GEFRAN

GFX4-IR
4-ZONE MODULAR POWER CONTROLLER FOR IR LAMPS AND INDUCTIVE LOADS

CONFIGURATION AND PROGRAMMING MANUAL

Software version: **3.0x**

code: **80415I - 05/2021 - ENGLISH**

CE

LIST OF ATTACHMENTS

This document supplements the following manuals:
- Instructions and warnings for GFXTERMO4
- Instructions and warnings for GFX4

ATTENTION!

This manual is an integral part of the product, and must always be available to operators.

This manual must always accompany the product, including if it is transferred to another user.

Installation and/or maintenance workers MUST read this manual and scrupulously follow all of the instructions in it and in its attachments. **GEFRAN** will not be liable for damage to persons and/or property, or to the product itself, if the following terms and conditions are disregarded.

The Customer is obligated to respect trade secrets. Therefore, this manual and its attachments may not be tampered with, changed, reproduced, or transferred to third parties without **GEFRAN's** authorization.

TABLE OF CONTENTS AND SUMMARIES

INTRODUCTION

The modular power controller described in this manual and shown on the cover is a separate unit for the independent control of a maximum of 4 temperature zones. It offers high applicative flexibility thanks to the extended configurability and programmability of its parameters.

Instrument configuration and programming must be performed with a GFX-OP operator terminal or a PC connected in USB/232/485, with specific software **(not supplied)**.

Since it is impossible to foresee all of the installations and environments in which the instrument may be applied, adequate technical preparation and complete knowledge of the instrument's potentials are necessary.

GEFRAN declines all liability if rules for correct installation, configuration, and/or programming are disregarded, as well as all liability for systems upline and/or downline of the instrument.

FIELD OF USE

The modular power controller is the ideal solution for applications in heat treatment furnaces, in thermoformers, in packaging and packing machines and, in general, in standard temperature control applications. Nevertheless, because it is highly programmable, the controller can also be used for other applications provided they are compatible with the instrument's technical data.

Although the instrument's flexibility allows it to be used in a variety of applications, the _field of use_ must always conform to the limits specified in the technical data supplied.

GEFRAN declines all liability for damage of any type deriving from installations, configurations, or programmings that are inappropriate, imprudent, or not conforming to the technical data supplied.

Prohibited use

It is absolutely prohibited:
- to utilize the instrument or parts of it (including software) for any use not conforming to that specified in the technical documentation supplied;
- to modify working parameters inaccessible to the operator, decrypt or transfer all or part of the software;
- to utilize the instrument in explosive atmospheres;
- to repair or convert the instrument using non-original replacement parts;
- to utilize the instrument or parts of it without having read and correctly understood the technical documentation supplied;
- to scrap or dispose of the instrument in normal dumps; components that are potentially harmful to the environment must be disposed of in conformity to the regulations of the country of installation.

CHARACTERISTICS OF PERSONNEL

This manual is intended for technical personnel, who commission the instrument by connecting it to other units, and for service and maintenance personnel.

It is assumed that such persons have adequate technical knowledge, especially in the fields of electronics and automation.

The instrument described in this manual may be operated only by personnel who are trained for their assigned task, in conformity to the instructions for such task and, specifically, to the safety warnings and precautions contained in such instructions.

Thanks to their training and experience, qualified personnel can recognize the risks inherent to the use of these products/systems and are able to avoid possible dangers.

It is forbidden to employ untrained personnel, persons with disabilities, legally disqualified persons, persons who are not sober, or persons who take drugs.

STRUCTURE OF THIS MANUAL

This manual was originally written in ITALIAN. Therefore, in case of inconsistencies or doubts, request the original manual or explanations from GEFRAN.

The instructions in this manual do not replace the safety instructions and the technical data for installation, configuration and programming applied directly to the product or the rules of common sense and safety regulations in effect in the country of installation.

For easier understanding of the controller's basic functions and its full potentials, the configuration and programming parameters are grouped according to function and are described in separate **chapters**.
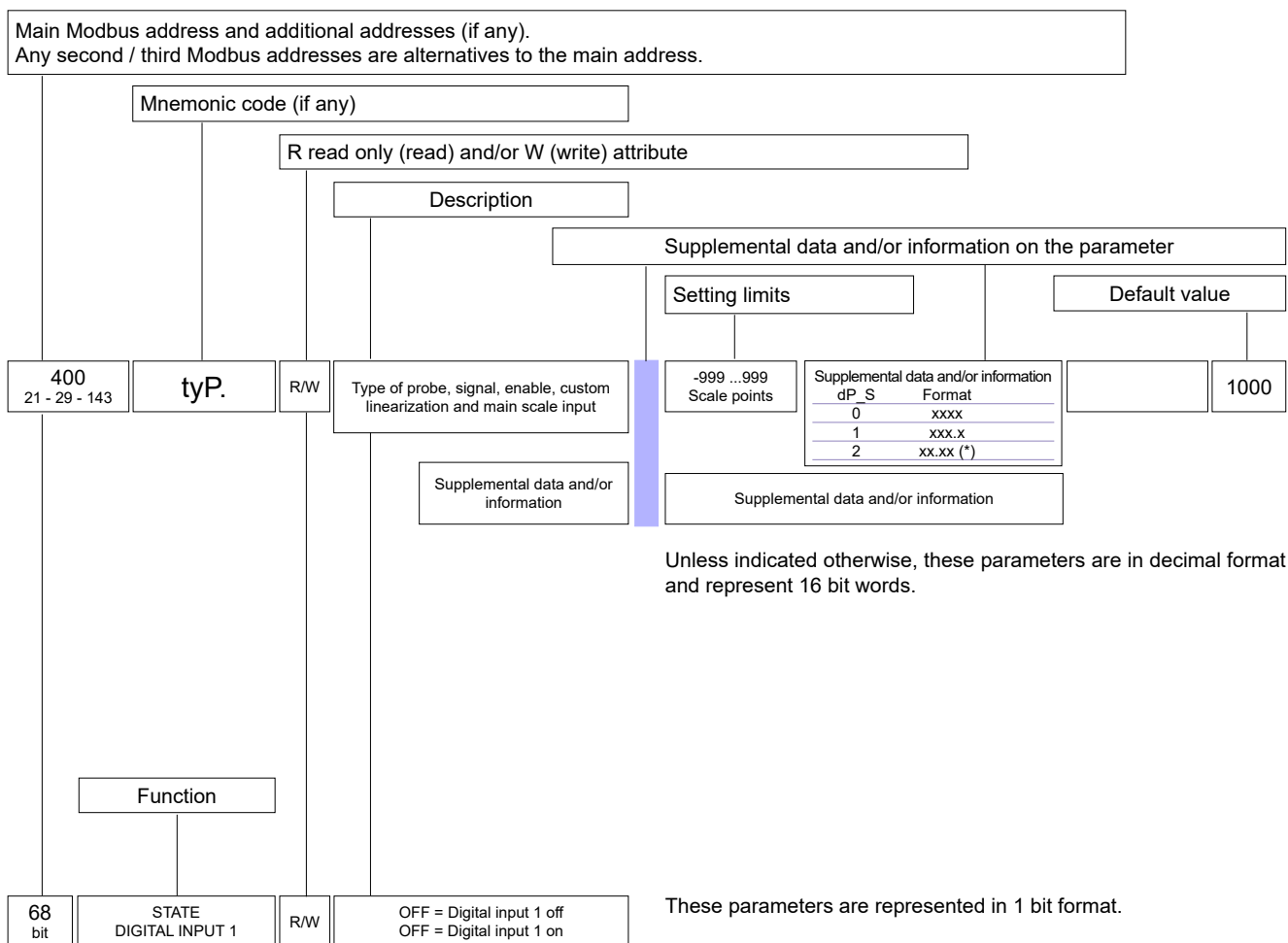
Each **chapter** has from 1 to 3 sections:

- the first section presents a general description of the parameters described in detail in the following zones;

- the second section presents the parameters needed for the controller's **basic applications**, which users and/or installers can access clearly and easily, immediately finding the parameters necessary for quick use of the controller;

- the third section (ADVANCED SETTINGS   ) presents parameters for advanced use of the controller: this section is addressed to users and/or installers who want to use the controller in special applications or in applications requiring the high performance offered by the instrument.

Some sections may contain a functional diagram showing interaction among the parameters described;

- terms used on other pages of the manual (related or supplemental topics) are shown in underlined italics and listed in the index (linked to IT support).

In each section, the programming parameters are shown as follows:

Main Modbus address and additional addresses (if any).
Any second / third Modbus addresses are alternatives to the main address.

Mnemonic code (if any)

R read only (read) and/or W (write) attribute

Description

Supplemental data and/or information on the parameter

Setting limits

Default value

400 21 - 29 - 143	tyP.	R/W	Type of probe, signal, enable, custom linearization and main scale input		-999 ...999 Scale points	Supplemental data and/or information		1000

dP_S	Format
0	xxxx
1	xxx.x
2	xx.xx (*)

Supplemental data and/or information

Supplemental data and/or information

Unless indicated otherwise, these parameters are in decimal format and represent 16 bit words.

Function

68 bit	STATE DIGITAL INPUT 1	R/W	OFF = Digital input 1 off OFF = Digital input 1 on

These parameters are represented in 1 bit format.

INSTRUMENT ARCHITECTURE

The modular power controller's flexibility permits replacement of previous-version instruments without changing the control software in use.

Based on the chosen work mode (see MODBUS SERIAL COMMUNICATION), you can use the instrument in 2 different modes:

- **GFX compatible mode**: as if there were 4 separate instruments (recommended for retrofitting projects and/or replacement of damaged instruments);

- **GFX4 mode**: as a single instrument with the same functions as 4 separate instruments, but with possibility of interaction among the various parameters, inputs and outputs (recommended for new projects).

New shared parameters, identified with Modbus addresses higher than 600, are accessible for both modes and permit more advanced functions such as:

604	Flt.2	R/W	Digital filter for auxiliary input		0.0 ... 20.0 sec		0.1

In addition to having a CUSTOM group of parameters for dynamic addressing, GFX4 mode lets you use a single communication network node instead of 4 nodes as in GFX compatible mode.

☞ *When programming, keep in mind that the addresses (parameters) described in this manual exist 4 times, specified by address node (ID).*

GFX Compatible HARDWARE

HARDWARE GFX4
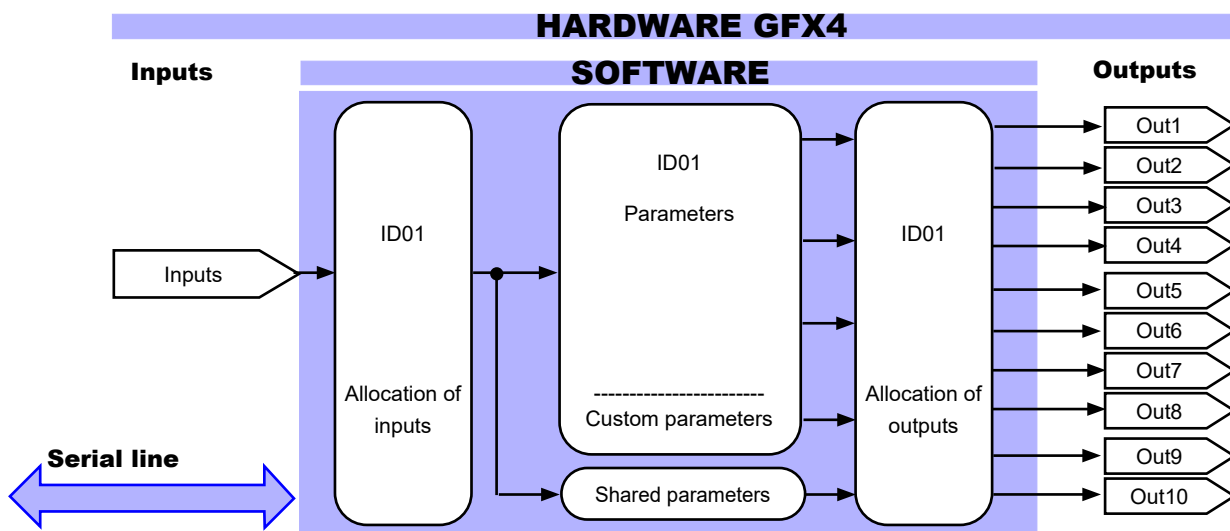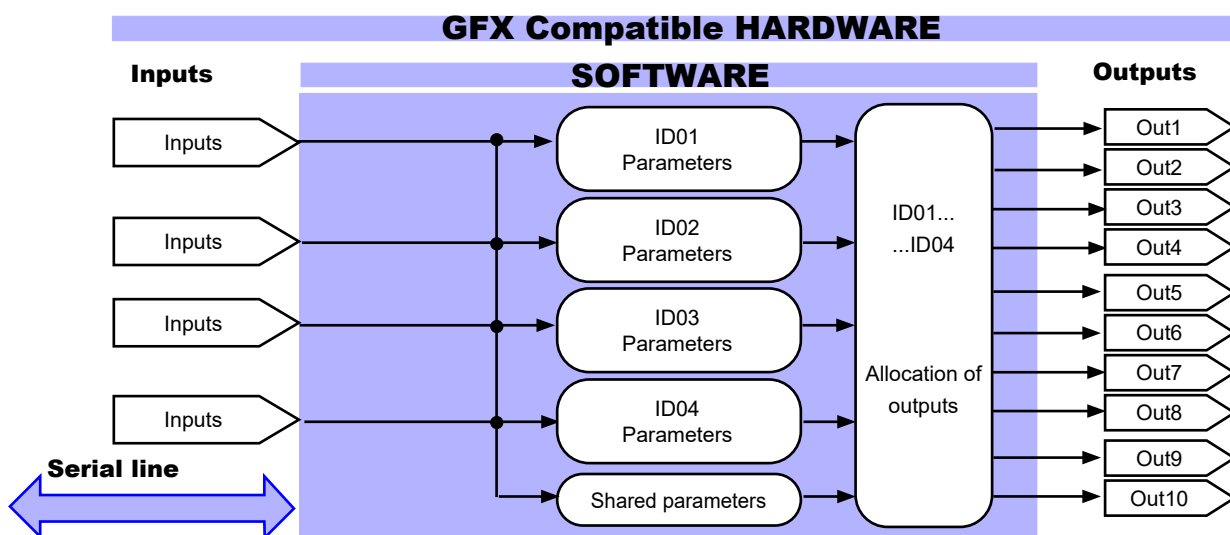
SERIAL COMMUNICATION (MODBUS)

There are two Modbus addressing modes for variables and configuration parameters:
- GFX compatible
- GFX4

The modes are selected with dip-switch-7.

☞ *All the parameters of formulation are saved in internal storage EEPROM (not flown them), of which a maximum of 100.000 cycles of cancellation is guaranteed/ writing. In order to avoid the express deterioration of the same one, when the only necessary writing is advised some. They make exception the parameters local setpoint SP (address Modbus 138) and MANUAL_POWER (address Modbus 252), whose memorization in EEPROM can be disabled by means of formulation of the SP.r parameter*

GFX-compatible mode (dip-switch-7 =ON)

This lets you uses supervision programs created for Geflex modules.
Memory is organized in 4 groups:
-     Zone 1
-     Zone 2
-     Zone 3
-     Zone 4

In each zone, the variables and parameters have the same address as a Geflex instrument; the value (Cod) set on the rotary switches corresponds to that of Zone 1; the values in the other zones are sequential.
Shared word parameters for the GFX4 instrument have addresses starting at 600.
Shared bit parameters have addresses high than 80.

Examples:
if the rotary switches have value 14, node 14 addresses Zone 1, node 15 Zone 2, node 16 Zone 3, node 17 Zone 4.
The process variable (PV) for Zone 1 has address Cod 0, the PV for Zone 2 has address Cod+1, 0, etc...
Parameter out.5, which defines the function of output OUT 5 on the GFX4, has address Cod 611.

Serial communication time constraints in Modbus RTU

The following time constraints must be complied with in order to allow correct serial data exchange with the device:

Reading Word/Register parameters: Reading N consecutive parameters, with N from 1 to 16, requires a time of almost 50 ms. In this case the following read and write Modbus command, to the same node, must be sent after this interval time.

Writing Word/Register parameters: Writing N consecutive parameters, with N ranging from 1 to 16, if all values (maximum 16) on the device are updated, will take a time of:50ms + N x 80ms(*) with N from 1 to 16.

The times reported refer to the case in which the Baudrate of the serial line (parameter bAu Modbus address 45) is 19200.

(*) If STATUS_W parameters (Modbus address 305) are included in the write request and their value is different from the one currently present in the slave, the time required to write each one will be 240ms (instead of 80ms).

GFX4 mode (dip-switch-7=OFF)

This lets you optimize the efficiency of serial communication by integrating 4 zones in the GFX4-IR. Memory is organized in 5 groups: 4 already in GFX-compatible mode, plus one group defined as custom:
- Custom (additional memory map for dynamic addresses)
- Zone 1
- Zone 2
- Zone 3
- Zone 4

The custom group contains variables and parameters for a maximum of 120 words. The meaning of these words can be changed.

There is a single value (Cod) set on the rotary switches; i.e., one for each GFX4-IR instrument. To access the data in each zone, simply add an offset to the address (+1024 for Zone 1, +2048 for Zone 2, +4096 for Zone 3, +8192 for Zone 4).

Words in the custom group have addresses 0,...,119. The variables and parameters are defined by default. At addresses 200,...,319 we have words containing the value of the address of the corresponding variables or parameters. These addresses can be changed by the user, offering the ability to read/write data with multi-word messages structured according to various supervision requirements.

☞ *Protection of Maps 1-2*
You have to write the value 99 on addresses 600 and 601 to enable change of the custom group (addresses 200... 31). This value is reset at each switch-on.

Examples:
you can access the PV variable in Zone 1 with address Cod, 0+1024 or address Cod, 0 custom variable 1 (address Cod, 200 has value 1024);
you can access the PV variable in Zone 2 with address Cod, 0+ 2048 or address Cod, 29 custom variable 30 (address Cod, 229 has value 2048);
if you want to read the 4 process variables in sequence at the first 4 addresses, set Cod, 200 = 1024, Cod.201 = 2048, Cod,202 = 4096, Cod,203 = 8192.

CONNECTION

Each GFX4-IR has an optically isolated serial port RS485 (PORT 1) with standard Modbus protocol via connectors S1 and S2 (type RJ10).
Connector S3 is suitable for direct connection to a Geflex slave module or to a GFX-OP operator terminal. Remember that the maximum communication speed of these devices is 19200 baud.

You can insert a serial interface (PORT 2). There are various models based on the field bus required: Modbus, Profibus DP, CANopen, DeviceNet and Ethernet.
This communication port (PORT 2) has the same Cod address as PORT 1.
The parameters for PORT 2 are bAu.2 (select baud-rate) and Par.2 (select parity).
The Cod parameter (read only) shows the value of the node address, settable from 00 to 99 with the 2 rotary switches; the hexadecimal settings are reserved.
A parameter can be read or written from both communication ports (PORT 1 and PORT 2).

☞ *Changing the* bAu *(select baud-rate) and/or* PAr *(select parity) parameters may cause communication failure.*

To set the bAu and PAr parameters, you have to run the Autobaud procedure described in the "Instruction and warnings" manual. Run the Autonode procedure for the Slave node parameter. For the Master, simply switch off and then back on.

Installation of the "MODBUS" serial network

A network typically has a Master that "manages" communication by means of "commands" and Slaves that interpret these commands.

GFX4-IRs 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 the rotary switches (tens + ones).

GFX4-IRs have a ModBus serial (Serial 1) and optional Fieldbus (Serial 2) serial (see order code) with one of the following protocols: ModBus, Profibus, CANopen, DeviceNet, Ethernet.

The following procedures are indispensable for the Modbus protocol.

For the remaining protocols, see the specific Geflex Profibus, Geflex CANopen, Geflex DeviceNet and Geflex Ethernet manuals.

GFX4-IR modules have the following default settings:
- node address   = 0 (0 + 0)
- speed Serial 1   = 19200 bit/s
- parity Serial 1   = none
- speed Serial 2 = 19200 bit/s
- parity Serial 2 = none

You can install a maximum of 99 GFX4-IR modules in a serial network, with node address selectable from "01" to "99" in standard mode, or create a mixed GFX4-IR/ GFX4 / Geflex network in Geflex compatible mode in which each GFX4-IR or GFX4 identifies 4 zones with sequential node address starting from the code set on the rotary switches.

In short, the valid rotary switch settings (tens + ones) are:
- (0 +0) = Autobaud Serial 1
- (B +0) = Autobaud Serial 2
- (A + 0) = Autonode Serial 1 for Geflex slaves connected to GFX4-IR.

46	Cod	R	*Instrument identification code*		1 ... 99	

45	bAu	R/W	Select Baudrate - Serial 1	*Baudrate table*		4
626	bAu.2	R/W	Select Baudrate - Serial 2			4

0	1200 bit/s
1	2400 bit/s
2	4800 bit/s
3	9600 bit/s
4	19200 bit/s
5	38400 bit/s
6	57600 bit/s
7	115200 bit/s

47	PAr	R/W	Select parity - Serial 1	*Parity table*		0
627	PAr.2	R/W	Select parity - Serial 2			0

0	No parity
1	Odd
2	Even

Communication error

If Modbus communication between GFX4-IR and Master node goes into timeout (settable in C.E.t parameter), you can force an output power value (C.E.P parameter of each zone) and transmit the alarm state to a relay output (rL.x parameters).

890	C.E.t.	R/W	Timeout for communication error	0 ... 121 sec.	Value 0 disables the function	0

891	C.E.m	R/W	Mode for communication error	*Mode table for communication error*	0

0	Delivered power is not changed
1	La potenza erogata viene forzata al valore C.E.P
+16	only for C.E.M -1 in MANUAL_POWER at the restart of the communication (only if in manual mode)

892	C.E.P	R/W	Output power when communication error is active	-100.0...100.0%		0,0

INPUTS

MAIN INPUT

The modular power controller has 4 main inputs to control 4 temperature zones, to which you can connect temperature sensors (thermocouples and RTD), linear sensors or custom sensors to acquire process variable (PV) values.

To configure, you always have to define the type of probe or sensor (tYP), the maximum and minimum scale limit (Hi.S – Lo.S) for the process variable value, and the position of the _decimal point_ (dP.S).
If the sensor is a thermocouple or resistance thermometer, the minimum and maximum limits can be defined on the specific scale of the sensor. These limits define the width of the proportional control band and the range of values settable for the setpoint and alarm setpoints.

There is a parameter to correct the offset of the input signal (oF.S): the set value is algebraically added to the read of the process variable.

You can read the state of the main input (Err) in which an input error is reported: when the _process variable_ goes beyond the upper or lower scale limit, it assumes the value of the limit and the corresponding state reports the error condition:
Lo = process variable < minimum scale limit
Hi = process variable > maximum scale limit
Err = Pt100 in short circuit and input value below minimum limit,
4...20mA transmitter interrupted or not powered
Sbr = Tc probe interrupted or input value above maximum limit

If noise on the main input causes instability of the acquired value, you can reduce its effect by setting a low pass digital filter (Flt). The default setting of 0.1sec is usually sufficient.

You can also use a _digital filter_ (Fld) to increase the apparent stability of the process variable PV; the filter introduces a hysteresis on its value: if the input variation remains within the set value, the DPV value is considered unchanged.

Probes and sensors

400	tyP.	R/W	Probe type, signal, enable, custom linearization and main input scale

☞ *Calibrate the UCA inputs by means of the GFX-OP terminal.*
The procedure is described in the GFX-OP manual.

Table of probes and sensors — 0

TC SENSOR

Type	Type of probe	Scale	Without dec. point	With dec. point
0	TC J	°C	0/1000	0.0/999.9
1	TC J	°F	32/1832	32.0/999.9
2	TC K	°C	0/1300	0.0/1300.0
3	TC K	°F	32/2372	32.0/999.9
4	TC R	°C	0/1750	0.0/999.9
5	TC R	°F	32/3182	32.0/999.9
6	TC S	°C	0/1750	0.0/999.9
7	TC S	°F	32/3182	32.0/999.9
8	TC T	°C	-200/400	-199.9/400.0
9	TC T	°F	-328/752	-199.9/752.0
28	TC	custom	custom	custom
29	TC	custom	custom	custom

SENSOR: RTD 3-wires

Type	Type of probe	Scale	Without dec. point	With dec. point
30	PT100	°C	-200/850	-199.9/850.0
31	PT100	°F	-328/1562	-199.9/999.9
32	JPT100	°C	-200/600	-199.9/600.0
33	JPT100	°F	-328/1112	-199.9/999.9

SENSOR: 60mV voltage

Type	Type of probe	Scale	Without dec. point	With dec. point
34	0...60 mV	Linear	-1999/9999	-199.9/999.9
35	0...60 mV	Linear	Custom linearization	Custom linearization
36	12...60 mV	Linear	-1999/9999	-199.9/999.9
37	12...60 mV	Linear	Custom linearization	Custom linearization

SENSOR: 20mA current

Type	Type of probe	Scale	Without dec. point	With dec. point
38	0...20 mA	Linear	-1999/9999	-199.9/999.9
39	0...20 mA	Linear	Custom linearization	Custom linearization
40	4...20 mA	Linear	-1999/9999	-199.9/999.9
41	4...20 mA	Linear	Custom linearization	Custom linearization

SENSOR: 1V voltage

Type	Type of probe	Scale	Without dec. point	With dec. point
42	0...1 V	linear	-1999/9999	-199.9/999.9
43	0...1 V	linear	Custom linearization	Custom linearization
44	200 mV..1 V	linear	-1999/9999	-199.9/999.9
45	200 mV..1 V	linear	Custom linearization	Custom linearization

SENSOR: Custom

Type	Type of probe	Scale	Without dec. point	With dec. point
46	Cust. 20mA	-	-1999/9999	-199.9/999.9
47	Cust. 20mA	-	Custom linearization	Custom linearization
48	Cust. 60mV	-	-1999/9999	-199.9/999.9
49	Cust. 60mV	-	Custom linearization	Custom linearization
50	PT100-JPT	-	custom	custom

SENSOR: 10V voltage

Type	Type of probe	Scale	Without dec. point	With dec. point
51	0...10V	linear	-1999/9999	-199.9/999.9
52	0...10V	linear	linear .custom	linear .custom
53	2...10V	linear	-1999/9999	-199.9/999.9
54	2...10V	linear	linear .custom	linear .custom

99 Input off

Maximum error of non linearity for thermocouples (Tc), resistance thermometer (PT100)

Tc type:
J, K
S, R   range 0...1750°C: error < 0.2% f.s. (t > 300°C)
       For other ranges: error < 0.5% f.s.
T   error < 0.2% f.s. (t > -150°C)

       And inserting a custom linearization
E, N, L   error <0.2% f.s.
B   range 44...1800°C; error < 0.5% f.s. (t > 300°C)
       range 44.0...999.9; error f.s.(t>300°C)
U   range -200...400; error < 0.2% f.s. (for t > -100°C)
       For other ranges;   error <0.5% f.s.
G   error < 0.2% f.s. (t > 300°C)
D   error < 0.2% f.s. (t > 200°C)
C   range 0...2300;   error < 0.2% f.s.
       For other ranges;   error < 0.5% f.s.

JPT100 and PT100   error < 0.2% f.s.

The error is calculated as deviation from theoretical value with % reference to the full-scale value expressed in degrees Celsius (°C).

403	dP.S	R/W	Decimal point position for input scale

Specifies the number of decimal figures used to represent the input signal value: for example, 875.4 (°C) with dP.S = 1.

Decimal point table — 0

	Format
0	xxxx
1	xxx.x
2	xx.xx (*)
3	x.xxx (*)

(*) Not available for TC, RTD probes

Scale limits

401	Lo.S	R/W	Minimum scale limit of main input

min...max scale of input selected in tyP — 0

Engineering value associated to minimum level of the signal generated by the sensor connected to the input: for example 0 (°C) with type K thermocouple.

402	Hi.S	R/W	Maximum scale limit of main input

min...max scale of input selected in tyP — 1000

Engineering value associated to maximum level of the signal generated by the sensor connected to the input: for example 1300 (°C) with type K thermocouple.

Setting the offset

519 / 23	oFS.	R/W	*Offset correction for main input*

-999...999 scale points — 0

Lets you set a value in scale points that is algebraically added to the value measured by the input sensor.

Read state

770	In.1	R	Main input value		

0 470	P.V.	R	Read of engineering value of *process variable* (PV)		

85	Err	R	*Self-diagnostic error code* of main input		*Error code table*

For custom linearization (tYP = 28 or 29):
- LO is signaled with input values below Lo.S or at minimum calibration value.
- HI is signaled with input values above Lo.S or at maximum calibration value.

0	No Error
1	Lo (process variable value is < Lo.S)
2	Hi (process variable value is > di Hi.S)
3	ERR [third wire interrupted for PT100 or input values below minimum limits (ex.: for CT with connection error)]
4	SBR (probe interrupted or input values beyond maximum limits)

349	DPV	R	Read of engineering value of *process variable* filtered by Fld		

ADVANCED SETTINGS

Input filters

24	Flt	R/W	*Low pass digital filter* on input signal	0.0 .... 20.0 sec		0.1

Sets a low pass *digital filter* on the main input, running the average value read in the specified time interval. If = 0 exclude the average filter on the sampled values.

179	Fld	R/W	*Digital filter on oscillations* of input signal	0.0 ... 9.9 scale points		0.5

Introduces a hysteresis zone on the input signal value within which the signal is considered unchanged, thereby increasing its apparent stability.

Linearization of input signal

The modular power controller lets you set a custom linearization of the signal acquired by the main input for signals coming from sensors and for signals coming from custom thermocouples.
Linearization is performed with 33 values (S00 ... S32: 32 segments).
S33, S34, S35 are an additional 3 values to be inserted in case of linearization with custom CT.

- Signals from sensors

For signals coming from sensors, linearization is done by dividing the input scale into 32 zones of equal dV amplitude, where:

$$dV = (\text{full-scale value} - \text{start of scale value}) / 32$$

Point 0 (origin) corresponds to the engineering value attributed to the minimum value of the input signal.
Subsequent points correspond to the engineering values attributed to input values equal to:

$$\text{Input value (k)} = \text{Minimum input value} + k * dV$$

where k is the order number of the linearization point
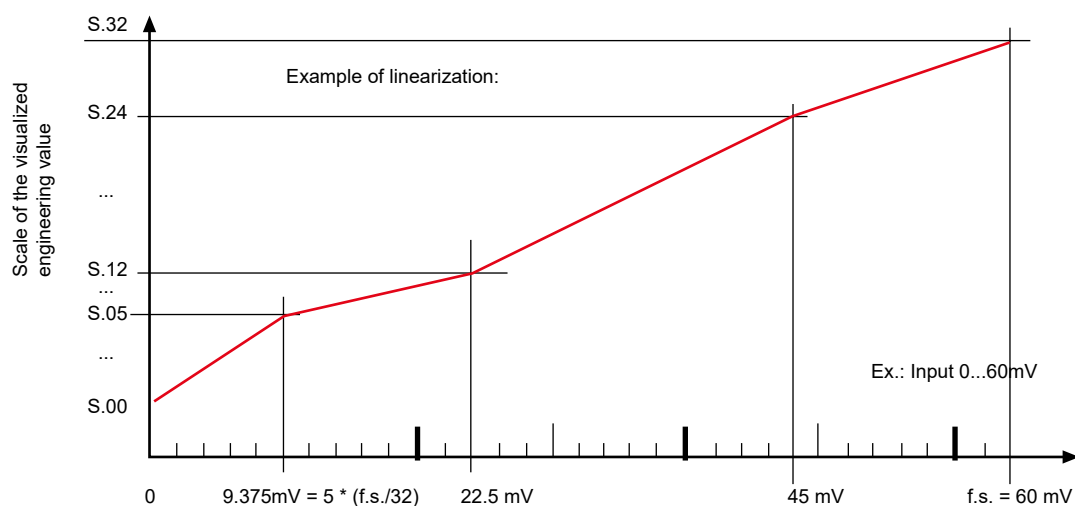
The engineering values calculated in this way by the user can be set by means of the following parameters.

| 86 | S.00 | R/W | Engineering value attributed to Point 0 (minimum value of input scale) | | (- 1999 ... 9999) |

| 87 | S.01 | R/W | Engineering value attributed to Point 1 | | (- 1999 ... 9999) |

| . . . . . | | | intermediate values | | |

| 118 | S.32 | R/W | Engineering value attributed to Point 32 (maximum value of input scale) | | (- 1999 ... 9999) |

☞ *For correct signaling of error state (Lo, Hi), the value set in S.00 must coincide with limit Lo.S and the value set in S.32 with limit Hi.S.*

- Signals coming from custom thermocouples

An alternate linearization is available only for sensors consisting of custom thermocouples, created by defining engineering values at three measurement scale points settable with the following parameters:

| 293 | S.33 | R/W | Engineering value attributed to minimum value of the input scale. | | mV start of scale (- 19.99 ... 99.99) |

| 294 | S.34 | R/W | Engineering value attributed to maximum value of the input scale. | | mV full scale ((S.33+1) ... 99.99) |

| 295 | S.35 | R/W | Engineering value attributed to input signal corresponding to 50°C. | | mV at 50° C (- 1.999 ... 9.999) |

FUNCTIONAL DIAGRAM

Input signal → Probe type (tYP). Linearization of signal (S00...S35) → Scale limits and decimal point (Hi.S, Lo.S, dP.S). Offset (OfS).) → Low pass filter (Flt) → Select PV for zone → Process variable (PV) / See control

→ Digital filter (Fld) → Variable DPV
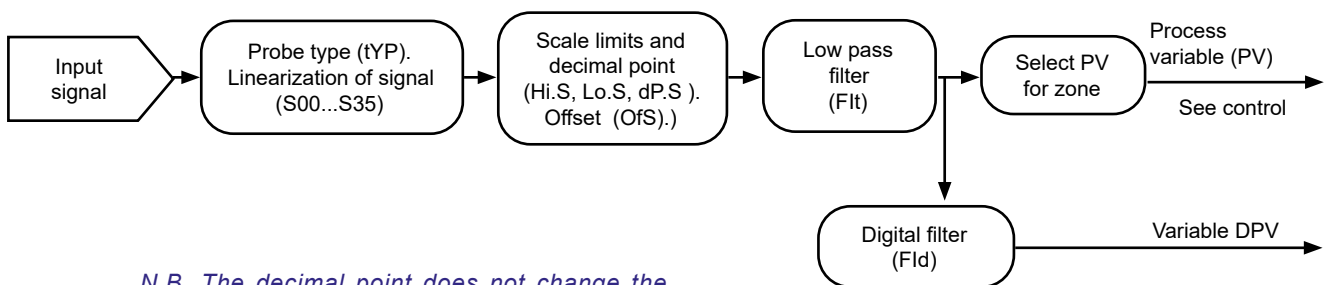
☞ *N.B. The decimal point does not change the contents of the PV, but only permits its correct interpretation.*
Ex.: if dP.S = 1 and PV = 300, the engineering value in °C is 30.0.

CURRENT VALUE IN LOAD

The RMS current value is read in variable Ld.A of each zone.
If zone 1 has a 3-phase load, variable Ld.At contains the average value of the three RMS currents. The Ld.A of the first three zones contain the RMS current value on lines L1, L2 and L3, respectively..
The measurement accuracy is 2% of full scale at 25°C ambient temperature in ZC, BF and HSC ignition mode and 3% in PA mode.
The circulating current in the load is acquired with a 0.25ms sampling time.

In addition, there are the following parameters for a zone with single-phase load:
      I.tA1 instantaneous ammeter value
      I.AF1 filtered ammeter value (see Ft.tA)
      I1on current with active control
      o.tA1 ammeter input offset correction
      Ft.tA ammeter input digital filter

There are also the following parameters if zone 1 has a three-phase load:
      I.tA1, I.tA2 and I.tA3 instantaneous ammeter value on line L1, L2 and L3
      I.AF1, I.AF2 and I.AF3 filtered ammeter value (see Ft.tA) on line L1, L2 and L3
      I1on, I2on and I3on current with active control
      o.tA1, o.tA2 and o.tA3 ammeter input offset correction on line L1, L2 and L3
      Ft.tA ammeter input digital filter

If diagnostics detects a fault condition on the load, the red ER LED will flash in synch with yellow LED O1 or O2 or O3 or O4 for the zone in question.
The condition POWER FAULT in OR with HB alarm can be assigned to an alarm or identified in the state of a bit in variables STATUS_STRUMENTO, STATUS_STRUMENTO_1, STATUS_STRUMENTO_2 and STATUS_STRUMENTO_3.
In STATUS_STRUMENTO_3 you can identify the condition that activated the POWER_FAULT alarm.

POWER_FAULT diagnostics is configurable with parameter hd.2, with which even just a part may be enabled

      SSR SHORT SSR module in short circuit
      NO VOLTAGE power failure or interrupted fuse
      NO CURRENT due to SSR module open or fuse or load interrupted

For alarm HB (load partially interrupted), refer to the specific section of this manual.

The default value of the maximum limit or ammeter full-scale depends on the model: 20.0A (30kW model), 40.0A (60kW model), or 60.0A (80kW model).

Setting the offset

220	o.tA1	R/W	*Offset correction CT input* (phase 1)	-99.9 ...99.9 scale points		0.0
415	o.tA2	R/W	Offset correction CT input (phase 2)	-99.9 ...99.9 scale points	With 3-phase load	0.0
416	o.tA3	R/W	Offset correction CT input (phase 3)	-99.9 ...99.9 scale points	With 3-phase load	0.0

Read state

227 473 - 139	I.tA1	R	Instantaneous CT ammeter input value (phase 1)	
490	I.tA2	R	Instantaneous CT ammeter input value (phase 2)	With 3-phase load
491	I.tA3	R	Instantaneous CT ammeter input value (phase 3)	With 3-phase load
756	I.AF1	R	Filtered ammeter input value (phase 1)	
494	I.AF2	R	Filtered ammeter input value (phase 2)	With 3-phase load
495	I.AF3	R	Filtered ammeter input value (phase 3)	With 3-phase load
468	I.1on	R	CT ammeter input value with output activated (phase 1)	
498	I.2on	R	CT ammeter input value with output activated (phase 2)	With 3-phase load
499	I.3on	R	CT ammeter input value with output activated (phase 3)	With 3-phase load
709	I.tAP	R	Peak ammeter input during phase softstart ramp	
716	CoS.F	R	Power factor in hundredths	
753	Ld.A	R	Current on load	
754	Ld.A.t	R	Current on 3-phase load	

ADVANCED SETTINGS

Input filter

219	Ft.tA	R/W	*CT input digital filter* (phases 1, 2 and 3)	0.0 ... 20.0 sec		0.0

Sets a low pass filter on the CT auxiliary input, running the average of values read in the specified time interval. If = 0 , excludes the average filter on sampled values.

FUNCTIONAL DIAGRAM

Monophase load

```
┌──────────────┐      ╭──────────────╮      ╭──────────────╮
│ CT1 auxiliary │────▶ │ Offset scale │────▶ │  Low pass    │────── Internal variable I.tA1 ──────▶   See generic alarms and
│    input      │      │    limits     │      │   filter     │                                                HB alarms
└──────────────┘      │ (H.tA1, o.tA1)│      │   (Ft.tA)    │
                      ╰──────────────╯      ╰──────────────╯────── Internal variable I.1On ──────▶
```
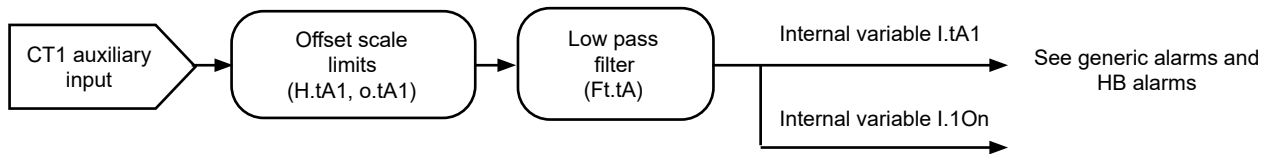
FUNCTIONAL DIAGRAM

Threephase load

```
┌──────────────┐      ╭──────────────╮      ╭──────────────╮
│     CT1      │────▶ │ Offset scale │──┬─▶ │  Low pass    │──┬── Variable  L.dA zone 1 ─────▶
│ auxiliary input │   │    limits     │  │   │   filter     │  │        (I.AF1, I.1.on)
└──────────────┘      │   (o.tA1)    │  │   │   (Ft.tA)    │  │
                      ╰──────────────╯  │   ╰──────────────╯  │
                                        └── Variable  I.tA1 ─▶│
                                                               │
┌──────────────┐      ╭──────────────╮      ╭──────────────╮  │
│     CT2      │────▶ │ Offset scale │──┬─▶ │  Low pass    │──┼── Variable  L.dA zone 2 ─────▶
│ auxiliary input │   │    limits     │  │   │   filter     │  │
└──────────────┘      │   (o.tA2)    │  │   │   (Ft.tA)    │  │
                      ╰──────────────╯  │   ╰──────────────╯  │
                                        └── Variable  I.tA2 ─▶│
                                                               │
┌──────────────┐      ╭──────────────╮      ╭──────────────╮  │
│     CT3      │────▶ │ Offset scale │──┬─▶ │  Low pass    │──┼── Variable  L.dA zone 3 ─────▶
│ auxiliary input │   │    limits     │  │   │   filter     │  │
└──────────────┘      │   (o.tA3)    │  │   │   (Ft.tA)    │  │
                      ╰──────────────╯  │   ╰──────────────╯  │
                                        └── Variable  I.tA3 ─▶│
                                                        ╭──────────────╮
                                                        │    media     │── Variable  Ld.A.t ──▶
                                                        ╰──────────────╯
```
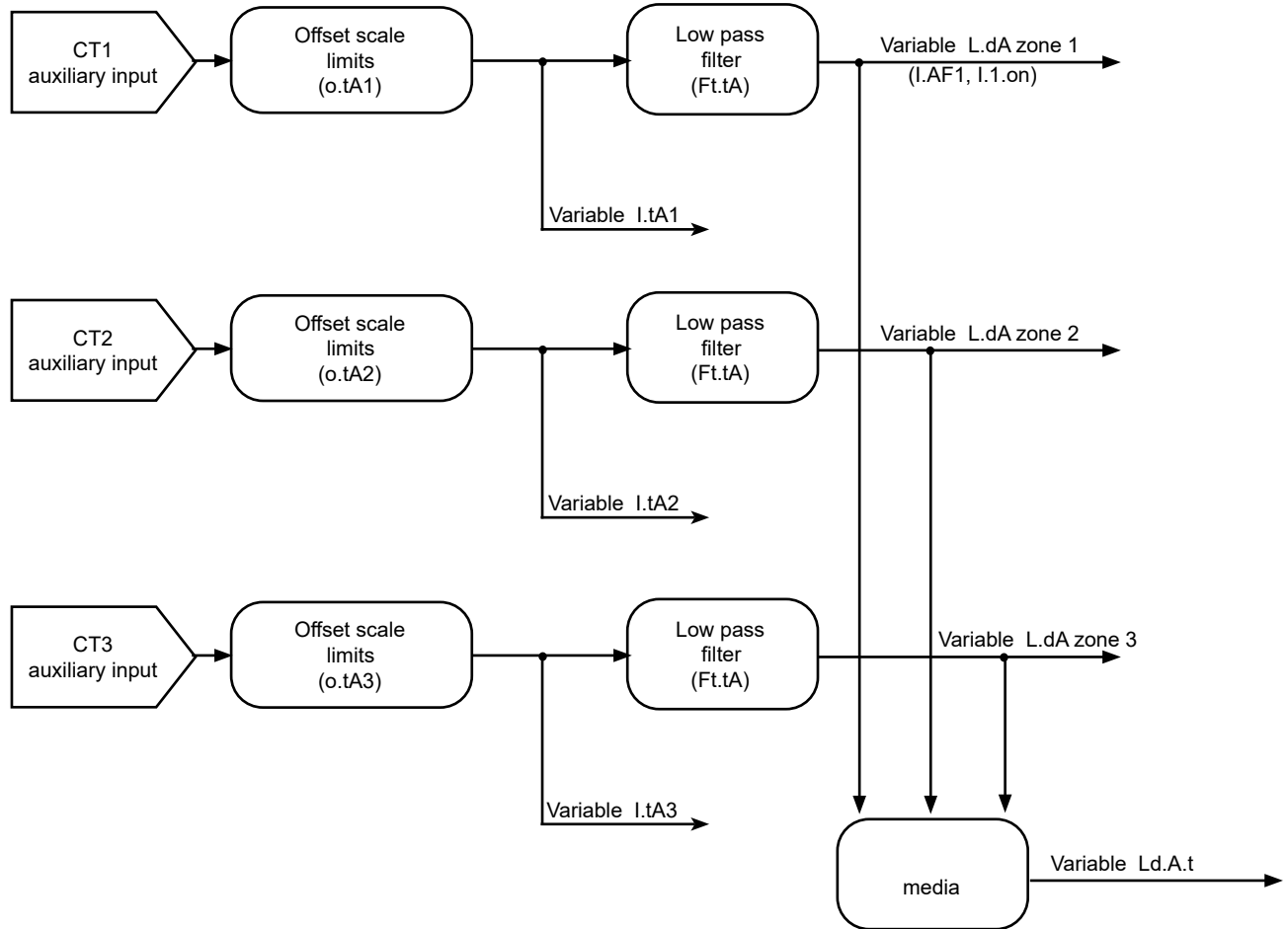
VOLTAGE VALUE ON LOAD

      RMS voltage is read in variable Ld.V of each zone. If zone 1 has a 3-phase load, variable Ld.V.t in the first zone contains the average RMS value of voltages of the three lines L1, L2 and L3.
Voltage on the load is acquired with sampling on each cycle, 20ms at 50Hz (16.6ms at 60Hz).
Accuracy is better than 1%.

☞   *ATTENTION: For load voltages below 90VAC, the voltage read on the load and possible related alarms have no value.*

751	Ld.V	R	Voltage on load	
752	Ld.V.t	R	Voltage on 3-phase load	

LINE VOLTAGE VALUE

The line voltage interval for correct operation is 90…530VAC.
There are the following parameters if zone 1 has a single-phase load:
      I.tV1 instantaneous voltmeter value of line
      I.VF1 filtered voltmeter value
      o.tV1 voltmeter input offset correction
      Ft.tV voltmeter input digital filter
There are the following parameters if zone 1 has a 3-phase load:
      I.tV1, I.tV2 and I.tV3, the instantaneous voltmeter value on line L1, L2 and L3, respectively.
RMS voltage values refer to neutral or to the internally rebuilt value if not available or not connected.
I.VF1, I.VF2 and I.VF3 filtered voltmeter value on line L1, L2 and L3
o.tV1, o.tV2 and o.tV3 voltmeter input offset correction on line L1, L2 and L3
In case of open delta connection, the linked RMS voltages are in registers I.V21 voltage between L2 and L1; I.V32 voltage between L3 and L2; I.V13 voltage between L1 and L3.
Each phase has a voltage presence check that shuts off the module in case of incorrect values.
3-phase loads have an imbalance diagnostic, with consequent shut-down of the load and signal via LEDs.
A "voltage status" parameter contains information on the status of line voltage, including mains frequency identified 50/60Hz.
3-phase loads have diagnostics for correct phase connection, lack of a voltage, or imbalance of the three line voltages.

☞   *LED status refers to the corresponding parameter, with the following special cases:*
- LED RN (green) + LED ER (red) both flashing rapidly: autobaud in progress
- LED ER (red) on: error in one of main inputs (Lo, Hi, Err, Sbr)
- LED ER (red) flashing: temperature alarm (OVER_HEAT or TEMPERATURE_SENSOR_BROKEN) or SHORT-CIRCUIT_CURRENT alarm (only in three-phase configuration)
- LED ER (red) + LED Ox (yellow) both flashing: HB alarm or POWER_FAIL in zone x
- All LEDs flashing rapidly except LED DI1: DIP-Switches configuration not provided for
- All LEDs flashing rapidly except LED DI2: 30%_UNBALANCED_LINE_WARNING alarm (only in three-phase configuration)
- All LEDs flashing rapidly except LED O1: SHORT_CIRCUIT_CURRENT alarm (only in three-phase configuration)
- All LEDs flashing rapidly except LED O2: TRIPHASE_MISSING_LINE_ERROR alarm (only in three-phase configuration)

Setting the offset

411	oF.tV1	R/W	*Offset correction for TV input* (phase 1)		-99.9 ...99.9 Scale points		0.0
419	oF.tV2	R/W	Offset correction for TV input (phase 2)		-99.9 ...99.9 Scale points	With 3-phase load	0.0
420	oF.tV2	R/W	Offset correction for TV input (phase 3)		-99.9 ...99.9 Scale points	With 3-phase load	0.0

Read state

232 485	1.tV1	R	Value of voltmeter input (phase 1)		
492	1.tV2	R	Value of voltmeter input (phase 2)		With 3-phase load
493	1.tV3	R	Value of voltmeter input (phase 3)		With 3-phase load
322	1.VF1	R	Value of voltmeter input (phase 1)		
496	1.VF2	R	Value of voltmeter input (phase 2)		With 3-phase load
497	1.VF3	R	Value of voltmeter input (phase 3)		With 3-phase load
702		R	Voltage status 5		

Voltage status 5

bit	
0	frequency_warning
1	10% umbalanced_line_warning
2	20% umbalanced_line_warning
3	30% umbalanced_line_warning
4	rotation 132
5	triphase_missing_line_error
6	60Hz

315	FrEq	R	Voltage frequency in tenths of Hz	
710	I.V21	R	Linked voltage V21	
711	I.V32	R	Linked voltage V32	
712	I.V13	R	Linked voltage V13	

ADVANCED SETTINGS

Input filter

412	Ft.tV	R/W	Digital filter for auxiliary TV input (phase 1, 2 and 3)		0.0 ... 20.0 sec.		2.0
Sets a low pass filter on the auxiliary TV input, running the average of values read in the specified time interval. If = 0 , excludes the average filter on sampled values.							

FUNCTIONAL DIAGRAM

Single-phase load
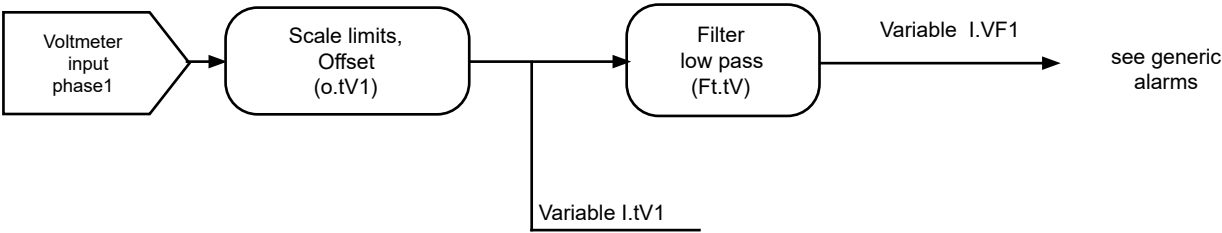
FUNCTIONAL DIAGRAM
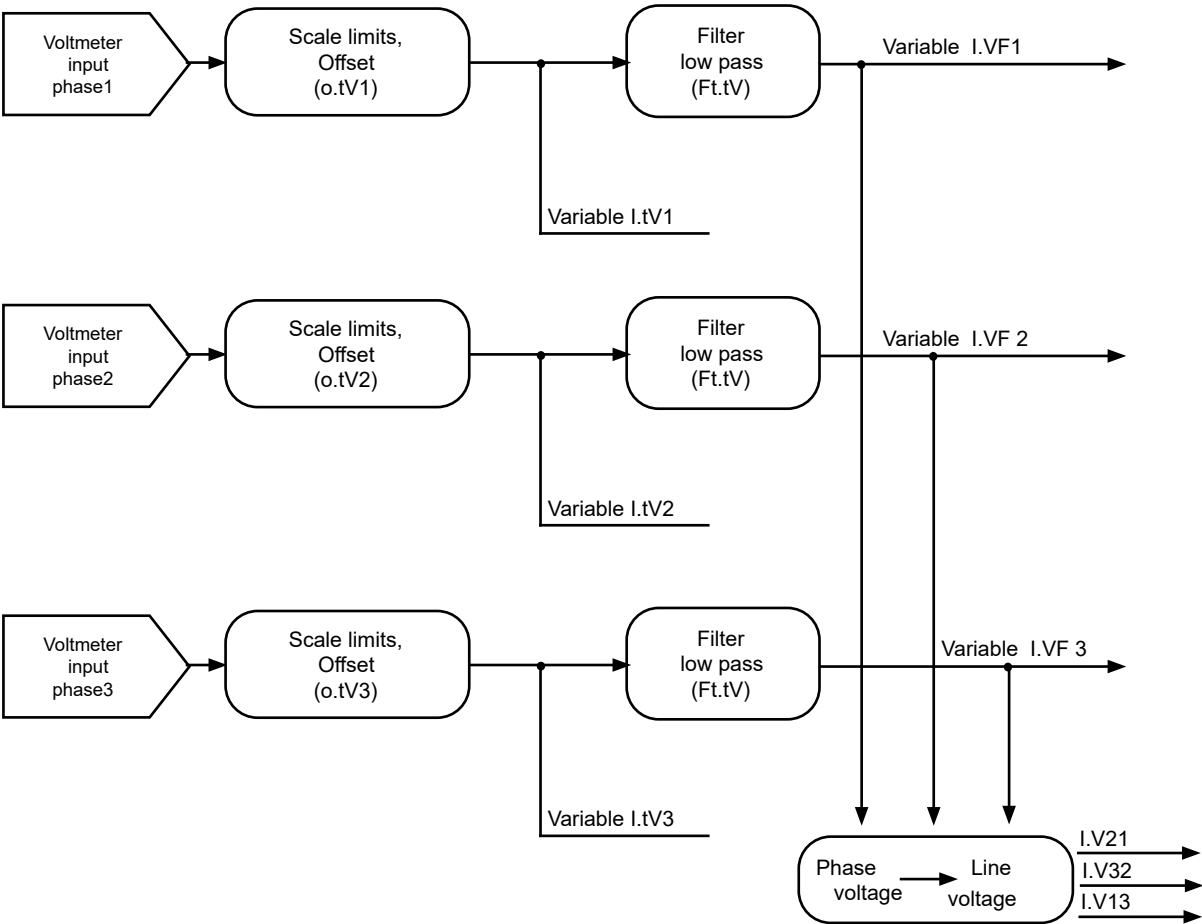
3-phase load

POWER ON LOAD

Power on the load in each zone is read in variable Ld.P

Impedance in each zone is read in variable Ld.I.

If zone 1 has a 3-phase load, variable Ld.P.t shows power and Ld.I.t total impedance.

Note that for loads such as IR lamps, impedance can vary greatly based on the power transferred to the load.

719	Ld.P	R	Power on load
720	Ld.P.t	R	Power on 3-phase load
749	Ld.I	R	Load impedance
750	Ld.I.t	R	Impedance on 3-phase load
775	Ld.P.t.kw	R	Three-phase load power in kW

FUNCTIONAL DIAGRAM

Single-phase load
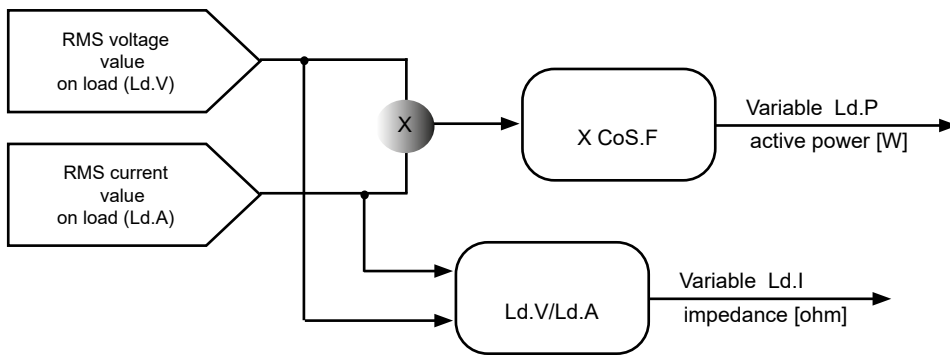
FUNCTIONAL DIAGRAM

3-phase load
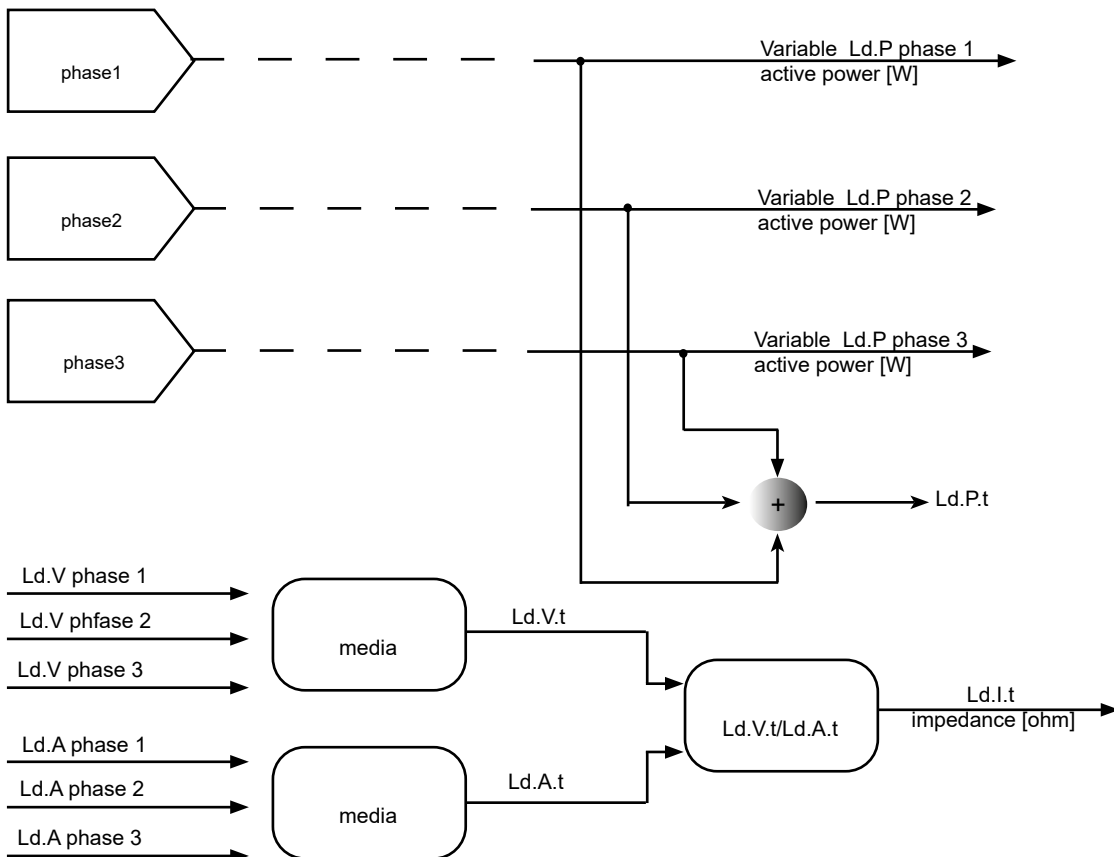
AUXILIARY ANALOG INPUT (LIN/TC)

The GFX4-IR has 4 inputs defined as auxiliary (IN5 for zone 1, IN6 for zone 2, IN7 for zone 3, IN8 for zone 4) to which TC or linear temperature sensors can be connected.
The presence of these inputs is optional and, for model GFX4-IR-x-x-4-x-x is defined by the order code.

The input value, saved in variable In.2, can be read and used to activate the alarm signals assigned to it.

When an auxiliary input is present, you have to define the following parameters:
- sensor type (AI.2);
- its function (tP.2);
- decimal point position (dP.2);
- scale limits (HS.2 – LS.2);
- offset correction value (oFS.2).

If the sensor is a thermocouple, the minimum and maximum limits can be defined in the specific scale of the sensor used. The range of values settable for alarm setpoints depends on these limits.

There is also a digital filter (Flt.2) that can be used to reduce noise on the input signal.

| 194 | AI.2 | R/W | Select type of auxiliary sensor input | | | | 0 |

Calibrate the UCA inputs by means of the GFX-OP terminal.
The procedure is described in the GFX-OP manual.

Auxiliary inputs sensors table

	Type of probe or sensor	Without dec. point	With dec. point
0	TC J °C	0/1000	0.0/999.9
1	TC J °F	32/1832	32.0/999.9
2	TC K °C	0/1300	0.0/999.9
3	TC K °F	32/2372	32.0/999.9
4	TC R °C	0/1750	0.0/999.9
5	TC R °F	32/3182	32.0/999.9
6	TC S °C	0/1750	0.0/999.9
7	TC S ° F	32/3182	32.0/999.9
8	TC T °C	-200/400	-199.9/400.0
9	TC T °F	-328/752	-199.9/752.0
34	0...60 mV	-1999/9999	-199.9/999.9
35	0...60 mV	Custom linearization	Custom linearization
36	12...60 mV	-1999/9999	-199.9/999.9
37	12...60 mV	Custom linearization	Custom linearization
99	Input off		

| 181 | tP.2 | R/W | Definition of auxiliary analog input function | | | | 0 |

Table of auxiliary input functions

	Auxiliary input function	LIMITS FOR SETTING the LS.2 and HS.2 min	max	
0	None	-1999	9999	
1	Remote setpoint	Absolute Lo.S, deviation -999	Absolute Hi.S, deviation +999	(*)
2	Manual analog remote	-100.0%	+100.0%	(*)
3	Reset analog power	-100.0%	+100.0%	(**)
10	Remote manual analog from main input			(*)

(*) see: Settings – Control Setpoint
(**) see: Controls –PID Parameters

| 677 | dP.2 | R/W | *Decimal point position for the auxiliary input scale* | | | | 0 |

Specifies the number of decimal figures used to represent the input signal value: for example, 875.4 (°C) with dP.S: = 1

Decimal point table

	Format
0	xxxx
1	xxx.x
2	xx.xx (*)
3	x.xxx (*)

(*) not available for TC probes

Scale limits

| 404 | LS.2 | R/W | Minimum limit of auxiliary input scale | Min...max input scale selected in AI.2 and tP.2 | 0 |

| 603 | HS.2 | R/W | Maximum limit of auxiliary input scale | Min...max input scale selected in AI.2 and tP.2 | 1000 |

Setting the offset

| 605 | oFS.2 | R/W | *Offset for auxiliary input correction* | -999 ...999 Scale points | | 0 |

Read state

602	In.2	R	Value of auxiliary input

606	Er.2	R	*Error code for self-diagnosis* of auxiliary input

Error code table	
0	No error
1	Lo (value of process variable is < Lo.S)
2	Hi (value of process variable is > Hi.S)
3	ERR [third wire interrupted for PT100 or input values below minimum limits (ex.: for TC with connection error)]
4	SBR (probe interrupted or input values beyond maximum limits)

ADVANCED SETTINGS

Input filter

604	Flt.2	R/W	Digital filter for auxiliary input	0.0 ... 20.0 sec		0.1

Sets a low pass filter on the auxiliary input, running the average of values read in the specified time interval. If = 0 , excludes the average filter on sampled values.

FUNCTIONAL DIAGRAM

Auxiliary input → Select sensor (AI.2) → Scale limits, decimal point, Offset (H.S2, L.S2, dP.2, oFS.2) → Low pass f ilter (Flt.2) → Internal In.2 → See generic alarms and Control
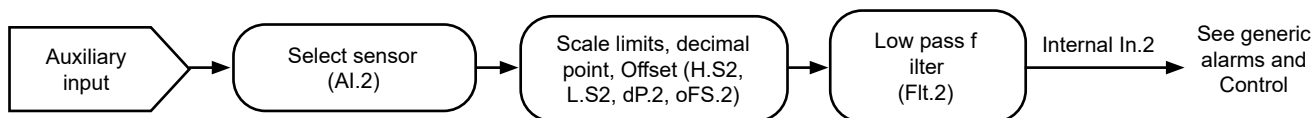
DIGITAL INPUTS

There are always two inputs. Each input can perform various functions based on the setting of the following parameters:

140	diG.	R/W	Digital input function

618	diG.2	R/W	Digital input 2 function

	Digital input functions table		0	*Activation*
0	No functions (input off)			
1	MAN/AUTO controller		0	On leading edge
2	LOC / REM			On leading edge
3	HOLD			On state
4	AL1, ..., AL4 alarms memory reset			On state
5	SP1 / SP2 selection			On leading edge
6	Software on/off			On leading edge
7	Restart Softstart/Dry out			
8	START / STOP Selftuning			On leading edge (**)
9	START / STOP Autotuning			On leading edge (**)
10	Power_Fault alarms memory reset			On state
11	LBA alarm reset			On state
12	AL1 .. AL4 and Power_Fault alarms reset memory			On state
13	Enable at software ON (*)			On state
14	Reference calibration of retroaction selected by Hd.6			On leading edge
15	Calibration threshold alarm HB			On leading edge
64	Termine forzato della fase Softstart/Dry out			On state
+ 16	for inverse logic input			
+ 32	to force logic state 0 (OFF)			
+ 48	to force logic state 1 (ON)			

(*) For diG. only
(**) IN diG. alternative to serial

Read state

68 bit	STATE of DIGITAL INPUT 1	R	OFF = Digital input 1 off ON = Digital input 1 on

92 bit	STATE of DIGITAL INPUT 2	R	OFF = Digital input 2 off ON = Digital input 2 on

317		R	State of INPUT DIG digital inputs		bit.0 = digital input status DI1 bit.1 = digital input status DI2

Functions related to digital inputs

- MAN / AUTO controller   see AUTO/MAN CONTROL
- LOC / REM   see SETTING THE SETPOINT
- HOLD   see HOLD FUNCTION
- Reset memory latch   see GENERIC ALARMS AL1 .. AL4
- Select SP1 / SP2   see SETTINGS - Multiset
- Software OFF / ON   see SOFTWARE SHUTDOWN
- START / STOP Selftuning   see SELFTUNING
- START / STOP Autotuning   see AUTOTUNING
- Calibration of feedback reference   see FEEDBACK
- Calibration of HB alarm setpoint   see HB ALARM

USING A FUNCTION ASSOCIATED WITH DIGITAL INPUT AND VIA SERIAL

At power-on or on the leading edge of digital input 1 or 2, all zones assume the state set by the digital input. For each zone, this state can be changed by writing via serial.
The setting via serial is saved in eeprom (STATUS_W_EEP, address 698).

State A/B	Setting	Address for writing via serial	
	dIG. or dIG.2	Access at 16 bits	Access at 1 bit
AUTO/MAN controller	1 word 305	bit 4	bit 1
LOC/REM setpoint	2 word 305	bit 6	bit 10
SP1/SP2 setpoint	5 word 305	bit 1	bit 75
ON/OFF software	6 word 305	bit 3	bit 11
STOP/START selftuning	8 word 305	bit 2	bit 3
STOP/START autotuning *	9 word 305	bit 5	bit 29

* continuous or one-shot
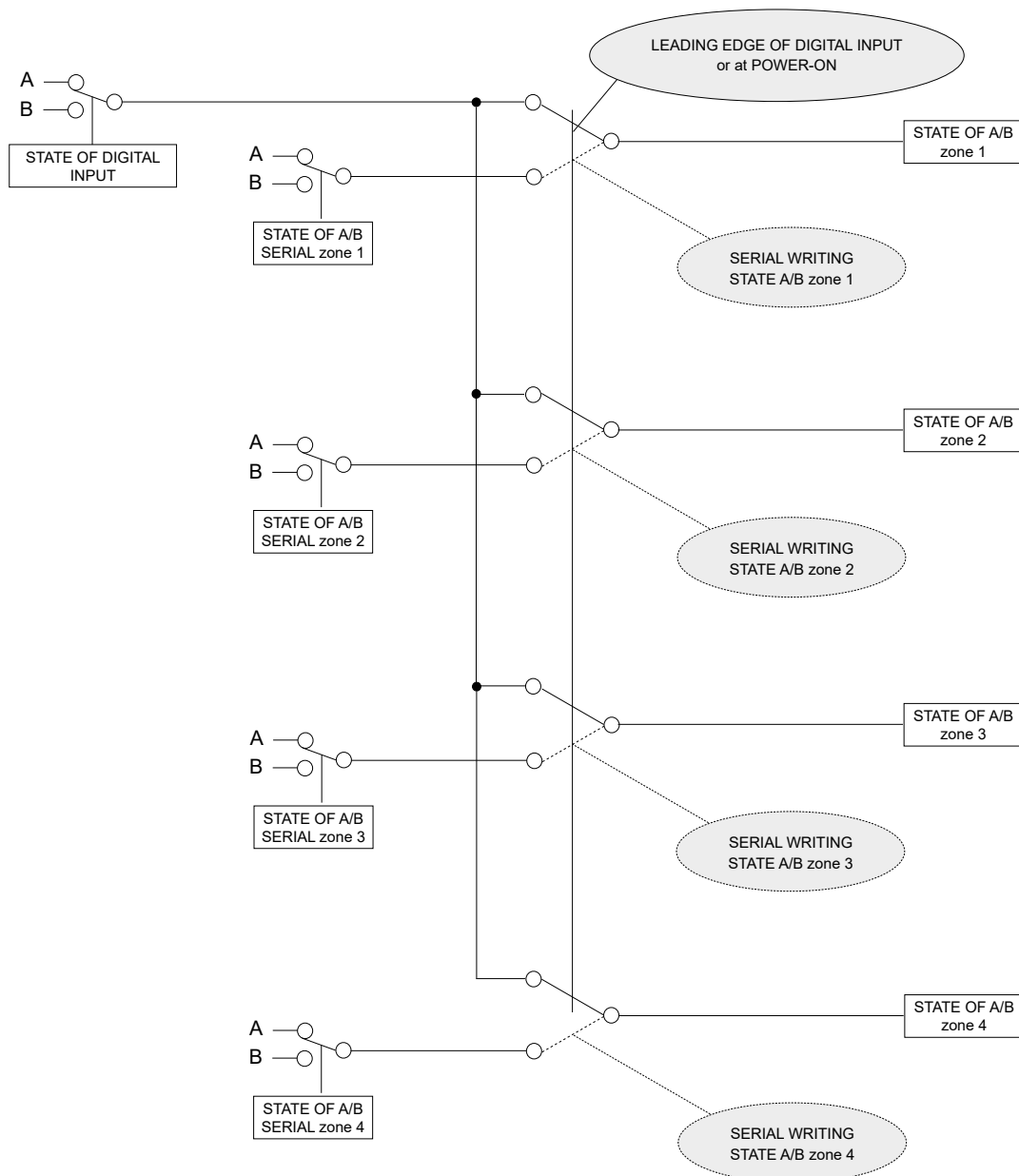
USING A FUNCTION OF DIGITAL INPUT 1 TO ENABLE AT SOFTWARE ON

Software ON can be configured either by enabling a digital input or by writing via serial. Enabling by digital input 1 1 (diG) is common to all zones, whereas enabling via serial is specific for each individual zone.

The ON/OFF setting via serial is saved in eeprom (STATUS_W_EEP, address 698 bit 3) for resetting of the condition at the next hardware power-on; use parameter P.On.t. to force software always ON or software always OFF at next power-on.

	Setting	Address for writing via serial	
	dIG	Access at 16 bits	Access at 1 bit
ON/OFF software	13	word 305 bit 3	bit 11
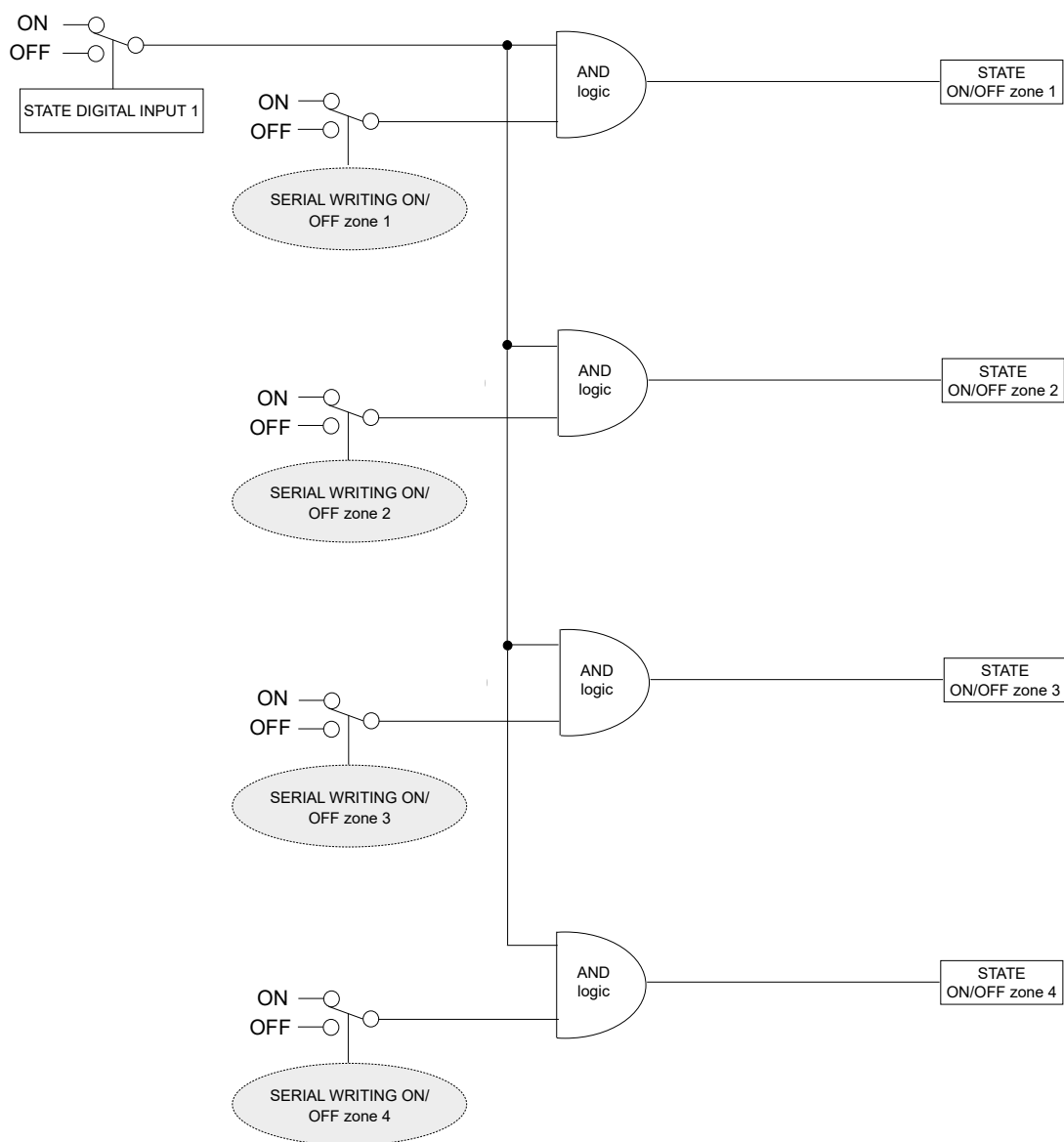
ALARMS

GENERIC ALARMS AL1, AL2, AL3 and AL4

Four generic alarms are always available and can perform various functions.
Typically, alarm AL.1 is defined as minimum and AL.2 as maximum.
These alarms are set as follows:

- select the reference variable to be used to monitor the value (parameters A1.r, A2.r, A3.r and A4.r): the origin of the variable can be chosen from the process variable PV (generally linked to the main input), the ammeter input, the voltmeter input, the auxiliary analog input, or the active setpoint.

- set the value of the alarm setpoint (parameters AL.1, AL.2, AL.3 and AL.4).
This value is used for comparison with the reference variable value: it can be absolute or indicate a shift from the variable in case of deviation alarm.

- set the hysteresis value for the alarm (parameters Hy.1, Hy.2, Hy.3 and Hy.4):
the hysteresis value defines a band for safe re-entry of the alarm condition: without this band, the alarm would be deactivated as soon as the reference variable re-entered the setpoint limits, with the possibility of generating another alarm signal in the presence of oscillations of the reference signal around the setpoint value.

- select alarm type:
- absolute/deviation: if the alarm refers to an absolute value or to another variable (for example, to the setpoint).
- direct/reverse: if the reference variable exceeds the alarm setpoint in the "same direction" as the control action or not. For example, the alarm is direct if the reference variable exceeds the upper setpoint value during heating or assumes values below the lower setpoint during cooling. In the same manner, the alarm is reverse if the reference variable assumes values below the lower setpoint during heating or exceeds the setpoint during cooling.
- normal/symmetrical: if band value is subtracted or added, respectively, to/from the upper and lower limit of the alarm setpoints or indicates a higher and lower band compared to the alarm setpoint.
- with/without disabling at switch-on: if you want to check the reference variable value at system switch-on or wait until the variable enters the control window.
- with/without memory: if the alarm signal persists even when the cause has been eliminated or stops when the variable returns to normal values.

- definition of upper and lower limits for setting absolute alarms: if the alarm is used to check that the operator does not set a setpoint value outside a certain band during multiset operation. The above concepts are better explained in the following figures:

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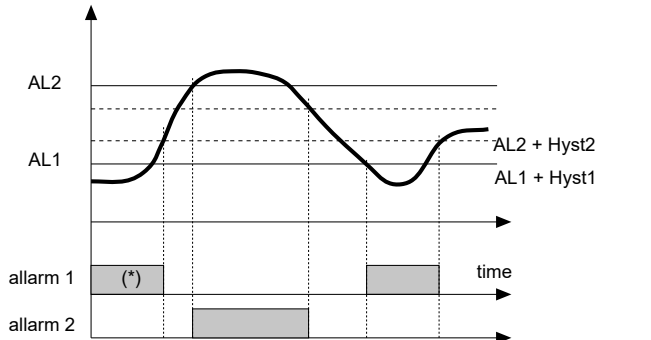
For AL1 reverse absolute alarm (low) with positive Hyst1, AL1 t = 1 (*) = OFF if disabled at switch on
For AL2 direct absolute alarm (high) with negative Hyst2, AL2 t = 0

Symmetrical absolute alarm
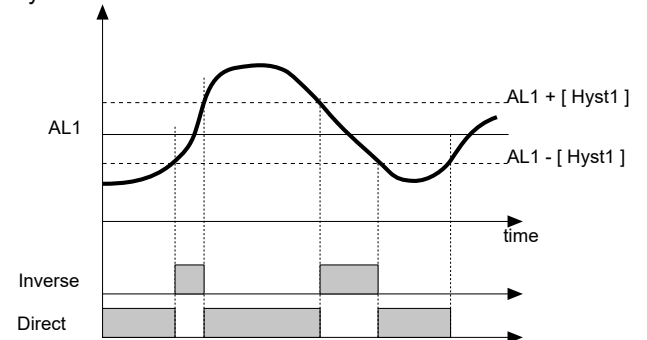
For AL1 = symmetrical inverse absolute alarm with Hyst1, AL1 t = 5
For AL1 = symmetrical direct absolute alarm with Hyst1, AL1 t = 4
Minimum hysteresis = 2 scale points

Deviation alarm
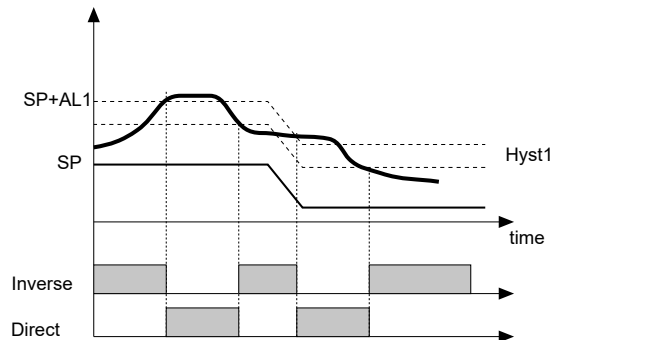
For AL1 = normal inverse deviation alarm with negative Hyst 1, AL1 t = 3
For AL1 = normal direct deviation alarm with negative Hyst 1, AL1 t = 2

Symmetrical deviation alarm
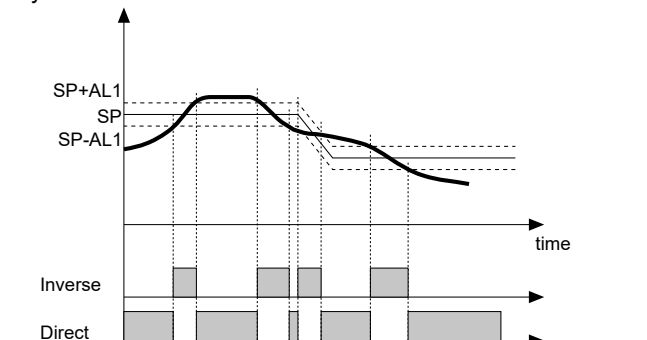
For AL1 = Symmetrical inverse deviation alarm with Hyst 1, AL1 t = 7
For AL1 = Symmetrical direct deviation alarm with Hyst 1, AL1 t = 6

Reference variables

215	A1.r	R/W	Select reference variable alarm 1		*Table of alarm reference setpoints*	0
216	A2.r	R/W	Select reference variable alarm 2			0
217	A3.r	R/W	Select reference variable alarm 3			0
218	A4.r	R/W	Select reference variable alarm 4			0

	Variable to be compared	Reference setpoint
0	PV (process variable)	AL
1	in.tA1 (In.tA1 OR In.tA2 OR In.tA3 WITH 3-PHASE LOAD)	AL
2	In.tV1 (In.tV1 OR In.tV2 OR In.tV3 WITH 3-PHASE LOAD)	AL
3	SPA (active setpoint)	AL (absolute only)
4	PV (process variable)	AL [deviation only and referred to SP1 (with multiset function)
5	In.2 auxiliary input	AL

N.B. for codes 1, 2 and 5, the reference to the alarm is in scale points and not to the decimal point (d.P)

Alarm setpoints

12 475 - 177	AL.1	R/W	*Alarm setpoint* 1 (scale points)	-1999...9999 scale points	-999...999 If symmetrical alarm 0...999 If symmetrical and relative alarm	500
13 476 - 178	AL.2	R/W	Alarm setpoint 2 (scale points)	-1999...9999 scale points	-999...999 If symmetrical alarm 0...999 If symmetrical and relative alarm	100
14 52 - 479	AL.3	R/W	Alarm setpoint 3 (scale points)	-1999...9999 scale points	-999...999 If symmetrical alarm 0...999 If symmetrical and relative alarm	700
58 480	AL.4	R/W	Alarm setpoint 4 (scale points)	-1999...9999 scale points	-999...999 If symmetrical alarm 0...999 If symmetrical and relative alarm	800

Alarms hysteresis

27 187	HY.1	R/W	*Hysteresis* for alarm 1	± 999 Scale points	0...999 sec. Se +32 in A1.t 0...999 min. Se +64 in A1.t	- 1
30 188	HY.2	R/W	Hysteresis for alarm 2	± 999 Scale points	0...999 sec. Se +32 in A2.t 0...999 min. Se +64 in A2.t	- 1
53 189	HY.3	R/W	Hysteresis for alarm 3	± 999 Scale points	0...999 sec. Se +32 in A3.t 0...999 min. Se +64 in A3.t	- 1
59	HY.4	R/W	Hysteresis for alarm 4	± 999 Scale points	0...999 sec. Se +32 in A4.t 0...999 min. Se +64 in A4.t	- 1

Alarm type

406	A1.t	R/W	Alarm type 1			0
407	A2.t	R/W	Alarm type 2			0
408 54	A3.t	R/W	Alarm type 3			0
409	A4.t	R/W	Alarm type 4			0

Table of alarm behaviour

	Direct (high limit) Inverse (low limit)	Absolute Relative to activfe setpoint	Normal Symmetrical (window)
0	direct	absolute	normal
1	inverse	absolute	normal
2	direct	relative	normal
3	inverse	relative	normal
4	direct	absolute	symmetrical
5	inverse	absolute	symmetrical
6	direct	relative	symmetrical
7	inverse	relative	symmetrical

+ 8 to disable at switch-on until first setpoint
+ 16 to enable memory latch
+ 32 Hys becomes delay time for activation of alarm (0...999 sec.)
  (excluding absolute symmetrical)
+ 64 Hys becomes delay time for activation of alarm (0...999 min.)
  (excluding absolute symmetrical)
+ 136 to disable at switch-on or at change of setpoint until first setpoint
+ 256 only for alarms with memory and delay time: the delay time becomes
  a timed hysteresis (with time stopped in case of SBR condition: when SBR
  condition disappears the delay time starts counting from zero)

46 bit	AL1 direct/inverse	R/W	
47 bit	AL1 absolute/relative	R/W	
48 bit	AL1 normal/symmetrical	R/W	
49 bit	AL1 disabled at switch-on	R/W	
50 bit	AL1 with memory	R/W	
54 bit	AL2 direct/inverse	R/W	
55 bit	AL2 absolute/relative	R/W	
56 bit	AL2 normal/symmetrical	R/W	
57 bit	AL2 disabled at switch-on	R/W	
58 bit	AL2 with memory	R/W	
36 bit	AL3 direct/inverse	R/W	
37 bit	AL3 absolute/relative	R/W	
38 bit	AL3 normal/symmetrical	R/W	
39 bit	AL3 disabled at switch-on	R/W	
40 bit	AL3 with memory	R/W	
70 bit	AL4 direct/inverse	R/W	
71 bit	AL4 absolute/relative	R/W	
72 bit	AL4 normal/symmetrical	R/W	
73 bit	AL4 disabled at switch-on	R/W	
74 bit	AL4 with memory	R/W	

Enable alarms

195	AL.n	R/W	Select number of enabled alarms		Table of enabled alarms					3

	Alarm 1	Alarm 2	Alarm 3	Alarm 4
0	disabled	disabled	disabled	disabled
1	enabled	disabled	disabled	disabled
2	disabled	enabled	disabled	disabled
3	enabled	enabled	disabled	disabled
4	disabled	disabled	enabled	disabled
5	enabled	disabled	enabled	disabled
6	disabled	enabled	enabled	disabled
7	enabled	enabled	enabled	disabled
8	disabled	disabled	disabled	enabled
9	enabled	disabled	disabled	enabled
10	disabled	enabled	disabled	enabled
11	enabled	enabled	disabled	enabled
12	disabled	disabled	enabled	enabled
13	enabled	disabled	enabled	enabled
14	disabled	enabled	enabled	enable
15	enabled	enabled	enabled	enabled

| +16 | to enable HB alarm |
| + 32 | to enable LBA alarm |

Reset memory latch

140	diG.	R/W	Digital input function		Digital input functions table		0

618	diG.2	R/W	Digital input 2 function				0

	Digital input functions table
0	No function (input off)
1	MAN /AUTO controller
2	LOC / REM
3	HOLD
4	AL1, ..., AL4 latch alarm reset
5	SP1 / SP2 selection
6	Software on/off
7	Restart Softstart/Dry out
8	START / STOP Selftuning
9	START / STOP Autotuning
10	Power_Fault latch alarm reset
11	LBA alarm reset
12	AL1 ..AL4 and Power_Fault latch alarm reset
13	Enable at software ON (*)
14	Reference calibration of retroaction selected by Hd.6
15	Calibration threshold alarm HB
64	Forced end of the Softstart/Dry out phase
+ 16	for inverse logic input
+ 32	to force logic state 0 (OFF)
+ 48	to force logic state 1 (ON)

(*) For diG. only

79 bit	Reset memory latch	R/W	OFF = - ON = Reset alarm latch

Read state

4 bit	STATE of ALARM 1	R	OFF = Alarm off ON = Alarm on

5 bit	STATE of ALARM 2	R	OFF = Alarm off ON = Alarm on

62 bit	STATE of ALARM 3	R	OFF = Alarm off ON = Alarm on

69 bit	STATE of ALARM 4	R	OFF = Alarm off ON = Alarm on

318		R	State of alarms ALSTATE IRQ		States of alarm table

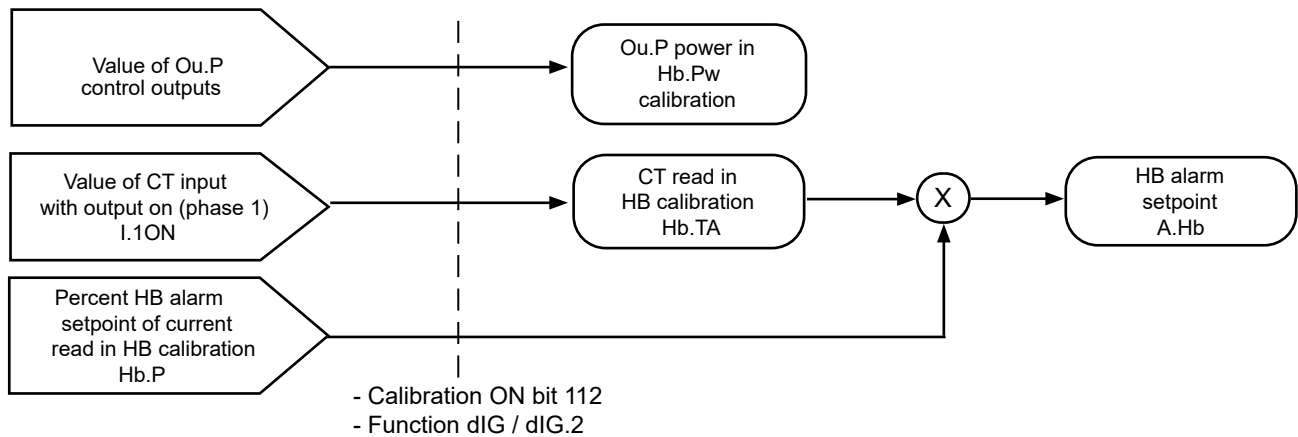| bit	
0	State AL.1
1	State AL.2
2	State AL.3
3	State AL.4
4	State AL.HB (if 3-phase or phase 1/2/3) or Power Fault
5	State AL.HB PHASE 1 (if 3-phase)
6	State AL.HB PHASE 2 (if 3-phase)
7	State AL.HB PHASE 3 (if 3-phase)

FUNCTIONAL DIAGRAM

Alarm setpoint AL1	→ Type of alarm and hysteresis (A1.t, HY.1) → State of alarm AL1
Alarm setpoint AL2	→ Type of alarm and hysteresis (A2.t, HY.2) → State of alarm AL2
Alarm setpoint AL3	→ Type of alarm and hysteresis (A3.t, HY.3) → State of alarm AL3
Alarm setpoint AL4	→ Type of alarm and hysteresis (A4.t, HY.4) → State of alarm AL4

See outputs

PV, SPA, In.2, I.tA1 or I.tA2 or I.tA3, I.tV1 or I.tV2 or I.tV3 → Select reference variable (A1.r, A2.r, A3.r, A4.r)

PV: process variable
SPA: active setpoint
In.2: auxiliary analog input
I.tAx: ammeter input
I.tVx: voltmeter input

LBA ALARM (Loop Break Alarm)

This alarm identifies incorrect functioning of the control loop due to a possible load break or to a short circuited or reversed probe.

With the alarm enabled (parameter AL.n), the instrument checks that in condition of maximum power delivered for a settable time (Lb.t) greater than zero, the value of the process variable increases in heating or decreases in cooling: if this does not happen, the LBA alarm trips. In these conditions, power is limited to value (Lb.P).

The alarm condition resets if the temperature increases in heating or decreases in cooling.

Enable alarm

195	AL.n	R/W	Select number of enabled alarms		*see: Table of enabled alarms*	3
44	Lb.t	R/W	Delay time for tripping of LBA alarm	0.0 ... 500.0 min	If Lb.t = 0, the LBA alarm is disabled	30.0
119	Lb.P	R/W	Limitation of power delivered in presence of LBA alarm	-100.0 ..100.0 %		25.0
81 bit	Reset LBA alarm	R/W	OFF = - ON = LBA alarm reset			

Read state

8 bit	STATE of LBA ALARM	R	OFF = LBA alarm off ON = LBA alarm on

FUNCTIONAL DIAGRAM
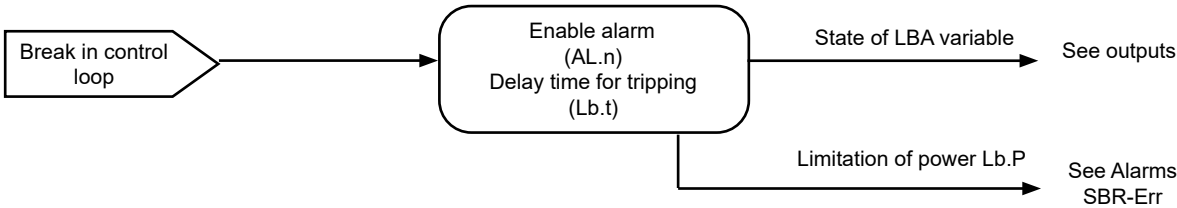
HB ALARM (Heater Break Alarm)

This type of alarm identifies load break or interruption by reading the current delivered by means of a current transformer.

The following three fault situations may occur:

- delivered current is lower than theoretical current: this is the most common situation, and indicates that a load element is breaking.

- delivered current is higher than theoretical current: this situation occurs, for example, due to partial short circuits of load elements.

- delivered current remains significant even during periods in which it should be zero: this situation occurs in the presence of pilot circuits for the short-circuited load or due to relay contacts soldered together. In these cases, prompt action is very important to prevent greater damage to the load and/or to the pilot circuits.

In standard configuration, output OUT1 is associated to heating control in zone 1, obtained by modulating electrical power with the ON/OFF control based on the set cycle time.

The current read performed during the ON phase identifies an anomalous shift from the rated value due to a load break (first two fault situations described above), while the current read performed during the OFF phase identifies a break in the control relay, with consequent output always active (third fault situation).

The alarm is enabled by means of parameter AL.n; select the type of function you want by means of parameter Hb.F:

Hb.F=0: alarm activates if the current load value is below the setpoint value set in A.Hbx while the associated control output is ON.

Hb.F=1: alarm activates if the current load value is above the setpoint value set in A.Hbx while the associated control output is OFF.

Hb.F=2: alarm activates by combining functions 0 and 1, considering the setpoint of function 1 as 12% of the ammeter full scale defined in H.tAx.

Hb.F=3 or Hb.F=7 (continuous alarm): alarm activates due to a load current value below the setpoint value set in A.Hbx; this alarm does not refer to the cycle time and is disabled if the heating (cooling) output value is below 3%.

Setting A.Hbx = 0 disables both types of HB alarm by forcing deactivation of the alarm state.

The alarm resets automatically if its cause is eliminated.

An additional configuration parameter for each zone, related to the HB alarm is:

Hb.t = delay time for activation of HB alarm, understood as the sum of times for which the alarm is considered active.

For example, with:

- Hb.F = 0 (alarm active with current below setpoint value),
- Hb.t = 60 sec and cycle time of control output = 10 sec,
- power delivered al 60%,

the alarm will activate after 100 sec (output ON for 6 sec each cycle);

if power is delivered at 100%, the alarm will activate after 60 sec.

If the alarm deactivates during this interval, the time sum is reset.

The delay time set in Hb.t must exceed the cycle time of the associated output.

If zone 1 has a 3-phase load, you can set three different setpoints for the HB alarm:

A.Hb1= alarm setpoint for line L1

A.Hb2= alarm setpoint for line L2

A.Hb3= alarm setpoint for line L3

For loads such as IR lamps, with high temperature coefficient, the HB alarm is disabled when delivered power is below 20% (ZC,BF,HSC modality) or 5% (PA modality).

Function: HB alarm setpoint self-learning

This function permits self-learning of the alarm setpoint.

To use this function, you first have to set parameter Hb.P, which defines the percentage of current compared to rated load below which the alarm trips.

The function can be activated via control from serial line or digital input (see parameter dIG or dIG.2)

When the Teach-in function is activated in modes ZC, BF and HSC, the RMS current value in conduction ON multiplied by parameter Hb.P determines the HB alarm setpoint.

When the Teach-in function is activated in mode PA, the existing RMS current value is shown at 100% of power, which, multiplied by parameter Hb.P, determines the HB alarm setpoint.

For IR lamps (see parameter Hd.5 option +128), the function activates automatic reading of the power/current curve useful for determining the HB alarm setpoint.

Automatic reading of the power/current curve takes place with the following sequence:

- softstart at maximum power (default 100%), 5 sec. delay
- reduction of power to 50%,30%, 20%, 10%, 5%, between each value 5 sec. delay
- return to normal operation.

The maximum value of conduction in this phase can be restricted through the PS.Hi. If required, must be enabled only with Hd. 6 = 0 (only after calibration, you can set the desired value Hd. 6)

Enable alarm

195	AL.n	R/W	Select number of enabled alarms		*See: Table of enable alarms*	3

57	Hb.F	R/W	HB alarm functions		*Table of HB alarm functions*	0

Default:
SINGLE-PHASE LOAD: each A.HbX refers to its respective phase.
2-PHASE LOAD: single reference setpoint A.Hb1 and OR between phases 1, 2 and phases 3, 4.
3-PHASE LOAD: single reference setpoint A.Hb1 and OR among phases 1, 2 and 3.

+ 8 HB reverse alarm
+ 16 relates to single setpoints and singled phases WITH 3-PHASE LOAD

0	Relay, logic output: alarm active at a load current value below set point for control output ON time.
1	Relay, logic output: alarm active at a load current value above set point for control output OFF time.
2	Alarm active if one of functions 0 and 1 is active (OR logic between functions 0 and 1) **(*)**
3	Continuous heating alarm
7	Continuous cooling alarm
(*) minimum setpoint is set at 12% of ammeter full scale	

56	Hb.t	R/W	Delay time for activation of HB alarm	0 ... 999 sec	The value must exceed the cycle time of the output to which the HB alarm is associated.	30

464		R/W	STATUS 11_W		Table settings STATUS 11_W (*)	0

bit		(*) To safeguard the other bit, writing should be done starting from the reading going to change only the bit interested.
5	Feedback calibration	
6	HB alarm calibration	

Alarm setpoints

55	A.Hb1	R/W	HB alarm setpoint (scale points ammeter input - Phase 1)			10.0
502	A.Hb2	R/W	HB alarm setpoint (scale points ammeter input - Phase 2)		With 3-phase load	10.0
503	A.Hb3	R/W	HB alarm setpoint (scale points ammeter input - Phase 3)		With 3-phase load	10.0

NB: In case of 3-phase load, you can set a different value for parameter A.Hb1, A.Hb2, A.Hb3 for each zone (ex.: to control an unbalanced 3-phase load).

737	Hb.P	R/W	Percentage HB alarm setpoint of current read in HB calibration	0.0 ... 100.0%		80.0
112 bit	Calibration HB alarm setpoint for zone	R/W	OFF = Calibration not enabled ON = Calibration enabled			
742	Hb.tA	R	CT read in HB calibration			0.0
743	Hb.Pw	R	Ou.P power in HB calibration			0.0
758	Ir.00	R/W	HB Calibration with IR lamp: current at 100% conduction			0.0
759	Ir.01	R/W	HB Calibration with IR lamp: current at 50% conduction			0.0
760	Ir.02	R/W	HB Calibration with IR lamp: current at 30% conduction			0.0
761	Ir.03	R/W	HB Calibration with IR lamp: current at 20% conduction			0.0
767	Ir.04	R/W	HB Calibration with IR lamp (only for PA modality): current at 15% conduction			0.0
768	Ir.05	R/W	HB Calibration with IR lamp (only for PA modality): current at 10% conduction			0.0
769	Ir.06	R/W	HB Calibration with IR lamp (only for PA modality): current at 5% conduction			0.0

Read state

744	Hb.tr	R	HB alarm setpoint as function of power on load	

26 bit	HB ALARM STATE OR POWER_FAULT	R	OFF = Alarm off ON = Alarm on

76 bit	State of HB alarm phase 1	R	
77 bit	State of HB alarm phase 2	R	with 3-phase loads
78 bit	State of HB alarm phase 3	R	with 3-phase loads

504		R	HB alarm states ALSTATE_HB (for 3-phase loads)

Table of HB alarm states

bit	
0	HB TA2 time ON
1	HB TA2 time OFF
2	HB alarm TA2
3	HB TA3 time ON
4	HB TA3 time OFF
5	HB alarm TA3

512		R	States of alarm ALSTATE

Table of alarm states ALSTATE

bit	
4	HB alarm time ON
5	HB alarm time OFF
6	HB alarm

318		R	State of alarms ALSTATE IRQ

States of alarm table

bit	
0	State AL.1
1	State AL.2
2	State AL.3
3	State AL.4
4	State AL.HB (if 3-phase or phase 1/2/3) or Power Fault
5	State AL.HB PHASE 1 (if 3-phase)
6	State AL.HB PHASE 2 (if 3-phase)
7	State AL.HB PHASE 3 (if 3-phase)

FUNCTIONAL DIAGRAM

HB Alarm

Alarm setpoint Hb.tr zone 1	
I.1on	
Alarm setpoint Hb.tr zone 2 (*)	Function of HB alarm and time for activation of HB alarm (Hb.F, Hb.t)
I.2on	
Alarm setpoint Hb.tr zone 3 (*)	
I.3on	

State of alarm HB phase 1

State of alarm HB phase 2 (*)

State of alarm HB phase 3 (*)

See outputs

(*) - Only for 3-phase applications

NOTE:

the value of setpoint Hb.tr for the HB alarm is calculated in two different ways, depending on the selected function mode:

if ZC, BF, HSC mode: .... Hb.tr = A.Hb

if PA mode .... Hb.tr = A.Hb $* \sqrt{(Ou.P)}$

HB Calibration in modes ZC - BF - HSC

Value of Ou.P control outputs	Ou.P power in Hb.Pw calibration
Value of CT input with output on (phase 1) I.1ON	CT read in HB calibration Hb.TA
Percent HB alarm setpoint of current read in HB calibration Hb.P	

X → HB alarm setpoint A.Hb

- Calibration ON bit 112
- Function dIG / dIG.2

HB Calibration in mode PA

Value of Ou.P control outputs	Ou.P power in Hb.Pw calibration
Value of CT input with output on (phase 1) I.1ON	
Percent HB alarm setpoint of current read in HB calibration Hb.P	

X → *(Load current referred to 100% of conduction)* CT read in HB calibration Hb.TA → X → HB alarm setpoint A.Hb

- Calibration ON bit 112
- Function dIG / dIG.2

ALARM SBR - ERR (probe in short or connection error)

This alarm is always ON and cannot be deactivated. It controls correct functioning of the probe connected to the main input.

In case of broken probe:
- the state of alarms AL1, AL2, AL3 and AL4 is set based on the value of parameter rEL;
- control power control is set to the value of parameter FAP.

Identification of the type of break detected on the main input is contained in Err.

Enable alarm

229	REL	R/W	Fault action (definition of state in case of broken probe) Sbr, ERR Only for main input						0

Table of probe alarm settings

	Alarm1	Alarm2	Alarm3	Alarm4
0	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

228	FA.P	R/W	Fault action power (supplied in conditions of broken probe)	-100.0 ..100.0 %	see: HOT RUNNERS CONTROL	0.0

Read state

85	Err	R	Error code in self-diagnostics of main input	See: Table of error codes

9 bit	STATE OF INPUT IN SBR	R	OFF = - ON = Input in SBR

Power Fault ALARMS (SSR_SHORT, NO_VOLTAGE, SSR_OPEN and NO_CURRENT)

| 660 | hd.2 | R/W | *Enable POWER_FAULT alarms* | | 0 |

Table of Power Fault alarms

	SSR_ SHORT	NO_ VOLTAGE	NO_CURRENT
0			
1	X		
2		X	
3	X	X	
4			
5	X		
6		X	
7	X	X	
8			X
9	X		X
10		X	X
11	X	X	X
12			X
13	X		X
14		X	X
15	X	X	X

+ 32 alarms with memory

661	dG.t	R/W	Refresh rate SSR SHORT The alarm activates after 3 seconds.	1...999 sec	10
662	dG.F	R/W	Time filter for NO_VOLTAGE, SSR_OPEN and NO_CURRENT alarms Note: set a value not less than cycle time.	0...99 sec	10
105 bit	Reset SSR_SHORT / NO_VOLTAGE / NO_ CURRENT alarms	R/W	OFF = - ON = Reset memory		

Read state

96 bit	State of alarm SSR_SHORT phase 1	R	OFF = Alarm disabled ON = Alarm active	
97 bit	State of alarm SSR_SHORT phase 2	R	OFF = Alarm disabled ON = Alarm active	With 3-phase load
98 bit	State of alarm SSR_SHORT phase 3	R	OFF = Alarm disabled ON = Alarm active	With 3-phase load
99 bit	State of alarm NO_VOLTAGE phase 1	R	OFF = Alarm disabled ON = Alarm active	
100 bit	State of alarm NO_VOLTAGE phase 2	R	OFF = Alarm disabled ON = Alarm active	With 3-phase load
101 bit	State of alarm NO_VOLTAGE phase 3	R	OFF = Alarm disabled ON = Alarm active	With 3-phase load
102 bit	State of alarm NO_CURRENT phase 1	R	OFF = Alarm disabled ON = Alarm active	
103 bit	State of alarm NO_CURRENT phase 2	R	OFF = Alarm disabled ON = Alarm active	With 3-phase load
104 bit	State of alarm NO_CURRENT phase 3	R	OFF = Alarm disabled ON = Alarm active	With 3-phase load

Overheat alarm

The controller has a temperature sensor for the internal heatsink.   The temperature value of the heatsink is in variable INPTC; the over_heat alarm trips when the temperature exceeds 85°C.

This condition may be caused by obstructed air vents or by a blocked cooling fan.

The over-heat alarm is cancelled when the heat sink temperature falls below the value of 75°C.

With the over_heat alarm on, the control disables control outputs OUT 1, OUT 2, OUT 3 and OUT 4.

It's provided the intervention of the alarm also for speed increase (derivative) of the temperature INPTC greater than 7°C in 12 seconds.

There is another maximum temperature protection that disables the hardware for the SSR controls.

655		R	INPTC SSR temperature		°C
675		R	INPTC_DER derivative of temperature SSR		°C/12sec

OUTPUTS

The modular power controller has high flexibility in the assignment of functions to the physical outputs. As a result, the instrument can be used in sophisticated applications.

A function is assigned to each physical output in two steps: first assign the function to one of internal reference signals rL.1 .. rL.6, and then attribute the reference signal to parameters out.1 .. out.10 (corresponding to physical outputs OUT1 .. OUT10).

The physical outputs Out5, Out6, Out7, Out8 are optional and the type of output is determined by the order code (relay, digital, continuous analogue, triac and 12 bit analogue). In standard configuration, these outputs perform the heating control function (Heat) for zone 1, zone 2, zone 3 and zone 4, respectively; value 0 (function HEAT) is assigned to reference signals rL.1 in each zone, and the following values to the output parameters: out.1=1 (output rL.1 zone 1), out.2=2 (output rL.1 zone 2), out.3=3 (output rL.1 zone 3) and out.4=4 (output rL.1 zone 4).

Physical outputs Out5, Out6, Out7, Out8 are optional, and the type (relay, logic, continuous or triac) is defined by the order code. In standard configuration, these outputs perform the cooling control function (Cool) for zone 1, zone 2, zone 3 and zone 4, respectively. In this configuration, value 1 (function COOL) is assigned to reference signals rL.2 in each zone, and the following values to the output parameters: out.5=5 (output rL.2 zone 1), out.6=6 (output rL.2 zone 2), out.7=7 (output rL.2 zone 3) and out.8=8 (output rL.2 zone 4).

Relay outputs Out9 and Out10 are always present, programmable by means of parameters out.9 and out.10, to which available alarm signal functions are assigned by means of the four reference signals rL.3, rL.4, rL.5, rL.6 in each zone.

Standard configuration has the following assignments:
- reference signals: rL.3=2 (function AL1), rL.4=3 (function AL2), rL.5=4 (function AL3) and rL.6=5 (function AL.HB or POWER_FAULT with HB alarm).
- output parameters: out.9 =17 and out.10 =18.

In this way, the state of output physical Out9 is given by the logic OR of AL1, AL3 in each zone, and the state of output Out10 is given by the logic AND of AL2, AL.HB in each zone.

Each output can always be disabled by setting parameter out.x = 0.

The state of outputs Out1,...,Out10 can be acquired by serial communication by means of bit variables.

The following additional configuration parameters are related to the outputs:

Ct.1 = cycle time for output rL.1 for heating control (Heat)

Ct.2 = cycle time for output rL.2 for cooling control (Cool)

rEL = alarm states AL1, AL2, AL3, AL4 in case of broken probe, Err, Sbr

(see: SETTINGS)	
(see: SETTINGS)	
(see: GENERIC ALARMS)	

ALLOCATION OF REFERENCE SIGNALS

160	rL.1	R/W	Allocation of _reference signal_

163	rL.2	R/W	Allocation of reference signal

NOTE: Parameters rL.1, ..., rL.6 for each zone can be considered as internal states.
Ex.: To assign alarm AL1 to physical output OUT5, assign rL.1-Zone1=2 (AL1-alarm 1) and than assign parameter out.5=1 (rL.1-Zone1)

	Table of reference signals	0
0	HEAT (heating control output) / in case of continuous output 0...20mA / 0...10V	
1	COOL (cooling control output) / in case of continuous output 0...20mA / 0...10V	1
2	AL1 - alarm 1	
3	AL2 - alarm 2	
4	AL3 - alarm 3	
5	AL.HB or POWER_FAULT with HB alarm (TA1 OR TA2 OR TA3)	
6	LBA - LBA alarm	
7	IN1 – repetition of logic input DIG1	
8	AL4 - alarm 4	
9	AL1 or AL2	
10	AL1 or AL2 or AL3	
11	AL1 or AL2 or AL3 or AL4	
12	AL1 and AL2	
13	AL1 and AL2 and AL3	
14	AL1 and AL2 and AL3 and AL4	
15	AL1 or AL.HB or POWER_FAULT with HB alarm (TA1 OR TA2 OR TA3)	
16	AL1 or AL2 or (AL.HB or POWER_FAULT) with HB alarm (TA1 OR TA2 OR TA3)	
17	AL1 and (AL.HB or POWER_FAULT) with HB alarm (TA1 OR TA2 OR TA3)	
18	AL1 and AL2 and (AL.HB or POWER_FAULT) with HB alarm (TA1 OR TA2 OR TA3)	
19	AL.HB - HB alarm (TA2)	
20	AL.HB - HB alarm (TA3)	
21	Setpoint power alarm	
22	AL.HB - HB alarm (TA1)	
23	POWER_FAULT	
24	IN2 - repetition of logic input DIG2	
29	Communication error	
64	HEAT (heating control output) with fast cycle time 0.1 ... 20.0sec. / in case of continuous output 4...20mA / 2...10V	
65	COOL (cooling control output) with fast cycle time0.1 ... 20.0sec. / in case of continuous output 4...20mA / 2...10V	

+ 32 for logic level denied in output
+ 128 to force output to zero

NOTE: continuous COOL OUTPUTS can be assigned codes 0, 1, 64 and 65 only, with cycle time fixed at 100 ms

NOTE: In the case of OUTPUT W (12bit analogue outputs) these references are not considered.

166	rL.3	R/W	Allocation of reference signal
170	rL.4	R/W	Allocation of reference signal
171	rL.5	R/W	Allocation of reference signal
172	rL.6	R/W	Allocation of reference signal

2	AL1 - alarm 1	2
3	AL2 - alarm 2	
4	AL3 - alarm 3	
5	AL.HB or POWER_FAULT with HB alarm (TA1 OR TA2 OR TA3)	35
6	LBA - LBA alarm	
7	IN1 - repetition of logic input DIG1	
8	AL4 - alarm 4	4
9	AL1 or AL2	
10	AL1 or AL2 or AL3	
11	AL1or AL2 or AL3 or AL4	
12	AL1 and AL2	160
13	AL1 and AL2 and AL3	
14	AL1 and AL2 and AL3 and AL4	
15	AL1 or AL.HB or POWER_FAULT with HB alarm (TA1 OR TA2 OR TA3)	
16	AL1 or AL2 or (AL.HB or POWER_FAULT) with HB alarm (TA1 OR TA2 OR TA3)	
17	AL1 and (AL.HB or POWER_FAULT) with HB alarm (TA1 OR TA2 OR TA3)	
18	AL1 and AL2 and (AL.HB or POWER_FAULT) with HB alarm (TA1 OR TA2 OR TA3)	
19	AL.HB - HB alarm (TA2)	
20	AL.HB - HB alarm (TA3)	
21	Setpoint power alarm	
22	AL.HB - HB alarm (TA1)	
23	POWER_FAULT	
24	IN2 - repetition of logic input DIG2	
28	State SoftStart/DryOut	
29	Communication error	

+ 32 for denied logic level at output
+ 128 to force output to zero

152 9	Ct.1	R/W	OUT 1 (HEAT) cycle time	1 ...200 sec (0.1 ...20.0 sec)	Set 0 for GTT function *See POWER CONTROL*	0	DIP5 = OFF (resistive load)
						4	DIP5 = ON (inductive load)

159	Ct.2	R/W	OUT 2 (COOL) cycle time	1 ...200 sec (0.1 ...20.0 sec)		20

Read state

308 319		R	State of outputs rL.x MASKOUT	0 ... 63	*Table of output states*

Table of output states

bit	
0	State rL.1
1	State rL.2
2	State rL.3
3	State rL.4
4	State rL.5
5	State rL.6

12 bit	STATE rL.1	R	OFF = Output off ON = Output on
13 bit	STATE rL.2	R	OFF = Output off ON = Output on
14 bit	STATE rL.3	R	OFF = Output off ON = Output on
15 bit	STATE rL.4	R	OFF = Output off ON = Output on
16 bit	STATE rL.5	R	OFF = Output off ON = Output on
17 bit	STATE rL.6	R	OFF = Output off ON = Output on

ALLOCATION OF PHYSICAL OUTPUTS

607	out.1	R/W	Allocation of physical output OUT 1
608	out.2	R/W	Allocation of physical output OUT 2
609	out.3	R/W	Allocation of physical output OUT 3
610	out.4	R/W	Allocation of physical output OUT 4
611	out.5	R/W	Allocation of physical output OUT 5
612	out.6	R/W	Allocation of physical output OUT 6
613	out.7	R/W	Allocation of physical output OUT 7
614	out.8	R/W	Allocation of physical output OUT 8
615	out.9	R/W	Allocation of physical output OUT 9
616	out.10	R/W	Allocation of physical output OUT 10

Table of output allocations	
0	Output disabled
1	Output rL.1 zone 1
2	Output rL.1 zone 2
3	Output rL.1 zone 3
4	Output rL.1 zone 4
5	Output rL.2 zone 1
6	Output rL.2 zone 2
7	Output rL.2 zone 3
8	Output rL.2 zone 4
9	Output rL.3 OR rL.5 zone 1
10	Output rL.3 OR rL.5 zone 2
11	Output rL.3 OR rL.5 zone 3
12	Output rL.3 OR rL.5 zone 4
13	Output rL.4 AND rL.6 zone 1
14	Output rL.4 AND rL.6 zone 2
15	Output rL.4 AND rL.6 zone 3
16	Output rL.4 AND rL.6 zone 4
17	Output (rL.3 OR rL.5) zone 1...zone 4
18	Output (rL.4 OR rL.6) zone 1...zone 4
19	Output rL.3 OR Zona1 to zone 4
20	Output rL.4 OR Zona1 to zone 4
21	Output rL.5 OR Zona1 to zone 4
22	Output rL.6 OR Zona1 to zone 4

	1
	2
	3
	4
	5
	6
	7
	8

+32 to reverse output status only for Logic and Relay output

NOTE: In 3-phase configuration, the state of physical output OUT1 is copied to OUT2 and OUT3. In case of COOL OUTPUT (5,6,7,8) are continuous, the same output functions can not be used on other outputs. Ex: If out.1 = 1 (out rL.1 zone 1) it is not possible to set out.5 with the same code, if out.5 is continuous The attributes of OUT5, OUT6, OUT7 and OUT9 are not considered in the case of OUTPUT W (12bit analogue outputs)	17
	18

Read state

82 bit	State of output OUT1	R	OFF = Output Off ON = Active output
83 bit	State of output OUT2	R	OFF = Output Off ON = Active output
84 bit	State of output OUT3	R	OFF = Output Off ON = Active output
85 bit	State of output OUT4	R	OFF = Output Off ON = Active output
86 bit	State of output OUT5	R	OFF = Output Off ON = Active output
87 bit	State of output OUT6	R	OFF = Output Off ON = Active output
88 bit	State of output OUT7	R	OFF = Output Off ON = Active output
89 bit	State of output OUT8	R	OFF = Output Off ON = Active output
90 bit	State of output OUT9	R	OFF = Output Off ON = Active output
91 bit	State of output OUT10	R	OFF = Output Off ON = Active output

664		R	State of outputs

bit	
0	OUT 1
1	OUT 2
2	OUT 3
3	OUT 4
4	OUT 5
5	OUT 6
6	OUT 7
7	OUT 8
8	OUT 9
9	OUT 10

FUNCTIONAL DIAGRAM

* Only for 3-phase applications
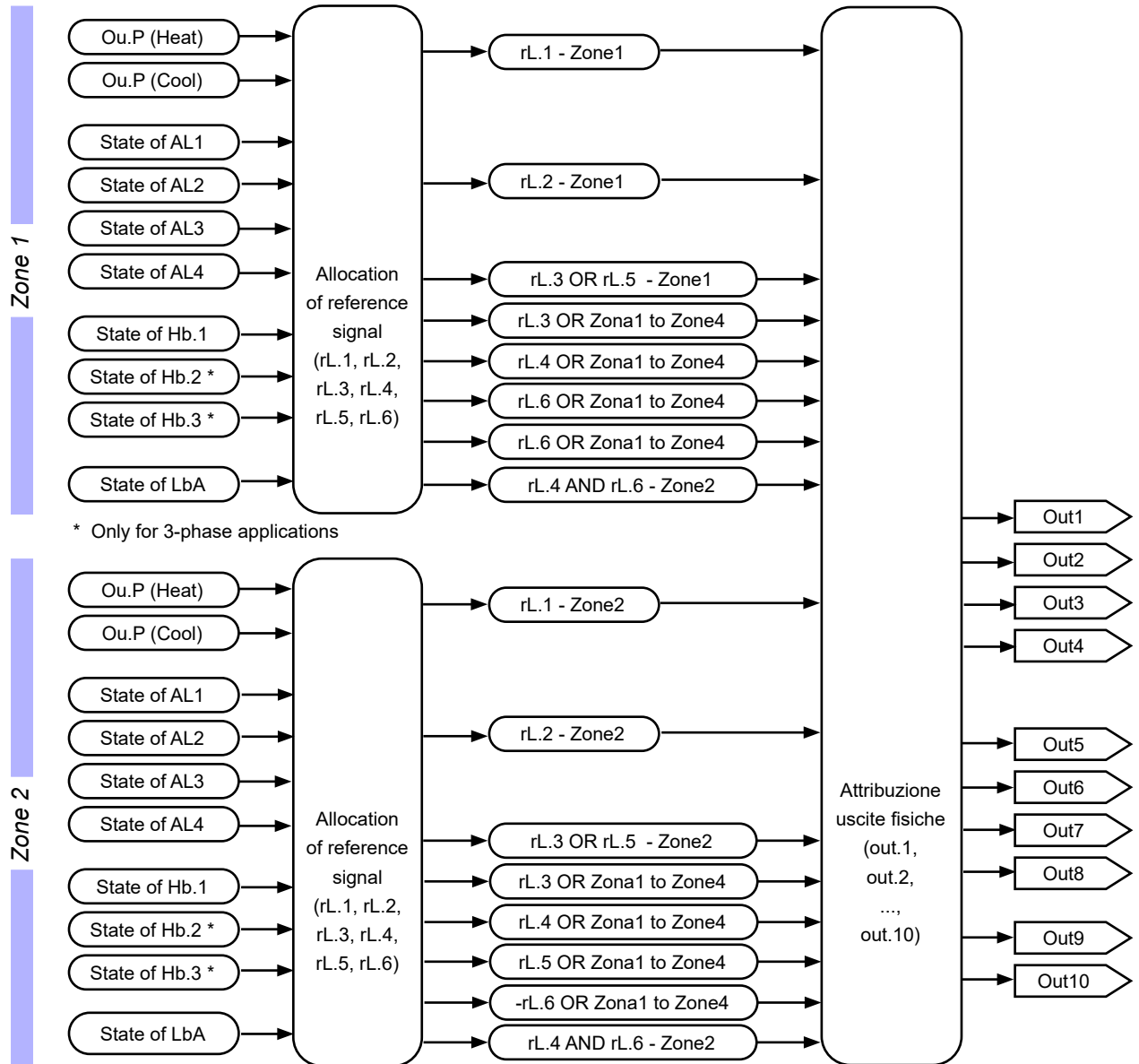
ANALOG OUTPUT

The 4 optional analog outputs let you retransmit the value of analog quantities. The engineering value of the quantity is limited to the set scale values and a reparameterization is applied based on the type of output selected.

Esempio 1:
To retransmit the local SP of zone 2 with a range of 0.0 - 600.0 °C with Analogue output1 (0-10V), set:
tP.AO1=2, rF.AO1=36(4+32), LS.AO1 = 0,0 °C, HS.AO1 = 600,0 °C

Esempio 2:
To retransmit the local SP of zone 1 with a range of 0 - 40 A with Analogue output1 (0-10V), set:
tP.AO1=2, rF.AO1=20 (20+0), LS.AO1 = 0,0 A, HS.AO1 = 600,0 A

865	tP.AO1	R/W	Output type analog 1		Table of analog output types		2
866	tP.AO2	R/W	Output type analog 2	0	0...20 mA output		2
				1	4...20 mA output		
867	tP.AO3	R/W	Output type analog 3	2	0...10 V output		2
				3	2...10 V output		
860	tP.AO4	R/W	Output type analog 4	+16 Inverse output			2

868	rF.AO1	R/W	Attribution reference output analog 1		Tabella segnali di riferimento		0
869	rF.AO2	R/W	Attribution reference output analog 2	0	NONE		32
				1	PV process variable zone 1		
870	rF.AO3	R/W	Attribution reference output analog 3	2	DPV filtered process variable zone 1		64
				3	SPA active setpoint zone 1		
861	rF.AO4	R/W	Attribution reference output analog 4	4	SP local setpoint zone 1		128
				5	IN1 main input zone 1		
				6	IN2 main input zone 2		
				7	DEV deviation |SSP-PV| zone 1		
				8	HEAT zone 1 heat regulation output		
				9	COOL cold output regulation zone 1		
				10	HEAT+COOL hot/cold regulation output zone 1		
				11	AL1 alarm threshold 1 zone 1		
				12	AL2 alarm threshold 2 zone 1		
				13	AL13 alarm threshold 3 zone 1		
				14	AL4 alarm threshold 4 zone 1		
				15	AL.HB HB alarm threshold zone 1		
				16	SERIAL value set by serial line		
				17	I.VF1 line voltage zone 1		
				18	I.1on current with active output zone 1		
				19	d.V voltage on load zone 1		
				20	Ld.A current in load zone 1		
				21	Ld.P power on load zone 1		
				22	Ld.I impedance of load zone 1		
				23	Ld.V.t voltage on three-phase load		
				24	Ld..A.t current in three-phase load		
				25	Ld.P.t power on three-phase load in kW		
				26	Ld.I.t impedance of three-phase load		

Offset by Zone: add a specific offset to retransmit the quantity representing the zone of interest.

+0	Zone1
+32	Zone2
+64	Zone3
+128	Zone4

871	LS.AO1	R/W	Minimum scale limit of analog output 1		0
872	LS.AO2	R/W	Minimum scale limit of analog output 2		0
873	LS.AO3	R/W	Minimum scale limit of analog output 3		0
862	LS.AO1	R/W	Minimum scale limit of analog output 4		0
874	HS.AO1	R/W	Maximum scale limit of analog output 1		1000
875	HS.AO2	R/W	Maximum scale limit of analog output 2		1000
876	HS.AO3	R/W	Maximum scale limit of analog output 3		1000
863	HS.AO4	R/W	Maximum scale limit of analog output 4		1000
856	SERIAL_OUTA1	R/W	Serial line value		0
857	SERIAL_OUTA2	R/W	Serial line value		0
858	SERIAL_OUTA3	R/W	Serial line value		0
859	SERIAL_OUTA4	R/W	Serial line value		0

The controller has the following setpoint controls.

SETTING THE SETPOINT

The active (control) setpoint (SPA) can be set by means of the local setpoint (_SP) or the remote setpoint (SP.rS). A remote setpoint can assume the value of an auxiliary input or one set via serial line (SP.r).

The remote setpoint can be defined in absolute value or relative to the local setpoint; in the latter case, the control setpoint will be given by the algebraic sum of the set local and the remote setpoint.

Local setpoint

138 16 - 472	SP	R/W	*Local setpoint*		Lo.L....HI.L		0

Remote setpoint

181	tP.2	R/W	Auxiliary analog input function		*See: AUXILIARY ANALOG INPUT (LIN/TC)*		0

The remote setpoint can be set by means of the auxiliary analog input by enabling the function with parameter tP.2

18 136 - 249	SP.r	R/W	*Remote setpoint* (SET gradient for manual power correction)				0

Setpoint table

	Type of remote set	Absolute/Relative
0	Digital (from serial line)	Absolute
1	Digital (from serial line)	Relative to local set (_SP o SP1 o SP2)
2	Auxiliary input	Absolute
3	Auxiliary input	Relative to set (_SP o SP1 o SP2)

+4 set gradient in digit/sec.
+8 manual power correction based on line voltage
+16 disables saving of local setpoint _SP
+32 disables saving of local manual power (at switch-off, returns to last value saved)

250	SERIAL_SP	R/W	*Remote Setpoint from serial line*		Lo.L....HI.L		0

Shared settings

25 20 - 28 - 142	Lo.L	R/W	Lower settable limit SP, SP.1, SP.2, SP remote		Lo.S ... Hi.S		0
26 21 - 29 - 143	Hi.L	R/W	Upper settable limit SP, SP.1, SP.2, SP remote		Lo.L ... Hi.S		1000
10 bit	LOCAL/REMOTE	R/W	OFF = Enable local setpoint ON = Enable remote setpoint				

305		R/W	Instrument state (STATUS_W)		*Table of instrument settings*	

bit	
0	-
1	Select SP1/SP2
2	Start/Stop Selftuning
3	Select ON/OFF
4	Select AUTO/MAN
5	Start/Stop Autotuning
6	Select LOC/REM

Read active setpoint

| 1 137 - 481	SPA	R	Active setpoint	
4		R	Deviation (SPA - PV)	

SETPOINT CONTROL

Set gradient

The "Set gradient" function sets a gradual variation of the setpoint, with programmed speed, between two defined values. If this function is active ($g.sp$ other than 0), at switch-on and at auto/man switching the initial setpoint is assumed equal to the PV, and the local or selected set is reached with set gradient. Every variation of set, including variations of the local setpoint, is subject to the gradient.
The value of remote setpoint SP.rS is not saved in eeprom.

The set gradient is inhibited at switch-on when self-tuning is enabled.
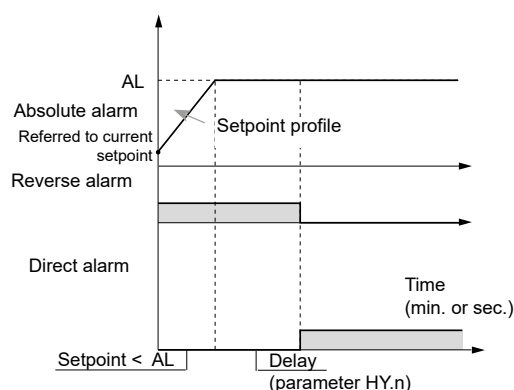
234 22	G.SP	R/W	Set gradient		0.0 ...999.9 digit / min (digit / sec see SP.r)		0.0

259	G.S2	R/W	Set gradient relative to SP2		0.0 ...999.9 digit / min (digit / sec see SP.r)		0.0

265	Hot	R/W	Select hot runner functions		*Table of hot runner functions*		0

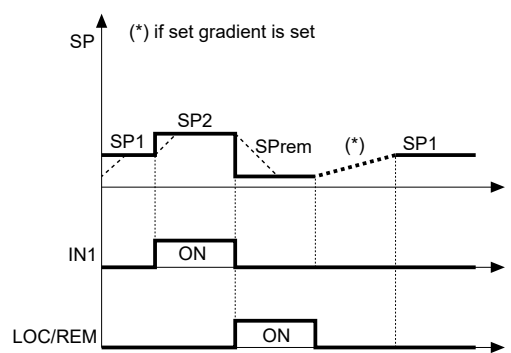|	Enable hot runners	Fault action power if PV is not stabilized	Enable preheating softstart
0		FA.P	
1	X	Average power	
2		FA.P	
3	X	FA.P	
4		FA.P	X
5	X	Average power	X
6		FA.P	X
7	X	FA.P	X
+ 8	enable GS.2		
+ 16	SoftStart in PA mode		
+ 32	enable DryOut Function		

FA.P – see alarm for probe in short or connection error (SBR-ERR)

Multiset

The MULTISET function determines the local setpoint by selecting the value from Setpoint 1 (SP.1) or from Setpoint 2 (SP.2) based on the state of a digital input or by setting from a serial line.

The variation between Setpoint 1 and Setpoint 2 can take place with gradient: parameter G.SP determines the speed for reaching Setpoint 1 and parameter G.S2 defines the speed for reaching Setpoint 2.

The MULTISET function is enabled with parameter hd.1 and automatically enables the gradient function.
Selection between Setpoint 1 and Setpoint 2 can be seen by means of LED.

191	hd.1	R/W	*Enable multiset:* control instruments via serial		*Multiset table*		0

	Enable Multiset	Enable virtual instrument
0		
1	X	
2		X
3	X	X

+16 For Heat/Cool control Ctr only: CT connected to cool output

230 482	SP.1	R/W	Setpoint 1		Lo.L...HI.L		100

231 483	SP.2	R/W	Setpoint 2		Lo.L...HI.L		200

140	diG.	R/W	Digital input function		*See: Table of digital input functions*		0
618	diG.2	R/W	Digital input 2 function		*See: Table of digital input functions*		0

75 bit	SELECT SP1 / SP2	R/W	OFF = Select SP1 ON = Select SP2	

305		R/W	Instrument state (STATUS_W)		*Table of instrument settings*	

bit	
0	-
1	Select SP1/SP2
2	Start/Stop Selftuning
3	Select ON/OFF
4	Select AUTO/MAN
5	Start/Stop Autotuning
6	Select LOC/REM

FUNCTIONAL DIAGRAM
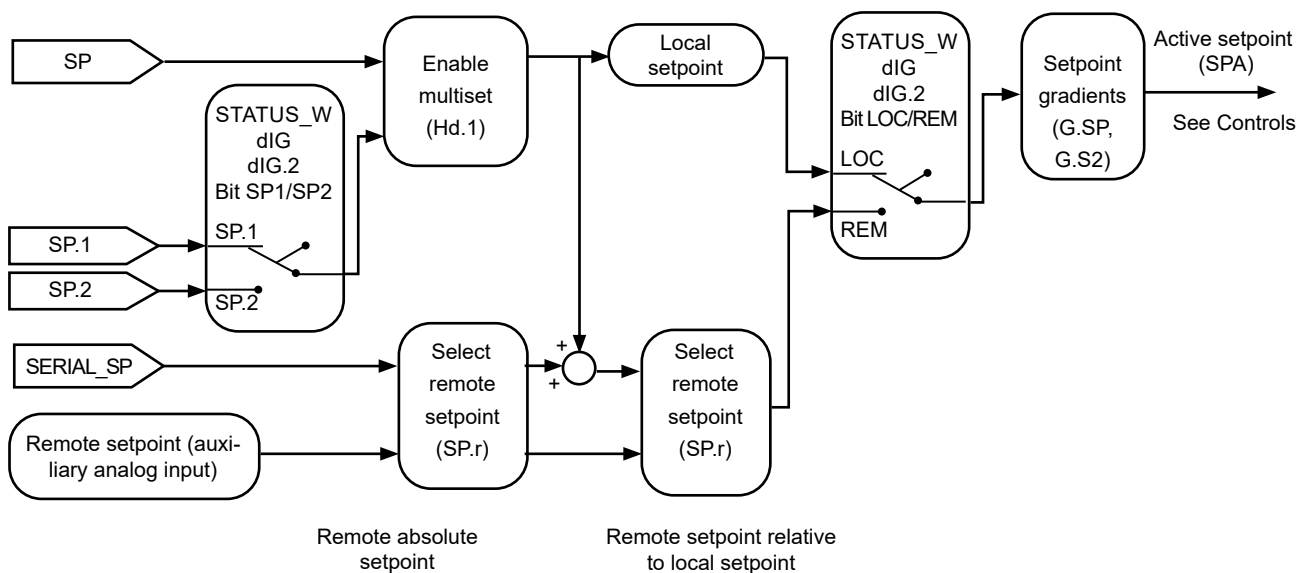
CONTROLS

PID HEAT/COOL CONTROL

The controller can manage a heating output and a cooling output in a completely independent manner. Heating and cooling parameters are described below. Parameters for *PID* (proportional band, integral and derivative time) control are typically calculated by means of Autotuning and Selftuning functions.

Control actions

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

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

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

Proportional, derivative, and integral action

Increasing the proportional band reduces oscillation but increases deviation.
Reducing the proportional band reduces deviation but causes oscillation of the controlled variable (excessively low proportional band values make the system unstable).
An increase in Derivative Action corresponds to an increase in Derivative Time, reduces deviation, and prevents oscillation up to a critical Derivative Time value, beyond which deviation increases and there are prolonged oscillations.
An increase in Integral Action corresponds to a decrease in Integral Time, tends to annul deviation between the controlled variable and the setpoint at rated operating speed.
If the Integral Time value is too long (weak Integral Action), there may be persistent deviation between the controlled variable and the setpoint.

For more information on control actions, contact GEFRAN.

Heat/cool control with separate or superimposed band
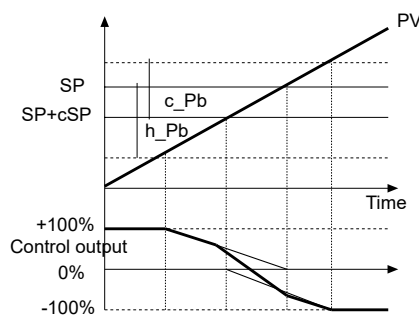
Output with separate band

Control output with only proportional action in case of proportional heating band separate from cooling band.
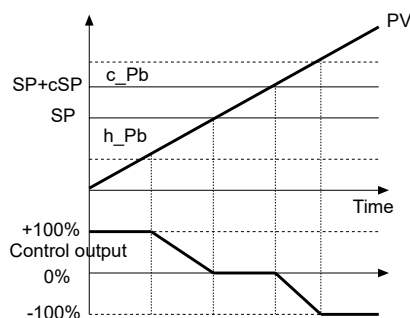
PV = process variable
SP + cSP = cooling setpoint
c_Pb = cooling proportional band

Output with superimposed band

Control output with only proportional action in case of proportional heating band superimposed on cooling band.

PV = process variable
SP = heating setpoint
h_Pb = heating proportional band

Heat/cool control with relative gain

This control mode (enabled with parameter Ctr = 14) asks you to specify cooling type. The _PID_ cooling parameters are then calculated based on heating parameters in the ratio specified (ex: C.ME = 1 (oil), H_Pb = 10, H_dt =1, H_It = 4 implies: C_Pb = 12.5, C_dt = 1 , C_It = 4)

Apply the following values when setting cycle times:

Air   T Cool cycle = 10 sec.
Oil   T Cool cycle = 4 sec.
Water   T Cool cycle = 2 sec.

NB.: Cool parameters cannot be changed in this mode.

PID Parameters

617	SPU	R/W	_Selection of process variable of zone / Zone reference power_	1 zone 1	2 zone 2	3 zone 3	4 zone 4

	Table of selections
1	PV zone 1
2	PV zone 2
3	PV zone 3
4	PV zone 4
9	POWER zone 1 (*)
10	POWER zone 2 (*)
11	POWER zone 3 (*)
12	POWER zone 4 (*)

(*):
- _The reference power of a slave zone in automatic mode is the power of a master zone in automatic or manual mode._
- _The reference power of a slave zone in manual mode is the zone manual power._

180	Ctr	R/W	Control type	6

	Table of heat/cool controls
0	P heat
1	P cool
2	P heat / cool
3	PI heat
4	PI cool
5	PI heat / cool
6	PID heat
7	PID cool
8	PID heat / cool
9	ON-OFF heat
10	ON-OFF cool
11	ON-OFF heat / cool
12	PID heat + ON-OFF cool
13	ON-OFF heat + PID cool
14	PID heat + cool with relative gain (see parameter C.MEd)

Select sample time for derivative action.

+0 sample 1 sec.

+16 sample 4 sec.

+32 sample 8 sec.

+64 sample 240 msec.

+128 No Reset of integral component at setpoint change

Note: the LBA alarm is not enabled in the ON/OFF control.

5 148 - 149	h.Pb	R/W	*Proportional band* for heating or hysteresis ON/OFF		0.0 ...999.9% f.s.		1.0
7 150	h.It	R/W	*Integral heating time*		0.00 ...99.99 min		4.00
8 151	h.dt	R/W	*Derivative heating time*		0.00 ...99.99 min		1.00
6	c.Pb	R/W	*Proportional band* for cooling or hysteresis ON/OFF		0.0 ...999.9% f.s.		1.0
76	c.It	R/W	*Integral cooling time*		0.00 ...99.99 min		4.00
77	c.dt	R/W	*Derivative cooling time*		0.00 ...99.99 min		1.00

Note: Parameters c.PB, c.It and c.dt are read-only if heat/cool control is enabled with relative gain (Ctr = 14).

513	C.ME	R/W	Select cooling fluid	0 ...2			0

|		Relative gain (rG)
0	Air	1
1	Oil	0.8
2	Water	0.4

Read state

The following registers are accessible via serial line:

2 132 - 471	OU.p	R	*Value of control outputs* (+Heat / -Cool)		(W – only in manual mode at address 252)

ADVANCED SETTINGS

39 484	c.Sp	R/W	*Cooling setpoint* relative to heating setpoint		±25.0% f.s.		0.0
78	rSt	R/W	Manual reset (value added to PID input)		-999 ...999 scale points		0
516	P.rS	R/W	*Reset power* (value added directly to PID output)		-100.00.... ....100.0 %		0.0
79	A.rS	R/W	Antireset (limits integral action of PID))		0 ...9999 scale points		0
80	FFd	R/W	Feedforward (value added to PID output after processing)		-100.00.... ....100.0 %		0.0
42 146	h.P.H	R/W	Maximum limit *heating power*		0.0 ...100.0 %		100.0
254	h.P.L	R/W	Minimum limit heating power (not available for double heat/cool action)		0.0 ...100.0 %		0.0
43	c.P.H	R/W	Maximum limit *cooling power*		0.0 ...100.0 %		100.0
255	c.P.L	R/W	Minimum limit cooling power (not available for double heat/cool action)		0.0 ...100.0 %		0.0
765	P.PEr	R/W	Percentage of output power		0.0 ...100.0 %		100.0
766	P.oFS	R/W	Offset of output power		-100.0 ...100.0 %		0.0
763	G.Out	R/W	Gradient for control output		0.0 ...200.0 % sec	set to 0 to disable	0.0
764	Lo.P	R/W	Minimum trigger output		0.0 ...50.0 %		0.0

FUNCTIONAL DIAGRAM
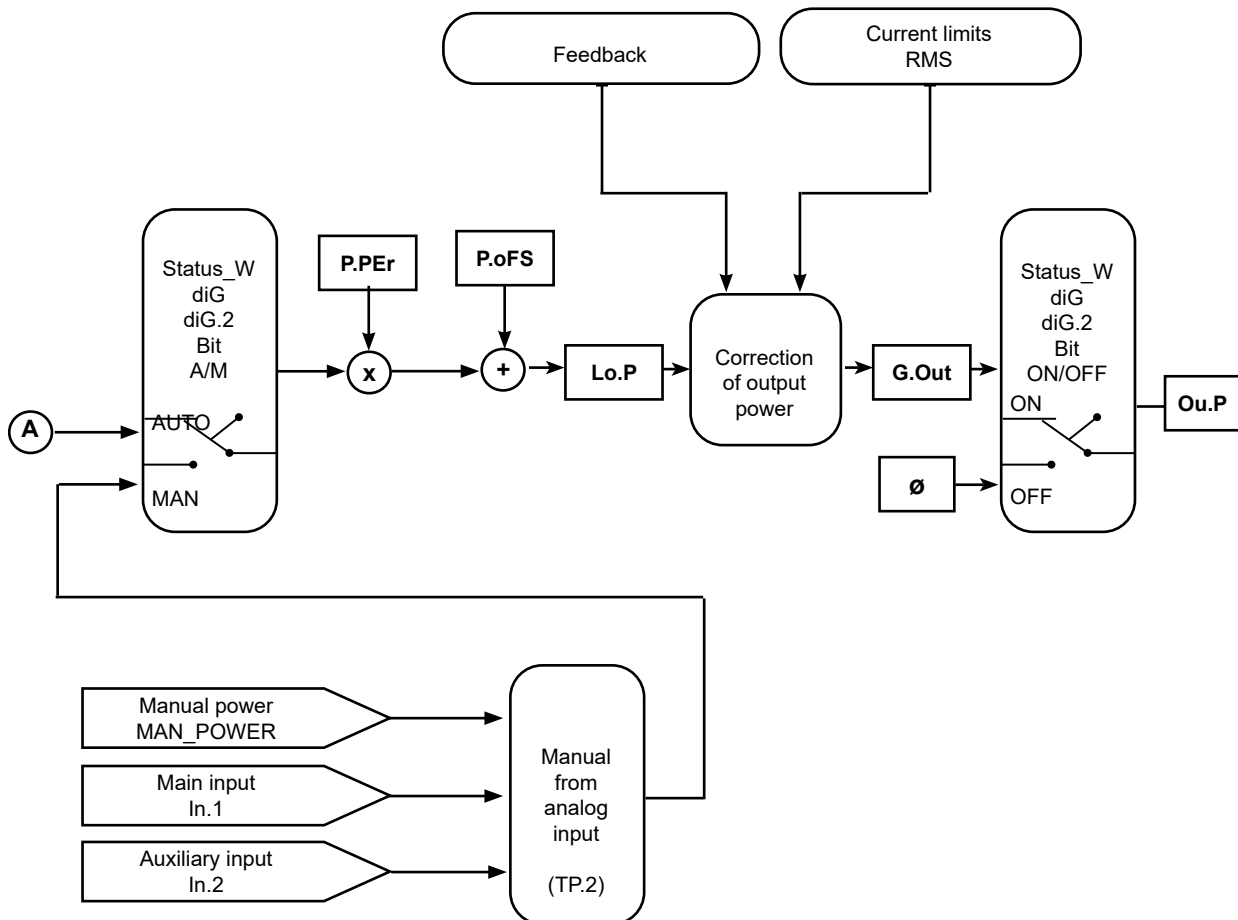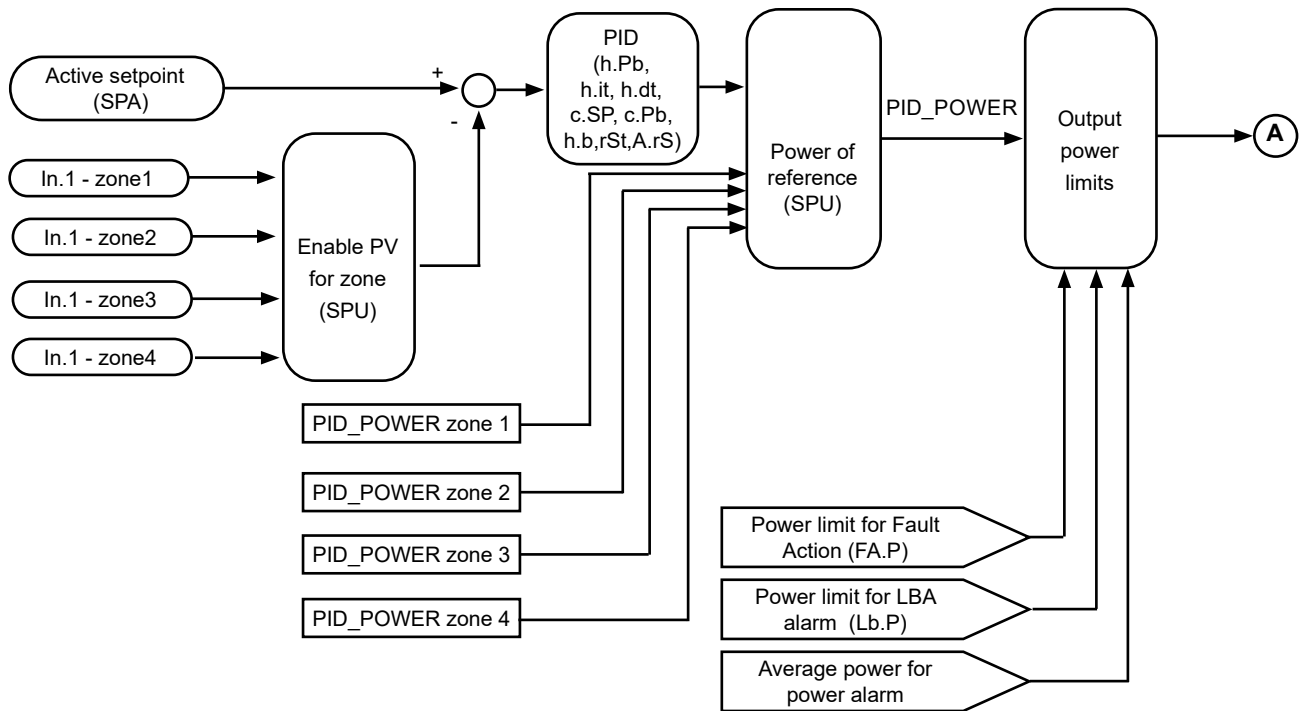
AUTOMATIC / MANUAL CONTROL

By means of the digital input function you can set the controller in MAN (manual) and set the control output to a constant value changeable by means of communication.

When returning to AUTO (automatic), if the variable is within the proportional band, switching is bumpless.

252		R/W	MANUAL_POWER		-100.0...100.0%		0.0
2 132 - 471	Ou.P	R	*Value of control outputs* (+Heat / -Cool)		(W – only in manual mode at address 252)		
140	diG.	R/W	Digital input function		*See: Table of digital input functions*		0
618	diG.2	R/W	Digital input 2 function				0
1 bit	AUTO/MAN	R/W	OFF = Automatic ON =Manual				
305		R/W	Instrument state (STATUS_W)		*See: Table of instrument settings*		

HOLD FUNCTION

The process variable value and the setpoints remain "frozen" for the time the digital input is active.

By activating the digital input with the Hold function when the variable is at values below the setpoint, a setpoint memory reset de-energizes all energized relays and resets all memory latches.

140	diG.	R/W	Digital input function		*See: Table of digital input functions*		0
618	diG.2	R/W	Digital input 2 function				0
64 bit	HOLD	R/W	OFF = Disable hold ON = Enable hold				

MANUAL POWER CORRECTION

With this function (available on models with CV diagnostics option), you can run a correction of power delivered in manual based on the reference line voltage (riF). The % value of the (Cor) is freely settable and acts in inverse proportion.

The function is activated/deactivated by means of parameter SP.r.

Example: with the following settings: Cor = 10%; riF = 380; SP.r = value + 8; instrument in manual; line voltage 380 VAC, manual power set at 50%, following a 10% increase in line voltage, 380V + 10% (380V) = 418V, there is a decrease in set manual power equal to the same % of change: 50% - 10% (50%) = 45%.

To use this function, the controller must have a CT (current transformer) and a VT (voltage transformer).

N.B.: the % change in manual power is limited to the value set in parameter "Cor".

The maximum manual power correction is limited to ± 65%.

505	RIF	R/W	*Line voltage*		0.0 ...999.9		0.0
			Compensation of the voltage transformer read to maintain output power at a constant level.				

506	Cor	R/W	Correction of manual power based on line voltage		0.0 ...100.0 %		0.0

18 136 - 249	SP.r	R/W	*Remote setpoint* (SET gradient for manual power correction)		*Setpoint table*		0

	Type of remote set	Absolute/Deviation
0	Digital (from serial line)	Absolute
1	Digital (from serial line)	Deviation local set (_SP o SP1 o SP2)
2	Auxiliary input	Absolute
3	Auxiliary input	Deviation set (_SP o SP1 o SP2)

+4 set gradient in digit/sec.
+8 correction of manual power based on line voltage
+16 disable saving of local setpoint _SP
+32 disable saving of local manual power (at switch-off returns to last value saved)

MANUAL TUNING

A) Enter the setpoint at its working value.
B) Set the proportional band at 0.1% (with on-off type setting).
C) Switch to automatic and observe the behavior of the varia-ble. It will be similar to that in the figure:
D) The PID parameters are calculated as follows: Proportional band

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

(V max - V min) is the scale range.
Integral time It = 1.5 x T
Derivative time dt = It/4
E) Switch the controller to manual, set the calculated parame-ters (activate the PID control by setting a cycle time for relay outputs, if any), switch to automatic.
F) To assess parameter optimization, change the setpoint value if possible and check temporary behavior. If oscillation persists, increase the value of the proportional band; if respon-se is too slow, decrease the value.
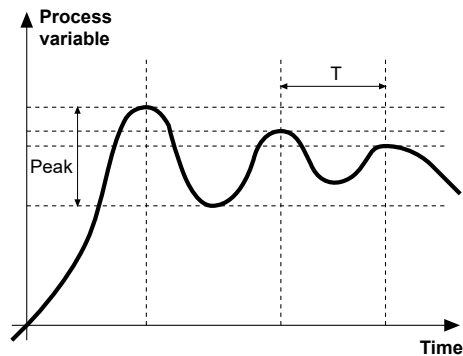
See: CONTROL - PID Parameters

AUTOTUNING

Enabling the autotuning function blocks the settings of the *PID* parameters.
Autotuning continues to measure the system oscillations, seeking as quickly as possible the PID parameter values that reduce the oscillation; it does not intervene if the oscillations drop to values below 1.0% of the proportional band.
It is interrupted if the setpoint is changed, and resumes automatically with a constant setpoint. The calculated parameters are not saved; if the instrument is switched off the controller resumes with the parameters programmed before autotuning was enabled.
Autotuning terminates the procedures with switching to manual.

Enabling the autotuning function blocks the settings of the PID parameters.
It can be two types: continuous or one shot.

Continuous autotunìng is enabled with parameter Stu (values 1, 3, 5); it continues to measure the system oscillations, seeking as quickly as possible the PID parameter values that reduce the oscillation; it does not intervene if the oscillations drop to values below 1.0% of the proportional band.
It is interrupted if the setpoint is changed, and resumes automatically with a constant setpoint.
The calculated parameters are not saved if the instrument is switched off, in case of switching to manual or disabling the code in configuration, and controller resumes with the parameters programmed before autotuning was enabled.
The calculated parameters are saved when the function is enabled via digital input or via A/M key (start /stop) at stop.

One-shot autotuning can be activated manually or automatically with parameter Stu (as can be seen on the table, the values to be set depend on enabling of Selftuning or Softstart).
It is useful for calculating PID parameters when the system is in the vicinity of the setpoint; it produces a variation on the control output of a maximum of ± 100% of the current control power limited by h.PH - h.PL (heat), c.PH - c.PL (cool) and assesses the effects in overshoot over time. The calculated parameters are saved.
Manual activation (code Stu = 8, 10, 12) by setting the parameter directly or via digital input or key.
Automatic activation (code Stu = 24, 26, 28 with error range of 0.5%) when the PV-SP error exceeds the defined range (programmable at 0.5%, 1%, 2%, 4% of full scale).

Activation is inhibited if PV <5% or PV >95% of input scale.

NB: at switch-on after selftuning, after switching to MANUAL, after software shutdown or after a setpoint change, automatic activation is inhibited for an interval equal to five times the integral time, with a minimum of 5 minutes.
An identical interval has to lapse after a one-shot run.

See: CONTROL - PID Parameters

| 31 | S.tu | R/W | *Enable selftuning, autotuning, softstart* | | | *Selftuning, autotuning, softstart table* | | | 0 |

	Autotuning continuous	Selftuning	Softstart
0	NO	NO	NO
1	YES	NO	NO
2	NO	YES	NO
3	YES	YES	NO
4	NO	NO	YES
5	YES	NO	YES
Autotuning One-shot			
8*	WAIT	NO	NO
9	GO	NO	NO
10*	WAIT	YES	NO
11	GO	YES	NO
12*	WAIT	NO	YES
13	GO	NO	YES

(*) +16 with automatic switching in GO if PV-SP > 0.5% f.s.
+32 with automatic switching in GO if PV-SP > 1% f.s.
+64 with automatic switching in GO if PV-SP > 2% f.s.
+128 with automatic switching in GO if PV-SP > 4% f.s.

| 140 | diG. | R/W | Digital input function | | | *See: Table of digital input functions* | | | 0 |

| 618 | diG.2 | R/W | Digital input 2 function | | | | | | 0 |

| 29 bit | AUTOTUNING | R/W | OFF = Stop Autotuning ON = Start Autotuning |

Read state

| 28 bit | AUTOTUNING STATE | R | OFF = Autotuning in Stop ON = Autotuning in Start |

| 68 bit | DIGITAL INPUT 1 | R | OFF = Digital input 1 off ON = Digital input 1 on | | | *See: Table of digital input functions* |

| 92 bit | DIGITAL INPUT 2 | R | OFF = Digital input 2 off ON = Digital input 2 on | | | |

| 296 | | R | Autotuning and selftuning enable state (FLG_PID) | | |

bit	
3	Selftuning on
6	Autotuning on

| 305 | | R/W | Instrument state (STATUS_W) | | | *Table of instrument settings* | | | 0 |

| bit	
0	-
1	Select SP1/SP2
2	Start/Stop Selftuning
3	Select ON/OFF
4	Select AUTO/MAN
5	Start/Stop Autotuning
6	Select LOC/REM

SELFTUNING

This function is valid for single-action (either heat or cool) systems and for double-action (heat/cool) systems.

Selftuning is activated to calculate the best control parameters when starting the process. The variable (example: temperature) must be the one assumed at zero power (room temperature).

The controller supplies the maximum power set until reaching an intermediate point between starting value and the setpoint, then resets power. The _PID_ parameters are calculated by evaluating superelongation and the time needed to reach the peak (**N.B.: This action is not considered in ON/OFF control**).

When the function is completed, it disengages automatically, and the control proceeds to reach the setpoint.

Selftuning

Process variable

S.P.

Peak

$\frac{S.P. - t.a.}{2}$

T

t.a.

Time
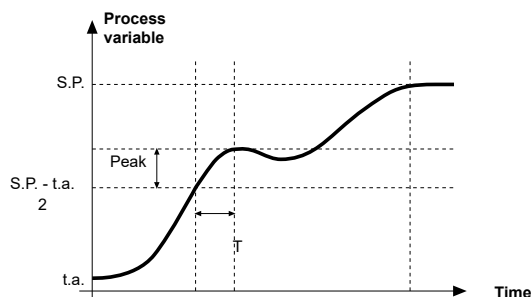
How to activate selftuning:

A. Activation at switch-on
1. Set the setpoint to the desired value.
2. Enable selftuning by setting parameter Stu to 2
3. Switch off the instrument.
4. Make sure that temperature is near room temperature.
5. Switch on the instrument.

B. Activation via serial command
1. Make sure that temperature is near room temperature.
2. Set the setpoint to the desired value.
3. Run the Start Selftuning command.

The procedure runs automatically until termination. At termination, the new PID parameters are saved: proportional band, integral and derivative times calculated for the current action (heat or cool). In case of double action (heat + cool), the parameters for the opposite action are calculated by maintaining the initial ratio between the parameters (example: Cpb = Hpb * K; where K = Cpb / Hpb when selftuning is started). At termination, the Stu code is automatically cancelled.

Note: The procedure does not start if temperature exceeds the setpoint for heat control, or is below the setpoint for cool control. In this case, the Stu code is not cancelled. It is advisable to enable the LEDs to signal selftuning state. By setting parameter Ld.St = 4 on the Hrd menu, the appropriate LED will light up or flash when selftuning is active.

see: CONTROLS - PID parameters

| 31 | s.tv | R/W | _Enable selftuning, autotuning, softstart_ | | _Selftuning, autotuning, softstart table_ | 0 |

	Autotuning continuous	Selftuning	Softstart
0	NO	NO	NO
1	YES	NO	NO
2	NO	YES	NO
3	YES	YES	NO
4	NO	NO	YES
5	YES	NO	YES
Autotuning One-shot			
8*	WAIT	NO	NO
9	GO	NO	NO
10*	WAIT	YES	NO
11	GO	YES	NO
12*	WAIT	NO	YES
13	GO	NO	YES

(*) +16 with automatic switching in GO if PV-SP > 0.5% f.s.
+32 with automatic switching in GO if PV-SP > 1% f.s.
+64 with automatic switching in GO if PV-SP > 2% f.s.
+128 with automatic switching in GO if PV-SP > 4% f.s.

140	diG.	R/W	Function digital input	_See: Table of digital input functions_		0
618	diG.2	R/W	Digital input 2 function			0
3 bit	SELFTUNING	R/W	OFF = Selftuning in Stop ON = Selftuning in Start			
305		R/W	Instrument state (STATUS_W)	_See: Table of instrument settings_		0

Read state

0 bit	SELFTUNING STATE	R	OFF = Selftuning in Stop ON = Selftuning in Start		
68 bit	STATE OF DIGITAL INPUT 1	R	OFF = Digital input 1 off ON = Digital input 1 on	*See: Table of digital input functions*	
92 bit	STATE OF DIGITAL INPUT 2	R	OFF = Digital input 2 off ON = Digital input 2 on		
296		R	Autotuning and selftuning enable state (FLG_PID)	bit 3 Selftuning on 6 Autotuning on	

SOFTSTART

If enabled, this function partializes power based on a percentage of time elapsed since instrument switch-on compared to the set time of 0.0 ... 500.0 min ("SoFt" parameter CFG phase). Softstart is an alternative to selftuning and is activated after each instrument switch-on. Softstart is reset when switching to manual.

31	S.tu	R/W	*Enable selftuning, autotuning, softstart*				0

Selftuning, autotuning, softstart table

	Autotuning continuous	Selftuning	Softstart
0	NO	NO	NO
1	YES	NO	NO
2	NO	YES	NO
3	YES	YES	NO
4	NO	NO	YES
5	YES	NO	YES
Autotuning One-shot			
8*	WAIT	NO	NO
9	GO	NO	NO
10*	WAIT	YES	NO
11	GO	YES	NO
12*	WAIT	NO	YES
13	GO	NO	YES

(*) +16 with automatic switching in GO if PV-SP > 0.5% f.s.
+32 with automatic switching in GO if PV-SP > 1% f.s.
+64 with automatic switching in GO if PV-SP > 2% f.s.
+128 with automatic switching in GO if PV-SP > 4% f.s.

147	SoF	R/W	Softstart time	0.0 ...500.0 min		0.0

30 bit	RESTART SOFTSTART	R/W	OFF = - ON = Restart Softstart

114 bit	END_OFF SOFTSTART/ DRY OUT	R/W	OFF = - ON = Forced end of the Softstart/Dry out phase

Read state

63 bit	STATE SOFTSTART/ DRY OUT	R	OFF = Softstart in Stop ON = Softstart in Start

START MODE

699	P.On.t	R/W	Start modes at Power-On	0* Function at previous state 1 Software shutdown 2 Software startup	

(*) digital input states always have priority

SOFTWARE SHUTDOWN

Running the software shutdown procedure causes the following:

1) Reset of Autotuning, Selftuning and Softstart.

2) Digital input (if present) enabled only if assigned to SW shutdown function.

3) In case of switch-on after SW shutdown, any ramp for the set (set gradient) starts from the PV.

4) Outputs OFF: except for rL.4 and rL.6 which are forced ON.

5) Reset of HB alarm.

6) Reset of LBA alarm.

7) The Heat and Cool bit on the state word STATUS_STUMENTO and POWER are reset.

8) At shutdown, the current power is saved. At switch-on, integral power is recalculated as the difference between saved power and proportional power; this calculation is defined as "desaturation at switch-on."

9) Alarms AL1 ...AL4 can be enabled or disabled by the oFF.t parameter.

140	diG.	R/W	Digital input function		*See: Table of digital input functions*	0
618	diG.2	R/W	Digital input 2 function			
11 bit	SOFTWARE LAUNCH/ SHUTDOWN	R/W	OFF = On ON =Off			

700	OFF.t	R/W	Modes at software shutdown	0	Outputs rL.1- rL.2 - rL.3 - rL.5 = OFF Outputs rL.4 - rL.6 = ON Alarms AL.1 -AL.2 -AL.3 - AL.4 disabled
				1	Outputs rL.1- rL.2 - rL.3 - rL.5 = OFF Outputs rL.4 - rL.6 = ON Alarms AL.1 -AL.2 -AL.3 - AL.4 enabled
				+16	Restart softstart to restart Software (ON Software)

Read state

68 bit	STATE of DIGITAL INPUT 1	R	OFF = Digital input 1 off ON = Digital input 1 on		*See: Table of digital input functions*	
92 bit	STATE of DIGITAL INPUT 2	R	OFF = Digital input 2 off ON = Digital input 2 on			
305		R/W	Instrument state (STATUS_W)		*See: Table of instrument settings*	0

HOT RUNNERS CONTROL

With the following parameters, you can perform a specific control for the hot runners (hot.runners).

The main functions are:

FAULT ACTION POWER

You can decide what power to supply in case of broken probe.

FAP is the reference power for parameter FAP.

Average power is the average power calculated in the last 300 sec.

The alarm reset and reference power update take place only at switch-on or after a setpoint change.

The alarm is not activated if the control (Ctr) is ON/OFF type, during Selftuning and in Manual.

| 265 | Hot | R/W | Select hot runner functions | | | | | 0 |

Table of hot runner functions

	Enable hot runners	Fault action power if PV is not stabilized	Enable preheating softstart
0		FA.P	
1	X	Average power	
2		FA.P	
3	X	FA.P	
4		FA.P	X
5	X	Average power	X
6		FA.P	X
7	X	FA.P	X
+ 8 enable GS.2			
+ 16 enable DryOut Function			

FA.P – see alarm for probe in short or connection error (SBR-ERR)

| 228 | FA.P | R/W | Fault action power (supplied in conditions of broken probe) | -100.0 ..100.0 % | | 0.0 |

Read state

26 bit	STATE OF HB ALARM OR POWER_FAULT	R	OFF = Alarm off ON = Alarm on
80	State of power alarm (hot runners)	R	OFF = Alarm off ON = Alarm on

POWER ALARM

The alarm signals any power changes (OuP) after the *process variable* (PV) has stabilized on the setpoint (SP). The time beyond which the process variable is considered stable is 300 sec (always on with hot runners).

The reference power update take place only at switch-on or after a setpoint change.

If the process variable leaves the stabilization band after the first stabilization, this does not influence the alarm.

In case of SBR:

- if the PV has not yet stabilized, either the average power over the last 5 minutes or FAP power is supplied (depending on the setting of the HOT parameter).

- if the PV has stabilized the average power over the last 5 minutes is supplied.

Function:

If necessary, assign an output (rL.2...6) for the power alarm.

Set the band (b.ST) within which the process variable is considered stable after 300 sec. have elapsed.

Set the band (b.PF) outside which the alarm is activated after time PF.t has elapsed.

The reference power is the active power after 300 sec. have elapsed.

The alarm reset and reference power update take place only at switch-on or after a setpoint change.

The alarm is not activated if the control (Ctr) is ON/OFF type, during Selftuning and in Manual.
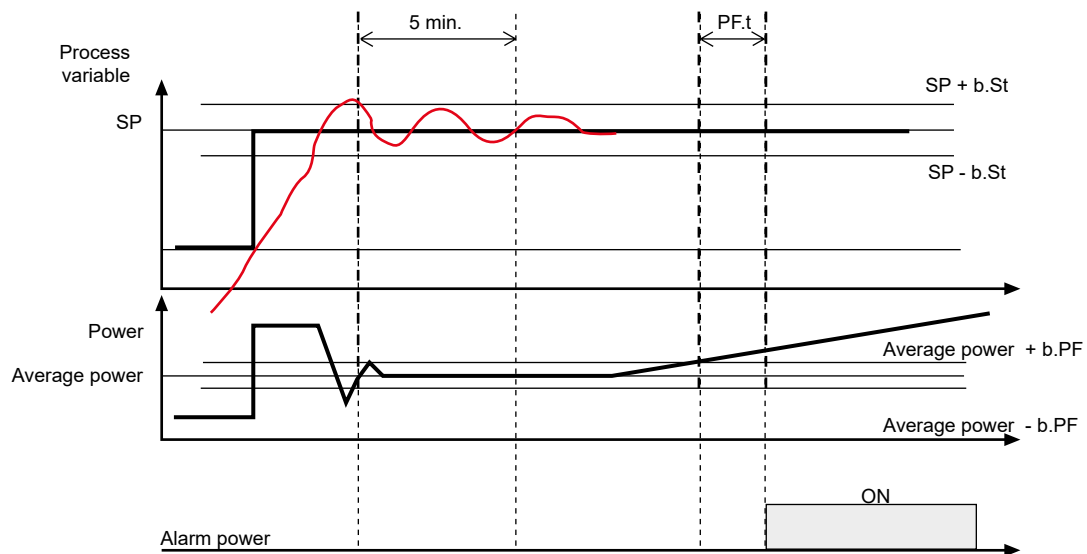
The parameters for alarm power are:

261	b.St	R/W	*Stability band* (hot runners alarm power function)		0.0 ......100.0 % f.s.		0.0
262	b.PF	R/W	*Alarm power band* (hot runners alarm power function)		0.0 ...100.0 %		0.0
260	Pf.t	R/W	Delay time for alarm power activation (hot runners)		0 ...999 sec		0

160	rL.1	R/W	Allocation of *reference signal*		*See: Generic alarms – Table of reference signals*	0
163	rL.2	R/W	Allocation of reference signal			1
166	rL.3	R/W	Allocation of reference signal - OR Output			2
170	rL.4	R/W	Allocation of reference signal - AND Output			35
171	rL.5	R/W	Allocation of reference signal - OR Output			4
172	rL.6	R/W	Allocation of reference signal - AND Output			160

SOFTSTART FOR PREHEATING

This function lets you deliver a settable power (So.P) for time (SoF), after which normal control is resumed by means of PID control.

Activation is only at switch-on, with manual-automatic switching during Softstart (the time restarts from 0), and if the process variable is below setpoint SP.S.

With softstart time SOF = 0 the preheating condition PV< SP.S with power delivery So.P is continuously evaluated. Setting the Hot +16 parameter enables the preheating function in PA mode.

The function consists of a Softstart option that can deliver the power set with PA (Phase angle) firing independently of the one set for normal control.

Once out of Softstart's preheating condition, firing returns to its original state. The softstart preheating function is not compatible with the DryOut Function.

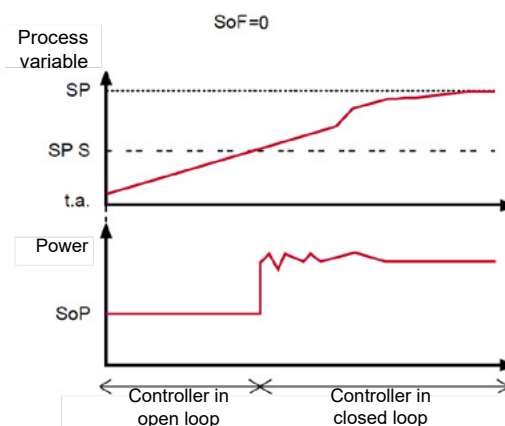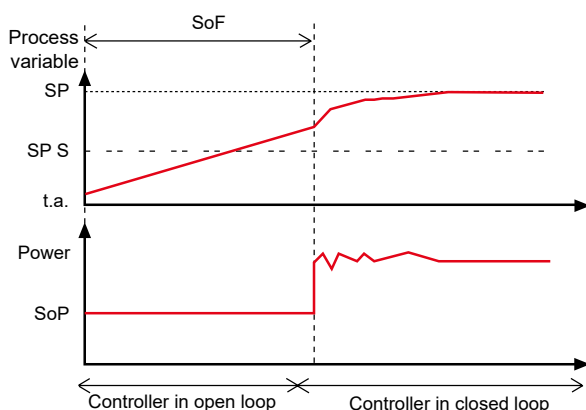| 265	Hot	R/W	Select hot runner functions

Table of hot runner functions

	Enable hot runners	Fault action power if PV is not stabilized	Enable preheating softstart
0		FA.P	
1	X	Average power	
2		FA.P	
3	X	FA.P	
4		FA.P	X
5	X	Average power	X
6		FA.P	X
7	X	FA.P	X
+ 8	enable GS.2		
+ 16	enable DryOut Function		

FA.P – see alarm for probe in short or connection error (SBR-ERR)

263	SP.S	R/W	*Softstart setpoint* (preheating of hot runners)	Lo.L....HI.L		0
264	So.P	R/W	Softstart/Dry out power (preheating of hot runners)	-100.00.... ....100.0 %		0.0
147	SoF	R/W	Softstart/Dry out time	0.0 ...500.0 min		0.0

30 bit	RESTART SOFTSTART	R/W	OFF = - ON = Restart Softstart/Dry out
114 bit	END_OFF SOFTSTART/DRY OUT	R/W	OFF = - ON = Softstart/Dry Out phase forced at the end and inhibited

140	dIG.	R/W	Digital input function	*See: Table of digital input function*		0
618	dIG.2	R/W	Digital input function 2			0

Read state

63 bit	STATO SOFTSTART/DRY OUT	R	OFF = Softstart/Dry Out in Stop ON = Softstart/Dry Out in Start

DRYOUT

The DryOut function allows drying of the load for a certain time SoF at constant power So.P delivered with firing PA mode, regardless of the value set in Hd.5.
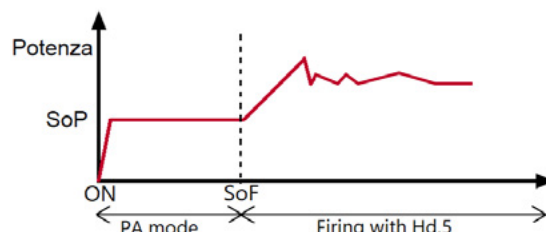
The option is enabled with the parameter Hot =+32 and excludes the Softstart preheating functions.
The drying phase is entered at the time of power-ON or ON-Software of the instrument.
Once the So.P power supply in PA mode has been completed, it go on to the firing required by Hd.5 and to the power managed automatically/manually (without ramps).
The drying phase ends with total execution for the set SoF time, but can be completed earlier with:
- DRY_OUT_ENDOFF command (available as digital input or via serial to bit 114)
- Manual override;

These conditions, in addition to ending the drying phase, inhibit the execution of the procedure.
Dry Out will not run until there is another power-ON or ON-Software, unless specifically called up by RESTART_SOFTSTART.
With this command, the Dry Out phase restarts if there are no conditions that inhibit it.
SelfTuning suspends the drying phase
As long as the instrument remains in the Dry Out phase it is indicated in the SOFT START/Dryout_active bit.

It is also possible to associate the signalling of each zone with the reference signals rL.1 ... rL.6 (RLx.x=28) and then assign them to the physical outputs Out9, Out10 and, when available, Out5, Out6, Out7 and Out8.

114 bit	END_OFF SOFTSTART/DRY OUT	R/W	OFF = - ON = Softstart/Dry Out phase forced at the end and inhibited			
63 bit	STATO SOFTSTART/DRY OUT	R	OFF = Softstart/Dry Out in Stop ON = Softstart/Dry Out in Start			
265	Hot	R/W	Selezione funzioni canali caldi			
264	So.P	R/W	Potenza di softstart/Dry out (preriscaldamento canali caldi)	-100.00.... ....100.0 %		0.0
147	SoF	R/W	Tempo di softstart/Dry out	0.0 ...500.0 min		0.0
30 bit	RIPARTENZA SOFTSTART	R/W	OFF = - ON = Restart softstart/Dry out			
140	dIG.	R/W	Digital input function	*See: Table of Digital input function*		0
618	dIG.2	R/W	Digital input function 2			0

If the Hd.5 signature includes Soft start ramps, the time spent running the ramp is included in the Dry Out time.
NOTE: The Dry Out function does not evaluate any temperature-related conditions; if you need this control, please refer to the Softstart preheating function, which can also be performed in PA mode.

NOTE: For the function to be started, there must NOT be MAIN INPUT ERR and/or MAIN INPUT Low errors on the MAIN input of each zone.

HEATING OUTPUT (Fast cycle)

For outputs rL.1 (Out 1) and rL.2 (Out 2) you can set a fast cycle time (0.1 ... 20.0 sec) by setting the parameter to 64 (Heat) or 65 (Cool).

160	rL.1	R/W	Allocation of reference signal	*See: Generic alarms -Table of reference signals*	0
163	rL.2	R/W	Allocation of reference signal		1

POWER CONTROL

SSR CONTROL MODES

ON Modality

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

PA phase angle: this mode controls power on the load via modulation of the phase angle.

ZC zero crossing: this type of operation reduces EMC emissions. This mode controls power on the load via a series of conduction ON and non conduction OFF cycles.
The cycle time is constant and can be set from 1 to 200 sec (or from 0.1 to 20.0 sec).

BF burst firing: 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 repeat period or cycle time is kept to a minimum for each power value.
Parameter bF.Cy defines the minimum number of conduction cycles, settable from 1 to 10.
In case of 3-phase load without neutral or closed delta, BF.Cy >= 5 has to be set to ensure correct operation (balancing of current in the 3 loads).

HSC Half Single Cycle: this mode corresponds to a BF that includes ON and OFF half-cycles.
It is useful for reducing flicker with short-wave IR loads (and is applied only to single-phase or 3-phase with neutre or open delta loads). Start mode is set with parameter Hd.5
Control of maximum rms current (whose value is set in parameter Fu.tA) can always be enabled with parameter Hd.5 in every power-on mode.
The cycle time can be set with two different resolutions in seconds or tenths of a second based on the type of heat or cool function assigned to outputs rL1 and rL2.
The use of short cycle times (< 2-3 sec) is always recommended in case of control with SSRs.

Settings

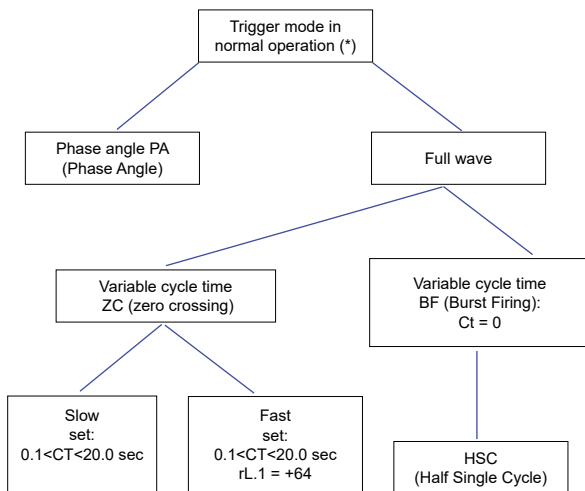| 703	Hd.5	R/W	Enable trigger modes

				RMS peak current control	
	Phase Soft star	Trigger mode in normal operation (*)	BF Mode	in softstart	in normal operat.
0	NO	ZC/BF	-	NO	NO
1	YES	ZC/BF	-	NO	NO
2	NO	PA	-	NO	NO
3	YES	PA	-	NO	NO
4	NO	ZC/BF	HSC	NO	NO
5	YES	ZC/BF	HSC	NO	NO
6	NO	PA	-	NO	NO
7	YES	PA	-	NO	NO
8	NO	ZC/BF	-	YES	NO
9	YES	ZC/BF	-	YES	NO
10	NO	PA	-	YES	NO
11	YES	PA	-	YES	NO
12	NO	ZC/BF	HSC	YES	NO
13	YES	ZC/BF	HSC	YES	NO
14	NO	PA	-	YES	NO
15	YES	PA	-	YES	NO
16	NO	ZC/BF	-	NO	YES
17	YES	ZC/BF	-	NO	YES
18	NO	PA	-	NO	YES
19	YES	PA	-	NO	YES
20	NO	ZC/BF	HSC	NO	YES
21	YES	ZC/BF	HSC	NO	YES
22	NO	PA	-	NO	YES
23	YES	PA	-	NO	YES
24	NO	ZC/BF	-	YES	YES
25	YES	ZC/BF	-	YES	YES
26	NO	PA	-	YES	YES
27	YES	PA	-	YES	YES
28	NO	ZC/BF	HSC	YES	YES
29	YES	ZC/BF	HSC	YES	YES
30	NO	PA	-	YES	YES
31	YES	PA	-	YES	YES

Table of trigger modes

141	DIP5 = OFF (resistive load)
32	DIP5 = ON (inductive load)

+ 32 only for ZC/BF modes: enable delay triggering
+ 64 linear phase Softstart in power
+128 phase Softstart for IR lamps
+ 256 phase Softstart for shutdown in software ON/OFF switching

					Model	30kW	60kW	80kW
707	Fu.tA	R/W	Max. limit of RMS current in normal op		0.0 ...999.9 A	15.0	30.0	60.0

704	bF.Cy	R/W	Min. number of cycles in BF mode		1 ...10		1	DIP5 = OFF (resistive load)
							5	DIP5 = ON (inductive load)

NB: In case of a 3-phase load, you can set a different value from parameter FU.tA for each zone (ex. to control an unbalanced 3-phase load).

SOFTSTART or START RAMP

This type of start can be enabled either in phase control or pulse train mode and acts via control of the conduction angle. It is enabled with parameter Hd.5.

The softstart ramp starts from a zero conduction angle and reaches the angle set in parameter PS.HI in the time set in parameter PS.tm, from 0.1 to 20.0 sec.

With parameter Hd.5 (+64), you can configure a linear softstart in power, i.e., starting from zero you reach the power value corresponding to the maximum conduction angle set in PS.HI. Softstart ends before the set time if power reaches the corresponding value set in manual control or calculated by PID.

Control of maximum peak current can be enabled with parameter Hd.5 during the ramp phase; peak value is settable in parameter PS.tA. This function is useful in case of short circuit on the load of loads with high temperature coefficients to automatically adjust start time to the load.

The softstart ramp activates at the first start after power-ON and after a software reboot. It can be reactivated via software control by writing bit 108 or automatically if there are OFF conditions for a time exceeding the one settable in PS.oF (if =0 the function is as if disabled).

The ramp can also be enabled with parameter Hd.5 (+256) after a software shutdown, i.e., zero is reached in the set time from delivered power.

630	PS.Hi	R/W	maximum phase of phase softstart ramp		0.0 ...100.0 %			100.0
705	PS.tm	R/W	Duration of phase softstart ramp		0.1 ...60.0 s			10.0
629	PS.of	R/W	Minimum non-conduction time to reactivate phase softstart ramp		0 ...999 s			2

						Model:	30kW	60kW	80kW
706	PS.tA	R/W	Maximum peak current limit during phase softstart ramp		0.0 ...999.9 A		28.0	56.0	84.0

108 bit	Restart of phase softstart ramp	R/W	OFF = Restart not enabled ON = Restart enabled

Read state

106 bit	State of phase softstart ramp	R	OFF = Ramp not active ON = Ramp active
107 bit	State of phase softstart ramp	R	OFF = Ramp not ended ON = Ramp ended

NB: In case of a 3-phase load, you can set a different value from parameter PS.tA for each zone (ex. to control an unbalanced 3-phase load).

DELAY TRIGGERING

In firing modes ZC and BF, with inductive loads, this function inserts delay triggering in the first cycle.
The delay is expressed in degrees settable in parameter dL.t, from 0 to 90 degrees. The function is enabled with parameter Hd.5 (+32).
In the case of wiring with rotated phases (VOLTAGE_STATUS,bit5: rotation132), the parameter in use will be dL.tr. The function activates automatically if there are OFF conditions for a time exceeding the one settable in dL.oF (if =0 the function is as if disabled).
  ◊ Optimised Delay-Triggering value for transformer: 60°
  ◊ Optimised Delay-Triggering value for 3-phase transformer: 90°, 90°, 50°

708	dL.t	R/W	Delay triggering (first trigger only)		0 ... 90 °		60
772	dL.tr	R/W	Delay triggering with phase rotation 1-3-2 1-3-2		0 ... 90 °		60
738	dL.oF	R/W	Minimum non-conduction time to reactivate delay triggering		0 ... 10000ms		10

FEEDBACK MODES

The GFX4-IR has the following power control modes:
V-voltage
V^2-squared voltage
I-current
I^2-squared current
P-power
A control mode is enabled with parameter Hd.6.

Voltage feedback (V)
To keep voltage on the load constant, this compensates possible variations in line voltage with reference to the rated voltage saved in riF.V. (expressed in Vrms).
The voltage value maintained on the load is (ref.V*P%_pid_man/100) and is indicated in the Modbus 757 register.

Voltage feedback (V^2)
To keep voltage on the load constant, this compensates possible variations in line voltage with reference to the rated voltage saved in riF.V. (expressed in Vrms).
The voltage value maintained on the load is (rif.V* V ~~(P%_pid_man/100)~~), and is indicated in the Modbus 757 register.

Current feedback (I)
To keep current on the load constant, this compensates possible variations in line voltage and/or variations in load impedance with reference to the rated current saved in riF.I. (expressed in Arms).
The current value maintained on the load is (rif.I*P%_pid_man/100), and is indicated in the Modbus 757 register.

Current feedback (I^2)
To keep current on the load constant, this compensates possible variations in line voltage and/or variations in load impedance with reference to the rated current saved in riF.I. (expressed in Arms).
The current value maintained on the load is (rif.I* V ~~(P%_pid_man/100)~~), and is indicated in the Modbus 757 register.

Power feedback P
To keep power on the load constant, this compensates both variations in line voltage and variations in load impedance with reference to the rated power saved in riF.P. (expressed in KWatt).
The current value maintained on the load is (rif.P*P%_pid_man/100), and is indicated in the Modbus 757 register.

⚠ IMPORTANT!

Feedback calibration can be activated from the digital input (parameters DIG and DIG.2) or by serial control (ref. bit113), and MUST be activated only with Hd.6=0 (the required Hd.6 value can be set only after calibration) and preferably with maximum power on the load (ex. P_man or P_pid 0 100%).
If you change function mode (PA, ZC, BF, HSC), you have to re-run the Feedback calibration procedure.
Voltage V (or current I or power P) feedback corrects the % of conduction with a maximum settable value in parameter Cor.V (or Cor.I or Cor.P).
For non-linear loads (ex.: Super Kanthal or Silicon Carbide) the automatic calibration procedure IS NOT necessary. Set the value of parameters ref.V, ref. I, ref. P based on the specific nominal of the load shown on the data-sheet (ref. GFX4-IR Installation Guide).

730	Hd.6	R/W	Enable feedback modes		Table feedback modes		0

0	None	
1	V² (Voltage)	
2	I² (Current)	
3	P (Power)	
4	None	
5	V (Linear voltage)	
6	I (Linear current)	

731	Cor.V	R/W	Maximum correction of voltage feedback		0.0 ...100.0 %		100.0
732	Cor.I	R/W	Maximum correction of current feedback		0.0 ...100.0 %		100.0
733	Cor.P	R/W	Maximum correction of power feedback		0.0 ...100.0 %		100.0
734	riF.V	R/W	Voltage feedback reference		0.0 ...999.9 V		0.0
735	riF.I	R/W	Current feedback reference		0.0 ...999.9 A		0.0
736	riF.P	R/W	Power feedback reference		0.0 ...99.99 kW		0.0
741	Fb.It	R/W	Feedback response speed		0.1 ...5.0 % / 60msec		0.3
113 bit	Calibration of voltage feedback reference	R/W	OFF = Calibration not enabled ON = Calibration enabled				

464		R/W	STATUS 11_W		Table settings STATUS 11_W (*)		0

bit		
5	Feedback calibration	
6	HB alarm calibration	

(*) To safeguard the other bit, writing should be done starting from the reading going to change only the bit interested.

READ STATE

757*	ARif	R	Reference of Feedback	0.0 ...999.9 V	Setpoint of V, I, P to maintain on load
				0.0 ...999.9 A	
				0.0 ...99.99 kW	

☞ NOTE: For other information see the hardware manual

HEURISTIC Control power

It is useful to be able to limit the delivery of total power to the loads in order to avoid input peaks from the single-phase power line.

This condition occurs during switch-on phases when the machine is cold; the demand for heating power is 100% until temperatures near the setpoint are reached. It is also useful to avoid simultaneity of conduction when there is ON-OFF modulation for temperature maintenance.

The cycle time must be identical for all zones; the power percentage for each zone is limited to that necessary to maintain current within set limits.

This function acts by enabling the control to search for the most appropriate input combinations.

Example 1:
4 loads 380V- 32A (zone 1), 16A (zone 2), 25A (zone 3), 40A (zone 4)
(maximum current is 113A in case of simultaneity of conduction).
Current limit I.HEU=50A.
The following combinations of conduction are possible:
(to define the number of combinations, remember that the combinations without repetitions are = n! / (k!*(n-k)!))
I1+I2 = 48A
I1+I3 = 57A
I1+I4 = 72A
I2+I3 = 41A
I2+I4 = 56A
I3+I4 = 65A
I1+I2+I3 = 73A
I1+I2+I4 = 88A
I2+I3+I4 = 81A
I1+I3+I4 = 97A
I1+I2+I3+I4 = 113A

The combination corresponding to current values below the limit value are:
I1+I2 = 48A
I2+I3 = 41A
The one with lower current is given by zone 2 and zone 3.

In the single cycle time for the enabled zones, the delivery of power may be reduced to respect the maximum current limit. The time distribution for activation of the zones is calculated at the start of each cycle:
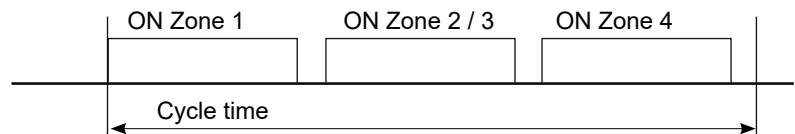Ptot = P1+ P2 (if P2>P3) + P3 (if P3>P2) + P4
Simultaneity is allowed for zones 2 and 3.

If P1= 100%, P2= 100%, P3= 100%, P4= 100%
Ptot=300%; since Ptot>100%, the conduction time of the zone x is obtained by Px * (100/Ptot)
P1,2,3,4 delivered = 100%*0.33 = 33%

If P1= 100%, P2= 50%, P3= 0%, P4= 25%
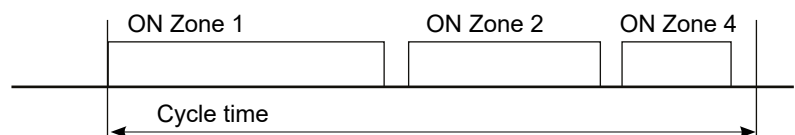Ptot=175%; since Ptot>100%, the conduction time of the zone x is obtained by Px * (100/Ptot)
P1 delivered = 100%*0.57 = 57%
P2 delivered = 50%*0.57   = 28.5%
P3 delivered = 0%*0.57   = 0%
P4 delivered = 25%*0.57   = 14.2%

680	Hd.3	R/W	*Enable heuristic power control*					0

Table for enabling heuristic power				
	ZONE 1	**ZONE 2**	**ZONE 3**	**ZONE 4**
0				
3	X	X		
5	X		X	
6		X	X	
7	X	X	X	
9	X			X
10		X		X
11	X	X		X
12			X	X
13	X		X	X
14		X	X	X
15	X	X	X	X

NOTE: Only for GFX4-IR output OUT1 ...OUT4 with slower cycle time (1.200sec) all HEAT or all COOL.

681	I.HEU	R/W	Maximum current for heuristic power control	*Heuristic power table*	0.0

Heuristic power table

0.0 ... 64.0 for GFX4 -IR 30 kW
0.0 ... 128.0 for GFX4-IR 60 kW
0.0 ... 160.0 for GFX4-IR 80 kW

HETEROGENEOUS power control

Available only for Mod. 80 kW 57A full scale

This function matches that of a thermal cutout that disconnects the load based on instantaneous input.
The load is disconnected based on a preset priority.

Zone 1 has priority: in case of overload, zone 4 is disconnected, followed by zone 3, etc.

The maximum total controllable current in four zones for the 80 kW model is 160A.
The maximum current in a single zone is 57A.
Example: you can control three 50A loads and one 10A load without limits. With four 50A loads, if there is simultaneity, the load connected to zone 4 is disconnected.

682	hd.4	R/W	*Enable heterogeneous power control*					0

Table for enabling heterogeneous power				
	ZONE 1	**ZONE 2**	**ZONE 3**	**ZONE 4**
0				
1	X			
2		X		
3	X	X		
4			X	
5	X		X	
6		X	X	
7	X	X	X	
8				X
9	X			X
10		X		X
11	X	X		X
12			X	X
13	X		X	X
14		X	X	X
15	X	X	X	X

683	I.HEt	R/W	Maximum current for heterogeneous power control	*Heterogeneous power table*	0.0

Heterogeneous power table

0.0 ... 64.0 for GFX4 -IR 30 kW
0.0 ... 128.0 for GFX4-IR 60 kW
0.0 ... 160.0 for GFX4-IR 80 kW

VIRTUAL INSTRUMENT CONTROL

Virtual instrument control is activated by means of parameter hd.1.

By setting parameters S.In and S.Ou you can enable the writing of some parameters via serial line, set the value of inputs and the state of outputs.

You have to enable alarm setpoints AL1, ..., AL4 when write operations are continuous, and you don't have to keep the last value in eeprom.

Enabling the PV input means being able to exclude the local Tc or RTD acquisition and replace it with the value written in the register VALUE_F.

Enabling digital input IN lets you set the state of this input, for example to run MAN/AUTO switching with the writing of bit 7 in the register V_IN_OUT.

Likewise, you can set the on/off state of outputs OUT1, ..., OUT10 and of the LEDs by writing bits in the register V_IN_OUT.

191	hd.1	R/W	*Enable multiset* instrument control via serial		0

Table for multiset/ virtual instrument

	Enable Multiset	Enable virtual instrument
0		
1	X	
2		X
3	X	X

+16 For Heat/Cool control Ctr only: CT connected to cool output

224	S.In	R/W	*Control inputs from serial*	0 ... 255		0

Inputs	InTA	In.2	-	In.1	AL4	AL3	AL2	AL1
Bit	7	6	5	4	3	2	1	0

225	S.Ou	R/W	*Control outputs from serial*	0 ... 1023		0

Outputs	Out10	Out9	Out8	Out7	Out6	Out5	Out4	Out3	Out2	Out1
Bit	9	8	7	6	5	4	3	2	1	0

628	S.LI	R/W	*Control LEDs and digital inputs from serial*	0 ... 1023		0

	Input				LED					
	D2	D1	O4	O3	O2	O1	D2	D1	ER	RN
Bit	9	8	7	6	5	4	3	2	1	0

Table of virtual register addresses

Parameter	bit	Resource enabled	Address of image register	Format	Name of register
S.In	0	Alarm setpoint AL1	341	word	AL1_RAM
	1	Alarm setpoint AL2	342	word	AL2_RAM
	2	Alarm setpoint AL3	343	word	AL3_RAM
	3	Alarm setpoint AL4	321	word	AL4_RAM
	4	Input In.1	347	word	VALUE_F
	6	Input In.2	348	word	VALAUX_F
	7	Input In.TA	685	word	VALTA_F
S.Ou	0	Output OUT 1	344	word, bit 0	V_IN_OUT
	1	Output OUT 2	344	word, bit 1	V_IN_OUT
	2	Output OUT 3	344	word, bit 2	V_IN_OUT
	3	Output OUT 4	344	word, bit 3	V_IN_OUT
	4	Output OUT 5 (relays)	344	word, bit 4	V_IN_OUT
	4	Output OUT 5 (continuous)	639	word	SERIAL_OUT5C*
	5	Output OUT 6 (relays)	344	word, bit 5	V_IN_OUT
	5	Output OUT 6 (continuous)	640	word	SERIAL_OUT6C*
	6	Output OUT 7 (relays)	344	word, bit 6	V_IN_OUT
	6	Output OUT 7 (continuous)	641	word	SERIAL_OUT7C*
	7	Output OUT 8 (relays)	344	word, bit 7	V_IN_OUT
	7	Output OUT 8 (continuous)	642	word	SERIAL_OUT8C*
	8	Output OUT 9	344	word, bit 8	V_IN_OUT
	9	Output OUT 10	344	word, bit 9	V_IN_OUT
S.LI	0	Led RN	351	word, bit 0	V_X_LEDS
	1	Led ER	351	word, bit 1	V_X_LEDS
	2	Led D1	351	word, bit 2	V_X_LEDS
	3	Led D2	351	word, bit 3	V_X_LEDS
	4	Led O1	351	word, bit 4	V_X_LEDS
	5	Led O2	351	word, bit 5	V_X_LEDS
	6	Led O3	351	word, bit 6	V_X_LEDS
	7	Led O4	351	word, bit 7	V_X_LEDS
	8	Input D1	344	word, bit 10	V_IN_OUT
	9	Input D2	344	word, bit 11	V_IN_OUT

* the value to be set is in the range 0...1000 if the corresponding rL.x is configured "0" or in the range 0...-1000 if the corresponding rL.x is configured "1".

HW/SW INFORMATION

The following data registers can be used to identify the controller HW/SW and check its operation.

122	UPd	R	*Software version code*

85	Err	R	*Self-diagnosis* error code for main input

606	Er.2	R	*Self-diagnosis* error code for auxiliary input

Table of main input errors

0	No Error
1	Lo (process variable value < Lo.S)
2	Hi (process variable value > Hi.S)
3	ERR [third wire interrupted for PT100 or input values below minimum limits (ex. for TC with connection error)]
4	SBR (probe interrupted or input values beyond maximum limits)

190	C.Hd	R	Hardware configuration codes

At value SV on the GFX-OP display, the figures indicate the value of bits as follows:
- THOUSANDS and HUNDREDS (Power GFX4-IR) correspond to bits 7 to 9
- TENS (COOL outputs) correspond to bits 1 to 4

Table of hardware configuration codes

bit	Correspondence	Value
0	= 1 COOL OUTPUT absent	0
1	= 1 COOL OUTPUT relay	r
2	= 1 COOL OUTPUT logic	d
3	= 1 COOL OUTPUT continuous 0...20mA / 0...10V	t
4	= 1 COOL OUTPUT triac 250Vac 1A	c
5	= 1 OUTPUT AUX analog 12bit 20mA/10V	w
6	-	
7	= 1 GFX4-IR 30 kW	30
8	= 1 GFX4-IR 60 kW	60
9	= 1 GFX4-IR 80 kW	80

508	C.Hd1	R	*Self-diagnosis error code* for auxiliary input

In correspondence to the SV value on the GFX-OP display, the digits indicate bit values as follows:
- TENS (auxiliary inputs) correspond to bits 0 to 1
- ONES (fieldbus interface) correspond to bits 6 to 15

Table of auxiliary input errors

bit	Correspondance	Value
0	= 1 INPUT AUX absent	0
1	= 1 INPUT AUX TC / 60mV	1
2	-	
3	= 1 FIELDBUS ETH4 (ProfiNet)	
4	= 1 FIELDBUS ETH5	
5	= 1 FIELDBUS ETH6	
6	= 1 FIELDBUS absent	O
7	= 1 FIELDBUS Modbus	m
8	= 1 FIELDBUS Profibus	P
9	= 1 FIELDBUS CanOpen	C
10	= 1 FIELDBUS DeviceNet	d
11	= 1 FIELDBUS Ethernet	E
12	= 1 FIELDBUS Euromap66	c
13	= 1 FIELDBUS ETH3	3
14	= 1 FIELDBUS ETH2 (Ethercat)	2
15	= 1 FIELDBUS ETH1 (Ethernet IP)	1

693 697	Upd.F	R	Fieldbus software version

695	Cod.F	R	Fieldbus node

696	Bau.F	R	Fieldbus baudrate

Profibus	
bAu.F	baudrate
0	12.00 Mbit/s
1	6.00 Mbit/s
2	3.00 Mbit/s
3	1.50 Mbit/s
4	500.00 Kbit/s
5	187.50 Kbit/s
6	93.75 Kbit/s
7	45.45 Kbit/s
8	19.20 Kbit/s
9	9.60 Kbit/s

Canopen	
bAu.F	baudrate
0	1000 Kbit/s
1	800 Kbit/s
2	500 Kbit/s
3	250 Kbit/s
4	125 Kbit/s
5	100 Kbit/s
6	50 Kbit/s
7	20 Kbit/s
8	10 Kbit/s

Devicenet	
bAu.F	baudrate
0	125 Kbit/s
1	250 Kbit/s
2	500 Kbit/s

Ethernet	
bAu.F	baudrate
0	100 Mbit/s
1	10 Mbit/s

894	F.SIZE	R/W	I/O dimension for fieldbus

I/O table data dimesion for Fieldbus | 0

0	16 words input + 16 words output
1	24 words input + 24 words output

346		R	*Jumper status / DIP Switches*			*Jumper status table / DIP-Switches*	

bit		OFF	ON
0	State DIP-Switch S1		
1	State DIP-Switch S2		
2	State DIP-Switch S7-1: (x)	Single-phase	3-phase
3	State DIP-Switch S7-2: (x)	Star	Delta
4	State DIP-Switch S7-3: (x)	Open delta	Closed delta
5	State DIP-Switch S7-4: (x)	With neutral	Without neutral
6	State DIP-Switch S7-5:	resistive load	inductive load
7	State DIP-Switch S7-6:	-	CFG forced
8	State DIP-Switch S7-7:	GFX4	Simulation 4 GFX

S7-1 *OFF = Single phase load / ON = Three-phase load*	S7-2 *OFF = Star / ON = Triangle*	S7-3 *OFF = Open triangle / ON = Closed triangle*	S7-4 *OFF = With Neutral / ON = Without Neutral*	(x) FUNCTION MODES
OFF	OFF	OFF	OFF	4 single-phase loads
OFF	ON	OFF	ON	3 independent single-phase loads in open delta
ON	ON	OFF	ON	3-phase load open delta
ON	ON	ON	ON	3-phase load closed delta
ON	OFF	-	ON	3-phase star load without neutral
ON	OFF	-	OFF	3-phase star load with neutral

773	J.SEt	R/W	DIP-Switches setting Enabling virtual DIP Switches management	0 priority DIP-Switches Hardware 1 priority virtual DIP-Switches (from serial)	?
774	J.SEr	R/W	Virtual DIP-Switches status	See: *Jumper status table*	?

☞ *NOTA: The factory configuration foresees management of active Hardware DIP-Switches (Parameter J.Set = 0); to switch to management of virtual DIP-Switches (via serial), it is necessary to set the parameter J.Set = 1.*
With virtual management active, the configuration considered is not the one described by the DIP Switches hardware but the one reported in the J.SEr parameter (to write J.SEr, refer to the Jumper Status / DIP-Switches table); the DIP-Switches hardware S7 positions 1-2-3-4-5-7 are no longer taken into consideration, while the DIP-Switch hardware S7 position 6 (forced CGF) if active (ON) has priority over the virtual DIP-Switches, resetting parameters J.Set and J.Ser to zero after restarting.

NOTA: Any change in the DIP-Switches hardware and J.Set and J.Ser parameters will only be active after a restart.

NOTA: As required for management of DIP-Switches hardware, for virtual management too, following a change in the configuration, the execution of the parameters initialization procedure is required by setting the virtual DIP-Switch position 6 (forced CGF) to ON and restarting the product.

120		R	Manufact - Trade Mark (Gefran)	Name of the manufacture	5000
121		R	Device ID (GFX4-IR)	Product identifier	212
197	Ld.St	R/W	*RN LED status function*	*Table of RN LED functions*	16

0	RUN
1	MAN/AUTO controller
2	LOC / REM
3	HOLD
4	Selftuning on
5	Autotuning on
6	Repeat digital input D1
7	Serial 1 dialog
8	State of OUT 2 zone 1
9	Softstart running
10	Indication of SP1...SP2 (SP1 with pilot input inactive and LED off)
11	Repeat digital input D2
12	Input in error (LO, Hi, Err, Sbr)
13	Serial 2 dialog
+ 16	LED flashing if active (code 8 excluded)

619	Ld.2	R/W	*ER LED status function*		12
620	Ld.3	R/W	Function of LED DI1		6
621	Ld.4	R/W	Function of LED DI2		11
622	Ld.5	R/W	Function of LED O1	*Table of OUT LED functions*	1
623	Ld.6	R/W	Function of LED O2		2
624	Ld.7	R/W	Function of LED O3		3
625	Ld.8	R/W	Function of LED O4		4

0	Disabled
1	Repetition of state OUT 1
2	Repetition of state OUT 2
3	Repetition of state OUT 3
4	Repetition of state OUT 4
5	Repetition of state OUT 5
6	Repetition of state OUT 6
7	Repetition of state OUT 7
8	Repetition of state OUT 8
9	Repetition of state OUT 9
10	Repetition of state OUT 10
+ 16	LED flashing if active

| 305 | | R/W | Current instrument state (STATUS_W) | *Table of instrument settings* | |

| 698 | | R | Instrument state saved in eeprom (STATUS_W_EEP) |

bit	
0	-
1	Select SP1/SP2
2	Start/Stop Selftuning
3	Select ON/OFF
4	Select AUTO/MAN
5	Start/Stop Autotuning
6	Select LOC/REM

| 467 | | R | Instrument state | *Table of instrument state* |

bit	
0	AL.1 or AL.2 or AL.3 or AL.4 or ALHB.TA1 or ALHB.TA2 or ALHB.TA3 or Power Fault
1	Input Lo
2	Input Hi
3	Input Err
4	Input Sbr
5	heat
6	cool
7	LBA
8	AL.1
9	AL.2
10	AL.3
11	AL.4
12	ALHB or Power Fault
13	ON/OFF
14	AUTO/MAN
15	LOC/REM

| 469 | | R | Instrument state 1 | *Table of instrument state 1* |

bit	
0	AL.1 or AL.2 or AL.3 or AL.4 or ALHB.TA1 or ALHB.TA2 or ALHB.TA3 or Power Fault
1	Input Lo
2	Input Hi
3	Input Err
4	Input Sbr
7	LBA
8	AL.1
9	AL.2
10	AL.3
11	AL.4
12	ALHB.TA1
13	ALHB.TA2 (only for three-phase load)
14	ALHB.TA3 (only for three-phase load)
15	Selftuning on

| 632 | | R | Instrument state 2 | *Table of instrument state 2* |

bit	
0	AL.1
1	AL.2
2	AL.3
3	AL.4
4	AL.HB1
5	AL.HB2 (only for three-phase load)
6	AL.HB3 (only for three-phase load)
7	AL.Lo
8	AL.Hi
9	AL.Err
10	AL.Sbr
11	AL.LBA
12	AL.Power

| 633 | | R | Instrument state 3 | *Table of instrument state 3* |

bit	
3	SSR_SHORT1
4	SSR_SHORT2 (only for three-phase load)
5	SSR_SHORT3 (only for three-phase load)
6	NO_VOLTAGE1
7	NO_VOLTAGE2 (only for three-phase load)
8	NO_VOLTAGE3 (only for three-phase load)
9	NO_CURRENT1
10	NO_CURRENT2 (only for three-phase load)
11	NO_CURRENT3 (only for three-phase load)

634		R	Instrument state 4		*Table of instrument state 4*

bit	
0	SSR Temperature sensor broken
1	SSR Temperature sensor over heat
2	phase_softstart_active
3	phase_softstart_end
4	frequency_warning or monophase_missing_line_warning
5	60Hz
6	short_circuit_current in phase softstart
7	over_peak_current in phase softstart
8	over_ms_current in normal operation

702		R	Voltage status		*Table of voltage status*

bit	
0	frequency_warning
1	10% unbalanced_line_warning
2	20% unbalanced_line_warning
3	30% unbalanced_line_warning
4	rotation 132
5	triphase_missing_line_error
6	60Hz

INSTRUMENT CONFIGURATION SHEET

PARAMETERS

Definition of parameter				Note	Assigned value

INSTALLATION OF MODBUS SERIAL NETWORK

				Note	Assigned value
46	Cod	R	Instrument identification code		
45	bAu	R/W	Select Baudrate - Serial 1		
626	bAu.2	R/W	Select Baudrate - Serial 2		
47	PAr	R/W	Select parity - Serial 1		
627	par.2	R/W	Select parity - Serial 2		
890	C.E.t.	R/W	Timeout for communication error		
891	C.E.m.	R/W	Mode for communication error		
892	C.E.P.	R/W	Output power when communication error is active		

MAIN INPUT

				Note	Assigned value
400	tyP.	R/W	Probe, signal, enable, custom linearization and main input scale		
403	dP.S	R/W	Decimal point position for input scale		
401	Lo.S	R/W	Minimum scale limit for main input		
402	Hi.S	R/W	Maximum scale limit for main input		
519 23	oFS.	R/W	Main input offset correction		
0 470	P.V.	R	Read of process variable (PV) engineering value		
85	Err	R	Self-diagnosis error code for main input		
349	DPV	R	Read of engineering value of *process variable* filtered by Fld		
24	Flt	R/W	low pass digital filter for input signal		
179	Fld	R/W	Digital filter on oscillations of input signal		
86	S.00	R/W	Engineering value attributed to Point 0 (minimum value of input scale)		
87	S.01	R/W	Engineering value attributed to Point 1		
88	S.02	R/W	Engineering value attributed to Point 2		
89	S.03	R/W	Engineering value attributed to Point 3		
90	S.04	R/W	Engineering value attributed to Point 4		
91	S.05	R/W	Engineering value attributed to Point 5		
92	S.06	R/W	Engineering value attributed to Point 6		
93	S.07	R/W	Engineering value attributed to Point 7		

94	S.08	R/W	Engineering value attributed to Point 8			
95	S.09	R/W	Engineering value attributed to Point 9			
96	S.10	R/W	Engineering value attributed to Point 10			
97	S.11	R/W	Engineering value attributed to Point 11			
98	S.12	R/W	Engineering value attributed to Point 12			
99	S.13	R/W	Engineering value attributed to Point 13			
100	S.14	R/W	Engineering value attributed to Point 14			
101	S.15	R/W	Engineering value attributed to Point 15			
102	S.16	R/W	Engineering value attributed to Point 16			
103	S.17	R/W	Engineering value attributed to Point 17			
104	S.18	R/W	Engineering value attributed to Point 18			
105	S.19	R/W	Engineering value attributed to Point 19			
106	S.20	R/W	Engineering value attributed to Point 20			
107	S.21	R/W	Engineering value attributed to Point 21			
108	S.22	R/W	Engineering value attributed to Point 22			
109	S.23	R/W	Engineering value attributed to Point 23			
110	S.24	R/W	Engineering value attributed to Point 24			
111	S.25	R/W	Engineering value attributed to Point 25			
112	S.26	R/W	Engineering value attributed to Point 26			
113	S.27	R/W	Engineering value attributed to Point 27			
114	S.28	R/W	Engineering value attributed to Point 28			
115	S.29	R/W	Engineering value attributed to Point 29			
116	S.30	R/W	Engineering value attributed to Point 30			
117	S.31	R/W	Engineering value attributed to Point 31			
118	S.32	R/W	Engineering value attributed to Point 32 (maximum value of input scale)			
293	S.33	R/W	Engineering value attributed to minimum value of the input scale			
294	S.34	R/W	Engineering value attributed to maximum value of the input scale.			
295	S.35	R/W	Engineering value of input signal corresponding to temperature of 50°C.			

LOAD CURRENT VALUE

220	o.tA1	R/W	Offset correction CT input (phase 1)			
415	o.tA2	R/W	Offset correction CT input (phase 2)	with three-phase load		
416	o.tA3	R/W	Offset correction CT input (phase 3)	with three-phase load		
227 473 - 139	I.tA1	R	Instantaneous CT input value (phase 1)			
490	I.tA2	R	Instantaneous CT input value (phase 2)			
491	I.tA3	R	Instantaneous CT input value (phase 3)			
756	I.AF1	R	Value of filtered ammeter input (phase 1)			
494	I.AF2	R	Value of filtered ammeter input (phase 2)			
495	I.AF3	R	Value of filtered ammeter input (phase 3)			
468	I.1on	R	CT input value with output on (phase 1)			
498	I.2on	R	CT input value with output on (phase 2)			
499	I.3on	R	CT input value with output on (phase 3)			
219	Ft.tA	R/W	CT input digital filter (phases 1, 2 and 3)			
709	I.tAP	R	Peak ammeter input during phase softstart ramp			
716	CoS.F	R	Power factor in hundredths			
753	Ld.A	R	Current on load			
754	Ld.A.t	R	Current on 3-phase load			

VALUE OF LOAD VOLTAGE

751	Ld.V	R	Voltage on load
752	Ld.V.t	R	Voltage on 3-phase load

LINE VOLTAGE VALUE

411	oF.tV1	R/W	Offset correction voltmeter transformer input TV (phase 1)			
419	oF.tV2	R/W	Offset correction voltmeter transformer input TV (phase 2)		with three-phase load	
420	oF.tV3	R/W	Offset correction voltmeter transformer input TV (phase 3)		with three-phase load	
232 485	I.tV1	R	Voltmeter input value (phase 1)			
492	I.tV2	R	Voltmeter input value (phase 2)			
493	I.tV3	R	Voltmeter input value (phase 3)			
322	I.VF1	R	Voltmeter input value (phase 1)			
496	I.VF2	R	Voltmeter input value (phase 2)			
497	I.VF3	R	Voltmeter input value (phase 3)			
412	Ft.tV	R/W	Digital filter TV auxiliary input (phase 1, 2, 3)			
315	FrEq	R	Voltage frequency in tenths of Hz			
710	1.U21	R	Linked voltage V21			
711	1.U32	R	Linked voltage V32			
712	1.U13	R	Linked voltage V13			
702			voltage status			

POWER ON LOAD

719	Ld.P	R	Power on load
720	Ld.P.t	R	Power on 3-phase load
749	Ld.I	R	Impedance on load
750	Ld.I.t	R	Impedance on 3-phase load
775	Ld.P.t.kw	R	Three-phase load power in kW

AUXILIARY ANALOG INPUT (LIN/TC)

194	AI.2	R/W	Select type of auxiliary input sensor			
181	tP.2	R/W	Definition of auxiliary analog input function			
677	dP.2	R/W	Decimal point position for auxiliary input scale			
404	LS.2	R/W	Minimum limit auxiliary input scale			
603	HS.2	R/W	Maximum limit auxiliary input scale			
605	oFS.2	R/W	Offset correction for auxiliary input			
602	In.2	R	Value of auxiliary input			
606	Er.2	R	Self-diagnosis error code of auxiliary input			
604	Flt.2	R/W	Digital filter for auxiliary input			

DIGITAL INPUTS

140	diG.	R/W	Function of digital input			
618	diG.2	R/W	Function of digital input 2			
317		R	State of digital inputs INPUT DIG			
68 bit	STATE OF DIGITAL INPUT 1	R	OFF = Digital input 1 off ON = Digital input 1 on			
92 bit	STATE OF DIGITAL INPUT 2	R	OFF = Digital input 2 off ON = Digital input 2 on			

GENERIC ALARMS AL1, AL2, AL3 and AL4

215	A1.r	R/W	Select reference variable alarm 1			
216	A2.r	R/W	Select reference variable alarm 2			
217	A3.r	R/W	Select reference variable alarm 3			
218	A4.r	R/W	Select reference variable alarm 4			
12 475 - 177	AL.1	R/W	Setpoint alarm 1 (scale points)			
13 476 - 178	AL.2	R/W	Setpoint alarm 2 (scale points)			
14 52 - 479	AL.3	R/W	Setpoint alarm 3 (scale points)			
58 480	AL.4	R/W	Setpoint alarm 4 (scale points)			
27 187	HY.1	R/W	Hysteresis for alarm 1			
30 188	HY.2	R/W	Hysteresis for alarm 2			
53 189	HY.3	R/W	Hysteresis for alarm 3			
59	HY.4	R/W	Hysteresis for alarm 4			
406	A1.t	R/W	Alarm type 1			
407	A2.t	R/W	Alarm type 2			
408 54	A3.t	R/W	Alarm type 3			
409	A4.t	R/W	Alarm type 4			
46 bit	AL1 direct/inverse	R/W				
47 bit	AL1 absolute/relative	R/W				
48 bit	AL1 normal/symmetrical	R/W				
49 bit	AL1 disabled at switch on	R/W				
50 bit	AL1 with memory	R/W				
54 bit	AL2 direct/inverse	R/W				
55 bit	AL2 absolute/relative	R/W				
56 bit	AL2 normal/symmetrical	R/W				
57 bit	AL2 disabled at switch on	R/W				
58 bit	AL2 with memory	R/W				
36 bit	AL3 direct/inverse	R/W				
37 bit	AL3 absolute/relative	R/W				
38 bit	AL3 normal/symmetrical	R/W				
39 bit	AL3 disabled at switch on	R/W				
40 bit	AL3 with memory	R/W				

70 bit	AL4 direct/inverse	R/W					
71 bit	AL4 absolute/relative	R/W					
72 bit	AL4 normal/symmetrical	R/W					
73 bit	AL4 disabled at switch on	R/W					
74 bit	AL4 with memory	R/W					

195	AL.n	R/W	Select number of enabled alarms				
140	diG.	R/W	Digital input function				
618	diG.2	R/W	Digital input 2 function				
79 bit	Reset alarm latch	R/W	OFF = - ON = Reset alarm latch				
4 bit	STATE OF ALARM 1	R	OFF = Alarm off ON = Alarm on				
5 bit	STATE OF ALARM 2	R	OFF = Alarm off ON = Alarm on				
62 bit	STATE OF ALARM 3	R	OFF = Alarm off ON = Alarm on				
69 bit	STATE OF ALARM 4	R	OFF = Alarm off ON = Alarm on				
318		R	States of alarm ALSTATE IRQ				

LBA ALARM (Loop Break Alarm)

195	AL.n	R/W	Select number of enabled alarms				
44	Lb.t	R/W	Delay time for LBA alarm activation				
119	Lb.P	R/W	Limit of supplied power in presence of LBA alarm				
81 bit	Reset LBA alarm	R/W	OFF = - ON = Reset alarm LBA				
8 bit	STATE OF LBA ALARM	R	OFF = LBA off ON = LBA alarm on				

HB ALARM (Heater Break Alarm)

195	AL.n	R/W	Select number of enabled alarms			
57	Hb.F	R/W	HB alarm function			
56	Hb.t	R/W	Delay time for HB alarm activation			
55	A.Hb1	R/W	HB alarm setpoint (ammeter input scale points - Phase 1)		with 3-phase load	
502	A.Hb2	R/W	HB alarm setpoint (ammeter input scale points - Phase 2)		with 3-phase load	
737	Hb.P	R/W	Percentage HB alarm setpoint of current read in HB calibration			
112 bit	Calibration HB alarm setpoint	R/W	OFF = Calibration not enabled ON = Calibration enabled			
464		R/W	STATUS 11_W			
742	Hb.tA	R	CT read in HB calibration			
743	Hb.Pw	R	Ou.P power in HB calibration			
758	Ir.00	R/W	HB Calibration with IR lamp: current at 100% conduction			
759	Ir.01	R/W	HB Calibration with IR lamp: current at 50% conduction			
760	Ir.02	R/W	HB Calibration with IR lamp: current at 30% conduction			
761	Ir.03	R/W	HB Calibration with IR lamp: current at 20% conduction			
767	Ir.04	R/W	HB Calibration with IR lamp (only for PA modality): current at 15% conduction			
768	Ir.05	R/W	HB Calibration with IR lamp (only for PA modality): current at 10% conduction			
769	Ir.06	R/W	HB Calibration with IR lamp (only for PA modality): current at 5% conduction			
744	Hb.tr	R	HB alarm setpoint as function of power on load			
26 bit	STATE OF HB ALARM or POWER_FAULT	R	OFF = Alarm off ON = Alarm on			
76 bit	State of HB alarm phase 1	R				
77 bit	State of HB alarm phase 2	R	with 3-phase load			
78 bit	State of HB alarm phase 3	R	with 3-phase load			
504		R	States of alarm HB ALSTATE_HB (for 3-phase loads)			
512		R	States of alarm ALSTATE (for single-phase loads)			
318		R	ALSTATE IRQ alarms state			

ALARM SBR - ERR (Probe in short or connection error)

229	REL	R/W	Fault action (in case of broken probe) Sbr, Err Only for main input		
228	FA.P	R/W	Fault action power (supplied in condition of broken probe)		
85	Err	R	Self-diagnosis error code for main input		
9 bit	STATE OF INPUT IN SBR	R	OFF = - ON = Input in SBR		

Power Fault ALARMS (SSR_SHORT, NO_VOLTAGE and NO_CURRENT)

660	hd.2	R/W	Enable POWER_FAULT alarms		
661	dG.t	R/W	Refresh rate SSR-SHORT		
662	dG.F	R/W	Time filter for alarms NO_VOLTAGE and NO_CURRENT		
105 bit	Reset SSR_SHORT / NO_VOLTAGE / NO_CURRENT alarms	R/W	OFF = - ON = Memory reset		

96 bit	State of alarm SSR_SHORT phase 1	R	OFF = Alarm OFF ON = Active alarm		
97 bit	State of alarm SSR_SHORT phase 2	R	OFF = Alarm OFF ON = Active alarm	with 3-phase load	
98 bit	State of alarm SSR_SHORT phase 3	R	OFF = Alarm OFF ON = Active alarm	with 3-phase load	
99 bit	State of alarm NO_VOLTAGE phase 1	R	OFF = Alarm OFF ON = Active alarm		
100 bit	State of alarm NO_VOLTAGE phase 2	R	OFF = Alarm OFF ON = Active alarm	with 3-phase load	
101 bit	State of alarm NO_VOLTAGE phase 3	R	OFF = Alarm OFF ON = Active alarm	with 3-phase load	
102 bit	State of alarm NO_CURRENT phase 1	R	OFF = Alarm OFF ON = Active alarm		
103 bit	State of alarm NO_CURRENT phase 2	R	OFF = Alarm OFF ON = Active alarm	with 3-phase load	
104 bit	State of alarm NO_CURRENT phase 3	R	OFF = Alarm OFF ON = Active alarm	with 3-phase load	

ALARM due to overload

655		R	INPTC	

OUTPUTS

160	rL.1	R/W	Allocation of reference signal		
163	rL.2	R/W	Allocation of reference signal		
166	rL.3	R/W	Allocation of reference signal		
170	rL.4	R/W	Allocation of reference signal		
171	rL.5	R/W	Allocation of reference signal		
172	rL.6	R/W	Allocation of reference signal		
152 9	Ct.1	R/W	OUT 1 (HEAT) cycle time		
159	Ct.2	R/W	OUT 2 (COOL) cycle time		

OUTPUTS

308 319		R	State outputs rL.x MASKOUT

12 bit	STATE rL.1	R	OFF = Output off ON = Output on
13 bit	STATE rL.2	R	OFF = Output off ON = Output on
14 bit	STATE rL.3	R	OFF = Output off ON = Output on
15 bit	STATE rL.4	R	OFF = Output off ON = Output on
16 bit	STATE rL.5	R	OFF = Output off ON = Output on
17 bit	STATE rL.6	R	OFF = Output off ON = Output on

607	out.1	R/W	Allocation of physical output OUT 1		
608	out.2	R/W	Allocation of physical output OUT 2		
609	out.3	R/W	Allocation of physical output OUT 3		
610	out.4	R/W	Allocation of physical output OUT 4		
611	out.5	R/W	Allocation of physical output OUT 5		
612	out.6	R/W	Allocation of physical output OUT 6		
613	out.7	R/W	Allocation of physical output OUT 7		
614	ovt.8	R/W	Allocation of physical output OUT 8		
615	out.9	R/W	Allocation of physical output OUT 9		
616	out.10	R/W	Allocation of physical output OUT 10		
290	FAD_OUTAN1	R	Value of analogue output 1		
291	FAD_OUTAN2	R	Value of analogue output 2		
292	FAD_OUTAN3	R	Value of analogue output 3		
258	FAD_OUTAN4	R	Value of analogue output 4		

82 bit	State of output OUT1	R	OFF = Uscita disattiva ON = Uscita attiva
83 bit	State of output OUT2	R	
84 bit	State of output OUT3	R	
85 bit	State of output OUT4	R	
86 bit	State of output OUT5	R	
87 bit	State of output OUT6	R	
88 bit	State of output OUT7	R	
89 bit	State of output OUT8	R	
90 bit	State of output OUT9	R	
91 bit	State of output OUT10	R	
664		R	State outputs

SETPOINT SETTINGS

138 16 - 472	SP	R/W	Local setpoint		
181	tP.2	R/W	Auxiliary analog input function		
18 136 - 249	SP.r	R/W	Remote setpoint (SET Gradient for manual power correction)		
250	SERIAL_SP	R/W	*Remote Setpoint from serial line*		
25 20 - 28 - 142	Lo.L	R/W	Lowest settable limit SP, SP remote and absolute alarms		
26 21 - 29 - 143	Hi.L	R/W	Highest settable limit SP, SP remote and absolute alarms		
10 bit	LOCAL / REMOTE	R/W	OFF = Enable local setpoint ON = Enable remote setpoint		
305		R/W	Instrument state (STATUS_W)		
1 137 - 481	SPA	R	Active setpoint		
4		R	Deviation (SPA - PV)		

SETPOINT CONTROL

234 22	G.SP	R/W	Set Gradient		
259	G.S2	R/W	Set Gradient for SP2		
265	Hot	R/W	Select hot runner functions		
191	hd.1	R/W	Enable multiset instrument control via serial		
230 482	SP.1	R/W	Setpoint 1		
231 483	SP.2	R/W	Setpoint 2		
140	diG.	R/W	Digital input function		
618	diG.2	R/W	Digital input 2 function		
75 bit	SELECT SP1 / SP2	R/W	OFF = Select SP1 ON = Select SP2		
305		R/W	Instrument state (STATUS_W)		

PID HEAT/ COOL CONTROL

617	SPU	R/W	Enable zone process variable			
180	Ctr	R/W	Control type			
5 148 - 149	h.Pb	R/W	Proportional band for heating or hysteresis ON/OFF			
7 150	h.It	R/W	Integral heating time			
8 151	h.dt	R/W	Derivative heating time			
6	c.Pb	R/W	Proportional band for cooling or hysteresis ON/OFF			
76	c.It	R/W	Integral cooling time			
77	c.dt	R/W	Derivative cooling time			
513	C.ME	R/W	Select cooling fluid			
2 132 - 471	Ou.P	R	Value control outputs (+Heat / -Cool)			
39 484	c.SP	R/W	Cooling setpoint relative to heating setpoint			
78	rSt	R/W	Manual reset (value added to PID input)			
516	P.rS	R/W	Reset power (value added directly to PID output)			
79	A.rS	R/W	Antireset (limits integral PID action)			
80	FFd	R/W	Feedforward (value added to PID output after processing)			
42 146	h.P.H	R/W	Maximum limit heating power			
254	h.P.L	R/W	Min. limit heating power (not available for double action heat/cool)			
43	c.p.x	R/W	Maximum limit cooling power			
255	c.p.L	R/W	Min. limit cooling power (not available for double action heat/cool)			
765	P.PEr	R/W	Percentage of output power			
766	P.oFS	R/W	Offset of output power			
763	G.Out	R/W	Gradient for control output			
764	Lo.P	R/W	Minimum output trigger			

865	tP.AO1	R/W	Output type analog 1	
866	tP.AO2	R/W	Output type analog 2	
867	tP.AO3	R/W	Output type analog 3	
860	tP.AO4	R/W	Output type analog 4	
868	rF.AO1	R/W	Attribution reference output analog 1	
869	rF.AO2	R/W	Attribution reference output analog 2	
870	rF.AO3	R/W	Attribution reference output analog 3	
861	rF.AO4	R/W	Attribution reference output analog 4	
871	LS.AO1	R/W	Minimum scale limit of analog output 1	
872	LS.AO2	R/W	Minimum scale limit of analog output 2	
873	LS.AO3	R/W	Minimum scale limit of analog output 3	
862	LS.AO4	R/W	Minimum scale limit of analog output 4	
874	HS.AO1	R/W	Maximum scale limit of analog output 1	
875	HS.AO2	R/W	Maximum scale limit of analog output 2	
876	HS.AO3	R/W	Maximum scale limit of analog output 3	
863	HS.AO4	R/W	Maximum scale limit of analog output 4	
856	SERIAL_OUTA1	R/W	Serial line value	
8574	SERIAL_OUTA2	R/W	Serial line value	
858	SERIAL_OUTA3	R/W	Serial line value	
859	SERIAL_OUTA4	R/W	Serial line value	

AUTOMATIC/MANUAL CONTROL

252		R/W	MANUAL_POWER		
2 132 - 471	Ou.P	R	Value control outputs (+Heat / -Cool)		
140	diG.	R/W	Digital input function		
618	diG.2	R/W	Digital input 2 function		
1 bit	AUTO/MAN	R/W	OFF = Automatic ON =Manual		
305		R/W	Instrument state *(STATUS_W)*		

HOLD FUNCTION

140	diG.	R/W	Digital input function		
618	diG.2	R/W	Digital input 2 function		
64 bit	HOLD	R/W	OFF = hold off ON = hold on		

MANUAL POWER CORRECTION

505	RIF	R/W	Line voltage		
506	Cor	R/W	Manual power correction based on line voltage		
18 136 - 249	SP.r	R/W	Remote setpoint (SET Gradient for power correction		

AUTOTUNING

31	S.tu	R/W	Enable selftuning, autotuning, softstart		
140	diG.	R/W	Digital input function		
618	diG.2	R/W	Digital input 2 function		
29 bit	AUTOTUNING	R/W	OFF = Stop Autotuning ON = Start Autotuning		
28 bit	AUTOTUNING STATE	R	OFF = Autotuning in Stop ON = Autotuning in Start		
68 bit	DIGITAL INPUT STATE 1	R	OFF = Digital input 1 off ON = Digital input 1 on		
92 bit	DIGITAL INPUT STATE 2	R	OFF = Digital input 2 off ON = Digital input 2 on		
296		R	Enable autotuning and selftuning state (FLG_PID)		
305		R/W	Instrument state *(STATUS_W)*		

SELFTUNING

31	S.tu	R/W	Enable selftuning, autotuning, softstart			
140	diG.	R/W	Digital input function			
618	diG.2	R/W	Digital input 2 function			
3 bit	SELFTUNING	R/W	OFF = Stop Selftuning ON = Start selftuning			
0 bit	SELFTUNING STATE	R	OFF = Selftuning in Stop ON = Selftuning in Start			
68 bit	DIGITAL INPUT STATE 1	R	OFF = Digital input 1 off ON = Digital input 1 on			
92 bit	DIGITAL INPUT STATE 2	R	OFF = Digital input 2 off ON = Digital input 2 on			
296		R	Enable autotuning and selftuning state (FLG_PID)			
305		R/W	Instrument state (STATUS_W)			

SOFTSTART

31	S.tu	R/W	Enable selftuning, autotuning, softstart			
147	SoF	R/W	Softstart time			
30 bit	RESTART SOFTSTART/ DRY OUT	R/W	OFF = - ON = Restart softstart/Dry out			
63 bit	SOFTSTART STATE/ DRY OUT	R	OFF = Softstart/Dryout in Stop ON = Softstart/Dryout in Start			
114 bit	END_OFF SOFTSTART/ DRY OUT	R/W	OFF = - ON = Fase di Softstart/Dry Out forzata al termine e inibita			
140	dIG.	R/W	Digital input function	See Table Digital input functions		0
618	dIG.2	R/W	Digital input 2 function			0

START MODE

699	P.On.t	R/W	Start mode at Power-On			

SOFTWARE SHUTDOWN

140	diG.	R/W	Digital input function			
618	diG.2	R/W	Digital input 2 function			
11 bit	SOFTWARE ON/OFF	R/W	OFF = On ON =Off			
68 bit	DIGITAL INPUT STATE 1	R	OFF = Digital input 1 off ON = Digital input 1 on			
92 bit	DIGITAL INPUT STATE 2	R	OFF = Digital input 2 off ON = Digital input 2 on			
305		R/W	Instrument state (STATUS_W)			

FAULT ACTION POWER

265	Hot	R/W	Select hot runner functions			
228	FA.P	R/W	Fault action power (supplied in conditions of broken probe)			
26 bit	STATE OF HB ALARM OR POWER_FAULT	R	OFF = Alarm off ON = Alarm on			
80	State of power alarm (hot runners)	R	OFF = Alarm off ON = Alarm on			

POWER ALARM

261	b.St	R/W	Stability band (hot runners power alarm function)		
262	b.PF	R/W	Power alarm band (hot runners power alarm function)		
260	Pf.t	R/W	Power alarm delay time (hot runners)		
160	rL.1	R/W	Allocation of reference signal		
163	rL.2	R/W	Allocation of reference signal		
166	rL.3	R/W	Allocation of reference signal - Output OR		
170	rL.4	R/W	Allocation of reference signal - Output AND		
171	rL.5	R/W	Allocation of reference signal - Output OR		
172	rL.6	R/W	Allocation of reference signal - Output AND		

PREHEATING SOFTSTART AND DRYOUT

265	Hot	R/W	Function selection hot runners		
263	SP.S	R/W	Softstart and dryout setpoint (preheating hot runners)		
264	So.P	R/W	Softstart and dryout power (preheating hot runners)		
147	SoF	R/W	Softstart and dryout time		
30 bit	RESTART SOFTSTART/ DRYOUT	R/W	OFF = - ON = Restart Softstart and dryout		
63 bit	STATE OF SOFTSTART/ DRYOUT	R	OFF = Softstart/dryout in Stop ON = Softstart/dryout in Start		
114 bit	END_OFF SOFTSTART/ DRY OUT	R/W	OFF = - ON = Fase di Softstart/Dry Out forzata al termine e inibita		
140	dIG.	R/W	Digital input function	*See Table Digital input functions*	0
618	dIG.2	R/W	Digital input 2 function		0

HEATING OUTPUT (fast cycle)

160	rL.1	R/W	Allocation of reference signal		
163	rL.2	R/W	Allocation of reference signal		

TRIGGER MODES

703	Hd.5	R/W	Enable trigger modes		
707	Fu.tA	R/W	Maximum limit of RMS current at normal operation		
704	bF.Cy	R/W	Minimum number of cycles of BF modes		

SOFTSTART

630	PS.Hi	R/W	Maximum phase of phase softstart ramp		
705	PS.Tm	R/W	Duration of phase softstart ramp		
629	PS.oF	R/W	Minimum non-conduction time to reactivate phase softstart ramp		
706	ps.tA	R/W	Maximum peak current limit during phase softstart ramp		
108 bit	Restart of phase softstart ramp	R/W	OFF = Restart not enabled ON=Restart enabled		

106 bit	State of phase softstart ramp	R	OFF = no Ramp in progress ON = current Ramp
107 bit	State of phase softstart ramp	R	OFF = unterminated Ramp ON = Ramp completed

DELAY TRIGGERING

708	dL.t	R/W	Delay triggering (first trigger only)		
772	dL.tr	R/W	Delay triggering with phase rotation 1-3-2		
738	dL.oF	R/W	Minimum non-conduction time to reactivate delay triggering		

FEEDBACK MODES

730	Hd.6	R/W	Enable feedback modes		
731	Cor.V	R/W	Maximum correction of voltage feedback		
732	Cor.I	R/W	Maximum correction of current feedback		
733	Cor.P	R/W	Maximum correction of power feedback		
734	riF.V	R/W	Voltage feedback reference		
735	riF.I	R/W	Current feedback reference		
736	riF.P	R/W	Power feedback reference		
109 bit	Calibration of voltage feedback reference	R/W	OFF=Calibration non enabled ON= Calibration enabled		
110 bit	Calibration of current feedback reference	R/W	OFF=Calibration non enabled ON= Calibration enabled		
111 bit	Calibration of power feedback reference	R/W	OFF=Calibration non enabled ON= Calibration enabled		
741	Fb.lt	R/W	Speed feedback response		
113 bit	Calibration of selected feedback reference	R/W	OFF=Calibration non enabled ON= Calibration enabled		
464		R/W	STATUS 11_W		
757*	ARif	R	Feedback		

HEURISTIC power control

680	Hd.3	R/W	Enable heuristic power control		
681	I.HEU	R/W	Maximum current for heuristic power control		

HETEROGENEOUS power control

682	Hd.4	R/W	Enable heterogeneous power control		
683	I.HEt	R/W	Maximum current for heterogeneous power control		

Virtual instrument control

191	hd.1	R/W	Enable multiset instrument control via serial		
224	S.In	R/W	Control inputs from serial		
225	S.Ou	R/W	Control outputs from serial		
628	S.LI	R/W	Control LEDs and digital inputs from serial		

122	UPd	R	Software version code
85	Err	R	Self-diagnosis error code for main input
606	Er.2	R	Self-diagnosis error code for auxiliary input
190	C.Hd	R	Hardware configuration codes
508	C.Hd1	R	Self-diagnosis error code for auxiliary input
693 697	Upd.F	R	Fieldbus software version
695	Cod.F	R	Fieldbus node
696	Bau.F	R	Fieldbus baudrate
346		R	State DIP-Switches
773	J.SEt	R	Virtual DIP-Switches status (by serial)
774	J.SEr	R	DIP-Switches settings
120		R	Manufact - Trade Mark (Gefran)
121		R	Device ID (GFX4-IR)
197	Ld.st	R/W	RN status LED function
619	Ld.2	R/W	ER status LED function
620	Ld.3	R/W	DI1 LED function
621	Ld.4	R/W	DI2 LED function
622	Ld.s	R/W	O1 LED function
623	Ld.6	R/W	O2 LED function
624	Ld.7	R/W	O3 LED function
625	Ld.8	R/W	O4 LED function
305		R/W	Instrument state *(STATUS_W)*
467		R	Instrument state
469		R	Instrument state 1
632		R	Instrument state 2
633		R	Instrument state 3
634		R	Instrument state 4
702		R	Voltage Status

Notes

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