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Imagine. Build. Succeed.

ReliaGATE 10-11-16
Multi-Service Gateway & Edge Controller

Trademarks

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Revision history

Revision	Description	Date
1-0	First release	15 February 2016

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1   IMPORTANT INFORMATION

CAREFULLY READ AND UNDERSTAND THE INSTRUCTIONS CONTAINED IN THIS DOCUMENT BEFORE INSTALLING / OPERATING THE PRODUCT.

KEEP THIS DOCUMENT FOR FUTURE REFERENCE.

Whenever you have any doubt regarding the correct understanding of the instructions contained in this document contact your local Eurotech Technical Support Team (see the last page of this document for further details).

To lower the risk of personal injury, electric shock, fire or damage to equipment, observe the following precautions, as well as using good technical judgment, whenever installing / operating the product.

1.1   Signals used in this document

⚠ **DANGER**
INDICATES A HAZARD WITH A HIGH LEVEL OF RISK WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY

⚠ **WARNING**
INDICATES A HAZARD WITH A MEDIUM LEVEL OF RISK WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY

⚠ **CAUTION**
INDICATES A HAZARD WITH A LOW LEVEL OF RISK WHICH, IF NOT AVOIDED, COULD RESULT IN MINOR OR MODERATE INJURY

NOTICE
Indicates practices not related to personal injury, such as: ● **An instruction to follow to use the product effectively** ● **A statement of company policy related to product or property protection**

1.2   Disclaimer of liability

Eurotech has reviewed the contents of this document to ensure accuracy and consistency with the hardware and software described.

Always refer to the latest available manual revision available at: www.eurotech.com.

1.3   Intended audience

This document is intended for **system integrators**, who are skilled persons with a thorough knowledge in bringing together component subsystems into a whole, ensuring that those subsystems function together.

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2   SAFETY INSTRUCTIONS

Observe the following safety instructions when installing / operating the product.

Failure to comply with these instructions or with specific warnings elsewhere in this document violates safety standards of design, manufacture, and intended use of the product.

Eurotech assumes no liability for any failure to comply with these instructions.

2.1   Observe antistatic precautions

NOTICE
PREVENTING ELECTROSTATIC DISCHARGE (ESD)

 When handing the product described in this document, always use appropriate antistatic precautions to avoid damages due to electrostatic discharge.

For example: use a wrist strap or ESD cuff kept in constant contact with bare skin and attached to an ESD ground.

2.2   Connect power supply correctly

⚠ WARNING

ELECTRIC SHOCK HAZARD

Before applying power, thoroughly review all installation, operation, and safety instructions.

Failure supply power correctly or to follow all operating instructions correctly, may create an electric shock hazard, which could result in personal injury or loss of life, and / or damage to equipment or other property.

To avoid injuries:
- **Before operating any equipment, carefully read any supplied instructions**
- **Do not perform any connections with wet hands**
- **Check any power cords for damage before using them**
- **Use certified power cables. The power cables must meet the power requirements of the device**
- **Position cables with care. Avoid positioning cables in places where they may be trampled or compressed by objects placed on them**
- **Take particular care of plugs, power-points and outlets. Avoid overcharging them**
- **Always disconnect power and discharge the circuits before touching them**
- **Only start the product with a power supply that meets the requirements stated on the voltage label. In case of uncertainties about the required power supply, contact the Eurotech Technical Support Team (see the back cover for full contact details) or the electricity authority.**

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3   HOW TO RECEIVE TECHNICAL ASSISTANCE

3.1   How to receive technical support

If you have technical questions, or if you cannot isolate a problem with your product, or for any inquiry about repair and returns policies, contact:

- The Eurotech Global Support Center: https://eurotech.desk.com/
- Your local Eurotech Technical Support Team: see the back cover for full contact details.

3.2   How to return a product to Eurotech

To return a product to Eurotech, complete the following steps:

1. Send an email to the Eurotech RMA Department (rma.it@eurotech.com) specifying:
    - Product Model Number (printed on the product label)
    - Product Serial Number (printed on the product label)
    - Recap of the fault description
2. Receive a reply from the Eurotech RMA Department. It contains:
    - The RMA number
    - The shipping information
3. Pack the product using anti-static material and place it in a sturdy box with enough packing material to adequately cushion it
4. Ship the product to Eurotech following the information received from the Eurotech RMA Department.

NOTICE
Any product returned to Eurotech that is found to be damaged due to inappropriate packaging will not be covered by the warranty! **When shipping the product:** 1. **Pack it using anti-static material** 2. **Place it in a sturdy box with enough packing material to adequately cushion it.**

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4　CONVENTIONS USED IN THIS DOCUMENT

4.1　Conventions for signal names

Convention	Description
GND	Digital ground plane
#	Active low signal
_P	Positive signal in differential pair
_N	Negative signal in differential pair

4.2　Abbreviations for direction and electrical characteristics of a signal

Convention	Description
I	Signal is an input to the system
O	Signal is an output from the system
IO	Signal may be input or output
P	Power and ground
A	Analog signal
3.3	3.3 V signal level
5	5 V signal level
NC	No Connection
Reserved	Use is reserved to Eurotech

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5   PRODUCT OVERVIEW

Your ReliaGATE 10-11-16 is a compact and lightweight IoT gateway based on the TI AM335X Cortex-A8 (Sitara) processor family, with 512MB of RAM, 4GB of eMMC, and a user-accessible microSD slot.

It is suitable for intensive workload in industrial and automotive applications. It supports a 9 to 36 V power supply with transient protection and vehicle ignition sense, and features a wide range of connectivity capabilities.
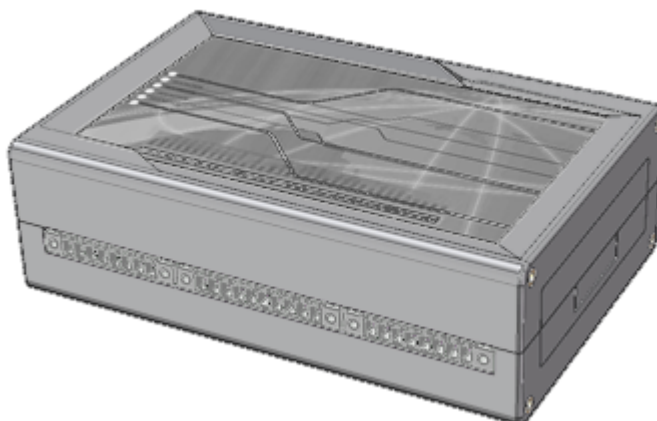
Figure 5.1 - The ReliaGATE 10-11-16

5.1   Product labels

The product label is placed on the bottom side of the product.
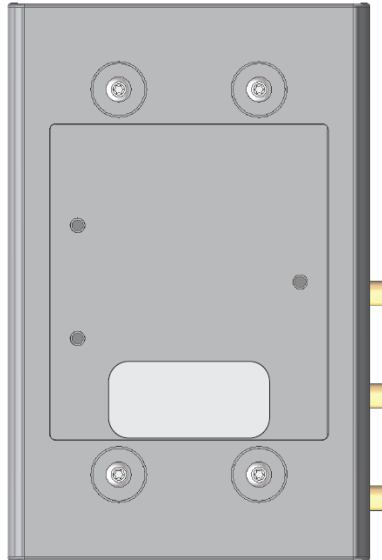
Label content	Label example
• FCC ID numbers • ReliaGATE serial number in bar-code format • ReliaGATE serial number in figures • CE mark • WEEE symbol	FCC ID: UKMMRG1011 Contains FCC ID: RI7HE910 CE S.N.: R1YYMDL0000

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6   DECLARATION OF CONFORMITY

The ReliaGATE 10-11-16 conforms to the following:
- Reduction of Certain Hazardous Substances (RoHS2)
- CE Mark
- Wi-Fi and Bluetooth Radio:
  - CE - EN300 328 (2.4GHz ISM), EN50371 (EMI), EN301 489 (EMC)
  - FCC - 15.209 (General RF device), 15.247 & 15.249 (2.4GHz ISM)
- Cellular Radio:
  - FCC PART 22, 24 & 27 and suitable GSM radio certifications
- UL 60950-1 Information Technology Equipment - Safety - Part 1: General Requirements
- Product compliance with part 15.21 of FCC

6.1   FCC compliance

This device and its accessories comply with part 15 of FCC rules. Operation is subject to the following two conditions:

1. This device and its accessories may not cause harmful interference.
2. This device and its accessories must accept any interference received, including interference that may cause undesired operation.

Change or modifications that are not expressly approved by the manufacturer could void the user's authority to operate the equipment.

FCC ID: UKMMRG1011
Contains FCC ID: RI7HE910

6.2   RoHS compliance

The product described in this document, including all its components and its sub-assemblies, have been manufactured in compliance with the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

6.3   WEEE compliance

In compliance with the Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE), the symbol on the right, shown on the product or within its literature, indicates separate collection for this electrical and electronic equipment (EEE) that has been placed on the market after 2005.

This product, at the end of its life cycle, must be collected separately and managed in accordance with the provisions of the current Directive on waste electrical and electronic equipment.

Because of the substances present in the product, improper use or disposal of the refuse can cause damage to human health and the environment.

To avoid any possible legal implications, contact your local waste collection body for full recycling information.

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7   EMI / EMC REQUIREMENTS

7.1   EN 61000-6-2:2005 Immunity Requirements, B criteria

Radiated Emission Limits at 10 meters	
IEC 61000-4-2: ED. 2.0 2008 Electrostatic Discharge	±4 kV contact discharge; ±8 kV air discharge
IEC 61000-4-3:2006 +A1:2007 RF Electromagnetic Field	10 V/m, 80 – 1000 MHz, 1.4 – 2 GHz, 3 V/m, 2.0 – 2.7 GHz, 1V/m 80% 1 kHz AM
IEC 61000-4-4: ED. 2, 2004 Electrical Fast Transient/Burst	DC power ports, ±2 kV
IEC 61000-4-6: ED 3.0, 2008 RF Common Mode	Signal ports, ±1 kV, 0.15 – 80 MHz, 10 Vrms, 80% 1 kHz AM
	DC power ports 0.15 – 80 MHz, 10 Vrms, 80% 1 kHz AM
	Signal ports: 0.15 – 80 MHz, 10 Vrms, 80% 1 kHz AM
	Functional earth ports 0.15 – 80 MHz, 10 Vrms, 80% 1 kHz AM
IEC 61000-4-8 :93+A1:01 Power Frequency Magnetic Field	30 Arms/m
	Continuous at 60 Hz

7.2   EN 61000-6-4:2001 Radiated Disturbance

Radiated Emission Limits at 10 meters	
Frequency band [MHz]	**Class A Quasi-Peak limits, [dBµV/m]**
30 – 230	40
230 – 1000	47

7.3   EN 61000-6-4:2007 Conducted Disturbance

Frequency band [MHz]	Limit [dBµV]	
	Quasi-Peak	**Average**
0.15 – 0.50	79	66
0.50 – 5.00	73	60
5.00 – 30.00	73	60

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8   TECHNICAL SPECIFICATIONS

Specifications		Description
Processor	**CPU**	TI AM335X, 800 MHz, 1 core
Memory	**RAM**	512 MB, DDR3
Storage	**Embedded**	4 GB eMMC
	Other	MicroSD slot (user accessible)
I/O interfaces	**Ethernet**	1x Fast Ethernet port
	USB	2x USB 2.0 host port 1x USB 2.0 client port
	Serial	2x RS232/485 (Surge protected, RS485 fail-safe resistors user accessible) 1x TTL Serial console
	CAN	2x CAN 2.0B ports
	Digital I/O	2x Insulated Digital Input 2x Insulated Digital Output
Radio interfaces	**Cellular**	Integrated 3G, global, with GPS Micro SIM card slot available behind the Service panel
	GPS	Integrated in Cellular
	Wi-Fi / BT	802.11b,g,n / 4.0 BLE
	Antennas (external)	1x SMA Cellular 1x SMA GPS 1x RP-SMA Wi-Fi / Bluetooth
Other	**RTC**	Yes (user accessible battery)
	Ext. watchdog	Yes
	EEPROM on I2C	256 kb
	Sensors	Not present
	LEDs	1x Power 1x Cellular activity 4x User configurable
	Buttons	1x Reset, 1x Programmable
	SIM slot	1x microSIM (user accessible)
Power	**Input**	Nominal: 24 V dc; Range: 9 - 36 V dc with transient protection, vehicle ignition sense
	Consumption	2W idle
Environment	**Operating Temp**	-20 °C to +70 °C
	Storage Temp	-40 °C to +80 °C
Certifications	**Regulatory**	CE, FCC, E-mark
	Safety	IC 60950-U
	Environmental	RoHS2; REACH
	Radio	FCC, PTCRB
	Cellular	FCC, PTCRB
	Ingress	IP40
	MTBF	>40000 h or 5 years
Mechanical	**Enclosure**	Material: ABS - Color: aluminum
	Dimensions	139 (L) x 95 (W) x 48 (H); mm
	Weight	160 g
	Mounting	Removable DIN mounting kit

8.1 Notes about the power supply unit

The ReliaGATE 10-11-16 comes equipped with a FRIWO MPP 15, 15 W switch-mode power supply unit.

The power supply unit has the following features:

- Model number: FRIWO MPP 15 (FW 7520/24)
- Input voltage: 100 to 240 V ac
- Output voltage: 24 V dc
- Output current: 625 mA
- Power rating: 15 W
- Type: Switch mode

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9   GETTING STARTED

Follow these steps to get started with the ReliaGATE 10-11-16:

1. **Know the ReliaGATE 10-11-16 interfaces.**

    The ReliaGATE 10-11-16 provides connectivity to several wired and wireless interfaces.
    For further information, see:
    - "Product interfaces" on page 25
    - "Interfaces in detail" on page 31

2. **Apply power to the ReliaGATE 10-11-16.**

    The ReliaGATE 10-11-16 supports a variety of usage scenarios.
    For further information, see "Power features" on page 41

3. **Log into the administrative console.**

    The ReliaGATE 10-11-16 runs a Linux distribution based on a Yocto framework and supports login
    via a variety of methods.
    For further information, see:
    - "Software" on page 49
    - "Administrative console" on page 51
    - "How to access to Linux peripherals" on page 53

4. **Install the ReliaGATE 10-11-16.**

    The ReliaGATE 10-11-16 is lightweight and compact. You can easily install it on a DIN rail.
    For further information, see:
    - "Mechanical specifications" on page 63
    - "Install / remove the product" on page 65

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10 PRODUCT INTERFACES

This section gives you an overview of the interfaces on the ReliaGATE 10-11-16.

10.1 Front panel interfaces

The interfaces available on the front panel are the following:
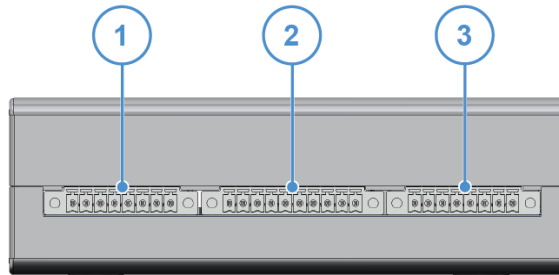
Figure 10.1 - Front panel interfaces layout

Ref#	Description
1	Digital I/Os
2	Serial ports 1 and 2
3	CAN ports

Table 10.1 - Rear panel interfaces description

10.2   Rear panel interfaces

The interfaces available on the rear panel are the following:
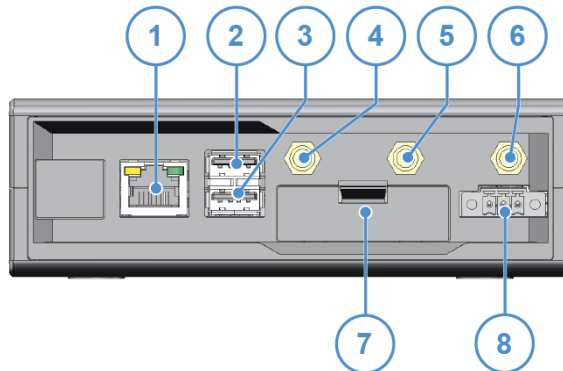
Figure 10.2 - Rear panel interfaces layout

Ref#	Description
1	Ethernet 0 port
2	USB 0 host port
3	USB 1 host port
4	Cellular antenna
5	GPS antenna
6	Wi-Fi/BT antenna
7	Service Panel
8	Power supply input

Table 10.2 - Rear panel interfaces description

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10.3   Service panel interfaces

The interfaces available behind the service panel are the following:
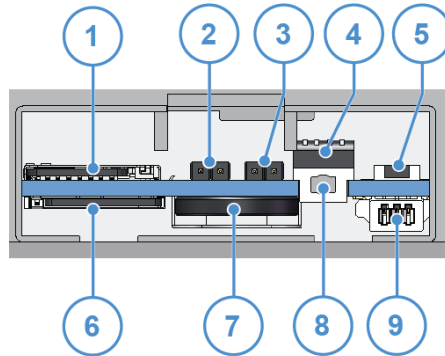
Figure 10.3 - Service panel interfaces layout

Ref#	Description
1	Micro SD card
2	RTC battery connection jumper
3	Boot selection jumper
4	Serial port configuration DIP-switch
5	Programmable pushbutton
6	Micro SIM card
7	RTC battery
8	Reset pushbutton
9	Debug Serial port

Table 10.3 - Service panel interfaces description

10.4   LED indicators

The LED indicators are available on the top side of the ReliaGATE 10-11-16:
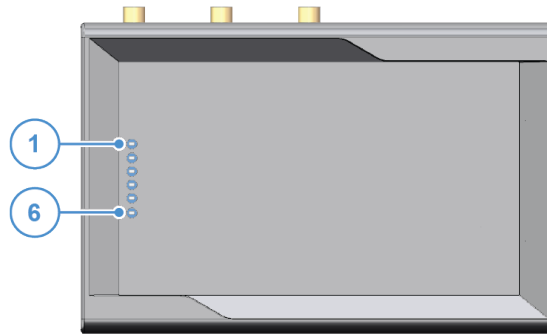
Figure 10.4 - LED indicators layout

Ref#	Use	Color
1	USER1 (General purpose)	Green
2	USER2 (General purpose)	Green
3	USER3 (General purpose)	Red
4	USER4 (General purpose)	Red
5	CELL (Modem activity)	Red
6	POWER	Green

Table 10.4 - LED indicators description

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10.5 Client USB interface

A USB 2.0 client interface for add-on modules is available on the right side.

This interface is noise and surge protected.

Figure 10.5 - Client USB interface layout

10.5.1 Connector and mating connector specifications

Connector	Micro-B USB socket
Mating connector	Micro-B USB plug

10.5.2 Connector pinout

Pin#	Name	Type	Description
1	VBUS	5	+5V
2	D-	IO	Negative data
3	D+	IO	Positive data
4	DGND	P	Digital ground

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11   INTERFACES IN DETAIL

11.1   Digital I/O interfaces

The ReliaGATE 10-11-16 provides:
- 2x Digital Inputs:
    ○ Independent 1 kV optoinsulated voltage (or volt free)
    ○ 5V TTL level
    ○ Not protected against reverse voltage polarity
- 2x Digital Outputs
    ○ Open collector (or drain)
    ○ 50 V DC rated with sink capacity of 10 mA
    ○ 1 kHz maximum switching frequency

These interfaces are available on the front panel

11.1.1   Connector and mating connector specifications

Connector	Phoenix Contacts MC 1.5/ 8-GF-3.5
Mating connector	

11.1.2   Connector pinout
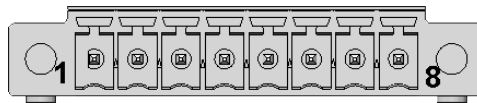
Pin#	Name	Type	Description
1	Digital OUT: 1C	O	Digital Output 1 Collector
2	Digital OUT: 1E	O	Digital Output 1 Emitter
3	Digital OUT: 2C	O	Digital Output 2 Collector
4	Digital OUT: 2E	O	Digital Output 2 Emitter
5	Digital IN: 1A	I	Digital Input 1 Anode
6	Digital IN: 1C	I	Digital Input 1 Cathode
7	Digital IN: 2A	I	Digital Input 2 Anode
8	Digital IN: 2C	I	Digital Input 2 Cathode

11.2   Serial ports 1 and 2

The ReliaGATE 10-11-16 provides 2 serial ports on the front panel. The interfaces are surge protected.

Maximum supported baud rates are:
- For RS232 mode: up to 450 kbps
- For RS485 mode: up to 3.6864 Mbps

Each data signal is routed to two different pins on the connector.

11.2.1   Connector and mating connector specifications

Connector	Phoenix Contacts MC 1.5/ 10-GF-3.5
Mating connector	-

11.2.2   Connector pinout
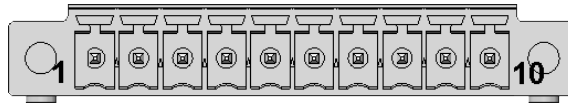
Pin#	Name	Type	Description
1	Serial 1: TX/B	O	Serial port 1: • RS232: Transmit Data • RS485: B Line
2	Serial 1: RX/A	I	Serial port 1: • RS232: Receive Data • RS485: A Line
3	Serial 1: DGND	P	Digital Ground
4	Serial 1: RX/A	I	Serial port 1: • RS232: Receive Data • RS485: A Line
5	Serial 1: TX/B	O	Serial port 1: • RS232: Transmit Data • RS485: B Line
6	Serial 2: TX/B	O	Serial port 2: • RS232: Transmit Data • RS485: B Line
7	Serial 2: RX/A	I	Serial port 2: • RS232: Receive Data • RS485: A Line
8	Serial 2: DGND	P	Digital Ground
9	Serial 2: RX/A	I	Serial port 2: • RS232: Receive Data • RS485: A Line
10	Serial 2: TX/B	O	Serial port 2: • RS232: Transmit Data • RS485: B Line

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Note for termination resistors and fail safe resistors in RS485 mode:
- Termination resistors: you can insert them using the additional pins
- Fail safe resistors: you can insert them using the DIP switch located behind the Service Panel.

11.2.3   *DIP switch for RS485 fail-safe resistors insertion*

You can use this DIP switch to insert the RS485 fail-safe resistors.

11.2.3.1   Switches meaning

Default DIP switch configuration is OFF; this means no resistors inserted.
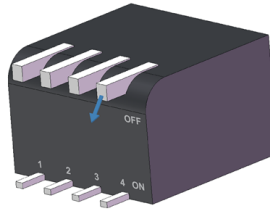
SW#	Signal	Description
1	RS232RX_1 / RS485+_1	ON: 4.7 kΩ pull-up resistor inserted
2	RS232TX_1 / RS485-_1	ON: 4.7 kΩ pull-down resistor inserted
3	RS232RX_2 / RS485+_2	ON: 4.7 kΩ pull-up resistor inserted
4	RS232TX_2 / RS485-_2	ON: 4.7 kΩ pull-down resistor inserted

11.3   CAN ports 0 and 1

The ReliaGATE 10-11-16 provides 2 CAN (Controller Area Network) ports compliant with the CAN Specification 2.0, Parts A and B.

These interfaces are available on the front panel.

Notes about CAN power supply:
- The ReliaGATE 10-11-16 can supply power to the 2 CAN ports: 100 mA @ 5V (each port)
- CAN power can be enabled / disabled by software
- The interfaces are surge protected.

11.3.1   Connector and mating connector specifications

Connector	Phoenix Contacts MC 1.5/ 1-GF-3.5
Mating connector	-

11.3.2   Connector pinout

Pin#	Name	Type	Description
1	CAN 0: H	IO	CAN port 0 Positive Data
2	CAN 0: L	IO	CAN port 0 Negative Data
3	CAN 0: 5V	5	CAN node 0 5 V Output power supply
4	CAN 0: DGND	P	Digital Ground
5	CAN 1: H	IO	CAN port 1 Positive Data
6	CAN 1: L	IO	CAN port 1 Negative Data
7	CAN 1: 5V	5	CAN node 1 5 V Output power supply
8	CAN 1: DGND	P	Digital Ground

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11.4   Cellular with integrated GPS

The ReliaGATE 10-11-16 provides a cellular modem with integrated GPS receiver on an external antennas connection.

The cellular modem has the following approvals:
- Fully type approved confirming with R&TTE directive
- CE, GCF (Global and Europe / Australia / New Zealand / Brazil variants)
- FCC, IC, PTCRB (North America variants)

11.4.1   Cellular antenna specifications

Cellular is available using an external cellular antenna.

Connector	Female SMA
Mating connector	Male SMA

11.4.2   Cellular modem specifications

- Advanced E-GPRS/WCDMA/HSDPA/HSUPA Software protocol stack
- (Layer 1 to 3) – Version: 3GPP Release 7
- GSM Quad band (850, 900, 1800, 1900)
- WCDMA Multi-band (I, II, IV, V, VI, VIII and XIX)
- HSDPA up 21.0Mbps (for the high-end variants; up to 7.2 Mbps for the others)
- HSUPA up to 5.76Mbps
- WCDMA up to 384kbps downlink/uplink
- DTM (Dual Transfer Mode)
- Receive Diversity, type3i interference cancellation receiver
- CPC (DRX/DTX) (Continuous Packet Connectivity)
- DARP
- Control via AT commands according to 3GPP TS27.005, 27.007 and Telit customized AT commands
- Serial port multiplexer 3GPP TS27.010
- SIM application Tool Kits 3GPP TS 51.014
- Power consumption (typical values):
    - Stand-by current 2G, DRX5, 1.1 mA
    - Stand-by current 3G, DRX7, 1.2 mA
- Output power
    - Class 4 (2W) @ 850 / 900 MHz, GSM
    - Class 1 (1W) @ 1800 / 1900 MHz, GSM
    - Class E2 (0.5W) @ 850/900 MHz, EDGE
    - Class E2 (0.4W) @ 1800/1900 MHz, EDGE
    - Class 3 (0.25W) @ 850/900/1700/1900/2100 MHz, WCDMA
- Sensitivity:
    - -109 dBm (typ.) @ 850 / 900 MHz (GSM)
    - -110 dBm (typ.) @ 1800 / 1900 MHz (GSM)
    - -111 dBm (typ.) @ 850/900/1700/1900 / 2100 MHz (WCDMA)

11.4.3   GPS antenna specifications

GPS is available using an external GPS antenna with a frequency of 1575.42 MHz (GPS L1).

Typically, GPS antennas must have line of sight to a wide area of the sky in order to receive signals from multiple positioning satellites.

Connector	Female SMA
Mating connector	Male SMA

11.4.4   GPS receiver specifications

- Advanced real time hardware correlation engine for enhanced sensitivity (better than -165 dBm for A-GPS)
- Fast Acquisition giving rapid Time-to-First-Fix (TTFF)
- Capability to monitor up to 28 channels
- Stand Alone and Assisted mode (SUPL 1.0)
- Integrated LNA
- Accuracy: 3 m
- Hot start autonomous time: 1.8 s
- Warm start autonomous time: 30 s
- Cold start autonomous time: 42 s
- L1 1575.42 MHz
- GPS NMEA 0183 output format
- Datum WGS-84

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11.5   Wi-Fi and Bluetooth

The ReliaGATE 10-11-16 includes a Wi-Fi & Bluetooth (BT) module and an external antenna connection to fully implement Wi-Fi 802.11b/g/n and Bluetooth 4.0 BLE functions.
The circuitry allows for Wi-Fi and Bluetooth coexistence.

11.5.1   Antenna specifications

Connector	Female RP-SMA
Mating connector	Male RP-SMA

11.5.2   Wi-Fi specifications

- Integrated 2.4 & 5G GHz Power Amplifier (PA) for WLAN solution
- WLAN Baseband Processor and RF transceiver Supporting IEEE Std 802.11b/g/n
- WLAN 2.4GHz SISO (20/40 MHz channels)
- 2.4-GHz MRC Support for Extended Range
- Baseband Processor:
  - IEEE Std 802.11a/b/g/n data rates and IEEE Std 802.11n data rates with 20 or 40 MHz SISO.
- Fully calibrated system. Production calibration not required.
- Medium Access Controller (MAC):
  - Embedded ARM™ Central Processing Unit (CPU)
  - Hardware-Based Encryption/Decryption using 64-, 128-, and 256-Bit WEP, TKIP or AES Keys,
  - Supports requirements for Wi-Fi Protected Access (WPA and WPA2.0) and IEEE Std 802.11i [includes hardware-accelerated Advanced Encryption Standard (AES)]
  - Designed to work with IEEE Std 802.1x
- IEEE Std 802.11d,e,h,i,k,r PICS compliant.
- New advanced co-existence scheme with BT/BLE/ANT.
- 2.4 GHz Radio:
  - Internal LNA and PA
  - Supports: IEEE Std 802.11a, 802.11b, 802.11g and 802.11n
- Supports 4 bit SDIO host interface, including high speed (HS) and V3 modes

11.5.3   Bluetooth specifications

- Supports Bluetooth 4.0 as well as CSA2
- Includes concurrent operation and built -in coexisting and prioritization handling of Bluetooth, BLE, ANT, audio processing and WLAN
- Dedicated Audio processor supporting on chip SBC encoding + A2DP:
  - Assisted A2DP (A3DP) support - SBC encoding implemented internally
  - Assisted WB-Speech (AWBS) support - modified SBC codec implemented internally

11.5.4   BLE specifications

- Fully compliant with BT4.0 BLE dual mode standard
- Support for all roles and role-combinations, mandatory as well as optional
- Supports up to 10 BLE connections
- Independent buffering for LE allows having large number of multiple connections without affecting BR/EDR performance

11.5.5 ANT specifications

Fully compliant with all ANT Protocols:

- ANT solution optimized for the fitness and health use-cases
- Simple to complex network topologies
- Supports high-resolution proximity pairing

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11.6 Ethernet port

Your ReliaGATE 10-11-16 provides one 10/100 Mbps Ethernet port for wired network connectivity.

This interface is available on the rear panel:
- it is referenced as eth0

11.6.1 Connector and mating connector specifications

Connector	Female RJ-45
Mating connector	Male RJ-45

11.6.2 Connector pinout
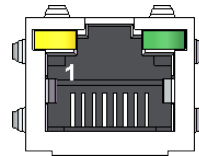
Pin#	Name	Type	Description
1	TX+	O	Transmit Data +
2	TX-	O	Transmit Data -
3	RX+	I	Receive Data +
6	RX-	I	Receive Data -

11.6.3 Port specifications

Feature	Description
Network Standard	IEEE802.3u 10/100-BaseTX. IEEE 802.3x full-duplex flow control.
Speeds	10/100-BaseTX interfaces with MAC
Notes	The interfaces are noise and surge protected. The RJ-45 connector has integrated magnetics.

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11.7 Host USB ports

The ReliaGATE 10-11-16 provides 2 USB 2.0 host ports for general purpose applications.

These interfaces are available on the rear panel, and are noise and surge protected.

11.7.1 Connector and mating connector specifications

Connector	USB Type-A socket
Mating connector	USB Type-A plug

11.7.2 Connector pinout
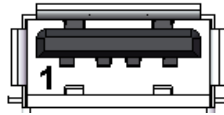
Pin#	Name	Type	Description
1	VBUS	5	+5V
2	D-	IO	Negative data
3	D+	IO	Positive data
4	DGND	P	Digital ground

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11.8　Power features

11.8.1　*Power supply*

The ReliaGATE 10-11-16 provides the power supply input port on the rear panel.

The port is protected against: surge, noise, reverse polarity, over-voltage and short circuit.
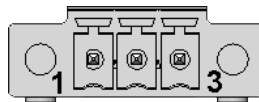
The power input is protected with a resettable fuse.

Power supply	Nominal: 24 V dc; Range: 9 - 36 V dc with transient protection
Power consumption	2 W
Peak demand	< 15 W

11.8.1.1　Connector and mating connector specifications

Connector	Phoenix Contacts MC 1,5/ 3-GF-3,5
Mating connector	-

11.8.1.2　Connector pinout

Pin#	Name	Type	Description
1	VIN+	P	Positive power supply input
2	VIN-	P	Negative power supply input
3	DGND	P	Digital Ground

11.8.2　*Power Management*

You can reduce the power consumption of the ReliaGATE 10-11-16 by turning off the radio interfaces and / or setting the CPU in low power consumption mode (stand-by / deep sleep).

The maximum power consumption at the lowest power state is ≤ 0.4 W.
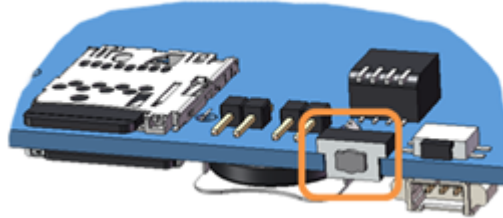
The ReliaGATE 10-11-16 can be woken up from the low power consumption mode by:

- the RTC alarm

11.9   The Reset pushbutton

A reset pushbutton is available to trigger a hardware reset of the ReliaGATE 10-11-16.

The pushbutton is located behind the Service Panel.

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11.10 RTC (Real Time Clock)

The ReliaGATE 10-11-16 includes the following two RTC (Real Time Clocks) devices:

RTC device	Description	Use
/dev/rtc0	• It comes from the CPU SoC	Reserved
/dev/rtc1	• It does not come from the CPU SoC • It is the default RTC used by Linux to set and get the Wall time while booting up and while suspending / resuming • It has an accuracy of 25 minutes per year (at 25 °C) • It can trigger an interrupt to the CPU.	Wake the ReliaGATE 10-11-16 up from a deep low power state

11.10.1 The RTC device "/dev/rtc1"

The RTC device "/dev/rtc1" offers:
- three timestamp registers
- one user-available byte.

11.10.2 The RTC battery

The ReliaGATE 10-11-16 includes a BR1225 lithium coin cell RTC battery behind the Service Panel.

The RTC battery retains the timestamp for up to 180 days when the ReliaGATE 10-11-16 is powered off:
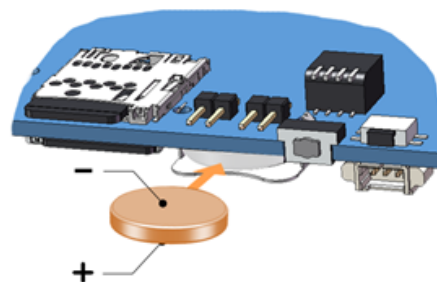
11.10.2.1 How to enable / disable the RTC battery

The ReliaGATE 10-11-16 includes an RTC battery jumper behind the Service Panel.

You can use the RTC battery jumper to enable / disable the RTC battery (this can be useful for example when the ReliaGATE 10-11-16 is stored in the warehouse to save RTC battery charge):
- Jumper inserted = Battery connected
- Jumper removed = Battery not connected
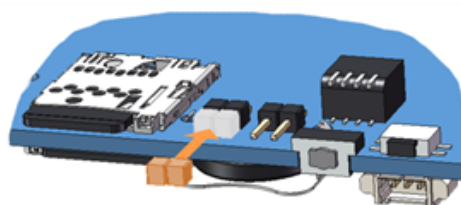
11.11 The Programmable pushbutton

Your ReliaGATE 10-11-16 includes a programmable pushbutton.

It is available behind the Service Panel.

The pushbutton is sensed by a Linux daemon which executes a shell script every time you push the button.

EUROTECH
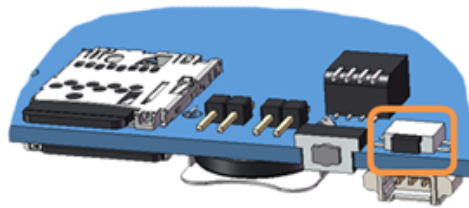
11.12   The MicroSD card receptacle

Your ReliaGATE 10-11-16 includes a push-push type Micro SD card receptacle.

This interface is available behind the Service Panel.

Insert the Micro SD card as in the picture below, with the contacts facing down.
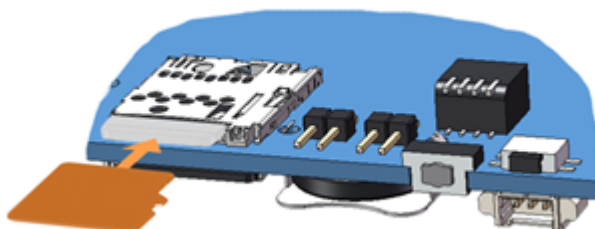
11.13   The MicroSIM card receptacle

Your ReliaGATE 10-11-16 includes a push-push type Micro SIM card receptacle.

This interface is available behind the Service Panel.

Insert the Micro SD card as in the picture below, with the contacts facing up.
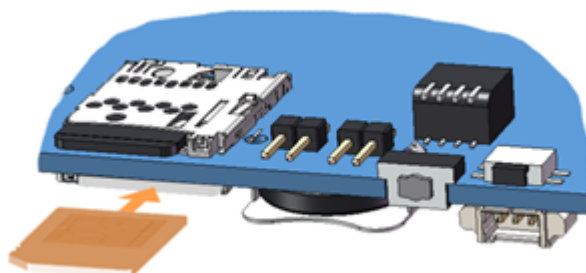
11.14 Debug Serial port

Your ReliaGATE 10-11-16 provides a debug TTL serial port (Linux OS console).

This interface is available behind the Service Panel.

11.14.1 Connector and mating connector specifications

Connector	Molex 53261-0371
Mating connector	Molex 51021-0300

11.14.2 Connector pinout
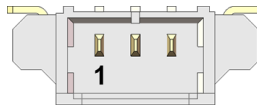
Pin#	Name	Type	Description
1	TX	O	Transmit Data
2	RX	I	Receive Data
3	DGND	P	Digital Ground

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11.15 Watchdog

Your ReliaGATE 10-11-16 includes a watchdog / supervisor IC, external to the CPU

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12   SOFTWARE

12.1   The Linux OS distribution

Eurotech provides a Linux operating systems based on Yocto framework (www.yoctoproject.org) as well as an SDK for application development.

All the documentation for the developer is available from:www.yoctoproject.org/documentation.

12.2   The bootloader procedure

The bootloader procedure is the following:
1. The MLO file is loaded from either the external microSD card or the onboard eMMC memory, and saved in the on-chip memory to configure the RAM memory for use
2. The u-boot.img file is loaded (from the same device where MLO was loaded from), saved in the RAM memory, and executed
3. The bootloader searches for a valid operating system. The search order is:
   a. microSD card
   b. eMMC
4. The bootloader fetches the Linux kernel (/boot/zImage) and the device tree (/boot/reliagate-10-11.dtb), and boots the operating system up

12.2.1   How to select the MLO source

The MLO file can be loaded from either the external microSD card or the onboard eMMC memory, according to the setting of the Boot selection jumper (JP2):
- JP2 inserted = MLO file loaded from the micro-SD card
- JP2 removed = MLO file loaded from the eMMC and, if not found, from the microSD card
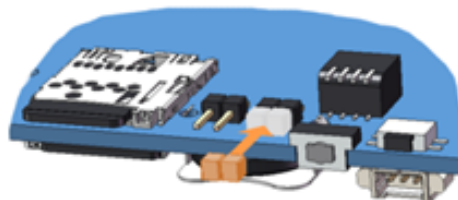
12.2.2   How to set up a correct microSD card / eMMC card partition

To allow the correct bootloader procedure, the microSD card and the eMMC memory have to be configured with at least these 2 partitions:
- 1st partition:
  - Type: FAT16
  - Flags: lba, boot
  - Contains the files: MLO and u-boot.img
- 2nd partition:
  - Type: ext4
  - Contains the operating system, including the Linux kernel (/boot/zImage) and the device tree (/boot/reliagate-10-11.dtb)

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13   ADMINISTRATIVE CONSOLE

This section describes how to log in the operating system using the administrative console (this can be useful for diagnostic and system maintenance purposes).

This section also describes how to change the security settings after the initial setup.

The ReliaGATE 10-11-16 runs a Yocto project based Linux operating system.

You can log in the administrative console in one of the following ways:
- Via a Serial console (Console Port)
- Via a Remote login (over a network connection) via SSH (Secure SHell)

13.1   How to log in using the Serial console

To log in using the serial console, complete the following steps:
1. Connect a null modem serial cable from your development PC to the Serial Console on the ReliaGATE device
2. Start a terminal emulation program such as TeraTerm on your development PC (minicom on a Linux host). Configure the serial port connection for 115200, 8 bits, 1 stop bit, no parity, and no flow control
3. Connect power supply to ReliaGATE device. The Power LED lights green when power is successfully connected
4. Via the Uboot bootloader, the Linux kernel is found and launched automatically.
5. At the login prompt, enter username and password:

   - Default username (case sensitive): **root**

   - Default password (case sensitive): **eurotech**

13.2   How to log in using the Remote login

13.2.1   If your development PC is running Linux

To log in over a network connection, use an SSH client:
1. Enter the command `ssh`. The SSH client opens.
2. At the login prompt, enter username and password:

   - Default username (case sensitive): **root**

   - Default password (case sensitive): **eurotech**

| NOTICE |
|---|
| **If you are running a Linux host, by default theReliaGATE 10-11-16 runs zeroconf.**
This means that you can detect the IP address of the unit remotely by running the command:
`avahi-discover.`
Example:
1. **Run the the command: `avahi-discover`. A dialog box pops-up reporting all the devices on your network that support this mechanism**
2. **Under "eth0 IPv4" > "local" > "Workstation", you should see your Reliagate's hostname (ie: rg-10-11). Select it to see its IP address**
3. **Log in your Reliagate using: `ssh root@rg-10-11.local`** |

13.2.2   *If your development PC is running Windows*

To log in over a network connection, use an SSH client (you can use PuTTY, a free SSH client):
1. Download, install, and run PuTTY:
   - Choose the Windows-based installer version from:
     http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html
2. Enter the IP address of the ReliaGATE 10-11-16:
   - Ethernet 0 (eth0 interface) acquires automatically the ReliaGATE 10-11-16 IP address using DHCP
3. Set the Connection type to 'SSH' and Port to '22'. Click Open to connect
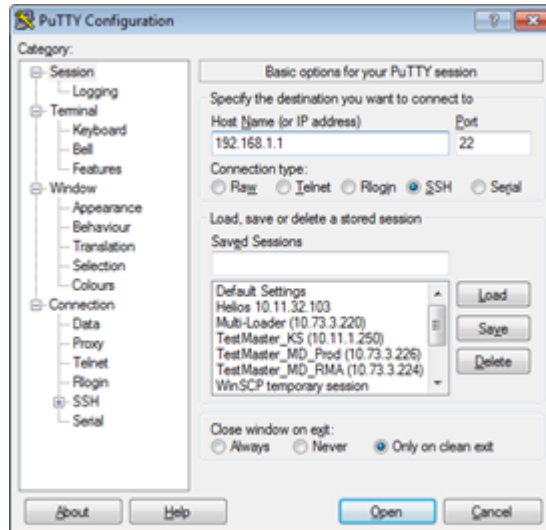
13.3   How to change your security settings

For security reasons, Eurotech recommends you to change the Linux password after your initial setup.

To change your Linux password, complete the followint steps:
1. At the login prompt, enter username and password:
   - Default username (case sensitive): **root**
   - Default password (case sensitive): **eurotech**
2. Use the command `passwd` to change the 'root' password
3. Enter a new 'root' account password when prompted

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14　HOW TO ACCESS TO LINUX PERIPHERALS

14.1　Ethernet port

The ReliaGATE 10-11-16 exposes one 10/100 Mbps Ethernet port for wired network connectivity as follows:

This interface is available on the rear panel:
- it is referenced as eth0, and aquires automatically the ReliaGATE 10-11-16 IP address using DHCP

14.2　Wi-Fi

The ReliaGATE 10-11-16 exposes the Wi-Fi interface as follows:
- Wi-Fi: wlan0; not configured

14.3　Serial Ports

The ReliaGATE 10-11-16 exposes the serial ports as follows:
- Console　　　　**/dev/ttyO0**
- Serial port1:　**/dev/ttyO3**
- Serial port2:　**/dev/ttyO4**

14.3.1　*How to set the RS232/485 serial modes*

Before you can use the serial ports, you have to configure them.

You can configure them in the following ways:
- using the **ethsetserial** utility
- implementing the ioctl in the source code

14.3.1.1　Use the ethsetserial utility to configure the serial ports

To set Serial port 1 to RS232 mode, use the following command:

```
ethsetserial –p ttyO3 –m232
```

To set Serial port 1 to RS485 mode, use the following command:

```
ethsetserial –p ttyO3 –m485
```

To see all the available options, use the following command:

```
ethsetserial –h
```

14.3.1.2　Implement the ioctl in the source code to configure the serial ports

To implement the ioctl in the source code, see the following sections.

Ioctl codes

```
/*Ioctl to read */
#define TIOCGRS485                          0x542E

/*Ioctl to write */
#define TIOCSRS485                          0x542F
```

Definition of the flags bit

```
/*FLAGS */
//#define SER_RS485_ENABLED                 (1 << 0)

/* Logical level for RTS pin when sending */
//#define SER_RS485_RTS_ON_SEND             (1 << 1)

/* Logical level for RTS pin after sent*/
//#define SER_RS485_RTS_AFTER_SEND          (1 << 2)
//#define SER_RS485_RX_DURING_TX            (1 << 4)

/* Inverted logic level for RS485 gpio */
#define SER_RS485_INVERT                    (1 << 5)

/* if enabled serial line drivers must be configured in HiZ*/
#define SER_HIZ_ENABLED                     (1 << 31)
```

Linux kernel data structure

```
struct serial_rs485 {
       __u32   flags;                   /* RS485 feature flags */
       __u32   delay_rts_before_send;   /* Delay before send (milliseconds) */
       __u32   delay_rts_after_send;    /* Delay after send (milliseconds) */
       __u32   padding[5];              /* Memory is cheap, new structs
};
```

Example: Configure the serial port in RS232 mode

Use the example below to configure the serial port in RS232 mode.

`ser_port_name` can be either `/dev/ttyO3` or `/dev/ttyO4`.

```
struct serial_rs485 rs485conf;
unsigned int rs_mode_mask=(SER_HIZ_ENABLED|SER_RS485_ENABLED|SER_RS485_
INVERT|SER_RS485_RTS_ON_SEND|SER_RS485_RTS_AFTER_SEND);

unsigned int set_flags=0;
unsigned int set_flags_mask=rs_mode_mask;

int fd;
fd=open(ser_port_name,O_RDWR);
if (fd==-1)
{
/* process the error */
…
}

/* get serial port configuration */
if (ioctl (fd, TIOCGRS485, & rs485conf) < 0)
{
/* process the error */
…
}

rs485conf.flags&=~ set_flags_mask;
set_flags&=set_flags_mask;
rs485conf.flags|= set_flags;
```

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```
/*set delay but not used in rs232 mode */
rs485conf.delay_rts_after_send=<delay after send in ms>;
rs485conf.delay_rts_before_send=<delay before send in ms>;

/* apply changes */
if (ioctl (fd, TIOCSRS485, & rs485conf) < 0)
{
/* process the error */
…
}
close(fd);
```

Example: Configure the serial port in RS485 mode

Use the example below to configure the serial port in RS485 mode.

ser_port_name can be either /dev/ttyO3 or /dev/ttyO4.

```
struct serial_rs485 rs485conf;
unsigned int rs_mode_mask=(SER_HIZ_ENABLED|SER_RS485_ENABLED|SER_RS485_
INVERT|SER_RS485_RTS_ON_SEND|SER_RS485_RTS_AFTER_SEND);

unsigned int set_flags=(SER_RS485_INVERT|SER_RS485_ENABLED|SER_RS485_RTS_ON_
SEND);
unsigned int set_flags_mask=rs_mode_mask;

int fd;
fd=open(ser_port_name,O_RDWR);
if (fd==-1)
{
/* process the error */
…
}

/* get serial port configuration */
if (ioctl (fd, TIOCGRS485, & rs485conf) < 0)
{
/* process the error */
…
}

rs485conf.flags&=~ set_flags_mask;
set_flags&=set_flags_mask;
rs485conf.flags|= set_flags;

/*set delays */
rs485conf.delay_rts_after_send=<delay after send in ms>;
rs485conf.delay_rts_before_send=<delay before send in ms>;

/* apply changes */
if (ioctl (fd, TIOCSRS485, & rs485conf) < 0)
{
/* process the error */
…
}
close(fd);
```

14.4   Modem

By default the ReliaGATE 10-11-16 exposes the modem as follows:

- AT commands port (data communication):   **/dev/ttyACM0**
- GPS port: **/dev/ttyACM3**

14.5   CAN Bus

The ReliaGATE 10-11-16 exposes the CAN bus (added through the SocketCAN kernel extension) as follows:

- CAN 0:   **/sys/class/gpio/gpio8/value**
- CAN 1:   **/sys/class/gpio/gpio9/value**

14.5.1   *How to enable the CAN bus 5V*

To enable CAN0 5V, use the following commands:

```
echo 1 >/sys/class/gpio/gpio8/value
```

To enable CAN1 5V, use the following commands:

```
echo 1 >/sys/class/gpio/gpio9/value
```

For further information on SocketCAN refer to the Linux kernel documentation:
www.kernel.org/doc/Documentation/networking/can.txt

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14.6   Digital I/Os

The ReliaGATE 10-11-16 exposes the Digital I/Os as follows:

- Input 1:   **/sys/class/gpio/gpio87/value**
- Input 2:   **/sys/class/gpio/gpio89/value**
- Outoput 1:   **/sys/class/gpio/gpio26/value**
- Outoput 2:   **/sys/class/gpio/gpio27/value**

14.7   LED indicators

The ReliaGATE 10-11-16 exposes the LED indicatiors as follows:

- LED 1 (green): **/sys/class/gpio/gpio117/value**
- LED 2 (green): **/sys/class/gpio/gpio114/value**
- LED 3 (red):   **/sys/class/gpio/gpio115/value**
- LED 4 (red):   **/sys/class/gpio/gpio116/value**
- LED 5 (red):   **LED ON means modem ON;**
                  LED blinking means modem attached to GSM network.
- LED 6 (green): **LED ON means ReliaGATE ON**

14.7.1   *How to drive a LED*

Each LED is m,anaged by its respective GPIO

To drive a LED, complete the following steps:
1. Export the LED (if it hasn't already exported before)
2. Drive the LED

To export LED1, use the following commands:

```
#export gpio 117
echo 117 >/sys/class/gpio/export
#gpio is output
echo out >/sys/class/gpio117/direction
```

To drive LED1, use the following commands:

```
#turn led on
echo 1 >/sys/class/gpio117/value
```

```
#turn led off
echo 0 >/sys/class/gpio117/value
```

14.8   Flash Memory

The ReliaGATE 10-11-16 exposes the flash memory as follows:

- Internal flash (eMMC) memory: **/dev/mmcblk0**
- MicroSD card memory: **/dev/mmcblk1**

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14.9 Watchdog

The ReliaGATE 10-11-16 exposes the watchdog as follows:

- Watchdog: **/dev/watchdog1**

14.9.1 Manage the watchdog using the C programming language

To manage the watchdog using the C programming language use the following commands:

```
Int interval;
Int bootstatus;
Long value;

/* display current watchdog value */
If (ioctl(fd,WDIOC_GETTIMEOUT,&interval)==0)
{
   // interval contains current timeout in seconds
}

/* Check if lasdt boot is caused by watchdog */
If (ioctl(fd,WDIOC_GETBOOTSTATUS,&bootstatus)==0)
{
   //bootstatus <> 0 Watchdog
   //bootstatus = 0 Power-on reset
}

/* set the watchdog value (for example: 30 seconds) */
value=30;
If (ioctl(fd,WDIOC_SETTIMEOUT,&value)==0)
{
   //Watchdog has been set to value content
}

/* stop the watchdog */
write(fd,"V",1);

/* feed the watchdog */
ioctl(fd,WDIOC_KEEPALIVE,0);
```

14.9.2 Manage the watchdog from the command line

To set the watchdog value (for example: 30 seconds), use the following command:

```
wdt_setup –d /dev/watchdog1 –t 30
```

To feed the watchdog, use the following command:

```
echo 10 >/dev/watchdog1
```

To stop the watchdog, use the following command:

```
echo V >/dev/watchdog1
```

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14.9.3   For furhter information

For further information on Linux support for watchdog, see:
www.kernel.org/doc/Documentation/watchdog/watchdog-api.txt

14.10 RTC

The ReliaGATE 10-11-16 exposes the user-available RTC as follows:

- RTC: **/dev/rtc1**

The "/dev/rtc1" offers:

- three timestamp registers
- one user-available byte.

14.10.1   How to use the timestamp registers

The timestamp registers are the following:

Timestamp register	What it contains
sys/class/rtc/rtc1/device/timestamp1	Reserved data
sys/class/rtc/rtc1/device/timestamp2	The timestamp that the system last lost power (only if a successful initialization has been achieved)
sys/class/rtc/rtc1/device/timestamp3	The timestamp that the system last has been powered (only if a successful initialization has been achieved)

You can only read and reset the timestamp registers.

To read the timestamp2, use the following command:

```
cat /sys/class/rtc/rtc1/device/timestamp2
```

To reset the timestamp2, use the following command:

```
echo timestamp2 > /sys/class/rtc/rtc1/device/resets
```

14.10.2 How to use the user-available byte

The user-available byte is the following:

User-available byte	What it contains
/sys/class/rtc/rtc1/device/ram_byte	The default value is 0. You can write in it a value included in the range: 0 to 255. This value is retained as long as the /dev/rtc1 device receives a valid power supply (main power supply or battery)

You can read and write the user-available byte.

To read the byte, use the following command:

```
cat /sys/class/rtc/rtc1/device/ram_byte
```

To write 112 in the byte, use the following command:

```
echo 112 > /sys/class/rtc/rtc1/device/ram_byte
```

14.10.3 How to automaticallly wake the ReliaGATE 10-11-16 up from the sleep mode

To wake the ReliaGATE 10-11-16 up 20 seconds after the current date and time, use the following commands:

```
#set current date
DATE="09/04/2015"
TIME="10:00:00"
date +"%m/%d/%y %H:%M:%s" -s "$DATE $TIME"
rtctest -d /dev/rtc1 -a "04/09/2015 10:00:20"
echo mem >/sys/power/state
```

14.11 EEPROM

You can use the EEPROM integrated in the ReliaGATE 10-11-16 to read and write data.

NOTE: By default the EEPROM is write-protected.

14.11.1 How to enable / disable the EEPROM write-protection

The write-protection is managed by the GPIO 73.

To enable/disable the EEPROM write-protection, complete the following steps:
1. Export the GPIO 73
2. Drive the GPIO 73 to enable / disable the write-protection

To export the GPIO 73, use the following commands:

```
#export gpio 73
echo 73 >/sys/class/gpio/export
#set gpio as output
echo out >/sys/class/gpio73/direction
```

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To drive the GPIO 73, use the following commands:

```
#enable write-protection
echo 1 >/sys/class/gpio73/value
```

```
#disable write-protection
echo 0 >/sys/class/gpio73/value
```

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15　MECHANICAL SPECIFICATIONS

The ReliaGATE 10-11-16 electronics are housed in an ABS enclosure having the following dimensions: 139 (L) x 95 (W) x 48 (H); mm (DIN mounting kit installed and connectors included[1]).
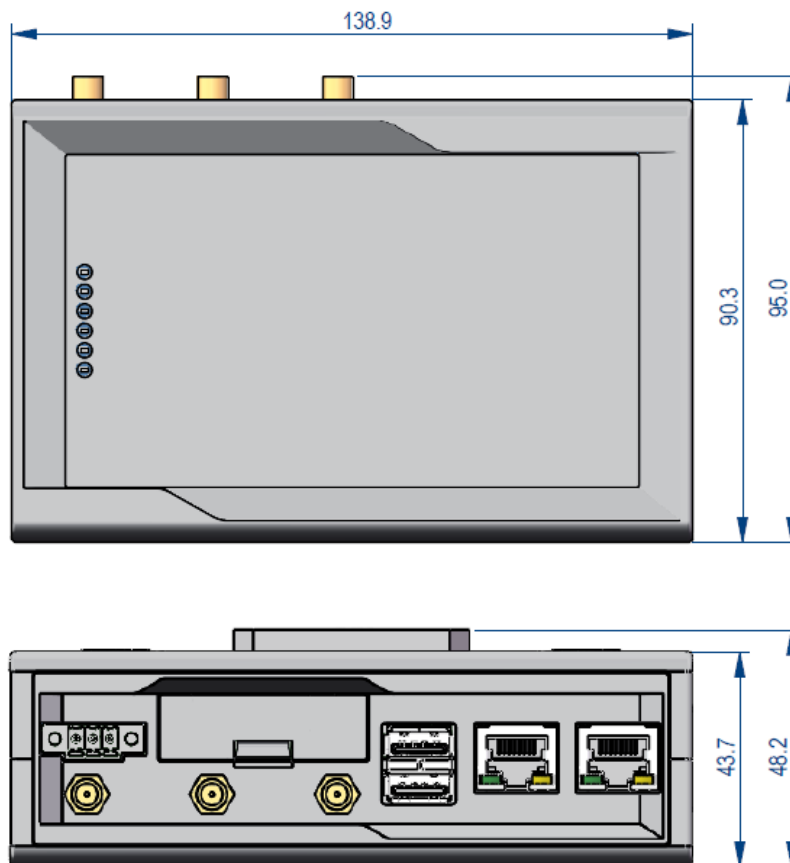
All dimensions are in millimeters.

Figure 15.1 - Mechanical dimensions

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[1] The figure above shows the rear panel of the ReliaGATE 10-11 fully populated. Not all interfaces may be available in your ReliaGATE 10-11 version.

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16   INSTALL / REMOVE THE PRODUCT

16.1   Install the ReliaGATE 10-11-16 on a DIN rail

The ReliaGATE 10-11-16[1] comes equipped with a mechanical adapter - the DIN mounting kit - that allows you to install the product on a DIN rail.

To install the ReliaGATE 10-11-16 on a horizontal DIN rail, complete the following steps:
1. Hook the upper mobile latches of the mechanical adapter on the upper edge of the din rail
2. Push the ReliaGATE 10-11-16 against the DIN rail. The lower latches of the mechanical adapter are locked on the din rail.
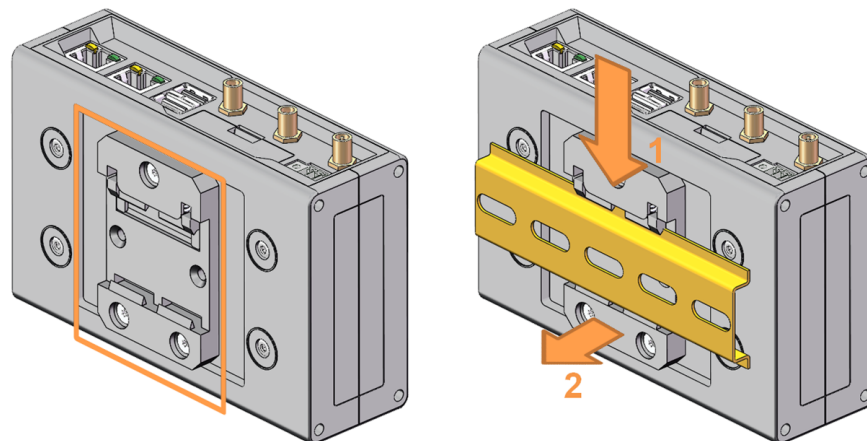
16.2   Remove the ReliaGATE 10-11-16 from a DIN rail

To remove the ReliaGATE 10-11-16[1] from a horizontal DIN rail, complete the following steps:
1. Push the upper mobile latches of the mechanical adapter downwards. The lower latches are released from the DIN rail
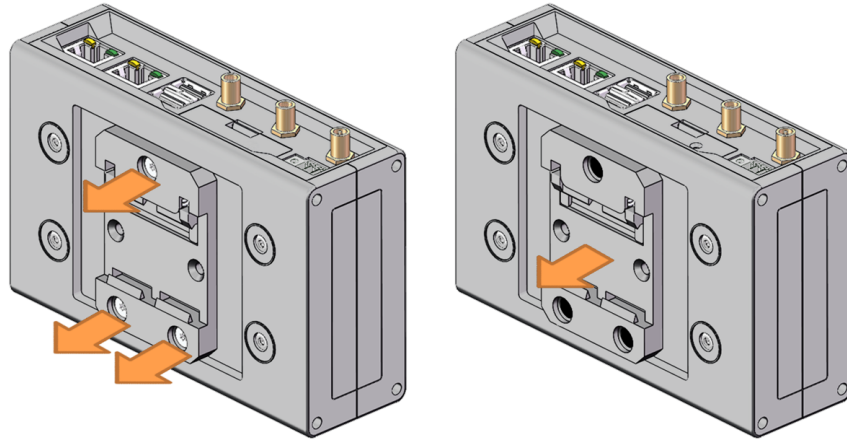2. Pull the ReliaGATE 10-11-16 out
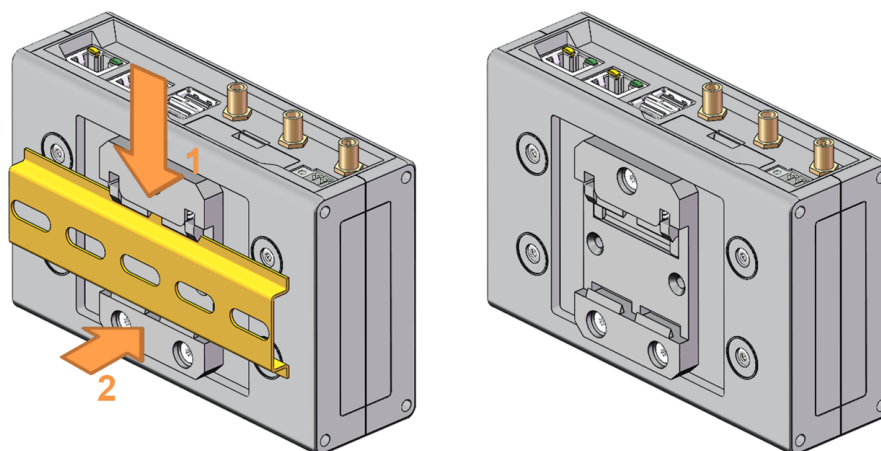
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[1]The figures above show the rear panel of the ReliaGATE 10-11 fully populated. Not all interfaces may be available in your ReliaGATE 10-11 version.

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16.3   Remove the DIN mounting kit from the ReliaGATE 10-11-16

To remove the DIN mounting kit from the ReliaGATE 10-11-16[1], complete the following steps:
1. Remove the three screws that keep the DIN mounting kit in place
2. Remove the DIN mounting kit

16.4   Install the DIN mounting kit on the ReliaGATE 10-11-16

To install the DIN mounting kit on the ReliaGATE 10-11-16[1], complete the following steps:
1. Put the DIN mounting kit in place
2. Tighten the three screws to keep the DIN mounting kit in place.
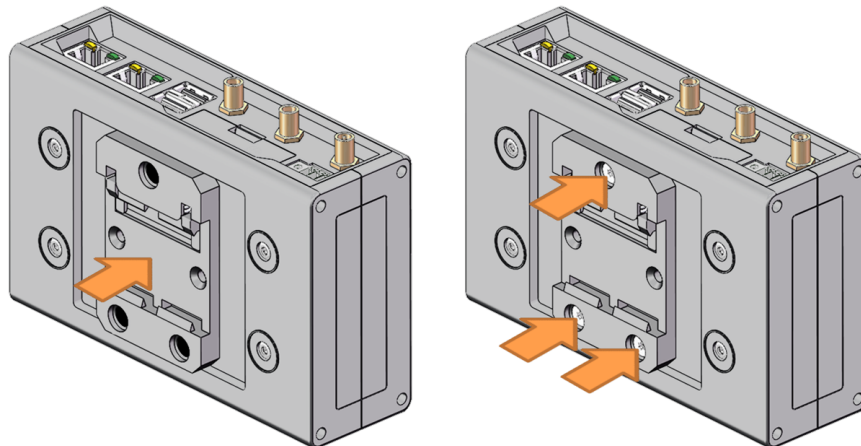
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[1]The figures above show the rear panel of the ReliaGATE 10-11 fully populated. Not all interfaces may be available in your ReliaGATE 10-11 version.

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