



OPERATING INSTRUCTIONS AND WARNINGS

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GRAPHIC SYMBOLS USED

To distinguish between the type and importance of the information provided in these instructions for use, graphic symbols have been used as a reference to make interpreting the information clearer.



Indicates the contents of the various manual sections, the general warnings, notes, and other points to which the reader's attention should be drawn



Indicates a particularly delicate situation that could affect the safety and correct working operation of the controller, or a rule that must be strictly observed to avoid dangerous situations



Indicates a condition of risk for the safety of the user, due to the presence of dangerous voltages at the points shown



Indicates a suggestion based on the experience of the GEFRAN Technical Staff, which could prove especially useful under given circumstances



Indicates a reference to Detailed Technical Documents available on the GEFRAN web site www.gefran.com



This section contains information and warnings of a general nature which should be read before proceeding with controller installation, configuration and use.

General description

Modular controllers GEFTRAN series GEFLEX have been designed for temperature control in any applications involving heating or cooling processes.

They represent an exclusive combination of performance, reliability and applicational flexibility.

In particular, this new line of Gefran temperature controllers is the ideal solution for application in sectors where performance and service continuity are important, including:

extrusion lines

- injection molding for plastic materials
- thermoformers
- presses for rubber
- wrapping and packaging machines
- processing plant for the food industry
- cooling switchboards
- climatic chambers and test benches
- ovens
- paint plants
- etc.

The GEFLEX series controllers are made on an extremely versatile hardware and software platform, that allows the most suitable I/O composition for the plant to be chosen from a series of options.



Attention: the programming and configuration parameters are described in the "Programming and Configuration" manual enclosed with the Geflex Master and downloadable from www.gefran.com

Preliminary Warnings



The following preliminary warnings should be read before installing and using the series GEFLEX controller. This will allow the controller to be put into service more quickly and will avoid certain problems which may mistakenly be interpreted as malfunctions or limitations of the controller.

- Immediately after unpacking the controller, make a note of the order code and the other identification data given on the label affixed to the outside of the container and copy them to the table below.

These details must always be kept close at hand and referred to the personnel involved in the event of help from Gefran Customer Service Assistance.

SN.....	(Serial Number)
CODE	(Product code)
TYPE.....	(Order code)
SUPPLY.....	(Type of electrical power supply)
VERS.	(Firmware Version)
VERS. PROFIBUS.....	(Fieldbus Version)

- Check also that the controller is complete and has not been damaged at all during transit, and that the package contains not only the controller and these Instructions for Use, as well as for the GEFLEX Master model, the "Programming and Configuration manual".

Any inconsistencies, omissions or evident signs of damage should be reported immediately to your Gefran sales agent.

- Check that the order code corresponds with the configuration requested for the application the controller is needed for, referring to Section: "Technical - Commercial Information".

Example	GFX-M1	40/480	M	D	RR	P	C0
Master model							
Rated current/voltage							
Interface							
Field bus							
Cooling output							
Auxiliary outputs							
Digital input							
Diagnostics							

- Before installing the GEFLEX temperature controller in the machine control panel or host system, read paragraph 2.1 "Overall dimensions and mounting dimensions".

- If the instrument is to be configured by PC, make sure you have the WINSTRUM Kit.
For the order code refer to Section "Technical-Commercial Information".



Users and/or system integrators who wish to know more about the concepts of serial communication between standard PC and/or Gefran Industrial PC and Gefran Programmable Instruments, can access the various technical reference Documents in Adobe Acrobat format available in the Download section of the Gefran Web Site www.gefran.com including:

- Serial Communication
- MODBus Protocol

In the event of presumed instrument malfunction, before contacting Gefran Technical Service Assistance, refer to the Troubleshooting Guide given in Section 6 "Maintenance", and if necessary refer to the F.A.Q. Section (Frequently Asked Questions) on the Gefran Web Site www.gefran.com



This section contains the instructions necessary for correct installation of the GEFLEX controllers into the machine control panel or the host system and for correct connection of the controller power supply, inputs, outputs and interfaces.



Advice for Correct Installation for EMC



Before proceeding with installation read the following warnings carefully!

Remember that lack of observation of these warnings could lead to problems of electrical safety and electromagnetic compatibility, as well as invalidating the warranty.

Electrical power supply

- the controller is NOT equipped with an On/Off switch: the user must provide a two-phase disconnecting switch that conforms to the required safety standards (CE marking), to cut off the power supply upstream of the controller. The switch must be located in the immediate vicinity of the controller and must be within easy reach of the operator. One switch may control more than one controller.
- if the controller is connected to NOT isolated electrical equipment (e.g. thermocouples), the earth connection must be made with a specific conductor to prevent the connection itself from coming directly through the machine structure.
- if the controller is used in applications with risk of damage to persons, machinery or materials, it is essential to connect it up to auxiliary alarm equipment. It is advisable to make sure that alarm signals are also triggered during normal operation. The controller must NOT be installed in flammable or explosive environments; it may be connected to equipment operating in such atmospheres only by means of appropriate and adequate types of interface, conforming to the applicable safety standards.

Notes Concerning Electrical Safety and Electromagnetic Compatibility:

- **CE MARKING: EMC Conformity (electromagnetic compatibility)**
in accordance with EEC Directive EMC 2004/108/CE.
Series GEFLEX controllers are mainly designed to operate in industrial environments, installed on the switchboards or control panels of productive process machines or plants. As regards electromagnetic compatibility, the strictest generic standards have been adopted, as indicated in the table below.
- **BT Conformity (low tension)**
in accordance with Directive 2006/95/CE.

EMC conformity has been tested with the following connections (table 1).

Instrument power supply

- The power supply to the electronic equipment on the switchboards must always come directly from an isolation device with a fuse for the instrument part.
- The electronic instruments and electromechanical power devices such as relays, contactors, solenoid valves, etc., must always be powered by separate lines.
- When the electronic instrument power supply is strongly disturbed by the commutation of transistor or power units or motors, an isolation transformer should be used for the controllers only, earthing the screen.
- It is essential that the plant has a good earth connection:
 - the voltage between neutral and earth must not be $> 1V$
 - the Ohmic resistance must be $< 6\Omega$;
- If the mains voltage fluctuates strongly, use a voltage stabilizer.
- In the proximity of high frequency generators or arc welders, use adequate mains filters.
- The power supply lines must be separate from the instrument input and output ones.

Inputs and outputs connection

- The externally connected circuits must be doubly isolated.
- To connect the analogue inputs (TC, RTD) the following is necessary:
 - physically separate the input cables from those of the power supply, the outputs and the power connections.
 - use woven and screened cables, with the screen earthed in one point only.
- To connect the regulating and alarm outputs (contactors, solenoid valves, motors, fans, etc.), fit RC groups (resistance and condensers in series) in parallel to the inductive loads that operate in Alternating Current.
(Note: all the condensers must conform to VDE (class X2) standards and withstand a voltage of at least 220V AC. The resistances must be at least 2W).
- Fit a 1N4007 diode in parallel with the coil of the inductive loads that operate in Direct Current.



GEFRAN S.p.A. declines all responsibility for any damage to persons or property caused by tampering, neglect, improper use or any use which does not conform to the characteristics of the controller and to the indications given in these Instructions for Use.

EMC conformity has been tested with the following connections

FUNCTION	CABLE TYPE	LENGTH
Power supply cable	1 mm ²	1 mt
Relay output cables	1 mm ²	3,5 mt
Serial connection wire	0,35 mm ²	3,5 mt
Power connection cable	see related sections	3.5 mt
Thermocouple input probe	0,8 mm ² compensated	5 mt
“PT100” temperature resistance input probe	1 mm ²	3 mt

Table 1

EMC Emission		
Generic standards, emission standard for residential commercial and light industrial environments	EN 61000-6-3	
Emission enclosure	EN 61000-6-3	Group1 Class B
Emission AC mains	EN 61000-6-3	Group1 Class B
Radiated emission	EN 61326 CISPR 16-2	Class B
EMC Immunity		
Generic standards, immunity standard for industrial environments	EN 61000-6-2	
Immunity ESD	EN 61000-4-2	4 kV contact discharge level 2 8 kV air discharge level 3
Immunity RF interference	EN 61000-4-3 /A1	10 V/m amplitude modulated 80 MHz-1 GHz 10 V/m amplitude modulated 1.4 GHz-2 GHz
Immunity conducted disturbance	EN 61000-4-6	10 V/m amplitude modulated 0.15 MHz-80 MHz (level 3)
Immunity burst	EN 61000-4-4	2 kV power line (level 3) 2 kV I/O signal line (level 4)
Immunity pulse	EN 61000-4-5	Power line-line 1 kV (level 2) Power line-earth 2 kV (level 3) Signal line-earth 1 kV (level 2)
Immunity Magnetic fields	EN 61000-4-8	100 A/m (level 5)
Voltage dips, short interruptions and voltage immunity tests	EN 61000-4-11	100%U, 70%U, 40%U,
LVD Safety		
Safety requirements for electrical equipment for measurement, control and laboratory use	EN 61010-1	

The Declaration of conformity CE is available on request

2.1 Overall dimensions and mounting dimensions

1) Position each GEFLEX module with the longer side aligned with the vertical axis of the electrical panel to increase adequate natural air flow to the heat sink. The minimum distance from the side walls of the panel must be 20 mm; from the top and bottom walls, the minimum distance must be 100mm.

2) If a Master (GFX-M2...), install the module at the extreme left of the space reserved on the electromechanical plate; line up the Slave (GFX-S2...) or Expansion (GFX-E2...) modules progressively to the right of the Master, for a maximum of ten modules in all (see "Connection Examples").

3) The distance between the modules is shown on the attached drawing. The minimum distances can be used if the actual current is less than or equal to 75% of the maximum current shown on the GEFLEX data plate.

4) Attach each GEFLEX module to the electromechanical plate by means of DIN EN50022 guide or directly with 5MA screws (see "Dimensions and Cutout").

5) Remove the screw fastening the wire to the ground terminal, and then remove the protective cover from the power terminals by sliding it upward.

6) Wire signal terminal boards "J1" and "J2", connect the INPUT power terminals to Line, OUTPUT to Load and COMMON to the return phase of Load (see "Electrical Connections").

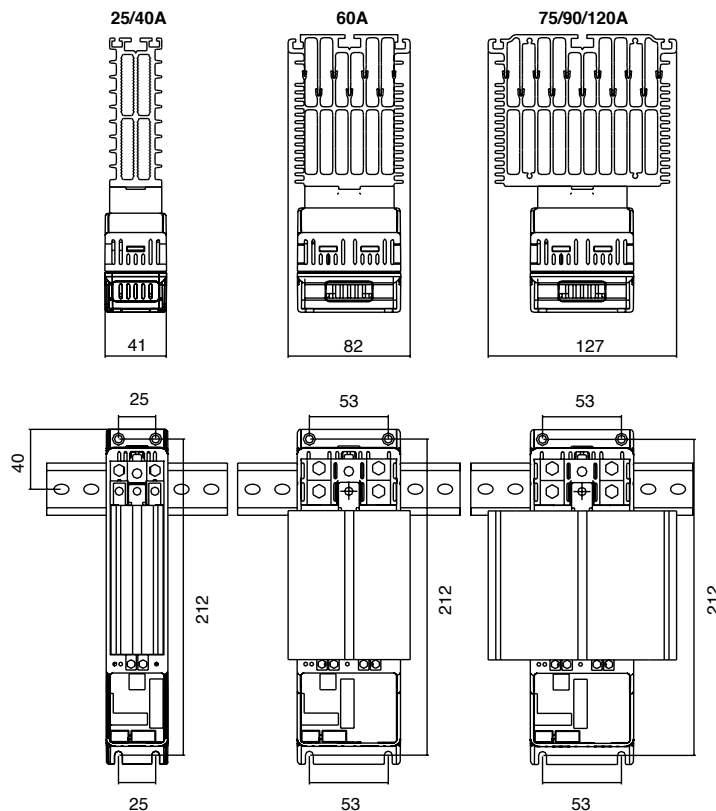
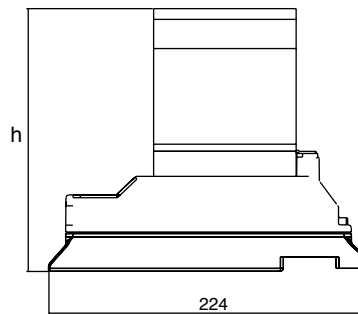
7) Attach the protective cover of the power terminals and connect the wire to the ground terminal.

8) If the module is a Master (GFX-M2...), wire its connector to the serial interface see "Electrical Connections".

9) If the module is a Slave (GFX-S2...) or Expansion (GFX-E2...), attach the flat wire to the corresponding connector "J3" of the module immediately to the left (see "Connection Examples").

10) If the module is a Expansion (GFX-E1...) with option "C0" or "CV" attach the flat wire corresponding (see three-phase connection).

	h (mm)
25A	160
40A ... 120A	195



2.2 Description of base

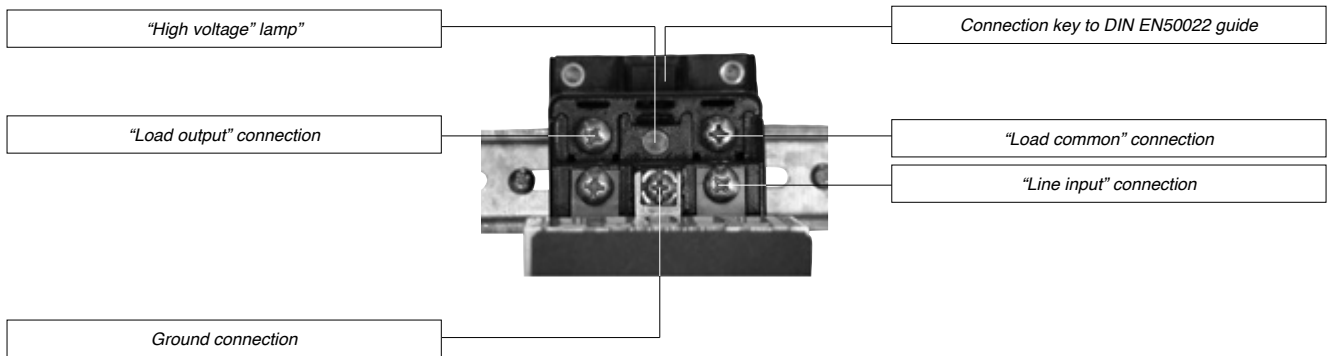
GEFLEX 25A - 40A



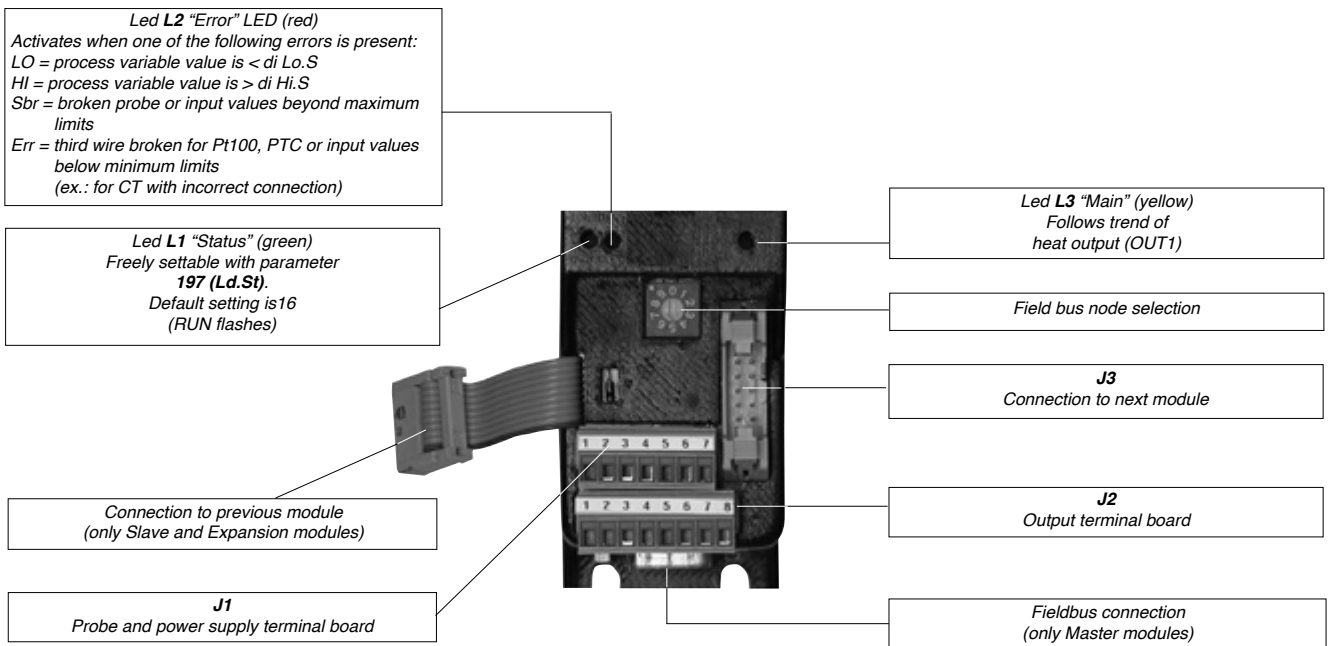
GEFLEX 60A - 75A - 90A - 120A



• Power



• Control and Communication



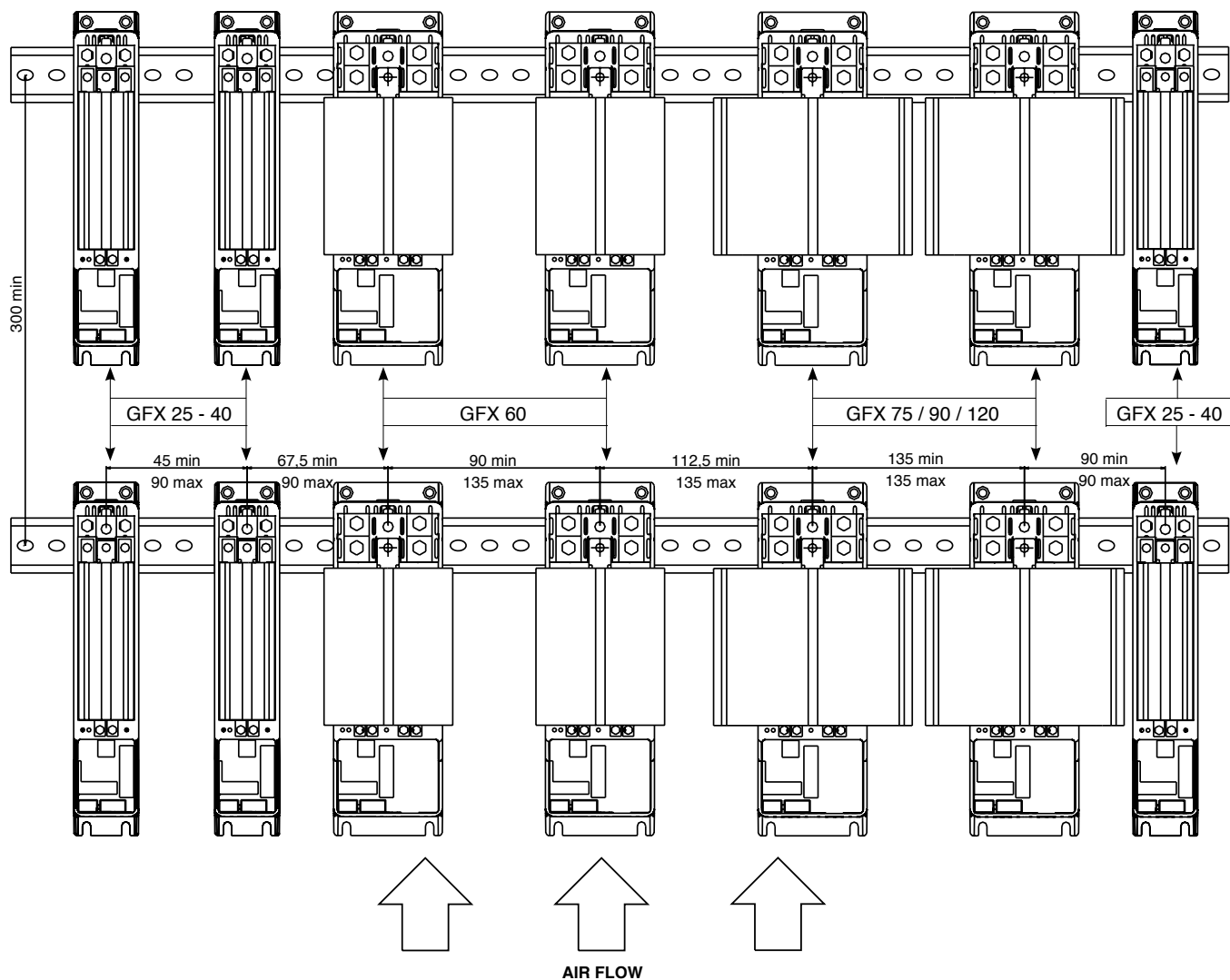
• Configuration of cooling output



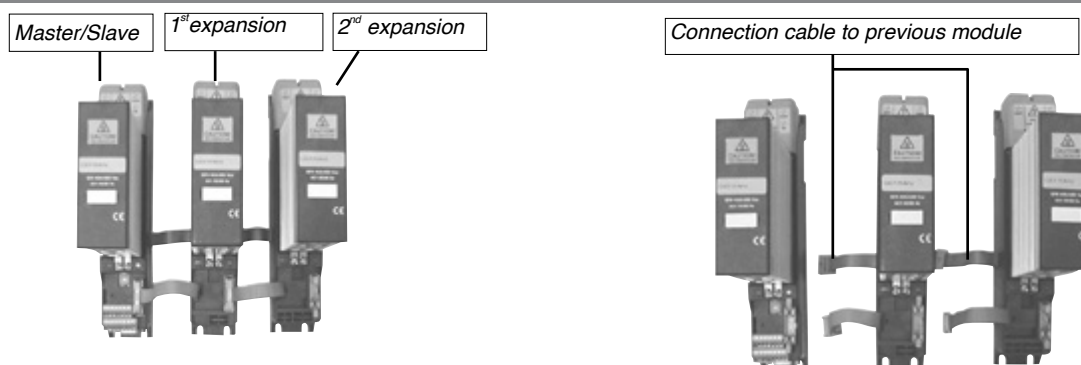
If you use the continuous cooling output (order code "C"), you can use a selector to change the factory setting from voltage (0/2...10V) to current (0/4...20mA).

Use a screwdriver to access the selector through the slot.

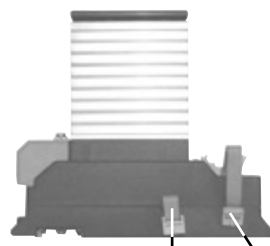
2.3 Connection examples



2.4 3-phase connection



Male connector on all Master/Slave models.
Remove the cover in case of use.



Connection cable to previous Master/Slave module
(present only if the expansion has a current
transformer) to detect current in the expansion.

Connection cable to
previous module



Check that the G.TA data shown on the expansion label equals the G.TA2 value (for the first expansion) and the G.TA3 value (for the second expansion) of the connected Master/Slave".
For more information, see the "Configuration and Programming" manual

3 · ELECTRICAL CONNECTIONS

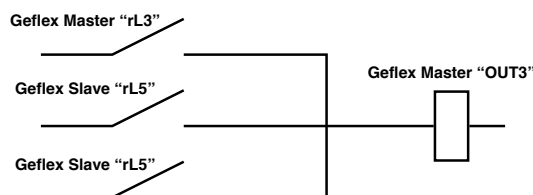
3.1 Wire terminal table

POWER	Level	Terminal contact area (LxD)	Terminal hole diameter	Recommended conductor section
	25A	12 x 12mm	5mm	6mm ²
	40A	12 x 12mm	5mm	10mm ²
	60A	14 x 12mm	6mm	16mm ²
	75A/90A	14 x 12mm	6mm	25mm ²
	120A	14 x 12mm	6mm	35mm ²
SIGNAL	Flexible wire conductor		Conductor with prod terminal with insulating collar	
	0,14 - 1,5mm ² / 28-16AWG		0,25 - 0,5mm ² / 24-20AWG	
	Cross-cut screwdriver, blade 0.4 x 2.5mm			

3.2 Operation of Geflex “Master” relay

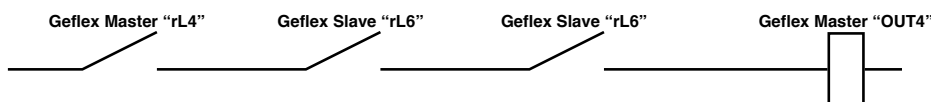
The “OUT3” and “OUT4” relays on the Geflex Master module provide special functions designed to reduce user wiring. These functions are active even when the Geflex Master module is not powered.

- The “OUT3” relay can be energized by the “rL3” command of the Geflex Master and by the “rL5” command of each Geflex Slave. This “**OR**” function of alarms among the devices can be used, for example, for a “maximum temperature setpoint” alarm in each zone to be heated by appropriately configuring the “Ax.t” parameters.



Output “OUT3” can function independently of the state of the Geflex Slaves by setting parameter “rL5” to 128 on each Geflex Slave.

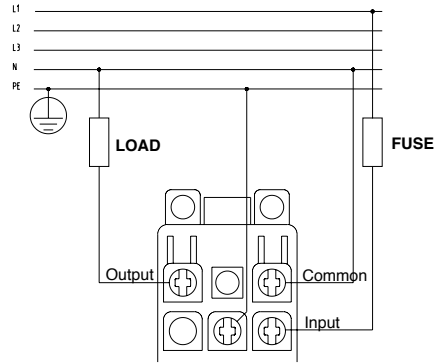
- The “OUT4” relay can be energized only with the simultaneous presence of the “rL4” command of the Geflex Master and commands “rL6” of all the Geflex Slave. This “**AND**” of alarms among the devices can be used, for example, to signal “minimum temperature setpoint reached” in each zone to be heated by appropriately configuring the “Ax.t” parameters.



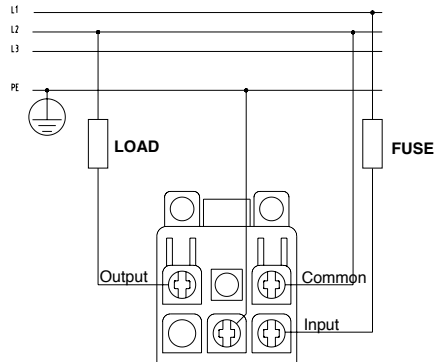
Output “OUT4” can operate independently of the state of the Geflex Slaves by setting parameter “rL6” to 160 (128+32) on each Geflex Slave. For more information, see the “Configuration and Programming” manual”.

3.3 Power / Input / Output / Power Supply connections

Three-phase line with neutral

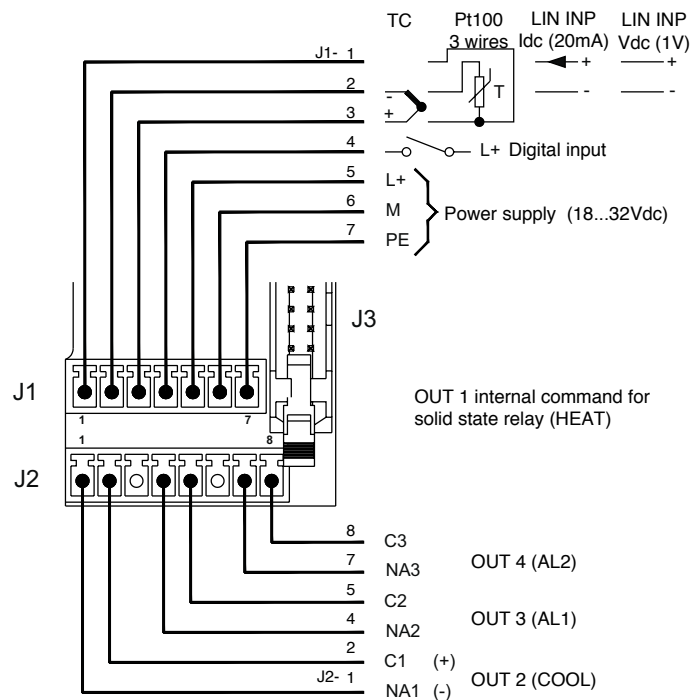


Three-phase line without neutral



The **Input** and **Common** connection to the network depend on the application.

A wire with 0,5mm² / 20AWG section is sufficient for the Common connection; tightening torque screws: 4Nm



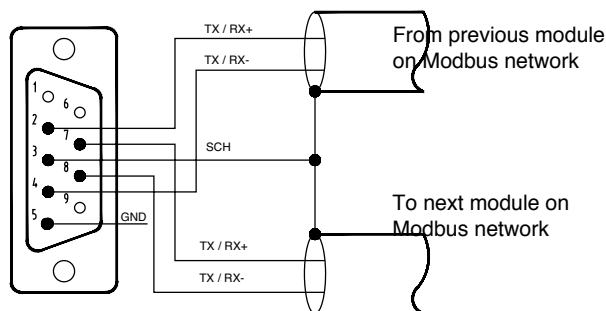
J1: Probe and power supply terminal board
J2: Relay output terminal board

(Output 2 with
"Logic" PNP18...32Vdc and
"Continuous" 0...10Vdc / 0...20mA options
not isolated from power supply)

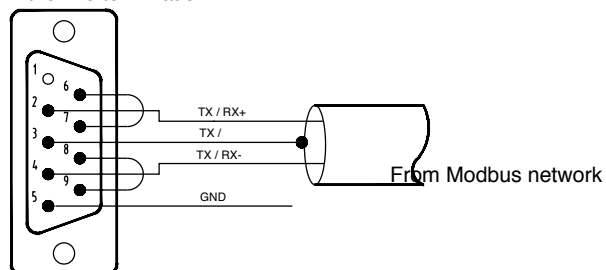
“MODBUS” serial

D-SUB Connector
9-pin Male

Shielded cable 1 pair 22 AWG
MODBUS conformity



We advise you to connect pins 6 to 7 and pins 8 to 9 on the connector of the last Geflex on the Modbus network to insert the line termination.

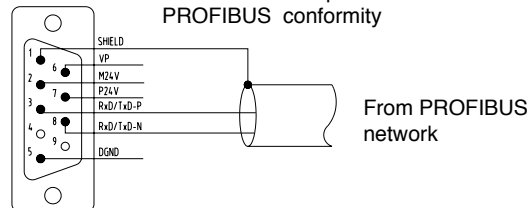


It is also advisable to connect the “GND” signal between Modbus devices having a line distance > 100m.

“PROFIBUS DP” serial

D-SUB connector
9-pin Male

Shielded cable 1 pair 22 AWG
PROFIBUS conformity

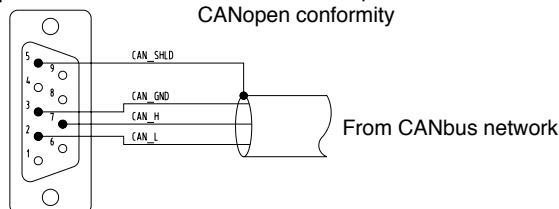


We advise you to connect a 220Ω 1/4W resistance between the “RxD/TxD-P” and “RxD/TxD-N” signals, a 390Ω 1/4W resistance between the “RxD/TxD-P” and “Vp” signals, and a 390Ω 1/4W resistance between the “RxD/TxD-N” and “DGND” signals at both ends of the Profibus network.

“CANopen” serial

D-SUB Connector
9-pin Female

Shielded cable 2 pairs 22/24 AWG
CANopen conformity

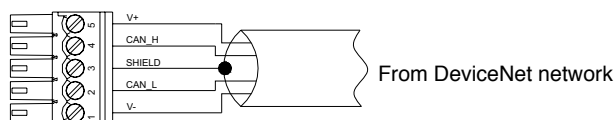


We advise you to connect a 120Ω 1/4W resistance between the “CAN_L” and “CAN_H” signals at both ends of the CANbus network.

“DeviceNet” serial

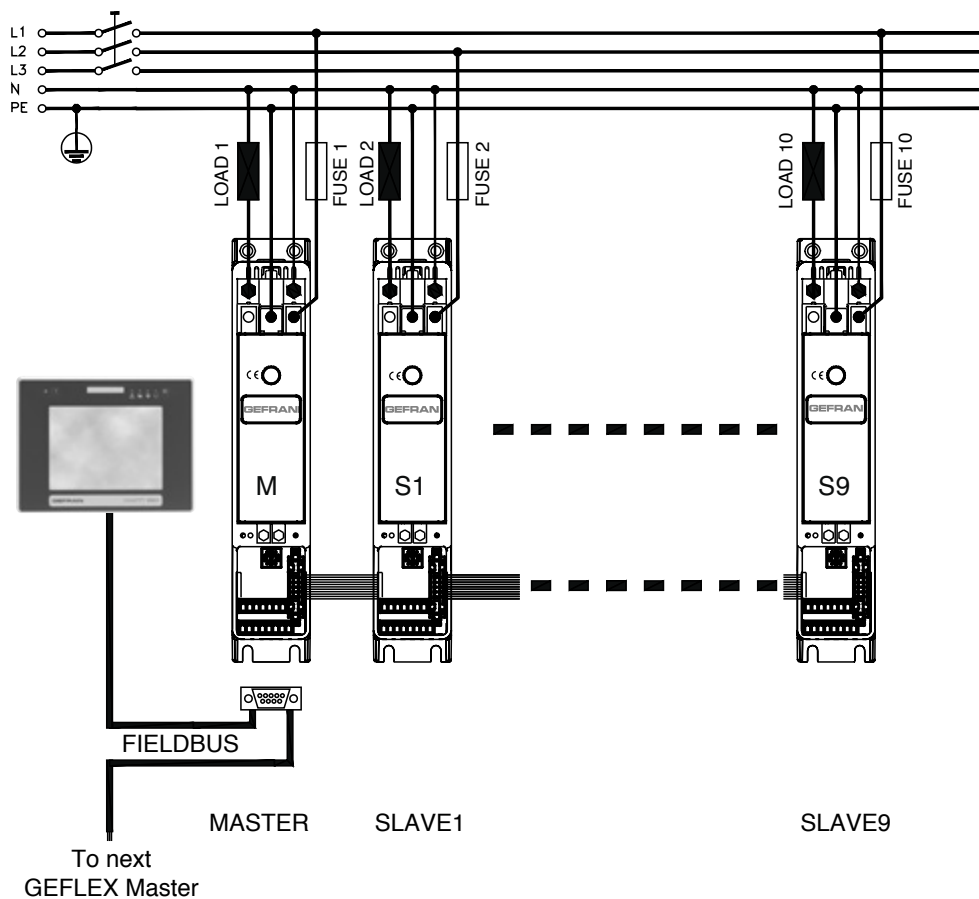
Connector 5 pin

Shielded cable 2 pairs 22/24 AWG
DeviceNet conformity



We advise you to connect a 120Ω 1/4W resistance between the “CAN_L” and “CAN_H” signals at both ends of the DeviceNet network.

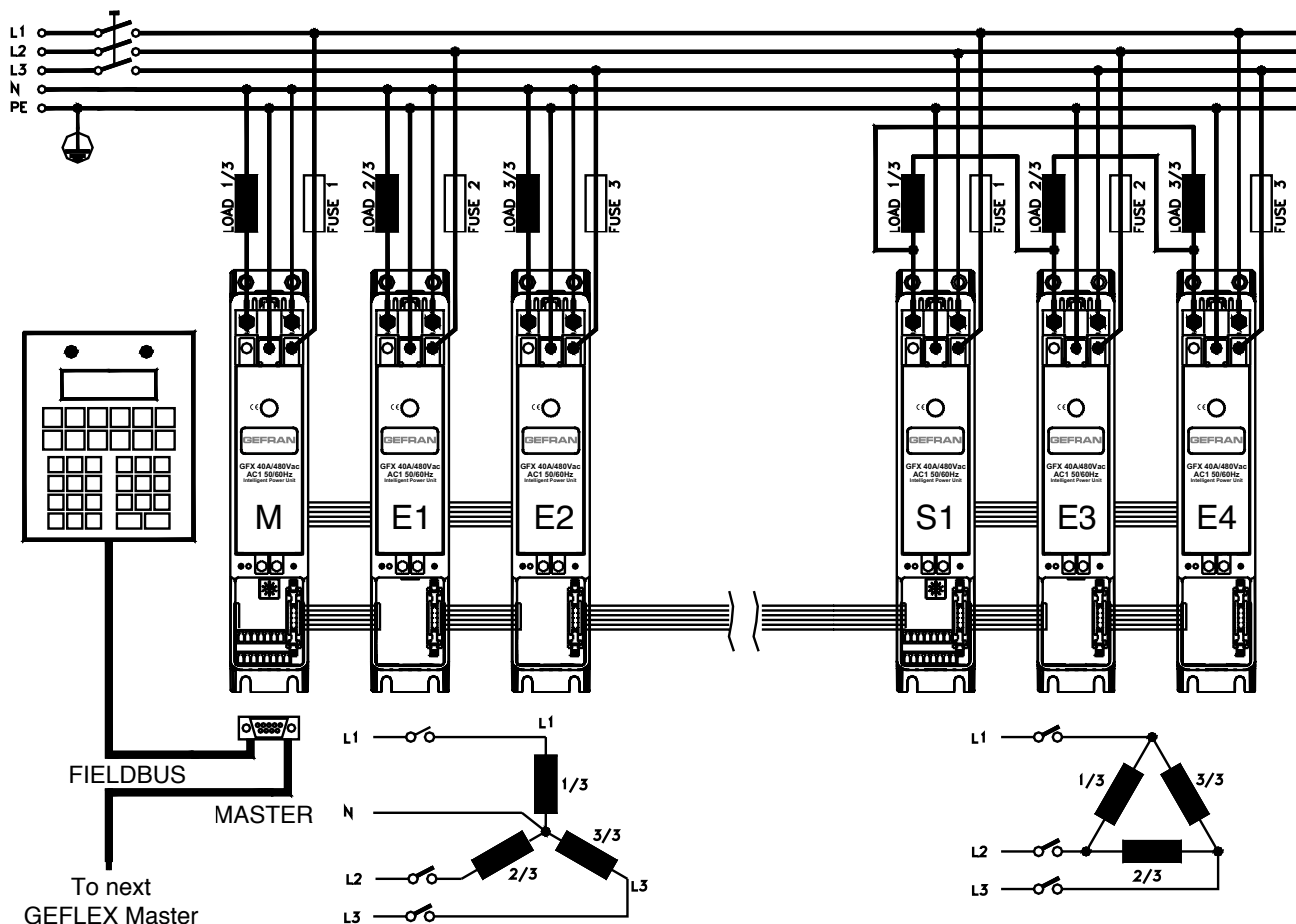
3.5 Connection of MASTER + SLAVE modules



3.6 Three-phase connection

Three-phase connection with neutral

Three-phase connection without neutral



4. INSTALLATION OF MODBUS SERIAL NETWORK

In a network, there is typically a Master that “manages” communication by means of “commands” and Slaves that interpret these commands.

Geflex Masters are to be considered slaves to the network master, which is usually a supervision terminal or PLC.

In addition, both the Geflex Masters and Slaves are identified in an unequivocal manner by means of a node address (ID).

The Geflex Master differs from the Geflex Slave only because the Geflex Master can be connected to the fieldbus.

In addition, the Geflex Master shows the state of the Geflex Slave on its outputs “OUT4” and “OUT5” by means of the OR and AND functions:

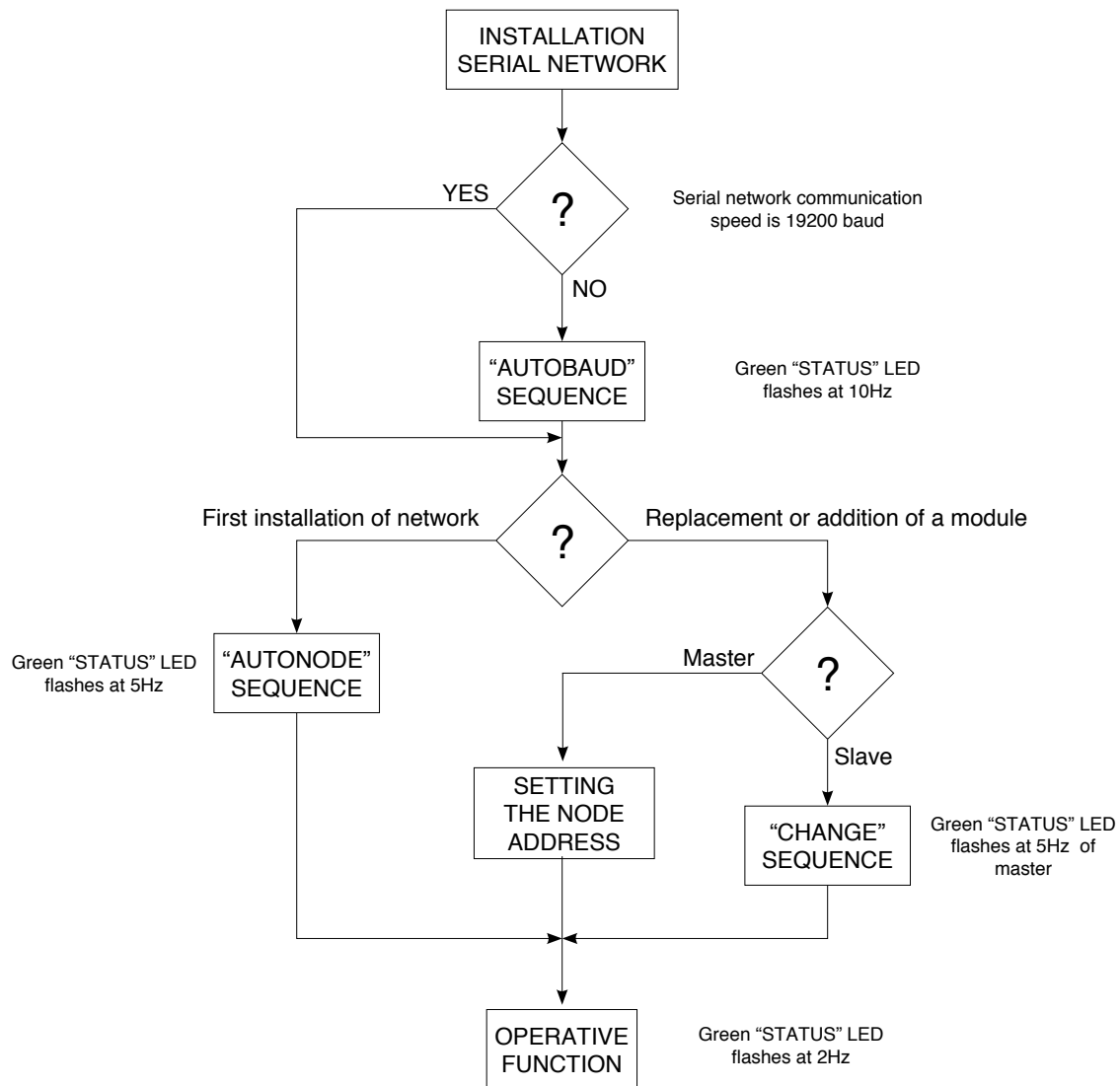
The Geflex Masters are available (see order code) with one of the following protocols: ModBus, Profibus or CANopen.

The following procedures are to be considered indispensable for the ModBus protocol.

For the other protocols, refer to the specific Geflex Profibus and Geflex CANopen manuals.

GEFLEX modules are supplied preset for 19200 baud without parity and with rotary selector for node address “0”.

A maximum of ninety GEFLEX modules can be installed in a serial network, with node address selectable from “10” to “99”.



4.1 “AUTOBAUD” sequence

Adjust the serial communication speed and parity of the Geflex models to the supervision terminal or PLC.

If network speed is 19200 baud and there is no parity, go directly to the “AUTONODE” sequence.



The green “STATUS” LED L1 mentioned in the procedure can vary its behavior based on parameter Ld.St , which has a default setting of 16.

The red LED not mentioned in the procedure can vary its behavior based on the presence of an error on the main input.

- 1) Cut power to the Geflex modules.
- 2) Connect the serial cables to all of the Master modules (GFX-M1...) in the network and to the supervision terminal.
- 3) Set the rotary selector on the Geflex modules to be installed (or on all the module in case of a first installation) to “0”.
- 4) Turn on power to the electrical pane.

5) Check that the green “STATUS” LEDs are flashing at high frequency (10Hz).

6) The supervision terminal has to transmit a series of generic “MODBUS” read messages to the network.

7) The procedure is finished when all of the green “STATUS” LEDs L1 on the Geflex modules flash at a normal frequency (2 Hz). (If parameter 197 Ld.St = 16 as default.).

The new speed parameter is saved permanently in each Geflex, so you will not have to activate the “AUTOBAUD” sequence at future power-ups.



Steps 1 and 4 are necessary only for Geflexes with firmware 1.0x. In later versions, when the rotary selector is moved, the green “STATUS” LED remains on steadily for about 6 seconds, after which it resumes its normal operation, saving the address.

4.2 “AUTONODE” sequence

Each GEFLEX module has to be assigned an unequivocal node address in the serial network.

If the entire network was previously initialized and you want to add a new module to the network, go directly to the “CHANGE” sequence. The node address is assigned by means of the rotary selector on each module.

Geflex Master modules can assume tens values only 1 = 10, 2 = 20, ... 9 = 90.

(ex. Geflex Master rotary selector = 2, node address = 20)

Geflex Slave modules can assume only the values that are the sum of their own rotary selector (representing units) plus the tens set on the connected master.

(ex. Geflex Master rotary selector = 2, node address = 20; Geflex Slave rotary selector = 3, node address = 20+3= 23).



The green “STATUS” LED L1 mentioned in the procedure can vary its behavior based on parameter Ld.St , which has a default setting of 16.

The red LED not mentioned in the procedure can vary its behavior based on the presence of an error on the main input.

- 1) Cut power to the Geflex modules.
- 2) Set the rotary selector on the Slave modules (GFX-S1...) in progression from “1” to “9”.
- 3) The rotary selector on the Master modules (GFX-M1..) must be set from “1” to “9”.
- 4) Energize the electrical panel, check that the green “STATUS” LEDs flash at a frequency of 2Hz. (If parameter 197 Ld.St = 16 as default). In this step, each module has acquired the status of its rotary selector.
- 5) Cut power to the Geflex modules.

6) Disconnect the serial cable from each Geflex Master.

7) Turn the rotary selector of the Master module to position “A”.

8) Energize the electrical panel.

9) Check that the green “STATUS” LED on the Master module flash at a frequency of about 5Hz.

10) The procedure is finished when the green “STATUS” LED and red “ERR” LED flash at a frequency of about 2Hz.

11) Turn the power off.

12) Return the rotary selector on the Master module to the position assigned at point 3

13) Connect the serial cable to each Geflex Master.

The new node address parameter is saved permanently in each Geflex, so you will not have to activate the “AUTONODE” sequence at future power-ups.



Steps 1, 4, 5, 8 and 11 are necessary only for Geflexes with firmware 1.0x. In later versions, when the rotary selector is moved, the green “STATUS” LED remains on steadily for about 6 seconds, after which it resumes its normal operation, saving the address.

4.3 “CHANGE” sequence

This is necessary when replacing a module or adding a new module to the network in order to assign a correct node address and communication speed.

For a Master module (GFX-M1...), simply set the rotary selector to the position you want, then energize the electrical panel.

For a Slave module (GFX-S1...), do as follows.

- 1) Cut power to the Geflex modules.
- 2) Disconnect the serial cable from the Geflex Master.
- 3) Turn the rotary selector of the Slave to be inserted to position “0”.
- 4) Turn the rotary selector of the Master to position “A”.
- 5) Turn on power to the Geflex modules.
- 6) Check that the green “STATUS” LED of the Slave is flashing at high frequency (10 Hz).
- 7) Check that the green “STATUS” LED of the Master is flashing at medium frequency (5Hz).
- 8) During this phase, the new module learns the speed and address (decimal part).

9) The procedure is finished when all of the green “STATUS” LEDs flash at a normal frequency (2 Hz).

10) Cut power to the Geflex modules.

11) Connect the serial cable to the Geflex Master module.

12) Return the rotary selector on the Geflex Master to the position assigned at point.

The new node address parameter is saved permanently in each Geflex, so you will not have to activate the “AUTONODE” sequence at future power-ups.



Steps 1, 4, 5, 8 and 11 are necessary only for Geflexes with firmware 1.0x. In later versions, when the rotary selector is moved, the green “STATUS” LED remains on steadily for about 6 seconds, after which it resumes its normal operation, saving the address.

4.4 Software On/Off

This function is obtained with the digital input if configured (diG = 6).

All outputs (control and alarms) are OFF (logic level 0, relays de-energized) and all the instrument control functions are inhibited except for “ON” function and serial dialog.

The PV input continues to be sampled

If software on/off is performed, you will have the following consequences:

- 1) Reset Auto-tuning, Self-tuning and Soft-start functions
- 2) Digital input (if present) enabled only if linked to SW shutdown function

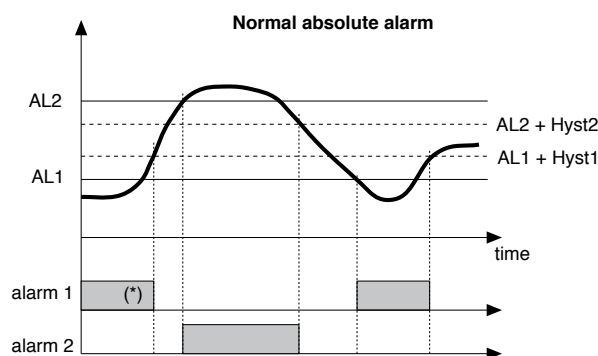
3) In case of restart after SW shutdown, the ramp linked to the set starts from the PV

4) Outputs OFF: except for OUT4 (Master) and OUT6 (Slave) of the Geflex instrument, which are forced ON

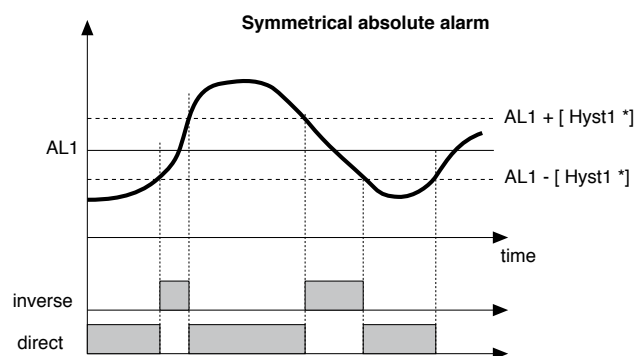
5) Reset HB alarm

6) Reset LBA alarm

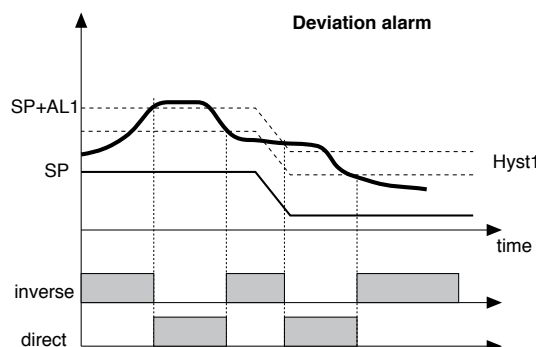
5. ALARMS



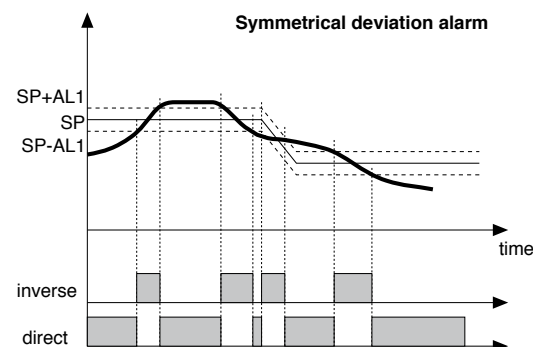
For AL1 = reverse absolute alarm (low) with positive Hyst1, AL1 t = 1
 (*) = OFF if disabled on power-up
 For AL2 = direct absolute alarm (high) with negative Hyst2, AL2 t = 0



For AL1 = symmetrical Lo absolute alarm with Hyst1, AL1 t = 5
 For AL1 = symmetrical Hi absolute alarm with Hyst1, AL1 t = 4
 (*) min. Hyst = 2 scale points



For AL1 = Lo deviation alarm with negative Hyst 1, AL1 t = 3
 For AL1 = Hi deviation alarm with negative Hyst 1, AL1 t = 2



For AL1 = Symmetrical Lo deviation alarm with Hyst 1, AL1 t = 7
 For AL1 = Symmetrical Hi deviation alarm with Hyst 1, AL1 t = 6

5.1 HB alarm function

This type of alarm can indicate variations of load current measured through transformer input in the range (0 ... **HS.tA**). It is enabled by means of configuration code (**AL.n**); in this case the alarm setpoint is expressed as HB scale points. The alarm function and the control output OUT1 are selected through parameter **Hb.F** ("Out" phase). The alarm setpoint is **A.Hb**. The direct HB alarm trips if current transformer input falls below the setpoint for **Hb.t** seconds of "ON" time for the selected output. The HB alarm can be activated only with ON times exceeding 0.4 seconds (excluding the continuous output). When the voltmeter input option is present, any alarm is canceled for voltage values below / of full scale. The HB alarm monitors load current even during the OFF period of the cycle time of the selected output. The HB alarm will trip if measured current exceeds 12,5% of the selected full scale (parameter **HS.tA** in InP) for **Hb_t**

seconds when the output is in OFF state. The alarm is reset automatically when alarm conditions have been cleared. If **A.Hb** = 0, both types of HB alarm are disabled and the assigned relay is de-energized. The current value is available in the **IntA** register. NOTE: ON/OFF times refer to the cycle time set for the selected output. Alarm **Hb_F** = 3 (7) for analog output is ON when the load current is lower than the alarm setpoint; the alarm is disabled if the heating (cooling) output is lower than 3%.

5.2 HOLD function

The input value and trip points are "frozen" while the logic input is active.

By activating the Hold input with the variable at a value below the trip points, a reset of the trip point memory de-energizes all energized relays and resets the memory of all alarms.

6. CONTROL ACTIONS

Proportional Action:

action in which contribution to output is proportional to deviation at input (deviation = difference between controlled variable and setpoint).

Derivative Action:

action in which contribution to output is proportional to rate of variation input deviation.

Integral Action:

action in which contribution to output is proportional to integral of time of input deviation.

Influence of Proportional, Derivative and Integral actions on response of process under control

* An increase in P.B. reduces oscillations but increases deviation.

* A reduction in P.B. reduces the deviation but provokes oscillations of the controlled variable (the system tends to be unstable if P.B. value is too low).

* An increase in Derivative Action corresponds to an increase in Derivative Time, reduces deviation and prevents oscillation up to a critical value of Derivative Time, beyond which deviation increases and prolonged oscillations occur.

* An increase in Integral Action corresponds to a reduction in Integral Time, and tends to eliminate deviation between the controlled variable and the setpoint when the system is running at rated speed.

If the Integral Time value is too long (Weak integral action), deviation between the controlled variable and the setpoint may persist.

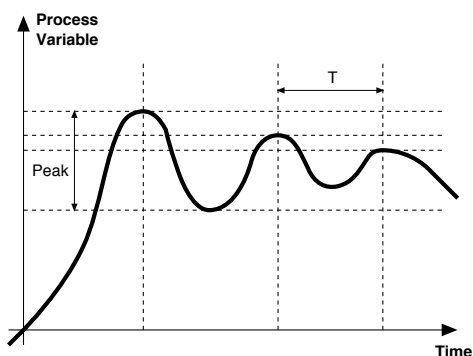
Contact GEFRA for more information on control actions.

7. MANUAL TUNING

A) Enter the setpoint at its working value.

B) Set the proportional band at 0.1% (with on-off type setting).

C) Switch to automatic and observe the behavior of the variable. It will be similar to that in the figure:



D) The PID parameters are calculated as follows: Proportional band

$$P.B. = \frac{\text{Peak}}{V_{\max} - V_{\min}} \times 100$$

(V max - V min) is the scale range.

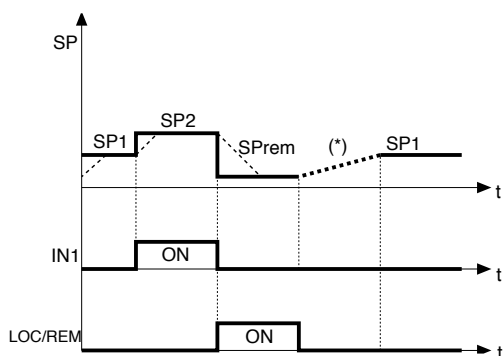
Integral time $I_t = 1,5 \times T$

Derivative time $d_t = I_t/4$

E) Switch the unit to manual, set the calculated parameters. Return to PID action by setting the appropriate relay output cycle time, and switch back to Automatic.

F) If possible, to optimize parameters, change the setpoint and check temporary response. If an oscillation persists, increase the proportional band. If the response is too slow, reduce it.

8. MULTISET FUNCTION, SET GRADIENT



(*) if the set gradient is set.

The multiset function is enabled in hd.1.

The gradient function is always enabled.

Selection of set point 1 or set point 2 can be made by digital input.

The selection of set point 1 / 2 can be displayed by LED.

SET GRADIENT: if set to 0, the setpoint is assumed equal to PV at power-up and when switching between auto/man; with gradient set, it reaches the local set or the one selected.

Every variation of the set is subject to a gradient.

The set gradient is inhibited at power-up when self-tuning is enabled.

If the set gradient is set to 0, it is active even with variations of local setpoints.

The control setpoint reaches the set value at a speed defined by the gradient.

The value of remote setpoint SP.rS is not saved in EEPROM.

9. SELF-TUNING

The function works for single output systems (heating or cooling).

The self-tuning action calculates optimum control parameter values during process startup.

The variable (for example, temperature) must be that assumed at zero power (room temperature).

The controller supplies maximum power until an intermediate value between starting value and setpoint is reached, after which it zeros power.

PID parameters are calculated by measuring overshoot and the time needed to reach peak.

When calculations are finished, the system disables automatically and the control proceeds until the setpoint is reached.

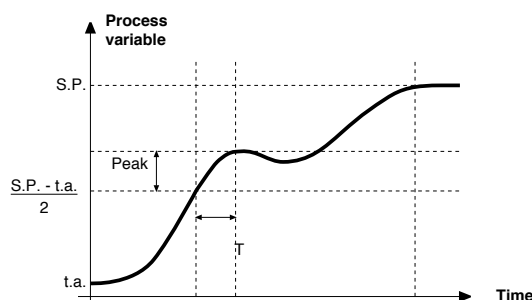
How to activate self-tuning:

A. Activation at switch-on

1. Adjust setpoint to required value
2. Enable self-tuning by setting **Stu** parameter to 2
3. Switch unit off
4. Make sure that temperature is approximately room temperature
5. Switch the unit on

B. Activation by serial command

1. Make sure that temperature is approximately room temperature
2. Adjust setpoint to required value
3. Give the Start Self-tuning command



The procedure runs automatically until finished, when the new PID parameters are stored: proportional band, integral and derivative times calculated for the active action (heating or cooling). In case of double action (heating or cooling), parameters for the opposite action are calculated by maintaining the initial ratio between parameters. (example: $Cpb = Hpb \cdot K$; where $K = Cpb / Hpb$ when selftuning starts). When finished, the **Stu** code is automatically cancelled.

Notes:

- The procedure interrupts when the setpoint value is exceeded. In this case, the **Stu** code is not cancelled.
- It is good practice to enable one of the configurable LEDs to signal self-tuning status.
By setting **Hrd** parameter **Ld.St** = 4 on the **Hrd**, the corresponding LED will be on or flashing when self-tuning is active.

N.B. Action not considered in ON/OFF control.

10. AUTO-TUNING

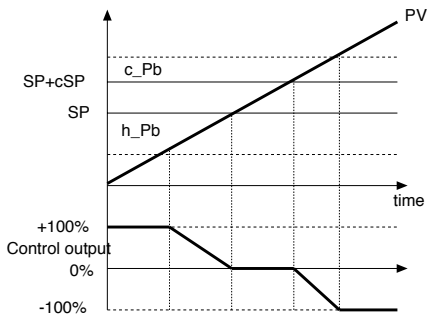
During the auto-tuning phase, changes in PID parameters are not considered.

Auto-tuning continuously measures system oscillations to find the optimum AID values to reduce such oscillations. It does not engage if the oscillations drop below 1.0% of the proportional band.

It is interrupted if the setpoint is changed, and is automatically resumed when the setpoint stabilizes. The calculated parameters are not stored. If the unit is switched off, the controller reverts to the values set before self-tuning was enabled.

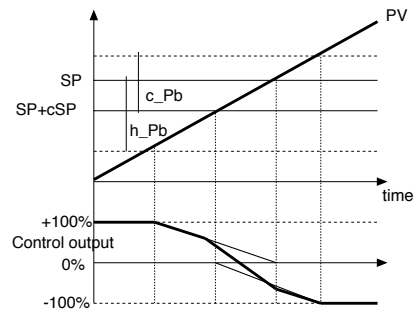
Auto-tuning with switching to Manual ends the procedure.

11. CONTROLS



Control output with proportional action only if proportional heating band is separated from proportional cooling band.

PV = process variable
SP+cSP = cooling setpoint
c_Pb = proportional cooling band



Control output with proportional action only if proportional heating band overlaps proportional cooling band.

SP = heating setpoint
h_Pb = proportional heating band

11.1 Heating/Cooling control with relative gain

In this control mode (enabled with Ctr = 14 parameter) the type of cooling has to be specified.

Cooling PID parameters are therefore calculated based on heating parameters according to the specified ratio.

(e: C_ME = 1 (oil), H_Pb = 10, H_dt = 1, H_Lt = 4 implies: C_Pb = 12,5, C_dt = 1, C_Lt = 4)

We advise you to apply the following values when setting output cycle times:

Air T Cool Cycle = 10 sec.

Oil T Cool Cycle = 4 sec.

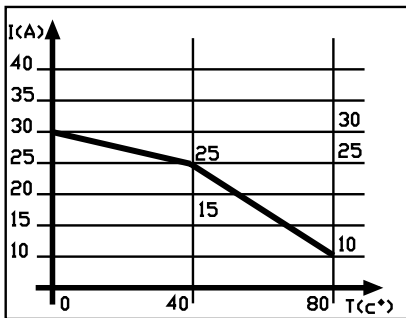
Water T Cool Cycle = 2 sec.

NB.: Cooling parameters **cannot be modified** in this mode.

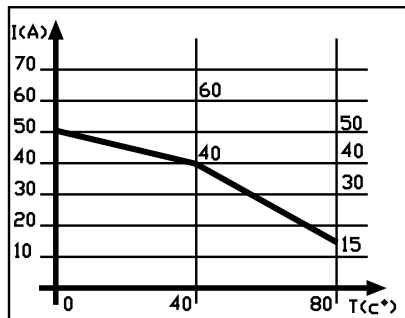
12. DISSIPATION CURVES

Rated current curves based on room temperature.

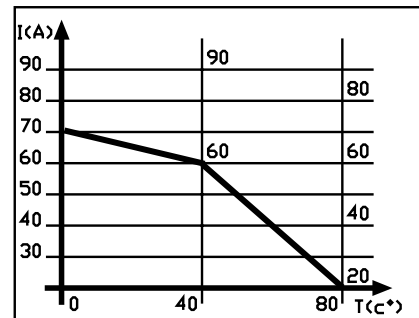
Geflex 25



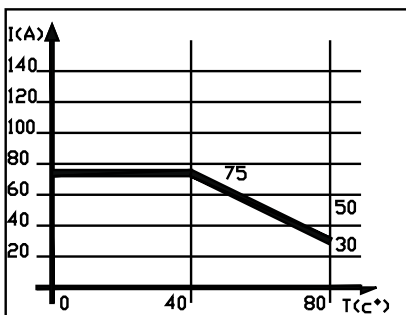
Geflex 40



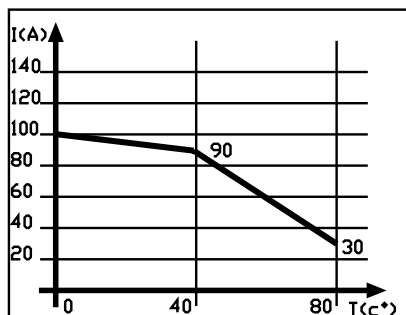
Geflex 60



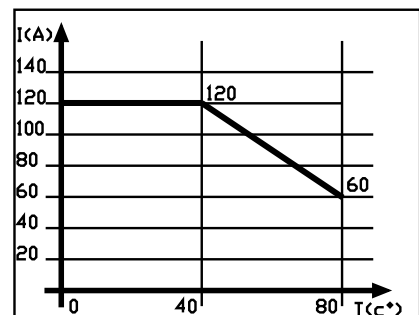
Geflex 75



Geflex 90



Geflex 120



Dissipated Thermal Power:

$P_{ds} = 1.6 \times I_{rms}$ (W)

I_{rms} = rated current of single-phase load

N.B.: Geflex 120 curves refer to the device complete with standard fan running.

13 • TECHNICAL SPECIFICATIONS

Inputs													
Accuracy main input	0,2% f.s. ±1 scale points at 25°C ambient temperature												
Thermal drift	0,005% f.s. / °C												
Main input (configurable digital filter)	TC, RTD 60mV,1V Ri≥1MΩ; 20mA Ri=50Ω Sampling time 120 msec.												
Type TC (Thermocouples) (ITS90)	J, K, R, S, T, (IEC 584-1, CEI EN 60584-1, 60584-2) a custom linearization can be inserted												
Cold junction error	0,1° / °C												
RTD type (scale settable in indicated range, with/without decimal point) (ITS90)	DIN 43760 (Pt100), JPT100												
Max. line resistance for RTD	20Ω												
Accuracy current transformer input	1% f.s. ± 1 scale points at 25°C ambient temperature												
Current transformer input	Internal CT 0...120A Sampling time 480msec. (1 fase), 1440msec. (3 fasi)												
Accuracy voltage transformer input	10% f.s. ± 1 scale points at 25°C ambient temperature on the range 0...100Vac and 400...500Vac 5% f.s. ± 1 scale point at 25°C ambient temperature on the range 100...400Vac												
Voltage transformer	Internal VT 0...500Vac. Sampling time 480msec (1 fase), 1440msec (3 fasi)												
Logic input	24V, 8mA												
Functionality													
Safety	Detection of short circuit or opening of probes, LBA alarm, HB alarm												
°C / °F selection	Configurable												
Linear scale ranges	-1999...9999												
Controls	Pid, Autotune, on-off												
pb - dt - it	0,0...999,9 % - 0,00...99,99 min - 0,00...99,99 min												
Action - Control outputs	heat / cool - on / off, PWM, GTT												
Max. power limit heat / cool	0,0...100,0 %												
Cycle time - Softstart	0...200 sec - 0,0...500,0 min												
Fault power setting	-100,0...100,0 %												
Automatic blanking	Maintains sampling of process variable PV; when active, disables the control												
Configurable alarms	Up to 4 alarm functions assignable to an output and configurable of type: maximum, minimum, symmetrical, absolute/relative, LBA, HB												
Alarm masking	Exclusion during warm up memory, reset from digital input												
Outputs													
2 relay outputs	NO, 3A, 250V cosφ=1												
2 logic outputs	24Vdc, 35mA												
2 continuous outputs	0/2...10V, 0/4...20mA su 500Ω max.												
Power supply													
Power supply	24Vdc ±25%, 5W max. Remote class 2 source or limited current												
Serial													
Serial interface	RS485, optoisolated												
Baude rate	1200, 2400, 4800, 9600, 19200												
Protocol for Geflex master	MODBUS RTU												
Optional field bus protocols	CANopen 10K...1Mbit/sec PROFIBUS DP 9,6...12Mbit/sec												
General characteristics													
Indications	3 LEDs (diagnostics) + lamp (presence of high voltage)												
Protection	IP20												
Working / storage temperature range	0...40°C / -20...70°C; Maximum surrounding air temperature 40°C												
Relative humidity	20...85% Ur not condensing												
Installation	Barra DIN EN50022 or pannel from 5MA screws												
Weight max	<table><tr><td>25A</td><td>40A</td><td>60A</td><td>75A</td><td>90A</td><td>120A</td></tr><tr><td>650gr</td><td>850gr</td><td>1300gr</td><td>1500gr</td><td>1500gr</td><td>1600gr</td></tr></table>	25A	40A	60A	75A	90A	120A	650gr	850gr	1300gr	1500gr	1500gr	1600gr
25A	40A	60A	75A	90A	120A								
650gr	850gr	1300gr	1500gr	1500gr	1600gr								

SSR		
Nominal voltage	480Vac	
Rated working voltage	24...253Vac	
Non-repetitive voltage	1200Vp	
Switching voltage for zero	$\leq 20V$	
Rated frequency	50...60Hz	
Rated current AC1	25A	40A
Non-repetitive overcurrent (t=20ms)	$\leq 400A$	$\leq 600A$
I ² t for blowout (t=1...10ms)	$\leq 645A^2s$	$\leq 1010A^2s$
dv/dt critical with output deactivated	$\leq 6600A^2s$	$\leq 8000A^2s$
Rated isolation voltage IN/OUT	$\leq 1150A$	$\leq 1500A$
Working temperature	$\leq 1500A$	$\leq 1500A$
	1000V/ μs	$\leq 11200A^2s$
	4000V	
	see dissipation curves	

14 • TECHNICAL-COMMERCIAL INFORMATION



This section contains information on the order codes for the Controller and on main accessories.

permits immediate identification the controller's hardware configuration. It is therefore essential to give the order code each time you have to contact Gefran's Customer Care Service to solve any problems.

As specified in the Preliminary Warnings of these Operating Instructions, correct interpretation of the Controller order code

Master		GFX-M1		/ 480		RR		P	
RATED CURRENT									
Base Master 25-40A without solid state power unit	B40								
Base Master 60-120A without solid state power unit	B120								
25A	25								
40A	40								
60A	60								
75A	75								
90A	90								
120A	120								
RATED VOLTAGE									
480Vac	480								
FIELD BUS INTERFACE									
RS485 MODBUS	M								
PROFIBUS DP	P								
CAN OPEN	C								
DeviceNet	D								
Ethernet Modbus TCP	E								
DIAGNOSTIC									
00	Absent								
C0	Current Transformer								
CV	Current Transformer + Voltage Transformer								
DIGITAL INPUT									
P	PNP Digital Input								
AUXILIARY OUTPUTS									
RR	2 Relays								
COOLING OUTPUT									
0	Absent								
D	Logic								
R	Relé								
C	Continuous output 0...10V (0/4...20mA)								

Slave		GFX-S1		/ 480		0		P	
RATED CURRENT									
Base Master 25-40A without solid state power unit	B40								
Base Master 60-120A without solid state power unit	B120								
25A	25								
40A	40								
60A	60								
75A	75								
90A	90								
120A	120								
RATED VOLTAGE									
480Vac	480								
COOLING OUTPUT									
Absent	0								
Logic	D								
Relay	R								
Continuous output 0...10V (0/4...20mA)	C								
DIAGNOSTIC									
00	Absent								
C0	Current Transformer								
CV	Current Transformer + Voltage Transformer								
DIGITAL INPUT									
P	PNP Digital Input								
AUXILIARY OUTPUTS									
00	Absent (**)								
RR	2 Relays								

(**) Option not available for current levels 75A, 90A and 120A

Expansion		GFX-E1		/ 480		0		00		0	
RATED CURRENT											
Base Master 25-40A without solid state power unit	B40										
Base Master 60-120A without solid state power unit	B120										
25A	25										
40A	40										
60A	60										
75A	75										
90A	90										
120A	120										
DIAGNOSTIC											
00	Absent										
C0	Current Transformer										
CV	Current Transformer + Voltage Transformer										
RATED VOLTAGE											
480	480Vac										

GEFRAN spa reserves the right to make aesthetic or functional changes at any time and without notice.

14.1 Accessories

KIT WINSTRUM



Software for management / configuration of Geflex units.

The main parameters of all Geflex models can be varied with a simple, intuitive interface.

ORDER CODE

Winstrum software on CD, RS232/485 converter complete
with cables to connect the PC and the Geflex..... **WSK - 1 - 1 - 0**

GFX-OP



Operator terminal for field configuration of the entire Geflex range

Two types of terminals are available:

- for installation on the Geflex heatsink or on DIN guide
- for installation on the faceplate

ORDER CODE

Programming terminal for Geflex (installation on DIN guide or on heatsink),
complete with connection cable to Geflex (L = 0.2 m)..... **GFX-OP-D**
Note: see cable section for other cable lengths

Programming terminal for Geflex (installation on faceplate)..... **GFX-OP-P**
Note: see cable section for connection cable

Kit consists of:

power supply, connection cable PC <--> GFX-DP-D (L = 2 m),
power adapter for the Geflex..... **GFX-OP-K**

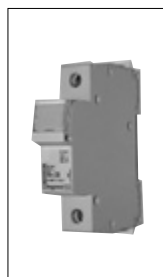
FUSES



ORDER CODE

GFX 25 FUS-025 (10x38mm)
GFX 40 FUS-040 (14x51mm)
GFX 60 FUS-080 (22x58mm)
GFX 90 FUS-100 (22x58mm)
GFX 120 FUS-125N (100x51x30mm)
non-extractable

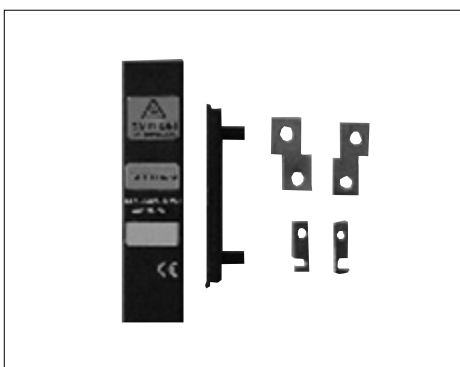
FUSE HOLDERS



ORDER CODE

PF - 10x38 (for FUS-025)
PF - 14x51 (for FUS-040)
PF - 22x58 (for FUS-080, FUS-100)
PF - DIN (for FUS-125N)

KIT TO ADAPT GTS MODULES TO GEFLEX BASE



Kit consisting of set of reeds with nickel-plated copper contact, pad-printed cover with hook cursor.

Permits installation of GTS series solid state power relays on the Geflex base.

ORDER CODE

Kit to insert GTS-25A on Geflex BASE Master/Slave 25-40 **CGK-25**
Kit to insert GTS-40A on Geflex BASE Master/Slave 25-40 **CGK-40**
Kit to insert GTS-60A on Geflex BASE Master/Slave 60-120 **CGK-60**
Kit to insert GTS-75A on Geflex BASE Master/Slave 60-120 **CGK-75**
Kit to insert GTS-90A on Geflex BASE Master/Slave 60-120 **CGK-90**
Kit to insert GTS-90A on Geflex BASE Master/Slave 60-120 **CGK-120**

Note: See the Geflex catalog for more accessories.