ECB02-Series IoT Devices Instruction Manual

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FCC Statements

Changes or modifications to the equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Class B Interference Statement (Required for all Class B devices) (§15.105b)

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.

-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-- Consult the dealer or an experienced radio/TV technician for help.

Indoor Mobile or Fixed Device (§2.1091)

To comply with FCC/IC RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from any persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

ISED Statements

This Device complies with Industry Canada License-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d’Industrie Canada applicables aux appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions suivantes : (1) l’appareil ne doit

pas produire de brouillage ; (2) l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This radio transmitter (identify the device by certification number, or model number if (Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

This device has been designed to operate with the antenna(s) listed below and having a maximum gain of 3 dBi. Antennas not included in this list or having a gain greater than 3 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

Introduction and Safety

Introduction

Scope

This instruction manual covers the mechanical properties and electrical interfaces of the ECB02 family of IoT connectivity boards and IoT devices and IoT Modules (hereinafter referred to as "device" or "product" in singular or plural):

- ECB02_A
- ECB02_B
- STA02_B
- ECB02_C

Further, this instruction manual states requirements on the host environment where the device is installed, and outlines safety precautions relevant at installation and operation.

Limitations

Certain aspects of the function and behaviour of the device is controlled by application software installed on the device. Such software is outside the scope of this instruction manual. The software configuration of a device is controlled from the Telenor Portal, that is referenced when applicable.

The devices described in this manual are offered to businesses that would like to integrate the devices into their solutions or customers products. The engineering, design and workmanship required for the integration of the devices into the customers product is outside the scope of this manual and outside Telenor's responsibility.

ECB02_C is designed as a module, and as such it is not possible to use stand alone. Selected aspects of ECB02_C is covered in this document to give an overview of the product line, but detailed technical documentation of ECB02_C is provided separately on request.

The Hardware shall not be subject to misuse, abuse, improper handling, maintenance or installation, or subject to use not following the Master Service Agreement, this instruction manual or other instructions. Further, the Hardware shall not be altered, modified or repaired otherwise than by Telenor or with its approval or instructions and the Hardware shall not be used in a non-standard environment (i.e. an environment requiring a robustness not documented, such as in space, aviation, military, nuclear, offshore, gentech and life critical health monitoring environments).

Certain aspects of the supply and usage of the device is governed by the Master Service Agreement entered by Telenor and the business entity to which the devices are supplied. Legal and commercial terms and conditions related to the usage of the devices is outside the scope of this document. If any information in this document is in conflict with the Master Service Agreement, the Master Service Agreement have precedence.

Intended audience

The intended audience for the instruction manual is professional technicians and engineers involved in the design, manufacturing, installation, operation and maintenance of customer products and solutions incorporating the devices.

Read and keep the instruction manual

CAUTION:

Read this manual carefully before installing and operating the product. Improper use can cause personal injury and damage to property, and may void the warranty.

Save this manual for future reference, and keep it at a readily available location.

Updated versions of this instruction manual will be published on the Telenor portal from time to time.

The equipment, and its function, may be impaired if used in a manner not specified by the manufactures intended use.

WARNING:

Installing, operating, or maintaining the product in any way that is not covered in this manual could cause death, serious personal injury, or damage to equipment and surroundings. Such non-documented usage includes, but is not limited to, any modification to the product or use of parts not provided by Telenor. If there is a question regarding the intended use of the equipment, please contact a Telenor representative before proceeding.

Safety terminology and symbols

It is of utmost importance that you read, understand, and follow the safety messages and regulations when using the product. They are documented to prevent the following hazards:

- Personal accidents and health problems
- Damage to the product and its surroundings
- Product malfunction

Safety message classification and labelling

Hazard level	Indication
 **DANGER:**	**A hazardous situation which, if not avoided, will result in death or serious injury**
 **WARNING:**	**A hazardous situation which, if not avoided, could result in death or serious injury**
 **CAUTION:**	**A hazardous situation which, if not avoided, could result in minor or moderate injury**
NOTICE:	**Notices are used when there is a risk of equipment damage or decreased performance, but not personal injury.**

Some hazard categories have specific symbols, as indicated below.

Electric hazards	Magnetic fields hazard
 **Electric hazard:**	 **CAUTION:**

User safety

Introduction

All government regulations, including but not limited to regulations and directives related to health and safety must be followed.

All risks related to electricity must be avoided. Any electrical connection must comply with the following:

- The latest version of the instructions in the product documentation, delivered with the product or available through the Telenor portal.
- All international, national, state, and local regulations.

For more information, please refer to the sections covering electrical connections.

Power lock-out

	**DANGER: Electric hazard** Before commencing any work with the device, make sure the device is isolated from power supply and cannot be powered.

Qualification of personnel

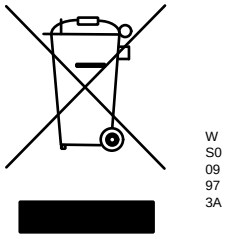
	**WARNING: Electric hazard** Risk of electrical shock or burn. A certified electrician must supervise all electric work. Comply with all local codes and regulations.

All work on the product must be carried out by certified electricians or Telenor authorized personnel. Telenor disclaims all responsibility for work done by non-certified or non-authorized personnel.

End of life product disposal

Handle and dispose all waste in compliance with local laws and regulations.

EU only: Correct disposal of this product — WEEE Directive on waste electrical and electronic equipment



This marking on the product, accessories or literature indicates that the product should not be disposed of with other waste at the end of its working life.

To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Waste from electrical and electronic equipment can be returned to the producer or distributor.

Spare parts

	**CAUTION:** Only use Telenor's original spare parts to replace any worn or faulty components. The use of spare parts from any other source will void warranties, and may cause malfunction, damage, and injuries.

Warranty

For information about warranty please see the Master Service Agreement.

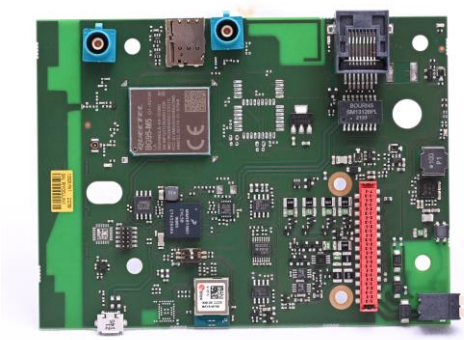
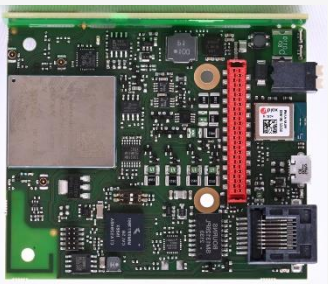
Support

Telenor only supports products that have been tested and approved. For further details please consult the Master Service Agreement.

Product description

Product design

Telenor IoT Complete's 02 range of IoT hardware is designed for flexibility and cost efficiency, while targeting a wide range of applications. The platform offers a common architecture in terms of key components and capabilities but is offered in different form factors catering to both stand-alone and embedded integration scenarios.

	Product Images	Key characteristics
ECB02A		• Manufacturing-friendly form factor • FAKRA Connectors • Antennas integrated in main PCB
ECB02B		• Optimized for size • Integrated antennas
STA02B		• Stand-alone device for DIN-rail or bolt-on

	Product Images	Key characteristics
ECB02C		• Module intended to be soldered on Customer's electronics to allow maximum flexibility

Installation

Connection and configuration

Preparations

Before starting any work, consult the Telenor portal to understand the software configuration for the specific device.

WARNING:
Before starting any work, make sure that the device is configured with the correct software, and that the software configuration is validated and fully understood.

To view and edit the software configuration, please login to the Telenor Portal, locate the device using its serial number, and review the configuration.

Precautions

Before starting work, make sure the safety instructions have been read and understood.

DANGER: Electric hazard
Before starting work on the device, make sure that the device and any connected equipment is isolated from the power supply and cannot be energized.

WARNING: Electric hazard
The device must be powered by a power supply that is insulated from mains and contains short circuit protection. The power supply shall be connected to one of the unit's power terminals.

WARNING: Electric hazard
There is a risk of electrical shock or overheating if the electrical connections are not correctly carried out, or if there is fault or damage on the product.

Visually inspect equipment for damaged cables, cracked casings or other signs of damage. Make sure that electrical connections have been correctly made.

WARNING: Electric hazard
Risk of electrical shock or burn. A certified electrician must supervise all fixed installation work. Comply with all local codes and regulations.

CAUTION: Electric hazard
Prevent cables from becoming sharply bent or damaged.

Requirements

These requirements apply for the power supply:

- The used power supply rating must agree with
    1) actual mains voltage and frequency and
    2) the device supply voltage range and
    3) the maximum supply current rating (alternatively, a 1 A fuse must be fitted between the power supply and the device)
- All cables, connections and installations must be in accordance with the local rules and regulations.

Cables

These requirements apply for cable installation:

- The cables must be in good condition, not have any sharp bends, and not be pinched.
- The sheathing must not be damaged and must not have indentations or be embossed at the cable entry.
- The minimum bending radius must not be below the accepted value.
- The cables must have the appropriate temperature rating.

Integration to customer equipment

Preparations

Before starting any work, consult the Telenor portal to understand the software configuration for the specific device.

WARNING:
Before starting any work, make sure that the device is configured with the correct software, and that the software configuration is validated and fully understood.

To view and edit the software configuration, please login to the Telenor Portal, locate the device using its serial number, and review the configuration.

Precautions

Before starting work, make sure the safety instructions have been read and understood.

DANGER: Electric hazard
Before starting work on the device, make sure that the device and any connected equipment is isolated from the power supply and cannot be energized.

1. Before installing the device, note the serial number of the device as it might be hard to read after the installation is completed.
2. Note the device form factor, i.e. ECB02_A, ECB02_B, STA02_B, or ECB02_C
3. Login at the Telenor Portal and identify the individual device and understand its software and hardware configuration.
4. Mount the device, subject to its form factor:
    a. ECB02_A should be mounted using screws or expanders on a stable non-conductive surface.

WARNING: Electric hazard
The ECB02_A must be mounted in such a way that the electronics are not in contact with conductive parts or surfaces of the customer product.

    b. ECB02_B should be mounted using screws or expanders on a stable non-conductive surface.

WARNING: Electric hazard
The ECB02_A must be mounted in such a way that the electronics are not in contact with conductive parts or surfaces of the customer product.

c. STA02_B should be
    i. attached to a DIN-rail using the supplied fixture, or
    ii. with screws on a flat and stable surface. Please see section Technical Reference, chapter “Mounting of STA02_B using screws”.

CAUTION: Falling objects
STA02_B must be mounted so that the device cannot come loose and fall and hit underlying objects or persons.

d. Mounting and connection of ECB02_C is outside the scope of this document. For details, please consult Telenor.

5. If applicable subject to the device type and configuration, attach the external antenna(s).
6. Subject to the configuration, connect the appropriate pins or connectors to the customer equipment. For additional details consult the Telenor portal, and the technical reference in the below section.

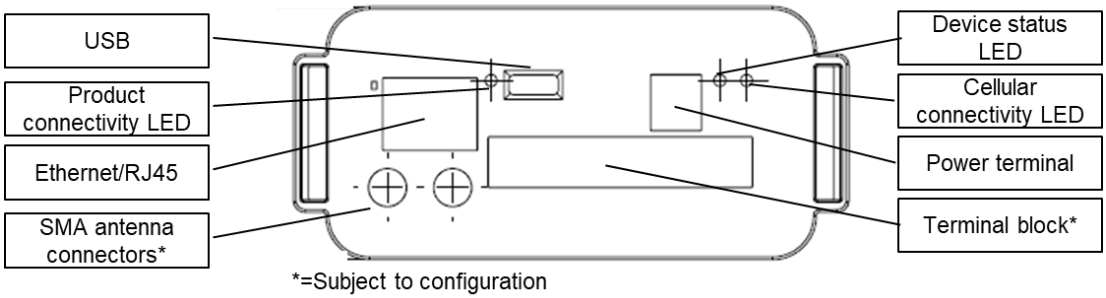
WARNING: Connections inactive or zero by default
All outputs are inactive or zero during power off or after power on, until actions are taken by application software.

Consider all connection states during the integration design and implement relevant safety precautions.

7. Connect the power leads
8. Validate the configuration and power on the customer equipment and the device, using the appropriate sequence subject to the solution design.

Using device LEDs to validate basic functionality

The Telenor Portal is the primary interface for monitoring the device, its functionality and status. However, if e.g. the device is unable to connect to the cellular network, the device LEDs can be used to validate basic device functionality and status.



Device status LED	
Off	No power
Red, blinking	Device is booting
Red, fixed	Device is waiting for connectivity
Orange, blinking	Connectivity available, enrolment in progress
Orange, fixed	Local swap in progress
Green, fixed	Normal operation
Green, blinking	Firmware download in progress

Cellular connectivity LED	
Off	No network
Red, blinking	Searching for network
Red, fixed	No network available
Orange, fixed	Connection established, low quality
Orange, blinking	Connection established, low quality, activity
Green, fixed	Connection established, good quality
Green, blinking	Connection established, good quality, activity

Product connection LED	
Off	No connection
Green, fixed	Connected
Green, blinking	Connected, activity

Troubleshooting

Symptoms and remedies

Symptom	Remedy
No connectivity	• Check that the physical antenna configuration matches the configuration in the Telenor Portal • Move the device to a different location • Configure the device with an external antenna • Reboot the device

Low quality on the cellular connectivity	• Check that the physical antenna configuration matches the configuration in the Telenor Portal • Move the device to a different location • Configure the device with an external antenna
No LEDs are lit	• Verify the power connection
No connection with customer equipment	• Verify the physical connections • Check that the physical connections matches the configuration in the Telenor Portal

Technical reference

Functions and features	ECB02_A	ECB02_B	STA02_B	ECB02_C
Product owner	Telenor Connexion			
MCU	ARM Cortex M7			
RAM	1MB			
Flash	4MB			
Modem	LTE Cat M1 or LTE Cat 4			
SIM	Soldered MFF2 supporting eUICC			
Plastic SIM holder	Yes, 4FF	No	No	No
Input power	12-56VDC or 24/48VDC Power over Ethernet			3.7-4.2VDC
GNSS	GNSS embedded in cellular modem. Optionally dedicated GNSS or RTK GNSS	GNSS embedded in cellular modem.		
Onboard sensors	Accelerometer, Temperature			
Onboard antennas	Cellular, GNSS, BLE/Wifi			N/A
Main dimensions (details subject to configuration, drawings available on request)	120 x 90	80 x 71	85,7 x 93,7 x 42,8	57.9 x 45.2

The devices offer numerous interfaces and connectors to allow integration with Customer's products. Detailed pinout and configuration can be adapted to customer requirements at volume.

Connector and interfaces	ECB02_A	ECB02_B	STA02_B	ECB02_C
RJ45 Connector	Ethernet incl. PoE	Ethernet incl. PoE	Ethernet incl. PoE	ECB02C is intended to be soldered onto a larger PCB, and hence does not include connectors. However, the corresponding interfaces can be accessed via solder points.
RJ25 Connector (alternative to RJ45)	CAN or UART, Power supply, GPIO	CAN or UART, Power supply, GPIO	CAN or UART, Power supply, GPIO	
Micro USB (AB)	USB2.0			
26-pin MM connector	Selection of CAN, RS485, RS232, 4xUART, 3xI2C, 2xSPI, 4xDIO, 2xADC, 2xPWM, Sensor feed, Power			
Power connector	Spring terminal			
Short-range radio	BLE/Wifi			
Status LEDs	LEDs to indicate integration and device status, and cellular signal strength.			
Antenna connectors	uFL or FAKRA for Cellular and GNSS	uFL for Cellular and GNSS	SMA for Cellular and GNSS	uFL for Cellular and GNSS

Environmental requirements

Property	ECB02_A	ECB02_B	STA02_B	ECB02_C
Operating temperature	-30 °C to +65 °C	-30 °C to +65 °C	-30 °C to +55 °C	-30 °C to +65 °C
Storage temperature	-40 °C to +85 °C			

Material

The casing for STA-models is manufactured in Polycarbonate + ABS.

Electric data

Property	ECB02_A	ECB02_B	STA02_B	ECB02_C
Supply voltage	12-56 VDC			3.7-4.2VDC

Property	ECB02_A	ECB02_B	STA02_B	ECB02_C
Supply current	Maximum 1 A			
Power rating	Maximum 6W			Maximum 3W
Degree of protection of enclosure	NA	NA	IP40or IP54	NA

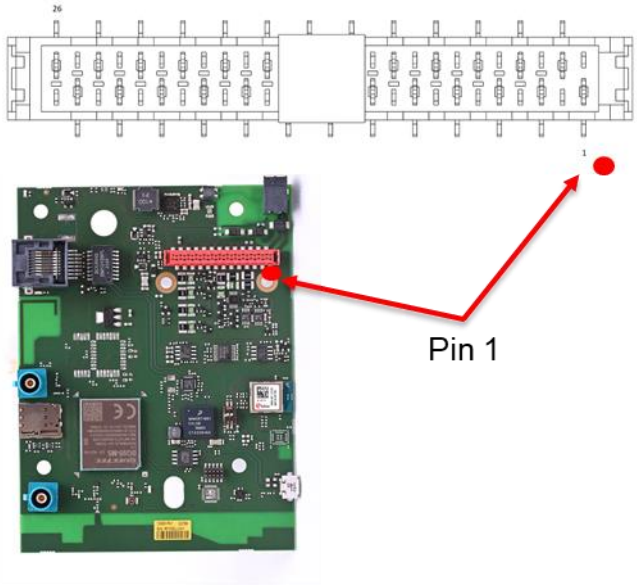
Radio data

Modem version	Frequency bands
BG95	Cat M1/NB2: B1/2/3/4/5/8/12/13/18/19/20/25/26/27/28/66/71/85 EGPRS: 850/900/1800/1900 MHz
EG95-EUX	LTE: B1/B3/B7/B8/B20/B28 WCDMA: B1/B8 GSM/EDGE: B3/B8
EG95-NAX	LTE: B2/B4/B5/B12/B13/B25/B26 WCDMA: B2/B4/B5

Terminals

Mini module Connection Table ECB02_A

Functions described are valid for fully populated boards. Optimized boards might not include all functions.

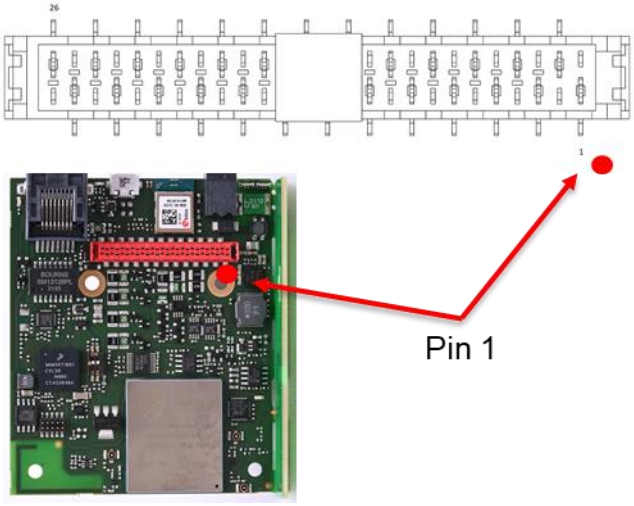


Pin MM	Default configuration	Possible configurations		
1	PWR -			
2	PWR +			
3	CAN_H	CAN_TX		
4	CAN_L	CAN_RX		
5	RS485_B	LPUART4_RX		
6	RS485_A	LPUART4_TX		
7	LPI2C3_SCL	GND	+3,3V	
8	RS232_Debug_TX	LPUART3_TX	LPI2C3_SDA	
9	RS232_RX	LPUART1_RX		
10	RS232_TX	LPUART1_TX		
11	LPUART8_TX		LPSPI1_PCS2	

Pin MM	Default configuration	Possible configurations		
12	LPUART8_RX		LPSPI1_CLK	
13		LPUART5_TX	LPSPI1_PCS0	
14		LPUART5_RX	LPSPI1_SDO	
15	DIG_IO-1			
16	DIG_IO-2		LPSPI1_SDI	
17	DIG_IO-3		LPI2C3_SDA	
18	DIG_IO-4	+5V	+3,8V	
19	GND			
20	Sensor_Feed			
21	DAC_V	DAC_A		
22	DAC_A	DAC_V		
23	ADC-1	+5V		
24	ADC-2	+5V		
25	Temp_Sense			
26	GND			

Mini module Connection Table ECB02_B

Functions described are valid for fully populated boards. Optimized boards might not include all functions.

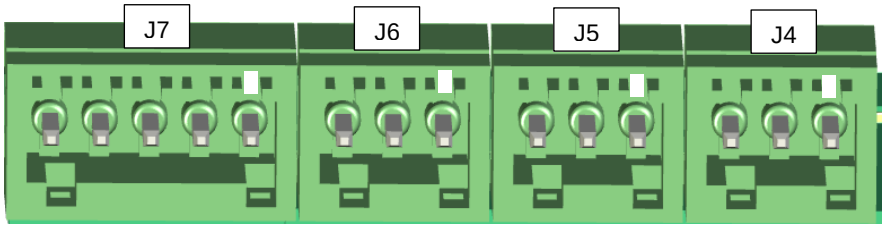


Pin MM	Default configuration	Possible configurations		
1	PWR -			
2	PWR +			
3	CAN_H	CAN_TX		
4	CAN_L	CAN_RX		
5	RS485_B	LPUART4_RX		
6	RS485_A	LPUART4_TX		
7	LPI2C3_SCL	GND	+3,3V	
8	RS232_Debug_TX	LPUART3_TX	LPI2C3_SDA	
9	RS232_RX	LPUART1_RX		
10	RS232_TX	LPUART1_TX		
11	LPUART8_TX		LPSPI1_PCS2	
12	LPUART8_RX		LPSPI1_CLK	
13		LPUART5_TX	LPSPI1_PCS0	

Pin MM	Default configuration	Possible configurations		
14		LPUART5_RX	LPSPI1_SDO	
15	DIG_IO-1			
16	DIG_IO-2		LPSPI1_SDI	
17	DIG_IO-3		LPI2C3_SDA	
18	DIG_IO-4	+5V	+3,8V	
19	GND			
20	Sensor_Feed			
21	DAC_V	DAC_A		
22	DAC_A	DAC_V	+3,8V	
23	ADC-1	+5V		
24	ADC-2	+5V		
25	Temp_Sense			
26	GND			

Terminal block on add on boards (relevant variants of ECB02_A, ECB02_B and STA02_B)

Connector Positions and Pinning:



NOTE: when mounted in STA02_B housing the board is mounted upside down

The pinout of the terminal block is available with different configurations, each identified by the last character in the product code. with configuration as per the below table.

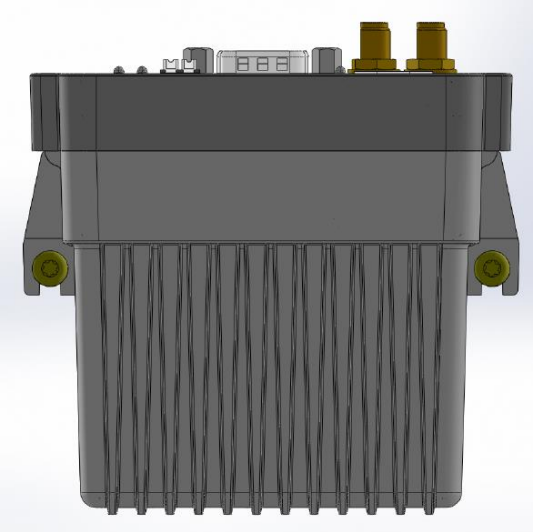
Term block position	**“C”**	**“F”** **Terminal addon block,**	**“G”**	**“A”**

	Standard terminal block	optimized for D/A I/O	Terminal addon block, optimized for CAN	
J4/1	MM PIN 6: RS485_A	MM PIN 20: Sensor_feed	MM PIN 6: RS485_A	No addon board mounted on product variant.
J4/2	MM PIN 5: RS485_B	MM PIN 23: ADC-1	MM PIN 5: RS485_B	
J4/3	MM PIN 19 & 26: GND	MM PIN 19 & 26: GND	MM PIN 19 & 26: GND	
J5/1	MM PIN 10: RS232_TX	MM PIN 20: Sensor_feed	MM PIN 3: CAN_H	
J5/2	MM PIN 9: RS232_RX	MM PIN 24: ADC-2	MM PIN 4: CAN_L	
J5/3	MM PIN 19 & 26: GND	MM PIN 19 & 26: GND	MM PIN 19 & 26: GND	
J6/1	MM PIN 23: ADC-1	MM PIN 15: DIG_IO-1	MM PIN 23: ADC-1	
J6/2	MM PIN 16: DIG_IO-2	MM PIN 16: DIG_IO-2	MM PIN 16: DIG_IO-2	
J6/3	MM PIN 19& 26: GND	MM PIN 19 & 26: GND	MM PIN 19& 26: GND	
J7/1	MM PIN 15: DIG_IO-1	MM PIN 22: DAC_A	MM PIN 15: DIG_IO-1	
J7/2	MM PIN 21: DAC_V	MM PIN 21: DAC_V	MM PIN 21: DAC_V	
J7/3	MM PIN 19 & 26: GND	MM PIN 19 & 26: GND	MM PIN 19 & 26: GND	
J7/4	MM PIN 2: Power_IN (+)	MM PIN 17:, DIG_IO-3	MM PIN 2: Power_IN (+)	
J7/5	MM PIN 1: Power_IN_Ret (-)	MM PIN 18: DIG_IO-4	MM PIN 1: Power_IN_Ret (-)	

Mounting of STA02_B using screws

Positioning

To minimize the risk that the device gets loose and fall to the ground when mounted with screws at heights greater than 2m, STA02_B should be mounted with the connectors pointing upwards, as illustrated in the below figure.



Screws

When STA02_B is mounted using screws, screws with the following specification (or equivalent) should be used: RTS ST3,5X9,5 ISO14585 T15 A2K, as illustrated in the below drawing.