GEFRAN

850

1/16 DIN Double PID Temperature Controller

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QUICK INSTALLATION GUIDE

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- Mounting
- Connections

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- Technical specifications

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WARNINGS AND SAFETY

Although all of the information in this manual has been carefully checked, Gefran S.p.A. assumes no liability regarding the presence of any errors or regarding damage to property and/or harm to individuals due to any improper use of this manual.

Gefran S.p.A. also reserves the right to make changes to the contents and form of this manual and to the characteristics of the devices illustrated at any time and without prior warning.

The installation of the devices illustrated in the manual must be carried out by qualified technicians in compliance with the laws and standards in force and in agreement with the instructions contained in the manual.

If the PID temperature controllers 1/16 DIN 850 is used in applications with the risk of damages to persons, machinery or materials, its use in conjunction with alarms is essential. It is advisable to envisage the possibility of checking the intervention of the alarms during regular operation.

Before interacting with the PID temperature controllers 1/16 DIN 850, the operator must receive full training in the procedures of operation, emergency, diagnosis and maintenance of the system.

More information on the device and procedures of the instalation, maintenance and use can be found in the Installation and Use Controllers 850-1650-1850, *which is available for free download from the GEFRAN website (www.gefran.com).*

MAINTENANCE

Use a cloth dampened in ethyl alcohol or water to clean the front panel and the housing.
Do not use solvents derived from hydrocarbons (trichlorethylene, gasoline, etc.).

CE EMC (electromagnetic compatibility): conforms to directiv 2014/30/EU with reference to standard EN 61326-1 emission in industrial environment class A
Safety LVD: conforms to directiv 2014/35/EU with reference to standard EN61010-1

⚠ This is a class A product intended for use in an industrial environment. There may be potential difficulties in ensuring electromagnetic.

Graphic simbol

☞ Indicates contents of sections, general instructions, notes, and other points to which the reader's attention needs to be called.

⚠ Indicates a particularly delicate situation that could affect the safety or correct operation of the controller, or an instruction that MUST be followed to prevent hazards.

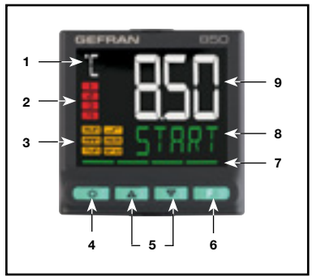
DISPOSAL

The 850 controllers must be disposed of in conformity to current laws and regulations. If not correctly disposed of, some of the components used in the devices may harm the environment.

PACKAGE CONTENTS

n. 1 PID Temperature Cotroller 1/16 DIN model 850
n. 1 Mounting bracket with screws
n. 1 Rubber gasket 48×48 front-box
n. 1 Instruction sheet

DISPLAY AND KEYS



1. Unit of measurement or number of program running or number of loop displayed.
2. State of outputs OUT1, OUT2, OUT3, OUT4.
3. Controller function states:
   - RUN = functioning (flashing = normal functioning, steady on = program running);
   - _/- = setpoint ramp active;
   - TUN = PID parameters tuning active;
   - MAN = manual/automatic (off = automatic control, on = manual control);
   - REM = remote setpoint enabled;
   - SP1/2 = setpoint active (off = setpoint 1,
4. Work mode key (manual/automatic) in standard mode. A function can be assigned via parameter but1. The key is active only when the display shows the process variable (HOME).
5. Up/down keys: raise/lower the value of the parameter displayed on the SV or PV display.
6. F key: lets you navigate among controller menus and parameters. Confirms the parameter value and selects the next parameter.
7. Key pressed signals.
8. SV display: setpoint value, description of parameters, diagnostics and alarm messages. Configurable with parameter dS.SP (default = setpoint).
9. PV display: process variable, parameter values.

MOUNTING

⚠ **Attention!** The devices described in this manual must be installed by trained personnel in conformity to current laws and regulations, following all of the instructions in this manual.

Before installing, check that the controller is in perfect condition and was not damaged in shipment. Make sure that the package contains all of the accessories listed on the accompanying document, especially the gasket and the fastening brackets.
Check that the order code matches the configuration required for the intended application (supply voltage, number and type of inputs and outputs).

⚠ **Attention!** If even one of the requirements mentioned above (trained technician in, device in perfect condition, correct configuration) is not satisfied, interrupt the installation and contact your Gefran dealer or Gefran Customer Service.

The controller is designed for permanent indoor installation. It must be mounted on electrical panels or on panels controlling machines or production process plants that are able to protect the exposed terminals on the rear of the controller.

⚠ **Attention!** DO NOT install the controller in a potentially inflammable or explosive atmosphere. It can be connected to elements that work in such atmospheres only by means of appropriate interfaces that conform to safety regulations in force in the country of installation.

⚠ **Attention!** If the controller is used in applications with risk of harm/damage to persons/property, it MUST be connected to dedicated alarm devices. It is advisable to provide the possibility, during normal functioning of the controller and of the system or equipment that it controls, of checking whether any alarms have tripped.

The controller must be installed in a location that is not subject to sudden temperature changes or to freezing or condensation, and no corrosive gases must be present.
The controller can work in Pollution Degree 2 environments (presence of non-conductive dust, only temporarily conductive due to possible condensation).
Do not allow scrap or metal particles from machining or condensation products to reach the device.

The controller is sensitive to strong electromagnetic fields. Do not position it near radio devices or other equipment that may generate electromagnetic fields, such as power contactors, relays, thyristor power units (especially phase angle), motors, solenoids, transformers, high-frequency welders, etc.

For correct installation, respect the dimensions of each hole and the distance between adjacent holes shown in the figures.

⚠ **Attention!** The support on which the operator panel is mounted must:
- be sufficiently rigid and robust to support the device without bending during use;
- be from 1 to 4 mm thick to allow the device to be fastened with the supplied bracket.

The front of the controller has an IP65 protection index, so the device can be installed without problems in rooms that are very dusty or subject to splashing water provided:
- the housing in which the device is inserted is dust-tight and watertight;
- the support on which the device is installed is perfectly smooth and without undulations on the front;
- the hole on the support scrupulously respects the specified drilling dimensions;
- the device is fully tightened to the support to ensure that the gasket inserted between the device and the panel is watertight.

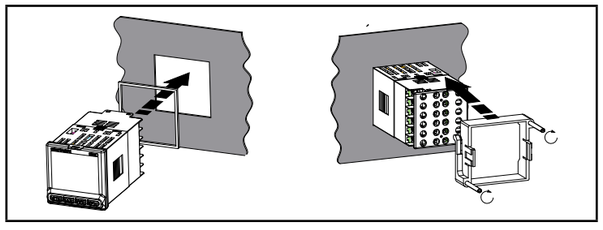
If not adequately protected, the controller has an IP20 protection index (rear container and terminal board).

The controller can support vibrations from 10 to 55 Hz, 20 m/s2, in all directions (X, Y and Z).
If the device is mounted on a support that exceeds these limits, it is advisable to provide a suspension system to reduce vibrations.

The temperature in the housing containing the controller must NEVER exceed 55°C. NEVER block the ventilation slits.
Forced cooling (for example, with a fan) of the rear of the controller may cause measurement errors.

The controller must be positioned so that the display is not subject to direct sunlight or to very strong sources of light.
If necessary, filter direct light, for example, with a reflective screen.
The controller must be tilted between 30° and 120°.

Fastening to the panel:
1. Insert the die-cut rubber gasket between the controller and the panel. The gasket (supplied) is indispensable for ensuring the declared protection index of the faceplate.
2. Insert the device into the hole previously made on the panel.
3. Place the supplied bracket(s) onto the rear of the controller.
4. Tighten the screws to fasten the device to the panel. The tightening torque must be between 0,3 and 0,4 N m..



Connected external circuits must have double isolation.
In case of shielded cables, the shield must be grounded at a single point, possibly near the controller.
Input cables must be physically separated from power cables, output cables, and power connections.
Do not connect unused terminals.
Tighten the terminals without forcing. Loose terminals may cause sparks and fires. The recommended tightening torque is 0.5 Nm. When making connections, respect polarity where required.
Do not bend or twist the cables beyond the limits specified by the manufacturers.

After connecting the cables, apply the transparent cover to protect the terminals. The terminal teeth limit and define the correct direction for applying the cover. Always use cables appropriate for the voltage and current limits specified in the Technical Characteristics.

Use copper cables with 60/75°C insulation.
Use twisted and shielded cables for non-power connections.

The controller's terminal board has screw terminals (M3) that accept stripped cables and crimped terminals for a tightening torque of 0.5 N m. Two ring or crimped fork terminals can be connected on each terminal.

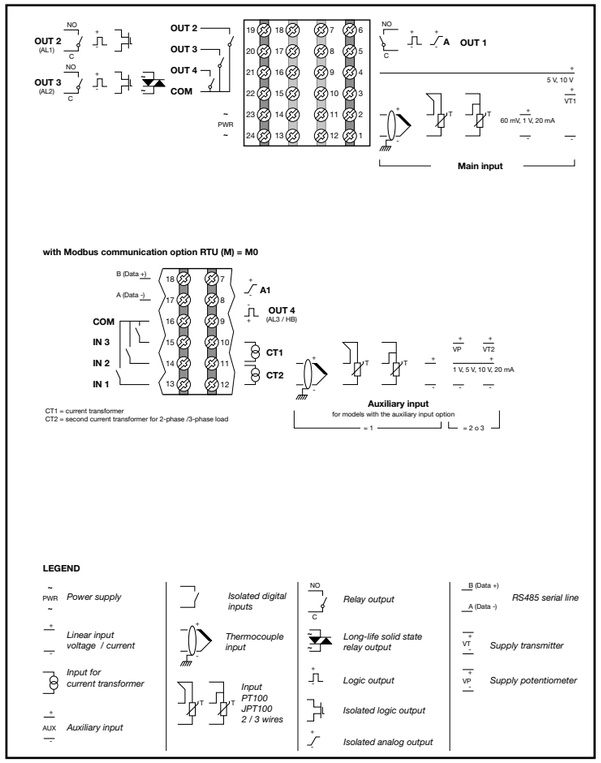
Cable / terminal	Cable section / terminal	Terminal size
Rigid cable	0,8...2,5 mm² (18...14 AWG)	
Twisted	0,8...2,5 mm² (18...14 AWG)	
Tag terminal (to be crimped)	0,25...2,5 mm² (23...14 AWG)	
Fork terminal (to be crimped)		5,8 mm
Ring terminal (to be crimped)		5,8 mm

Attention! Anchor the cables, at least in pairs, so that mechanical stresses do not discharge on the terminal connections.

Attention! Before powering the controller, make sure that the supply voltage matches the one shown on the controller data plate.

Because the controller does not have a switch, a bipolar switch with fuse must be inserted upline.
The switch, or isolator, must be positioned in the immediate vicinity of the device and must be easily reached by the operator.
A single switch can control multiple controllers.

CONNECTIONS



The controller must be powered by a line separated from the one used for electromechanical power devices (relays, contactors, solenoids, etc).
It is advisable to install a ferrite core on the power line, as close as possible to the device, to limit the controller's susceptibility to electromagnetic noise.

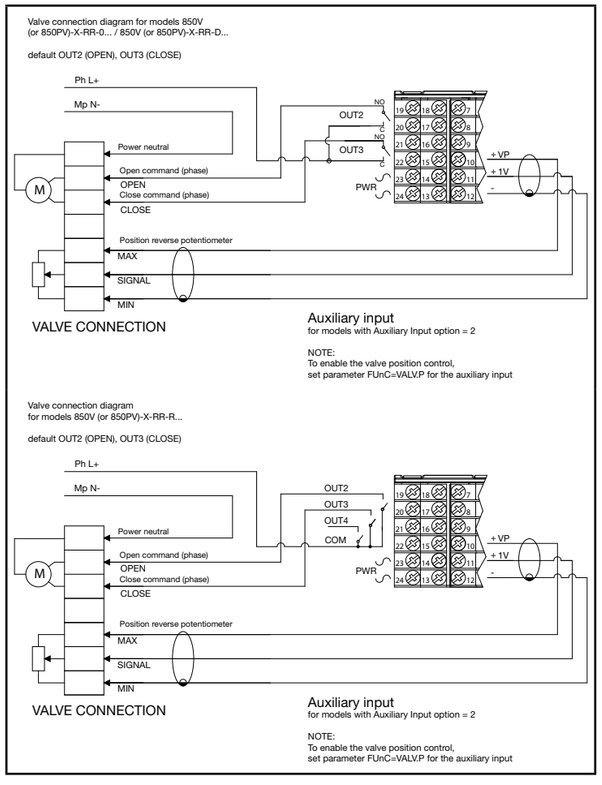
If the controller's power line is heavily disturbed by the switching of thyristor power units or by motors, it is advisable to use an isolation transformer only for the controller, grounding the shield.
Use appropriate line filters in the vicinity of high-frequency generators or arc welders. Use a voltage stabilizer if there are wide shifts in line voltage.

20...27 VAC/VDC models must be powered by a class II or low-voltage limited-energy source. The power supply must use a line separated from the one used for electromechanical power devices, and low-voltage power cables must run along a path separated from the system or machine power cables.

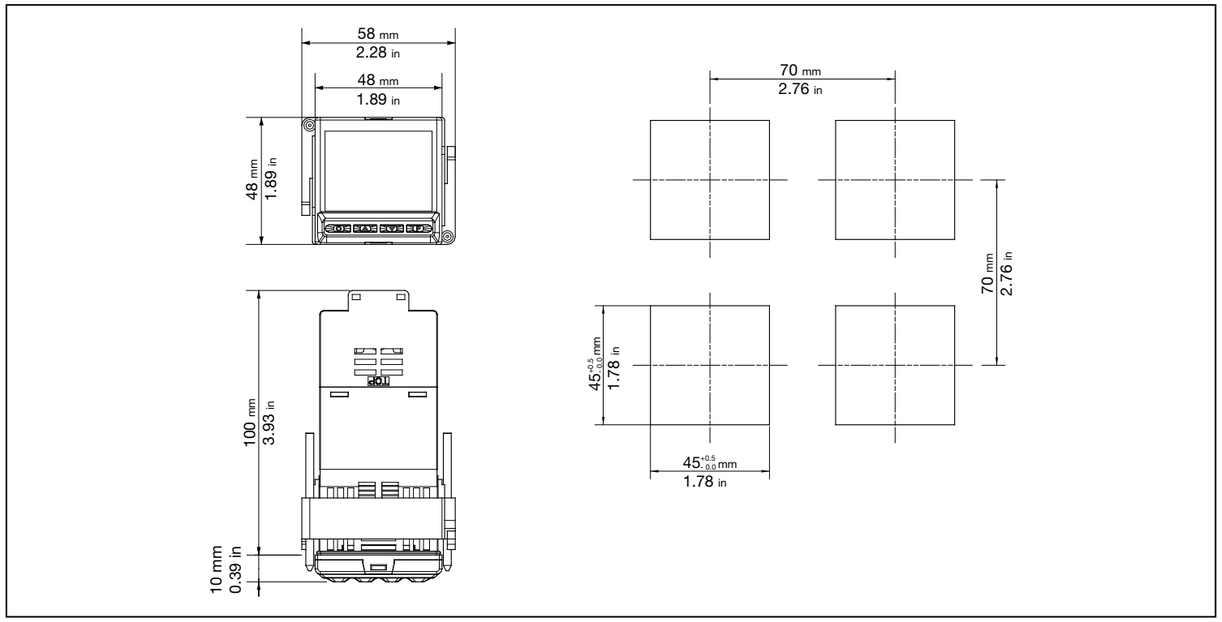
⚠ **Attention!** Make sure the ground connection is efficient.
Absent or inefficient grounding can make the device unstable due to excessive noise. Specifically, check that:
- voltage between mass and ground is < 1 V;
- resistance is < 6 Ω.

⚠ **Attention!** If the controller is connected to devices that are NOT electrically isolated (such as thermocouples), ground with a specific conductor to prevent grounding directly through the machine structure.

The controller's input and output lines must be separated from the power line.
To prevent noise, the controller's input and output cables must be kept away from the power cables (high voltages or high currents).
The input and output cables and the power cables must not be placed parallel to one another. Use shielded cables or separate cable trays.



DRILLING DIMENSIONS AND TEMPLATES



TECHNICAL DATA

OPERATOR INTERFACE		
DISPLAY	Type	LCD black background
	Screen area (L x H)	35 × 30 mm
	Lighting	Backlit with LEDs, life > 40.000 hours @ 25 °C (with brightness level backl = 8)
	PV display	Number of digits: 4 to 7 segments, with decimal point. Digit height: 17 mm Color: white
	SV display	Number of digits: 5 to 14 segments, with decimal point. Digit height: 7.5 mm Color: green
	Unit of measurement	Selectable, °C, °F or custom [1] Color: same as PV display
	Controller state signals	Number: 6 (RUN, MAN, _/-, REM, SP1/2) Color: amber
	Output state signals	Number: 4 (1, 2, 3, 4) Color: red
KEYPAD		Number of keys: 4 silicon (Man/Auto, INC, DEC, F) Type: mechanical
INPUTS		
MAIN INPUT	Sensor type	TC, RTD (PT100, JPT100), IR ES1B, DC linear sensor
	Accuracy	**TC input** Calibration accuracy: < ± (0,25% of reading in °C +0,1°C) Linearization accuracy: 0,1% of reading Cold junction accuracy: < ± 1°C at 25°C ambient temperature Cold junction compensation: > 30:1 rejection to the change of the ambient temperature **RTD input** Calibration accuracy: < ± (0,15% of reading in °C +0,4°C) Temperature drift: < ± (0,005% of reading in °C +0,015°C)/°C from 25°C ambient temperature Linearization accuracy: 0,1% of reading **Linear input**: Calibration accuracy: < 0,1% F.S. Temperature drift: < ± 0,005% F.S. /°C from 25°C ambient temperature
	Sampling time	60 ms / 120 ms, selectable
	Digital filter	0,0...20,0 s
	Temperature unit of measurement	Degrees C / F, selectable from keypad
	Signal interval	Type: linear Scale: -1999...9999, settable decimal point
	TC (thermocouple) input	Thermocouple: J, K, R, S, T, C, D Linearization: ITS90 or custom
	RTD (resistance thermometer) input	Resistance thermometer: PT100, JPT100 Input impedance (Ri): ≥ 30 kΩ Linearization: DIN 43760 or custom Max. line resistance: 20 Ω
	DC linear input	0...60 mV input impedance (Ri): > 70 kΩ 0...1 V input impedance (Ri): > 15 kΩ 0...5 V / 0...10 V input impedance (Ri): > 30 kΩ 0/4...20 mA input impedance (Ri): 50 Ω Linearization: linear or custom

AUXILIARY INPUT	Sensor type	TC, RTD (PT100, JPT100), sensor IR ES1B, linear DC
	Accuracy	**TC input** Calibration accuracy: < ± (0,25% of reading in °C +0,1°C) Linearization accuracy: 0,1% of reading Cold junction accuracy: < ± 1°C a 25°C ambient temperature Cold junction compensation: > 30:1 rejection to the change of the ambient temperature **RTD input** Calibration accuracy: < ± (0,15% of reading in °C +0,4°C) Temperature drift: < ± (0,005% of reading in °C +0,015°C)/°C from 25°C ambient temperature Linearization accuracy: 0,1% of reading **Linear input**: Calibration accuracy: < 0,1% F.S. Temperature drift: < ± 0,005% F.S. /°C from 25°C ambient temperature
	Temperature unit	°C / °F, selectable from keyboard
	Range of indication	Type: linear Range: -1999...9999, decimal point position
	TC (thermocouple) input	Thermocouples: J, K, R, S, T, C, D Linearization: ITS90 or custom
	RTD (resistance thermometer) input	Resistance thermometer: PT100, JPT100 Input impedance (Ri): ≥ 10 MΩ Linearization: DIN 43760 or custom Max. line resistance: 20 Ω
	DC linear input	0...60 mV input impedance (Ri): > 10 MΩ 0...1 V input impedance (Ri): > 300 kΩ 0...5 V / 0...10 V input impedance (Ri): > 300 kΩ 0/4...20 mA input impedance (Ri): 50 Ω Linearization: linear or custom
	Isolation	Functional isolation
CT (ammeter) INPUT	Type	Isolated via external transformer
		Number: 2 max Max. capacity: x / 50 mA AC Line frequency: 50/60 Hz Input impedance (Ri): 10 Ω
	Accuracy	±2% f.s. ±1 digit @25 °C
DIGITAL INPUTS	Type	voltage-free contact, or NPN 24 V - 4,5 mA, o PNP 12/24 V - max 3,6 mA *for detail see electrical connections*
	Isolation	250 V
	Number	3 max

TECHNICAL DATA

OUTPUTS		
	Relay (R)	Number: 3 max (4 max with 3 relays with contact in common) Type of relay contact: NO Max. current: 5 A, (2A for certification UL) 250VAC Minimum load: 5 V, 10 mA Life cycle: > 100.000 operations Double isolation
	Logic (D)	Number: 4 max Type: for solid-state relays Voltage: 24 V ±10% (min 10 V @20 mA) Isolated from main input
	Isolated logic (M)	Number: 2 max Type: MOS optically isolated inputs for PLC and AC / DC Voltage: 30 V AC/DC max Current: 100 mA max Resistance ON: 0,8 Ω max Isolation: 1500 V
	Triac (long life relay) (T)	Number: 1 max Load: resistive Voltage: 75...240 VAC Current max: 1 A Isolation 3 kV snubber circuit integrated zero crossing switching
	Continue (A)	Number: 1 max 0...10 V, max 20 mA, R_{out}: > 500 Ω 0...20 mA, 4...20 mA, R_{out}: < 500 Ω Resolution: 12 bit Insulation compared to main input
	Analog retransmission (A1)	Number: 1 max 0...10 V, max 20 mA, R_{out}: > 500 Ω 0...20 mA, 4...20 mA, R_{out}: < 500 Ω Resolution: 12 bit Insulation compared to main input
ALARMS	Possible configurations	Maximum, minimum, symmetric, absolute/relative, exclusion at firing, memory, reset from keypad and/or contact, LBA, HB HBB Hold Back Band if enabled with Programmer function Power variation alarm
POWER SUPPLY	For sensor VT1, VT2	Voltage: 24 VDC ±10% Current max: 30 mA
	For potentiometer VP	Voltage: 1 VDC ±1% Current max: 30 mA
CONTROL FUNCTIONS		
CONTROL	Type	Single loop, double loop
	Control	PID, ON/OFF, single action heat or cool, double action heat/cool
	Control output	Continuous or ON/OFF Cycle time: constant or optimized (BF)
	Control output for motorized valves	OPEN/CLOSE for floating motorized valve or with feedback with position control by potentiometer on Relay, Solid-state, Triac outputs.
SETPOINT PROGRAMMER (double Programmer if double loop)	Number of programs	Max 16 (if double loop 8 + 8) Start / Stop / Reset / Skip via digital inputs and/or outputs from logic operations Output state: Run /Hold / Ready / End
	Number of steps	Max 128, each with own setpoint, ramp time and hold time Times settable in HH:MM or MM:SS Max 4 consents, configurable for ramp and for hold Max 4 events, configurable in ramp and in hold
MULTIPLE SETPOINTS	Number of setpoints	Max 4, selectable from digital input Each setpoint change is subject to set ramp, different for up and down ramp
LOGIC OPERATIONS [1]	Digital function blocks	Max 32, with 4 input variables per block. The result can act on the state of the controller, of the programmer on alarms and outputs. Each function has an AND, OR with TIMER block.
OPERATIONS MATHEMATICAL [1]	Analog function blocks	Max 8, with 2 input variables per block, with operators such as + , - , × , : , average, square root, ... The result may act on analog variables in input to PID loops (controlled variable, setpoint) or analog outputs .
TIMER FUNCTION	Number timer	Standard: 1 If double loop: 2 independent
	Modes	START / STOP STABILIZATION (timer is on when PV enters a band set around setpoint; at end of count you can activate an output, shut down SW or change SP1/SP2) FIRING (timed activation of control after power on)
ENERGY COUNTER		Calculation done on nominal line voltage and nominal load power or on rms current measured on load via CT
DIAGNOSTIC		Short circuit or open circuit (LBA alarm) Interrupted or partially interrupted load (HB alarm) Short circuit of control output (SSR alarm)
RETENTIVE MEMORY	Type	FRAM
	Writes	Max. number: > 10^{10} cycles Retention: > 10 years

GENERAL DATA		
POWER SUPPLY	Operating voltage	100...240 VAC/VDC ±10%, 50/60 Hz (20...27 VAC/VDC ±10%, 50/60Hz)
	Power dissipation	10 W max
	Protections	Overvoltage 300 V / 35 V
	Connection	Screw terminals and crimp connector, max. wire section 1 mm²
CONNECTIONS	Serial configuration port	Connector: microUSB
	RS485 (option)	Baudrate: 1200, 2400, 4800, 9600, 19.200, 38.400, 57.600, 115.200 bit/s Protocol: Modbus RTU Insulation respect to main input Screw terminals and crimp connector, max. wire section 2,5mm²
	Inputs and outputs	Screw terminals and crimp connector, max. wire section 2,5 mm²
AMBIENT CONDITIONS	Use	Internal
	Altitude	2000 m max
	Operating temperature	-10 ... +55 °C (as per IEC 68-2-14)
	Storage temperature	-20 ... +70 °C (as per IEC 68-2-14)
	Relative humidity	20...85% RH non-condensing (as per IEC 68-2-3)
PROTECTION LEVEL		IP 65 on front panel (as per IEC 68-2-3)
ASSEMBLY	Positioning	On panel, removable faceplate
	Installation regulations	Installation category: II Pollution degree: 2 Isolation: double
DIMENSIONS		48 X 48 mm (1/16 DIN), Depth: 100 mm
WEIGHT		0,16 kg
1) Programming is done with the GF_eXpress configuration program		