

# RTCW DX4i warp

## Technical Manual

Version 1.02



## Introduction

This manual contains technical documentation which allows for easy installation and use of the **RTCU DX4i warp** product. For information on the programming and software configuration of the product please refer to the RTCU IDE documentation.

The RTCU DX4i warp has been designed from the ground up for professional wireless industrial applications with its strong on-board I/O capabilities and powerful communication interfaces.

Housed in a standard DIN-rail encapsulation it is a perfect component for automation and control applications.

The on-board I/O system can be expanded almost indefinitely and completely transparently by adding external MODBUS compatible I/O modules! This unique I/O expansion capability, combined with the ability to operate as a MODBUS master and slave simultaneously, positions the RTCU DX4i warp as the perfect product for SCADA-like applications.

The RTCU DX4i warp is based on the X32 Execution Architecture offering high performance along with a large memory capacity for both program and data - meeting the requirements of today's most demanding and sophisticated M2M/IoT applications.

The RTCU DX4i warp includes many sophisticated standard features and can be further upgraded as required with the following on-demand hardware features:

*DIO option:* **8 x digital inputs, 8 x digital outputs (total).**  
*AIO option:* **4 x analog inputs (total) and 4 analog outputs (total).**  
*COM:* **RS485/MODBUS and 1-Wire interface.<sup>1</sup>**

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

The RTCU DX4i 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*.

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<sup>1</sup> The 'COM' on-demand option is FREE and just requires activation.



## The technical highlights of the RTCU DX4i warp:

- Based on the **RTCU M2M Platform**<sup>1</sup>
- **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, MODBUS.
- World-wide **Quad-band GSM engine.**
- Internal SIM-card reader.
- Large data-flash/logger memory with a capacity of **4.5 MB.**
- Internal **4 MB FAT32 flash drive.**
- **1 x RS232** channel / service port.
- **5 x digital inputs** and **3 x high-power solid-state digital outputs.**
- **2 x analog inputs** with 0..10 volt / 0..20 mA.
- **2 x analog outputs** with 0..10 volt / 0..20 mA
- Up to 4 x digital inputs can be configured as **IEC62053-31 Class A** compliant.
- **Powerful on-demand hardware options:**
  - Digital I/O option: **8 x digital inputs** and **8 x digital outputs** (total).
  - Analog I/O option: **4 x analog inputs** and **4 x analog outputs** (total). *Free!*
  - Communication option: **RS485/MODBUS** and **1-Wire bus support.**
- **On-demand options** can be applied **anytime** — even remotely after installation.
- **Expandable I/O** with standard MODBUS modules.
- **1-Wire** for accessories such as ID-button reader, temperature sensors, etc.
- 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 **USB programming cable** support.
- Housed in an industry standard **M36 DIN compliant** encapsulation.
- Two-part pluggable connectors for easy installation and maintenance.
- Fully supported by the **RTCU Gateway 2** and the **RTCU Deployment Server.**

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<sup>1</sup> Please see "The RTCU M2M Platform" data sheet for more information.



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## Graphical view

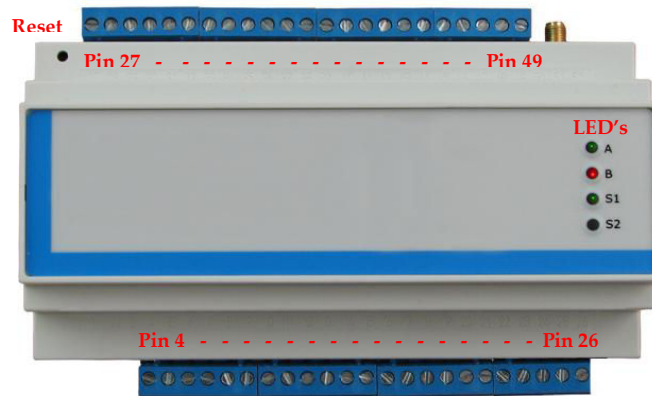


## External connections

### Overview

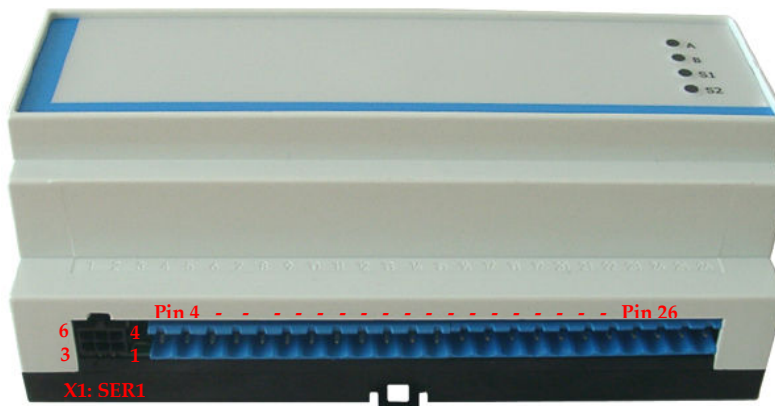
Connections to external equipment are done via pluggable screw terminals that are located on the top and bottom sides of the product. All connections are available externally for easy access and maintenance.

On the front there is four user-controlled and three system LED's for system information and status.



**Front view with pluggable screw terminals.**

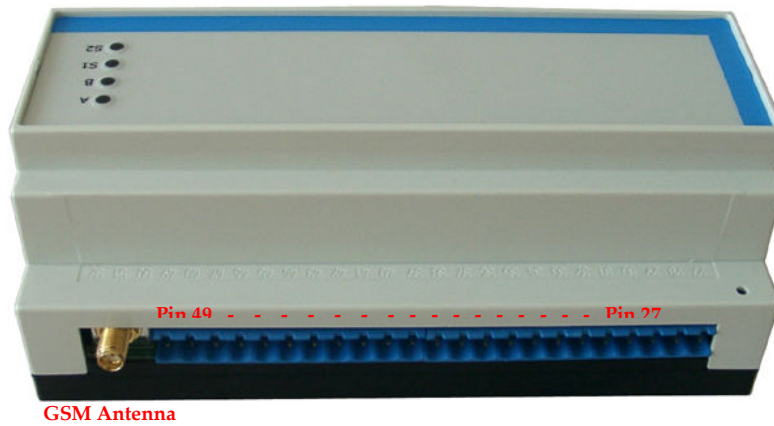
The bottom side of the RTCU DX4i warp has all the communication interfaces: 1-Wire, RS232, RS485. The analog inputs/outputs are also found on this side.



**Bottom-side view**



On the top side of the RTCU DX4i warp the following interfaces are found: power, digital inputs, digital outputs and an SMA female connector for an external GSM antenna.



**Top-side view**

The RTCU DX4i warp uses two-way pluggable screw terminals for maximum flexibility and easy installation and maintenance.

## Signal Overview

### Connector X1: 6-pin SER1 connector overview

Pin	Name	Description
1	TXD	Transmit data from serial port 1, RS232 compatible
2	RS-DET	Programming cable detect, normally unconnected <i>(if programming cable, connect to SGND)</i>
3	DC-OUT	+3.3V / 400mA DC-OUT for external equipment.
4	RXD	Receive data for serial port 1, RS232 compatible
5	SGND	Signal ground
6	SGND	Signal ground

### Pin 4 - 26 overview

Pin	Name	Description
4	N.C	Not Connected
5	N.C	Not Connected
6	SGND	Signal ground
7	1Wire	1-Wire bus ( <i>Communication option</i> )
8	1Wire-LED	1-Wire ID-Button LED ( <i>Communication option</i> )
9	SGND	Signal ground
10	RS485_1+	RS485 non-inverting signal for RS485 ( <i>Communication option</i> )
11	RS485_1-	RS485 inverting signal for RS485 port ( <i>Communication option</i> )
12	SGND	Signal ground
13	N.C	Not Connected
14	N.C	Not Connected
15	SGND	Signal ground
16	N.C	Not Connected
17	AIN1	Analog input 1
18	AIN2	Analog input 2
19	AIN3	Analog input 3 ( <i>Analog I/O option</i> )
20	AIN4	Analog input 4 ( <i>Analog I/O option</i> )
21	AGND	Analog ground
22	AOUT1	Analog output 1
23	AOUT2	Analog output 2
24	AOUT3	Analog output 3 ( <i>Analog I/O option</i> )
25	AOUT4	Analog output 4 ( <i>Analog I/O option</i> )
26	AGND	Analog ground

**Pin 27 - 49 overview**

Pin	Name	Description
27	PGND	Power ground, negative (-) connection
28	SUPP	Power supply, positive (+) connection
29	SUPP	Power supply, positive (+) connection
30	DOUT1	Digital output 1
31	DOUT2	Digital output 2
32	DOUT3	Digital output 3
33	DOUT4	Digital output 4 ( <i>Digital I/O option</i> )
34	DOUT5	Digital output 5 ( <i>Digital I/O option</i> )
35	DOUT6	Digital output 6 ( <i>Digital I/O option</i> )
36	DOUT7	Digital output 7 ( <i>Digital I/O option</i> )
37	DOUT8	Digital output 8 ( <i>Digital I/O option</i> )
38	SGND	Signal ground
39	SGND	Signal ground
40	DIN1 / S0IN1	Digital input 1 / S0 input 1
41	DIN2 / S0IN2	Digital input 2 / S0 input 2
42	DIN3 / S0IN3	Digital input 3 / S0 input 3
43	DIN4 / S0IN4	Digital input 4 / S0 input 4
44	DIN5 / WAKEUP	Digital input 5 / Wakeup ( <i>ignition</i> ) input
45	DIN6	Digital input 6 ( <i>Digital I/O option</i> )
46	DIN7	Digital input 7 ( <i>Digital I/O option</i> )
47	DIN8	Digital input 8 ( <i>Digital I/O option</i> )
48	SGND	Signal ground
49	SGND	Signal ground

**Please note:**

Depending on the ordered RTCUCDX4i warp the screw-terminal mating plugs may be included as standard:

**SKU: RT-DX4IW** - Do NOT include the screw-terminal mating plugs.

**SKU: RT-DX4IWP** - Includes the screw-terminal mating plugs as standard.

A complete set of screw-terminal mating plugs can be separately ordered using the Logic IO order code: **RT-O-DX4PLUGSET**

**Accessories for cable assembly**

Order-code	Name
RT-O-TYCO-H6 TYCO p/n: 794617-6	Tyco, Connector house 6 pins. Bag with 10 pcs
RT-O-TYCO-CR TYCO p/n: 794606-1	Tyco, Crimp Contacts for connector house. Wire size 0.2 to 0.5 mm <sup>2</sup> . Bag with 100 pcs.
RT-O-TYCO-TOOL TYCO p/n: 91501-1	Tyco, Crimp hand tool for easy assembly of TYCO crimp contacts. Wire size 0.2 to 0.5 mm <sup>2</sup>
Recommended tool:	Tyco 91501-1 (0.20 to 0.50mm <sup>2</sup> ) RS 495-9675, Farnell 1111475 Tyco 91502-1 (0.05 to 0.15mm <sup>2</sup> ) RS 495-9675, Farnell 1111476
Alternative tools:	Molex 69008-0982 (0.20 to 0.50mm <sup>2</sup> ) RS 233-3059, Farnell 673122 Molex 69008-0983 (0.05 to 0.05mm <sup>2</sup> ) RS 233-3065, Farnell 673134
Extraction tool:	Tyco 843996-6 extraction tool. RS 495-9704, Farnell 1111477

## Power supply

The RTCUC DX4i warp unit can be supplied with 8..36VDC from an external DC power source. Positive power is applied to the SUPP pin and ground is connected to the PGND pin. There are two SUPP pins, as these also supply the digital outputs. If the total current consumption of the digital outputs exceeds 1A, please refer to the digital output section for more information on the wiring. Otherwise one pin is sufficient.

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

The RTCUC DX4i warp is protected against wrong polarity. If a chassis or system ground is connected to either SGND or AGND, a wrong polarity on the supply lines will destroy the internal GND connection.

The RTCUC DX4i warp also contains an internal high capacity backup battery which will supply the RTCUC if the external power supply fails or is disconnected. By default the RTCUC is powered down when a power fail occurs. This setting, however, can be changed. Please consult the RTCUC IDE on-line help for more information. The display will automatically turn off when external power is removed.

When the wakeup/ignition input is activated with a logical high, the RTCUC DX4i warp unit will wake-up if it was in power-down mode.

### Please Note:

- Minimum 12VDC supply is necessary for 0-10V analog output configuration.
- Minimum 16VDC supply is necessary for digital inputs 1-4 to work as S0 compliant inputs.
- In-rush currents up to 2A can occur on initial power apply.

### Power supply pins

Pin	Name	Description
27	PGND	Power ground, negative (-) connection
28	SUPP	Power supply, positive (+) connection
29	SUPP	Power supply, positive (+) connection

## Digital I/O

The RTCU DX4i warp unit has by standard 5 digital inputs and 3 digital outputs, with additional 3 digital inputs and 5 digital outputs available as an on-demand option.

Digital input 1-4 has several operation modes. Please refer to the digital input section for additional information. The digital outputs are integrated high performance “high-side” switches.

### Digital outputs

The digital outputs control eight “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 directly from the SUPP power pins which also supply the rest of the RTCU unit. As the power is also the main power of the unit, a power-fail would also affect the digital outputs.

The RTCU DX4i warp unit 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 PGND must be used as return path for the output(s).

If the total current consumption of the digital outputs exceeds 5A, then both SUPP and the PGND must be used for supply.

### Digital output pins

Pin	Name	Description
27	PGND	Power ground, negative (-) connection
28	SUPP	Power supply, positive (+) connection
29	SUPP	Power supply, positive (+) connection
30	DOUT1	Digital output 1
31	DOUT2	Digital output 2
32	DOUT3	Digital output 3
33	DOUT4	Digital output 4 ( <i>enabled with Digital I/O option</i> )
34	DOUT5	Digital output 5 ( <i>enabled with Digital I/O option</i> )
35	DOUT6	Digital output 6 ( <i>enabled with Digital I/O option</i> )
36	DOUT7	Digital output 7 ( <i>enabled with Digital I/O option</i> )
37	DOUT8	Digital output 8 ( <i>enabled with Digital I/O option</i> )

### Digital inputs / S0 inputs / wakeup (*ignition*) input

The digital inputs are all low-pass filtered (450kHz) and transient-protected. To activate the inputs, connect a positive voltage between the corresponding input (DINx) and SGND.

Digital input 1-4 can be configured individually as S0 input (*IEC62053-31, Class A*) and DIN5 can work as a wakeup (*ignition*) input.

As default the digital inputs are configured as normal inputs. For placement and configuration of the hardware jumpers inside the unit, please refer to the configuration guide in Appendix A.

### S0 compliant inputs (*IEC62053-31, Class A compatible*)

In S0 configuration the relevant RTCU DX4i warp input will act as a 'pulse input device', and a current is supplied into the input connector so that a simple switch between SGND and the appropriate input will activate it. This is used in most electricity metering equipment.

**Please note:** The RTCU DX4i warp unit must be supplied with a minimum of 16 VDC for the S0 mode to work correctly.

S0 must also be enabled from the application in order to work as an S0 compliant input.

### Wakeup (*ignition*) input

The DIN5 / wakeup (*ignition*) input is a special input in that it also functions as the wakeup input. If the input is activated with a logical high or low (Wait For Event mode only) when the RTCU DX4i warp is in low-power mode it will wake-up the unit. A power apply will also wake the unit up if it is in power-down mode or in Wait For Event mode with power Apply and/or ignition selected for wakeup. The input 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 greater than 2 ms to be valid.

The power management allows for the possibility of configuring a wakeup on one or more digital inputs with individually configured falling- or rising edge detection. Please consult the RTCU IDE on-line help for more information.

**Digital input pins**

Pin	Name	Description	Jumper Setting
40	DIN1 / S0IN1	S0 input 1 Digital input 1	JP8 position 1-2 JP8 position 2-3 ( <i>default</i> )
41	DIN2 / S0IN2	S0 input 2 Digital input 2	JP9 position 1-2 JP9 position 2-3 ( <i>default</i> )
42	DIN3 / S0IN3	S0 input 3 Digital input 3	JP10 position 1-2 JP10 position 2-3 ( <i>default</i> )
43	DIN4 / S0IN4	S0 input 4 Digital input 4	JP11 position 1-2 JP11 position 2-3 ( <i>default</i> )
44	DIN5 / WAKEUP	Digital input 5 Wakeup ( <i>ignition</i> ) input	
45	DIN6	Digital input 6	
46	DIN7	Digital input 7	
47	DIN8	Digital input 8	
48	SGND	Signal ground	
49	SGND	Signal ground	

For placement and configuration of the hardware jumpers inside the unit, please refer to the unit configuration guide in Appendix A.



## Analog I/O

The RTCX DX4i warp unit has by standard 2 analog inputs and 2 analog outputs, with additionally 2 analog inputs and 2 analog outputs available as an on-demand option.

The analog inputs and the analog outputs have a resolution of 10 bits and can individually be configured to either voltage or current input/output.

### Analog inputs

The analog inputs can be configured individually to work either as voltage or current measurements inputs. The range in voltage mode is 0-10 VDC and in current mode it is 0-20mA. The resolution of the analog-to-digital converter is 10 bit or 1024 in decimal scale. The decimal value with 10V/20mA applied to the input is 1023 and 511 for 5V/10mA.

As default the inputs are configured as voltage inputs. For placement and configuration of the hardware jumpers inside the unit, please refer to the unit configuration guide in Appendix A.

The input signal is connected between AINx 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 high current, fast changing signals routed parallel to the analog signals.

Each input is low-pass filtered, ESD and transient protected.

### Analog input pins

Pin	Name	Description	Jumper Setting
17	AIN1	Analog input 1 – Voltage	JP1 not installed ( <i>default</i> )
		Analog input 1 – Current	JP1 installed
18	AIN2	Analog input 2 – Voltage	JP14 not installed ( <i>default</i> )
		Analog input 2 – Current	JP14 installed
19	AIN3	Analog input 3 – Voltage	JP16 not installed ( <i>default</i> )
		Analog input 3 – Current	JP16 installed
20	AIN4	Analog input 4 – Voltage	JP17 not installed ( <i>default</i> )
		Analog input 4 – Current	JP17 installed
21	AGND	Analog ground	
26	AGND	Analog ground	

**Specification for each analog input (voltage mode)**

	Min.	Typ.	Max.	Unit	
	0	-	10	VDC	Protected against transients and
Resolution	-	-	10	Bit	low-pass filtered
Precision	-1.5	-	1.5	%FSR	Precision is based on
Cut-off frequency	-	4.5	-	kHz	measurements @ 25 °C
Input impedance	-	40	-	kΩ	

**Specification for each analog input (current mode)**

	Min.	Typ.	Max.	Unit	
	0	-	20	mA	Protected against transients and
Resolution	-	-	10	Bit	low-pass filtered
Precision	-1.5	-	1.5	%FSR	Precision is based on
Cut-off frequency	-	4.5	-	kHz	measurements @ 25 °C
Input impedance	-	504	-	Ω	

### Analog outputs

The analog outputs can individually be configured to work either as voltage or current outputs. The range in voltage mode is 0-10VDC and in current mode it is 0-20mA. The resolution of the digital-to-analog converter is 10bit or 1024 in decimal scale.

The decimal value for 10V/20mA output are 1023 and 512 for 5V/10mA.

As default the outputs are configured as voltage outputs. For placement and configuration of the hardware jumpers inside the unit, please refer to the unit configuration guide in Appendix A.

The output signal is connected to external equipment between AOUTx 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. In current mode the specifications for the analog output only valid if the load is maximal 250Ω.

Each output is ESD and transient protected.

**Please note:** The RTCU DX4i warp unit must be supplied with minimum 12VDC in order for the analog outputs to work according to specifications.

### Analog output pins

Pin	Name	Description	Jumper Setting
22	AOUT1	Analog output 1 – Voltage	JP2 position 2-3 ( <i>default</i> )
		Analog output 1 – Current	JP2 position 1-2
23	AOUT2	Analog output 2 – Voltage	JP3 position 2-3 ( <i>default</i> )
		Analog output 2 – Current	JP3 position 1-2
24	AOUT3	Analog output 3 – Voltage	JP4 position 2-3 ( <i>default</i> )
		Analog output 3 – Current	JP4 position 1-2
25	AOUT4	Analog output 4 – Voltage	JP6 position 2-3 ( <i>default</i> )
		Analog output 4 – Current	JP6 position 1-2
21	AGND	Analog ground	
26	AGND	Analog ground	

### RS232 communication port (EIA/TIA-232 and V.28/V.24 compatible)

A general purpose RS232 port (without handshaking) is available on the RTCU DX4i warp unit and it's compliant with the EIA/TIA-232 standard.

This can be used as general-purpose RS232 serial port or as a RTCU DX4i warp programming port. In order to use the port for programming, the RS-DET pin must be connected to SGND. When using the port as general-purpose RS232, the RS-DET pin must be left unconnected. Further details on the programming cable are available in the RTCU-IDE on-line help.

#### X1: SER1 connector overview (6-pin TYCO Mate-n-Lock)

Pin	Name	Description
1	TXD	Transmit data from serial port 1, RS232 compatible
4	RXD	Receive data for serial port 1, RS232 compatible
2	RS-DET	Programming cable detect, normally unconnected (in programming cable, connect to SGND)
5	SGND	Signal ground
6	SGND	Signal ground

### RS485 communication port (EIA/TIA-485-A compatible)

The RS485 port is available on the RTCU DX4i warp unit and can be activated with the Communication on-demand option.

RS485 is a multi-drop network with a maximum of 32 units connected simultaneously to the bus. The RS485 bus contains an RS485+ (*non-inverting*) and an RS485- (*inverting*) signal as well as a signal ground which must always be connected to the common signal ground for all units connected to the RS485 bus!

The maximum cable length for the RS485 bus is according to the EIA/TIA-485-A standard (max. 1200m @ <100kbit); this limit is highly influenced by the quality of the cable, signaling rate, noise etc.

At longer cable lengths, noisy environments, or high communication speeds, it might be necessary to terminate the transmission line with a 120<sup>1</sup> ohm resistor at each end of the transmission line to terminate it and avoid signal reflections. If the RTCU DX4i warp is used as an endpoint unit, the hardware jumper JP7 (*port 1*) can be installed to terminate the RS485 communication lines with 120 ohm.

<sup>1</sup> Assuming use of a CAT5 twisted pair cable

By default the RS485 communication lines are not terminated with 120 ohm. For placement and configuration of the hardware jumpers inside the unit, please refer to the configuration guide in Appendix A

This port is available on the pluggable screw terminals and is not shared with other resources.

**Standard RS485 port pins**

Pin	Name	Description
9	SGND	Signal ground
10	RS485_1+	RS485 non-inverting signal for standard RS485 port
11	RS485_1-	RS485 inverting signal for standard RS485 port
12	SGND	Signal ground

## 1-Wire bus

The 1-Wire bus is available as an on-demand option.

The 1-Wire bus is available on the pluggable screw terminals. 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.

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 documentation for further information.

For further information regarding modular 1-wire concept, please refer to the document “Modular 1-Wire Concept Technical Manual” on the Logic IO webpage.

### 1-Wire pins

Pin	Name	Description
7	1Wire	1-Wire bus for communication
8	1Wire-LED	1-Wire ID-Button LED
9	SGND	Signal ground

## DC-Out

A 3.3VDC output is available in the TYCO 6-pin connector (X1). It is possible to control the output in order to save power. The output is short circuit- (to ground), ESD- and transient protected. Make sure not to exceed the current specification of the output and be aware that inrush currents of the external equipment may exceed the specifications. It is recommended to install a fuse to protect the output.

This output must be enabled from the application. Please consult the RTCU IDE on-line manual for more information.

### Connector X1: 6-pin SER1 connector overview

Pin	Name	Description
3	DC-OUT	+3.3V / 400mA DC-OUT for external equipment.
5	SGND	Signal ground
6	SGND	Signal ground

## LED Indicators

Three bi-colored (red and green) and a single yellow LED indicator are present on the front of the unit (see graphical view).

Two bi-colored LED's (A and B) 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 and B

LED A and B are composed of four individually controllable LEDs:

- LED named A on the front consists of LED 1 (green) and LED 2 (red).
- LED named B on the front consists of LED 3 (green) and LED 4 (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 <sup>1</sup>	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 <sup>1</sup>	The unit is executing the application program
1.5s On / 0.5s Off. green <sup>1</sup>	The unit is executing the application program, while charging the internal back-up battery.
Fast blinking, red <sup>1</sup>	A runtime error has been detected in the program. Use the RTCU IDE to obtain the fault log.
Alternating Fast/Slow, red <sup>1</sup>	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.

<sup>1</sup> Or yellow when communicating with the RTCU IDE or another program, supporting the RTCU RACP protocol).

## System switch (RST)

The RTCU DX4i warp unit contains a combined reset/diagnostic switch. This switch is accessible from the front of the unit (see graphical view) It is necessary to use a small thin object with a diameter of approx. 2 mm, for example a straightened-out paper clip for this purpose.

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<sup>1</sup> the unit will enter recovery mode<sup>2</sup> 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.

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<sup>1</sup> System LED S2 will flash three times when this state is entered.

<sup>2</sup> System LED S1 will indicate 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 and analog 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 DX4i warp” below or consult the RTCU DX4i warp Datasheet.

## GSM

For GSM and GPRS communication an industry leading QUAD band (850/900/1800/ 1900MHz) GSM module are used.

The RTCU DX4i warp supports:

- SMS (Text and PDU)
- GPRS Multislot class 10.
- CSD (Datacall)

## SIM-Card

The RTCU DX4i warp unit contains a standard SIM card reader which is located inside the unit on top of the GSM module. The SIM card readers form factor and mechanical design is securing the SIM card when inserted. Please refer to Appendix B for SIM card installation/removal guide.

If the SIM-card is removed during GSM operation the unit will be rejected from the GSM network shortly after.

**Please Note:** It's possible to detect SIM present state on the RTCU DX4i warp unit but due to the integrated SIM reader the SIM locked signal will always return as locked. Please consult the RTCU-IDE on-line manual for more information.

## GSM Antenna

The RTCU DX4i warp unit contains an SMA female connector for connecting 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 to metallic parts or anything else that can influence the efficiency of the GSM antenna. Please consult the installation guide that follows the GSM antenna.

## Barcode

The barcode found on the DX4i warp unit contains the serial number.

There are 9 digits in the barcode that are equal to the unit serial-number.

The first three digits in the serial-number identify the unit type, and for the RTCU DX4i warp this unique code is 271.

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

## Power consumption

Detailed information on the maximum power consumption of the RTCU DX4i warp unit in different states and different supply voltages is listed below.

### Maximum power consumption: unit running on external supply

	8V	12V	36V	
Unit active	60	50	16	mA
Unit active with GSM on*	90	55	25	mA GSM idle @ -63dBm*
Unit active with GPRS session* (102kB file transfer over GPRS)	190	130	50	mA GSM @ -65dBm, LCD off, Battery not charging*
Unit active while charging	900	580	300	mA
Unit in power-down	0.8	0.6	0.3	mA Restart on DIN5, RTC
Unit in "wait for event"	0.8	0.6	0.3	mA Resume on DIN, RTC
Unit in "wait for event"	11	8	3	mA Resume on RS232
Unit in "wait for event"	30	17	6	mA Resume on GSM activity

**Note:** Values marked with (\*) is average and should be considered as guidelines as they may vary depending on the GSM signal strength.

If the external power source is removed and the internal battery is enabled and installed 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 in power-down	0.8	mA Restart on DIN5, RTC
Unit in "wait for event"	0.8	mA Resume on DIN, RTC
Unit in "wait for event"	13	mA Resume on RS232
Unit in "wait for event"	27	mA Resume on GSM activity

**Note:** Power consumption from a fully charged battery.

## Appendix A – Unit configuration guide

The RTCU DX4i warp has many features and some of them require configuration by using hardware jumpers inside the unit.

The following figure shows the location of the jumpers when the lid is removed. Blue lined boxes show the default state of the jumpers. A dot on the corner of the 2-state jumpers indicates the pin number 1.



A number of jumpers enable/disable a feature while the others are used to select between two features. A brief overview can be found in the following table.

Feature	Jumper	State	Default state
Communication	JP7 (RS485_1)	Installed	120 ohm resistor enabled
		Not installed	120 ohm resistor disabled ( <i>default</i> )
Analog input	JP1	Installed	AIN1 current measurement
		Not installed	AIN1 voltage measurement ( <i>default</i> )
	JP14	Installed	AIN2 current measurement
		Not installed	AIN2 voltage measurement ( <i>default</i> )
JP16	Installed	AIN3 current measurement	
	Not installed	AIN3 voltage measurement ( <i>default</i> )	
JP17	Installed	AIN4 current measurement	
	Not installed	AIN4 voltage measurement ( <i>default</i> )	
Analog output	JP2	Position 1-2	AOUT1 current
		Position 2-3	AOUT1 voltage ( <i>default</i> )
	JP3	Position 1-2	AOUT2 current
		Position 2-3	AOUT2 voltage ( <i>default</i> )
JP4	Position 1-2	AOUT3 current	
	Position 2-3	AOUT3 voltage ( <i>default</i> )	
JP6	Position 1-2	AOUT4 current	
	Position 2-3	AOUT4 voltage ( <i>default</i> )	
Digital input	JP8	Position 1-2	DIN1 S0
		Position 2-3	DIN1 normal ( <i>default</i> )
	JP9	Position 1-2	DIN2 S0
		Position 2-3	DIN2 normal ( <i>default</i> )
JP10	Position 1-2	DIN3 S0	
	Position 2-3	DIN3 normal ( <i>default</i> )	
JP11	Position 1-2	DIN4 S0	
	Position 2-3	DIN4 normal ( <i>default</i> )	

### **JP7**

Enables/disables an on-board 120 ohm line termination resistor which according to RS485 standards requires proper line termination in both endpoints of the network (*assuming a CAT5 twisted pair cable is used*).

If the RTCU DX4i warp unit is used as endpoint the relevant jumper can be installed.

By default the 120 ohm termination resistor are disabled.

### **JP1, JP14, JP16 and JP17**

These jumpers are used to select between current and voltage input. With a jumper installed on the relevant analog input it will measure current between 0-20mA.

By default the inputs measure voltage.

### **JP2, JP3, JP4 and JP6**

These jumpers are used to select either current or voltage output. With the relevant jumper installed on pin 1+2, the output is a current between 0-20mA. When installed on pin 2+3, the output is a voltage.

By default the jumper is installed on pin 2+3 which means a voltage output.

### **JP8, JP9, JP10 and JP11**

These select either normal or S0 input for DIN1-4. With the relevant jumper installed on pin 1+2, the input is configured to S0. When installed on pin 2+3 the input is a normal digital input.

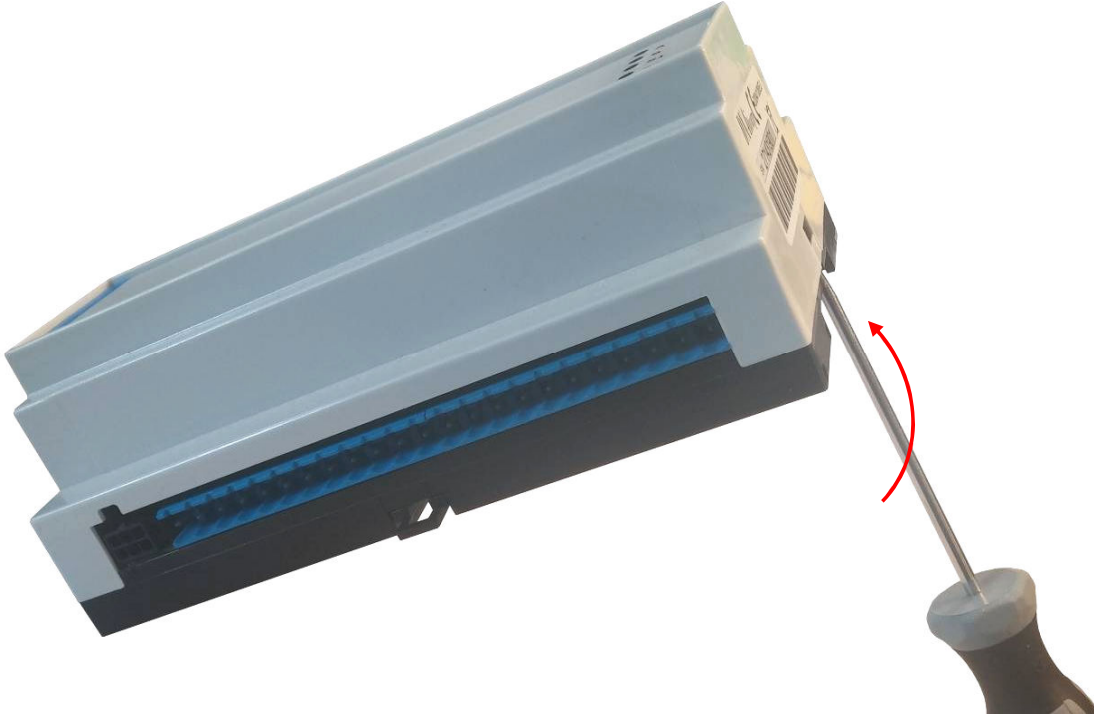
By default the jumper is installed on pin 2+3 and acts as normal digital input.

Follow the instructions on the next page on how to open the lid and change the jumper settings.



### Opening the lid

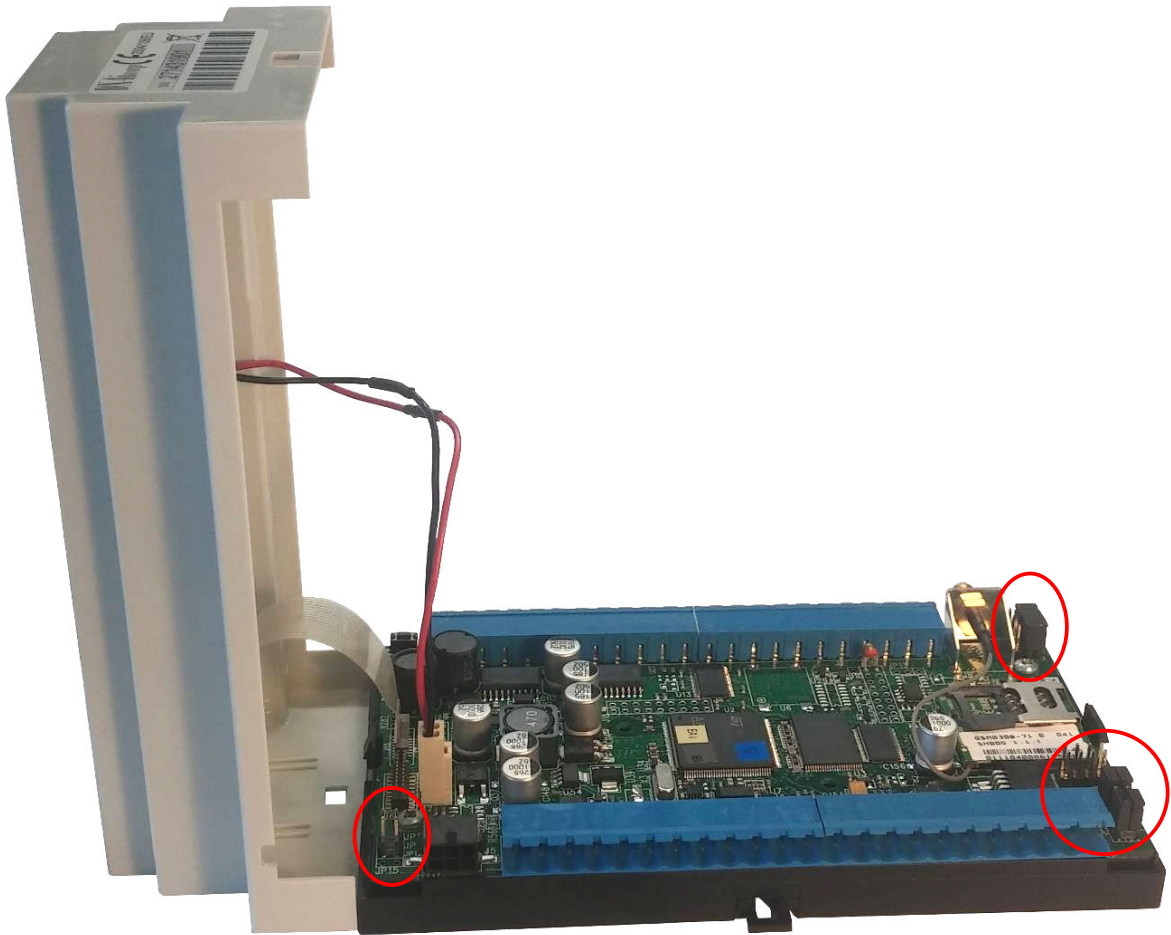
1. Place a screwdriver or a flat-tipped tool as shown in the picture and lift the screwdriver handle upwards to unlock the lid.



2. Lift the lid carefully to the right. Be aware of the cables at the left end and do not use force.

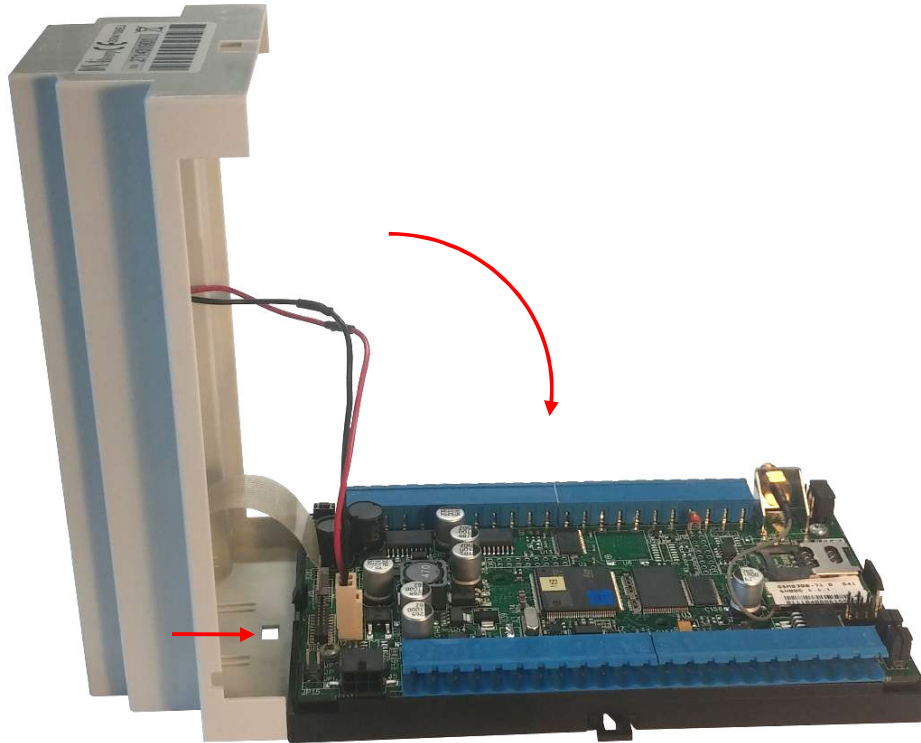


3. Rest the lid as in the following picture. The jumper locations are marked with red circles.



**Closing the lid:**

1. Begin by placing the left side of the lid onto the tap on the bottom part then close the lid gently.



2. Make sure that the cables, especially the battery cable, are placed correctly and not stuck anywhere.



3. Push gently on the right side of the lid until you hear a click.

## Appendix B – Installing the SIM card

The SIM card is located inside the unit on top of the GSM module. The form factor and mechanical design of the reader is securing the SIM card when inserted.

Orientate the card as shown below, and push it into the reader – the card will now stay in position. Please make sure that the power to the GSM module is off during this operation.

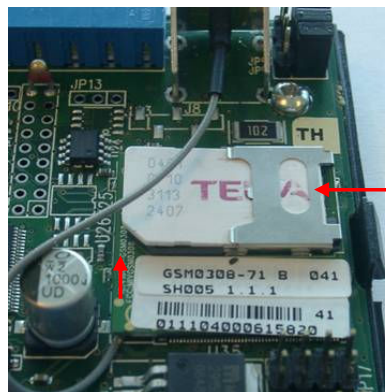


**SIM card orientation**



**SIM card inserted**

To remove the SIM card gently lift the left side of the card and push from the right side. The SIM should now be able to slide out of the reader.



**SIM card removal**

## Appendix C – On-demand hardware options

The RTCU DX4i warp utilizes a state of the art on-demand option concept allowing actual hardware options to be applied to the unit at any time - or even over the air after installation. The following upgrade options are currently available:

### Digital I/O option

The RTCU DX4i warp has by standard 5 digital inputs and 3 digital outputs. Applying the Digital I/O option will expand the available I/O to 8 digital inputs and 8 digital outputs.

### Analog I/O option

The RTCU DX4i warp has by standard 2 analog inputs and 2 analog outputs. Applying the Analog I/O option will expand the available I/O to 4 analog inputs and 4 analog outputs.

### Communication option

The RTCU DX4i warp does not by standard support RS485 and the 1-Wire interface. By applying the Communication option the unit will support RS485 and 1-Wire. 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 DX4i 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 DX4i warp 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 FRAM with fast access / unlimited write endurance.

### 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.
- Internal SIM card-reader.
- Optional Gemalto SIM-on-chip.

### User Interaction

- 3 x bi-colour LED.
- Yellow status LED.
- Reset / recovery switch.

### Electrical Specification.

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

### Battery and Charger

- On-board 1Ah (nominal) Li-Ion battery.
- Intelligent charger with temperature throttle and sub-zero degrees support.
- On-board temperature sensor.

### Digital/Analog Interface

- Up to 8 x solid-state digital outputs. Max. 36 volt / 1.5 A per. channel. Short-circuit, ESD, Inductive kick-back protected up to 20 mH.
- Up to 8 x digital inputs. Logic high: 6 to 40 VDC. Logic low: -5 to 3 VDC.
- Digital input #5 can be used as ignition.
- 4 x IEC62053-31 Class A input.
- Up to 4 x analog inputs. Range is 0..10VDC or 0..20 mA Resolution: 10 bit Precision:  $\pm 1.5\%$  FSR @ 25°C
- Up to 4 x analog outputs. Range is 0..10VDC or 0..20 mA Resolution: 10 bit Precision:  $\pm 1.5\%$  FSR @ 25°C
- Protected against transients and low-pass filtered.
- Expandable I/O with MODBUS.

### Communication

- 1 x RS232/service port.
- 1 x RS485 (on-demand)
- 1-Wire bus (on-demand)

### Power Management

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

### On-Demand Hardware Options

- Applied "any-time" - locally or remotely.
- Over-the-air hardware upgrade.

### Physical Characteristics

- Encapsulation: 9 Module M36 DIN-rail.
- Approx. 330 gram without accessories.
- W 157 x H 86 x D 58 mm. (without SMA and screw-terminals).

### Environmental Specification

- Operating temperature: -30 to 60°C.
- Battery charge temperature: -10 to 45 °C
- Recommended storage temperature: 0 to 45°C.
- Humidity: 5..90% (non condensing).
- Ingress Protection: IP20.

### Approvals

- CE. EU EMC directive 2004/108/EU.
- 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 \*\*\*