

THE RIGHT DEVICE
FOR ANY IoT
SOLUTION

AVIC LEGIOBOX USER MANUAL
Devices for the Internet of Things



THANK YOU!

We are honored and proud that you have considered and chosen AVIC LegioBox as the most suitable device for your IoT solution. We see the creation of IoT devices as a craft and have put our combined decades of experience into building this new range of LegioBox IoT devices,

With just this one single purpose: to make IoT simple. For you!

We wish you lots of success in creating your very own IoT solution!

JUMP RIGHT IN AND GET STARTED...

1. Go to Quick Start Guide on the next page
2. Set-up and configure your LegioBox IoT device
3. Activate your LegioBox IoT device in Avision

OR, FIRST LEARN MORE ABOUT LEGIOBOX...

1. Read the ins-and-outs of LegioBox on page 9
2. Discover the LegioBox interfaces on page 11
3. Follow the installation instructions on page 37

Carefully read and observe all device handling and safety instructions throughout this manual! Contact us if you need any help.

LEGAL INFORMATION

WARNING NOTICE SYSTEM

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.



DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.



WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.



CAUTION

indicates that minor personal injury can result if proper precautions are not taken.



NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

QUALIFIED PERSONNEL

The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions.

Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

PROPER USE OF AVIC PRODUCTS

Please note the following:



WARNING AVIC products may only be used for the applications described in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by AVIC. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

TRADEMARKS

All brands as well as trade and company names used in this document are the property of their lawful owner.

DISCLAIMER OF LIABILITY

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

SAFETY INFORMATION

GENERAL SAFETY INSTRUCTIONS



DANGER AVIC products may only be used for the applications described in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by AVIC. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.



WARNING The LegioBox IoT devices, for their operation, depend on external communication infrastructure such as cellular networks. Disruptions in these networks may impact, influence or delay the delivery of information to the Avison IoT Platform, and the timely reporting of events, alerts or alarms, and any subsequent procedures. Consequently, applications that have strict real-time deadlines must not be implemented with LegioBox and Avison.

DAMAGED UNITS

Do not connect a unit to an external power source if any visual damage is present or if internal damage is suspected. If any visual damage is present or if internal damage is suspected, take the suspected unit out of service, disconnect it from all external power sources and inform any party concerned. Contact your LegioBox sales representative for further advice on handling the affected unit.

MAINS POWERED UNITS

Mains powered units must only be connected to a grounded AC power outlet with circuit breaker protection with a maximum capacity of 16A, using the supplied power cable. Voltage range for this AC power outlet is 100-240VAC, 50/60Hz.

ADAPTER POWERED UNITS

Adapter powered units must only be connected to an AC power outlet with circuit breaker protection with a maximum capacity of 16A. Voltage range for this AC power outlet is 90-264VAC, 47 to 63Hz. The use of other than the supplied adapter is forbidden.

EXTERNAL AC/DC POWERED UNITS

External AC/DC powered units must only be connected to a power source with circuit breaker, correctly dimensioned for the wires used to connect the unit.

PRIMARY AND RECHARGEABLE BATTERIES

Improper handling of batteries can result in explosion of the batteries. Explosion of the batteries and the released pollutants can cause severe physical injury. Worn batteries jeopardize the function of the LegioBox IoT device.

Note the following when handling batteries:

- Replace batteries in due time; see the relevant sections on replacing the batteries in the operating instructions in Chapter 6: "LegioBox General Operating Instructions" on page 37.
- Replace the batteries only with identical batteries or types recommended by AVIC; for ordering information, please refer to the relevant of Chapter 10: "LegioBox Accessories and Spare Parts" on page 84.
- Do not throw batteries into fire.
- Do not solder on the cell body.
- Do not open, do not short-circuit, do not reverse polarity, do not heat above 100°C.
- Protect from direct sunlight, moisture and condensation.
- Do not attempt to recharge primary batteries.
- Replace battery sets with new sets only. Do not mix batteries with an unknown charging state with new batteries.

USAGE OF PERIPHERAL EQUIPMENT

Peripheral equipment connected to a LegioBox IoT device may be faulty and can affect or damage the operation of the entire installation of which it is part. The installation of peripheral equipment may violate safety rules and regulations regarding radio interference suppression. If you install or exchange peripheral equipment and damage your LegioBox IoT device, the warranty becomes void.

Note the following on the usage of peripheral equipment:

- Only install peripheral equipment that is compatible with the respective LegioBox IoT device. Contact your LegioBox sales representative to check which peripheral equipment may safely be installed.
- Observe the information on electromagnetic compatibility (section 4.3: "Regulatory Compliance" on page 20).

SIM CARDS

LegioBox IoT devices that make use of cellular connectivity require a correctly working SIM card for their reliable and safe operation. The SIM card supplied by AVIC must not be removed under any circumstance unless under explicit instruction by AVIC.

STRONG HIGH-FREQUENCY RADIATION

LegioBox IoT devices have an increased immunity to RF radiation according to the specifications on regulatory compliance in Chapter 9: "Regulatory Compliance" on page 83. Exposure to radiation in excess of the specified immunity limits can impair device functions, result in malfunctions and therefore injuries or damages.

ELECTROSTATIC DISCHARGE (ESD)

When touching electrostatic sensitive components, such as the integrated circuits used in LegioBox IoT device, they can be destroyed by voltages that are far below the threshold that humans can perceive. If you work with components that can be destroyed by electrostatic discharge, observe appropriate guidelines for preventing electrostatic discharge. Exposure to electrostatic discharge in excess of the tolerable limits can lead to immediate, short-term or long-term device malfunctions and therefore injuries or damages.

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QUICK START GUIDE

1 Prepare your LegioBox IoT device

2 Carry out the device-specific configuration steps.

Locate your LegioBox IoT device type from the pictures and proceed to the pages indicated with each type.

3 Launch your LegioBox IoT device



SolarGate > page 54



NanoGate > page 47



LightGate > page 63



BasicGate > page 39



MiniGate > page 70



PicoWise > page 76

READ THE SAFETY INSTRUCTIONS

Carefully read the general safety instructions on page 4 before proceeding.

UNPACK YOUR LEGIOBOX

Remove the LegioBox IoT device from its packaging and remove any wrapping material.

IDENTIFY THE DEVICE TYPE

On the product label, locate the device product code, e.g. SG00173.

OPEN AVISION

Log in to Avision using your username and password,

DRAG-2-ACTIVATE

The device will be in the stock node. Simply drag it to the right application node to bring it into service.

RUN YOUR DEVICE

That's all there is to it! Your LegioBox IoT device is ready.

1 OVERVIEW

The LegioBox family of IoT devices are based on a common platform architecture. As such, the LegioBox devices display a high degree of functional similarity. The LegioBox IoT devices are integrated with the Avision IoT Platform for commissioning, deployment and device management, making their operation and maintenance very straightforward and simple.



NOTICE Should you encounter any unclarity in this User Manual with respect to the terms and their definitons, please contact your LegioBox sales representative before proceeding.

11. HIGH-LEVEL LEGIOBOX IOT DEVICE CHARACTERISTICS

- Exposure to harsh environments
- Low power consumption
- Performing edge processing functions
- Independent (stand-alone) operation

In the following subsections, the LegioBox IoT device functions will be discussed in detail, mainly from an application perspective.

12 TERMS AND DEFINITIONS

In this LegioBox User Manual, the following terms and definitions are used:

LegioBox IoT Device	An apparatus for the Internet of Things designed and manufactured by Avic.
Device	The LegioBox IoT device that is subject of the respective text.
Peripheral (equipment)	External equipment that is connected to a LegioBox IoT device.
Signal interface	Interface to which analog or digital sensor or actuator equipment is connected.
Communication interface	Interface to which data communication equipment is connected.

13 STRUCTURE OF THIS USER MANUAL

This User Manual is structured as follows:

CHAPTER 2: "The Ins and Outs of a LegioBox IoT Device" on page 9

This chapter provides a high-level description of the internal design of LegioBox IoT devices, how they work and interact with their outside world.

CHAPTER 3: "Interfacing with a LegioBox IoT Device" on page 11

This chapter explains what types of peripheral equipment can be connected to a LegioBox IoT device, and how the interfaces work.

CHAPTER 4: "LegioBox Product Family Technical Specifications" on

page 19 This chapter contains the detailed technical specifications of all devices of the LegioBox IoT product family, as well as some supporting background information.

CHAPTER 5: "LegioBox General Installation Precautions and Preparations"

on page 36: This chapter contains the precautions that must be observed and the preparations that must be carried out that apply to all LegioBox IoT devices.

CHAPTER 6: "LegioBox General Operating Instructions" on page 37:

This chapter covers the operating instructions that apply to all LegioBox IoT devices.

CHAPTER 7: "LegioBox Product-specific Operating Instructions" on page 38:

This chapter contains all product-specific installation and operating instructions, as well as an overview of each LegioBox IoT device.

CHAPTER 8: "Mounting Patterns" on page 82: This chapter contains the mounting patterns for the LegioBox IoT devices, as well as supporting instruction to ensure that a device can operate reliably in its environment.

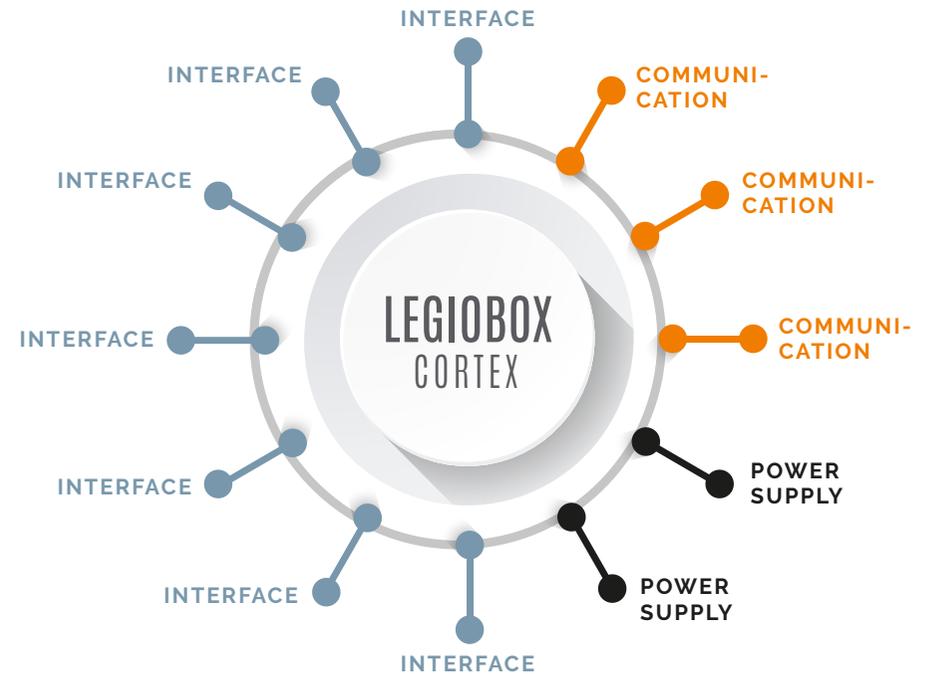
CHAPTER 9: "Regulatory Compliance" on page 83 This chapter contains all information to the regulatory compliance of the LegioBox IoT devices, as well as any device approvals that apply to the LegioBox product range.

CHAPTER 10: "LegioBox Accessories and Spare Parts" on page 84: This chapter contains all ordering information with respect to accessories and spare parts that are available for LegioBox IoT devices.

2 THE INS AND OUTS OF A LEGIOBOX IOT DEVICE

All LegioBox IoT devices are built from the same collection of function blocks, making it simple to mix and match devices across IoT solutions. They are also directly integrated with the Avison IoT Platform, making device management effortless. Finally, external connectors are standardized for all LegioBox IoT devices, so sensors and other peripherals can be attached and exchanged without giving it much thought.

To conceptually understand how LegioBox IoT devices work from a functional perspective, the figure below outlines the structure that is common to the entire LegioBox family.



Whereas the number and type of functions will vary from device to device, all LegioBox IoT box interface, communication and power supply functions are always arranged around the same LegioBox Cortex that sits at the core of every LegioBox IoT device.



EXTERNAL CONNECTORS

The external connectors of LegioBox IoT devices are compatible with the industry-standard M8 or M12 connector system. Using these connectors, sensors and other peripherals can be attached with little effort while maintaining the ingress protection level of the device.

The connection schemes are standardized for all LegioBox IoT devices.



INTERNAL CONNECTORS

Offering a high level of wiring flexibility, the internal connectors of the LegioBox IoT devices allow attachment of sensor and peripherals on terminal clamps.

For some functions, configuration options can be set with jumpers. Cables will be fed into the LegioBox enclosure through glands to maintain the ingress protection level.

INTERFACE FUNCTIONS

As connection with the outside world, the LegioBox IoT devices host a multitude of interface functions such as:

- Analog sensor interfaces
- Environmental sensors
- Digital interfaces
- Data ports
- User interface functions

Most, though not all of these functions, are externally accessible through the device connectors (as shown in the overview on top of this page).

COMMUNICATION FUNCTIONS

To interact with the Avision IoT Platform, LegioBox IoT devices support a wide range of communication standards, e.g.

- 2G/GPRS
- Narrowband IoT
- LTE Cat M1
- 100BaseTx Ethernet
- Wireless LAN

A dedicated radio serves the communication with other LegioBox IoT devices through AVIC's WiseRF wireless networking protocol.

LEGIOBOX CORTEX

Neatly tucked inside the device, the LegioBox Cortex performs the following functions:

- Signal processing
- Event detection
- Information storage
- Alarm generation
- Device management

The functional behavior of a LegioBox IoT device can be defined entirely by configuring the LegioBox Cortex in the Avision IoT Platform.

POWER SUPPLY FUNCTIONS

LegioBox IoT devices are designed for ultra low-energy operation, and can be supplied from various power sources:

- Primary batteries
- Rechargeable batteries
- Solar panels
- AC mains
- DC mains

The LegioBox IoT devices also generate the supply voltages for sensors, allowing stand-alone operation in remote locations.



3 INTERFACING WITH A LEGIOBOX IOT DEVICE

The interfaces serve as the input and output functions for the LegioBox Cortex which performs all the actual device intelligence that you have put into the LegioBox IoT device. The interfaces merely translate physical and electrical signals to a 'language' that the LegioBox Cortex understands. The interface functions of the LegioBox IoT devices can be grouped as follows:

- Analog sensor interfaces
- Digital interfaces
- Data ports
- Environmental sensors
- User interface functions

The following sections describe all the signals of each interface, as well as their operational behavior from a functional perspective, and any configuration options they may offer. This chapter concludes with a section on the connection schemes of the external M-style connectors of the LegioBox IoT devices.



WARNING Please observe appropriate care when applying power and/or connecting external equipment such as sensors to a LegioBox IoT device.



CAUTION To ensure the compatibility of a LegioBox IoT device and other equipment, compare the specifications of both prior to making any connections between them.

3.1 INTEGRATED POWER SUPPLY FOR EXTERNAL SENSORS

Specifically for situations in which a LegioBox IoT device operates stand-alone, it provides an integrated power supply for connected sensors.

VSE sensor power supply

The integrated sensor power supply is a function of the LegioBox IoT devices that is shared by a number of the other LegioBox interface functions; the voltage level, referred to as VSE, depends on the specific LegioBox IoT device and the interface by which it is employed. Please refer to the device-specific sections in this User Manual for further details.

Generally, a connected sensor will be powered through the VSE output of the LegioBox; for illustration purpose a situation with a DC-powered sensor is shown. The sensor power supply is enabled and disabled automatically by the LegioBox Cortex whenever it is needed for performing the relevant functionality.

3.2 ANALOG SENSOR INTERFACES

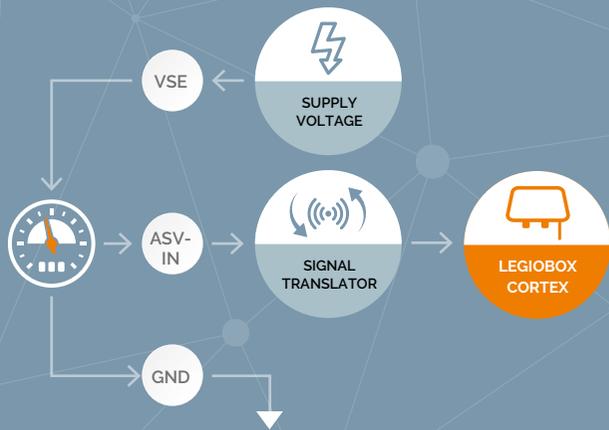
Analog sensor interfaces are used to measure physical quantities such as temperature, pressure or mass flow through an external sensor. Sensor devices typically have a industry-standard interfaces, of which the LegioBox IoT devices support the most common ones.

4-20 mA transmitter interface

The 4-20 mA current transmitter interface is an industry standard that is widely adopted by almost all manufacturers of sensors and industrial devices; it is highly insensitive to external influences such as noise sources. Please refer to datasheet of the sensor for its specification. The sensor characteristics can conveniently be programmed into the LegioBox IoT device through the Avison IoT Platform.

Generally, the 4-20 mA sensor will be powered by the VSE supply voltage of the LegioBox. The current flowing through the sensor and into the ASI-IN input of the LegioBox represents the value of the physical quantity being measured; this current is translated (converted) into a digital format that the LegioBox Cortex can process.





0-10V transmitter interface

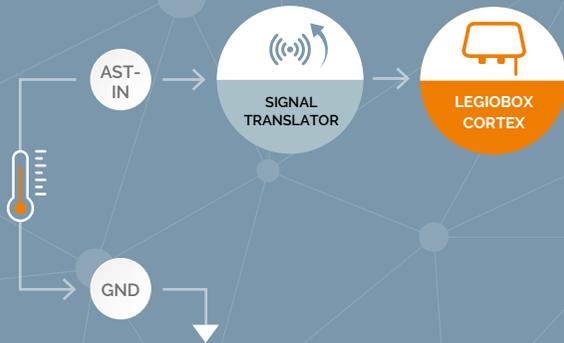
The 0-10V transmitter interface is commonly used and offered by many manufacturers of sensors and industrial devices. Please refer to datasheet of the sensor for its specification. The sensor characteristics can conveniently be programmed into the LegioBox IoT device through the Avision IoT Platform.

Generally, the sensor will be powered by the VSE supply voltage of the LegioBox. The voltage generated by the sensor and measured between the ASV-IN and GND inputs of the LegioBox represents the value of the physical quantity being measured; this voltage is translated (converted) into a digital format that the LegioBox Cortex can process.

Pt1000 thermosensor interface

Specifically for high-quality localized temperature measurements, the LegioBox IoT devices (depending on the product version) offer analog sensor interfaces for thermosensors based on the industry-standard Pt1000 specification, which effectively is temperature-dependent measurement of an electrical resistance.

The thermosensor is connected to the LegioBox AST-IN and GND inputs. The resistance of the thermosensor is measured by the LegioBox and represents the actual temperature being measured. The measured electrical resistance is translated (converted) into a digital format that the LegioBox Cortex can process.



3.3 DIGITAL INTERFACES

Digital inputs are used to monitor or count states or events, such as ones signalled by opening or closing of an electromechanical switch or applying a voltage. The LegioBox digital inputs can be isolated, or non-isolated; from a functional perspective both types are equivalent.

Digital outputs are used to control external function by opening or closing a solid-state relay in the LegioBox. GND signals of the LegioBox. The detected state is translated (converted) into a digital format that the LegioBox Cortex can process.

Non-isolated digital input interface

The non-isolated digital inputs of the LegioBox are used to detect and count states or state changes indicated by an opened/closed switch (as depicted), an open-collector signal, or an applied voltage. A LegioBox IoT device, depending on its version, may have configurable options, such as pull-up or pull-down resistors; please refer to the device-specific instructions for further details.

The external signals that control the state of a LegioBox IoT device digital input will be connected to the DI-IN and DI-GND signals of the LegioBox. The detected state is translated (converted) into a digital format that the LegioBox Cortex can process.

Isolated digital input interface

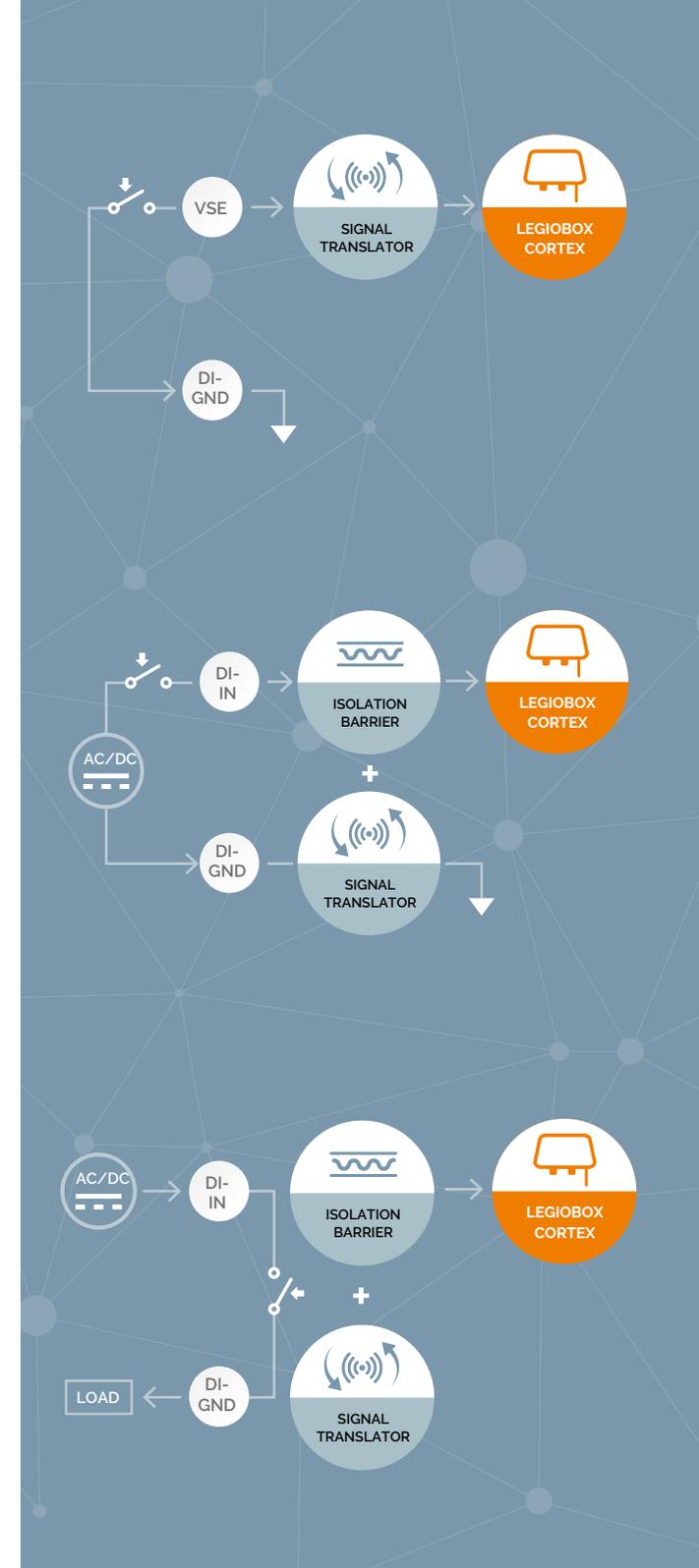
The isolated digital inputs of the LegioBox are used to detect and count states or state changes indicated by an applied AC or DC voltage. An isolation barrier provides the appropriate galvanic isolation of these interfaces from the LegioBox IoT device internals. For illustration purposes, the diagram of this interface depicts a switch that is used to apply or remove the respective voltage.

The external signals that control the state of a LegioBox IoT device digital input will be connected to the DI-IN and DI-GND signals of the LegioBox. The detected state is translated (converted) into a digital format that the LegioBox Cortex can process.

Digital control output interface (non-isolated and isolated)

The digital control outputs of the LegioBox are used to drive external equipment either by closing and opening an internal solid-state relay, or by setting an output voltage. Depending on the digital control output type, the interface is either non-isolated (for voltage outputs), or isolated (for relays, as depicted in the diagram for illustration purposes). Please refer to the device-specific instructions for further details.

The external signals that are controlled by a LegioBox IoT device digital output are connected to the DO-IN and DO-OUT signals of the LegioBox. The state of the relay is controlled from a digital format that is generated by the LegioBox Cortex.



3.4 DATA PORTS

The data ports of the LegioBox IoT devices are used for serial data communication with connected peripheral equipment. Depending on the LegioBox device version one or more of these data port interfaces may be available; please refer to the device-specific information for further details.

For some data ports, the LegioBox IoT devices include integrated data communication protocol support.

RS485 interface

The RS485 data port interface of the LegioBox IoT devices supports half-duplex bi-directional serial data communication according to the ANSI/TIA/EIA-485-A-1998 standard. The RS485 interface provides termination resistors which in some cases are user-configurable; please refer to the device-specific information for further details. The RS485 data port is adequately protected against surges and transients, making it suitable for operation outdoors; frame ground is not used. The RS485 interface offers built-in support for ModBus/RT.

The RS485 A/B line signals are connected to the SER-A and SER-B terminals of the LegioBox, respectively. The RS485 signals are translated (converted) into a digital format that the LegioBox Cortex can process.

UART (RS232- and TTL-level) interface

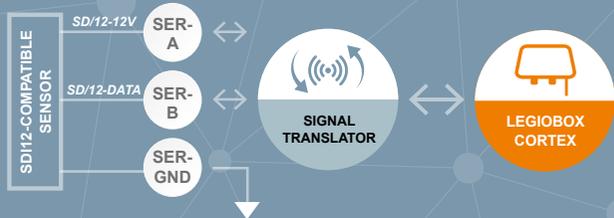
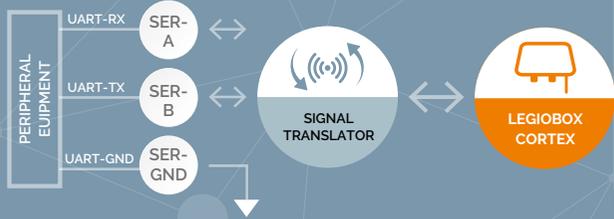
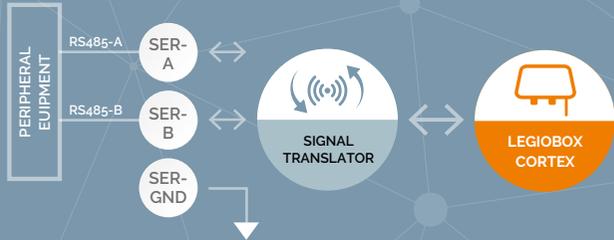
The UART data port interface of the LegioBox IoT devices supports full-duplex bi-directional serial data communication at RS232-levels according to the TIA/EIA-232-F standard, as well as at +3.0V TTL levels. The UART interface provides a number of user-configurable options, such as the bitrate and parity usage; please refer to the device-specific information for further details. The UART data port offers limited protection against surges and transients, it should only be used indoors and with relatively short cables.

The RX, TX and GND signals are connected to the SER-A, SER-B and SER-GND LegioBox terminals, respectively. The UART signals are translated (converted) into a digital format that the LegioBox Cortex can process.

SDI-12 interface

The SDI-12 data port interface of the LegioBox IoT devices supports half-duplex bi-directional serial data communication according to the SDI-12 Specification which is maintained the SDI-12 Support Group. The LegioBox SDI-12 interface offers built-in support for the SDI-12 data communication protocol, and also provides the 12VDC power supply voltage. The SDI-12 interface offers limited protection against surges and transients, it should only be used indoors and with relatively short cables.

The SDI-12 12V, DATA and GND signals are connected to the SER-A, SER-B and SER-GND LegioBox terminals, respectively. The DATA signal is translated (converted) into a format that the LegioBox Cortex can process.



3.5 DIGITAL INTERFACES

The (internally mounted) environmental sensors of the LegioBox IoT devices support measurement of ambient conditions. They can be used in the same way as sensors that are externally connected through one of the interfaces described in section 3.2: "Analog Sensor Interfaces" on page 12.

All environmental sensors work without configuration and calibration within the Avison IoT Platform.

Ambient barometric pressure

The internal sensor for the measurement of the current barometric pressure. Among other purposes, it can be used to compensate for the air pressure in level measurements with absolute pressure transmitters.

Ambient temperature

The LegioBox IoT devices feature a variety of integrated sensors for ambient temperature measurement, with different accuracies. Please refer to the device-specific sections of this User Manual for further details.

Ambient relative humidity

On some LegioBox devices with a temperature sensor, an integrated sensor for the measurement for the measurement of relative humidity is also provided.

Ambient light intensity

The ambient light sensor is only available on the LightGate LegioBox IoT device. It is primarily used to control the luminous intensity of its integrated alarm light. The light strength value however can also be used for application purposes.

Position (GNSS geo-location)

A LegioBox IoT device can determine its actual geographic location using its integrated Global Navigation Satellite System (GNSS) receiver, that supports multiple GNSS standards. Please refer to the specifications of the LegioBox GNSS receiver for further details.

Movement, orientation and acceleration

Changes in movement, orientation and acceleration (including detection of shocks) can be registered with the integrated accelerometer of the LegioBox IoT device. Depending on the product version, the LegioBox IoT device may be equipped with a single or dual accelerometer.



AMBIENT BAROMETRIC PRESSURE



AMBIENT TEMPERATURE



AMBIENT RELATIVE HUMIDITY



AMBIENT LIGHT INTENSITY



POSITION (GNSS GEO-LOCATION)



MOVEMENT, ORIENTATION AND ACCELERATION



3.6 USER INTERFACE FUNCTIONS

Although LegioBox IoT devices are primarily designed for stand-alone operation, most devices are equipped with basic interfaces for user interaction. The operational behavior of the LegioBox user interface functions can be defined in the Avison IoT Platform.

Visual indicators

To convey a visible signal to warn users of conditions that require their attention, the LegioBox IoT devices (depending on the product version) provide one or more LED indicators in various colors.

Buzzer

To convey an audible signal to warn users of conditions that require their attention, the LegioBox IoT devices (depending on the product version) provide an integrated electro-magnetic buzzer.

User buttons

To trigger user-initiated actions or events, the LegioBox IoT devices (depending on the product version) provide one or more tactile switch buttons.

Alarm lights

The integrated alarm lights of the LightGate LegioBox IoT device provide a visible signal, with various defineable illuminaton patterns, that is clearly perceivable even from greater distances.



VISUAL INDICATORS



BUZZER



USER BUTTONS



ALARM LIGHTS

INTERFACE GROUP	LEGIOWBOX INTERFACE FUNCTION	LEGIOWBOX IOT DEVICE					
		NanoGate	BasicGate	SolarGate	MiniGate	LightGate	PicoWise
Digital	Digital inputs (non-isolated)	0-2	4	4	2	-	2
	Digital inputs (isolated)	-	-	-	-	3	-
	Digital control outputs (voltage)	-	-	-	1	-	-
	Digital control outputs (relay)	-	-	-	-	1	-
Analog sensor	Sensor supply voltage	14VDC ¹	14VDC ²	14VDC	14VDC	14VDC ³	14VDC
	4-20 mA sensor interface	0-2	0-6	0-6	0-3	0-3	0-2
	0-10V sensor interface	0-6	0-6	0-6	0-3	0-3	0-2
	Pt1000 sensor interface	0-4	0-6	0-6	0-3	0-3	0-2
Data ports	RS485	●	●	●	●	●	●
	UART/TTL	●	●	●	-	-	-
	UART/RS232	●	●	●	●	●	●
	SDI-12	-	-	●	●	-	●
Environmental sensors	Barometric air pressure	●	-	●	●	●	●
	Temperature - standard	●	-	●	●	●	●
	Temperature - high precision	-	-	-	-	-	●
	Relative humidity	●	-	●	●	●	●
	Ambient light	-	-	-	-	●	-
	GNSS	●	-	●	●	●	●
	Accelerometer	2	-	1	2	1	1
User interface	Visual indicators	15	9 + 8	15	1	1	2
	Buzzer	-	-	-	-	-	●
	User switches	2	2	2	1	1	1
	Alarm lights	-	-	-	-	●	-

Table 1 LegioBox Interface configurations

1: Unit in UPS mode; otherwise VSE = DC supply voltage
 2: Unit in UPS mode; otherwise VSE = 24 VDC (Universal AC mains powered units), or VSE = DC supply voltage
 3: Unit in UPS mode; otherwise VSE = DC supply voltage, or VSE = AC supply voltage x 1,4

3.7 LEGIOWBOX INTERFACE CONFIGURATIONS

Depending on the product version, your LegioBox IoT device will have a combination of interface functions, as summarized in the overview in Table 1.



4 LEGIOBOX PRODUCT FAMILY TECHNICAL SPECIFICATIONS

Since the LegioBox IoT devices share a common set of functional blocks, as outlined in Chapter 2: "The Ins and Outs of a LegioBox IoT Device" on page 9, the technical specifications also apply generically across the LegioBox product range for many functions. Other specifications, e.g. for the power supply of a LegioBox IoT device, differ per product; in such cases, the specifications will be shown per product.

4.1 LEGIOBOX POWER SUPPLY SPECIFICATIONS

The power-related specifications of the LegioBox IoT devices are listed in Table 2.

CATEGORY	ITEM	LEGIOBOX IOT DEVICE SPECIFICATION					
		NanoGate	BasicGate	SolarGate	MiniGate	LightGate	PicoWise
Supply type(s)	Primary battery - Alkaline (quantity/size)	4 / AA	-	-	-	-	2 / AA
	Primary battery - Lithium (quantity/size)	4 / AA	-	-	1 / D	-	-
	Integrated battery charger (UPS)	●	●	●	-	●	-
	Rechargeable battery - Lilon (quantity/size)	4 / AA	-	-	-	-	2 / AA
	Rechargeable battery - NiMH (quantity/size)	-	1/PP3	-	-	-	-
	DC supply voltage (V)	12-32	12-32	-	-	24	-
	Required min. DC supply voltage for UPS operation (V)	20	15	-	-	-	-
	24V AC supply voltage (24VAC/50-60Hz)	-	-	-	-	●	-
	Universal AC mains (100-260VAC/50-60Hz)	-	●	-	-	-	-
	Solar panel (integrated), with 8Ah LeadAcid battery)	-	-	●	-	-	-
Power consumption	Stand-by power consumption	96 μ W	58 mW	87 μ W	52 μ W	96 μ W	5.1 μ W
	Active power consumption	18.42 mW	0.5 W	2.05 mW	1.83 mW	2.94 mW	0.15 mW
	Maximum power consumption (mW)	8.0 W	9.0 W	8.0 W	8.0 W	7.44 W	0.14 W
	Typ. battery lifetime (with primary batteries, in years)	6	-	-	8	-	5
Safety protection	Internal fuse voltage rating (slow-blow)	125 V	250 V	250 V	32 V	32 V	32 V
	Internal fuse current rating (slow-blow)	1.5 A	1 A	5 A	3 A	2 A	3 A
	External fuse voltage rating (slow-blow)	-	-	250 V	-	-	-
	External fuse current rating (slow-blow)	-	-	3 A	-	-	-

Table 2 LegioBox power supply specifications

CATEGORY	ITEM	LEGIOW IOT DEVICE SPECIFICATION					
		NanoGate	BasicGate	SolarGate	MiniGate	LightGate	PicoWise
Mechanical	Product length (mm)	114	60	315	82	121	34
	Product width (mm)	129	160	205	122	121	97
	Product height (mm)	48	85	80	62	38	34
	Product weight (kg)	0.38	0.85	3.50	0.44	0.20	0.14
	Enclosure material: ASA, UV resistant	●		●	●	●	●
	Enclosure material: aluminum, powder-coated		●				
Environmental	Ingress protection level	IP-66	IP-66	IP-66	IP-67	IP-66	IP-66
	Mechanical impact class (enclosure only)	IK-08	IK-08	IK-08	IK-08	IK-08	IK-08
	Operational temperature range (min/max, in °C)	-30/+80	-30/+80	-30/+80	-30/+80	-30/+80	-30/+80
	Storage temperature range (min/max, in °C)	-40/+85	-40/+85	-40/+85	-40/+85	-40/+85	-40/+85

Table 3 Mechanical and Environmental Specifications

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
Measurement current range	0	-	25	mA	
Allowable sensor current	0	-	27	mA	Limited by protection circuitry
Measurement accuracy	-	±20	-	µA	Of the full-scale measurement range
Allowable input voltage	-	-	36	V	
Supported interface cable length	-	-	3	meters	

Table 4 4-20 mA transmitter interface technical specifications

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
Measurement voltage range	0.0	-	10.0	V	
Input impedance	100	-	-	kOhm	
Measurement accuracy	-	±10	-	mV	Of the full-scale measurement range
Allowable input voltage	0	-	15	V	
Supported interface cable length	-	-	3	meters	

Table 5 0-10VDC transmitter interface technical specifications

4.2 MECHANICAL AND ENVIRONMENTAL SPECIFICATIONS

As shown in Table 3.

4.3 REGULATORY COMPLIANCE

LegioBox IoT devices are designed to comply with relevant regulations with respect to:

- Electromagnetic emissions and immunity
- Operational safety
- Wireless communication
- Environmental safety

Please refer to the respective sections of Chapter 9: "Regulatory Compliance" on page 83 for the details of the LegioBox IoT device regulatory compliance. For some device functions, the LegioBox IoT device meets additional compliance specifications. In such cases, the compliance levels of the respective device function are provided as part of their technical product specifications in this chapter.



NOTICE For analog sensor interfaces, the use of shielded cables is required to meet the regulatory compliance of the LegioBox IoT device.

4.4 ANALOG SENSOR INTERFACE SPECIFICATIONS

The analog sensor interfaces of the LegioBox IoT devices, as functionally described in section 3.2, each have their own technical specifications, given in the subsections below.

4-20 mA transmitter interface

The technical specifications of the 4-20 mA transmitter interface are given in Table 4.

0-10 VDC transmitter interface

The technical specifications of the 0-10VDC transmitter interface are given in Table 5.

Pt1000 thermosensor interface

The technical specifications of the Pt1000 thermosensor interface are given in Table 6.

4.5 SENSOR SIGNAL PROCESSING SPECIFICATIONS

The LegioBox IoT devices implement a signal processing chain that includes the generation of the VSE sensor supply voltage and analog-to-digital conversion of the analog signals.

The signal processing specifications are given in Table 7.

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
Measurement temperature range	-200	-	+100	°C	
Measurement accuracy	-	± 0.4	-	°C	
Supported interface cable length	-	-	3	meters	

Table 6 Pt1000 thermosensor interface technical specifications

CATEGORY	ITEM	LEGIOBOX IOT DEVICE SPECIFICATION					
		NanoGate	BasicGate	SolarGate	MiniGate	LightGate	PicoWise
Sensor power supply	Nominal VSE sensor supply voltage (VDC)	14 ¹	14 ²	14	14	14 ³	14
		40	40	40	40	40	40
	VCE sensor voltage regulation	±1%	±1%	±1%	±1%	±1%	±1%
	Maximum VSE sensor current (mA)	40	40	40	40	40	40
Signal processing	Analog-to-digital conversion (ADC) architecture	S/D	S/D	S/D	SAR	SAR	SAR
	Analog-to-digital conversion (ADC) resolution (bits)	24	24	24	12	12	12
	Maximum ADC sampling rate (samples/second)	19.2k	19.2k	19.2k	1.2M	1.2M	1.2M
	Programmable gain amplifier	●	●	●	-	-	-

Table 7 Sensor signal processing technical specifications

1: Unit in UPS mode; otherwise VSE = DC supply voltage

2: Unit in UPS mode; otherwise VSE = 24 VDC (Universal AC mains powered units), or VSE = DC supply voltage

3: Unit in UPS mode; otherwise VSE = DC supply voltage, or VSE = AC supply voltage x 1.4

4.6 DIGITAL INTERFACES

The digital interfaces of the LegioBox IoT devices, as functionally described in section 3.3, each have their own technical specifications, given in the subsections below..

Non-isolated digital input interface

The non-isolated digital inputs of the LegioBox IoT devices can be operated in one of two primary operation modes: switch/open-collector or external voltage. In case of the former, a mechanical switch or open-collector output can be used to control the state of the digital input. In the latter case, an external voltage source is used to drive the input state. Normally, a digital input will be used for state (transistion) detection. In addition, both primary modes are supported by a secondary mode to support the counting of pulses.

Table 8 contains the technical specifications for the non-isolated digital input interfaces.

Isolated digital input interface

An AC or DC voltage can be applied to drive the signal state of the LegioBox IoT devices isolated digital input interfaces.

Table 9 contains the technical specifications for the isolated digital input interfaces..

MODE	ITEM	SPECIFICATION				REMARKS
		Min	Typ	Max	Unit	
Primary: Switch/ open-collector	Allowable input voltage	0	-	24	V	Limited by protection circuitry
	Open circuit voltage	2.9	3.0	31	V	Available as output on some devices
	Closed circuit threshold voltage	-	-	0.9	V	
	Input impedance	-	100	-	kOhm	1 MOhm on the NanoGate and PicoWise
Primary: External voltage	Input voltage range	0	-	24	V	Limited by protection circuitry
	High level threshold voltage	2.0	-	-	V	
	Low level threshold voltage	-	-	0.9	V	
	Input impedance	-	10	-	kOhm	
Secondary: Counter	Pulse counting frequency	0	-	30	Hz	
	Pulse width	20	-	-	ms	
	Pulse duty cycle LOW	40	-	60	%	
	Pulse duty cycle HIGH	40	-	60	%	

Table 8 Non-isolated digital input interface technical specifications

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
Input voltage range - DC	0	-	40	V	Limited by protection circuitry
Input voltage range - AC	0	-	24	V	Limited by protection circuitry
High level threshold voltage - DC	10.0	-	-	V	
High level threshold voltage - AC	7.0	-	-	V	
Input impedance	-	820	-	Ohm	
Isolation voltage	-	560	-	V	
Common mode rejection	-	15	-	kV/ μ s	At 1500 V common-mode voltage
Supported interface cable length	-	-	3	meters	

Table 9 Isolated digital input interface technical specifications

Non-isolated digital control output interface

The non-isolated digital control outputs of the LegioBox IoT devices are voltage sources that can be used to signal a state, or drive high-impedance loads.

Table 10 contains the technical specifications for the non-isolated digital control outputs.

Isolated digital control output interface

The isolated digital outputs of the LegioBox IoT devices are solid-state relays that can be used to switch AC or DC loads.

Table 11 contains the technical specifications for the isolated digital outputs.

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
Output voltage - ON	-	3.8	-	V	Limited by protection circuitry
Internal DC resistance - ON	-	82	-	Ohm	Limited by protection circuitry
Output current	-	-	40	mA	
Maximum switching frequency	-	1	-	Hz	
Supported interface cable length	-	-	3	meters	

Table 10 Non-isolated digital input interface technical specifications

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
DC or peak AC load voltage	-	-	60	V	
Load current (DC only)	-	-	0.7	A	
Peak load current (AC/DC)	-	-	3.6	A	10 mS max.
On-resistance (AC/DC)	-	0.18	0.25	Ohm	
On-resistance (DC only)	-	0.05	0.07	Ohm	
Maximum switching frequency	-	1	-	Hz	
Supported interface cable length	-	-	3	meters	

Table 11 Isolated digital control output interface technical specifications

4.7 DATA PORTS

The data port interfaces of the LegioBox IoT devices, as functionally described in section 3.4, each have their own technical specifications, given in this subsection.

RS485 interface

The technical specifications of the RS485 data port interface are given in Table 12.

The resilience of the RS485 data port against electromagnetic and electrostatic disturbances has been enforced to make it more robust in outdoors applications where RS485 is typically used with longer cable lengths. Table 13 contains the relevant compliance levels.

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
Communication bitrate	-	-	250	kbps	
Termination resistance (integrated)	-	120	-	Ohm	
Bias resistor (pull-up and pull-down)	-	430	-	Ohm	On BasicGate only, configurable
Driver capacity	-	-	32	UL	UL: Unit Load
Load of the LegioBox RS485 interface	-	-	1	UL	UL: Unit Load
Supported RS485 bus length	-	-	500	meters	

Table 12 RS485 data port interface technical specifications

IMMUNITY ITEM	COMPLIANCE LEVEL	VOLTAGE
Electrical fast transients (EFT)	IEC61000-4-4, level 4	±2 kV
Surges	IEC61000-4-4, level 1	±0.5 kV
Electrostatic discharge (ESD), in airgap	IEC61000-4-2, level 4	Max. ±8 kV
Electrostatic discharge (ESD), in contact	IEC61000-4-2, level 4	Max. ±4 kV

Table 13 RS485 data port interface immunity specifications

UART (RS232- and TTL-level) interface

The technical specifications of the UART data port interface, for both the RS232- and TTL-level modes interface are given in Table 14.

SDI-12 interface

The technical specifications of the SDI-12 data port interface are given in Table 15.

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
Communication bitrate	-	-	115.2	kbps	
UART/RS232 mode - MARK (1) transmit voltage	-6.3	-	-5.0	V	
UART/RS232 mode - SPACE (0) transmit voltage	-5.0	-	7.0	V	
UART/RS232 mode - MARK (1) receive voltage	-15.0	-	-5.0	V	
UART/RS232 mode - SPACE (0) receive voltage	5.0	-	15.0	V	
UART/TTL mode - MARK (1) transmit voltage	2.4	-	3.0	V	
UART/TTL mode - SPACE (0) transmit voltage	0.0	-	0.6	V	
UART/TTL mode - MARK (1) receive voltage	2.1	-	3.0	V	
UART/TTL mode - SPACE (0) receive voltage	0.0	-	0.9	V	
Supported UART cable length	-	-	3	meters	

Table 14 UART data port interface technical specifications

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
SDI-12 supply voltage	11.9	12.0	12.1	V	
SDI-12 sensor supply current	-	-	80	mA	
SDI-12 bus capacity	-	-	10	sensors	
Supported SDI-12 cable length	-	-	3	meters	

Table 15 SDI-12 data port interface technical specifications

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
Barometric pressure measurement range	260	-	1260	hPa	
Measurement temperature range	0	-	80	°C	
Absolute measurement accuracy	-	±1	-	hPa	Within measurement temperature range
Pressure output data	-	24	-	bits	
Pressure sampling frequency	-	1	-	Hz	

Table 16 Barometer technical specifications

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
Temperature measurement range	-40	-	+85	°C	
Measurement accuracy [-10°C ÷ +85°C]	-	±0.3	±0.4	°C	
Measurement accuracy [-40°C ÷ -10°C], worst case	-	±0.6	±0.9	°C	Typical value is average over applicable range
Temperature output data	-	14	-	bits	
Response time	0.7	5	-	s	Time to reach 63% of final value.
Long-term stability	-	≤0.01	-	°C/year	

Table 17 Standard-accuracy temperature sensor technical specifications

4.8 ENVIRONMENTAL SENSORS

The internal environmental sensors of the LegioBox IoT devices, as functionally described in section 3.5, each have their own technical specifications, given in this subsection.

Ambient barometric pressure sensor

The technical specifications of LegioBox integrated barometer are given in Table 16.

Ambient temperature sensor - standard-accuracy

The technical specifications of standard-accuracy LegioBox temperature sensor are given in Table 17.

Ambient temperature sensor - high-precision

The technical specifications of high-precision LegioBox temperature sensor are given in Table 18.

Ambient relative humidity sensor

The technical specifications of the LegioBox relative humidity sensor are given in Table 19.

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
Temperature measurement range	-40	-	+125	°C	
Measurement accuracy [-40°C ÷ +125°C]	-	-	±0.25	°C	
Measurement accuracy [+20°C ÷ +70°C]	-	-	±0.13	°C	
Measurement accuracy [+20°C ÷ +70°C]	-	-	±0.1	°C	
Temperature output data	-	14	-	bits	
Response time	0.7	5	-	s	Time to reach 63% of final value.
Long-term stability	-	≤0.01	-	°C/yr	

Table 18 High-precision temperature sensor technical specifications

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
Relative humidity measurement range	0	-	100	%RH	Non-condensing
Measurement accuracy [0%RH ÷ 80%RH]	-	±2	±3	%RH	
Measurement accuracy [80%RH ÷ 100%RH]	-	±3	±4.5	%RH	
Relative humidity output data	-	12	-	bits	
Response time	-	18	-	s	Time to reach 63% of final value.
Long-term stability	-	≤0.25	-	%RH/yr	

Table 19 Relative humidity sensor technical specifications

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
Measurement optical power range	0.0012	-	10000	$\mu\text{W}/\text{cm}^2$	
Peak spectral sensitivity	-	505	-	nm	
Optical power output data	-	23	-	bits	
Response time	-	1	-	s	

Table 20 Ambient light sensor technical specifications

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
Full-scale acceleration measurement range (3-axis)	± 2.0	± 4.0	$+8.0$	g	Unit of gravitational acceleration
Sensitivity [at full scale $\pm 2.0\text{g}$]	-	0.061	-	mg/digit	The unit 'mg' in this case means 0.001 g
Sensitivity [at full scale $\pm 4.0\text{g}$]	-	0.122	-	mg/digit	The unit 'mg' in this case means 0.001 g
Sensitivity [at full scale $\pm 8.0\text{g}$]	-	0.244	-	mg/digit	The unit 'mg' in this case means 0.001 g
Accelerometer output data	-	16	-	bits	
Refresh rate	10	-	800	Hz	
Response time	12	-	100	ms	

Table 21 Accelerometer technical specifications

Ambient light intensity sensor

The technical specifications of the ambient light sensor are given in Table 20.

Accelerometer

The technical specifications of accelerometer are given in Table 21. Please note that, depending on the LegioBox product version, a single accelerometer, or two orthogonally oriented accelerometers are provided.

Position (GNSS geo-location)

The integrated GNSS receiver of the LegioBox supports the following constellations:

- Galileo
- GPS
- Glonass
- BeiDou

The technical specifications of the GNSS receiver are given in Table 22.

4.9 LEGIOBOX COMMUNICATION FUNCTIONS

The LegioBox IoT devices can have a number of communication interfaces, either for the exchange of information with the Avison IoT Platform, or for local wireless networking using AVIC's WiseRF protocol. In the following subsections, the technical specifications of all available communication interfaces within the LegioBox IoT device portfolio are provided.

Mobile network operator SIM card holders

For cellular connectivity, holders for SIM cards of the mobile network operator are provided as shown in Table 23.

Cellular Communication - 2G/GPRS

The technical specifications of the LegioBox 2G/GPRS cellular communication interface are given in Table 24. These specifications also cover to the fallback modes of the other cellular communication interfaces of the LegioBox IoT devices; this mode is provided to ensure that where local network capabilities and capacities allow this, redundancy is available for the interaction with the Avison IoT platform.

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
Horizontal position accuracy	-	2.5	-	m	
Time-To-First-Fix - Cold start	-	30	-	s	
Time-To-First-Fix - Hot start	-	1	-	s	
Sensitivity - Cold start	-	-147	-	dBm	
Sensitivity - Hot start	-	-156	-	dBm	
Sensitivity - Tracking & navigation	-	-164	-	dBm	

Table 22 GNSS receiver technical specifications

SIM CARD FORMAT	NanoGate	BasicGate	SolarGate	MiniGate	LightGate
Mini SIM Card (2FF)		●		●	
Nano SIM Card (4FF)	●		●		●

Table 23 LegioBox IoT device SIM card sizes

ITEM	SPECIFICATION	REMARKS
GSM/GPRS operating frequency bands	GSM 850/900/1800/1900 MHz, 3GPP Release 99	Global coverage
GPRS performance class	GPRS Class 12 (downgradeable to Class 10)	
GPRS coding scheme support	CS1, CS2, CS3, and CS4 with PBCCH support	
GPRS power class - 850/900 bands	Class 4 (33 dBm)	
GPRS power class - 1800/1900 bands	Class 1 (30 dBm)	
Receiver sensitivity	-109 dBm (all frequency bands)	
Maximum data throughput	85.6 kbps	
Standard data throughput	TBD	

Table 24 2G/GPRS communication interface technical specifications

ITEM	SPECIFICATION	REMARKS
GSM/UMTS operating frequency bands	19/5/8/2/1 (800/850/900/1900/2100 MHz), 3GPP Release 7	Global coverage
Supported UMTS modes	HSPA (HSDPA/HSUPA)	
UMTS power class	Class 3 (24 dBm) for HSDPA/HSUPA mode	
Receiver sensitivity - UMTS Band 19, 5 and 8	-111 dBm	
Receiver sensitivity - UMTS Band 1 and 2	-110 dBm	
Packet switched data rate - downlink	HSDPA category 8, up to 7.2 Mbit/s DL	
Packet switched data rate - uplink	HSUPA category 6, up to 5.76 Mbit/s UL	

Table 25 3G/UMTS communication interface technical specifications

ITEM	SPECIFICATION	REMARKS
LTE/NB-IoT operating frequency bands	12/13/20/5/8/4/3/2 (700/750/800/850/900/1700/1800/1900 MHz)	Global coverage
LTE/NB-IoT Protocol Stack	3GPP Release 13	
LTE/NB-IoT power class	Class 3 (24 dBm)	
Receiver sensitivity - LTE Band 12	-113.5 dBm	
Receiver sensitivity - LTE Band 13 and 20	-112.0 dBm	
Receiver sensitivity - LTE Band 5	-112.5 dBm	
Receiver sensitivity - LTE Band 8, 3 and 2	-113.0 dBm	
Receiver sensitivity - LTE Band 4 and 1	-114.0 dBm	
NB-IoT communication mode	LTE NB1 Half-Duplex	
Data rate - downlink	up to 27.2 kb/s DL	
Data rate - uplink	up to 62.5 kb/s UL	

Table 26 LTE/NB-IoT communication interface technical specifications

Cellular Communication - 3G/UMTS

The technical specifications of the LegioBox 3G/UMTS cellular communication interface are given in Table 25. The 3G/UMTS cellular communication interface of the LegioBox IoT devices supports fallback to 2G/GPRS.

Cellular Communication - LTE/NB-IoT

The technical specifications of the LegioBox LTE/NB-IoT cellular communication interface are given in Table 26. The LTE/NB-IoT cellular communication interface of the LegioBox IoT devices supports fallback to 2G/GPRS.

Cellular Communication - LTE/Cat-M1

The technical specifications of the LegioBox LTE/Cat-M1 cellular communication interface are given in Table 27. The LTE/Cat-M1 cellular communication interface of the LegioBox IoT devices supports fallback to 2G/GPRS.

ITEM	SPECIFICATION	REMARKS
LTE/Cat-M1 operating frequency bands	12/13/20/5/8/4/3/2 (700/750/800/850/900/1700/1800/1900 MHz)	Global coverage
LTE/Cat-M1 Protocol Stack	3GPP Release 13	
LTE/Cat-M1 power class	Class 3 (24 dBm)	
Receiver sensitivity - LTE Band 12	-107.0 dBm	
Receiver sensitivity - LTE Band 13 and 20	-105.0 dBm	
Receiver sensitivity - LTE Band 5	-105,5 dBm	
Receiver sensitivity - LTE Band 8	-106,5 dBm	
Receiver sensitivity - LTE Band 4 and 1	-107,5 dBm	
Receiver sensitivity - LTE Band 3 and 2	-106.0 dBm	
Cat-M1 communication mode	LTE Cat-M1 Half-Duplex	
Data rate - downlink	up to 300 kb/s DL	
Data rate - uplink	up to 375 kb/s UL	

Table 27 LTE/Cat-M1 communication interface technical specifications

CELLULAR CONNECTIVITY	FREQUENCY BANDS	ITU REGION			CAVEATS
		Region 1	Region 1	Region 1	
2G/GPRS	850 MHz	●		●	With exception of Japan/South Korea
	900 MHz		●		
	1800 MHz	●		●	With exception of Japan/South Korea
	1900 MHz		●		
3G/UMTS	Band 5 (850 MHz)	●	●	●	With exception of North America
	Band 8 (900 MHz)		●		
	Band 2 (1900 MHz)		●		
	Band 1 (2100 MHz)	●	●	●	With exception of North America
LTE (NB-IoT and Cat-M1)	Band 12 (700 MHz)		●		
	Band 13 (750 MHz)		●		
	Band 5 (800 MHz)		●	●	
	Band 8 (900 MHz)	●		●	
	Band 4 (1700 MHz)		●		
	Band 3 (1800 MHz)	●	●	●	With exception of North America
	Band 2 (1900 MHz)		●		

Table 28 100BaseTx Ethernet communication interface technical specifications

ITEM	SPECIFICATION	REMARKS
Supported Ethernet standards	100BaseTx, 10BaseT	According to and compliant with IEEE 802.3
Supported features	Auto-negotiation,	
	Auto-MDIX	
	Wake-on LAN	
Diagnostics support	Faulty cable detection	
Supported cable type	Category 5 UTP cable	According to ANSI/TIA/EIA-568-A
Maximum supported cable length	3 meters	

Table 29 100BaseTx Ethernet communication interface technical specifications

Global cellular network frequency usage

The cellular communication interfaces of the LegioBox IoT devices, as shown in Table 28, are designed to operate globally wherever there is coverage by mobile networks. The frequency bands used worldwide are assigned by the International Telecommunications Union (ITU) to one or more of 3 regions, roughly divided as follows:

- ITU Region 1: Europe (including Russia), Africa, Middle East
- ITU Region 2: Americas
- ITU Region 3: Asia and Oceania

Depending on the service offered by the local mobile network operator, the frequency bands applicable to the LegioBox IoT devices are listed per ITU region in the overview on the left.

AVIC, through its contracts with operators and their global roaming partners, has ensured that cellular network coverage is available in most countries around the planet. However, please verify with AVIC that appropriate network service is provided in the deployment region.

100BaseTx Ethernet

The technical specifications of the 100BaseTx Ethernet communication interface are given in Table 29.

The resilience of the Ethernet communication interface against electromagnetic and electrostatic disturbances has been designed to comply with what the IEEE 802.3 stipulates in this respect. Table 30 contains the relevant compliance levels.

Wireless LAN (WiFi)

The technical specifications of the Wireless LAN (WiFi) communication interface are given in Table 31.

WiseRF

The technical specifications of the WiseRF communication interface are given in Table 32.

ITEM	SPECIFICATION	REMARKS
Electrical fast transients (EFT)	IEC61000-4-4	±2.0 kV, 80A (5/50ns)
Surges	IEC61000-4-5	±2.0 kV, 12A (8/20µs)
Electrostatic discharge (ESD), in airgap	IEC61000-4-2	Min. ±15 kV
Electrostatic discharge (ESD), in contact	IEC61000-4-2	Min. ±8 kV

Table 30 100BaseTx Ethernet communication immunity technical specifications

ITEM	SPECIFICATION	REMARKS
WiFi frequency	2.4 GHz ISM band, channel 1-13	
Supported IEEE 802.11 standards	b/g/n	
WiFi security	WPA2 (IEEE 802.11i)	
Maximum radiated output power	19 dBm EIRP	EIRP: Equivalent Isotropically Radiated Power
Maximum communication range	500 meters	Free line-of-sight
Data rates - IEEE 802.11b	1/2/5.5/11 Mbit/s	
Data rates - IEEE 802.11g	6/9/12/18/24/36/48/54 Mbit/s	
Data rates - IEEE 802.11n	MCS0-MCS7 (6.5-72 Mbit/s)	

Table 31 Wireless LAN (WiFi) technical specifications

ITEM	SPECIFICATION	REMARKS
WiseRF frequency	868 MHz ISM band	
WiseRF security	AES-128 encryption, pre-shared key	
Maximum transmit power	25mW/14dBm	
Receive sensitivity	-110dBm (BER10-3)	
WiseRF data rate	5 kbps	
Maximum communication range	600 meters	Free line-of-sight

Table 32 WiseRF communication interface technical specifications

ITEM	SPECIFICATION				REMARKS
	Min	Typ	Max	Unit	
Frequency range	0.5	-	8.5	kHz	
Sound pressure	88	-	-	db(A)	At 10 cm distance and a frequency of 2.670 kHz

Table 33 Buzzertechnical specifications

4.10 MISCELLANEOUS FUNCTIONS

Although LegioBox IoT devices are primarily designed for stand-alone operation, most devices are equipped with basic interfaces for user interaction. The operational behavior of the LegioBox user interface functions can be defined in the Avision IoT Platform.

Buzzer

The technical specifications of the electro-magnetic buzzer are given in Table 33.

User buttons

To trigger user-initiated actions or events, the LegioBox IoT devices (depending on the product version) provide one or more tactile switch buttons.

Alarm lights

The integrated alarm lights of the LightGate LegioBox IoT device provide a visible signal, with various defineable illumination patterns, that is clearly perceivable even from greater distances.



5 LEGIOBOX GENERAL INSTALLATION PRECAUTIONS AND PREPARATIONS

Before installing your LegioBox IoT device, first read the following sections with appropriate diligence, making sure that you have fully understood their contents:

- "Legal information" on page 3
- "Safety Information" on page 4



WARNING Should you have any questions or concerns, contact your LegioBox sales representative immediately for assistance and guidance.

For all LegioBox IoT devices, the following precautions and preparations must be observed:

- 1 After unpacking your LegioBox IoT device, inspect the device for any exterior visible damages. Should you find any such damages, do not proceed and contact your LegioBox sales representative immediately for further instructions.



WARNING Failure to report exterior damages may void the warranty on your LegioBox IoT device. Proceeding with installation despite the presence of such damages may lead to serious personal or material injury for which AVIC cannot be held responsible.



NOTICE AVIC takes its responsibility for protection of our environment very seriously and tries to minimize the environmental impact of its products and services as much as possible. Please re-use, recycle or dispose of the packaging materials of your LegioBox IoT device in a environment-friendly manner.

- 2 Inspect the contents of the LegioBox IoT shipment and verify that all materials and accessories are enclosed and in pristine condition. Should any of the materials and/or accessories be missing and/or damaged, do not proceed and contact your LegioBox sales representative immediately for further instructions. Please refer to the device-specific device instructions for the list of items that should have been shipped along with your LegioBox device.



WARNING Failure to report damages to the materials and/or accessories may void the warranty on your LegioBox IoT device. Proceeding with installation despite the presence of such damages may lead to serious personal or material injury for which AVIC cannot be held responsible.

- 3 Before installing your LegioBox IoT device, verify that all electric power supply sources are switched OFF. Do not apply power to your LegioBox IoT device before the respective steps of the product-specific installation instructions indicate that it is safe to apply power to the device.



DANGER Within a LegioBox IoT device, high voltages may be present during operation. Under normal conditions, i.e. when the product housing is properly closed in accordance with the product specifications and installation instructions, these voltages are compliant with safety regulations. However, when the device is opened, as may be necessary for installation purposes, such voltages may cause severe personal injury and even loss of life. Under no circumstances must installations be carried out while active power supplies. Failure to observe these instructions may cause severe personal injury and loss of life for which AVIC cannot be held responsible.

- 4 When installing your LegioBox IoT device at the location where it operates, ensure that its environment is clean and dry, and free of hazardous gases. Specifically in for locations outdoors, the LegioBox IoT device may only be installed if meteorological conditions permit it. Installation is not allowed under weather conditions of precipitations of any form, or gale wind forces. Unless environmental conditions permit safe installation of the LegioBox device, installation must not be carried out.



WARNING Installation of a LegioBox IoT device under detrimental environmental conditions may lead to serious personal or material injury for which AVIC cannot be held responsible.

- Before opening your LegioBox device, ensure that you have taken measures to prevent damages by electrostatic discharge. At a minimum, place the device on a properly earthed and tested antistatic mat, and wear a properly earthed and tested wrist strap at all times during installation.



WARNING Damage as a result of electrostatic discharge (ESD) may severely impact the proper operational behavior of your LegioBox IoT device. Such damage may have an immediate or a time-delayed effect. In the latter case, the effects will be the result of latent ESD-caused damage, which is the most common form of ESD-related damage. It may take months or even years before such effects can be perceived, but they may nevertheless lead to serious personal or material injury for which AVIC cannot be held responsible.

- Carefully read the entire product-specific instructions that apply to your LegioBox IoT device prior to commencing its installation, and make sure that you have fully understood what they entail.



NOTICE Please contact your LegioBox sales representative for assistance and guidance should anything in this User Manual raise questions or concerns.

6 LEGIOBOX GENERAL OPERATING INSTRUCTIONS

All LegioBox IoT devices share common (sub)sets of functionality, which will be briefly described in this section.

6.1 DEVICE INITIALIZATION

Upon first power-up, the LegioBox IoT device will automatically establish a connection with the Avison IoT Platform, based on its factory-set communication parameters, and will subsequently download its device functionality configuration. No user action is needed to perform this procedure.

6.2 WAKE-UP BUTTON

To trigger a communication session with Avison, or to perform a warm or cold reset, the Wake-Up button can be pressed. Please refer to the device-specific sections for further details.

6.3 VISUAL STATUS INDICATORS (LEDS)

All LegioBox IoT devices are equipped with LEDs as visual status indicators. For each device type, the illumination patterns for a corresponding status are described in the device-specific operating instructions. The graphics used to depict these patterns are briefly described in the overview below.

ILLUMINATION PATTERN	DESCRIPTION
	LED is steady ON
	LED continuously blinking at a slow rate (around once per two seconds)
	LED continuously blinking at a fast rate (around three times per second)
	LED blinks for a defined number of times (3 in this example), to indicate a specific substatus, and is then turned OFF
	LED is steady OFF
	Free line-of-sight



SolarGate > page 54



NanoGate > page 47



LightGate > page 63



BasicGate > page 39



MiniGate > page 70



PicoWise > page 76

For more information about our devices, check our webpage: www.avic-iot.nl/iot-devices.



WARNING Before proceeding with the installation of your LegioBox IoT device, please make sure you have completely read and fully comprehended the sections in this User Manual on legal and safety-related matters. Please refer to the Table of Contents for the relevant sections. In particular, the general LegioBox IoT device installation instructions described in Chapter 5: "LegioBox General Installation Precautions and Preparations" on page 36 are considered an integral part of all product-specific installation instructions.

6.4 WISERF WIRELESS COMMUNICATION (DEVICE PAIRING)

LegioBox IoT devices support local wireless networking through Avic's proprietary WiseRF protocol. A Gate device (e.g. the NanoGate) will serve as network master, while a Wise device (e.g. the PicoWise) will act as slave. Upon power-up, a Wise device will automatically search for Gate devices in its vicinity. Once a Gate device has been found, said Gate device will perform all network provisioning actions under supervision of the Avision IoT Platform. This process typically takes 10-15 minutes; in very rare situation (e.g. in case of uncommonly poor network conditions between the Gate device and the Avision IoT Platform) it may consume up to 60 minutes. No user action is needed to perform this procedure.

7 LEGIOBOX PRODUCT-SPECIFIC OPERATING INSTRUCTIONS

For each LegioBox IoT device, product-specific installation and operating instructions apply. Please refer to the subsection that covers the installation of your device. For your convenience, a short-form product overview is provided on the left..

7.1 LEGIOBOX BASICGATE

For installation of the LegioBox BasicGate, the instructions in this subsections must be followed. The information contained in Chapter 5: "LegioBox General Installation Precautions and Preparations" on page 36 is considered to be an integral part of the product-specific installation-related information in this subsection.

Product versions

Identify the version of your LegioBox IoT device on the product label of the BasicGate; in the overview in table 34, the available functionality of your BasicGate is summarized. Please refer to Chapter 4: "LegioBox Product Family Technical Specifications" on page 19 for a detailed description of the product features.



WARNING Carefully read the information in Chapter 5: "LegioBox General Installation Precautions and Preparations" on page 36 before proceeding with the installation of your LegioBox as instructed in this subsection.



DANGER Before performing any of the actions described in this subsection, switch OFF the electrical power supply of the LegioBox IoT device, and remove the batteries. Performing actions on the device while it is powered on may lead to significant material damage, severe personal injury, or even the loss of life.

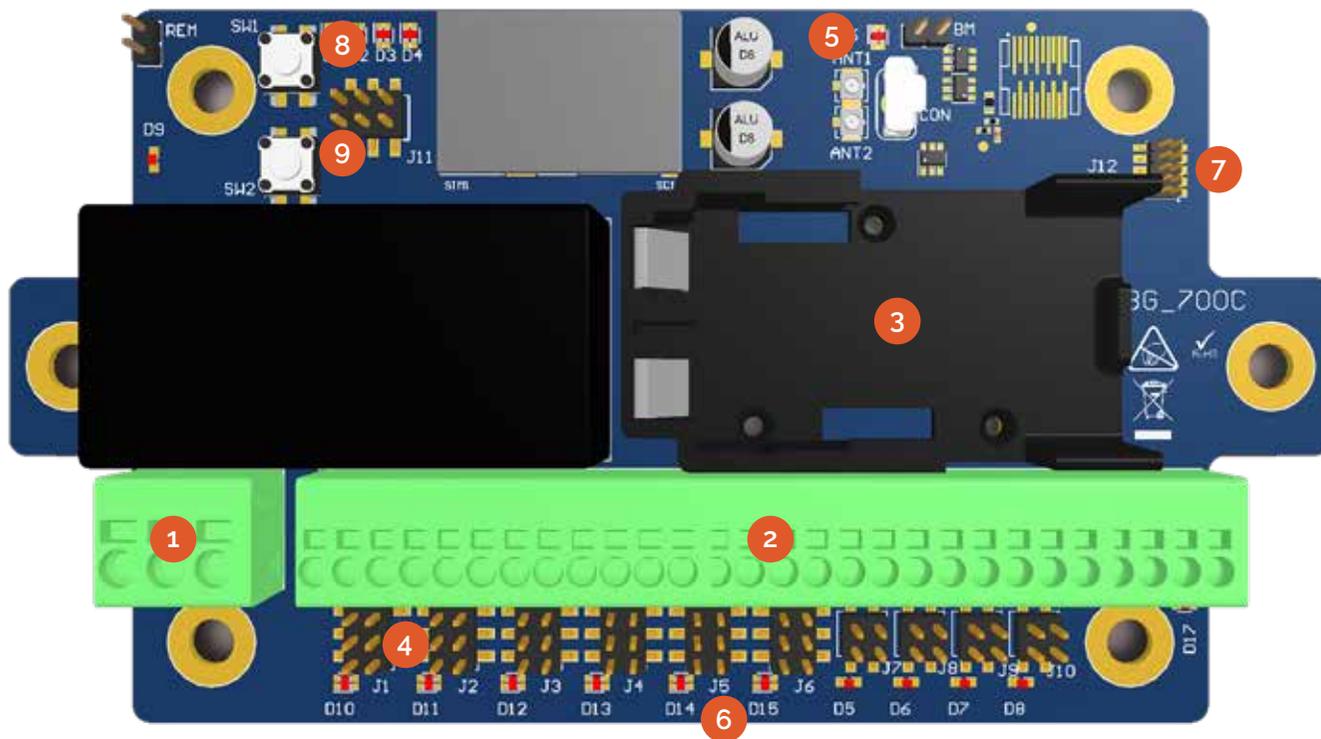
LEGIOBOX BASICGATE		COMMUNICATION					POWER			SENSORS AND INTERFACES (*)			
Model	Application area	Cat.M1/NB-IoT/2G	GPRS/2G	RS232	RS485	Serial TTL	Universal AC mains	24VDC	UPS	0-10VDC	Pt-1000	4-20mA	Digital input
BG00143	Telemetry RS232	●	-	●	-	-	●	-	●	2	6	4	4
BG00144	Telemetry RS485	●	-	-	●	-	●	-	●	2	6	4	4
BG00329	Telemetry RS232	●	-	●	-	-	-	●	●	2	6	4	4
BG00330	Telemetry RS485	●	-	-	●	-	-	●	●	2	6	4	4
BG00334	Telemetry RS485	●	-	-	●	-	●	-	●	-	6	6	4
BG00141	Telemetry RS232	-	●	●	-	-	●	-	●	2	6	4	4
BG00142	Telemetry RS485	-	●	-	●	-	●	-	●	2	6	4	4

Table 34 Product versions

(*) The number of interfaces indicates the maximum available. The BasicGate has 6 configurable analog inputs, with varying supported interface types.

LEGIOSBOX BASICGATE OVERVIEW

The electronics of the BasicGate with its main functions are shown below.



- | | | |
|------------------------|-------------------------|----------------------------|
| 1 Power connector | 4 Configuration jumpers | 7 RS485 line termination |
| 2 Interface connectors | 5 Communication LED | 8 Wake-up button (SW1) |
| 3 Battery holder | 6 Interface LEDs | 9 Application button (SW2) |

OPENING THE BASICGATE

1 Remove the screw cover blinds.



2 Completely loosen the four screws in the cover lid



3 Pull the lid upwards and tilt towards you



4 The lid will remain attached to the enclosure base by its hinges

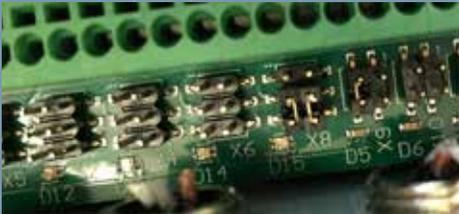


QUICK-STEP INSTRUCTIONS

- 1 Open the BasicGate, following instructions on page 40.



- 2 Set the interface configuration jumpers, see overview on this page.



- 3 Connect external equipment, following instructions on page 43.



- 4 Close the BasicGate, when ready



CONFIGURING THE BASICGATE SIGNAL INTERFACES

The signal interfaces of the BasisGate are located at the bottom side of the device as a series of terminal clamps. For each interface, a jumper block is provided that allows configuration of the respective interface type, as shown below. The AI section, with 6-pin jumper blocks, contains the analog interfaces, while the DI section contains the digital inputs, with 4-pin jumper blocks.

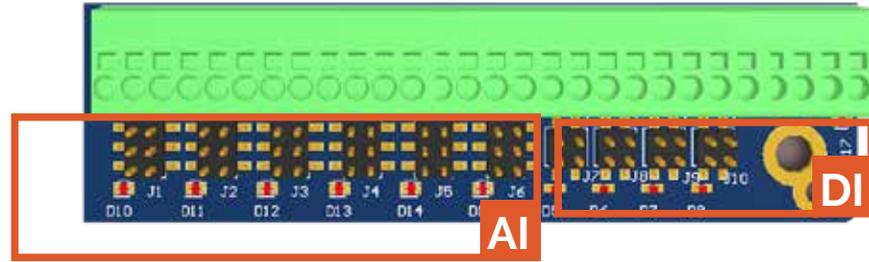


Table 35 below summarizes the available functions and configuration settings of each analog interface and digital input. To perform the configuration, place the jumpers as indicated for each interface.

	ANALOG SIGNAL INTERFACES						DIGITAL INPUTS				
	Interface	Jumpers	Pt-1000	4-20mA	0-10V	0-2.5V	Input	Jumpers	SW/OC (1)	V-LI (2)	V-HI (3)
FUNCTIONS	1	J1	●	●		●	1	J7	●	●	●
	2	J2	●	●		●	2	J8	●	●	●
	3	J3	●	●		●	3	J9	●	●	●
	4	J4	●	●		●	4	J10	●	●	●
	5	J5	●		●	●					
	6	J6	●		●	●					
CONFIGURATION	Place the jumper on the pins as indicated by the orange rectangle.						Place the jumper on the pins as indicated by the orange rectangle.				

Table 35 Configuration of the BasicGate Signal Interfaces

1 SW: potential-free switch; OC: open-collector. 2 Voltage-driven, low-impedance. 3 Voltage-driven, high-impedance.

SETTING THE RS485 LINE TERMINATION

The RS485 communication interface of the BasicGate offers the option of connecting a line termination resistor and applying fail-safe biasing with jumpers. Fail-safe biasing will be enabled and disabled under software control, provided the associated configuration jumpers are set.

 **NOTICE** To configure the line termination of the BasicGate RS485 interface, jumpers are required which are not included with as standard product contents. You may request these jumpers from AVIC as accessory free-of-charge. For the ordering code, please refer to section 10.2 of this User Manual.

Please proceed as follows to set the desired line termination of the BasicGate RS485 interface:

- 1 If the BasicGate is not already opened, first remove the cover lid.
- 2 Depending on the preferred termination mode, place the jumpers on jumper block J12 as indicated in the overview below.

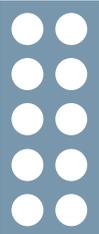
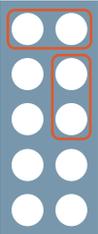
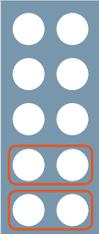
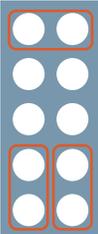
		RS485 LINE TERMINATION			
		Mode 1	Mode 2	Mode 3	Mode 4
MODE	120 Ohm termination		●		●
	Fail-safe biasing			●	●
CONFIGURATION	Place the jumper on the pins as indicated by the orange rectangle.				

Table 36 line termination of the BasicGate RS485 interface

- 3 Close the BasicGate if all configuration/installation actions are completed.

QUICK-STEP INSTRUCTIONS

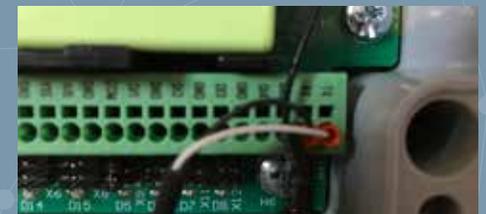
- 1 Open the BasicGate, following instructions on page 40.



- 2 Set the RS485 termination jumpers on J12, see overview on this page.



- 3 Connect external equipment, following instructions on page 43.



- 4 Close the BasicGate, when ready



QUICK-STEP INSTRUCTIONS

- 1 Loosen the interface cable glands



- 2 Feed the signal cables into the enclosure through the glands



- 3 Press the signal wires into the terminal clamps (see overview in Table 37)



- 4 Fasten the interface cable glands.



CONNECTING EXTERNAL EQUIPMENT

For the wired connection of external equipment, such as sensors or devices communicating through serial data protocols, the BasicGate provides clamp terminals that are located inside the enclosure.



NOTICE It is strongly recommended to configure the analog interfaces and digital inputs, as described on page 41, before connecting any equipment.

Please proceed as follows to connect equipment to the BasicGate:

- 1 Make sure the BasicGate main power supply is switched OFF or is disconnected before proceeding; if not already opened, first remove the cover lid.
- 2 Take out the internal safeguard by removing the two nylon fastening screws, and loosen the cable glands of all entries through which the equipment wires will be fed.
- 3 If equipment needs to be disconnected from a certain interface, detach the wires of said equipment; the wires are released when a sharp object such as a screwdriver is pressed into the small slot at the top of the respective terminal clamp.
- 4 Press the signal wire into the terminal clamp as indicated in the terminal assignment overview below. Where an 'n' is used as suffix in a terminal name, this characters must be replace by the the number of the respective interface (e.g. AI4 for analog interface nr. 4). Please also pay attention to the notices.

ANALOG SIGNAL INTERFACES					DIGITAL INPUTS			SERIAL PORT		
terminal	Pt-1000	4-20mA	0-10V	0-2.5V	terminal	OC/SW (1)	Voltage	Terminal	RS232 (2)	RS485
AI _n	Wire-1	Signal	Signal	Signal	DI _n	Signal	DIn	TX	TXD	A
GND	Wire-2	-	Ground	Ground	GND	Ground	Ground	RX	RXD	B
VSE	-	Supply	Supply	Supply	COM			GND	GND	-

Table 37 Connection of equipment to the BasicGate

1 SW: potential-free switch; OC: open-collector. 2 For a UART serial port, the same terminal assignments apply.



NOTICE For a connection of a switch to a digital input, the way the wires are connected is irrelevant. For open-collector signals, the terminal assignment must be strictly observed.



NOTICE The COM terminal is a shared voltage output that can be used to operate a digital input in low-impedance voltage mode without the need of an external voltage source.

- 1 Fasten the cable glands securely.
- 2 Close the BasicGate if all configuration/installation actions are completed.

CONNECTING THE POWER SUPPLY

The BasicGate operates from an external power supply, depending on the device type. To connect the BasicGate to its supply voltage, the device provides clamp terminals located inside the enclosure.



DANGER Performing actions on the device while it is powered on may lead to significant material damage, severe personal injury, or even the loss of life. Take appropriate care when following the instructions below.

Please proceed as follows to connect the power supply to the BasicGate:

- 1 Make sure the BasicGate main power supply is switched OFF or is disconnected before proceeding; if not already opened, first remove the cover lid.
- 2 Loosen the power cable gland.
- 3 Press the power wires into the terminal clamp as indicated in the terminal assignment overview below.

POWER CONNECTOR

Terminal	Universal AC mains	Terminal	24DC mains
PE	Protective Earth		-
L	Live	+	24 VDC
N	Neutral	-	GND

Table 38 Connection of the power supply

- 4 Fasten the power cable gland securely.
- 5 Refit the internal safeguard by applying the two nylon fastening screws, connect the power and verify the BasicGate power-up behavior by observing the Communication LED as described on page 46.
- 6 Close the BasicGate if all configuration/installation actions are completed.

QUICK-STEP INSTRUCTIONS

- 1 Loosen the power cable gland



- 2 Feed the power cable into the enclosure and connect the power wires



- 3 Apply the device power and verify the start-up sequence.



- 4 Close the BasicGate, when ready



QUICK-STEP INSTRUCTIONS

- 1 Loosen the power cable gland



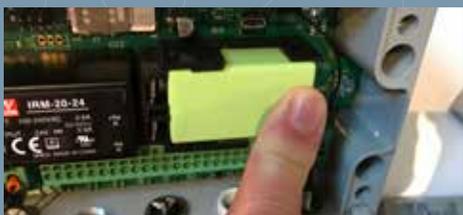
- 2 If a battery is already present, remove it by lifting its bottom



- 3 Place the battery in its holder, against the ledge



- 4 Place the battery in its holder, by aligning its bottom with the ledge on the appropriate side of the holder.



PLACING OR REPLACING THE BATTERY

As a backup supply voltage during power outages, the BasicGate is equipped with a battery that will automatically be recharged when the mains supply voltage is active. The BasicGate battery that is included with the product contents needs to be placed during initial installation. During the device's operational lifetime, the battery may need to be replaced.



DANGER Maltreatment of batteries, in particular when their contacts short-circuit, mixing battery chemistries or types, may lead to their overheating and even explosion, possibly resulting in material damage, severe personal injury, and even the loss of life, for which AVIC cannot be held responsible.



WARNING Only use batteries that are approved by AVIC. Replacement batteries may be ordered as spare part; for the ordering information, please refer to Chapter 10: "LegioBox Accessories and Spare Parts" on page 84. Usage of non-approved batteries voids the product warranty.



CAUTION The use of tools is not required to place or remove the battery, and can be done with finger actions. Since metal tools may inadvertently lead to short-circuiting of the battery's contacts, the use of tools when handling batteries is strongly discouraged.



CAUTION Please dispose of a removed battery in an environmentally responsible manner.

Please proceed as follows to place or replace the BasicGate rechargeable battery:

- 1 Make sure the BasicGate main power supply is switched OFF or is disconnected before proceeding.
- 2 If the BasicGate is not already opened, first remove the cover lid and take out the internal safeguard by removing the two nylon fastening screws.
- 3 If a battery is present, lift it from its holder at the bottom using a finger. Once lifted, the battery can easily be removed entirely from its holder.
- 4 Place the battery in its holder, by aligning its bottom with the ledge on the appropriate side of the holder.
- 5 Using a finger, gently press the battery down into its holder to establish the connection between the contacts of the holder and the battery.
- 6 Refit the internal safeguard by applying the two nylon fastening screws and close the BasicGate if all installation and configuration actions have been completed.

LED NR	FUNCTION	ILLUMINATION PATTERN	STATUS
A	Power/communication		Power ON & communication OK
			Communicating with Avision
			Communication error
B	Cellular signal quality		Signal quality: EXCELLENT
			Signal quality: GOOD
			Signal quality: AVERAGE
			Signal quality: POOR
10 - 15	Power-up status (upon continuously pressing SW1)		Wake-up (release during first 15 seconds)
			Warm start (release after 15, and no later than 60 seconds)
			Cold start (release after 60 seconds)
10 - 15	Analog sensor status		Interface not configured in Avision
			Sensor error LOW
			Sensor signal level below LOW-LOW
			Sensor signal level between LOW-LOW and LOW
			Sensor signal level between LOW and HIGH
			Sensor signal level between HIGH and HIGH-HIGH
			Sensor signal level above HIGH-HIGH
			Sensor error HIGH
5 - 8	Digital input status		Interface not configured in Avision
			Digital input ACTIVE
			Digital input INACTIVE
17	ModBus		Modbus absent
			All modbus devices responding
			No modbus devices responding
			Modbus devices responding 50% or more
			Modbus devices responding less than 50%

Visual Indicator Patterns

The illumination patterns of the LegioBox BasicGate are shown in Table 39; in low-power mode, the LEDs will only be activated for approximately 15 seconds after briefly pressing SW1.

Table 39 Visual Indicator Pattern of the LegioBox BasicGate

7.2 LEGIOBOX NANOGATE

For installation of the LegioBox NanoGate, the instructions in this subsections must be followed. The information contained in Chapter 5: "LegioBox General Installation Precautions and Preparations" on page 36 is considered to be an integral part of the product-specific installation-related information in this subsection.

Product versions

Identify the version of your LegioBox IoT device on the product label of the NanoGate; in the overview in table 40, the available functionality of your NanoGate is summarized. Please refer to Chapter 4: "LegioBox Product Family Technical Specifications" on page 19 for a detailed description of the product features.



WARNING Carefully read the information in Chapter 5: "LegioBox General Installation Precautions and Preparations" on page 36 before proceeding with the installation of your LegioBox as instructed in this subsection.



DANGER Before performing any of the actions described in this subsection, switch OFF the electrical power supply of the LegioBox IoT device, and remove the batteries. Performing actions on the device while it is powered on may lead to significant material damage, severe personal injury, or even the loss of life.

LEGIOBOX NANOGATE		COMMUNICATION							POWER	SENSORS AND INTERFACES (*)								
Model	Application area	Cat.M1/NB-IoT/2G	GPRS/2G	Ethernet	Wireless LAN	RS232	RS485	WISE RF	24VDC/UPS	Battery-powered	0-10VDC	Pt-1000	4-20mA	Digital-input	Rel. humidity	Barometer/temp.	GNSS receiver	Accelerometer (2)
NG00130	Outdoor RF hub	-	●	-	-	-	-	●	●	-	-	-	-	-	-	●	●	-
NG00131	Indoor RF hub	-	●	-	-	-	-	●	●	-	-	-	-	-	●	●	-	-
NG00132	Telemetry outdoor	-	●	-	-	-	●	●	●	-	2	2	2	2	-	●	●	-
NG00133	Telemetry indoor	-	●	-	-	-	●	●	●	-	2	2	2	2	●	●	-	-
NG00134	Telemetry autonomous	-	●	-	-	●	-	●	-	●	2	2	2	2	-	●	●	-
NG00135	Outdoor RF hub	●	-	-	-	-	-	●	●	-	-	-	-	-	-	●	●	-
NG00136	Indoor RF hub	●	-	-	-	-	-	●	●	-	-	-	-	-	●	●	-	-
NG00137	Telemetry outdoor	●	-	-	-	-	●	●	●	-	2	2	2	2	-	●	●	-
NG00138	Telemetry indoor	●	-	-	-	-	●	●	●	-	2	2	2	2	●	●	-	-
NG00139	Telemetry autonomous	●	-	-	-	●	-	●	-	●	2	2	2	2	-	●	●	-
NG00315	Indoor RF gateway. Ethernet 12V (**)	-	●	●	-	●	-	-	●	-	-	-	-	1	●	●	-	-
NG00321	Indoor RF gateway Ethernet	-	●	●	-	-	●	-	●	-	-	-	-	1	●	●	-	-
NG00326	Indoor RF hub Ethernet	●	-	●	-	-	●	●	●	-	-	-	-	1	●	●	-	-
NG00327	Indoor RF gateway Ethernet	-	●	●	-	●	-	-	●	-	-	-	-	1	●	●	-	-
NG00328	Indoor RF hub WLAN	●	-	-	●	-	●	●	●	-	-	-	-	1	●	●	-	-

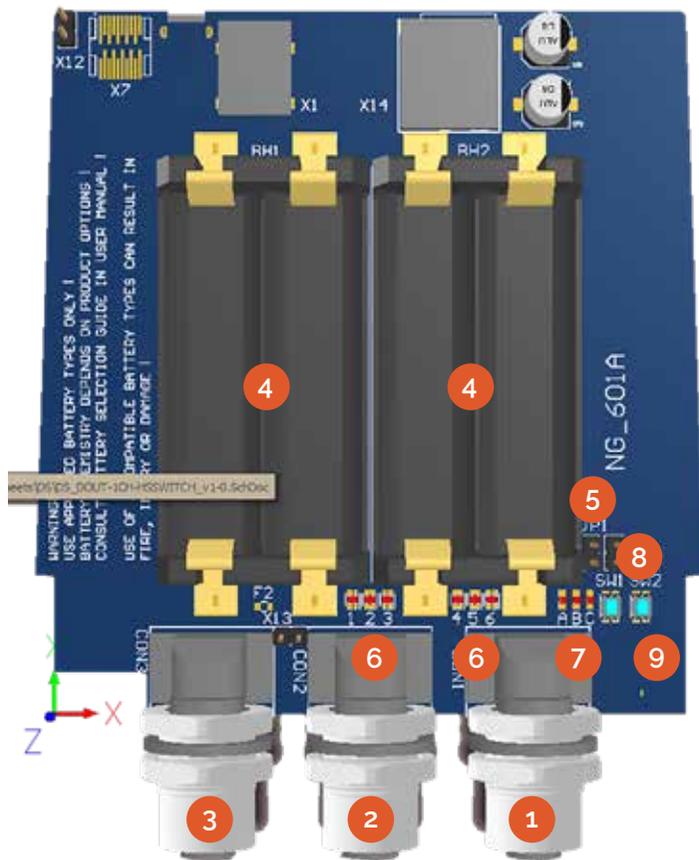
Table 40 Product versions

* The number of interfaces indicates the maximum available. The NanoGate has at most 6 analog inputs, with varying supported interface types.

** This product does not provide the UPS function.

LEGIOBOX NANOGATE OVERVIEW

The electronics of the NanoGate with its main functions are shown below.



- | | | |
|-------------------------|------------------------------|----------------------------|
| 1 Interface connector 1 | 4 Battery holders | 7 Communication LEDs |
| 2 Interface connector 2 | 5 Configuration jumper (JP1) | 8 Wake-up button (SW1) |
| 3 Interface connector 3 | 6 Interface LEDs | 9 Application button (SW2) |

OPENING THE NANOGATE

- 1 Position the NanoGate enclosure with the logo facing upwards



- 2 Leave at least one connected equipment cables attached



- 3 Completely loosen the two screws in the cover lid using a Phillips screwdriver



- 4 Slide the electronics from the enclosure by pulling a connector cable towards you



QUICK-STEP INSTRUCTIONS

- 1 Open the NanoGate, following instructions on page 48.



- 2 If a battery is already present, remove it by lifting its bottom



- 3 Place the battery in its holder, against minus contact



- 4 Press the battery firmly into its position in the holder and repeat until all batteries are correctly fitted



PLACING OR REPLACING THE BATTERIES

Either as a backup supply voltage during power outages or as primary power source, the NanoGate is equipped with four batteries. Backup batteries will automatically be recharged when the mains supply voltage is active. The NanoGate batteries that are included with the product contents need to be placed during initial installation. During the operational lifetime of the NanoGate, the batteries may need to be replaced.



DANGER Maltreatment of batteries, in particular when their contacts short-circuit, mixing battery chemistries or types, may lead to their overheating and even explosion, possibly resulting in material damage, severe personal injury, and even the loss of life, for which AVIC cannot be held responsible.



WARNING Only use batteries that are approved by AVIC. Replacement batteries may be ordered as spare part; for the ordering information, please refer to Chapter 10: "LegioBox Accessories and Spare Parts" on page 84. Usage of non-approved batteries voids the product warranty.



CAUTION The use of tools is not required to place or remove the battery, and can be done with finger actions. Since metal tools may inadvertently lead to short-circuiting of the battery's contacts, the use of tools when handling batteries is strongly discouraged.



CAUTION Please dispose of a removed battery in an environmentally responsible manner.

Please proceed as follows to place or replace the NanoGate rechargeable battery:

- 1 Make sure the NanoGate main power supply is switched OFF or is disconnected before proceeding.
- 2 If the NanoGate is not already opened, first remove the cover lid.
- 3 If a battery is present, lift it from its holder at the bottom using a finger. Once lifted, the battery can easily be removed entirely from its holder.
- 4 Place the battery in its holder, by aligning its bottom with the ledge according to the polarity marks (- / +) in the battery holders.
- 5 Using a finger, gently press the battery down into its holder to establish the connection between the contacts of the holder and the battery.
- 6 Close the NanoGate when all installation and configuration actions have been completed.

CLOSING THE NANO GATE DEVICE

To close the NanoGate device, please follow the instructions below.



WARNING Great care must be observed during closing of the device to avoid damage to the enclosure and/or the electronics. Should damage occur during device handling, remove power and batteries from the device and contact your LegioBox sales representative for further advice.



CAUTION The device must be properly closed according to the instructions below to maintain the specified ingress protection level. Failure to properly close the device may lead to irreparable damage of the electronics and/or the device enclosure.

Please proceed as follows to close the NanoGate device:

- 1 Make sure the NanoGate main power supply is switched OFF or is disconnected before proceeding (if applicable).
- 2 Place the NanoGate on a stable surface with the LegioBox log facing upwards.
- 3 The electronics is most conveniently placed into the enclosure if at least one of the equipment connectors is attached to the receptacles.
- 4 Place the electronics in front of the enclosure opening with the battery holders facing downwards.
- 5 Gently slide the electronics into the enclosure until it is fully inside.
- 6 Using a Phillips screwdriver, fasten the two mounting screws in the frontpanel until they are firmly secured.
- 7 Place the NanoGate back in its operating location, connect any remaining equipment cables, and apply the device power.

QUICK-STEP INSTRUCTIONS

- 1 Position the NanoGate enclosure with the logo facing upwards



- 2 Align the electronics with the enclosure with the battery holders facing down



- 3 Gently slide the electronics into the enclosure



- 4 Firmly fasten the screws using a Phillips screwdriver



Visual Indicator Patterns (Non-Ethernet/WLAN Types)

The illumination patterns of the LegioBox NanoGate are shown in Table 41; in low-power mode, the LEDs will only be activated for approximately 15 seconds after briefly pressing SW1.

LED NR	FUNCTION	ILLUMINATION PATTERN	STATUS
A	Power/communication		Power ON & communication OK
			Communicating with Avision
			Communication error
B	Cellular signal quality		Signal quality: EXCELLENT
			Signal quality: GOOD
			Signal quality: AVERAGE
			Signal quality: POOR
C	Wise RF communication		Wise RF communication ACTIVE
			Wise RF communication INACTIVE
1 - 6	Power-up status (upon continuously pressing SW1)		Wake-up (release during first 15 seconds)
			Warm start (release after 15, and no later than 60 seconds)
			Cold start (release after 60 seconds)
1 - 6	Analog sensor status		Interface not configured in Avision
			Sensor error LOW
			Sensor signal level below LOW-LOW
			Sensor signal level between LOW-LOW and LOW
			Sensor signal level between LOW and HIGH
			Sensor signal level between HIGH and HIGH-HIGH
			Sensor signal level above HIGH-HIGH
			Sensor error HIGH
3 / 6	Digital input status		Interface not configured in Avision
			Digital input ACTIVE
			Digital input INACTIVE

Table 41 Visual Indicator Patterns (Non-Ethernet/WLAN Types)

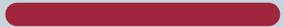
LED NR	FUNCTION	ILLUMINATION PATTERN	STATUS
A	Power/communication		Power ON & communication OK
			Communicating with Avison
			Communication error
			
B	Cellular signal quality		Signal quality: EXCELLENT
			Signal quality: GOOD
			Signal quality: AVERAGE
			Signal quality: POOR
	Wise RF communication		Wise RF communication ACTIVE
			Wise RF communication INACTIVE
4 - 6	Power-up status (upon continuously pressing SW1)		Wake-up (release during first 15 seconds)
			Warm start (release after 15, and no later than 60 seconds)
			Cold start (release after 60 seconds)
			
7	Network communication status		No network communication
			Network communication active
8	Network link status		No network link
			Network link established

Table 42 Visual Indicator Patterns (Ethernet/WLAN Types)

Visual Indicator Patterns (Ethernet/WLAN Types)

The illumination patterns of the LegioBox NanoGate (Ethernet and WLAN types) are shown in Table 42; in low-power mode, the LEDs will only be activated for approximately 15 seconds after briefly pressing SW1.

The NanoGate connectors numbers, from left to right, are 1, 2, and 3



CONNECTOR SCHEMES

Depending on the product version, your LegioBox NanoGate IoT device will have a combination of interface functions, as summarized in the table below.

LEGIOBOX CONNECTOR SCHEMES (M12 FEMALE CONNECTOR)						
Pin	AD1: Analog/digital	AD2: Analog/digital	DSD: Digital/serial	PSD1: Power/serial	PSD2: Power/serial	NWK: Ethernet
1	Analog 1 (*)	Analog 4 (*)	Serial RXD/RS485-A	Serial RXD/RS485-A	Serial RXD/RS485-A	Ethernet TXP
2	Analog 2 (*)	Analog 5 (*)	Serial TXD/RS485-B	Serial TXD/RS485-B	Serial TXD/RS485-B	Ethernet RXP
3	Analog 3 (*)/Digital 1	Analog 6 (*)/ Digital 2	Signal ground	VSE sensor voltage	Signal ground	Ethernet TXN
4	Signal ground	Signal ground	Digital 1	DC supply ground	DC supply ground	Ethernet RXN
5	VSE sensor voltage	VSE sensor voltage	Signal ground	DC supply voltage	DC supply voltage	-

Table 43 Connector schemes

* Analog 1/4: Pt-1000 (resistance); Analog 2/5: 4-20mA (current); Analog 3/6: 0-10VDC (voltage)

Standard wire colours in M12 connecting cable:

1 = Brown | 2 = White | 3 = Blue | 4 = Black | 5 = Gray

In the overview below, the connector assignment per NanoGate product version is provided.

LEGIOBOX NANO GATE		CONNECTOR SCHEME ASSIGNMENT			
Codes	Description	1	2	3	Remarks
NG00130, NG00135	Outdoor RF hub	PSD1	n.a.	n.a.	Connector 1 pins 1, 2, and 3 not used
NG00131, NG00136	Indoor RF hub	PSD1	n.a.	n.a.	Connector 1 pins 1, 2, and 3 not used
NG00132, NG00137	Telemetry outdoor	PSD1	AD1	AD2	Serial data: RS485
NG00133, NG00138	Telemetry indoor	PSD1	AD1	AD2	Serial data: RS485
NG00134, NG00139	Telemetry autonomous	PSD1	AD1	AD2	Connector 1 pin 5 not used, serial data: RS232
NG00315	Redundant Gateway Ethernet 12V	PSD2	NWK	DSD	Serial data: RS232
NG00321	Redundant Gateway Ethernet	PSD2	NWK	DSD	Serial data: RS485
NG00326	Redundant RF Hub Ethernet	PSD2	NWK	DSD	Connector 1/3 serial data pins unused
NG00327	Redundant Gateway Ethernet	PSD2	NWK	DSD	Serial data: RS232
NG00328	Redundant RF Hub WLAN	PSD2	n.a.	n.a.	Serial data: RS485

Table 44 Connector assignment per NanoGate product version



WARNING Carefully read the information in Chapter 5: "LegioBox General Installation Precautions and Preparations" on page 36 before proceeding with the installation of your LegioBox as instructed in this subsection.



DANGER Before performing any of the actions described in this subsection, switch OFF the electrical power supply of the LegioBox IoT device, and remove the batteries. Performing actions on the device while it is powered on may lead to significant material damage, severe personal injury, or even the loss of life.

LEGIOWOX SOLARGATE		COMMUNICATION						POWER	SENSORS AND INTERFACES (*)										
Model	Application area	Cat.M1/NB-IoT/2G	GPRS/2G	RS232	RS485	Serial TTL	WISE RF	Solar panel	Internal battery	0-10VDC	Pt-1000	4-20mA	Digital-input	Rel. humidity	Barometer/temp	GNSS receiver	Accelerometer	SDI-12	Camera/PIR
NG00130	Outdoor RF hub	-	●	-	●	-	●	●	●	2	6	4	4	●	●	●	-	-	-
NG00131	Indoor RF hub	-	●	-	-	-	●	●	●	2	6	4	4	●	●	-	-	-	-
NG00132	Telemetry outdoor	●	-	-	●	-	●	●	●	2	6	4	4	●	●	●	-	-	-

Table 45 Product versions

* The number of interfaces indicates the maximum available. The SolarGate has 6 configurable analog inputs, with varying supported interface types.

7.3 LEGIOWOX SOLARGATE

For installation of the LegioBox SolarGate, the instructions in this subsections must be followed. The information contained in Chapter 5: "LegioBox General Installation Precautions and Preparations" on page 36 is considered to be an integral part of the product-specific installation-related information in this subsection.

Product versions

Identify the version of your LegioBox IoT device on the product label of the SolarGate; in the overview in table 45, the available functionality of your SolarGate is summarized. Please refer to Chapter 4: "LegioBox Product Family Technical Specifications" on page 19 for a detailed description of the product features.

OPENING THE SOLARGATE

- 1 Place the SolarGate with the solar panel facing downwards



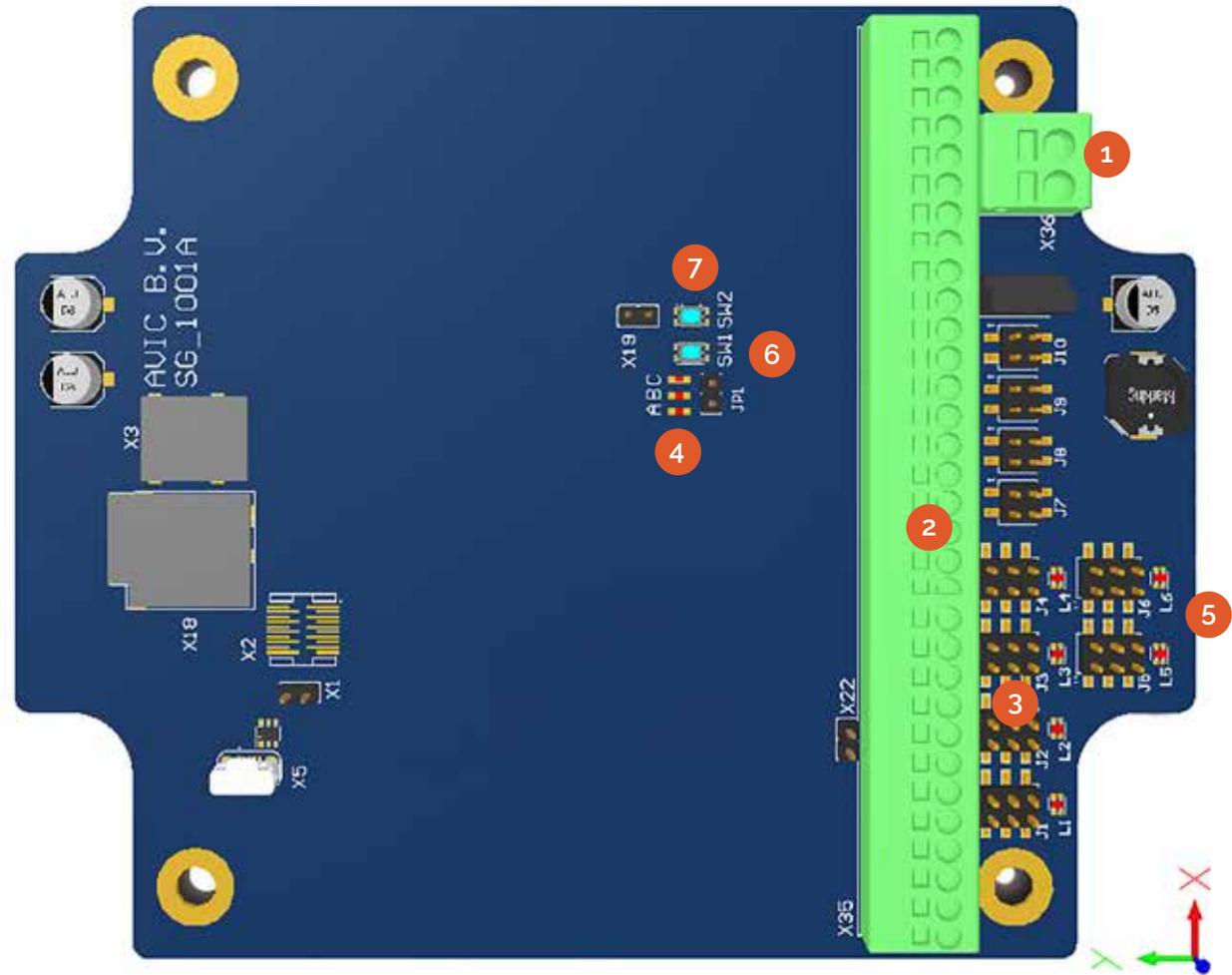
- 2 Completely loosen the screws in side and remove the back lid



- 3 Remove the fuse from its holder



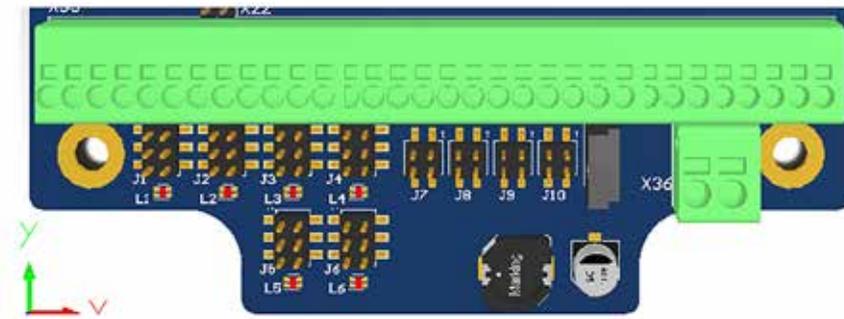
- 4 Loosen the screws in the backpanel and remove it from the device housing



- | | | |
|-------------------------------|-------------------------|----------------------------|
| 1 Battery connector | 4 Communication LED (A) | 7 Application button (SW2) |
| 2 Interface connectors | 5 Interface LEDs | |
| 3 Configuration jumper blocks | 6 Wake-up button (SW1) | |

CONFIGURING THE SOLARGATE SIGNAL INTERFACES

The signal interfaces of the SolarGate are located at the bottom side of the device as a series of terminal clamps. For each interface, a jumper block is provided that allows configuration of the respective interface type, as shown below. The AI section, with 6-pin jumper blocks, contains the analog interfaces, while the DI section contains the digital inputs, with 4-pin jumper blocks.



The overview below summarizes the available functions and configuration settings of each analog interface and digital input. To perform the configuration, place the jumpers as indicated for each interface.

	ANALOG SIGNAL INTERFACES						DIGITAL INPUTS				
	Interface	Jumpers	Pt-1000	4-20mA	0-10V	0-2.5V	Input	Jumpers	SW/OC (1)	V-LI (2)	V-HI (3)
FUNCTIONS	1	J1	•	•		•	1	J7	•	•	•
	2	J2	•	•		•	2	J8	•	•	•
	3	J3	•	•		•	3	J9	•	•	•
	4	J4	•	•		•	4	J10	•	•	•
	5	J5	•		•	•					
	6	J6	•		•	•					
CONFIGURATION	Place the jumper on the pins as indicated by the orange rectangle.						Place the jumper on the pins as indicated by the orange rectangle.				

Table 46 Functions and configuration settings

1 SW: potential-free switch; OC: open-collector. 2 Voltage-driven, low-impedance. 3 Voltage-driven, high-impedance.

QUICK-STEP INSTRUCTIONS

- 1 Open the SolarGate, following instructions on page 55



- 2 Set the interface configuration jumpers, see overview on this page



- 3 Connect external equipment, following instructions on page 57



- 4 Close the SolarGate, when ready

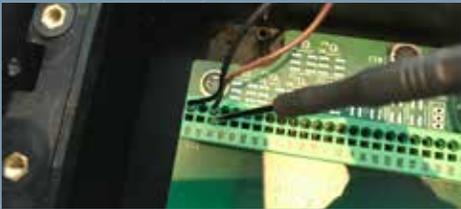


QUICK-STEP INSTRUCTIONS

- 1 Open the SolarGate, following instructions on page 55



- 2 Detach connected signal wires



- 3 Press the signal wires into the terminal clamps (see overview)



- 4 Close the SolarGate as described on page 60



RE-WIRING THE SOLARGATE EQUIPMENT CONNECTORS

For the wired connection of external equipment, such as sensors or devices communicating through serial data protocols, the SolarGate provides clamp terminals that are located inside the enclosure. The SolarGate is equipped with 2 or 4 M12-style connectors which as factory-standard are wired as described on page 62. At your own discretion you may re-wire these connectors to flexibly adapt the connection scheme to suit your own solution.

Standard wire colours in M12 connecting cable:

1 = Brown | 2 = White | 3 = Blue | 4 = Black | 5 = Gray



NOTICE It is strongly recommended to configure the analog interfaces and digital inputs, as described on page 56, before connecting any equipment.

Please proceed as follows to connect equipment to the SolarGate:

- 1 Disconnect all M12 style connectors from the SolarGate end and remove the fuse from its holder. Then, remove the cover lid.
- 2 Detach the wires of interfaces that will be modified; the wires are released when a sharp object such as a screwdriver is pressed into the small slot at the top of the respective terminal clamp
- 3 Press the signal wire into the terminal clamp as indicated in the terminal assignment overview below. Where an 'n' is used as suffix in a terminal name, this character must be replaced by the number of the respective interface (e.g. AI4 for analog interface nr. 4). Please also pay attention to the notices.

ANALOG SIGNAL INTERFACES					DIGITAL INPUTS			SERIAL PORT		
terminal	Pt-1000	4-20mA	0-10V	0-2.5V	terminal	OCISW (1)	Voltage	Terminal	RS232 (2)	RS485
AIn	Wire-1	Signal	Signal	Signal	DIn	Signal	DIn	BnT	TXD	B
GND	Wire-2	-	Ground	Ground	GND	Ground	Ground	AnR	RXD	A
VSE	-	Supply	Supply	Supply	COM			GND	GND	-

Table 47 Connection of the equipment to the SolarGate

1 SW: potential-free switch; OC: open-collector. 2 For a UART serial port, the same terminal assignments apply.



NOTICE For a connection of a switch to a digital input, the way the wires are connected is irrelevant. For open-collector signals, the terminal assignment must be strictly observed.



NOTICE The COM terminal is a shared voltage output that can be used to operate a digital input in low-impedance voltage mode without the need of an external voltage source.

- 4 Close the SolarGate when all configuration/installation actions are completed.

REPLACING THE BATTERY PACK

The SolarGate is equipped with a battery pack that will automatically be recharged by the integrated solar panel. During the operational lifetime of the SolarGate, its battery pack may need to be replaced.



DANGER Maltreatment of batteries, in particular when their contacts short-circuit, mixing battery chemistries or types, may lead to their overheating and even explosion, possibly resulting in material damage, severe personal injury, and even the loss of life, for which AVIC cannot be held responsible.



WARNING Only use batteries that are approved by AVIC. Replacement batteries may be ordered as spare part; for the ordering information, please refer to Chapter 10: "LegioBox Accessories and Spare Parts" on page 84. Usage of non-approved batteries voids the product warranty.



CAUTION Other than for removing its bracket, the use of tools is not required to place or remove the battery, and can be done with finger actions. Since metal tools may inadvertently lead to short-circuiting of the battery's contacts, the use of tools when handling batteries is strongly discouraged.



CAUTION Please dispose of a removed battery in an environmentally responsible manner.

Please proceed as follows to replace the SolarGate rechargeable battery:

- 1 If the SolarGate is not already opened, first open it as instructed on page 55.
- 2 Loosen the six screws that secure that battery bracket; remove the bracket
- 3 Using a small sharp object, such as a screwdriver, press into each of both slots of the battery connector to retract the battery pack wires. Isolate each battery wire.
- 4 Remove the battery and place the new battery.
- 5 Press the battery wires into the terminal clamp as indicated in the terminal assignment overview below.

BATTERY CONNECTOR

Terminal	Battery wire
+ (plus)	Red
- (minus)	Black

Table 48 Placement of the battery pack

- 6 Secure the battery with its bracket by fastening its six mounting screws.
- 7 Close the SolarGate when all installation and configuration actions have been completed.

QUICK-STEP INSTRUCTIONS

- 1 After opening the SolarGate (see page 55), disconnect the battery wires



- 2 Loosen the battery bracket screws and remove the battery bracket



- 3 Lift the battery from the SolarGate



- 4 Place the new battery, install its bracket and re-connect the battery wires



QUICK-STEP INSTRUCTIONS

- 1 Open the fuse holder using a flat screwdriver



- 2 Remove the fuse holder cap from the enclosure



- 3 Place the existing or replacement fuse into the holder cap



- 4 Close the fuse holder with a flat screwdriver



REMOVING OR REPLACING THE SOLARGATE DEVICE FUSE

For safety purposes, the SolarGate is equipped with an externally accessible fuse, that can also be used to remove the power from the device. During the device's operational lifetime, the fuse may need to be replaced.



WARNING A blown fuse is generally an indication of device malfunction. Although a replacement fuse can safely be installed without hazard, it is recommended to inspect the electronics for any visible damages or traces of damages prior to exchanging a blown fuse. Should a replacement fuse immediately blow again, contact your LegioBox sales representative for further advice.



WARNING Only use fuses that are approved by AVIC. Replacement fuses may be ordered as spare part; for the ordering information, please refer to Chapter 10: "LegioBox Accessories and Spare Parts" on page 84. Usage of non-approved batteries voids the product warranty.



CAUTION The fuse holder must be properly closed according to the instructions below to maintain the specified ingress protection level. Failure to properly close the fuse holder may lead to irreparable damage of the electronics and/or the device enclosure.



CAUTION Please dispose of a removed fuse in an environmentally responsible manner.

To remove the external fuse of the SolarGate, please proceed as follows:

- 1 Using a flat screwdriver, unscrew the top of the fuse holder cap until it releases and slightly pops out.
- 2 Pull the fuse cap from its holder in the enclosure and remove the fuse from the cap; verify that the fuse holder cap is clean.
- 3 Place the non-blown existing or replacement fuse into the holder cap and push the cap back into the fuse holder in the SolarGate enclosure.
- 4 Using a flat screwdriver, gently push the fuse holder cap into its holder, and fasten it to close the holder.
- 5 The SolarGate will attempt to contact the Avision platform. Once the communication has been established and the SolarGate is operational, this can be seen in Avision.

CLOSING THE SOLARGATE DEVICE

To close the SolarGate device, please follow the instructions below.



WARNING Great care must be observed during closing of the device to avoid damage to the enclosure and/or the electronics. Should damage occur during device handling, remove power and batteries from the device and contact your LegioBox sales representative for further advice.



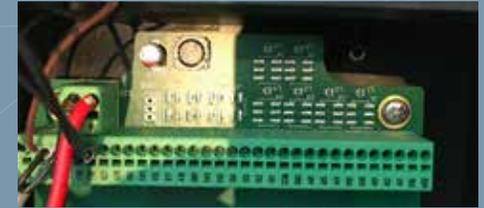
CAUTION The device must be properly closed according to the instructions below to maintain the specified ingress protection level. Failure to properly close the device may lead to irreparable damage of the electronics and/or the device enclosure.

Please proceed as follows to close the SolarGate device:

- 1 Remove the fuse of the SolarGate device from its holder to remove the power supply voltage from its electronics.
- 2 Place the SolarGate housing onto a stable surface with the side of the solar panel facing downwards.
- 3 Make sure the SolarGate battery and solar panel are connected to the appropriate terminals, and the battery is properly secured by its bracket.
- 4 Make sure the sealing ring is properly placed over the screw inserts in the SolarGate housing and the electronics compartment.
- 5 Place the SolarGate metal backpanel onto the device housing, while verifying that none of the cables are caught between the enclosure and backpanel.
- 6 Using a Phillips screwdriver, fasten the twenty mounting screws in the bottom enclosure part until they are firmly secured.
- 7 Using a Phillips screwdriver, place the backlid onto the SolarGate and fasten the four screws in the side of the device enclosure.
- 8 Place the SolarGate back in its operating location, connect any remaining equipment cables, and apply the device power by putting the fuse back in its holder.

QUICK-STEP INSTRUCTIONS

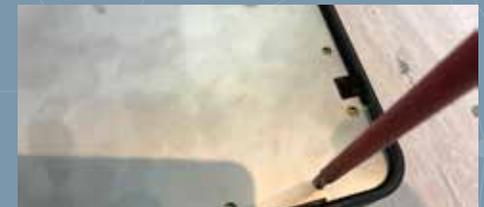
- 1 After removing the fuse, verify the internal cabling and seals



- 2 Make sure the battery bracket is installed



- 3 Place the backpanel onto the housing, and fasten all 20 screws



- 4 Place the backlid and fasten the 4 screws on the side; place the fuse back in its holder



SolarGate Visual Indicator Patterns

The illumination patterns of the LegioBox SolarGate are shown in Table 49; in low-power mode, the LEDs will only be activated for approximately 15 seconds after briefly pressing SW1.

LED NR	FUNCTION	ILLUMINATION PATTERN	STATUS
A	Power/communication		Power ON & communication OK
			Communicating with Avision
			Communication error
B	Cellular signal quality		Signal quality: EXCELLENT
			Signal quality: GOOD
			Signal quality: AVERAGE
			Signal quality: POOR
C	Wise RF communication		Wise RF communication ACTIVE
			Wise RF communication INACTIVE
1 - 6	Power-up status (upon continuously pressing SW1)		Wake-up (release during first 15 seconds)
			Warm start (release after 15, and no later than 60 seconds)
			Cold start (release after 60 seconds)
1 - 6	Analog sensor status		Interface not configured in Avision
			Sensor error LOW
			Sensor signal level below LOW-LOW
			Sensor signal level between LOW-LOW and LOW
			Sensor signal level between LOW and HIGH
			Sensor signal level between HIGH and HIGH-HIGH
			Sensor signal level above HIGH-HIGH
			Sensor error HIGH

Table 49 Visual Indicator Patterns of the LegioBox SolarGate

SOLARGATE CONNECTOR SCHEMES

Depending on the product version, your LegioBox SolarGate IoT device will have a combination of interface functions, as summarized in the table below.

LEGIOBOX CONNECTOR SCHEMES (M12 FEMALE CONNECTOR)

Pin	AD1: Analog/digital	AD2: Analog/digital
1	Analog 1 (*)	Analog 4 (*)
2	Analog 2 (*)	Analog 5 (*)
3	Analog 3 (*)	Analog 6 (*)
4	Signal ground	Signal ground
5	VSE sensor voltage	VSE sensor voltage

Table 50 SolarGate connector schemes

*)Analog 1/4: Pt-1000 (resistance); Analog 2/5: 4-20mA (current); Analog 3/6: 0-10VDC (voltage)

Standard wire colours in M12 connecting cable:

1 = Brown | 2 = White | 3 = Blue | 4 = Black | 5 = Gray

In the overview below, the connector assignment per SolarGate product version is provided.

LEGIOBOX SOLARGATE		CONNECTOR SCHEME ASSIGNMENT				
Codes	Description	1	2	3	4	Remarks
SG00170	Telemetry I	AD1	AD2	n.a.	n.a.	
SG00322	Telemetry II	AD1	AD2	n.a.	n.a.	
SG00173	Telemetry I	AD1	AD2	n.a.	n.a.	

Table 51 Connector assignment per SolarGate product version

The NanoGate connectors numbers, from left to right, are 1, 2, and 3



7.4 LEGIOBOX LIGHTGATE

For installation of the LegioBox LightGate, the instructions in this subsection must be followed. The information contained in Chapter 5: "LegioBox General Installation Precautions and Preparations" on page 36 is considered to be an integral part of the product-specific installation-related information in this subsection.

Product versions

Identify the version of your LegioBox IoT device on the product label of the LightGate; in the overview in Table 52, the available functionality of your LightGate is summarized. Please refer to Chapter 4: "LegioBox Product Family Technical Specifications" on page 19 for a detailed description of the product features.



WARNING Carefully read the information in Chapter 5: "LegioBox General Installation Precautions and Preparations" on page 36 before proceeding with the installation of your LegioBox as instructed in this subsection.



DANGER Before performing any of the actions described in this subsection, switch OFF the electrical power supply of the LegioBox IoT device, and remove the batteries. Performing actions on the device while it is powered on may lead to significant material damage, severe personal injury, or even the loss of life.

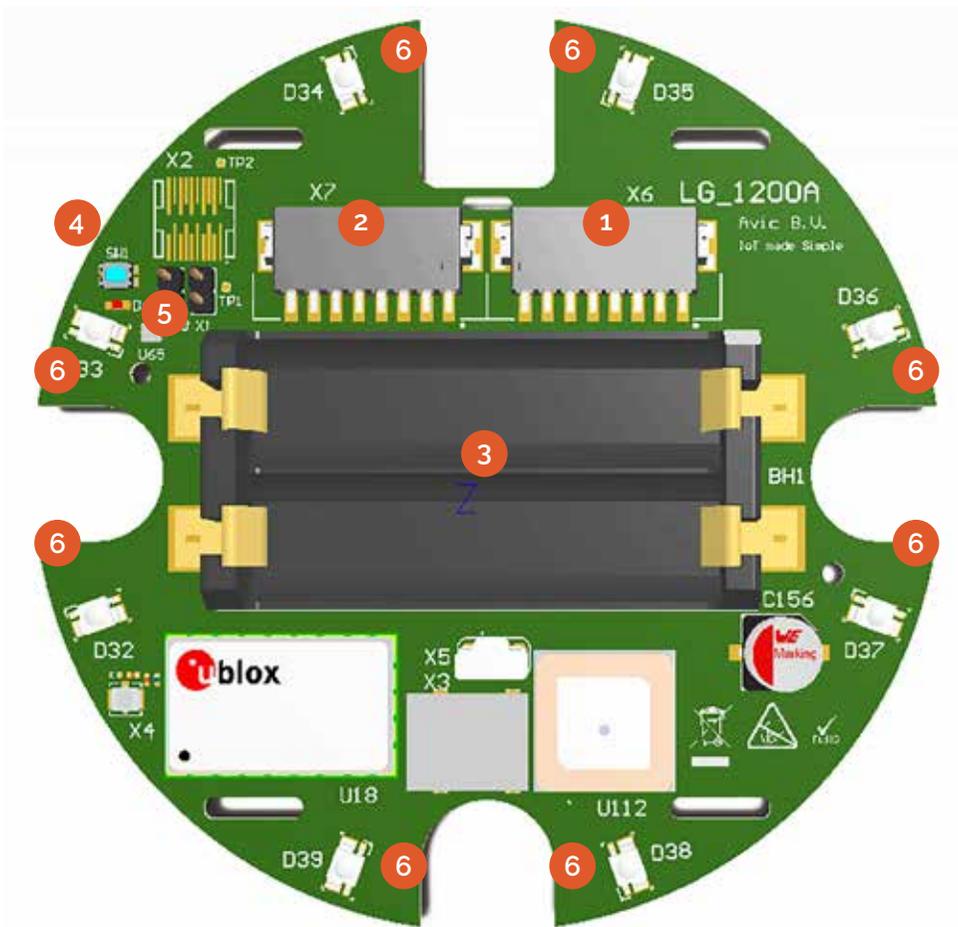
LEGIOBOX SOLARGATE		COMMUNICATION				POWER			SENSORS AND INTERFACES (*)									
Model	Description	Cat.M1/NB-IoT/2G	GPRS/2G	RS232	RS485	24VAC/24VDC	Primary battery	UPS	0-10VDC	Pt-1000	4-20mA	Digital-input	Relay	Rel. humidity	Barometer	Temperature	Accelerometer	GNSS
LG00311	Telemetry Do M12	-	●	-	-	●	-	●	1	-	1	3	●	●	●	●	●	-
LG00335	Telemetry Temp M12	-	●	-	-	●	-	●	1	1	1	3	-	●	●	●	●	-
LG00331	Telemetry Temp M12	●	-	-	-	●	-	●	1	1	1	3	-	●	●	●	●	●
LG00332	Telemetry Do M12	●	-	-	-	●	-	●	1	-	1	3	●	●	●	●	●	●
LG00333	Telemetry 485 M12	●	-	-	●	●	-	●	1	-	1	3	-	●	●	●	●	●
LG00336	Telemetry Cable	●	-	-	●	●	-	●	1	1	1	3	●	●	●	●	●	●
LG00337	Telemetry Gland	●	-	-	●	●	-	●	1	1	1	3	●	●	●	●	●	●

Table 52 Product versions

* The number of interfaces indicates the maximum available. The LightGate has 3 analog inputs, with varying supported interface types.

LEGIOSBOX LIGHTGATE OVERVIEW

The electronics of the LightGate with its main functions are shown below.



- | | | |
|---------------------------------------|------------------------|---------------------|
| 1 Power and digital signals connector | 3 Battery holder | 6 Alarm signal LEDs |
| 2 Analog signal interface connector | 4 Wake-up button (SW1) | |
| | 5 Communication LED | |

OPENING THE LIGHTGATE

- 1 Remove the connector cable



- 2 Place the LightGate with the red cover facing downwards



- 3 Remove the seal and completely loosen the four mounting screws



- 4 Remove the enclosure base



QUICK-STEP INSTRUCTIONS

- 1 Open the LightGate, following instructions on page 64; remove the battery clip



- 2 If batteries are already present, remove them by lifting them at one end



- 3 Place the batteries in their holder, against the minus contact



- 4 Press each battery gently into its position in the holder



PLACING OR REPLACING THE BATTERIES

As a backup supply voltage during power outages, the LightGate is equipped with two AA-cell batteries that will automatically be recharged when the mains supply voltage is active. The LightGate batteries that are included with the product contents need to be placed during initial installation. During the device's operational lifetime, the batteries may need to be replaced.



DANGER Maltreatment of batteries, in particular when their contacts short-circuit, mixing battery chemistries or types, may lead to their overheating and even explosion, possibly resulting in material damage, severe personal injury, and even the loss of life, for which AVIC cannot be held responsible.



WARNING Only use batteries that are approved by AVIC. Replacement batteries may be ordered as spare part; for the ordering information, please refer to Chapter 10: "LegioBox Accessories and Spare Parts" on page 84. Usage of non-approved batteries voids the product warranty.



CAUTION The use of tools is not required to place or remove the battery, and can be done with finger actions. Since metal tools may inadvertently lead to short-circuiting of the battery's contacts, the use of tools when handling batteries is strongly discouraged.



CAUTION Please dispose of a removed battery in an environmentally responsible manner.

Please proceed as follows to place or replace the LightGate rechargeable battery:

- 1 Make sure the LightGate main power supply is switched OFF or is disconnected before proceeding.
- 2 If the LightGate is not already opened, first remove the cover lid. Using a small flat screwdriver, remove the clip that secures the batteries in their holder
- 3 If batteries are present, lift each battery from its holder at one end using a finger. Once lifted, the battery can easily be removed entirely from its holder.
- 4 Carefully observing the correct polarity, place each battery in its holder, by aligning its minus pole with the appropriate side of the holder.
- 5 Using a finger, gently press the battery down into its holder to establish the connection between the contacts of the holder and the battery.
- 6 Close the LightGate when all installation and configuration actions have been completed.

CLOSING THE LIGHTGATE DEVICES

To close the LightGate device, please follow the instructions below.



WARNING Great care must be observed during closing of the device to avoid damage to the enclosure and/or the electronics. Should damage occur during device handling, remove power and batteries from the device and contact your LegioBox sales representative for further advice.



CAUTION The device must be properly closed according to the instructions below to maintain the specified ingress protection level. Failure to properly close the device may lead to irreparable damage of the electronics and/or the device enclosure.

Please proceed as follows to close the LightGate device:

- 1 Make sure the LightGate main power supply is switched OFF or is disconnected before proceeding (if applicable).
- 2 Place the LightGate red transparent enclosure cover on a stable surface with the open side facing upwards.
- 3 Make sure the sealing ring is properly placed in the rim of the LightGate red transparent enclosure cover.
- 4 Place the enclosure base with the electronics facing downwards onto the red transparent enclosure cover, while aligning the screw holes of both enclosure parts.
- 5 Using a Phillips screwdriver, fasten the four mounting screws in the bottom enclosure part until they are firmly secured.
- 6 Place the LightGate back in its operating location, connect any remaining equipment cables, and apply the device power.

QUICK-STEP INSTRUCTIONS

- 1 Position the LightGate cover with the opening facing upwards



- 2 Place the device base onto the cover with the electronics facing downwards



- 3 Align screw holes in the device base with the cover



- 4 Firmly fasten the screws using a Phillips screwdriver



LightGate Visual Indicator Patterns

The illumination patterns of the LegioBox LightGate are shown in table 53; in low-power mode, the LEDs will only be activated for approximately 15 seconds after briefly pressing SW1

LED NR	FUNCTION	ILLUMINATION PATTERN	STATUS
A	Power/communication		Power ON
			Communicating with Avision
			Communication error
			Communication OK

Table 53 Visual Indicator Patterns of the LegioBox LightGate

LIGHTGATE CONNECTOR SCHEMES

Depending on the product version, your LegioBox LightGate IoT device will have a combination of interface functions as summarized in the table below, or a fixed cable / open connector assignment as described on the next page.

LEGIOWBOX CONNECTOR SCHEMES (M12 FEMALE CONNECTOR)				
Pin	Wire colour	LG1	LG2	LG3
1	White	AC live/DC voltage	AC live/DC voltage	AC live/DC voltage
2	Brown	AC neutral/DC ground	AC neutral/DC ground	AC neutral/DC ground
3	Green	Digital input ground	Digital input ground	Digital signal ground
4	Yellow	Analog signal ground	Analog signal ground	Analog signal ground
5	Gray	Digital 1 signal	Digital 1 signal	Digital 1 signal
6	Pink	Digital 2 signal	Digital 2 signal	Digital 2 signal
7	Blue	Digital 3 signal	Digital 3 signal	Digital 3 signal
8	Red	-	Digital output signal	Serial RXD/RS485-B
9	Orange	VSE sensor voltage	VSE sensor voltage	VSE sensor voltage
10	Light-green	Analog Pt1000 signal	Digital output ground	Serial TXD/RS485-A
11	Black	Analog 4-20 mA signal	Analog 4-20 mA signal	Analog 4-20 mA signal
12	Violet	Analog 0-10VDC signal	Analog 0-10VDC signal	Analog 0-10VDC signal

Table 54 LegioBox connector schemes

COLOUR SCHEME FOR THE LG4 (16 CONDUCTOR CABLE) PRODUCT:

Pin	Wire colour	Function
1	White	AC live/DC voltage
2	Brown	AC live/DC voltage
3	Gray	Digital 1 signal
4	Pink	Digital 2 signal
5	Blue	Digital 3 signal
6	Green	Digital input ground
7	Red	Digital output signal
8	Green/Brown	Digital output ground
9	White/Green	Analog Pt1000 signal
10	Black	Analog 4-20 mA signal
11	Violet	Analog 0-10VDC signal
12	Yellow	Analog signal ground
13	Yellow/Brown	VSE sensor voltage
14	Red/Blue	Digital signal ground
15	Pink/Gray	Serial TXD/RS485-A
16	Yellow/White	Serial RXD/RS485-B

Table 55 Colour scheme for the LG4





CONNECTOR ASSIGNMENT IN THE LG5 (PUSH-IN TERMINALS) PRODUCT:

Connector	Pin number	Function
Power and digital signals connector (1), entries numbered from right to left	1	AC live/DC voltage
	2	AC live/DC voltage
	3	Digital 1 signal
	4	Digital 2 signal
	5	Digital 3 signal
	6	Digital input ground
	7	Digital output signal
	8	Digital output ground
Analog signal interface connector (2), entries numbered from right to left	1	Analog Pt1000 signal
	2	Analog 4-20 mA signal
	3	Analog 0-10VDC signal
	4	Analog signal ground
	5	VSE sensor voltage
	6	Digital signal ground
	7	Serial TXD/RS485-A
	8	Serial RXD/RS485-B

Table 56 Connector assignment in the LG5

In the overview below, the connector assignment per LightGate product version is provided.

LEGIOWOX LIGHTGATE		CONNECTOR SCHEME ASSIGNMENT	
Codes	Description	Version	Remarks
LG00335, LG00331	Telemetry M12	LG1	No serial, No DO
LG00311, LG00332	Telemetry M12	LG2	No serial, No Pt1000
LG00333	Telemetry M12	LG3	No Pt1000
LG00336	2G/4G Telemetry	LG4	factory-installed 16 conductor cable with cable gland
LG00337	2G/4G Telemetry	LG5	Miniature push-in terminals, cable gland only

Table 57 Connector assignment per LightGate product version



WARNING Carefully read the information in Chapter 5: "LegioBox General Installation Precautions and Preparations" on page 36 before proceeding with the installation of your LegioBox as instructed in this subsection.



DANGER Before performing any of the actions described in this subsection, switch OFF the electrical power supply of the LegioBox IoT device, and remove the batteries. Performing actions on the device while it is powered on may lead to significant material damage, severe personal injury, or even the loss of life..

LEGIOWOX MINIGATE		COMMUNICATION					POWER	SENSORS AND INTERFACES (*)										
Model	Application area	Cat.M1/NB-IoT/2G	GPRS/2G	RS232	RS485	SDI-12	Primary battery	Sensor supply (V)	0-5VDC	0-10VDC	Pt-1000	4-20mA	Digital-input	Relay output	Rel. humidity	Barometer/temp.	GNSS receiver	Accelerometer (2)
MG00270	Telemetry SDI12	●	-	-	-	●	●	14	-	3	3	3	2	1	●	●	-	-
MG00304	Telemetry	●	-	-	-	-	●	14	-	3	3	3	2	1	●	●	-	-
MG00318	Telemetry 5V sensors	●	-	-	-	-	●	5	3	●	3	3	2	1	●	●	-	-
MG00306	Telemetry GNSS	●	-	-	-	-	●	14	-	3	3	3	2	1	●	●	●	-
MG00303	Telemetry	-	●	-	-	-	●	14	-	3	3	3	2	1	●	●	-	-
MG00317	Telemetry 5V sensors	-	●	-	-	-	●	14	-	3	3	3	2	1	●	●	-	-

Table 58 Product versions

* The number of interfaces indicates the maximum available. The MiniGate has 3 configurable analog inputs, with varying supported interface types.

7.5 LEGIOBOX MINIGATE

For installation of the LegioBox MiniGate, the instructions in this subsections must be followed. The information contained in Chapter 5: "LegioBox General Installation Precautions and Preparations" on page 36 is considered to be an integral part of the product-specific installation-related information in this subsection.

Product versions

Identify the version of your LegioBox IoT device on the product label of the MiniGate; in the overview in Table 58, the available functionality of your MiniGate is summarized. Please refer to Chapter 4: "LegioBox Product Family Technical Specifications" on page 19 for a detailed description of the product features.

OPENING THE MINIGATE

- 1 Place the MiniGate on a stable surface with the lid facing upwards



- 2 Completely loosen the four screws in the cover lid

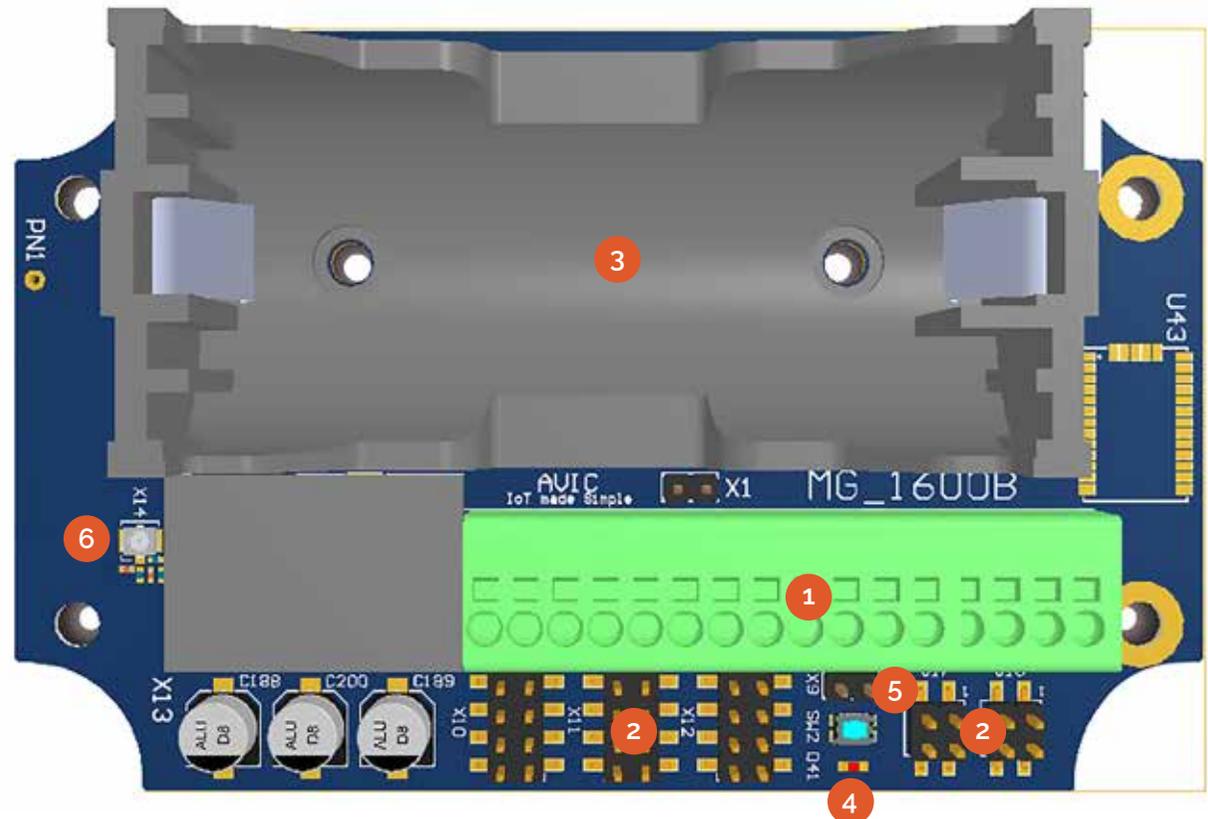


- 3 Place the batteries in their holder, against the minus contact



LEGIOBOX MINIGATE OVERVIEW

The electronics of the MiniGate with its main functions are shown below.



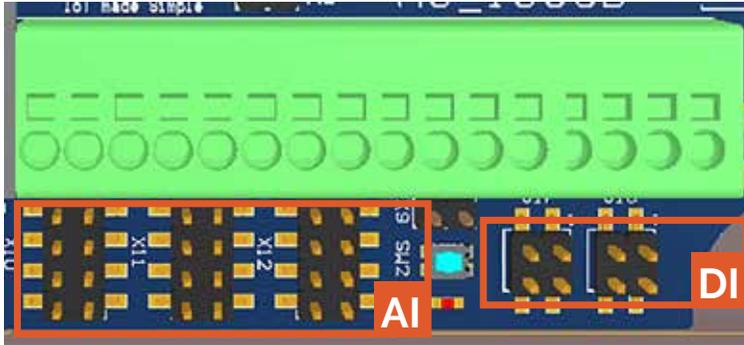
1 Interface connectors
2 Configuration jumper blocks

3 Battery holder
4 Communication LED

5 User button (SW1)
6 Antenna connector

CONFIGURING THE MINIGATE SIGNAL INTERFACES

The signal interfaces of the MiniGate are located at the bottom side of the device as a series of terminal clamps. For each interface, a jumper block is provided that allows configuration of the respective interface type, as shown below. The AI section, with 8-pin jumper blocks, contains the analog interfaces, while the DI section contains the digital inputs, with 4-pin jumper blocks.



The overview below summarizes the available functions and configuration settings of each analog interface and digital input. To perform the configuration, place the jumpers as indicated for each interface.

	ANALOG SIGNAL INTERFACES						DIGITAL INPUTS				
	Interface	Jumpers	Pt-1000	4-20mA	0-10V	0-2.5V	Input	Jumpers	SW OC (1)	V-LI (2)	V-HI (3)
FUNCTIONS	1	J1	•	•	•	•	1	J4	•	•	•
	2	J2	•	•	•	•	2	J5	•	•	•
	3	J3	•	•	•	•					
CONFIGURATION	Place the jumper on the pins as indicated by the orange rectangle.						Place the jumper on the pins as indicated by the orange rectangle.				

Table 59 Functions and configuration settings

1 SW: potential-free switch; OC: open-collector. 2 Voltage-driven, low-impedance. 3 Voltage-driven, high-impedance.

QUICK-STEP INSTRUCTIONS

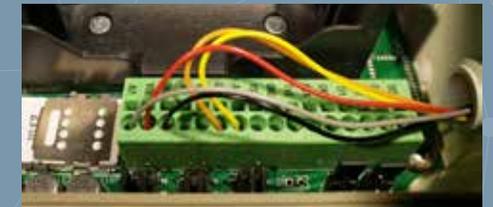
- 1 Open the MiniGate, following the instructions on page 71.



- 2 Set the interface configuration jumpers, see overview on this page.



- 3 Connect external equipment, following instructions on page 73



- 4 Close the MiniGate when ready



QUICK-STEP INSTRUCTIONS

- 1 Loosen the interface cable glands



- 2 Feed the signal cables into the enclosure through the glands



- 3 Press the signal wires into the terminal clamps (see overview)



- 4 Fasten the interface cable glands



CONNECTING EXTERNAL EQUIPMENT

For the wired connection of external equipment, such as sensors or devices communicating through serial data protocols, the MiniGate provides clamp terminals that are located inside the enclosure.



NOTICE It is strongly recommended to configure the analog interfaces and digital inputs, as described on page 72, before connecting any equipment.

Please proceed as follows to connect equipment to the MiniGate:

- 1 If the MiniGate is not already opened, first remove the cover lid.
- 2 Remove the battery from its holder.
- 3 Loosen the cable glands of all entries through which the equipment wires will be fed.
- 4 If equipment is already connected to a certain interface, detach the wires of said equipment; the wires are released when a sharp object such as a screwdriver is pressed into the small slot at the top of the respective terminal clamp
- 5 Press the signal wire into the terminal clamp as indicated in the terminal assignment overview below. Where an 'n' is used as suffix in a terminal name, this characters must be replace by the the number of the respective interface (e.g. AI2 for analog interface nr. 2). Please also pay attention to the notices.

ANALOG SIGNAL INTERFACES					DIGITAL INPUTS			SERIAL PORT			
terminal	Pt-1000	4-20mA	0-10V	0-2.5V	terminal	OC SW (1)	Voltage	Terminal	RS232 (2)	RS485	SDI12
AIn	Wire-1	Signal	Signal	Signal	DIn	Signal	DIn	TXB	TXD	B	+12V
GND	Wire-2	-	Ground	Ground	GND	Ground	Ground	RXA	RXD	A	Data
VSE	-	Supply	Supply	Supply	COM			GND	GND	-	-

Table 60 Connection of external equipment to the MiniGate

1 SW: potential-free switch; OC: open-collector. 2 For a UART serial port, the same terminal assignments apply.



NOTICE For a connection of a switch to a digital input, the way the wires are connected is irrelevant. For open-collector signals, the terminal assignment must be strictly observed.



NOTICE The COM terminal is a shared voltage output that can be used to operate a digital input in low-impedance voltage mode without the need of an external voltage source.

- 6 Fasten the cable glands securely, place the battery back into its holder and close the MiniGate device when all configuration/installation actions are completed.

PLACING OR REPLACING THE BATTERY

As power source, the MiniGate is equipped with one primary D-cell battery. The MiniGate battery that is included with the product contents needs to be placed during initial installation. During the device's operational lifetime, the battery may need to be replaced.



DANGER *Maltreatment of batteries, in particular when their contacts short-circuit, mixing battery chemistries or types, may lead to their overheating and even explosion, possibly resulting in material damage, severe personal injury, and even the loss of life, for which AVIC cannot be held responsible.*



WARNING *Only use batteries that are approved by AVIC. Replacement batteries may be ordered as spare part; for the ordering information, please refer to Chapter 10: "LegioBox Accessories and Spare Parts" on page 84. Usage of non-approved batteries voids the product warranty.*



CAUTION *The use of tools is not required to place or remove the battery, and can be done with finger actions. Since metal tools may inadvertently lead to short-circuiting of the battery's contacts, the use of tools when handling batteries is strongly discouraged.*



CAUTION *Please dispose of a removed battery in an environmentally responsible manner.*

Please proceed as follows to place or replace the MiniGate battery:

- 1 If the MiniGate is not already opened, first remove the cover lid.
- 2 If a battery is present, lift it from its holder at the bottom using a finger. Once lifted, the battery can easily be removed entirely from its holder.
- 3 Carefully observing the correct polarity, place the battery in its holder, by aligning its minus pole with the appropriate side of the holder.
- 4 Using a finger, gently press the battery down into its holder to establish the connection between the contacts of the holder and the battery.
- 5 Close the MiniGate when all installation and configuration actions have been completed.

QUICK-STEP INSTRUCTIONS

- 1 Open the MiniGate and (if present) remove the used battery by pulling the tie-wrap



- 2 Make sure to re-fit the tie-wrap for future use



- 3 Place the new battery in its holder, observe polarity marks!



- 4 Press the battery firmly into its position in the holder



QUICK-STEP INSTRUCTIONS

- 1 Inspect the proper connection of all equipment wires



- 2 Inspect the sealing for dirt and/or damages



- 3 Place the lid on the enclosure base



- 4 Securely fasten the four screws



CLOSING THE MINIGATE DEVICE

To close the MiniGate device, please follow the instructions below.



WARNING Great care must be observed during closing of the device to avoid damage to the enclosure and/or the electronics. Should damage occur during device handling, remove power and batteries from the device and contact your LegioBox sales representative for further advice.



CAUTION The device must be properly closed according to the instructions below to maintain the specified ingress protection level. Failure to properly close the device may lead to irreparable damage of the electronics and/or the device enclosure.

Please proceed as follows to close the MiniGate device:

- 1 Make sure the MiniGate battery is correctly installed. Verify that all equipment cables are firmly inserted into their respective terminal clamps.
- 2 Place the MiniGate enclosure base on a stable surface with the device opening facing upwards.
- 3 Inspect the sealing ring in the device cover for any dirt or damages, and clean or repair as necessary.
- 4 Place the cover of the device enclosure onto the base, and align the screws in the lid with the corresponding screw holes in the enclosure base.
- 5 Using a flat screwdriver, fasten the four mounting screws in the frontpanel until they are firmly secured.
- 6 Place the MiniGate back in its operating location.

MINIGATE VISUAL INDICATOR PATTERNS

The illumination patterns of the LegioBox MiniGate are shown below; in low-power mode, the LEDs will only be activated for approximately 15 seconds after briefly pressing SW1.

LED NR	FUNCTION	ILLUMINATION PATTERN	STATUS
A	Power/communication		Power ON & communication OK
			Communicating with Avision
			Communication error

Table 61 Visual Indicator Patterns of the LegioBox MiniGate



WARNING Carefully read the information in Chapter 5: "LegioBox General Installation Precautions and Preparations" on page 36 before proceeding with the installation of your LegioBox as instructed in this subsection.



DANGER Before performing any of the actions described in this subsection, switch OFF the electrical power supply of the LegioBox IoT device, and remove the batteries. Performing actions on the device while it is powered on may lead to significant material damage, severe personal injury, or even the loss of life.

LEGIOWISE		COMMUNICATION				POWER	SENSORS AND INTERFACES (*)									
Model	Application area	WISE RF	RS232	RS485	SDI-12	Battery-powered	0-5VDC	0-10VDC	Pt-1000	4-20mA	Digital-input	Rel. humidity	Barometer	Temperature	Buzzer	Accelerometer
PW00181	RS232	●	●	-	-	●	-	-	-	-	2	-	-	●	-	-
PW00182	RS485	●	-	●	-	●	-	-	-	-	2	-	-	●	-	-
PW00183	Current (0-25mA)	●	-	-	-	●	-	-	-	2	-	-	-	●	-	-
PW00184	Voltage (0-10Volt)	●	-	-	-	●	-	2	-	-	-	-	-	●	-	-
PW00185	Temperature External	●	-	-	-	●	-	-	-	-	2	-	-	●	-	-
PW00186	Humidity autonomous	●	-	-	-	●	-	-	-	-	-	●	●	●	-	-
PW00187	Temperature Internal	●	-	-	-	●	-	-	-	-	-	-	-	●	-	-
PW00300	Voltage (0-5Volt)	●	-	-	-	●	2	-	-	-	-	-	-	●	-	-

Table 62 Product versions

* The number of interfaces indicates the maximum available. The MiniGate has 3 configurable analog inputs, with varying supported interface types.

7.6 LEGIOBOX PICOWISE

For installation of the LegioBox PicoWise, the instructions in this subsections must be followed. The information contained in Chapter 5: "LegioBox General Installation Precautions and Preparations" on page 36 is considered to be an integral part of the product-specific installation-related information in this subsection.

Product versions

Identify the version of your LegioBox IoT device on the product label of the PicoWise; in the overview in Table 62, the available functionality of your PicoWise is summarized. Please refer to Chapter 4: "LegioBox Product Family Technical Specifications" on page 19 for a detailed description of the product features.

OPENING THE PICOWISE

- 1 Position the PicoWise enclosure with the logo facing upwards



- 2 Leave at least one connected equipment cable attached



- 3 Completely loosen the two screws in the cover lid using a Phillips screwdriver

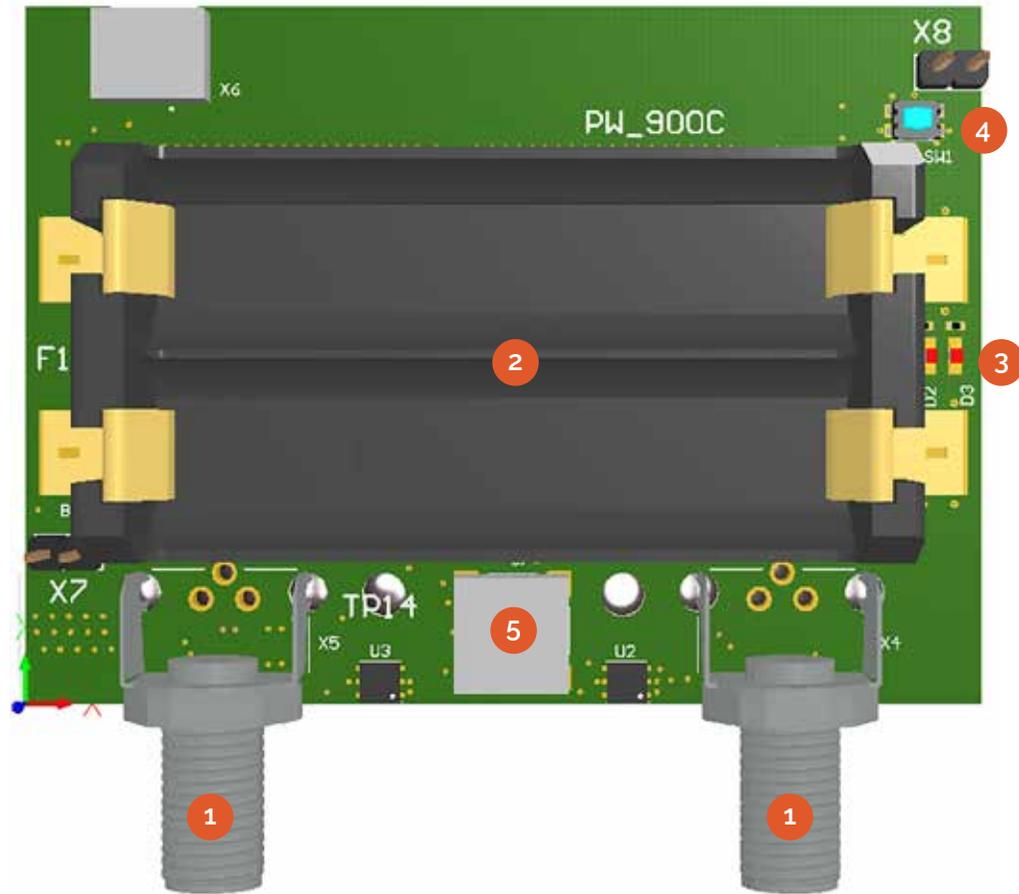


- 4 Slide the electronics from the enclosure by pulling a connector cable towards you



LEGIOBOX PICOWISE OVERVIEW

The electronics of the PicoWise with its main functions are shown below.



1 Interface connectors

2 Battery holder

3 Communication LEDs

4 Wake-up button (SW1)

5 Buzzer

PLACING OR REPLACING THE BATTERIES

As power source, the PicoWise is equipped with two primary AA-cell batteries. The PicoWise batteries that are included with the product contents need to be placed during initial installation. During the device's operational lifetime, the batteries may need to be replaced.



DANGER Maltreatment of batteries, in particular when their contacts short-circuit, mixing battery chemistries or types, may lead to their overheating and even explosion, possibly resulting in material damage, severe personal injury, and even the loss of life, for which AVIC cannot be held responsible.



WARNING Only use batteries that are approved by AVIC. Replacement batteries may be ordered as spare part; for the ordering information, please refer to Chapter 10: "LegioBox Accessories and Spare Parts" on page 84. Usage of non-approved batteries voids the product warranty.



CAUTION The use of tools is not required to place or remove the battery, and can be done with finger actions. Since metal tools may inadvertently lead to short-circuiting of the battery's contacts, the use of tools when handling batteries is strongly discouraged.



CAUTION Please dispose of a removed battery in an environmentally responsible manner.

Please proceed as follows to place or replace the PicoWise batteries:

- 1 If the PicoWise is not already opened, first remove the cover lid. For easier access to the batteries, remove the sealing ring.
- 2 If batteries are present, lift each battery from its holder at one end using a finger. Once lifted, the battery can easily be removed entirely from its holder.
- 3 Carefully observing the correct polarity, place each battery in its holder, by aligning its minus pole with the appropriate side of the holder.
- 4 Using a finger, gently press the battery down into its holder to establish the connection between the contacts of the holder and the battery.
- 5 Place the sealing ring pack and close the PicoWise when all installation and configuration actions have been completed.

QUICK-STEP INSTRUCTIONS

- 1 Open the PicoWise, following the instructions on page 77; remove the seal



- 2 If batteries are already present, remove them by lifting them at one end



- 3 Place the batteries in their holder, against the minus side



- 4 Press each battery firmly into its position in the holder



QUICK-STEP INSTRUCTIONS

- 1 Position the PicoWise enclosure with the logo facing upwards



- 2 Align the electronics with the enclosure with the battery holders facing down



- 3 Gently slide the electronics into the enclosure



- 4 Firmly fasten the screws using a Phillips screwdriver



CLOSING THE PICOWISE DEVICE

To close the PicoWise device, please follow the instructions below.



WARNING Great care must be observed during closing of the device to avoid damage to the enclosure and/or the electronics. Should damage occur during device handling, remove power and batteries from the device and contact your LegioBox sales representative for further advice.



CAUTION The device must be properly closed according to the instructions below to maintain the specified ingress protection level. Failure to properly close the device may lead to irreparable damage of the electronics and/or the device enclosure.

Please proceed as follows to close the PicoWise device:

- 1 Make sure the PicoWise main power supply is switched OFF or is disconnected before proceeding (if applicable).
- 2 Place the PicoWise on a stable surface with the LegioBox log facing upwards.
- 3 The electronics is most conveniently placed into the enclosure if at least one of the equipment connectors is attached to the receptacles.
- 4 Place the electronics in front of the enclosure opening with the battery holders facing downwards.
- 5 Gently slide the electronics into the enclosure until it is fully inside.
- 6 Using a Phillips screwdriver, fasten the two mounting screws in the frontpanel until they are firmly secured.
- 7 Place the PicoWise back in its operating location, connect any remaining equipment cables, and apply the device power.

LED NR	FUNCTION		ILLUMINATION PATTERN	STATUS
1-2	Power-up status (upon continuously pressing SW1)	LED1		Wake-up (release during first 15 seconds)
		LED2		
		LED1		Warm start (release after 15, and no later than 60 seconds)
		LED2		
		LED1		Cold start (release after 60 seconds)
		LED2		

Table 63 Visual Indicator Patterns of the LegioBox PicoWise

LED NR	FUNCTION		ILLUMINATION PATTERN	STATUS
1	Wise RF signal RSSI level	LED1		RSSI < -120 dBm
		LED2		-120 dBm <= RSSI < -115 dBm
		LED1		-115 dBm <= RSSI < -110 dBm
		LED2		-110 dBm <= RSSI < -105 dBm
		LED1		-105 dBm <= RSSI < -100 dBm
		LED2		-100 dBm <= RSSI < -95 dBm
		LED2		-95 dBm <= RSSI < -0 dBm

Table 64 Signal Strength Indicator (RSSI) of the LegioBox PicoWise

PicoWise Visual Indicator Patterns

The illumination patterns of the LegioBox PicoWise are shown in table 63.

When SW/1 is released within 15 seconds after pressing it, LED1 will display the Received Signal Strength Indicator (RSSI) level with various blink patterns as shown in table 64.

The PicoWise connector numbers, from left to right, are 1 and 2.



PICOWISE CONNECTOR SCHEMES

Depending on the product version, your LegioBox PicoWise IoT device will have a combination of interface functions, as summarized in the table below.

LEGIOWISE CONNECTOR SCHEMES (M8 MALE CONNECTOR)						
Pin	AD1-x (*): Digital/Pt-1000	AD2-x (*): 4-20mA	AD3-x (*): Digital/0-10VDC	AD4-x (*): Digital/0-5VDC	SER: Serial data	SUP: Serial data supply
1	Digital input 1 / 2	VSE sensor voltage	VSE sensor voltage	VSE sensor voltage	Serial RXD/RS485-A	VSE sensor voltage
3	Signal ground	Signal ground	Signal ground	Signal ground	Signal ground	Signal ground
4	Pt-1000 signal 1/2	4-20mA signal 1/2	0-10VDC signal 1/2	0-5VDC signal 1/2	Serial TXD/RS485-B	-

Table 65 Connector schemes

* The 'x' specifies which signal number is assigned to the connector, e.g. AD3-1 would indicate that digital input 1 and analog signal 1 are assigned to this connector.

Standard wire colours in M8 connecting cable:

1 = Brown | 3 = Blue | 4 = Black

In the overview below, the connector assignment per PicoWise product version is provided.

LEGIOWISE PICOWISE		CONNECTOR SCHEME ASSIGNMENT		
Codes	Description	1	2	Remarks
PW00181	RS232	SUP	SER	Serial data: RS232
PW00182	RS485	SUP	SER	Serial data: RS485
PW00183	Current (0-25mA)	AD2-1	AD2-2	
PW00184	Voltage (0-10Volt)	AD3-1	AD3-2	
PW00185	Temperature External	AD1-1	AD1-2	
PW00186	Humidity autonomous	n.a.	n.a.	
PW00187	Temperature Internal	n.a.	n.a.	
PW00300	Voltage (0-5Volt)	AD4-1	AD4-2	

Table 66 Connector assignment per PicoWise product version

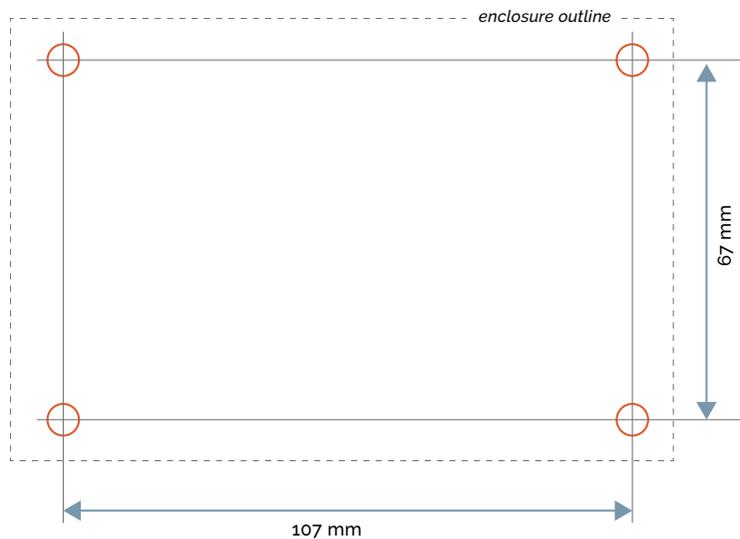
8.1 LEGIOBOX BASICGATE MOUNTING PATTERN

The mounting pattern for the LegioBox BasicGate (all versions) is depicted below



8.2 LEGIOBOX MINIGATE MOUNTING PATTERN

The mounting pattern for the LegioBox MiniGate (all versions) is depicted below.



8 MOUNTING PATTERNS

To ensure that a LegioBox IoT device operates reliably and safely in its environment, please observe the mounting instructions in this chapter.



CAUTION

Mounting position

Make sure to mount any LegioBox IoT device with the connections in a downwards position. This mounting direction offers the best possible protection for water ingress.



CAUTION

Cleaning

Units may be cleaned using a damp cloth only.



9 REGULATORY COMPLIANCE

The Avic IoT devices fulfill all relevant provisions of the RED directive 2014/53/EU, the EC EMC directive 2014/30/EU, the Low voltage directive 2014/35/EU and the EC RoHS directive 2011/65/EU. Detailed information can be found on our website www.avic-iot.nl/regulatory-compliance

10 LEGIOBOX ACCESSORIES AND SPARE PARTS

For the LegioBox IoT devices, a number of accessories and spare parts are available, for which you will find the ordering information in this chapter.

10.1 LEGIOBOX NANO GATE

The items listed in Table 67 below are available as accessory and/or spare part for the LegioBox NanoGate.

ORDERING CODE	DESCRIPTION	REMARKS
acc-00281	NanoGate primary batteries (set of 4)	Alkaline-Lithium; Low temperture
acc-00293	NanoGate rechargeable batteries (set of 4)	Lithium-Ion
acc-00336	NanoGate primary batteries (set of 4)	Lithium; high capacity

Table 67 NanoGate accessories and spare parts

10.2 LEGIOBOX BASICGATE

The items listed in Table 68 below are available as accessory and/or spare part for the LegioBox BasicGate.

ORDERING CODE	DESCRIPTION	REMARKS
acc-00341	M12 connector set for BasicGate	
acc-00030	BasicGate rechargeable battery	
acc-00338	BasicGate RS485 bias jumper kit	
acc-00220	BasicGate antenna	
acc-00339	BasicGate antenna cable	
acc-00340	BasicGate Gasket	

Table 68 BasicGate accessories and spare parts





10.3 LEGIOBOX SOLARGATE

The items listed in Table 69 below are available as accessory and/or spare part for the LegioBox SolarGate.

ORDERING CODE	DESCRIPTION	REMARKS
acc-00211	SolarGate battery	
acc-00301	SolarGate replacement fuse	

Table 69 SolarGate accessories and spare parts

10.4 LEGIOBOX LIGHTGATE

The items listed in Table 70 below are available as accessory and/or spare part for the LegioBox LightGate .

ORDERING CODE	DESCRIPTION	REMARKS
acc-00337	LightGate rechargeable batteries (set of 2)	

Table 70 LightGate accessories and spare parts

10.5 LEGIOBOX MINIGATE

The items listed in Table 71 below are available as accessory and/or spare part for the LegioBox MiniGate.

ORDERING CODE	DESCRIPTION	REMARKS
acc-00060	MiniGate primary battery	

Table 71 MiniGate accessories and spare parts

10.6 LEGIOBOX PICOWISE

The items listed in Table 72 below are available as accessory and/or spare part for the LegioBox PicoWise.

ORDERING CODE	DESCRIPTION	REMARKS
acc-00294	PicoWise primary batteries (set of 2)	Alkaline-Lithium; Low temperture

Table 72 PicoWise accessories and spare parts





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