

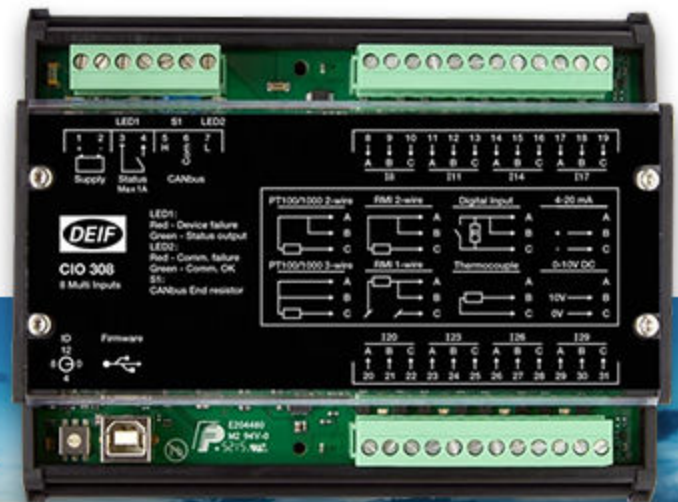
CIO 308

CAN bus-based I/O module with 8 multi-inputs

Installation and commissioning guide



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1. Introduction

1.1 Warnings, legal information and safety

1.1.1 Warnings and notes

Throughout this document, a number of warnings and notes with helpful user information will be presented. To ensure that these are noticed, they will be highlighted as follows in order to separate them from the general text.

Warnings



DANGER!



This shows dangerous situations.

If the guidelines are not followed, these situations will result in death, serious personal injury, and equipment damage or destruction.



WARNING



This shows potentially dangerous situations.

If the guidelines are not followed, these situations could result in death, serious personal injury, and equipment damage or destruction.



CAUTION



This shows low level risk situation.

If the guidelines are not followed, these situations could result in minor or moderate injury.

NOTICE



This shows an important notice

Make sure to read this information.

Notes

NOTE Notes provide general information, which will be helpful for the reader to bear in mind.

1.1.2 Legal information and disclaimer

DEIF takes no responsibility for installation or operation of the generator set. If there is any doubt about how to install or operate the engine/generator etc. controlled by the specific extension, the company responsible for the installation or the operation of the extension must be contacted.

NOTICE



Loss of warranty

The CIO module is not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

The English version of this document always contains the most recent and up-to-date information about the product. DEIF does not take responsibility for the accuracy of translations, and translations might not be updated at the same time as the English document. If there is a discrepancy, the English version prevails.

1.1.3 Safety issues

Installing and operating the CIO module may imply work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel who understand the risks involved in working with live electrical equipment.



WARNING



Live currents and voltages

Be aware of live currents and voltages. Do not touch any live inputs as this could lead to injury or death.

1.2 About the installation and commissioning guide

1.2.1 General purpose

This installation and commissioning guide mainly includes general product and hardware information, mounting instructions, terminal strip descriptions, I/O lists and limits, wiring descriptions and how to produce translations for the CIO module through the USW.

The general purpose of this document is to give the user important information to be used in the installation of the unit.



CAUTION



Read the instructions

Read this document before starting to work with the CIO module and the controller. Failure to do this could result in human injury or damage to the equipment.

1.2.2 Intended users

This installation and commissioning guide is mainly intended for the person responsible for the design and installation. In most cases, this would be a panel builder designer. Naturally, other users might also find useful information in the document.

1.2.3 Software version

CIO 308

SW version 1.10 or later

2. Installation, mounting and wiring

2.1 Installation

Installation

The CIO module is delivered in a sturdy carton to prevent shipping damage. When you receive a system, check the part number against that of the requisition and packaging list for agreement. Inspect for damage, and if there is evidence of such, immediately file a claim with the carrier and notify the regional DEIF sales office, your sales representative or a sales representative at DEIF's head office in Skive, Denmark.

If the unit is not installed immediately, store it in the original shipping package in a moisture and dust free environment.

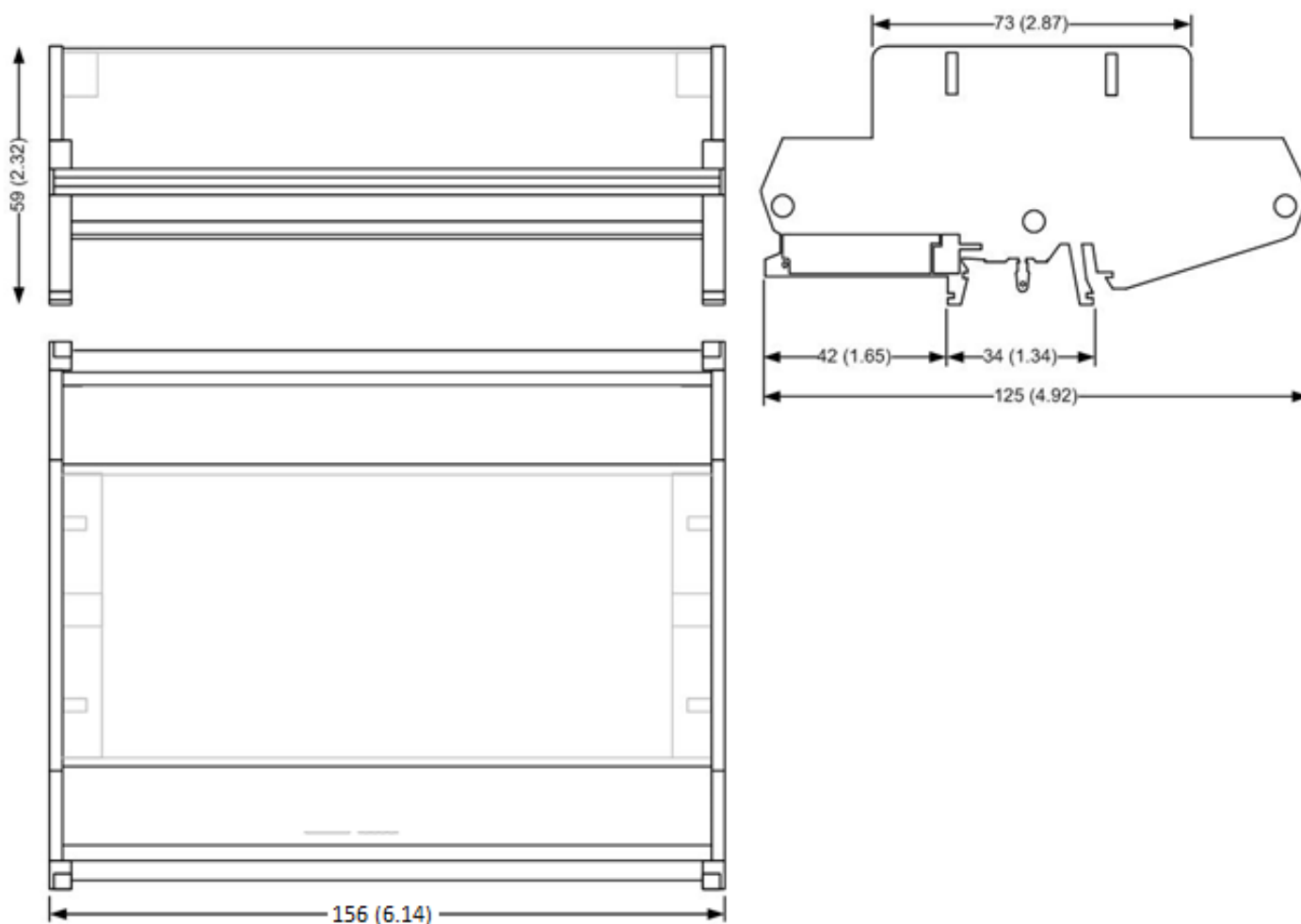
2.2 Mounting

2.2.1 Mounting the CIO modules

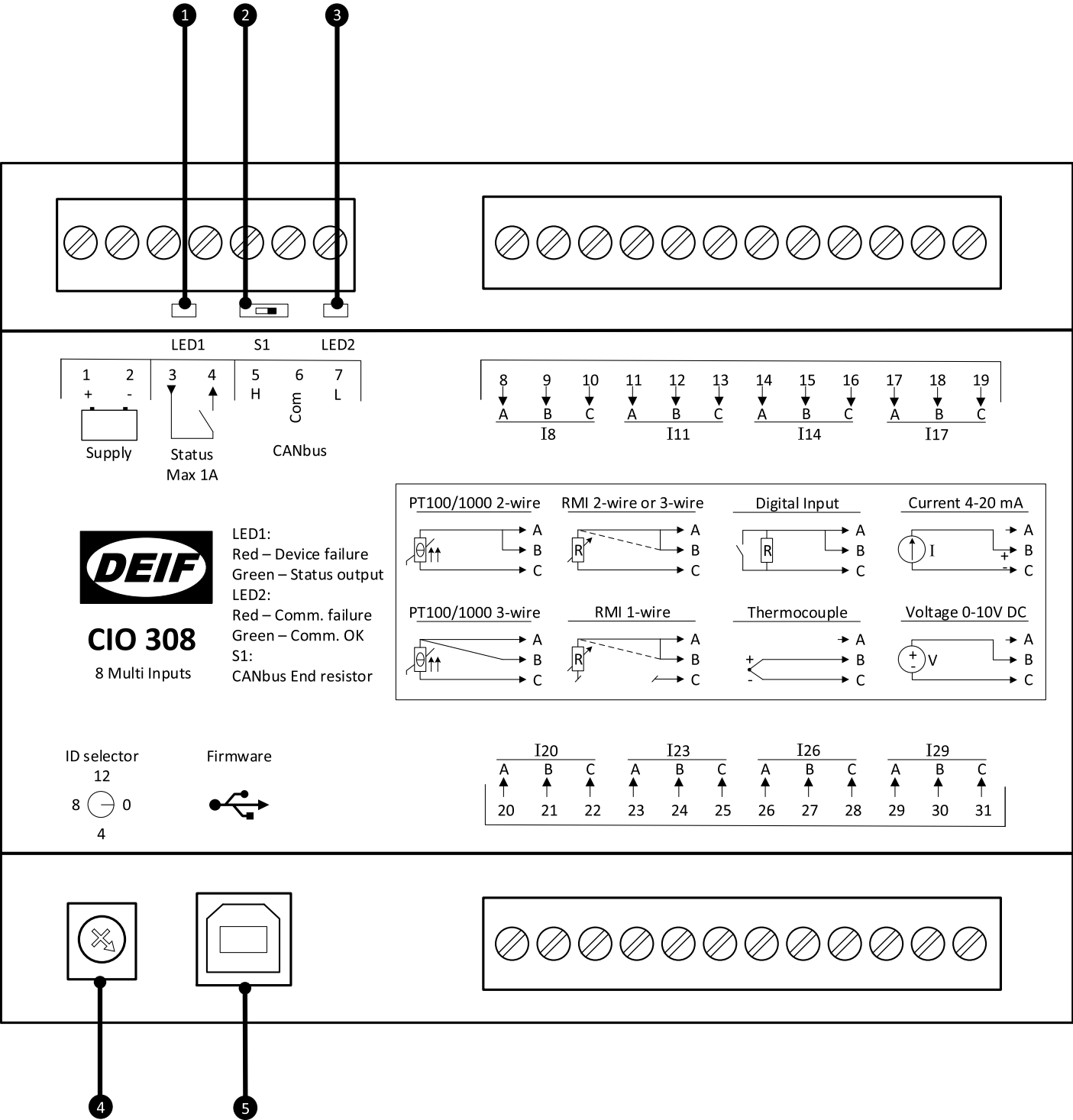
The CIO module is designed for mounting in a closed cabinet on a DIN rail. The module can be mounted on either a TS35 or G-type rail. The unit must be mounted where the ambient temperature does not exceed the range -40 to +70 °C.

2.2.2 Dimensions

The CIO 308 module dimensions are presented here in mm (inches):



2.3 Common functions



1. LED1 (Status LED)

LED1 indicates the operation status of the module, and the status output of this LED is located at terminal 3-4.

Set up as either status or configurable relay:

Set up as status relay

LED colour	Description
Green	Status is OK, the relay is closed.
Red constant	The CIO module is not working correctly, the relay is open.
Red flashing	ID 0 is selected, relay is open.

Set up as configurable relay

LED colour	Description
Green	Status is OK, the relay is closed.
Turned off/no light	Status is OK, the relay is open.
Red constant	The CIO module is not working correctly, the relay is open.
Red flashing	ID 0 is selected, relay is open.
Yellow	The relay is closed, status is not OK.

2. Terminal resistor

The CIO module has a built-in 120 ohm end-termination for the CAN bus line which can be activated via the switch (S1) located at terminal 5. See the section "CAN bus" in "Wiring and terminals" for more information and to see when to activate the switch.

3. LED2 (CAN bus LED)

LED2 indicates the status of the CAN bus communication to the host controller. This LED is located at terminal 7.

LED colour	Description
Green constant	Communication to the controller is working correctly.
Red constant	No CAN bus communication detected.
Red 2 flashes	CAN bus communication detected, but no CIO-specific communication
Red flashing	CIO communication detected, but not to this module.

4. ID selector

The ID selector is used to give CIO modules of the same type different IDs.

CIO 116 can use IDs from 1 to 15

CIO 208 can use IDs from 1 to 15

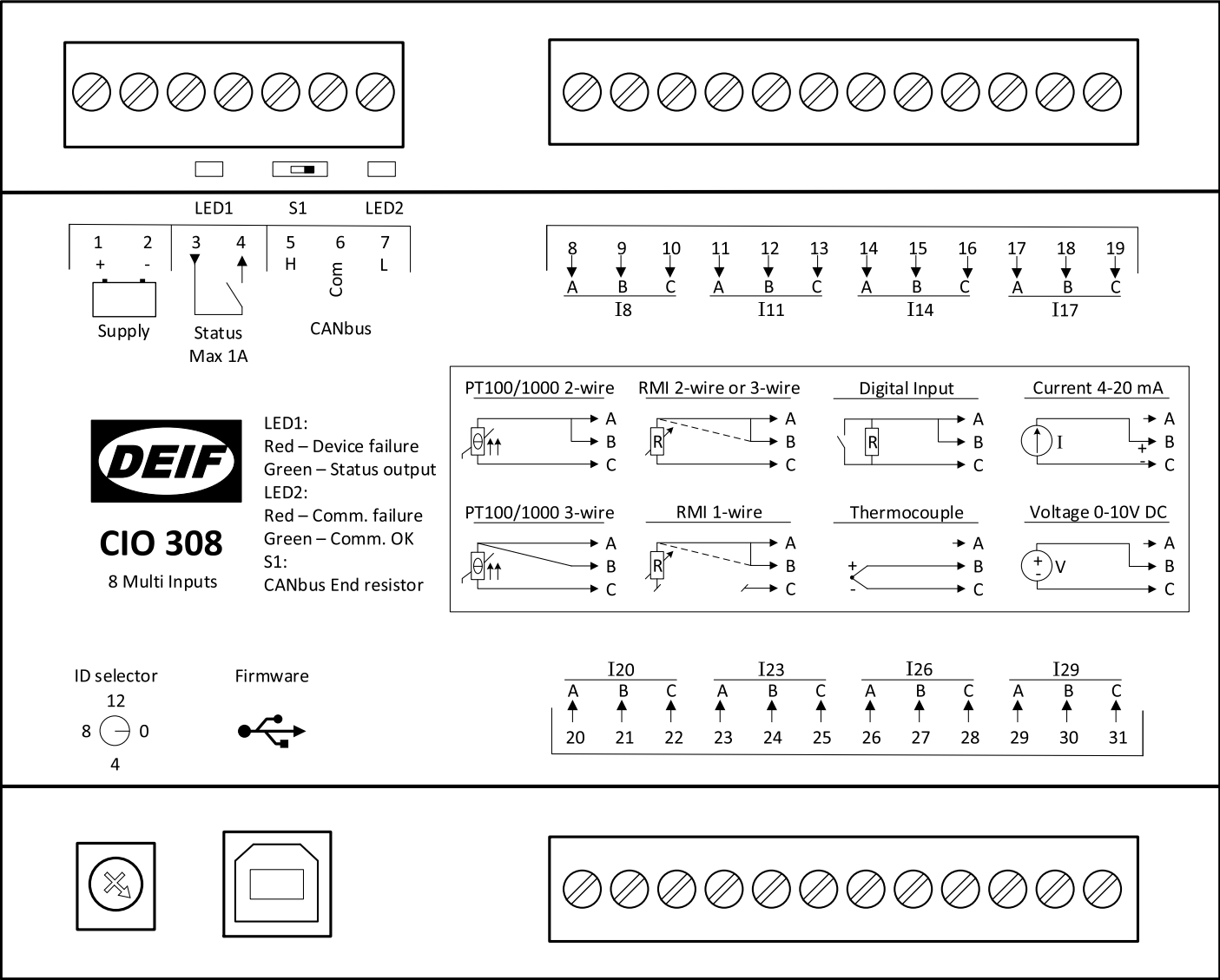
CIO 308 can use IDs from 1 to 15

5. USB for firmware update

The firmware of the CIO modules can be updated via the USB port.

2.4 Wiring and terminals

2.4.1 Terminal overview CIO 308



Terminal	Name	Description	Comment
1	+	+12/24 V DC	Power supply
2	-	0 V DC	
3	Status	Common	Status output (configurable)
4		Normally open	
5	H	CAN-High	CAN bus interface
6	Com	CAN-Common	
7	L	CAN-Low	

Terminal	Name	Description	Comment	
8	I8	Input A	Multi-input 8	Multi-input group 1
9		Input B		
10		Input C		
11	I11	Input A	Multi-input 11	
12		Input B		
13		Input C		
14	I14	Input A	Multi-input 14	
15		Input B		
16		Input C		
17	I17	Input A	Multi-input 17	
18		Input B		
19		Input C		
20	I20	Input A	Multi-input 20	Multi-input group 2
21		Input B		
22		Input C		
23	I23	Input A	Multi-input 23	
24		Input B		
25		Input C		
26	I26	Input A	Multi-input 26	
27		Input B		
28		Input C		
29	I29	Input A	Multi-input 29	
30		Input B		
31		Input C		

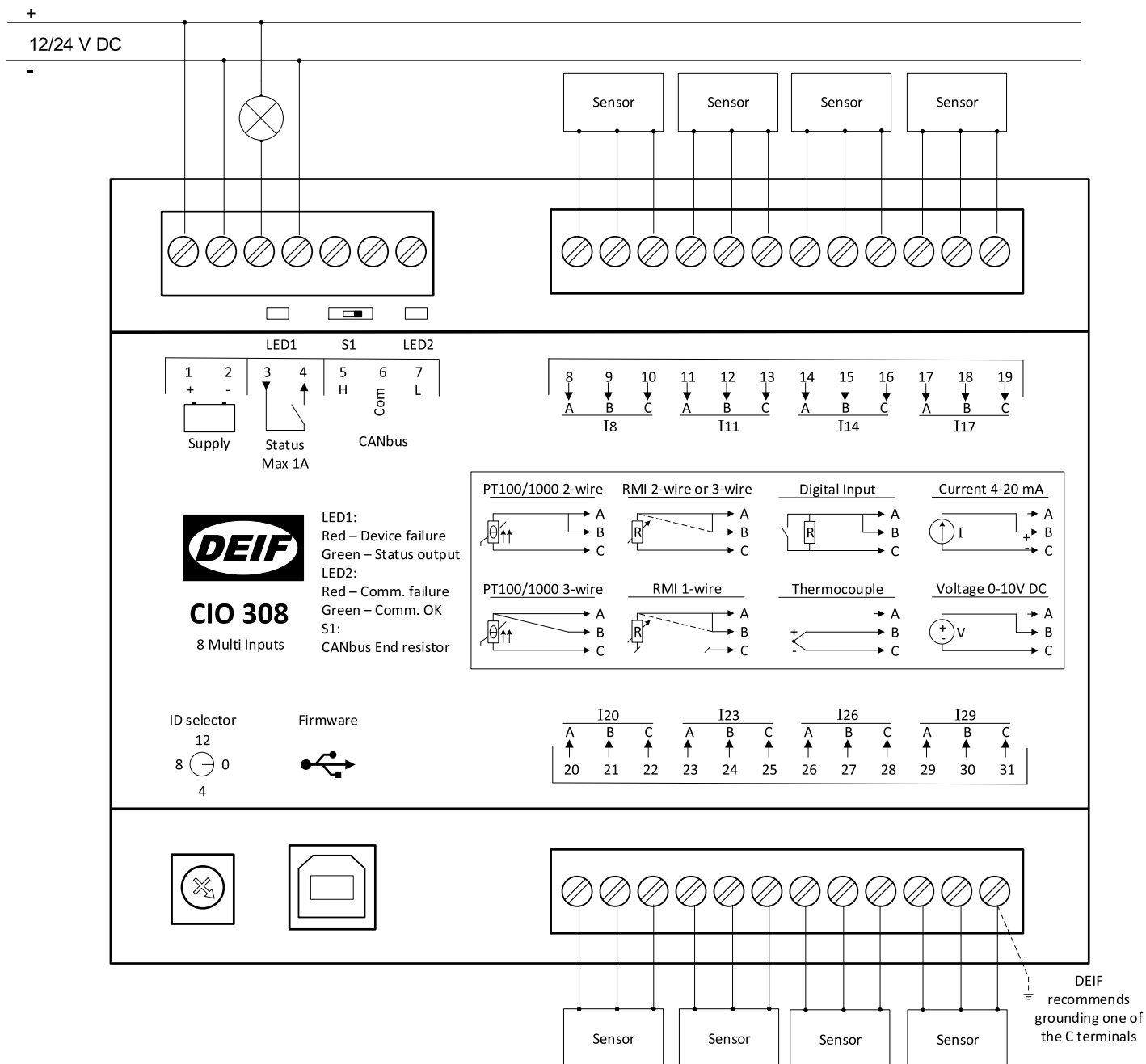
Input LED

Each multi-input has its own LED, and the table below illustrates when the LED is on/off.

Input type	LED	Description
Digital input	On	Input is active
	Off	Input is inactive
0(4) to 20 mA	On	Within input range 4 to 20 mA
	Off	Outside input range 4 to 20 mA (LED is flashing when in protection mode: >30 mA)
0 to 10 V	On	Within input range 0.2 to 10 V
	Off	Outside input range 0.2 to 10 V
RMI	On	Within input range 10 to 2500 Ω
	Off	Outside input range 10 to 2500 Ω

Input type	LED	Description
Pt100 sensor	On	Within selected input range (Low range -50 to 250°C or high range: -200 to 850°C)
	Off	Outside selected input range (Low range -50 to 250°C or high range: -200 to 850°C)
Pt1000 sensor	On	Within selected input range (Low range -50 to 250°C or high range: -200 to 850°C)
	Off	Outside selected input range (Low range -50 to 250°C or high range: -200 to 850°C)
Thermocouple	On	Within input range of selected type of thermocouple
	Off	Outside input range of selected type of thermocouple

2.4.2 CIO 308 wiring



NOTE When thermocouples and Pt100/ Pt1000 sensors are used, it is recommended to connect one of the C terminals to Earth (all C terminals are internally connected). It will minimise noise and sensitivity if touching terminals when measuring.

NOTE Twisted pair or/and shielded cable on input, is recommended to achieve specified accuracy and for optimisation of immunity-noise.

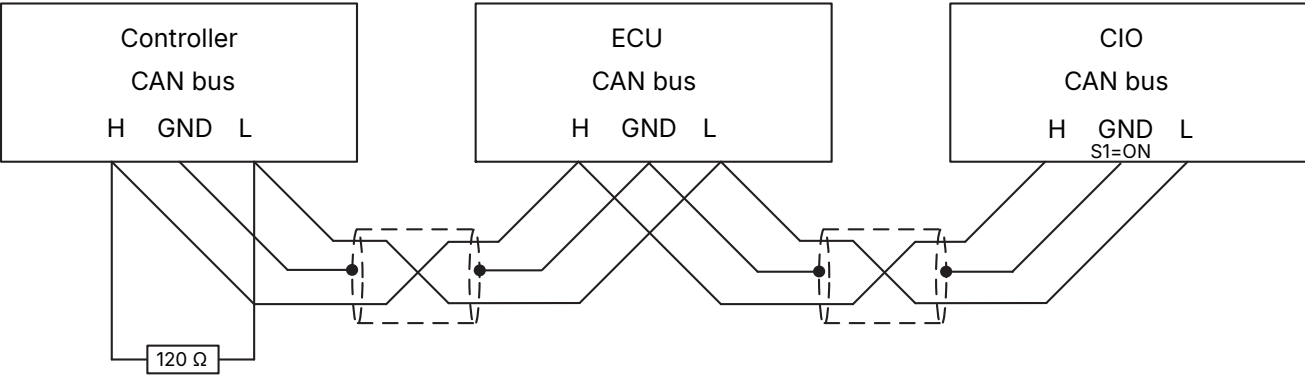
2.4.3 CAN bus

The CIO module(s) can be configured as the only device on the CAN bus or together with an engine controller (ECU) on the same CAN bus as shown in the below example. CIO module(s) can be placed together with all the different engine protocols which are available in the controller (both J1939 and CANopen), because the CIO module will adapt to the baud rate on the CANline.

It is possible to connect up to three CIO modules of each type to one controller.

NOTE A controller cannot have both CIO modules and Beckhoff modules connected

Below is an example that shows how the CAN bus can be connected:



AGC-4 Mk II, AGC-4, and AGC Plant Management

On the AGC-4 Mk II, AGC-4, and AGC Plant Management, it is possible to use the CAN ports C, D, E or F, and you need to have at least one of the following options: H5, H8 or H12.

NOTE Option H7 is not available for use with CIO modules.

Terminal	Function	Description
29	CAN H	CAN port C
30	Com	
31	CAN L	
32	CAN H	CAN port D
33	Com	
34	CAN L	
131	CAN L	CAN port E
132	Com	
133	CAN H	
128	CAN L	CAN port F
129	Com	
130	CAN H	

iE 150 and AGC 150

See the **Installation instructions** for details.

AGC 200

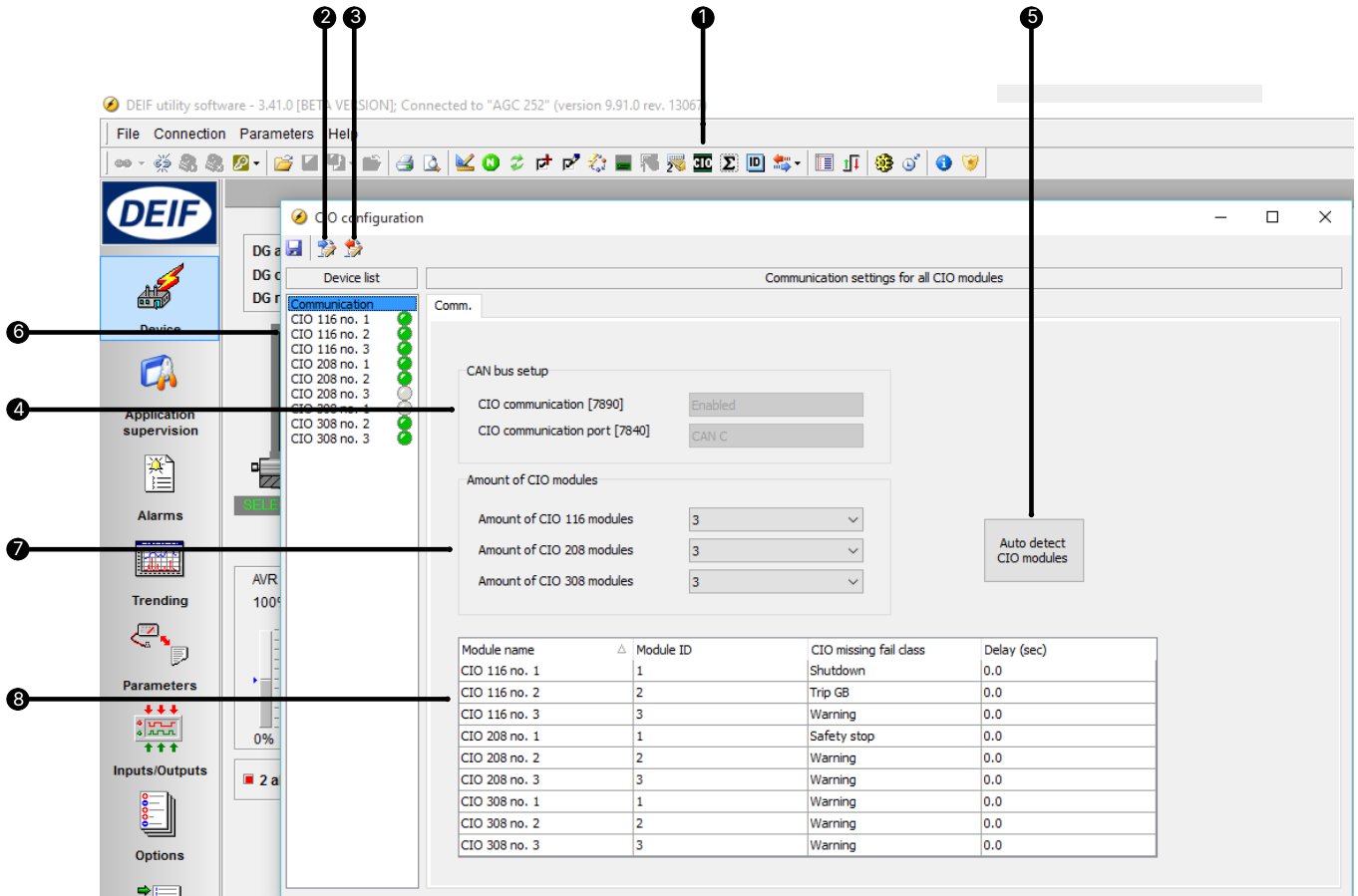
On the AGC 200, only CAN port C is available.

Terminal	Function	Description
13	CAN H	CAN port C
14	Com	
15	CAN L	

3. Communication

3.1 Communication setup

A few parameters revolving around communication to the CIO can be accessed through the display. Through the CIO tab in the USW, full access to all the CIO parameters is available. The CIO configuration menu is accessed from the top menu bar of the USW.



1. CIO configuration menu

When you open the CIO configuration menu, the first page is Communication setup.

2. Read configuration from the controller

3. Write configuration to the controller

4. CAN bus setup

The CAN port for the CIO modules is illustrated as well as the communication port, which are both configured in the USW parameter list.

5. Auto detect

If the CIO modules are already connected and have the correct ID, the USW can automatically detect the number and composition of CIO modules by using the auto detect function.

6. Device navigation list

Click a module from the list to access setup of the module. The green/grey light indicates if connection to the module is established.

7. Manually select how many devices are connected

8. List of modules

The module ID must correspond with the ID selected on the module and can be changed manually in the list. The fail class and delay set here are triggered if the specific module is missing.

NOTE The first time you open the menu, the buttons will be inactive and it is necessary to read the configuration from the controller.

NOTE If the communication to a CIO 116 or CIO 308 module is lost, the controller will continue with the last received input value.

3.1.1 Step-by-step guide to setting up communication the first time

Follow these steps to establish communication to the CIO modules. Setup of the I/Os is described in a later chapter.

- Adjust the ID from 1-15 on the switch by rotating the screw in the lower left corner
- Select which CAN port to use for CIO (parameter 7840).

Select "Ext. modules DEIF" if the CAN port is only used to CIO modules, but if an engine (ECU) also is connected to the CAN line then "H5 EIC" or similar should be selected.

- Enable CIO communication (parameter 7890).
- Open the CIO menu by pressing the CIO icon 
- Read the configuration from the controller.
- Auto-detect the number of modules and their ID.

This only works if the CIO modules are connected, but it is also possible to manually add and configure modules by changing value in "Amount of CIO xxx modules"

- Determine fail class for module missing for all modules.
- Write the configuration to the controller.



CAUTION



I/Os disabled during update

When the configuration is written to the controller all I/Os are temporarily disabled. For example, all relays are de-energised.

3.1.2 Step-by-step guide to update firmware to CIO module

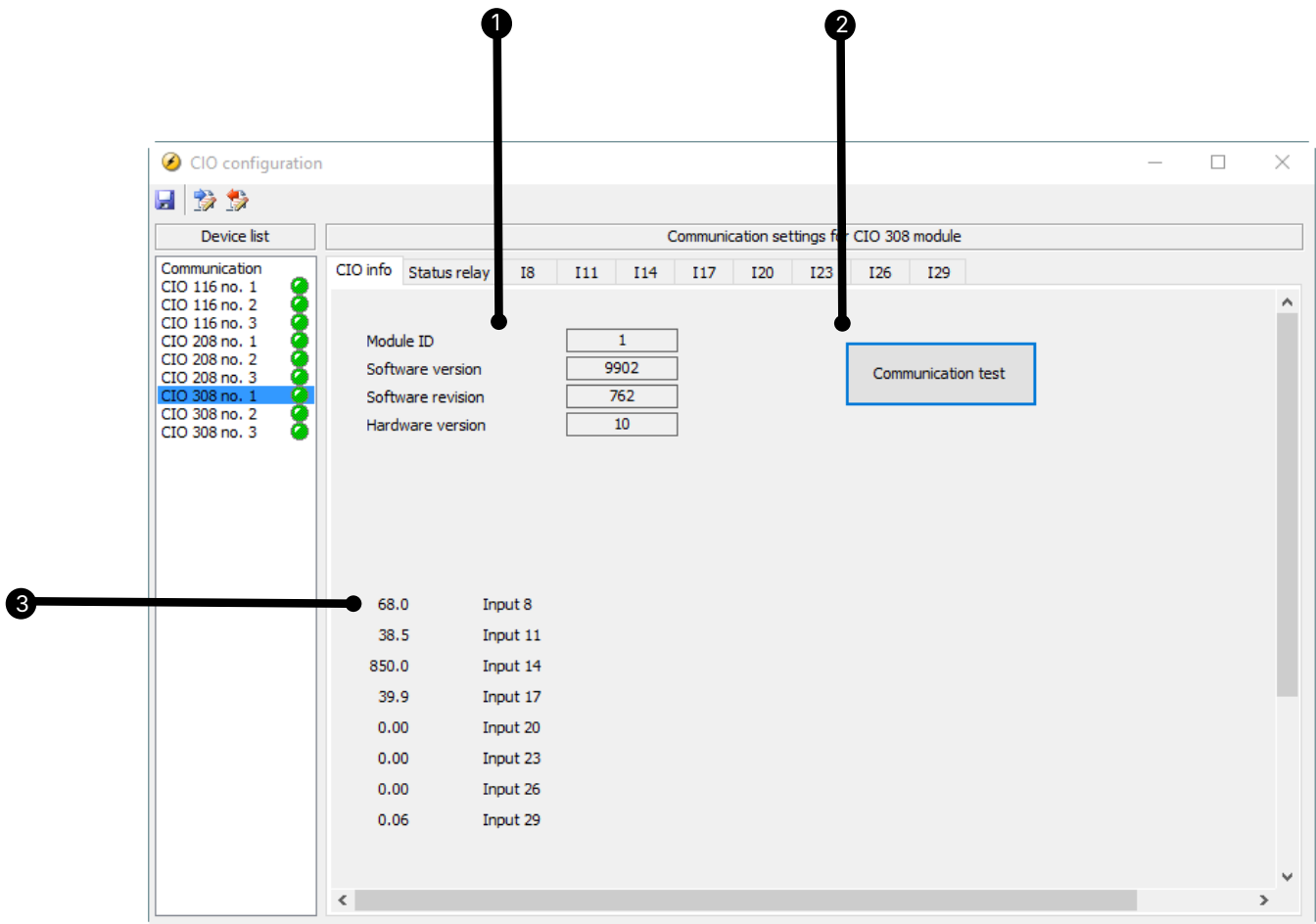
Follow these steps to update the firmware for a CIO module.

- Apply power to the module
- Set ID to 0.
- Connect a USB cable between the CIO module and a PC
- Open the utility software and connect to the CIO module via USB.
- Login as "Customer" with the password 2000.
- Write a new firmware to the device by pressing this icon 

- When the firmware is completed, the connection can be stopped , the USB cable can be removed, and the ID should be returned to the desired ID.

4. I/O setup

4.1 CIO info tab



1. Module info

This section gives an overview of the specific module's ID and the software and hardware version of the module. This information is important if support is needed for the product.

2. Communication test

When you click the Communication test button, the CAN bus LED (LED2) of the corresponding module will flash green.

3. I/O status

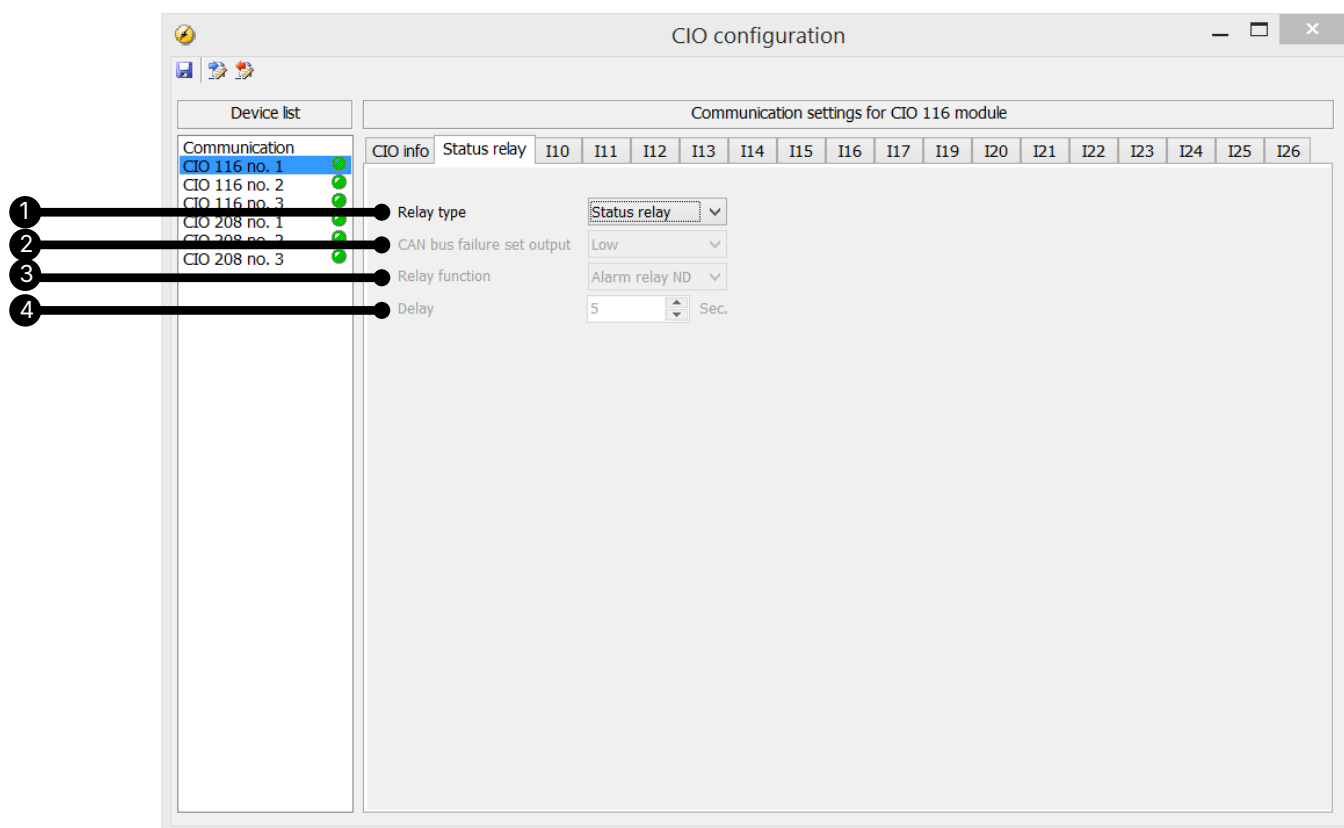
In this section, the value (like temperature, pressure, voltage and so on) is shown for each input.

4.2 Status relay

The module has a status relay, which can be used as a status relay or as a configurable relay.

NOTE Power cycling the CIO module while there is no communication to the controller will reset the settings results, and the relay will be set as a status relay until communication is established. The CIO configuration is stored in the

controller, and this means that the CIO module will be configured when the communication to the controller is available.



1. Relay type

This setting has two states: Status relay and Configurable.

If it is used as a status relay, the relay will stay closed as long as the state of the module is OK, which corresponds with a constant green status LED (see Status LED). If the relay is used as a status relay, the settings below are disregarded.

2. CAN bus failure set output

This setting has three levels: Low, High and Stay. In case of a CAN bus failure, the related relay will change its state based on this setting. If it is set to Stay, the relay will keep its current state until communication is working again.

3. Relay function

The relay function can be set to five different settings:

Alarm relay ND

The related relay is used as an alarm relay of the type "ND" (Normally De-energised).

The relay is activated until the alarm that caused the activation is acknowledged and gone.

Limit relay

The relay will activate at a certain predefined limit set point. When the condition that activated the relay has returned to normal, and when the delay has expired, the relay will deactivate. The delay is adjustable.

An output relay should be configured as a limit relay, otherwise an alarm will be raised when the output is activated.

NOTE To use the relay in M-Logic, it must be configured as a limit relay.

Horn relay

All configurable relays can be selected to be a horn output (horn relay).

This means that, for example, the relay can be connected to an alarm annunciator, like a horn. When "Horn relay" is selected, an external horn is activated every time a new alarm occurs. If the alarm horn timer in parameter 6130 is adjusted to 0 seconds, the horn remains activated until the alarm is acknowledged. If the alarm horn parameter (6130) is not 0 seconds, the horn relay output is active until the timer expires and then the relay deactivates, even though the alarm is still present.

Siren relay

When "Siren relay" is selected, an external siren is activated on all alarms, like the selection "Horn relay". When the siren relay is activated and another alarm is active, a short-time reset will be activated. If the alarm horn timer in parameter 6130 is adjusted to 0 seconds, the siren relay remains activated until all alarms are acknowledged.

Alarm relay NE

The related relay is used as an alarm relay of the type "NE" (Normally Energised).

The relay is normally closed, and if the related alarm occurs, the relay will open until the alarm is acknowledged and gone.

4. Delay

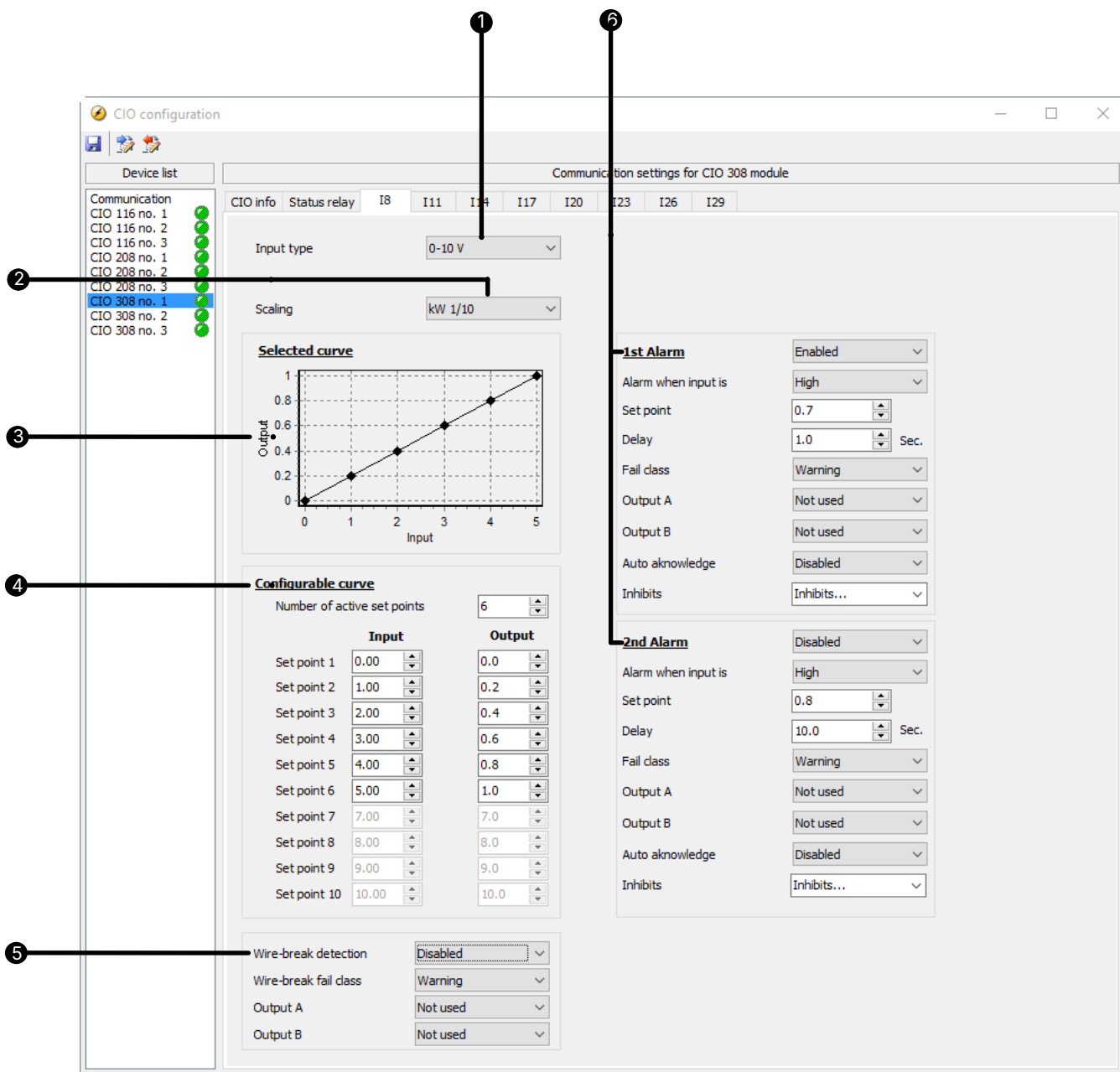
Used when the relay function is "Limit".

The delay setting indicates how many seconds the relay stays energised after the input has become inactive. This functionality is also called off-delay.

4.3 Multi-input

4.3.1 Setting up a multi-input

Below is the functionality generally described. The screen changes depending on the input type (item 1 on the picture).



1. Input type

This setting determines the type of signal that the sensor sends to the input. Among the options are: Pt100, Pt1000, 0-10 V, RMI, 0-20 mA, thermocoupler types and binary.

2. Scaling

This list contains options regarding the origin of the multi-inputs measurement. It is possible to select between various units like °C, bar, kW and "No unit". There is also a scaling involved, which can be 1/1, 1/10 and 1/100.

If 1/100 is selected, there are 2 decimals in the output value, the max value is 327.67, and there are 0 decimals if 1/1 is chosen, then the max value is 32767.

3. Selected curve

This graph shows the curve for the values in the Configurable Curve table (item 4).

4. Configurable curve

In this table it is possible to type the relation between input 0-10 V and output kW 1/10 in this example.

As seen in the table, the input ranges from 0-5 V, and the output is 0.0-1.0 kW. If the input voltage goes above 5 V, the output will stay at 1.0 kW.

5. Wire-break detection

If the input signal is outside of configured range, the wire fail detection is activated. It depends on the input type working area of the sensor whether open circuit and short circuit failures will be detected. Read more about this in the chapter about wire fail detection.

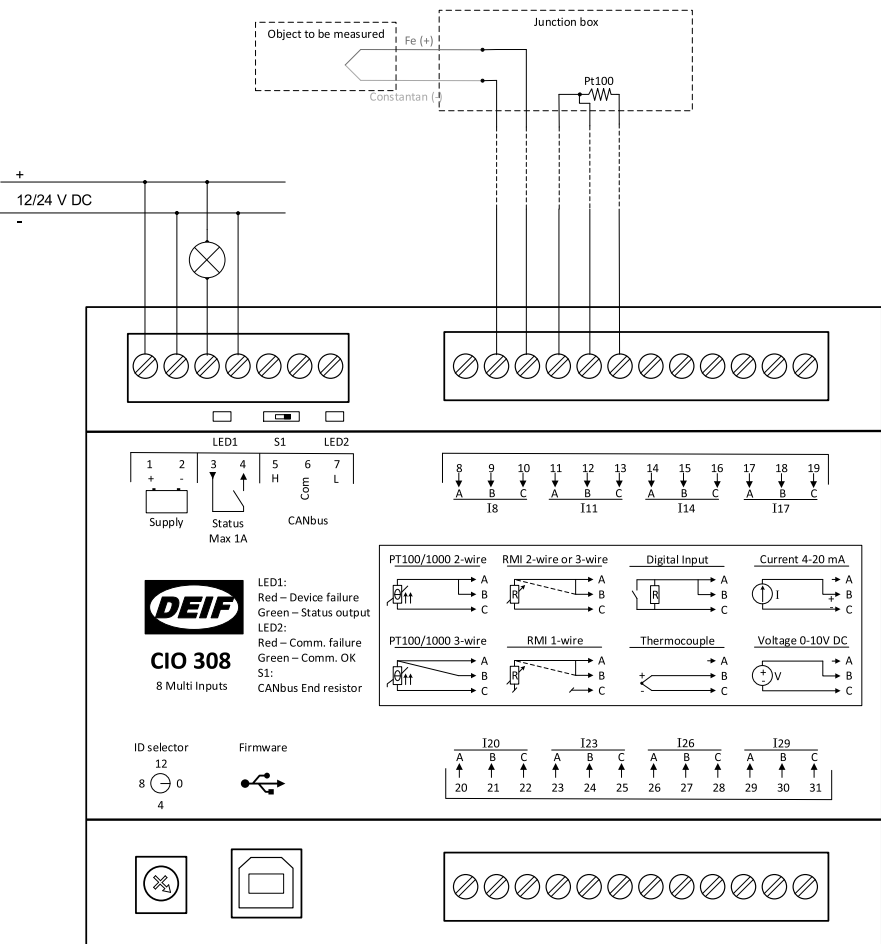
6. Alarm setup

It is possible to set two alarms, and the related settings are the same as for regular inputs on the controllers. The selected set point relates to the output value. In this example, the output value is 0-1 kW, and the first alarm activates when the value has been above 0.7 kW in 1 second.

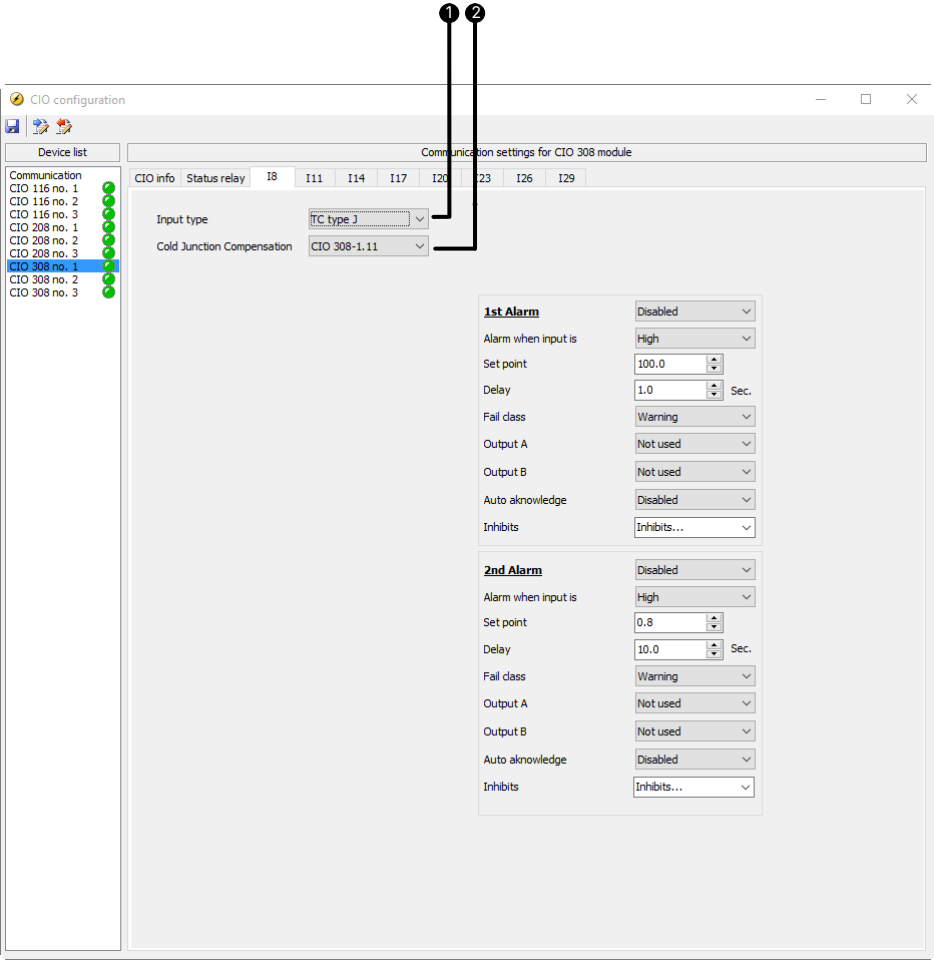
4.3.2 Thermocoupler with cold junction compensation

The CIO 308 module compensates for the cold junction. This can be done with the internal temperature measurement if the thermocoupler is connected to the CIO 308 module terminals.

If there is a long distance to the measured object, a conductor is often used from the CIO module to a junction box, where the thermocoupler is connected. In this case, it is possible to compensate by using a temperature sensor, for example a Pt100, and place it in the junction box as the picture below illustrates:



Configuring the cold junction function in the CIO 308 module through the USW:



1. Input type

Here you can select the thermocoupler and which type it is.

2. Cold Junction Compensation

This is where the compensation input is selected. It is possible to choose another input that should be used for cold junction compensation, or the internal temperature in the CIO 308 module can be selected.

4.3.3 Wire fail detection

The CIO 308 module can detect wire fail if the signal goes outside the working range. It depends on the signal type and working range if a short circuit or a broken cable will be detected.

To prevent a false "Wire fail" alarm, small deviations from the working area are accepted for some signals.

Table 4.1 Wire break values overview

Input	Wire failure low area	Normal range	Wire failure high area
0-10 V	1 V below lowest value in the working range	Configurable	1 V above highest value in the working range
0-20 mA	1 mA below lowest value in the working range	Configurable	1 mA above highest value in the working range

Input	Wire failure low area	Normal range	Wire failure high area
Thermocoupler (all types)	Does not have wire fail detection		
Pt100 (low range)	< 80.3 Ω	80.3-194.1 Ω	> 194.1 Ω
Pt100 (high range)	< 18.5 Ω	18.5-390.5 Ω	> 390.5 Ω
Pt1000 (low range)	< 803 Ω	803-1941 Ω	> 1941 Ω
Pt1000 (high range)	< 185 Ω	185-3905 Ω	> 3905 Ω
RMI (all types)	10 % of the range below the lowest value	Configurable	10 % of the range above the highest value
Binary	Short circuit cannot be detected	-	Set a 240 Ω resistor parallel with the switch (see picture below)

Examples:

0-10 V

If the signal is configured to 2-10 V, "Wire fail" alarm will occur if the voltage is below 1 V or above 11 V. If the signal is configured to 0-10 V, a wire break cannot be detected because the signal would become 0 V in case of a wire break.

0-20 mA

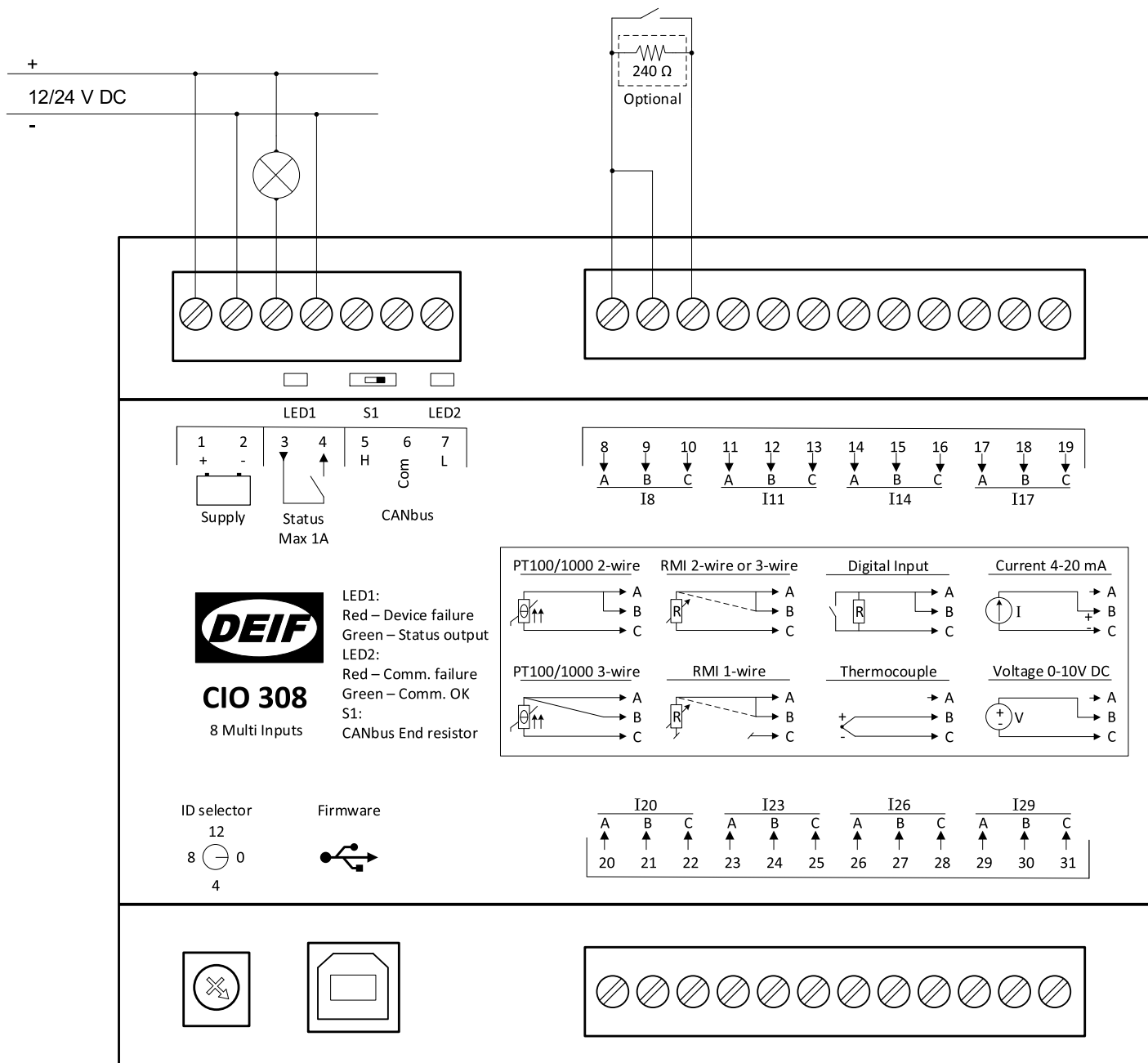
If a 0-20 mA signal is used, it is not possible to detect wire break, because in this case the signal would become 0 mA, which is inside the acceptable area. A 4-20 mA could be used instead to detect wire break. In this case, a wire break would be detected below 3 mA and above 21 mA.

RMI

If an RMI signal is used where the working area is 50-200 Ω , then the tolerance is 15 Ω (10 % of the range, 150 Ω), so the "Wire fail" alarm occurs below 35 Ω or above 215 Ω .

Binary

To detect wire failures, a 240 Ω resistor must be put in parallel to the switch, but if wire fail detection is not used, then it is not necessary to use the resistor. If used, the resistor should always be located near the switch. When $\sim 0 \Omega$ is measured, the terminal is energised, and when 240 ohm is measured, the terminal is deenergised. If a high resistance is measured, then the "Wire fail" alarm is triggered and "N.A." is shown as a value in the display. See the picture below for a wiring example of a binary input with wire break detection.



4.3.4 Change text in the display

In the "Translations" section in the utility software, it is possible to change the text shown in the display. This can be used to translate the text into another language and to change the text to something more informative regarding what is measured. For AGC-4 and AGC PM, it is also possible to change the unit to the measurement.

There are numerous languages, and the language is set in parameter 6080.

AGC-4 Mk II, AGC-4, and AGC PM

For the input where the text should be customised, the scaling has to be set to "No unit 1/100", "No unit 1/10" or "No unit 1/1". In the translations section, there are 3 texts to each input, where the text with 2 decimals relates to "No unit 1/100" and so forth. As the picture below illustrates, it is also possible to configure the "CIO - X.XX N.A." if needed.

As example, "CIO-1.17 ###.##" would relate to CIO 308 module no. 1 input 17 with scaling "No unit 1/100" and could be changed into "Fuel tank ###.## L". The hash symbol (#) represents the digits from the measurement.

DEIF									
Master									
Status	Master language		Language 1		Language 2		Language 3		
	CIO-1.17	N.A.	CIO-1.17	N.A.	CIO-1.17	N.A.	CIO-1.17	N.A.	
	CIO-1.17	#####	CIO-1.17	#####	CIO-1.17	#####	CIO-1.17	#####	
	CIO-1.17	##### #	CIO-1.17	##### #	CIO-1.17	##### #	CIO-1.17	##### #	
	CIO-1.17	##### #	Fuel Tank ##### L		CIO-1.17	##### #	CIO-1.17	##### #	
	CIO-1.20	N.A.	CIO-1.20	N.A.	CIO-1.20	N.A.	CIO-1.20	N.A.	
	CIO-1.20	#####	CIO-1.20	#####	CIO-1.20	#####	CIO-1.20	#####	
	CIO-1.20	##### #	CIO-1.20	##### #	CIO-1.20	##### #	CIO-1.20	##### #	
	CIO-1.20	##### #	CIO-1.20	##### #	CIO-1.20	##### #	CIO-1.20	##### #	
	CIO-1.23	N.A.	CIO-1.23	N.A.	CIO-1.23	N.A.	CIO-1.23	N.A.	
	CIO-1.23	#####	CIO-1.23	#####	CIO-1.23	#####	CIO-1.23	#####	
	CIO-1.23	##### #	CIO-1.23	##### #	CIO-1.23	##### #	CIO-1.23	##### #	
	CIO-1.23	##### #	CIO-1.23	##### #	CIO-1.23	##### #	CIO-1.23	##### #	

IE 150, AGC 150, ASC 150, and AGC 200

The displayed text can be edited in the translations section, and an example of this is shown in the picture below. The unit of the measurement can also be changed in the translation setting, but the text field for the units are shared among all text fields. This means that if "%" is changed to "m3", then m3 will be used at all places where the unit was % originally.

DEIF									
Master									
Status	Master language		Language 1		Language 2		Language 3		Language 4
Translated	CIO 308 1.11		Winding temp.		CIO 308 1.11		CIO 308 1.11		CIO 308 1.11
Translated	CIO 308 1.14		Air inlet temp.		CIO 308 1.14		CIO 308 1.14		CIO 308 1.14
Translated	CIO 308 1.17		Fuel level		CIO 308 1.17		CIO 308 1.17		CIO 308 1.17
Translated	CIO 308 1.20		Cooling water temp.		CIO 308 1.20		CIO 308 1.20		CIO 308 1.20
Translated	CIO 308 1.23		CIO 308 1.23		CIO 308 1.23		CIO 308 1.23		CIO 308 1.23
Translated	CIO 308 1.26		CIO 308 1.26		CIO 308 1.26		CIO 308 1.26		CIO 308 1.26
Translated	CIO 308 1.29		CIO 308 1.29		CIO 308 1.29		CIO 308 1.29		CIO 308 1.29
Translated	CIO 308 1.8		CIO 308 1.8		CIO 308 1.8		CIO 308 1.8		CIO 308 1.8
Translated	CIO 308 2.11		CIO 308 2.11		CIO 308 2.11		CIO 308 2.11		CIO 308 2.11
Translated	CIO 308 2.14		CIO 308 2.14		CIO 308 2.14		CIO 308 2.14		CIO 308 2.14
Translated	CIO 308 2.17		CIO 308 2.17		CIO 308 2.17		CIO 308 2.17		CIO 308 2.17
Translated	CIO 308 2.20		CIO 308 2.20		CIO 308 2.20		CIO 308 2.20		CIO 308 2.20

NOTE To avoid confusion, it is recommended not to change the unit in the translation for these controllers.