

G3-C2

G-Mation G3 – 2 Encoder Inputs

USE AND INSTALLATION MANUAL

G3 C2 code F092711

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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[®]

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

2. G-MATION G3 PLATFORM

2.1. System



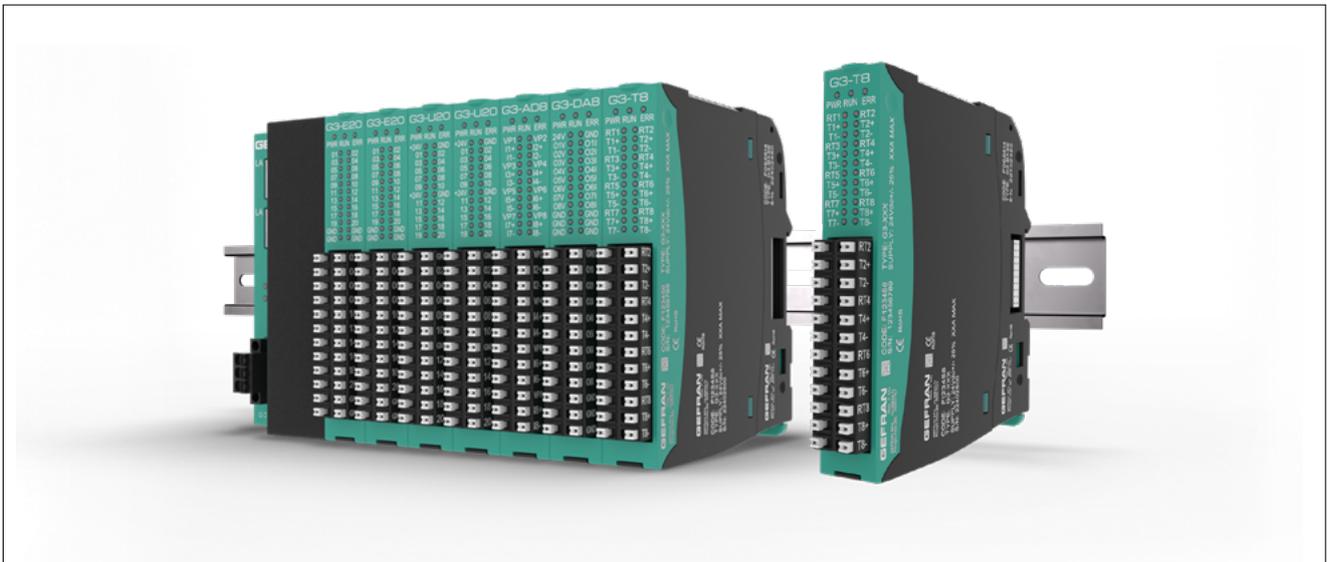
G-Motion G3 is a modular IO system based on EtherCAT technology. EtherCAT provides a maximum of 65535 addressable modules.

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.

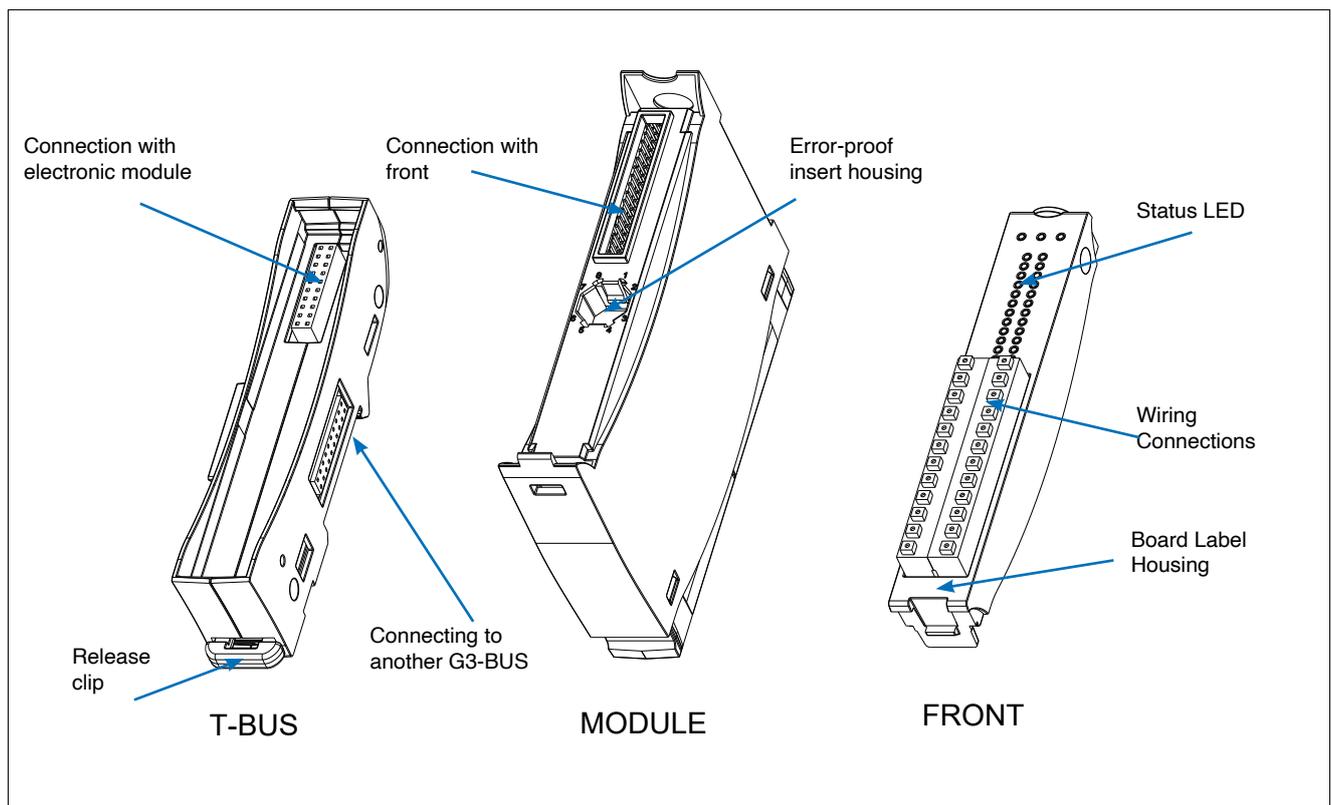
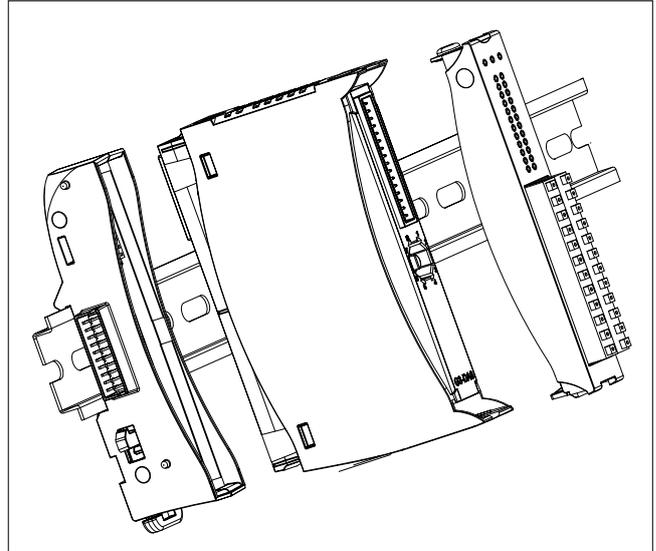
The boards are designed for coupling on a 35 mm DIN rail and the lateral coupling with the rack takes place by sliding to the left (refer to paragraph “2.6. DIN rail mounting” on page 13).



2.2. Board modularity

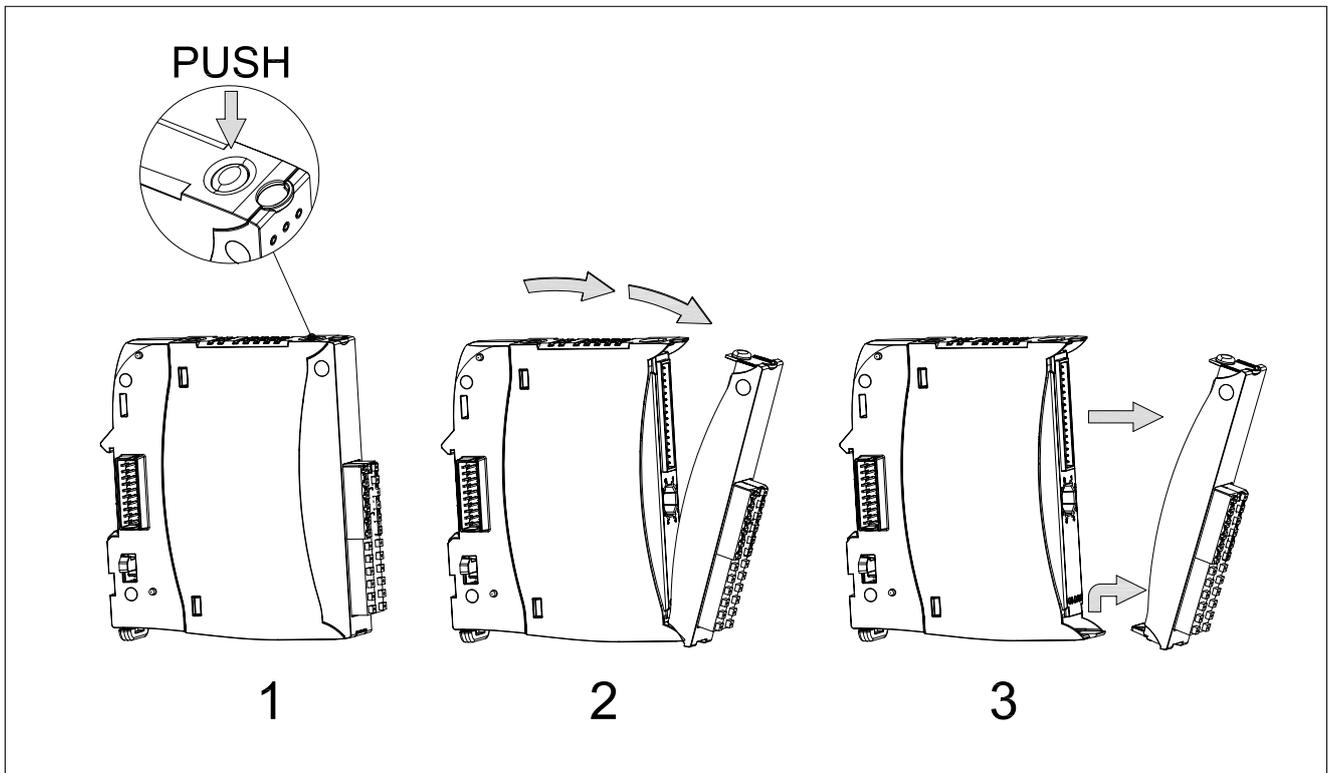
Each I/O board consists of three parts:

- **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

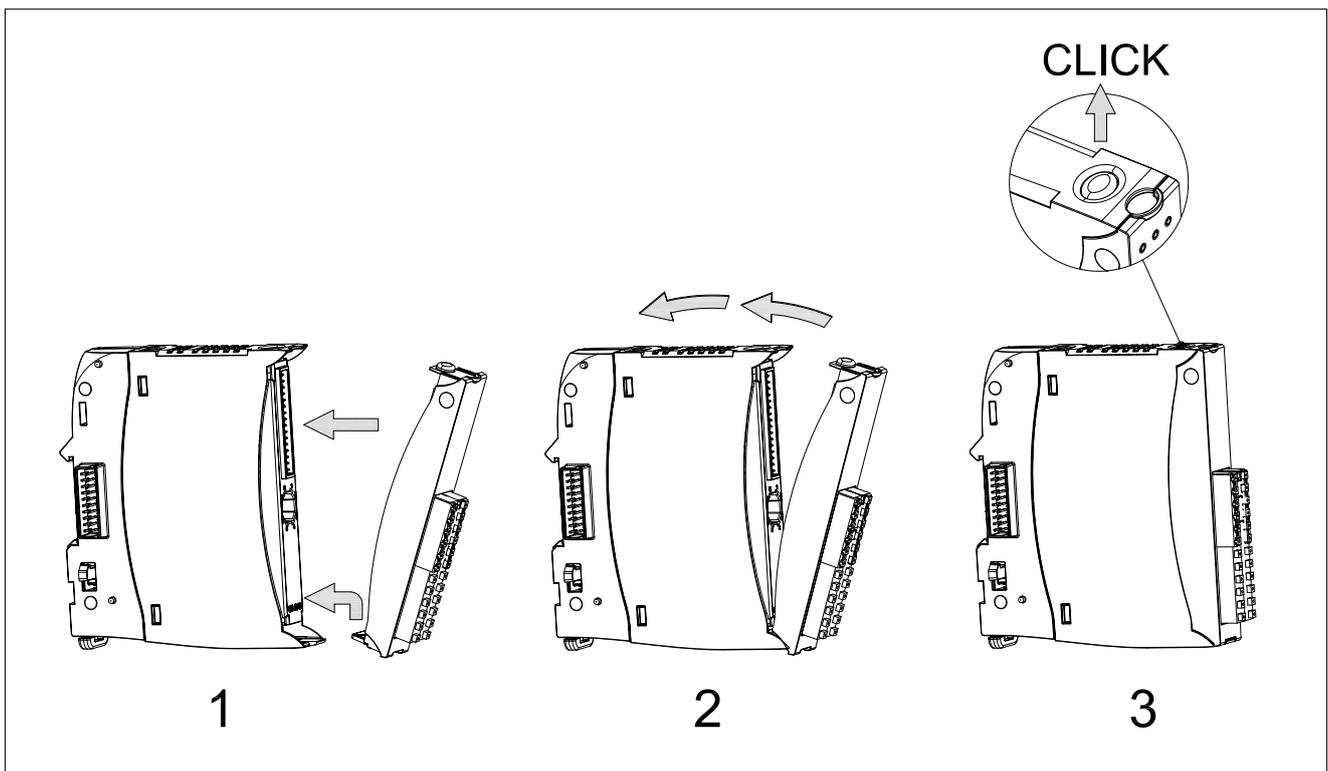


The coupling and uncoupling between the different parts is possible without the use of tools, using only your hands. The movement is constrained in such a way as to be easy and to prevent alignment errors that could compromise the connections.

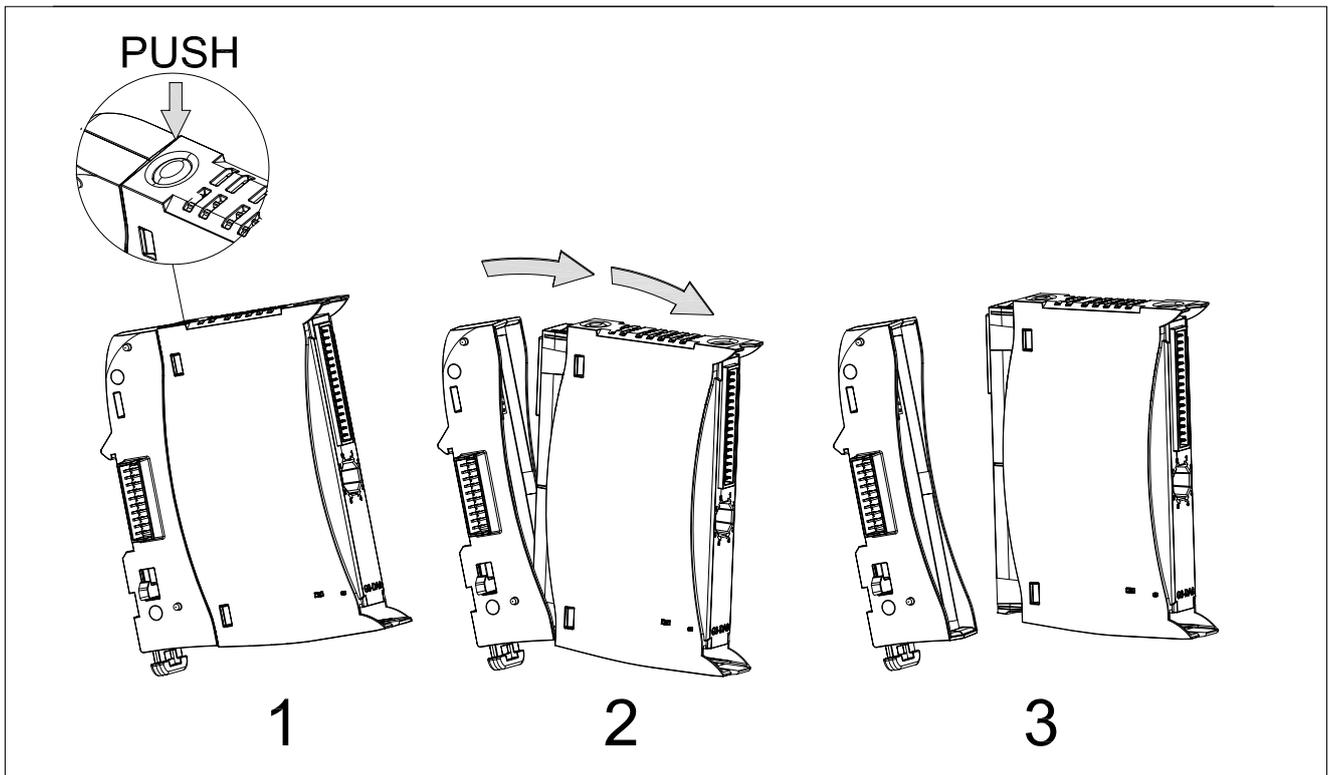
Press the upper button as shown in the figure and pull the board down in the indicated direction to remove the front module.



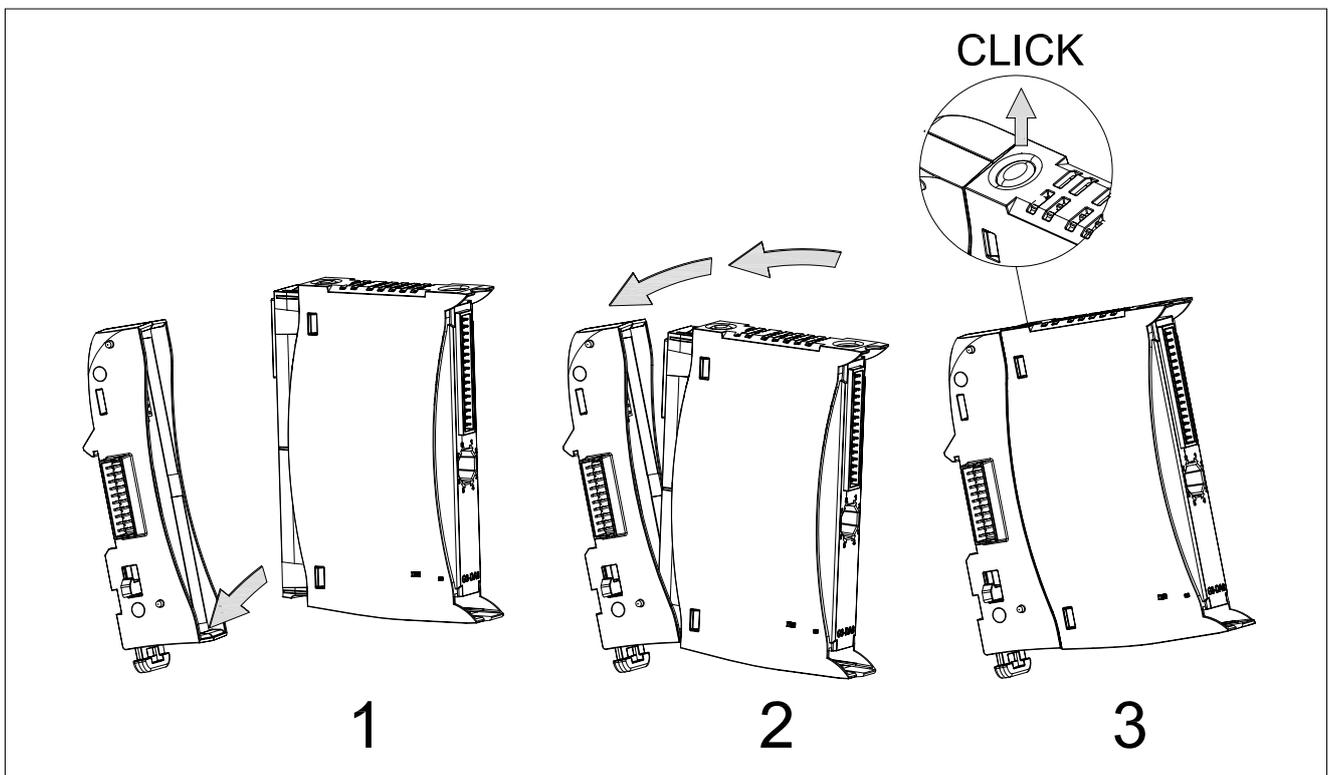
To re-couple the module, first place the lower part inside the constrained housing of the electronic part and then push the front until you feel the upper button couple.



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.



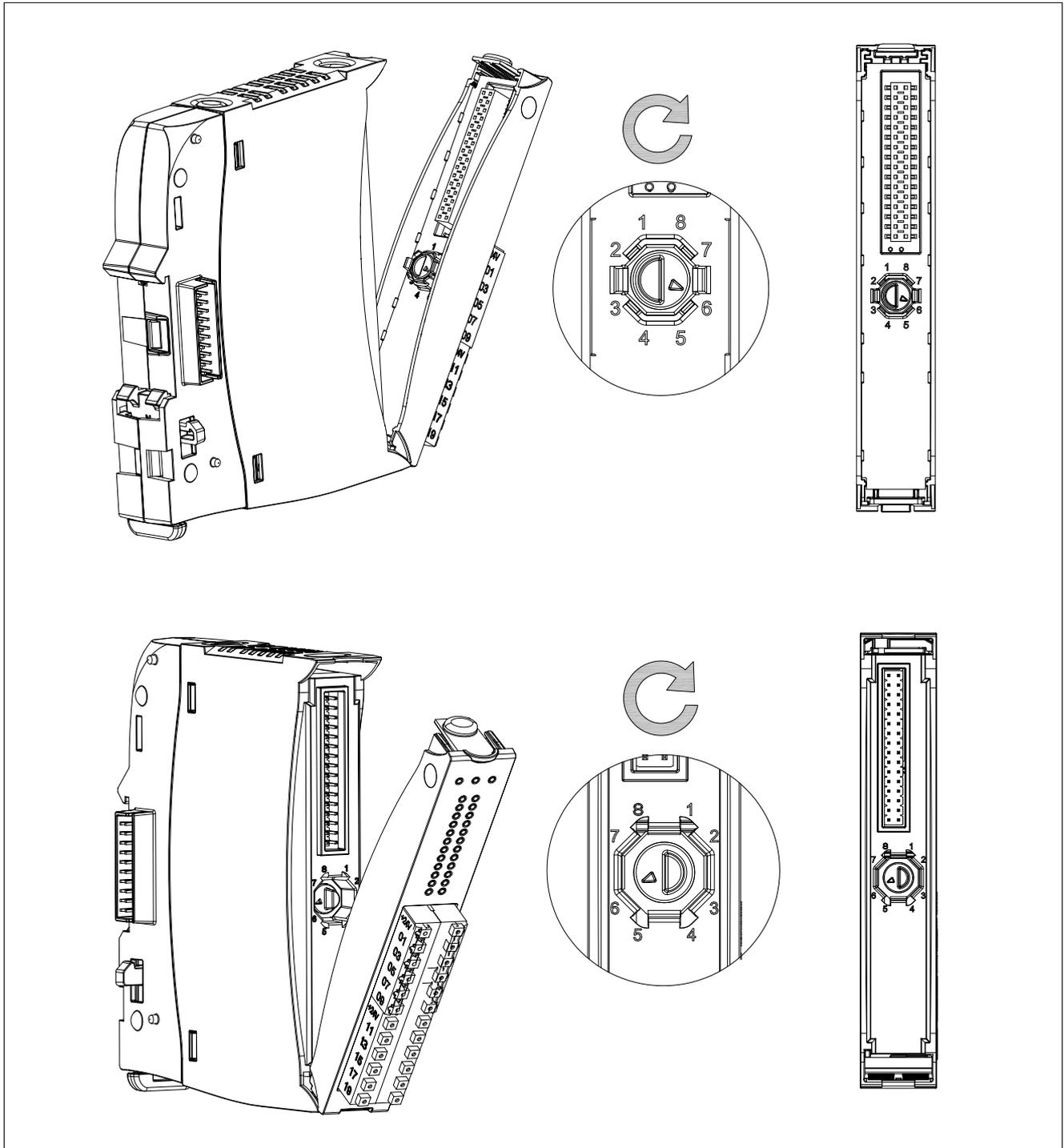
2.3. Front polarisation

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

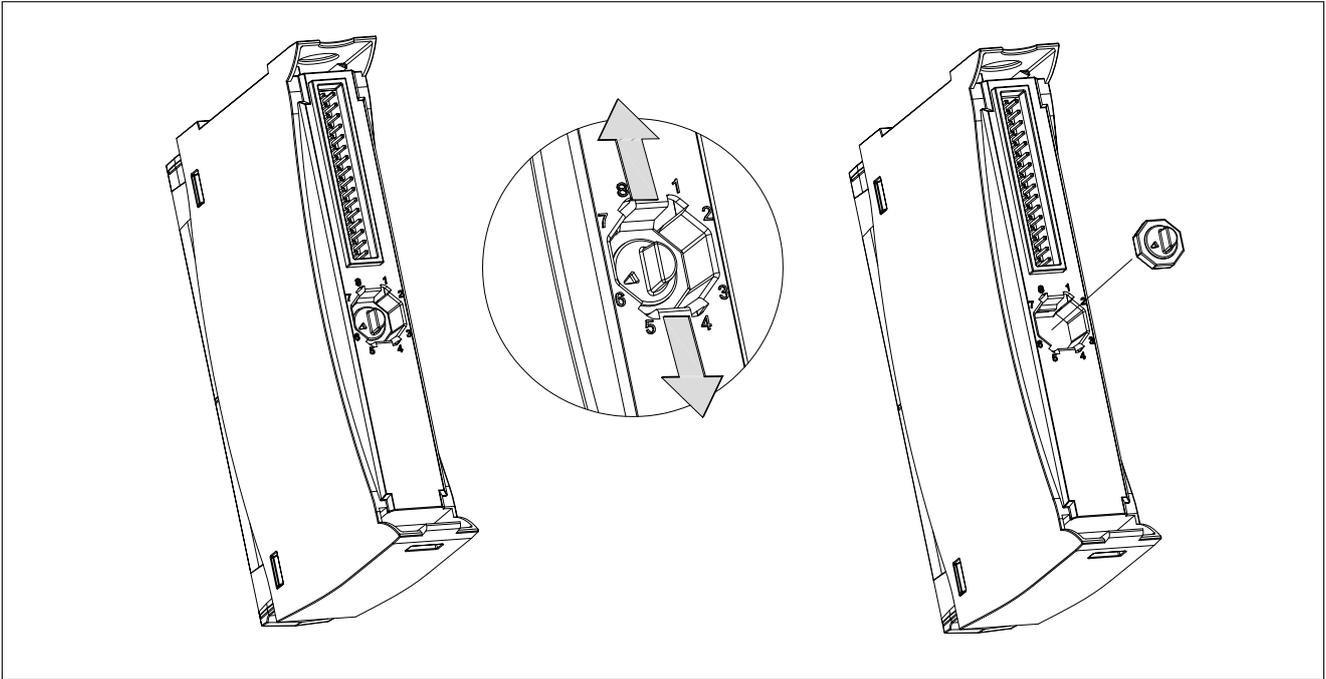
A kit of male-female coupled octagonal-shaped inserts may be provided as an accessory.

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

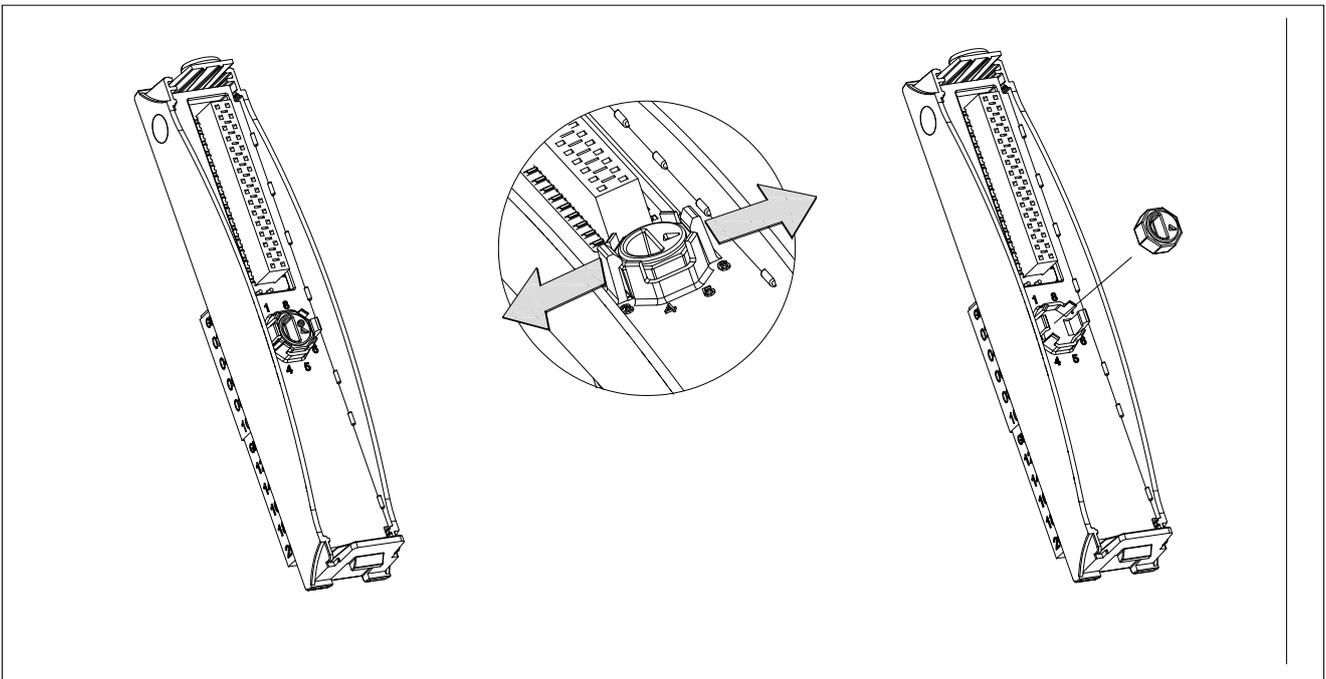
There is a housing for the male insert and one in the front for the female insert in the electronic part.



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.

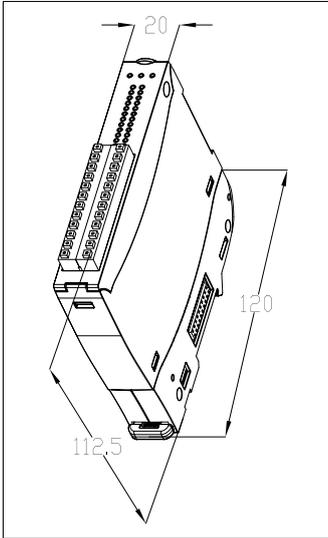


Once inserted, the inserts can be extracted and rotated as desired.

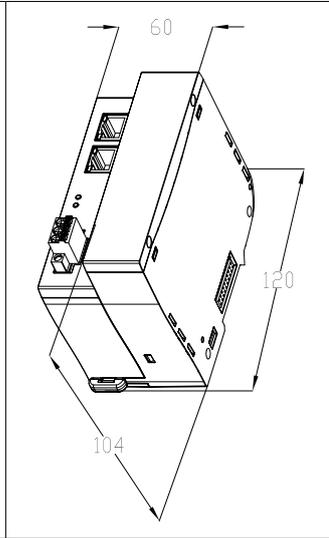
2.4. Mechanical dimensions

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

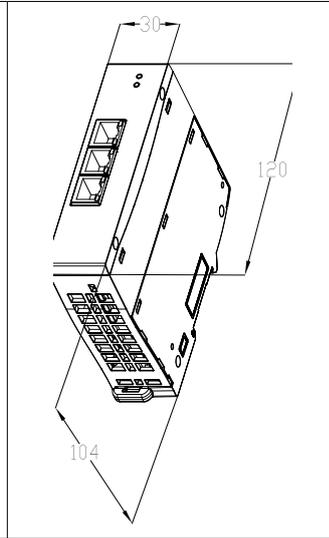
Full G3-xxxx Board



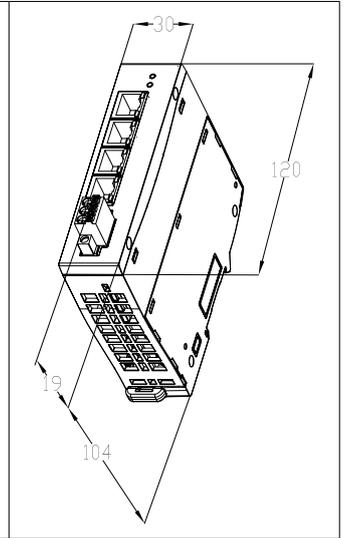
G3-ECAT hub head



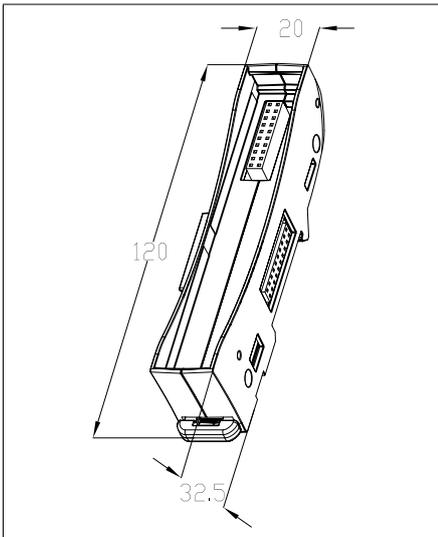
G3-JNC3



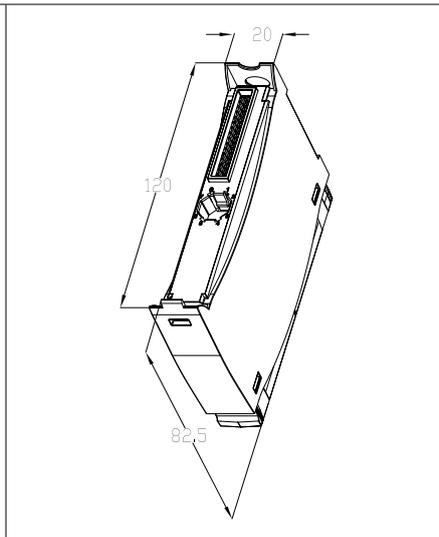
G3-JNC4



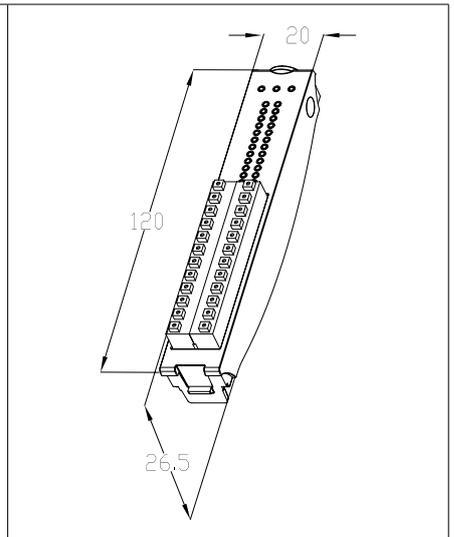
G3-BUS Base



G3-xxxx E Electronic board



G3-xxxx F Front



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:

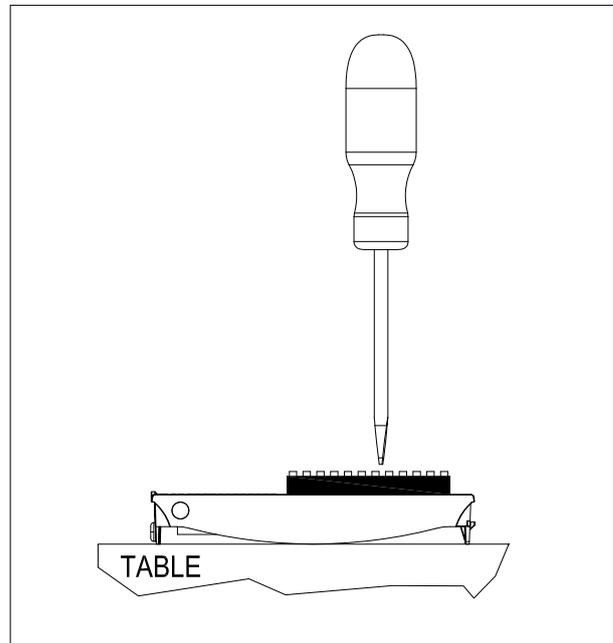
press the button with a screwdriver pull out the wire/tip
release the button

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



It is recommended NOT TO WELD the electric wire.

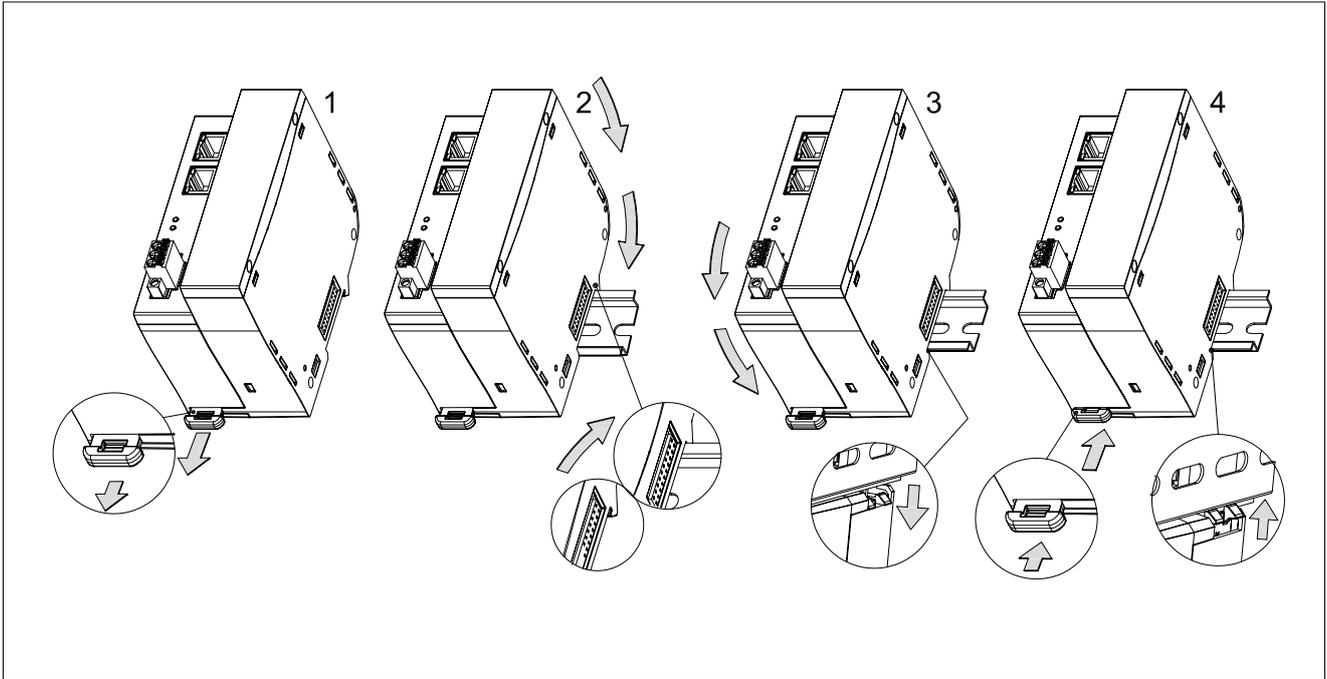
Minimum temperature rating of the cable to be connected to the field wiring terminals, 85 °C



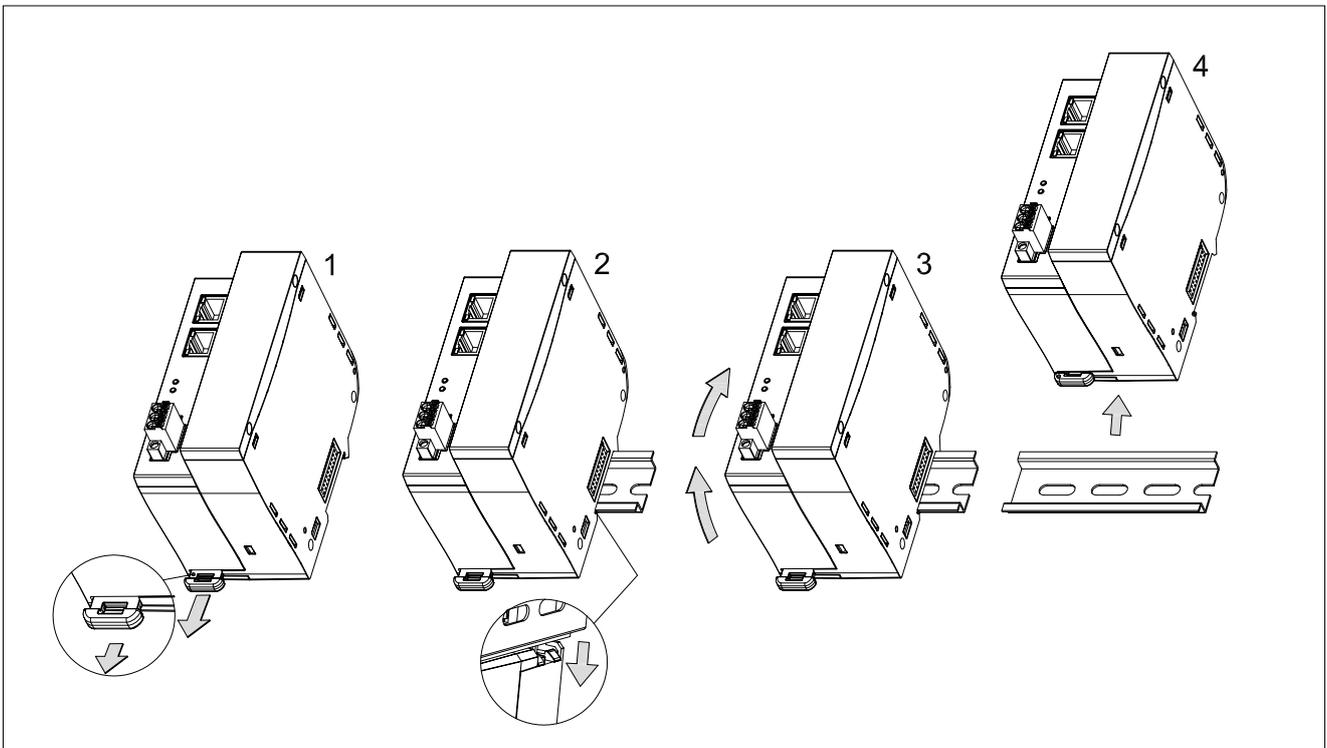
2.6. DIN rail mounting

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.

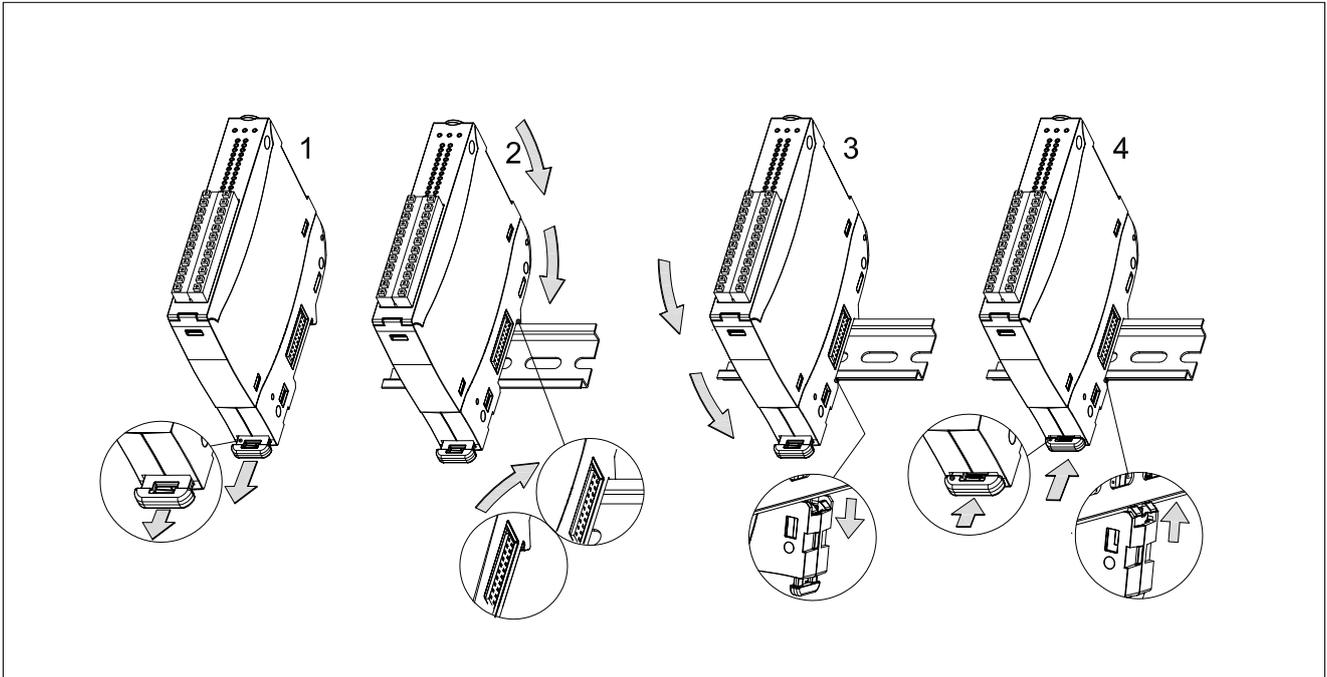


To remove the head the hub from the DIN rail, release the lower clip by slightly levering with a screwdriver and turn the board to release it.

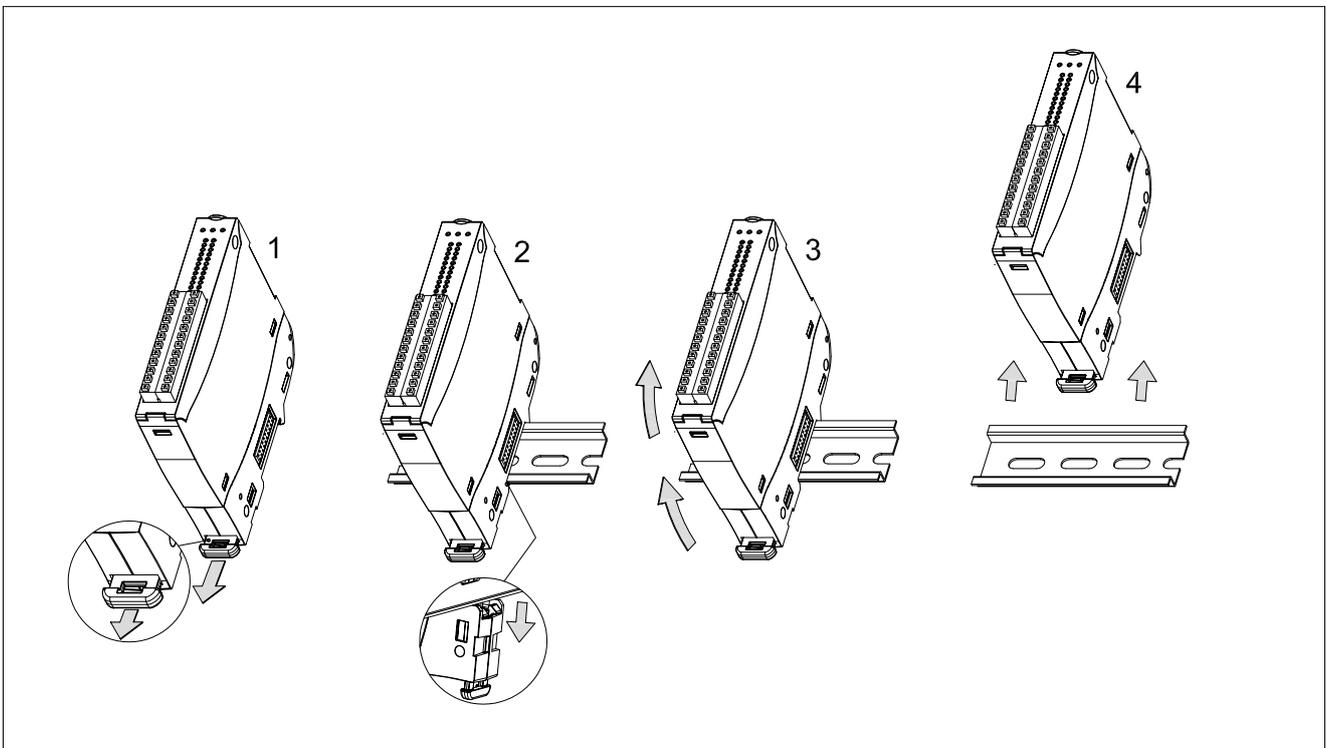


2.6.2. G3-xxxx (all models unless otherwise specified)

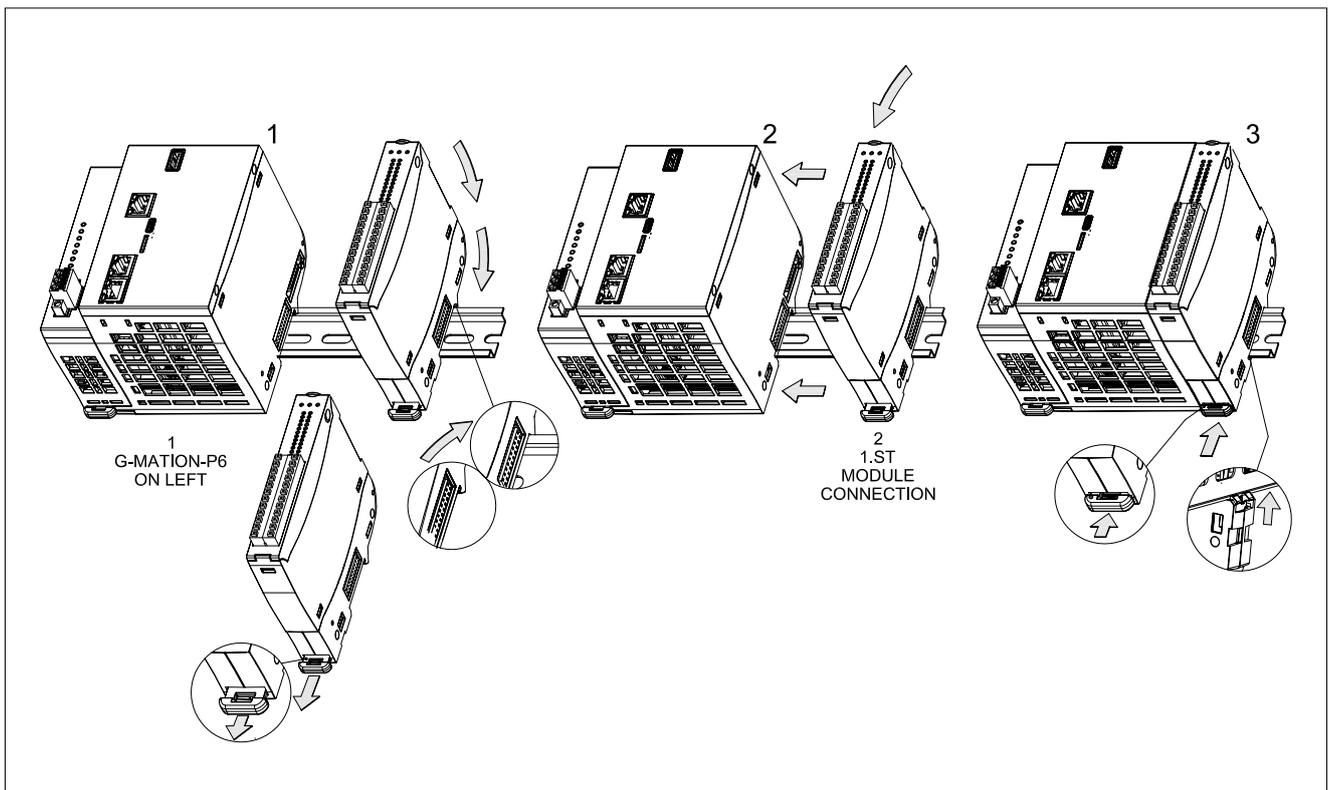
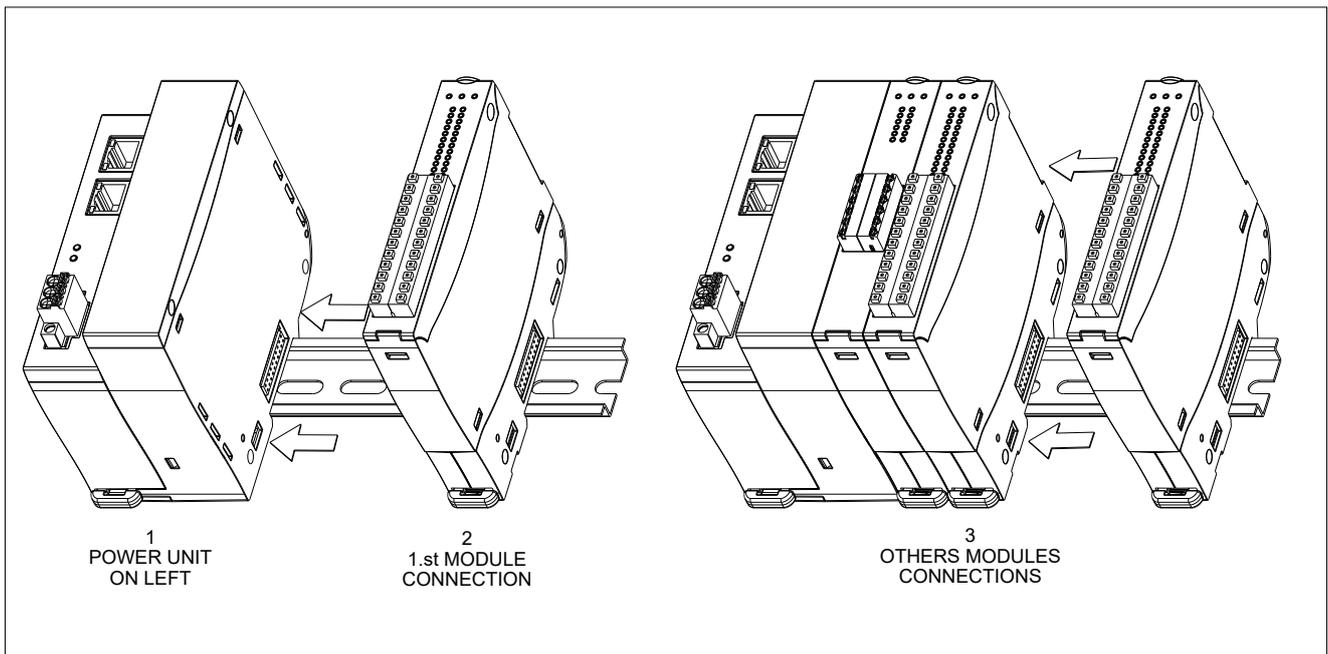
To mount the module to the din rail, unclip the lower clip and leave it in the open stable position. Insert the part top of the hook on the rail, rotate the board and place it on the DIN rail. Raise the lower clothespin slightly to free it and allow it to be hooked to the bar even in the lower part.



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.

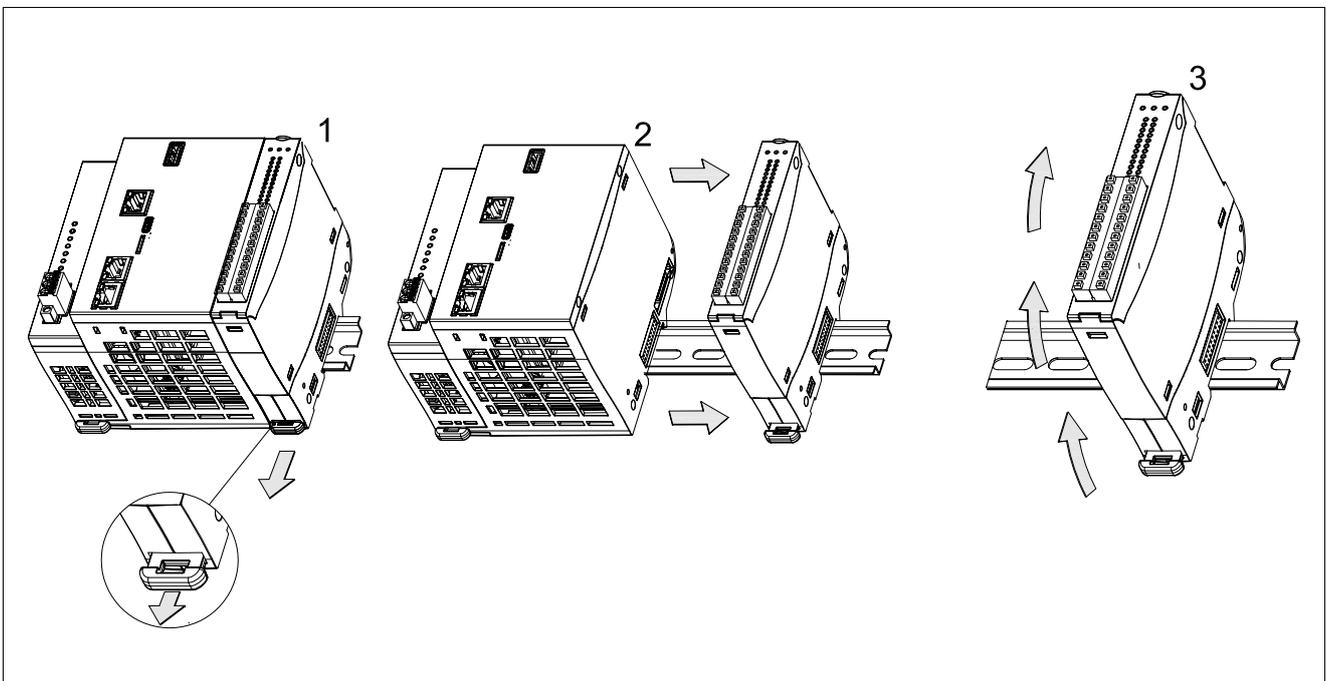
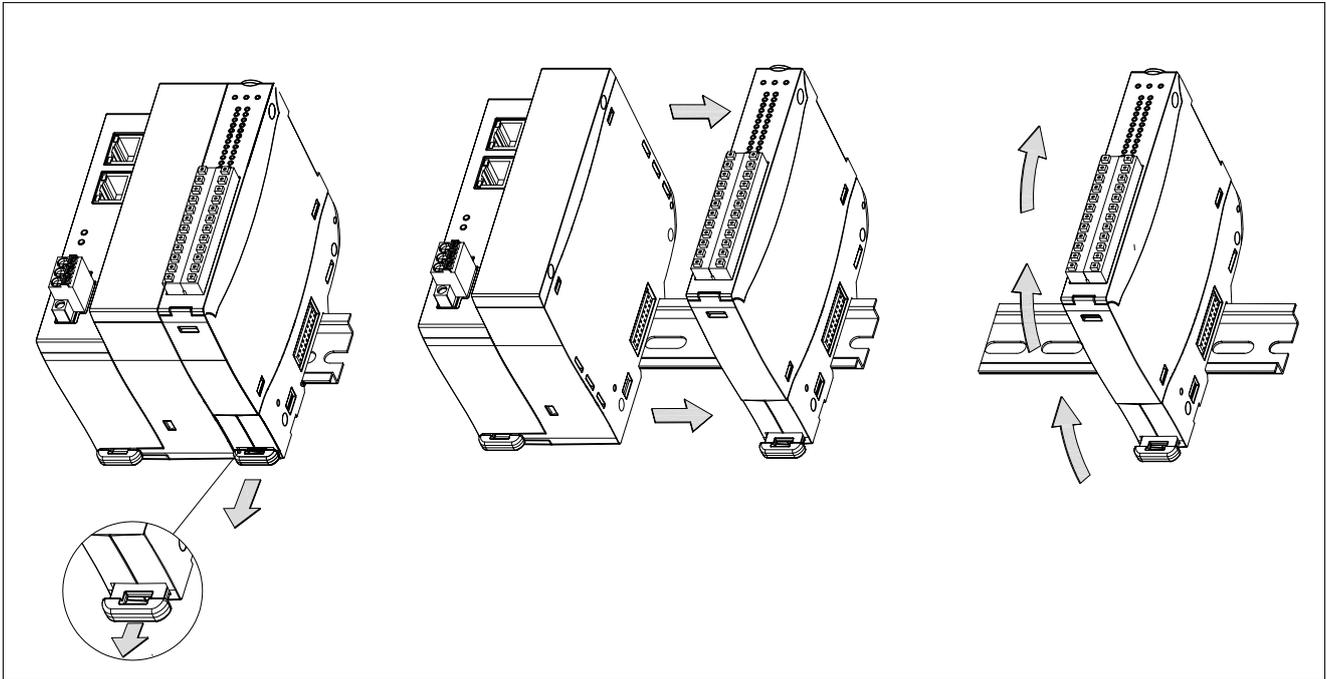


Once the board has been coupled, it is possible to secure the lower clip in the stable released position and slide it longitudinally on the rail until it is coupled to the previous board.



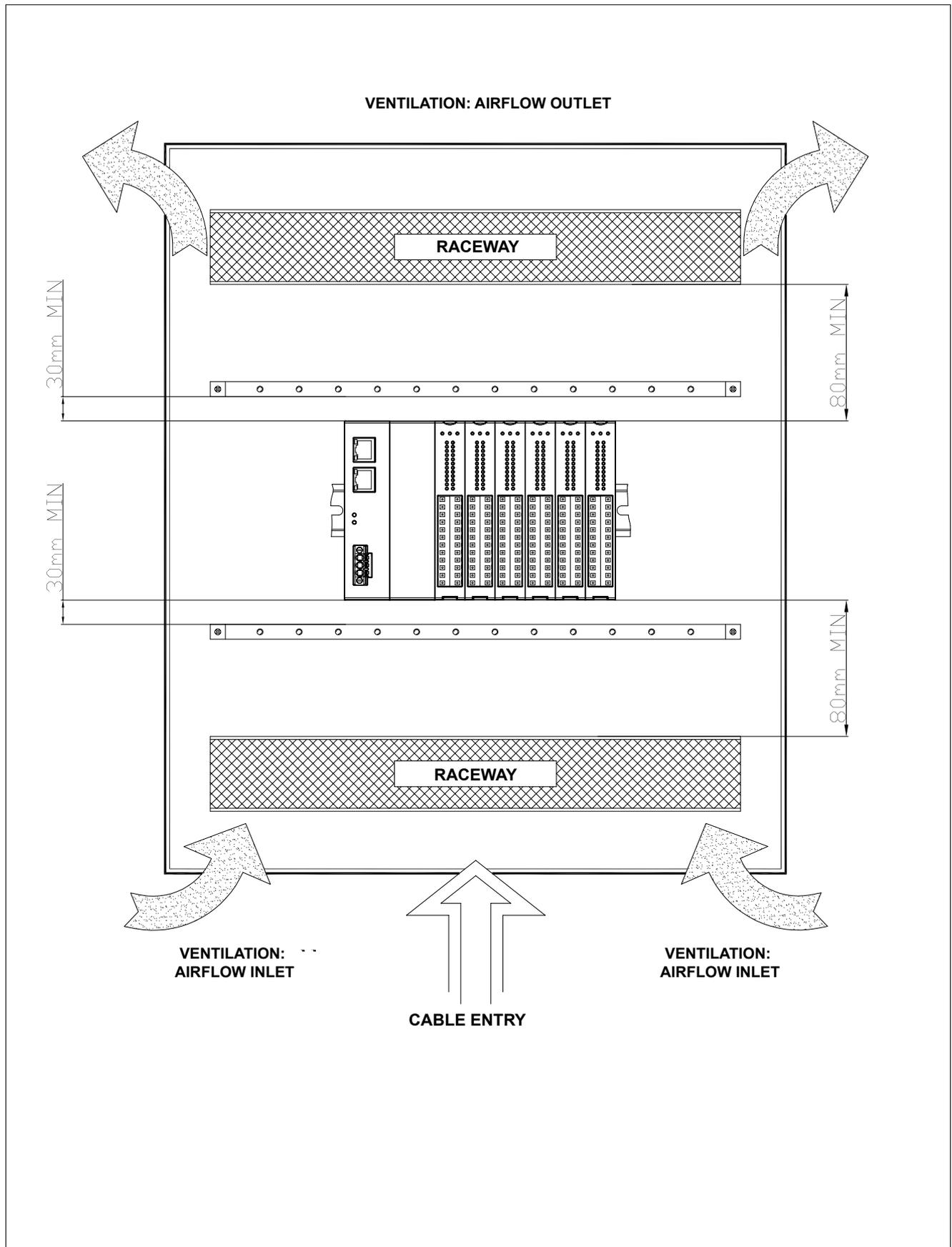
Once coupled, reinsert the lower clip so that the coupling with the DIN rail and the left board is firm and maintained by the force of the internal spring.

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-C2** module has 2 independent 32 bit counters inputs for Differentials, Single ended, Push Pull, Open Collector encoders or 2/3 wires proximity.

The operating mode can be programmed for each counter as Up/Down counting, Mono and Bidirectional encoder, or Measurement of period or frequency.

For fast response with counters 2 digital inputs and 2 digital outputs can be wired directly to the board.

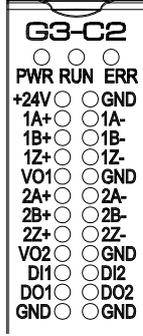
G3-C2 is EN61131-2 compliant and can be used with all the G-Mation gateways and Px modules from which it receives power supply.



TECHNICAL DATA	
2 encoder / counter inputs	32 bit
Input voltage	8..32Vdc, 25mA max
Input insulation	>2kV
Overvoltage on inputs for 1 ms	1kV max
Digital filter	Software configurable (20kHz or 500kHz)
Input type	Differentials, Single ended, Push Pull, Open Collector encoders or 2/3 wires proximity
Encoder power supply	24Vdc, 500mA max from pin 1 supply and internally distributed to channels +5V internally generated
2 digital inputs	24Vdc \pm 25% optically isolated
Maximum input voltage	32V@5mA
Protection against reverse polarity	Yes
Input voltage trigger levels and input current	IEC61131-2 Type1, Type3 inputs
2 digital outputs	24VDC \pm 25% optically isolated
Maximum voltage of power supply	32V
Maximum current per channel	max 0.1A
Isolation	>1.5kV
Power supply	From G3-ECAT or G3-Px modules for control electronics, +24V (\pm 25%) for Field Signals
Power dissipation	1,2 W, \pm 5%
FUNCTION MODE	
Encoder Monodirectional	CHA Counter input CHB Counter direction ((0 = down; 1 = up) CHZ reset / interrupt / not active
Encoder Bidirectional	CHA Counter input CHB Counter input CHZ reset / interrupt / not active
Counter	CHA Counter input CHB Count direction (0 = down; 1 = up) CHZ Count enable (0 = stop; 1 = count)
Period	CHA input CHB not used CHZ: measure enable (0 = stop; 1 = measure) (evaluation clock internal)
Frequency	CHA input CHB not used CHZ: measure enable (0 = stop; 1 = measure) (evaluation clock internal)

Impulse	CHA input CHB input polarity (0= low front; 1= up front) CHZ measure enable (0 = stop; 1 = measure)
Speed	Self-adaptive input calculation
MECHANICAL DATA	
Dimensions	120x110x20 mm
Weight	150 g
Protection level	IP20 For UL: not UL evaluated. Open type device
Connector	Front 24 pin-5.08 mm pitch removable connection system with spring wire retention, no tool required to fix or remove wires
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

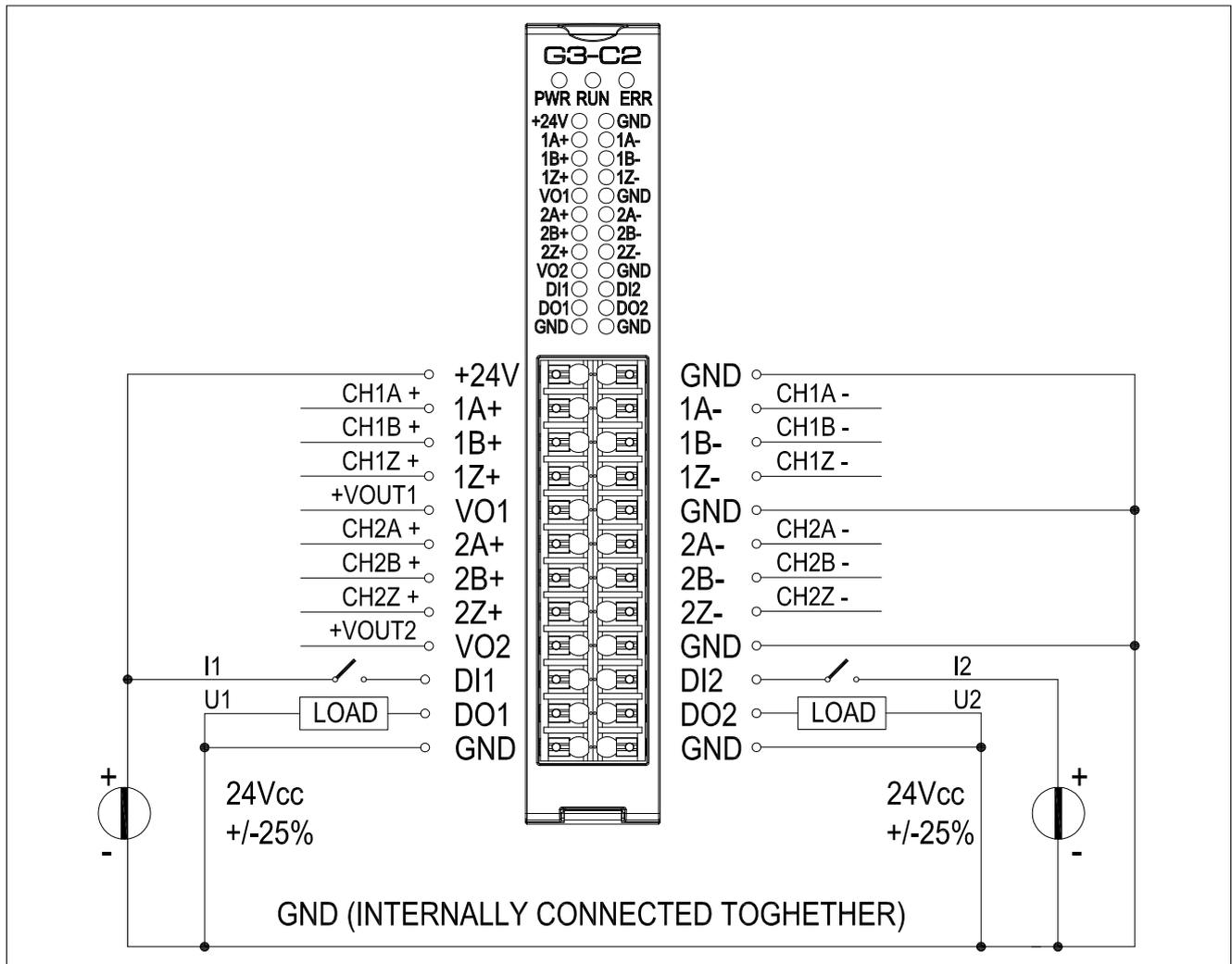
3.2. Meaning of LEDs

	ACRONYM	COLOR	LED STATUS	MEANING
MODULE DIAGNOSTICS 	PWR	YELLOW	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
	ERR	RED	ON	OPERATIONAL status
			OFF	no error
			Blinking (Slow blinking)	configuration error
			Single Flash	generic runtime error
Double Flash			wdog on cyclic data.	
IOs DIAGNOSTICS: 2 encoder input + 2 digital input + 2 digital output 	nA+, nA- / nBK+, nBK- / nC+, nC- (n = 1, 2) DIn (n = 1, 2) DOn (n = 1, 2)	GREEN	ON	Channell polarized = 1 logic active digital input = 1 logic active digital output = 1 logic
			OFF	Channell polarized = 0 logic digital input not active = 0 logic digital output not active = 0 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 electrical wire with a 0.75 .. 1.50 mm² section and 8 .. 9 mm strip length to wire DIGITAL INPUTS.

See paragraph “2.5. Front connector wiring” on page 12 of this manual for wiring modes

3.4. Resource software management

G3-C2 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 called:
Gefran G3-C2 Vxx where xx is the version.

The file is available on the Gefran WEBSITE (www.gefran.com).
 The default configuration is programmed in the factory, when turned on the master initializes the card with only the telegrams indicated by the developer, not with the default ones

3.4.1. Module objects

Module information:

INDEX	SUB.	NAME	TYPE	ACCESS	DEFAULT / NOTE	
0x1000	0	Device type	Unsigned32	RO	0x0001389	5001 TBD
0x1001	0	Error Register	Unsigned8	RO	0x00	
0x1008	0	Device Name	Visible string	RO	G3-C2	
0x1009	0	Manufacturer Hardware version	Visible string	RO	01	
0x100A	0	Manufacturer Software version	Visible string	RO	1.1	
0x1018	0	Objects number	Unsigned8	RO	4	
	1	Vendor Id	Unsigned32	RO	0x0000 0093 (Gefran)	
	2	Product Code	Unsigned32	RO	0x00000BC3 (3011)	
	3	Revision Number	Unsigned32	RO	0x0000 0001	
	4	Serial Number	Unsigned32	RW	32-bit product serial number	

3.4.2. IOs managements

Position inputs G3-C2

INDEX	SUB INDEX	NAME	TYPE	ACCESS	DEFAULT / NOTE
0x6002	0	Objects number	USINT	RO	2
	1	Counter Input Value 1	DINT	RO	
	2	Counter Input Value 2	DINT	RO	

Value of C2 inputs 1 and 2 is available in object at su-index 1,2

Position Input type (n): **DINT**

Speed inputs G3-C2

INDEX	SUB INDEX	NAME	TYPE	ACCESS	DEFAULT / NOTE
0x600A	0	Objects number	USINT	RO	2
	1	Speed Freq Period Pulse Input Value 1	DINT	RO	
	2	Speed Freq Period Pulse Input Value 2	DINT	RO	

Based on the input configuration, the object in sub-index 1,2 indicates:

- the value of the speed with which the position of the sensors connected to the C2 input 1,2 varies in tens of points per second,
- the measured value of the period in tens of ns,
- the value of the frequency is in Hz
- the duration of the pulse is in tens of ns

Speed Freq Period Pulse Input (n): **DINT**

Digital inputs G3-C2

INDEX	SUB INDEX	NAME	TYPE	ACCESS	DEFAULT / NOTE
0x6003	0	Objects number	USINT	RO	2
	1	Digital Input Value 1	BOOL	RO	FALSE
	2	Digital Input Value 2	BOOL	RO	FALSE
	3	DigitFiller	6 bit	RO	0b000000
	4	DigitFiller2	USINT	RO	0x00
	5	DigitFiller3	UINT	RO	0x0000

Boolean value of digital inputs 1 and 2 is available in object at su-index 1,2
 Digital input type (n): **BOOL**

false: not active input
true: active input

Digital outputs G3-C2

INDEX	SUB INDEX	NAME	TYPE	ACCESS	DEFAULT / NOTE
0x7003	0	Objects number	USINT	RO	2
	1	Digital Output Value 1	BOOL	RW	FALSE
	2	Digital Output Value 2	BOOL	RW	FALSE
	3	DigitFiller	6 bit	RO	0b000000
	4	DigitFiller2	USINT	RO	0x00
	5	DigitFiller3	UINT	RO	0x0000

Boolean value of digital inputs 1 and 2 is available in object at su-index 1,2
 Digital Output type (n): **BOOL**

Threshold G3-C2

INDEX	SUB INDEX	NAME	TYPE	ACCESS	DEFAULT / NOTE
0x7002	0	Objects number	USINT	RO	2
	1	Threshold Value 1	DINT	RO	0x00000000
	2	Threshold Value 2	DINT	RO	0x00000000

The threshold value related to the data coming from the sensor connected to input C2 (see paragraph 3.4.3 for a description of the related functions) is available in the object in sub-index 1,2

Threshold type (n): **DINT**

3.4.3. IOs configuration objects

The table below defines the configuration management objects.

Inputs configuration: encoder type

INDEX	SUB INDEX	NAME	TYPE	ACCESS	DEFAULT / NOTE
0x8000	0	Objects number	USINT	RO	2
	1	Counter Input Type 1	ENUM	RW	0
	2	Counter Input Type 2	ENUM	RW	0

Encoder type is available in the object in sub-index 1,2

0 = Differential, Single Ended, Push-Pull (default)
 1 = Open Collector, Limit Switch

Inputs configuration: mode

INDEX	SUB INDEX	NAME	TYPE	ACCESS	DEFAULT / NOTE
0x8001	0	Objects number	USINT	RO	2
	1	Encoder Input Mode 1	ENUM	RW	0
	2	Encoder Input Mode 2	ENUM	RW	0

Channel mode is available in the object in sub-index 1,2

- 0 = Bidirectional Encoder (default)
- 1 = Monodirectional Encoder
- 2 = Counter
- 3 = Period Gauge
- 4 = Frequency Gauge
- 5 = Pulse Length

Counter filters vaules

INDEX	SUB INDEX	NAME	TYPE	ACCESS	DEFAULT / NOTE
0x8002	0	Objects number	Unsigned8	RO	2
	1	Counter Filter Value 1	ENUM	RW	0
	2	Counter Filter Value 2	ENUM	RW	0

Counter filters vaules is available in the object in sub-index 1,2

- 0 = 500 kHz (default)
- 1 = 100 kHz
- 2 = 10 kHz
- 3 = 100 Hz

Z Channel function

INDEX	SUB INDEX	NAME	TYPE	ACCESS	DEFAULT / NOTE
0x8003	0	Objects number	Unsigned8	RO	2
	1	ZChannel Use 1	ENUM	RW	0
	2	ZChannel Use 2	ENUM	RW	0

Channel Z function is available in the object in sub-index 1,2

- 0 = Not used (default)
- 1 = Counter Reset

Power Configuration

INDEX	SUB INDEX	NAME	TYPE	ACCESS	DEFAULT / NOTE
0x8004	0	Objects number	USINT	RO	1
	1	Input Power Selection	ENUM	RW	0

Choiche of power supply of encoders is available in the object in sub-index 1,2

- 0 = Int. Power 5Vcc (default)
- 1 = Ext. Power 8..32Vcc

Digital Outputs Mode

INDEX	SUB INDEX	NAME	TYPE	ACCESS	DEFAULT / NOTE
0x8005	0	Objects number	USINT	RO	2
	1	Digital Output Mode Value 1	ENUM	RW	0
	2	Digital Output Mode Value 2	ENUM	RW	0

The object in sub-index 1,2 defines the functionality of the digital output

- 0 = Enabled by master ON/OFF (controlled by object 0x8006)
- 1 = Active when the counter position is greater than the threshold value
- 2 = Active when the counter position is less than the threshold value

Digital Outputs Polarity

INDEX	SUB INDEX	NAME	TYPE	ACCESS	DEFAULT / NOTE
0x8006	0	Objects number	USINT	RO	2
	1	Digital Output Polarity Value 1	ENUM	RW	0
	2	Digital Output Polarity Value 2	ENUM	RW	0

The object in sub-index 1,2 defines the active state of 0x8005 object

- 0 = FALSE
- 1 = TRUE (default)

Digital Outputs Time Setting

INDEX	SUB INDEX	NAME	TYPE	ACCESS	DEFAULT / NOTE
0x8007	0	Objects number	USINT	RO	2
	1	Digital Output Time Setting Value 1	UINT	RW	0x0000
	2	Digital Output Time Setting Value 2	UINT	RW	0x0000

The time in which the digital outputs remain set before resetting (following a user-commanded Boolean state change or following a threshold interception) is available in the object in sub-indexes 1,2

Digital Output Time Setting type: **UINT**

Reset Counter

INDEX	SUB INDEX	NAME	TYPE	ACCESS	DEFAULT / NOTE
0x8008	0	Objects number	Unsigned8	RO	2
	1	Reset Counter Value 1	BOOL	RW	FALSE
	2	Reset Counter Value 2	BOOL	RW	FALSE

The command to manually reset the counter value is available in the object in sub-index 1,2

Tip: Reset Counter: **BOOL**

- false**: no action
- true**: counter reset

3.4.4. Control objects

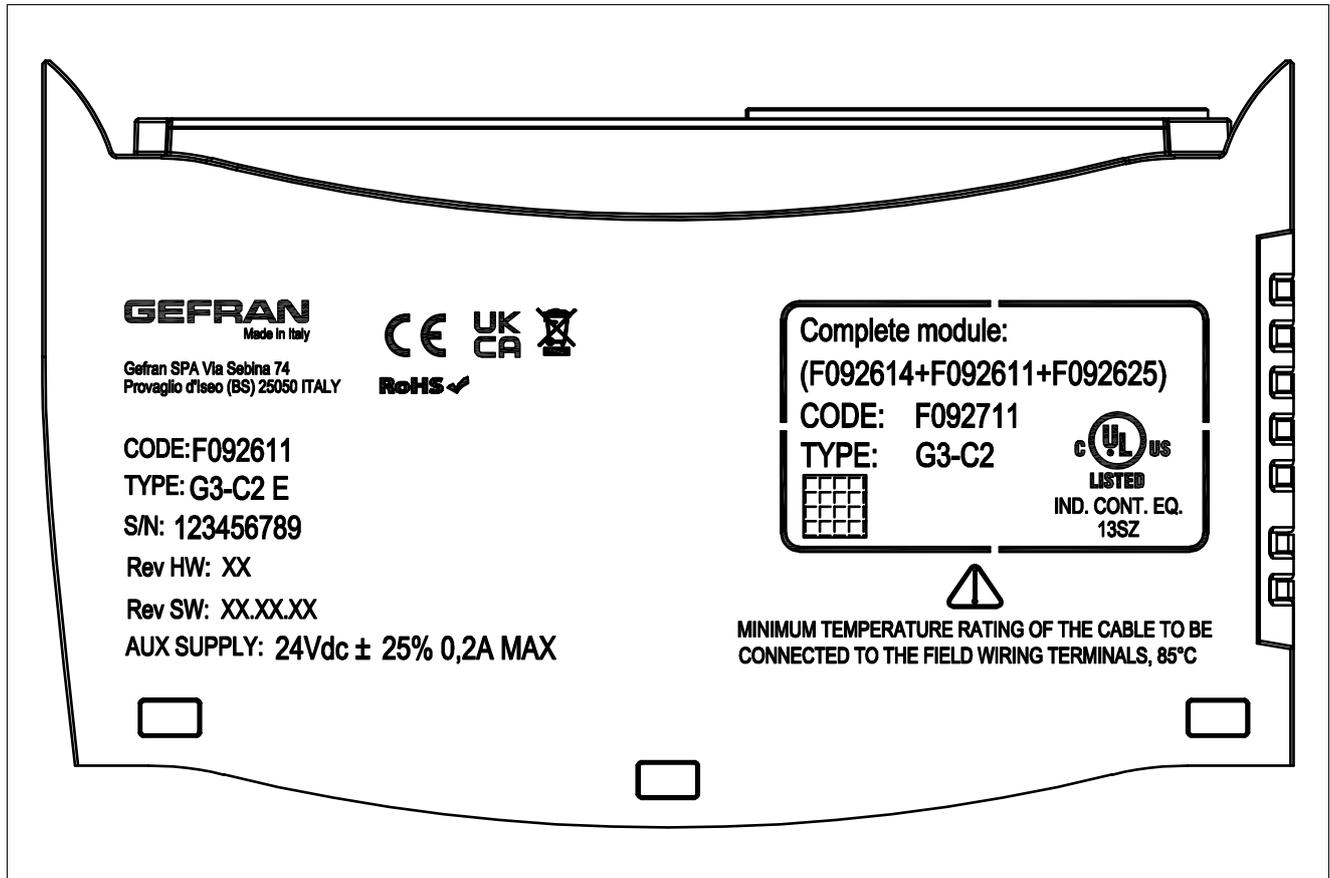
INDEX	SUB INDEX	NAME	TYPE	ACCESS	DEFAULT / NOTE
0x9000	0	Device Code	UINT	RO	0x0BC3
0x9001	0	Hardware Revision	UINT	RW	0x01
0x9002	0	Firmware Version	UINT	RO	0x0110
0x9003	0	Serial Number	UDINT	RW	0x00000000
0x9004	0	Order Code	STRING(7)	RO	F092611

4. ACRONYM AND ORDER CODE

COMPLETE MODULE	G3-C2	F092711
Front	G3-C2 F	F092625
Electronic module	G3-C2 E	F092611
Bus	G3-BUS	F092614

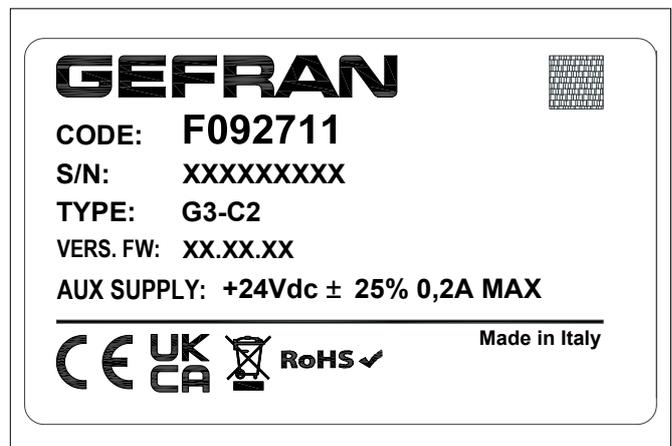
5. MARKING

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
- GEFFRAN 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.geffran.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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