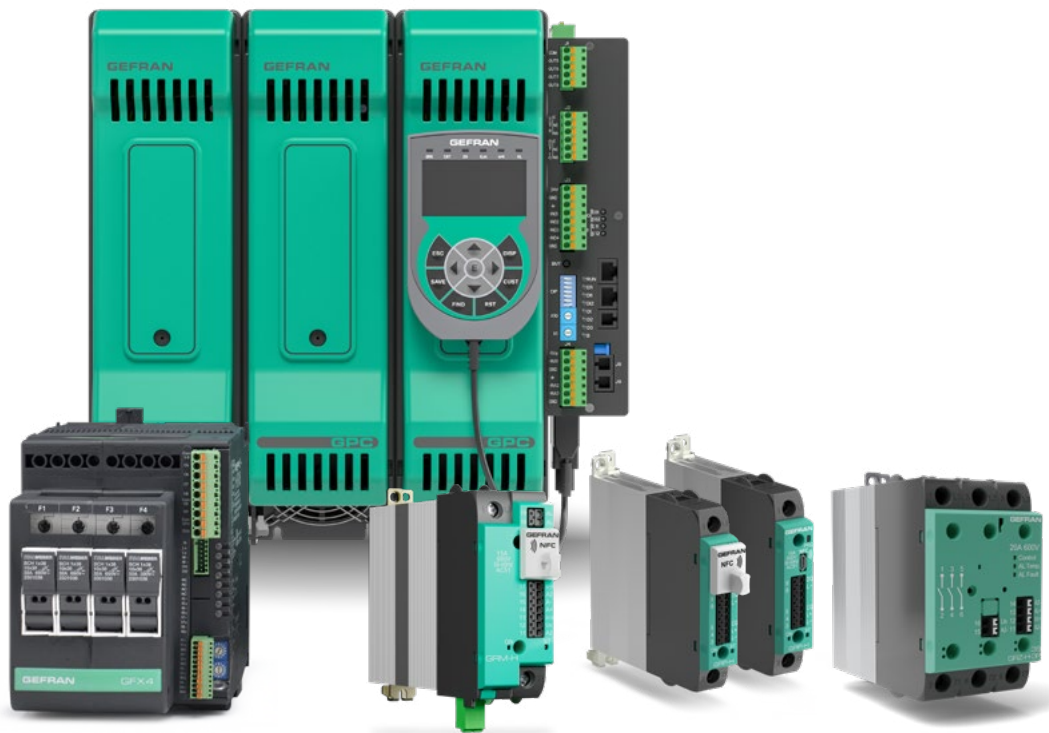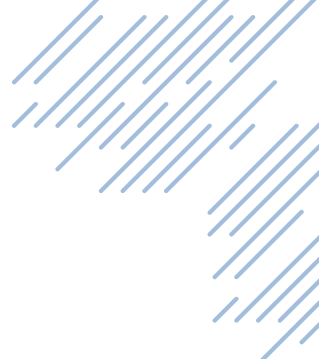# POWER CONTROL

RELAYS, STATIC UNITS AND POWER CONTROLLERS
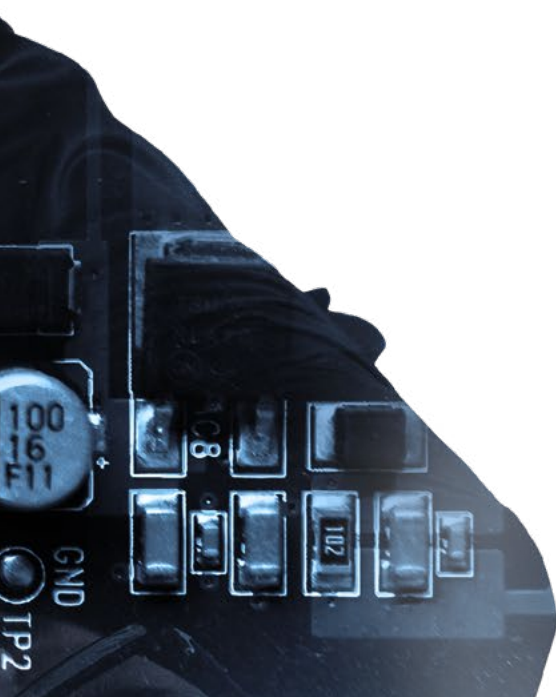

GEFRAN

BEYOND TECHNOLOGY

GEFRAN

BEYOND TECHNOLOGY

More than fifty years of experience, an organisation with a strong focus on the customer's needs and non-stop technological innovation have made Gefran a benchmark in the design and production of sensors, systems and components for industrial process automation and control. Expertise, flexibility and process quality are the factors that distinguish Gefran in the production of integrated tools and systems for specific applications in various fields of industry, with consolidated know-how in the plastics, mobile hydraulics, heating and lifting sectors.

Technology, innovation and versatility represent the catalogue's added value, in addition to the ability to create specific application solutions in association with the world's leading machine manufacturers.

Thanks to its consolidated experience in the supply of process controls and an ongoing research and development programme, Gefran offers a series of solutions for all applications requiring accurate and safe control in heating processes with electric heaters to meet today's challenges in a variety of industries.

Gefran offers a wide range of products that are scalable in terms of both performance and characteristics, indispensable for management of various types of electrical resistors, such as infrared lamps, linear resistors, SiC, MoSi2 and graphite. Gefran's Power Controllers and SSR units are designed with a special focus on ease of use and configuration. In addition, Gefran's internationally patented system (Xtra) automatically triggers a safety mechanism in the event of a short circuit, which, combined with an automatic reset, guarantees continuity of production in the event of a momentary short circuit.

Not only resistive load control, but also connectivity, remote diagnostics, predictive maintenance and energy counting. These are just some of the additional features that allow devices to communicate and make decisions independently, basing their actions on the process data available to them, turning them into intelligent components.

APPLICATION SECTORS

AUTOMOTIVE

AEROSPACE
AERONAUTICAL

FOOD
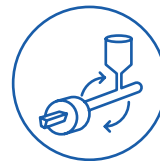INDUSTRY

INDUSTRIAL FURNACES

LABORATORIES /
MEDICAL

OIL & GAS

HEAT TRACING

PLASTIC
EXTRUSION INJECTION
BLOW MOLDING

PACKAGING

GLASS PRODUCTION

IR DRYING
PROCESSES

PRINTING
MACHINES

COMPOUND MATERIAL
PRODUCTION

THERMOFORMING

PHOTOVOLTAIC

RESISTIVE ELECTRICAL LOADS

Electrical energy is transformed into thermal energy (heat) by devices called "electrical resistors".

Different types of resistors are used depending on the temperature of the heating process, requiring different types of control.

LINEAR RESISTORS

Heat treatment applications up to 900 °C (1652 °F)

Low/medium current

Control Devices

• SSR/Power controller

INFRARED (IR) LAMPS

Surface heating applications up to 800 °C (1472 °F).

Low/medium current

3 types:
• Short wave (SWIR)
• Medium wave (MWIR)
• Long wave (LWIR)

Control Devices

• SSR/Power Controller

NON-LINEAR RESISTORS

Heat treatment applications up to 2400 °C (4352 °F)

Types:
• Silicon-Molybdenum ($MoSi_2$)
• Silicon Carbide (SiC)
• Graphite (C)

Medium/high current

Control Devices

• Power Controller

THE RIGHT SETTING FOR ALL
IR HEATING LAMPS

Gefran offers a complete range of devices for precise control of infrared heating lamps, from long wave lamps to short wave lamps.

Infrared lamps are used in many applications due to their versatility and their ability to provide thermal energy with precision, high efficiency and energy savings.
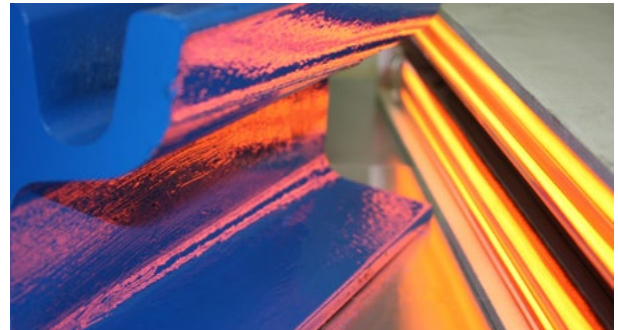
Gefran Power Controllers, with their specific functions, allow safe, perfect control of infrared lamps, optimizing their performance and increasing their average operating life.

DEDICATED SOFT START IR

A dedicated Soft Start algorithm ensures precise control of overloads and the current peaks typical of infrared lamps in cold heating phases.

CONFIGURABLE TRIP MODE

Half Single Cycle mode allows you to control IR lamps by reducing flickering and eliminating EMC emissions. Phase Angle mode ensures perfect stability of control power.

FEEDBACK FUNCTIONS

Voltage, current or power control feedback functions permit perfect regulation, automatically correcting any variations in voltage and current so that exactly the amount of energy required is supplied at any time and under all conditions.

BROKEN LAMP DETECTION

Rapid reading of RMS current ensures that lamp breakage is reported in all control modes. The self-learning function of the thermal characteristics of lamps improves the accuracy of lamp breakage diagnostics.

CURRENT LIMITS

The current limit function prevents the risk of exceeding the command limit. Peaks and RMS current value are constantly under control.

GEFRAN Xtra POWER CONTROL

PERMANENT COMPLETE PROTECTION

Automatic, continuous, uninterrupted and repeatable short circuit protection.

Easy to rearm, requiring no training or special equipment

AUTOMATIC SHORT-CIRCUIT FAILURE PROTECTION

No need to replace, find or operate fuses or reset circuit breakers.

Automatic reset following temporary short circuit to maintain production

Increases machine uptime, reduces scrap and improves productivity.

BENEFITS

Cost reduction and optimization of spare fuse stocks

Guaranteed production

Easy to install with limited maintenance

Fully automated reset
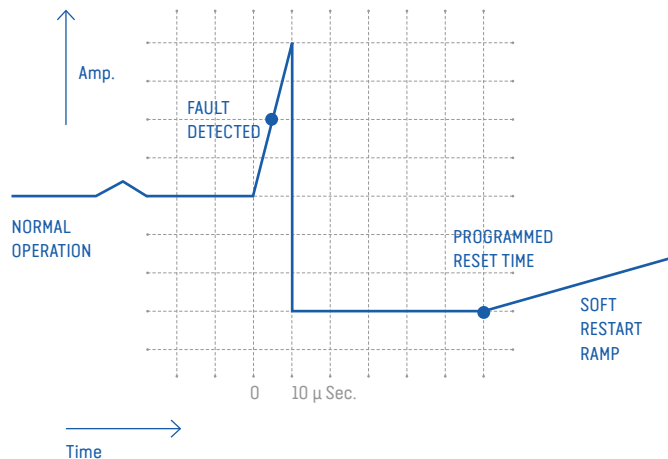
SHORT CIRCUIT CURRENT RATING (SCCR)

WHAT IS SCCR CERTIFICATION

The amount of current that a component, if applied correctly, can safely withstand in the event of a failure.

WHAT IS REQUIRED

Having sufficient protection against short circuits in industrial control panels to protect equipment and personnel from risks and damage.

WHERE IT IS APPLICABLE

In US industrial control panels used for machines or plants.

WHO REQUIRES IT?

The Occupational Safety and Health Administration (OSHA) and the National Electrical Code (NEC), via Underwriters Laboratories (UL).

**SCCR RMS SYM
100KA / 600V**

GEFRAN
BEYOND TECHNOLOGY

CONFIGURATION
SOFTWARE

GF_eXpress

GF_eXpress is a software for configuration/ parameterization of all GEFRAN devices (components, automation products, drives and sensors).

The selection and parameterization of the device is simple and intuitive thanks to a completely graphic interface.

ETHERNET

USB
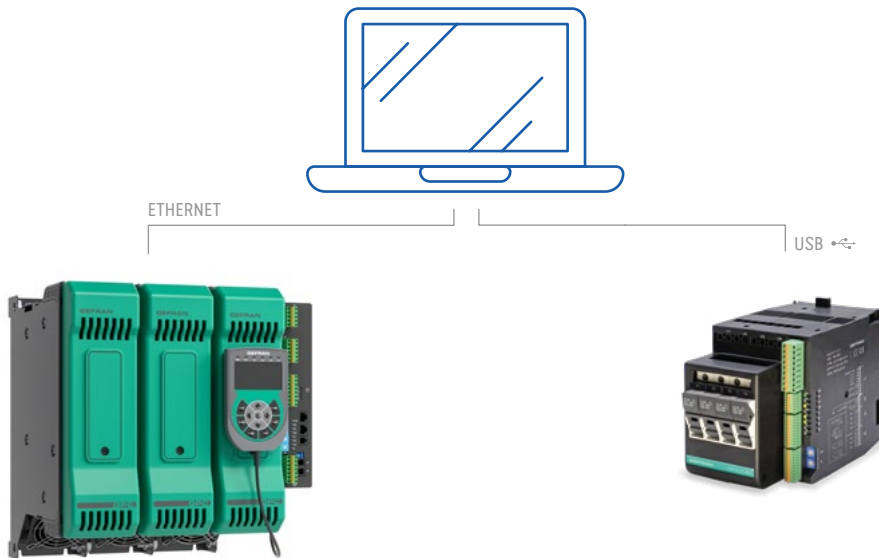
"GEFRAN NFC" APP - SMART CONFIGURATION

- Easy-to-use configuration
- Data monitoring
- Integrated diagnostic

- Backup and Restore configuration
- Remote sharing GF_eXpress configuration file

NFC

GF_eXpress

CONNECTIVITY

FACTORY INTEGRATION AND SYSTEM DIAGNOSTICS

Solid State Relay and Power Controllers are prepared for connection to centralized acquisition or control systems such as HMI and DCS within factory automation networks. Thanks to the wide range of communication fieldbuses available, Power Controllers may be connected with all major factory automation systems.

CERTIFICATIONS

ODVA and PI certification for Eternet/IP and ProfiNET fieldbuses, respectively, guarantees the efficiency and compatibility of data exchange between the Power Controller and the control system.

GEFRAN
BEYOND TECHNOLOGY
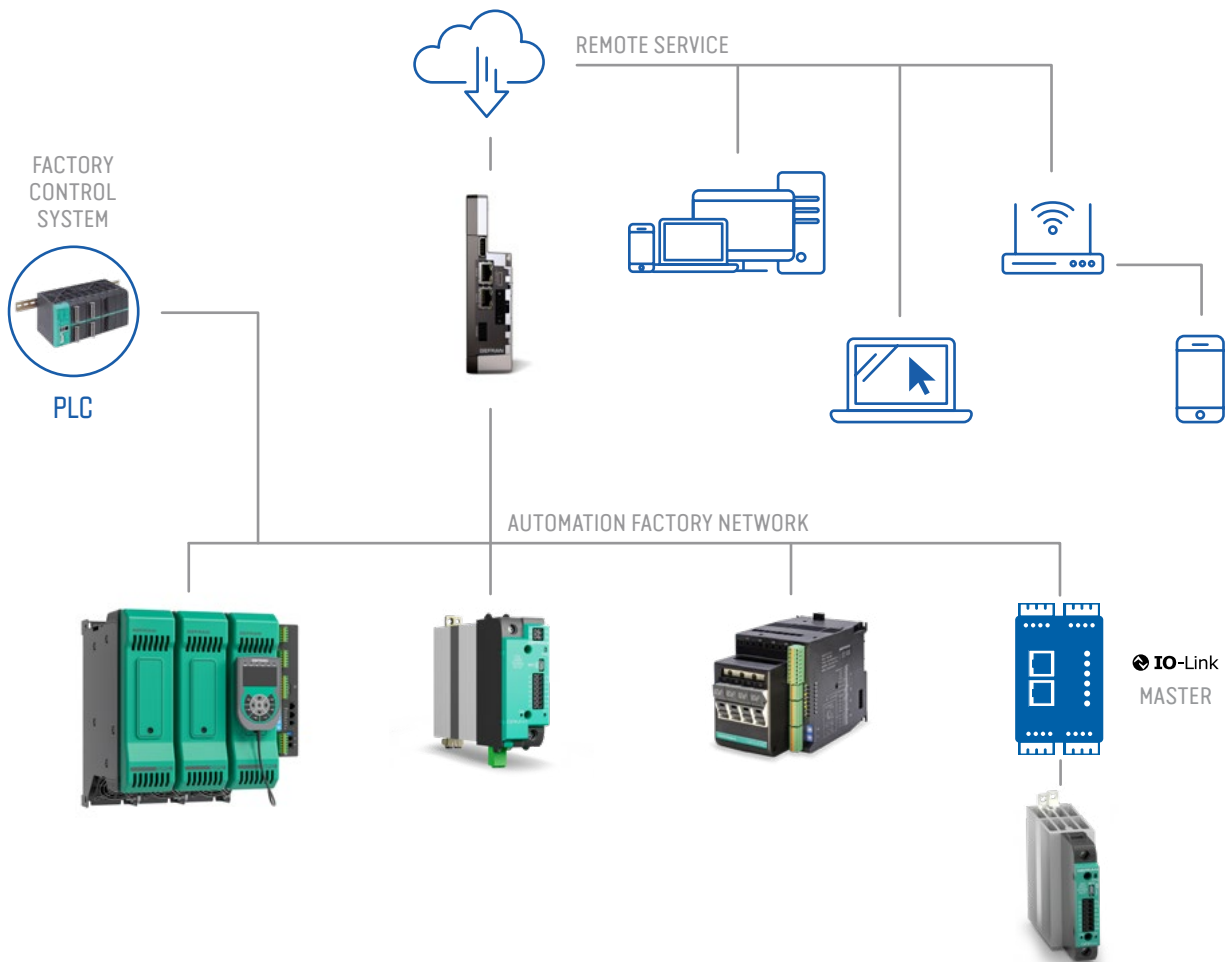
SOLID STATE RELAY SERIES

SIMPLE AND ROBUST, SUITABLE FOR A VARIETY OF APPLICATIONS

· 10A to 120A
· Logic / Analogic command
· Load disconnection alarm (HB) and overheating alarm
· Single and three-phase
· With and without integrated heat sink

GQ
(15... 90A)

GRS
(15... 120A)

GRZ
(10... 75A)
(BI-THREE-PHASE)

GRP
(15... 120A)

GRS-H
(15... 120A)

GRZ-H
(10... 75A)
(BI-THREE-PHASE)
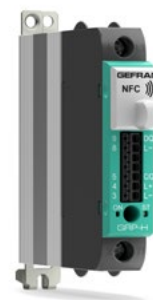
GRP-H
(15... 120A)

GFX4-IR / GFX4 POWER CONTROLLER SERIES

AN EXCLUSIVE COMPACT PRODUCT INTEGRATING PID & POWER CONTROLLER REGULATION

- 4 Solid State relays
- Up to 40A/channel
- 4 PID regulators
- Fieldbus communication

GRM POWER CONTROLLER SERIES

COMPACT AND VERSATILE, SUITABLE FOR THE CONTROL OF MEDIUM AND HIGH COMPLEXITY ELECTRIC HEATING PROCESSES

- From 10A to 120A
- Linear and non-linear resistors and transformers
- Single-phase
- Fully configurable command signal, firing mode and feedback
- Digital communication

GPC POWER CONTROLLER SERIES

SIMPLE AND PRECISE, IDEAL FOR ADVANCED ELECTRIC HEATING CONTROL

- 40A to 600A
- Linear and non-linear resistors and transformers
- Mono, two and three phase
- Fieldbus communication
- Preventive maintenance

PHOTOVOLTAIC, PLASTIC, FURNACES, GLASS, PAPER, FOOD POWER CONTROLLER		**GFX-M1 GFX-S1** (25A … 120A)	**GFX-M2 GFX-S2** (5A,10A,15A)	**GFX4** (16,32,40A) (4 CHANNELS) MULTI FIELDBUS
PLASTIC, PACKAGING, FURNACES STATIC UNITS		**GRS-H** (15… 120A)	**GRZ-H** (10… 75A) (BI-THREE-PHASE)	
PLASTICS, PACKAGING STATIC RELAYS	**GQ** (15… 90A)	**GRS** (15… 120A)	**GRZ** (10… 75A) (BI-THREE-PHASE)	

ZERO CROSSING

LOAD DISCONNECTION ALARM

"BURST FIRING" ZERO CROSSING

HALF SINGLE CYCLE, PHASE ANGLE, FEEDBACK

Modbus

GTF-XTRA (PATENTED)
(25...60A).

IO-Link
Modbus

GRM/GRM-H
(10...120A).

MULTI FIELDBUS

GPC
(40...600A).

PROFI NET®
Modbus

IR12/IR24
9A (12/24 CHANNELS)

MULTI FIELDBUS

GFX4-IR
(16, 32, 40A)(4 CHANNELS)

IO-Link

GRP-H
(15... 120A)

IO-Link

GRP
(15... 120A)

MULTIFIELDBUS

PROFI NET®   **PROFI BUS®**

DeviceNet   **EtherNet/IP**

Modbus TCP/RTU   **EtherCAT**   **CANopen**

SELECTION GUIDE BY FUNCTION

	SERIES	STATIC RELAYS			
		GQ	GRS	GRP	GRZ
RATING	Rated voltage values (Vac)	230Vac, 480Vac, 600Vac	230Vac, 600Vac	230Vac,600Vac	400Vac, 480Vac, 600Vac
	Rated current values (A)	15, 25, 50, 90	15, 25, 30, 40, 50, 60, 75, 90, 120	15, 25, 30,40, 50, 60, 75, 90, 120	15, 25, 30, 40, 50, 75 (2 pole) 10, 20, 25, 30, 40, 65 (3 pole)
INTEGRATED HEAT SINK	Integrated heat sink with DIN rail mounting	no	no	no	no
TYPE OF LOAD	Low thermal coefficient resistors	X	X	X	X
	Long wave IR lamps	X	X	X	X
	Medium wave IR lamps			X	
	Short wave IR lamps				
	High thermal coefficient resistors: (Kanthal, Super Kanthal, Silicon Carbide)				
	Single-phase transformers				
	Three-phase transformers				
INPUT CONTROLS	Digital ON/OFF Vdc	X	X	X	X
	Digital ON/OFF Vac	X	X		X
	Digital PWM				
	Analogue 0-10V, 4-20mA			X	
	Analogue, potentiometer			X	
	IO-Link communication			X	
TYPE OF TRIGGER	Zero crossing, ON/OFF (ZC)	X	X	X	X
	Fast "Burst firing" (BF) zero crossing			X	
	Optimized fast zero crossing "Half Single Cycle" (HSC)			X	
	Phase angle (PA)			X	
	Delay triggering (DT)				
OPTIONS	Soft Start			X	
	Current limits				
	Disconnected load alarm		X	X	X
	Short circuit alarm			X	
	Overheating alarm		X	X	X
	Integrated extra-rapid fuse				
	Overcurrent fault protection (Xtra) (*)				
	Temperature PID on board				
	V, I, P analogue retransmission				
FEEDBACK FUNCTIONS	Voltage feedback (V, V²)				
	Current feedback (I, I²)				
	Power feedback				
FIELDBUS	Profibus DP				
	CanOpen				
	DeviceNet				
	Modbus TCP/RTU				
	Ethernet/ IP				
	EtherCAT				
	Profinet				
	IO-Link			X	
CONFIGURATION	PC configuration			X	
	Easy "Smart Configuration"			APP Android/IOs	
	Hand-held keypad programming				
CERTIFICATION	CE	X	X	X	X
	UL	X	X	X	X
	TÜV				
	CSA	X			
	EAC	X	X		
	SCCR (Short Circuit Current Rating)	100KA with appropriate fuse	X	X	

(*) European Patent No. 2660843

SERIES		STATIC UNITS		
		GRS-H	GRP-H	GRZ-H
RATING	Rated voltage values (Vac)	230Vac, 600Vac	230Vac, 600Vac	400Vac, 480Vac, 600Vac
	Rated current values (A)	15, 25, 30, 40, 50, 60, 75, 90, 120	15, 25, 30, 40, 50, 60, 75, 90, 120	15, 25, 30, 40, 50, 75 (2 pole) 10, 20, 25, 30, 40, 65 (3 pole)
INTEGRATED HEAT SINK	Integrated heat sink with DIN rail mounting	yes	yes	yes
TYPE OF LOAD	Low thermal coefficient resistors	X	X	X
	Long wave IR lamps	X	X	X
	Medium wave IR lamps		X	
	Short wave IR lamps			
	High thermal coefficient resistors: (Kanthal, Super Kanthal, Silicon Carbide)			
	Single-phase transformers			
	Three-phase transformers			
INPUT CONTROLS	Digital ON/OFF Vdc	X	X	X
	Digital ON/OFF Vac	X		X
	Digital PWM			
	Analogue 0-10V, 4-20mA		X	
	Analogue, potentiometer		X	
	IO-Link communication		X	
TYPE OF TRIGGER	Zero crossing, ON/OFF (ZC)	X	X	X
	Fast "Burst firing" (BF) zero crossing		X	
	Optimized fast zero crossing "Half Single Cycle" (HSC)		X	
	Phase angle (PA)		X	
	Delay triggering (DT)			
OPTIONS	Soft Start		X	
	Current limits			
	Disconnected load alarm	X	X	X
	Short circuit alarm		X	
	Overheating alarm	X	X	X
	Integrated extra-rapid fuse			
	Overcurrent fault protection (Xtra) (*)			
	Temperature PID on board			
	V, I, P analogue retransmission			
FEEDBACK FUNCTIONS	Voltage feedback (V, V²)			
	Current feedback (I, I²)			
	Power feedback			
FIELDBUS	Profibus DP			
	CanOpen			
	DeviceNet			
	Modbus TCP/RTU			
	Ethernet/ IP			
	EtherCAT			
	Profinet			
	IO-Link		X	
CONFIGU-RATION	PC configuration		X	
	Easy "Smart Configuration"		APP Android/IOs	
	Hand-held keypad programming			
CERTIFICATION	CE	X	X	X
	UL	X	X	X
	TÜV			
	CSA			
	EAC	X		
	SCCR (Short Circuit Current Rating)	X	X	

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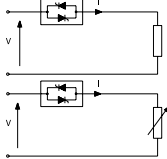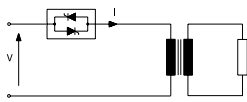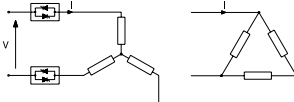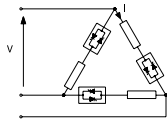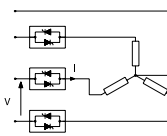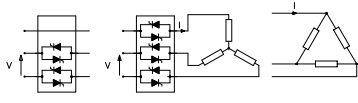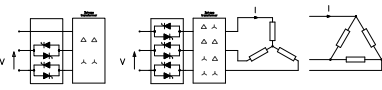
SELECTION GUIDE BY FUNCTION

	SERIES	POWER CONTROLLERS				
		GFX-M/S/E-1	GFX-M/S-2	GFX4	GFX4-IR	IR12/IR24
RATING	Rated voltage values (Vac)	480V	480V	480Vac	480Vac	480Vac
	Rated current values (A)	25,40, 60, 75, 90, 120	5,10,15	16, 32, 40	16, 32, 40	9A/ch
INTEGRATED HEAT SINK	Integrated heat sink with DIN rail mounting	yes	yes	yes	yes	yes (panel mount)
TYPE OF LOAD	Heating elements with low thermal coefficient	X	X	X	X	X
	Long wave IR lamps	X	X	X	X	X
	Medium wave IR lamps				X	X
	Short wave IR lamps				X	X
	High thermal coefficient resistors: (Kanthal, Super Kanthal, Silicon Carbide)				X	
	Single phase transformers				X	
	Three-phase transformers				X	
INPUT CONTROLS	Digital ON/OFF Vdc			X	X	
	Digital ON/OFF Vac					
	Digital PWM					
	Analogue 0-10V, 4-20mA			X (4-20mA)	X	
	Analogue, potentiometer					
	Fieldbus	X	X	X	X	X
TYPE OF TRIGGER	Zero crossing, ON/OFF (ZC)	X	X	X	X	
	Fast "Burst firing" (BF) zero crossing				X	X
	Optimized fast zero crossing "Half Single Cycle" (HSC)				X	X
	Phase angle (PA)				X	X
	Delay triggering (DT)				X	
OPTIONS	Soft Start	X	X	X	X	X
	Current limits				X	
	Disconnected load alarm	X	X	X	X	X
	Short circuit alarm			X	X	X
	Overheating alarm	X	X	X	X	X
	Integrated extra-rapid fuse		X	X	X	X
	Overcurrent fault protection (Xtra) (*)					
	V, I, P analogue retransmission				X	
FEEDBACK FUNCTIONS	Voltage feedback (V, V²)				X	X (V)
	Current feedback (I, I²)				X	
	Power feedback				X	
FIELDBUS	Profibus DP	X	X	X	X	
	CanOpen	X	X	X	X	
	DeviceNet	X	X	X	X	
	Modbus TCP/RTU	X	(Modbus RTU)	X	X	(Modbus RTU)
	Ethernet/ IP			X	X	
	EtherCAT			X	X	
	Profinet			X	X	X
CONFIGU-RATION	PC configuration	X	X	X	X	X
	Easy "Smart Configuration"				X	
	Hand-held keypad programming	X	X	X	X	
CERTIFICATION	CE	X	X	X	X	X
	UL	X	X	X	X	X
	TÜV					
	CSA			X	X	
	EAC	X	X	X	X	
	SCCR (Short Circuit Current Rating)			UL 508 100KA	UL 508 100KA	

(*) European Patent No. 2660843 - (**) not applicable for 150A
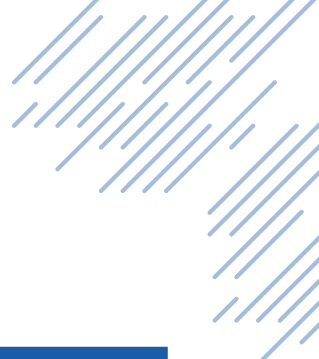
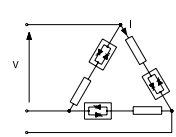|	SERIES	GRM	GTF	GTF-XTRA	GPC
RATING	Rated voltage values (Vac)	230Vac, 600Vac	480Vac, 600Vac, 690Vac	480Vac	480Vac, 600Vac, 690Vac
	Rated current values (A)	10, 15, 25, 30, 40, 50, 60, 75, 90, 120	25, 40, 50, 60, 75, 90, 120 150, 200, 250	25, 40, 50, 60	40, 60, 100, 150, 200, 250, 300, 400,500,600
INTEGRATED HEAT SINK	Integrated heat sink with DIN rail mounting	yes	yes	yes	yes (panel mount)
TYPE OF LOAD	Heating elements with low thermal coefficient	X	X	X	X
	Long wave IR lamps	X	X	X	X
	Medium wave IR lamps	X	X	X	X
	Short wave IR lamps	X	X	X	X
	High thermal coefficient resistors: (Kanthal, Super Kanthal, Silicon Carbide)	X	X	X	X
	Single phase transformers	X	X	X	X
	Three-phase transformers				X
INPUT CONTROLS	Digital ON/OFF Vdc	X	X	X	X
	Digital ON/OFF Vac				
	Digital PWM	X	X	X	X
	Analogue 0-10V, 4-20mA	X	X	X	X
	Analogue, potentiometer	X	X	X	X
	Fieldbus	X	X	X	X
TYPE OF TRIGGER	Zero crossing, ON/OFF (ZC)	X	X	X	X
	Fast "Burst firing" (BF) zero crossing	X	X	X	X
	Optimized fast zero crossing "Half Single Cycle" (HSC)	X	X	X	X
	Phase angle (PA)	X	X	X	X
	Delay triggering (DT)	X	X	X	X
OPTIONS	Soft Start	X	X	X	X
	Current limits	X	X	X	X
	Disconnected load alarm	X	X	X	X
	Short circuit alarm	X	X	X	X
	Overheating alarm	X	X	X	X
	Integrated extra-rapid fuse			X (I >= 150A)	X
	Overcurrent fault protection (Xtra) (*)			X	
	V, I, P analogue retransmission				X
FEEDBACK FUNCTIONS	Voltage feedback (V, V²)	X	X	X	X
	Current feedback (I, I²)	X	X	X	X
	Power feedback	X	X	X	X
FIELDBUS	Profibus DP				X
	CanOpen				X
	DeviceNet				
	Modbus TCP/RTU	(Modbus RTU)	(Modbus RTU)	(Modbus RTU)	X
	Ethernet/ IP				X
	EtherCAT				X
	IO-Link	X			
	Profinet				X
CONFIGU-RATION	PC configuration	X	X	X	X
	Easy "Smart Configuration"	APP Android/IOs			X
	Hand-held keypad programming				X
CERTIFICATION	CE	X	X	X	X
	UL	X	X	X	X
	TÜV		X	X	
	CSA	X	X	X	X (up to 250A)
	EAC		X	X	X
	SCCR (Short Circuit Current Rating)	X	UL 508 100KA (200A; 250A)		UL 508 100KA (100A...600A) **
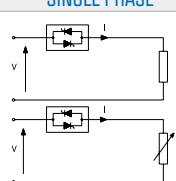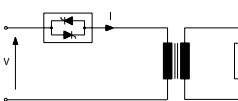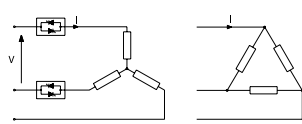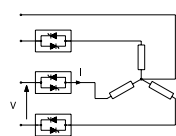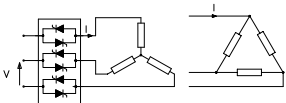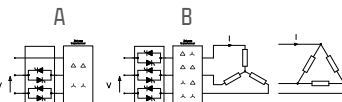
SELECTION GUIDE FOR CONNECTIONS / TYPE OF LOADS

CONNECTIONS	TYPE OF LOADS	MODELS				
		GQ	GRS GRS-H	GRP GRP-H	GRZ GRZ-H	GFX-M/S/E-1
		15…90A	15…120A	15…120A	10…75A	
SINGLE PHASE	LOW THERMAL COEFFICIENT RESISTORS					
	Resistor	1x	1x	1x		1x
	Long wave IR lamp	1x	1x	1x		1x
	HIGH THERMAL COEFFICIENT RESISTORS					
	Medium wave IR lamp			1x		
	Short wave IR lamp					
	Kanthal, Super Kanthal elements					
	Silicon carbide elements					
SINGLE PHASE TRANSFORMER	LOW THERMAL COEFFICIENT RESISTORS					
	Resistor					
	Long wave IR lamp					
	HIGH THERMAL COEFFICIENT RESISTORS					
	Medium wave IR lamp					
	Short wave IR lamp					
	Kanthal, Super Kanthal elements					
	Silicon carbide elements					
TWO-PHASE (Triangle closed star, no neutral)	LOW THERMAL COEFFICIENT RESISTORS					
	Resistor	2x	2x	2x	1x	
	Long wave IR lamp	2x	2x	2x	1x	
	HIGH THERMAL COEFFICIENT RESISTORS					
	Medium wave IR lamp					
	Short wave IR lamp					
	Kanthal, Super Kanthal elements					
	Silicon carbide elements					
THREE-PHASE OPEN TRIANGLE	LOW THERMAL COEFFICIENT RESISTORS					
	Resistor	3x	3x	3x	1x	
	Long wave IR lamp	3x	3x	3x	1x	
	HIGH THERMAL COEFFICIENT RESISTORS					
	Medium wave IR lamp					
	Short wave IR lamp					
	Kanthal, Super Kanthal elements					
	Silicon carbide elements					
THREE-PHASE STAR WITH NEUTRAL	LOW THERMAL COEFFICIENT RESISTORS					
	Resistor	3x	3x	3x	1x	3X
	Long wave IR lamp	3x	3x	3x	1x	3X
	HIGH THERMAL COEFFICIENT RESISTORS					
	Medium wave IR lamp					
	Short wave IR lamp					
	Kanthal, Super Kanthal elements					
	Silicon carbide elements					
THREE-PHASE	LOW THERMAL COEFFICIENT RESISTORS					
	Resistor	3x	3x		1x	
	Long wave IR lamp	3x	3x		1x	
	HIGH THERMAL COEFFICIENT RESISTORS					
	Medium wave IR lamp					
	Short wave IR lamp					
	Kanthal, Super Kanthal elements					
	Silicon carbide elements					
THREE-PHASE TRANSFORMER (**)	LOW THERMAL COEFFICIENT RESISTORS					
	Resistor					
	Long wave IR lamp					
	HIGH THERMAL COEFFICIENT RESISTORS					
	Medium wave IR lamp					
	Short wave IR lamp					
	Kanthal, Super Kanthal elements					
	Silicon carbide elements					

MODELS				RECOMMENDED FIRING					RECOMMENDED FUNCTIONS					NOMINAL CURRENT CALCULATION (*)	NOTES
GFX-M/S-2	GFX4	GFX4-IR	IR12/IR24	ZC	BF	HSC	PA	DT	Soft Start	Current Limit	Feedback (I)	Feedback (V)	Feedback (P)	P= total power I= rated current to be selected	pw= % of controllable power on the load
	16, 32, 40A	16, 32, 40A													
1x	1/4x	1/4x	1/24X-1/12X	x	x									I=P/Vline	
1x	1/4x	1/4x	1/24X-1/12X	x	x									I=P/Vline	
	1/4x		1/24X-1/12X			x	x		x	x				I=P/Vline	
	1/4x		1/24X-1/12X			x	x		x	x		x	x	I=P/Vline	
	1/4x						x		x		x			I=P/Vline	
	1/4x					x	x		x				x	I=P/Vline	
	1/4x			x				x						I= 1.2 (P+10%)/ Vline	
	1/4x			x				x						I= 1.2 (P+10%)/ Vline	
	1/4x						x		x	x				I= 1.2 (P+10%)/ Vline	
	1/4x						x		x	x		x	x	I= 1.2 (P+10%)/ Vline	
	1/4x						x		x		x			I= 1.2 (P+10%)/ Vline	
	1/4x						x		x				x	I= 1.2 (P+10%)/ Vline	
	2/4x			x	x									I= P/ (√3 Vline)	
	2/4x			x	x									I= P/ (√3 Vline)	
	3/4x	3/4x		x	x									I= P/ (3 Vline)	
	3/4x	3/4x		x	x									I= P/ (3 Vline)	
		3/4x				x	x		x	x				I= P/ (3 Vline)	
		3/4x				x	x		x	x		x	x	I= P/ (3 Vline)	
		3/4x					x		x		x			I= P/ (3 Vline)	
		3/4x				x	x		x				x	I= P/ (3 Vline)	
3X	3/4x	3/4x	1/8X-1/4X	x	x									I= P/ (√3 Vline)	
3X	3/4x	3/4x	1/8X-1/4X	x	x									I= P/ (√3 Vline)	
		3/4x	1/8X-1/4X			x	x		x	x				I= P/ (√3 Vline)	
		3/4x	1/8X-1/4X			x	x		x	x		x	x	I= P/ (√3 Vline)	
		3/4x					x		x		x			I= P/ (√3 Vline)	
		3/4x				x	x		x				x	I= P/ (√3 Vline)	
	3/4x	3/4x		x	x									I= P/ (√3 Vline)	
	3/4x	3/4x		x	x									I= P/ (√3 Vline)	
		3/4x					x		x	x				I= P/ (√3 Vline)	
		3/4x					x		x	x				I= P/ (√3 Vline)	
		3/4x					x		x				x	I= P/ (√3 Vline)	
	3/4x			x				x						I= 1.2 (P+10%)/ (√3 Vline) (**)	
	3/4x			x				x						I= 1.2 (P+10%)/ (√3 Vline) (**)	
		3/4x					x		x	x				I= 1.2 (P+10%)/ (√3 Vline) (**)	
		3/4x					x		x	x				I= 1.2 (P+10%)/ (√3 Vline) (**)	
		3/4x					x		x				x	I= 1.2 (P+10%)/ (√3 Vline) (**)	

(*) It is advisable to always add a safety margin of at least 10% on the theoretical calculation of the current - Formulas valid if Vline=Vload
(**) It is advisable to contact Gefran's specialized personnel

SELECTION GUIDE FOR CONNECTIONS / TYPE OF LOADS

CONNECTIONS	TYPE OF LOADS	MODELS			
		GRM GRM-H	GTF	GTF-XTRA	GPC
		10…120A	25…250A	25…60A	40…600A
SINGLE PHASE	LOW THERMAL COEFFICIENT RESISTORS				
	Resistor	1M	1M	1M	1PH
	Long wave IR lamp	1M	1M	1M	1PH
	HIGH THERMAL COEFFICIENT RESISTORS				
	Medium wave IR lamp	1M	1M	1M	1PH
	Short wave IR lamp	1M	1M	1M	1PH
	Kanthal, Super Kanthal elements	1M	1M	1M	1PH
	Silicon carbide elements	1M	1M	1M	1PH
SINGLE PHASE TRANSFORMER	LOW THERMAL COEFFICIENT RESISTORS				
	Resistance	1M	1M	1M (**)	1PH
	Long wave IR lamp	1M	1M	1M (**)	1PH
	HIGH THERMAL COEFFICIENT RESISTORS				
	Medium wave IR lamp	1M	1M	1M (**)	1PH
	Short wave IR lamp	1M	1M	1M (**)	1PH
	Kanthal, Super Kanthal elements	1M	1M	1M (**)	1PH
	Silicon carbide elements	1M	1M	1M (**)	1PH
TWO-PHASE (Triangle closed star, no neutral)	LOW THERMAL COEFFICIENT RESISTORS				
	Resistor	1M 1S	1M 1S	1M 1S	2PH
	Long wave IR lamp	1M 1S	1M 1S	1M 1S	2PH
	HIGH THERMAL COEFFICIENT RESISTORS				
	Medium wave IR lamp				
	Short wave IR lamp				
	Kanthal, Super Kanthal elements				
	Silicon carbide elements				
THREE-PHASE OPEN TRIANGLE	LOW THERMAL COEFFICIENT RESISTORS				
	Resistor	3M	1M 2S	1M 2S	3PH
	Long wave IR lamp	3M	1M 2S	1M 2S	3PH
	HIGH THERMAL COEFFICIENT RESISTORS				
	Medium wave IR lamp	3M	3M	3M	3PH
	Short wave IR lamp	3M	3M	3M	3PH
	Kanthal, Super Kanthal elements	3M	3M	3M	3PH
	Silicon carbide elements	3M	3M	3M	3PH
THREE-PHASE STAR WITH NEUTRAL	LOW THERMAL COEFFICIENT RESISTORS				
	Resistor	3M	1M 2S	1M 2S	3PH
	Long wave IR lamp	3M	1M 2S	1M 2S	3PH
	HIGH THERMAL COEFFICIENT RESISTORS				
	Medium wave IR lamp	3M	3M	3M	3PH
	Short wave IR lamp	3M	3M	3M	3PH
	Kanthal, Super Kanthal elements	3M	3M	3M	3PH
	Silicon carbide elements	3M	3M	3M	3PH
THREE-PHASE	LOW THERMAL COEFFICIENT RESISTORS				
	Resistor	1M 2S	1M 2S	1M 2S	3PH
	Long wave IR lamp	1M 2S	1M 2S	1M 2S	3PH
	HIGH THERMAL COEFFICIENT RESISTORS				
	Medium wave IR lamp				3PH
	Short wave IR lamp				3PH
	Silicon carbide elements				3PH
THREE-PHASE TRANSFORMER (**)	LOW THERMAL COEFFICIENT RESISTORS				
	Resistor				2PH [A]/3PH [A]
	Long wave IR lamp				2PH [A]/3PH [A]
	HIGH THERMAL COEFFICIENT RESISTORS				
	Medium wave IR lamp				3PH [A/B]
	Short wave IR lamp				3PH [A/B]
	Kanthal, Super Kanthal elements				3PH [A/B]
	Silicon carbide elements				3PH [A/B]

RECOMMENDED FIRING					RECOMMENDED FUNCTIONS					NOMINAL CURRENT CALCULATION (*)	NB:
ZC	BF	HSC	PA	DT	Soft Start	Current Limit	Feedback (I)	Feedback (V)	Feedback (P)	P= total power I= rated current to be selected	pw= % of controllable power on the load
x	x									I=P/Vline	
x	x									I=P/Vline	
		x	x		x	x				I=P/Vline	
		x	x		x	x				I=P/Vline	
			x		x		x			I=P/Vline	
		x	x		x				x	I=P/Vline	
x				x						I= 1.2 (P+10%)/ Vline	
x				x						I= 1.2 (P+10%)/ Vline	
			x		x	x				I= 1.2 (P+10%)/ Vline	
			x		x	x				I= 1.2 (P+10%)/ Vline	
			x		x		x			I= 1.2 (P+10%)/ Vline	
			x		x				x	I= 1.2 (P+10%)/ Vline	
x	x									I= P/ (√3 Vline)	
x	x									I= P/ (√3 Vline)	
x	x									I= P/ (3 Vline)	
x	x									I= P/ (3 Vline)	
		x	x		x	x				I= P/ (3 Vline)	
		x	x		x	x				I= P/ (3 Vline)	
			x		x		x			I= P/ (3 Vline)	
		x	x		x				x	I= P/ (3 Vline)	
x	x									I= P/ (√3 Vline)	
x	x									I= P/ (√3 Vline)	
		x	x		x	x				I= P/ (√3 Vline)	
		x	x		x	x				I= P/ (√3 Vline)	
			x		x		x			I= P/ (√3 Vline)	
		x	x		x				x	I= P/ (√3 Vline)	
x	x									I= P/ (√3 Vline)	
x	x									I= P/ (√3 Vline)	
			x		x	x				I= P/ (√3 Vline)	pw>6%P (***)
			x		x	x				I= P/ (√3 Vline)	pw>6%P (***)
			x		x				x	I= P/ (√3 Vline)	pw>6%P (***)
x				x						I= 1.2 (P+10%)/ (√3 Vline) (**)	
x				x						I= 1.2 (P+10%)/ (√3 Vline) (**)	
			x		x	x				I= 1.2 (P+10%)/ (√3 Vline) (**)	pw>6%P (***)
			x		x	x				I= 1.2 (P+10%)/ (√3 Vline) (**)	pw>6%P (***)
			x		x				x	I= 1.2 (P+10%)/ (√3 Vline) (**)	pw>6%P (***)

(*) It is recommended to always add a safety margin of at least 10% on the theoretical calculation of the current - Formulas valid if Vline=Vload
(**) It is advisable to contact Gefran's specialized personnel
(***) Valid only for GFW / GFW-Xtra

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