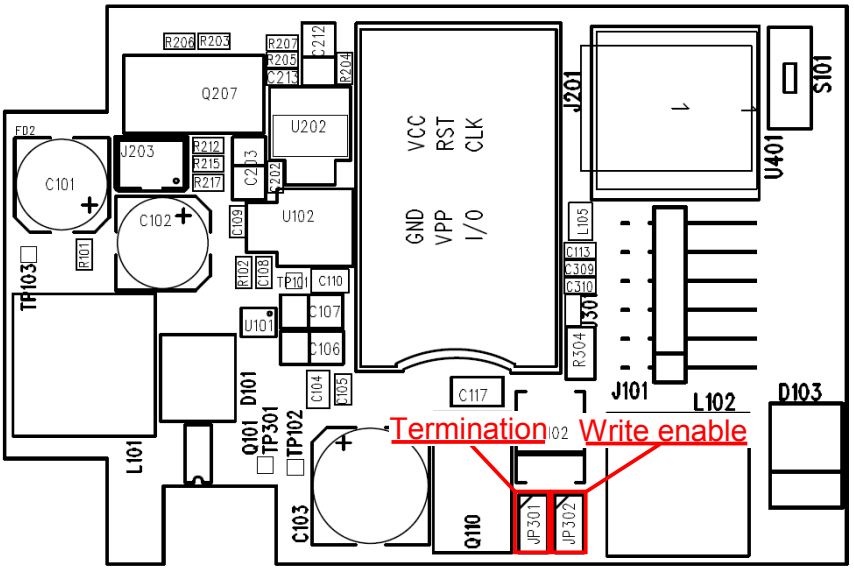

Jumper	Name	Status	Description
JP301	CAN-bus termination	Installed Not installed	120 ohm termination enabled 120 ohm termination disabled
JP302	CAN-bus write enable	Installed Not installed	CAN-bus write enabled CAN-bus write disabled

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 (RACP compliant application). 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

3D-movement Sensor

The RTCU CX1 pro-c unit contains a 3D-movement and vibration sensor. It makes it possible to detect movement and position change in 3 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.

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Indicators (LED's)

Two bi-colored (red and green) and a single yellow LED indicators are present on the top side of the unit (see external connections overview). One bi-colored LED (A) is available to the user and the remaining two LED's (S1 and S2) are signaling the status and possible errors of the RTCU unit.

The user control LED one and two for application specific signaling purposes.

- LED named A on the top side of the RTCU unit, consists of LED 1 (green) and LED 2 (red)

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

The remaining two LED's are used by the RTCU to signal the status of the unit. The different patterns are listed in the table below. If the color of the system LED 1 (S1) is yellow, the unit is actively communicating with for example the RTCU-IDE program (or another program, supporting the RTCU protocol, RACP).

S1: System LED1 pattern overview.

Pattern	Description
Fastest blinking, green	The unit is initializing, preparing to start the VPL program
Fast blinking, green (or yellow)	The VPL program is not executing, but stopped by the reset/diagnostic switch.
500ms On / 500ms Off green (or yellow)	The unit is executing the VPL program
1.5s On / 0.5s Off. green (or yellow)	The unit is executing the VPL program and charging the internal back-up battery.
Fast blinking, red (or yellow)	A runtime error has been detected in the program. Use the RTCU IDE to obtain the fault log.
Alternating Fast/Slow, red (or yellow)	The unit has lost its Firmware! This can only happen if, during a firmware upgrade, the RTCU Unit looses power, or the communication is lost completely. In this case, simply upload the firmware to the unit again.
75ms On / 925ms Off	Execution speed is different from full-speed.

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The single yellow LED (S2) is signaling either the GSM module activity or if all other LED's are off it will signal that the RTCU is in the "wait for event" low power state. Please see the table below:

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	No SIM card inserted or no PIN code entered, or network search in progress, or ongoing user authentication, or network logon in progress.
75 ms On / 3 s Off	Logged to the network. No call in progress.
75 ms On / 75 ms Off / 75 ms On / 3 s OFF	A GPRS session is active
Flashing	Indicates GPRS data transfer.
On	Connected to remote party for datacall or exchange of parameters while setting up or disconnecting a call.
8 s OFF / 10 ms ON	The RTCU unit is in "Wait For Event" low power state.

System switch (RST)

The RTCU CX1 pro-c unit 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[2] the VPL program/project uploaded to the unit will not be started and the unit will turn on the GSM module and establish connection to the GSM network and to GPRS / Gateway (if configured). This method will also activate the unit if it is powered down due to a power fail. The feature is very helpful when maintenance without power is needed. To "exit" (power down the unit again) from this mode simply activate the reset switch shortly.
The status indicator indicates the state by fast blinking green or yellow as stated above.

[2] System LED S2 will flash three times when this state is entered.

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Internal Li-Ion battery

The RTCU CX1 pro-c contains an internal Li-Ion battery for operation even during an external power fail. Making it possible to report power loses etc. Please note that when external power is removed the unit will by default be powered down. This setting can be changed though and is documented in the RTCU-IDE online manual. The digital outputs are also disabled when a power fail occur, due to that the power supplies both the digital outputs and RTCU unit itself.

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 for the user though. Please consult the RTCU-IDE online manual for more information.
The charge current is very high, for shorter charge time, as specified in the technical specifications; 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 making the battery ready for the next power fail. A maintenance charge will start every 100-hour after the last charge. This is to compensate for the battery self-discharge etc.
As standard the battery cannot be charged above 45 °C or below 0 °C, but the RTCU utilizes an advanced charging algorithm allowing charging down to -10 °C.
The RTCU unit will automatically detect the temperature and terminate the charge process if the temperature is out of range.

Low temperature charging is available as an option. Please consult Logic IO for further information.

The temperature has 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) has also influence on the capacity. After 300 cycles the capacity has dropped to approximately 80% of the initial capacity.

Warning:
Misusing the RTCU CX1 pro-c unit may cause the built-in battery security circuit to be damaged.

- Do not place the RTCU unit in high temperature locations such as 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 allow the battery to get wet.
- Avoid strong impacts and shocks.

For more information regarding the environmental limitations see “Specifications for RTCU CX1 pro-c” below or consult the RTCU CX1 pro-c datasheet.

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Micro SD card reader

The RTCU CX1 pro-c unit has a standard Micro SD card reader which is located inside the unit (see drawing below or graphical view). The Micro SD card reader is a lid based system with mechanical lock for reliable insertion and operation.

The RTCU CX1 pro-c supports a FAT file-system for standard PC-compatibility. Up to 32 GByte capacity is supported. Please refer to Appendix C for SD-Card installation guide.

Both the card detect and the write protect[3] information is available to the user through the application. Please consult the RTCU IDE on-line help for more information. Avoid removing the Micro SD card during access to the card.

868MHz ISM RF

The RTCU CX1 pro-c 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.

In the table below the specifications of the RF module is shown:

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)[4] 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.

[3] There is lack of hardware implementation of this signal, but for compatibility reason the software function will always return “not write protected”.
[4] LBT is a term used in radio communication whereby a radio transmitter senses its radio environment before it starts a transmission

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Antennas

GSM

The RTCU CX1 pro-c unit 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. The unit may be delivered with a standard antenna already mounted (see Appendix D).

GPS

The RTCU CX1 pro-c unit 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. The unit may be delivered with a standard antenna already mounted (see Appendix D).

Barcode

The barcode found on the CX1 pro-c unit contains 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 for the RTCU CX1 pro-c this unique code is **221** or **253**.

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

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Power consumption

Detailed information on the maximum power consumption of the CX1 pro-c unit 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 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	0.8	0.6	0.3	mA	Restart on Ignition, RTC
Unit in “wait for event”	0.8	0.6	0.3	mA	Resume on DI, Vibration, RTC
Unit in “wait for event”	20	10	5	mA	Resume on CAN
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 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	0.9	mA	Restart on Ignition, RTC
Unit in “wait for event”	0.9	mA	Resume on DI, Vibration, RTC
Unit in “wait for event”	25	mA	Resume on CAN
Unit in “wait for event”	35	mA	Resume on GSM activity

Note: Power consumption from a fully charged battery.

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Specifications for the RTCU CX1 pro-c

	Min	Typ	Max		
Operating Voltage	8	-	36	VDC	Protected against wrong polarity.
On-board Li-Ion Battery Pack		1000		mAh	Low-temperature charging possible.
Unit Active		50		mA	*Typical measurements @ 12 VDC Supply.*
Unit Active with GSM On		60		mA	GSM idle @ -63 dBm
Unit Active with GPS On		60		mA	
Unit Active with GSM/GPS On		75		mA	GSM idle @ -63 dBm
Unit Active while Charging		500		mA	
Unit in Power-down		0,6		mA	Restart on: Ignition and RTC
Unit in "Wait for Event"		0,6		mA	Resume on: DI, 3D accel., RTC
Unit in "Wait for Event"		7		mA	Resume on: RS232
Unit in "Wait for Event", GSM On		20		mA	Resume on: GSM
I/O:					• Digital inputs are protected against transients and low-pass filtered.
Digital input logic "high"	8	12	40	VDC	
Digital input logic "low"	-5	-	3	VDC	• Digital outputs are short-circuit, transient and ESD protected.
Digital output voltage	-	-	36	VDC	
Digital output current	-	-	750	mA	• Digital Output current is per channel
Analog input	0	-	10	VDC	• Analog input resolution is 10 bits. Input are protected against transients / low-pass filtered.
3D Movement Sensor:					3-axis digital accelerometer with hardware buffer.
Resolution		12 bit @ +/- 16g			
GPS:					Supports SBAS (WAAS, EGNOS, MSAS)
• Channels		66 Channels SuperGPS			
• Tracking Sensitivity		-165 dBm			
On-board ISM RF:					
• Frequency		868 MHz			GFSK modulation
• Channel Spacing		250 kHz			Automatic frequency compensation.
• Maximum Transmit power		+10 dBm			Compliant with EN 300 220
• Receiver sensitivity		-112 dBm			Operating range depends on the environment
• Operating Range		Indoor:up to 15m / Outdoor:up to 50m			Outdoor range is at line-of-sight
Storage temperature:	-30	-	+65	ºC	External color coded wires and LED's:
Operating temperature (According to GSM 11.10 specification)	-25	-	+55	ºC	• Power • Digital I/O • Analog Input • RS232 (pro) / CAN-bus (pro-c) • Two Bi-color LED and one yellow status LED • SMA connector for GPS / GSM antennas • Delivered GSM/GPS antennas pre-mounted.
Restricted operation (deviations from the GSM specification may occur)	-30	-	+65	ºC	
Charging Temperature	-10	-	+45	ºC	
Humidity (RH non condensing)	5	-	90	%	Internal interfaces: • Mini USB programming connector. • Standard 3 Volt SIM Card Reader
Weight (with antennas/cable)		0.250		Kg	
External dimensions		W 92 x H 30 x D 58 mm			Excluding mounting flanges
Ingress Protection (IP)		IP-66			Black UL94 plastic enclosure with sealing membrane
Approvals		EN-61000-6-3;2001 Emission EN-61000-6-2;2001 Immunity			E1 10R-036481 CE

Technical data subject to change

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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 @ 1 Hz	
Accuracy:	Position	<2.5m CEP
	DGPS/SBAS	<2.5m CEP[5]
Sensitivity:	Tracking/navigation	-165 dBm
	Reacquisition	-160 dBm
	Cold Start (Autonomous)	-148 dBm
	(GPS chipset reference parameters)	
Time-To-First-Fix:[6]	Autonomous Operation in Standard Sensitivity Mode	
	Reacquisition	< 1 sec.
	Hot Start	< 1 sec.
	Aided start	< 3 sec.
	Warm start	32 sec.
	Cold start	32 sec.
Interface protocol:	NMEA 0183 v3.0 with GGA, VTG, GLL, GSA, GSV and RMC	

Definitions:

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

Hot Start:
The GPS has been powered down for less than 2 hours and the stored position and time are valid

Aided Start:
The GPS has valid A-GPS information. A-GPS is currently unsupported in the standard firmware.

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

Cold Start:
The GPS has no valid navigation data.

[5] Depends on accuracy of correction data provided by the SBAS service
[6] All satellites at -130 dBm

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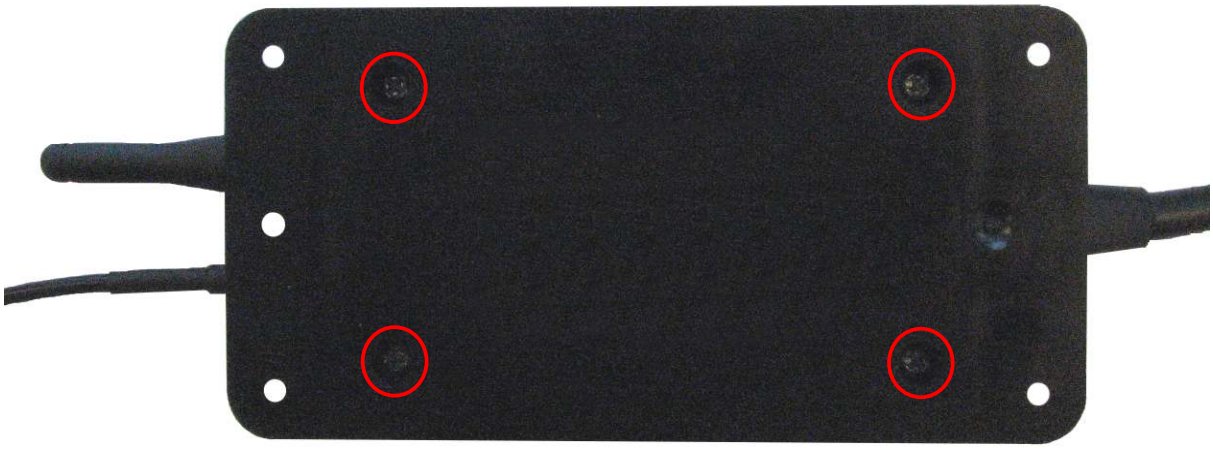
Appendix A – Assembling/Disassembling of the Unit

In order to comply with IP-66 the SIM-Card reader, Micro-SD card reader and Service port connector (mini-USB), and CAN configuration jumpers are mounted in 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 back plate of the RTCU CX1 pro-c. The four screws are located at the corners of the back plate as shown below:



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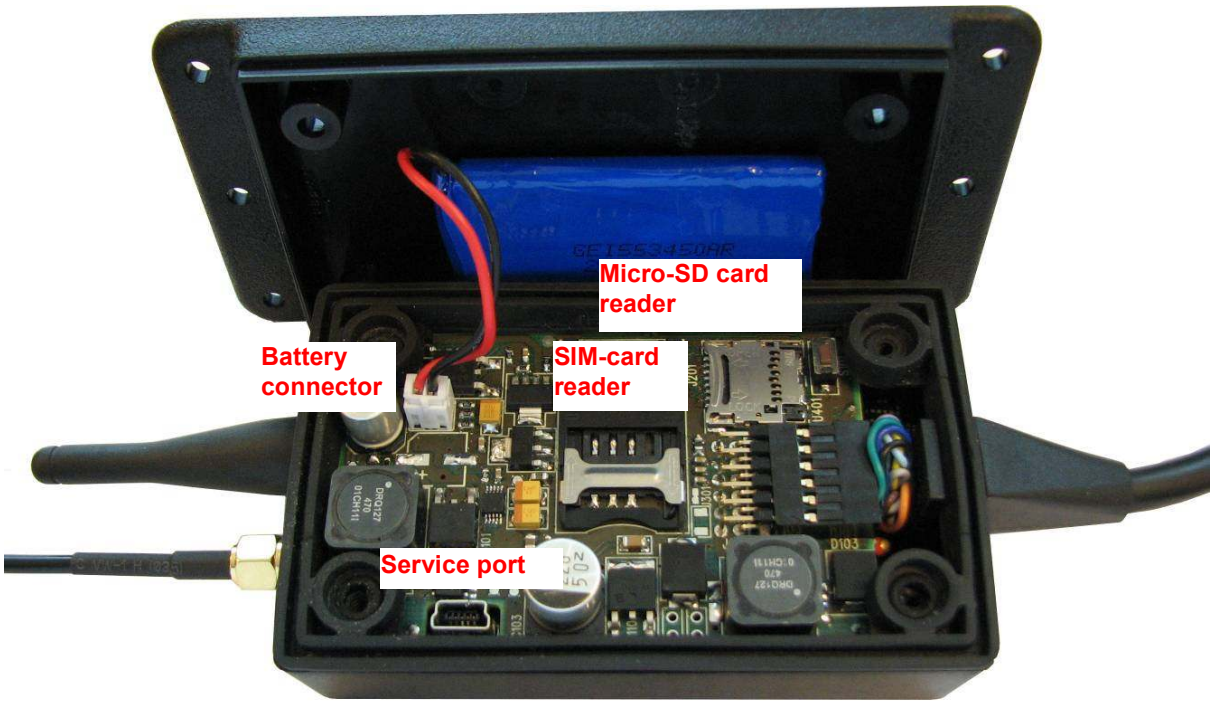
2. Gently lift the back plate. Please note, that the internal backup battery is mounted on the back plate and connected to the unit with short cables. If the necessary precaution is not taken when removing the back plate the battery, battery cable or the unit may be damaged. The open enclosure should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



3. To avoid the 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 achieve IP-66.

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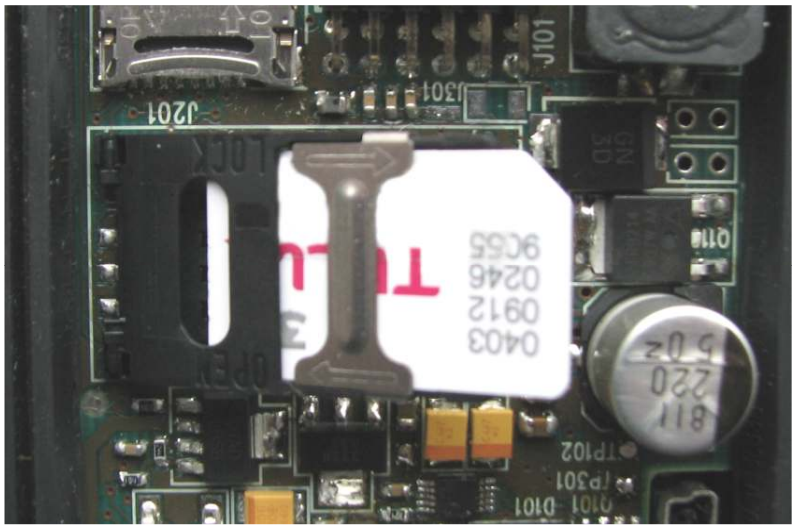
Appendix B – Installing the SIM card

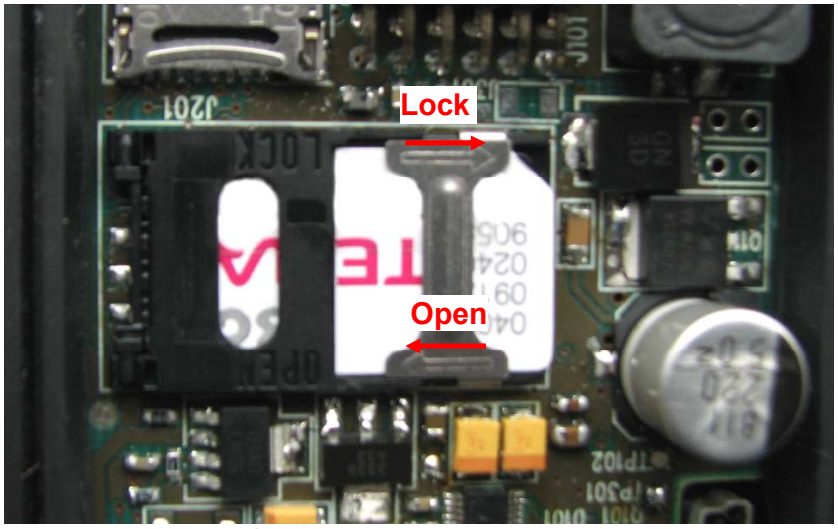
The SIM card reader is a lid based type with a mechanical lock for secure installation of the SIM card.

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

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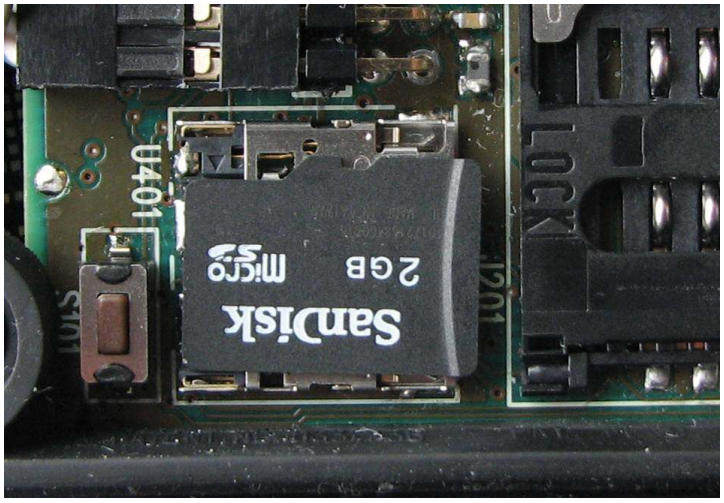
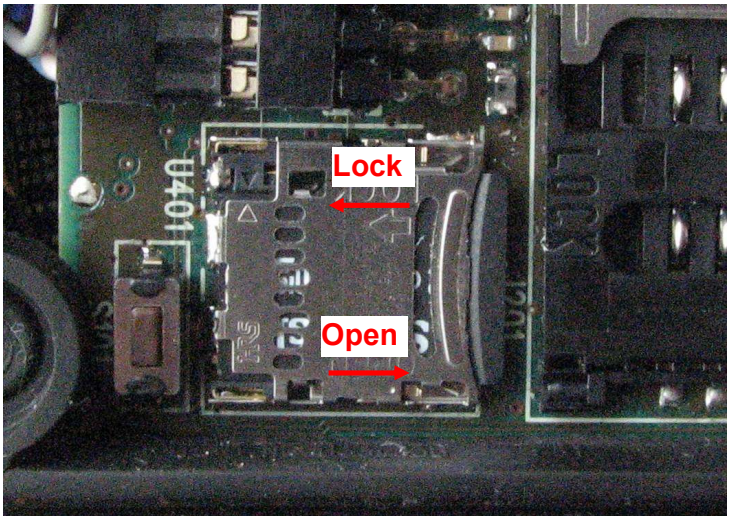
Appendix C – Installing the Micro SD card

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

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Appendix D – Unpacking of boxed RTCU CX1 pro-c

The RTCU CX1 pro-c is typically delivered as a boxed product with GSM and GPS antennas all 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

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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 card

4. Insert the screws from the plastic pack at the back of the unit and fasten tight.

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

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7. The unit is now ready for use. When installing the device please take notice the following consideration.

    a. ***GPS antenna***.
    The GPS antenna should be paced with free access to GPS satellite reception. The optimal position is with a full view of the sky and with the "GPS" text pointing up and the magnetic part facing down.

    b. ***GSM antenna***.
    The GSM antenna is mounted directly onto the unit and therefore the entire unit should not be surrounded by metal surfaces as it may reduce the reception performance in areas with weak signals.

Alternative GPS or GSM antenna may be used when required.

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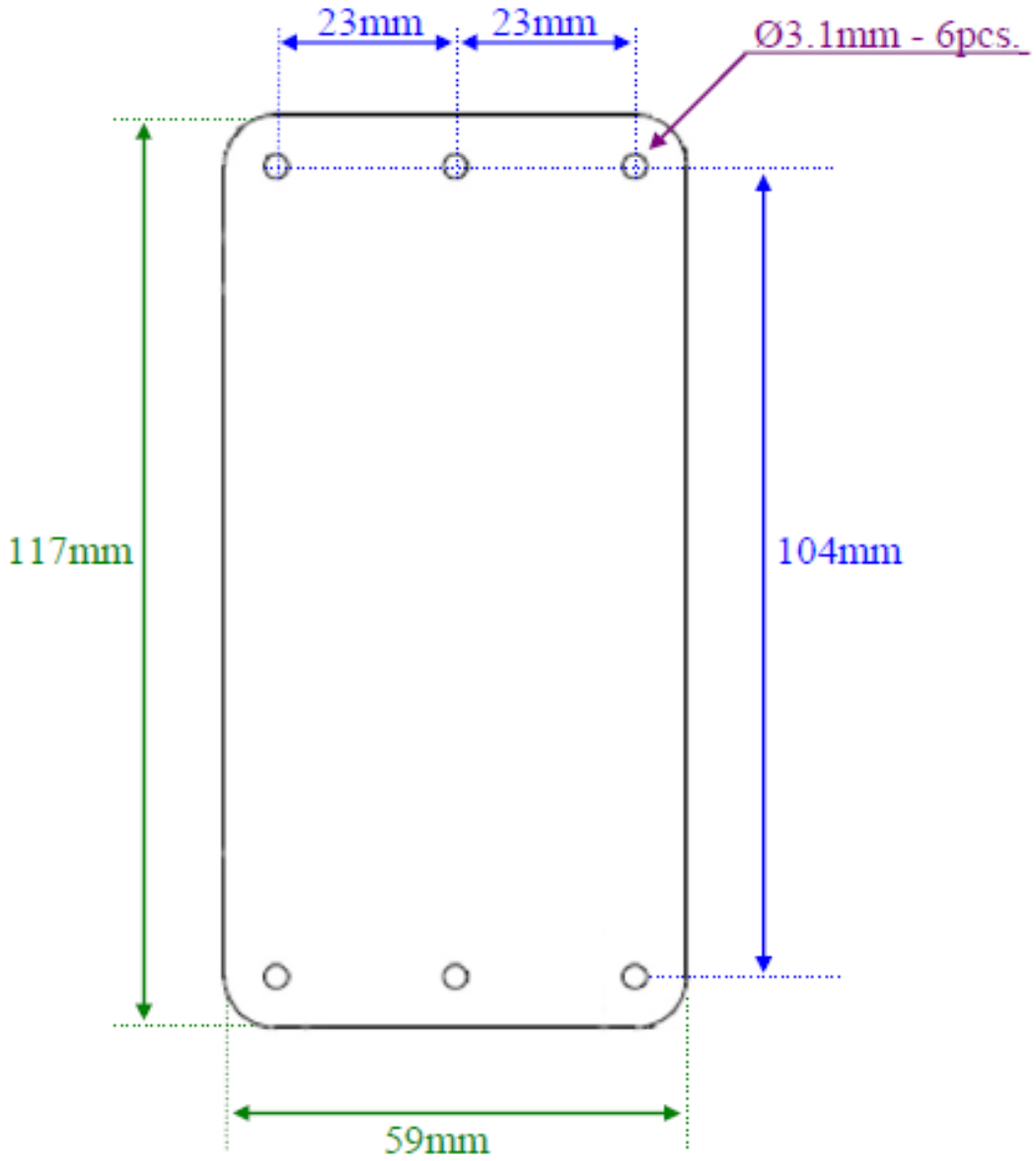
Appendix E – CX1 pro-c mounting drawing

Below drawing shows the placement of the mounting holes on the back plate of the unit:



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