Logic IO
www.logicio.com

Technical Manual for the RTCU M11i Series

Version 1.00

RTCU M11i / RTCU M11Gi

Introduction

This manual contains technical documentation allowing easy installation and use of the RTCU M11i Series unit. In the following text "RTCU M11i" will refer to both members of the Series, the RTCU M11i and RTCU M11Gi units. The only difference between the two versions is that the RTCU M11Gi includes an on-board GPS-receiver.

The RTCU M11i Series is another member of a growing range of sophisticated and advanced Remote Telemetry and Control Units (RTCU) all based on the same concept. The RTCU M11i Series extends the usage into the area of mobile tracking / locating applications by the inbuilt GPS-receiver. The RTCU M11i Series is also an exclusive member of the next-generation of RTCU units that has a full TCP/IP stack implemented to support communicating via. GPRS. For more information about these possibilities and the programming of the unit we ask you to please consult the RTCU Programming Documentation and/or the RTCU IDE Online help.

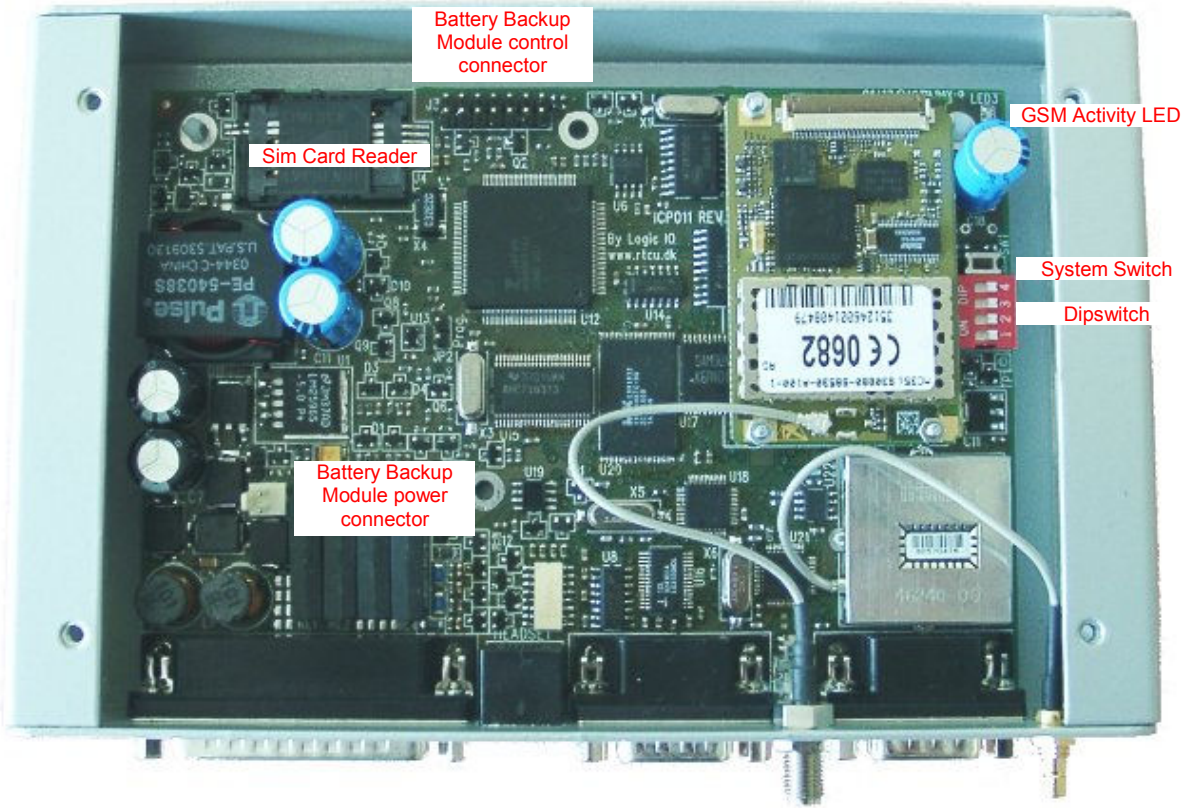The RTCU M11i Series is an updated version of the popular RTCU-M11 Series with the following enhancements:

- Supports the Lassen IQ 12-channel GPS receiver.
- Support for optional 512 KByte extra flash capacity for additional 2000 persistent entries.
- Up to additional 8 MByte on-board flash supported by the hardware.
- Digitized audio is available on the headset connector.
- No restriction on the use of the ignition input.
- The Ignition input can permanently be activated and the unit can still recover from GSM/GPRS network problems.
- Fully "plug compatible" with the RTCU M11 Series.

Logic IO
www.logicio.com

Table of Content

Graphical view

Battery Backup Module control connector

GSM Activity LED

Sim Card Reader

System Switch

Dipswitch

Battery Backup Module power connector

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

Logic IO
www.logicio.com

External connections

Connections to external equipment are done via one 25-pin Male SUB-D connector, two 9-pin Male SUB-D connectors and a 6 pin RJ12 connector (for external Headset). Connection to Dual-band GSM antenna is via a SMA Female and connection to a 3V active GPS antenna is done via the SMB Female connector

All connectors are located at one side of the unit, see picture below:
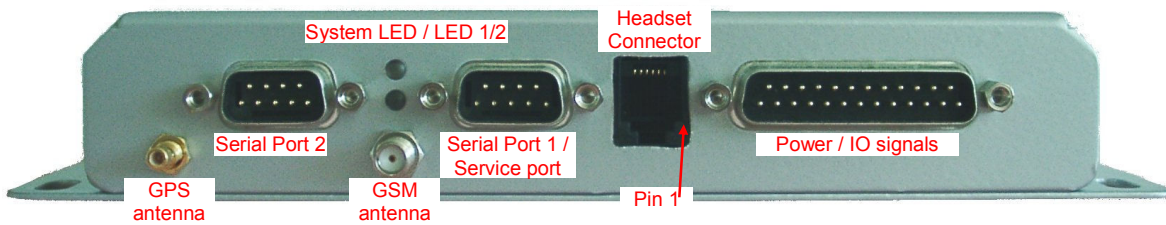
Power / IO signals connector, overview.

Pin	Name	Description
1	SUPP	Power supply, positive (+) connection
2	SUPP	Power supply, positive (+) connection
3	DI1	Digital input 1
4	DI3	Digital input 3
5	R1A	Contact set for relay output number 1
6	R2A	Contact set for relay output number 2
7	R3A	Contact set for relay output number 3
8	R4A	Contact set for relay output number 4
9	DI5/IGN	Digital input number 5 / Ignition input
10	AI2	Analog input number 2
11	AI4	Analog input number 4
12	RS485 A+	Positive wire for RS485 port
13	GND	Ground
14	GND	Power supply, ground (-) connection
15	GND	Power supply, ground (-) connection
16	DI2	Digital input number 2
17	DI4	Digital input number 4
18	R1B	Contact set for relay output number 1
19	R2B	Contact set for relay output number 2
20	R3B	Contact set for relay output number 3
21	R4B	Contact set for relay output number 4
22	AI1	Analog input number 1
23	AI3	Analog input number 3
24	GND	Ground
25	RS485 B-	Negative wire for RS485 port

Power supply

The RTCU-M11i Series unit is to be supplied with 8..36 VDC from an external DC power source connected to the Power / IO connector, or by the Logic IO battery pack connected to the external battery connector (see graphical view).

Power / IO connector, 25 pins Male connector:

Pin	Name	Description
1	SUPP	Power supply, positive (+) connection
2	SUPP	Power supply, positive (+) connection
14	GND	Power supply, ground (-) connection
15	GND	Power supply, ground (-) connection

Headset connector

The RTCU M11i Series unit has provisions for connecting a Headset to the built-in GSM modem. Please consult the RTCU-IDE online manual, function gsmHeadset() for more information.

Headset connector, RJ12 connector:

Pin	Name	Description
1	Voice	Digitized Voice output. *Note This pin is a ground pin on the M11 Series*
2	MICP	Microphone input, positive
3	MICN	Microphone input, negative
4	EPP	Loudspeaker output, positive
5	EPN	Loudspeaker output, negative
6	GND	Ground

Pin 1 is located to the left (see the picture on the previous page)

Analog Inputs

The analog inputs are voltage inputs, with a range from 0V to 5V DC. The analog voltage is converted to a digital value with a resolution of 10bit or 1024 in decimal. The decimal value with 5V applied to the input is 1023 and 512 for 2.5V.

The input signal is connected between AIn and GND. GND must be connected to the reference of the connected equipment. Please be aware that deviations may occur in the converted voltage, as the system is very sensitive to noise.

Power/IO connector, 25 pin Male connector:

Pin	Name	Description
13	GND	Ground
24	GND	Ground
22	AI1	Analog input number 1
10	AI2	Analog input number 2
23	AI3	Analog input number 3
11	AI4	Analog input number 4

Digital Inputs / Ignition Input
The digital inputs are optically isolated (except the ignition input) from the rest of the RTCU with optocouplers (however, the RTCU shares the GND pin with the inputs) and they are also low-pass filtered and transient protected. To activate the inputs, connect a positive voltage between the input and the GND connector. Please note that the DI5/IGN input is a special input. It will function as a "normal" digital input, however, it will also turn on the unit, if the unit is in Powerdown mode (see the PowerDown() function in the RTCU-IDE manual).

Power/IO connector, 25 pins Male connector:

Pin	Name	Description
3	DI1	Digital input number 1
16	DI2	Digital input number 2
4	DI3	Digital input number 3
17	DI4	Digital input number 4
9	DI5/IGN	Digital input number 5 / Ignition input
13	GND	Ground
24	GND	Ground

IMPORTANT NOTE:
Firmware release 4.75 or later must be used. Older firmware versions will disallow the automatic GSM recovery mechanism during the time when the Ignition input (DI5) is activated.

Digital outputs

The digital outputs controls four relay contacts. All outputs have a Normally Open contact set. Please note that some equipment may have a high inrush current which may exceed the specifications of the relay, even though the normal operating current is far from the limits.

Power/IO connector, 25 pin Male connector:

Pin	Name	Description
5	R1A	Contact set for relay output number 1
18	R1B	
6	R2A	Contact set for relay output number 2
19	R2B	
7	R3A	Contact set for relay output number 3
20	R3B	
8	R4A	Contact set for relay output number 4
21	R4B	

Serial port 1 / Programming connector and 1-Wire port

This connector can be used as a 1-wire and as general-purpose RS232 serial port or as a programming connector. In order to use the connector as a programming connector, the RSDET pin (pin 6) must be connected to GND. When using this connector as a general-purpose serial port, the RSDET pin (pin number 6) must be left unconnected. Further details on the programming cable are available in the RTCU-IDE online help.

The 1-Wire signal is available on pin 7. All 1-Wire communication goes through this single pin and all 1-Wire devices connected to this pin retrieves its power directly of the bus (called parasitic power). When an ID-Button with a built-in LED is connected to the port it is not possible to communicate through RS232. So in order to debug an application, which uses the 1-wire function, a special programming cable is needed. The information about this programming cable is available as an application note. It is still not possible though to control the built-in LED in the ID-Button, but it is possible to retrieve other 1-Wire information ID-Button ROM number, Temperature sensor information etc. Please consult the RTCU-IDE online help for further information.

Serial port 1/Programming connector, 9 pin Male connector:

Pin	Name	Description
1	NC	Leave unconnected
2	RxD	RS232 Receive data TO RTCU
3	TxD	RS232 Transmit data FROM RTCU
4	NC	Leave unconnected
5	GND	Ground
6	RSDET	Programming cable detect, normally unconnected (if programming cable, connect to GND)
7	1-Wire	1-Wire bus connection for ID-Button / Temperature sensor
8	NC	Leave unconnected
9	NC	Leave unconnected

Serial port 2 used as RS232 port
The connector can be used as a general-purpose serial port. Either as a RS232 port with all control signals, or as a RS485 port, see the section below.

The pin-out of the connector is the same as a standard PC serial COM port.

Serial port 2, 9 pin Male connector:

Pin	Name	Description
1	DCD	Data Carrier Detect
2	RxD	Receive data
3	TxD	Transmit data
4	DTR	Data Terminal Ready
5	GND	Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	RI	Ring Indicator

Serial port 2 used as RS485 port

The RS485 port is a multidrop port, with maximum 32 units connected simultaneously to the line. The RS485 connection contains the A (positive) and B (negative) signals, as well as a signal ground, which always needs to be connected to the common signal ground for all units connected to the RS485 bus ! The RS485 port is shared with the Serial port 2, if the RS485 port is used, the RS232 interface cannot be used, and vice versa. The maximum cable length for the RS485 bus is approx 400 meters, however this limit can be influenced by the quality of the cable, signaling rate, noise etc.

Power/IO connector, 25 pins Male connector:

Pin	Terminal	Description
12	RS485 A+	Positive wire for RS485 port
25	RS485 B-	Negative wire for RS485 port
13	GND	Ground for RS485 port

GSM Activity LED

The GSM Activity LED is placed in the upper right corner of the PCB (see previous picture) and shows the current activity of the GSM module as follows:

LED mode	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. When a GPRS transfer is in progress the LED goes on 1 second after data packets were exchanged. Flash duration is approx. 500 ms.
On	Depending on type of call: *Voice call*: Connected to remote party. *Data call:* Connected to remote party or exchange of parameters while setting up

	or disconnecting a call.

Installing SIM card / connecting the GSM and GPS antenna

SIM Card
The RTCU unit contains a standard SIM card reader. It is located in the upper left corner on the printed circuit board (please see the graphical view). The SIM card reader is opened by carefully pressing down on the lid of the reader, and at the same time, pressing the lid towards the screw terminals. It is then possible to open the SIM card reader, and insert your SIM card into it. Close the lid by pressing it down, while at the same time, pressing it towards the programming connector.

GSM Antenna
The RTCU unit contains an SMA Female connector for connection of a suitable GSM Dual band antenna (900/1800 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. Please consult the installation guide that follows the GSM antenna.

GPS Antenna
The RTCU unit contains an SMB Female connector for connection of a suitable GPS antenna. The GPS antenna must be a 3V active GPS antenna mounted with a SMB 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. Please also consult the installation guide that follows the GPS antenna.

Switches / Indicators

A status indicator is present on the unit (see the graphical view). Different colors/blinking patterns are used to signal different types of errors/status change in the RTCU unit:

Fastest blinking, green	The unit is initializing, preparing to start the VPL program
Fast blinking, green (or yellow)	The VPL program is not executing, stopped by the reset/diagnostic switch.
Slow blinking green (or yellow)	The unit is executing the VPL program
Fast blinking, red (or yellow)	A runtime error has been detected in the program
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.

If the color of the status indicator is yellow, the unit is actively communicating with for example, the RTCU-IDE program (or another program, supporting the RTCU protocol, RACP).

The RTCU unit contains a combined reset/diagnostic switch. This switch is located just to the right of the GSM-Module (System switch). When this switch is activated during reset of the unit (or power on), 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). The status indicator indicates this by fast blinking green or yellow as stated above.
If the switch is activated for more than 3 seconds, the unit will reset (same as power on).

A two-colored (red/green) indicator is visible above the status indicator. This indicator can be controlled from within the VPL program in the unit; the green part is accessed as LED1 and the red part as LED2.

The RTCU unit contains a dipswitch. The dipswitch is located just to the right of the GSM-module (see the graphical view). To use the dipswitch in the RTCU-IDE declare a Boolean input variable, and define it as a dipswitch in the RTCU-IDE Job variable configuration dialog.

Logic IO
www.logicio.com

Specifications for the RTCU M11i

Analog inputs		Min		Max		
		0	-	+5	VDC	Resolution is 10 bits. All inputs are protected against transients and lowpass filtered.
Digital inputs		Min	Typ	Max		
	Logic "High"	8	12	40	VDC	All inputs are protected against transients and lowpass filtered. All inputs are optically isolated
	Logic "Low"	-5	-	3	VDC	
Digital outputs (Relay)		Min		Max		
		-	-	30	Volt	Normally open contacts.
		-	-	1	Amp	
Power supply		Min	Typ	Max		
Operating Voltage		8	-	36	VDC	Protected against wrong polarity.
Unit Active with GSM off Unit in Sleep with GSM off Unit in Powerdown Unit Active with GSM on			80 36 0.28 95	 270	mA mA mA mA	At 12 VDC supply voltage.
Storage temperature		-40	-	+90	ºC	External connections: • SUB-D9M for RS232 port 1 (service-port) • SUB-D9M for RS232 port 2 (general) • SUB-D25M for power, digital, analog and RS485. • SMA-Female for GSM antenna. • RJ12 connector for headset
Operating temperature		-25	-	+55	ºC	
Restricted operation (deviations from the GSM specification may occur)		-29	-	+70	ºC	
Humidity (non condensing)		5	-	90	%	
Weight			0.5		Kg	
External dimensions		W* 170 x H 110 x D 31 mm				*W 202 with mounting flanges
Ingress Protection (IP)		IP54 (with RJ12 in use)				Steel / Aluminum enclosure
Approvals		EN-50081-1 Emission EN-61000-6-2 Immunity				E 1 10R-024063 C E

Technical data subject to change

Logic IO
www.logicio.com

Specifications for the RTCU M11Gi:

Analog inputs		Min		Max		
		0	-	+5	VDC	Resolution is 10 bits. All inputs are protected against transients and lowpass filtered.

Digital inputs		Min	Typ	Max		
	Logic "High"	8	12	40	VDC	All inputs are protected against transients and lowpass filtered. All inputs are optically isolated
	Logic "Low"	-5	-	3	VDC	

Digital outputs (Relay)	Min		Max		
	-	-	30	Volt	Normally open contacts.
	-	-	1	Amp	

Power supply	Min	Typ	Max		
Operating Voltage	8	-	36	VDC	Protected against wrong polarity.
Unit Active with GSM/GPS off Unit in Sleep with GSM/GPS off Unit in Powerdown Unit Active with GSM on Unit Active with GPS on Unit Active with GSM/GPS on.		80 36 0.28 95 100 115	 270 290	mA mA mA mA mA mA	At 12 VDC supply voltage.

	Min	Typ	Max		
Storage temperature	-40	-	+90	ºC	External connections: • SUB-D9M for RS232 port 1 (service-port) • SUB-D9M for RS232 port 2 (general) • SUB-D25M for power, digital, analog and RS485. • SMA-Female for GSM antenna. • SMB-Male for active (3V) GPS antenna. • RJ12 connector for headset
Operating temperature	-25	-	+55	ºC	
Restricted operation (deviations from the GSM specification may occur)	-29	-	+70	ºC	
Humidity (non condensing)	5	-	90	%	
Weight		0.510		Kg	
External dimensions	W* 170 x H 110 x D 31 mm				*W 202 with mounting flanges
Ingress Protection (IP)	IP54 (with RJ12 in use)				Steel / aluminum enclosure
Approvals	EN-50081-1 Emission EN-61000-6-2 Immunity				E 1 10R-024063 CE

Technical data subject to change

The RTCU M11Gi can be delivered with an 8-Channel or 12-Channel GPS-Receiver.

Specifications for the 12-channel GPS receiver

Trimble Lassen IQ

General: 12 Channels simultaneous operation
                   DGPS capable
                   L1 frequency (1575.42MHz)
                   C/A code (Standard Positioning Service)
                   Continuous tracking receiver

Update Rate: NMEA @ 1Hz

Accuracy: Horizontal   < 5 meters (50%)
                                < 8 meters (90%)

                   Altitude   < 10 meters (50%)
                                < 16 meters (90%)

                   Velocity   0.06 m/s

Acquisition: Autonomous Operation in Standard Sensitivity Mode
                   Reacquisition   < 2 sec. (90%)

                   Hot Start   < 10 sec. (50%)
                                          < 13 sec. (90%)
                   Warm start   < 38 sec. (50%)
                                          < 42 sec. (90%)
                   Cold start   < 50 sec. (50%)
                                          < 84 sec, (90%)

Interface protocol: NMEA 0183 v3.0 with GGA, VTG, GLL, GSA, GSV and RMC

Defintions:

Cold Start:
The GPS has no valid navigation data.

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

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

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

Logic IO
www.logicio.com

Specifications for the 8-channel GPS receiver

Trimble Lassen SQ

General: 8 Channels
                    DGPS capable
                    L1 frequency (1575.42MHz)
                    C/A code (Standard Positioning Service)
                    Continuous tracking receiver

Update Rate: NMEA @ 1Hz

Accuracy: Horizontal   < 6 meters (50%)
                                 < 9 meters (90%)

                    Altitude   < 11 meters (50%)
                                 < 18 meters (90%)

                    Velocity   0.06 m/s

Acquisition: Reacquisition   < 2 sec. (90%)

                    Hot Start   < 14 sec. (50%)
                                         < 18 sec. (90%)
                    Warm start   < 38 sec. (50%)
                                         < 45 sec. (90%)
                    Cold start   < 90 sec. (50%)
                                         <170 sec, (90%)

Interface protocol: NMEA 0183 v3.0 with GGA, VTG, GLL, GSA, GSV and RMC

Defintions:

Cold Start:
The GPS has no valid navigation data.

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

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

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