

G3-U16

G-Mation G3 – 16 Optically isolated digital outputs

USE AND INSTALLATION MANUAL

G3 U16 code F099391

code: 80661 - Ver 1.0 - 10-2025 - ENG



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1. PREFACE

1.1. Warnings and safety

Although all the information in this document has been carefully checked, Gefran S.p.A. cannot be held liable for the possible presence of errors, or for damage to persons or property due to improper use of this manual. Gefran S.p.A. also reserves the right to make changes to the content and form of this document and to the features of the devices it describes at any time without prior notice.

The devices described in this manual must be installed by qualified technicians, following current laws and regulations and in accordance with the instructions given in this manual. If the card is used in applications with risk of injury, or of damage to machinery or materials, it must be combined with auxiliary alarm devices. It is advisable to provide for the possibility of checking alarm activation also during normal operation.

Before interacting with the card, the operator must be adequately instructed in the system operation, emergency, diagnostics and maintenance procedures.

1.2. Typographical conventions used in the manual

Pay attention when the following symbols are found in the manual.



Indicates particularly important information relevant to correct product operation or safety, or provides instructions that must be strictly followed



Identifies an action that is possible / permitted



Highlights a risk condition for the installation technician or user due to hazardous voltage levels



Identifies an action that is NOT possible / NOT permitted

1.3. EtherCAT declaration



EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

2. G-MATION G3 PLATFORM

2.1. System



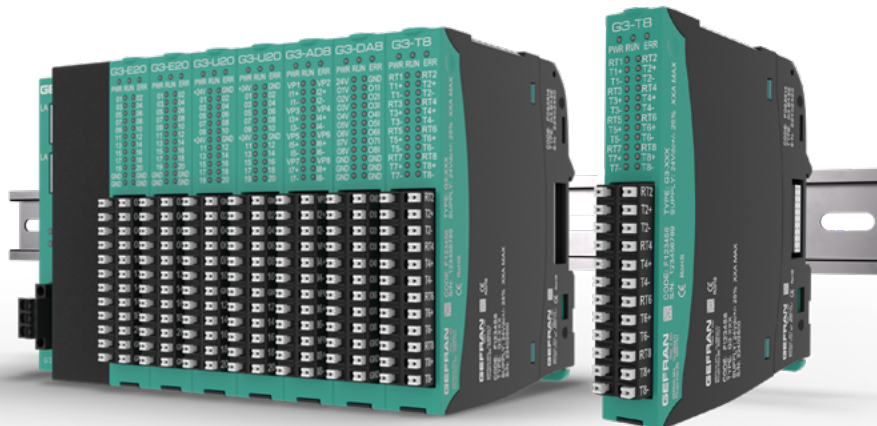
G-Motion G3 is a modular IO system based on EtherCAT technology. EtherCAT provides a maximum of 65535 addressable modules.

A G3 rack of I/Os is composed of the system coupler, G3-ECAT, with a number of I/O boards on the right side as desired according to system needs and up to a maximum of 20.

The G3-ECAT module provides power supply for 20 boards.

If a number of boards greater than 20 is necessary, the power supply module G3-PWR must be inserted between the 20nd and 21st boards.

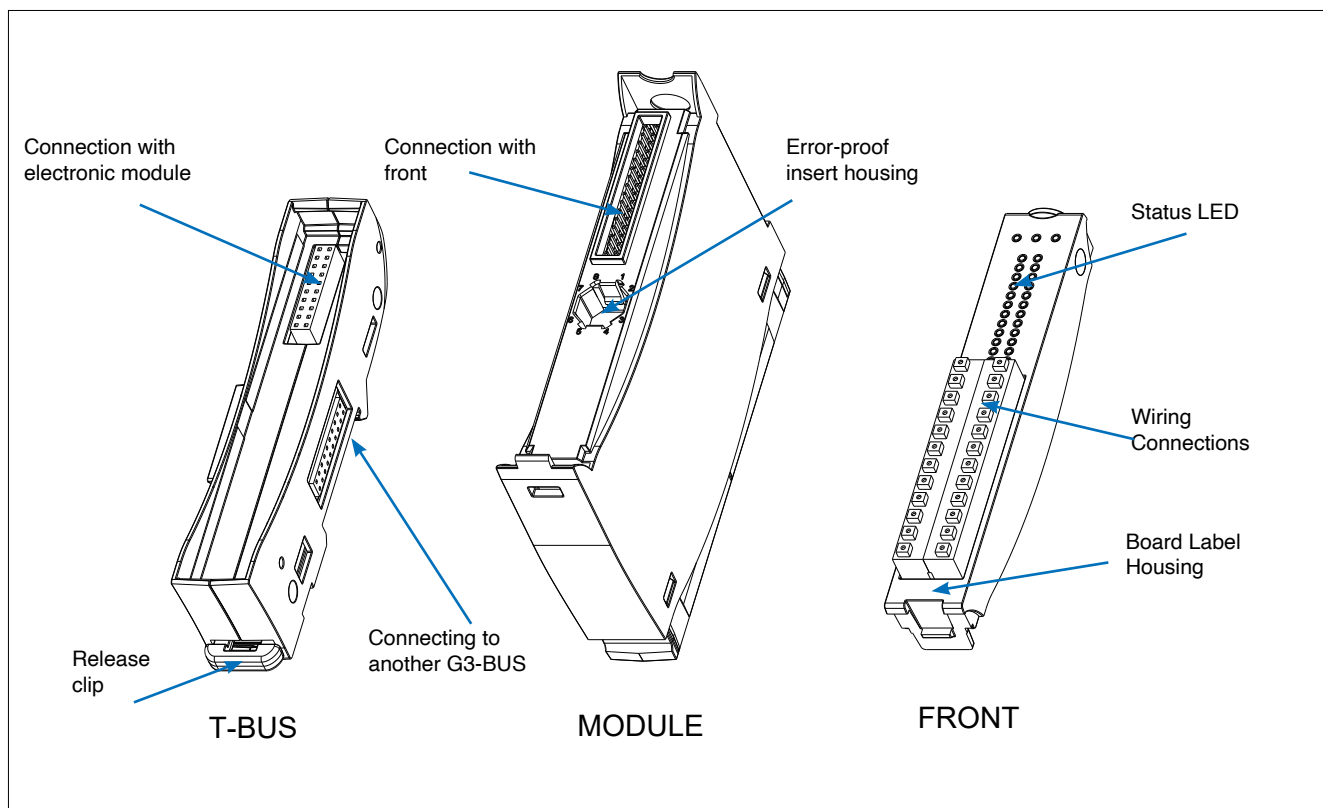
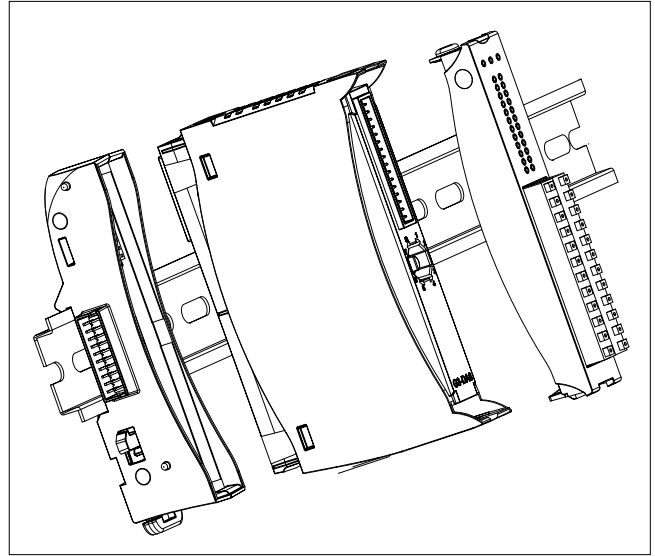
The boards are designed for coupling on a 35 mm DIN rail and the lateral coupling with the rack takes place by sliding to the left (refer to paragraph “2.6. DIN rail mounting” on page 13).



2.2. Board modularity

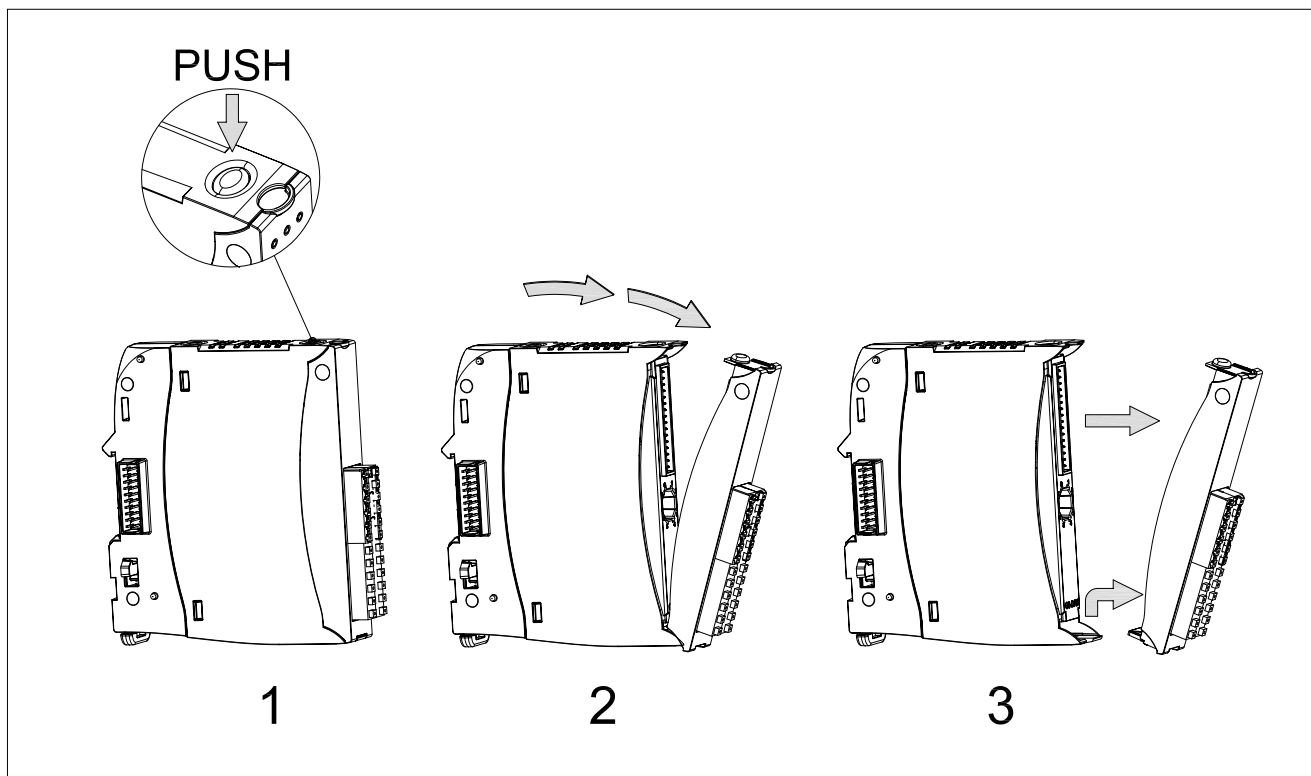
Each I/O board consists of three parts:

- **The base module:** it is the module that guarantees coupling with the din rail and bus transmission between one board and the next. It is called G3-BUS (F092614) and is common to all boards.
- **Electronics:** is the module that contains all the electronics dedicated to managing board I/Os. It is proprietary to each board.
- **The front:** it is the module that houses the push-in connector for the wiring and the front LEDs. It is proprietary to each board

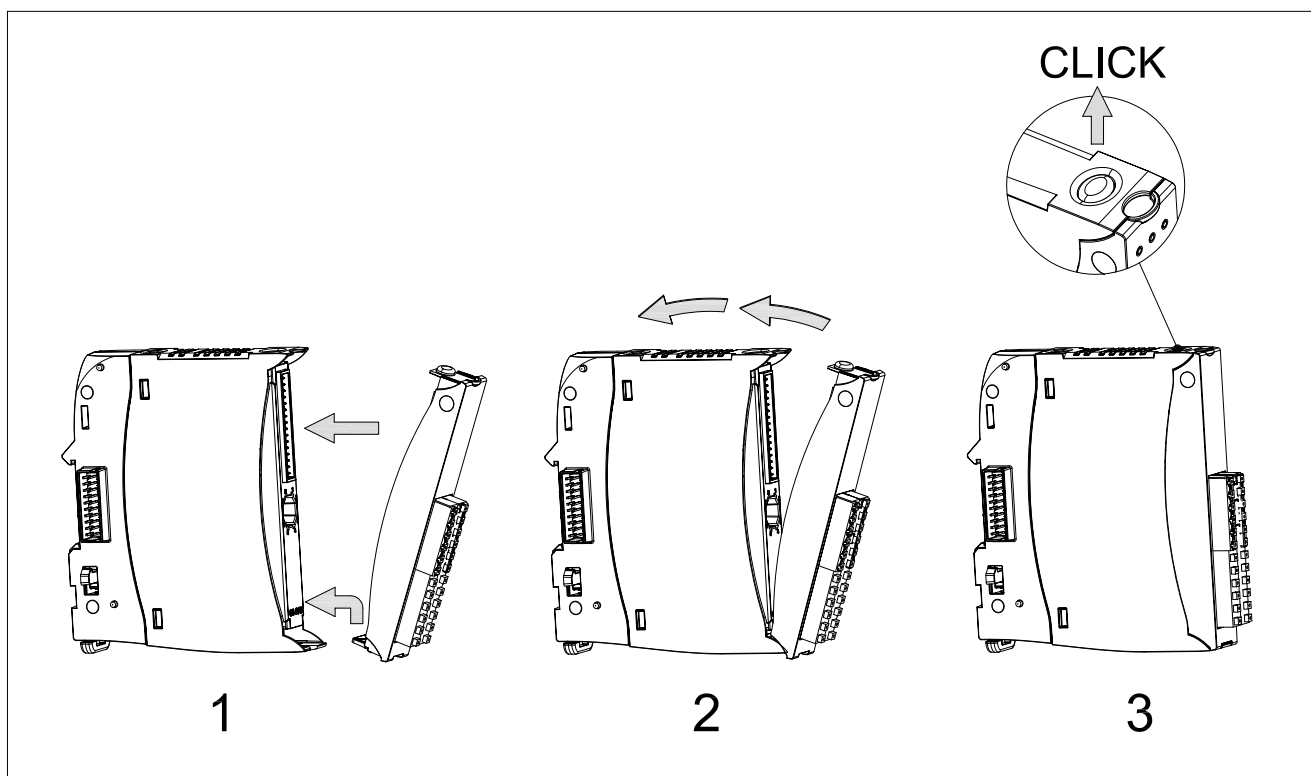


The coupling and uncoupling between the different parts is possible without the use of tools, using only your hands. The movement is constrained in such a way as to be easy and to prevent alignment errors that could compromise the connections.

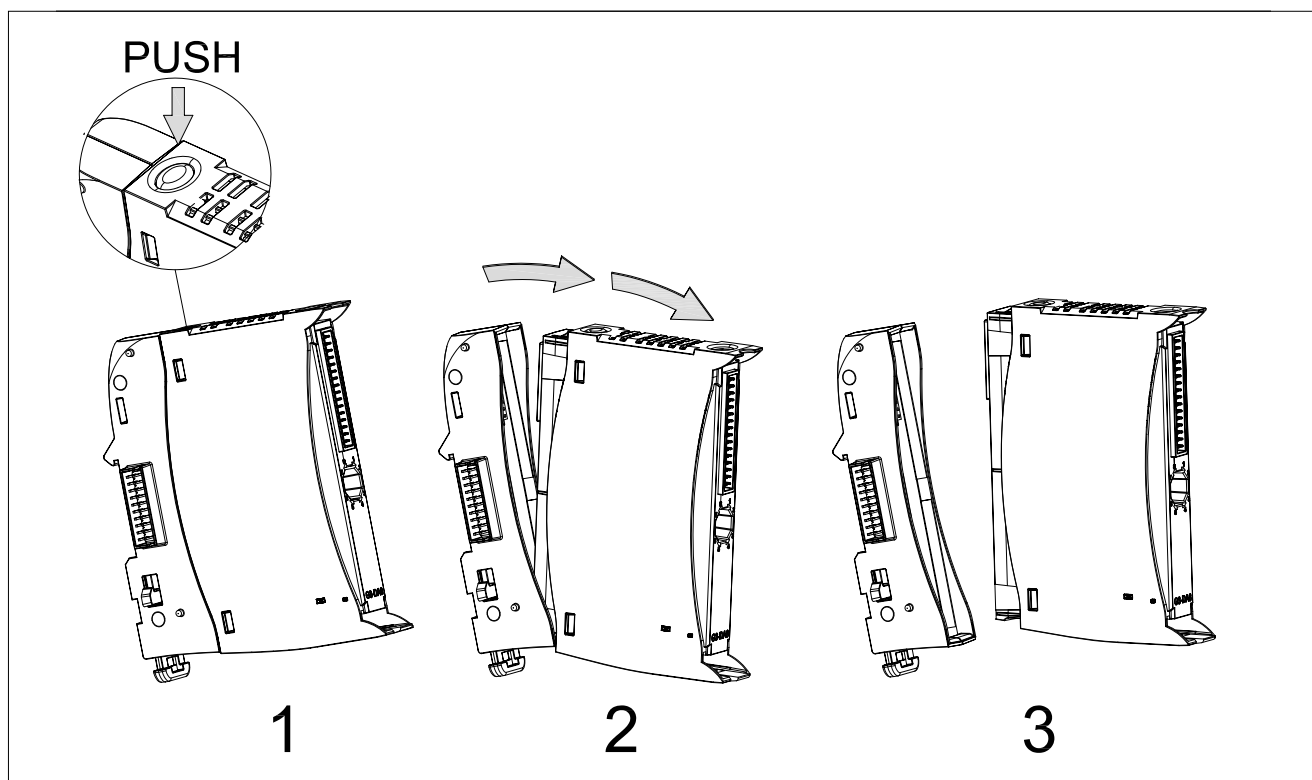
Press the upper button as shown in the figure and pull the board down in the indicated direction to remove the front module.



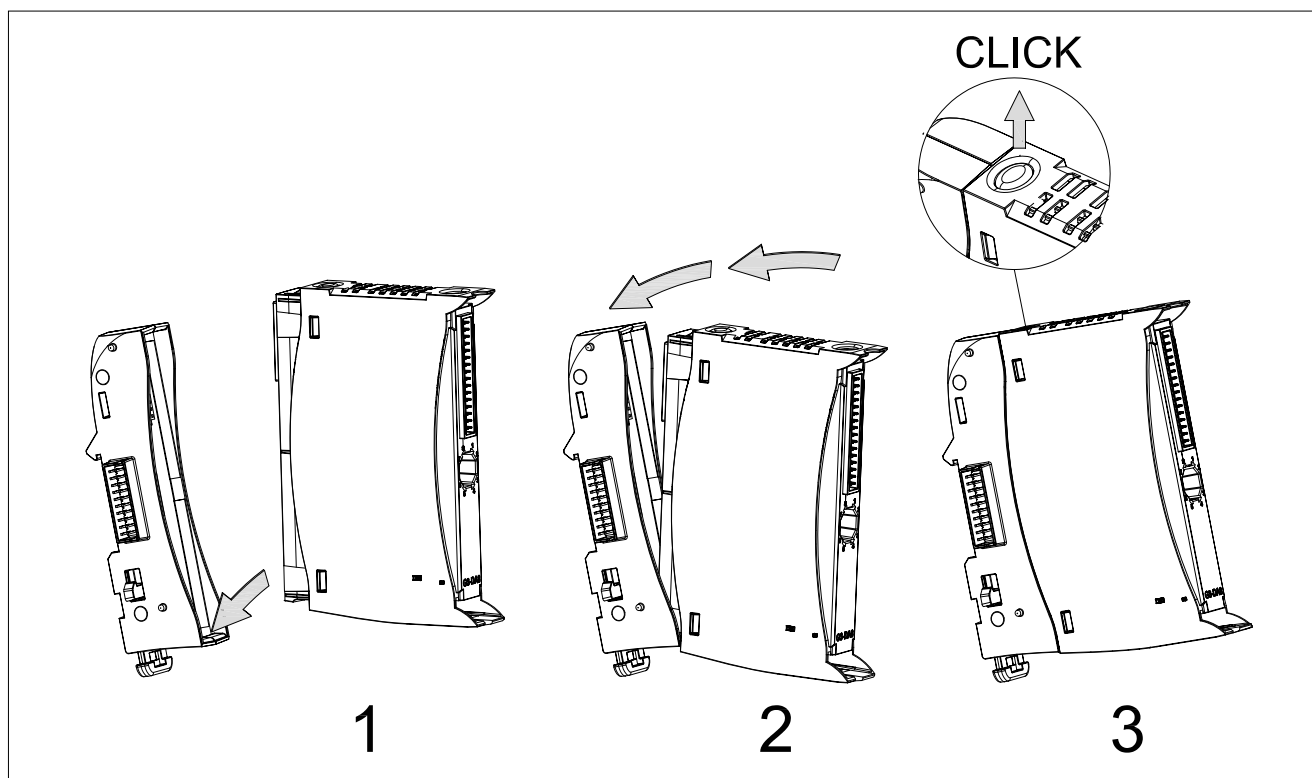
To re-couple the module, first place the lower part inside the constrained housing of the electronic part and then push the front until you feel the upper button couple.



The electronic part can be detached from the base both with the front connected and without. To release the electronic part press the upper button as shown in the figure and pull the board down in the indicated direction.



To re-couple the electronics, first place the bottom part inside the constrained housing of the base and then push the board until you feel the upper button couple.



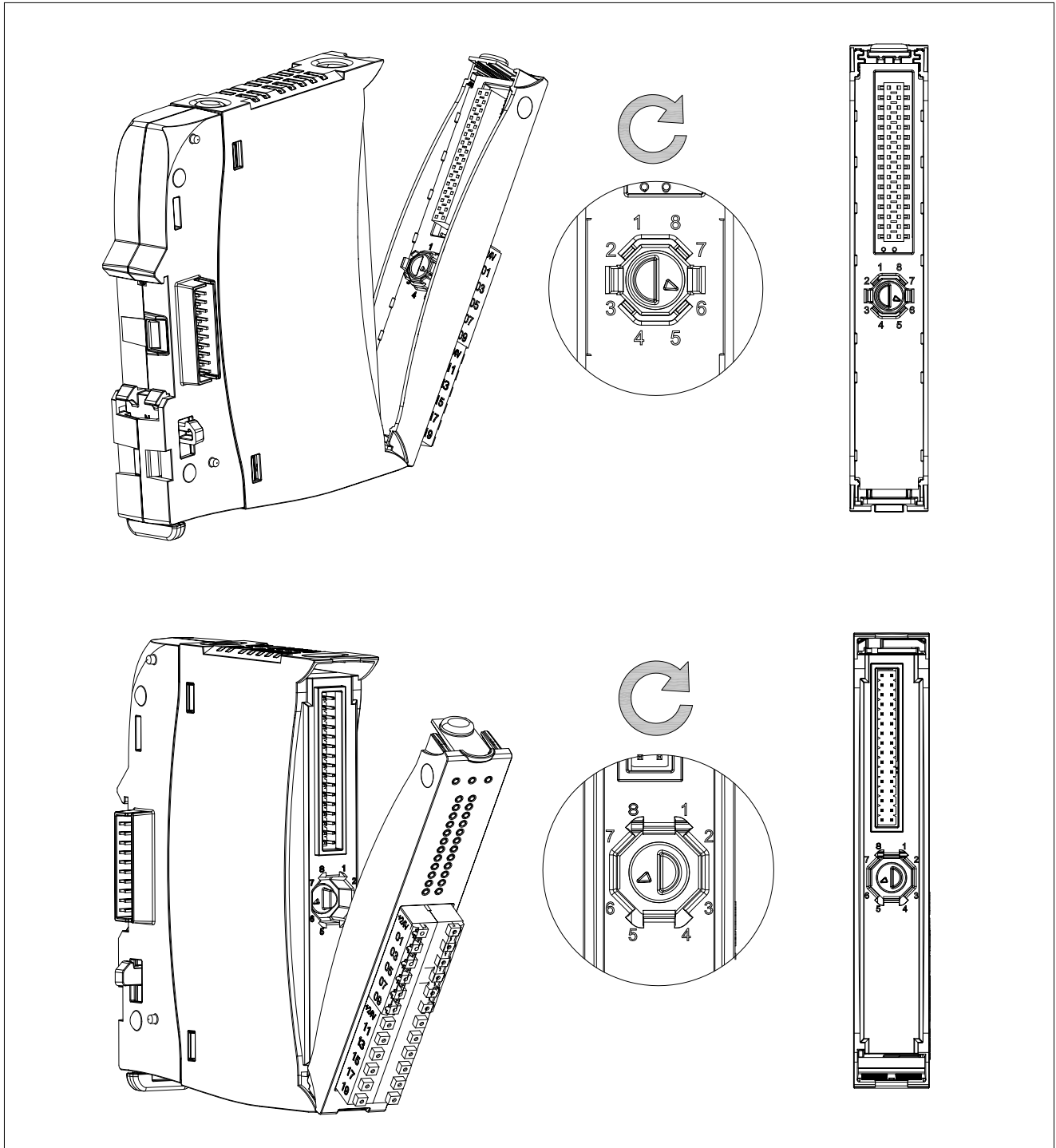
2.3. Front polarisation

A polarisation system is provided that allows you to associate a front to your board to avoid board and front positioning errors.

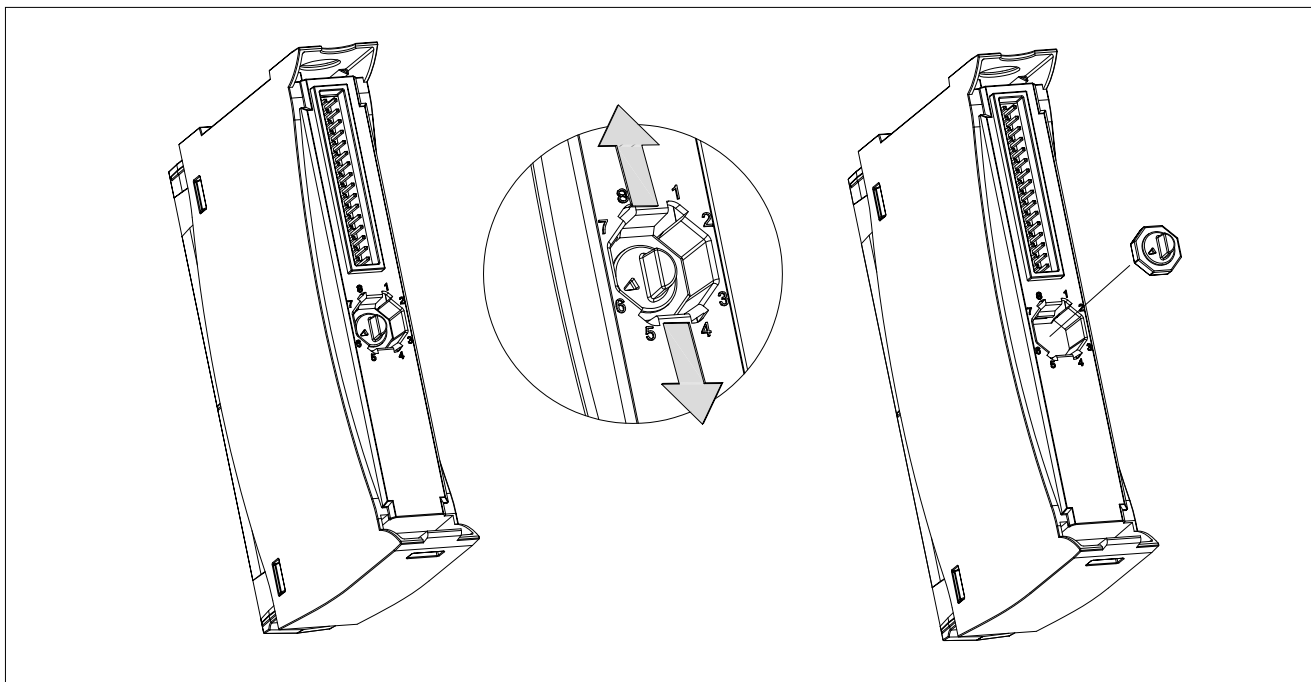
A kit of male-female coupled octagonal-shaped inserts may be provided as an accessory.

The figures on the insert are available in different versions so as to cover a wide range of combinations.

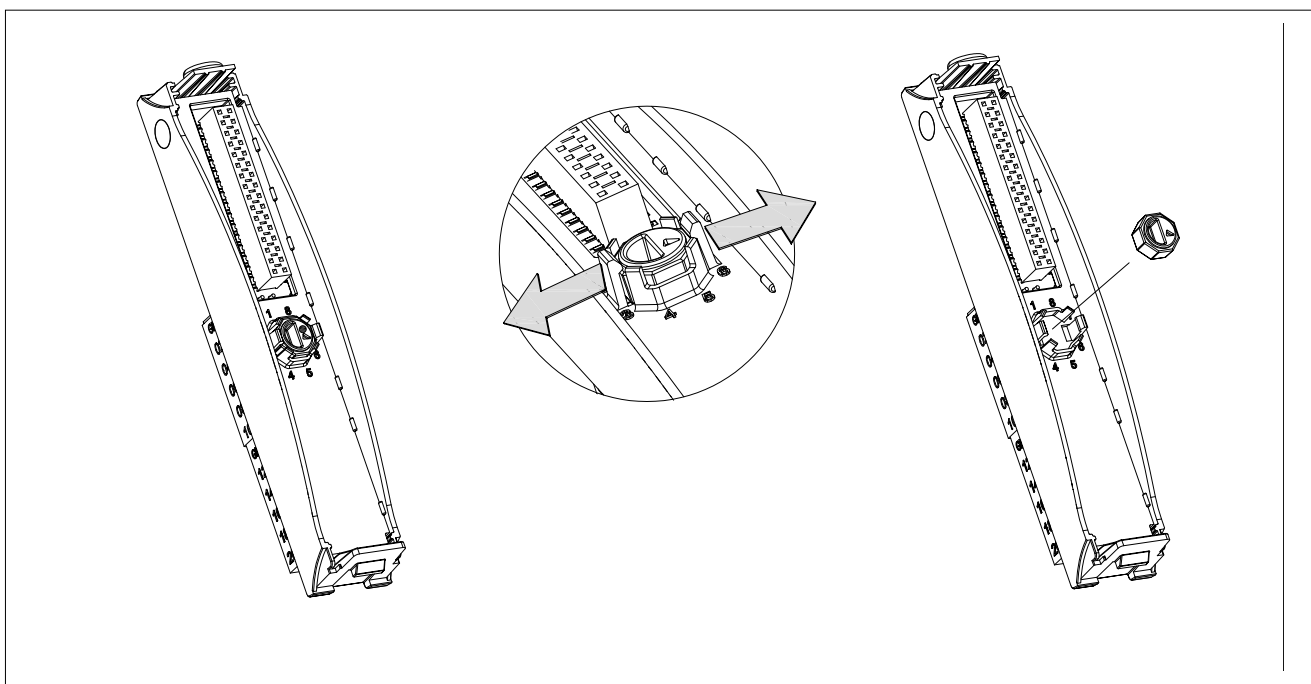
There is a housing for the male insert and one in the front for the female insert in the electronic part.



The insert must be mounted with the aid of tweezers and can be rotated in eight different positions. Proceed as shown in the figure by grasping the insert with tweezers to insert or remove the insert from the electronic board.



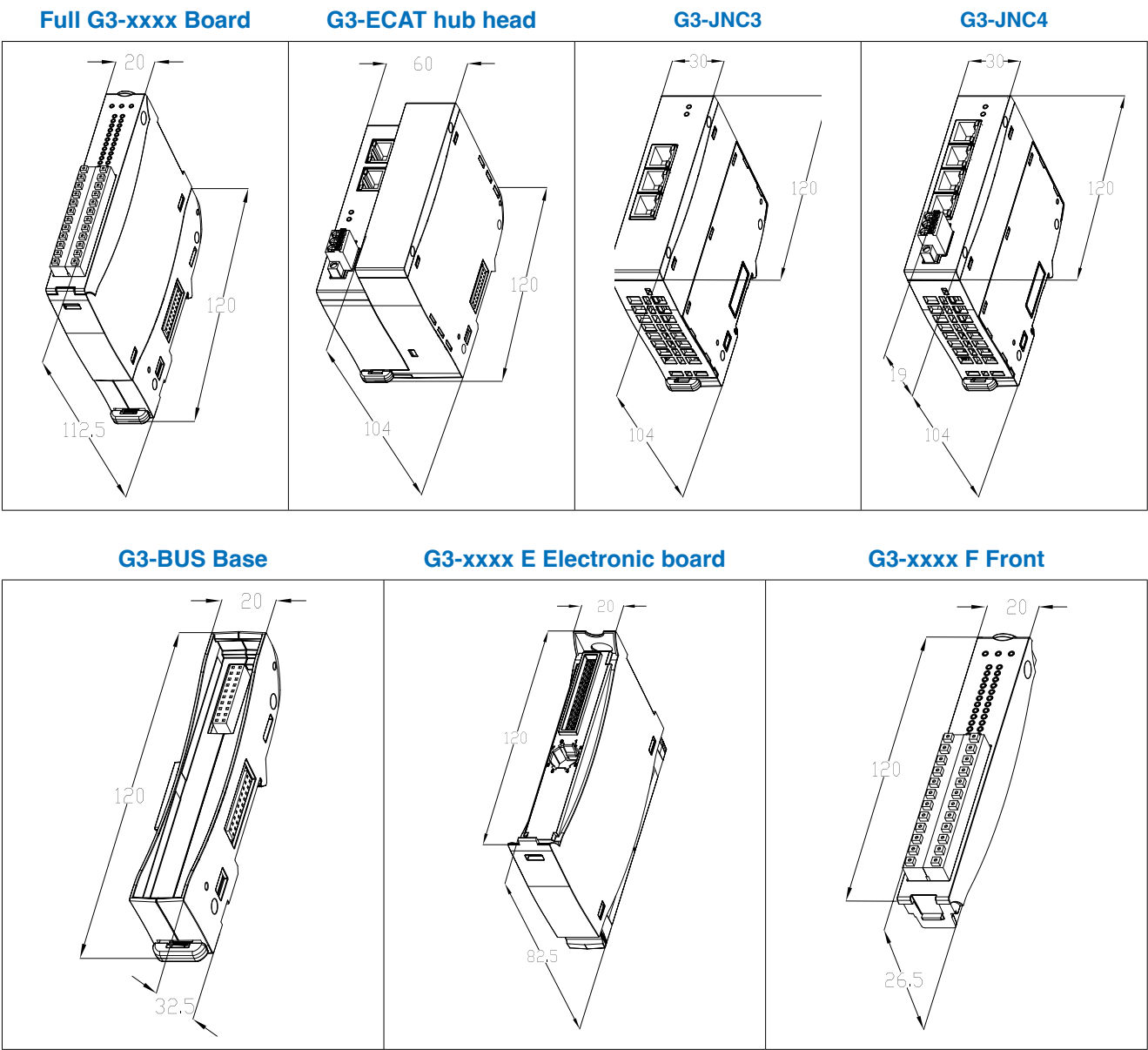
Proceed as shown in the figure by grasping the insert with tweezers to insert or remove the insert from the front module.



Once inserted, the inserts can be extracted and rotated as desired.

2.4. Mechanical dimensions

The mechanical dimensions of the product, without the DIN rail, may be seen in the image below.



2.5. Front connector wiring

The connector can be wired both with the front coupled with the module and with the front detached from the module. The front connector can be placed on a bench to facilitate wiring.

For wiring, both the use of NON terminated flexible electrical wire and flexible electrical wire terminated with a TIP are allowed.

Use unipolar flexible electric wire with maximum section of 1.50 mm² (AWG 16) with 8 - 9 mm strip length.

If a TIP is used, use a model with a section appropriate to the wire used and with a length of 8 - 9 mm.

To connect the wire **without TIP**:

press the button with a screwdriver insert the wire into the seat release the button.

To connect the wire **with TIP**:

push the tip directly into the seat

To disconnect the wire:

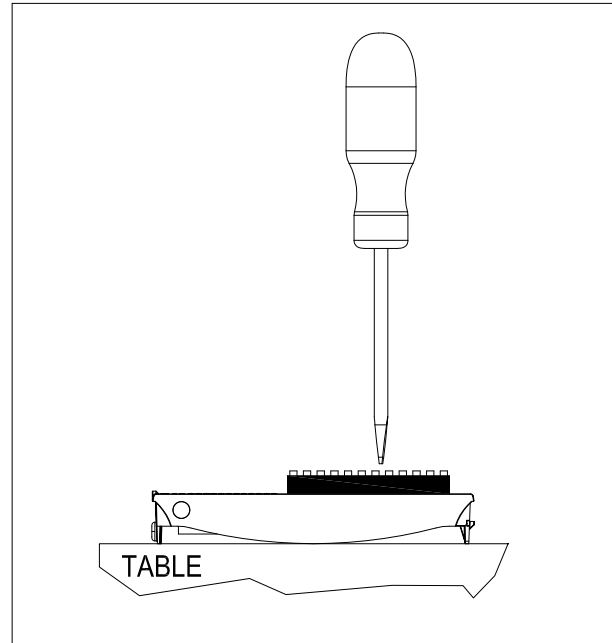
press the button with a screwdriver pull out the wire/tip
release the button

A pressed flexible wire can be used as an alternative to the TIP.



It is recommended NOT TO WELD the electric wire.

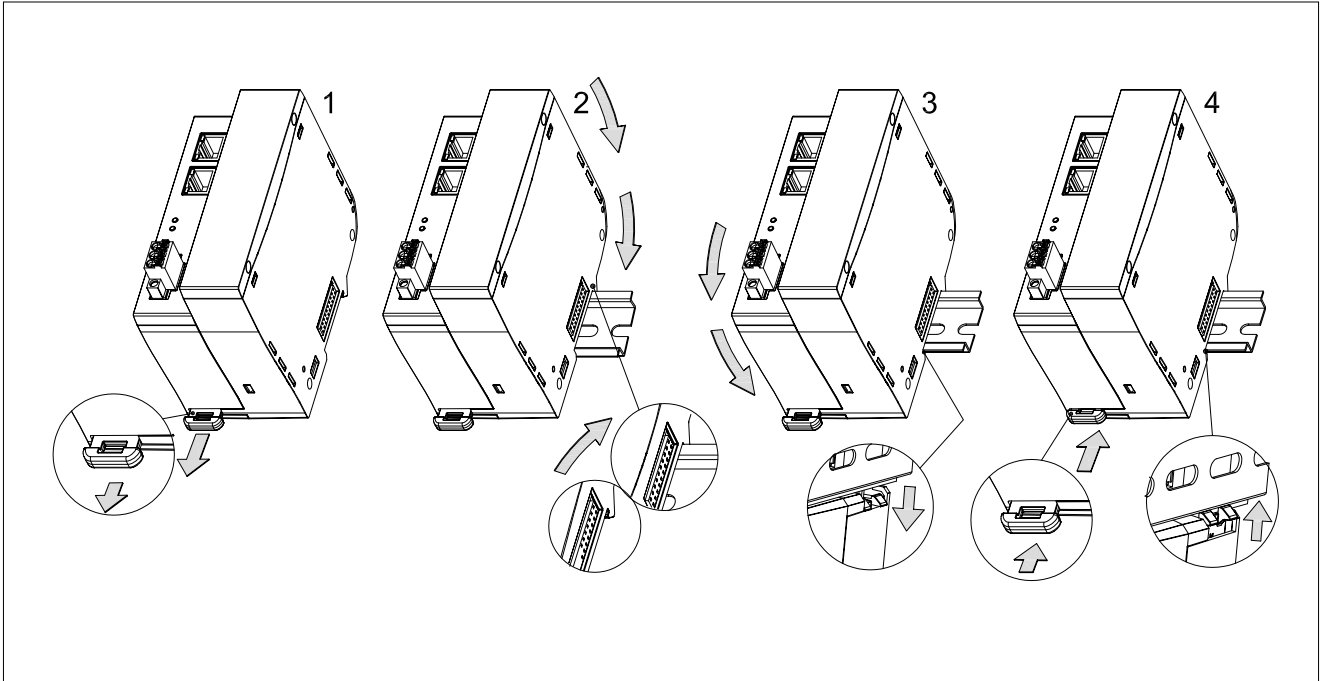
Minimum temperature rating of the cable to be connected to the field wiring terminals, 85 °C



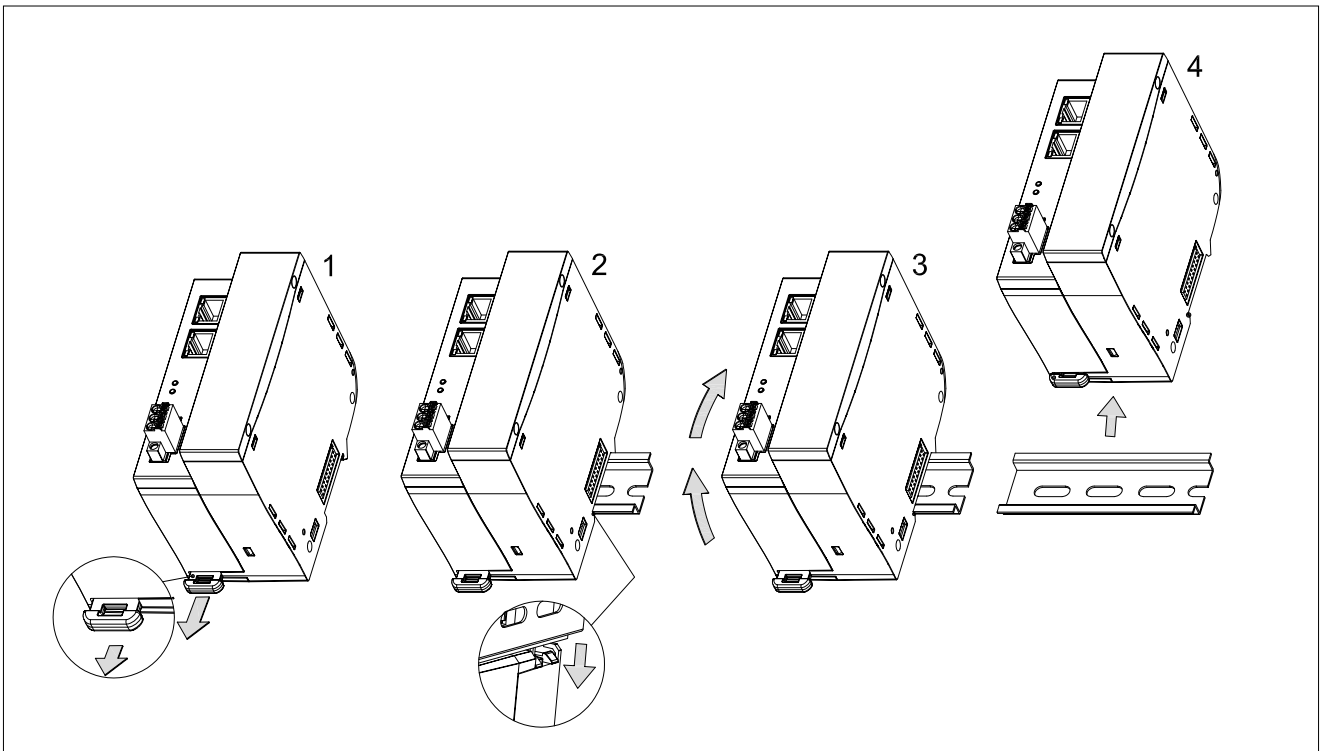
2.6. DIN rail mounting

2.6.1. G3-ECAT

To mount the G3-ECAT to the din bar, unclip the lower clip and leave it in the open stable position. Enter the top of the latch on the rail, rotate the board and place it on the DIN rail. Raise the lower clothespin slightly to free it and allow it to be hooked to the bar even in the lower part.

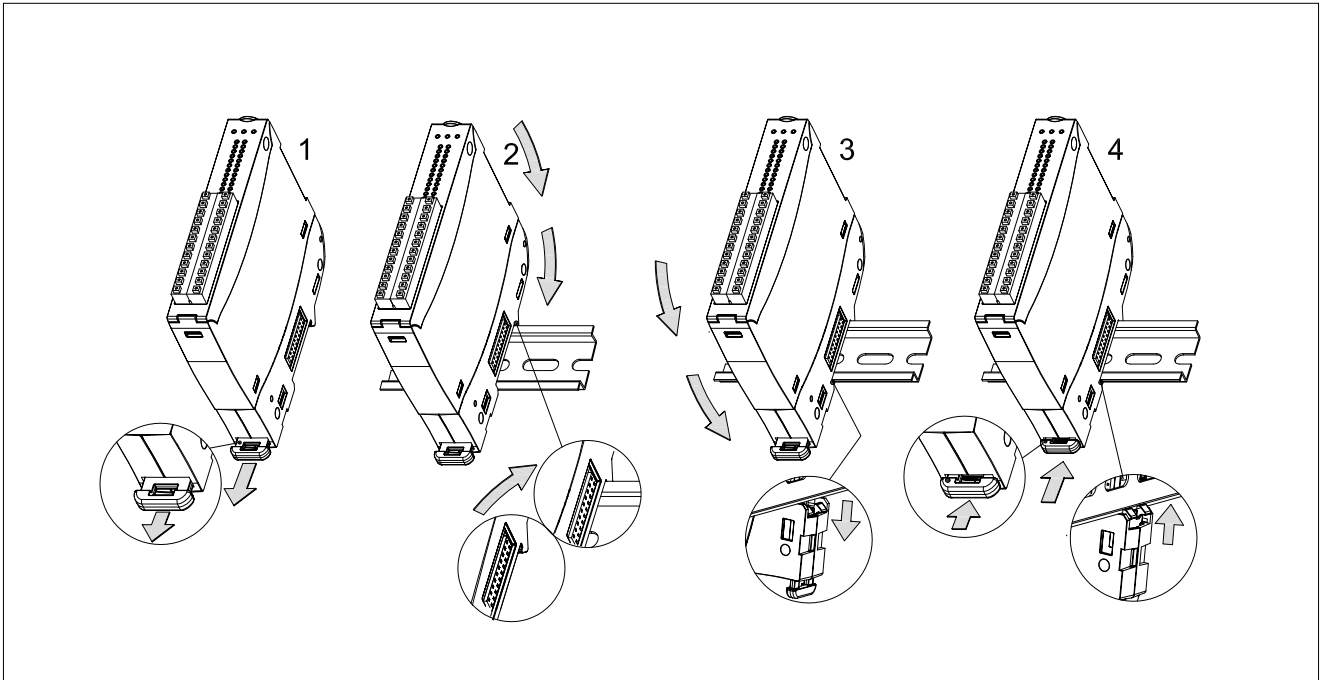


To remove the head the hub from the DIN rail, release the lower clip by slightly levering with a screwdriver and turn the board to release it.

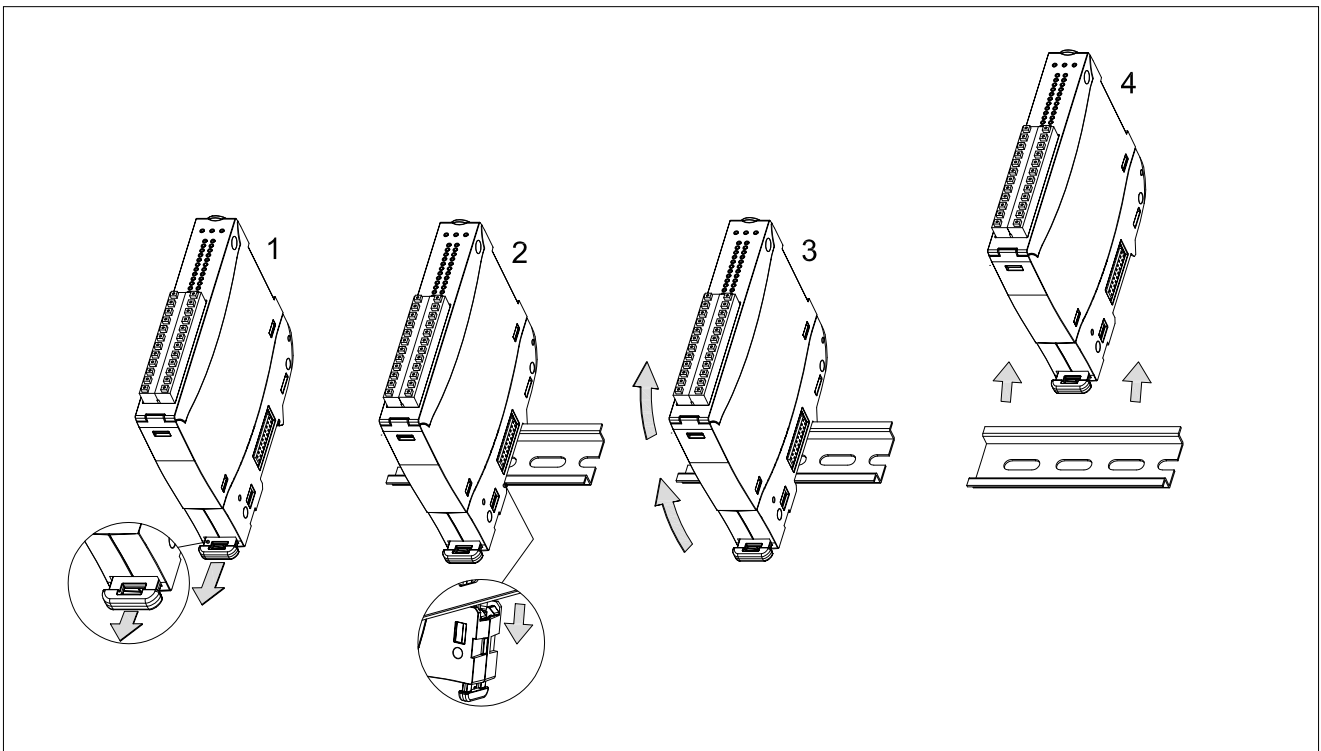


2.6.2. G3-xxxx (all models unless otherwise specified)

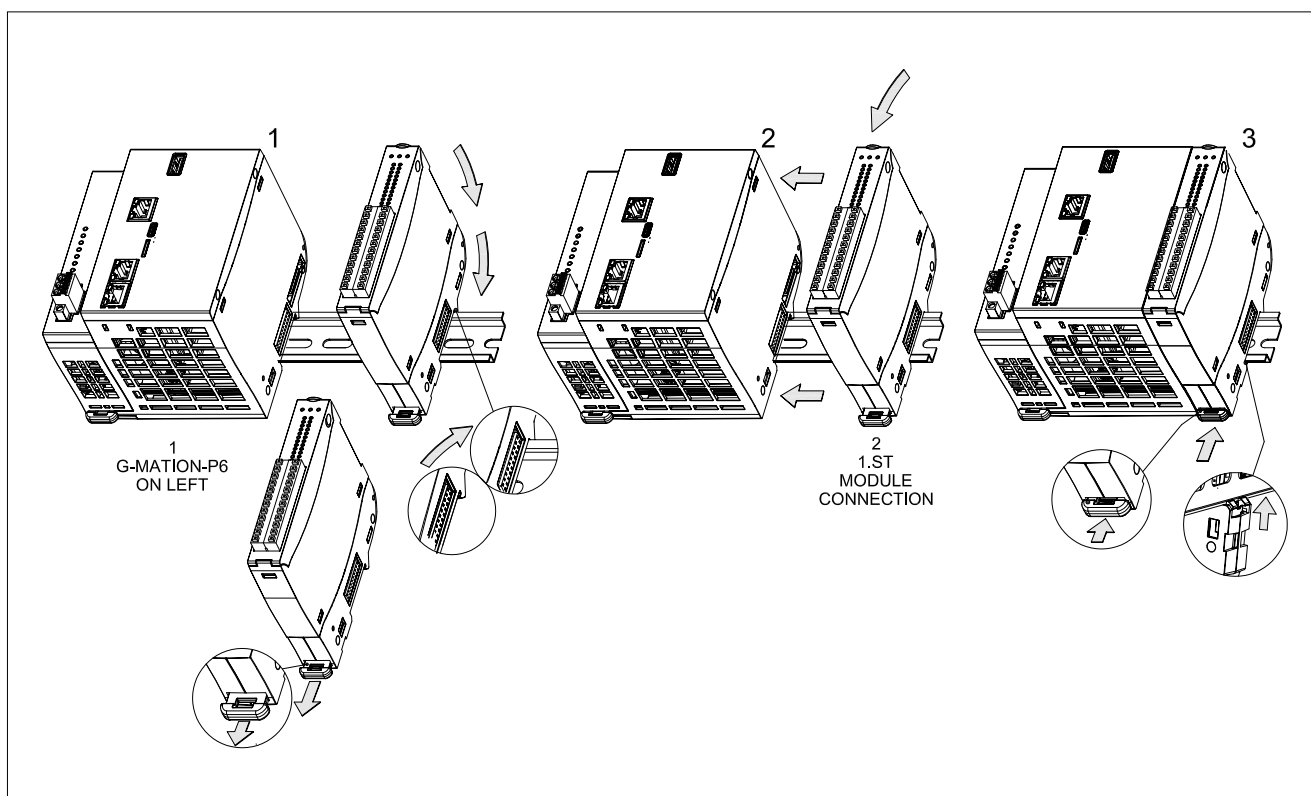
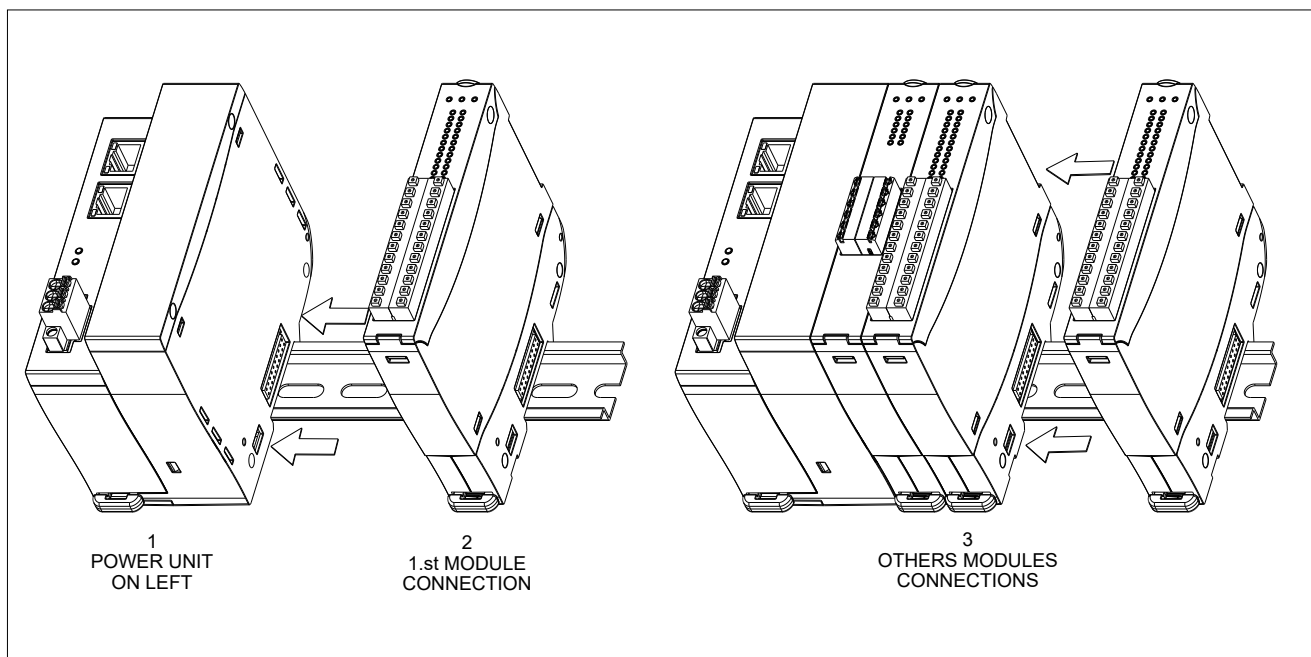
To mount the module to the din rail, unclip the lower clip and leave it in the open stable position. Insert the part top of the hook on the rail, rotate the board and place it on the DIN rail. Raise the lower clothespin slightly to free it and allow it to be hooked to the bar even in the lower part.



Remove the board from the DIN rail, release the lower clip using a screwdriver to lever it slightly, and turn the board to release it.

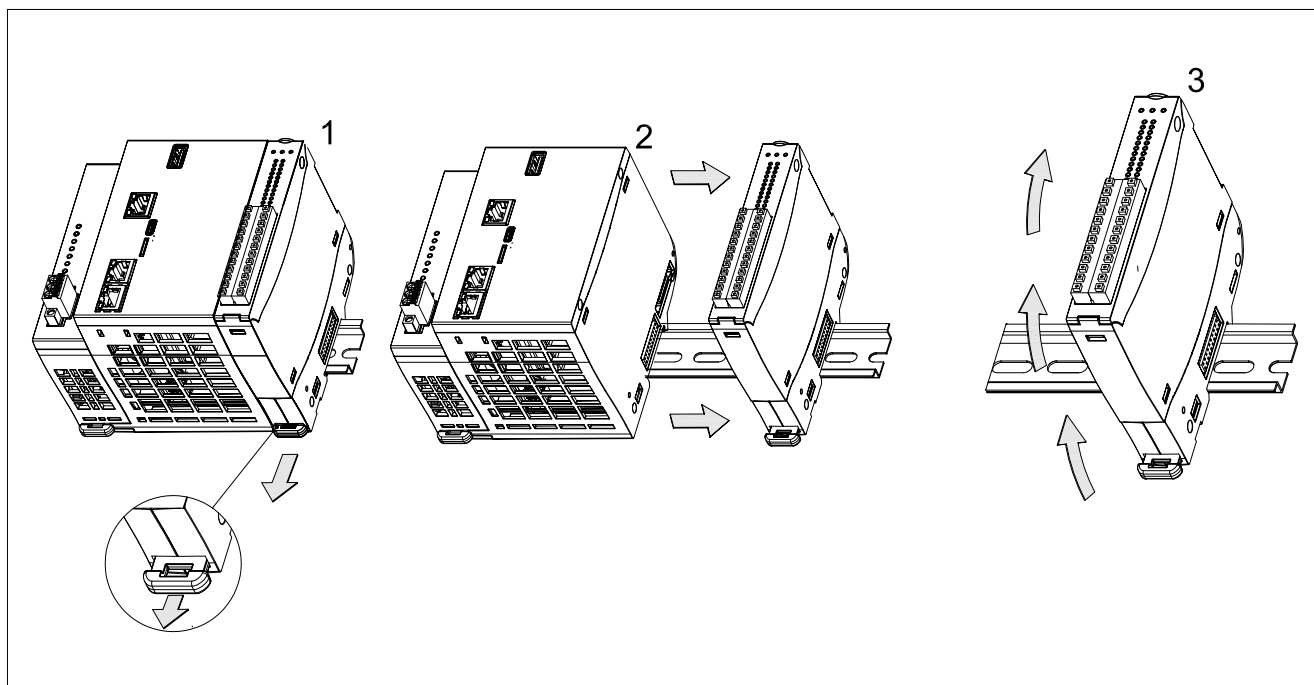
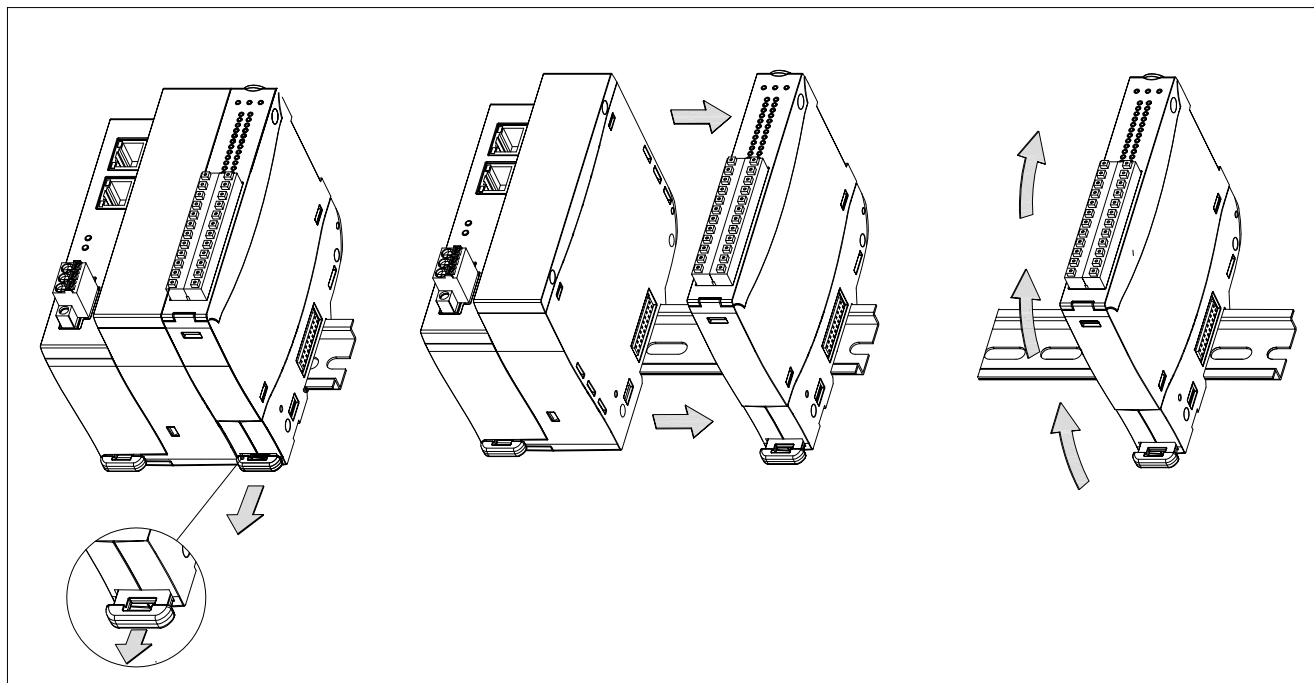


Once the board has been coupled, it is possible to secure the lower clip in the stable released position and slide it longitudinally on the rail until it is coupled to the previous board.



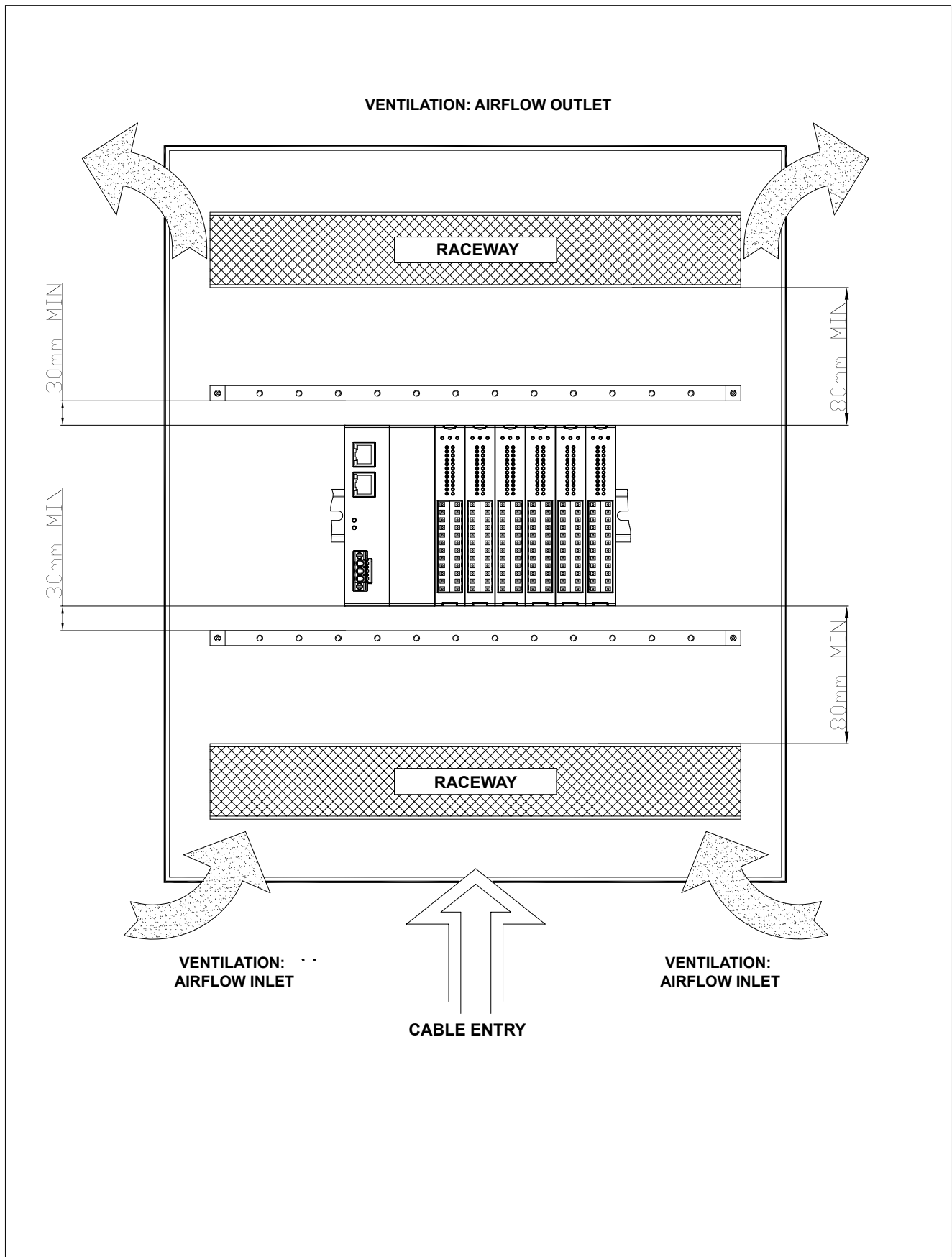
Once coupled, reinsert the lower clip so that the coupling with the DIN rail and the left board is firm and maintained by the force of the internal spring.

To release the board from the rack, use the lower clip and lock it in the stable released position. Slide the board to the right to separate it from the rack. Use the lower clip again and pull it so that you can lift the board from the din r.



2.7. Positioning

For the installation into an electrical cabinet of a G3 I/O rack, the ventilation distances as defined in the figure must be respected underlying.



3. TECHNICAL SPECIFICATIONS

3.1. Board equipment

The **G3-U16** module has 16 optically isolated, current source digital outputs at 24 VDC $\pm$ 25%, 2A max directly power loads in VDC within the limits of rated currents, or control loads of any kind via solid state relay, contactors. G3-U16 can be connected with all the G-Mation gateways and Px modules from which it receives power supply.

The outputs are divided into 4 groups of 4 outputs, with maximum current of 6A per group.

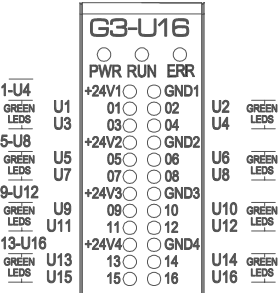
Each output is protected against short-circuit, overload and overheating.

There is an Internal demagnetization circuit for inductive loads.



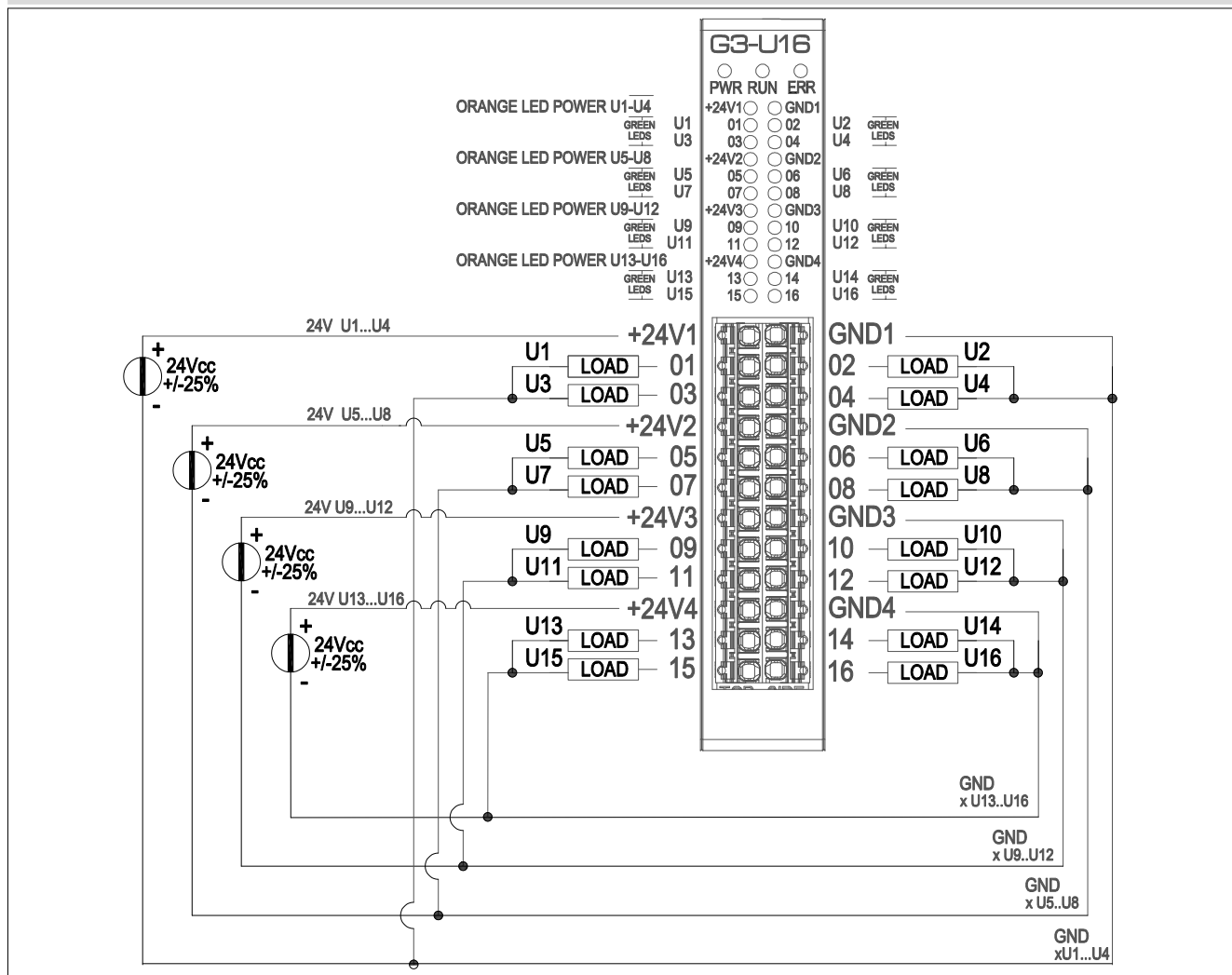
TECHNICAL DATA	
Outputs	x16 optically isolated digital outputs 24VDC $\pm$ 25%
Organization	4 isolated groups: group 1: OUT 01.....OUT 04 group 2: OUT 05.... OUT 08 group 3: OUT 09.... OUT 12 group 4: OUT 13.... OUT 16
Maximum current per channel	2A
Maximum current for group	6A
Maximum current for module	14A
Current protection for single output	> 2,2A
Current protection for each group	> 6,6A
Transition time	from 0 to 1: 15us from 1 to 0: 38us
Outputs switching frequency	250Hz
Power supply	From G3-ECAT or Px CPU for control electronics, +24V ($\pm$ 25%) for Field Signals
Overvoltage category	II
Power dissipation	1 W $\pm$ 5%
MECHANICAL DATA	
Dimensions	120x110x60 mm
Weight	150 g
Protection level	IP20 For UL: not UL evaluated. Open type device
Connectors	Front 24 pin-5.08 mm pitch removable connection system with spring wire retention, no tool required to fi x or remove wires and module
Attachment	mechanically snaps onto DIN rail
ENVIRONMENTAL CONDITIONS	
Working temperature	-10...55°C
Storage temperature	-25...70°C
Humidity	max. 90% Rh not condensing
Pollution degree	2
Maximum altitude	2000 m

3.2. Meaning of LEDs

	ACRONYM	COLOR	LED STATUS	MEANING
MODULE DIAGNOSTICS 	PWR	GREEN	OFF	no power supply
			ON	power supply present
	RUN	GREEN	OFF	INIT or BOOT status
			Blinking: 2.5 Hz (Slow blinking)	PRE-OPERATIONAL status
			Single Flash: on 200 ms off 1000 ms (Single Flash)	SAFEOP status
			Flickering: 10 Hz (Fast flickering)	BOOT status
			ON	OPERATIONAL status
	ERR	RED	OFF	no error
			Blinking (Slow blinking)	configuration error
			Single Flash:	generic runtime error
			Double Flash	wdog on cyclic data
			Flickering (Fast flickering)	error during the BOOTING phase
			ON	Slave specific error (ref. par. 3.5)
IOs DIAGNOSTICS: 16 digital outputs 	+24Vn(1...4)	GREEN	OFF	Power supply ABSENT
			ON	Power supply PRESENT
	nn (01..16)	GREEN	OFF	output not active = 0 logic
			ON	active output = 1 logic

If communication with the master is active, more information can be obtained from the objects in the module itself.

3.3. Connections



3.3.1. Front connections

Use unipolar flexible electric wire with a section of 0.75 .. 1.50 mm² and 8 .. 9 mm strip length to wire DIGITAL OUTPUTS.

For wiring modes see paragraph “2.5. Front connector wiring” a pagina 12 of this manual.

3.4. Resource software management

G3-U16 module resources are available through the objects described below, which are provided by the EtherCAT protocol according to directive ETG 5001.

All objects are made available to the master through the ESI file calle:
Gefran G3-U16 Vxx where xx is the version.

The file is available on the Gefran WEBSITE (www.gefran.com).

3.4.1. Module Objects

INDEX	SUB.	NAME	MAP	TYPE	ACCESS	DEFAULT / NOTE	
0x1000	0	Device type	No	UDINT	RO	0x0001389	5001
0x1001	0	Error Register	No	USINT	RO	0x00	
0x1008	0	Device Name	No	STRING	RO	G3-U16	
0x1009	0	Manufacturer Hardware version	No	STRING	RW	1.0	
0x100A	0	Manufacturer Software version	No	STRING	RO	1.0.0	
0x1018	0	Objects number	No	USINT	RO	4	
	1	Vendor Id	No	UDINT	RO	0x0000 0093 (Gefran)	
	2	Product Code	No	UDINT	RO	0x00000BBD (3005)	
	3	Revision Number	No	UDINT	RO	0x0000 0001	
	4	Serial Number	No	UDINT	RW	0x0000 0000 product serial number	

3.4.2. IOs managements

INDEX	SUB INDEX	NAME	PDO MAP	TYPE	ACCESS	Default / Note
0x7003	0	Objects number	No	USINT	RO	21
	1	Digital Output Value 1	Yes	BOOL	R,W OP	FALSE
	2	Digital Output Value 2	Yes	BOOL	R,W OP	FALSE
	3	Digital Output Value 3	Yes	BOOL	R,W OP	FALSE
	4	Digital Output Value 4	Yes	BOOL	R,W OP	FALSE
	5	Digital Output Value 5	Yes	BOOL	R,W OP	FALSE
	6	Digital Output Value 6	Yes	BOOL	R,W OP	FALSE
	7	Digital Output Value 7	Yes	BOOL	R,W OP	FALSE
	8	Digital Output Value 8	Yes	BOOL	R,W OP	FALSE
	9	Digital Output Value 9	Yes	BOOL	R,W OP	FALSE
	10	Digital Output Value 10	Yes	BOOL	R,W OP	FALSE
	11	Digital Output Value 11	Yes	BOOL	R,W OP	FALSE
	12	Digital Output Value 12	Yes	BOOL	R,W OP	FALSE
	13	Digital Output Value 13	Yes	BOOL	R,W OP	FALSE
	14	Digital Output Value 14	Yes	BOOL	R,W OP	FALSE
	15	Digital Output Value 15	Yes	BOOL	R,W OP	FALSE
	16	Digital Output Value 16	Yes	BOOL	R,W OP	FALSE

The logical status of outputs 1..16 is available in the object in sub-indexes 1..16

BOOL Output Type:

false: output NOT active

true: ON output

3.4.3. IOs Configuration objects

Output Status in Alarm Condition

INDEX	SUB INDEX	NAME	PDO MAP	TYPE	ACCESS	DEFAULT / NOTE
0xA001	0	Objects number	No	USINT	RO	17
	1	OutputErrorValue 1	No	BOOL	RW	FALSE
	2	OutputErrorValue 2	No	BOOL	RW	FALSE
	3	OutputErrorValue 3	No	BOOL	RW	FALSE
	4	OutputErrorValue 4	No	BOOL	RW	FALSE
	5	OutputErrorValue 5	No	BOOL	RW	FALSE
	6	OutputErrorValue 6	No	BOOL	RW	FALSE
	7	OutputErrorValue 7	No	BOOL	RW	FALSE
	8	OutputErrorValue 8	No	BOOL	RW	FALSE
	9	OutputErrorValue 9	No	BOOL	RW	FALSE
	10	OutputErrorValue 10	No	BOOL	RW	FALSE
	11	OutputErrorValue 11	No	BOOL	RW	FALSE
	12	OutputErrorValue 12	No	BOOL	RW	FALSE
	13	OutputErrorValue 13	No	BOOL	RW	FALSE
	14	OutputErrorValue 14	No	BOOL	RW	FALSE
	15	OutputErrorValue 15	No	BOOL	RW	FALSE
	16	OutputErrorValue 16	No	BOOL	RW	FALSE

Digital output behavior in case of overload / short circuit

false: the alarm output is set to '0'

true: the i-th alarm output is set to the value specified in the i-th subindex of object 0xA001

INDEX	SUB INDEX	NAME	PDO MAP	TYPE	ACCESS	DEFAULT / NOTE
0xA002	0	Objects number	No	USINT	RO	17
	1	OutputStatus Behaviour 1	No	BOOL	RW	FALSE
	2	Output Status Behaviour 2	No	BOOL	RW	FALSE
	3	Output Status Behaviour 3	No	BOOL	RW	FALSE
	4	Output Status Behaviour 4	No	BOOL	RW	FALSE
	5	Output Status Behaviour 5	No	BOOL	RW	FALSE
	6	Output Status Behaviour 6	No	BOOL	RW	FALSE
	7	Output Status Behaviour 7	No	BOOL	RW	FALSE
	8	Output Status Behaviour 8	No	BOOL	RW	FALSE
	9	Output Status Behaviour 9	No	BOOL	RW	FALSE
	10	Output Status Behaviour 10	No	BOOL	RW	FALSE
	11	Output Status Behaviour 11	No	BOOL	RW	FALSE
	12	Output Status Behaviour 12	No	BOOL	RW	FALSE
	13	Output Status Behaviour 13	No	BOOL	RW	FALSE
	14	Output Status Behaviour 14	No	BOOL	RW	FALSE
	15	Output Status Behaviour 15	No	BOOL	RW	FALSE
	16	Output Status Behaviour 16	No	BOOL	RW	FALSE

Defines the state that output n should assume in the alarm condition, if the bit "Output Status Behaviour Enable Value x" is ON".

BOOL Output Type:

false: output maintain its value

true: ON output forced

3.4.4. Control objects

INDEX	SUB.	STORE	NAME	PDO MAP	TYPE	ACCESS	DEFAULT / NOTE
0x9000	0	No	Device Code	No	UINT	RO	0x0BBC
0x9001	0	No	Hardware Version	No	UINT	RW	0x00
0x9002	0	No	Firmware Revision	No	UINT	RO	0x0132
0x9003	0	No	Serial Number	No	UDINT	RW	0x00000000
0x9004	0	No	Order Code	No	STRING(7)	RO	F099391

3.5. Alarm Management

3.5.1. Alarm Status

INDEX	SUB.	NAME	PDO MAP	TYPE	ACCESS	DEFAULT / NOTE
0xA000	0	Alarm Status	Si	UINT	RO	0x00000000

This object contains the bit mapping of the output alarms.

BIT (15 downto 0): Each bit represents the alarm status of an output (Bit 0 □ Output 1 ... Bit 15 □ Output 16).

BIT 16: Group 1 output alarm

BIT 17: Group 2 output alarm

BIT 18: Group 3 output alarm

BIT 19: Group 4 output alarm

3.5.2. Short Circuit Acknowledge

INDEX	SUB.	NAME	PDO MAP	TYPE	ACCESS	DEFAULT / NOTE
0xA003	0	Short Circuit Acknowledge	Si	UINT	WO	0x00000000

This object contains the bit mapping of the output alarm ACKs (Acknowledges).

BIT (15 downto 0): Each bit represents the alarm status of an output (Bit 0 □ Output 1 ... Bit 15 □ Output 16).

BIT 16: Group 1 output alarm

BIT 17: Group 2 output alarm

BIT 18: Group 3 output alarm

BIT 19: Group 4 output alarm

3.5.3. Emergency message

The Emergency message is encoded as follows (ref. ETG.1000.6)

ERROR_CODE	ERROR_REGISTER	DATA_0	DATA_1	DATA_2	SPARE_0	SPARE_1
3300	04	00	00	02	00	00

Example:

3300,04,00,00,02,00,00

Error code : 0x3300 (Short circuit output tension)

Error register : 04 (Bit2 voltage error)

Data [0] :00

Bit0 sc1 status OFF

Bit1 sc2 status OFF

Bit2 sc3 status OFF

Bit3 sc4 status OFF

Data [1] :00

Bit0 out 9 status OFF

Bit1 out 10 status OFF

Bit2 out 11 status OFF

Bit3 out 12 status OFF

Bit4 out 13 status OFF

Bit5 out 14 status OFF

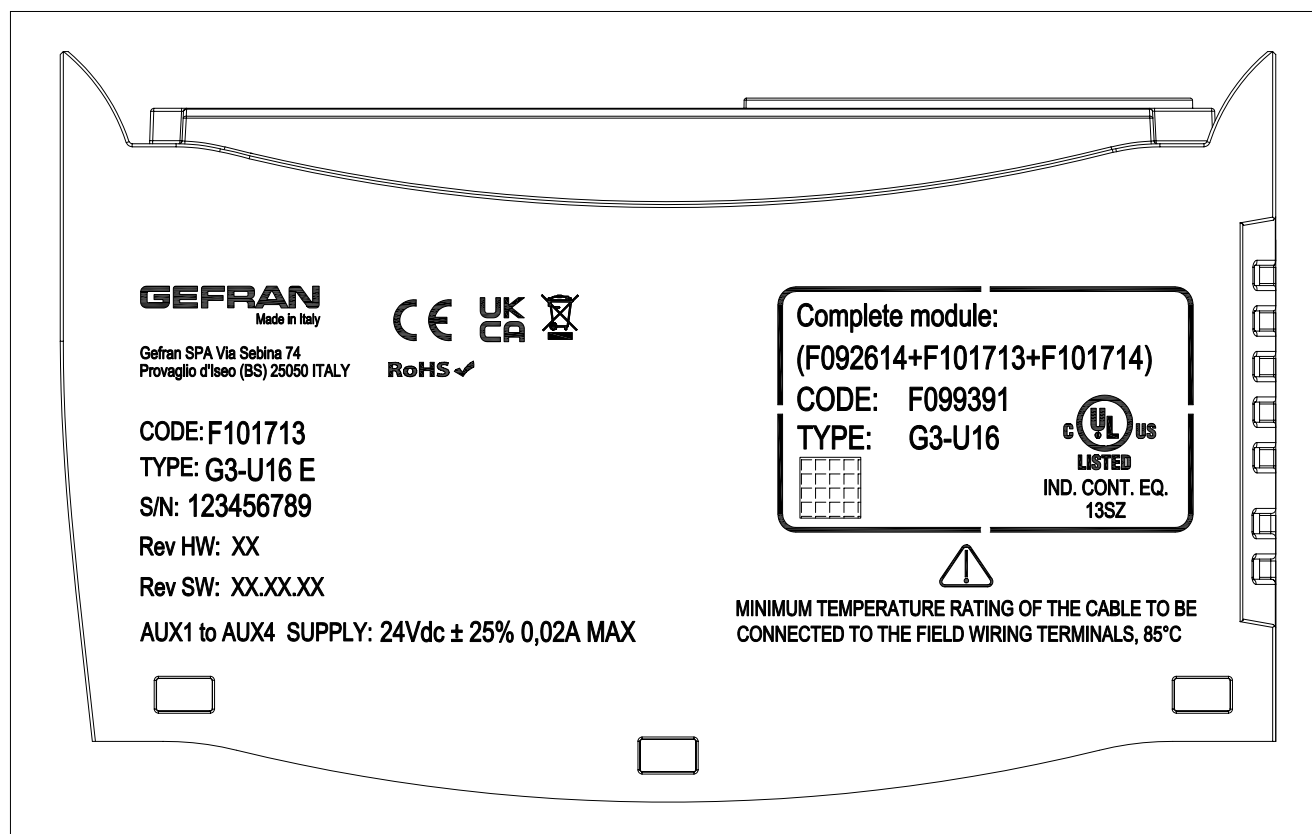
Bit6 out 15 status OFF
Bit7 out 16 status OFF
Data [2] :02
Bit0 out 1 status OFF
Bit1 out 2 status ON
Bit2 out 3 status OFF
Bit3 out 4 status OFF
Bit4 out 5 status OFF
Bit5 out 6 status OFF
Bit6 out 7 status OFF
Bit7 out 8 status OFF

4. ACRONYM AND ORDER CODE

COMPLETE MODULE	G3-U16	F099391
Front	G3-U16 F	F101714
Electronic module	G3-U16 E	F101713
Bus	G3-BUS	F092614

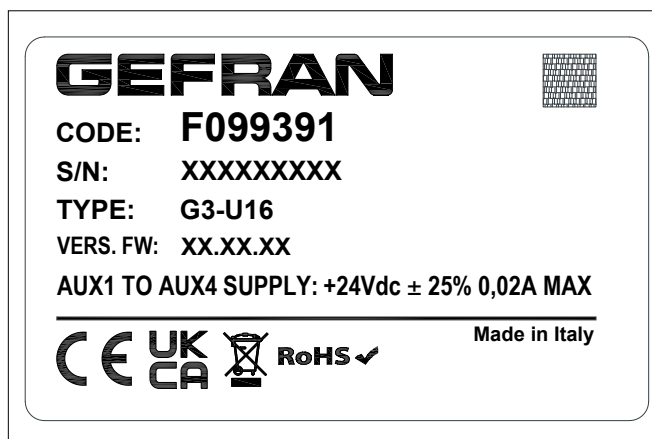
5. MARKING

Every module contain the datas of every module part and the full module.



The following information may be found on the label:

- CODE: product code
- S/N: product serial number
- TYPE: product name / description
- HW: hardware version 1 .. 99
- GEFHRAN logo
- certifications
- logo specifying product disposal



This symbol present on the product label stands for further indications on product manual. For correct and sale installation, follow the instructions and observe the warnings contained in this manual. No hazards shall arise by any reasonably foreseeable misuse in a way not intended, and not described in this manual. The complete manual is available for download from the website www.gefran.com. UL file number E-198546.

Certifications

	This device conforms to European Union Directive 2014/30/EU and 2014/35/EU as amended with reference to generic standards: EN 61000-6-2 (immunity in industrial environment) EN 61000-6-4 (emission in industrial environment) - EN 61010-1 (safety regulations).
	cULus listed, Conformity UL61010-1 - File: E198546

6. DISPOSAL



The product must be disposed of in accordance with the regulations in force.

Some of the components used in the devices can cause damage to the environment if incorrectly disposed.

Pursuant to art. 26 of Legislative Decree 14 March 2014, no. 49 "Implementation of Directive 2012/19/EU on waste from electrical and electronic equipment (WEEE)".

The symbol showing a crossed-out wheeled bin on equipment or its packaging indicates that the product must be collected separately from other waste at the end of its useful life.

By collecting the disused equipment separately, it can be recycled, treated or disposed of in an environmentally friendly manner, thus helping to prevent the environment and public health from being affected negatively and enabling reuse and/or recycling of the materials forming the equipment.

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