logic IO
The M2M Enabler

Technical Manual for the RTCU SX1 pro / pro-r

Version 1.21

Introduction

This manual contains technical documentation allowing easy installation and use of the RTCU SX1 unit. For information on the programming and software configuration of the RTCU SX1 please refer to the RTCU IDE documentation.

The RTCU SX1 is a compact tracking, monitoring and data collection device especially designed for stand-alone extremely long operating time in harsh environments. The product is fully integrated in an IP66 ingress-protected ruggedized plastic encapsulation, which can withstand years of operation. The **zero-power** saving mode allows the unit to enter power saving mode - waking up on the on-board 3D accelerometer, digital input change or after a certain time period – and to stay in this mode virtually forever only limited by the battery technology used!
The RTCU SX1 series is available in versions for standard GSM named **RTCU SX1 pro** and a railroad based GSM-R named **RTCU SX1 pro-r.**
When this document refers to the RTCU SX1 pro it indirectly also refers to the RTCU SX1 pro-r.

Key features of the RTCU SX1 series:

- Based on the X32 generation platform sharing the same features and code compatibility.
- Advanced zero-power saving mode with virtually no power consumption.
- Wake-up from zero-power mode: accelerometer, digital input, time and external power.
- Integrated power consumption measurement for management and statistical purposes.
- Quad-band GSM or GSM-R
- Support for GSM SIM Chip.
- SuperGPS chipset with world-class performance and 2D/3D fix wake-up capability.
- Internal GSM quad-band antenna and GPS antenna.
- Optional external GSM, GPS and RF antennas.
- Medium range ISM RF Transceiver (868 Mhz) with internal or external antenna.
- Ruggedized IP66 plastic encapsulation with mounting flange. 126 mm x 174 mm.
- Externally / internally visible system LED and user LED. Internal DIP-switch.
- Several power-configurations supported:
    - 58 Ah (nominel) non-rechargeable battery. Height: 56 mm.
    - 24 Ah (nominel) non-rechargeable battery. Height: 43 mm.
    - 10 Ah (nominel) rechargeable battery. Height: 43 mm.
    - 2 Ah (nominel) rechargeable battery. Height: 43 mm.
- Dedicated high-speed USB programming port.
- One RS232 Serial ports.
- Micro SDHC compatible SD-CARD reader with FAT32 file-system and internal flashdrive.
- Optional expanded flash memory (XF8).
- 2 digital inputs, 2 digital outputs and 2 analog inputs (0..10V)
- 1-wire bus.

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

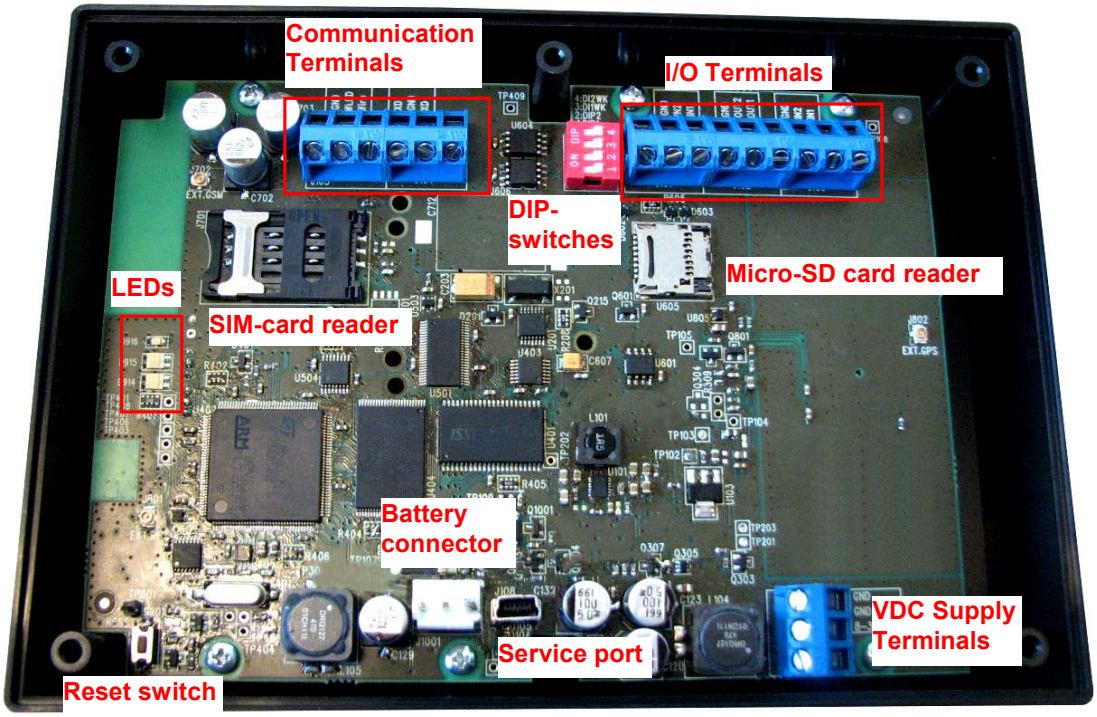
Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Table of Contents

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Graphical view



Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

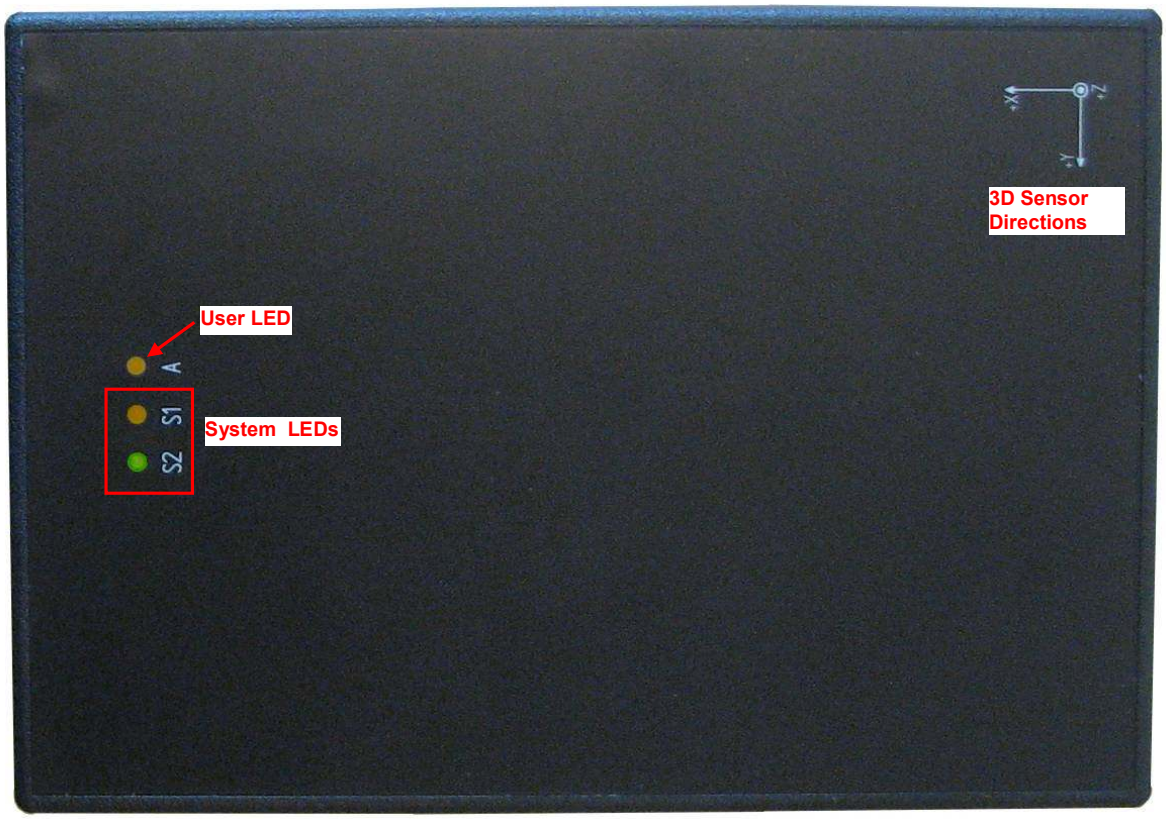
External interface

Overview

As default there are no external interfaces available, but internally all interfaces are available on screw terminals. This includes power supply, digital input/output, analog input, 1-wire and serial communication.
The RTCU SX1 is delivered with blinded PG7 holes which easily can be replaced with PG7 cable glands if one or more of the interfaces are necessary external.

The unit has internal GSM, GPS and RF antennas as default, but is prepared for connecting an external antenna for demanding applications.

A graphical overview of the top side is shown below:



Top-side view

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Power supply sources

The RTCU SX1 can be supplied from three different sources; VDC, battery or via USB.

There are four different labels for the ground connections: Ground (GND), Signal Ground (SGND), Digital Ground (DGND) and Analog Ground (AGND). The signal, digital and analog grounds are filtered from the ground (GND) which must only be used as power supply return path. The signal ground is used as ground reference for serial interfaces, and digital ground for digital I/O's. The analog ground is used as a low noise analog ground reference for the analog inputs.

DC supply

The RTCU SX1 unit can be supplied with 8-36 VDC from an external DC power source connected to the VDC supply terminals. Positive power is applied to the terminal labeled "8-36VDC" and ground is connected to one of the terminals labeled "GND".

The RTCU SX1 has a protection circuit on the VDC supply line which includes protection against wrong polarity, electrical disturbances, conducted transients and load-dumps that can occur in a vehicle.

VDC Supply Terminals

Terminal Name	Description
8-36VDC	Power supply, positive (+) connection
GND	Power supply, negative (-) connection

There are two GND connector terminals, which are internally connected.

USB supply

The SX1 is powered through the USB connection, when inserted. This feature is useful during service and development. Internally the unit is current limited (@500mA) in order to protect the external USB power source. Please note that due to the high power consumption demand of the GSM in some cases interruption of operation and/or unintended behavior may occur during GSM communication.

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Battery supply

The RTCU SX1 may also contain an internal battery, which will supply the RTCU if the external power supply should fail or be disconnected. By default the RTCU will power down when a power fail occur. This setting however can be changed. Please consult the RTCU-IDE online help for more information. The following battery options are available:

Battery Type	Capacity	Description
Lithium-Ion	2 Ah	Rechargeable low capacity
Lithium-Ion	10 Ah	Rechargeable high capacity
Lithium-thionyl Chloride	24 Ah	Non-rechargeable capacity
Lithium-thionyl Chloride	58 Ah	Non-rechargeable capacity

Digital Outputs

The digital outputs of the SX1 are open-collector outputs which functions like a contact, where the output will be connected to ground. The outputs are protected against transients. Please note that when an inductive load is connected to the outputs an external current limiting circuit and diode must be applied.

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 all low-power modes – except zero-power. Please consult the RTCU-IDE online help for more information.

Please note, that the digital outputs are disabled when entering zero-power mode.

Digital Output Terminals

Terminal Name	Description
DOUT1	Digital output 1
DOUT2	Digital output 2
DGND	Digital ground

Digital Input / Ignition Input

The inputs are not true open-collector, but act like an open collector in a such way that the input will be read logic “high” when it is connected to the ground, and the input must be floating for a logic “low” reading. The input is internally pulled-up and defined for floating connection. The digital inputs are low-pass filtered and transient protected.

Digital Input Terminals

Terminal Name	Description
DIN1	Digital input 1 / Ignition input
DIN2	Digital input 2
DGND	Digital ground

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Please note: The DIN1 input is a special input as it also functions as the ignition input. If the ignition input is activated (WaitForEvent mode only) 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 digital inputs are low-pass filtered, so any logical level applied to this input must be longer than 50 ms to be valid.

The digital inputs can be used to wake up the unit from the zero-power mode when configured using the dip switches 3 and 4, respectively, as shown in the following table:

DIP3	ON	Digital input 1 wake-up enabled
	OFF	Digital input 1 wake-up disabled
DIP4	ON	Digital input 2 wake-up enabled
	OFF	Digital input 2 wake-up disabled

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.

Analog Inputs

The analog inputs are 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.

Analog Input Terminals

Terminal Name	Description
AIN1	Analog input 1
AIN2	Analog input 2
AGND	Analog ground

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Serial port

This port is a general-purpose RS232 serial port and does not support handshaking.

Serial Port Terminals

Terminal Name	Description
TXD	Transmit data from the SX1, RS232 compatible
RXD	Receive data for SX1, RS232 compatible
SGND	Signal ground

1-Wire

The 1-Wire bus is available on the 3-pins screw terminals. All 1-Wire communication goes through single pin labeled “1Wire” and all 1-Wire devices connected to this pin retrieves its power directly from the bus (called parasitic power). By this only two wires are needed: the 1-wire signal and the ground reference – allowing minimal cable installations.
For 1-Wire ID-Button readers, which include a built-in LED, a dedicated output is available for this purpose. Please consult the RTCU IDE on-line help for further information.
Further information regarding 1-wire networks, topology and limitations can be found in the application note area on the Logic IO webpage.

1-Wire terminals

Terminal Name	Description
1Wire	1-Wire bus for ID-Button / Temperature sensor
1WLED	1-Wire ID-Button LED output
DGND	Digital ground

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 the graphical view section.

Please note that the unit will always be powered from the USB, when inserted.

3D-movement Sensor

The RTCU SX1 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.

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Indicators (LED's)

Two bi-colored (red and green) and a single yellow LED indicators are present on the top side and bottom side of the unit (see external connections overview). The latter are for easy access during development. 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 controlled LED A 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 S1 and S2 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.

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 WaitForEvent mode. Please see the table below:

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

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.

Switches

System switch (RST)

The RTCU SX1 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. If the reset switch is held down for approx. 3 seconds[1] 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" from this mode simply activate the reset switch shortly. The status indicator indicates the state by fast blinking green or yellow as stated above.

The system switch is involved in the wake-up circuit during zero-power mode. In order to wake up the unit from zero-power mode the system switch need to be depressed at least 1s.

DIP-Switches

The RTCU SX1 unit contains four dip-switches, where two of them are available for the application to use, and two of them for configuration purpose. The dip-switches are located inside the unit (see graphical view). To use the dip-switches in the RTCU IDE declare a Boolean input variable, and define it as a dip-switch in the RTCU IDE Job variable configuration dialog.

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

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Dip Switch	State	Description
DIP1	ON	DIP1 is logical “high”
	OFF	DIP1 is logical “low”
DIP2	ON	DIP2 is logical “high”
	OFF	DIP2 is logical “low”
DIP3	ON	Digital input 1 wake-up enabled
	OFF	Digital input 1 wake-up disabled
DIP4	ON	Digital input 2 wake-up enabled
	OFF	Digital input 2 wake-up disabled

Internal Battery

The RTCU SX1 has four different internal battery options for operation even during an external power fail: 2 Ah and 10 Ah rechargeable Lithium-ion battery, 24 Ah and 58 Ah non-rechargeable Lithium-thionyl Chloride battery allowing long time autonomous operation. Please note that when external power is removed the unit will by default power down. This setting can be changed and is documented in the RTCU-IDE online manual.

Rechargeable Battery

The battery charging of Li-ion backup option 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 restore the capacity so the battery is 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.

Please note that the SX1 unit will not charge the battery when the unit is supplied through the USB only.

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.

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Non-rechargeable Battery

The non-rechargeable battery option is intended for long term operation without external power supply available or very limited external supply.
When non-rechargeable battery option is installed the on-board battery charger will be disabled.

Warning:
Misusing the RTCU SX1 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 SX1” below or consult the RTCU SX1 datasheet.

Micro SD card reader

The RTCU SX1 unit has a standard Micro SD card reader which is located inside the unit (see graphical view). The Micro SD card reader is a lid based system with mechanical lock for reliable insertion and operation.

The RTCU SX1 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[2] 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 SX1 is provided with an ISM band RF module, which gives the unit ability of communicating with other wireless devices. 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.

[2] There is lack of hardware implementation of this signal, but for compatibility reason the software function will always return “not write protected”.

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

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)[3] 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.

Antennas

The SX1 contains internal ready to use antennas for GSM, GPS and RF circuitry. If demanding applications requires external antennas the unit is prepared for this via micro coaxial connectors placed near the respective circuit. For placement of internal antennas and external antenna connectors, see Appendix D.

Switching between internal and external antenna of the GSM and RF can be controlled by the user from application, but the GPS has its own detection circuit that makes possible to switch between the internal and external antenna automatically. Please consult the RTCU-IDE online help for more information on antenna switching.

GSM

The RTCU SX1 unit contains an internal antenna and a micro coaxial connector for connection of a suitable GSM quad band antenna (850/900/1800/1900 MHz). When installing the external 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 SX1 unit contains an internal patch antenna and a micro coaxial connector for connection of a suitable GPS antenna. The GPS external antenna must be a 3V active GPS antenna.
When installing the external 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 GPS will always use the external antenna, when present.

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

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

RF

The RTCU SX1 unit contains an internal 868 MHz frequency band antenna.
When installing the external 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 RF antenna.

Barcode

The barcode found on the SX1 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 SX1 pro this unique code is **240**, **242** or **244** and for RTCU SX1 pro-r **241**, **243** or **245**.

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

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Power consumption

Detailed information on the maximum power consumption of the SX1 unit in different states and at different supply voltages is listed below.

Maximum power consumption: Unit operating on external supply.

	8V	12V	36V		
Unit Active	55	35	15	mA	
Unit Active with GSM On	65	45	20	mA	GSM idle @ -63dBm
Unit active with GPS On	70	50	20	mA	
Unit Active with GSM/GPS On	80	55	25	mA	GSM idle @ -63dBm
Unit Active while charging[4]	520	500	190	mA	
Unit in power-down	0.7	0.5	0.3	mA	Restart on Ignition, RTC
Unit in “wait for event”	0.7	0.5	0.3	mA	Resume on DI, Vibration, RTC
Unit in “wait for event”	8	5	3	mA	Resume on RS232
Unit in “wait for event”	20	15	5	mA	Resume on GSM activity
Unit in “wait for event”	22	17	6	mA	Resume on 2D/3D GPS fix

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 operating on internal battery.

	Non-rechargable	Re-chargable		
Unit Active	95	85	mA	
Unit Active with GSM On[5]	130	110	mA	GSM idle @ -63dBm
Unit active with GPS On	130	110	mA	
Unit Active with GSM/GPS On	165	135	mA	GSM idle @ -63dBm
Unit in power-down	0.9	0.8	mA	Restart on Ignition, RTC
Unit in “wait for event”	0.9	0.8	mA	Resume on DI, Vibration, RTC
Unit in “wait for event”	15	15	mA	Resume on RS232
Unit in “wait for event”	40	35	mA	Resume on GSM activity
Unit in “wait for event”	38	35	mA	Resume on 2D/3D GPS fix
Unit in “zero-power”	0.05	0.05	mA	Start on RTC, Vibration And DI

Note: Power consumption from a fully charged battery.

[4] Only for units with rechargeable Lithium-ion battery option
[5] All measurements on the RTCU SX1 pro-r was performed in non-railway operating mode

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Zero-power Mode

As a unique and new power-saving mode the RTCU SX1 unit is provided with zero-power mode. In this mode the unit is sleeping and ready to be woken up in various scenarios. The following events can trigger the wake-up event on the unit:

- Time-out on predefined time
- Change on the digital inputs[6]
- Vibration
- External power apply
- Reset switch

When the unit enters the zero-power mode the system supply is turned off, only the vibration sensor, RTC, GPS backup and the digital input detection circuits will be powered. Wake-up on one of the above events the unit will perform a restart. Please note that as it takes time for the unit to start-up in some cases the unit may wake up but unable to detect the source because of the rapid change of the state of the wake-up source. Please consult the RTCU IDE online help for the usage of the zero-power mode.

Battery consumption measurement

The RTCU SX1 is provided with a current consumption measurements circuit, which gives the ability of measuring an average consumption and the total consumption over time in mA, so the battery usage can be monitored. The internal circuit is connected to the battery terminals and will only measure the current consumption from the battery.

Please note that the power to the current consumption measurement circuit is supplied by the battery. When the circuit is enabled in the user application the circuit will measure the current consumption of the unit **and** the measurement circuit, which is approx. 1,3 mA.

The measurement will only be active when the unit is operating on battery and will automatically be suspended when externally supplied, or when the unit enters power saving modes such as 'wait for event''
For resetting the current consumption measurement a batConsumptionClear() command needs to be issued from the user application.

The accuracy of the measurement depends on how rapidly the current consumption of the system changes, and component tolerances combined with the environment. An inaccuracy up to 2% may be experienced. For instance during GSM communication the rapid current consumption changes caused by the TX bursts may lead to inaccuracy in the measurement.

Please consult the RTCU IDE online help for detailed information on the current consumption measurement.

[6] This feature need to be enabled with dip switches 3 and 4

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Specifications for the RTCU SX1

	Min	Typ	Max		
Operating Voltage	8	-	36	VDC	Protected against wrong polarity.
On-board Battery Pack		2/10 24/58		Ah Ah	Rechargeable Li-ion battery. Non-rechargeable battery.
Unit Active Unit Active with GSM On Unit Active with GPS On Unit Active with GSM/GPS On Unit Active while Charging Unit in Power-down Unit in "Wait for Event" Unit in "Wait for Event" Unit in "Wait for Event", GSM On Unit in "zero-power" mode		35 45 50 55 500 0,5 0,5 5 15 50		mA mA mA mA mA mA mA mA mA µA	*Typical measurements @ 12 VDC Supply.* GSM idle @ -63 dBm. GSM idle @ -63 dBm. * Only with Li-ion battery backup option. Restart on: Ignition and RTC. Resume on: DI, 3D accelerometer., RTC. Resume on: RS232. Resume on: GSM. On internal battery, Vibration and RTC active.
I/O: Digital input logic "high" Digital input logic "low" Digital output voltage Digital output sink current Analog input	 0 0,5 - - 0	 - - - - -	 0,3 30 36 100 10	 VDC VDC VDC mA VDC	• Digital inputs are protected against transients and low-pass filtered. • Digital outputs are transient protected. • Digital Output current is per channel. • Analog input resolution is 10 bits. Input are protected against transients / low-pass filtered.
3D Movement Sensor:	12 bit @ +/- 16g				3-axis digital accelerometer with hardware buffer.
GPS: • Channels • Tracking Sensitivity	 66 Channels SuperGPS -165 dBm				Supports SBAS (WAAS, EGNOS, MSAS).
On-board ISM RF: • Frequency • Channel Spacing • Maximum Transmit power • Receiver sensitivity • Operating Range	 868 MHz 250 kHz +10 dBm -112 dBm Indoor:up to 15m / Outdoor:up to 50m				GFSK modulation. Automatic frequency compensation. Compliant with EN 300 220. Operating range depends on the environment. Outdoor range is at line-of-sight.
Storage temperature:	-30	-	+65	ºC	**External connections and LED:** • Power. • Digital and analog I/O. • RS232 and 1-wire. • Two Bi-color LED and one yellow status LED. **Internal interfaces:** • Mini USB programming connector. • 2 user defined, 2 configuration DIP-switches. • Standard 3 Volt SIM Card Reader . • Micro-SD card reader.
Operating temperature (According to GSM 11.10 specification)	-40	-	+70	ºC	
Battery Charging Temperature	-10	-	+45	ºC	
Humidity (RH non condensing)	5	-	90	%	
Weight (Low profile with 10 Ah bat.) Weight (High profile with 58 Ah bat.)	0,530 0,820			Kg. Kg.	
External dimensions	W 175 x H 42 x D 126 mm W 175 x H 54 x D 126 mm				Low profile enclosure. Excluding mounting flanges. High profile enclosure. Excluding mounting flanges.
Ingress Protection (IP)	IP-66				Black UL94 plastic enclosure with sealing membrane
Approvals	EN 61000-6-2 / EN 61000-6-3				CE **EU EMC Directive 2004/108/EU**

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Specifications for the 66-channels SuperGPS receiver

MediaTek MT3339 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[7]
Sensitivity:	Tracking/navigation	-165 dBm
	Reacquisition	-160 dBm
	Cold Start (Autonomous)	-148 dBm
	(GPS chipset reference parameters)	
Time-To-First-Fix:[8]	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.

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

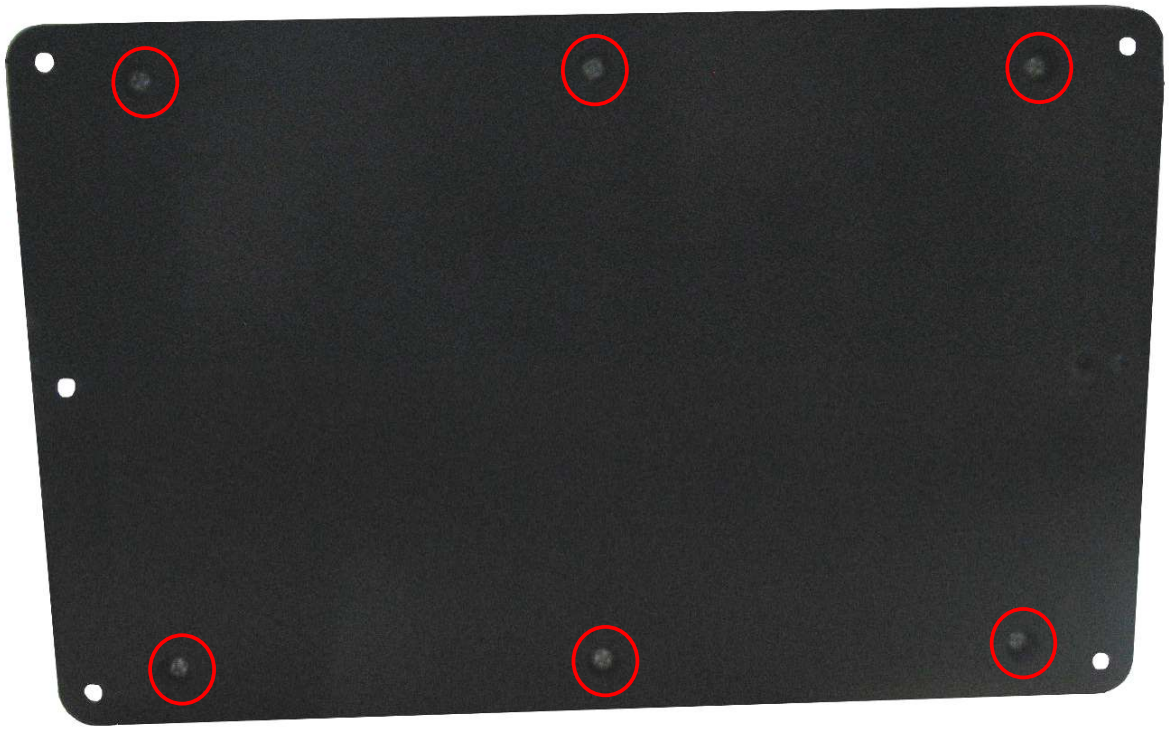
Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

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) are inside the unit. User may need to open the enclosure in order to get access to these connections. The following steps describe assembling and disassembling the enclosure:

1. Remove the back plate of the RTCU SX1. The six screws are located at the back plate as shown below:



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:

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

3. To avoid the damaging the battery cable or connector it is also possible to detach the battery cable. Detaching the battery will reset the Real-time clock and the GPS ephemeris information.

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 rubber must be fitted properly in order to achieve IP-66.

The unit enclosure is provided with PG7 blinds, these can easily be replaced with PG7 cable glands.

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

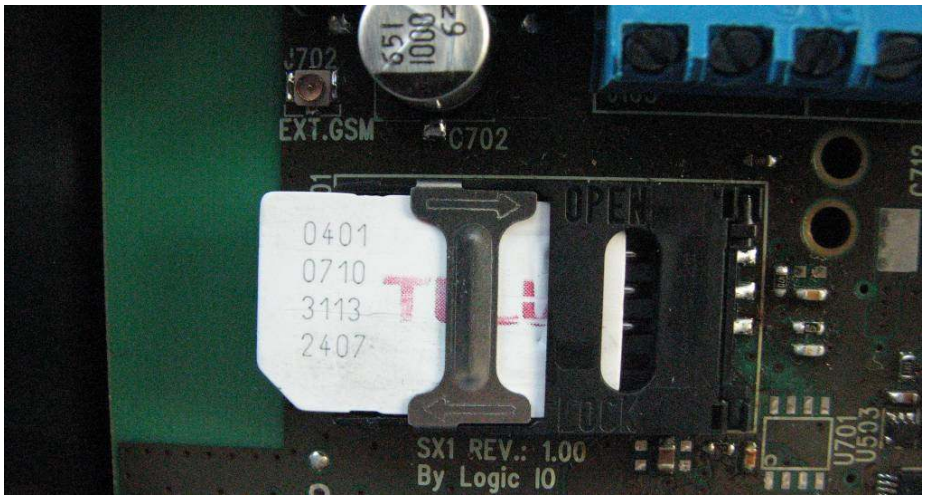
Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Appendix B – Installing the SIM card

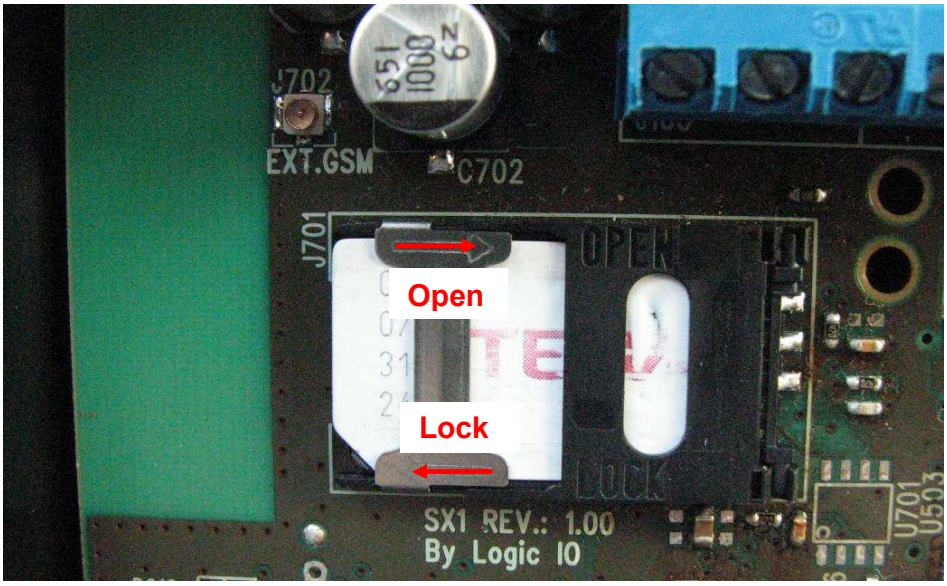
The SIM card reader is a lid based type with a mechanical lock for secure installation of the SIM card.

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

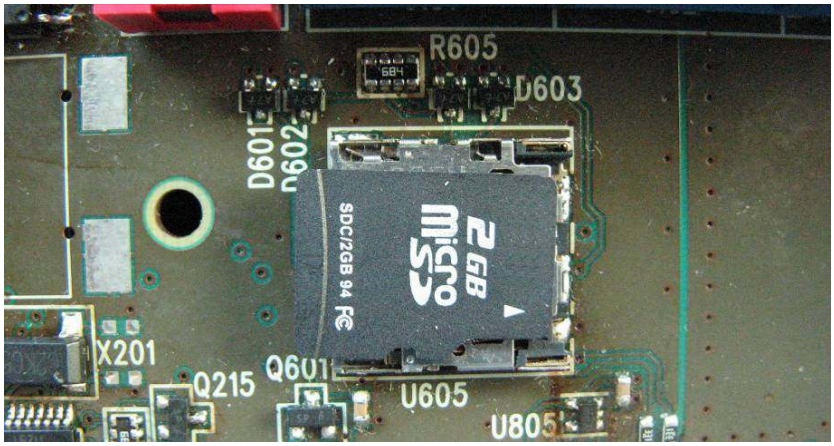
Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

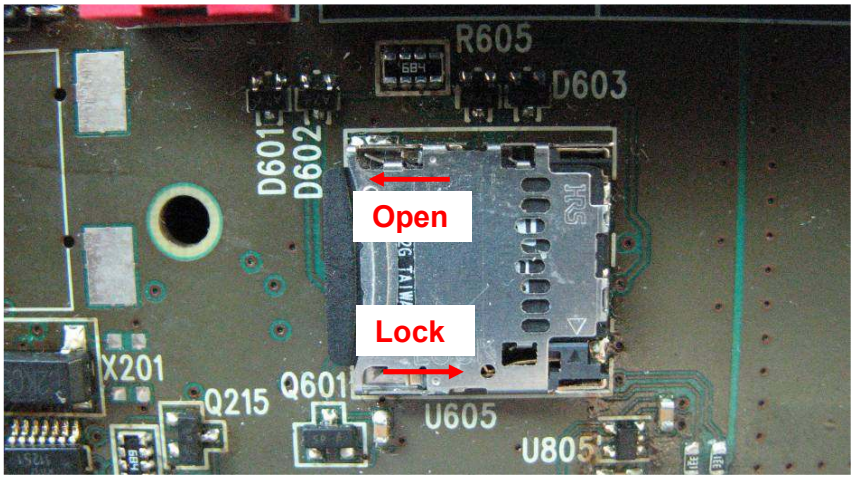
Appendix C – Installing the Micro SD card

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



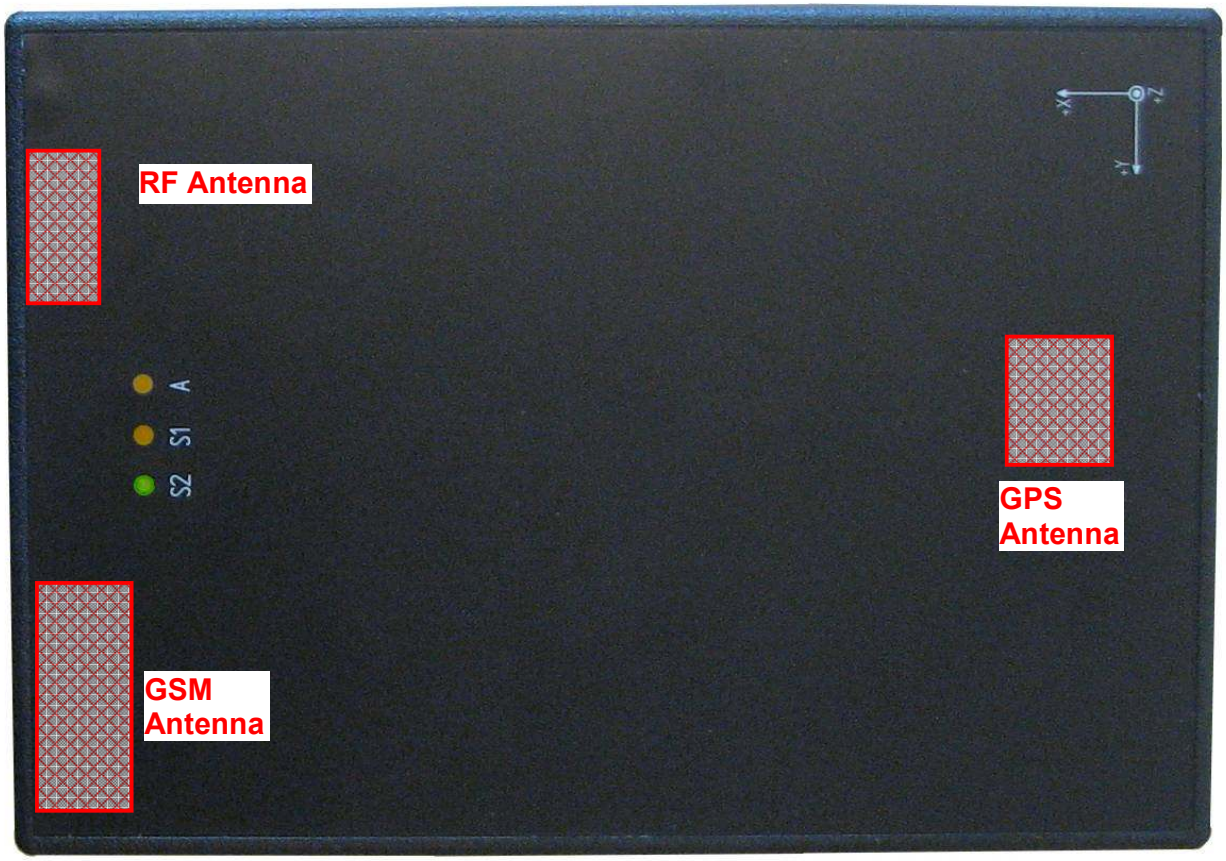
Micro SD card inserted and locked

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Appendix D – Locations of the internal antennas and micro coaxial connectors

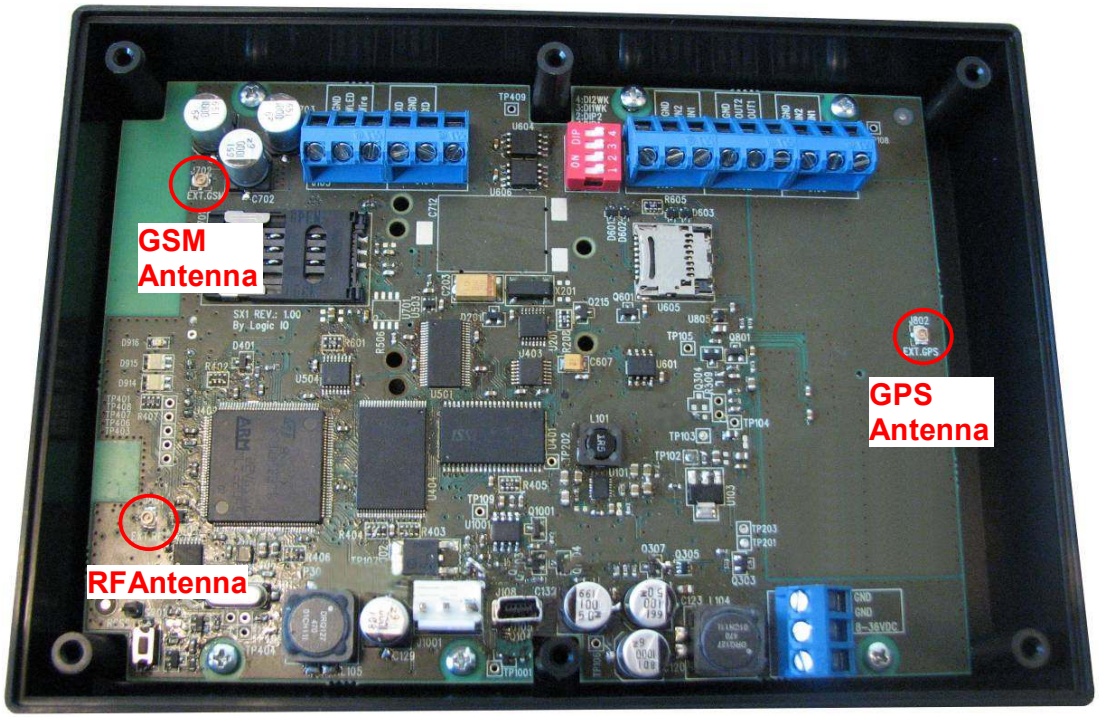
The three internal antennas, GSM, GPS and RF, are all located at the top side of the unit. In order to get best possible reception the unit must be mounted in such a way that the top side is not in close proximity of metallic parts or anything else that can influence the efficiency. In the following picture the antenna location areas are marked:



Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

The micro coaxial antenna connectors of all three RF circuits for external antenna connection are placed at the bottom side of the unit for easy access. In the following picture the locations are marked:



Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Appendix E – External antenna connectors (optional)

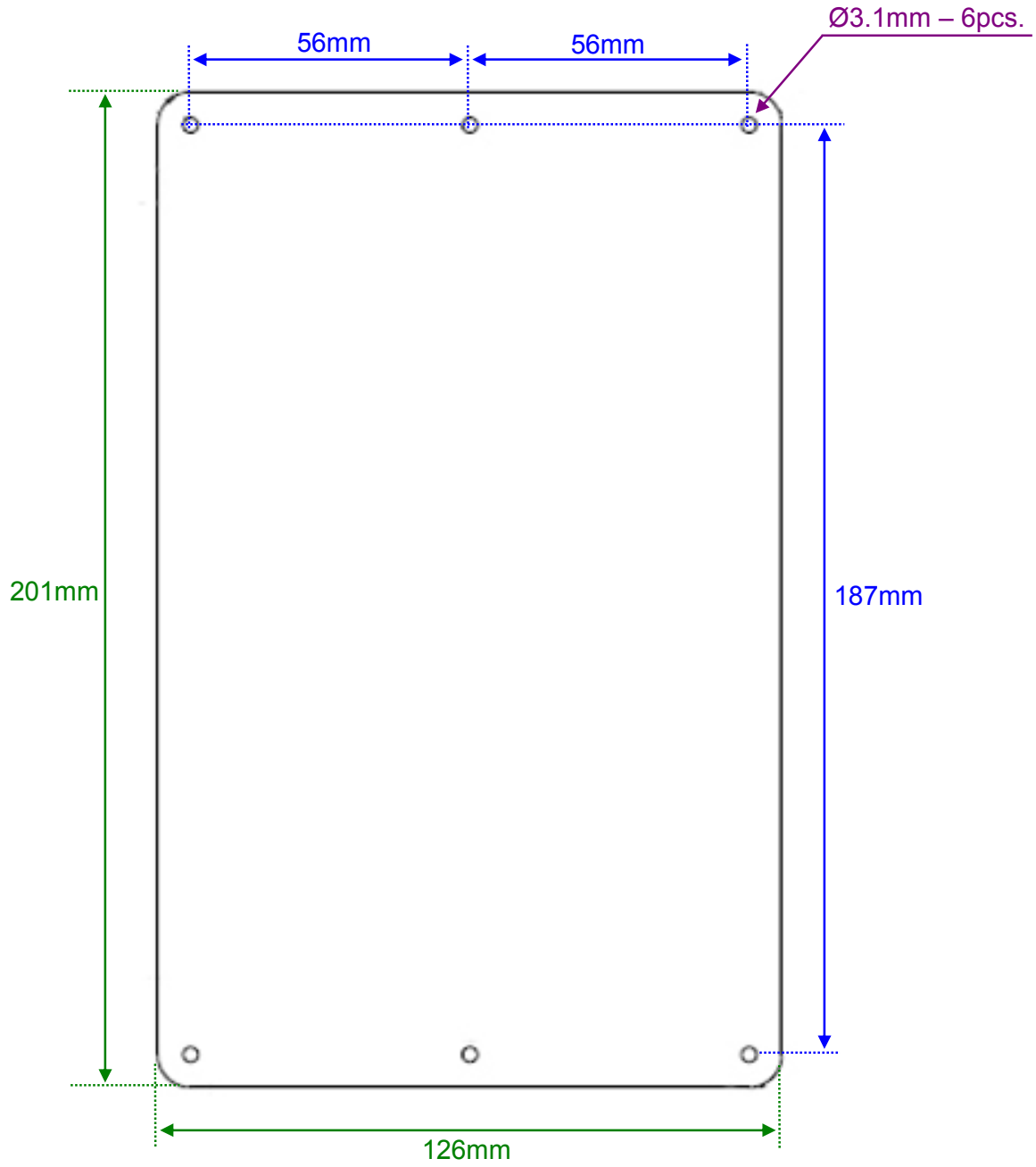
The RTCU SX1 series can optionally be ordered with external GSM, GPS or RF antennas. External antenna connectors are located at the top end of the enclosure as shown in the following picture:

Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk

Appendix F – SX1 Mounting drawing

Below drawing shows the placement of the mounting holes on the back plate of the SX1.



Logic IO ApS.
Holmboes Allé 14
8700 Horsens
Denmark

Ph: (+45) 7625 0210
Fax: (+45) 7625 0211
Email: info@logicio.com
www.logicio.com / www.rtcu.dk