GEFRAN

GFX4-IR

4-ZONE MODULAR POWER CONTROLLER FOR IR LAMPS AND INDUCTIVE LOADS

INSTALLATION AND OPERATION MANUAL

Software version: **1.2x**

code **80404F - 03/2015 - ENGLISH**

INDEX

GRAPHIC SYMBOLS

To differentiate the type and importance of the information in this User Manual, graphic reference symbols are used to make such information easier to interpret.

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

Indicates a suggestion based on the experience of GEFRAN's Technical Personnel that could be especially useful under certain circumstances.

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.

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

Indicates a risk to the user's safety due to high voltage at the points indicated.

1 • PRELIMINARY INSTRUCTIONS

The section contains general information and warnings to be read before installing, configuring and using the controller.

1.1 General Description

GFX4-IR is an extremely compact, independent unit for separate control of 4 zones, complete with communication interface in all popular fieldbus standards.
It offers an exclusive combination of performance, reliability, and flexibility.
In particular, this new line of Gefran controllers is the ideal solution for sectors demanding high performance and continuity of service, such as:

- *Thermoforming*
- *Blowing*
- *Hot runners for injection presses*
- *Texturizing of fibers*
- *Heat treatment furnaces*
- *Woodworking machines*
- *Glass tempering furnaces*

Series GFX4-IR controllers are based on an extremely versatile hardware and software platform, with options to select the best I/O configuration for your system.

GFX4-IR is used for the power control of single-phase and 3-phase loads, including resistive loads with high and low temperature coefficient, short wave IR lamps, or transformer primaries.

Attention: the description of programming and configuration parameters are contained in the "Programming and configuration" manual, downloadable from the website www.gefran.com

1.2 Preliminary instruction

Read the following preliminary instructions before installing and using the GFX4-IR modular power controller.
This will make start-up faster and avoid some problems that could be mistakenly interpreted as malfunctions or limitations of the controller.

Immediately after unpacking the unit, check the order code and the other data on the label attached to the outside of the container.

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

Write them on the following table.
This data must always be available and given to Gefran Customer Care representatives if technical service is needed.
Check that the controller is in perfect condition, was not damaged during shipment, and that the package also contains the "Configuration and Programming" manual.

Immediately report any errors, shortages, or signs of damage to your Gefran dealer.
Check that the order code matches the configuration requested for the intended application by consulting the section: "Technical-Commercial Information."

Example: GFX4-IR 30 - D - 2 - F

- Model: GFX4-IR
- Total controlled power 30KW: 30
- Outputs 5...8 logic type: D
- Auxiliary inputs absent: 2
- Fuse holders present: F

See paragraph 2.1 " Dimensions and mounting" before installing the GFX4-IR controller on the machine/host system control panel.

In case of PC configuration, make sure you have the WINSTRUM Kit.
For the order code, see Section 7 "Technical-Commercial Information".

Users and/or system integrators who want detailed information on serial communication between Gefran standard and/or industrial PCs and Gefran Programmable Instruments can access Technical Reference Documents on serial communication and MODBus protocol, etc., in Adobe Acrobat format on the Gefran website **www.gefran.com**:

- Serial Communication
- MODBus Protocol

Before calling Gefran Customer Care in case of assumed malfunctions, please see the Troubleshooting Guide in the "Maintenance" section and, if necessary, the F.A.Q. (Frequently Asked Questions) section on the Gefran website **www.gefran.com**

2 • INSTALLATION AND CONNECTION

This section contains the instructions needed for correct installation of GFX4-IR controllers on the machine/host system control panel and for correct connection of the power supply, inputs, outputs and interfaces.

CAREFULLY READ THE FOLLOWING WARNINGS BEFORE INSTALLING THE INSTRUMENT!
Disregard of such warnings could create electrical safety and electromagnetic compatibility problems, as well as void the warranty.

2.1 Electrical power supply

- the controller DOES NOT have an On/Off switch: the user must install a 2-phase switch/isolator conforming to safety requisites (CE mark) to cut off the power supply up-line of the controller.
  The switch must be installed in the immediate vicinity of the controller in easy reach of the operator.
  A single switch can be used for multiple controllers.
- if the controller is connected to devices that are NOT electrically isolated (for example, thermocouples), the ground connection must be made with a specific conductor and NOT via the machine structure.
- if the controller is used in applications with risk of harm to persons or damage to machines or materials, it MUST be equipped with auxiliary alarm devices.
  It is advisable to provide the ability to check for tripped alarms during regular operation.
  DO NOT install the controller in rooms with hazardous (inflammable or explosive) atmosphere; it may be connected to elements that operated in such atmosphere only by means of appropriate interfaces that conform to current safety standards.

2.2 Notes on electrical safety and electromagnetic compatibility:

2.2.1 MARCATURA CE: EMC (electromagnetic compatibility) conformity

in compliance with Directive 89/336/CEE and following modifications.
Series GFX4-IR controllers are mainly intended for industrial use, installed on panels or control panels of production process machines or systems.
For purposes of electromagnetic compatibility, the most restrictive generic standards have been adopted, as shown on the table.

2.2.2 LV (low voltage) conformity

in compliance with Directive 2006/95/CE.

EMC conformity has been verified with the connections indicated on table 1.

2.3 Recommendations for Correct Installation for purposes of EMC

2.3.1 Instrument power supply

- The power supply for the electronic instrumentation on the panels must always come directly from a cut-off device with fuse for the instrument part.
- Electronic instrumentation and electromechanical power devices such as relays, contactors, solenoids, etc., MUST ALWAYS be powered by separate lines.
- When the power supply line of electronic instruments is heavily disturbed by switching of thyristor power groups or by motors, you should use an isolation transformer only for the controllers, grounding its sheathing.
- It is important for the system to be well-grounded:
  - voltage between neutral and ground must not be > 1V
  - Ohmic resistance must be < 6Ω;
- If the grid voltage is highly unstable, use a voltage stabilizer.
- In proximity of high-frequency generators or arc welders, use adequate grid filters.
- The power supply lines must be separate from instrument input and output lines.
- Supply from Class II or from limited energy source

2.3.2 Input and output connections

Before connecting or disconnecting any connection, always check that the power and control cables are isolated from voltage
Appropriate devices must be provided: fuses or automatic switches to protect power lines.
The fuses present in the module function solely as a protection for the GFX4-IR semiconductors.

- Connected outside circuits must be doubly isolated.
- To connect analog inputs, strain gauges, linears, (TC, RTD), you have to:
  - physically separate the input cables from those of the power supply, outputs, and power connections.
  - use braided and shielded cables, with sheathing grounded at a single point.
- To connect the control outputs and alarm outputs (contactors, solenoids, motors, fans, etc.), install RC (series of capacitors and resistors) groups parallel to inductive loads that work in AC.
  (Note: all condensers must conform to VDE standards (class X2) and support voltage of at least 220Vac. Resistances must be at least 2W).
- Install a 1N4007 diode anti-parallel to the coil of inductive loads that work in DC.

GEFRAN S.p.A. assumes no liability for any damage to persons or property deriving from tampering, from incorrect or improper use, or from any use not conforming to the characteristics of the controller and to the instructions in this User Manual.

Table 1 EMC Emission

AC semiconductor motor controllers and conductors for non-motor loads	EN 60947-4-3	
Emission enclosure compliant in firing mode single cycle and phase angle if external filter fitted	EN 60947-4-3 CISPR-11 EN 55011	Class A Group 2

Table 2 EMC Immunity

Generic standards, immunity standard for industrial environments	EN 60947-4-3	
ESD immunity	EN 61000-4-2	4 kV contact discharge 8 kV air discharge
RF interference immunity	EN 61000-4-3 /A1	10 V/m amplitude modulated 80 MHz-1 GHz 10 V/m amplitude modulated 1.4 GHz-2 GHz
Conducted disturbance immunity	EN 61000-4-6	10 V/m amplitude modulated 0.15 MHz-80 MHz
Burst immunity	EN 61000-4-4	2 kV power line 2 kV I/O signal line
Surge immunity	EN 61000-4-4/5	Power line-line 1 kV Power line-earth 2 kV Signal line-earth 2 kV Signal line-line 1 kV
Magnetic fields immunity	Test are not required. Immunity is demostrated by the successfully completion of the operating capability test	
Voltage dips, short interruptions and voltage immunity tests	EN 61000-4-11	100%U, 70%U, 40%U,

Table 3 LVD safety

Safety requirements for electrical equipment for measurement, control and laboratory use	EN 61010-1	

ATTENTION

This product has been designed for class A equipment. Use of the product in domestic environments may cause radio interference, in which case the user may be required to employ additional mitigation methods.

External EMC filters

EMC filters are required in PA mode (Phase Angle, i.e., SCR trigger with phase angle modulation). The filter model and current level depend on the configuration and load used.
The power filter must be connected as close to the GFX4-IR as possible.
You can use a filter connected between the power supply line and the GFX4-IR or an LC group connected between each GFX4-IR output and the load. We recommend the following filters:

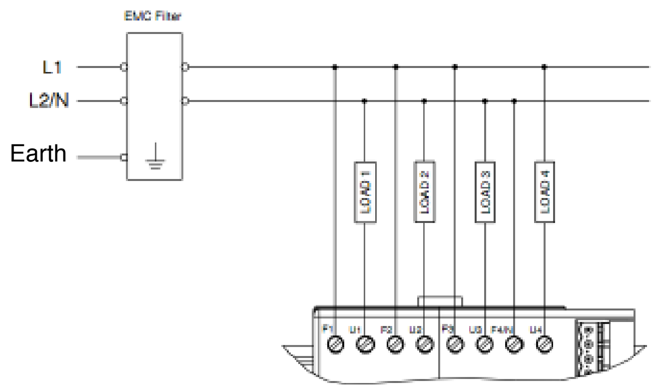
3-PHASE FILTERS WITHOUT NEUTRAL (to be connected between line and GFX4-IR)		
Model REO	**Nominal voltage (Vn)**	**Nominal current (In)**
CNW103/16	Vn = 400V	In = 16A
CNW207/20	Vn = 400V	In = 20A
CNW207/35	Vn = 400V	In = 35A
CNW207/50	Vn = 400V	In = 50A

FILTERS WITH NEUTRAL (to be connected between line and GFX4-IR)		
Model REO	**Nominal voltage (Vn)**	**Nominal current (In)**
CNW105/16	Vn = 400V	In = 16A
CNW106/25	Vn = 400V	In = 25A
CNW105/36	Vn = 400V	In = 36A
CNW105/50	Vn = 400V	In = 50A

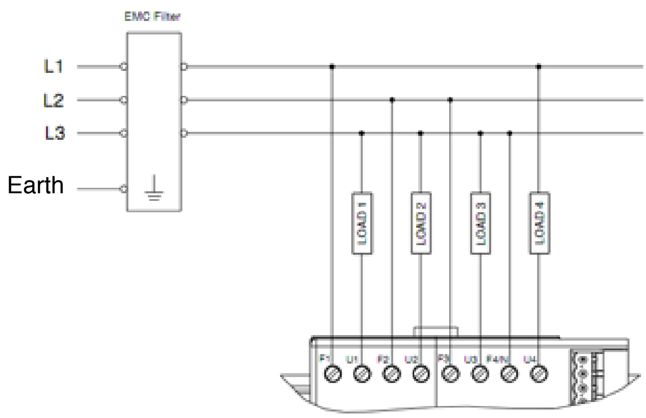
DISCRETE LC FILTERS (to be connected between GFX4-IR and load)		
MYRRA inductance code 74194	Ln = 450µH	In = 10A
MYRRA inductance code 74195	Ln = 250µH	In = 20A
KEVIN SHURTER inductance DLFP0132-16D2	Ln = 300µH	In = 16A
KEVIN SHURTER inductance DLFP0132-25D2	Ln = 150µH	In = 25A
KEVIN SHURTER inductance DLFP0132-45D2	Ln = 200µH	In = 45A
ELECTRONICON condenser E62.C58-102E10	C = 1µH	Vn = 1200V
ELECTRONICON condenser E62.C51-152E10	C = 1,5µH	Vn = 1200V

EMC FILTER CONNECTION EXAMPLES

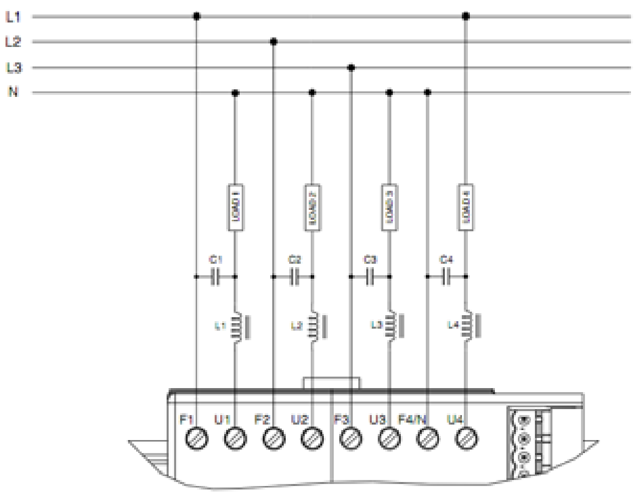
Connection for 4 single-phase loads, single-phase line



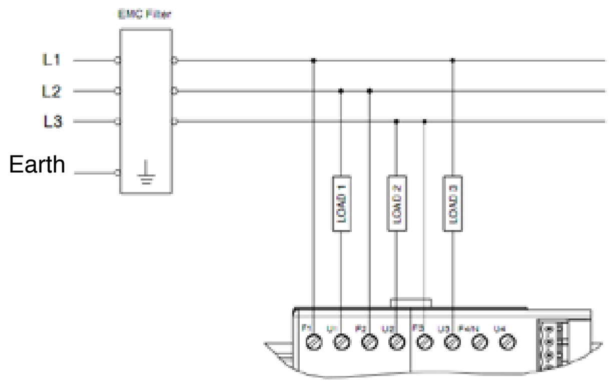
Connection for 4 single-phase loads, 3-phase line without neutral

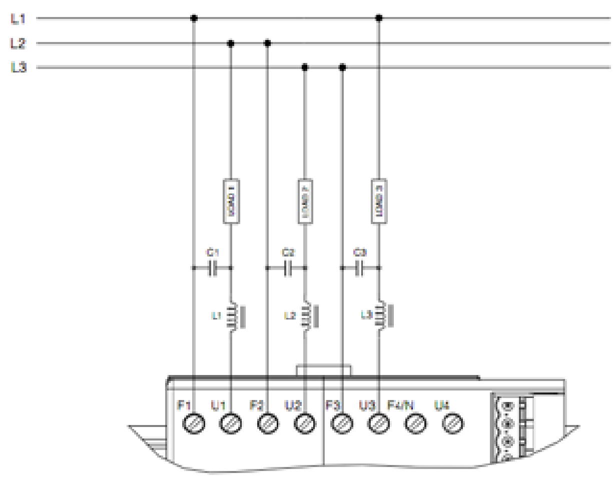


Connection for 4 single-phase loads, 3-phase line with neutral

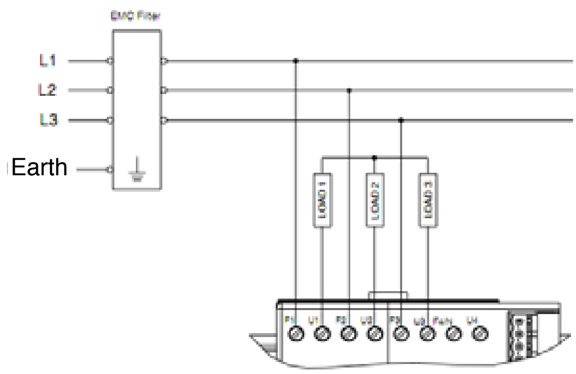


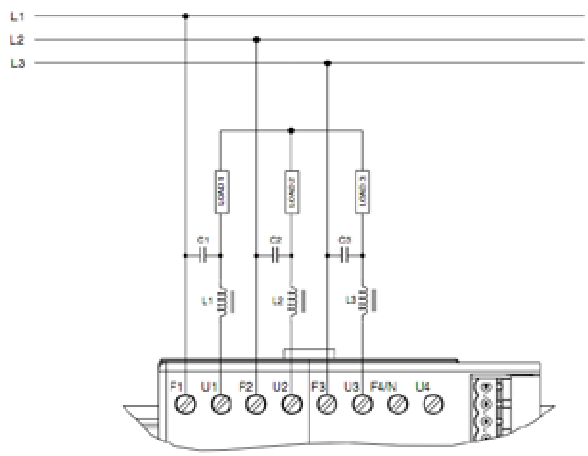
Connection for 3 independent single-phase loads in open delta, 3-phase line without neutral



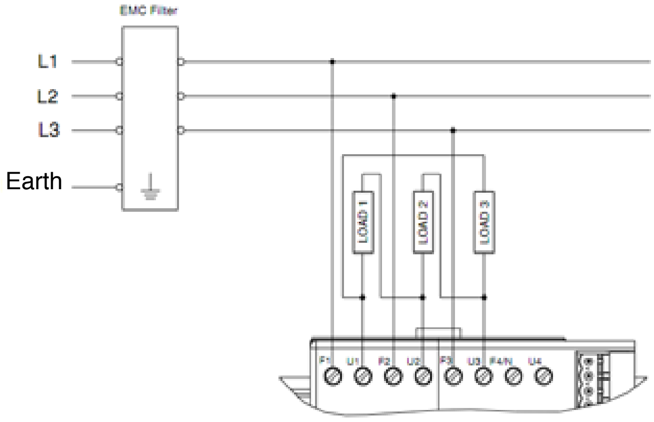


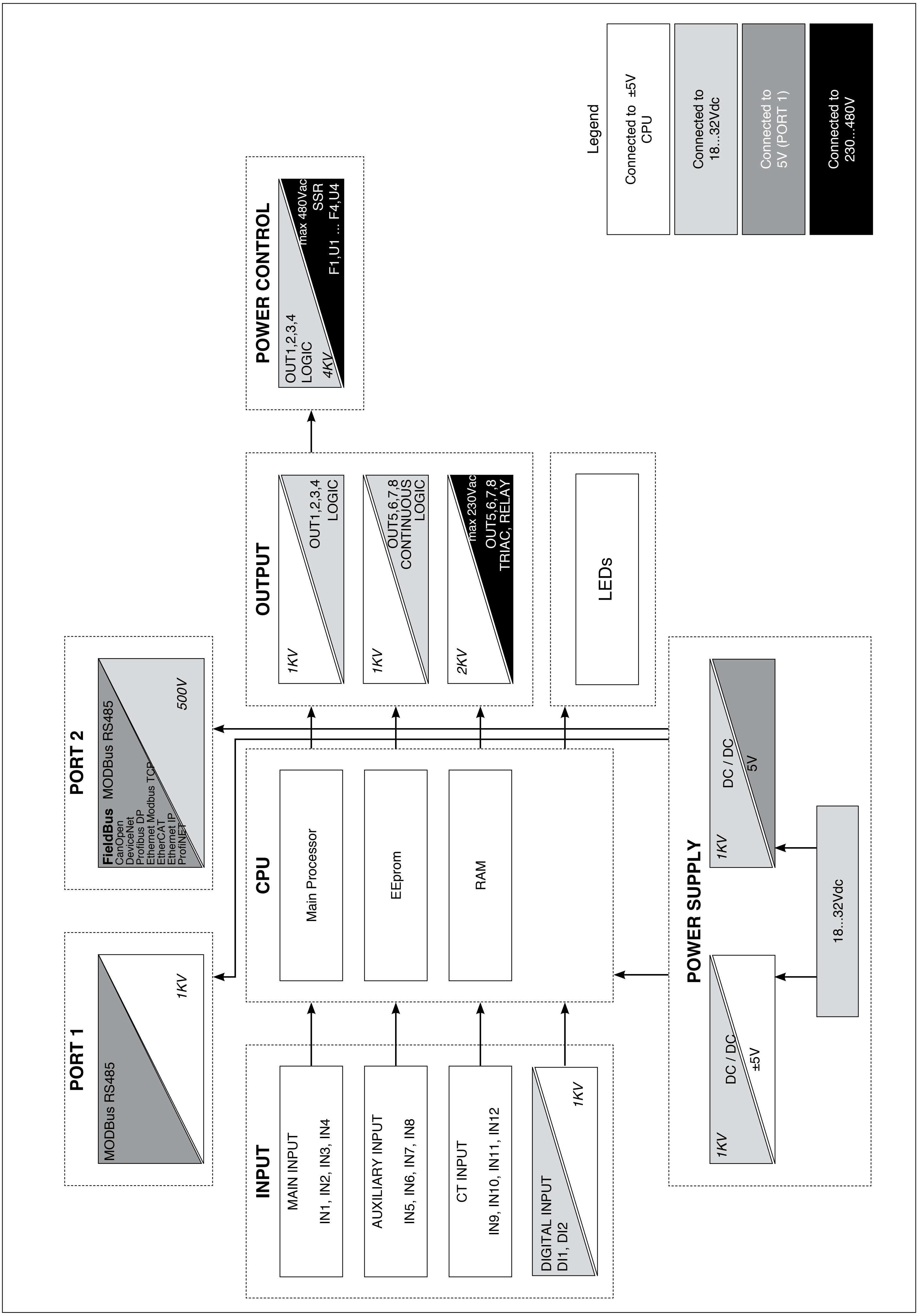
Connection for 3-phase star load without neutral





Connection for 3-phase load in closed delta




INPUT
MAIN INPUT
IN1, IN2, IN3, IN4
AUXILIARY INPUT
IN5, IN6, IN7, IN8
CT INPUT
IN9, IN10, IN11, IN12
DIGITAL INPUT
DI1, DI2
1KV
PORT 1
MODBus RS485
1KV
PORT 2
FieldBus
CanOpen
DeviceNet
Profibus DP
Ethernet Modbus TCP
EtherCAT
Ethernet IP
ProfiNET
MODBus RS485
500V
CPU
Main Processor
EEprom
RAM
OUTPUT
1KV
OUT1,2,3,4
LOGIC
1KV
OUT5,6,7,8
CONTINUOUS
LOGIC
2KV
max 230Vac
OUT5,6,7,8
TRIAC, RELAY
LEDs
POWER CONTROL
OUT1,2,3,4
LOGIC
4KV
max 480Vac
SSR
F1,U1 ... F4,U4
POWER SUPPLY
1KV
DC / DC
±5V
1KV
DC / DC
5V
18..32Vdc
Legend
Connected to ±5V
CPU
Connected to
18...32Vdc
Connected to
5V (PORT 1)
Connected to
230...480V

2.4 DIMENSIONS

Fastening may be done on DIN guide (EN50022) or with (5MA). See figures 1 and 2. All dimensions are expressed in mm.

Figure 1 Model without fuse holder

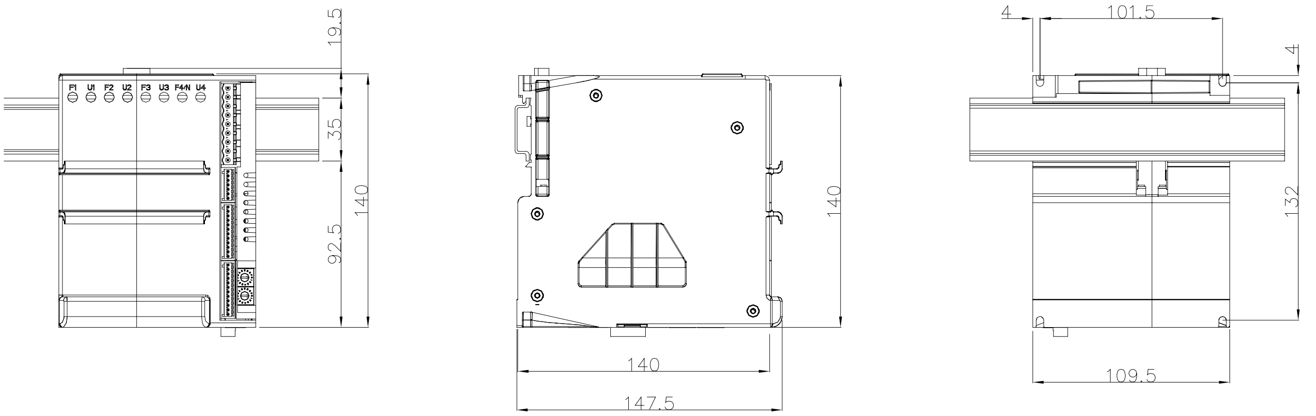
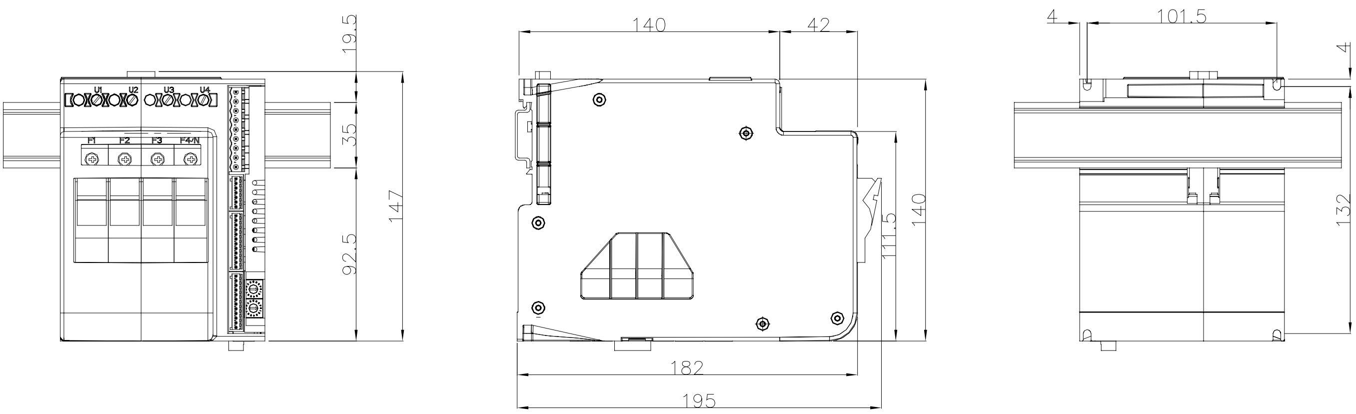


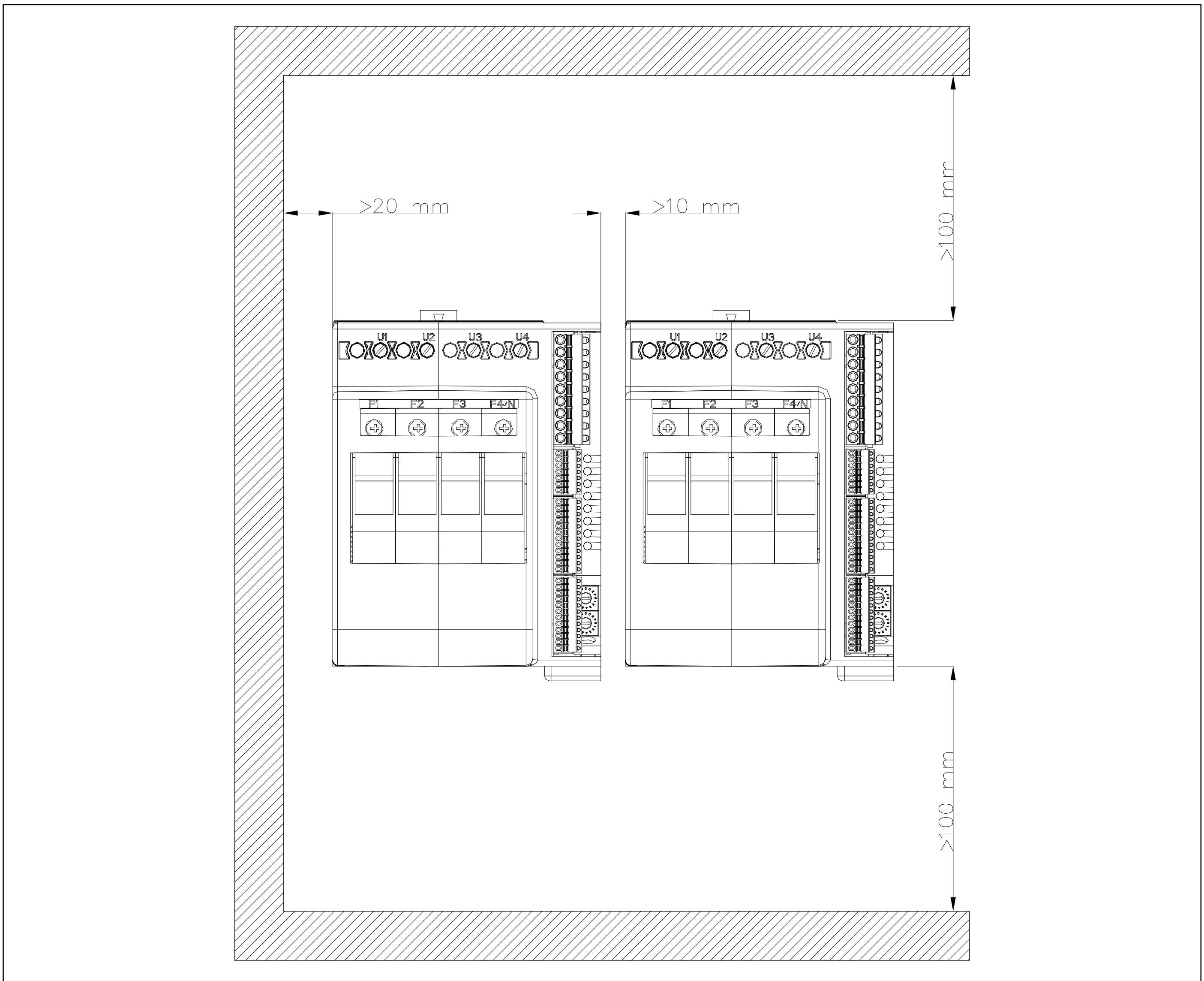
Figure 2 Model with fuse holder



2.5 INSTALLATION

Attention: respect the minimum distances shown in figure 3 to provide adequate air circulation.

Figure 3



For correct attachment/release of the module on the DIN guide, do as follows:
- keep the attach/release cursor pressed
- insert/remove the module
- release the cursor

Figure 4

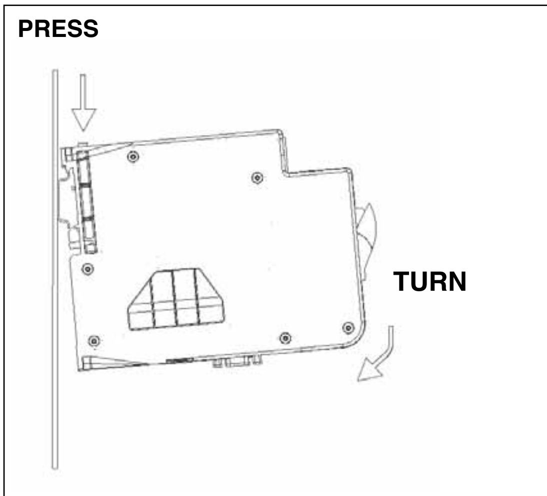


Figure 5

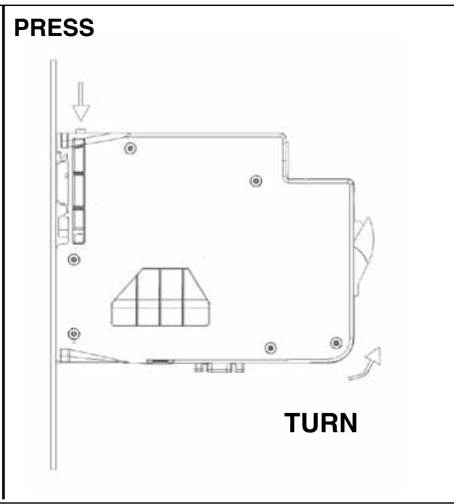


Figure 6

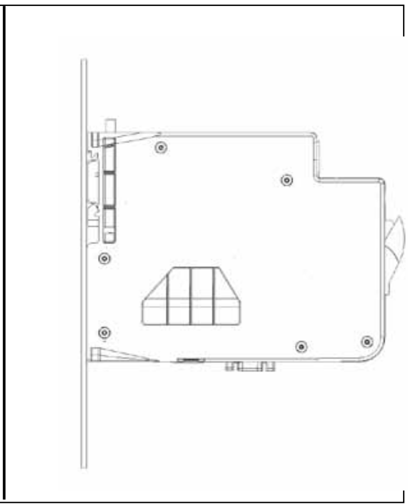
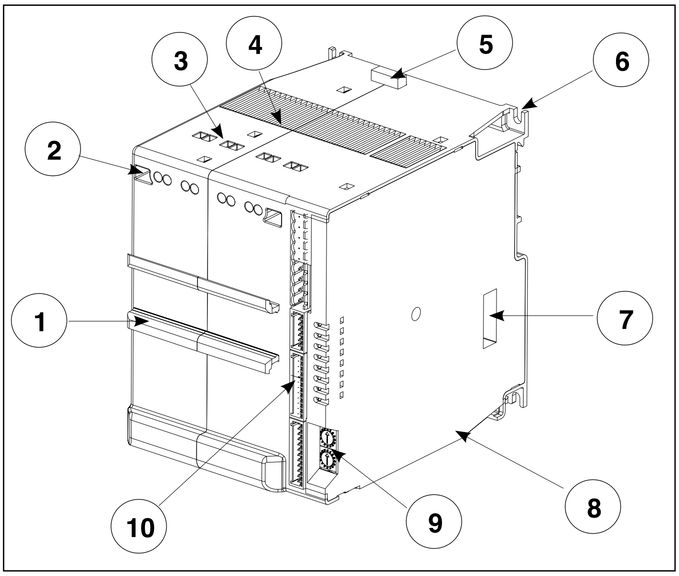
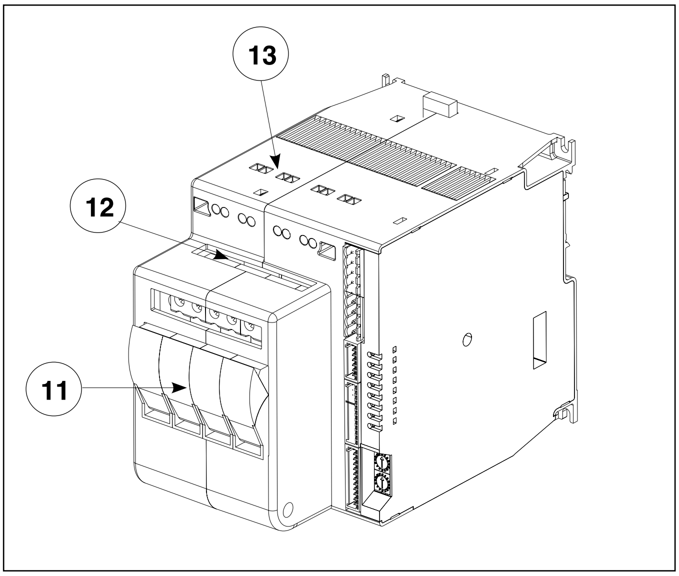


Figure 7



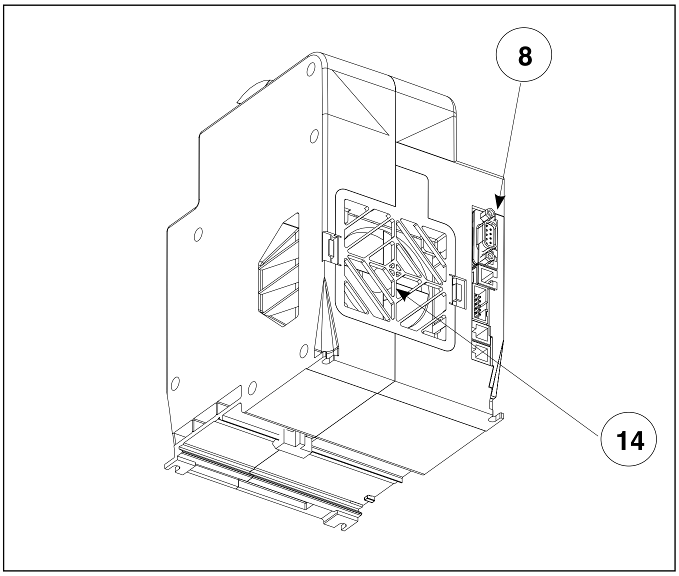
1 DIN bar for modules, for example, signal converters (only on models without fuse holders).
2 access for screwdriver to power connector screws
3 power connection terminals
4 ventilation grill: DO NOT OBSTRUCT
5 cursor for insertion/removal of DIN bar attachment
6 screw seats for fastening module on plate
7 dip switches for function configuration
8 connectors for communication ports (Port1, Port2)
9 rotary switches for setting node address or number
10 signal and power supply connectors (J1, J2, J3, J4)

Figure 8



11. fuse holder (only for models 30KW and 60KW)
12 terminals for fuse holder connection (F1, F2, F3, F4/N)
13. terminals for load power connection (U1, U2, U3, U4)

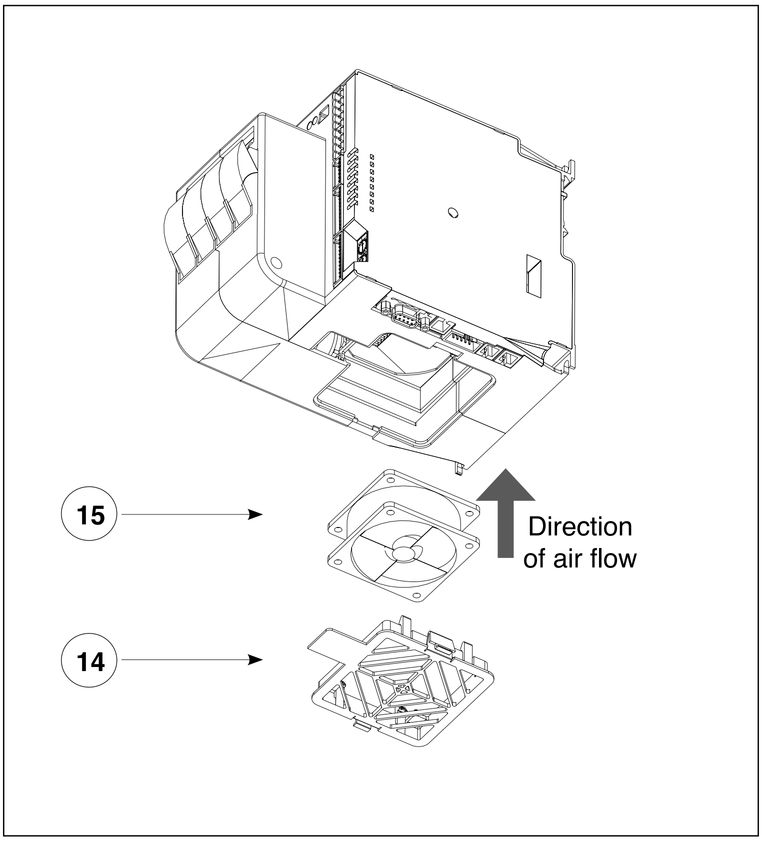
Figure 9



14. ventilation air intake grill: DO NOT OBSTRUCT

2.7 CLEANING/CHECKING OR REPLACING THE FAN

Figure 10



14 ventilation air intake grill
15 fan

PERIODIC CLEANING

Every 6-12 months (depending on the dust level of the installation) blow a compressed air jet downward through the upper rectangular cooling grilles (on the side opposite the fan).
This will clean the internal heat dissipater and the cooling fan.

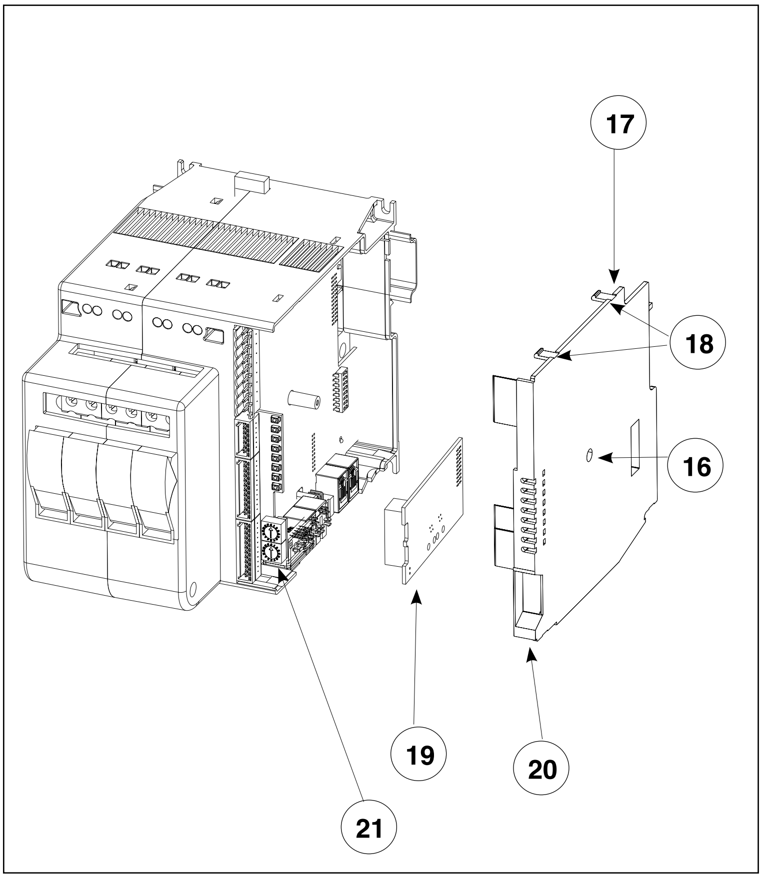
IN CASE OF OVERHEAT ALARM

If periodic cleaning does not eliminate the problem, do as follows:
a Remove the fan support grille by detaching the two support tabs
b Disconnect the fan connector from the board
c Check the condition of the fan
d Clean or replace the fan (*)
e Insert the connector into the board
f Insert the fan support grille until it attaches
g Power up the device and check fan rotation when at least one load is on

(*) ATTENTION: check the fan to make sure that the arrow indicating the direction of air flow is pointed toward the heatsink.

2.8 INSERTING THE FIELD BUS INTERFACE BOARD

Figure 11

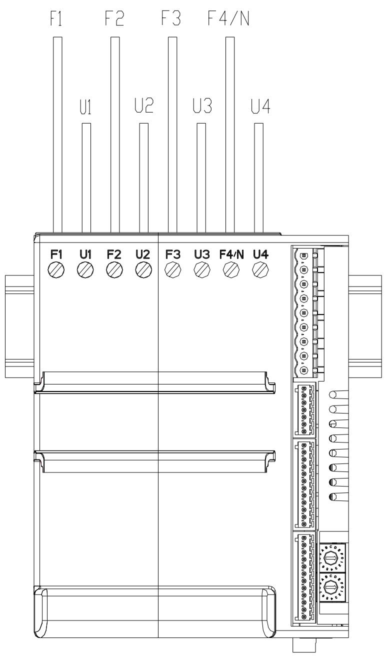


Do as follows:

a Unscrew screw **16**
b With a screwdriver, gently apply leverage at points **18**
c Remove cover **17**
d Place interface board **19** on the connectors on board **21**
e Remove pre-formed parts **20** on cover **17** based on the type of interface installed
f Reposition cover **17** in its housing
g Tighten screw **16**

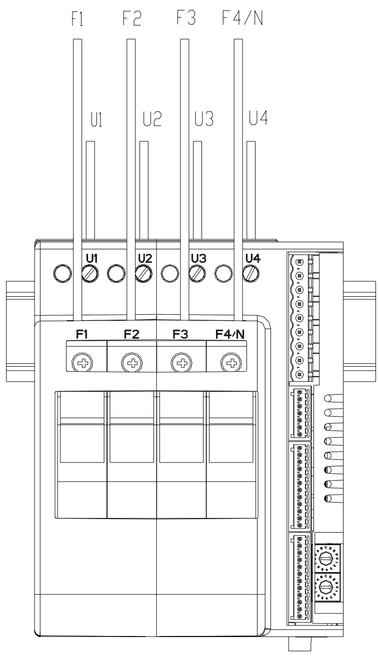
3.1 POWER CONNECTIONS

Figure 12 model without fuse holder



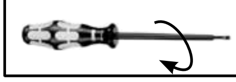
F1,F2,F3,F4/N	Line connection terminals
U1,U2,U3,U4	Load connection terminals

Figure 13 model with fuse holder



F1,F2,F3,F4/N	Line connection terminals
U1,U2,U3,U4	Load connection terminals

Table 4

Model	30kW		60kW		80kW	
max current	16A		32A (30A)*		57A (40A)*	
 rigid	**0,2 - 6mm²**	**24-10AWG**	**0,2 - 6mm²**	**24-10AWG**	**0,5 - 16mm²**	**20-6AWG**
 flexible	**0,2 - 4mm²**	**24-10AWG**	**0,2 - 4mm²**	**24-10AWG**	**0,5 - 10mm²**	**20-7AWG**
	**0,25 - 4mm²**	**23-10AWG**	**0,25 - 4mm²**	**23-10AWG**	**0,5 - 10mm²**	**20-7AWG**
	**0,25 - 4mm²**	**23-10AWG**	**0,25 - 4mm²**	**23-10AWG**	**0,5 - 10mm²**	**20-7AWG**
	**0,5 - 0,6Nm**		**0,5 - 0,6Nm**		**1,2 - 1,5Nm**	

* UL certification

3.2 Input/Output Connections

Use adequate compensated cable for thermocouple inputs. Respect polarity by avoiding junctions on the cables.
If the thermocouple is grounded, the connection must be at a single point.
For resistance thermometer inputs, use copper extension cables. Resistance must not exceed 20 ohm; avoid junctions on the cables. For 2-wire resistance thermometer, make the connection indicated instead of the third wire.

Figure 14

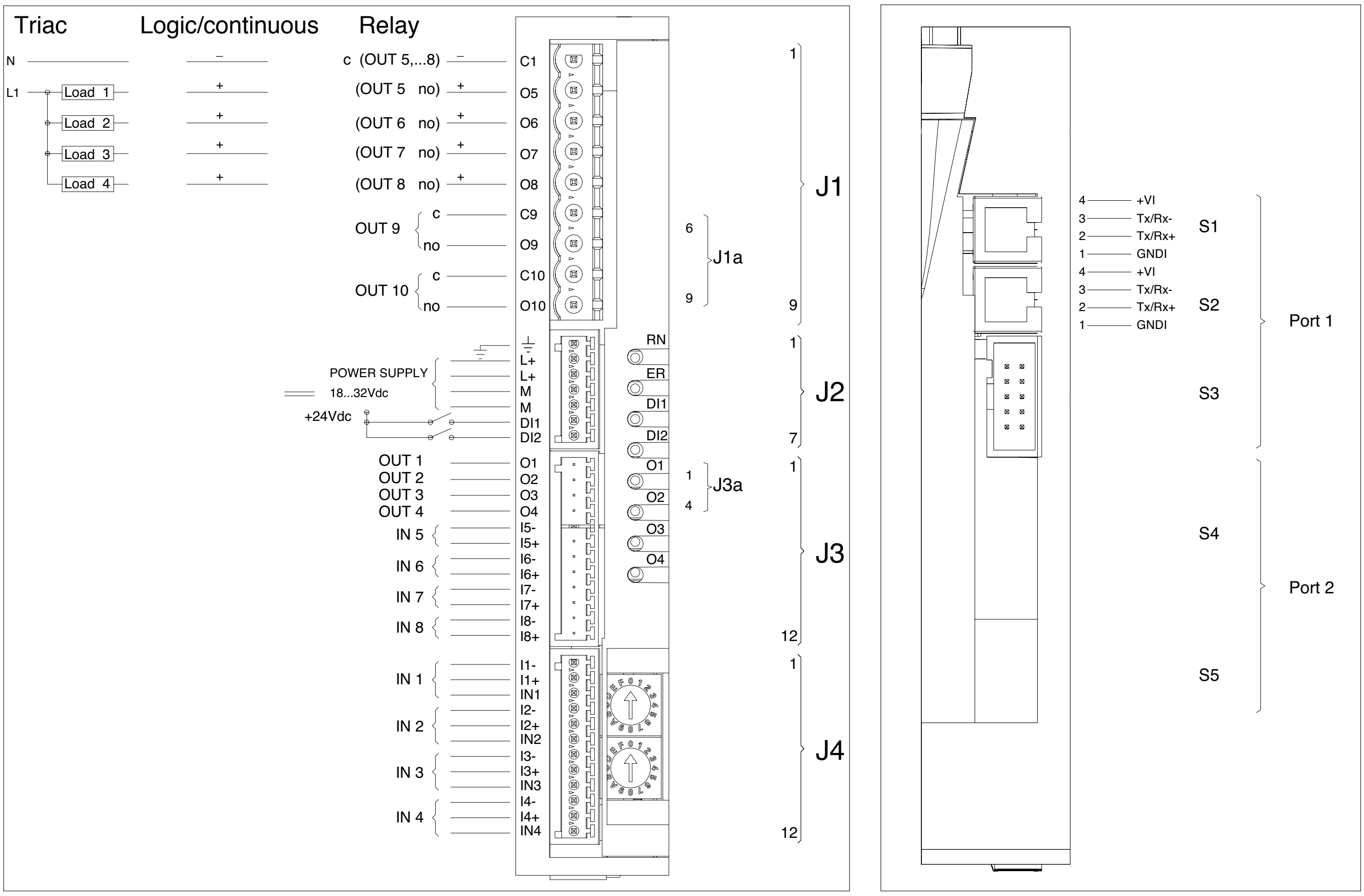
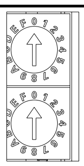


Table 5 *Description of LEDs*

Led	Description	color
RN	RN (green) flashing during normal operation	green
	RN (green) + ER (red) both flashing rapidly: autobaud in progress	
ER	ER (red) on: error in one of main inputs (Lo,Hi,Err,Sbr)	red
	ER (red) flashing: overheat alarm: (OVER_HEAT or TEMPERATURE_ SENSOR_BROKEN) or alarm SHORT_CIRCUIT_CURRENT (only in single-phase configuration)	
	ER (red) - Ox (yellow) both flashing: HB alarm or POWER FAIL zone x	
DI1	State digital input 1	yellow
DI2	State digital input 2	yellow
O1	State output Out 1	yellow
O2	State output Out 2	yellow
O3	State output Out 3	yellow
O4	State output Out 4	yellow

- All LEDs flashing rapidly: ROTATION123 alarm (only in 3-phase configuration).
  Switch off 3-phase network and reverse wires F2 and F3
- All LEDs flashing rapidly except LED DI1: jumper configuration not provided for
- All LEDs flashing rapidly except LED DI2: 30%_UNBALANCED_LINE_WARNING. (only in 3-phase configuration)
- All LEDs flashing rapidly except LED O1: SHORT_CIRCUIT_CURRENT alarm (only in 3-phase configuration)
-All LEDs flashing rapidly except LED O2: TRIPHASE_MISSING_LINE_ERROR alarm (only in 3-phase configuration)

Table 6 *Description of Rotary Switches*

Switch	Description
 **x10** **x1**	Defines address of module 00...99 (in case of function mode equivalent to four Geflex units, this address is assigned to the first of the four) Hexadecimal combinations are reserved.

3.3 Connector J1 outputs 5...10

If auxiliary outputs (O5...O8), are present, connector J1a becomes J1.

Figure 15 Connector J1

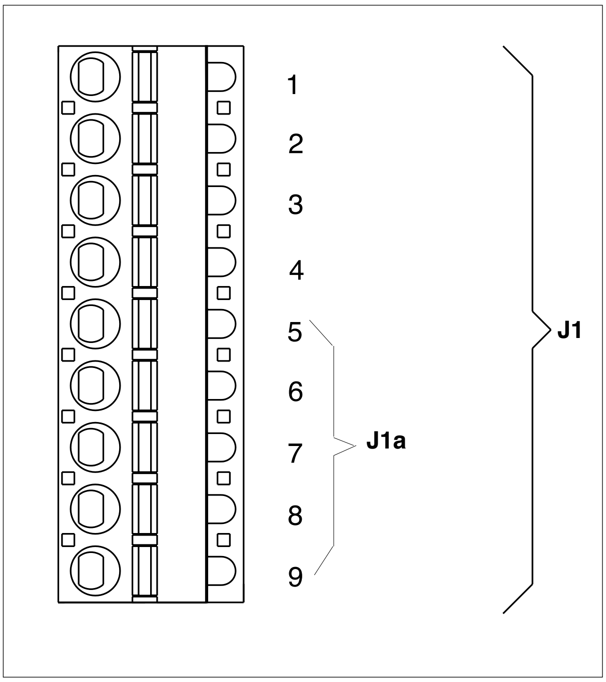


Table 8

	**0,2 - 2,5mm²**	**24-14AWG**
	**0,25 - 2,5mm²**	**23-14AWG**

Outputs 5...8 logic/continuous type
Logic outputs 18...36Vdc, max 20mA
Continuous outputs: voltage (default) 0/2...10V, max 25mA
current 0/4...20mA, max 500Ω

Figure 16 Connection scheme for logic/continuous outputs

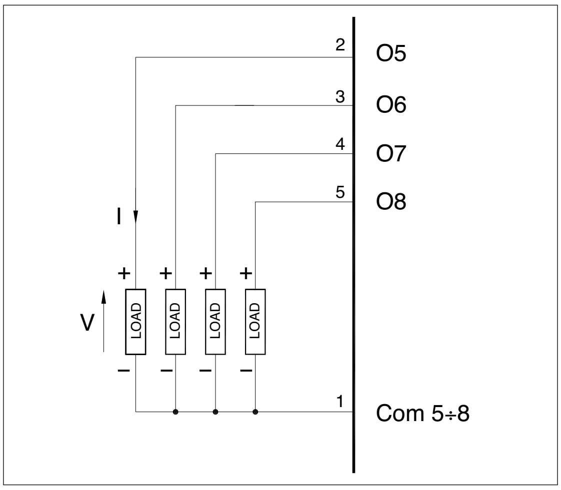
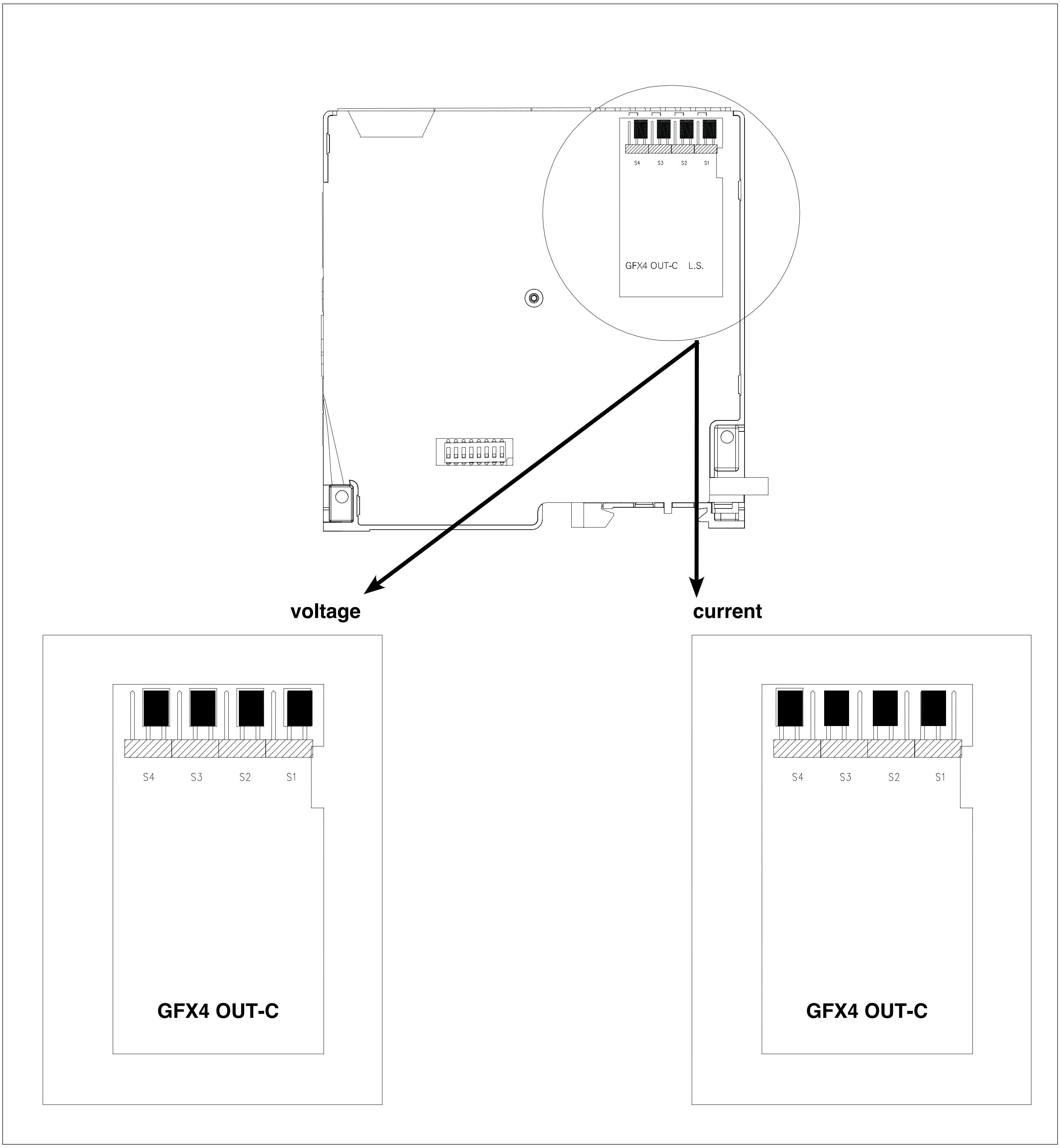


Table 9

PIN	Name	Decription	
		Logic	Continuous
1	Com 5-8	Outputs common	(-)
2	O5	Output 5	(+)
3	O6	Output 6	(+)
4	O7	Output 7	(+)
5	O8	Output 8	(+)

When using the continuous “C” output option, voltage or current is set using jumper links on the board (Figure 16a refers).

Figure 16a Connection for logic/continuous utputs



Outputs 5...8 triac type

Triac outputs Vac = 24...230Vac, max 1A

Figure 17 Connection scheme for triac outputs

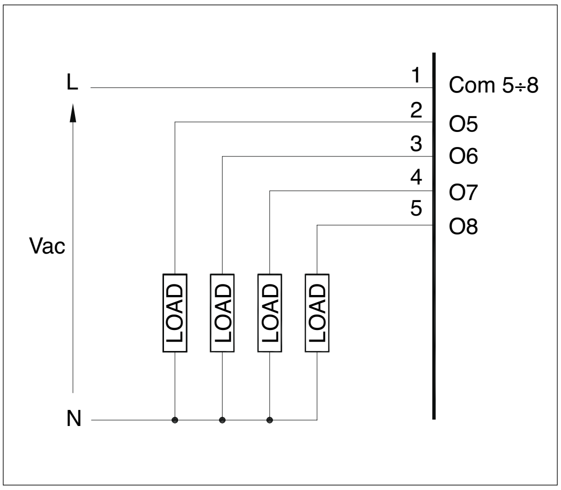


Table 9

PIN	Name	Decription
1	Com 5-8	Outputs common
2	O5	Output 5
3	O6	Output 6
4	O7	Output 7
5	O8	Output 8

Outputs 5...8 relay type

Outputs Out 5...8 relay Ir = 3A max, NO

V = 250V/30Vdc cosφ = 1; I = 12A max

Figure 18 Connection scheme for relay outputs

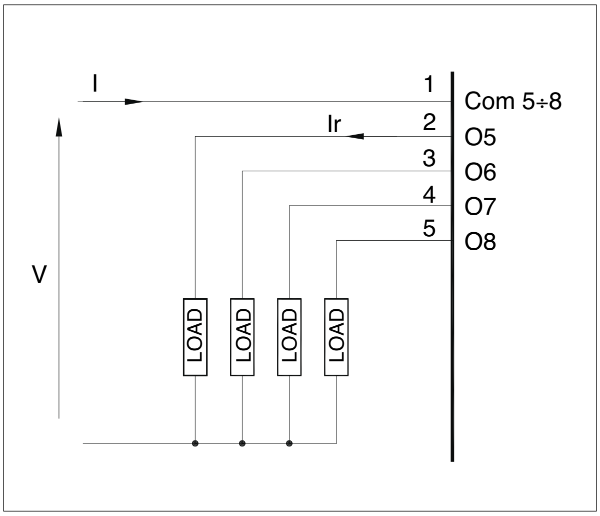


Table10

PIN	Name	Description
1	Com 5-8	Outputs common
2	O5	Output 5
3	O6	Output 6
4	O7	Output 7
5	O8	Output 8

Outputs 9, 10 relay type

Outputs Out 9, 10 relay 5A max,

V = 250V/30Vdc cosφ = 1; I = 5A max

Figure 19 Connection scheme for relay outputs

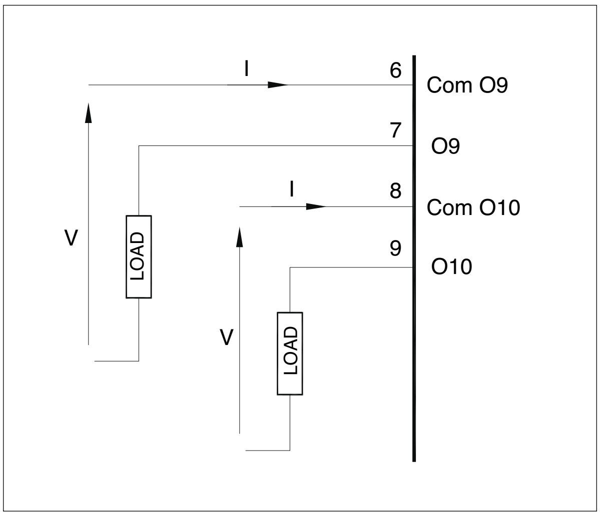


Table 11

PIN	Name	Description
1	Com O9	Output common O9
2	O9	Output O9
3	Com O10	Output common O10
4	O10	Output O10

3.4 Connector J2 power supply, digital inputs 1, 2

Figure 20

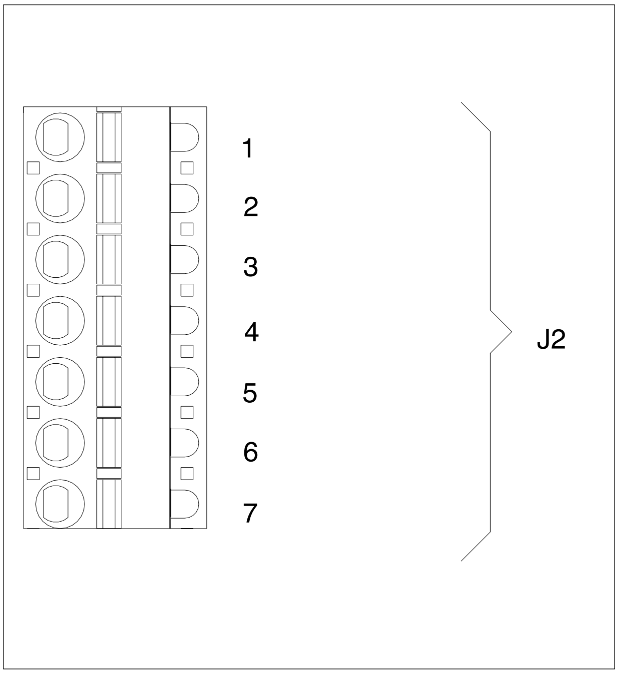


Table 12

	**0,14 - 0,5mm²**	**28-20AWG**
	**0,25 - 0,5mm²**	**23-20AWG**

Figure 21 *Connection scheme for digital inputs and power supply*

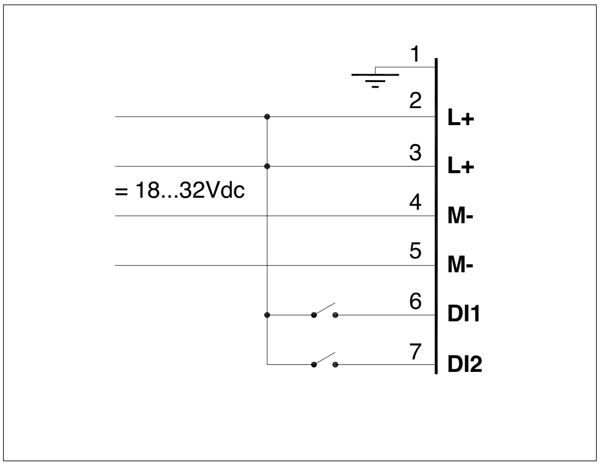


Table 13

PIN	Name	Description
1	⏚	Ground
2	L+	Power supply 18...32Vdc
3	L+	
4	M-	
5	M-	
6	DI1	Digital input 1
7	DI2	Digital input 2

3.5 CONNECTOR J3 AUXILIARY INPUTS 5...8

Figure 22

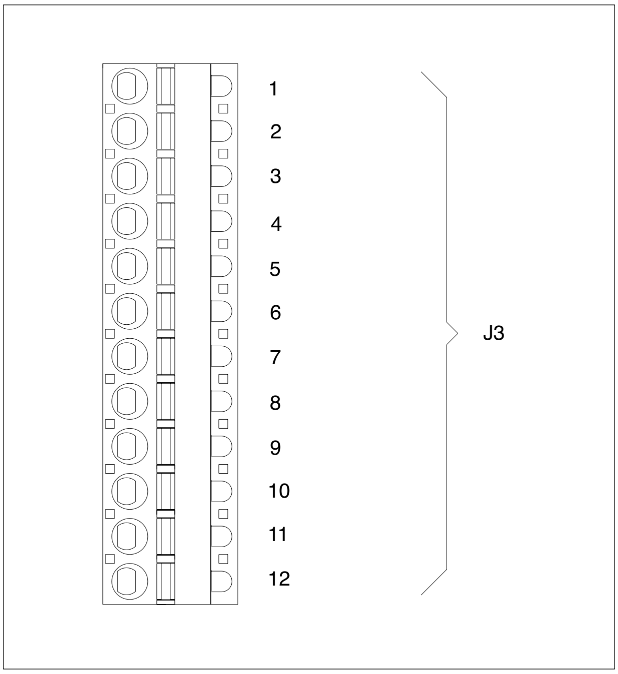


Table 14

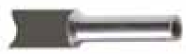
	**0,14 - 0,5mm²**	**28-20AWG**
	**0,25 - 0,5mm²**	**23-20AWG**

Figure 23 *Connection scheme for 60mV/TC auxiliary linear inputs*

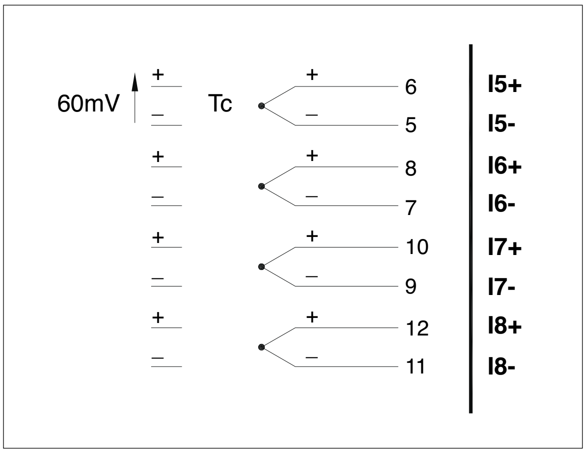


Table 15

PIN	Name	Description
1	-	nc
2	-	nc
3	-	nc
4	-	nc
5	I5-	Auxiliary input 5
6	I5+	
7	I6-	Auxiliary input 6
8	I6+	
9	I7-	Auxiliary input 7
10	I7+	
11	I8-	Auxiliary input 8
12	I8+	

3.6 Connector J4 inputs 1...4

Figure 24

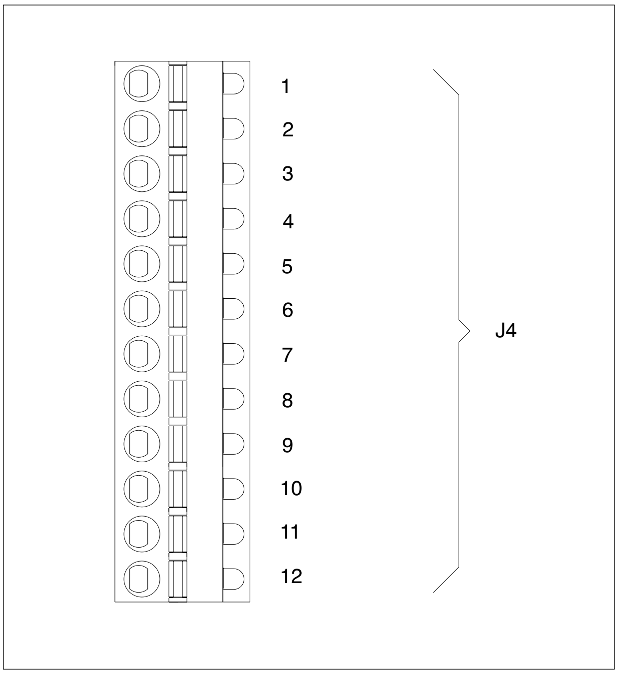


Table 16

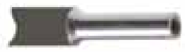
	**0,2 - 2,5mm²**	**24-14AWG**
	**0,25 - 2,5mm²**	**23-14AWG**

Figure 25 Connection scheme for 60mV TC/linear input

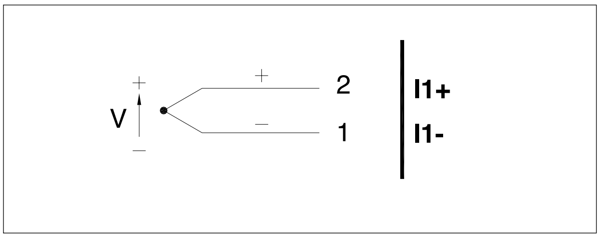


Table 17

PIN	60mV/Tc linear input	1V/20mA linear input	Pt100 input
1	I1-	I1-	I1-
2	I1+		I1+
3		IN1+	IN1
4	I2-	I2-	I2-
5	I2+		I2+
6		IN2+	IN2
7	I3-	II3-	I3-
8	I3+		I3+
9		IN3+	IN3
10	I4-	I4-	I4-
11	I4+		I4+
12		IN4+	IN4

Figure 26 Connection scheme for Pt100 input

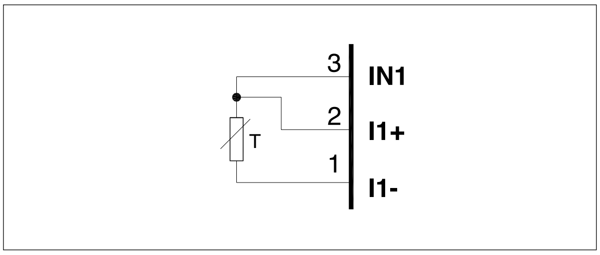
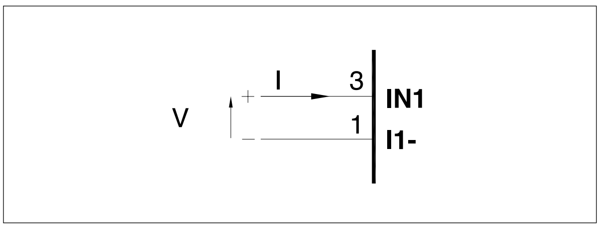


Figure 27 Connection scheme for 1V/20mA linear input



3.7 Description of dip-switches

Figure 28

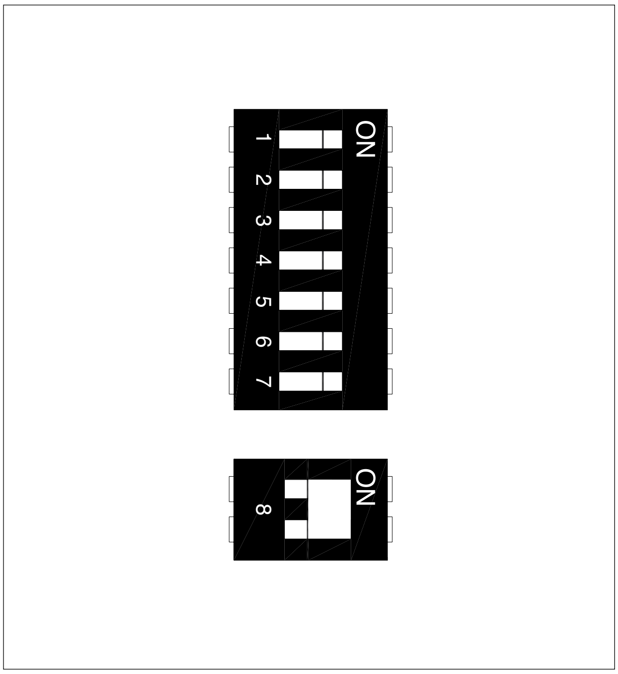


Table 18

dip-switches	Description
1	Connection type: (see table 18-a)
2	Connection type: (see table 18-a)
3	Connection type: (see table 18-a)
4	Connection type: (see table 18-a)
5	OFF = resistive load ON = inductive load (transformer primary control)
6	ON = reset factory configuration
7	ON = Geflex simulation function
8	ON = insert line termination for Port1 / RS485

Table 18-a

Single-phase / 3-phase	Star / Delta	Delta Open / Closed	With / without Neutral OFF ON	OFF: resistive load ON :inductive load (transformer primary control)	
Dip 1	**Dip 2**	**Dip 3**	**Dip 4**	**Dip 5**	**Connection type**
OFF	OFF	OFF	OFF	OFF/ON	4 single-phase loads
OFF	ON	OFF	OFF/ON	OFF/ON	3 independent single-phase loads in open delta
ON	ON	OFF	OFF/ON	OFF/ON	3-phase load open delta
ON	ON	ON	OFF/ON	OFF/ON	3-phase load closed delta
ON	OFF	-	ON	OFF/ON	3-phase star load without neutral
ON	OFF	-	OFF	OFF/ON	3-phase star load with neutral

IMPORTANT!

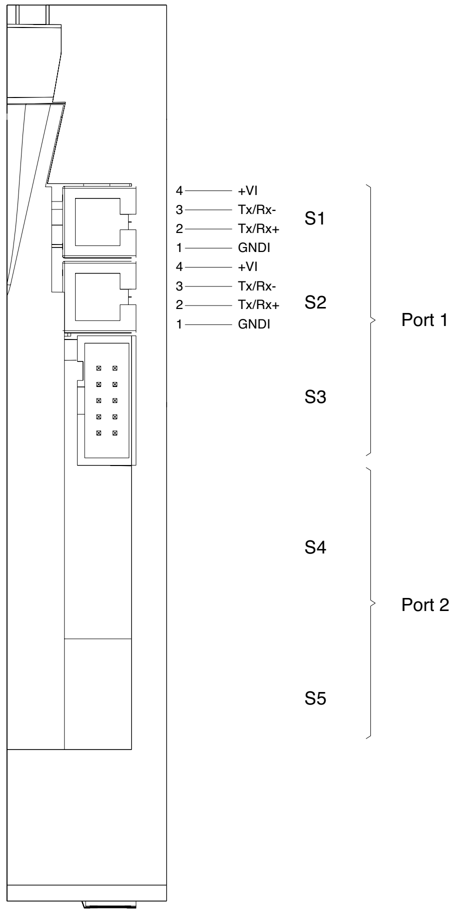
After setting the required DIP-SWITCH configuration, run the following parameter initialization procedure once:

- Check the correct setting of DIPS 1-2-3-4-5
- Set DIP 6 to “ON” (factory configuration)
- Power the device with 24 VDC
- Wait for correct and regular flashing of the GREEN RUN LED
- Set DIP 6 to “OFF”
- The device is correctly configured

3.8 Serial communication ports

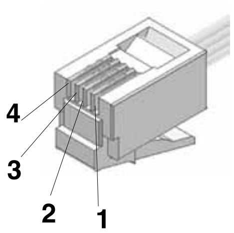
Port1 (local bus): Modbus serial interface – connectors S1, S2, S3

Figure 29



Connector S3 to connection at GFX-OP terminal or to Geflex slave modules (GFX-S1, GFX-S2)

Table 19

Connector S1/S2 RJ10 4-4 pin	Nr. Pin	Name	Description	Note
	1	GND1 (**)	-	**(*)** Insert the RS485 line termination in the last device on the Modbus line, see dip-switches. **(**)** Connect the GND signal among Modbus devices with a line distance > 100 m.
	2	Tx/Rx+	Data reception/transmission (A+)	
	3	Tx/Rx-	Data reception/transmission (B-)	
	4	+V (reserved)	-	
Cable type: flat telephone cable for pin 4-4 conductor 28AWG				

Port2 (fieldbus): connectors S4, S5 MODBUS RTU/MODBUS RTU

Figure 30 Port2: Fieldbus Modbus RTU/Modbus RTU interface

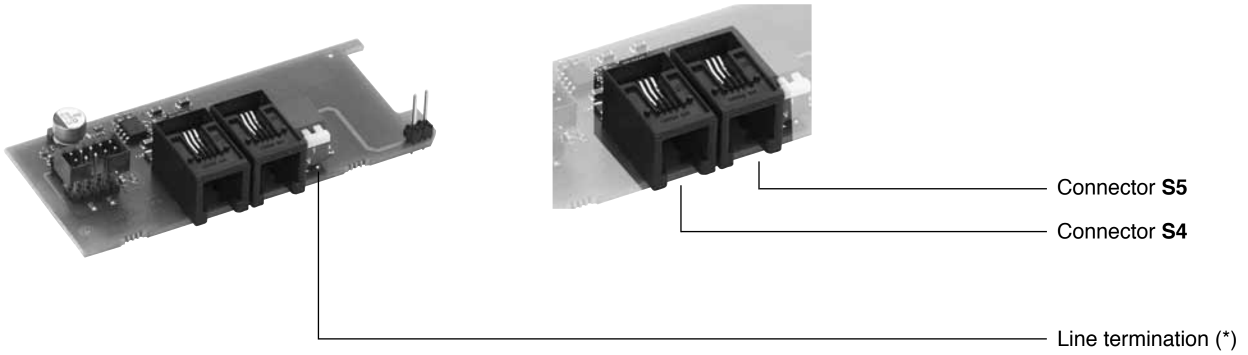
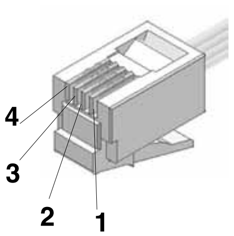


Table 20

Connector S4/S5 RJ10 4-4 pin	Nr. Pin	Name	Description	Note
 4 3 2 1	1	GND1 (**)	-	**(*)** Insert the line termination in the last device on the Modbus line. **(**)** Connect the GND signal among Modbus devices with a line distance > 100 m.
	2	Tx/Rx+	Data reception/transmission (A+)	
	3	Tx/Rx-	Data reception/transmission (B-)	
	4	+V (reserved)	-	
Cable type: flat telephone cable for pin 4-4 conductor 28AWG				

Port2 (fieldbus): connectors S4, S5 MODBUS RTU/Profibus DP

Figure 31 Port2: Fieldbus Modbus RTU/Profibus DP interface

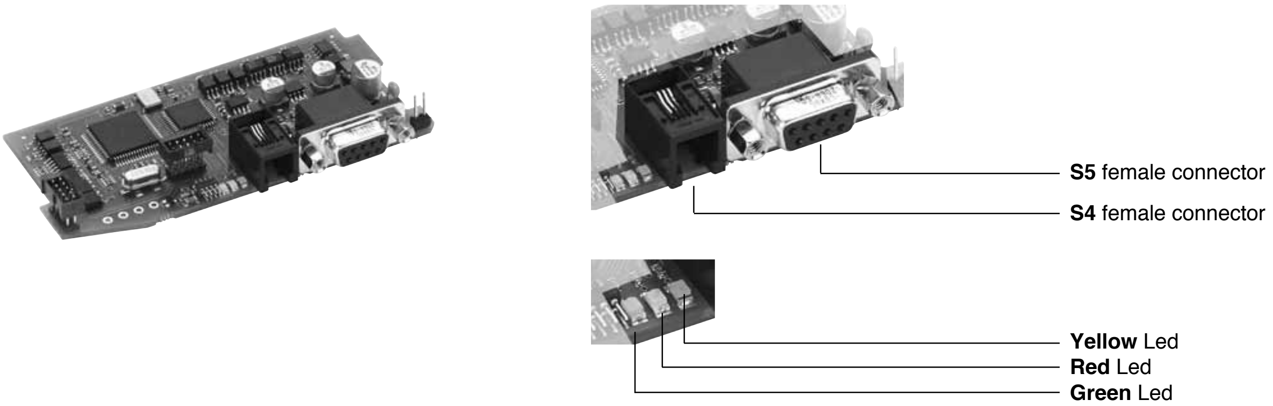


Table 21

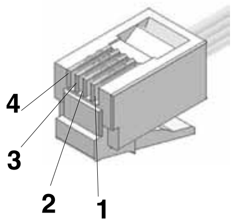
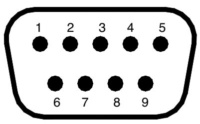
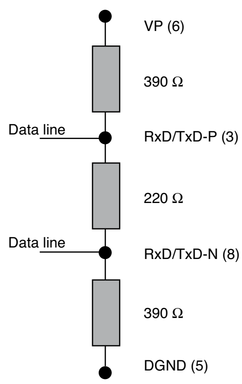
Connector S4 RJ10 4-4 pin	Nr. Pin	Name	Description	Note
	1	GND1 (**)	-	**(**)** Connect the GND signal among Modbus devices with a line distance > 100 m.
	2	Rx/Tx+	Data reception/transmission (A+)	
	3	Rx/Tx-	Data reception/transmission (B-)	
	4	+V (reserved)	-	
Cable type: flat telephone cable for fin 4-4 conductor 28AWG				

Table 22

Connector S5 D-SUB 9 pins male	Nr. Pin	Name	Description	Note
 	1	SHIELD	EMC protection	Connect the terminal resistances as shown in the figure. 
	2	M24V	Output voltage - 24V	
	3	RxD/TxD-P	Data reception/transmission	
	4	n.c.	n.c.	
	5	DGND	Data Ground	
	6	VP	Positive power supply +5V	
	7	P24V	Output voltage +24V	
	8	RxD/TxD-N	Data reception/transmission	
	9	n.c.	n.c.	
Cable type: Shielded 1 pair 22AWG conforming to PROFIBUS.				

Port2 (fieldbus): connectors S4, S5 MODBUS RTU/CANopen or EUROMAP 66

Figure 32 *Port2: Fieldbus Modbus RTU/CANOpen interface or EUROMAP 66*

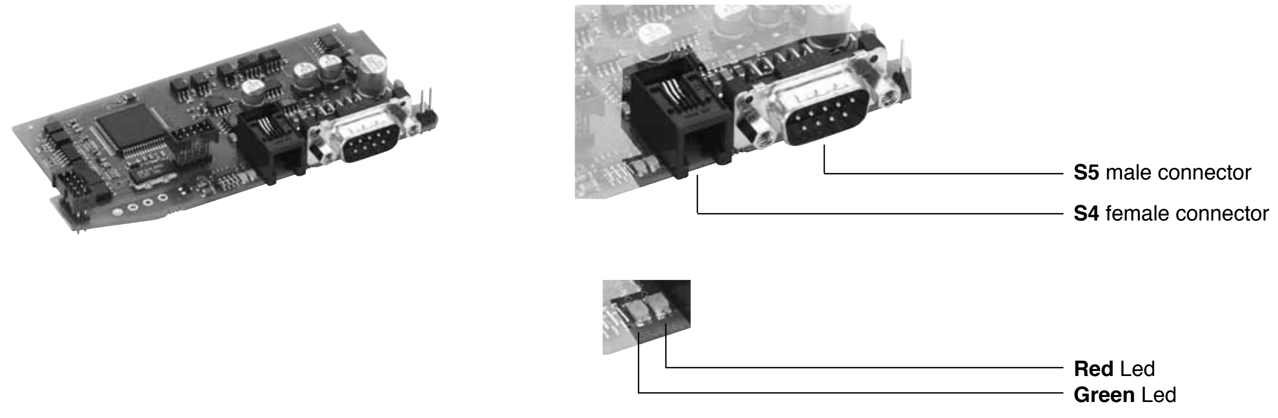


Table 23

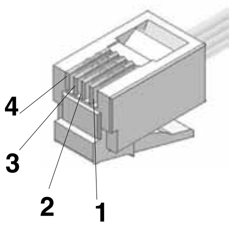
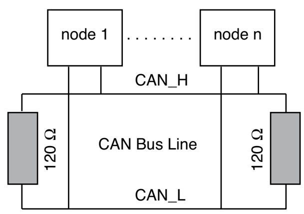
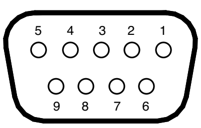
Connector S4 RJ10 4-4 pin	Nr. Pin	Name	Description	Note
	1	GND1 (**)	-	**(**)** Connect the GND signal among Modbus devices with a line distance > 100 m.
	2	Rx/Tx+	Data reception/transmission (A+)	
	3	Rx/Tx-	Data reception/transmission (B-)	
	4	+V (reserved)	-	
Cable type: flat telephone cable for fin 4-4 conductor 28AWG				

Table 24

Connector S5 D-SUB 9 pins female	Nr. Pin	Name	Description	Note
	1	-	Reserved	Connect the terminal resistances as shown in the figure.
	2	CAN_L	CAN_L bus line (domination low)	
	3	CAN_GND	CAN Ground	
	4	-	Reserved	
	5	(CAN_SHLD)	Optional CAN Shield	
	6	(GND)	Optional Ground	
	7	CAN_H	CAN_H bus line (domination high)	
	8	-	Reserved	
	9	(CAN_V+)	Optional CAN external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies)	
Cable type: Shielded 2 pairs 22/24AWG conforming to CANopen.				

Port2 (fieldbus): connectors S4, S5 MODBUS RTU/DeviceNet

Figure 33 Port2: Fieldbus Modbus RTU/DeviceNet interface

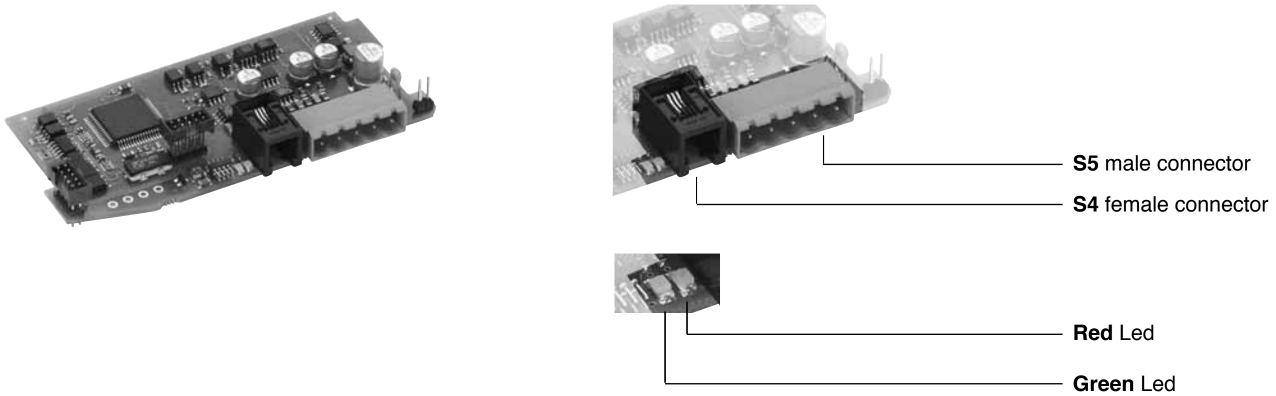


Table 25

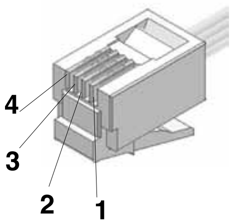
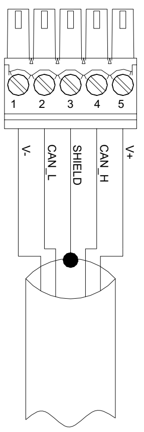
Connector S4 RJ10 4-4 pin	Nr. Pin	Name	Description	Note
	1	GND1 (**)	-	**(**)** Connect the GND signal among Modbus devices with a line distance > 100 m.
	2	Rx/Tx+	Data reception/transmission (A+)	
	3	Rx/Tx-	Data reception/transmission (B-)	
	4	+V (reserved)	-	
Cable type: flat telephone cable for fin 4-4 conductor 28AWG				

Table 26

Connector S5 MC-1,5/5 - ST1-5,08 5 pole female	Nr. Pin	Name	Description	Note
	1	V-	Negative power supply	Connect a 120Ω / 1/4W resistance between the “CAN_L” and “CAN_H” signals at each end of the DeviceNet network.
	2	CAN_L	Low signal	
	3	SHIELD	Shield	
	4	CAN_H	high signal	
	5	V+	Positive power supply	
Cable type: Shielded 2 pairs 22/24AWG conforming to DeviceNet.				

Port2 (fieldbus): connectors S4, S5 Modbus RTU / Ethernet Modbus TCP

Figure 34 Port2: Modbus RTU / Ethernet Modbus TCP interface

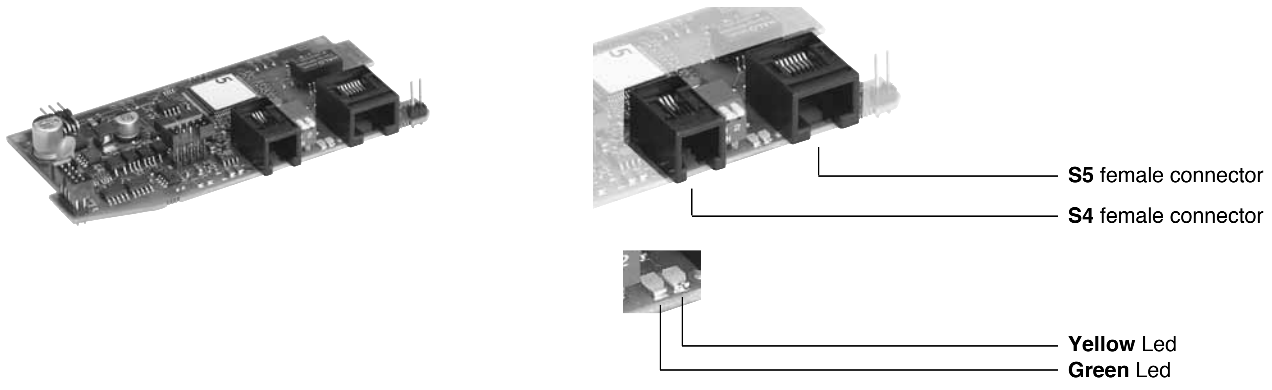


Table 26

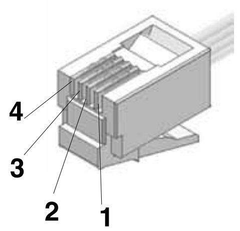
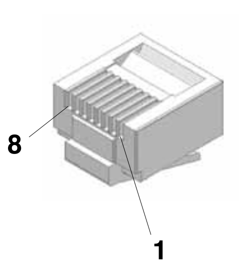
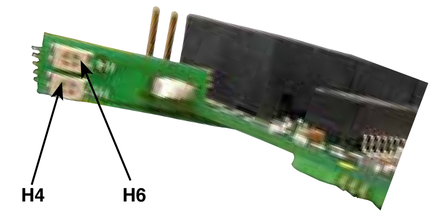
Connector S4 RJ10 4-4 pin	Nr. Pin	Name	Description	Note
	1	GND1 (**)	-	**(**)** Connect the GND signal among Modbus devices with a line distance > 100 m.
	2	Rx/Tx+	Data reception/transmission (A+)	
	3	Rx/Tx-	Data reception/transmission (B-)	
	4	+V (reserved)	-	
Cable type: flat telephone cable for pin 4-4 conductor 28AWG				

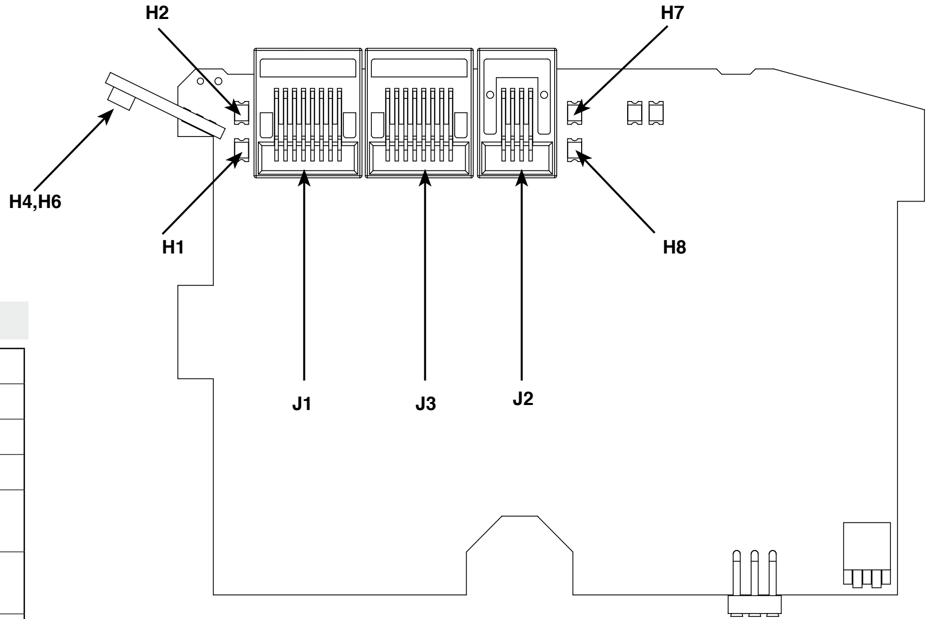
Table 27

Connector S5 RJ45	Nr. Pin	Name	Description	Note
	1	TX+	Data + transmission	
	2	TX-	Data - transmission	
	3	RX+	Data + reception	
	4	n.c.		
	5	n.c.		
	6	RX-	Data - reception	
	7	n.c.		
	8	n.c.		
Cable type: Use standard category 6 cable according to TIA/EIA-568A				

Port2 (fieldbus): connectors S4, S5 Modbus RTU/ Ethernet IP or Modbus RTU / EtherCAT or Modbus RTU / ProfiNET

Figure 35 Port2: Modbus RTU / Ethernet IP or Modbus RTU/EtherCAT or Modbus RTU / ProfiNET Interfaces





LED Ethernet IP

H1	Led GREEN module state	
H2	Led RED module state	
H7	Led RED network state	
H8	Led GREEN network state	
H4	Led bicolor GREEN (H1) RED (H2)	
H6	Led bicolor GREEN (H8) RED (H7)	
J1	Connector	Port ETH0
J3	Connector	Port ETH1
J2	Connector	Serial Modbus

LED EtherCAT

H1	Led GREEN link/activity	Port ETH0
H2	Led RED run	Run
H7	Led RED run	Run
H8	Led GREEN link/activity	Port ETH1
H4	Led bicolor GREEN (H1) RED (H2)	Port ETH0
H6	Led bicolor GREEN (H8) RED (H7)	Port ETH1
J1	Connector	Port ETH0 (IN)
J3	Connector	Port ETH1 (OUT)
J2	Connector	Serial Modbus

LED ProfiNET

H1	Led GREEN LINK	Port ETH0
H2	Led RED signal	Port ETH0
H7	Led RED activity	Port ETH1
H8	Led GREEN LINK	Port ETH1
H4	Led bicolor GREEN (H1) RED (H2)	Port ETH
H6	Led bicolor GREEN (H8) RED (H7)	Port ETH
J1	Connector	Port ETH0
J3	Connector	Port ETH1
J2	Connector	Serial Modbus

Table 28

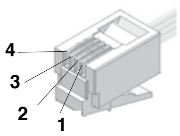
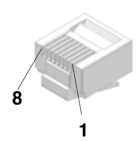
Connector J2 RJ10 4-4 pin				
	N°Pin	**Name**	**Description**	**Note**
 4 3 2 1	1	GND1 (**)	-	**(**)** It is advisable to also connect the GND signal between Modbus devices with a line distance > 100 m
	2	Rx/Tx+	Data reception/ transmission (A)	
	3	Rx/Tx-	Data reception/ transmission (B)	
	4	+V (reserved)	-	
Cable type: flat telephonic for 4-4 pin 28AWG conductor				

Table 29

Connector J1 and J3 RJ45				
	N°Pin	**Name**	**Description**	**Note**
 8 1	1	TX+	Data transmission +	
	2	TX-	Data transmission -	
	3	RX+	Data reception +	
	4	n.c.		
	5	n.c.		
	6	RX-	Data reception -	
	7	n.c.		
	8	n.c.		
Cable type: use standard category 5 cable according to TIA/EIA-568B				

3.9 CONNECTION EXAMPLE: COMMUNICATION PORTS

Integration of GFX4 with GEFLEX modules connected in RS485 Modbus

Figure 36

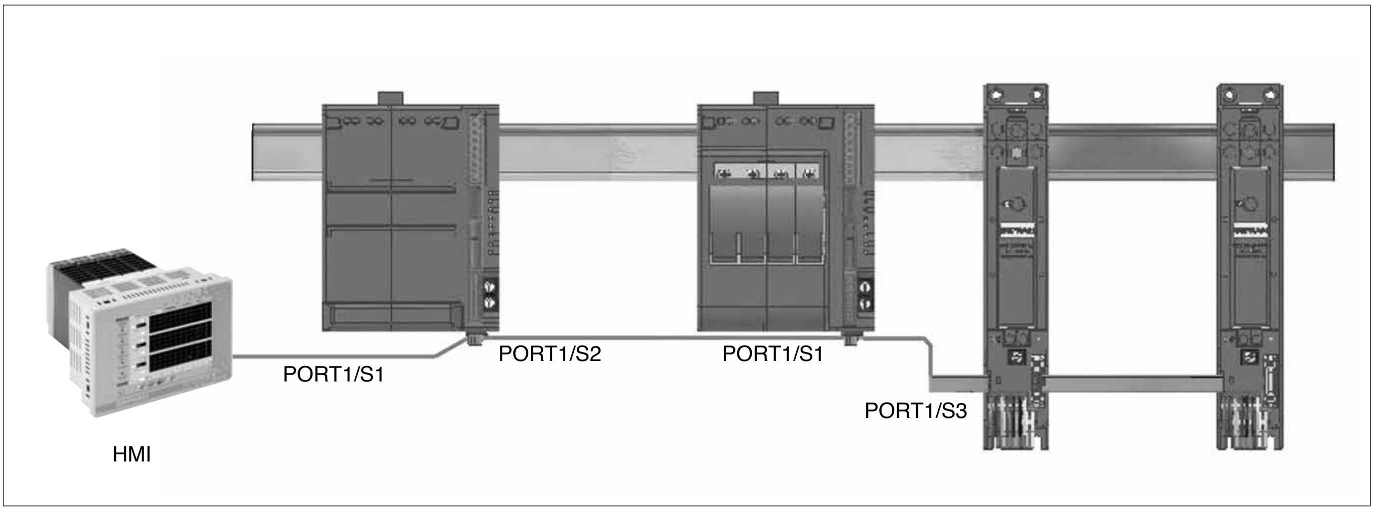


Figure 37

Supervision from PC/PLC simultaneous with GFXOP configuration terminal (each module must have a fieldbus interface)

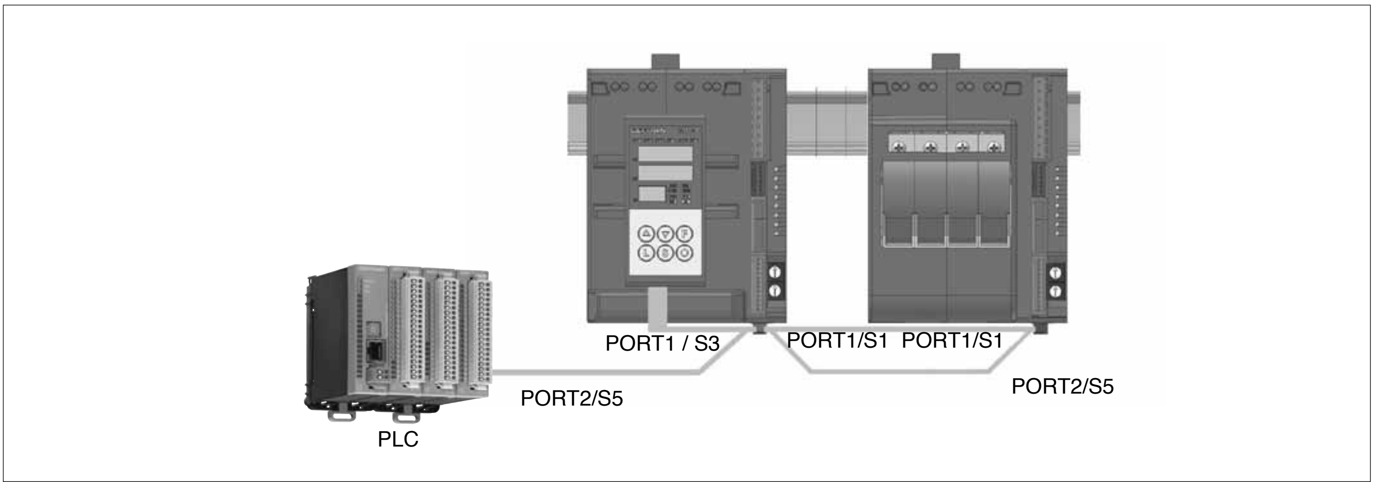
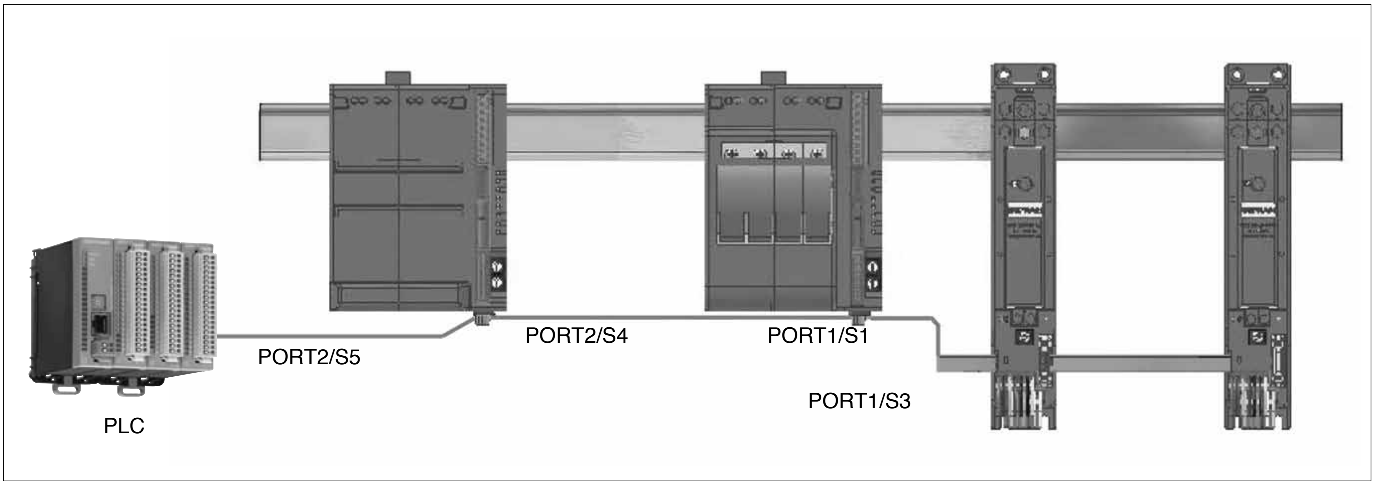


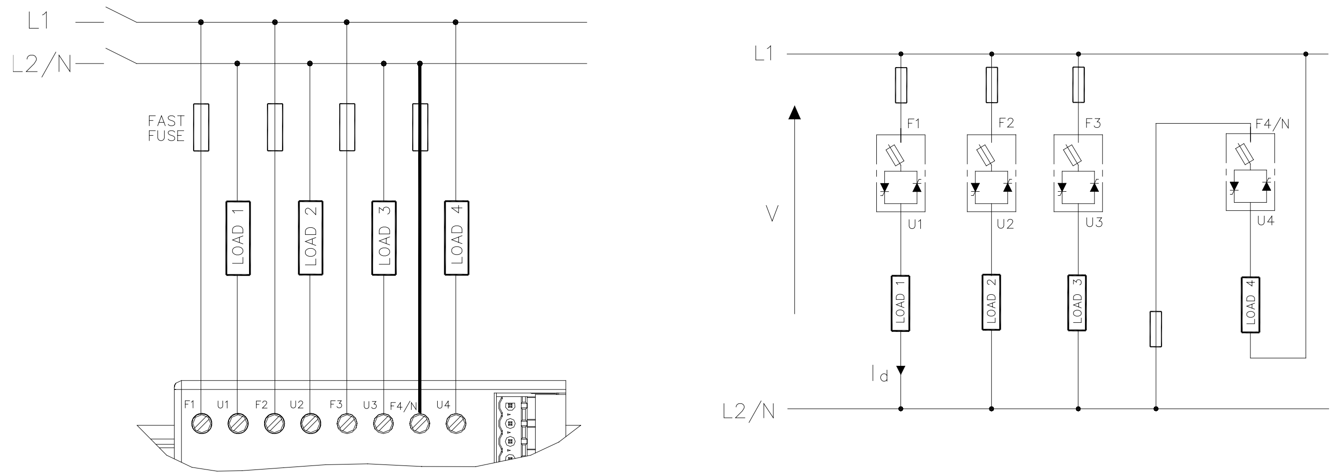
Figure 38

Supervision from PC/PLC via a single module equipped with fieldbus interface



3.10 CONNECTION EXAMPLE: POWER SECTION

Figure 39- – Connection example for 4 single-phase loads, single-phase line L1-L2/N



Dip-Switches configurations				
Dip 1	**Dip 2**	**Dip 3**	**Dip 4**	**Dip 5**
OFF	OFF	OFF	OFF	OFF

- FIRING MODE: ZC, BF, HSC, PA
- HB DIAGNOSTIC AVAILABLE: Partial and total load failure of each single leg

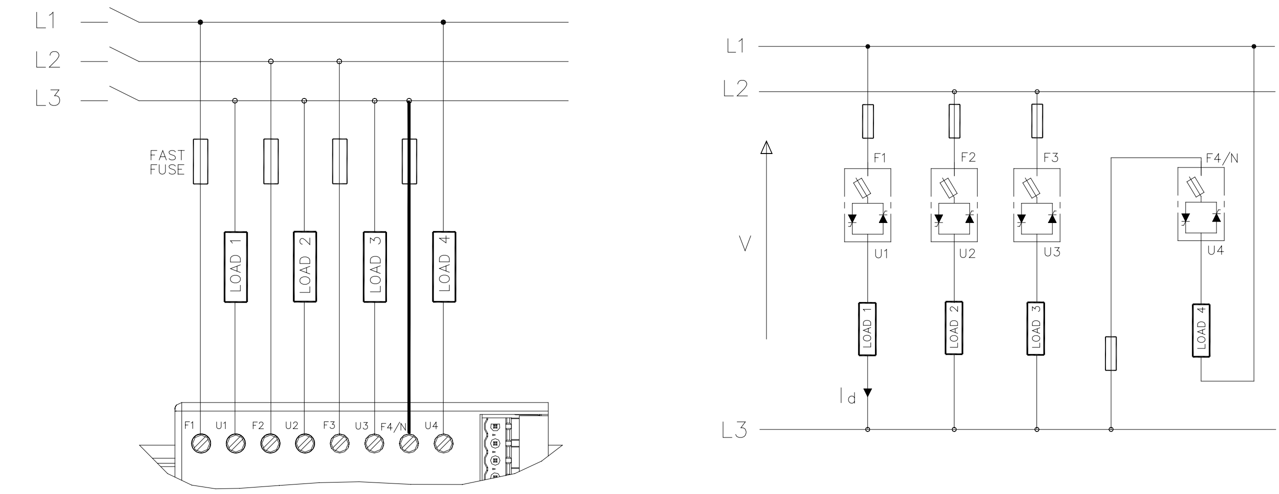
FAST FUSE needed only for controller without option “F”
See table Fuse/Fuseholders
NOTE: Take care about the “F4/N” connection (see the picture)
The wire “F4/N” is required always (also if Load 4 is not used)

$$Id = \frac{P}{V\ \cos\varphi}$$

V = phase voltage (line L1 - line L2/N)
P = power of each single-phase load
Id = load current

if resistive load $\cos\varphi = 1$

Figure 39a – Connection example for 4 single-phase loads, 3-phase line without neutral



Dip-Switches configurations				
Dip 1	**Dip 2**	**Dip 3**	**Dip 4**	**Dip 5**
OFF	OFF	OFF	OFF	OFF

- FIRING MODE: ZC, BF, HSC, PA
- HB DIAGNOSTIC AVAILABLE: Partial and total load failure of each single leg

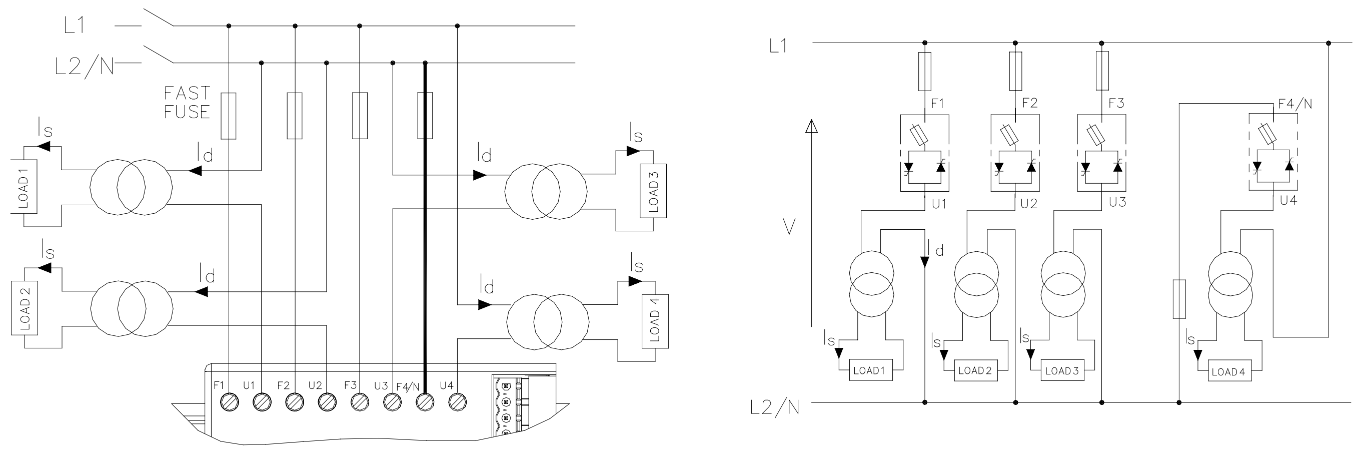
FAST FUSE needed only for controller without option “F”
See table Fuse/Fuseholders
NOTE: Take care about the “F4/N” connection (see the picture)
The wire “F4/N” is required always (also if Load 4 is not used)

$$Id = \frac{P}{V\ \cos\varphi}$$

V = phase voltage (line L1 - line L2/N)
P = power of each single-phase load
Id = load current

if resistive load $\cos\varphi = 1$

Figure 40 - Connection example for 4 single-phase transformer loads, single-phase line L1-L2/N



Dip-Switches configurations				
Dip 1	**Dip 2**	**Dip 3**	**Dip 4**	**Dip 5**
OFF	OFF	OFF	OFF	ON

- FIRING MODE: ZC, PA
- HB DIAGNOSTIC AVAILABLE: Partial and total load failure of each single leg

FAST FUSE needed only for controller without option "F"
See table Fuse/Fuseholders
NOTE:
Take care about the "F4/N" connection (see the picture)
The wire "F4/N" is required always (also if Load 4 is not used)

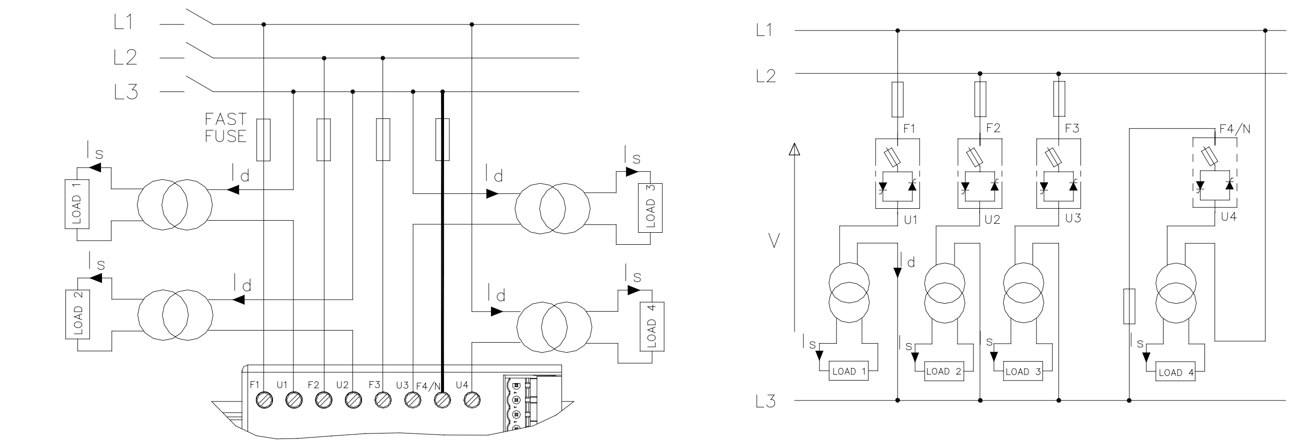
See notes for use with inductive loads and transformers

$$Id = \frac{P}{\eta \, . \, V \, . \, \cos\varphi} \qquad Is = \frac{P}{Vload \, . \, \cos\varphi}$$

P = power of each single-phase load
V = phase voltage (line L1- line L2/N)
Vload = voltage on secondary (load)
Id = current in primary
Is = current in secondary (load)
η = transformer output (type 0.9)

if resistive load $\cos\varphi = 1$

Figure 40a - Connection example for 4 single-phase transformer loads, 3-phase line without neutral



Dip-Switches configurations				
Dip 1	**Dip 2**	**Dip 3**	**Dip 4**	**Dip 5**
OFF	OFF	OFF	OFF	ON

- FIRING MODE: ZC, PA
- HB DIAGNOSTIC AVAILABLE: Partial and total load failure of each single leg

FAST FUSE needed only for controller without option "F"
See table Fuse/Fuseholders
NOTE:
Take care about the "F4/N" connection (see the picture)
The wire "F4/N" is required always (also if Load 4 is not used)

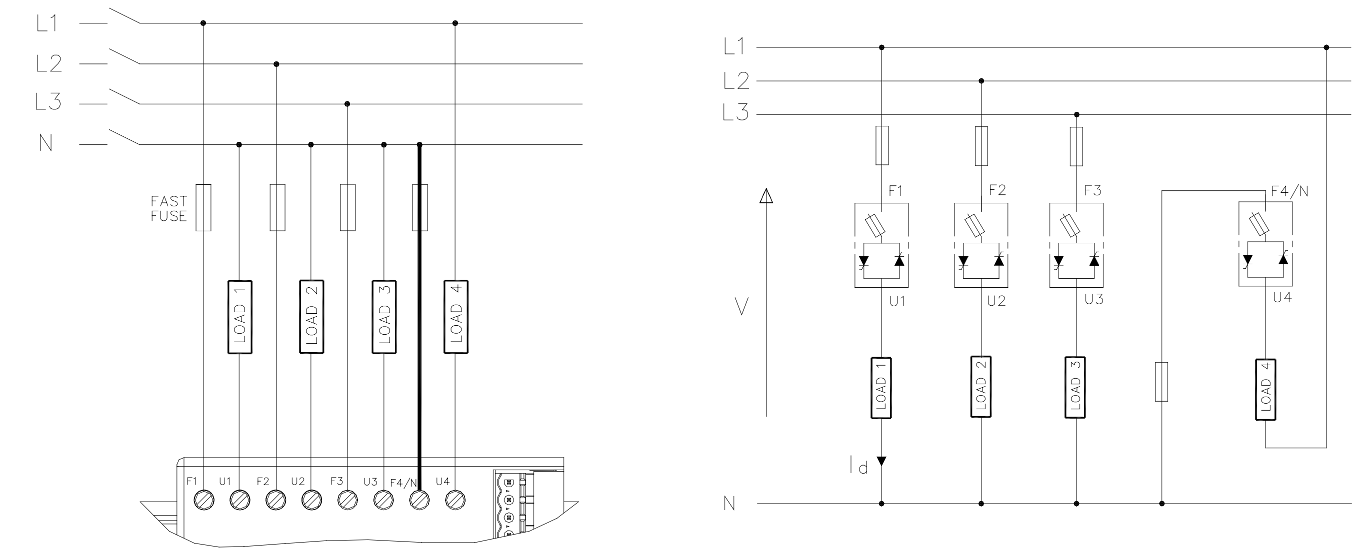
See notes for use with inductive loads and transformers

$$Id = \frac{P}{\eta \, . \, V \, . \, \cos\varphi} \qquad Is = \frac{P}{Vload \, . \, \cos\varphi}$$

P = power of each single-phase load
V = phase voltage (line L1- line L2/N)
Vload = voltage on secondary (load)
Id = current in primary
Is = current in secondary (load)
η = transformer output (type 0.9)

if resistive load $\cos\varphi = 1$

Figure 41 - Connection example for 4 single-phase loads, 3-phase line with neutral



Dip-Switches configuration				
Dip 1	**Dip 2**	**Dip 3**	**Dip 4**	**Dip 5**
OFF	OFF	OFF	OFF	OFF

- FIRING MODE: ZC, BF, HSC, PA
- HB DIAGNOSTIC AVAILABLE: Partial and total load failure of each single leg

FAST FUSE needed only for controller without option “F” See table Fuse/Fuseholders

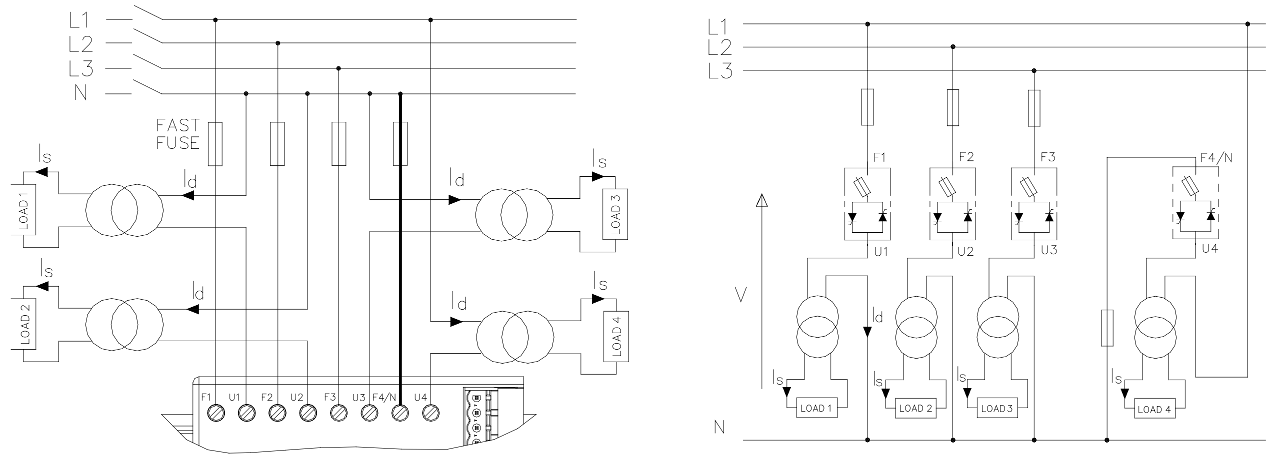
NOTE:
Take care about the “F4/N” connection (see the picture)
The wire “F4/N” is required always (also if Load 4 is not used)

$$Id = \frac{P}{V \ \cos\varphi}$$

V = phase voltage (line - neutral)
P = power of each single-phase load
Id = load current

if resistive load $\cos\varphi = 1$

Figure 42 -Connection example for 4 single-phase transformer loads, 3-phase line with neutral



Dip-Switches configurations				
Dip 1	**Dip 2**	**Dip 3**	**Dip 4**	**Dip 5**
OFF	OFF	OFF	OFF	ON

- FIRING MODE: ZC, PA
- HB DIAGNOSTIC AVAILABLE: Partial and total load failure of each single leg

FAST FUSE needed only for controller without option “F” See table Fuse/Fuseholders

NOTE:
Take care about the “F4/N” connection (see the picture)
The wire “F4/N” is required always (also if Load 4 is not used)

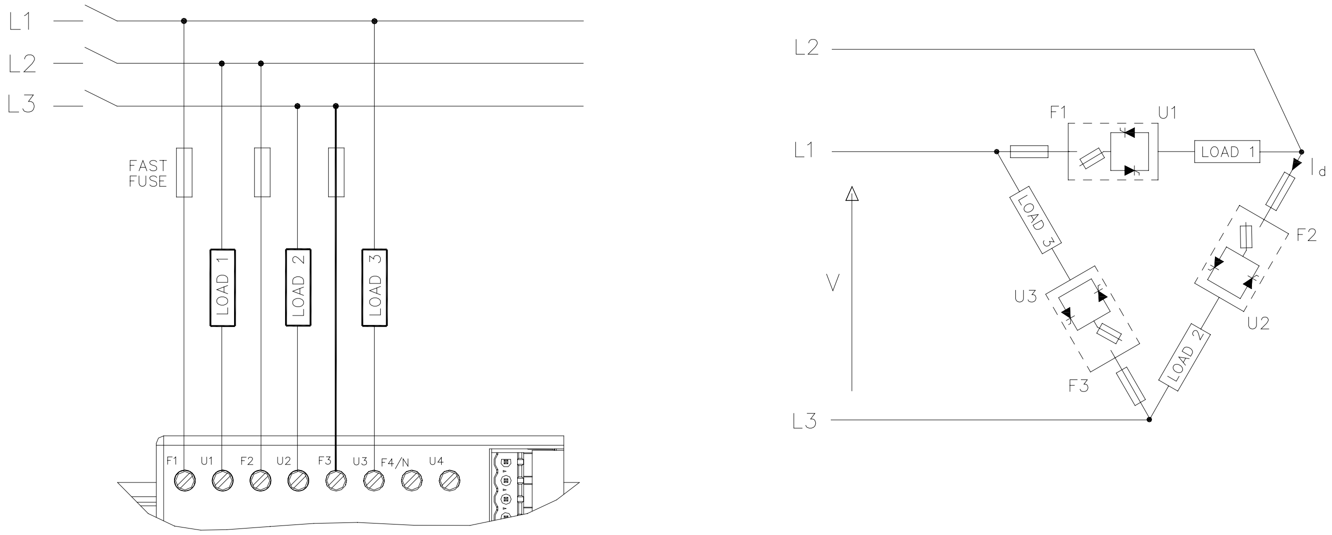
$$Id = \frac{P}{\eta \ . \ V \ . \ \cos\varphi} \qquad Is = \frac{P}{Vload \ . \ \cos\varphi}$$

P = power of each single-phase load
V = phase voltage (line L1- line L2/N)
Vload = voltage on secondary (load)
Id = current in primary
Is = current in secondary (load)
η = transformer output (type 0.9)

if resistive load $\cos\varphi = 1$

See notes for use with inductive loads and transformers

Figure 43 - Connection example for 3 independent single-phase loads in open delta, 3-phase line without neutral



Dip-Switches configuration				
Dip 1	**Dip 2**	**Dip 3**	**Dip 4**	**Dip 5**
OFF	ON	OFF	ON	OFF

$$Id = \frac{P}{V \cos\varphi}$$

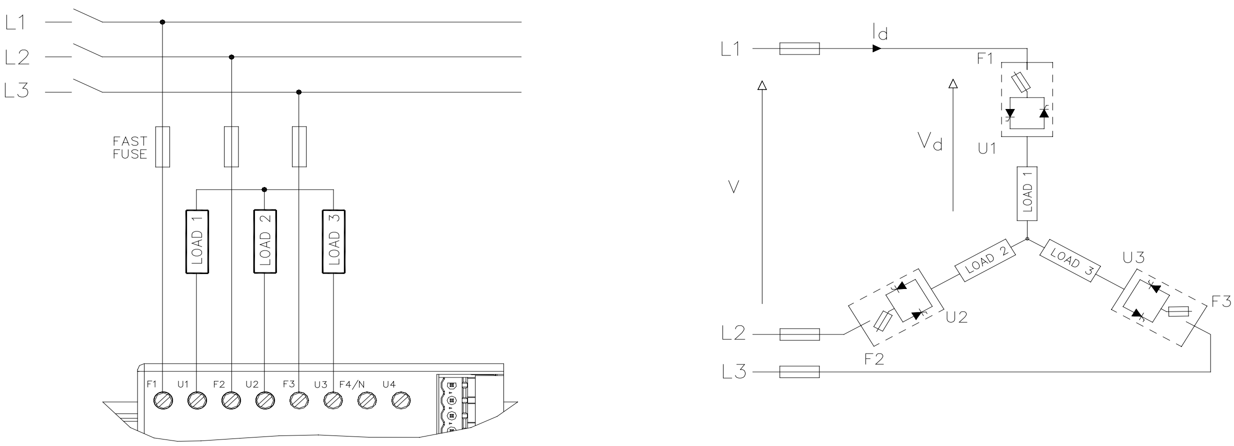
V = line voltage
P = power of each single-phase load
Id = load current

if resistive load cosφ = 1

- FIRING MODE: ZC, BF, HSC, PA
- HB DIAGNOSTIC AVAILABLE: Partial and total load failure of each single leg

FAST FUSE needed only for controller without option “F” See table Fuse/Fuseholders

Figure 44 - Connection example for 1 3-phase star load without neutral (3 wires)



Dip-Switches configuration				
Dip 1	**Dip 2**	**Dip 3**	**Dip 4**	**Dip 5**
ON	OFF	-	ON	OFF

$$Vd = \frac{V}{\sqrt{3}} \qquad Id = \frac{P}{\sqrt{3}\ V \cos\varphi}$$

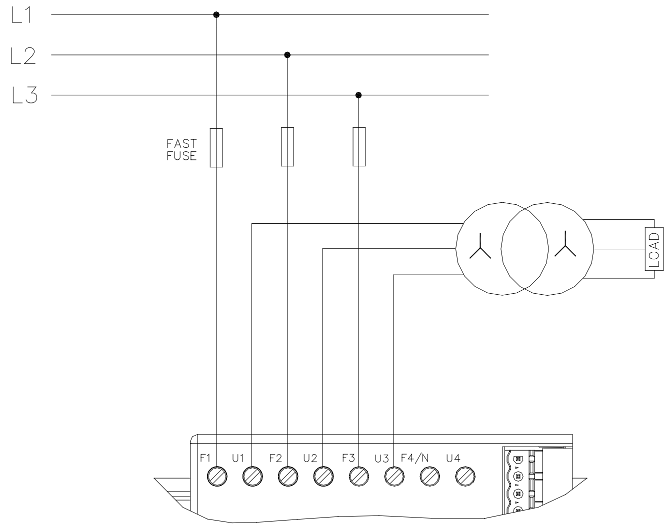
V = line voltage
Vd = load voltage
Id = load current
P = total power

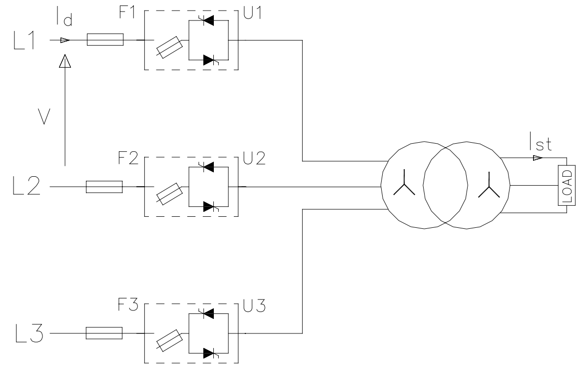
if resistive load cosφ = 1

- FIRING MODE: ZC, BF, PA (P>6%)
- HB DIAGNOSTIC AVAILABLE: Partial and total load failure of each single leg

FAST FUSE needed only for controller without option “F” See table Fuse/Fuseholders

Figura 45 - Connection example for 1 3-phase star transformer without neutral (3 wires) with 3-phase load





Dip-Switches configuration				
Dip 1	**Dip 2**	**Dip 3**	**Dip 4**	**Dip 5**
ON	ON	ON	ON	ON

- FIRING MODE: ZC, PA (P>6%)
- HB DIAGNOSTIC AVAILABLE: Partial and total load failure of each single leg

FAST FUSE needed only for controller without option "F"
See table Fuse/Fuseholders

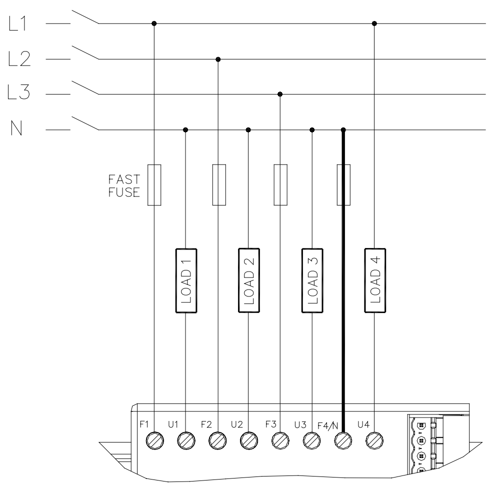
See notes for use with inductive loads and transformers

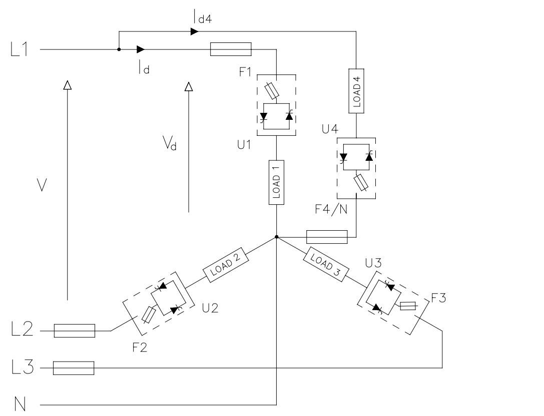
$$Id = \frac{P}{\eta \cdot \sqrt{3} \cdot V \cdot \cos\varphi} \qquad Ist = \frac{P}{\sqrt{3} \cdot Vload \cdot \cos\varphi}$$

P = total power
V = line voltage
Vload = line voltage on secondary (load)
Id = current in primary
Ist = current in secondary (3-phase load)
η = transformer output (type 0.9)

if resistive load $\cos\varphi = 1$

Figure 46- Connection example for 1 3-phase star load with neutral (4 wires) + possible single-phase load





Dip-Switches configuration				
Dip 1	**Dip 2**	**Dip 3**	**Dip 4**	**Dip 5**
ON	OFF	-	OFF	OFF

- FIRING MODE: ZC, BF, HSC, PA
- HB DIAGNOSTIC AVAILABLE: Partial and total load failure of each single leg

FAST FUSE needed only for controller without option "F" See table Fuse/Fuseholders

NOTE:
Take care about the "F4/N" connection (see the picture)
The wire "F4/N" is required always (also if Load 4 is not used)

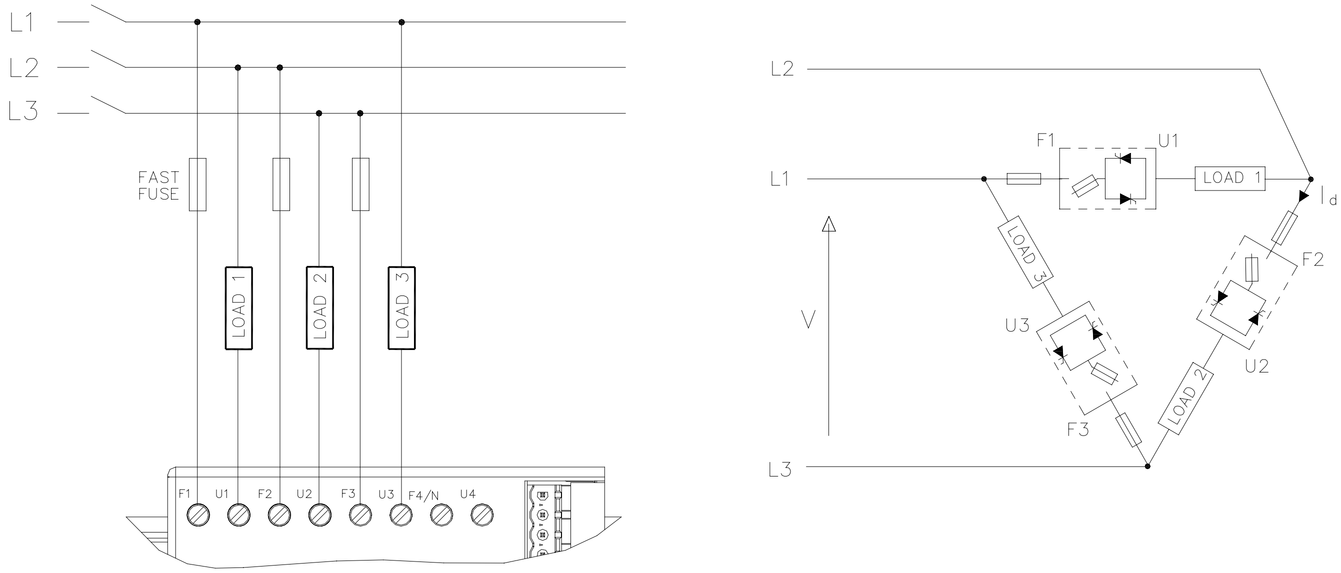
$$Vd = \frac{V}{\sqrt{3}} \qquad Id = \frac{P}{\sqrt{3}\ V \cos\varphi}$$

V = line voltage
Vd = load voltage
Id = current in 3-phase load
P = total power 3-phase load
if resistive load $\cos\varphi = 1$

$$Id4 = \frac{P4\ \sqrt{3}}{V \cos\varphi}$$

Id4 = current in single-phase load
P4 = power in single-phase load
if resistive load $\cos\varphi = 1$

Figure 47 -Connection example for 1 3-phase open delta load (6 wires)



Dip-Switches configuration				
Dip 1	**Dip 2**	**Dip 3**	**Dip 4**	**Dip 5**
ON	ON	OFF	ON	OFF

- FIRING MODE: ZC, BF, PA, HSC
- HB DIAGNOSTIC AVAILABLE: Partial and total load failure of each single leg

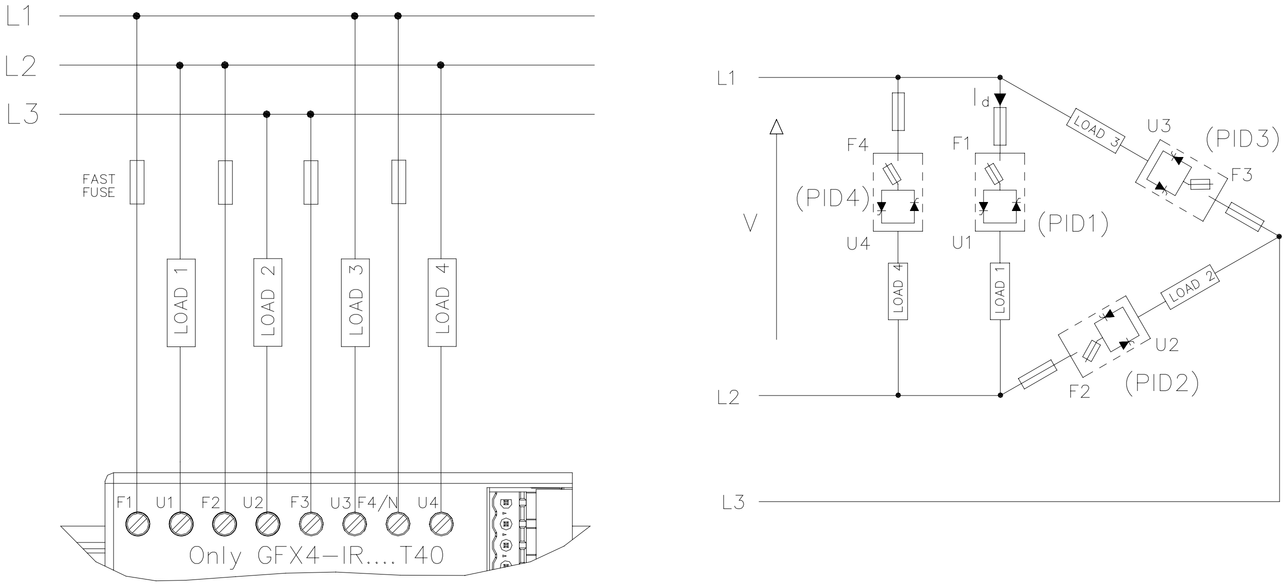
FAST FUSE needed only for controller without option “F”
See table Fuse/Fuseholders

$$Id = \frac{P}{3V \cos\varphi}$$

V = line voltage
Id = load current
P = total power

if resistive load $\cos\varphi = 1$

Figura 47a -Control of 4 independent loads open delta GFX4-IR...T40



Dip-Switches configuration				
Dip 1	**Dip 2**	**Dip 3**	**Dip 4**	**Dip 5**
OFF	ON	OFF	ON	OFF

- FIRING MODE: ZC, BF, PA, HSC
- HB DIAGNOSTIC AVAILABLE: Partial and total load failure of each single leg

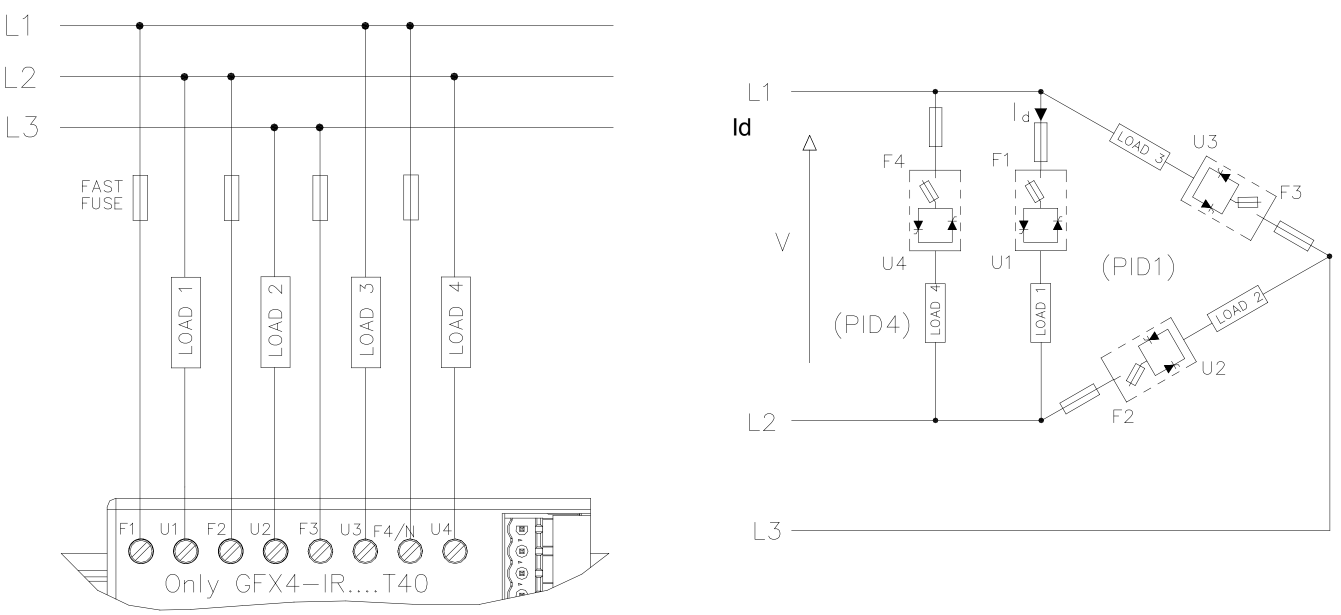
FAST FUSE needed only for controller without option “F” See table Fuse/Fuseholders

$$Id = \frac{P}{V \cos\varphi}$$

V = line voltage
Id = load current
P = total power

if resistive load $\cos\varphi = 1$

Figura 47b -Control of 1 triphase load open delta, and 1 single load on CH4 GFX4-IR...T40



Dip-Switches configuration				
Dip 1	**Dip 2**	**Dip 3**	**Dip 4**	**Dip 5**
ON	ON	OFF	ON	OFF

$$Id = \frac{P}{V \cos\varphi}$$

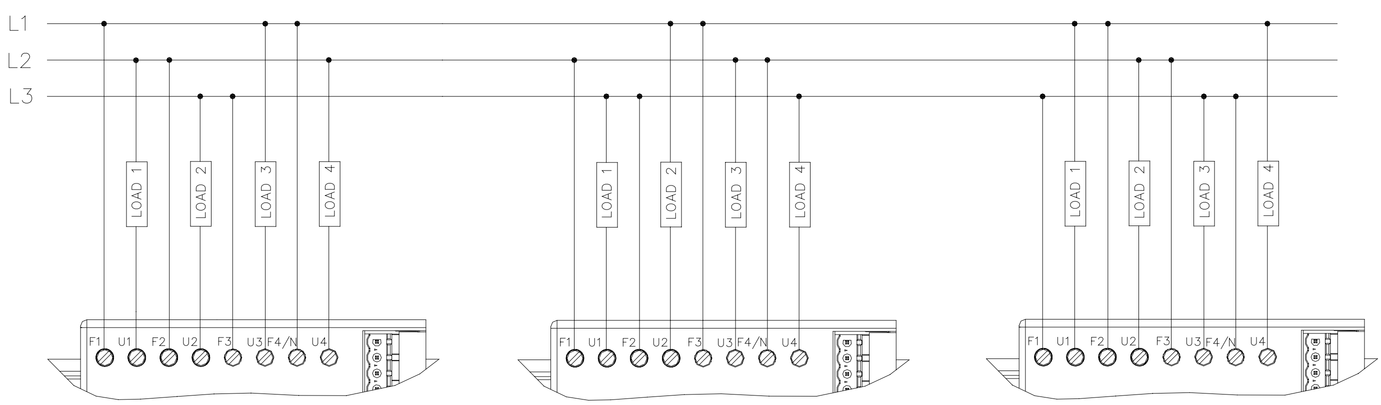
V = line voltage
Id = load current
P = total power

if resistive load $\cos\varphi = 1$

- FIRING MODE: ZC, BF, PA, HSC
- HB DIAGNOSTIC AVAILABLE: Partial and total load failure of each single leg

FAST FUSE needed only for controller without option “F”
See table Fuse/Fuseholders

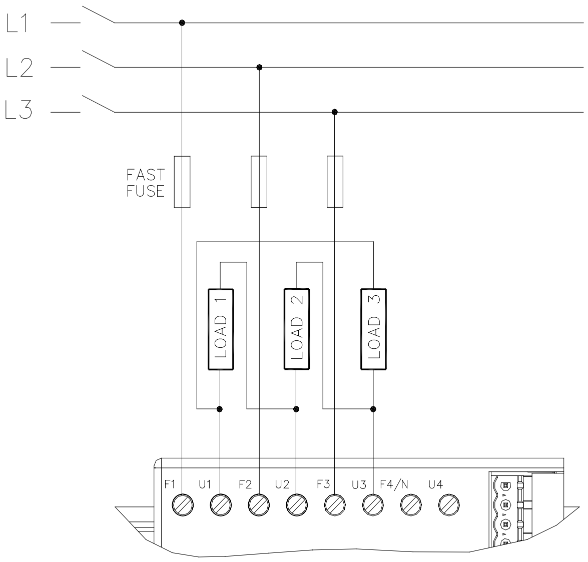
Figura 47c - Wiring example of three GFX4-IR...T40 with optimized line current sharing

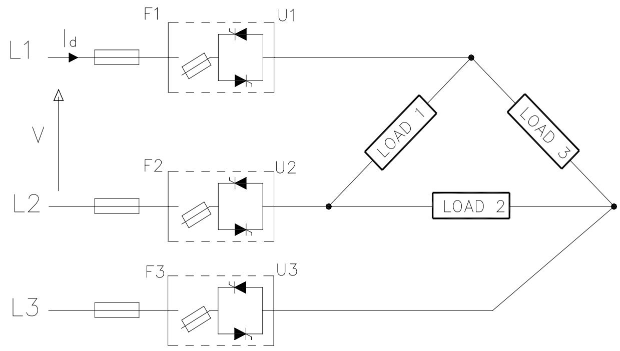


NOTES:

1 The GFX4-IR T40 product is especially designed for open delta applications, but can control also other load configurations.
2 The GFX4-IR T40 can control a three-phase load closed-delta (figure 48)
3 The GFX4-IR T40 can control a three-phase load star without neutral (figure 44)
4 The GFX4-IR T40 can control a three-phase transformer (figure 45)
5 The GFX4-IR T40 can NOT control all kind of single-phase loads or three-phase with neutral (figure 39 - 39A - 40 - 40A - 41 - 42 - 46)

Figure 48 - Connection example for 1 3-phase closed delta load (3 wires)





Dip-Switches configuration				
Dip 1	**Dip 2**	**Dip 3**	**Dip 4**	**Dip 5**
ON	ON	ON	ON	OFF

- FIRING MODE: ZC, BF, PA (P>6%)
- HB DIAGNOSTIC AVAILABLE: Partial and total load failure of each single leg
- in PA mode, HB diagnostic active with P>30%

FAST FUSE needed only for controller without option "F"
See table Fuse/Fuseholders

$$Id = \frac{P}{\sqrt{3} \cdot V \cos\varphi}$$

V = line voltage
Id = load current
P = total power

if resistive load cosφ = 1

NOTES: USE WITH INDUCTIVE LOADS AND TRANSFORMERS

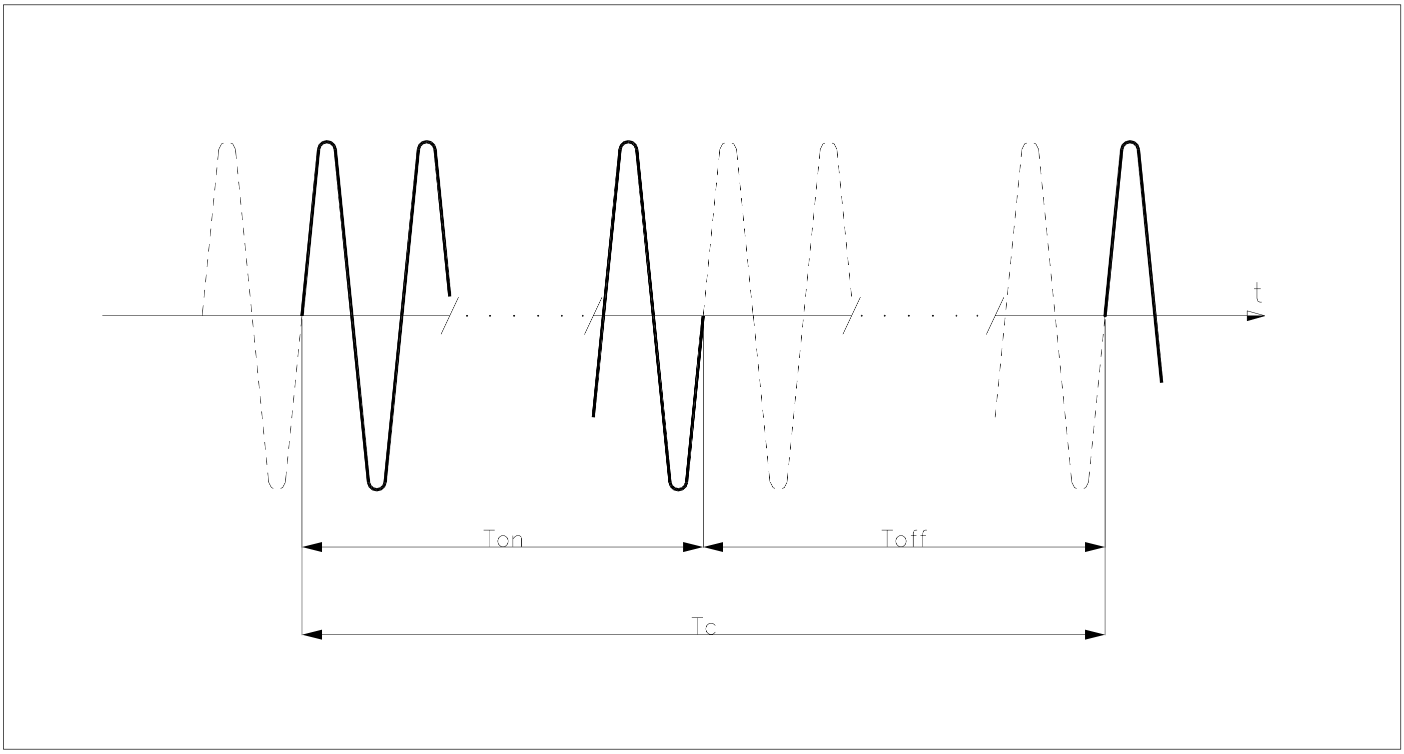
a) Connect a varistor (MOV) between each wire of the primary transformer and ground.
Varistor data: rated voltage 660Vrms,…, 1000Vrms; minimum energy 100J
b) The maximum current controllable by the device is less than the product's rated value (see technical data).
c) In ZC and BF trigger mode, use the Delay-triggering function to limit peak magnetization current.
d) In PA trigger mode, use the Softstart function.
e) DO NOT use HSC trigger mode.
f) DO NOT connect RC snubbers in parallel to the transformer primary.
g) Always set Dip-Switch 5 to ON (and run the initial configuration procedure described in paragraph 3.7)

Trigger modes
The GFX4-IR has the following power control modes:
- modulation via variation of number of conduction cycles with zero crossing trigger.
- modulation via variation of phase angle.

Zero Crossing mode
This function eliminates EMC noise. This mode controls power on the load via a series of conduction ON and non conduction OFF cycles.

ZC - constant cycle time (Tc ≥ 1 sec, settable from 1 to 200 sec)
Cycle time is divided into a series of conduction and non conduction cycles in proportion to the power value to be transferred to the load.

Figure 49



For example, if Tc = 10sec, if the power value is 20% there is conduction for 2 sec (100 conduction cycles @ 50Hz) and non conduction for 8 sec (400 non conduction cycles @ 50Hz).

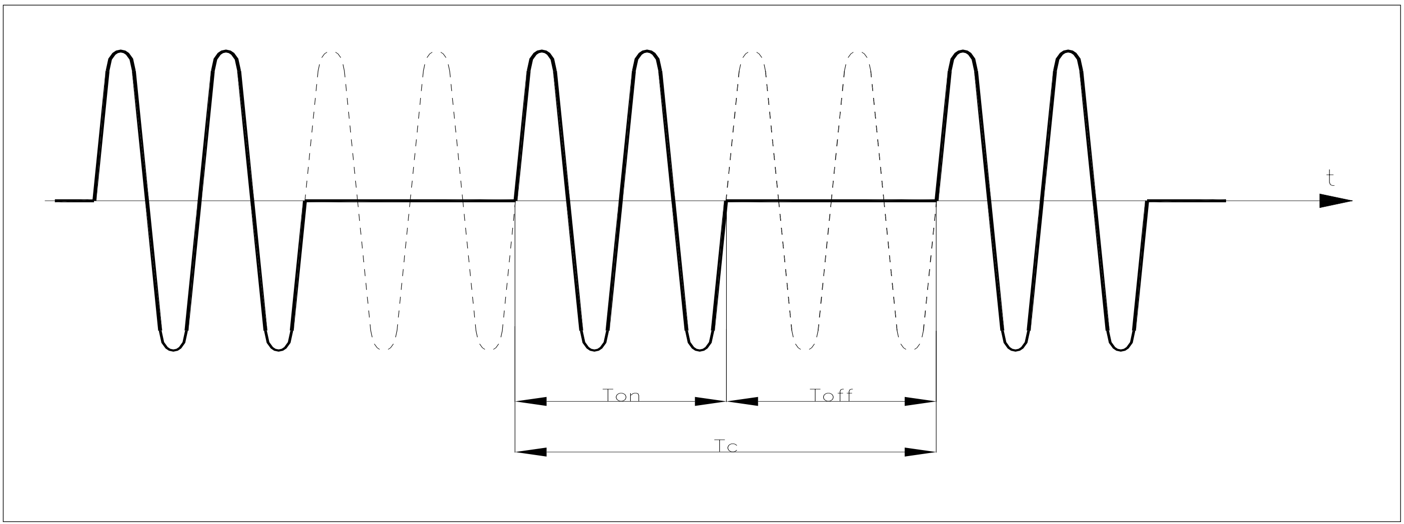
BF - variable cycle time (GTT)

This mode controls power on the load via a series of conduction ON and non conduction OFF cycles.

The ratio of the number of ON cycles to OFF cycles is proportional to the power value to be supplied to the load.

The CT repeat period is kept to a minimum for each power value (whereas in ZC mode the period is always fixed and not optimized).

Figure 50



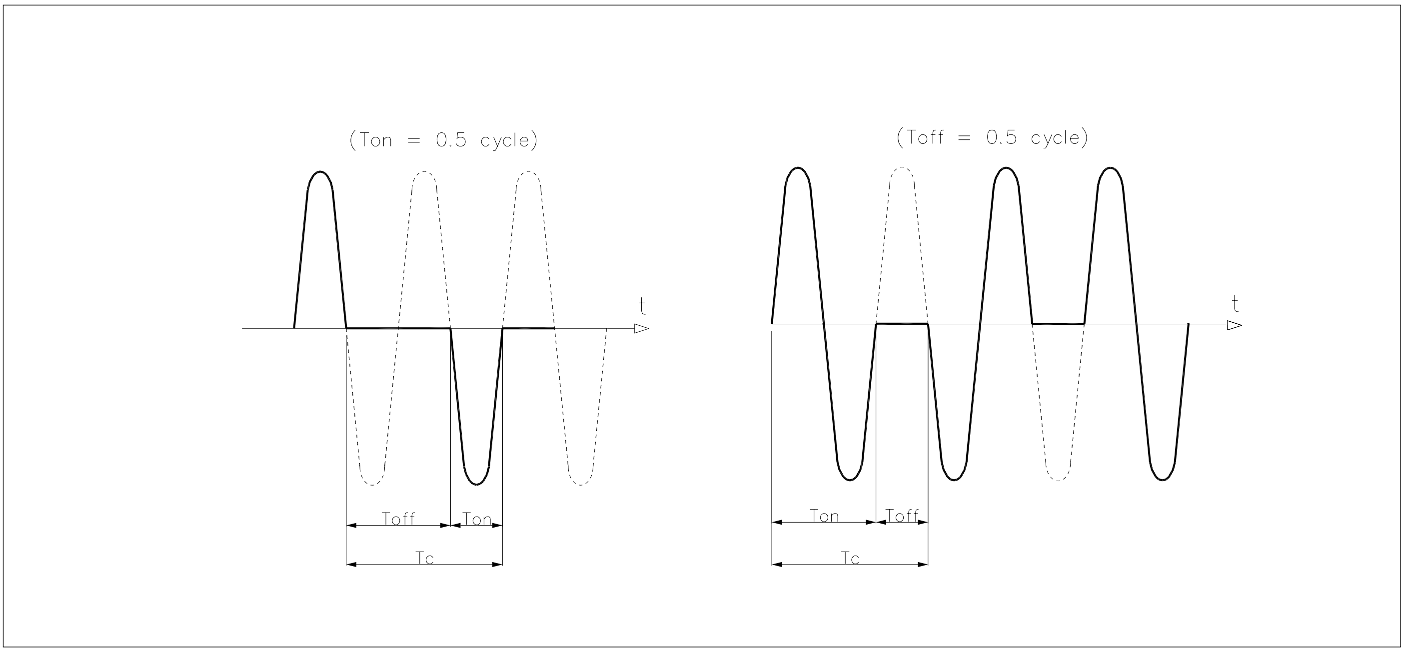
parameter defines the minimum number of conduction cycles settable from 1 to 10.
In the following example, the parameter = 2.

HSC - Half single cycle

This mode corresponds to Burst Firing that manages ON and OFF half-cycles. It is useful for reducing the flickering of filaments with short/medium-wave IR lamp loads. With these loads, to limit operating current with low power, it is useful to set a minimum power limit (for example, Lo.p = 10%).

NB: This mode is NOT allowed with inductive loads (transformers) It is used with resistive loads in singlephase, star with neutral, or open delta configuration.

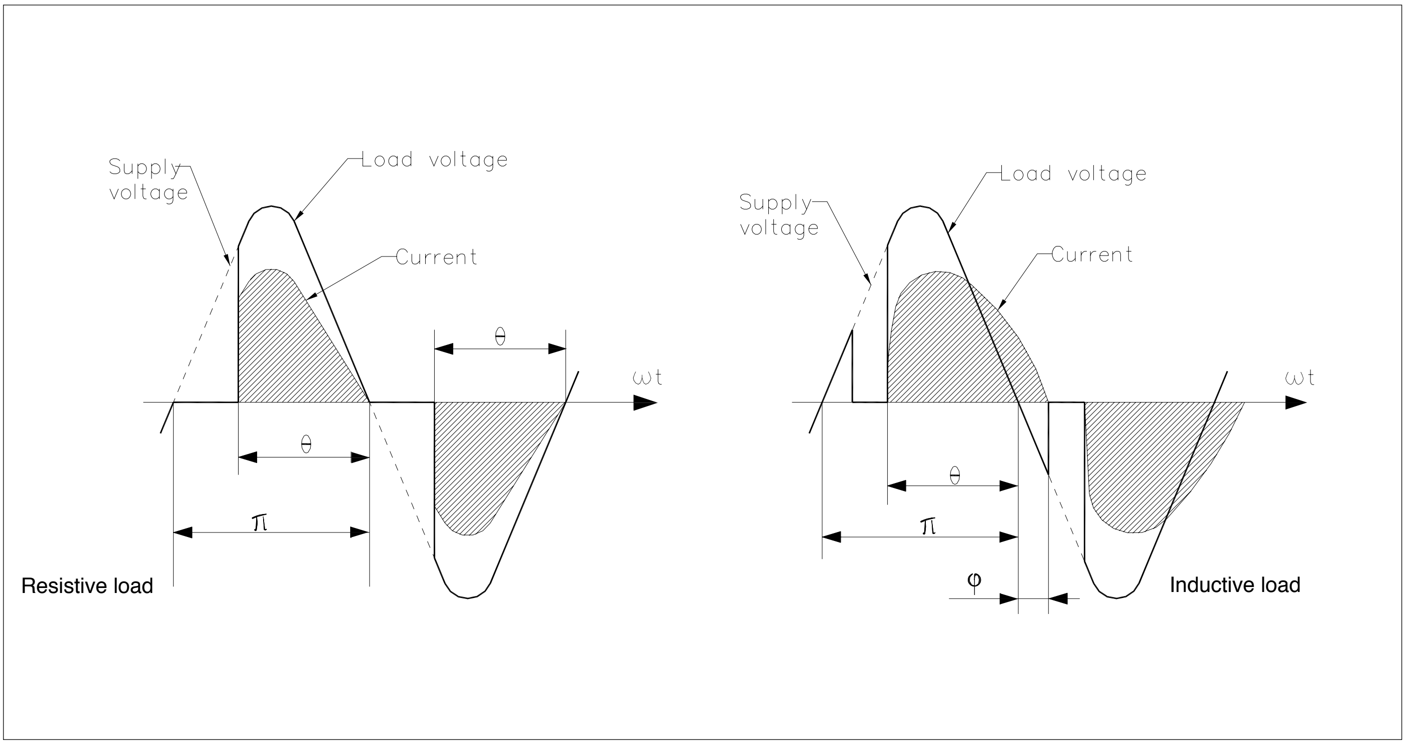
Figure 51



Example of operation in HSC mode with power at 33 and 66%.

Phase angle (PA)
This mode controls power on the load via modulation of trigger angle θ
if power to be transferred to the load is 100%, θ = 180°
if power to be transferred to the load is 50%, θ = 90°

Figure 52

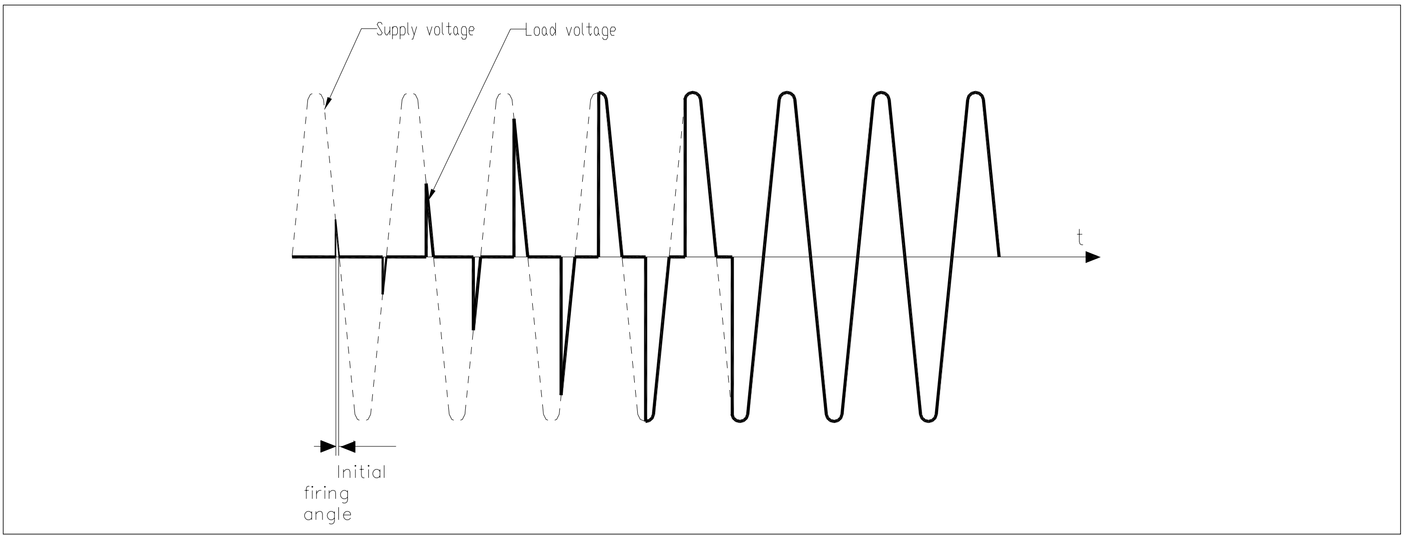


ADDITIONAL FUNCTIONS

Softstart

This type of start can be enabled either in phase control or pulse train mode and in zero-crossing mode (ZC, BF, HSC).
In phase control, the increment of conduction angle q stops at the corresponding value of the power to be transferred to the load.
Control of maximum peak current (useful in case of short circuit on the load or of loads with high temperature coefficients to automatically adjust start time to the load) can be enabled during softstart. When the load shut-off time (settable) is exceeded, the ramp is reactivated at the next power-on.

Figure 53

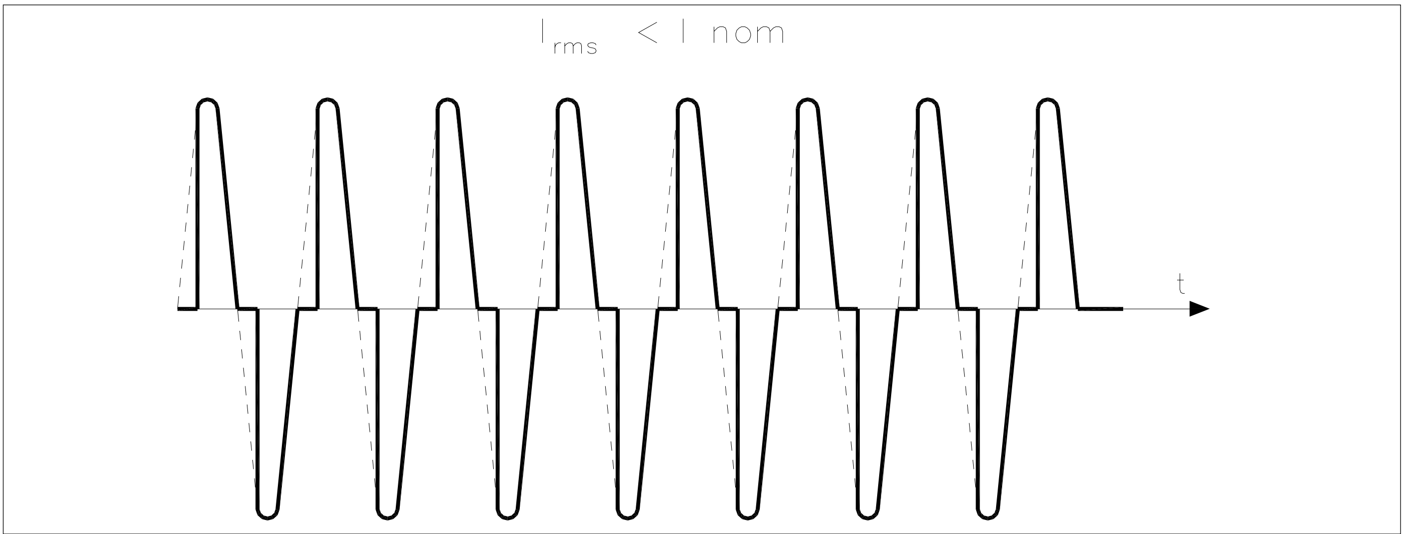


Example of firing ramp with phase Soft-Start

RMS current limit

The option for controlling the load current limit is available in all work modes.
If the current value exceeds the limit (settable in the nominal full-scale range) in mode PA the conduction angle is limited, while in zero-crossing mode (ZC, BF, HSC) the cycle time conduction percentage is limited.
This limitation ensures that the RMS value (i.e., not the instantaneous value) of the load current does NOT exceed the set RMS current limit.

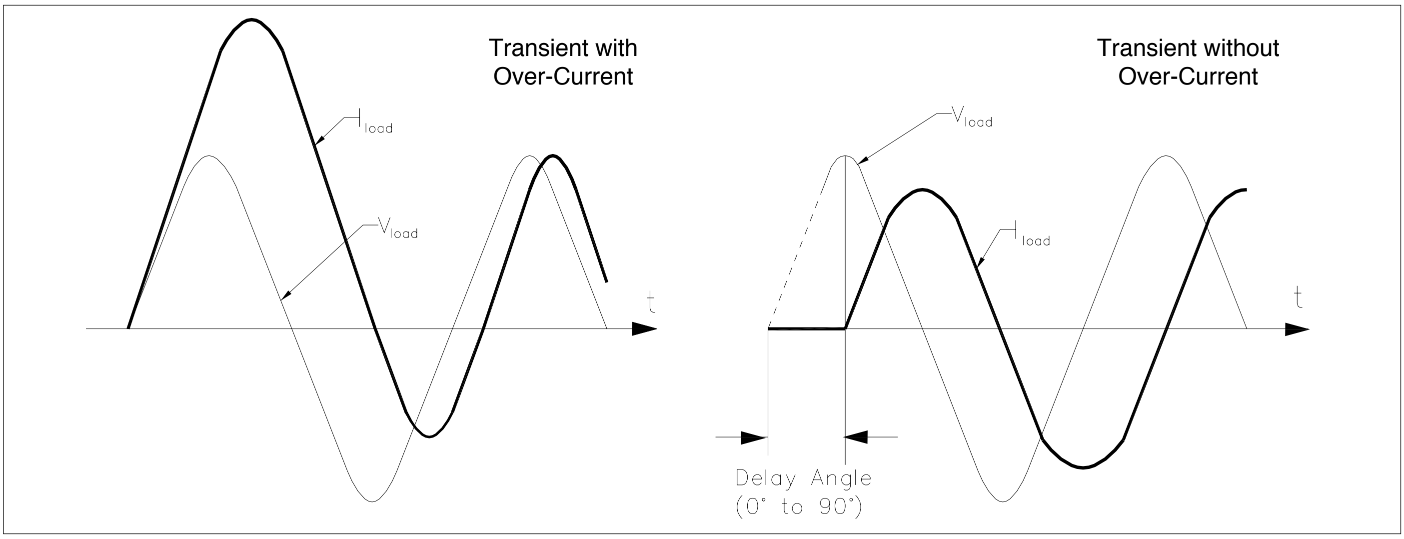
Figure 54



Example of conduction angle limitation in PA mode to respect an RMS current limit below the nominal current of the load.

DT - "Delay triggering" (for ZC, BF control modes only)
Settable from 0° to 90°.
Useful for inductive loads (transformer primaries) to prevent current peak that in certain cases could trip the high-speed fuses that protect the SCRs.

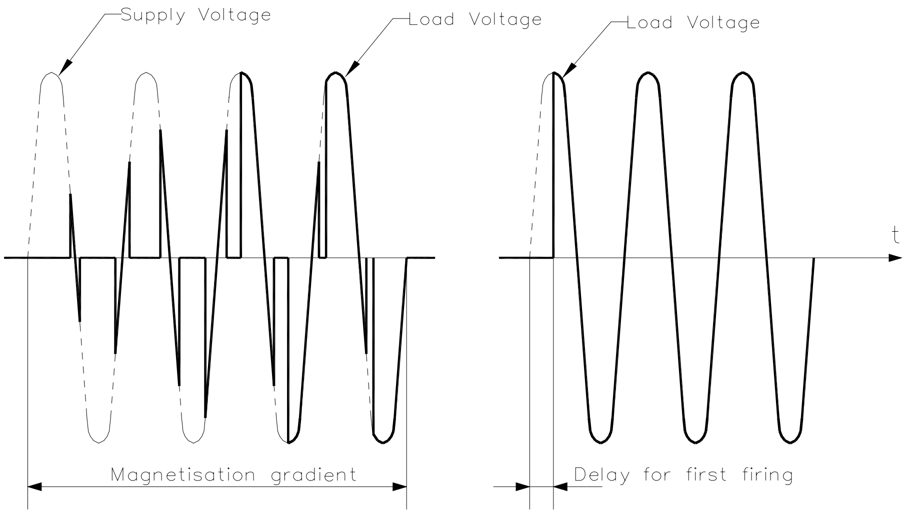
Figure 55



Example of firing of inductive load with/without delay-triggering.

To conduct inductive loads controlled in PA mode, do not use delay triggering; instead, use the phase Soft-Start ramp.

Figure 56



Example of phase ramp to fire a transformer in PA mode

Example of firing with Delay-Triggering of a transformer in ZC mode

Comparison of method to fire a transformer: Soft-Start Ramp (for PA mode) / Delay triggering (for ZC and BF mode)

4 • INSTALLATION OF "MODBUS" SERIAL NETWORK

A network typically has a Master that "manages" communication by means of "commands," and Slaves that carry out these commands.
GFX4-IR modules are considered Slaves to the network master, which is usually a supervision terminal or a PLC.
They are positively identified by means of a node address (ID) set on rotary switches (tens + units).
A maximum of 99 GFX4-IR, modules can be installed in a serial network, with node address selectable from "01" to "99" in standard mode or can also create a network with GFX4-IRand Geflex mixed in Geflex compatible mode, in which each GFX4-IR identifies 4 zones with sequential node address starting with the code set on the rotary switches.

I GFX4-IR modules have a ModBus serial (Serial 1) and, optionally (see order code) a Fieldbus serial (Serial 2) with one of the following protocols: Modbus RTU, Profibus DP, CANopen, DeviceNet, Ethernet Modbus TCP, Ethernet IP, EtherCAT, ProfiNET..

The MODBUS RTU port 1 has the follwing factory settings (default):

Parameter	Default	Range
ID	1	1...99
BaudRate	19,2Kbit/s	1200...115kbit/s
Parity	None	parity/odd parity/none
StopBits	1	-
DataBits	8	-

The following procedures are indispensable for the Modbus protocol.For the other protocols, see the specific Geflex manuals.
The use of rotary switches (A...F) letters is for particular procedures described in the following paragraphs.
Here are the tables showing them:

Procedure	Positions of rotary switches		Description
	Tens	Units	
AutoBaud	0	0	It enables to set the correct BaudRate value
*AutoNode	A	0	It enables to transfer of the correct node (ID) address (tens) to eventual GEFLEX S1/S2

* **Note**: the AutoNode procedure is also required for Profibus DP, CANOpen, DeviceNet, Ethernet Modbus/TCP protocols.
Check its correct address in the specific manuals in question.

4.1 "AUTOBAUD SERIAL 1" sequence

Function

Adapt the serial communication speed and parity of the GFX4-IR modules to the connected supervision terminal or PLC.

Green LED L1 "STATUS" mentioned in the procedure can vary its behavior based on parameter Ld.1, which is set to a default value of 16.

Procedure

1) Connect the serial cables for all modules on the network to serial 1 and to the supervision terminal.

2) Set the rotary switch on the GFX4-IR modules to be installed, or on all modules present in case of first installation, to position "0+0".

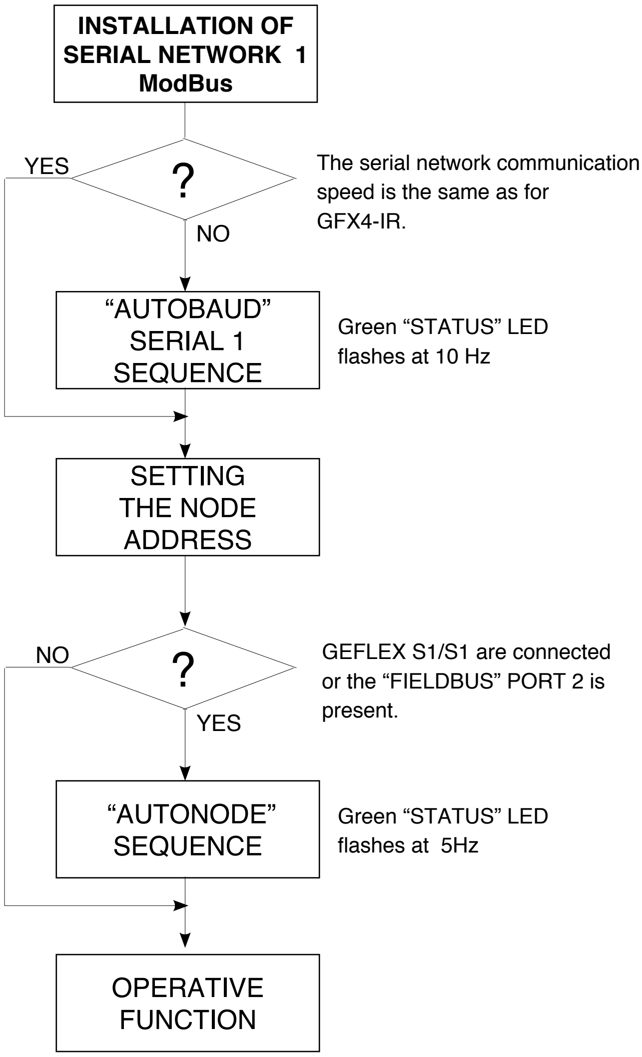
3) Check that the green "STATUS" LEDs flash at high frequency (10Hz).

4) The supervision terminal must transmit a series of generic "MODBUS" read messages to the network.

5) The procedure is over when all of the green L1 "STATUS" LEDs on the Geflex modules flash at a normal frequency (2Hz) (if parameter 197 Ld.1 = 16 as default).

The new speed parameter is saved permanently in each GFX4-IR; therefore, the "AUTOBAUD SERIAL 1" sequence does not have to be run at subsequent power-ups.

When the rotary switch is turned, the green "STATUS" LED stays on steadily for about 6 seconds, after which it resumes normal operation and saves the address.



4.2 "AUTONODE PORT 1" sequence

Function

Assigning the **Function**

Adapt the serial communication speed and parity of the GFX4-IR modules to the connected supervision terminal or PLC.

Green LED L1 "STATUS" mentioned in the procedure can vary its behavior based on parameter Ld.1, which is set to a default value of 16.

Procedure

1) Connect the serial cables for all modules on the network to serial 1 and to the supervision terminal.

2) Set the rotary switch on the GFX4-IR modules to be installed, or on all modules present in case of first installation, to position "0+0".

3) Check that the green "STATUS" LEDs flash at high frequency (10Hz).

4) The supervision terminal must transmit a series of generic "MODBUS" read messages to the network.

5 • TECHNICAL CHARACTERISTICS

INPUTS	
IN1,…,IN4 analog process inputs	
Function	Acquisition of process variable
Max. error	0.2% f.s. ± 1 scale point at room temperature of 25°C
Thermal drift	< 100 ppm/°C on f.s.
Sampling time	120 ms
Thermocouple Tc (ITS90)	J,K,R,S,T (IEC 584-1,CEI EN 60584-1, 60584-2) Error cold junction comp. 0,1°/°C
Resistance thermometer RTD (ITS90)	Pt100 (DIN 43760) Max line resistance 20ohm
Voltage	Linear: 0,…,60mV, Ri>1Mohm 0,…,1V, Ri>1Mohm a 32-segment custom linearization can be inserted
Current	Linear: 0/4…20mA, Ri =50ohm a 32-segment custom linearization can be inserted
IN5,…,IN8 auxiliary analog inputs (option)	
Function	Acquisition of variables (mV or Thermocouple)
Accuracy	1% f.s. ± 1 scale point at room temperature of 25°C
Thermocouple Tc (ITS90)	480 ms
Resistance thermometer RTD (ITS90)	J,K,R,S,T (IEC 584-1,CEI EN 60584-1, 60584-2) Error cold junction comp. 0,1°/°C
Voltage	Linear: 0,…,60mV, Ri>1Mohm
Line Voltage and Current measurement	
RMS current measurement function	Load current read; minimum measurable current: 2A (model 30KW), 4A (model 60KW), 6A (model 80KW)
Accuracy RMS current measurement	2% f.s. at room temperature of 25°C in start mode ZC and BF in mode PA 3% f.s. with conduction angle >90°, 10% f.s. with conduction angle <90°
RMS voltage measurement function	Line voltage read; (acquisition of voltage values is valid for voltage in range 90...530Vac)
Accuracy RMS voltage measurement	1% f.s. with neutral connected; 3% f.s. without neutral.
Current and Voltage sampling time	0,25 ms
DI1,…,DI2 digital inputs	
Function	Configurable (default: disabled)
Type	PNP, 24Vdc, 8mA isolation 3500V
OUTPUTS	
OUT1,…,OUT4 heat control outputs connected directly to solid-state units	
Function	Configurable (default: heat control) State of control is displayed by LED (O1,…,O2)
OUT5,...,OUT8 cooling control outputs (option)	
Function	Configurable (default: cooling control)
Relay	Contact NO 3A, 250V/30Vdc cosφ =1
Continuous	0/2…10V (default), max 25mA short circuit protection 0/4…20mA, max. load 500ohm isolation 1500V
Logic	24Vdc, > 18V a 20mA
Triac	230V/ max 4A AC51 (1A for each channel)
OUT9, OUT10 alarms	
Function	Configurable (default alarms)
Relay	Contact NO 5A, 250V/30Vdc cosφ =1
COMMUNICATION PORTS	
PORT1 (always present)	
Function	Local serial communication
Protocol	ModBus RTU
Baudrate	Settable 1200,…,115200, (default 19,2Kbit/s)
Node address	Settable with rotary-switches
Type	RS485 isolation 1500V, double connector RJ10 telephone type 4-4

PORT 2 (Fieldbus option)	
Function	Fieldbus serial communications
Protocol	ModBus RTU, tipo RS485, baudrate 1200...115000Kbit/s CANOpen 10K…1Mbit/s DeviceNet 125K…0,5Mbit/s Profibus DP 9,6K...12 Mbit/s Ethernet Modbus TCP, Ethernet IP 10/100Mbps EtherCAT, ProfiNET 100Mbps
POWER (Solid-state power units, 4 units)	
Load type	**AC 51** resistive or low inductance loads **AC 55b** short wave infrared lamps (SWIR) **AC 56a** transformers, resistive loads with high temperature coefficient
Trigger mode	**PA** - load control via adjustment of firing phase angle **ZC** - Zero Crossing with constant cycle time (settable in range 1-200sec) **BF** - Burst Firing with variable cycle time (GTT) optimized minimum. **HSC** - Half Single Cycle corresponds to Burst Firing that includes ON and OFF half-cycles. Useful for reducing flicker with short-wave IR loads (applied only to single-phase resistive or 3-phase 6-wire open delta loads).
Feedback mode	**V** Voltage feedback: proportional to RMS voltage value on load to compensate possible variations in line voltage. **I** Current feedback: proportional to RMS current value on load to compensate variations in line voltage and/or variations in load impedance. **W** Power feedback: proportional to real power value on load to compensate variations in line voltage and/or variations in load impedance. You have to calibrate each time you change feedback mode.
Max rated voltage	480Vac
Work voltage range	90…530Vac
Non-repetitive voltage	1200Vp
Rated frequency	50/60Hz auto-determination
Rated current AC51 non-inductive or slightly inductive loads, resistance furnaces	30KW 60KW 80KW 4x16A 4x32A (4x30)* 4x40A (4x40)* (single channel 57A ∑I = 160A)
Nominal current AC55b short wave infrared lamps	30KW 60KW 80KW 4x8A 4x16A 4x20A for applications in which you can set a minimum power output limit (ex: Lo.P = 10%) by also limiting the lamp power variation speed with gradient limit (ex: G.out = 20%, PS.TM = 20s). Under these conditions, the nominal currents shown on the table can be raised up to the values indicated for AC51 type loads.
Rated current AC56A load transformer permitted trigger modes: ZC, BF con DT (Delay Triggering), PA with softstart	30KW 60KW 80KW 4x12A 4x25A 4x32A
Non-repetitive overcurrent (t=20msec)	400A 600A 1150A
I^2t for melting (t=1…10msec)	645A^2s 1010A^2s 6600A^2s
Critical Dv/dt with output deactivated	10,000V/μs High static dv/dt
Rated isolation voltage	4000V
FUNCTION	
Safety	Detection of short circuit or opening of inputs, absence of input feed, LBA alarm, HB alarm
Selection of °C/°F	Configurable
Linear scale range	-1999…9999
Control actions	4 control loops: Double action (heat/cool) PID, on-off Self-tuning at start, continuous Autotuning, one-shot Autotuning
PID Parameters: 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 limit heat/cool power	0,0…100,0 %
Fault power setting	-100,0…100,0 %
Shutdown function	Maintains sampling of PV; maintains control off
Configurable alarms	The alarm is assignable to an output and configurable as: maximum, minimum, symmetrical, absolute/deviation, LBA, HB
Alarm masking	Exclusion at power-on, latch, reset from digital input

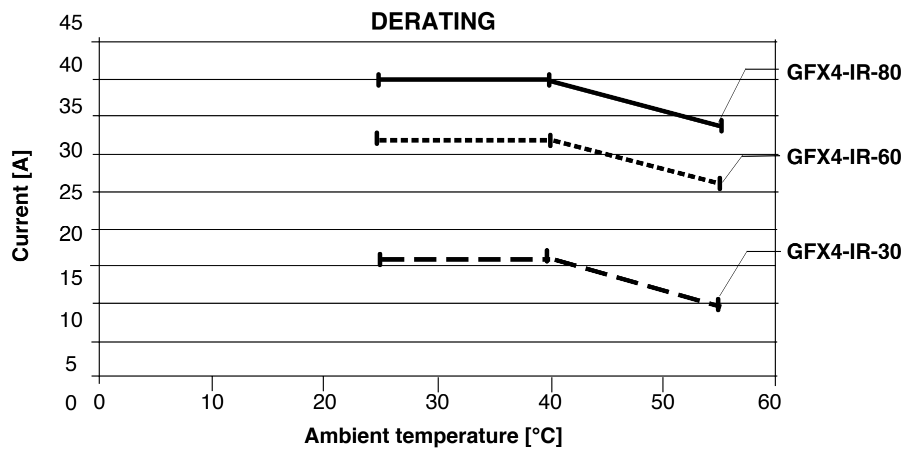
OPTIONS	
Options	- Timed Soft-Start firing ramp, with or without peak current control - Soft-Start firing ramp, specific for infrared lamps - Timed shut-off ramp - Limitation of RMS current in load - 0-90° Delay-Triggering for firing inductive loads in ZC and BF mode
Diagnostic	- SCR in short circuit (presence of current with OFF control) - No voltage - No current due to open SCR/interrupted load • Overheat alarm Current read • HB alarm interrupted or partially interrupted load • Automatic calibration of HB alarm setpoint starting from current value in load • Alarm for load in short circuit or overcurrent Voltage read • 3-phase line imbalanced • Incorrect phase rotation in configuration of 3-phase load
Type of connection and load Selection via dip-switches	4 single-phase loads 3 independent single-phase loads open delta 1 3-phase load open delta 1 3-phase load closed delta 1 3-phase load star with neutral 1 3-phase load star without neutral
GENERAL DATA	
Power supply	24Vdc ±25%, max 8VA Class II
Signals	Eight LEDs: RN run state of CPU ER error signal DI1, DI2 state of digital inputs O1,…,O4 state of SCR control
Protection	IP20
Work/storage temperature	0…50°C (refer to dissipation curves) / -20…70°C
Relative humidity	20…85% RH non-condensing
Ambient conditions for use	indoor use, altitude up to 2000m
Installation	DIN bar EN50022 or panel with screws
Installation requirements	Installation category II, pollution level 2, double isolation Max. temperature of air surrounding device 50°C Device type: “UL Open Type”
Weight	30Kw, 60Kw, 80Kw models 1200g. 30Kw, 60Kw models with fuses 1600g
(*) UL Certification	

5.1 Voltage/Current Table

Model GFX4-IR	Current (Amp) max for channel	Voltage (Vac) range	Voltage (Vac) nominal	Voltage (Vac) working	Power (kW) total contemporary	Power (kW) single channel	Power (kW) max for single channel
30 (4x16A)	16	90...530	480	110	(4x16x110) **7**	(16x110) **1,7**	(1x16x110) **1,7**
				230	(4x16x230) **14,7**	(16x230) **3,6**	(1x16x230) **3,6**
				400	(4x16x400) **25,6**	(16x400) **6,4**	(16x400 **6,4**
				480	(4x16x480) **30,7**	(16x480) **7,6**	(1x16x480) **7,6**
60 (4x32A) (4x30A)*	32 (30)*	90...530	480	110	(4x32x110) **14**	(32x110) **3,5**	(32x110) **3,5**
				230	(4x32x230) **29,4**	(32x230) **7,3**	(1x32x230) **7,3**
				400	(4x32x400) **51,2**	(32x400) **12,8**	(1x32x400) **12,8**
				480	(4x32x480) **61,4**	(32x480) **15,3**	(1x32x480) **15,3**
80 (4x40A)	40* 57	90...530	480	110	(4x40x110) **17,6**	(40x110) **4,4**	(1x57x110) **62,7**
				230	(4x40x230) **36,8**	(40x230) **9,2**	(1x57x230) **13,1**
				400	(4x40x400) **64**	(40x400) **16**	(1x57x400) **22,8**
				480	(4x40x480) **76,8**	(40x480) **19,2**	(1x57x480) **27,3**

* UL certification

5.2 Dissipation curves



5.3 Fuses / Fusesholders

Model	EXTRARAPID FUSES Size I² t	EXTRARAPID FUSES Code Format	EXTRARAPID FUSES Model Code	EXTRARAPID FUSES Power Dissipated @ In	FUSES-HOLDER ISOLATORS Approval Code
GFX4-IR 30 kw	16A 150 A²s	FUS-016 10x38	FWC16A10F 338470	3,5 W	PFI-10x38 337134 UR30A@690V
GFX4-IR 60 kw	30A 675 A²s	FUS-030 10x38	FR10GR69V30 338481	4,8 W	PFI-10x38 337134 UR30A@690V
GFX4-IR 80 kw	63A 3080 A²s	FUS-063 22x58	FWP63A22F 338191	11 W	PFI-22x58 337223 UR80A@600V

6 • TECHNICAL / COMMERCIAL INFORMATION

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

As mentioned in the Preliminary Instructions in this User Manual, a correct reading of the Controller order code immediately identifies the unit's hardware configuration. Therefore, you must always give the order code when contacting Gefran Customer Care for the solution to any problems.

GFX4-IR ☐ ☐ ☐ ☐ ☐

NOMINAL POWER	
30KW	30
60KW	60
80KW	80

AUXILIARY OUTPUTS	
Absent	0
Relay	R
Logic	D
Continuous	C
Triac	T

AUXILIARY INPUTS	
Assenti	2
4 Linear inputs (**)	4

(**) Option NOT available with fieldbus E1, E2, E4, E5

FUSES	
0	Absent
F	fuses-holder + fuses extrarapid (*)

(*) Available only for 30, 60kW power.

FIELDBUS - Port 2	
0	Absent
M	Modbus RTU
P	Profibus DP
C	CANopen
C1	Euromap 66
D	DeviceNet
E	Ethernet Modbus TCP
E1	Ethernet IP
E2	EtherCAT
E4	ProfiNET
E5	Ethernet IP ODVA certificate

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

6.1 Accessoires

CONFIGURATION KIT

GF_eXpress

Configuration/supervision kit for GFX by means of PC with USB (Windows environment).
Lets you read or write all of the parameters of a single GFX
A single software for all models
• Easy and rapid configuration
• Saving and management of parameter recipes
• On-line trend and saving of historical data
Component Kit:
- Connection cable PC USB <----> GFX RS485 port
- Serial line converter
- CD SW GF Express installation

ORDER CODE

GF_eXK-2-0-0....................................Cod. F049095

GFX-OP

Operator terminal for in-field configuration of the entire Geflex line.

Two types of terminals:
- for installation on Geflex heatsink or on DIN guide
- for panel installation

ORDER CODE

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

Programming terminal for Geflex (panel installation) ....***GFX-OP-P***
[Note: for connection cable, see the cable section in the accessories catalog]

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