Manual

> INSTALLING PRIVA COMPASS

CREATING
A CLIMATE
FOR GROWTH
PRIVA

Contact

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Contents

About this manual

This manual provides information on installing and maintaining the Compass system. The manual specifically focuses on the field equipment in a Compass system.

This manual is intended only for installers and service engineers, not for users.
A Compass Operator manual is available for users. User documentation must be available in the workplace.

The manual deals with the following topics:
- the components of Compass
- installing and connecting field equipment to the Compass cabinet
- specifications
- resolving errors

Related documents

Document	Article no.	Availability
insert sheet on connecting and suspending Compass	-	included in the box of the Compass cabinet
Compass Operator manual	-	as Help in the Compass Operator
Compass price list	-	download as a PDF via the Priva Support Portal: https://support.priva.nl (registered partners only)

Priva Blue ID C-Line documentation

Document	Article no.	Availability
Installing and commissioning Priva Blue ID C-Line manual	5001010	• download as PDF via the Priva Support Portal: https://support.priva.nl (registered partners only) • view in your browser via the *Manuals and other documentation* link in the Top Control installation menu
Communicating with Priva Blue ID C-Line manual	5001011	
Priva Blue ID C-Line connection examples	5001012	
datasheet Priva Blue ID C-Line system overview	5001135	
Priva Blue ID C-Line Quick Reference Card	5001013	
datasheets for the Priva Blue ID C-Line hardware	various	

Target groups and required competencies

Target group	Tasks and responsibilities	Training, knowledge and experience required
installers / service engineers	the system: • transport • position • install • commission and set up • test after initial commissioning and resolve any problems • operate • perform an annual check • take it out of operation and dispose of it at end of service life	• technical training in the field of electrical engineering and process engineering • experience with electrical installations for the horticulture industry • command of (technical) English

Explanation of symbols in this document

DANGER
Instruction to prevent physical injury or damage to the product, the installation or the environment.

CAUTION
Instruction to prevent problems with the product or the service.

INFORMATION
Additional information.

TIP
A tip or other useful information.

Safety

- Before starting to work with the product, read the entire manual so that you are familiar will all safety instructions and safety precautions.
- In addition, read any other manuals supplied with specific components.

Safety - general

- Use the system only for its intended purpose.
- Follow the instructions in this manual and the related manuals.
- Making alterations to the safeguards and safety icons on the equipment is prohibited.
- Both the installer/service engineer and the user must regularly check and maintain the equipment (the safeguards in particular) in accordance with the instructions in this manual. Keep the equipment clean and the surroundings tidy.
- Report malfunctions or damage to your installer immediately. Take the equipment out of operation and do not use it if a defect is found.
- Only use original spare parts for repairs (refer to the spare parts price list).
- After making repairs check the correct status and functioning of the equipment.
- If the user allows personnel to operate the equipment, he/she must adequately instruct this personnel. In particular this should cover the safety risks and safety instructions stated in this manual. He/she must also supervise correct compliance with the instructions.
- Display the safety icons that are applicable in the room where the equipment is set up.
- Position the cabinet in a space that meets the environmental requirements.
- Make sure the space and the cabinet are easily accessible. There must be enough space to open the cabinet for maintenance and installation. This is especially important if you need to switch off the system with the circuit breaker in the event of problems.
- Keep water out of the cabinet. Do not use a high pressure cleaner to clean the cabinet.
- Do not use aggressive cleaning agents, scouring sponges or abrasives for cleaning.
- Damage to Compass components may occur as a result of:
  - Incorrect transportation or storage.
  - Incorrect installation and assembly.
  - Incorrect environmental conditions.
  - Wearing, aging or metal fatigue.

Electrical safety

The unit is powered from the mains voltage. There is a potential hazard of electrocution or fire resulting from a short circuit. You must therefore adhere to the following safety instructions:

- Keep the housings of electrical components closed.
- Keep the electrical parts dry.
- Make sure the earthing is connected according to the principle "make contact first, break contact last". The earth wire must therefore be twice as long as the phase wire and neutral wire.
- Ensure that the unit is connected to its own fuse group with the correct fuses.

During installation, maintenance or while resolving faults it may be necessary to open the housing for the electrical components. In this case, adhere to the following safety instructions:

- Preferably, make the unit totally free of electricity by removing the plug from the socket outlet, switching off the circuit breaker or by removing fuses from the fuse group.
- If the unit cannot be made free of electricity then take extreme care. Use well-insulated tools and do not touch the ends of wires, connections and electrical components with your bare hands. Keep the surroundings dry and ensure that there is someone close by to keep an eye on you.
- Wear an earthed wrist strap when working in the cabinet. Otherwise the electronic components may be damaged due to static electricity.

Warranty

The warranty expires if the product is not installed, used and maintained in accordance with the instructions in the Priva manual. For more details refer to the general terms of delivery (Priva will supply these on request and refer to www.priva.com) and the specifically agreed terms of delivery.

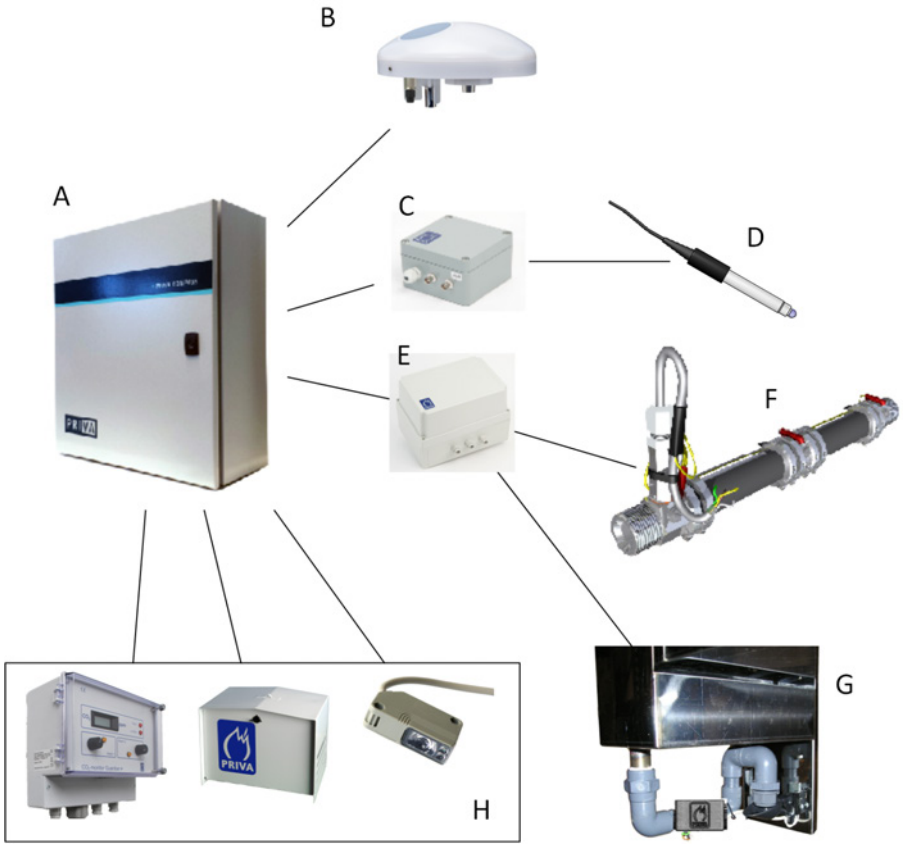
Functions and intended use

The function of the Compass system is to control, regulate and monitor equipment in the horticulture industry in order to maintain an optimum environment for the crop. Connected field equipment is controlled from the Compass cabinet. The field equipment consists of various sensors and other systems for the horticulture industry.

Compass system overview

A Compass system always consists of a Compass cabinet to which field equipment such as sensors can be connected. On account of to the many different possible combinations of field equipment, almost every Compass system will be different. Below there is an example of a comprehensive configuration.

The Priva Compass price list gives an overview of the sensors and systems that are supported.



A. Compass cabinet
B. Weather station
C. pH interface
D. pH sensor
E. EC-DSS interface
F. EC sensor
G. Drain sensor system
H. Other sensors

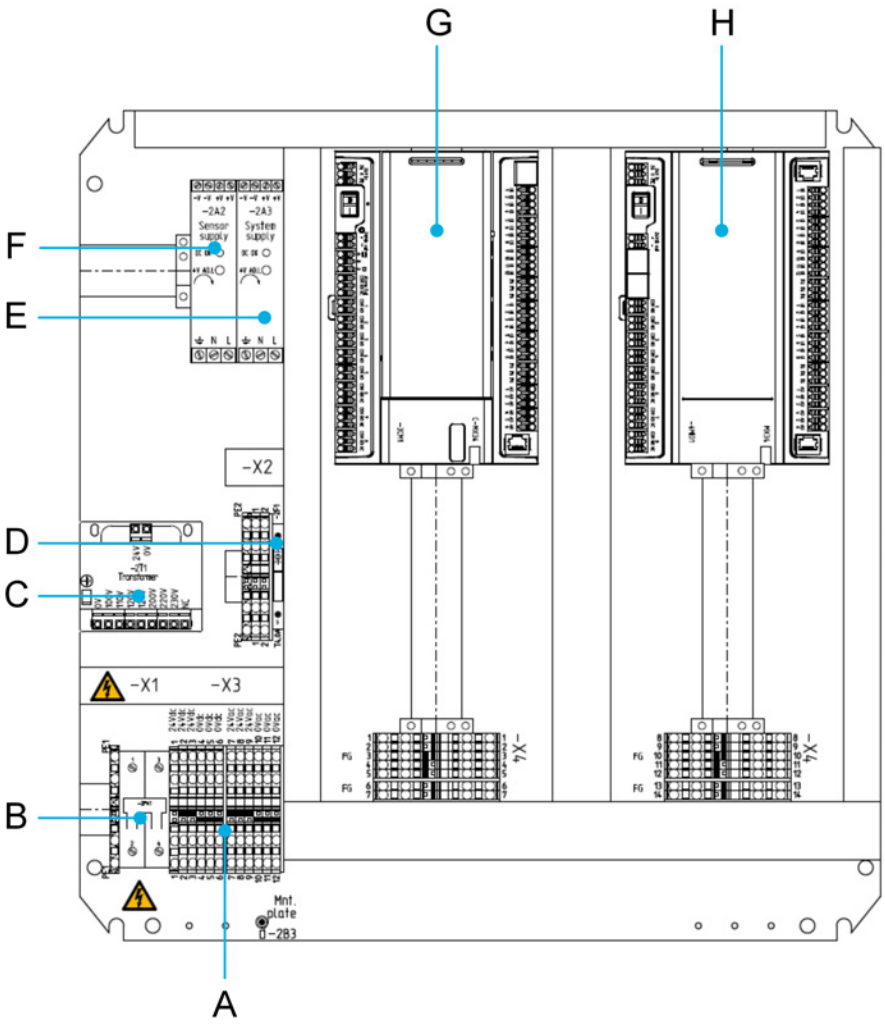
The Compass cabinet is the heart of the Compass system. The Priva Blue ID controller in the Compass cabinet controls the system and the sensors or actuators are connected to the inputs and outputs of the Priva Blue ID modules. Sensors are connected directly to the inputs and outputs of the modules or are connected via interfaces, such as the pH interface.

The components are supplied separately. An installer positions the separate components and connects them to each other.

Compass cabinet components

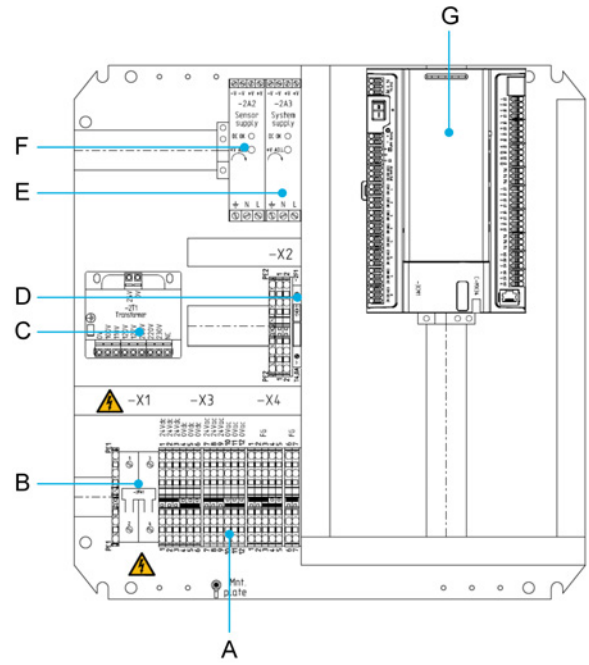
The Compass cabinet consists of the following main components:

- a controller for controlling the system
- modules with inputs and outputs for connecting the sensors or interfaces
- a gateway for configuring the system or controlling the system via a smartphone
- power supplies for the components in the cabinet and the connected sensors



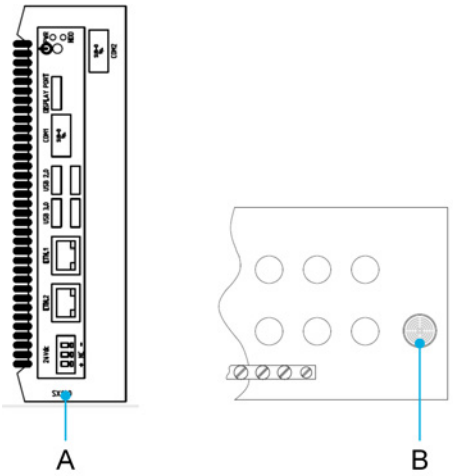
Compass 4S hardware configuration

A. 0 V and 24 V connections (both VAC and VDC)
B. circuit breaker
C. 24 VAC transformer
D. 24 VAC fuse
E. 24 VDC system power supply
F. 24 VDC power supply field equipment
G. DIN rail with controller and space for expansion modules
H. DIN rail with Mix I/O module and space for expansion modules



Compass 2S hardware configuration

A. 0 V and 24 V connections (both VAC and VDC)
B. circuit breaker
C. 24 VAC transformer
D. 24 VAC fuse
E. 24 VDC system power supply
F. 24 VDC power supply field equipment
G. DIN rail with controller and space for expansion modules



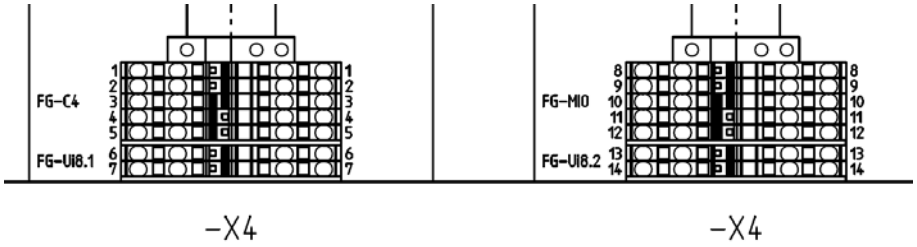
Door and underside of Compass 4S and Compass 2S

A. Priva Gateway (mounted on the door)
B. buzzer (on the bottom of the cabinet)

Compass FG terminals

The Compass cabinet has multiple sets of FG terminals. The FG terminals must not be used randomly. The FG terminals are specific to the different modules in the cabinet. Extension modules are delivered separately and must therefore be connected with the correct FG terminals after installation.

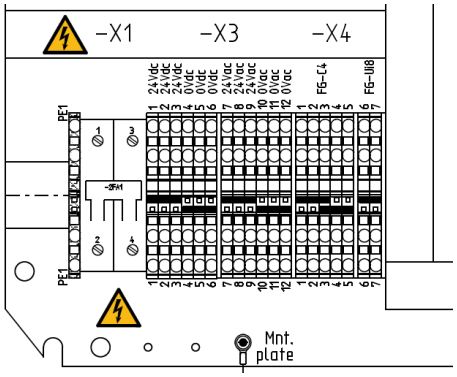
Compass 4S



FG terminals Compass 4S

FG terminals	For
X4.1 ... X4.5	C4 C-MX34 controller
X4.6 ... X4.7	UI8 extension module 1
X4.8 ... X4.12	MX34 Mix I/O module
X4.13 ... X4.14	UI8 extension module 2

Compass 2S



FG terminals Compass 2S

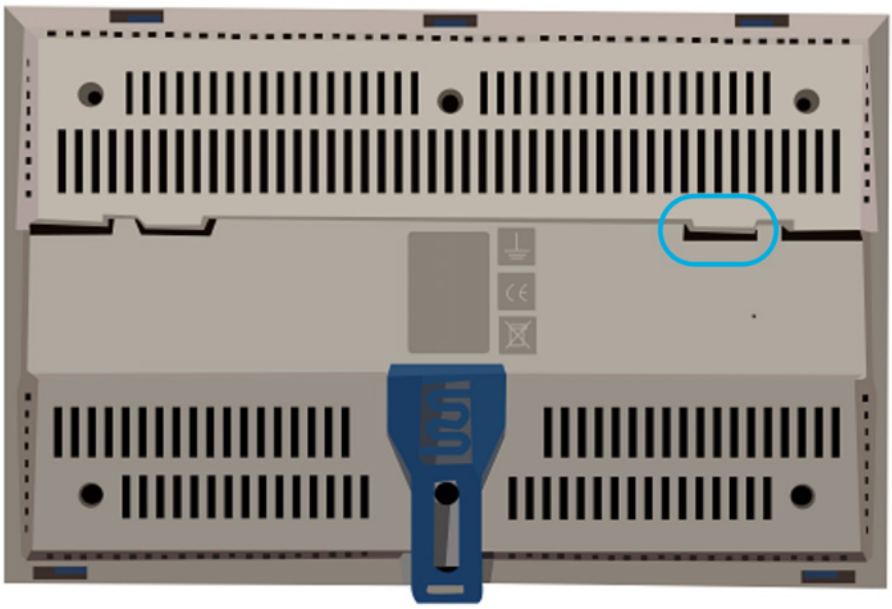
FG terminal	For
X4.1 ... X4.5	C4 C-MX34 controller
X4.6 ... X4.7	UI8 extension module 1

Priva Blue ID hardware

The Compass cabinet has a Priva Blue ID controller and, optionally, a Priva Blue ID Mix I/O module and other expansion modules. The controller and modules form part of the Priva Blue ID C-Line. These chapters provide information about the Priva Blue ID C-Line hardware.

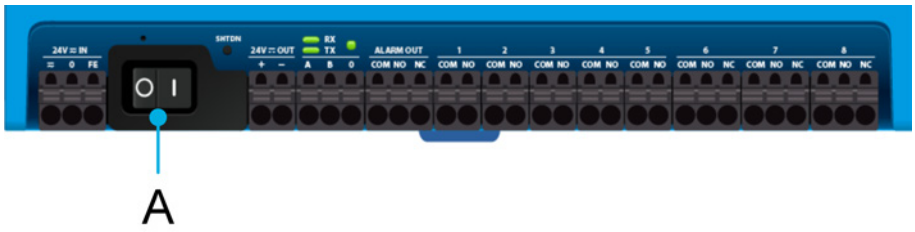
The Priva Blue ID C-Line has modules with and without manual operation and signalling. Compass only uses Priva Blue ID C-Line modules without manual operation and signalling.

Earth contact



The modules have a functional earth contact (A). It is not therefore a safety earth. The functional ground makes contact with the DIN rail when the hardware is installed. This guarantees the grounding of the hardware, provided that the DIN rail itself is also earthed.

Switching system power on and off



A. on/off button

You use the on/off button (A) to switch the system power on and off.

- switch off: place button (A) in position 0
- switch on: place button (A) in position 1

Do not switch expansion modules off by removing the I/O bus cable.

The expansion modules are powered via the I/O bus and do not have their own on-off button. If you switch a controller or Mix I/O module on or off, the connected expansion modules will automatically be switched on or off at the same time.

Connecting field equipment

- To install wiring in a terminal block, use a suitable screwdriver. See Screwdriver for terminal block (page 15).
- For connecting, use only wiring as specified in General specifications of Priva Blue ID C-Line controllers and modules (page 154).
- When using flexible wire, it is best to use crimp-on terminals.
- All terminal blocks are printed with an explanatory abbreviation; see the *Connections* section of the relevant module in the chapter Connecting hardware (page 14).
- For the field power, use the 24 VDC power supply for field equipment. Do not use the 24 VDC system power supply. This prevents any faults, such as a short circuit, in connected field equipment having an effect on the Priva Blue ID hardware.

The modules have a number of common FG connections which serve as a 'neutral signal' for the universal inputs, digital inputs and analogue outputs. The Priva Blue ID C-Line does not have any field power for powering field equipment. Field equipment must therefore be powered externally.

Do not use the 24 VDC system power supply to power field equipement. Use the 24 VDC power supply for field equipment.

1. Connect the field equipment to the desired inputs and outputs.
2. Connect the FG (Field Ground).
   The FG serves as a 'neutral signal' for the universal inputs, digital inputs and analogue outputs. Use the FG connection on the same module to which the input or output is connected.

   The cabinet has different FG terminals for different modules. Use the appropriate FG terminal for the module. See Compass FG terminals (page 11).

Connections - RS485

A	RS485-A
B	RS485-B
0	RS485-GND

Connecting hardware

Overview of a Priva Blue ID C-Line system

A Priva Blue ID C-Line system consists of one controller and one or more modules with I/O. A system may consist of the controller alone, since the controller is equipped with various inputs and outputs. If there is a need for more inputs and outputs, the system may be expanded with additional modules.

All modules are connected to each other via the I/O bus.

Connections

The hardware is equipped with the connections described in the table below. A picture of the connections is provided and other details are described later in this chapter.

Hardware	Connecting	Number
Priva Blue ID C-Line hardware		
C4 C-MX34 controller	Power supply voltage (24 VDC) I/O bus out RS485 port Ethernet port Shield (for Ethernet ports) Digital inputs Universal inputs Analogue outputs Relay outputs USB host USB device	1 1 1 4 1 12 8 6 8 1 1
C-Line MX34 module	Power supply voltage (24 VDC) I/O bus in and out Digital inputs Universal inputs Analogue outputs Relay outputs	1 2 12 8 6 8
C-Line UI8 module	I/O bus in and out Universal inputs	2 6
C-Line DOR6 module	I/O bus in and out Relay outputs	2 6

For UL916 / CSA C22.2 No. 205: use UL-listed or CSA-certified wiring and crimp-on terminals.

Connectors

To make connections, use the supplied connectors or the optionally available right-angled screw connectors. Right-angled screw connectors are supplied as a set for a module. The set contains the right-angled screw connectors that are needed for the connectors on the module concerned.

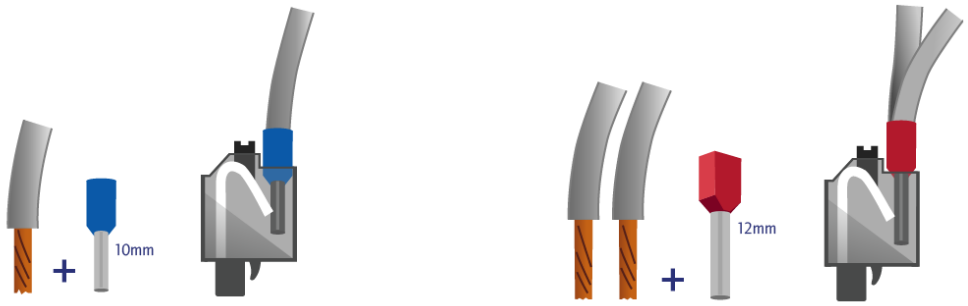
Connecting with flexible wire

When using flexible wire, always use a crimp-on terminal.

With crimp-on terminals

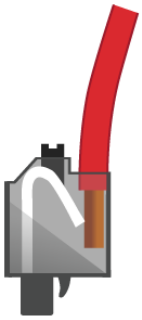
1. Strip the wire:
   - If using single crimp-on terminals: strip 10 mm off (8 mm for RS-485 connector).
   - If using double crimp-on terminals: strip 12 mm off.
2. Fit the crimp-on terminal.

3. Insert the crimp-on terminal into the terminal block until it can go no further.



Connecting with solid wire

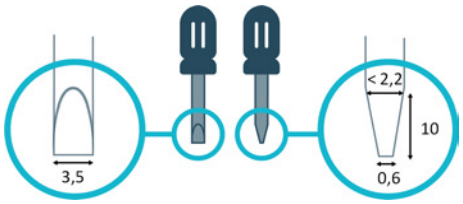
1. Strip 10 mm off the wire.
2. Insert the wire into the terminal block until it can go no further.



Screwdriver for terminal block

To install wiring in a terminal block, use a screwdriver with the correct dimensions. For instance, a Phoenix Contact Screwdriver SZF 1-0.6X3.5 (article number 1204517).

Using a screwdriver that is too large or too small may damage the connections on the modules.



Connecting the supply voltage

Connect the supply voltage to the controllers and the Mix I/O modules. The other modules are powered via the I/O bus.

Use a power supply that meets the safety requirements laid down in General specifications of Priva Blue ID C-Line controllers and modules (page 154).

- To install wiring in a terminal block, use a suitable screwdriver. See Screwdriver for terminal block (page 15).
- When using flexible wire, it is best to use crimp-on terminals.

- All terminal blocks are equipped with an explanatory abbreviation; see the *Connections* sections for the various connections.
- For Priva Blue ID projects, do not connect the FE terminal block. This terminal is intended for possible future use.
  For Compass, connect the FE terminal block.
- Switch the system power off before connecting devices to the modules; see Switching system power on and off (page 12).

Connections - I/O bus

The right-hand I/O bus is the outgoing I/O bus. The left-hand I/O bus is the incoming I/O bus. Always connect the right-hand I/O bus to the left-hand I/O bus of the next module.

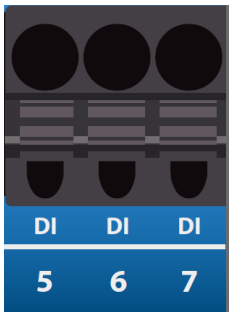
Points to be considered when connecting the I/O bus

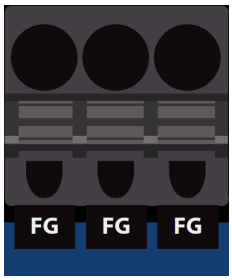
The I/O bus cables are not hot-pluggable. Always disconnect the system power from all modules when removing or connecting I/O bus cables.

Connect the modules to each other via the I/O bus. Use the supplied I/O bus cables (10 cm) or a long I/O bus cable (72 cm, article number 5219112). Always take the permitted I/O bus cable length into account (maximum total length and maximum length between modules).

The controller's I/O bus connector has a dust cover. Remove the dust cover before connecting an I/O bus cable. No I/O bus cable is connected in the outgoing I/O bus connector of the last module; always install a dust cover there

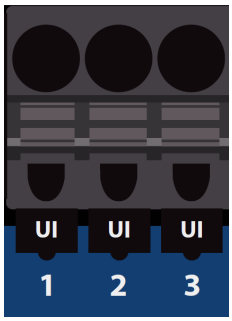
Connections - digital input

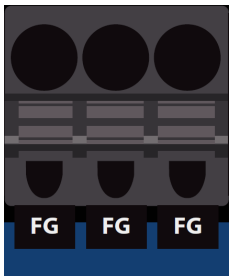




DI	digital input
FG (Field Ground)	common neutral for input

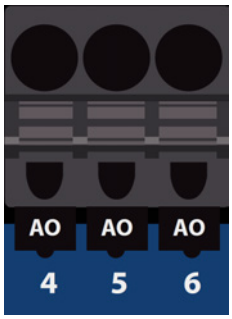
Connections - universal input

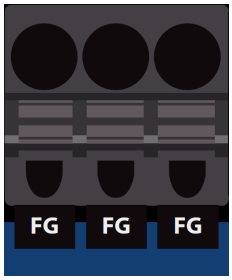




UI	universal input
FG (Field ground)	common neutral for input

Connections - analogue output





AO	analogue output
FG (Field ground)	common neutral for output

Connections - relay output

COM	common contact
NO (normally open)	normally open contact, open when output is not powered
NC (normally closed)	normally closed contact, closed when output is not powered

Points to be considered

The use of mains wiring is not permitted in the Compass cabinet.

A	low voltage wiring

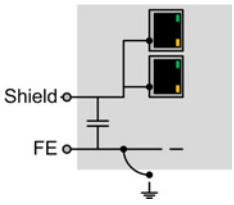
- Always use a crimp-on terminal with flexible wiring.
- Avoid short circuits by bundling and fixing both the mains wiring and the low voltage wiring as close to the connector as possible. See picture above.
- Compared to the mains wiring, the low voltage wiring must be double insulated. The cross section and insulation of the mains wiring must comply with applicable local installation regulations.
- If double crimp-on terminals are used, the sum of the currents of all the relay outputs of the same module may not exceed 20 A.
- During maintenance work on field equipment connected to a relay output, or when removing a connector of a relay output, always turn off the mains power supply using an external local isolator. An open relay contact must not be considered to be a safe separation.

Across inductive loads (such as a reed switch) use a spark extinguisher. This significantly extends the service life of the switch contacts.

Ethernet connections

With the Ethernet connections on the controller you can connect the system to a network. The Ethernet connections do not provide Power over Ethernet (PoE).

Connecting an Ethernet port



The shielding of the Ethernet ports is fitted externally to the shield connection on the controller. The Shield connection is located below the Ethernet ports. In principle, this shielding does not have to be connected, as this is coupled internally and at a high frequency (capacitive coupling) with the functional earth (FE). The shield connection only has to be connected directly to the functional earth (FE) if communication problems arise as a result of low-frequency electromagnetic interference.

Connections - alarm output

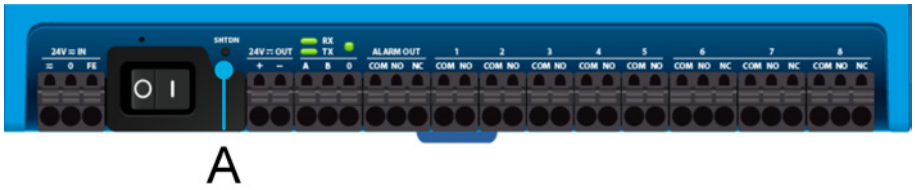
COM	common contact
NO (normally open)	normally open contact, open when output is not powered
NC (normally closed)	normally closed contact, closed when output is not powered

Disassembling hardware

When working on the system, be careful with regard to parts carrying a dangerous voltage.

Performing a shutdown

In the case of a shutdown, the running processes on the controller are closed down properly. This relates, for instance, to read and write actions to memory and communication with other modules and systems.

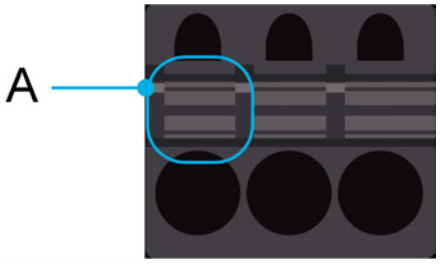


1. Depress button (A) and hold it down for 2 seconds.
2. Release button (A).
   The shutdown is complete when the blue LED is off and the green I/O LEDs flash.

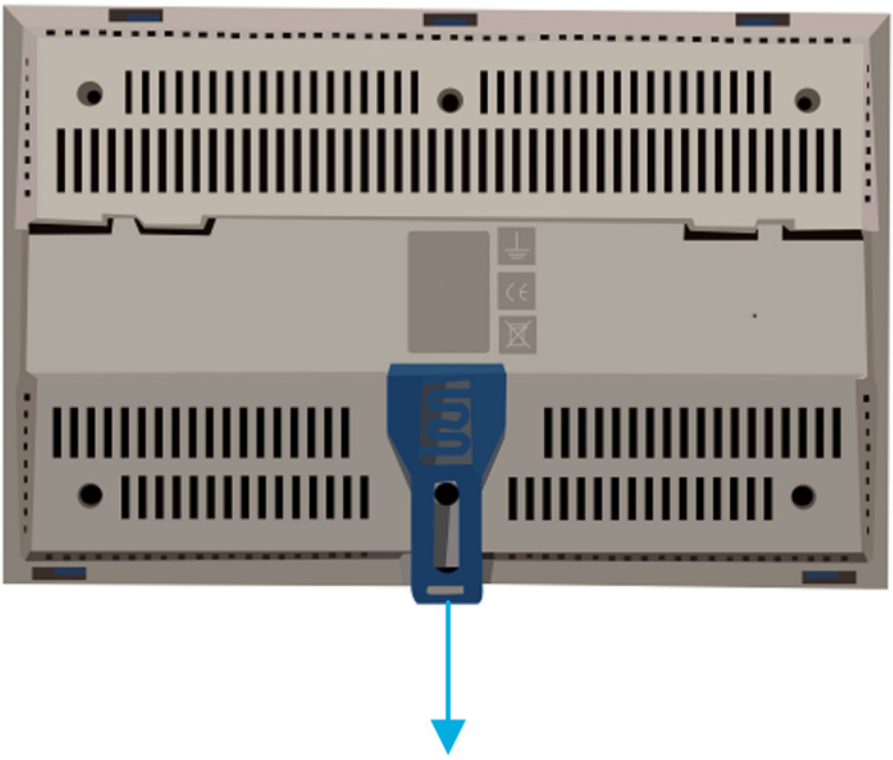
Disassembling hardware

1. Perform a shutdown.
2. Switch the system power off.
3. Turn off the voltage for the entire system.
4. Label the wiring before disconnecting it.
5. You can remove the connectors complete with wiring, or disconnect the wiring from the connectors.
   Remove a connector by gently pulling it forward.
   Disconnect the wiring from the connector by pressing the catch (A) with a screwdriver and removing the wire.

Do not turn the screwdriver. This will damage the hardware.



6. Unlock the hardware by placing a screwdriver in the blue locking clip on the bottom of the module and pushing it down.



7. Tilt the bottom of the module forwards
8. Lift the module up and out of the DIN rail.

Maintaining hardware

Replacing the controller battery

- Replace the battery while the controller is on, or the time setting will be lost.
- Priva recommends that the controller battery should be replaced once every five years.

The controller contains one battery. The battery can be replaced while power is connected.

1. Remove the battery holder and battery.
2. Take the old battery out of the battery holder.
3. Install the new battery in the battery holder. Pay attention to the polarity.
   The controller will trigger an alarm if no battery has been inserted or if the battery has been inserted with the incorrect polarity.
4. Install the battery holder and battery in the controller.
5. Dispose of the old battery as chemical waste.

Cleaning hardware

- Avoid contact with live parts.
- Make sure that no water runs into the electrical components.

The following safety precautions apply for cleaning the housing of the hardware:
- Use insulating gloves.
- Remove dust using a soft brush.
- Clean the plastic housing with a slightly damp, soft, lint-free cloth.
- Use warm water only, with a few drops of washing-up liquid if necessary. Do not use solvents or corrosive or gaseous cleaning agents.

Compass system installation steps

General installation

The general installation steps for Compass are explained in the Compass insert sheet. The Compass insert sheet is included in the box of the Compass cabinet.

The Compass insert sheet explains how to perform the following steps.
1. Suspension of the Compass cabinet.
2. Connect the power supply to the Compass cabinet.
3. Switch on the Compass system.
4. Connect the laptop and run the initial configuration.
5. Install extra Priva Blue ID hardware.

The insert sheet shows the basics of connecting field equipment, but cannot display details for all field equipment. This manual provides additional information and details that are necessary for installing and connecting field equipment, e.g. for commissioning (see Commissioning Compass (page 34)).

To be able to commission a new Compass, both the Gateway and the controller must be equipped with the latest version of the software. This software is available at https://support.priva.com, under Priva Compass, in the article *Where can I find the latest Priva Compass software?*. Save these files on your laptop.

Make sure you have a software licence, which can be purchased via web production.

Installing field equipment

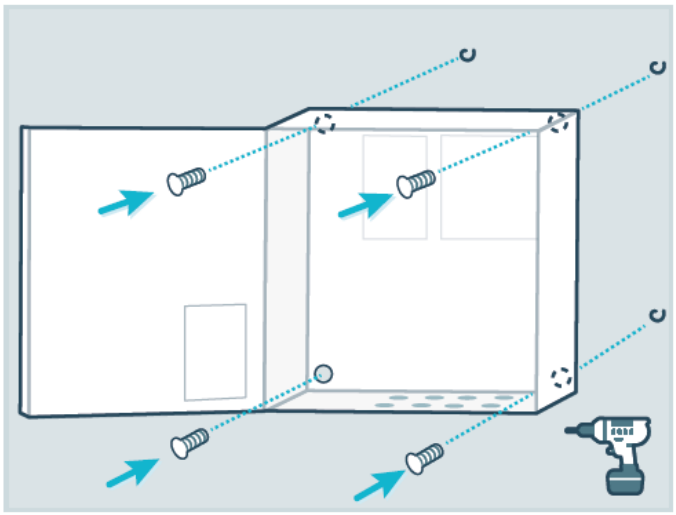
Perform these steps to install and connect field equipment:
1. Install the weather station.
2. Install the pH sensor.
3. Position the pH interface.
4. Connect the pH sensor to the pH interface.
5. Connect the pH interface to the Compass cabinet.
6. Install the EC sensor.
7. Install the Drain sensor system.
8. Position the EC-DSS interface.
9. Connect the DSS to the EC-DSS interface.
10. Connect the EC sensor to the EC-DSS interface.
11. Connect the EC-DSS interface to the Compass cabinet.
12. Install other sensors.
13. Connect other sensors to the Compass cabinet.
14. Test the Compass system.

Position the Compass cabinet

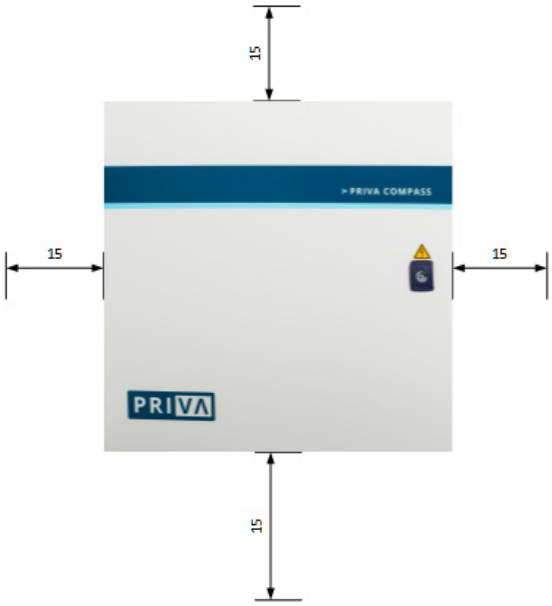
De Compass cabinet is heavy. Lift the cabinet with 2 persons or use a suitable lifting device.

When positioning the cabinet, bear the following in mind:

- Position the cabinet against a wall or other solid background.
- Ensure there is sufficient space around the cabinet.
- Ensure there is sufficient space underneath the cabinet to feed the wiring through.
- Ensure there is sufficient space above and next to the cabinet for the dissipation of heat.
- Use the 4 specified mounting holes for installing the cabinet.
- Use M8 bolts or M8 screws that can bear the weight of the cabinet.
- The cabinet is heavy. Have more than one person hold the housing in the correct position while placing it. Or use a suitable lifting device.
- Position the cabinet in a space that meets the environmental requirements.
- Make sure the space and the cabinet are easily accessible. There must be enough space to open the cabinet for maintenance and installation. This is especially important if you need to switch off the system with the circuit breaker in the event of problems.



Mounting holes



Recommended space (in cm) to be left free around the cabinet

Cable grommets and glands

The underside of the Compass cabinet has various types of cable grommets with cable glands. The cable glands are intended for various types of cabling. Always use a cable grommet and gland that is associated with a cable type with the specified cable diameter.

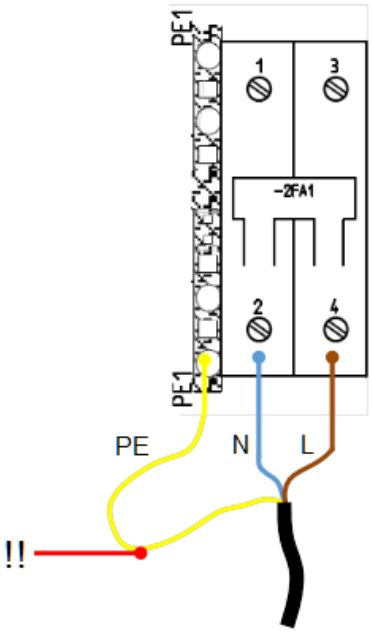
Always close a cable gland with a supplied dummy plug if a cable grommet is not being used.

Cable grommet / gland	Number	Cable type	Cable diameter
PG21	2	Ethernet optical fibre [1]	10 ... 18 mm
M20	2	mains power supply other cabling	6 ... 12 mm
M25	6 (Compass 2S) 10 (Compass 4S)	cabling for field equipment	9 ... 16 mm

[1] optional

Connecting the mains cable

Always switch off the mains power supply when you are working on electrical connections.



PE: Protective Earth (ground)
N: Neutral
L: Line (phase)
!!: Length of earth wire = 2x length of phase wire

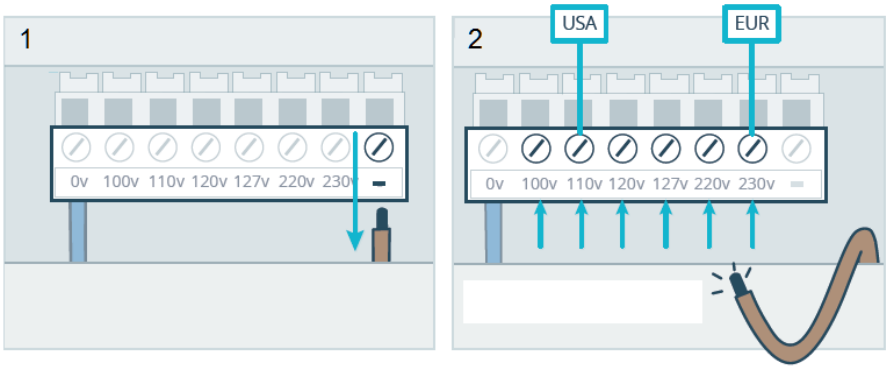
Use a mains cable with a diameter of 5 ... 10 mm. This is suitable for the M20 cable gland.

1. Strip around 10 cm from the outer sheath of the mains cable.
2. Cut the wires to length. Make sure the earth wire is twice as long as the phase wire and the neutral wire.
3. Strip the wires.
4. Feed the mains cable through the M20 cable gland.
5. Connect the earth wire (PE) to the earth terminal next to the circuit breaker.
6. Connect the neutral wire (N) to input 2 of the circuit breaker.
7. Connect the phase wire (L) to input 4 of the circuit breaker.
8. Screw tight the cable gland.

If you need to disconnect the mains cable, first disconnect the phase wire (L) and neutral wire (N), and then disconnect the earth wire (PE) last.

Setting the mains voltage on the 24 VAC transformer

The Compass cabinet is suitable for various mains voltages. The transformer converts the mains voltage to the 24 VAC system power. You must set the locally used mains voltage on the transformer. When the Compass cabinet is delivered, the phase wire is connected to an unused terminal on the input side of the transformer.



1. Switch off the circuit breaker.
2. Disconnect the power cable to the cabinet from the mains supply.
3. Unplug the phase wire from the unused terminal.
4. Connect the phase wire to the terminal that corresponds to the local mains voltage.
   Example: Europe has a 230 VAC network. In Europe, therefore, connect the phase wire to the 230 V terminal.
5. Check the connections of the neutral wire and earth wire. These are already connected upon delivery.

Connecting the I/O Bus

A Priva Blue ID C-Line system consists of one CMX-34 controller. The system may be expanded with additional modules. These modules may consist of a combination of UI8 modules for universal inputs, DOR6 modules for digital outputs or MX34 mixed I/O modules.

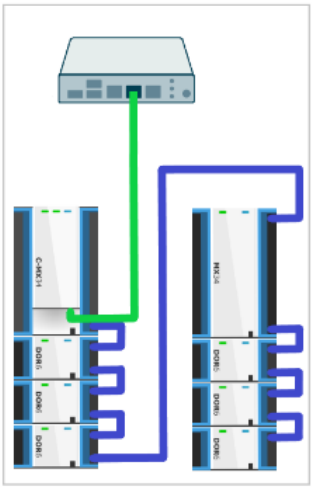
The I/O bus cable (shown in blue in diagram) is to be run in a daisy chain configuration with the CMX-34 controller at the beginning of the network. The CMX-34 acts as a power supply for up to 3 smaller modules. These smaller modules can be connected in series after the CMX-24 modules and can consist of any combination of UI8 and DOR6 modules.

A MX-34 mixed I/O module can also be included in the bus. This module allows for extra I/O in the bus since the MX-34 contains extra I/O on board as well as acting as a power supply for up to 3 more smaller modules. These smaller modules can be connected in series after the MX-24 modules and can consist of any combination of UI8 and DOR6 modules.

Once the modules are connected, they need to be confirmed in the software before inputs and outputs can be assigned.

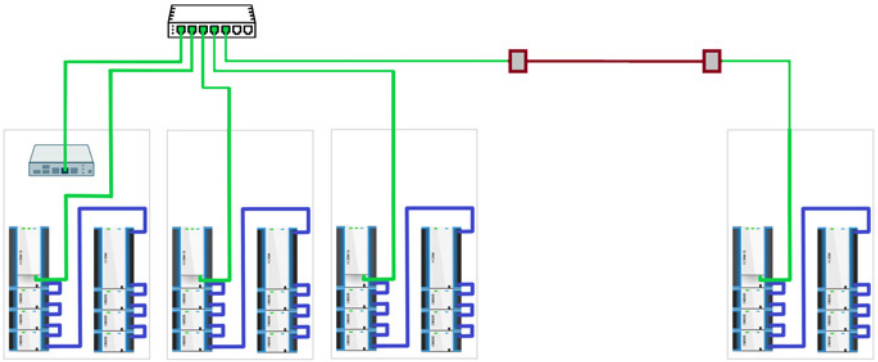
Connecting the Compass network

A Compass 2S or 4S already has a built in (small) Compass network. This is the Ethernet cable that connects between one of the 4 ethernet ports on the CMX-34 to Ethernet port 2 on the Gateway (shown in green in diagram).



Compass network with Gateway

Extra Compass 2X or 4X controllers can be added to this network. There can be a total of 5 controllers in a Compass network (shown in green on drawing).



Compass network with switch and Gateway

When connecting multiple Compass controllers together in a network there are some rules that need to be followed:

1. Do not use the additional ethernet ports on the CMX-34 to connect other controllers to the network. Instead, install a separate hub to connect the gateway and all the controllers. If you use the extra ethernet ports and the power is turned off on this controller for maintenance, the other controllers will also loose connection.
2. There are 4 ports on the CMX-34. You can use any one of these ports to connect to the switch.
3. Many problems are caused by poor ethernet installations. Plan your ethernet infrastructure properly and follow all the ethernet cabling rules and guidelines.
4. When running cabling between buildings, use fibre optic networks or galvanic isolation to protect against lightning damage (shown in red on drawing).
5. The Compass network must use Ethernet port 2 on the gateway.

Priva Network (process computers)	
LAN2 IP address	172.17.1.2 (or 192.168.1.1 for older systems)
LAN2 subnet mask	255.255.255.0
URL	http://<*gateway name*>/ [1] http://<*IP address*>/ [2]

[1] the *gateway name* is configured by the customer during the initial configuration of the system.
[2] If DNS is not used and the Windows hosts file has not been modified.

Network specifications

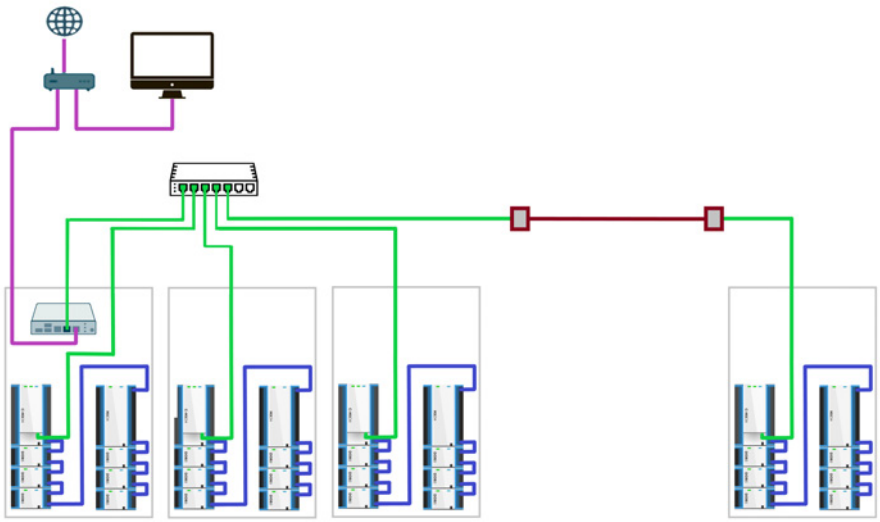
Physical layer	**100BASE-TX**	**100BASE-FX**	**1000BASE-LX**
Network protocol	Fast Ethernet (IEEE 802.3u)	Fast Ethernet (IEEE 802.3u)	Gigabit Ethernet (IEEE 802.3, clause 38)
Supported network classes	• A, B and C • Classless Inter-Domain Routing (CIDR) where IP-codes with a " / " can be used		
Permitted network topology	line, star or ring network (or a combination of these)		
Maximum number of Ethernet switches to be connected	• 50 in a ring network (HiPER Ring requirement) • 50 in a line network (because of response time)		
Maximum ring network configuration time in normal operation	300 ms		
Connect to switched on Compass	yes		

Cabling specifications

Physical layer	**100BASE-TX**	**100BASE-FX**	**1000BASE-LX**
Cable required	F/UTP cable, category 6	fibre optic cable (multi-mode, 50/125 micrometer)	fibre optic cable (multi-mode, 50/125 micrometer)
Maximum cable length per segment	100 m	2000 m (when prescribed cable is used)	550 m
Baud rate	100 Mbit/sec	100 Mbit/sec	1 Gbit/sec
Galvanic isolation per segment	no	yes	yes

Connecting the Office network

The Office Network is your own network on your site. To access your gateway from any device on your site, you will need to connect your Office Network to Ethernet port 1 on the gateway (shown in violet in drawing). Depending on the gateway, this will be labelled as ETH1 or LAN1. By default, this port on the gateway is set up for DHCP, but your IT department can change it to a static IP address from the Gateway setup page if necessary.



Compass network with internet router, switch and Gateway

Office Network (office environment)	
LAN1 IP address	DHCP if no DHCP present: 172.16.1.1 or 192.168.1.2 for older systems
LAN1 subnet mask	DHCP if no DHCP present: 255.255.255.0
URL	http://*<gateway name>*/ [1] http://*<IP address>*/ [2]

[1] the *gateway name* is configured by the customer during the initial configuration of the system.
[2] If DNS is not used and the Windows hosts file has not been modified.

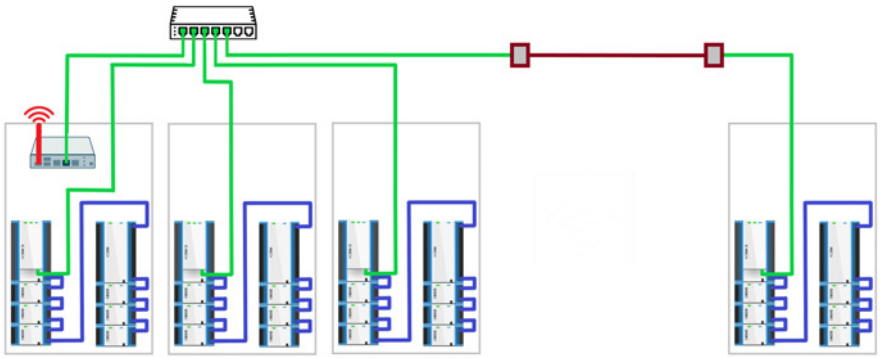
Connecting Wi-Fi

For the Wi-Fi connection, you do not need to install or configure anything.

The Wi-Fi adapter is already connected to the Priva Gateway's USB port when the cabinet is delivered.

When the Priva Gateway is switched on, the Wi-Fi adapter installs itself and the wireless network is set up automatically.

After a restart of the Gateway, it may take a few minutes before the wireless network is available.



Compass network with switch and Gateway, including Wi-Fi adapter

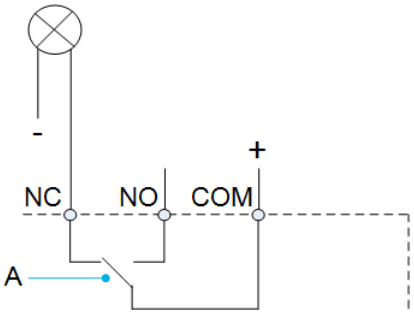
Data for wireless network

Network name	PRIVADA-XXXXXXX (This is the default gateway name. If the gateway is given a different name, the new name will be used)
Password	welcome@priva

Factory settings for Wi-Fi adapter

IP address	192.168.137.1
Subnet mask	255.255.255.0
DHCP	Enabled
SSID	PRIVADA-XXXXXXX
WLAN security protocol	WPA2-PSK

Using the alarm output



The alarm output is a relay that is controlled based on alarms within the network of controllers. This alarm output is also activated if there are communication problems within the network. The connection depends on the alarm reporter. The Normally Closed (NC) relay is generally used, and is therefore open if there is no supply voltage or if there is an alarm.

Faults in the controller can be sent to the outside as alarm signals via the controller's on-board alarm output (A). This way, you are quickly informed about an active alarm or fault in the system by a lamp or alarm dialer that is connected to the alarm output. The alarm signal stops when it is acknowledged. Also when the alarm itself is no longer active, but was not acknowledged yet, the alarm signal remains active until it is acknowledged.

The buzzer in the Compass control cabinet is connected to analog output 1. This output switches synchronously with the alarm output.

Switching the Compass system on and off

Switch on

1. Switch on the Compass system by switching on the circuit breaker.
2. Switch on the controller and the Mix I/O module (if present) with the on/off button. See Switching system power on and off (page 12).
   This automatically switches on the other Priva Blue ID modules that are connected to the controller and Mix I/O module.

Switch off

1. Perform a shutdown of the controller. See Performing a shutdown (page 20).
2. Switch off the controller and the Mix I/O module (if present) with the on/off button. See Switching system power on and off (page 12).
3. Switch the Compass system off by switching off the circuit breaker.
   This switches off the power supplies in the Compass cabinet, which automatically switches off the sensors that are powered by the system.

Testing

Perform the following tests after switching on the system or in the event of malfunctions.

1. Check the LEDs on the controller, the Mix I/O module and expansion modules.
   The blue line-up LED (all modules) must be on continuously.
   The green status LED for controller (C) (on controller only) must be on continuously.
   The green status LED for I/O (I/O) (all modules) must be on continuously.
2. Check whether the power indicator LEDS on the power supplies are on.
3. Check the LEDs on the Priva Gateway.
   The green LED for the supply voltage must be on continuously.
   The green LED for SSD activity will flicker when information is being written to the hard disk.
4. Test the operation of the sensors.
   See the chapters in this manual for the relevant sensor or the manuals of connected systems.

See also Troubleshooting the Compass system (page 41).

Commissioning Compass

Preparation

To be able to commission a new Compass, both the Gateway and the controller must be equipped with the latest version of the software. This software is available at https://support.priva.com, under Priva Compass, in the article *Where can I find the latest Priva Compass software?*. Save these files on your laptop.

Setting up the Priva network

The Priva network is an industrial network separated from your office network, and is only used for Priva products.

The Gateway creates a separation between the Priva network and the office network with the aid of 2 network ports. The Priva network is connected to the second network port on the Gateway (ETH2 or LAN2).

Each Compass controller has a built-in switch with 4 ports. The Priva network can be connected to any of these ports. If you have several Compass controllers or other Priva products in the Priva network, you can decide how the network infrastructure should be set up. A subsequent controller can be connected directly to the built-in switch or via an external switch. The desired degree of operational safety determines your choice of network infrastructure.

Before connecting the office network to the Gateway, you must first commission the Compass.

Gateway

From your laptop or another mobile device (tablet or mobile phone), you can start *Gateway setup* via Wi-Fi or via a wired network connection.

Via Wi-Fi

Make sure the Wi-Fi dongle is inserted into one of the Gateway's USB ports before starting *Gateway setup*. After starting *Gateway setup*, it takes a few minutes before the Gateway's Wi-Fi network can be seen in the list of wireless network connections on your laptop or mobile device.

By default, the Gateway name begins with PRIVADA- followed by a number of characters. Establish the Wi-Fi connection between your laptop and the Gateway. The Wi-Fi password is *welcome@priva*.

Open a web browser (Internet Explorer, Chrome, Edge or Firefox) and go to http://192.168.137.1 to start *Gateway setup*.

Via wired network connection

Go to the Ethernet properties of your laptop's network card and choose an IP address in the Gateway range, for instance IP address 172.16.1.134 (192.168.1.134 for older systems) with subnet mask 255.255.255.0.

Connect your laptop to the first network port (ETH1 or LAN1) on the Gateway using a network cable.

Open a web browser (Internet Explorer, Chrome, Edge or Firefox) and go to http://172.16.1.1 (or http://192.168.1.2 for older systems) or http://PRIVADA-xxxxxxx to start *Gateway setup*.

Gateway setup

Update Gateway software

The first time that *Gateway setup* launches, it will prompt you to update the Gateway software. Choose *Select update file* to update the software with the Gateway setup file from the preparation stage. The file will then be uploaded to the Gateway, which verifies the file. The Gateway update process may take up to 15 minutes.

Once the update has been completed, the home screen will reappear. To continue, select *Not now*; the update has already been carried out.

Creating authorisations

No authorisations are defined in the factory settings; you select them yourself. The first step is to select a 5-digit PIN code that protects access to *Gateway setup* and *Compass setup*. Save this code carefully!

Next, you create a user name for the *Operator* in the format of an e-mail address, such as name@companyname.com. The Gateway also uses this user name as a temporary password for logging on to the *Operator* for the first time. When logging on for the first time, the user changes this temporary password to a password of his/her choice. Save the user name and password carefully!

Tab: settings

You will now be taken to the *Settings* tab of *Gateway setup*. Select *Edit* next to the *Time zone* to choose the correct time zone for the location in which the Compass has been installed. You should also set the correct date and time.

You can also rename the Compass. Bear in mind that the name PRIVADA-xxxxxxx will change and that you must use the new name (if there is a DNS server) or IP address in the browser to access the *Gateway setup* and the local *Operator*. The use of punctuation marks, such as spaces, '@', '/' and '#', in the name is not allowed.

Tab: network

The Compass is supplied with default IP addresses. These must be changed to prevent network conflicts. Compare the IP address with your home address; it must be unique to ensure that mail arrives correctly.

Ethernet 1 is intended for connecting the Gateway to your office network. By default, this port automatically receives an IP address from your office network. This will generally work well, but it depends on your office network. Your IT administrator can give you more information on that.

Please note that the office network may not automatically issue an IP address. In that case, use an IP address for Ethernet 1 in the same range as the office network.

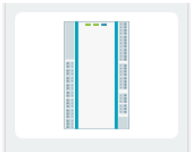
Ethernet 2 is the Priva industrial network for the controller(s). Use a different IP range for this network than that of your office network, e.g. 172.17.16.80.

It is possible that Ethernet 3 is now being used for the Wi-Fi network with the dongle. Apart from that, it is not used.

Tab: preferences

Set your preferences here for the language of the local *Operator* and the units used.

Compass setup



Update device

On the *Settings* tab of *Gateway setup* you can see the controllers that the Gateway has detected in the Priva network.

Select *Update device*. You will now be taken to *Compass setup*.

The controller's IP address must be in the same range as Ethernet port 2 of the Gateway to which the controller is connected, e.g. 172.17.16.85. Change the controller's IP address by clicking on next to the IP address. You can change the IP settings by typing them yourself or by selecting *Auto assign*. Once the changed settings have been saved, the controller needs some time to implement the changes.

Click on the button in the top right-hand corner of *Compass setup*.

Select *Upload platform image* to update the software with the Controller Setup file from the preparation stage. The file will then be uploaded to the controller, which verifies the file. You will then be prompted to confirm the update. The controller update process takes approximately 5 minutes.

Tab: network

After updating the controller software, you will see the *Network* tab of *Compass setup* where you can adjust the network settings. This has already been done and you can proceed to the next step.

Tab: zones

On the *Zones* tab you can add the zones. A zone can be used as a zone for the climate area and at the same time as an area for a water system, for instance.

Each controller can contain a maximum of 4 zones. When adding a zone, select the zone number that you wish to use. These numbers do not have to be consecutive, but must always be unique within the Compass system, including in the event that there are several controllers.

Select *Save* to save the zone configuration.

Tab: software

Once the zones have been added, enter the licence code on the *Software* tab and confirm it with *Submit*.

On the left-hand side of the browser page, you will then see the software options that have been enabled by the licence code. On the right-hand side, you will see the zones that have been added and the available software modules. You can distribute the software modules across the zones and then click on *Save*.

Tab: I/O connection

The software has been distributed across the zones and equipment must be connected to the controller on the *I/O connection* tab.

Before we can allocate the inputs and outputs, check whether *Compass setup* is detecting the correct hardware. On the left-hand side, you will see the hardware modules that are detected. If these match the modules that are present, confirm them with *Confirm*.

If the modules displayed do not match what has been installed, check the cabling between the modules and whether the controller (CMX34) and the extension module (MX34) are switched on.

After confirming the hardware module layout, you will also see a blue LED illuminate on each module.

You can now allocate sensors/actuators to the inputs and outputs for each zone. The list box for the sensors/actuators depends on the licence and the assignment of the software modules to the zones. Next, select the hardware module and the input or output for this sensor/actuator to which you wish to connect the sensor/actuator. The software will display a suggestion. Select *Assign* to save the assignment.

After allocating the inputs and outputs, save the list of I/O connections as an Excel file, as a PDF file or as a file that can be imported on the same or a different controller (select *Export*).

Other controller settings

In the top right-hand corner of *Compass setup* you will see the  button for the frequency of the mains power supply (50 or 60 Hz), the buzzer volume and the option for updating the controller software (*Upload platform image*).

At the top right of *Compass setup* there is also the  button for exiting *Compass setup* and returning to *Gateway setup*. Select this once *Compass setup* has been completed.

You will return to the *Settings* tab of *Gateway setup*.

To include the configured controller in the operating software, the final step is to connect this controller to the Gateway by selecting *Connect* on the controller.

Repeat this procedure within *Compass setup* for each controller in the Compass system.

Once all the controllers have been commissioned, disconnect your laptop if you are connected to the Gateway with an Ethernet cable. If the Compass is being operated via the office network or with a Wi-Fi router for direct wireless operation, connect the Gateway's Ethernet port 1 to your office network.

Starting operation

To start the operating software, select the Gateway's IP address in the address bar of a browser.

Go to *Settings* to set the latitude and longitude of the location in which the Compass has been installed. This is important in order to synchronise the set times with the sunrise and sunset times.

Updating Compass software

Preparation

Make sure that the following preparations have been made:

- Download the update packages for the Compass controller and for the Gateway. This software is available at https://support.priva.com, under Priva Compass, in the article *Where can I find the latest Priva Compass software?*
  Save these files on your laptop.
- Be sure the two networks of the Gateway, the office network (ETH1) and the Priva network (ETH2), are in seperate network ranges.
- Inform the customer/grower that the process computer can't control and can't be accessed during the update procedure.
- Collect the user name and password to log into the *Operator* and the PIN code to access the *Gateway setup* or someone should be able to log in.
- Be sure that all controls for climate, energy and irrigation are in rest and in a safe position.

- Be aware that the updates of the Controller and the Gateway may take some time (up to an hour).
- Update of both the Controller and the Gateway is required (if new software is available), otherwise the communication will get lost.

Update procedure

Update the Compass controller first and then the Gateway to prevent communication being lost.

1. Start the Local *Operator* and log in with the customer's user name and password.
2. Open the apps by clicking the *apps* button.
3. Click on the *Gateway setup* button.
4. Use the PIN code to log in the *Gateway setup*.
5. Once the *Gateway setup* screen is shown, navigate to the Controller by clicking on the *Device Setup* button on the controller icon.
6. Open the *Settings* menu by clicking on the sprocket in the upper right corner of the display.
7. Select *Upload platform image* and you will be prompted to select your update file.
8. Open the file "Compass_ControllerSetup_xxxxxxxx.zip" and confirm the update.
9. A blue page is shown for a while and then a status bar appears. This will take about five minutes and your controller will reset at one point during the update. After the update is finished, the controller will restart, and you will see the Compass setup screen.
10. Go back to the *Gateway setup* by clicking the "exit" button.
11. Repeat steps 5-10 to update each controller in your network.
12. To update the Gateway, go to the *Gateway setup* screen and select *Upload package*.
13. Open the file "Gateway_Setup_x_x_x_xxxxxxxx.zip".
14. Once the file is uploaded, you need to confirm that you want to update the Gateway.

    Do not switch off the Gateway at this time!

15. The *Gateway setup* screen will reappear once the update is completed.
16. For each controller, press the *Reconnnect* button to load the updated controller screens into the gateway.
17. When the updates are completed, you will need to make a backup of the settings and IO of your controller to protect yourself against data loss. Click on the *Device setup* button on the controller.
    - Reopen the *Settings* menu by clicking on the sprocket in the upper right corner of the display.
    - Press the *Backup* button to make a backup of the settings and IO configuration for your controller.
    - Save this backup in a secure place.
18. Repeat step 17 for each controller.
19. Go back to the *Gateway setup* by clicking the *Exit* button.
20. From the gateway setup screen, press *Start Operator* to return to your normal operation.

IP address assignment

Both Connext, Compass and FS Performance projects use fixed IP addresses. When assigning IP addresses, use the following rules and format:

- For a class B network with an address space of 65535 addresses, for instance, choose the address range 172.17.16.X. The network mask will be 255.255.240.0.
- Use the same range for each greenhouse. For instance:
  - Greenhouse 1 – 172.17.**16**.1 to 172.17.**16**.255
  - Greenhouse 2 – 172.17.**17**.1 to 172.17.**17**.255
- Group system components per function.
- Record the used IP addresses in FDCT (also FS Performance projects) and on a plan.

Group	Function	IP series	Maximum number
Greenhouse 1	Operation (Gateway, POD Server/Clients, FS Performance Server / Clients, Panel PC, etc.)	172.17.16.1 to 172.17.16.30	30
	Spare	172.17.16.31 to 172.17.16.39	9
	Switches	172.17.16.40 to 172.17.16.79	40
	Compass	172.17.16.80 to 172.17.16.99	20
	CPC (CLIMATE, WATER, ENERGY)	172.17.16.100 to 172.17.16.119	20
	Transrouters	172.17.16.120 to 172.17.16.159	40
	Spare	172.17.16.160 to 172.17.16.179	20
	Service	172.17.16.180 to 172.17.16.199	20
	Third-party application (LeenHuisman, Hotraco, Priva LWE, DHCP Server)	172.17.16.200 to 172.17.16.219	20
	Spare (or DHCP range)	172.17.16.220 to 172.17.16.254	35
Greenhouse 2	Operation (Gateway, POD Server/Clients, FS Performance Server / Clients, Panel PC, etc.)	172.17.17.1 to 172.17.17.30	30
	Spare	172.17.17.31 to 172.17.17.39	9
	Switches	172.17.17.40 to 172.17.17.79	40
	Compass	172.17.17.80 to 172.17.17.99	20
	CPC (CLIMATE, WATER, ENERGY)	172.17.17.100 to 172.17.17.119	20
	Transrouters	172.17.17.120 to 172.17.17.159	40
	Spare	172.17.17.160 to 172.17.17.179	20
	Service	172.17.17.180 to 172.17.17.199	20
	Third-party application (LeenHuisman, Hotraco, Priva LWE, DHCP Server)	172.17.17.200 to 172.17.17.219	20
	Spare (or DHCP range)	172.17.17.220 to 172.17.17.254	35

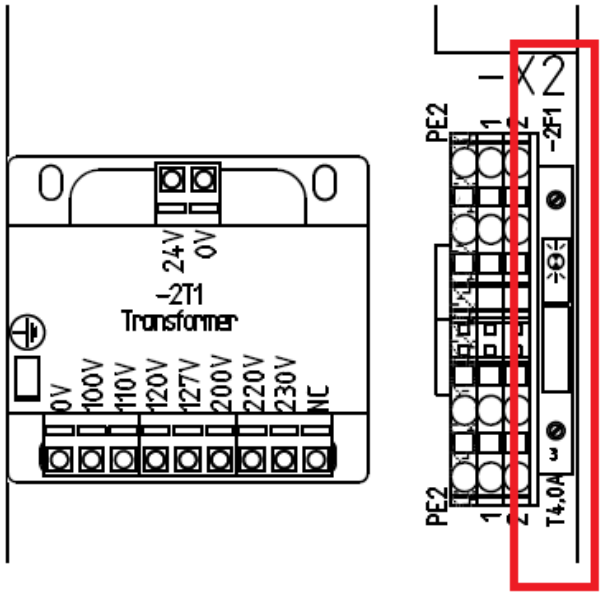
Cleaning Compass cabinet

Clean the outside of the Compass cabinet with a damp cloth.

- Keep water out of the cabinet.
- Do not use a high pressure cleaner to clean the cabinet.
- Do not use aggressive cleaning agents.
- Do not use abrasives.

Replacing fuses

The Compass cabinet has a fuse for protecting the 24 VAC supply voltage in the event of a short circuit. Always replace a fuse with a fuse of the same type.



1. Switch the Compass system off with the circuit breaker.
2. Replace the fuse.
   Use the correct type of fuse.
3. Switch the Compass system on with the circuit breaker.

Troubleshooting the Compass system

Perform the following checks and steps if problems occur. If the problem persists, please contact your Priva partner.

Malfunction	Possible cause and solution.
System does not switch on	Check whether the cabinet is receiving power.
	Check whether the mains voltage has been set on the 24 VAC transformer.
	Check whether the circuit breaker is switched on.
	Check whether the controller and Mix I/O module are on.
	Check the fuse.
Priva Blue ID modules do not switch on	Check whether the circuit breaker is switched on.
	Check the 24 VDC power supplies. The indication LEDs must be on.
	Check whether the controller and Mix I/O module are on.
	Check whether Priva Blue ID expansion modules are connected with the I/O bus cable to the controller or Mix I/O module. **Please note:** First switch off the modules before inserting an I/O bus cable.
Sensors are not receiving power	Check the 24 VDC power supplies. The indication LEDs must be on.
	Check the 24 VAC transformer.
	Check external power supplies.
	Check the fuse and the circuit breaker.
	Check the connections.
No connection with Compass during the Setup process	Check the connection to the WLAN adapter or Ethernet connection. Refresh the browser.

Performing a reset of the VDC power supply

Perform a reset of the power supply if the input of the VDC power is receiving power, but 24 VDC is not present at the output. In that case, the DC OK LED will be off.

1. Switch the Compass system off with the circuit breaker.
2. Wait 30 seconds.
3. Switch the Compass system on with the circuit breaker.
4. Check whether the DC OK LED is on.
   If the LED is not on, the 24 VDC power supply is defective or there is a short circuit in the system.

To determine if there is a short circuit and to find its source:

1. Switch the Compass system off with the circuit breaker.
2. Disconnect all 24 VDC common wires from the 24 VDC connecting terminals.
3. Switch the Compass system on with the circuit breaker.
4. Check whether the DC OK LED is on.
   If the DC OK LED is off, the power supply is defective. Replace the power supply.
   If the DC OK LED is on, there is a short circuit in the system. Continue with the next step to find the source.
5. Connect the 24 VDC common wires to the connecting terminals one by one.
6. Check the DC OK LED after connecting each wire.
   If the DC OK LED stays on after you have connected a wire, this wire does not cause a short circuit.
   If the DC OK LED goes out after you have connected a wire, this wire causes the short circuit.
7. Resolve the short circuit.
8. Switch the Compass system off with the circuit breaker.
9. Reconnect all wiring.
10. Switch the Compass system on with the circuit breaker.

Sensors

Overview of connecting sensors and systems

The following sensors and systems can be used in a Compass system and can be connected to the Compass cabinet.

Sensor, interface or system	Article number	Connect to
Weather station WSC11	3779240	RS485 input of Priva C4
Weather interface WI2	3771351	universal input of a Priva Blue ID module 24 VDC power supply 24 VAC power supply
Meteorological station with:	3771009	
Wind speed sensor	3779203	Weather interface WI2
Outside temperature sensor	3779204	Weather interface WI2
Rain sensor	3779206	Weather interface WI2
Wind direction sensor	3779215	Weather interface WI2
Linear light sensor LS2WI 0-50 mV	3779205	Weather interface WI2
Linear light sensor LS2 0-5 V	3779213	universal input of a Priva Blue ID module 24 VDC power supply 24 VAC power supply
Solari / radiation sensor	3779207	Weather interface WI2
Snow sensor	3779000	potential-free contact, connect directly to the universal input of a Priva Blue ID module 24 VAC power supply
Air humidity sensor	3779219	4 ... 20 mA, connect directly to the universal input of a Priva Blue ID module universal input of a Priva Blue ID module 24 VAC power supply
EC-DSS interface [1]	3771051	universal input of a Priva Blue ID module 24 VDC power supply 24 VAC power supply
EC sensor, short, with NTC 1 kΩ/25°C (inline)	3771052	EC-DSS interface
EC sensor, long, with NTC 1 kΩ/25°C (angled)	3771041	EC-DSS interface
Drain sensor system	3779224	EC-DSS interface
pH interface	3771056	universal input of a Priva Blue ID module 24 VDC power supply 24 VAC power supply
pH sensor	3779046	pH interface
Priva Measuring Box T+RH [2]	3779024	universal input of a Priva Blue ID module 24 VDC power supply 24 VAC power supply
Priva Measuring Box T	3779027	universal input of a Priva Blue ID module 24 VAC power supply
Guardian CO2 monitor	3795044	universal input of a Priva Blue ID module 90 ... 260 VAC power supply (50 - 60Hz)
Water temperature sensor	3779013	universal input of a Priva Blue ID module
Soil temperature sensor	3779016	universal input of a Priva Blue ID module
Priva Groscale weighing system	3771140	universal input of a Priva Blue ID module 24 VDC power supply 24 VAC power supply
Dosing Channel Driver	3770170	analogue output of a Priva Blue ID module 24 VAC power supply

[1] connections for 2 EC sensors or 2 Drain sensor systems
[2] temperature sensor and relative air humidity sensor are connected separately

Assigning sensors to Compass

Enter Gateway Setup

a. From the local Compass Operator (this does not work from the cloud) choose *Apps* > *Gateway Setup*.
b. Enter *PIN code* and click the log in button.
c. Click on the link *Device Setup* of the connected Compass controller.

Assign an I/O sensor to a UI port

You can assign sensors or actuators to the I/O of Campass.

1. Go to tab: *I/O connection*.
2. Choose the I/O
   - Choose in the assign connections form the zone or room: Zone/Room.
   - Type a search string in the *Sensor/Actuator* search box and select your choice from the drop-down.
   - If a type is needed enter your choice of *Type*.
3. Select a *Module* and *I/O channel* and input type.
   - The system comes up with the first available channel.
   - You can change the *Module* and *I/O channel* by selecting first the module and then your choice from the available channels
4. Click *Save* to store this in the system
5. Click  to exit the *Compass setup* and return to the *Gateway setup*.
6. Click *Start Operator* to return to Compass Operator.

Priva weather station WSC11

The Priva weather station WSC11 integrates all the measurements that are relevant to the horticulture industry in a single compact station.

The following measurements are available when the weather station is used with the Compass:
- Wind speed
- Wind direction
- Global radiation (Radiation sensor)
- Rain alarm
- Outside temperature
- Relative humidity

Principle

Wind speed / wind direction

Wind measurement is based on the hot wire principle. The bottom is equipped with a heated cylindrical sensor. The supplied heat energy is a measure of wind speed.

The metal cylinder contains 4 temperature-measuring resistors. These resistors are thermally coupled with the cylinder and positioned according to the 4 points of the compass. When an incident flow affects the cylinder as a function of the wind direction, this is accompanied by a temperature gradient which is registered by the measuring resistors. The relationships between the 4 temperature values are used to calculate the wind direction.

Light

The light measurement is carried out via 4 silicium photo sensors, which are aligned to the 4 cardinal directions in the mean elevation angle (40°).

Twilight

Twilight is calculated from the sum of the 4 measuring values of the direction-independent light sensors.

Global irradiance

A silicon PIN photodiode is used to measure global irradiance. The sensor is positioned horizontally and registers the diurnal values of the solar irradiation intensity.

Precipitation

The detection of precipitation is based on capacitance measurement. The sensor is installed in the housing cover. An integrated heating system adjusts the sensor area to an overtemperature in relation to the ambient temperature. This overtemperature (approximately 2K) prevents bedewing of the sensor surface. The thermal output is increased with precipitation. This accelerates drying of the sensor, allowing the time at which precipitation ended to be identified more accurately.

Air temperature

A PT1000 measuring resistor is used to measure the air temperature. The sensor is mounted on a flexible printed board and positioned in the lower section of the housing.

Air pressure

Absolute air pressure is measured with a piezoresistive MEMS sensor.

Time / date and geostationary data

The WSC11 has a GPS receiver with a built-in RTC (Real Time Clock). This allows it to receive the position of the WSC11 (degree of longitude/latitude, local altitude) time (UTC) and date. The GPS receiver does not need alignment. The built-in RTC is buffered with a backup capacitor and retains its data without a voltage supply for a period of minimum 3 days.

Position of the sun (elevation / azimuth)

On the basis of the GPS data the current sun position is calculated every second.

Humidity measurement

A built-in hygro-thermosensor is used to measure humidity levels. The sensor uses a small air exchange and responds to changes in humidity within seconds. The relative humidity and air temperature are used to calculate absolute humidity and the dew-point temperature.

Inside temperature of housing

A silicon temperature sensor measures the temperature inside the housing.

Determine the location of the weather station

To obtain representative measurements, keep in mind the following when selecting a location for the weather station:

- Make sure that the weather station sticks out approximately 2 metres above the greenhouse roof or shed roof.
- Do not position the weather station in the vicinity of, or in the shade of, buildings or trees for example.
- To limit the effect of side-wall warming on the weather station, you should position the weather station:
  - not in the vicinity of a heat source such as chimneys or ventilation openings;
  - in the northern hemisphere on the north side of the side-wall, or in the southern hemisphere on the south side.
- Do not install the weather station in the vicinity of ceiling sprinklers.
- Install the weather station in such a way that it is not obscured by shadows. Bear in mind that shadow propagation changes throughout the day.

WSC11 Connection

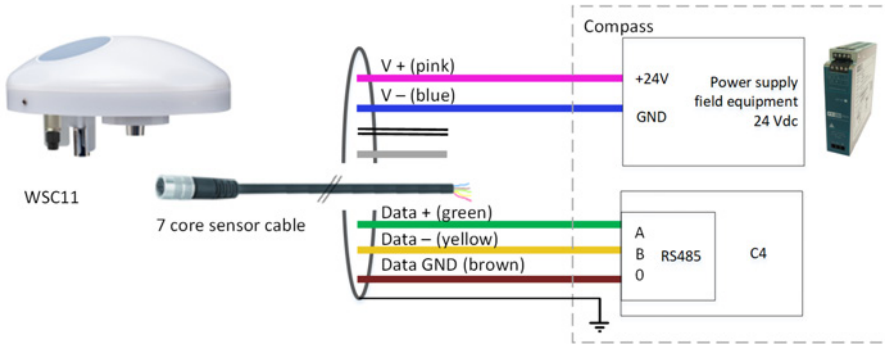
You can connect the WSC11 directly to the Priva Blue ID controller via an RS485 connection.

The WSC11 is supplied with a 15 meter cable. If the distance between the WSC11 and the PRIVA Blue ID controller is greater than 15 metres, you must take measures to ensure a stable connection. See description below on 15 to 150 meter connection.

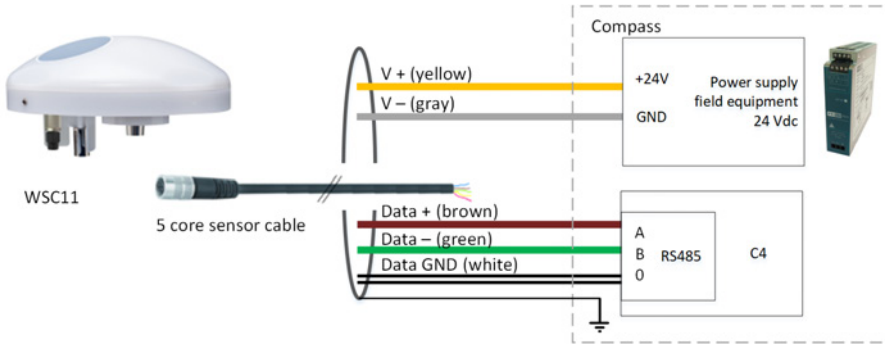
Connection (max. 15 metres)

For distances up to 15 metres, you can connect the WSC11 directly to the Priva Blue ID controller and to a 24 VDC power supply.

The power supply and the data bus are not electrically isolated.



7 core sensor cable

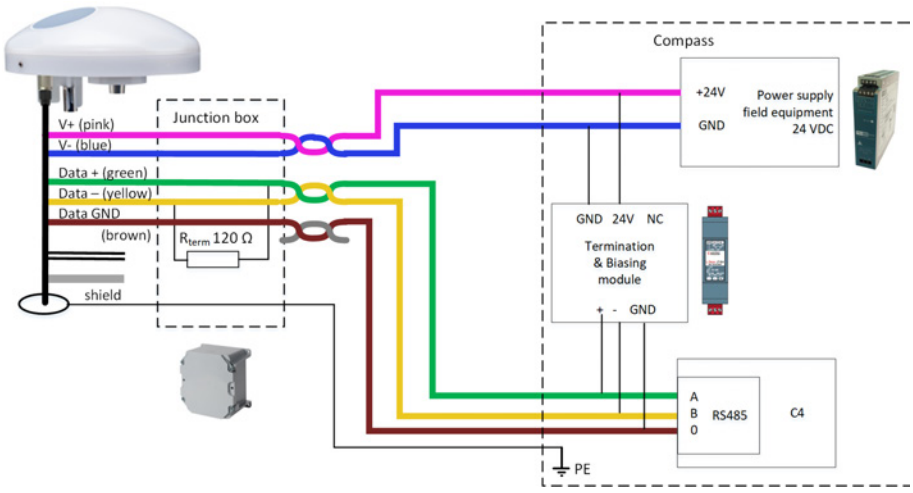


5 core sensor cable

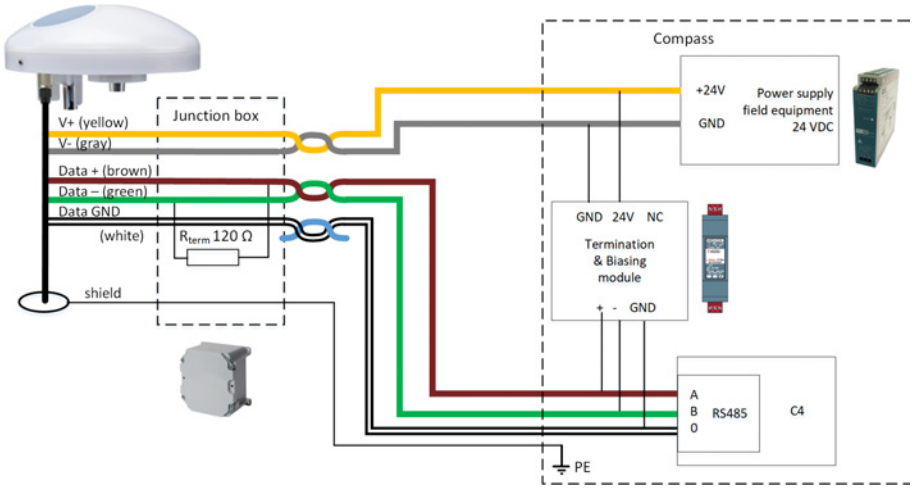
1. Connect the supplied sensor cable (AWG26) with the screw connector to the WSC11. Make sure that the cable is no longer than 15 meters.
2. Calculate whether the 24 VDC power supply for Compass field equipment has sufficient capacity to also power the WSC11. Add an extra power supply if the capacity is insufficient.
3. Connect the cores for power supply to the 24 VDC power supply for Compass field equipment, depending on the cable used (5 or 7 cores), see diagrams above.
4. Connect the cores for data to the RS485 port of the C4. See Connections - RS485 (page 13).

Connection (15 to 150 metres)

For distances greater than 15 metres, you must take measures against electrical noise affecting the communications between the WSC11 and the Priva Blue ID controller. This is done by terminating the RS485 network on both sides and ensure biasing (see drawing below).



7 core sensor cable



5 core sensor cable

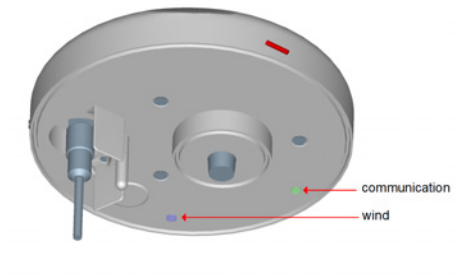
- **Requirements**
- A junction box with an IP code of at least IP65.
- A terminating resistor of 120 Ω / ½ W
- An extension cable with 6 cores:
  - 0.6 mm (AWG22)
  - twisted pair
  - shielded
- A bus termination and biasing on the side of the Compass. Use a *Set networkterminator RS-485 + resistor* (article number 3771028).

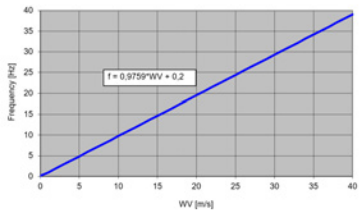
1. Connect the supplied sensor cable (AWG26) with the plug to the WSC11.
2. In a junction box, connect the cores of the sensor cable to the extension cable.
3. In the junction box, install a terminating resistor of 120 Ω / ½ W between the data+ and data- line as a bus termination.
4. Calculate whether the 24 VDC power supply for Compass field equipment has sufficient capacity to also power the WSC11. Add an extra power supply if the capacity is insufficient.
5. Connect the cores for power supply to the 24 VDC power supply for Compass field equipment, depending on the cable used (5 or 7 cores), see diagrams above.
6. Connect the cores for data to the RS485 port of the C4. See Connections - RS485 (page 13).
7. Connect the biasing and bus termination module in accordance with the diagrams above. For the specifications, see Set networkterminator RS-485 + resistor (page 52).

The power supply and the data bus are not electrically isolated.

LEDs

The LEDs at the bottom of the WSC11 are visible through the housing.



LED	Behaviour	Meaning
green	flashing (1 Hz)	The WSC is ready for operation and has not received a query command for 3 seconds or longer.
blue	flashing	The current wind speed. The correlation between the flash frequency and wind speed is shown in the following figure: 

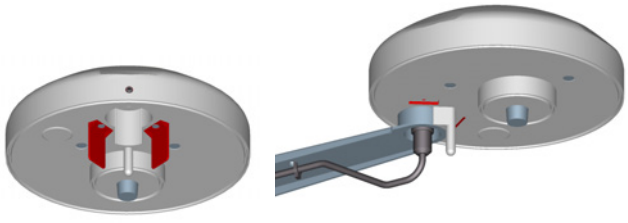
Mounting of WSC11

The working position of the WSC11 is horizontal (plug connection underneath). During installation, de-installation, transport or maintenance of the WSC11 make sure that no water gets into the device and connector.

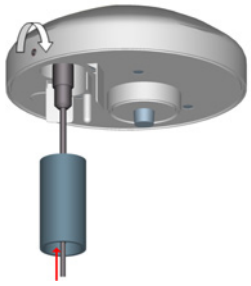
The intended installation of the WSC11 requires:

- a tube with an outside diameter of ≤25mm and an inside diameter of ≥19mm
  or
- a mounting bracket (optional, article no. 3779242)

1. If you are using a mounting bracket, remove the corner guides.

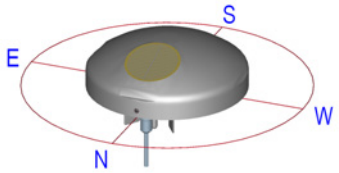


2. Pull the plug of the connecting cable through the tube or mounting bracket.



3. Mount the WSC11 on the tube or mounting bracket.
4. Use a compass to detect a prominent object (tree, building etc.) to the north.
5. Orient the north indicator (N) of the WSC11 in the direction of this prominent object.

When aligning, bear in mind that the direction of a compass needle may differ from true north and that there may be deviations on account of magnetic fields.



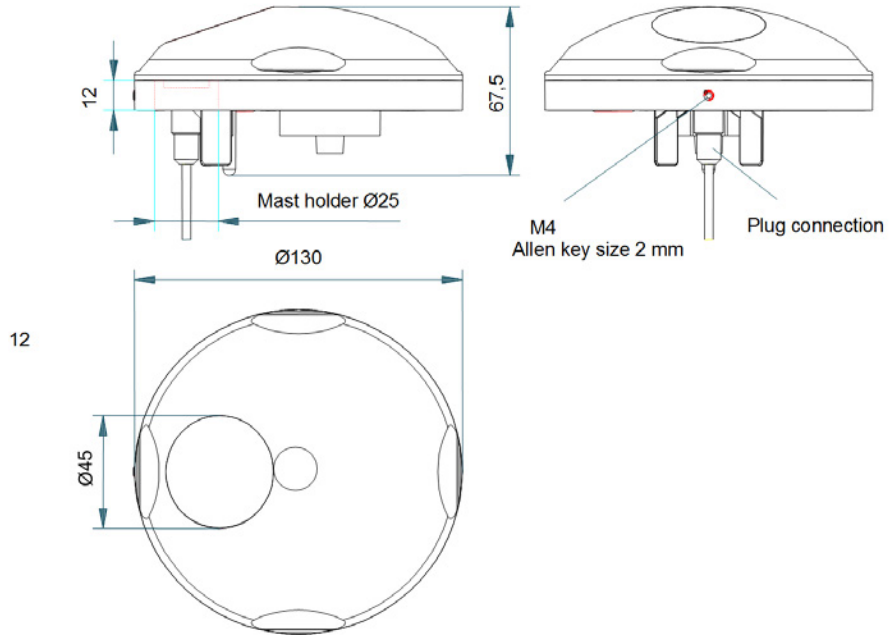
6. Secure the WSC11 with the M4 socket head screw (maximum torque 0.6 Nm).

Specifications

General

Article description	Weather station WSC11
Article number	3779240
Operating voltage	18 ... 30 Vdc
Power consumption	<300 mA at 24 Vdc
Temperature range	-30 ... +60 °C
Humidity range	Non-condensing
GPS reception	GPS receiver with low power consumption, built-in RTC and antenna
Holding time of RTC (without voltage supply)	Approx. 3 days

Housing



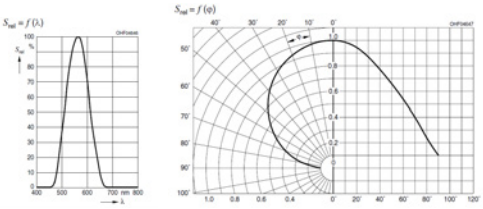
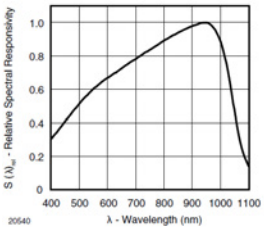
Material	Polycarbonate
Dimensions	See Dimension drawing
Weight	0.22 kg
Type of protection	IP65 in working position
Type of connection	7-pin plug connector

Sensors (in combination with Compass)

Available measurements in combination with Compass	• Wind speed • Wind direction • Global radiation (Radiation sensor) • Rain alarm • Outside temperature • Relative humidity

Sensors

Wind speed	
Type	Thermal anemometer
Measuring range	0 ... 40 m/s
Resolution	0.1 m/s
Accuracy	To 10 m/s: ±1 m/s (rms - mean over 360°).From 10m/s: ±5 % (rms - mean over 360°).
Wind direction	
Type	Thermal anemometer
Measuring range	1 ... 360°
Resolution	1°
Accuracy with laminar incident flow	±10°
Light (north, east, south, west)	
Type	Silicon sensor
Measuring range	0 ... 150 kLux
Resolution	0.1 kLux

Accuracy	±3% (± 4.5 kLux)
Spectral range	475 ... 650 nm  Spectrum of light sensors/Directional characteristics of light sensors (Source: data sheet for component SFH5711 / OSRAM)
Twilight	
Type	Silicon sensor
Measuring range	0 ... 999 Lux
Resolution	1 Lux
Accuracy	±10 Lux
Global irradiance	
Type	Silicon sensor
Measuring range	0 ... 1300 W/m2
Resolution	1 W/m2
Accuracy	±10 % (± 130 W/m²)
Spectral range	350 ... 1100nm  Spectrum for global irradiance sensor (Source: data sheet for component TEMD5080X01 / VISHAY)
Precipitation	
Type	Ceramics, capacitive measurement, sensor area heated
Measuring range	1 / 0 (precipitation yes/no)
Thermal output, sensor dry, bedewing protection	0.1 W
Thermal output, sensor wet, drying phase	1.1 W
Temperature	
Type	PT1000
Measuring range	-30 ... +60 °C
Resolution	0.1 °C
Accuracy with wind speed >2m/s	±1 °C (-5 ... +25 °C)
Air pressure sensor	
Type	Piezoresistive
Measuring range	300 ... 1100 hPa
Resolution	0.01 hPa
Accuracy	±0.5 hPa at 20°C
Long-term stability	±0.1 hPa / year
Relative humidity	
Type	CMOS capacitive
Measuring range	0 ... 100 % rel. humidity
Resolution	0.1 % rel. humidity
Accuracy with wind speed >2m/s	±10% rel. humidity at 20°C
Absolute humidity	
Measuring range	0 ... 400 g/m3
Resolution	0.01 g/m3
Dew-point temperature	
Measuring range	-30 ... +60 °C

Resolution	0.1 °C
Inside temperature of housing	
Type	Silicon sensor
Measuring range	-30 ... +60°C
Resolution	0.1 °C
Accuracy	±2 °C
Digital interface	
Type	RS485
Mode	Half-duplex mode
Baud rate	115200
Data format	MODBUS RTU

Accessories

Article description	WSC11 Connection cable
Article number	3779241
Length	15 m
Features	Cable with cable socket on device side and open ends on reception side.

Article description	Mounting bracket
Article number	3779242
Length	250 mm
Width	60mm
Material	Stainless steel 1.4301
Features	Used for lateral attachment of WSC11 to a vertical surface.

Set networkterminator RS-485 + resistor

article number	3771028
power supply	24 VDC
termination resistance	120 Ω
bias voltage	5 V
bias resistances	510 Ω
dimensions (W x D x H)	27 x 60 x 89 mm
housing	DIN rail mounting, IP40
ambient conditions	0°C to 50°C, 10 – 90% RH (non-condensing)

Rain sensor RD2WI

Rain sensor

The Rain sensors determines whether it is raining, and does so virtually immediately. Any rain falls on the Rain sensor's grid of gilded copper. Droplets of water conduct electricity between the grid's contact lines. A resistance measurement is carried out to detect any droplets between the contact lines. The Rain sensor is equipped with heating to prevent condensation and to dry any rain droplets quickly.

The Rain sensor should preferably be mounted on the Meteorological station and connected to a Priva process computer.

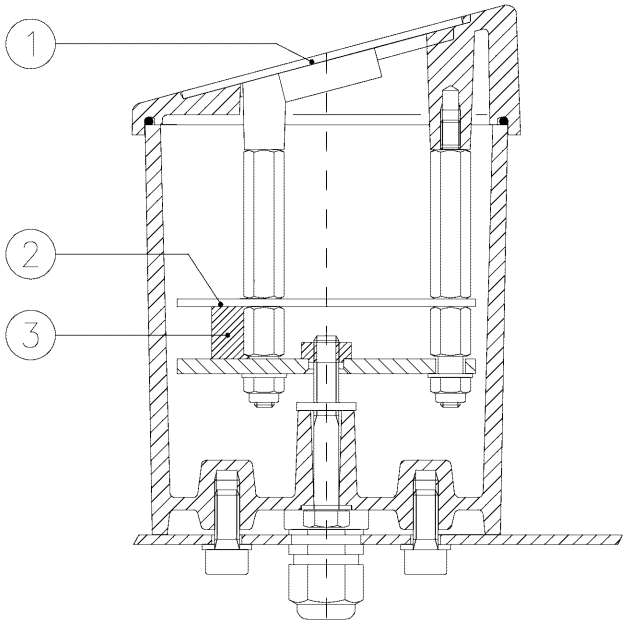
The Rain sensor indicates solely that it is raining, where relevant; it does not measure the precipitation intensity. In addition, the sensor is less suitable for the identification of hail or snow.

Mounting

1. Unscrew the two socket head screws (including clamping rings) on the underside of the Rain sensor completely.
2. Guide the cable through the appropriate opening in the mast.

   The Rain sensor has a set position on the mast.

3. Mount the Rain sensor with the two socket head screws (including clamping rings) on the support of the mast.
4. Feed the cable through the hole in the clamp block assembly so that the cable re-emerges on the underside of the block.



Cross-section of Rain sensor

1. Contact surface + heating
2. Printed circuit board (9583)
3. Connector

The Rain sensor is supplied with a 10-metre shielded cable. It is recommended that you do not shorten this cable when mounting the unit. Coil the remaining length of cable or leave a loop; This ensures that the cable will not be too short in the event of eventual extensions with supports and mast components.

Connecting

See Connecting sensors to the Weather interface WI2 (page 177) for how to connect the Rain sensor.

Speeding up the initial rain detection

After the connection and commissioning of the Rain sensor, the electronic systems require some time before the rain detection functions properly. This time can be as long as 60 minutes when the grid is dry. You can reduce this time to 1 minute as follows:

1. Place a clean wet sponge with tap water on the cartridge. Do not use demineralised water, because it is not conductive.
   The Rain sensor should detect rain after 1 minute.
2. Remove the sponge.
   A short time after this, the Rain sensor should no longer detect rain.

Rain sensor maintenance

Clean the rain sensor at least once a year, or earlier if the Rain sensor develops measurement deviations (for instance, due to leaves or bird droppings). Clean the unit with a damp cloth and a little mild detergent if required. Also check for corrosion or any other damage to the surface of the sensor. Replace the sensor if the surface has been damaged.

Do not use aggressive cleaning and/or abrasives. This damages the gilded contact surface of the Rain sensor.

Make sure that no moisture, dirt or dust enters the housing when opening the Rain sensor. This can negatively impact the measurement.

Specifications

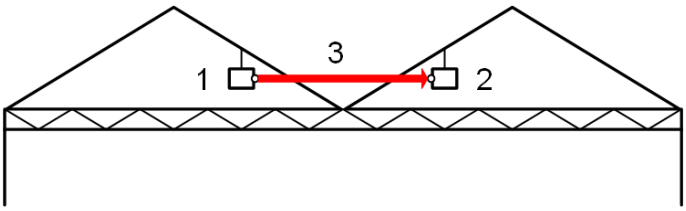
Article description	Rain sensor
Article number	3779206
Measuring principle	Determining the conductivity across copper pattern
Pattern material	Copper, gilded
Track spacing	1.0 mm
Pattern area	16 cm^2
Pattern heating	1.5 – 6.0 W
Protection	Continuous 24 VAC Discharges 900 V/100 nF
Ambient temperature	-40 – +80° C

Snow Detector

1. Infrared transmitter
2. Infrared receiver

The Snow detector is an optic sensor that detects a layer of snow on the greenhouse roof. It works as a security device to avoid the weight of snow on the greenhouse roof from becoming too great, and thus posing a possible threat of damage to the greenhouse.

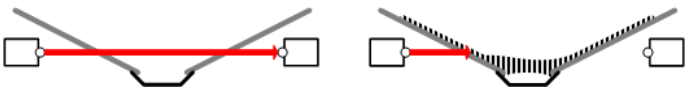
The Snow detector consists of an infrared transmitter and an infrared receiver and mounting brackets, which come supplied with the device. The detector is usually mounted in the greenhouse under the glass roof.



Installing the Snow detector

1. Infrared transmitter
2. Infrared receiver
3. Infrared bundle

If the infrared light bundle is interrupted, the Snow detector activates a switching relay. This can occur when snow accumulates, but also in case of frost forming or frostwork on the greenhouse roof, in case of hail or if something comes between the transmitter and the receiver (for example, a person walking on the greenhouse roof).



Operation of the Snow detector

To ensure that only snow is detected, the Snow detector is combined via the process computer with an outside temperature security device. This helps ensure that the Snow detector only becomes active if the outside temperature falls below, for example, 5 °C. Any precipitation that falls above this temperature is usually rain or wet snow. These types of precipitation pose no threat to the greenhouse construction.

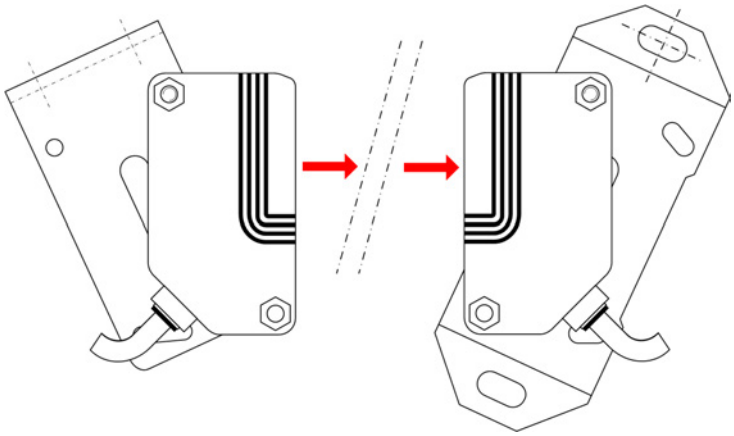
The infrared receiver of the Snow detector has a potential-free switching contact as output. Together with the outdoor temperature safety device, a control action can be initiated. In addition, the heating system in the greenhouse can be corrected so that the snow will melt and the meltwater will be drained awau nu the deiced drainpipe. This can be realised, for example, by increasing the room temperature by means of the heating nets or the partial opening of curtains.

The Snow detector was developed for glas greenhouse roofs, but can also be used with platic greenhouse roofs. Bear in mind the following factors, which can negatively impact the operation of the Snow detector:

- As a aresult of aging, the translucency of a plastic roof deteriorates.
- It can occur that the plastic greenhouse roof will not let through the infrared light frequency that is required for the Snow detector.

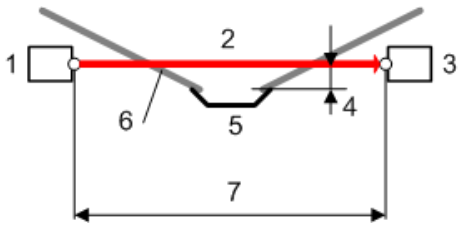
Mounting

Mount the transmitter and the receiver with the help of the mounting cables supplied with the device, see the illustrationMounting Snow detector (page 57)



Mounting Snow detector

Install the transmitter and the receiver in the manner indicated in the illustrationInstalling the Snow detector (page 57). Ensure that the infrared beam from the transmitter is precisely aimed at the "eye" of the receiver (both horizontally and vertically).



Installing the Snow detector

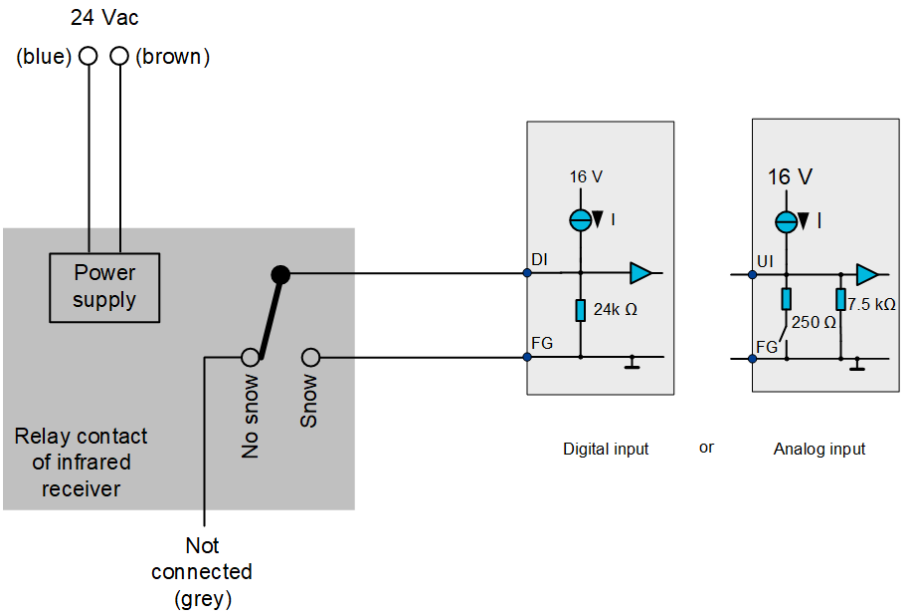
1. Infrared transmitter
2. Infrared bundle
3. Infrared receiver
4. Distance light beam - gutter: approximately 10 to 15 cm
5. Gutter
6. Greenhouse roof
7. Distance transmitter - receiver: 1.5 to 2 m

In addition, bear the following in mind as well when installing the Snow detector:
- Install the Snow detector in a representative location in the greenhosue; this is usually near the coldest spot on the greenhouse, such as in the shade of a taller building. It can also be the location where the most snow accumulates due to wind turbulence.
- Install the infrared beam between transmitter and receiver a maximum 10 cm above the top of the drainpipe.
- Install the transmitter and the receiver horizontally a maximum of 1.5 to 2 m apart and make sure that they are directly across from each other.
- Install the transmitter and the receiver in such a way that the swivels of the cables point downwards. This helps avoid condensation water from accumulating.

Connecting the Snow detector

Select *External Override* in the I/O setup as sensor type (see Assigning sensors to Compass (page 43)).

Safety precautions:
- Make sure that the power is switched off while connecting the Snow detector.
- Incorrect connection will damage the Snow detector.
- If a switching power supply or another noise-producing device is located in the vicinity of the Snow detector, make sure that these devices have adequate noise suppression.
- Make sure that the low voltage wiring is kept separate from the mains wiring.
- Make sure that the Snow detector is not exposed directly to a fluorescent lighting installation. This may adversely affect the operation of the Snow detector.
- Only use the Snow detector indoors.
- Avoid dust, dirt, condensation water and steam.
- Make sure that the Snow detector does not come into contact with oil, grease, solvents, acids, etc.
- Fit a fuse in the 24 VAC power supply.



Core	Function	Compass
Brown	Supply voltage	Power supply 24 Vac
Blue	Supply voltage	Power supply 24 Vac
Black	Potential free contact	Field ground
White	Potential free contact	Digital input
Grey		Do not connect

Cable type and length

You can extend the cable: feed the cable from the transmitter and/or the receiver in a junction box and use a soldering link to connect the cores with each other. Bridge the distance from the junction box to the computer with a new screened cable.

Do not use only tape to extend and insulate the cable.

Cable information

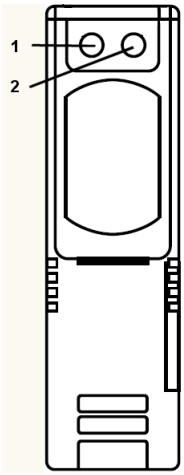
Core diameter	Ø 0.8 mm (0.5 mm^2)
Maximum cable length	300 m

Checking operation

The Snow detector is working correctly if:

- the red LED light is lit on the transmitter and receiver (device is on), and
- the green LED light is lit on the receiver (infrared beam is stable).

LEDs



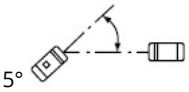
LED	Infrared transmitter	Infrared receiver
1	-	green: light beam is stable
2	red: device is on	red: device is on

Snow detector maintenance

Clean the Snow detector at least once a year and check to ensure that the light bundle is not being interrupted by debris, such as leaves or sand. For cleaning the snow detector, use a damp cloth and, if necessary, some mild soap.

Ensure also that the greenhouse roof around the Snow detector remains clean to help ensure proper translucency.

Specifications

Article description	Snow detector
Article number	3779000
Type	Infrared transmitter and receiver
Protective class	IP66
Dimensions (l x w x h)	62 x 35 x 18 mm
Sensor range	3 m
Maximum visibility angle	 5°
Supply voltage	24 Vac ± 10% - 50/60 Hz
Switching power	24 Vac 1 A
Input power	Maximum 3.5 VA (transmitter + receiver)
Electrical life expectancy	Minimum 500,000 actions
Mechanical life expectancy	Minimum 100,000.000 actions
Response time	Maximum 10 ms
Environmental temperature	-20 to +55 °C (without condensation, no freezing permitted)
Storage temperature	-30 to 70 °C
Environmental humidity	35 to 85% RV
Length of cable included	2 m

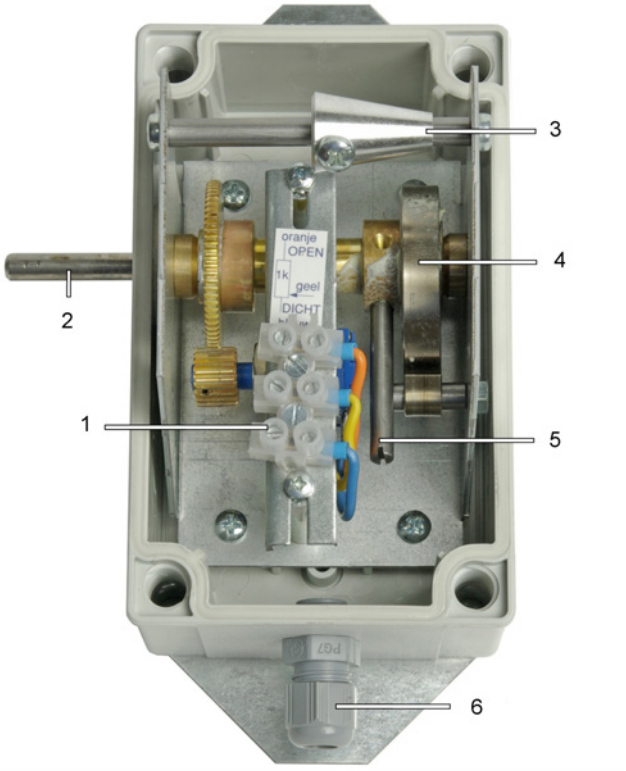
Vent position indicator

Using the Vent position indicator you can very accurately read out the position of a vent in your greenhouse. For optimal accuracy, particularly in the range when the vent is almost closed, the Vent position indicator uses two measurement rods. The vent position is measured using a potentiometer, which provides a resistance value between 0 and 1 kΩ.

The Vent position indicator is available in two types, with a different mechanical angular displacement:

- 0 - 60°
- 0 - 90°

Setting the closed vent position on the potentiometer



Vent position indicator overview

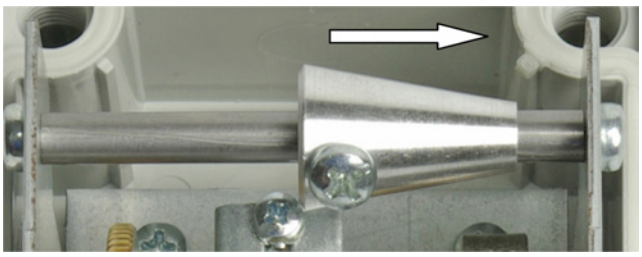
1. Terminal block
2. Shaft for the measurement rods
3. Adjustment cone
4. Spring
5. Spring arm
6. Swivel

Using the adjustment cone (3 in the illustration Vent position indicator overview (page 62)) you can set the furthest position of the potentiometer with the spring tensioned. In this position the vent is closed and resistance changes are measured as soon as the vent opens. When the furthest position is not properly set, it is in the 'dead' zone of the potentiometer. In the furthest position the potentiometer does not then measure any resistance change when the vent opens.

The furthest position has normally already been properly set by the manufacturer. To make absolutely certain, check it as follows:

1. Ensure that the Vent position indicator is *not* connected to the process computer.
2. Unscrew and open the Vent position indicator housing.
3. Turn the spring arm (5) until it is against the adjustment cone (3) by placing one of the measurement rods on the shaft (2) and turning the shaft. This is the furthest position, in which the vent is closed and the spring is fully tensioned.
4. Using a multimeter, measure the resistance between the blue wire and the yellow wire at the terminal block (1).
   The resistance measured must be between 5 and 20 Ω.

5. If the resistance is less, move the adjustment cone in the direction indicated in the illustration Setting the adjustment cone (page 63). Use the screw on the adjustment cone for this.



Setting the adjustment cone

6. Measure the resistance again.
7. Close the Vent position indicator and fasten the screws.

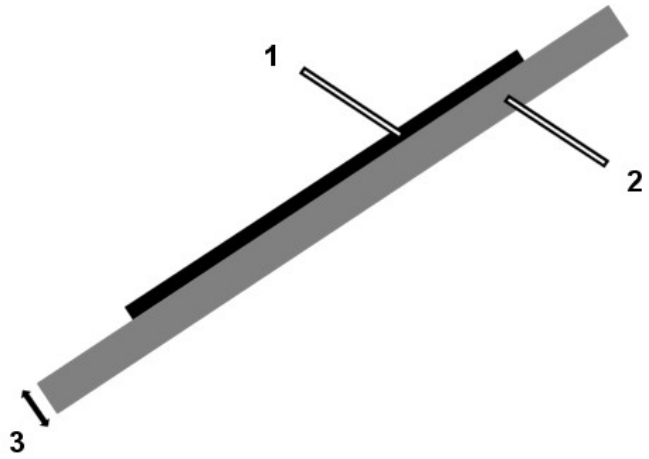
Installation

Before you install the Vent position indicator, you must first determine the position of the measurement rods and the position of the Vent position indicator.

Fitting the measurement rods

You can determine the position of the measurement rods and the position of the Vent position indicator on the vent frame as follows:

1. With the vent closed, measure the thickness of the vent on which the Vent position indicator will be mounted.



Measurement rod positioning 1

1. VENT
2. Vent frame
3. Vent frame thickness

2. Place the Vent position indicator on a table, on an object that is 1 mm thinner than the thickness you measured in the previous step.

Measurement rod positioning 2

1. increase

3. Slide the long measurement rod onto the shaft and tighten the screw finger-tight (so not fully tightened), see the illustration Measurement rod positioning 3 (page 64). Keep a space of 1 to 2 mm between the shaft and the housing.

Measurement rod positioning 3

4. Slide the short measurement rod onto the shaft too. Do not tighten the screw, but allow it to rest on the table, see the illustration Measurement rod positioning 4 (page 64)

Measurement rod positioning 4

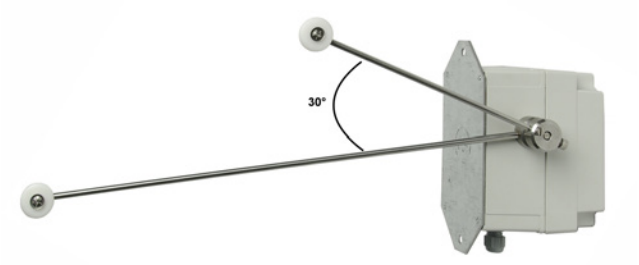
5. Keep the housing firmly pressed down on the table (for example, with a frame clamp) and stretch the spring using the long rod as far as the furthest position, where you can feel the catch, see the illustration Measurement rod positioning 5 (page 64)

Measurement rod positioning 5

6. Tightly fasten the screw of the short rod, while it is still resting on the table.
7. Release the spring carefully and lay the Vent position indicator flat on the table, see the illustration Measurement rod positioning 6 (page 65).

Measurement rod positioning 6

8. Loosen the screw of the long measurement rod and turn it so that it is at an angle of 30° to the short rod, see the illustration Measurement rod positioning 7 (page 65)



Measurement rod positioning 7

9. Tightly fasten the screw of the long measuring rod.

Fitting the Vent position indicator on the vent frame

For positioning the Vent position indicator, the vent must be fully open.

1. Place the Vent position indicator with the spring not under tension against the vent frame. The Vent position indicator must be positioned with the cable gland pointing downwards to prevent water being able to enter the housing.
2. Position the Vent position indicator so that the long measurement rod exactly touches the glass of the fully open vent, see the illustration Vent position indicator fitted (page 65).

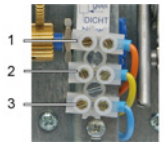
Vent position indicator fitted

3. In this position, screw the Vent position indicator securely against the vent frame with two cross-head screws.
4. Measure the distance between the Vent position indicator and the vent hinge. Use this distance for positioning another Vent position indicator on the same type of vent.

Connecting the Vent position indicator

The vent position indicator is supplied without a cable. The table below shows the specifications of the cable to be used.

Cable type	3 x 0.8 mm (0.5 mm^2)
Maximum cable length	100 m



1. 5 VDCm x-connection (orange)
2. Output signal (yellow)
3. 0 V connection (blue)

1. Open the housing of the vent position indicator by unscrewing it.
2. Feed the cable through the cable gland into the housing and tighten the cable gland.
3. Connect the cores of the cable to the terminal block, see picture.
4. Close the vent position indicator again by screwing it tight.
5. Connect the cable as shown in the table below.

Connection on vent position indicator	Function	Compass
1 (orange)	Supply voltage	Not connected
2 (yellow)	Signal sensor	Analogue input
3 (blue)	GND sensor	Field ground

Vent position sensor maintenance

Check the Vent position indicator regularly for fouling and clean it as necessary. Clean the unit with a damp cloth and a little mild detergent if so required.

Do not use aggressive cleaning agents or abrasives.

Make sure that no moisture, dirt or dust enters the housing when opening the Vent position indicator, since these can be detrimental to the measurement.

Spare Parts

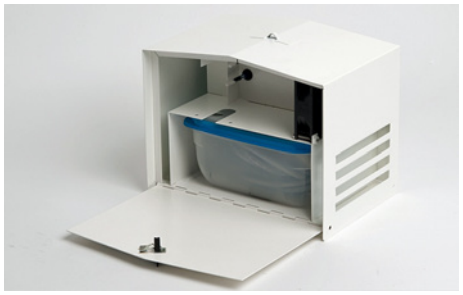
The following spare parts are available for the vent position sensor:

Part	Article number
Potentiometer set 1 kΩ for Vent position indicator 60°	3770885
Potentiometer set 1 kΩ for Vent position indicator 90°	3770886
Short rod with nylon pulley for Vent position indicator 60° and 90°	3779034
Long rod with nylon pulley for Vent position indicator 60° and 90°	3779035
Nylon pulley with locking spring and shaft for mounting on the rods for the Vent position indicator 60° and 90°	3779037

Specifications

Article	Vent position indicator
Article number	0 - 60º: 3779032 0 - 90º: 3779033
Operation	Potentiometer (1 kOhm, linear)
Sensitivity	in two ranges: • accurate: closed - 20% open • coarse: 20% open - fully open

Measuring box T+RH



Measurement principle

The Measuring box T+RH (dry/wet bulb) operates on the physical principle of an aspirated psychrometer. The Measuring box T+RH measures the wet and dry bulb temperatures. The process computer calculates the absolute and relative air humidities, as well as the humidity deficit based on the difference between these two temperatures.

The dry bulb temperature is the ambient temperature as measured by a dry bulb temperature sensor. The wet bulb temperature is measured by a wet bulb temperature sensor inside a damp wick. This wick absorbs the water from the fluid reservoir. Below the dew point, water in the wick evaporates and in so doing extracts heat from the air.

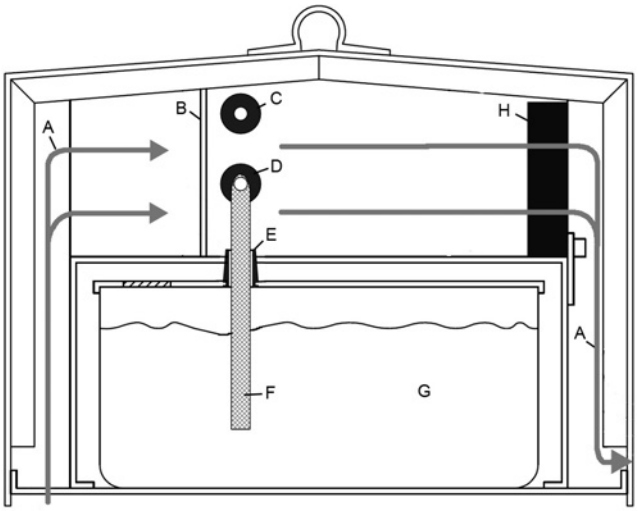
The extent to which water is able to evaporate out of the wick is dependent on how much moisture the surrounding air is still able to absorb, i.e. the more humid the air flow, the less moisture the air can absorb and the less water can evaporate out of the wick. The wick in turn absorbs less heat. The smaller the difference between the dry and wet bulb temperatures, the higher the relative air humidity (%RH) and the lower the humidity deficit (g/kg).

The speed with which air flows past the dry and wet bulb sensors is determined by the fan and the restrictor plate. The air speed is independent of the frequency of the fan's power supply.

The Measuring box T+RH temperature sensors are shielded from direct sunlight.

Do not install the Measuring box T+RH in areas with a hanging mist, as fine mist droplets can condense inside the fan housing when compressed. This can cause damage to the electronic componentry.

Measuring box T+RH summary



Measuring box T+RH front/interior (measurement section)

A. Air flow
B. Restrictor plate
C. Dry bulb temperature sensor
D. Wet bulb temperature sensor
E. Grommet
F. Hygrowick
G. Aquanex fluid reservoir
H. Fan

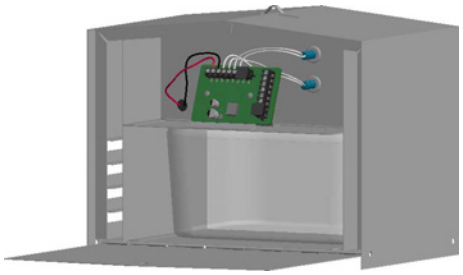
Measuring box T+RH and supplied components

Measuring box T+RH shown with supplied components

A. Measuring box T+RH
B. Connecting cable
C. Fluid reservoir
D. Suspension chain
F. Hygrowick
F. Hygrowick grommet
G. Clamping gland for connecting cable
H. S-hooks for suspension chain

Assembly

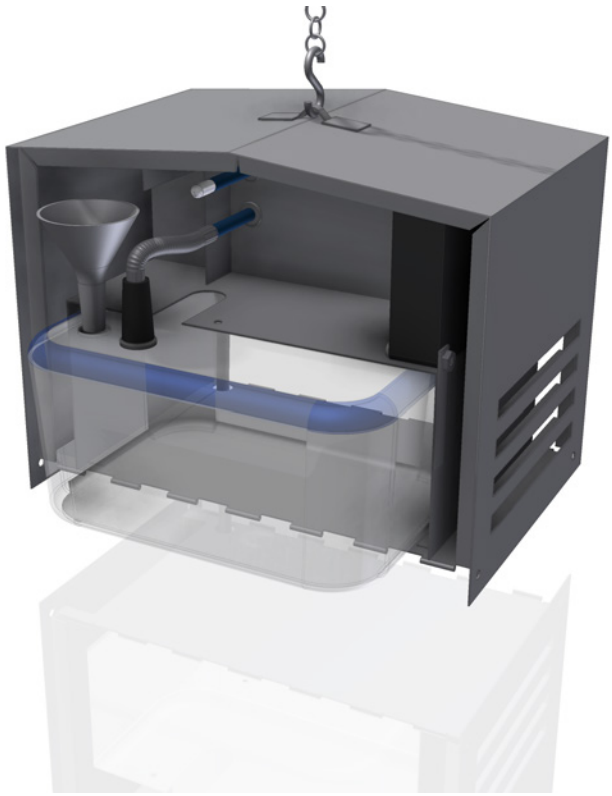
Connection section



Measuring box T+RH connection section assembly

1. Fasten the clamping gland to the connecting cable at about 20 cm from the stripped wire ends.
2. Feed the connecting cable through the hole in the base of the housing and fasten the clamping gland firmly in the base.
3. At a representative measurement location, hang the Measuring box T+RH from a sturdy hook using the S-hooks and chain. Pay attention to the following points:
    - For crops grown on crop wire, such as tomatoes, suspend the Measuring box T+RH at the same height as the tops of the plants. This means that you will need to raise the Measuring box T+RH regularly to match the growth of the plants..
    - Hang the Measuring box T+RH at least 10 to 15 m away from concrete paths or walls to minimize heat effects from these objects.
    - Do not hang the Measuring box T+RH under a sulphur evaporator, irrigation system or low-volume mist system.
    - Hang the Measuring box T+RH at least 50 cm higher than any nearby heating pipes to minimize the effect of convection.

Measurement section



Measuring box T+RH measurement section assembly

1. Insert the Hygrowick grommet into the small hole in the fluid reservoir lid from below.

   Incorrect fitting of the grommet results in at least 35% more water usage due to secondary evaporation.

2. Insert the Hygrowick through the grommet in the fluid reservoir lid.
3. Fit the lid onto the reservoir
4. Fill the fluid reservoir with Aquanex using a funnel, and place the reservoir in the housing.
5. Push the Hygrowick over the lower temperature sensor (the wet bulb temperature sensor), and feed it as far back as possible.

   Make sure that the wick forms a right angle between the sensor and the grommet.

Connecting

Select Priva Temperature sensor in the I/O setup as sensor type for both temperature and humidity readings.

1. Connect the supplied cable to the Measuring box T+RH terminal strip and to a junction box. See table below.
2. Connect the cable from the junction box to the Compass. Use two separate cables for this purpose: one for the sensors and one for the power supply to the fan. See Cable specifications (page 72) for the specifications of the required cables.

Core	Measuring box terminal	AI16/DO32 I/O module connecting terminal
P1-1	24 Vac	24 Vac/Vdc (fuse 24 Vac)
P1-2	0 Vac	0 Vac/Vdc (fuse 24 Vac)
P1-3	RH+	Analogue input
P1-4	RH-	Field ground
P1-5	T+	Analogue input
P1-6	T-	Field ground
P1-7	24 Vdc ! DC power supply only	
P1-8	0 Vdc ! DC power supply only	

Core	Internal connection Measuring box
P2-1	Fan (AC)
P2-2	Fan (AC)
P2-3	T+ (wet bulb)
P2-4	T- (wet bulb)
P2-5	T+ (dry bulb)
P2-6	T- (dry bulb)
P2-7	Fan (DC) ! DC power supply only
P2-8	Fan (DC) ! DC power supply only

! Only connect the Measuring Box T + RV to a DC power supply if an AC power supply 24 Vac is not available.

Cable specifications

Use a cable with Ø 0.8 mm (0.5 mm^2) cores.

The table below lists the number of cores that each cable should contain for each connection for a given connection length.

Connection	Cores by connection distance			
	0 – 100 m	**100 – 200 m**	**200 – 300 m**	**300 – 400 m**
dry bulb temperature sensor (analogue)	2	2	2	4
wet bulb temperature sensor (analogue)	2	2	2	4
24 V fan power supply	2	2	2	4

Maintenance of measurement box T+RH

Introduction

The following maintenance tasks should be performed regularly:

- check for Hygrowick moistness
- replenish fluid
- clean fluid reservoir
- inspect and clean fan
- check measurements

Checking Hygrowick moistness

Check regularly that the Hygrowick is still sufficiently moistened. Check more frequently when the Measuring box T+RH is hung in a dry environment.

1. Open the front of the Measuring box T+RH and pull the fluid reservoir a little towards you.
2. Check that the Hygrowick is still clean and sufficiently moistened. Replace the wick if it is dirty or insufficiently moisenedt.

Do not touch the Hygrowick with your hands. Wear clean gloves.

Replenishing the fluid

The fluid reservoir should be regularly replenished with Aquanex fluid, which is available from Priva either ready-mixed or as a concentrate (see Table Aquanex fluid (page 73)). Aquanex fluid contains additives to combat algae and bacterial growth in the fluid reservoir, so that the Hygrowick will work reliably for an extended period.

1. Open the front of the Measuring box T+RH and pull the fluid reservoir a little towards you.
2. Add Aquanex fluid to the fluid reservoir using a funnel.

Never use:

- pure tap water
- condensation water from a flue gas condenser
- additives other than Aquanex

Aquanex fluid

Article	Article number
Aquanex concentrate (25 cl)	3779084
Aquanex fluid (5 l)	3779086

Cleaning the fluid reservoir

Clean the fluid reservoir regularly using water and dishwashing liquid. Rinse well with clean water.

Inspecting and cleaning the fan

Regularly check that the fan is working correctly and remove any dust from the rotor blades using a soft brush.

Checking measurements

Check the measurements of temperature (and therefore humidity) according to the procedure below:

1. Remove the Hygrowick from the lower temperature sensor (wet bulb temperature sensor).
2. Close the cover of the measurement section.
3. Let this sensor dry thoroughly (at least 15 minutes).
4. Compare the temperature measurements of the dry and wet bulb temperature sensors. At an ambient temperature between 15 ° C and 35 ° C, the maximum difference may be 0.4 ° C. The measured values can be found in M105 (Connext) and in the moisture card (Compass).

Spare parts

The following spare parts are available for the Measuring box T+RH (article number 3779024):

Article	Article number
Temperature sensor in glass tube Ø6 mm x 60 mm with NTC/thermistor 3kΩ/25°C	3770882
Valve.24VDC/80mmT+RH hs 1.4W	3659032
Power supply interface 24VAC/24VDC for fan for measuring box T + RH	3770610
Fluid reservoir	3476142
2 x S-hooks	3802851
Suspension chain (thermally galvanized)	3802861
Connecting cable (7 x 0.5 mm^2)	3471375
Clamping gland for connecting cable	3802523
Hygrowick (25 cm)	3779088
Grommet for Hygrowick	3802733
Quarter-turn fastener (grip head)	3476140
Quarter-turn fastener (slotted head)	3476143
Fastener latch	3476141

To avoid causing measurement errors, always replace defective components using original Priva parts.

Specifications

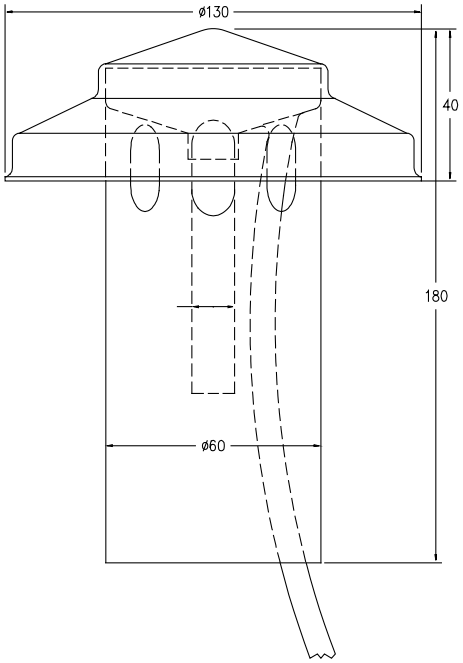
Article	Measuring box T+RH
Article number	3779024
Housing	Single-walled, thermally galvanized sheet metal with white coating
Dimensions (L x W x H)	260 x 175 x 205 mm
Measurement principle	Aspirated psychrometer
Fluid reservoir capacity	1800 ml
Connecting cable	7-core, Ø 0.8 mm (0.5 mm^2), length 5 m
Working range	2.5–50 °C 20–100% RH (non-condensing)
Range	2.5–70 °C 0–100% RH (non-condensing)
Thermistor resistance	3 kΩ at 25 °C (non-linear)
Temperature precision (software-determined value)	0.3 °C (15–35 °C) 0.4 °C (< 15 °C and > 35 °C)
RH precision (software-determined value)	3% (10–100% RH), (15–35 °C) 4% (10–100% RH), (< 15 °C and > 35 °C)
Fan power supply	24 Vdc/Vac (±20%) at 50/60 Hz
Fan load current	0.1 A

Measuring box T

The Measuring box T contains a temperature-dependent resistance with a negative temperature coefficient (NTC) for measuring the ambient temperature.

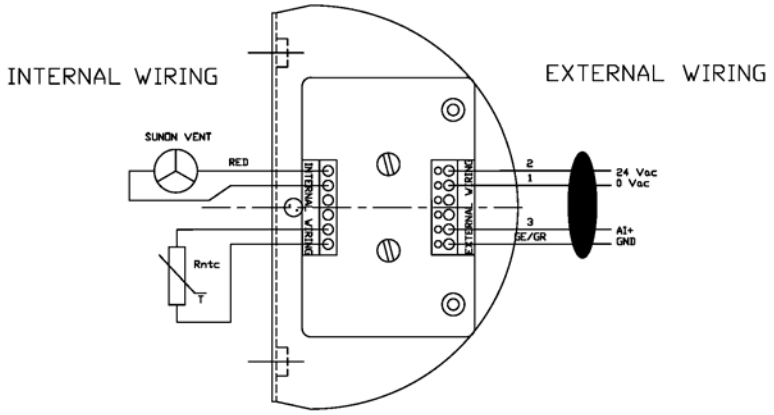
Mounting

Hang the Measuring box T at a representative location (not above a heating pipe or blowing out a CO_2 tube) at a height that is significant for the growth of the plant.



Connecting

Select *Priva temperature sensor* in the I/O setup as sensor type (see Assigning sensors to Compass (page 43)).



Terminal	Function	Compass	Power supply
1	0 Vac	Not connected	0 Vac
2	power supply for fan	Not connected	24 Vac
3	Signal	Analogue input	Not connected
GE/GR	Sensor GND (not electrically isolated)	Field ground	Not connected

Cable specifications

Use a cable with Ø 0.8 mm (0.5 mm^2) cores.

The table below lists the number of cores that each cable should contain for each connection for a given connection length.

Connection	Cores by connection distance			
	0 - 100 m	100 - 200 m	200 - 300 m	300 - 400 m
temperature sensor (analogue)	2	2	2	4
24 V fan power supply	2	2	2	4

Maintenance of Measurement box T

Check for pollution regularly and remove any pollution.

Specifications

Article	Measuring box T
Article number	3779027
Housing	white painted PVC
Measurement principle	NTC (resistance sensor)
Measurement range	-40 .. 80 °C
Ohmic resistance	3 kΩ at 25 °C (non-linear)
Temperature precision (software-determined value)	0,2 °C (15 .. 35 °C) 0,4 °C (< 15 °C and > 35 °C)
Cable	Supplied: 5 meters
Maximum cable length	400 meters
Fan power supply	24 Vdc/Vac (±20%) at 50/60 Hz
Fan load current	0,1 A

Plant temperature camera

The Plant temperature camera measures the infrared radiation emitted by plants in the 8 – 15 micrometer range. This is also called heat radiation. The camera enables you to measure the temperature of a 5 to 16 m² area of your crop without contacting it or damaging it.

Place the protective plastic cap on the camera during crop protection. Contact with crop protection products or other chemical agents could damage the lens.

Protect the entire camera when the greenhouse is being disinfected with aggressive substances.

Plant temperature in Compass

Using the plant temperature, greenhouse air temperature and relative air humidity, Compass calculates the vapour pressure deficit. The vapour pressure deficit (VPD) is the difference in vapour pressure between the greenhouse air and the stomata of the leaf. The larger this vapour pressure deficit, the greater are the opportunities for the plant to transpire moisture. With this plant temperature and VDP you can adjust your humidity and irrigation control.

Installing the camera

Installation in greenhouse

The camera is to be attached by the suspension bracket to a greenhouse post. This bracket makes sure that measurement always occurs at the proper angle. The bar weight ensures camera stability.

In selecting a greenhouse post, consideration should be given to the following points:

- The camera measurement area must be quite close to the the climate measuring box, but this box must remain outside the field of view.
- It must be possible for the suspension bracket to be moved from a half meter above the ground to the rafter or the ridge.
- The camera may not be mounted under a rain pipe.

Determine the side of the greenhouse post to which the suspension bracket must be attached in order to point the camera away from the sun.

Installing the camera

Plant temperature camera placed in a suspension bracket.

1. Attach the suspension bracket to the greenhouse post at operating height as shown in the accompanying assembly diagram.
2. Use two lock nuts to fasten the swivel joint to the top of the suspension housing.
3. Attach the bar weight with a wing bolt to the underside of the suspension housing.
4. Attach the suspension housing with the swivel joint and wing bolt to the support arm.
5. Place the camera in the suspension housing as shown in the photograph alongside. (The camera lens is angled downward.)
6. Leave some slack in the cable connecting the camera so that the camera aim can be adjusted. Attach the cable to the support arm to prevent the weight of the remaining cable from pulling the camera off balance. The remaining cable should hang freely down the greenhouse post, allowing the suspension bracket to be raised and lowered.

Connecting the camera

Select *Infrared temperature sensor (-10 to 50 degrees)* in the I/O setup as sensor type (see Assigning sensors to Compass (page 43)).

Required power supply:
- 24 VDC power supply field equipment

The camera is supplied with a cable. Connect this cable to the process computer as indicated in the table below.

Connecting the camera

Core	Function	Compass
Brown	supply voltage 24 VAC or +24 VDC	Power supply 24 VDC
White	ground for power supply	Power supply 0 VDC
Yellow	analogue sensor signal	Analogue input
Green	sensor signal ground	Field ground
Shielding	connection to ground busbar	
Other	do not connect, but do insulate	

Adjusting the camera

To use the camera properly, it must be properly aimed and adjusted to the correct height.

Height

On the back of the suspension bracket are two wing bolts used to fasten the bracket to the greenhouse post. Loosen these bolts to raise or lower the bracket on the post. Position the camera at the desired height and re-tighten the wing bolts.

Place the camera 60 cm above plant tops. The tops may grow to 40 cm below the lens, at which point the camera has to be raised by 20 cm.

Direction

Aim the camera as follows:

1. Slightly loosen the wing bolt on the top of the suspension bracket arm.
2. Point the camera away from the sun and, preferably, across the rows of plants.
3. Point the camera so no distracting elements are in the field of view (greenhouse posts, cable winches, heating pipes, CO_2 tubing, ground, plastic sheeting, etc.). Two round holes have been made in the suspension housing under the camera. Look through them to view approximately the same area that the camera will measure.
4. Tighten the wing bolt on the top of the arm.

The viewing angle of the camera will remain accurately fixed by the swivel joint and bar weight.

Specifications

Article description	Plant temperature camera
Article number	3779011 (including the suspension bracket for a greenhouse post up to 14 cm)
Temperature range	-10 - +50°C
Response time	3 s
Spectral sensitivity	8 - 15 µm
Start-up time	15 min
Accuracy	0.8°C plus 0.6% of the temperature difference between the camera housing and the object being measured
Course	less than 0.03°C per year
Output current	4 - 20 mA
Supply voltage	10.5 - 32 VDC (or 24 VAC, 48 .. 400 Hz)
Power consumption	2 W
Current consumption	80 mA
Resistance	≤ 550 Ω
Permissible transport and storage temperature	-20 - +70 °C
IP code	IP 67
Camera weight (without suspension bracket)	approx. 1.4 kg
Length of the camera (without connector and suspension bracket)	174.9 mm
Camera diameter	62.8 mm

Dimensions of the Plant temperature camera (in millimetres)

Plant temperature camera TopCrop Monitor

The Priva TopCrop Monitor Infrared plant temperature sensor measures the infrared radiation emitted by plants in the 5 – 15 micrometre range. This is also called heat radiation. The sensor enables you to measure the temperature of your crop without contacting it or damaging it. The camera has a measuring spot with a diameter of ±4 cm. The camera is equipped with a directional laser, which is activated by a push button. This laser shows you exactly where the centre of the measuring surface is.

Place the protective plastic cap on the sensor during crop protection. Contact with crop protection agents or other chemical agents could damage the lens.

Protect the entire camera when the greenhouse is being disinfected with aggressive substances.

Warning laser class 2. Class 2 laser: Do not look into the laser beam and do not aim the laser pointer at anyone's eyes.

Plant temperature in Compass

Using the plant temperature, greenhouse air temperature and relative air humidity, Compass calculates the vapour pressure deficit. The vapour pressure deficit (VPD) is the difference in vapour pressure between the greenhouse air and the stomata of the leaf. The larger this vapour pressure deficit, the greater are the opportunities for the plant to transpire moisture. With this plant temperature and VDP you can adjust your humidity and irrigation control.

Installation

Determining position

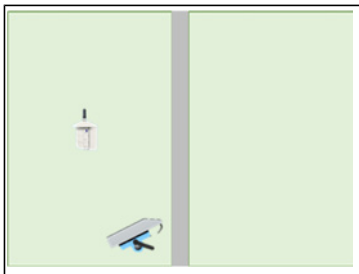
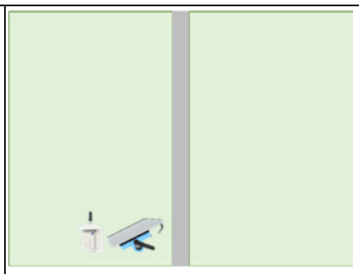
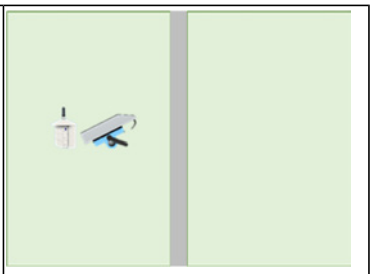
Make sure that the measuring set-up is in a representative location. This location must meet the following requirements:

- Camera in the immediate vicinity of the measuring box (within 3 meters)

  In this case it involves a measuring box and this combined with the camera is used for the TopCrop functionality. This is not necessarily the compartment measuring box.

- The measuring set-up in the middle of the compartment (thus representative for the compartment);
- The measuring set-up is easy to access for directing and maintenance;
- Take account of the other installations in the greenhouse, such as side shading, fan or internal transport system;
- Measuring set-up may not itself be disruptive to other systems, such as rolling façades and hoist heating.

Example positions (plan view)

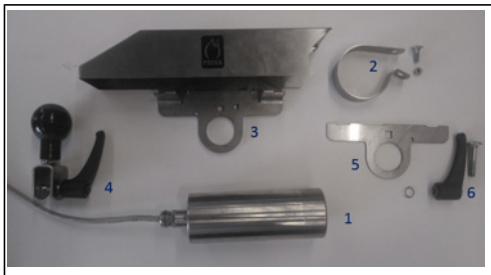
		
Incorrect	**Incorrect**	**Correct**
• Camera not in the direct vicinity of the measuring box. • Camera on the edge of the compartment (measurement is influenced by side wall, centre aisle or adjacent compartment).	• Measuring box on the edge of the compartment. As a result the side wall/centre aisle/adjacent compartment will have an influence on measuring. • Camera on the edge of the compartment (measurement is influenced by side wall, centre aisle or adjacent compartment).	

The sensor is to be attached by a suspension bracket to a greenhouse post. The suspension bracket and sensor bracket allow you to aim the sensor correctly and ensure that it is protected against radiation and moisture.

In selecting a greenhouse post, consideration should be given to the following points:

- The sensor measurement area must be quite close to the measuring box, but this box must remain outside the field of view.
- It must be possible for the suspension bracket to be moved from a half meter above the soil to the rafter or the ridge.
- The sensor may not be mounted under a rain pipe.
- Determine the side of the greenhouse post to which the suspension bracket must be attached in order to point the camera away from the sun.

Installing the sensor

	1) Infrared plant temperature sensor 2) Sensor clamp 3) Protective cover 4) Ball mount 5) Ball mount clamp 6) Latch Tools required; Spanner 10
	Attach the sensor clamp around the sensor.
	Place the sensor and clamp in the protective cover and tighten the bolt so that the sensor is clamped into position.
	Place the ball mount in the appropriate cut-out
	Place the ball mount clamp on the ball mount. Pay attention to the cut-out for the sensor clamp.

	Insert the bolt through the clamp
	Rotate the whole set-up, keeping the latch and bolt in their positions
	Place the latch on the bolt and tighten it to clamp it into position.

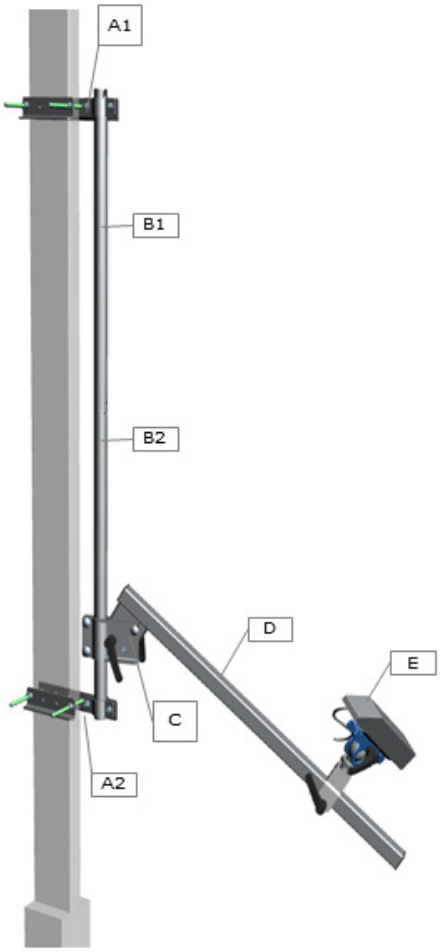
To use the sensor correctly, it must be properly aimed and adjusted to the correct height.

Installation

On the side of the greenhouse post clamp, there are 2 imperial adaptation rings with bolts for clamping the bracket to the greenhouse post. Loosen these bolts to be able to position the bracket around the greenhouse post. Next, tighten the bolts at the desired height. Install the greenhouse post clamp in such a way that the slide rail is located on the north side of the greenhouse post. Mount the clamps at such a height that the sensor can move at the height of the young mature leaves during cultivation. In many crops, this means that the sensor must be adjustable to half the height of the crop.

Place the first slide rail in the greenhouse post clamp, position the slide rail clamp around the slide rail and attach the second slide rail to the first slide rail. Then place the second greenhouse post clamp around the greenhouse post and clamp the slide rail into it. With low-growing crops, it is possible to use one part of the rail.

Then slide the sensor clamp around the sensor arm and secure it with the latches.



A1, A2: Greenhouse post clamp
B1, B2: Slide rail
C: Slide rail clamp
D: Sensor arm
E: Sensor clamp

Setup

Aiming

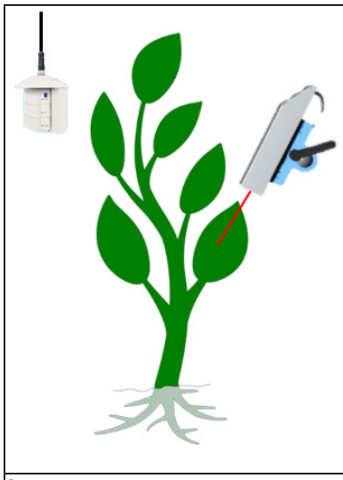
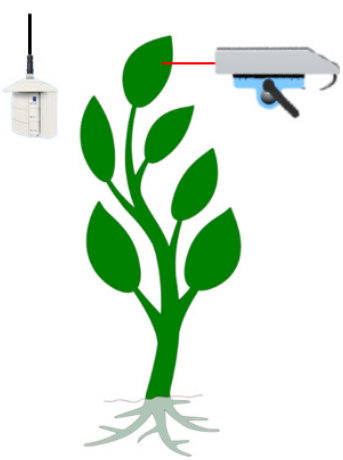
Aim the sensor as follows:

1. Loosen the latch on the slide rail clamp by one turn and move the arm to the desired position.
2. Loosen the latch on the sensor arm by one turn and place the arm at the desired angle.
3. Loosen the latch on the sensor clamp by one turn and place the sensor in the desired position.
4. Loosen the upper latch on the sensor clamp and aim the sensor between *northwest and northeast* (away from the sun) at a *shaded young mature leaf*. Make sure that the sensor ultimately has a viewing angle of between 15° and 30° relative to the horizon.

   If the sloping rear side of the protective cover is horizontal, the sensor angle is 30° (maximum)

5. Aim the sensor so that there are no distracting elements in the field of view (greenhouse posts, cable winches, heating pipes, CO2 tubing, soil, plastic sheeting etc.).

The sensor is equipped with a directional laser, which is activated for 1 minute by a push button. This laser shows you exactly where the centre of the measuring surface is. The sensor's measuring spot has a diameter of ±4 cm. Make sure that the whole measuring area is aimed at a young mature leaf.

		
Incorrect	**Incorrect**	**Correct**
• Sensor is aimed at an old leaf • Sensor angle is too great • Measuring box not at the same height as the sensor	• Sensor is aimed at a young leaf • Sensor angle too small • Measuring box suspended at the height of young leaves.	• Sensor is aimed at a young mature leaf • Sensor angle is between 10° and 30°. • Measuring box suspended at the height of young mature leaves.

Connecting

Select *Infrared temperature sensor (-10 to 50 degrees)* in the I/O setup as sensor type (see Assigning sensors to Compass (page 43)).

Required power supply:
- 24 VDC power supply field equipment

The camera is supplied with a cable. Connect this cable to the process computer as indicated in the table below.

Laser operation

The sensor is also supplied with a junction box with push button. This can be used to connect the sensor to the system, and you can use the push button to link the digital input to the ground sensor in order to activate the built-in laser.

Core	Function	Connect to
		Compass
Brown	power supply voltage +24 VDC	Power supply 24 VDC
White	ground for power supply	Power supply 0 VDC
Yellow	analogue sensor signal	Analogue input
Green	sensor signal ground	Field ground
		Laser operation
Shielding	connection to ground busbar	
Grey-pink	digital input	pressure switch
Other	do not connect, but do insulate	

Maintaining the plant temperature camera

Since soiling of the camera, especially the lens, can inhibit operation, check the camera for dirt at least once every 3 months and clean it as required. Use a a spray can of compressed air to remove dust. If this proves inadequate, clean the lens using a tissue or cotton cloth, and alcohol or methyl spirit.

Do not use aggressive cleaning agents and/or abrasives.

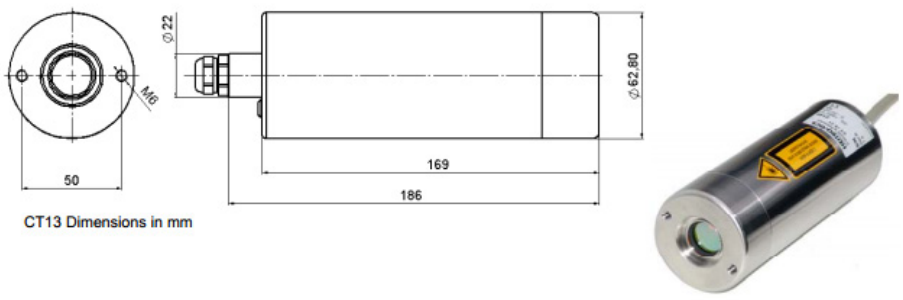
Place the protective plastic cap on the sensor during crop protection. Contact with crop protection agents or other chemical agents could damage the lens.

Checking by dealer

The camera is calibrated prior to delivery. Have the camera checked every 3 years by your dealer to ensure accurate and correct measurement.

Specifications

Article description	PT camera TopCrop Monitor
Article number	3779008
Temperature range	-0 - +50°C
Response time	3 s
Spectral sensitivity	8 - 14 µm
Start-up time	15 min
Accuracy	0.3°C
Field of view	32 mm at 1 metre
Output current	4 - 20 mA
Current output resistance	≤ 550 Ω
Supply voltage	10.5 - 30 VDC
Used power	< 2.5 W
Current consumption	80 mA
Permissible transport and storage temperature	-40 - +85°C
Ambient conditions	-25 - +60°C, solar irradiation 0 - 1000 W/m^2
IP code	IP 68
Camera weight (without suspension bracket)	approx. 1.4 kg



Dimensions of the Infrared plant temperature sensor (in millimetres)

CO2 monitor Guardian NG

The CO_2 monitor measures and monitors carbon dioxide concentrations. The CO_2 monitor hangs in the working area and extracts air via a hose from the greenhouse. By inserting a CO_2 selector, it is possible to measure CO_2 concentrations at a maximum of five locations. The CO_2 monitor provides accurate digital measurement, is expandable and is easy to calibrate.

Mounting

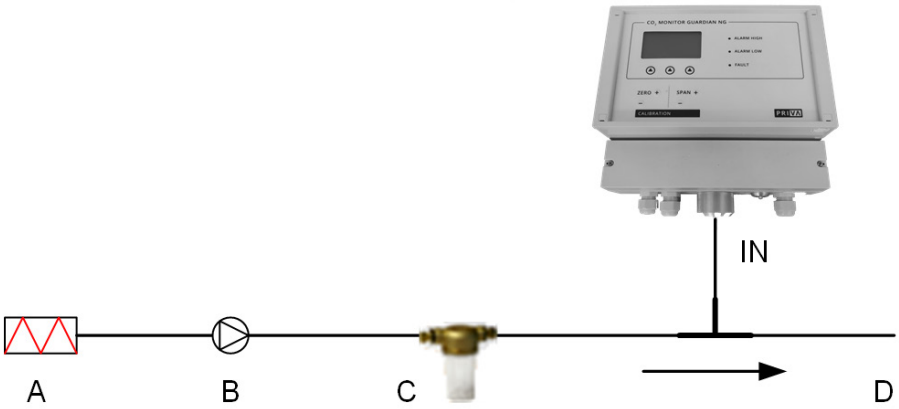
When mounting the CO_2 monitor, note the following:

- Hang the monitor in a place in the working space outside the influence of direct heat, hot air or (condensation) water.
- Use is not permitted in spaces where there is a danger of explosion.
- The suction pipes of the monitor must be equipped with a dust filter. Dirt in the pump of the measurement chamber can damage the monitor.
- The monitor must not suction any corroding or alkaline gases.
- The monitor must not come into contact with any solvents or oil.
- When operational the monitor must not bump or vibrate.
- The monitor must not be dismantled or modified.
- Prevent the monitor from suctioning water.

See also the supplied *Guardian NG Infra-Red Gas Monitor* manual.

Connecting the suction hose

1. Install the supplied steam trap immediately beneath the CO_2 monitor.
2. Insert the supplied small hose (8 x 5 mm), the reducing nipple and a length of hose (6 x 4 mm) on to the gas inlet of the monitor. Connect this hose to the steam trap.
   The reducing nipple is also useful when calibrating the monitor.



Connecting the CO_2 monitor to an external pump

A. dust filter
B. external pump
C. steam trap
D. free outlet

3. Use a hose (6 x 4 mm) from the greenhouse to the steam trap.
   The maximum length of this hose is 30 m. In the case of longer lengths, use an external pump and a T-piece with a free outlet to prevent overpressure occurring in the monitor (see drawing).
4. Use the prescribed dust filter (article number 3659010) for the suction hose inlet. This prevents pollution and blockages in the hoses. A short blue hose and reducing nipple are supplied for connecting the dust filter to the suction hose.
5. If required, install a short hose on the gas outlet of the monitor to muffle the pump noise. You can also connect a flow indicator to the gas outlet.

Prevent leakages in the hoses and steam trap in order to ensure reliable measurements.

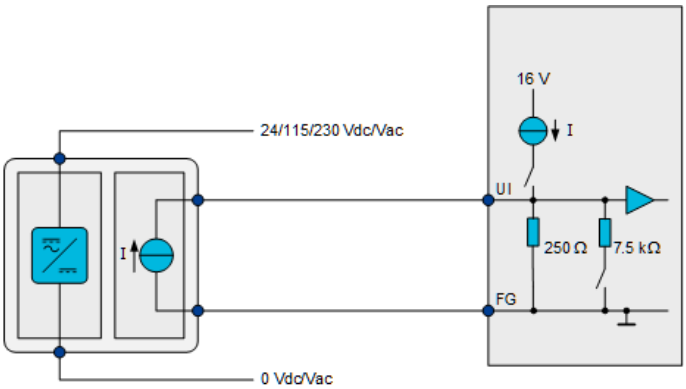
Connecting the Guardian NG CO_2

Select *Guardian + CO2 meter* in the I/O setup as sensor type (see Assigning sensors to Compass (page 43)).

The CO_2 monitor is supplied without a cable. The table below shows the specifications of the cable to be used.

Cable type	2 x 0.8 mm (0.5 mm^2) shielded

1. The CO_2 monitor is supplied by default with a CEE 7/4 European plug. If this is replaced, connect the power cables to the specified location on the PCB.
2. Make sure that the range of the CO_2 monitor analogue output is 0 - 20 mA (DIP switch).
3. Connect the cable as shown in the figure and table below.



Guardian NG CO_2 connections	Function	Compass
Analogue output O/P	Signal sensor	Analogue input
Analogue output 0V	GND sensor	Field ground

Maintaining the CO2 monitor Guardian NG

- For cleaning the CO_2 monitor use a cloth with a mild cleaning agent or water. Make sure you do not get any liquid in the gas opening.
- Empty the steam trap regularly. The frequency depends on the environment.
- Replace both the dust filter and the filter capsule (article no. 3660250) in the filter housing between the suction tube and the monitor every year.

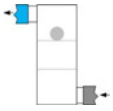
Calibrating the CO2 monitor Guardian NG

Calibrate the CO_2 monitor after it has been installed and then every year.

Required items:

- Pressure control kit (article number 3795159).

- Calibration gas 0 ppm (article number 3795115).
- Calibration gas 2600 ppm (article number 3795118).

1. Do not start the calibration until the CO_2 monitor has been in operation for at least one hour.
2. Carefully follow the calibration procedure in the supplied manual.
3. During the calibration procedure, supply calibration gas at a rate of ±1.1 l/min, see flow indicator on the pressure regulator set: 

The password of the CO2 monitor Guardian NG is LCRLCRLC (L=left, C=centre, R=right)

Specifications

Article description	Guardian NG CO_2 monitor
Article number	3795044
Permitted temperature for normal operation	0 - 40°C
Permitted relative air humidity for normal operation	0 - 95% (non-condensing)
Measurement range	0 - 3000 ppm
Measurement accuracy	+/- 2 % of range
Start-up time	initial: 1 min; full specifications: 30 min
Sensor response time (T_{90})	< 30 s
Pump flow	1 l/min
Other specifications	see supplied manual

Hot water temperature sensor

Hot water temperature sensors 80 mm and 150 mm

Hot water temperature sensors measure the temperature of the water in a hot water pipe or hot water storage tank. You can use the water temperature sensors in situations in which the water temperature to be measured is higher than the ambient temperature, so that no condensation will occur in or on these sensors when the system is at a standstill. The sensors are available in 80 mm and 150 mm lengths.

Do not use the sensors where there is a high mechanical load, such as extremely high flow speeds or pressure pulses in the water.

Do not use the sensors in a humid environment if the water temperature is lower than the ambient temperature.

Installation

Make sure that the pressure on the main has been removed.

When using a sensor after a mixing valve, ensure at least 1 meter distance between the mixing valve and the sensor.

Ensure that the interior of the sensor and the immersion pocket remain dry.

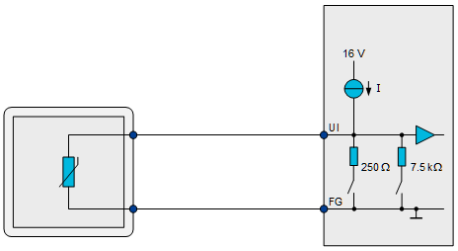
Dismantled hot water temperature sensor

Install the hot water temperature sensor as follows:
1. Screw the water temperature sensor into the G1/2" opening. Use Teflon tape to prevent leaks. Ensure that the cable gland points downward.
2. Remove the cap from the sensor by removing the 2 screws at the top.
3. Disconnect the cable gland. Note the loose washer in the opening.
4. Insert the cable through the rubber seal in the cable gland opening.

If necessary, make the opening bigger by removing ring sections from the rubber seal.

5. Strip the ends of the 2 cores of the cable (approx. 8 mm).
6. Attach the stripped ends of the cores to the 2 terminal screw connectors.
7. Slide the cable gland over the cable and tighten the cable gland.
8. Mount the cover on the sensor using the 2 screws.

Connecting



Cable length

The hot water temperature sensor is supplied without a cable. Use a shielded cable with a core diameter of 0.8 mm (0.5 mm^2). To limit voltage loss along the cable as far as possible you must double the number of cores as shown in the table below.

Number of cores in relation to the cable length

Cable length	Number of cores
< 300 m	2
300 .. 600 m	4
600 .. 900 m	8

Check operation

The sensor can be tested by measuring the resistance and comparing it with the value of the measurement characteristic below.

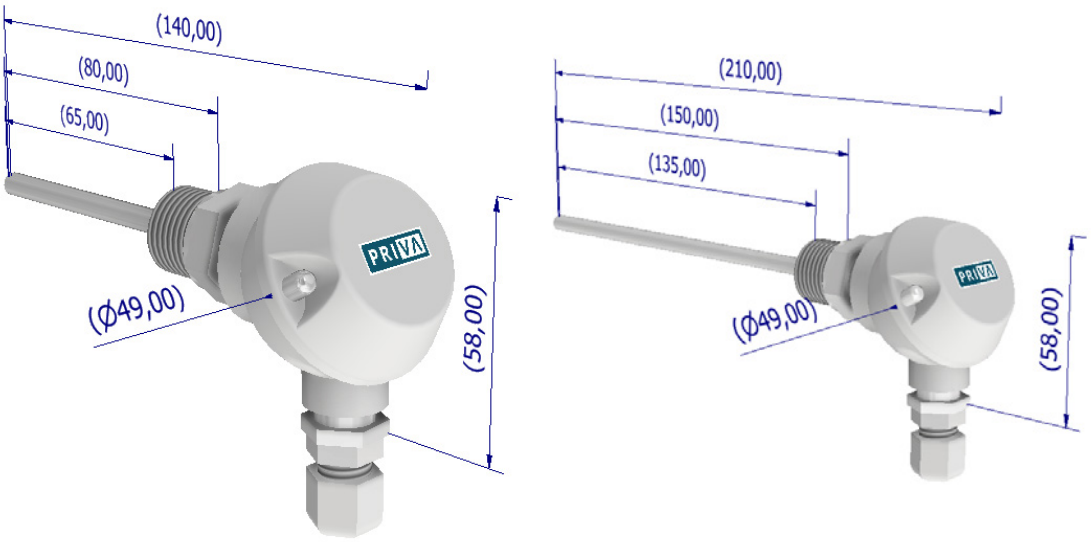
R (Ohm)	T (°C)
5970	10
4713	15
3747	20
3000	25
1598	40
1080	50
746	60
443	75
274	90

Specifications

Hot water temperature sensor

article numbers	3779013 (Hot water temperature sensor 80mm) 3779012 (Hot water temperature sensor 150mm)
application range	0 ... +125 °C
resistor type	NTC (measuring range NTC 0 ... 125 °C)
resistance	3000 Ω @ 25 °C
accuracy in application range	0 ... 40 °C: 0,1 °C 40 ... 90 °C: 0,6 °C 90 ... 125 °C: 1 °C
housing material	aluminium
thread	G1/2" (parallel)
material immersion pocket	AISI 316Ti
max. water pressure	20 bar
core diameter	Ø 0,8 mm (0,5 mm^2), maximum Ø 1,5 mm
thread of cable gland	M16 x 1,5
spare parts	3779014 (Ceramic insert with NTC/thermistor 80mm)

Dimensions



Soil temperature sensor

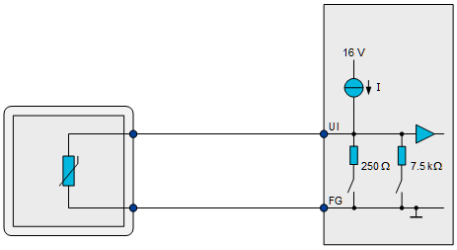
Soil temperature sensor

Soil temperature sensors measure the temperature of the soil or the slab. If the grower has a heating system for the benches or for soil heating, the process computer can use a temperature sensor to control it.

Installation

The sensor must be placed in a location where it gets an accurate measurement of the media. To extend the cable, feed the cable from the sensor into a junction box (minimum IP code IP65) and bridge the distance from the junction box to the process computer with a new shielded cable.

Connecting



Cable length

The soil temperature sensor is supplied with a cable. Use a shielded cable with a core diameter of 0.8 mm (0.5 mm^2). To limit voltage loss along the cable as far as possible you must double the number of cores as shown in the table below.

Number of cores in relation to the cable length

Cable length	Number of cores
< 300 m	2
300 .. 600 m	4
600 .. 900 m	8

Check operation

The sensor can be tested by measuring the resistance and comparing it with the value of the measurement characteristic below.

R (Ohm)	T (°C)
5970	10
4713	15
3747	20
3000	25
1598	40
1080	50
746	60
443	75
274	90

Specifications

article number	3779016
application range	0 ... +50 °C
resistor type	NTC
resistance	3000 Ω @ 25 ºC
accuracy in application range	0 ... 40 °C: 0,1 °C 40 ... 90 °C: 0,6 °C 90 ... 125 °C: 1 °C
Material protection tube	stainless steel AISI 304
Dimensions protection tube	Ø 0,8 mm (0,5 mm^2), maximum Ø 1,5 mm
Material of cable	orange PUR-cable
Length of cable	length 6 meters

Clamp on temperature sensor

Clamp on temperature sensor

You can use the clamp on temperature sensor:
- in existing installations in which the draining of the water circuit is difficult,
- on a pipe with a diameter is too small for an immersion sensor,
- for a temporary (test) positioning.

The sensor is often used as a boiler water temperature sensor.

The clamp on sensor is slower and less accurate than an immersion sensor.

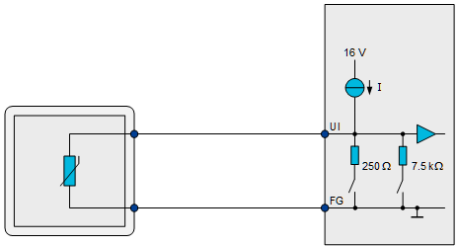
Installation

Use this sensor in a dry area only (not in greenhouse area) and install it on top of the warm water heating pipe. Don't use this sensor on cold water loops, as it is not hermetically sealed and protected against condensing water.

1. Remove any dirt or dust on the surface on which the sensor will be mounted.
2. Sandpaper the surface to enable a strong adhesion.
3. Use thermal-conducting paste to cover the surface of the underside of the sensor.
4. Tighten the clip binding provided (Ø 25-175mm) securely.

If the conduit will be insulated, the sensor must also be insulated.

Connecting



1. Remove the cover.
2. Screw the two threads into the terminal block.
3. Connect the threads to a filed ground and a universal input on the Compass. No need to worry about polarity.

Cable length

The clamp on temperature sensor is supplied without cable. Use a shielded cable with a core diameter of 0.8 mm (0.5 mm^2). To limit voltage loss along the cable as far as possible you must double the number of cores as shown in the table below.

Number of cores in relation to the cable length

Cable length	Number of cores
< 300 m	2
300 .. 600 m	4
600 .. 900 m	8

Specifications

article number	111233
application range	-40 ... +110 °C
resistor type	NTC
resistance	3000 Ω @ 25 °C
accuracy in application range	0 ... 40 °C: 0,1 °C 40 ... 90 °C: 0,6 °C 90 ... 125 °C: 1 °C
Suitable for heating pipe	between Ø25mm and Ø175mm

Level sensor

With a level sensor (also known as a percentage measurement or 0-100% level measurement), you can measure the water level in tanks and silos using a hydrostatic pressure sensor. This pressure sensor is not influenced by atmospheric pressure. You can use the level sensor in day storage tanks, drain water and fresh water tanks and in A and B fertiliser tanks with a low concentration composition.

To measure the level in A and B fertiliser tanks with a high concentration composition, you can, for example, use a *Rhythm stick* from Royal Brinkman.

The installation of the level sensor is easy and requires much less work than a 4-level measurement, for which a construction must be made with 4 float switches in the tank, equipped with a resistance bridge/ladder network.

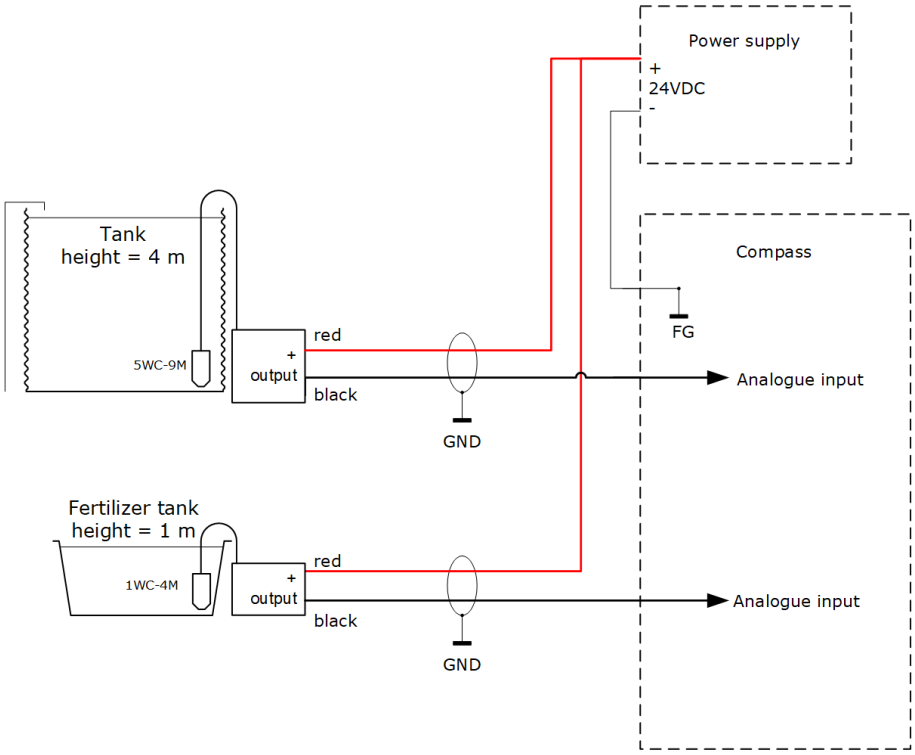
Mounting the level sensor

- Do not apply a sharp object to the membrane.
- Prevent blockage at the end of the bleed line by installing in a (ventilated) junction box at the end.

1. Place the level sensor in a quiet position in the tank, i.e. not in the vicinity of a suction or discharge pipe of a pump or an overflow pipe.
2. Make sure that the integrated bleed line in the connecting cable does not kink; the bend must have a radius of at least 10 cm.

Connecting a level sensor

Required power supply:
- 24 VDC power supply field equipment



You can extend the cable: feed the cable from the sensor to a junction box (minimum protection class IP 65) and bridge the distance from the junction box to the computer with a new shielded cable.

Cable type	2 x 0.8 mm (0.5 mm^2) shielded
Maximum cable length	80 m

Maintenance of Level sensor

Clean the level sensor when necessary with a water jet. Avoid, however, pointing the direct water jet at the sensor's membrane.

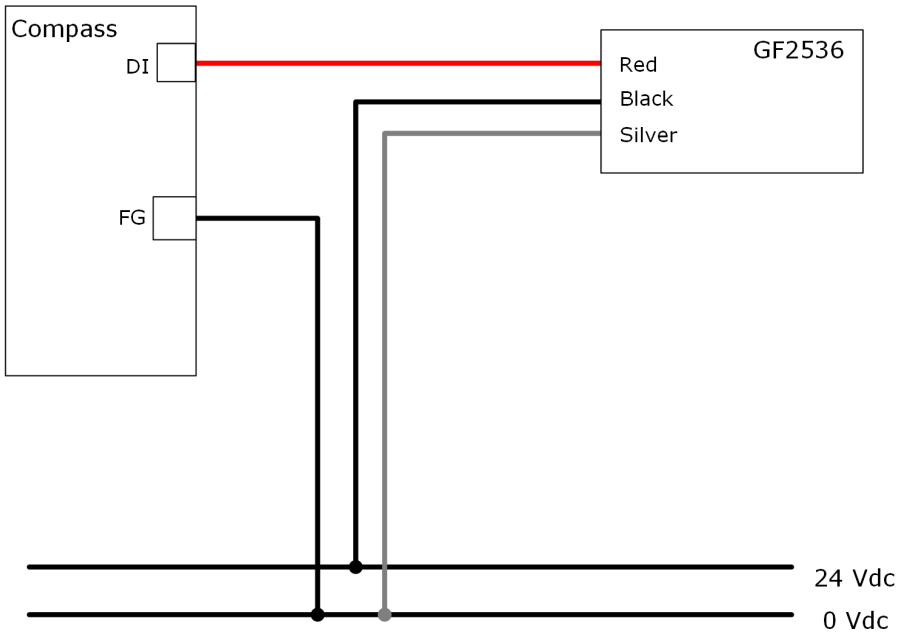
Specifications

Article description	Level sensor 1WC-4M	Level sensor 5WC-9M
Article number	3651067	3651068
Liquids to be used	solutions containing up to 1% weight percent nitric acid	solutions containing up to 1% weight percent nitric acid
Measurement principle	Hydrostatic pressure measurement independent of barometric pressure	Hydrostatic pressure measurement independent of barometric pressure
Measurement range	0-1 metre water column, linear, fixed measurement range	0-5 metre water column, linear, fixed measurement range
Accuracy	0.2% of the measurement range	0.2% of the measurement range
Maximum overpressure	6.4 bar	6.4 bar
Temperature range	-20°C to +80°C	-20°C to +80°C
Supply voltage	13-40 VDC	13-40 VDC
Analogue output signal	4-20 mA	4-20 mA
Load capacity of output	Maximum load capacity of the analogue output is 550Ω	Maximum load capacity of the analogue output is 550Ω
Connection	2-wire with shielding	2-wire with shielding
Cable length	4 metres, with integrated bleed line	9 metres, with integrated bleed line
Material of connecting cable	PE	PE
Housing material	Stainless steel 316	Stainless steel 316
Material of membrane	Stainless steel 316L	Stainless steel 316L

Flow sensor

Connecting

The flow sensor records the volume flow through the irrigation water pipe.



Colour	Function	Connection
Red	open collector signal output	digital input of Compass
Black	power supply 3.3 .. 24 VDC	24 VDC
Metallic	ground	FG of Compass

Cleaning the flow sensor

1. Set the unit to maintenance mode (software-wise and pump switch(es) off).
2. Make sure the main irrigation line is pressure-less and, if necessary, empty.
3. Unscrew the flow sensor from the T-piece.
4. Clean the paddle wheel of the flow sensor using a small, soft brush.
5. Apply a little acid-free grease to the rubber O-rings to prevent them from being damaged when placing the sensor back.
6. Screw the flow sensor back onto the T-piece: you can only do this one way.
7. Fill and bleed the main irrigation line to prevent water hammer.
8. Check that the flow sensor coupling is not leaking.

Technical specifications – flow sensor

Article description	Flow sensor GF2536-P0 (for lines Ø 20 – 110 mm and 2.5 - 4")	Flow sensor GF2536-P1 (for lines Ø 125 – 225 mm and 6")
Article number	750470 (short housing)	750465 (long housing)
Measurement principle	paddle wheel	
Measurement range	0.1 - 6 m/s	
Recommended measurement range	0.5 - 3 m/s	
Accuracy	1% (of max. measured value)	
Reproducibility	0.5% (of max. measured value)	
IP code	IP67	
Minimum Reynolds number required	4500	
Supply voltage	3.3 - 24 VDC	
Supply current	< 1.5 mA at 3.3 - 6 VDC < 20 mA at 6 - 24 VDC	
Output type	Open collector, max. 10 mA	
Cable length	7.5 m	
Cable type	2-core shielded twisted pair (22 AWG, 0.326 mm^2)	

Technical specifications - T-piece/saddle fitting for flow sensor

Left: flow sensor with T-piece; Right: flow sensor in saddle fitting

The K-factor is dependent on the flow sensor used, the T-piece or saddle fitting, the line diameter and the wall thickness. K-factors should be regarded as indicative values. For optimum performance, the system should be calibrated after installation.

For different configurations, a K-factor calculator is available at www.gfsignet.com.

Refer to the supplier's documentation for the assembly instructions.

The maximum speed at which the pulses can be processed depends on the hardware used.

Lines with a metric diameter (20 - 63 mm)

Article description	PVC T-piece for flow sensor GF2536-P0					
Article number	750471	750472	750473	750474	750475	750476
Line diameter, external (mm)	20 (DN15)	25 (DN20)	32 (DN25)	40 (DN32)	50 (DN40)	63 (DN50)
Pressure class of line	PN16	PN16	PN16	PN16	PN16	PN16
Recommended measuring range (m³/h) at a rate of flow of 0.5 - 3 m/s	0.41 - 2.45	0.64 - 3.81	1.05 - 6.28	1.63 - 9.81	2.57 - 15.39	4.06 - 24.37
K-factor (pulses per litre)	256.90	128.32	78.54	44.98	27.40	15.72
Litre per pulse (1/K)	0.0039	0.0078	0.0127	0.0222	0.0365	0.0636

Lines with a metric diameter (75 - 110 mm)

Article description	PVC saddle fitting for flow sensor GF2536-P0		
Article number	750477	750478	750479
Line diameter, external (mm)	75 (DN65)	90 (DN80)	110 (DN100)
Pressure class of line	PN10	PN10	PN10
Recommended measuring range (m³/h) at a rate of flow of 0.5 - 3 m/s	6.5 - 39.0	9.4 - 56.2	14.0 - 83.8
K-factor (pulses per litre)	9.787	7.281	4.806
Litre per pulse (1/K)	0.1022	0.1373	0.2081

Lines with a metric diameter (125 - 225 mm)

Article description	PP saddle fitting for flow sensor GF2536-P1		PVC saddle fitting for flow sensor GF2536-P1	
Article number	750482	750483	750466	750467
Line diameter, external (mm)	125 (DN115)	140 (DN125)	160 (DN150)	225 (DN200)
Pressure class of line	PN10	PN10	PN10	PN10
Recommended measuring range (m³/h) at a rate of flow of 0.5 - 3 m/s	18.1 - 108.3	22.7 - 136.0	29.6 - 177.4	58.5 - 350.9
K-factor (pulses per litre)	3.928	3.116	2.394	1.141
Litre per pulse (1/K)	0.2546	0.3210	0.4177	0.8765

Lines with an imperial diameter (2.5 - 4")

Article description	PVC saddle fitting for flow sensor GF2536-P0		
Article number	750781	750782	750783
Line diameter, internal (")	2.5	3	4
Pressure class of line	SCH 40	SCH 40	SCH 40
Recommended measuring range (m³/h) at a rate of flow of 0.5 - 3 m/s	5.5 - 32.7	8.5 - 50.7	14.6 - 87.4
K-factor (pulses per litre)	9.817	6.261	3.555
Litre per pulse (1/K)	0.1019	0.1597	0.2813

Lines with an imperial diameter (6")

Article description	PVC saddle fitting for flow sensor GF2536-P1
Article number	750784
Line diameter, internal (")	6
Pressure class of line	SCH 40
Recommended measuring range (m³/h) at a rate of flow of 0.5 - 3 m/s	33.2 - 199.1
K-factor (pulses per litre)	1.971
Litre per pulse (1/K)	0.5074

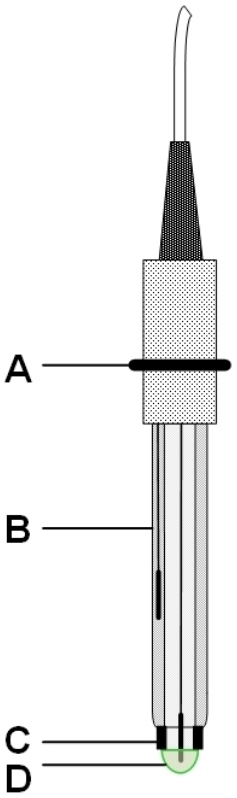
pH interface

pH sensor

The pH sensor is used to measure the acidity of a liquid or test solution. The pH sensor is equipped with a pH measuring electrode with a pH-sensitive glass membrane (green glass sphere D) and a pH reference electrode. The pH is determined by measuring the potential difference between the pH measuring electrode and the pH reference electrode. The potential of the measuring electrode is dependent on the pH in the test solution, while the potential of the pH reference electrode is fixed. The reference electrode is electrically connected to the test solution via the diaphragm (ceramic ring C).

A protective cover is supplied by default (see picture above, on the right). Placing this protective cover on the pH sensor protects it from impact and therefore makes it suitable for pressureless systems. Without this protective cover, the pH sensor is suitable for pressure systems.

The process computer can apply a temperature correction to the measured value if a temperature measurement is carried out in the same liquid. This is the case with an EC sensor on the same I/O module EC/pH.



Cross section of pH sensor

A. Rubber O-ring
B. Housing
C. Diaphragm
D. Glass membrane

Installing the pH sensor

General directions

- Always keep the pH sensor without the protective cover in the supplied bottle of storage solution until you are ready to install the sensor. In this way, you can avoid inaccurate measurement results because:
  - the pH sensor dries out.
  - the fluid in the pH sensor diffuses outwards.
- Replace cracked or broken sensors promptly. These cannot be repaired.
- The pH sensor is not refillable.
- Always install the pH sensor upright, with the glass membrane pointing downwards.

The mounting is different for pressure systems and pressureless systems.

Installing the pH sensor in pressure systems

The mounting also differs according to the pH sensor holder:

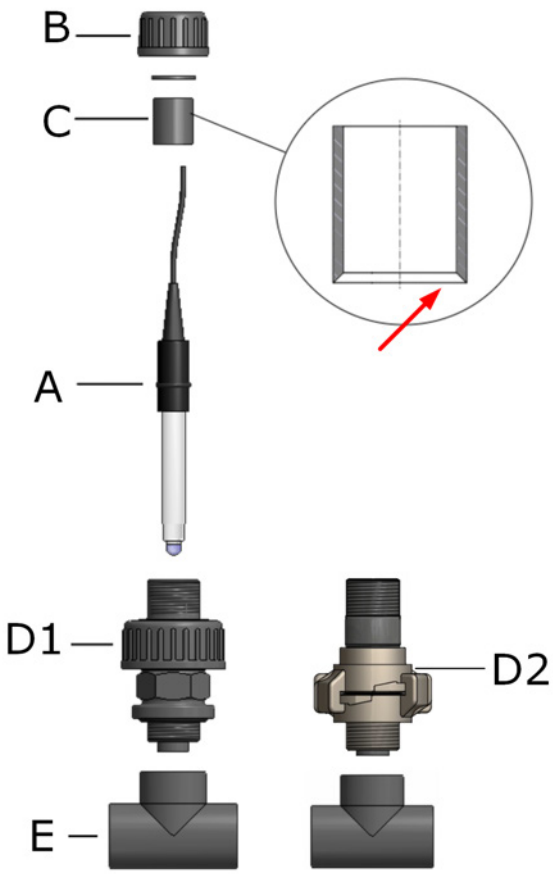
				
pH sensor holder	3770858 pH holder 3/4" with screw ring	3770854 pH holder bayonet fixing 3/4 **This part is no longer available.**	3770857 pH holder bayonet fixing 3/4 -V 2 **This part is no longer available.**	3770885 pH holder with screw cap **This part is no longer available.**
O-ring to be used with pH sensor	O-ring 12 x 3 mm (751076) (supplied from 2017)	O-ring 12 x 3 mm (751076) (supplied from 2017)	O-ring 12 x 3 mm (751076) (supplied from 2017)	O-ring 10.69 x 3.53 mm; position this on the glass shaft of the pH sensor
O-ring to be used in the coupling of the pH sensor holder	-	O-ring GEKA 120AC (751100)	O-ring GEKA 120AC (751100)	-

The pH sensor holder (3770858) fits in the following T-pieces:
- PVC T-piece 25 mm x ¾" x 25 mm (3770856)
- PVC T-piece 32 mm x ¾" x 32 mm (751288)
- PVC T-piece 40 mm x ¾" x 40 mm (751285)

Do not use any parts from third parties, because the mounting parts and the pH sensor are precisely tailored to each other.

Procedure

This procedure describes how to fit the pH sensor in pH holder (3770858).



A. O-ring, supplied with sensor
B. Cap for the pH sensor holder
C. Bolt spacer
D. pH sensor holder with 3/4" screw thread (3770858)
E. T-piece

1. Install the pH sensor holder (D) and the T-piece (E) in the installation (if this has not been done already).

   Install the pH sensor holder in such a way that the pH sensor stands straight up.

2. Unscrew the cap of the plastic bottle and remove it from the new pH sensor.
3. Rinse the glass membrane and the pH sensor housing with drinking water.
4. Before using the pH sensor for the first time, or after an extended period of being in storage, place the sensor in drinking water for 30 minutes. This prepares the pH sensor for operation.
5. Make sure the O-ring is located at the specified position (A).

   Use one O-ring, never two!

6. Fit the pH sensor in the pH sensor holder.

   Make sure that the bevel of the bolt spacer (C) is pointing downwards.

7. Screw on the cap (B) of the pH sensor holder.
8. Connect the BNC connector of the pH sensor to the process computer.
9. If there are glass bubbles in the glass membrane, shake the pH sensor until the glass membrane fills with fluid.
10. Calibrate the pH sensor.
11. Make sure that the fluid is in the installation.

Installing the pH sensor in pressureless systems

1. Unscrew the cap of the plastic bottle and remove it from the new pH sensor.
2. Fit the protective cover (see photo below).

3. Rinse the glass membrane and the pH sensor housing with drinking water.
4. Before using the sensor for the first time, or after an extended period of being in storage, place it in drinking water for 30 minutes. This prepares the pH sensor for contact with test fluids.
5. Make sure that the fluid is in the installation.
6. Place the pH sensor in the installation.
7. Connect the BNC connector of the pH sensor to the process computer.
8. Calibrate the pH sensor.

Connecting the pH interface

The installation and maintenance of the pH sensor is described in detail in the pH sensor manual.

1. Connect the BNC connector of the pH sensor to the BNC connector of the pH interface.
2. Unscrew and open the pH interface.
3. Feed the cabling through the cable gland.
4. Connect the wiring of the universal input of the Priva Blue ID module and the power supply to the connector terminals of the interface. Use a 6-core shielded cable with cores of 6 x 0.8 mm (0.5 mm²).
5. Screw the interface closed.

Connecting the cable

Name	Function	Connection
24V	24 VAC	FP or 24 VAC from external power supply
0V	0 VAC	FG or 0 VAC from external power supply
PH1	sensor signal pH sensor 1	UI Add a pull-down resistor (100kΩ) to GND for cable break detection.
GND	pH sensor 1 GND (not electrically isolated)	FG
PH2	sensor signal pH sensor 2	UI Add a pull-down resistor (100kΩ) to GND for cable break detection.
GND	pH sensor 2 GND (not electrically isolated)	FG

Maintenance of the pH sensor

Storage and transport

The glass membrane of the pH sensor is kept in a bottle containing a 50/50 mixture of pH 4 buffer and 4M KCl.

Keep the pH sensor in the supplied solution until you are ready to install it.

Do not, under any circumstances, use distilled water to store the pH sensor.

Store and transport the pH sensor frost-free.

Cleaning the pH sensor normally

1. Clean the glass membrane and the housing of the sensor with a solution of liquid detergent in warm water. Use a soft brush or a clean cloth, dipped in the soap solution. Do not use a paper towel.

   Do not apply excessive pressure to the glass membrane as it is fragile.

2. Rinse the glass membrane well with distilled water. Then immerse the sensor for at least 30 minutes in a 50/50 mixture of pH 4 buffer and 4M KCl before using it again.

It is advisable to recalibrate the pH measurement after cleaning.

Cleaning the pH sensor thoroughly

If there is an anorganic deposit on the pH sensor then remove it as follows:

1. Make a homogeneous acid dilution of:
   - approximately 1 part drinking water and 1 part concentrated nitric acid (38% (by weight)) or
   - 4 parts drinking water and 1 part concentrated phosphoric acid (59% (by weight)).

   Add the acid to the water; never add water to acid.

2. Immerse the glass membrane of the pH sensor in the acid solution for 5 minutes (no longer!).
3. Rinse the pH sensor with drinking water, and rinse the glass membrane with distilled water. Next, calibrate the pH measurement.
4. Dispose of the acid dilution in accordance with the locally applicable regulations.

Resolving problems with acidity measurement

Cracked or broken sensors cannot be repaired; replace the sensor straightaway.

Inspect the insulation of the cable.
Check the plug for corrosion and fouling.

If you experience problems measuring the acidity in your installation, you can use the Priva pH meter to investigate the problem. This pH meter (article number 3779192 includes:

- 1 flask of distilled water
- 1 flask of preserving fluid
- 1 flask of buffer fluid pH 4
- 1 flask of buffer fluid pH 7

pH meter and fluids

Calibrating the pH interface

Calibrate the pH sensor using the Compass software. See the help text in the software.

Technical specifications - pH-interface

Article description	pH-interface
Article number	3771056
Housing material	aluminium
Dimensions H x L x W (without grommet)	85 x 120 x 120 mm
Connections	on housing: • 2 BNC-connectors for 2 pH-sensors (3770946) on pH-interface board 9969: • 24 VAC input power supply • 2 analog outputs
Supply voltage	24 VAC
Ambient temperature	0 ... 35 °C

Technical specifications – pH sensor

Article description	pH sensor (max. 10.0 bar)
Article number	3779046
Housing	glass
Length of sensor	77 mm
Diameter of sensor	Ø 12 mm (Ø 15 mm with protective cover)
Measurement principle	pH electrode for H^+ ions
Discrimination	59 mV/pH (in operating range 4 .. 7 pH at 25 ˚C)
Operating range (measurement values comply with specified accuracy)	4 .. 7 pH
Range (sensor produces measurement values)	0 .. 14 pH
Accuracy (after calibration)	± 0.1 pH (in operating range 4 .. 7 pH at 5 .. 30 ˚C)
Cable	coax, Ø 2.5 mm, length 3 m
Connector	BNC

Dosing Channel Driver

Operation of Dosing Channel Driver

The Dosing Channel Driver is used to control dosing channels on Priva's Nutri-line units. Since these dosing channels are activated and deactivated quite often when the water system is actively dosing, they can prematurely wear out the normal relay outputs used with the Compass. The triacs used on the Dosing Channel Driver can last for millions of cycles, allowing the system to continue to operate over long periods of time.

For Connext, the Dosing Channel Driver can also be used as a repeater to increase the distance between the outputs and the dosing channels.

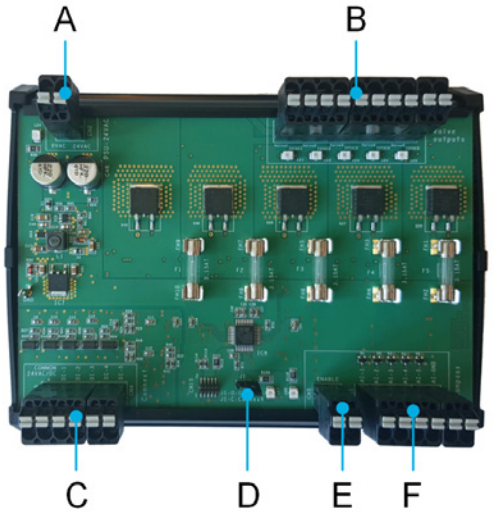
The Compass provides a 0 ... 10 V analog output to indicate the amount of dosing required. The Dosing Channel Driver converts this 0 ... 10 V signal to a 24 VAC triac output signal with a variable duty cycle that is used for the dosing channels. It is possible to connect and control 5 dosing channels. The interface has 5 analogue inputs and an enable input for starting a dosing cycle.

The Dosing Channel Driver supports dosing channels with the following dosage valves.

Type of dosage valve	Article number
Gevasol 24 VAC / 50Hz / 8W	750446
Gevasol 24 VAC / 60Hz / 8W	750454
Buschjöst 24 VAC 50-60Hz 1/4"-3mm	750468

For digital inputs, the Dosing Channel Driver enhances the digital input signals. The digital inputs of the Dosing Channel Driver are used for Connext.

The application is selected with a jumper. In addition to a connector for the power supply, each application has its own connector.



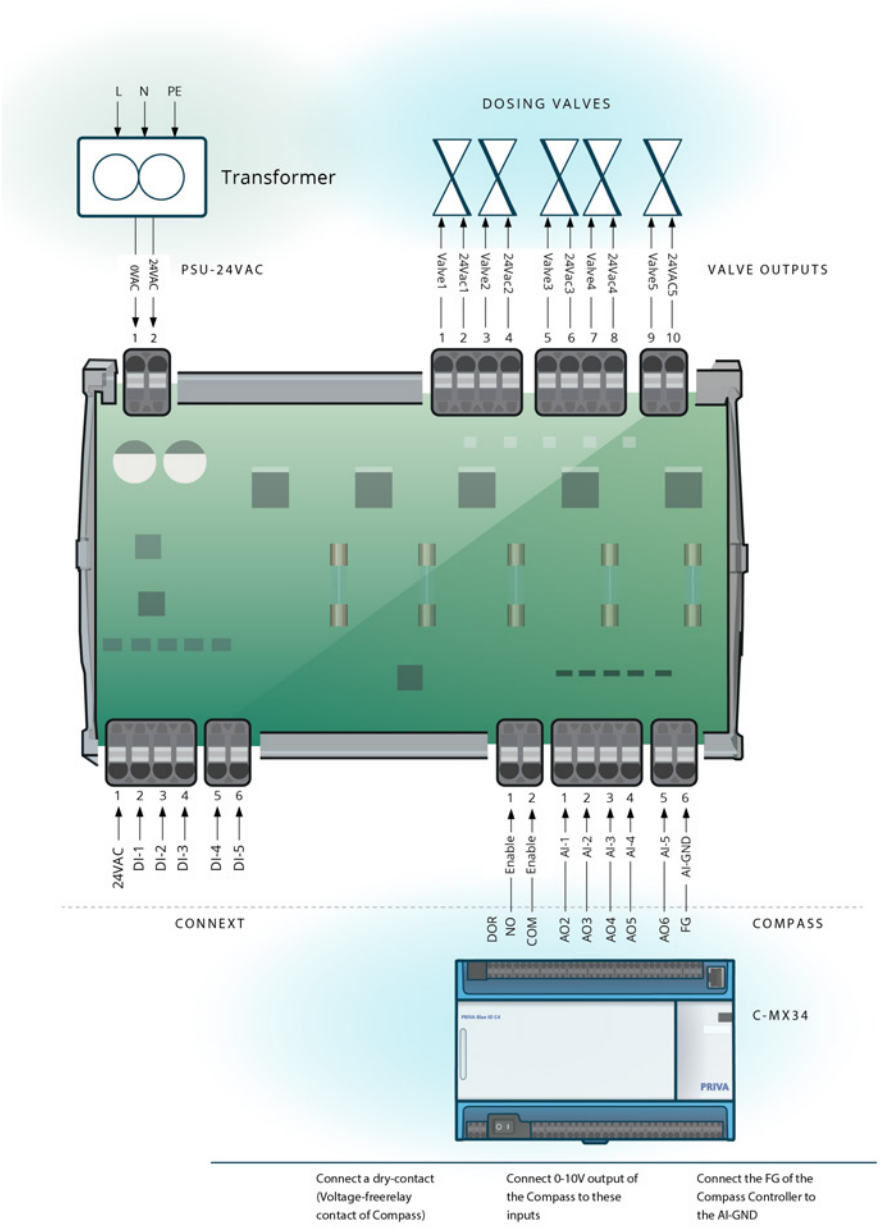
A: connecting terminals for 24 VAC power supply (CN2)
B: connecting terminals for 24 VAC TRIAC output signals (CN7-9)
C: connecting terminals for digital inputs (CN4)
D: selection jumper analog (converter) - digital (repeater) (J1)
E: connecting terminals for enable dosing cycle (CN5)
F: connecting terminals for analogue inputs (CN1)

Jumper setting	Application
Jumper open	analog inputs for Compass (converter)
Jumper closed	digital input for Connext (repeater)

Connecting the Dosing Channel Driver

Position the Dosing Channel Driver close to the dosing channel. The cable from the TRIAC output of the Dosing Channel Driver to the valve of the dosing channel may be no more than 10 metres long.

1. Use jumper J1 to set the interface for analogue inputs (Converter) for Compass. The jumper must be open for the use of analogue inputs for Compass.
2. Connect the power supply to the connecting terminals (CN2) of the Dosing Channel Driver. Use a 2-core shielded cable with cores of 1.4 mm (1.5 mm²).
3. Connect the wiring of the analogue output of the Priva Blue ID module to the connector terminals (CN1) of the Dosing Channel Driver. Use a 6-core non-shielded cable with cores of 0.8 mm (0.5 mm²). The maximum cable length is 100 metres.
4. Connect the wiring to the 24 VAC TRIACs for the dosing channels to the connecting terminals (CN7-9) of the Dosing Channel Driver. Use a 2-core non-shielded cable with cores of 0.75 mm. The maximum cable length is 10 metres.
5. Connect the wiring of the relay output of the Priva Blue ID module to the Enable connector terminals (CN5) of the interface. Use a 2-core non-shielded cable with cores of 0.8 mm (0.5 mm²). The maximum cable length is 100 metres.



The use of 5 dosing channels with GevaSol valves requires at least 100VA. Therefor the graphic above includes a 300VA transformer. The 24 VAC transformer from the Compass cabinet can be used, but this means there is no output power available for other components.

Dosing Channel Driver power supply cable

Name	Function	Connection
24VAC	24 VAC	to 24 VAC of external power supply [1]
0VAC	0 VAC	to 0 VAC of external power supply [1]

[1] Use a transformer of at least 24 VAC 100VA; 300VA is desirable.

Cables from Dosing Channel Driver to Compass

Name	Function	Connection
ENABLE	start dosing cycle	to relay output (voltage free) of Priva Blue ID module
AI-1 ...AI-5	sensor signal	to AO of Priva Blue ID module
GND	GND	to FG of Priva Blue ID module

Cable from Dosing Channel Driver to dosing channel

Name	Function	Connection
Valve1 ... Valve5	0 VAC	to 0 VAC to TRIAC of dosing channel
24VAC1... 24VAC5	24 VAC	to 24 VAC to TRIAC of dosing channel

Specifications Dosing Channel Driver

General	
Module article description	Dosing Channel Driver for Priva dosing channels
Module article number	3770170
Number of outputs	5
Dimensions (XYZ)	130 x 160 x 70 mm (5.1 x 6.3 x 2.8 inch)
Maximum power consumption	1.9 W
Installation	clicks onto DIN rail
Housing material	PVC V-0 (UL94)
Connector type for power supply and I/O	pluggable terminal block
Permitted core cross section area	solid:: 0.2 ... 2.5 mm² (25 ... 14 AWG) flexible with ferrule connector: 0.2 ... 2.5 mm² (25 ... 14 AWG) flexible with double ferrule connector: 0.2 ... 1.5 mm² (25 ... 16 AWG)
Strip length/connector length (terminal block)	solid: 10 mm (0.39 inches) flexible with ferrule connector: 10 mm (0.39 inches) flexible with double ferrule connector: 12 mm (0.47 inches)

Digital solid-state outputs (TRIAC)	
Switching voltage	0 ... 30 VAC
Load current	0 ... 2.5 A (RMS)
Overvoltage protection	3.15 AT fuse (per channel)
Protection	output protected against overload (not self-restoring) power supply input protected against overload (self-restoring)
Maximum length of output cable	10 m
Switch type	TRIAC
Maximum switching frequency	0.2 Hz
Duty cycle	0.1 ... 5 s
Indication	• red LEDs for status of outputs • green flashing LED for status of the module • green LED for status of the enable input
Applicable dosing valve and connector combinations	Gevasol 24Vdc/10W + Connector solenoid valve yellow LED and Rectifier (article number 750449+750469) Gevasol 24Vac/50Hz/8W + Connector solenoid valve red LED (article number 750446+750400) Gevasol 24Vac/60Hz/8W + Connector solenoid valve red LED (article number 750454+750400) Buschjost 24Vac/50-60Hz (FPM)* + Connector solenoid valve yellow LED and Rectifier (article number 750468+750469) Buschjost 24Vac/50-60Hz (EPDM)* + Connector solenoid valve yellow LED and Rectifier (article number 750488+750469) FIP 24Vac 50-60Hz* + Connector solenoid valve yellow LED and Rectifier (article number 750448+750469)

*the coil is DC, the valve is delivered with connector with rectifier, therefore the valve is listed as AC.

Analogue inputs	
Input voltage range	0 ... 10 VDC
Minimum input voltage for pulse control	2 V
Protection	input protected against overvoltage up to 30 VDC and 30 VAC
Maximum length of input cable	100 m
Minimum core cross section	0.5 mm² (0.8 mm)

Digital inputs	
Input voltage range	0 ... 24 VAC 0 ... 24 VDC
Protection	input protected against overvoltage up to 30 VDC and 30 VAC
Maximum length of input cable	100 m
Minimum core cross section	0.75 mm² (1 mm)

Housing	
IP code	IP20 (IEC 60529)
Flammability class	V-0 (UL 94)
Colour	jet black (RAL9011)
Type of device	open type equipment for: • indoor use only • pollution degree 2 environment

Installation and connection	
Installation	in control panel: • accessible to authorised personnel only • can be clicked onto horizontally or vertically positioned DIN rail.
Type of DIN rail	35 x 7.5 (1.38 x 0.30 inches) or 35 x 15 mm (1.38 x 0.59 inches) (height x depth), in accordance with IEC 60715

Environment	
Permitted temperature inside control panel of a working system	0 ... 50 °C (32 ... 122 °F)
Permitted temperature during transport and storage	-20 ... 70 °C (-4 ... 158 °F)
Permitted ambient relative humidity	10 % ... 95 % (niet-condenserend)
Shock and vibration resistance	IEC 61131-2
Installation category	II

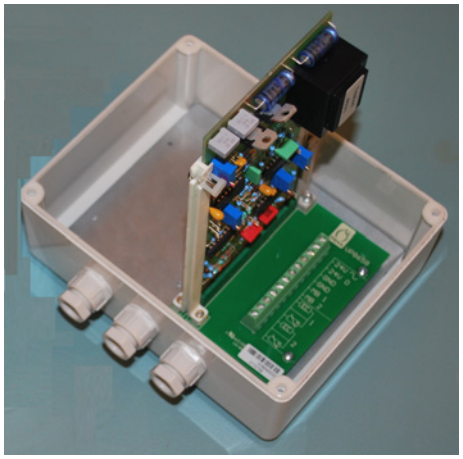
Legislation and standards		

Europe	CE	• Low Voltage Directive 2006/95/EC:
		  • EN 61010-1 (measurement and control equipment)
		• EN 61010-2-201 (measurement and control equipment)
		• EMC Directive 2004/108/EC:
		  • EN 61326-1 (measurement and control equipment)
		  • EN 61000-6-2 (generic immunity standard)
		  • EN 61000-6-3 (generic emission standard)
		• RoHS directive 2011/65/EU

EC-DSS interface

Operation of EC-DSS interface

The EC-DSS interface allows you to connect EC sensors or drain sensor systems (DSS). You can connect two EC sensors or drain sensor systems to one EC-DSS interface. The EC-DSS interface can be expanded with a second EC interface board 8658 and connection board 9943 to enable you to connect two more EC sensors or drain sensor systems.



Connecting the EC-DSS interface

1. Unscrew and open the interface.
2. Feed the cabling through the cable glands.
3. Connect the wiring of the EC sensors to the connector terminals of the interface. See Connecting the Compass EC sensor (page 119).
4. Connect the wiring of a universal input of the Priva Blue ID module to the connector terminals of the interface. Use a 4-core shielded cable with cores of 0.8 mm (0.5 mm²).
5. Connect the wiring of the power supply to the connector terminals of the interface. Use a 2-core shielded cable with cores of 0.8 mm (0.5 mm²).
6. Screw the interface closed.

EC-DSS interface cable to Compass

Name	Function	Connection
MB1	sensor signal sensor 1	UI of Priva Blue ID module Add a pull-down resistor (100kΩ) to GND for cable break detection.
GND	GND	FG of Priva Blue ID module
MB2	sensor signal sensor 2	UI of Priva Blue ID module Add a pull-down resistor (100kΩ) to GND for cable break detection.
GND	GND	FG of Priva Blue ID module
0 VAC	0 V	0 VAC of power supply
24 VAC	24 V	24 VAC of power supply

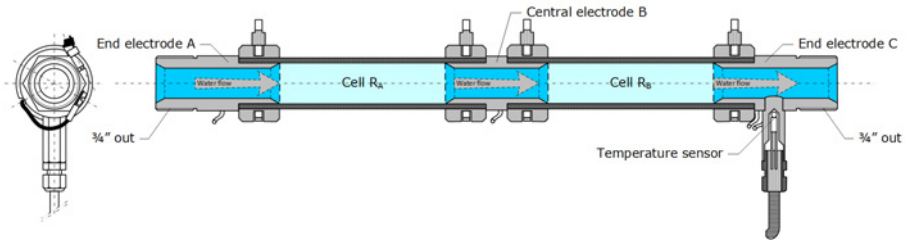
Expanding the EC-DSS interface

1. Unscrew and open the interface.
2. Screw a connection board 9943 to the bottom plate.
3. Insert an EC interface board 8658 into the connector of the connection board 9943.
4. Screw the interface closed.

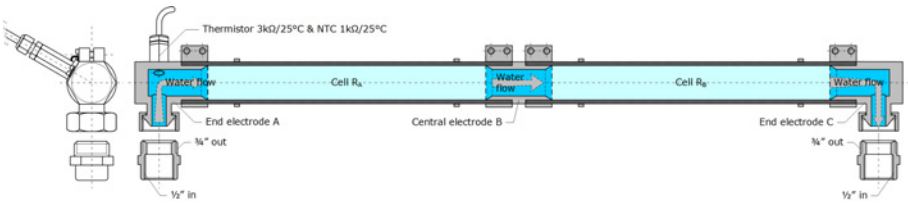
Technical specifications - EC-DSS-interface

Article description	EC-DSS-interface
Article number	3771051
Housing material	plastic
Dimensions H x L x W (without grommet)	180 x 165 x 135 mm
Connections	on EC-interface board 8658: • 24 VAC input power supply • 2 inputs for EC or DSS • 2 analog outputs
Supply voltage	24 VAC, 50/60 HZ
Ambient temperature	0 ... 35 °C

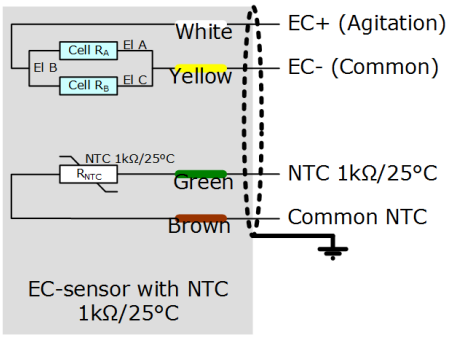
Connecting the Compass EC sensor



Cross section of inline EC sensor



Cross section of angled EC sensor



Connecting the Compass EC sensor

EC sensor	EC interface VP9943+VP8658	
Core colour	**Measuring cell 1**	**Measuring cell 2**
White	6 (EC)	3 (EC)
Yellow	5 (Comm.)	2 (Comm.)
Grey	Do not connect	Do not connect
Green	4 (Temp.)	1 (Temp.)
Brown	5 (Comm.)	2 (Comm.)

1. Connect the EC sensor to the interface with a 4-core shielded cable with cores of 0.34 mm^2 (Ø 0.64 mm).
2. It may be possible to extend the cable. Extending the cable will, however, increase the measuring error (see tables below).

   In the case of an EC measurement via single cores, limit the length to 60 m.

3. Connect the shielding on the cable to the earth bar in the housing.
4. Adjust the cell factor with the potentiometer, see Calibrating the EC sensor (Compass) (page 120).

Cable length (2x 0.34 mm²)	Measuring error at 15 mS	Measuring error at 10 mS	Measuring error at 5 mS	Measuring error at 0.1 mS
5 m	1%	0.5%	0.3%	--
60 m	9%	6%	3%	0.1%
120 m	16%	11%	6%	0.1%

Cable length (4x 0.34 mm²)	Measuring error at 15 mS	Measuring error at 10 mS	Measuring error at 5 mS	Measuring error at 0.1 mS
5 m	0.4%	0.3%	0.1%	--
60 m	5%	3%	1.5%	--
120 m	9%	6%	3%	0.1%

Cleaning the EC sensor

Blockages can affect the EC measurement. It is recommended that the EC sensor is cleaned each year with a scale remover.

1. Close the manually operated valves and disconnect the EC sensor.
2. Fill the EC sensor with a highly concentrated scale remover. Follow the instructions for the scale remover.

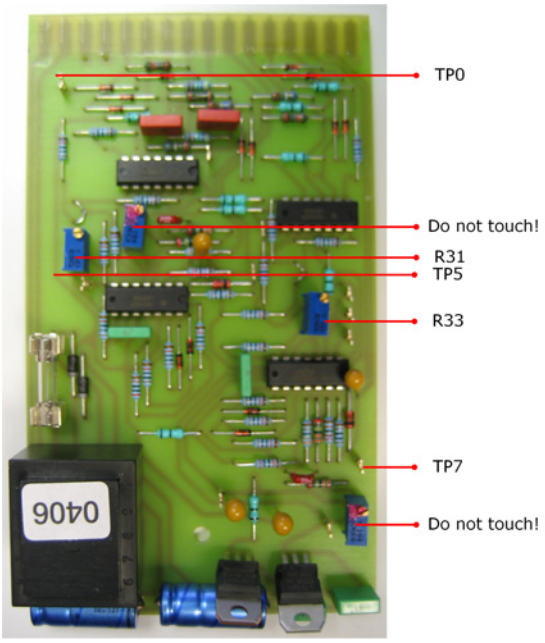
   The quantity of the scale remover to use depends on the severity of the pollution.

3. Afterwards, flush the EC sensor with tap water to prevent scale residue getting into the system.
4. Re-connect the EC sensor and open the manually operated valves.
5. Calibrate the EC sensor (dealer).

Calibrating the EC sensor (Compass)

Have the EC sensor calibrated by a dealer at least once a year. The calibration can be done using a portable EC meter. Use the portable EC meter to determine the EC value of the water within the sensor.

A portable reference EC meter is required for calibrating the EC measurement, like Portable EC and pH analyzer (3779190) or Portable EC analyzer (3779191).



EC Interface VP9943

1. Go to *Water Room* > *Water system* > *Settings* > *Stop water system for maintenance* and select *IMMEDIATE*.
2. Make sure that water with a constant composition is pumped through the EC measuring sensor. Use the available valves and pumps of the unit, depending on the type of unit and the model.

   For a usable calibration the EC value must be within the unit's normal control range, for instance around 2 mS.

3. Collect some water with fertiliser and measure its EC value using a reference EC meter.
4. Calculate the desired output signal (in mV) of the EC Interface VP9943: desired output signal=EC value x 500.
5. Connect a digital multimeter to test point TP0 (Gnd) and TP5 (signal EC sensor 1) on EC Interface VP99433.
6. Adjust the potentiometer R31 until the multimeter shows the desired output signal (calculated in step 4).
7. Connect a digital multimeter to test point TP0 (Gnd) and TP7 (signal EC sensor 2) on EC Interface VP99433.
8. Adjust the potentiometer R33 until the multimeter shows the desired output signal (calculated in step 4).
9. Go to *Water Room* > *Water system* > *Settings* > *Stop water system for maintenance* and select *NO STOP*.
10. Reset the unit valves and pumps to the correct position.

Specifications for EC sensor

Article description	Inline EC sensor, short, with NTC 1 kΩ/25°C	Inline EC sensor with NTC and thermistor	Angled EC sensor, long, with NTC 1 kΩ/25°C	Angled EC sensor with NTC and thermistor
Article number	3779052	3779043 This part is no longer available.	3779041	3779045 This part is no longer available.
Temperature sensors	NTC 1 kΩ/25 °C	NTC 1 kΩ/25 °C Thermistor 3 kΩ/25 °C	NTC 1 kΩ/25 °C	NTC 1 kΩ/25 °C Thermistor 3 kΩ/25 °C
Spare parts	NTC 1k with cable, short EC sensor (3476073)	-	NTC 1k with cable, long EC sensor (3476074)	-
Measurement range	0.01 to 15 mS/cm		0.01 to 15 mS/cm	
Cell factor	1.23 cm/cm^2		1.82 cm/cm^2	
Temperature compensation	Necessary approx. 1.8 to 2.2 %/°C		Necessary approx. 1.8 to 2.2 %/°C	
Temperature range	0 to 45 °C (when active) 0 to 65°C (when inactive)		0 to 45 °C (when active) 0 to 65°C (when inactive)	
Pressure range	Maximum 10 bar		Maximum 6 bar	
Flow speed	0.5 to 25 m^3/hour		0.5 to 25 m^3/hour	

Drain water sensor

Use

Drain water is water that is not taken up by the plants and the substrate (for instance mineral wool, coco peat or Perlite). This excess of irrigation water is necessary to prevent the substrate from becoming excessively saline as a result of the accumulation of fertilisers.

The Priva Drain water sensor accurately measures the electrical conductivity (EC value) of the drain water and the quantity of drain water from the substrate. The Drain water sensor is connected to the process computer.

EC measurement

The EC value is an indicator of the fertiliser-water ratio in the drain water: a high EC value points to a high concentration of fertilisers, while a low EC value points to a low concentration of fertilisers. The chemical composition of the drain water is determined by the selective uptake of the fertiliser elements by the plant roots.

The desired EC value of the irrigation water depends on the crop, the substrate and the composition of the fertilisers.

The EC sensor is located in the flow tube underneath the Drain water sensor. This tube is a trap construction, so that drain water is always present in the EC sensor.

Quantity measurement

Based on the quantity measurement of the Drain water sensor, the optimum strategy for supplying irrigation water is determined.

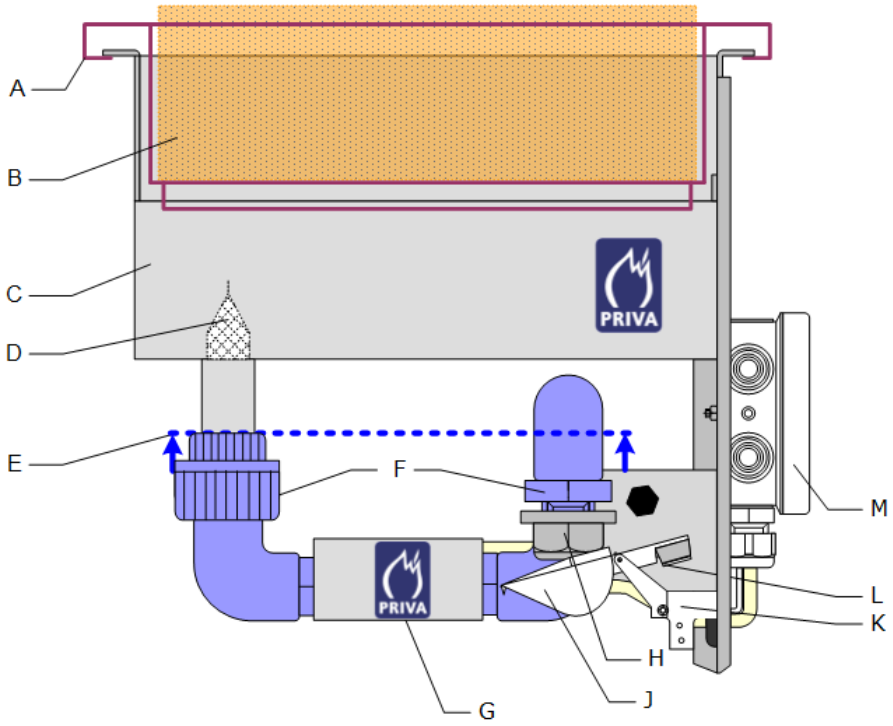
The drain water derived from the substrate is collected in a drain trough (available separately). At the end of the drain trough, the drain water flows into the tray of the Drain water sensor. The water then flows, via a dirt filter, into the flow tube underneath the Drain water sensor.

At the end of the tube, the drain water is collected drop by drop on the tipping ladle. When the ladle is full, it tilts downwards, thus activating a reed relay. The number of times that the tipping ladle tilts over is a measure of the quantity of drain water.

The Drain water sensor has a maximum measuring capacity of 3.6 litres per hour.

If the Drain water sensor is processing 3.6 litres per hour, the tipping ladle is continuously active. This is not a desirable situation. There must be a period between two irrigation cycles in which the tipping ladle is not active, otherwise the cycles run into each other and it is not possible to correctly measure the quantity per irrigation cycle.

Overview



Overview of the Drain water sensor

A. Drain trough
B. Substrate slab
C. Tray
D. Dirt filter
E. Water level in the flow tube when drain water has drained away
F. Flow tube/trap
G. Temperature sensor (NTC 1 kΩ/25°C or thermistor 3 kΩ/25°C) and EC sensor (moulded-in)
H. Outflow cap with opening diam. 1.5 mm
J. Tipping ladle
K. Reed relay contact
L. Magnet (counterweight of tipping ladle)
M. Junction box

Mounting the Drain water sensor

If the Drain water sensor is used for a crop in the soil, the Drain water sensor is buried in the soil.
The Drain water sensor must not stand in water, as this may cause corrosion. For that reason, bear in mind the following:

- The drain water should be able to drain away into the ground. With loam and clay in particular, this can be a problem.
  If necessary, ensure that the drain water drains away correctly.
- The groundwater level should not be too high.

Also make sure that the Drain water sensor is well ventilated, so that dirt cannot accumulate. If the Drain water sensor is placed in an enclosed space below ground level, its service life is reduced considerably.

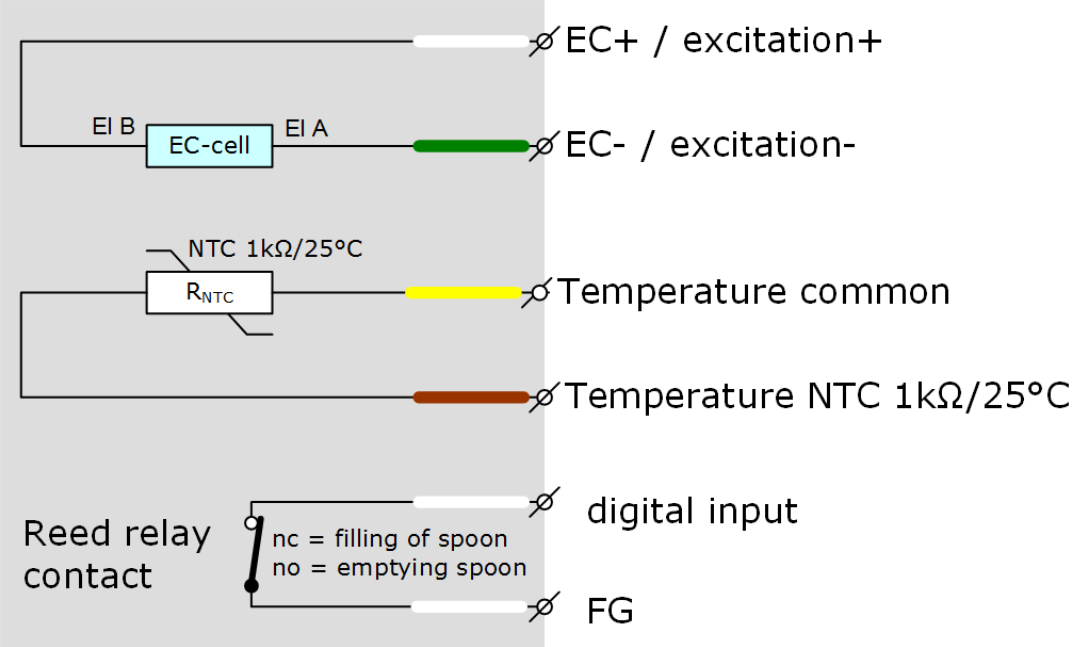
1. Install the trough in such a way that the drain water can easily flow into the tray of the Drain water sensor. The trough must have a slope of around 1%.
2. Hang the Drain water sensor at the end of the trough.

   In the case of slab weighing, do **not** hang the Drain water sensor at the end of the trough, but in a different place. If the Drain water sensor is suspended at the end of the trough, the drain will also be included, which will disrupt the measurement.

3. Cover the substrate slab, the trough and the Drain water sensor with foil, to prevent dirt and algae growth in the Drain water sensor.

Connecting the Drain water sensor (Compass)

Connect the Drain water sensor to:
- EC interface board VP9943 (via connection board VP8658)
- Compass C4



Connection diagram for Drain water sensor with NTC 1 kΩ/25°C

Connection in junction box	Connection to		
	EC interface board VP9943 (via connection board VP8658)		
1 White (EC+ / excitation+)	3 (EC)	or	6 (EC)
2 Green (EC- / excitation-)	2 (EC Comm)		5 (EC Comm)
3 Yellow (NTC/Thermistor wire 1)	2 (Temp Comm)		5 (Temp Comm)
4 Brown (NTC/Thermistor wire 2)	1 (Temp)		4 (Temp)
	Compass C4		
5 Black (Reed relay wire 1)	DI		
6 Black (Reed relay wire 2)	FG		

You must connect the green and yellow core of the Drain water sensor jointly to Common (terminal 2 or terminal 5) of EC interface board VP9943.

Cable specifications

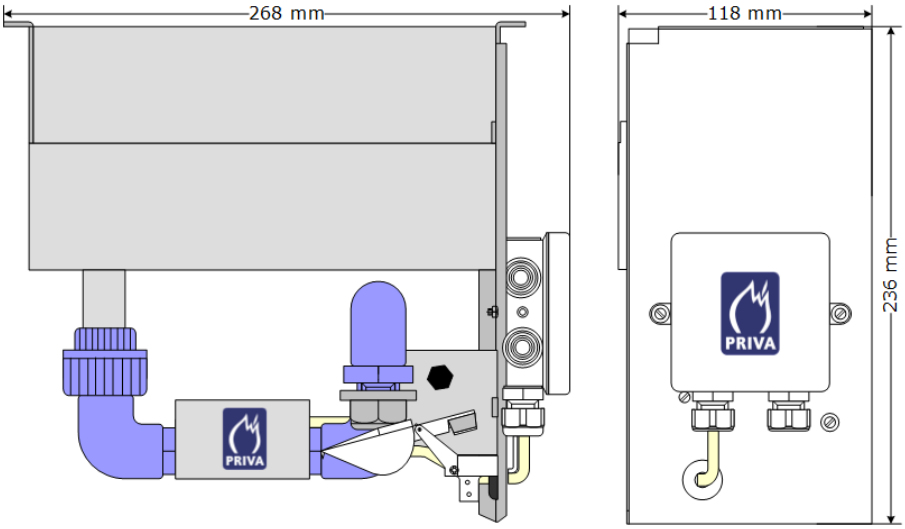
Cable type	6 x 0.64 mm (0.34 mm^2) shielded
Maximum cable length	60 m

After installation, you must calibrate the Drain water sensor.

Specifications of the Drain water sensor 1 kΩ

Drain water sensor

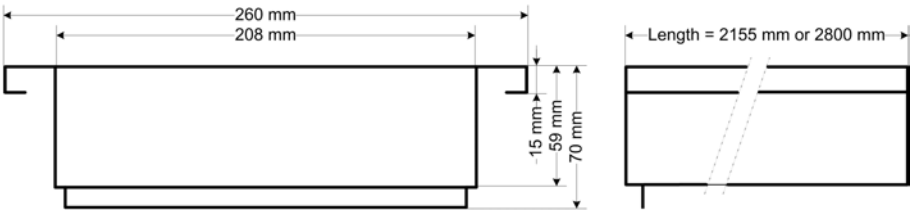
Article description	Drain sensor system DSS with NTC 1 kΩ/25°C
Article number	3779224
To connect to	Spectra 92 and CD/I C line Compass
Temperature sensor	NTC 1 kΩ/25 °C
Measurement range	0.01 to 15 mS/cm
Cell factor	5.0 cm/cm^2
Temperature compensation	Necessary approx. 1.8 to 2.2 %/°C
Temperature range	0 to 45 °C (when active) 0 to 65°C (when inactive)
Maximum measuring capacity	3.6 litres/hour (tipping ladle is continuously loaded)



Dimensions of the Drain water sensor

Drain trough

Article description	Drain trough 200 cm	Drain trough 280 cm
Article number	3475021	3475022
Dimensions (LxW)	200 x 20 cm	280 x 20 cm
Material	Stainless steel	



Dimensions of Drain trough

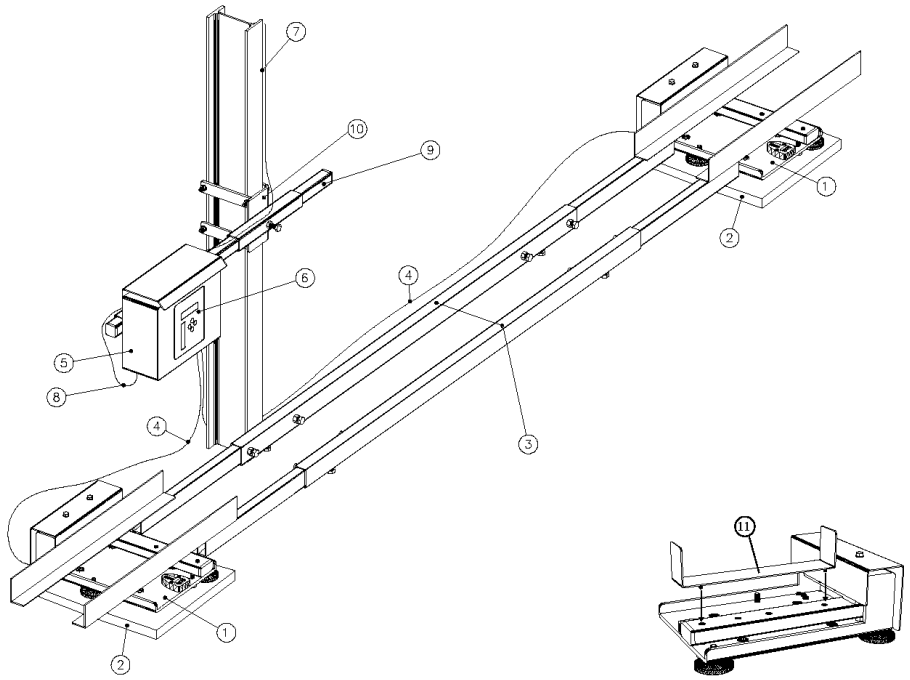
Groscale

Priva Groscale allows you to accurately follow the fluctuation in the slab weight and thus the amount of water present in the substrate slab. This will give you an insight into the amount of water absorbed by your plants in the course of the day. When the right software is installed on the process computer, this will give you an extra set of tools to regulate and keep an eye on the water dosage, as well as to protect your plants from being deprived of water as a result of substrate slabs becoming too dry. You can avoid loss of production and even achieve an increase in production by simply reacting correctly to the amount of water present in the slabs.

The Groscale consists of two or four weighing platforms connected to a weighing indicator. The weighing platforms are fitted with a sensor which records the measured weight. The weighing indicator combines the signals of the weighing platforms and converts these into a total weight. Weight measurements are taken continually by the weighing indicator. The computer will allow you to request collective measurement values in a table and a diagram. For further information on viewing and using the measurement values, please refer to your process computer manuals.

The Groscale is developed with a view to highly accurate measurements of substrate slab weights. Therefore, the device is more accurate than is strictly necessary for the measurement of moisture content; this makes the system suitable for extension in the future, even if these extensions require a higher level of accuracy.

Layout



1 Weighing platform
2 Paving-stones (30 x 30cm), not part of the delivery
3 Support frame (optional)
4 Connection cables weighing platforms
5 Weighing indicator
6 Control panel
7 Greenhouse post, not part of the delivery
8 Connecting cable to process computer, not part of the delivery
9 Support arm
10 Support lock
11Box position bow (optional)

The Groscale consists of a weighing indicator, two or four weighing platforms, one support frame for every two weighing platforms and the fitting materials necessary. The two weighing platforms are connected by means of the support frame. The boxes with substrate slabs can then be placed on top of this support frame.

The support frame has an adjustable length and width in order to make it suitable for a variety of box dimensions. When no subsurface boxes are used, a plate can be placed on the support frame as a support for the slabs. The support frame can be left out if using a drain tray which is rigid enough not to bend. Measures have to be taken to prevent moving or dragging of the drain tray. This will influence the measurement.

This can be accomplished by using box position bows, which positions self carrying drain trays up to 21 cm width.

It would be a good idea to put the substrate slabs on a slight lengthways slant, since this would encourage drainage.

When using additional materials to support the substrate slabs, it is important not to use wood or other materials which absorb moisture. This would affect the weights measured.

Preparing for installation

Determining the location for weighing platforms and weighing indicator

It is desirable to set up the Groscale at the location before the start of a new crop. However, it is possible to set up the weighing platforms in an existing situation.

First and foremost, you need to determine the location where you want to take the weighings. This location should be a representative spot in the middle of the crop. When using an unit with four weighing platforms (2 x 2 weighing platforms), one unit should be placed on the left and the other on the right of the row of crops in the same section. This way an average value is obtained for the slab weight of plants on the sunny and the shadowy side of the row of crops are taken into account. This is because of differences in transpiration. With a V-system, the weighing platforms can be placed one after the other and the weighing indicator in the middle.

When determining location, the following conditions should also be met:

- The total weight resting on top of the weighing platforms from the support frame, the drain troughs, subsurface boxes, plants and saturated slabs may not exceed the capacity of the weighing unit. This is 100 kg (2 weighing platforms 50 kg), 200 kg (2 weighing platforms 100 kg or 400 kg (4 weighing platforms 100 kg).
- Preferably, the weighing unit should be placed in the valve section which also contains a box to measure drainage. Dosage and drain measurement can be compared, which gives a surplus value because the effect on the moisture content can be determined.
- Every weighing platform has a maximum cable length of 5 metres. Therefore, you should bear in mind that the maximum distance between weighing platform and weighing indicator cannot exceed 3.5 metres (1.5 metres will be lost on the distance between soil and weighing indicator).
- Weighing platform should not be placed underneath a gutter, because condensation water could drip off the gutter onto the slab and because the gutter could overflow after heavy rainfall.
- Place the weighing platforms sufficiently high that they remain dry and no water collects underneath the weighing platforms. This could damage the electrical parts and cause corrosion over a long period of time.
- Make sure that the higher part of the weighing platform does not get too close to the tubular heating system or any other source of heating. The radiated warmth could affect the sensor in the weighing platform and therefore affect the measurement itself.
- When using CO_2-hoses, you need to make sure that these have no discharge openings at the location where the weighing platform is installed. The waste gases will warm the sensor in the weighing platform and affect the measurement.
- Preferably, do not suspend CO_2-hoses over the weighing unit, since condensation drops could fall onto the slab.
- Slab heating should be led around the weighing unit so that it is not accidentally included in measurements. Due to the way the weighing unit is installed, the slabs do not lie on the cold floor; therefore slab heating will be superfluous in most cases.
- Please decide whether you want to set up your substrate slabs on the same level with your other slabs or whether a difference in height is acceptable (maximum 15 cm difference). When using a countersunk configuration for the weighing platforms, it is necessary to ensure good drainage. In addition, it is necessary to dig a groove in between the two weighing platforms, for the support frame and/or the subsurface box.

Configuration of substrate slabs

Below you will find a number of examples of substrate slabs and an indication of the weight of an unit with a saturated slab.

Possible layouts for slabs 2 x (133x20x7.5 cm)	**weight saturated slab**
Rigid boxes which are placed directly onto the weighing platforms without support frame with box position bow.	41 kg
Boxes which are placed on a drain trough on top of the weighing platforms without support frame with box position bow.	48 kg
Boxes placed on top of specially developed support frames.	55 kg

Materials required

A 4 x twisted pair of shielded cables should be laid between the process computer and the weighing indicator, with the following specifications:

- 8 core, twisted pair, fully shielded
- Core area 0.5 mm^2
- Cable diameter 8 mm (this is necessary for a correct fit when feeding it through the grommet supplied with the weighing indicator).

Out of these, 4 cores (4 pairs) will be used for the power supply and 2 cores (2 pairs) will be used for the output signals of the weighing indicator. The weighing indicator will be supplied by a supply voltage of 24VAC or 24VDC coming from the process computer. Use a fused supply voltage for this.

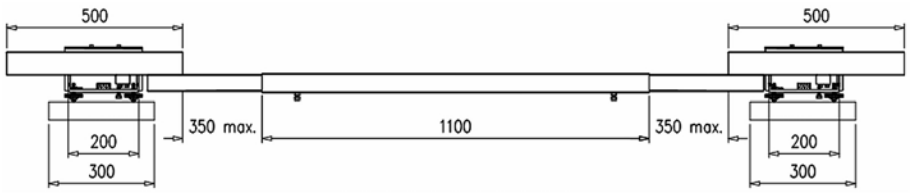
The weighing indicator contains two analog outputs which are used to pass the weight shown on the display to the process computer. Either one or two analog inputs are used, depending on the type of process computer being used and the software version running. With modern computer systems, it would be advisable to connect both outputs to a 0 - 5V analog input, with a view to future software operation. In this case, both analog inputs should be used on the same IO-board. On older computers, only the first analog output can be connected.

A double core pair can be used to bridge the distance to the weighing indicator, depending on whether the supply voltage is AC or DC. Use a separate cable for each weighing indicator.

Power supply	Maximum cable length
24VAC	800 m
24VDC	1600 m

Installation

Installing weighing platforms

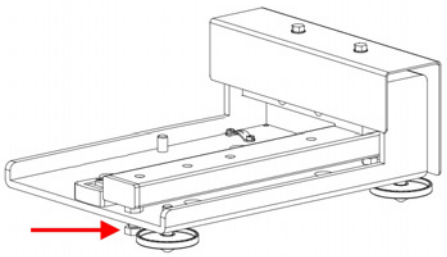


Layout for support frame, dimensions in mm

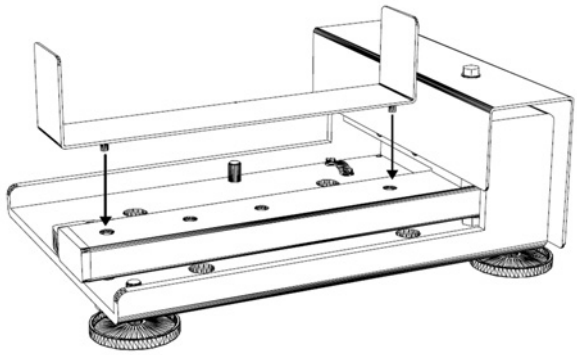
1. Determine the distance between the weighing platforms. If you are using the weighing support frame, position the platforms with a centre-to-centre distance equal to the length of your weighing system minus 60 cm. (For instance: with two 100 cm tanks plus a distance between them of 20 cm, the platforms should be positioned with a centre to centre distance of 220 - 60 = 160 cm apart). If the weighing support frame is not being used, it is best to position the platforms at a quarter of the total distance from both ends of the weighing system.
2. Determine whether the weighing platforms should be installed in a recessed manner, so that the substrate slabs are flush with the other slabs. In this case, it must be guaranteed that the weighing platforms will remain dry. Make sure therefore that there is good drainage and pay attention to the maximum groundwater levels that may occur.
3. Excavate at least 5 cm of soil below the foundations of the weighing platforms for a bed of sand. If the weighing platforms are to be installed in a recessed manner, the soil below the weighing support frame must also be removed, so that the weighing frame is suspended entirely freely. In the case of a recessed arrangement, it is advisable to use a bed of sand of at least 30 cm in order to ensure good drainage and, in addition, to apply a casing around the weighing platform to prevent the excavation from collapsing.
4. Spread white sand in the excavated soil, and place the paving slabs on top.
5. Level the paving slabs and tap them with a rubber hammer. There may be a small difference in height between the various paving slabs, to provide a slope.
6. Place the weighing platforms in their correct position. Make sure that the supporting side of the weighing platform, the upper part, is turned away from the pipe rail. This is because the radiant heat of the rail can influence the measurement.

7. With the aid of the three adjustable posts, level the weighing platforms on the paving slabs (a spirit level is included on the platform).

   Do not turn the bolt that protects the load cell from overload (see illustration). In the unladen state, there must be a distance of 6 mm between the underlay and the bolt. If the distance is too great, the load cell will be insufficiently protected; if the distance is too small, the measurement range will be incomplete.



8. Adjust the weighing support frame to the correct length and width (see figure: “dimensions for setting up the weighing support frame”). Place the substrate tanks on the weighing support frame (see Configuration of substrate slabs (page 129)).
9. If you are using a self-supporting drain tray of up to 21 cm in width with supplied brackets, place the brackets in which the tank is located on the arm of the weighing platforms in accordance with the figure below.



Placing box position bow for drain tray up to 21 cm width

Positioning of weighing indicator

The weighing indicator should be fitted on the greenhouse post at a distance less than 3.5 metres away from the location where the weighing platform are to installed. Use the support arm and the

support lock. The support plate onto which the weighing indicator is mounted is then slid onto the support arm and bolted using the wing nut. Proceed as follows:

1. Fit the support lock, the support arm and the weighing indicator in such a manner that they do not interfere with any existing overhead heating. This also applies to any cabling running to the process computer and weighing platforms. The overhead heating needs to move freely either in front or behind the unit.
2. Fit the weighing indicator at the correct operating height and check that the connecting cables of the weighing platforms are sufficiently long.
3. Open up the weighing indicator and let the control panel hang from the earth-wires.
4. Feed the weighing platforms' connecting cable plugs around the back of the control panel and plug them into connectors L1-L4. The sequence does not matter.

   Make sure you place the plugs correctly when plugging them into the connectors and that all pins are rightly inserted.

5. Push the connecting cable grommet into the holes in the edge of the housing.
6. Roll up excess lengths of cable and hang these onto the side of the weighing indicator.

   Never shorten the cables of weighing platforms!

Connecting Groscale to Compass

Terminal C1	Name	Function	Twisted Pair	Compass connector
1	0VAC or 0VDC	Power supply	1+2	- of a 24 VDC power supply
2	24VAC or 24VDC	Power supply	1+2	+ of a 24 VDC power supply
3	DAC1gnd	GND 1st analogue output	3	UI
4	DAC1OUT	Signal 1st analogue output	3	FG
5	DAC2gnd	GND 2nd analogue output	4	UI
6	DAC2OUT	Signal (fine) 2nd analogue output	4	FG
7	Shield	Cable shielding	Shield	Compass ground busbar

1. Unscrew the weighing indicator to open it and allow the operating panel to hang from the ground wires.
2. On account of the removal of the weighing indicator during crop change, do **not** feed the connecting cable to the process computer through the tube. Also remove this from behind the operating panel, as well as the connecting cables of the weighing platforms. Position the supplied grommet over the cable. This is absolutely necessary in order to achieve a watertight sealing of the housing.
3. Connect the cores of the twisted pairs to the supplied plug in accordance with the table above.
4. Use two pairs per terminal for the power supply.
5. On the process computer side, the shielding of the connecting cable is connected to the earth strap.
6. Fit the plug cap, slide the grommet to the correct length, fit a hose clip as strain relief and press the grommet into the appropriate hole in the housing.
7. Feed the cabling through the cable glands.
8. Close the weighing indicator by screwing it tight.

Make sure that the 24VAC/24VDC and 0VAC/0VDC are electrically isolated from the DAC1gnd and DAC2gnd. With the twisted pair, it can easily be mixed up, which leads to errors. Be sure to check this again!

Commissioning

Commissioning for the first time

1. Check that the unit is working (see Checking operation of the weighing indicator (page 133))
2. Enter the data for the load cells (see Setting the load cell data (to be performed by the service engineer only) (page 133))
3. Follow the calibration procedure, see Calibrating slab (weight of dry and saturated slab) (page 134).

Checking operation of the weighing indicator

Check the status of the LEDs in the housing. The three green LEDs with the text V24ac, Vcc and V18+ must light up brightly. The yellow LED with the text T1 must flash after the weighing indicator has started up. Go to the chapter "Fault diagnosis" if the weighing indicator does not work after it has been connected.

Setting the load cell data (to be performed by the service engineer only)

When the slab weigher is taken into use, the specific data for the load cells in the weighing platforms must be entered in the weighing indicator. You can do this in the *Load cells* menu. The numbers for *Sensitivity* and *Zero point* appear on the cables in the weighing indicator.

1. Open the weighing indicator and let the cover with the display hang down.
2. Go to the menu *Load Cells* .
3. Deactivate the menu protection by pressing “Enter” followed by “ ↑ ” and hold this key combination down for 3 seconds. <<MENU>> will change to >>MENU<<.
4. Activate the menu by pressing “Enter”. The display will show *Sensitivity 1* .
5. Press “Enter” to enter the sensitivity of load cell 1.
6. Enter the sensitivity by using the arrow keys. This figure can be found on the weighing platform cable. The value of the setting changes more quickly if either of the arrow keys is pressed down continuously.
7. Press “Enter” to confirm the value you just set.
8. Press “ ↓ ”.
9. The display will now show *Zero 1* ; press “Enter” if this is to be adjusted.
10. Enter the zero by using the arrow keys. This figure can be found on the weighing platform cable.
11. Press “ ↓ ” and enter the sensitivity for load cell 2 and the zero for load cell 2.
12. Then enter the zero for load cell 2. Enter the data for load cells 3 and 4, if present.
13. After pressing “ ↓ ” following the entry of *Zero 4* for load cell 4, the display will show *# of Load Cells* .
14. Press “Enter”; this enables you to enter the number of load cells.
15. Enter the number of load cells (2 or 2) using the arrow keys and press “Enter” to confirm if this value differs from the default value (which is set to 4).
16. Press “ ↓ ”: the display will now show *#kg/Load Cell* .
17. Press “Enter” if the weight range of the load cells is to be changed.
18. Press “ ↓ ”. The display will now show *Set tare Weight* ; here the new zero weight should be recorded. The display shows the current nett weight surrounded by << >> brackets. Pressing “Enter” will change the brackets so they are turned inwards, i.e. >> <<. Press “Enter” again in order to record the new zero weight. The display will now show <<000,000>>. Press “Esc” if the current nett weight is not to be adjusted. The same can be done with the menu *Slab calibration* (please refer to the chapter “Operation and display”). This function can be used to check the weighing unit using a small calibration weight (1 kg). Perform the *Set tare Weight* function and place the calibration weight on the unit. Check the display to see if the correct weight is shown, while keeping in mind the measuring accuracy of the weighing unit as a whole.
19. Press “ ↓ ” if you wish to rectify small deviations caused by installing the weighing unit. However, it is not mandatory to perform this function.
20. The display will show *Adjust Sens.* It is assumed that the weighing unit has been tared. Place a 20 kg calibration weight at the height of each of the weighing platforms. The left of the display will show the nett weight. If this is incorrect it can be adjusted by pressing “Enter” and using the arrow keys until the actual nett weight on the left of the display shows a value which equals the total weight of all calibration weights. Press “Enter” to confirm.
21. Press “Esc” to leave the menu and reactivate the menu protection.

Calibrating slab (weight of dry and saturated slab)

In order to register the most accurate weight in the process computer, it is necessary to match the output range of the analog output as closely as possible to the maximum nett weight to be weighed. For this, the dry weight and the weight of the saturated substrate slab should be recorded after which the output range can be set in the menu *Service*, menu item *Max #kg/5V* on the basis of the saturated slab weight. This can be entered by using the menu *Slab calibration* .

If a weighing platform carries a dry substrate slab witdry plant pots, the weighing unit can be tared. The following procedure should be performed:

1. If necessary, put the empty subsurface box(es) on a drain trough or a support frame. Add the dry slab and place the dry plant pots on the weighing platforms.
2. Go to the *Slab calibration* menu.
3. Deactivate the menu protection by pressing "Enter" followed by " ↑ " and hold this key combination down for 3 seconds. <<MENU>> will change to >>MENU<<.
4. Press "Enter" to activate the menu.
5. The display now shows *Set tare Weight* and it shows the current nett weight. Press "Enter" to indicate that the Set tare Weight function is to be performed. The brackets on either side of the weight will change direction to >> <<. Press "Enter" again to set the measured value to zero.
6. Press "Esc" to leave the menu and to reactivate the menu protection.
7. Saturate the slab fully. Place the plant pots - which have been moistened as well - onto the slab. The slab should not be allowed to drain. If the slab is not fully saturated you should proceed with this setting procedure and adjust the range at a later date by means of the *Service* menu (Please refer to "Setting output range and adjusting slab calibration data at a later date").
8. Go to the *Slab calibration* menu.
9. Deactivate the menu protection by pressing "Enter" followed by " ↑ " and hold this key combination down for 3 seconds. <<MENU>> will change to >>MENU<<.
10. Press "Enter" to activate the menu.
11. Press the "↓" key once.
12. The display will now show the text *Saturated Slab* and it shows the current nett weight. Press "Enter" to indicate whether you want to adjust the setting. The brackets surrounding the displayed weight will change direction to >> <<. Press "Enter" again to record the displayed weight in the weighing indicator.
13. Press "Esc" to leave the menu and reactivate the menu protection.

In order to calibrate the unit in one day, moisture should be dripped onto the slab until this is saturated and a number of similar slabs and subsurface boxes should be kept aside for taring purposes.

Setting output range and adjusting slab calibration data at a later date

If you have not used the dry or saturated slab for calibration purposes during the calibration process, you will still be able to enter the weight of an empty or full slab (or an estimate of these) manually by using the *Service* menu. The output range of the analog output 1 to the process computer can also be set here.

1. Go to the *Service* menu.
2. Deactivate the menu protection by pressing "Enter" followed by " ↑ " and hold this key combination down for 3 seconds. <<MENU>> will change to >>MENU<<.
3. Press "Enter" to activate the menu.
4. The display will show the text *Set tare Weight* . Press "Enter" if this weight is to be adjusted. Here the weight of an empty unit has to be entered. This will usually equal the weight of the support frame including substrate slabs and subsurface boxes. This weight will be used as the new zero weight in relation to the absolute zero point of the weighing indicator.
5. Use the arrow keys to set the weight of a dry slab and press "Enter" to confirm.
6. Press the " ↓" key.
7. The display will now show the text *Saturated Slab* . Press "Enter" if this weight is to be adjusted.
8. Set the weight of the saturated slab using the arrow keys and press "Enter" to confirm.
9. Press the " ↓" key.
10. The display will now show the text *Max #kg/5V* . This is the maximum number of kg nett weight that the analog outputs can pass to the process computer. This maximum nett weight must be derived from the saturated slab weight. Keep a safety margin for plant weight increase due to plants which are not fully supported. The weighing indicator will show a 5000 mV output voltage at this maximum number of kg.
    This maximum number of kg should never be exceeded by the nett weight. Therefore it is not advisable to adjust this figure.

11. Press “Enter”.
12. Set the desired number of kg by means of the arrow keys and press “Enter” to confirm.
13. Press “Esc” to leave the menu and reactivate the menu protection.

Testing outputs signals and cabling (to be performed by service engineer only at first commissioning)

The weighing indicator has been fitted with a function which gives you the opportunity to check the cabling from the analog outputs to the process computer, so it can be established whether these are functioning properly. In reverse phase, both analog outputs will transmit a block wave during 5000 seconds: a high and a low signal of respectively 0 mV and 0 mV. The 5000 mV of the first analog output equals 30 kg value, the 0 mV will match the *Max #kg/5V* set value.

If the measuring data are not given correctly by the process computer, this signal can be used to check whether a signal is transmitted through the cable. The signal can also be used to weaken the signal for connection to the process computer.

1. Go to the *Test Outputs* menu.
2. Deactivate the menu protection by pressing “Enter” followed by “ ↑ ” and hold this key combination down for 3 seconds. <<MENU>> will change to >>MENU<<.
3. Press “Enter” to activate the menu.
4. The display will now show *Toggle Outputs*; press “Enter”.
5. Press “↑” and “Enter” to set the setting to 1. Now a 30 second signal will be controlled to the process computer, first 0 mV followed by 5000 mV. During this signal, the analog outputs are controlled in reverse phase, i.e. output 1 will be 0 mV and output 2 will be 5000 mV followed by a 30 second signal in reversed order.
6. Perform the desired calibration or check with the 0 mV and 5000 mV signals. Wait 30 seconds for the next signal to be given. LED T2 will now give four flashing signals.
7. Go to the weighing indicator and change the setting *Toggle Outputs* from 1 to 0 by pressing “Enter” and “ ↑ ”, followed by “Enter” again.
8. Press “Esc” to leave the menu and reactivate the menu protection.

Recording essential data

The calibration data will be lost if there is a defect in your weighing indicator. The *Service* menu can be used to re-enter the old calibration values, immediately after the weighing indicator has returned after being repaired. Using the known Service menu can data for the weighing platforms and the number of platforms, the Groscale can be started up again without re-calibrating a dry and a saturated slab . (for this is not possible during growing since the weighing platforms are already loaded with substrate slabs)

It is highly recommended to copy the calibration data on the form found in the weighing indicator.n When you have calibrated the slab, you should go to the *Measurements* menu using the arrow keys. From this menu you need to get the values *Tare Weight*, *Saturated Slab* and *Max #kg/5V* and enter them on the form which accompanies the weighing indicator. These values should be recorded after every calibration (which is usually once every growing season).

The form should be returned to its little bracket behind the weighing indicator.

Placing plants on the slab

You can now place the plants on the substrate slabs. When weighing the water in the slab you should prevent the weight of the plants themselves from being weighed as well. The way you do this depends on the type of crop. Plants which are suspended from wire can be supported. For other crops, another solution will have to be found or you will have to accept the weight of the plant as being part of the weighing result.

At the start, young plants can distort the measurement results, since their weight will not yet be supported by any wire. You should take this continuously increasing weight into consideration when viewing and analysing the measurement results.

Supporting plants suspended from wire

When the plants you want to suspend from wire are big enough, you can support both the plants and the wire itself by braces which are available from a variety of suppliers. During the growing season, it would be advisable to check the plants and the bracing at least once a week to give you the opportunity to replace and adjust the bracing if necessary. This means that plants could possibly more or less rest on the substrate slab. As a result of this, there will be a change in the measurement results. In order to counteract this, the nett weight can be changed accordingly. However, after changing the calibration point a few times, the measuring results will no longer be accurate. Therefore an adjustment should be considered when reading the measurement data in your process computer.

If you might still want to change the nett weight, proceed with the following but only in a period when there is no water dosage:

1. Write down the weight shown on the display.
2. Rehang the plants and move the braces.
3. Determine the difference between the old and the new weight shown on the display and if this is the case, follow the procedures outlined below.
4. Go to the *Adj. Nett Weight*.
5. Deactivate the menu protection by pressing "Enter" followed by " ↑ " and hold this key combination down for 3 seconds. <<MENU>> will change to >>MENU<<.
6. Press "Enter" to activate the menu.
7. Change the current *Nett Weight* with the old value by using the arrow keys and finally confirm this weight by pressing "Enter".
8. Press "Esc" to leave the menu and reactivate the menu protection.

LEDs

number/colour of LED	text with LED	meaning
1/green	V24ac	input voltage of weighing indicator
2/green	VCC	supply voltage digital part
3/green	V18+	supply voltage analogue part
4/yellow	T1	processor activity (it should flash, at irregular intervals)
5/yellow	T2	• continuously off: system OK • continuously on: system OK, the production jumper has been installed. • 1x flashing signal: the display is not responding • 2x flashing signal: no ADC interrupt • 4x flashing signal: the Test outputs menu is still active. The number of flashing signals is added together. Thus: 6 flashing signals means: ADC is defective, and the operating mode for testing the outputs is still active.
6/red	RST	power supply monitor/watchdog

Operation and display

Operation

The keys on the weighing indicator control panel have the following functions:

key	showing on display	result
↓	Menu	shows following menu
	value/setting	shows following value/setting
	setting to be changed	shows following setting value
↑	Menu	shows previous menu
	value/setting	shows previous value/setting
	setting to be changed	shows previous setting value
Enter	Menu	shows value/setting
	value setting	makes change to setting
	setting to be changed	confirms value set
Esc	Menu	shows software version number
	value/setting	shows menu
	setting to be changed	stops change to setting without saving

In order to prevent anyone from accidentally changing settings, all menus with the exception of *Measurements* and *Display* are protected. This protection can be removed by first selecting the “Enter” key, followed by the “ ↑” key and holding this key combination for a minimum of 3 seconds. When protection is removed, the double brackets surrounding <<MENU>> will change to >>MENU<<. When this has changed, the menu can be activated by pressing the “Enter” key.

Protection is automatically re-activated after 15 minutes. However, it can be re-activated manually by “Esc” ; the name of the menu will then be shown normally again.

Examples of operation

When the weighing indicator display is not in use, the *Nett weight* is shown.

This is the actual weight of the water in the substrate slabs. By entering the “ ↓ ” key , the following setting is displayed: *# of Load Cells* . You will now be shown how the Groscale has been calibrated.

By pressing “ ↓ ” when the display shows *Nett weight* , the following items are shown respectively:
- *Nett weight* (is updated 3 times per second)
- *# of Load Cells* (# represents number of cells)
- *Tare Weight*
- *Saturated Slab*
- *Max #kg/5V*

Examples of settings changes

In the *Display menu*, the display contrast can be set as well as the language in which the settings should be shown. Please note that the values are still in Dutch decimal numbers. The menu appears when “Esc” is pressed, followed by the “↓ ” key. The menu choices or settings are:
- *Contrast*
- *Language select*

The “↑ ” and “ ↓ ” keys are used to toggle between these two settings. By pressing “Enter”, the setting currently displayed will be activated. The following instructions explain how the display contrast itself can be adjusted:

- Activate the setting *Contrast* by pressing “Enter”; on the display, the double brackets *50<<50* will change to *50>>50* .
- Press “ ↑ ” to obtain a stronger contrast or press “ ↓ ” to obtain a lighter contrast. The result will be visible immediately since the display changes according to the instruction given. Pressing the key down for a longer period of time will increase the speed at which the value changes.
- Press “Enter” to record the adjustment to the contrast or press “Esc” if no change is to be made.

Menu structure

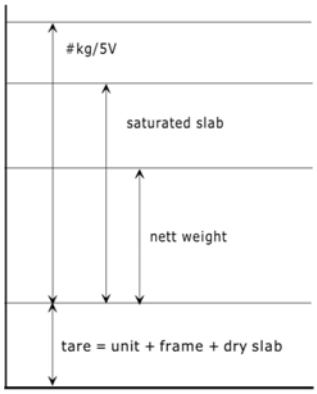
Menu	Value or setting	Set-up range	Default
Measurements	Nett weight # of Load Cells Tare Weight Saturated Slab Max #kg/5V		
Display	Contrast Language select	0 - 100% Dutch/English/German/French	50% Dutch
Load Cells	Sensitivity 1 Zero 1 Sensitivity 2 Zero 2 Sensitivity 3 Zero 3 Sensitivity 4 Zero 4 # of Load Cells #kg/Load Cell Set tare Weight Adj. Adjust Sens.	1,9000 - 2,1000 -0,1000 - 0,1000 1,9000 - 2,1000 -0,1000 - 0,1000 1,9000 - 2,1000 -0,1000 - 0,1000 1,9000 - 2,1000 -0,1000 - 0,1000 1 - 4 1 - 500 kg confirm -10.000 - 10.000 ppm	2,0000 0,0000 2,0000 0,0000 2,0000 0,0000 2,0000 0,0000 2 50 kg - 0 ppm
Slab calibration	Set tare Weight Saturated Slab	confirm confirm	
Adj. Nett Weight	Nett weight	-20.000 - 20.000 g	
Test Outputs	Toggle Outputs	0 or 1 (0 = off, 1 = on)	0
Service	Tare Weight Saturated Slab Max #kg/5V	-5.000 200.000 g 0.0 - 200.000 g 5 - 200 kg	

The menus coloured grey in the above table can only be accessed after a certain key combination is pressed. This way, they are protected from their contents being unintentionally changed. Please find an explanation of the meaning of the menus themselves in the chapter “Explanation menus”.

Explanation menus

In this chapter the structure and meaning of the menus is described. (see also chapter “Operation and display”)

Measurements



Nett weight

This measurement value shows the actual nett weight which is currently resting on the weighing unit. This weight is passed to the process computer via the analog outputs. This menu item will become active automatically after you have started up the indicator or if no operations are performed for 15 minutes.

of Load Cells

This shows the number of weighing platforms entered into the weighing indicator. This number should match the actual number of weighing platforms being used (i.e. 2 or 4).

Tare Weight

This figure indicates the weight in relation to the absolute zero point of the weighing indicator. This information is gained after performing the *Set tare Weight* function in *Load Cells* or *Slab calibration*. After finishing with the *Slab calibration* menu, this figure shows the weight of the unit while only incorporating a dry slab. This information must be entered on the accompanying form so it can be entered into any new weighing indicator without first having to calibrate the unit (please also refer to the menu *Service*).

Saturated Slab

This figure indicates the weight of saturated substrate slab after using the function *Saturated Slab* from the *Slab calibration* menu. This information must be entered on the accompanying form.

Max #kg/5V

This figure indicates the maximum nett weight in number of kg set by you and which can be passed to the process computer. It should match an output signal of 5000 mV from the first analog output. The maximum nett weight to be weighed must never exceed this value.

Display

In this menu, the contrast and choice of language can be set:

Contrast

This allows you to set the contrast between 0 - 100%, which means optimum readability can be obtained under different light and temperature conditions. This value has a default of 50%.

Language select

This allows you to set the language to Dutch, English, German or French.

Load Cells

In this menu, you can enter the load cell data necessary for the weighing indicator to function properly. The load cell is the sensor inside the weighing platform which measures the weight. Information such as sensitivity and zero of the separate load cells, the number of load cells and the weight range of a load cell is involved.

Sensitivity 1 - 4

In this menu item is set the sensitivity for each of the separate load cells. The sensitivity is derived from the difference voltage given out by the load cell between zero load and maximum load. The sensitivity of the separate load cells needs to be equal in order to prevent deviations in the weighing unit.

Zero 1 - 4

In this menu item is entered the voltage given out at zero load by each of the separate load cells. This is called the zero. The zero load is measured when the weighing platform is empty.

# of Load Cells

In this menu item is entered the number of load cells (weighing platforms) of which the weighing unit consists. This should be either two (2) or four (4), the default is set at two (2).

#kg/Load Cell

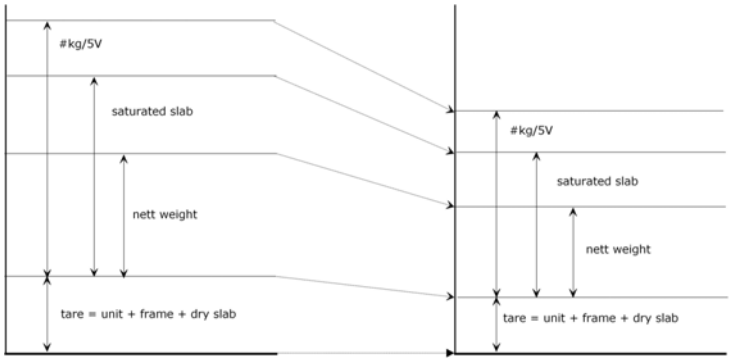
Here, the weight range of each of a separate load cell is entered in kilograms, the default is set to 50 kg. This figure represents the maximum weight which can safely be placed on the platform without damaging the load cell. The weight range must be the same for all weighing platforms in the unit.

Set tare Weight

This menu item can be used to record the new zero weight. The figure shown on the display is the actual nett weight. By activating this function, the current weight of the whole weighing unit is set to 0 kg. This menu item is also part of the menu *Slab calibration*. After performing the *Set tare Weight* function, the new difference in weight between the new zero point and the absolute zero point of the weighing indicator will be calculated in the item *Tare Weight* of the *Measurements* menu.

Adj. Adjust Sens.

This menu item allows you to make corrections in order to rectify small deviations introduced as a result of installing the weighing unit.



Effect of using the function Ajust Sens.

This can be done by a procentual adjustment of the total sensitivity of the load cells as entered in the menu items *Sensitivity 1 - 4*. To do this, check the weighing unit by using large calibration weights (2x20 kg). Before these are placed on the weighing unit, the unit itself should be tared. Then each of the calibration weights can be placed at the height of a weighing platform. The actual nett weight is then adjusted to the absolute calibration weight. It is not necessary to perform this function to achieve a good performance by the weighing unit.

Slab calibration

In this menu, the data for the weighing unit including the substrate slabs is entered, usually at the start of a new crop.

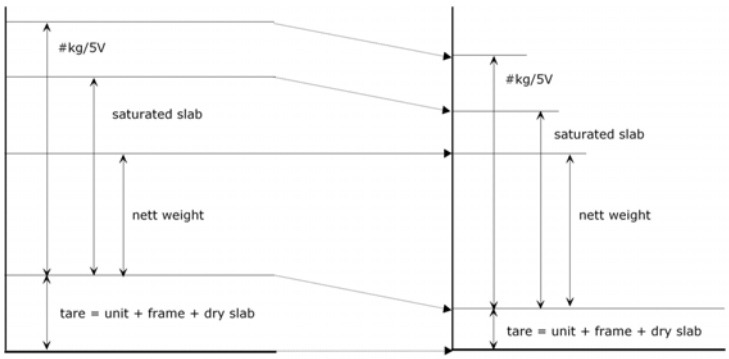
Set tare Weight

This function is used to record a new zero weight. Place the dry substrate slab on top of the weighing unit and perform the *Set tare Weight* function.

Saturated Slab

This function is used to record the weight of the saturated slab in the weighing indicator, only to backup your memory. The function *Saturated Slab* is used only after the function *Set tare Weight* has been performed. Place the saturated slab on the weighing unit or drip moisture onto the dry slab until this is saturated.

Adj. Nett Weight



Effect of using the function Adj. Nett Weight

With this menu the nett weight can be changed by shifting the current zero point. The current nett weight is shown on the left of the display, while the new nett weight is displayed on the right. This can be changed by using the arrow keys. This function can be performed after a change in weight has occurred as a result of crop activity. When this function is to be performed, you should record the nett weight showing on the display before the crop activity is performed. Also, no water dosage should take place in the meantime. It is advisable to use this function as little as possible and instead, change the nett weight by making a change to the hanging plant support system.

Test Outputs

By activating this menu, the process computer cabling can be checked. Both analog outputs will transmit a reverse phase block-wave with a low relatively high signal of 0 mV and 5000 mV within a time period of 30 seconds. This way, any short circuiting in the cabling or any loss of voltage in the cabling can be spotted early.

Service

In this menu, data regarding the weighing unit can be entered directly, which means that the weighing unit does not have to be calibrated again when the weighing indicator is replaced. The data should be taken from the accompanying form.

Tare Weight

In this item, you need to enter the weight taken from the accompanying form which represents the value of the item *Tare Weight* in the menu *Measurements*.

Saturated Slab

In this item, you should enter the weight taken from the accompanying form which represents the value of the item *Saturated Slab* in the menu *Measurements*. With this data the *Max #kg/5V* can be recorded.

Max #kg/5V

In this menu item the number of kilograms that correspond with 5000 mV is recorded. *Max #kg/5V* must be derived from the saturated slab weight. The maximum nett weight to be weighed must never exceed this value. The figure displayed here and under the menu *Measurements*, item *Max #kg/5V* , must be entered on the accompanying form.

Maintenance Groscale

The various parts of the Groscale do not require a great deal of maintenance. In order to guarantee reliable weighing, the following should be checked on a regular basis. Depending on the crop and the situation within the company, this check should be performed either weekly or daily.

- Check that nothing has fallen onto the substrate slab (leaves, fruit, flowers).
- Check that no dirt or fruit has dropped underneath the support frame or into the weighing platforms.
- Check that the plants are still properly supported by the braces.
- Check the reading (in kg) on the display of the weighing indicator.
- Prevent moisture from dripping onto the weighing indicator.

Remove the weighing platforms in the event of a change of crop. Cover the weighing indicator with a plastic bag to protect it against moisture and cleaning materials, or remove the whole weighing indicator. Cover the remaining plug with a plastic bag to protect it from moisture and cleaning materials.

Replacement and repair

Weighing platform

To obtain the desired high level of accuracy a number of sensitivities have been determined for the weighing platforms. The sensitivity has no bearing on quality, but is determined by the type of output signal from the weighing platform. The weighing platforms of each weighing indicator should have the same sensitivity. In case of a breakdown in one of the weighing platforms, it is important that the repaired or replaced weighing platform has the same sensitivity. This sensitivity is marked on the label of the load cell cable.

The same applies to the repair or acquisition of a second set of platforms for a weighing indicator.

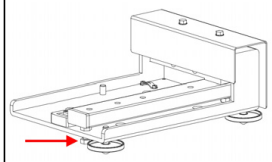
After repair or after increasing the weighing platforms to four, the correct data should be entered in the *Load Cells* menu after the load cell cables have been connected.

Weighing indicator

In the event of a weighing indicator breakdown, the procedure below should be followed:

1. Use the LEDs and the table in the chapter “Fault analysis” to check the voltage on the weighing indicator and check which of the LEDs are working and which are not.
2. If the supply voltage to the weighing indicator is present but it still does not function, the weighing indicator should be returned to your supplier. When returning the weighing indicator, please make sure the following information is available:
    - a thorough description of the failure
    - remove the form containing the settings for the growing season in question from the weighing indicator and keep it in a safe place so that the repaired weighing indicator can be set up for the existing situation.
3. When the weighing indicator is returned, the values of the *Tare Weight*, *Saturated Slab* and *Max #kg/5V* can be taken from the form you have saved and entered in the menu *Service*. Here, the specific figures of the load cells in the *Load Cells* menu can also be entered, as explained in the chapter “Commissioning”.

Troubleshooting

Problem	Possible cause	Solution
The weighing indicator no longer displays any changes in weight.	The bolt that determines the measurement range has been rotated. As a result, the full measurement range is not available.	Have the position of the adjusting bolt checked (see picture): in the unladen state, there must be a distance of 6 mm between the underlay and the bolt. If the distance is too great, the load cell will be insufficiently protected; if the distance is too small, the measurement range will be incomplete. 
The weighing indicator displays sudden changes in weight.	Various	Perform maintenance checks (see Maintenance Groscale (page 142)).
		Check whether anything has rolled underneath the weighing platforms.
		Place a calibration weight on the substrate slab and see whether the weight displayed on the weighing indicator actually increases by the value of the calibration weight.
		Use a syringe, for instance, to withdraw 20 ml of liquid from the slab and see whether the weight actually decreases by 20 grams.
		Check whether the cables are intact and have been connected correctly.
		Use the LEDs in the weighing indicator to check whether it is functioning properly.

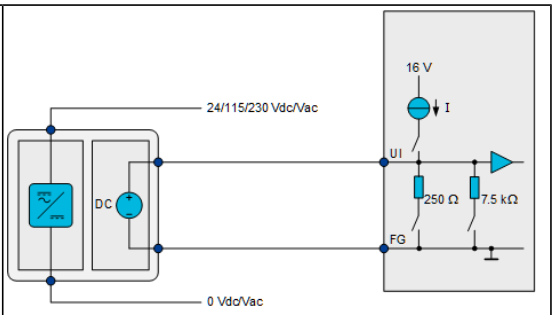
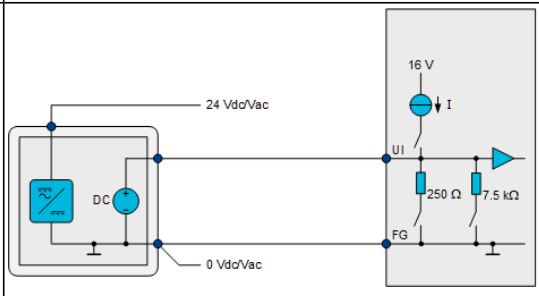
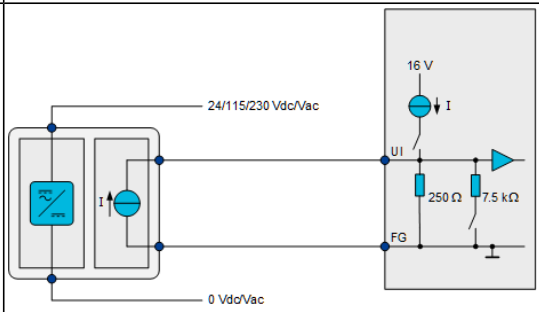
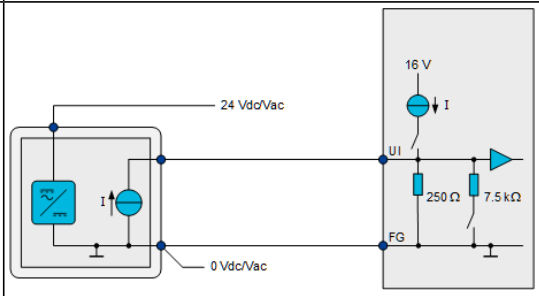
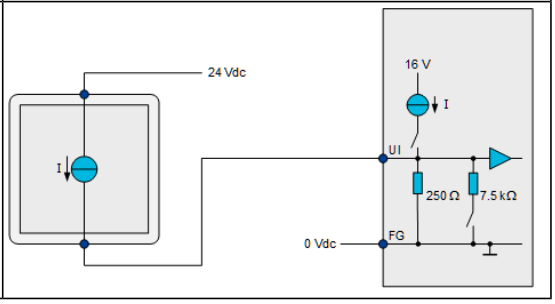
Technical specifications

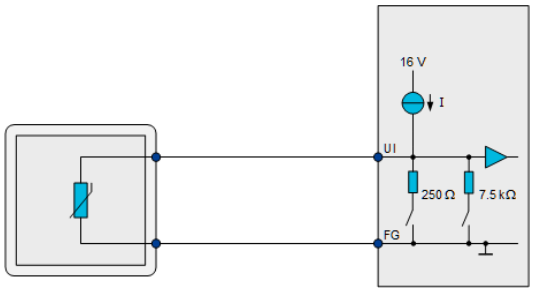
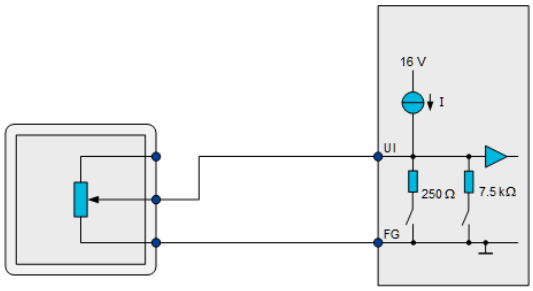
Groscale	
Product	Groscale 100 kg • 1 weighing indicator (part number 3771140) • 2 weighing platform 50 kg Groscale 200 kg • 1 weighing indicator (part number 3771140) • 2 weighing platform 100 kg Groscale 400 kg • 1 weighing indicator (part number 3771140) • 4 weighing platform 100 kg
Weighing platform	
Part number	3771142 (weighing platform for 50 kg) 3771147 (weighing platform for 100 kg)
Accuracy	0.05% Full Scale minimum
Drift at output signal	10 ppm of placed weight /°C
Drift at zero point	23 ppm of weight range /°C
Load cell interface	
Number of load cells	1 - 4
Load cell impedance	415 Ohm ±10%
Agitation voltage	4,4 VAC
Input voltage range	-0,1 - 2,4 mV/V
Sensitivity	<0.1 µV/div, intern 0.01 V/div
Drift	<8 ppm / °C
Analog outputs	
Output range	0 - 5300 mV
Work area	0 - 5000 mV
Resolution	1 mV / LSB
Absolute accuracy	0,5% Full Scale
Relative accuracy	0,5 LSB
Output impedance	500 Ohm
Power supply	
DC	20 - 38 VDC (power supply galvanically separated)
AC	24VAC ± 10% (power supply galvanically separated)
Power consumption	< 4W
Temperature range	
Work area	15 - 35°C
Work range	0 - 50°C
Overall system performance	
Measuring accuracy	0,1 % Full Scale. minimal
Absolute accuracy data transfer (2 outputs)	4000 parts Full Scale
Relative accuracy data transfer (2 outputs)	50000 parts Full Scale

Other sensor connection examples

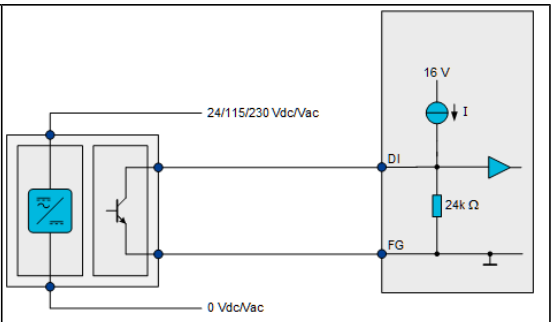
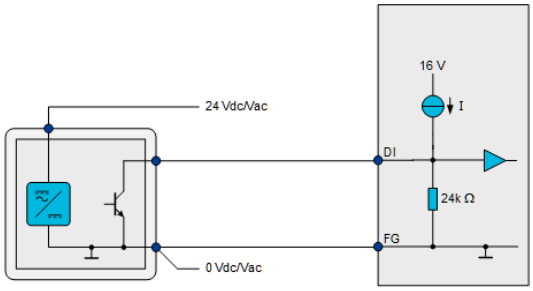
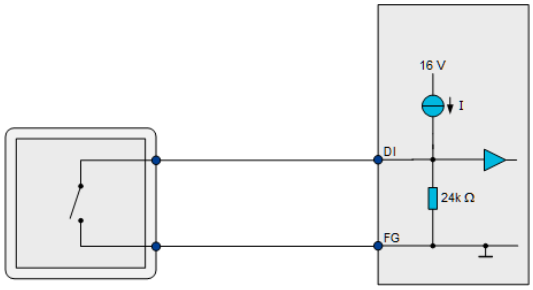
These examples illustrate the connection of I/O to the inputs and outputs of Compass.

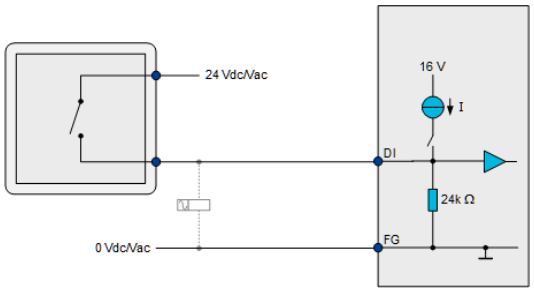
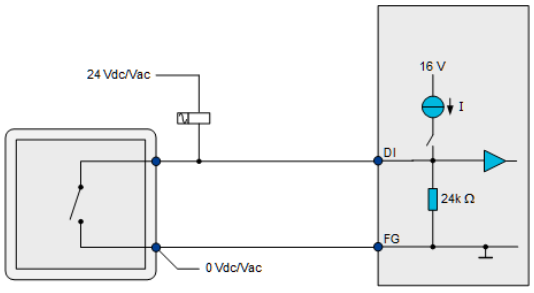
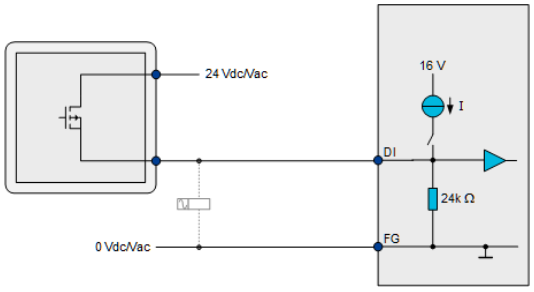
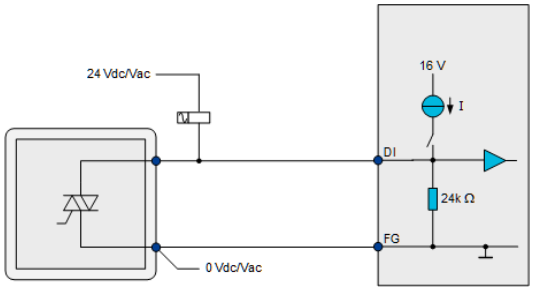
Connecting I/O to universal input

Connecting isolated sensors with voltage output to universal input	
Connecting non-isolated sensors with voltage output to universal input	
Connecting isolated sensors with current output to universal input	
Connecting non-isolated sensors with current output to universal input	
Connecting current transmitters to universal input	

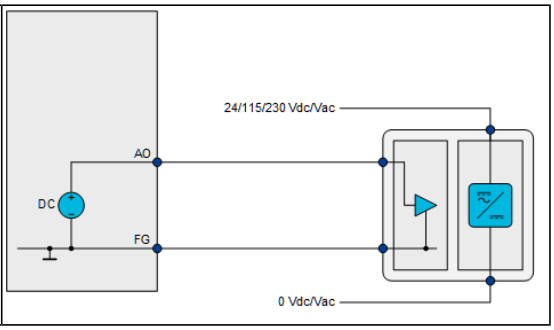
Connecting resistive sensors to universal input	
Connecting two-wire potentiometers universal input	

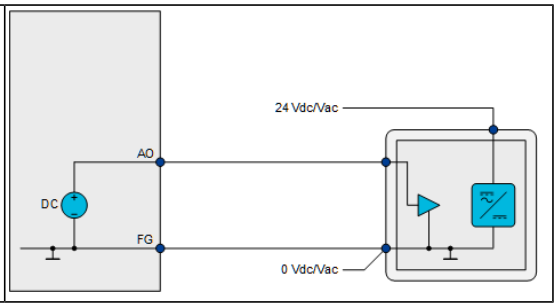
Connecting I/O to digital input

Connecting isolated sensors with open collector output to digital input	
Connecting non-isolated sensors with open collector output to digital input	
Connecting dry contacts to digital input	

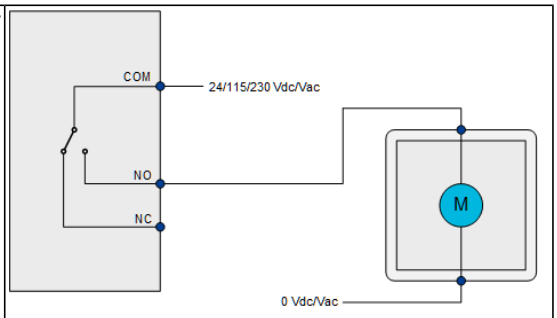
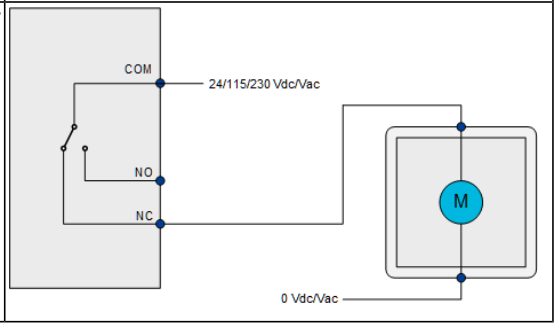
Connecting powered contacts to digital input (sourcing)	
Connecting powered contacts to digital input (sinking)	
Connecting powered solid-state outputs to digital input (sourcing)	
Connecting powered solid-state outputs to digital input (sinking)	

Connecting I/O to analog output

Connecting isolated actuators with voltage input to analog output	

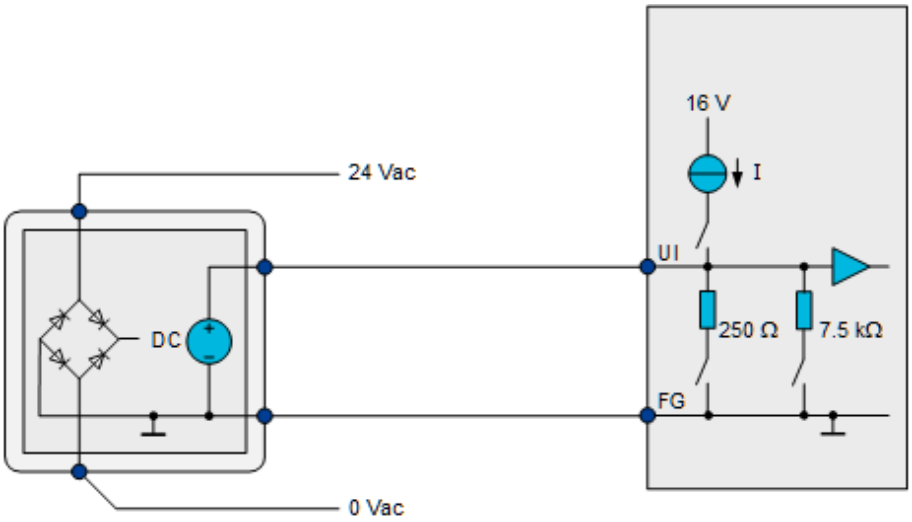
Connecting non-isolated actuators with voltage input to analog output	

Connecting I/O to relay output

Connecting actuators to normally open contact of relay output	
Connecting actuators to normally closed contact of relay output	

Points to be considered

Non-isolated sensors or actuators with a bridge rectifier also have four connections. These must be equipped with a "floating" power supply that is not connected to FG.



Connecting non-isolated sensors or actuators with a bridge rectifier to an I/O module

Abbreviations used

Abbreviation or symbol	Explanation
AO	analogue output
COM	common contact
DC	direct current
DI	digital input
DO	digital output
FG	field ground
FP [1]	field power
I	intensity (of electrical current)
M	motor
NC	normally closed contact
NO	normally open contact
Ref [1]	reference voltage
UI	universal input
VAC	volts alternating current
VDC	volts direct current

[1] Not for Priva Blue ID C-Line.

Disposing of waste products

At the end of its service life the product must be taken to a recognized collection point for waste electrical equipment.

The product is marked in accordance with European directive 2002/96/EC in relation to waste electrical and electronic equipment (WEEE):

The mark indicates that the product must not be disposed of together with other household waste at the end of use. To prevent damage to the environment or to human health resulting from the uncontrolled disposal of waste, you must keep the product separate from other types of waste and recycle it (have it recycled) in a responsible manner so that the reuse of material sources is supported.

General Compass specifications

General		
Article description	Compass 2S	Compass 4S
Article number	3772100	3772101
Weight	23 kg	32 kg
Dimensions (W x H x D)	500 x 500 x 210 mm	600 x 600 x 210 mm
Modules	• Priva Blue ID C3 C-MX34 Controller (article number 5210001)	• Priva Blue ID C3 C-MX34 Controller (article number 5210001) • Priva Blue ID C-Line MX34 Mix input/output module (article number 5211001)
Optional extension modules	• Priva Blue ID C-Line UI8 Universal input module (article number 5213001) • Priva Blue ID C-Line DOR6 Relay output module (article number 5215001)	
Components	• single-door cabinet (left-opening door) • buzzer (article number 3651124) • Priva Blue ID C-Line IO-bus cable length 72 cm (article number 5219112) • Priva Gateway (article number 3771810) • WLAN adapter • 24 VAC transformer 100/110/120/127/210/220 V - 24V (article number 3653033) • system power supply and field equipment power supply: Power supply 24 VDC / 75 W (article number 3659054) • circuit breaker • earth bar • fuse • mounting and connection material	
Interfaces	• Ethernet (5x) • USB 2.0 • WLAN	
Packaging (dimensions W x H x D)	cardboard box (550 x 550 x 230 mm)	cardboard box (650 x 650 x 230 mm)

Specifications of Compass cabinets

Item description	Compass 4S/4X enclosure
Manufacturer	nVent HOFFMAN
Article number	MAS0606021R5
Size	600 x 600 x 210 mm
Rating	IP 66 | TYPE 4, 12 | IK 10

Item description	Compass 2S/2X enclosure
Manufacturer	nVent HOFFMAN
Article number	MAS0505021R5
Size	500 x 500 x 210 mm
Rating	IP 66 | TYPE 4, 12 | IK 10

Electrical specifications

	Compass 2S	Compass 4S
Rated voltage	100-110-120-127-200-220-230 Vac	
Mains frequency	50 Hz or 60 Hz	
Maximum power consumption	240 VA at 230 Vac 250 VA at 115 Vac	
Internal circuit breaker	6 A (Char. C)	
Protection class	Class I (earth connected chassis)	

Other specifications

	Compass 2S	Compass 4S
Maximum number of extension modules	3	6 3 on each DIN rail
Cable input	bottom: • 2x PG21 for Ethernet and fibre optic [1] • 2x M20 for mains power supply and other cable • 6x M25 for cabling for field equipment	bottom: • 2x PG21 for Ethernet and fibre optic [1] • 2x M20 for mains power supply and other cable • 10x M25 for cabling for field equipment
Colour	RAL7035	
Material cabinet	sheet steel with polyurethane powder coating	

[1] optional

Ethernet	
Network standard used	IEEE 802.3 100BASE-TX (100 Mbps) auto negotiation auto MDIX
Baud rate	10 Mbps and 100 Mbps (auto negotiation)
Power over Ethernet	No
Cable type required	UTP or STP, minimum category 5
Maximum cable length	100 m (328 ft)
Connector type	RJ45, screened

WLAN specifications

Supported specifications	IEEE 802.11 b/g/n
Frequency bands	2.4 GHz 5 GHz ETSI FCC bands (ETSI/FCC bands to be configured in software)
Protection	WEP, WPA, WPA2, TKIP, AES, 802.1x
Interface	USB 2.0

Preconditions for installation and use

	Compass 2S	Compass 4S
IP code (NEN-EN-IEC 60529)	IP 66	
Permitted ambient temperature during normal operation	0 ... 35 °C	
Permitted ambient relative humidity during normal operation	10 ... 95 % (non-condensing)	
Pollution factor (NEN-EN-IEC 61010-1)	2 (normal, non-conducting pollution)	
Permitted temperature for transport and storage	-25 ... 70 °C	
Permitted ambient relative humidity for transport and storage	0 ... 95 % (non-condensing)	
Maximum temperature inside cabinet during normal operation	50 °C	
Maximum heat generated in cabinet	57 W at maximum permitted ambient temperature (active cooling is required if more heat is generated)	75 W at maximum permitted ambient temperature (active cooling is required if more heat is generated)
Installation	on the wall using four mounting holes using 4 M8 bolts (minimum length 5 cm) (not included)	
Other installation and environmental requirements	do not expose to direct sunlight	
	do not install close to a heat source or outdoors	
Maximum installation height	2000 meters above sea level	
Installation category	II	

General specifications of Priva Blue ID C-Line controllers and modules

System power supply	Requirements
The system power supply for the controllers and Mix I/O modules must meet the following requirements.	
Output voltage	24 VAC ± 25%; 50/60 Hz ± 5 % 24 VDC ± 10%
Insulation	double insulation between input and output
Type of power supply	for UL916, CSA C22.2 No. 205: UL listed / CSA certified Class 2 extra low output voltage power supply

Housing	
IP code	IP20 (IEC 60529)
Flammability class	V-0 (UL 94)
Recycle code	7
Colour	housing: white (RAL9001) and blue (NCS S 1560-R90B) connections and connectors: black (RAL9011)
Type of device	open type equipment for: • indoor use only • pollution degree 2 environment

Installation and connection	
Installation	in control panel: • accessible to authorised personnel only • can be clicked onto horizontally or vertically positioned DIN rail. DIN rail installed directly on a mounting plate or floating with respect to the mounting plate in DIN 43870 distribution box
Type of DIN rail	35 x 7.5 (1.38 x 0.30 inches) or 35 x 15 mm (1.38 x 0.59 inches) (height x depth), in accordance with IEC 60715
Connector type for power supply and I/O	pluggable terminal block screw connectors (optional)
Permitted core cross section area	solid:: 0.2 ... 2.5 mm² (25 ... 14 AWG) flexible with ferrule connector: 0.2 ... 2.5 mm² (25 ... 14 AWG) flexible with double ferrule connector: 0.2 ... 1.5 mm² (25 ... 16 AWG)
Strip length/connector length (terminal block)	solid: 10 mm (0.39 inches) flexible with ferrule connector: 10 mm (0.39 inches) flexible with double ferrule connector: 12 mm (0.47 inches)
Strip length/connector length (screw connector)	8 mm (0.31 inches)
Identification of connections	labelling with an explanatory abbreviation
Maximum length of I/O bus cable between modules	3 m (9.84 ft)
Maximum length of I/O bus (total, including modules)	20 m (65.62 ft)

Environment	
Permitted temperature inside control panel of a working system (without air flow)	0 ... 50 °C (32 ... 122 °F)
Permitted temperature during transport and storage	-20 ... 70 °C (-4 ... 158 °F)
Maximum height	3000 m (9842 ft)
Permitted ambient relative humidity	10%...95% (non-condensing)
Shock resistance	EN 60068-2-27 (Ea)
Vibration resistance	EN 60068-2-27 (Fc)
Installation category	II
Other installation and environmental requirements	do not expose to direct sunlight

Legislation and standards		
Canada / USA		• UL 916 (energy management equipment) • UL 61010-1 (measurement and control equipment) • UL 61010-2-201 (measurement and control equipment) • CSA C22.2 No 61010-1-12 (measurement and control equipment) • CSA C22.2 No 61010-2-201-14 (measurement and control equipment) • CSA C22.2 No 61010-1-04 (measurement and control equipment) • CSA C22.2 No 205-12 (signal equipment)
	EMC	• in compliance with 47 CFR Part 15 Subpart B, Class B (FCC Rules) Functioning must meet two conditions: 1. The system must not cause harmful interference. 2. The system must acknowledge all interference received, including interference that may cause unwanted operations. • ISM system, in accordance with Canadian standard ICES-001

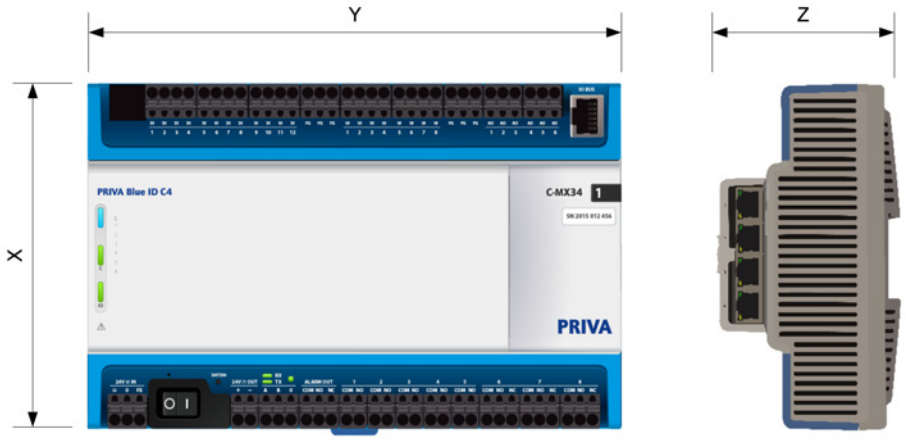
Europe		• Low Voltage Directive 2006/95/EC:
		  • EN 61010-1 (measurement and control equipment)
		• EN 61010-2-201 (measurement and control equipment)
		• EMC Directive 2004/108/EC:
		  • EN 61326-1 (measurement and control equipment)
		  • EN 61000-6-2 (generic immunity standard)
		  • EN 61000-6-3 (generic emission standard)
		• RoHS directive 2011/65/EU

		in compliance with WEEE directive 2012/19/EU
International	IEC	• IEC 61010-1 (measurement and control equipment) • IEC 61010-2-201 (measurement and control equipment)
International		• The Priva Blue ID C4 C-MX34 Controller and Priva Blue ID C4 C-MX34m Controller with manual override are BTL-registered with BACnet International. • Priva is a member of the BACnet Interest Group Europe.

Specifications of Priva Blue ID C4 C-MX34 Controller

General	
Module article description	Priva Blue ID C4 C-MX34 Controller
Module article number	5210001
Number of inputs and outputs	0 ... 84 (depending on licence)
Dimensions (XYZ)	140 x 216 x 82 mm (5.5 x 8.5 x 3.2 inches)
Width according to DIN 43880	12 TE (HP) (1 TE = 18 mm (0.71 inches))
Mounting depth for DIN 43870 distribution box [1]	75 mm (2.95 inches)
Weight	0.6 kg (1.23 lb)
Maximum power consumption (including power for USB port, I/O bus and power supply output)	24 VDC: 23.2 W 24 VAC: 31.2 VA
Maximum power consumption (excluding power for USB port, I/O bus and power supply output)	24 VDC: 8.4 W 24 VAC: 12.2 VA
Typical power dissipation [2]	6.6 W
MTBF [3]	461,053 hours
Installation	clicks onto DIN rail can be mounted in DIN 43870 distribution box
Housing material	mixture of polycarbonate and ABS
Button material	TPE (synthetic rubber)
Number of Ethernet ports	4
Number of digital inputs	12, consisting of: 10 x low current pull-up (inputs 1 .. 10) 2 x high current pull-up (inputs 11 and 12)
Number of universal inputs	8
Number of analogue outputs	6
Number of relay outputs	8, consisting of: 5 with normally open contact 3 with changeover contact
Number of RS485 ports	1
Number of alarm outputs	1
Accuracy of internal temperature measurements	+/- 2°C (35.6 °F)

[1] measured between the front of the DIN rail and the rear of the cover plate.
[2] Dissipation under the following conditions:
- I/O load of 50%
- 50% of the LEDs on
[3] The MTBF is calculated according to the *Telcordia SR-332 standard Issue 3* under the following conditions:
- ambient temperature: 35 ... 50°C (95 ... 122 °F)
- supply voltage: 24 VDC
- time in operation per day: 24 hours
- reliability level: 60%



Processor	
Processor	Freescale i.MX6 processor
USB connection file system[1]	FAT32
Clock frequency	800 MHz
Working memory	256 MB DDR3 SDRAM
Storage memory	2 GB SLC NAND flash

[1] for future applications

Memory card	
Maximum ambient temperature	70°C (158 °F)
Supported SD formats	• SDSC: storage capacity up to 2 GB • SDHC: storage capacity up to 32 GB
File system	FAT32

Electrical	
System power input	24 VAC ±25%; 50/60 Hz ± 5 % 24 VDC ±10%
System power output (via I/O bus or power supply output)	24 VDC ±10%
Maximum output power	10 W (combined for I/O bus and power supply output)
Functional isolation of power supply input in relation to system neutral	250 V
Protection of system power	protected against overload and short-circuits by means of a self-resetting fuse
Accuracy of system power measurement	± 2%
Under-voltage warning level	18.5 ... 19.5 VDC
Accuracy of system clock (normal operation)	± 20 ppm 0 ... 50°C (32 ...122 °F)
Accuracy of real-time clock (in the event of power failure)	± 20 ppm at 25°C (77 °F) ± 95 ppm 0 ... 50°C (32 ...122 °F)
Type of battery	BR2032
Battery service life	5 years
Speed of USB ports[1]	480 Mbps
Maximum output current of USB host connection[1]	500 mA
Indication	• blue line-up LED • green/red LED for status of controller • green LED for status of I/O
Switching voltage alarm output	max. 30 VAC max. 30 VDC
Switching current alarm output	0.1 mA ... 1 A (cosφ = 1)

[1] USB connection for future applications

Ethernet	
Network standard used	IEEE 802.3 100BASE-TX (100 Mbps) auto negotiation auto MDIX
Baud rate	10 Mbps and 100 Mbps (auto negotiation)
Power over Ethernet	No
Cable type required	UTP or STP, minimum category 5
Maximum cable length	100 m (328 ft)
Connector type	RJ45, screened

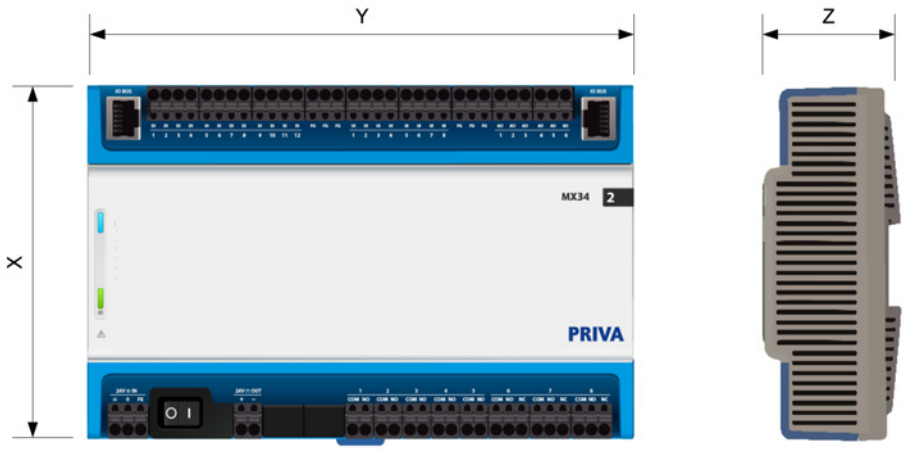
Specifications of inputs and outputs

For the specifications of the inputs and outputs, see Specifications of inputs and outputs (page 162)

Specifications of Priva Blue ID C-Line MX34 Mix input/output module

General	
Module article description	Priva Blue ID C-Line MX34 Mix input/output module
Module article number	5211001
Dimensions (XYZ)	140 x 216 x 62 mm (5.5 x 8.5 x 2.5 inches)
Width according to DIN 43880	12 TE (HP) (1 TE = 18 mm (0.71 inches))
Mounting depth for DIN 43870 distribution box [1]	53.5 mm (2.11 inches)
Weight	0.5 kg (1.10 lb)
Maximum power consumption (including power for I/O bus and power supply output)	24 VDC: 16.4 W 24 VAC: 24.3 VA
Maximum power consumption (excluding power for I/O bus and power supply output)	24 VDC: 5.2 W 24 VAC: 8.8 VA
Typical power dissipation [2]	4.1 W
MTBF [3]	796,364 hours
Installation	clicks onto DIN rail can be mounted in DIN 43870 distribution box
Housing material	mixture of polycarbonate and ABS
Button material	TPE (synthetic rubber)
Number of digital inputs	12, consisting of: 10 x low current pull-up (inputs 1 ... 10) 2 x high current pull-up (inputs 11 and 12)
Number of universal inputs	8
Number of analogue outputs	6
Number of relay outputs	8, consisting of: 5 with normally open contact 3 with changeover contact
Accuracy of internal temperature measurements	+/- 2 °C (35.6 °F)

[1] measured between the front of the DIN rail and the rear of the cover plate.
[2] Dissipation under the following conditions:
- I/O load of 50%
- 50% of the LEDs on
[3] The MTBF is calculated according to the *Telcordia SR-332 standard Issue 3* under the following conditions:
- ambient temperature: 35 ... 50°C (95 ... 122 °F)
- supply voltage: 24 VDC
- time in operation per day: 24 hours
- reliability level: 60%



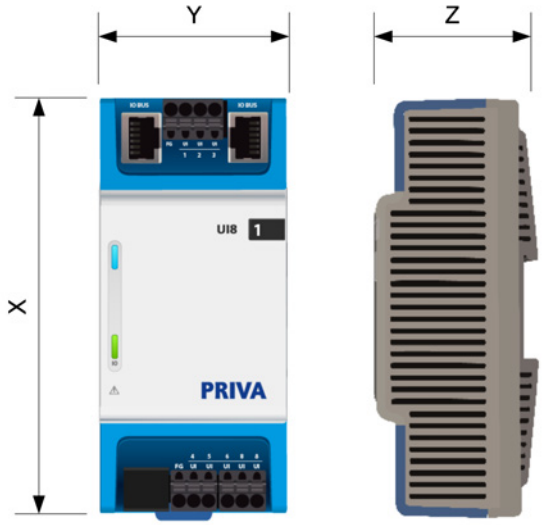
Specifications of inputs and outputs

For the specifications of the inputs and outputs, see Specifications of inputs and outputs (page 162)

Specifications of Priva Blue ID C-Line UI8 Universal input module

General	
Module article description	Priva Blue ID C-Line UI8 Universal input module
Module article number	5213001
Dimensions (XYZ)	140 x 63 x 62 mm (5.6 x 2.5 x 2.5 inches)
Width according to DIN 43880	3.5 TE (HP) (1 TE = 18 mm (0.71 inches))
Mounting depth for DIN 43870 distribution box [1]	53.5 mm (2.11 inches)
Weight	0.16 kg (0.35 lb)
Maximum power consumption	24 VDC: 1.5 W
Typical power dissipation [2]	1.8 W
MTBF [3]	2,190,000 hours
Installation	clicks onto DIN rail can be mounted in DIN 43870 distribution box
Housing material	mixture of polycarbonate and ABS
Button material	TPE (synthetic rubber)
Number of universal inputs	8
Accuracy of internal temperature measurements	+/- 2°C (35.6 °F)

[1] measured between the front of the DIN rail and the rear of the cover plate.
[2] Dissipation under the following conditions:
- I/O load of 50%
- 50% of the LEDs on
[3] The MTBF is calculated according to the *Telcordia SR-332 standard Issue 3* under the following conditions:
- ambient temperature: 35 ... 50°C (95 ... 122 °F)
- supply voltage: 24 VDC
- time in operation per day: 24 hours
- reliability level: 60%



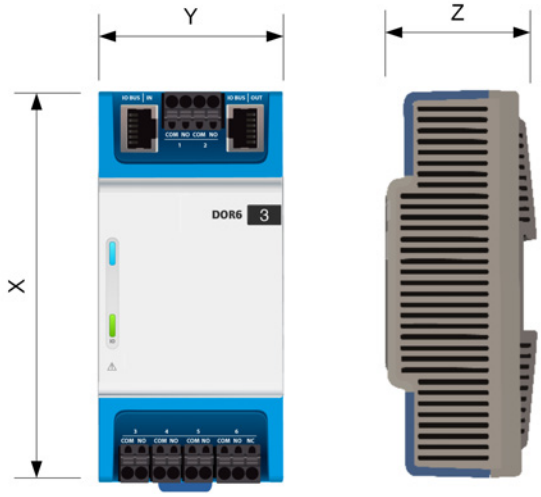
Specifications of inputs

For the specifications of the inputs, see Specifications of inputs and outputs (page 162)

Specifications of Priva Blue ID C-Line DOR6 Relay output module

General	
Module article description	Priva Blue ID C-Line DOR6 Relay output module
Module article number	5215001
Dimensions (XYZ)	140 x 63 x 62 mm (5.6 x 2.5 x 2.5 inches)
Width according to DIN 43880	3.5 TE (HP) (1 TE = 18 mm (0.71 inches))
Mounting depth for DIN 43870 distribution box [1]	53.5 mm (2.11 inches)
Weight	0.18 kg (0.40 lb)
Maximum power consumption	24 VDC: 1.2 W
Typical power dissipation [2]	1.2 W
MTBF [3]	4,380,000 hours
Installation	clicks onto DIN rail can be mounted in DIN 43870 distribution box
Housing material	mixture of polycarbonate and ABS
Button material	TPE (synthetic rubber)
Number of relay outputs	6, consisting of 5 with normally open contact 1 with changeover contact

[1] measured between the front of the DIN rail and the rear of the cover plate.
[2] Dissipation under the following conditions:
- I/O load of 50%
- 50% of the LEDs on
[3] The MTBF is calculated according to the *Telcordia SR-332 standard Issue 3* under the following conditions:
- ambient temperature: 35 ... 50°C (95 ... 122 °F)
- supply voltage: 24 VDC
- time in operation per day: 24 hours
- reliability level: 60%



Specifications of outputs

For the specifications of the outputs, see Specifications of inputs and outputs (page 162)

Specifications of inputs and outputs

The various types of inputs and outputs are available on various modules. The module specifications indicate which inputs and outputs are available on the module in question. The specifications of the inputs and outputs are described in this chapter.

Digital inputs	Alternating current	Direct current
Input voltage measurement range	0 ... 30 VAC	0 ... 30 VDC
Maximum permitted input voltage	0 ... 30 VAC	-30 ... 30 VDC
Type of measurement	pulse and status	pulse and status
Minimum detectable pulse width (Live contact)	500 ms (Mechanical switch)	10 ms (Mechanical switch)
	500 ms (Electronic switch)	350 µs (Electronic switch)
Minimum detectable pulse width (Dry / open collector)	-	10 ms (Mechanical switch)
		350 µs (Electronic switch)
Maximum input frequency (Live contact, 50% duty cycle)	-	50 Hz (Mechanical switch)
		1,400 Hz (Electronic switch)
Maximum input frequency (Dry / open collector, 50% duty cycle)	-	50 Hz (Mechanical switch)
		1,400 Hz (Electronic switch)
Maximum input voltage for low	3 VAC	3 VDC
Minimum input voltage for high	12 VAC	12 VDC
Input resistor with pull-up circuit disabled	24 kΩ nominal for positive voltages 19 kΩ nominal for negative voltages	
Input resistor with pull-up circuit enabled	-1 mA (low current pull-up) -5 mA (high current pull-up)	
Functional isolation of inputs in relation to system neutral	250 V	
Maximum current of FG connections	10 A	
Indication (only for modules with manual override)	• green/red LEDs for status of inputs (colour is adjustable)	

Universal inputs - Analogue use	
Type of measurement to be set per input	voltage current resistance
Mains frequency suppression (NMRR @ 50/60 Hz)	-60 dB (applies for a pure sinus)

Universal input - Voltage measurement	
Measurement range	0 ... 10 V
Maximum permissible input voltage	26.4 VAC -24 ... 30 VDC
Number of measurements per second	50 @ 50 Hz mains frequency 60 @ 60 Hz mains frequency
Resolution	14 bits over 12 V (730 µV)
Accuracy	± (5mV + 0.1% of the measurement)
Input resistance	> 1 MΩ
Maximum source resistance	1 kΩ

Universal input - Current measurement	
Input current measurement range	0 ... 22 mA
Maximum permissible input voltage	26.4 VAC 0 ... 30 VDC
Number of measurements per second	50 @ 50 Hz mains frequency 60 @ 60 Hz mains frequency
Resolution	2.3 µA (approximately 13 bits over 20 mA)
Accuracy	± (40 µA + 0.4% of measurement)
Input resistance	250 Ω, nominal
Protection	resistor for current measurement is switched off automatically in the event of overvoltage (self-restoring after 5 minutes)

Universal input - Measurement of resistance				
Measuring range (automatic selection)	0 ... 2.5 kΩ	0 ... 10 kΩ	0 ... 40 kΩ	0 - 200 kΩ
Accuracy (nominal, at an ambient temperature of 50 °C (122 °F))	± (0.8 Ω + 0.22% of the measurement)	± (1.0 Ω + 0.4% of the measurement)	± (2.3 Ω + 0.41% of the measurement)	± (41 Ω + 1.12% of the measurement)
Maximum permissible input voltage	26.4 VAC -24 ... 30 VDC			
Number of measurements per second	1 @ 50 Hz mains frequency 1.2 @ 60 Hz mains frequency			
Resolution	approximately 14 bits			
Maximum permitted capacity at input	10 nF			

Universal inputs - Digital use	Alternating current	Direct current
Voltage range	0 ... 26.4 VAC	0 ... 30 VDC
Maximum permitted input voltage range	0 ... 26.4 VAC	-24 ... 30 VDC
Type of measurements	status and pulse	status and pulse
Minimum detectable pulse width (Live contact)	500 ms (Mechanical and electronic switch)	35 ms (Mechanical and electronic switch)
Minimum detectable pulse width (Dry / open collector)	-	1000 ms (Mechanical and electronic switch)
Maximum input frequency (Live contact, 50% duty cycle)	-	14 Hz (Mechanical and electronic switch)
Maximum input voltage "0"	3 VAC	3 VDC
Minimum input voltage "1"	12 VAC	12 VDC
Current from input with pull-up circuit enabled	-	-4 mA nominal

Universal input - Other	
Functional isolation of inputs in relation to system neutral	250 V
Maximum current of FG connections	10 A
Indication (for modules with manual override or indication only)	• green/red LEDs for status of inputs for digital use (colour is adjustable)

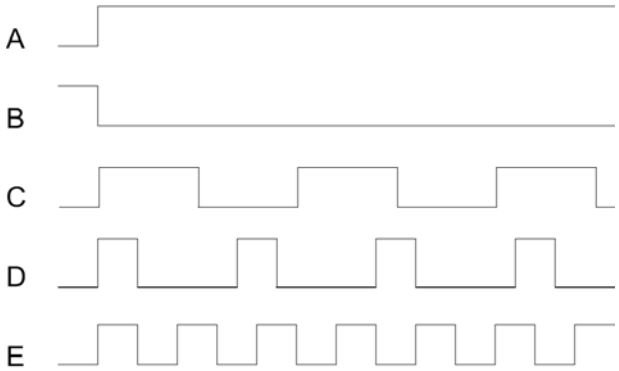
Analogue outputs	
Output voltage control range	0 ... 10 V
Maximum load current supplied per output (source)	5 mA
Maximum current load drawn per output (sink)	
Load resistance	> 2 kΩ
Resolution	600 µV (> 13 bits over 10 V)
Accuracy	± (10 mV + 0.5% of the control signal)
Accuracy of feedback	± 150 mV
Adjustment time	200 ms (to 70% of the set value)
Input leakage current with high impedance output[1]	maximum 5 µA
Protection	output is short-circuit proof (self-restoring after a brief short circuit/overload) output is protected against ± 30 VDC and 30 VAC
Number of switch-on attempts in the event of short circuit or overload[2]	5
Functional isolation of outputs in relation to system neutral	250 V
Maximum current of FG connections	10 A
Indication (for modules with manual override only)	• orange LEDs for indication of output voltage • orange LED for status of control (automatic or manual)
Controls (for modules with manual override only)	buttons to set the voltage level of the output manually: • +: manually increase output voltage • A: automatic control of output voltage • -: manually decrease output voltage

[1] The output is high impedance ex-factory; the module has not yet been configured then. In addition, unused outputs and the outputs where the overload protection has been activated are high impedance.
[2] After a short-circuit or overload the output is switched back on after 0.5 s. The output switches back off immediately if the overload is still present. The output performs a maximum of 5 switch-on attempts with a time interval of 0.5 seconds. After 5 attempts, the output is switched off and manual intervention is required.

Digital relay outputs	
Output configuration	normally open contact or changeover contact (depending on output)
Maximum switching voltage	250 VAC (30 VAC when used in Compass) 30 VDC
Maximum switching current	3 A (cosφ = 1)
Maximum switching voltage in USA/Canada when switching different mains voltage phases on the same module	125 VAC
External fuse	8 A maximum
Expected service life of relay contacts with cosφ = 1 and maximum of 6 switches per minute	up to 250 VAC and 3 A: 300,000 switches 24 VDC and 3 A: 300,000 switches
Expected service life of relay contacts with cosφ ≠ 1 and maximum of 6 switches per minute	250 VAC and 2 A AC15: 200,000 switches 250 VAC motor 370 W AC3: 300,000 switches 24 VDC and 3 A L/R 7 ms: 100,000 switches 24 VDC and 1 A DC13: 200,000 switches
UL certified service life of relay contacts with cosφ = 1 and maximum of 6 switches per minute	up to 250 VAC and 3 A: 30,000 switches 24 VDC and 3 A: 30,000 switches
UL certified service life of relay contacts with cosφ ≠ 1 and maximum of 6 switches per minute	240 VAC and 0.5 hp motor: 1,000 switches 120 VAC and 0.25 hp motor: 1,000 switches B300 pilot duty rating: 6,000 switches
Maximum switching frequency	6 times per min.
Fail-safe	if communication with the controller fails, the outputs are set to a user-configured state
Indication (for modules with manual override only)	• green/red LEDs for status of outputs (colour is adjustable) • orange LED for status of control (automatic or manual) • red alarm LED
Controls (for modules with manual override only)	buttons for manual operation to control connected equipment: • 0: relay off • A: automatic or manual control • 1: relay on

LEDs and line-up LED

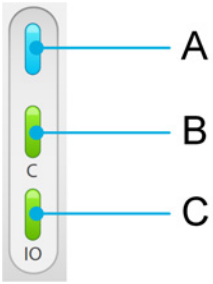
During the various phases of commissioning and operation, the LEDs on the modules and the line-up LED should be predictably on or off, or flashing. The figure and table below show the possible flashing patterns. After that, there follows an explanation of the meaning of the flashing patterns on the controller and all modules.



Flashing patterns

	Behaviour		Line-up LED	LEDs
A	LED is continuously on	-	x	x
B	LED is continuously off	-	x	x
C	LED flashing slowly	0.5 sec. on / 0.5 sec. off		x
D	LED flashing irregularly	0.2 sec. on / 0.5 sec. off		x
E	LED flashing quickly	0.2 sec. on / 0.2 sec. off	x	x

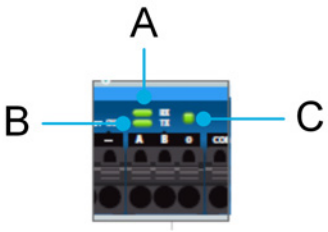
General



LED	When	Colour	Pattern (sec.)
A. Line-up	module in expected position	blue	on
	module not in expected position	blue	0.2 on / 0.2 off
	module not operational		
	module is updating or resetting		
	fatal error		
	energy-saving mode	-	off
B. CPU status [1]	operational	green	on
	system power present	green	on
	platform update	green	0.5 on / 0.5 off
	software download	green	0.5 on / 0.5 off
	wiping memory	orange	0.5 on / 0.5 off
	non-fatal error	green	0.2 on / 0.5 off
	module startup error [2]	red	0.5 on / 0.5 off
	fatal error [2]	red	0.2 on / 0.2 off
	energy-saving mode	green	on
C. I/O status	operational	green	on
	non-fatal error	green	0.5 on / 0.5 off
	software download	green	0.2 on / 0.5 off
	fatal error [3]	green	0.2 on / 0.2 off

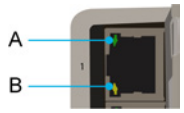
[1] For controllers only.
[2] If the same error status remains after a restart, a factory reset may be a solution. If not, replacement is necessary.
[3] The connection between the CPU and the I/O is broken. Replacement is necessary.

RS485



LED	When	Colour	Pattern (sec.)
A. RX (receive)	there is communication	orange	0.1 s on / 0.1 s off
	there is no communication	-	off
B. TX (transmit)	there is communication	orange	0.1 s on / 0.1 s off
	there is no communication	-	off
C. status of port	operational	green	on
	communication error	red	on
	software download	green	0.5 s on / 0.5 s off
	non-fatal error	green	0.2 s on / 0.5 s off
	fatal error	green	0.2 s on / 0.2 s off
	not operational	-	off
	energy-saving mode	-	off

Ethernet



LED	When	Colour	Pattern (sec.)
A. status of Ethernet	connection present	green	on
	connection absent	-	off
B. data communication	there is communication	yellow	flashing randomly
	there is no communication	-	off

Obsolete sensors

These sensors have been discontinued and are no longer available for new projects.

Meteorological station

Meteorological station

The Meteorological station is designed for the optimum positioning of the weather sensors. By installing these sensors at an adequate height, the effect of interference can be limited. The Meteorological station is supplied as a kit comprised of two supports, two mast sections, clamping blocks, wall brackets, and mounting materials. This chapter describes the composition and the construction of the Meteorological station.

Positioning the meteorological station

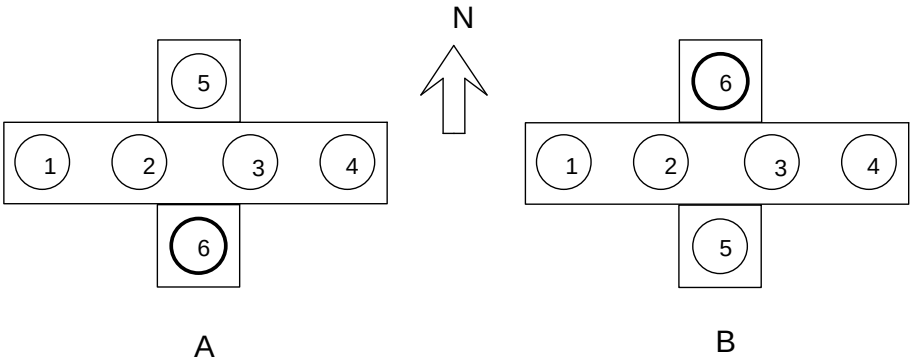
See Determine the location of the weather station (page 45).

Fitting the sensors

Fitting sensors on the supports of the Meteorological station

The Meteorological Station has two supports on which a total of six sensors can be mounted. The sensors must be fitted to specific positions on the supports.

The bottommost support must be situated in a north-south alignment, and the upper support must be in an east-west alignment.



A: further north than 15° N
B: further south than 15° S

Position	Weather sensor
Upper support	
1	Wind direction sensor
2	Outside temperature sensor
3	Reserve position for expansion, for a Precipitation intensity sensor or Irradiation sensor for instance.
4	Wind speed sensor
Bottommost support	
5	Rain sensor
6	Linear Light Sensor or Radiation sensor (only with a geographical situation more northerly than 15° NL or more southerly than 15° SL; otherwise place these sensors on a separate mast)

To prevent the shadow of the Meteorological station falling on the Linear light sensor or the Radiation sensor, the Linear light sensor or Radiation sensor must be positioned as follows:

- Further north than 15° N (in Europe for instance): position the sensor on the southern side of the mast.
- Further south than 15° S (in Australia for instance): position the sensor on the northern side of the mast.
- Avoid cast shadows at locations between 15° N and 15° S (near the Equator) mount the sensor on a separate mast, on the upper support.

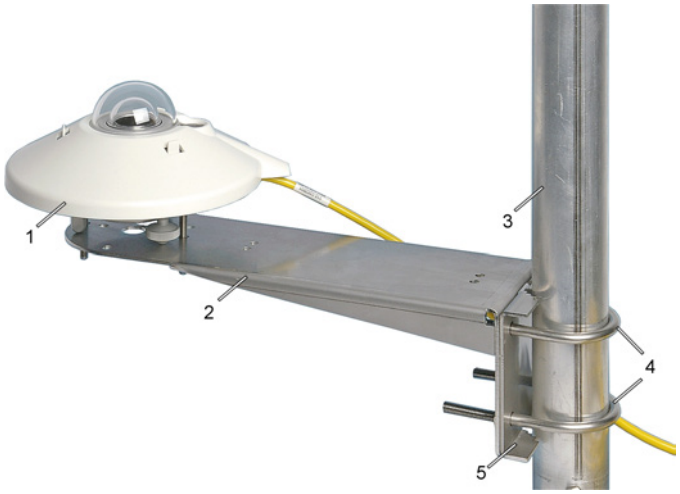
Fitting sensors on the universal mounting support

Sensors are fitted on the universal mounting support (article number 3779211) as follows:

1. If required, feed the cable for the sensor through the large hole in the mounting support, from above.

   Feed the cable carefully through the hole to help avoid damages to the cable.

2. Mount the sensor on the mounting support. You do so using the procedure for mounting a sensor on a Meteorological station support.
3. Fit the crossbar to the Meteorological station using the brackets supplied with the kit, whereby the clamping block is fitted between the mounting support and the Meteorological station.



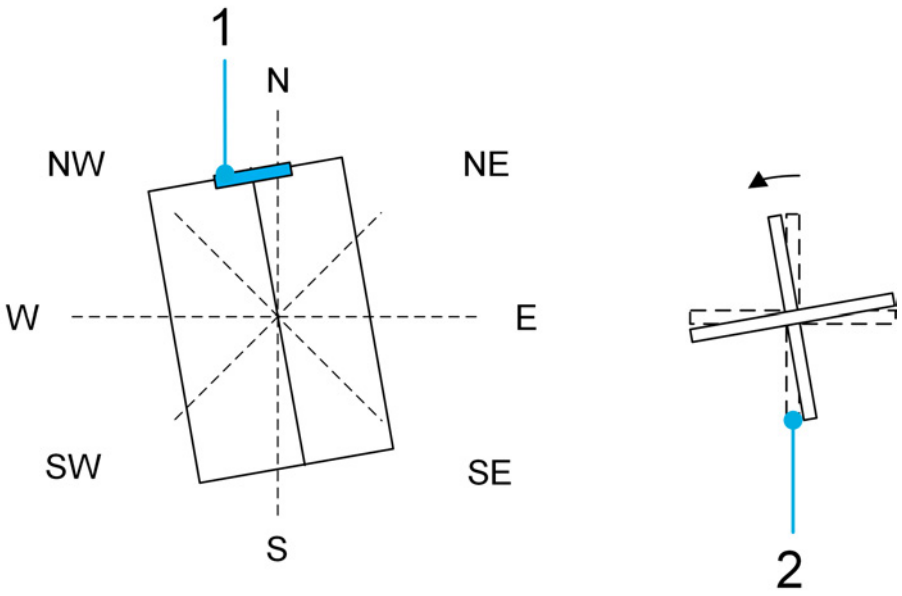
Sensor fitted on mounting support

1. Sensor
2. Mounting support
3. Meteorological station
4. Mounting brackets
5. Clamp plate

Ridge direction meteorological station

The meteorological station must be oriented based on 1 of the 8 points of the compass. This is necessary because the settings in the Compass software are also based on one of the 8 point of the compass. This means the meteorological station must be rotated when the ridge direction is in between the point of the compass.

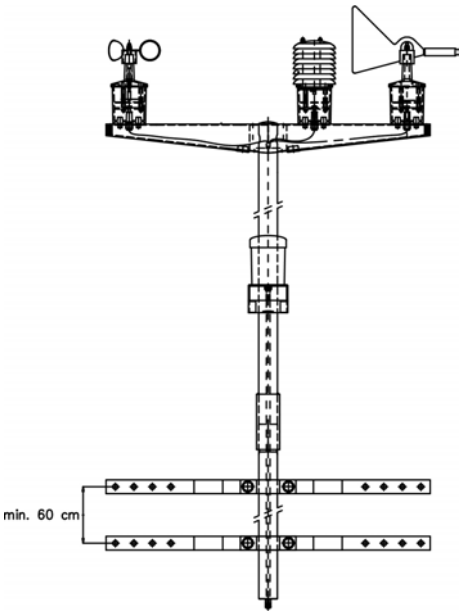
In the example below, the ridge direction is between north and north-west. When the meteorological station is oriented north, the orientation of the window does not match north or north-west. Rotate the meteorological station to closest point of the compass (North in this case). You can now set the window orientation to North.



1. Window
2. Rotate meteorological station

Mounting the mast

To mount the mast, take the following steps:



Position of the wall brackets

1. Mount both wall brackets above each other on the side wall so that the mast is positioned vertically. See figure Position of the wall brackets (page 173). The distance between the brackets must be at least 60 cm and the brackets must be securely mounted on the side wall.
2. Mount the first two clamping blocks on the top mast component near the socket, placing the flat side on top. See the left-hand diagram in the figure Mounting the clamping blocks (page 175). Fasten the blocks with the supplied bolts and nuts. Fasten the bolts uniformly.
3. Slide the small support on the mast component and fasten it to the clamp block with four bolts, nuts and rings. (The small support has room for two sensors.)
4. Mount the other two clamping blocks at the top of the topmost mast component in the same manner as described under step 2. See the right-hand diagram in the figure Mounting the clamping blocks (page 175).
5. Place the large support on the mast component and fasten it to the clamp block with four bolts, nuts and rings.
6. Mount the Rain sensor and the Linear light sensor or Radiation sensor on the bottommost support. The Linear light sensor or Radiation sensor must be fitted onto the requisite opening. Feed the cables of the two sensors through the hole in the clamp block into the mast component so that the cable re-emerges on the underside of the mast component.

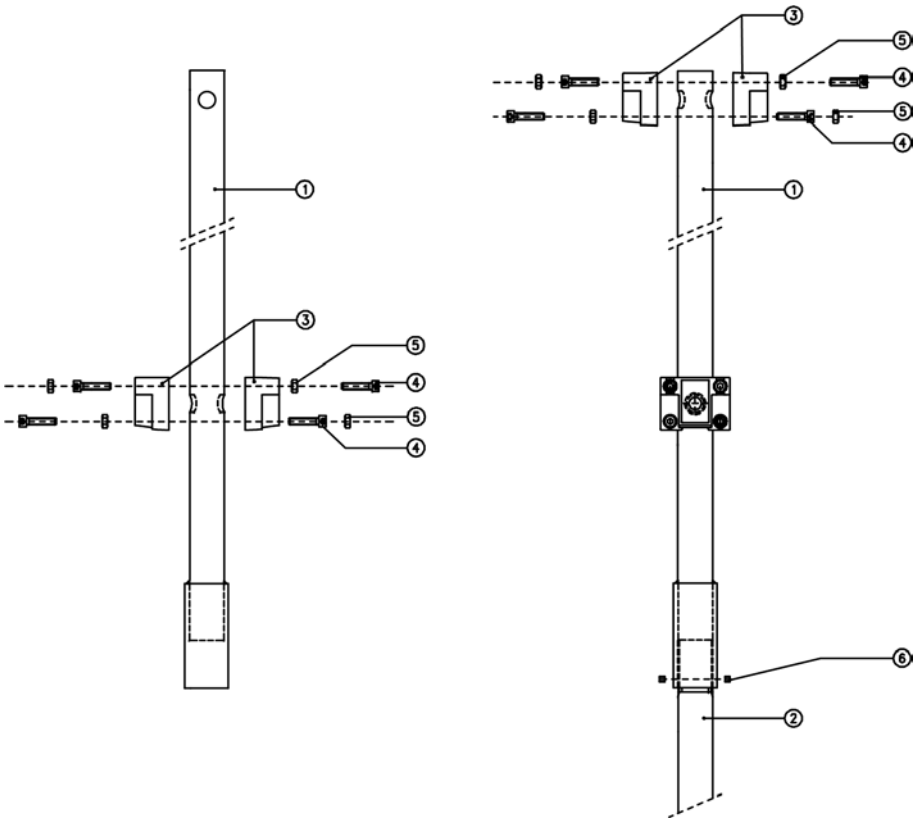
   Make sure that the sensors are not damaged during the further installation.

7. Mount the other sensors on the top support and feed the cables through the mast component downwards.

   Pay careful attention to the position of the sensors on the support. Position the sensors as described in chapter Fitting the sensors (page 171).

8. Slide the cap on the underside in both supports until they lock onto the clamp block.
9. Mount the plastic rings in the holes of the caps. These rings prevent the cap from coming loose when being slid open.
10. Tape together the cables that come out of the underside of the mast component and feed the cables through the bottom mast component.
11. Tighten the bottom mast component firmly in the socket of the top mast component and secure the connection by screwing the two socket head screws tightly with the supplied socket head key.
12. Place the mast in both wall brackets. The base of the mast must protrude at least 10 cm in relation to the bottom wall bracket.
13. Turn the mast so that the weather sensors are in the position described in the chapter Fitting the sensors (page 171).

The sensors are supplied with 10-metre screened cable. It is recommend that you do not shorten these cables when mounting the sensors. Coil the remaining length of cable or leave a loop; this will simplify any future expansion of the Meteorological station with additional crossbars of mast sections.



Mounting the clamping blocks

1. Upper mast section
2. Lower mast section
3. Clamping block
4. Bolt for clamping block
5. Nut for clamping block
6. Socket-head screw

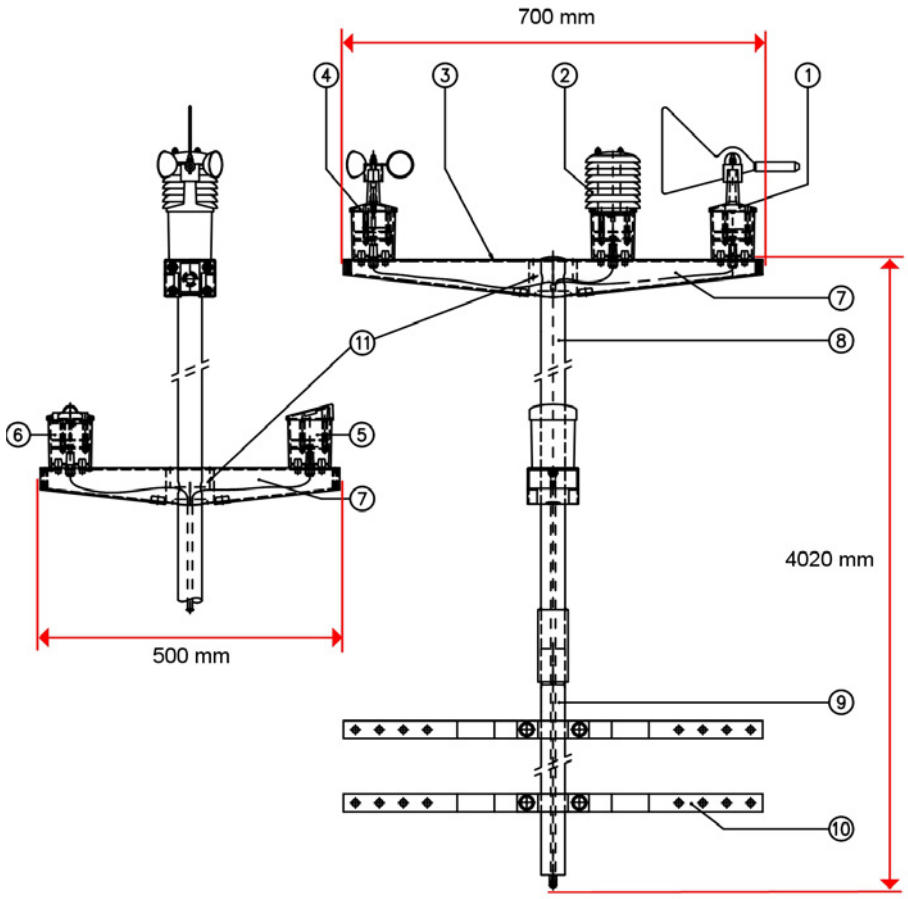
Maintenance of Meteorological station

Check the condition of the mast section's fastening bolts at least once a year (the bolts must not be rusted).

Meteorological station specifications

Construction	two supports two mast components clamping blocks wall brackets installation material
Supports material	aluminium (AlMg1)
Mast component material	Al 50 St
Clamping block material	aluminium
Wall bracket material	galvanized steel
Dimensions (l x w x h)	500 x 700 x 3200 mm

Configuration	Article number
Meteorological station, including: • Wind speed sensor • Wind direction sensor • Outside temperature sensor • Rain sensor	3771009
Meteorological station, including: • Wind speed sensor • Outside temperature sensor	3771024



Meteorological station

1. Wind direction sensor
2. Outside temperature sensor
3. Reserve position
4. Wind speed sensor
5. Rain sensor
6. Linear light sensor
7. Support
8. Top mast component (160 cm)
9. Bottom mast component (160 cm)
10. Wall bracket
11. Clamping blocks

Weather interface WI2

Not all sensors can be directly connected to an I/O module of Priva Blue ID connected; for these sensors, the Weather interface WI2 is required. The interface ensures that the output signals of the sensors are brought to the right level so that the controller can read them.

The interface is supplied in a splashproof housing, which enables it to be used either inside or outside. In most cases, the interface will be mounted on or near the Meteorological station.

Connecting sensors to the Weather interface WI2

Connect the following to the interface:
- 24 VAC power supply for the interface
- sensors
- output signals of sensors to the Priva Blue ID modules.

General

1. Unscrew and open the interface.
2. 

Cable glands of Weather interface WI2

A. 24 VAC power supply
B. Output signals to I/O module
C. Rain sensor
D. Wind speed sensor
E. Wind direction sensor
F. Linear light sensor LS2WI
G. Outside temperature sensor
H. Reserve

   Feed the wiring for the 24 VAC power supply, sensors and output signals through the correct cable glands; see the figure Cable glands of Weather interface WI2 (page 178).
3. Connect the wiring from the various components to the connector terminals of the interface. Connect the output signals of the sensors to the universal inputs of the Priva Blue ID modules. See table Connections of Weather interface WI2 (page 178).

   The power supply for the Weather interface WI2 must not be delivered by the same power supply that powers the controller.

4. Only for a Linear light sensor or Radiation sensor CM3P: set the Weather interface jumpers. See Setting the Weather interface WI2 jumpers (page 180).
5. Screw the interface closed

Connections of Weather interface WI2

Weather interface WI2		Sensors or power supply		
Connector	**Name**	**Group**	**Wire colour**	**Function**
1 HIGH	24 VAC IN	24 VAC power supply for interface and sensors (electrically isolated) (24 VAC ± 15 %, 0.4 A, 10 VA)		
1 LOW	0 VAC			
2 HIGH	24 VAC IN			
2 LOW	0 VAC			
3 HIGH	24 VDC OUT	24 VDC power supply for external devices (100 mA)		
3 LOW	PGND	⏚		
4 HIGH	24 VDC OUT	24 VDC power supply for external devices (100 mA)		
4 LOW	PGND	⏚		
5 HIGH	RGVW1	Rain sensor	White	Connection 1 heating element
5 LOW	RGVW2		Brown	Connection 2 heating element
6 HIGH	RGKM1		Green	Connection 1 measurement pattern
6 LOW	RGKM2		Yellow	Connection 2 measurement pattern
7 HIGH	24 VDC	Wind speed sensor	White	24 VDC power supply
7 LOW	GND		Brown	Ground
8 HIGH	WS IN		Green	Signal
8 LOW	GND		Yellow	Ground

Weather interface WI2		Sensors or power supply		
9 HIGH	24 VDC	Wind direction sensor	White	24 VDC power supply
9 LOW	GND		Brown	Ground
10 HIGH	WR IN+		Green	Signal +
10 LOW	WR IN-		Yellow	Signal -
11 HIGH	24 VDC	Linear light sensor LS2WI or Solarimeter CM3P	White	**Do not connect (insulate core)**
11 LOW	GND		Brown	**Do not connect (insulate core)**
12 HIGH	LL/SOL+		Green	Signal
12 LOW	GND		Yellow	Ground
13 HIGH	GND	Outside temperature sensor	White	Connect to GND
13 LOW	GND		Brown	Connect to GND
14 HIGH	BT+		Green	Signal +
14 LOW	BT-		Yellow	Signal -
15 HIGH	RES IN	Reserve connection (mA)	-	Signal (0–20 mA)
15 LOW	GND		-	Ground
16 HIGH	+12 V		-	+12 V power supply (100 mA)
16 LOW	GND		-	Ground
17 HIGH	RG OUT	Output signals to universal input	according to requirements	Output of Rain sensor RD2WI
17 LOW	WS OUT		according to requirements	Output of Wind speed sensor WSS2WI
18 HIGH	WR OUT		according to requirements	Output of Wind direction sensor WDS2WI
18 LOW	LL/SOL OUT		according to requirements	Output of Linear light sensor LS2WI
19 HIGH	RES OUT		-	Output of reserve connection
19 LOW	GND		brown	Ground for all output signals to universal input
20 HIGH	BT+		according to requirements	Outside temperature sensor OTS2 +
20 LOW	BT-		according to requirements	Outside temperature sensor OTS2 -

Connecting the Weather interface WI2 to a universal input

1. Connect the interface to a universal input. Use a shielded eight-cored cable, 0.8 mm (0.5 mm²).
2. In the Compass setup, select the correct sensor and, if applicable, the correct sensor type.

Extending cabling

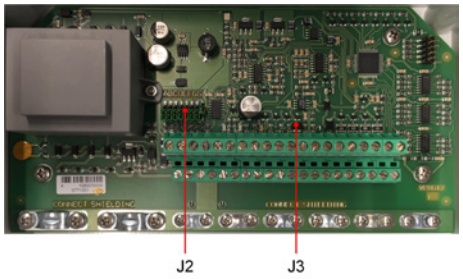
You can extend the cable. Feed the cable from the sensor into a junction box (minimum IP code IP 65) and bridge the distance from the junction box to the Weather interface WI2 with a new shielded cable.

Never use just tape to extend the cable.

Cable specifications

Cable type	4 x 0.8 mm (0.5 mm²), shielded
Maximum cable length	100 m

Setting the Weather interface WI2 jumpers



The Weather interface has jumpers for setting the type of sensor (Radiation sensor CM3P and Linear light sensor).

For the **Radiation sensor CM3P**:

1. Set up the WI2 jumpers as following:
   - J2-A ON
   - J2-B ON
   - J2-C ON
   - J2-D ON
   - J2-E ON
   - J2-F ON
   - J2-G ON
   - J2-S OFF
   - J3 OFF
2. Find the calibration sensitivity on the calibration certificate of your CMP3 and enter it in as the sunlight sensor multiplication factor in the weather calibration page. For instance, if your calibration sensitivity is 22.73 x 10-6 V / (W/m2) , you will need to enter 2273 as the sunlight sensor multiplication factor.

For the **Linear light sensor**:

1. Remove jumper J3.
2. Connect jumper S on J2:
3. Remove jumper G from J2.
4. Connect or remove the other jumpers in accordance with the table below and the sensor's *Radiation sensor factor*. This value is stated on the supplied calibration certificate.

Sensor radiation factor min	Sensor radiation factor max	Jumper A	Jumper B	Jumper C	Jumper D	Jumper E	Jumper F
343.64		X	X	X	X	X	X
338.44	343.64	X	X	X	X	X	-
333.41	338.44	X	X	X	X	-	X
328.49	333.41	X	X	X	X	-	-
323.72	328.49	X	X	X	-	X	X
319.11	323.72	X	X	X	-	X	-
314.63	319.11	X	X	X	-	-	X
310.25	314.63	X	X	X	-	-	-
305.99	310.25	X	X	-	X	X	X
301.86	305.99	X	X	-	X	X	-
297.85	301.86	X	X	-	X	-	X
293.92	297.85	X	X	-	X	-	-
290.09	293.92	X	X	-	-	X	X
286.39	290.09	X	X	-	-	X	-
282.78	286.39	X	X	-	-	-	X
279.12	282.78	X	X	-	-	-	-
275.55	279.12	X	-	X	X	X	X
272.21	275.55	X	-	X	X	X	-

Sensor radiation factor min	Sensor radiation factor max	Jumper A	Jumper B	Jumper C	Jumper D	Jumper E	Jumper F
268.94	272.21	X	-	X	X	-	X
265.73	268.94	X	-	X	X	-	-
262.60	265.73	X	-	X	-	X	X
259.56	262.60	X	-	X	-	X	-
256.59	259.56	X	-	X	-	-	X
253.66	256.59	X	-	X	-	-	-
250.81	253.66	X	-	-	X	X	X
248.03	250.81	X	-	-	X	X	-
245.32	248.03	X	-	-	X	-	X
242.64	245.32	X	-	-	X	-	-
240.03	242.64	X	-	-	-	X	X
237.49	240.03	X	-	-	-	X	-
235.00	237.49	X	-	-	-	-	X
232.32	235.00	X	-	-	-	-	-
229.70	232.32	-	X	X	X	X	X
227.37	229.70	-	X	X	X	X	-
225.08	227.37	-	X	X	X	-	X
222.83	225.08	-	X	X	X	-	-
220.63	222.83	-	X	X	-	X	X
218.47	220.63	-	X	X	-	X	-
216.37	218.47	-	X	X	-	-	X
214.28	216.37	-	X	X	-	-	-
212.24	214.28	-	X	-	X	X	X
210.25	212.24	-	X	-	X	X	-
208.30	210.25	-	X	-	X	-	X
206.37	208.30	-	X	-	X	-	-
204.47	206.37	-	X	-	-	X	X
202.62	204.47	-	X	-	-	X	-
200.81	202.62	-	X	-	-	-	X
198.96	200.81	-	X	-	-	-	-
197.14	198.96	-	-	X	X	X	X
195.42	197.14	-	-	X	X	X	-
193.73	195.42	-	-	X	X	-	X
192.06	193.73	-	-	X	X	-	-
190.42	192.06	-	-	X	-	X	X
188.82	190.42	-	-	X	-	X	-
187.24	188.82	-	-	X	-	-	X
185.68	187.24	-	-	X	-	-	-
184.14	185.68	-	-	-	X	X	X
182.64	184.14	-	-	-	X	X	-
181.17	182.64	-	-	-	X	-	X
179.70	181.17	-	-	-	X	-	-
178.27	179.70	-	-	-	-	X	X
176.86	178.27	-	-	-	-	X	-
175.47	176.86	-	-	-	-	-	X

X = connect jumper
- = disconnect jumper

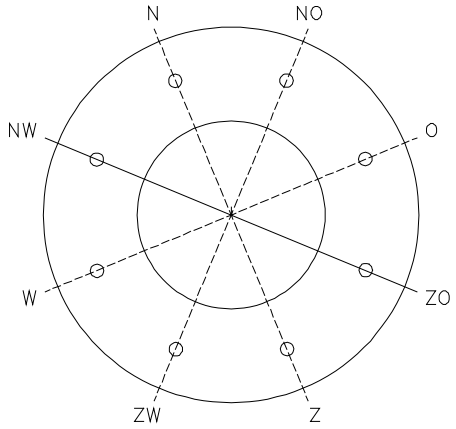
Specifications

General	
Article description	Meteorological station interface WI2
Article number	3771351
Supply voltage	24 VAC ±15 %, 50/60 HZ
Power consumption (Weather interface WI2 only)	300 mA, 7VA
Connector terminals	screw
Dimensions (L x W x H)	22 x 16 x 10 cm

Rain sensor	
Rain alarm output voltage	< 1 V
Output voltage dry message	> 4 V

Wind speed sensor	
Input	frequency
Output range	0 – 1,47 V (0 ... 30 m/s)
Accuracy	8.4 %

Wind direction sensor	
Input	voltage, differential 0 – 5 V
Output range	1 .. 8 kOhm
Resolution	8 steps from 1 kOhm (45° compass rose, see table and figure below)
Accuracy	7.4 % (25° compass rose)



Each of the 8 wind directions indicates a specific resistance value

Wind direction	Resistance (kOhm)	Voltage (mV) at Rt=3k01
N	1	1247
NO	2	1996
E	3	2496
SE	4	2853
S	5	3121
SW	6	3330
W	7	3465
NW	8	3633

Linear light sensor LS2WI	
Input	high impedance (< 150 pA)
Output range	0 ... 50 mV (0 .. 150 klux)
Accuracy	gain error: 4.75 % offset error: 0.5 % (of the full scale)

Outside temperature sensor	
Input/output (signal is only through wired)	NTC 3000 Ω/25°C (-40°C ... 80°C)

Linear light sensor LS2 and LS2WI

Linear light sensor

The Linear light sensor measures the intensity of the (sun)light, but not the infrared heat radiation. This sensor is therefore not suitable for energy calculations.

The Linear light sensor consists of a photodiode whose output current is dependent on the quantity of light collected.

The Linear light sensor should preferably be mounted on the Meteorological station and connected to a Priva process computer.

The Linear light sensor is supplied with a calibration certificate. If the calibration certificate is missing then you can request a duplicate from Priva. You will need to state the Linear light sensor's serial number.

Mounting

1. Place the four-core female connector of the housing on the four-core male connector of the Linear light sensor.
2. Place the Linear light sensor in the housing and tighten the hexagon-head bolt on the underside of the housing. Make sure that the cover drops into the lock.
3. Unscrew the two socket head screws (including clamping rings) on the underside of the housing completely.
4. Guide the cable through the appropriate opening on the mast.

   The Linear light sensor has a set position on the mast.

   Avoid cast shadows at locations between 15° N and 15° S (near the Equator) mount the sensor on a separate mast, on the upper support.

5. Mount the Linear light sensor with the two socket head screws (including clamping rings) on the support of the mast.
6. Feed the cable through the hole in the clamp block assembly into the mast section so that the cable re-emerges on the underside of the block.

Interior of Linear light sensor

1. Cap with photodiode
2. Printed circuit board (9583)
3. Connector

The Linear light sensor is supplied with a 10-metre shielded cable. It is recommended that you do not shorten this cable when mounting the unit. Coil the remaining length of cable or leave a loop; This ensures that the cable will not be too short in the event of eventual extensions with supports and mast components.

Connecting

Linear light sensor LS2

1. Connect the Linear light sensor LS2 to a universal input of the Priva Blue ID hardware.
2. Connect the cable as shown in the table below.

Colour	Function	Connection
White	power supply	24 VDC
Brown	power supply	0 VDC
Green	sensor signal	UI
Yellow	Sensor GND (not electrically isolated)	FG

Linear light sensor LSWI2

Connect the Linear light sensor to a universal input via the Meteorological station interface WI2. See also Connecting sensors to the Weather interface WI2 (page 177).

Maintain linear light sensor

Clean the Linear light sensor's port at least once a year, or earlier if the Linear light sensor develops measurement deviations. Clean the unit with a damp cloth and a little mild detergent if so required.

Do not use aggressive cleaning and/or abrasives!

Make sure that no moisture, dirt or dust enters the housing when opening the Linear light sensor. This can negatively impact the measurement.

Specifications

Linear Light Sensor LS2

Article description	Linear Light Sensor LS2
Article number	3779213
Measurement principle	photodiode
Spectrum	525 ... 1100 nm (50 % spectral sensitivity points)
Peak response	850 nm
Half angle	60°
Sensitivity	33 mV/klux
Measurement range	0 ... 150 klux
Output range	0 ... 5 V (not electrically isolated)
Supply voltage	21.6 .. 26.4 VDC
Protection	short-circuit proof 24 VAC continuous discharges 900 V/100 nF
Ambient temperature range	-40 ... 80 °C

Linear Light Sensor LS2WI (0 ... 50 mV)

Article description	Linear Light Sensor LS2WI (0 ... 50 mV)
Article number	3779205
Measurement principle	photodiode
Spectrum	525 ... 1100 nm (50 % spectral sensitivity points)
Peak response	850 nm
Half angle	60°
Sensitivity	180 ... 340 µV/klux (refer to calibration certificate)
Measurement range	0 ... 160 klux
Output range	0 ... 50 mV (depending on sensitivity, refer to calibration certificate)
Protection	short-circuit proof 24 VAC continuous discharges 900 V/100 nF
Ambient temperature	-40 ... 80 °C

Radiation sensor CM3P

Radiation sensor CM3P

The Radiation sensor (also called a pyranometer) measures a part of the spectrum of sunlight, including the infrared part. The Radiation sensor therefore measures the quantity of incoming radiation energy that the sun introduces into the greenhouse. You can use this sensor for energy calculations.

The Radiation sensor CM3P consists of a black body with thermopile, the output signal of which is dependent on the quantity of radiation collected.

The Radiation sensor CM3P is supplied with a calibration certificate. If the calibration certificate is missing, you can also find the data on a sticker on the sensor. To do this, remove the sensor from the black housing.

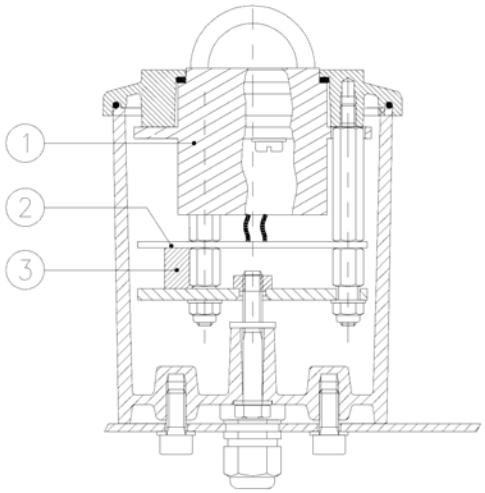
Installation

1. Remove the two socket head screws (including clamping rings) on the underside of the Radiation sensor CM3P.
2. Guide the cable through the appropriate opening on the Meteorological station.

   The Radiation sensor CM3P has a set position on the Meteorological station. See Fitting sensors on the supports of the Meteorological station (page 171).

   - Mount the Radiation sensor CM3P in such a way that the arrow on the housing is pointing in the direction of the nearest pole.
   - Avoid cast shadows at locations between 15° N and 15° S (near the Equator) mount the sensor on a separate mast, on the upper support.

3. Mount the Radiation sensor CM3P with the two socket head screws (including washers) on the support of the Meteorological station.
4. Feed the cable through the hole in the clamp block assembly so that the cable re-emerges on the underside of the block.



Cross section of the Radiation sensor CM3P

1 Thermopile housing
2 Printed circuit board (9583)
3 Connector

Do not shorten the supplied cable. Coil the remaining length of cable or leave a loop. Exchanging and calibrating is only possible with an original cable, without additional costs for replacing the cable.

Connecting

Connect the sensor to a universal input via the Meteorological station interface WI2. See also Connecting sensors to the Weather interface WI2 (page 177).

Check operation

Check the operation of the sensor in daylight. Use a multimeter to measure the voltage across the connecting terminals of the I/O module. Depending on the ingress of light, you must measure a voltage between 0 mV (no light) and 50 mV (a lot of light).

In the Netherlands, the maximum radiation level in the summer is around 1000 W/m^2. With a sensitivity value of 18.6 µV/(Wm^{-2} this results in an output voltage of 18.6 mV.

Solari CM3P maintenance

Clean the Radiation sensor CM3P at least once per year or more frequently if the Radiation sensor CM3P begins to provide inaccurate measurements.Clean the unit with a damp cloth and a little mild detergent if so required.

Do not use aggressive cleaning agents and/or abrasives.

Make sure that no moisture, dirt or dust enters the housing when opening the Radiation sensor CM3P, since these can be detrimental to the measurement.
When closing the housing, be aware that the cover only fits in one position (tab fits in notch).

Checking by dealer

The Radiation sensor CM3P has been calibrated before delivery. Have the Radiation sensor CM3P checked by your dealer once a year to guarantee correct and accurate measurement.

Customers in the Benelux can take out a maintenance contract with Priva for the Radiation sensor CM3P. Your Radiation sensor will then be replaced with a calibrated sensor every two years. Repairs are not included in this contract. If you have any questions concerning the maintenance contract, please contact Priva.

Specifications

Article	Radiation sensor CM3P
Article number	3779207
Measurement principle	Thermopile (thermocouples)
Spectral sensitivity	305 - 2800 nm (50% spectral sensitivity points)
Sensitivity	7 - 25 µV/W/m² (see calibration certificate)
Response time	18 s (95%)
Measurement range	-100 - 2000 W/m²
Output range	-1 - 50 mV (depending on the sensitivity, see calibration certificate)
Course	< 1% per year
Non-linearity	+/- 2.5% (< 1000 W/m²)
Ambient temperature range	-40 - +80 °C

Wind direction sensor WDS2WI

Wind direction sensor

The Wind direction sensor determines the wind direction in a completely contactless manner and supplies as an output signal a voltage between 200 mV and 3440 mV. Any value outside this range is interpreted by the process computer as a sensor defect.

The Wind direction sensor should preferably be mounted on the Meteorological station and connected to a Priva process computer.

Mounting

1. Unscrew the two socket head screws (including clamping rings) on the underside of the Wind direction sensor completely.
2. Guide the cable through the appropriate opening on the mast.

   The Wind direction sensor has a set position on the mast and can only be mounted in one way on the support of the mast.

3. Mount the Wind direction sensor with the two socket head screws (including clamping rings) on the support of the mast.
4. Feed the cable through the hole in the clamp block assembly into the mast section so that the cable re-emerges on the underside of the block.
5. Check the direction of the Wind direction sensor with a compass. Turn the mast so that the identifying mark on the housing of the Wind direction sensor points to the north.

Considering that the accuracy of the measurement depends strongly on the environment (turbulence), you must reconsider the positioning of the Wind direction sensor with every change in the surroundings (new buildings, tree growth).

The Wind direction sensor is supplied with a 10-metre shielded cable. It is recommended that you do not shorten this cable when mounting the unit. Coil the remaining length of cable or leave a loop; this will simplify any future expansion of the Meteorological station with additional crossbars of mast sections.

Connecting

See Connecting sensors to the Weather interface WI2 (page 177) for how to connect the Wind direction sensor.

Maintenance of wind direction sensor

Check the wind direction sensor regularly for pollution and clean it if necessary. Pollution may cause the wind vane to be obstructed. Clean the unit with a damp cloth and a little mild detergent if required.

Do not use aggressive cleaning agents or abrasives.

Make sure that no moisture, dirt or dust enters the housing when opening the Wind direction sensor. This can negatively impact the measurement.

Specifications

Article description	Wind direction sensor
Article number	3779215
Measurement principle	optical or magnetic
Wind direction	0 – 359°
Resolution	1°
Measuring error	1°
Measurements/sec	20
Output signal	Single ended
Output range	200 - 3440 mV
Supply voltage	18 – 40 VDC
Power consumption	15 mA (max)
Protection	Continuous 24 VAC Discharges 900 V/100 nF Short circuit-proof output
Ambient temperature	-40 – +80 °C

The output signal is divided across seven measurement zones, including two defect zones. See the table below.

Output voltage (mV)	Wind direction
0 – 200	Defect
200 – 920	North – East
920 – 1640	East – South
1640 – 2360	South – West
2360 – 3080	West – North
3080 – 3440	North – North-east
3440 – 4096	Defect

Wind speed sensor WSS2WI

Wind speed sensor

The Wind speed sensor generates pulses at a frequency depending on the wind speed. The Wind speed sensor consists of a rotor with interrupter disc, light source and photo diode.

The Wind speed sensor should preferably be mounted on the Meteorological station and connected to a Priva process computer.

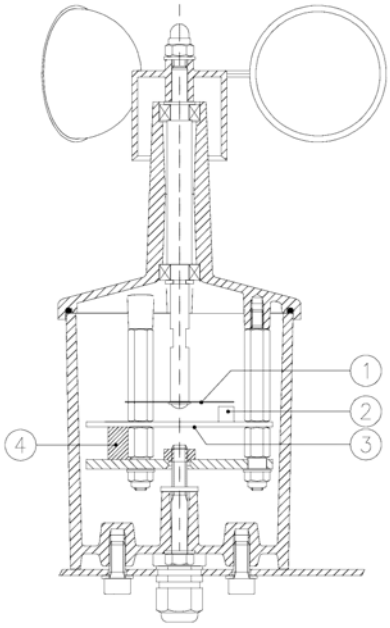
Mounting

1. Unscrew the two socket head screws (including clamping rings) on the underside of the Wind speed sensor completely.
2. Guide the cable through the appropriate opening in the mast.

   The Wind speed sensor has a set position on the mast and can only be mounted correctly in one way on the support of the mast.

3. Mount the Wind speed sensor with the two socket head screws (including clamp rings) on the mounting plate of the mast.
4. Feed the cable through the hole in the clamp block assembly so that the cable re-emerges on the underside of the block.

Considering that the accuracy of the measurement depends strongly on the environment (turbulence), you must reconsider the positioning of the Wind speed sensor with every change in the surroundings (new buildings, tree growth).



Cross-section of Wind speed sensor

1. Interrupter disc
2. Photodiode
3. Printed circuit board (9582)
4. Connector

The Wind speed sensor is supplied with a 10-metre shielded cable. It is recommended that you do not shorten this cable when mounting the unit. Coil the remaining length of cable or leave a loop; this will simplify any future expansion of the Meteorological station with additional crossbars of mast sections.

Connecting

See Connecting sensors to the Weather interface WI2 (page 177) for how to connect the Wind speed sensor.

Wind speed sensor maintenance

Check the Wind speed sensor regularly for pollution and clean it if necessary. Pollution and dust can cause the paddle wheel to spin more slowly. Clean the unit with a damp cloth and a little mild detergent if so required.

Do not use aggressive cleaning and/or abrasives!

Make sure that no moisture, dirt or dust enters the housing when opening the Wind speed sensor. This can negatively impact the measurement.

Specifications

Item description	Wind speed sensor
Item number	3779203
Measuring principle	Optic by means of interrupter disc
Measurement range	0 – 36 m/s
Just operate speed	1 m/s
Output type	Power output with square wave
Frequency range	0 – 175 Hz, 4 pulses per rotation
Output current	0 or 2.5 mA
Duty cycle	60/40 (low/high)
Supply voltage	18 – 40 VDC
Supply current	17 mA (max)
Protection	Continuous 24 VAC Discharges 900 V/100 nF Output short circuit proof
Ambient temperature	-40° C – +80° C

Outside temperature sensor OTS2

Outside temperature sensor

The Outdoor temperature sensor contains a temperature-dependent resistor with a negative temperature coefficient (NTC) in a hermetically-sealed glass tube.

The Outside temperature sensor should preferably be mounted on the Meteorological station and connected to a Priva process computer.

Connecting

The Outside temperature sensor can be connected both directly to a universal input, or via the Meteorological station interface WI2.

Direct to universal input

1. Connect the sensor to a universal input of the Priva Blue ID hardware.
2. Connect the cable as shown in the table. No need to worry about polarity.

Connection of cable to universal input

Colour	Function	Connection
Green	sensor signal	UI
Yellow	Sensor GND (not electrically isolated)	FG
White	None	Not connected
Brown	None	Not connected

Cable type and length

You can extend the cable: feed the cable from the Outside temperature sensor to a junction box (minimum protection class IP 65) and bridge the distance from the junction box to the computer with a new shielded cable.

Under no circumstances must you use tape alone to extend the cable.

Cable data

Cable type	4 x 0.8 mm (0.5 mm^2) shielded
Maximum cable length	100 m

Via Meteorological station interface WI2

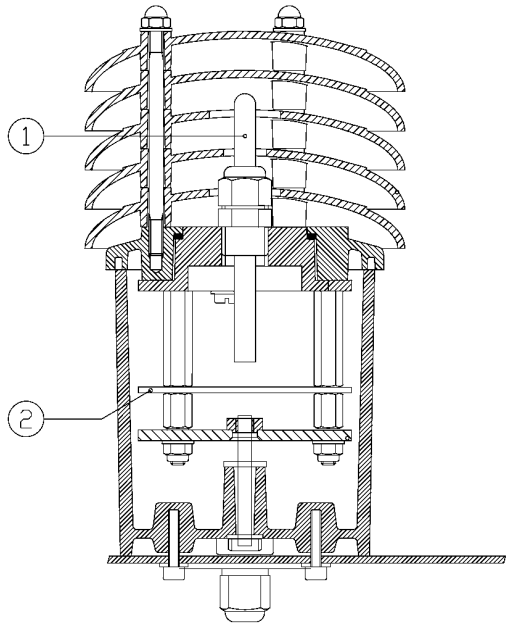
Connect the sensor via the Meteorological station interface WI2 to a universal input. See also Connecting sensors to the Weather interface WI2 (page 177).

Mounting

1. Unscrew the two socket head screws (including clamping rings) on the underside of the Outside temperature sensor completely.
2. Guide the cable through the appropriate opening in the mast.

   The Outside temperature sensor has a set position on the mast.

3. Mount the Outside temperature sensor with the two socket head screws (including clamping rings) on the support of the mast.
4. Feed the cable through the hole in the clamp block assembly so that the cable re-emerges on the underside of the block.



Cross-section of the Outside temperature sensor

1. Temperature sensor
2. Printed circuit board (9583)

The Outside temperature sensor is supplied with a 10-metre shielded cable. It is recommended that you do not shorten this cable when mounting the unit. Coil the remaining length of cable or leave a loop; this will simplify any future expansion of the Meteorological station with additional crossbars of mast sections.

Outside temperature sensor maintenance

Check the Outside temperature sensor regularly for pollution and clean it if necessary. Pollution can interfere with the performance of the Outside temperature sensor. Clean the unit with a damp cloth and a little mild detergent if so required.

Do not use aggressive cleaning and/or abrasives.

Make sure that no moisture, dirt or dust enters the housing when opening the Outside temperature sensor. This can negatively impact the measurement.

The item 'Temp.sensor 6x60 (glass)' (Part number 111070) is available for replacing a defective sensor.

Specifications

Article description	Outside temperature sensor
Article number	3779204
Measuring principle	NTC - 3000 Ω/25 °C
Resolution	0,1 °C
Measurement accuracy	0,2 °C, at temperatures between 0 and 40 °C 0,5 °C, at temperature < 0 °C or > 40 °C
Range	-40 °C .. +80 °C
Response speed (T63%)	55 s
Protection	Discharges 900 V/100 nF

Measurement characteristic

R (Ohm)	T (°C)
55.8	150.00
62.7	145.00
70.6	140.00
79.7	135.00
90.3	130.00
102.5	125.00
116.6	120.00
145.7	111.63
190.6	102.07
251.4	92.70
327.3	84.22
416.1	76.80
527.6	69.75
665.0	63.10
833.1	56.85
1022.0	51.36
1234.4	46.43
1447.5	42.39
1644.3	39.21
1872.3	36.01
2106.7	33.16
2355.1	30.52
2626.9	27.95
2991.7	24.95
3399.7	22.05
3863.2	19.20
4430.7	16.20
5083.6	13.24
5874.4	10.19
6792.8	7.18
7885.9	4.15
9169.9	1.14
10713.2	-1.90
12521.9	-4.89
14693.4	-7.90
17320.3	-10.93
20438.6	-13.92
24061.2	-16.81
28108.2	-19.51
36760.2	-24.17
51396.4	-29.66
71521.9	-34.89
99925.9	-40.00

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