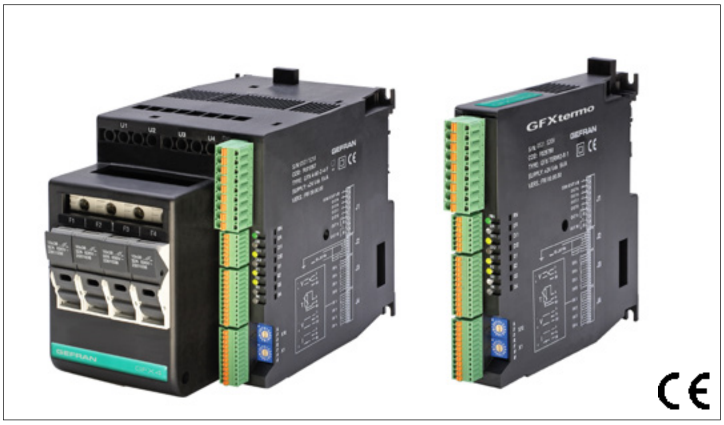
GFX4 / GFXTERMO4
4-ZONE MODULAR POWER CONTROLLER



CONFIGURATION AND PROGRAMMING MANUAL

Software version: **2.1x**

code: **80397O - 07-2022 - ENGLISH**

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 on extrusion lines, in plastic injection presses, thermoforming machines, packaging and packing machines and, in general, in traditional 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.

STRUCTURE OF THIS MANUAL

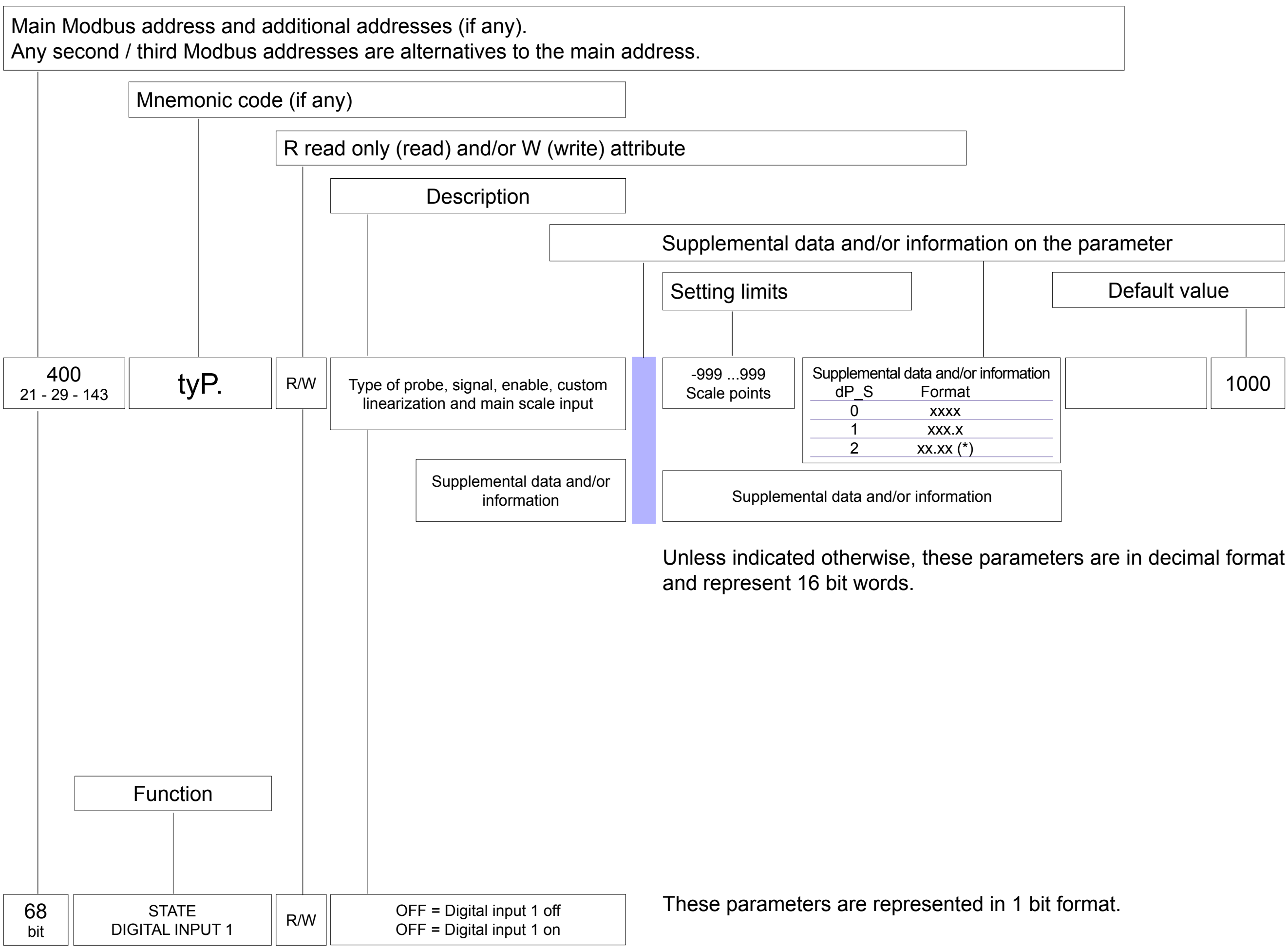
This manual was originally written in ITALIAN. Therefore, in case of inconsistencies or doubts, request the original manual or explanations from GEFRAN.
The instructions in this manual do not replace the safety instructions and the technical data for installation, configuration and programming applied 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:



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);

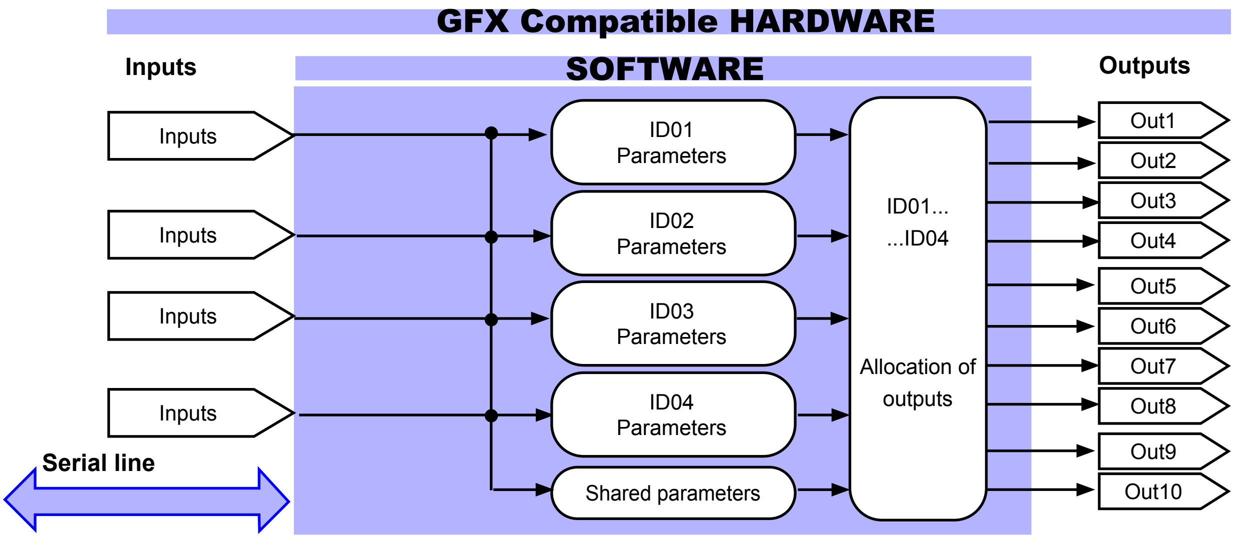
- GFX4 mode: as a single instrument with the same functions as 4 separate instruments, but with possibility of interaction among the various parameters, inputs and outputs (recommended for new projects).

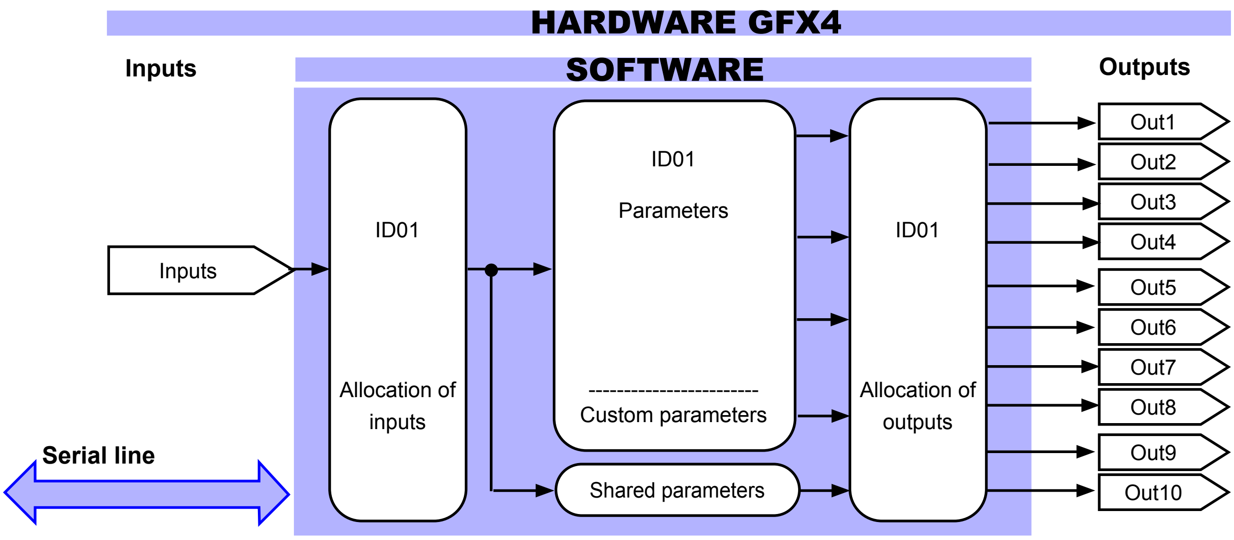
New shared parameters, identified with Modbus addresses higher than 600, are accessible for both modes and permit more advanced functions such as:

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).





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 From 2.50 version the EEP.E parameters has been added to disable EEPROM memory for all parameters. When the memory is disabled, the last modified value with enabled memory remains.

901	EEP.E	R/W	EEPROM saving	*EEPROM saving table* 0 Enables 1 Disabled		0

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. 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 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 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.
GFX4s 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).
GFX4s 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 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 modules in a serial network, with node address selectable from “01” to “99” in standard mode, or create a mixed GFX4 / Geflex network in Geflex compatible mode in which each 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.

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

Baudrate table

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 No parity 1 Odd 2 Even		0

Communication error

If Modbus communication between GFX4 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 Delivered power is not changed 1 La potenza erogata viene forzata al valore C.E.P +16 only for C.M.E -1 in MANUAL_POWER at the restart of the communication (only if in manual mode)		0
892	C.E.P	R/W	Output power when communication error is active	-100.0...100.0%		0,0

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 PV value is considered unchanged.

In the case of a Modbus TCP connection, the parameter ENABLE_DISABLE_BACKGROUND_TASK must be set to 0 at Modbus address 65527 to make active the control on Dialog timeout.

Settings necessary to use the custom map

1. Set the internal variable of the card **Enable serial background** to address 65527 (0xfff7) to value 0 **(default value for this parameter is 1)**
2. Set the internal variable of the **UnLock Custom Map** tab to address 65529 (0xfff9) to value 1 **(the default value for this parameter is 1)**

Settings required for using the second modbus tcp channel

Set the internal variable of the Enable tab according to the TcpModbus socket at 65528 (0xfff8) to the value 1 (the default value for this parameter is 0)

Settings required to reset the card to the default values

1. Turn on the instrument (if OFF)
2. Place rotary X10 = C and rotary X1 = 0
3. Wait for more than 10 seconds
4. Turn off the instrument
5. Reposition the rotary to the desired working value between 1 and 99
6. Turn the instrument on

Parameter name	Address	Access Type	Description	Default
ENABLE_DISABLE_BACKGROUND_TASK	65527	RW	Enable\Disable Background task(1): 1: Backgroud task ENABLED 0: Backgroud task DISABLED	1
ENABLE_DISABLE_SECOND_SOCKET	65528	RW	Enable\Disable second socket Modbus TCP 0: Second socket Modbus TCP DISABLED 1: Second socket Modbus TCP ENABLED	0
LOCK_UNLOCK_DATA_AREA_ACCESS	65529	RW	Lock\Unlock objects access 1: Free access to all modbus object parameters. 0: Access limited ONLY to Custom Map Data Area	1

Note :
Background task must be used ONLY when compatible mode is setting on GFW, GFX4\GFXTERMO4, GFX4-IR.

Probes and sensors

400	tyP.	R/W	Probe type, signal, enable, custom linearization and main input scale	*Table of probes and sensors*	0

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

TC SENSOR

	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	0.0/999.9
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
28	TC	custom	custom	custom
29	TC	custom	custom	custom

SENSOR: RTD 3-wires

	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 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	Custome linearization	Custome linearization
36	12...60 mV	Linear	-1999/9999	-199.9/999.9
37	12...60 mV	Linear	Custome linearization	Custome linearization

SENSOR: 20mA current

	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	Custome linearization	Custome linearization
40	4...20 mA	Linear	-1999/9999	-199.9/999.9
41	4...20 mA	Linear	Custome linearization	linear. custom

SENSOR: 1V voltage

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

SENSOR: Custom

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

99 Input off

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

Tc type:
J, K error < 0.2% f.s.
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	*Decimal point table*	0

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

	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

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)

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 ... 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

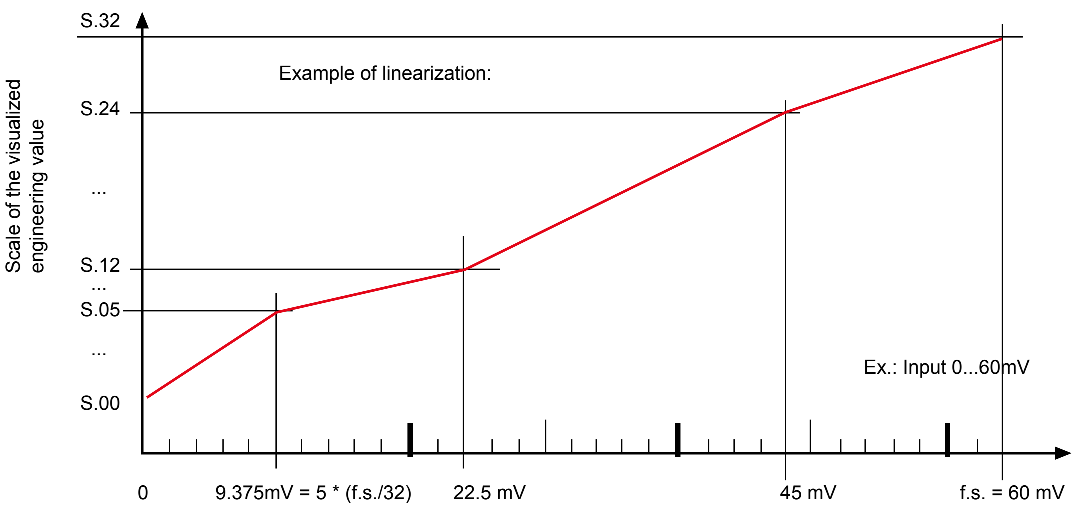
For signals coming from sensors, linearization is done by dividing the input scale into 32 zones of equal dV amplitude, where:

dV = (full-scale value – 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:

Input value (k) = 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)

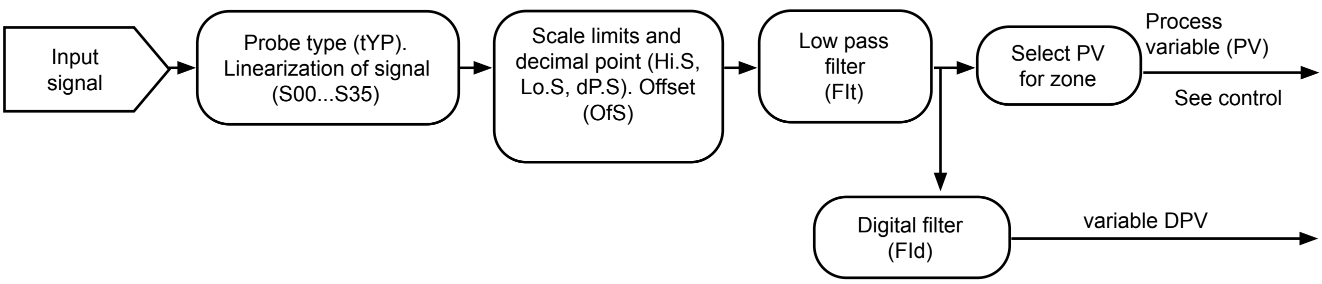
For correct signaling of error state (Lo, Hi), the value set in S.00 must coincide with limit Lo.S and the value set in S.32 with limit Hi.S.

- 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



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.

CT AUXILIARY INPUT (Ammeter)

Optional input used to monitor current delivered to the load, both single phase and 3-phase, with automatic recognition of the internal ammeter transformer.

Models with 4 TA (GFX4-x-x-2-x-x and GFX4-x-x-4-x-x) let you continuously acquire the current values circulating in the load with sampling interval of 60ms. The current value can be read in variable I.tA1 of each zone. If zone 1 has a 3-phase load, variables I.tA1, I.tA2 and I.tA3 in the first zone have the current value in line 1, line 2 and line 3, respectively.

You can also read the maximum current value corresponding to running state (ON) in variable I1on. This value is reset when no power is requested. In 3-phase load configuration, variables I1on, I2on and I3on in the first zone contain the current value in line 1, line 2 and line 3, respectively.

Models with 1 CT (GFX4-x-x-1-x-x and GFX4-x-x-3-x-x) sample the load current value at a programmable time interval (parameter dG.t). Therefore, you can use the best sampling time for the application being run and, especially, for load type, since activation of the scan to identify faults on the load with fast systems and short cycle times may be critical for stable temperature control.
How does the periodic scan work? First, power to all 4 zones is interrupted (control outputs = OFF), then, in succession, if the power requested exceeds a minimum settable value (dG.P), the individual zones activate to acquire the current value.
If there is current with the 4 zones OFF, the device is in SSR SHORT condition, but the faulty zone is not identified. If no current is detected with the zone ON (control output = ON), the device is in NO CURRENT condition, corresponding to a possible interrupted load or SSR open or no line voltage or blown fuse. If current flows, the sampled value is saved in variable I.tA1.

The 4 ammeter inputs are IN9, IN10, IN11, IN12, and the current value is found in variable ItA1 for zones 1, 2, 3, 4, respectively.

If diagnostics identifies a fault on the load, the red ER LED starts to flash in sync with yellow LED O1 or O2 or O3 or O4 for the faulty zone.
The condition POWER_FAULT in OR with the HB alarm can be assigned to an alarm or can be identified in the state of a bit in the STATUS_INSTRUMENT, STATUS_INSTRUMENT_1, and STATUS_INSTRUMENT_2 variables.
In STATUS_INSTRUMENT_3, you can identify the condition that activated the POWER_FAULT alarm.

The POWER_FAULT diagnostics is configurable with parameter hd.2, with which you can also enable only one of its parts.

With models that have 4 CTs, you can diagnose the following single conditions:
- SSR SHORT: SSR module in short circuit;
- NO VOLTAGE: no line voltage or fuse blown or load interrupted;
- SSR OPEN: SSR module open ;
- HB: load partially interrupted.

With models that have 1 CT, you can diagnose the following conditions:
- SSR SHORT: SSR module in short circuit;
- NO CURRENT: load interrupted or SSR open or no line voltage or fuse blown;
- HB: load partially interrupted.

For a zone with single-phase load, the default value of the maximum limit or full scale of the current transformer (H.tA1) depends on the model, and equals 20.0A (30 kW model), 40.0A (60 kW model) or 60.0A (80 kW model). Parameters for correction of offset (o.tA1) and for the digital filter (Ft.tA) refer to the ammeter input.

If zone 1 has a 3-phase load, the following parameters are significant:
- I.tA1, I.tA2 and I.tA3: ammeter value on line L1, L2 and L3, respectively;
- 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 control O1 on (ON) on line L1, L2 and L3;
- H.tA1, H.tA2 and H.tA3: maximum limit or full scale of current transformer on line L1, L2 and L3;
- o.tA1, o.tA2 and o.tA3 = offset correction for ammeter input on line L1, L2 and L3;
- Ft.tA = digital filter for ammeter input.

Scale limits

						Model		
						30kW	60kW	80kW
405	H.tA1	R/W	Maximum scale limit of current transformer CT (phase 1)	0.0 ... 999.9		20,0	40,0	60,0
413	H.tA2	R/W	Maximum scale limit of current transformer CT (phase 2)	0.0 ... 999.9	With 3-phase load	20,0	40,0	60,0
414	H.tA3	R/W	Maximum scale limit of current transformer CT (phase 3)	0.0 ... 999.9	With 3-phase load	20,0	40,0	60,0

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 input value (phase 1)	Not significant if there is only 1 CT (refers to I.1On)
490	I.tA2	R	Instantaneous CT input value (phase 2)	With 3-PHASE LOAD– Not significant if there is only 1 CT (refers to I.2On)
491	I.tA3	R	Instantaneous CT input value (phase 3)	With 3-PHASE LOAD– Not significant if there is only 1 CT (refers to I.3On)
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)	

ADVANCED SETTINGS

Input filter

219	Ft.tA1	R/W	*CT input digital filter* (phases 1, 2 and 3)	0.0 ... 20.0 sec		0.0

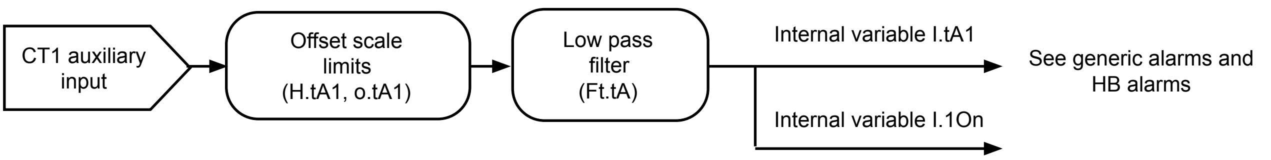
Sets a low pass filter on the CT auxiliary input, running the average of values read in the specified time interval. If = 0 , excludes the average filter on sampled values.

Input sampling interval

661	dG.t	R/W	CT input sampling interval	10 ...999 sec	Only for GFX4 1TA	10

Sets an interval for the sampling load current value for activation of the SSR_SHORT and NO_CURRENT alarms *(see: Power Fault ALARMS)*.

SCHEMA FUNZIONALE



VOLTAGE VALUE ON THE LOAD (Voltmeter)

The voltage read value is present for each zone only on models with 4 CTs (GFX4-x-x-2-x-x and GFX4-x-x-4-x-x), and is used to monitor voltage applied to a single-phase or 3-phase load, with automatic recognition of the internal voltmeter transformer.

The value of the voltage applied to the load is saved in variable I.tV1. For each phase, the voltage value is updated while the control output is inactive, otherwise, the value is frozen at the last valid read.

The voltmeter function is significant with:
- 4 independent zones with 4 single-phase loads;
- 1 zone with 3-phase star load with neutral + 1 single-phase zone;
- 1 zone with 3-phase load with open triangle + 1 single-phase zone.

For a zone with single-phase load, the default value of the maximum limit or full scale of the volumetric value (H.tV1) is 530V, and the input is linear on the interval 90...530V. The parameters for correction of offset (o.tV1) and the digital filter (Ft.tV) refer to the voltmeter input.

If zone 1 has a 3-phase load, the following parameters are not significant:
- I.tV1, I.tV2 and I.tV3: voltmeter value on line L1, L2 and L3, respectively;
- I.VF1, I.VF2 and I.VF3: filtered voltmeter value (see Ft.tV) on line L1, L2 and L3;
- H.tV1, H.tV2 and H.tV3: maximum limit or full scale of voltage transformer on line L1, L2 and L3;
- o.tV1, o.tV2 and o.tV3 = offset correction for voltmeter input on line L1, L2 and L3;
- Ft.tV = digital filter for voltmeter input.

ATTENTION: for load voltages below 90VAC, the voltage read on the load and possible alarms have no value.

Scale limits

410	HS.tV1	R/W	Maximum scale limit of voltage transformer TV input (phase 1)	0.0 ... 999.9		530,0
417	H.tV2	R/W	Maximum scale limit of voltage transformer TV input (phase 2)	0.0 ... 999.9	With 3-phase load	530,0
418	H.tV3	R/W	Maximum scale limit of voltage transformer TV input (phase 3)	0.0 ... 999.9	With 3-phase load	530,0

Setting the offset

411	oF.tV1	R/W	*Offset correction for TV input* (phase 1)	-99.9 ...99.9 Scale points		0,0
419	o.tV2	R/W	Offset correction for TV input (phase 2)	-99.9 ...99.9 Scale points	With 3-phase load	0,0
420	o.tV3	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	I.tV1	R	Value of voltmeter input (phase 1)	
492	I.tV2	R	Value of voltmeter input (phase 2)	With 3-phase load
493	I.tV3	R	Value of voltmeter input (phase 3)	With 3-phase load

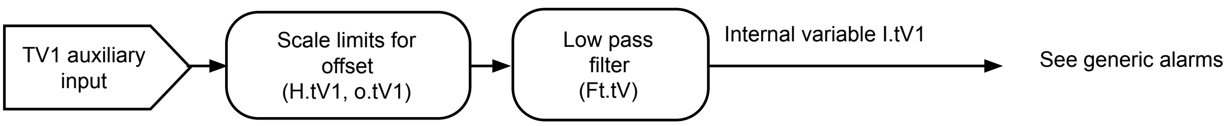
ADVANCED SETTINGS

Input filter

412	Ft.tV1	R/W	Digital filter for auxiliary TV input (phase 1, 2 and 3)	0.0 ... 20.0 sec.		0.0

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



AUXILIARY ANALOG INPUT (LIN/TC)

The GFX4 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 models GFX4-x-x-3-x-x/GFX4-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	*Auxiliary inputs sensors table*	0

	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		

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

181	tP.2	R/W	Definition of auxiliary analog input function	*Table of auxiliary input functions*	0

	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%	(**)

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

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

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

	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 scal selected in AI.2 e tP.2	0
603	HS.2	R/W	Maximum limit of auxiliary input scale	Min...max input scal selected in AI.2 e 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)

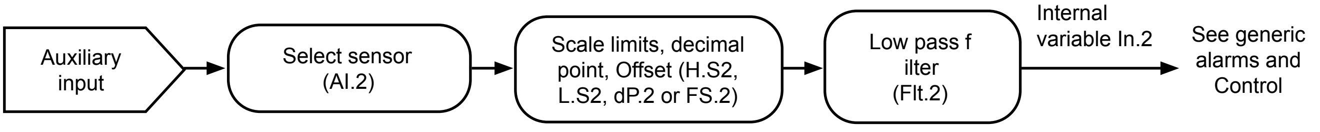
ADVANCED SETTINGS

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



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	*Digital input functions table*	0	*Activation*
618	dIG.2	R/W	Digital input 2 function		0	

	Digital input functions table	*Activation*
0	No functions (input off)	
1	MAN/AUTO controller	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	None	
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 (*)	
	+ 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 = state dIG bit.1 = state dIG.2	

Functions related to digital inputs

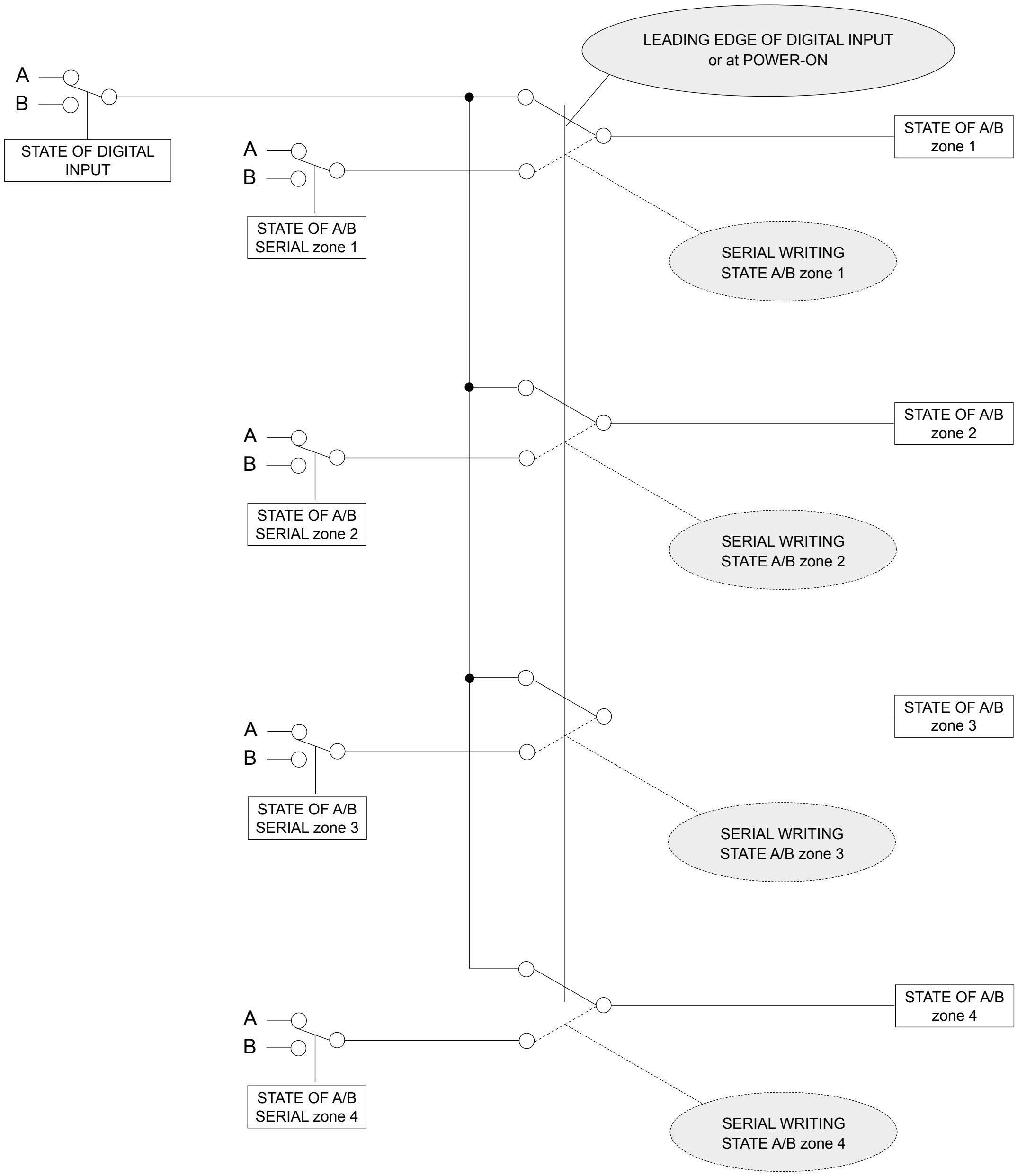
- MAN / AUTO controller	see AUTO/MAN CONTROL
- LOC / REM	see SETTING THE SETPOINT
- HOLD	see HOLD FUNCTION
- Reset memory latch	see GENERIC ALARMS AL1 .. AL4
- Select SP1 / SP2	see SETTINGS - Multiset
- Software OFF / ON	see SOFTWARE SHUTDOWN
- START / STOP Selftuning	see SELFTUNING
- START / STOP Autotuning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

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

* continuos or one-shot

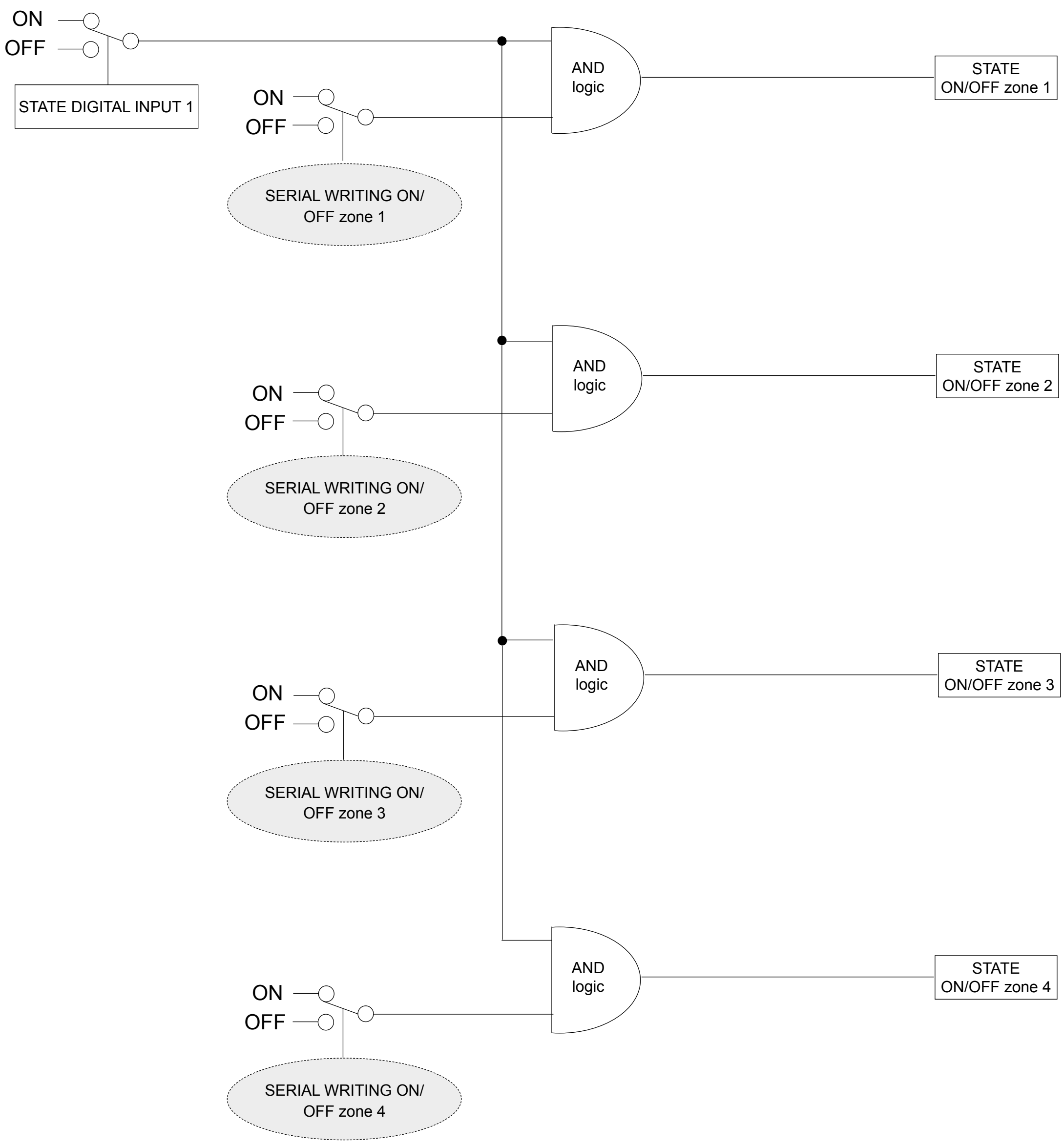


USING A FUNCTION OF DIGITAL INPUT 1 TO ENABLE AT SOFTWARE ON

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



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):

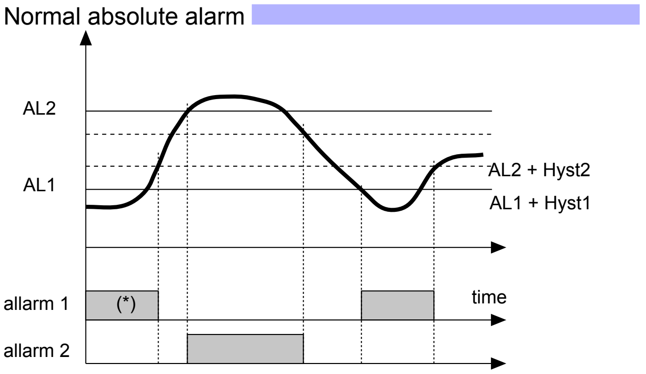
the hysteresis value defines a band for safe re-entry of the alarm condition: without this band, the alarm would be deactivated as soon as the reference variable re-entered the setpoint limits, with the possibility of generating another alarm signal in the presence of oscillations of the reference signal 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 exceed 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.

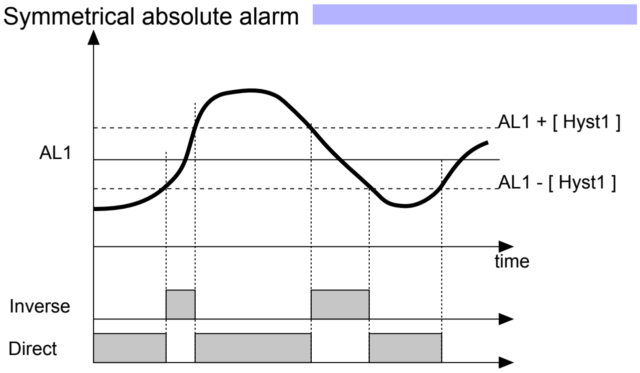
- definition of upper and lower limits for setting absolute alarms: if the alarm is used to check that the operator does not set a setpoint value outside a certain band during multiset operation. The above concepts are better explained in the following figures:

Normal absolute alarm



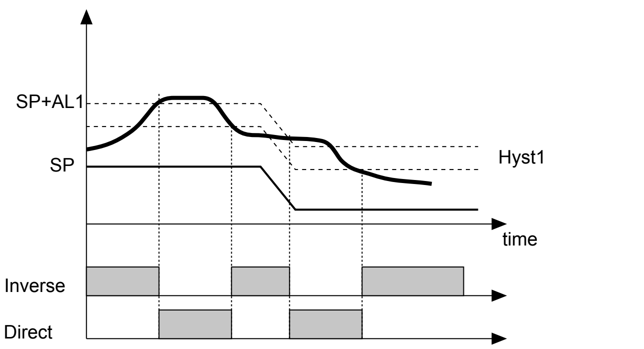
For AL1 reverse absolute alarm (low) with positive Hyst1, AL1 t = 1 (*) = OFF if disabled at switch on
For AL2 direct absolute alarm (high) with negative Hyst2, AL2 t = 0

Symmetrical absolute alarm



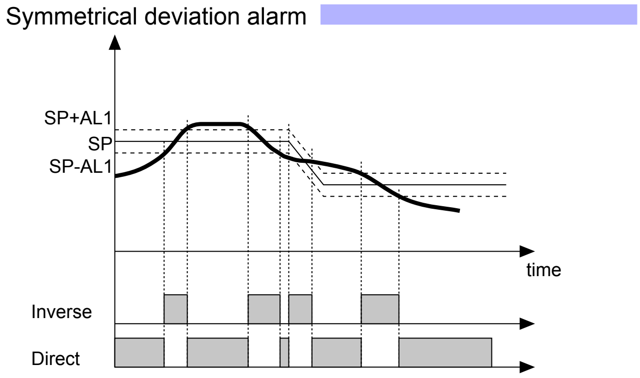
For AL1 = symmetrical inverse absolute alarm with Hyst1, AL1 t = 5
For AL1 = symmetrical direct absolute alarm with Hyst1, AL1 t = 4
Minimum hysteresis = 2 scale points

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 (dP.S)

Alarm setpoints

12 475 - 177	AL.1	R/W	*Alarm setpoint* 1 (scale points)		500
13 476 - 178	AL.2	R/W	Alarm setpoint 2 (scale points)		100
14 52 - 479	AL.3	R/W	Alarm setpoint 3 (scale points)		700
58 480	AL.4	R/W	Alarm setpoint 4 (scale points)		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 A1.t 0...999 min. Se +64 in A1.t	- 1
53 189	HY.3	R/W	Hysteresis for alarm 3	± 999 Scale points	0...999 sec. Se +32 in A1.t 0...999 min. Se +64 in A1.t	- 1
59	HY.4	R/W	Hysteresis for alarm 4	± 999 Scale points	0...999 sec. Se +32 in A1.t 0...999 min. Se +64 in A1.t	- 1

Alarm type

406	A1.t	R/W	Alarm type 1	*Table of alarm behaviour*	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

	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	

Limits of absolute alarm settings

25 20 - 28 - 142	Lo.L	R/W	Lower settable limit SP, SP remote and absolute alarms	Lo.S ... Hi.S	*See: SETTINGS – Setpoint Control*	0
26 21 - 29 - 143	Hi.L	R/W	Upper settable limit SP, SP remote and absolute alarms	Lo.S ... Hi.S		1000

Enable alarms

195	AL.n	R/W	Select number of enabled alarms	*Table of enabled alarms*	0

AL.nr	Alarm 1	Alarm 2	Alarm 3	Alarm 4
0	disabled	disabled	disabled	disabled
1	enables	disabled	disabled	disabled
2	disabled	enables	disabled	disabled
3	enables	enables	disabled	disabled
4	disabled	disabled	enables	disabled
5	enables	disabled	enables	disabled
6	disabled	enables	enables	disabled
7	enables	enables	enables	disabled
8	disabled	disabled	disabled	enables
9	enables	disabled	disabled	enables
10	disabled	enables	disabled	enables
11	enables	enables	disabled	enables
12	disabled	disabled	enables	enables
13	enables	disabled	enables	enables
14	disabled	enables	enables	enables
15	enables	enables	enables	enables

+ 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 function 2		0

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	None
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 (*)
	+ 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	

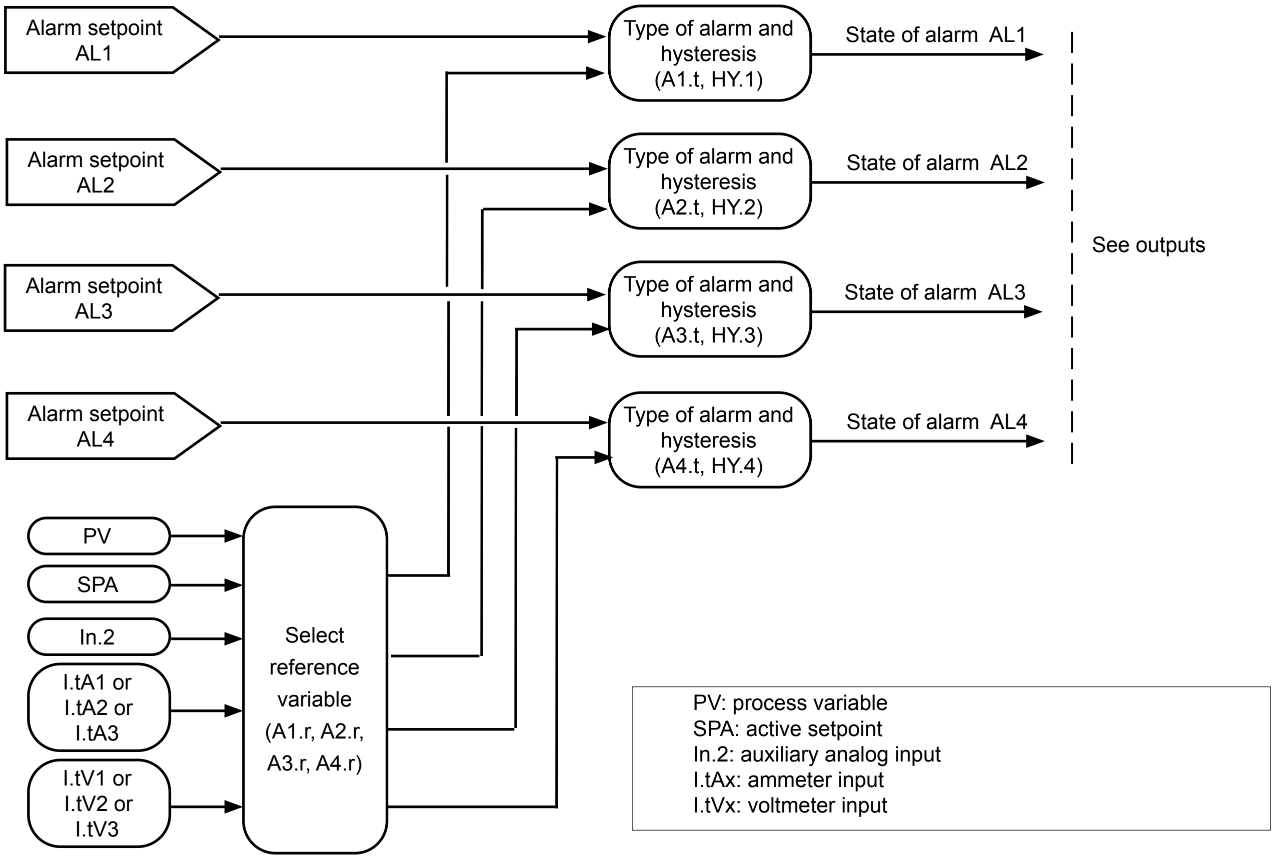
Read state

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 FASE 2 (if 3-phase)
7	State AL.HB FASE 3 (if 3-phase)

FUNCTIONAL DIAGRAM



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.

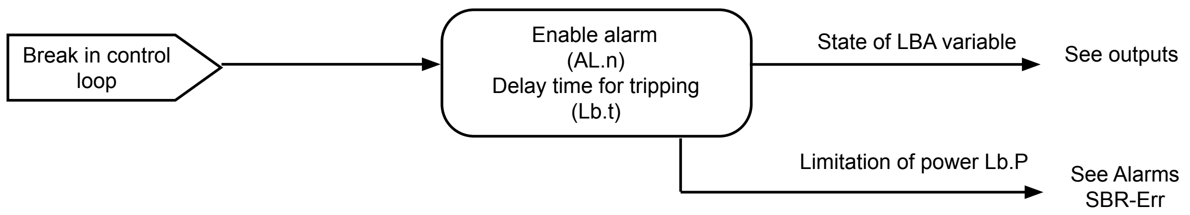
Enable alarm

195	AL.n	R/W	Select number of enabled alarms	*see: Table of enabled alarms*		0
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				

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

Enable alarm

195	AL.n	R/W	Select number of enabled alarms	*See: Table of enable alarms*	0
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.

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

+ 8 HB reverse alarm
+ 16 relates to single setpoints and singled phases WITH 2 and 3-PHASE LOAD

(*) 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

Alarm setpoints

55	A.Hb	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

Read state

26 bit	HB ALARM STATE OR POWER_FAULT	R	OFF = Alarm off ON = Alarm on
76 bit	State of HB alarm phase 1TA	R	
77 bit	State of HB alarm phase 2TA	R	
78 bit	State of HB alarm phase 3TA	R	

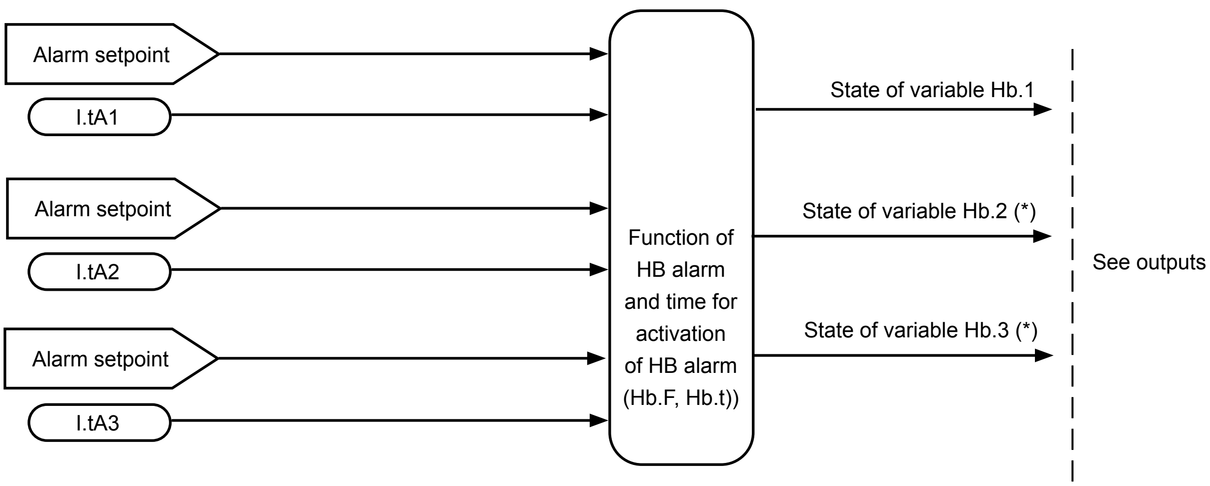
504		R	HB alarm states ALSTATE_HB (for 3-phase loads)	*Table of HB alarm states*

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 (for single-phase loads)	*Table of alarm states ALSTATE*

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

FUNCTIONAL DIAGRAM



(*) - Only for 3-phase applications
I.tAx: ammeter input

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	*Table of probe alarm settings*	0

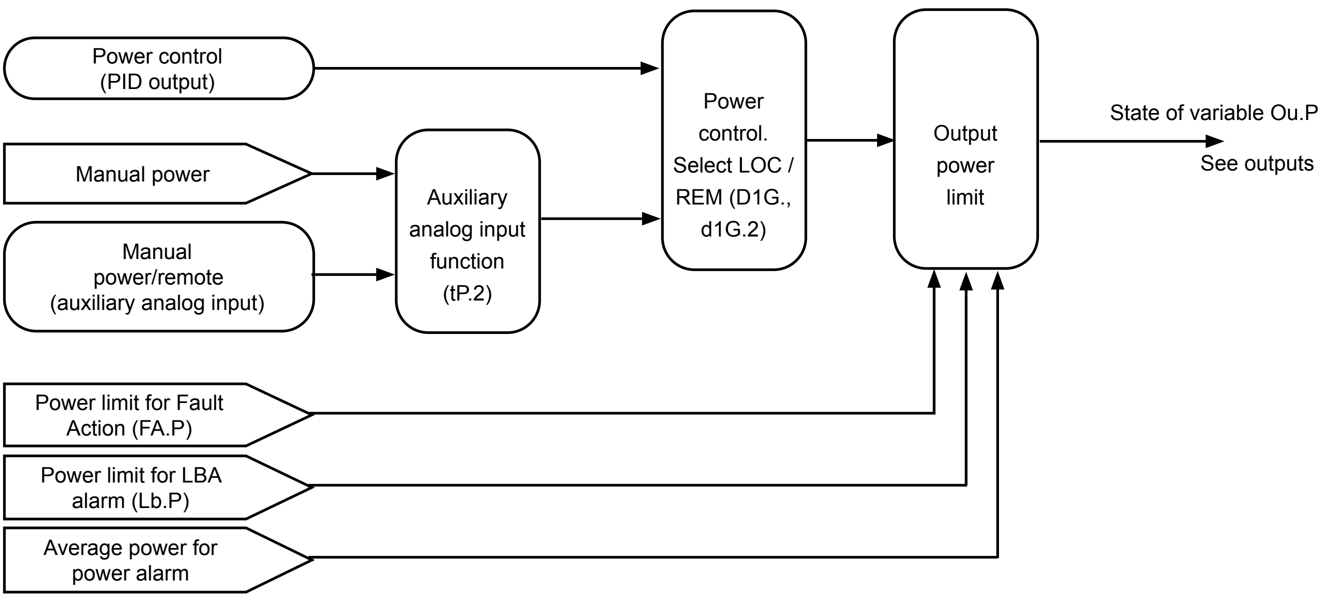
	Alarm 1	Alarm 2	Alarm 3	Alarm 4
0	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

228	FA.P	R/W	Fault action power (supplied in conditions of broken probe)	-100,0 ..100,0 %	*see: HOT RUNNERS CONTROLl*	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	

FUNCTIONAL DIAGRAM



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

GFX4 with 4 TA

660	hd.2	R/W	*Enable POWER_FAULT alarms*	*Table of Power Fault alarms*	0

	SSR_SHORT	NO_ VOLTAGE	SSR OPEN	NO_CURRENT
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

+ 32 alarms with memory

NOTE: the NO_CURRENT alarm setpoint is fixed at 1A

661	dG.t	R/W	Refresh rate SSR_SHORT The alarm activates after 3 faults.	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 inferior to cycle time.	0...99 sec	10

Note: with output power at 100%, NO_VOLTAGE alarm in diagnostic is detected only if an SSR_SHORT-code is active.

Note related to the parameter dG.t **only with 4 CT**
* for dG.t < 10 sec. the SSR_SHORT alarm is detected every dG.t seconds only when power = 0%.

* for dG.t ≥ 10 sec. the SSR_SHORT alarm is detected every dG.t seconds switching off the power for 60 msec. indipendently from the power value.

GFX4 with 1 TA

660	hd.2	R/W	*Enable POWER_FAULT alarms*	*Table of Power Fault alarms*	0

	SSR_SHORT			NO_CURRENT
0				
1	X			
2				
3	X			
4				
5	X			
6				
7	X			
8				X
9	X			X
10				X
11	X			X
12				X
13	X			X
14				X
15	X			X

+ 32 alarms with memory

NOTE: - Activation and state of alarm SSR SHORT is global for all 4 zones
- the NO_CURRENT alarm setpoint is fixed at 1A

661	dG.t	R/W	Refresh rate In.TA, SSR_SHORT and NO_CURRENT alarms The alarm activates after 3 faults.	1...999 sec	10
663	dG.P	R/W	Minimum power for acquisition In.TA and for NO_CURRENT alarm	0.0...100.0%	10,0

Note: with output power < dG.P the SSR_SHORT alarm in diagnostic is not detected.

GFXTERMO4 with 4 TA

660	hd.2	R/W	*Enable POWER_FAULT alarms*	*Table of Power Fault alarms*	0

NOTE: the NO_CURRENT alarm setpoint is fixed at 1A

	SSR_SHORT			NO_CURRENT
0				
1	X			
2				
3	X			
4				
5	X			
6				
7	X			
8				X
9	X			X
10				X
11	X			X
12				X
13	X			X
14				X
15	X			X
+ 32 alarms with memory				

661	dG.t	R/W	Refresh rate SSR_SHORT The alarm activates after 3 faults.	1...999 sec	10
662	dG.F	R/W	Time filter for NO_CURRENT alarms Note: set a value not inferior to cycle time.	0...99 sec	10

Read state

105 bit	Reset SSR_OPEN /SSR_ SHORT / NO_VOLTAGE / NO_CURRENT alarms	R/W	
93 bit	State of alarm SSR_OPEN phase 1	R	
94 bit	State of alarm SSR_OPEN phase 2	R	
95 bit	State of alarm SSR_OPEN phase 3	R	
96 bit	State of alarm SSR_SHORT phase 1	R	
97 bit	State of alarm SSR_SHORT phase 2	R	
98 bit	State of alarm SSR_SHORT phase 3	R	
99 bit	State of alarm NO_VOLTAGE phase 1	R	
100 bit	State of alarm NO_VOLTAGE phase 2	R	
101 bit	State of alarm NO_VOLTAGE phase 3	R	
102 bit	State of alarm NO_CURRENT phase 1	R	
103 bit	State of alarm NO_CURRENT phase 2	R	
104 bit	State of alarm NO_CURRENT phase 3	R	

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.

Is provided the intervention of the alarm also for speed of temperature rise (derivate) INPTC greater than 7°C in 12 seconds.

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

The alarm over_heat is canceled when the heat sink temperature falls below the value of 75°C.

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 the SSR temperature		°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).

In standard configuration, physical outputs Out1, Out2, Out3, Out4 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)	*(see: SETTINGS)*
Ct.2 = cycle time for output rL.2 for cooling control (Cool)	*(see: SETTINGS)*
rEL = alarm states AL1, AL2, AL3, AL4 in case of broken probe, Err, Sbr	*(see: GENERIC ALARMS)*

Allocation of reference signals

160	rL.1	R/W	Allocation of reference signal	0
163	rL.2	R/W	Allocation of reference signal	1

Table of reference signals

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
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 time 0.1 ... 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: 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)

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

166	rL.3	R/W	Allocation of reference signal	2
170	rL.4	R/W	Allocation of reference signal	35
171	rL.5	R/W	Allocation of reference signal	4
172	rL.6	R/W	Allocation of reference signal	160

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	AL1or 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
+ 32 for denied logic level at output	
+ 128 to force output to zero	

Read state

308 319		R	State of outputs rL.x MASKOUT	*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	1
608	out.2	R/W	Allocation of physical output OUT 2	2
609	out.3	R/W	Allocation of physical output OUT 3	3
610	out.4	R/W	Allocation of physical output OUT 4	4
611	out.5	R/W	Allocation of physical output OUT 5	5
612	out.6	R/W	Allocation of physical output OUT 6	6
613	out.7	R/W	Allocation of physical output OUT 7	7
614	out.8	R/W	Allocation of physical output OUT 8	8
615	out.9	R/W	Allocation of physical output OUT 9	17
616	out.10	R/W	Allocation of physical output OUT 10	18

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 AND rL.6) zone 1...zone 4

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

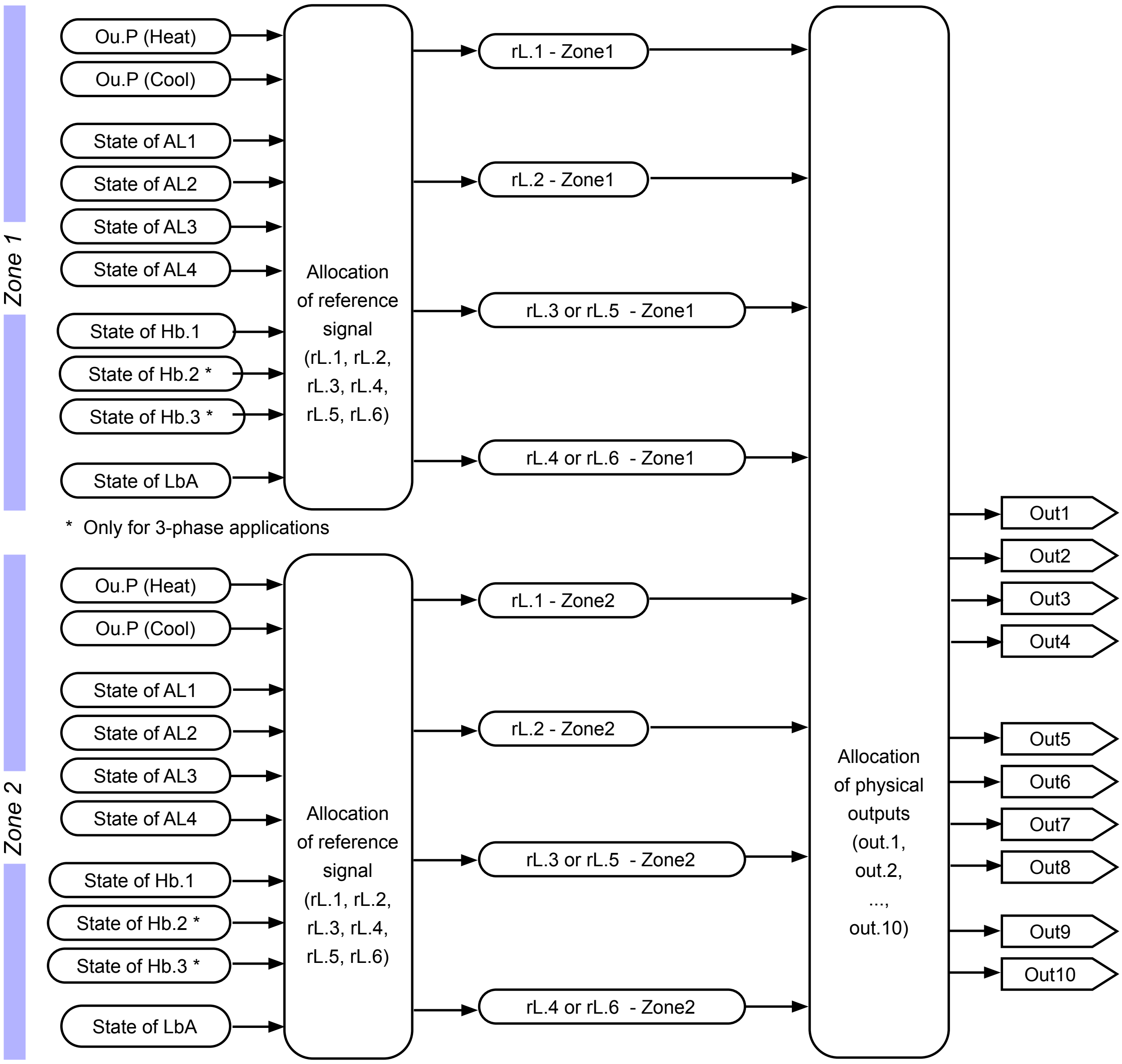
NOTE: In 3-phase configuration, the state of physical output OUT1 is copied to OUT2 and OUT3. In 2-phase configuration, the state of physical output OUT1 is copied to OUT2 and the state of physical output OUT3 to OUT4
In case of COOL OUTPUT (5,6,7,8) are continuous, the same output functions can not 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

Read state

82 bit	State of output OUT1	R	
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 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



SETTINGS

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*		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)	*Setpoint table*	0

	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)

Shared settings

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

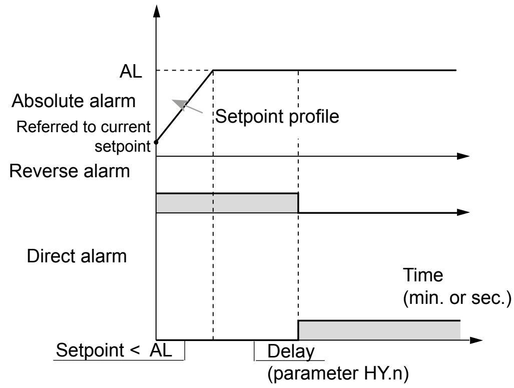
1 137 - 481	SPA	R	Active setpoint
4		R	Deviation (SPA - PV)

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

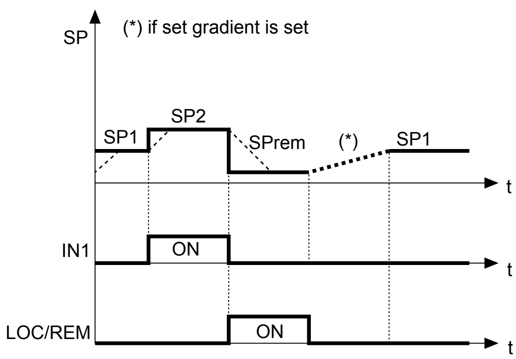
FA.P – see alarm for probe in short or connection error (SBR-ERR)

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		100
231 483	SP.2	R/W	Setpoint 2		200

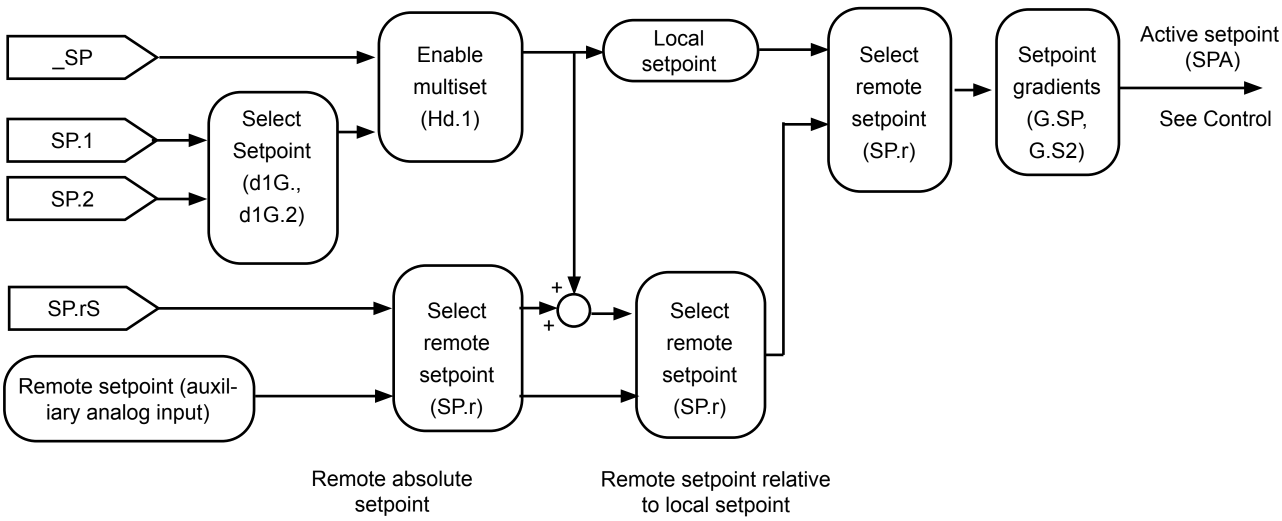
140	diG.	R/W	Digital input function	See: Table of digital input functions		0
618	dIG.2	R/W	Digital input function 2	See: Table of digital input functions		0

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

305		R/W	Instrument state	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



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

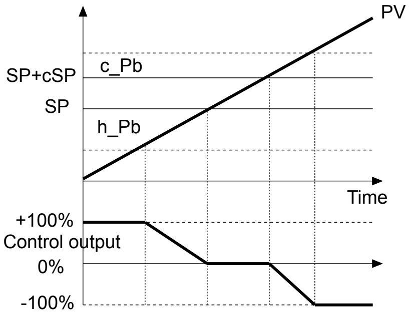
Increasing the proportional band reduces oscillation but increases deviation.
Reducing the proportional band reduces deviation but causes oscillation of the controlled variable (excessively low proportional band values make the system unstable).
An increase in Derivative Action corresponds to an increase 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

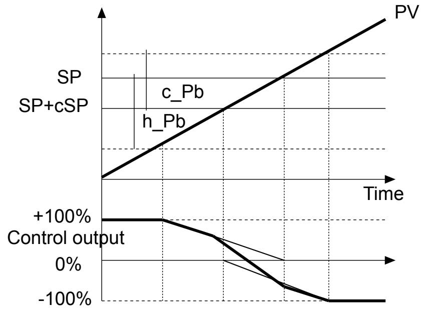
Control output with only proportional action in case of proportional heating band separate from cooling band.



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.



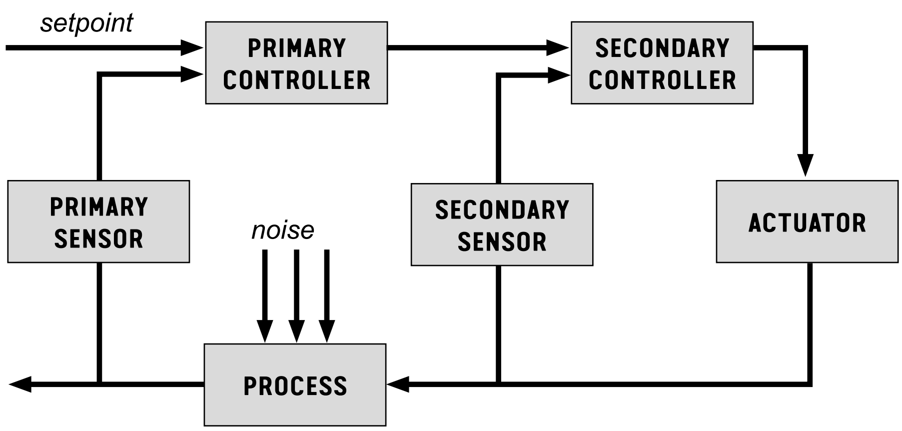
PV = process variable
SP = heating setpoint
h_Pb = heating proportional band

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.

Cascade Control



Two controllers are arranged in cascade when the output signal from the first becomes the input signal to the second, which in turn sends a signal to the control unit. The primary controller compares the controlled variable to the setpoint, while the secondary controller compares the value of the controlled variable to the signal from the primary controller.
Cascade control provides faster control of the primary variable value.
In addition, the primary variable is less subject to deviations.
The secondary controller keeps the flow constant, changing it only when instructed by the primary controller.
The cascade controller is used especially in very slow processes. In these processes, the error is recovered over a long time, and when noise enters the process, you have to wait a long time before the error is revealed and before corrective action begins; therefore, the corrective action does not start immediately.
After the action has started, you have to wait a long time for the result.
A cascade control is built by finding intermediate controlled variables that can forform rapid corrective actions in case of noise.
The primary and secondary controllers are arranged in cascade: each has its own process variable but only the secondary one has an output that commands the process.

The main advantages of cascade control are:

- noise in the secondary loop is corrected by the secondary controller before it can affect the primary variable;
- delays in the secondary part of the process are significantly reduced by the secondary loop, and this increases primary loop response speed;
- gain changes in the secondary part are compensated in its chain; • the secondary loop lets the primary controller act precisely on the flow of material or energy.

Cascade control is very useful when you require highly efficient control in the event of noise or when the secondary part of the process involves a long delay.

Cascade control has two controllers (a primary and a secondary); normally, the choice of control actions, based on process speed, is made as follows:

- Generally fast processes: for precise control, integral action in the primary and only proportional in the secondary is sufficient (primary controller PI, secondary controller P).
- Generally, very slow processes: for best system readiness, precision, and stability, configure the primary controller PID and the secondary controller PI.

The simplest example of a cascade control is a controller on a valve positioner: in this application the positioner is used to overcome hystereses and to reduce valve time constants.
Cascade control is normally not required in fast control loops (flow rates, pressures, etc.) and is more useful in temforature controls.

On GFX4 and GFXTERMO4 series:

- the parameter **APP.p** allow one cascade regulation between PID.1/PID.2 or PID.3/PID.4, or two cascade regulations between PID.1/PID.2 and PID.3/PID.4.

The default value is: CASCADE disable.

- the control PID.1 output (PID.3) is the set point of PID.2 (PID.4): configure PID.2 (PID.4) to remote (setpoint LOC/REM function of the corresponding zone STATUSWORD)
- primary sensor is IN.1 (IN.3)
- secondary sensor is IN.2 (IN.4)
- the parameter APP.t configure the control reference for the cascade control, necessary to scale the PID.1 (PID.3) output power into remote setpoint od PID.2 (PID.4)
- as the scale of IN.2 (IN.4), from HI.S2-Lo.S2 (HI.S4-Lo.S4)
- as the scale of PID.2 (PID.4), from HI.L2-Lo.L2 (HI.L4-Lo.L4)
- with the APP.t parameter the operator could configure:
    - PID.1/PID.2 (and/or PID.3/PID.4) in cascade control with HEAT control ouput of PID.1 (PID.3) = setpoint to PID.2 (PID.4)*
    - PID.1/PID.2 (and/or PID.3/PID.4) in cascade control with COOL control ouput of PID.1 (PID.3) = setpoint to PID.2 (PID.4)*
    - PID.1/PID.2 (and/or PID.3/PID.4) in cascade control with HEAT+COOL control ouput of PID.1 (PID.3) = setpoint to PID.2 (PID.4)*

(*)
PID.1 (PID.3) control often automatically keep PV.1 (PV.3) = SSP.1 (SSP.3)
PID.2 (PID.4) control often keep PV.2 (PV.4) = OUP.1 (OUP.3) in remote setpoint mode

Tuning two PIDs configured for cascade control

If you need to tune two PIDs configured for cascade control do as follows:
1.Set the primary PID to Manual and keep the secondary PID in Automatic mode
2 Set the value of power delivered by the primary PID (secondary PID setpoint)
3 Start the Self-Tuning procedure for the secondary PID
4 When the Self-Tuning procedure for the secondary PID is done, return the primary PID to Automatic
5 Start the Self-Tuning procedure for the primary PID

902	APP.t	R/W	Application type

Table application type — 0

APP.t	4 indipendent PID	PID.1 / PID.2 cascade	PID.3 / PID4 icascade
0	YES	NO	NO
1	NO	HEAT	NO
2	NO	COOL	NO
3	NO	HEAT/COOL	NO
8	NO	NO	HEAT
9	NO	HEAT	HEAT
10	NO	COOL	HEAT
11	NO	HEAT/COOL	HEAT
16	NO	NO	COOL
17	NO	HEAT	COOL
18	NO	COOL	COOL
19	NO	HEAT/COOL	COOL
24	NO	NO	HEAT/COOL
25	NO	HEAT	HEAT/COOL
26	NO	COOL	HEAT/COOL
27	NO	HEAT/COOL	HEAT/COOL

+4 setpoint scale of PID.2 is the reference of cascade control PID.1/PID.2
+32 setpoint scale of PID.4 is the reference of cascade control PID.3/PID.4

PID Parameters

617	SPU	R/W	*Selection of process variable of zone / Zone reference power*	*Table of selections*	1 zone 1	2 zone 2	3 zone 3	4 zone 4

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.*
- *Software shutdown remains independent for each zone.*

180	Ctr	R/W	Control type	*Table of heat/cool controls*	134

***WARNING**: the Control ("**Ctr**") default parameter changed from **"6" to "134"** starting from products with serial number "**SN 1013A1965**" (March 2010).*
*The option "**+128**", used to disable the "Integral power reset" has been introduced as an improvement, starting from the Software version "**1.43**".*
*We strongly suggest to verify the eventual recipes created with Software versions before the **1.43**, because, if the parameter "**Ctr"** is included in the recipe, it could be configured in an undesirable way.*

Val	Control type
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.ME)

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 ...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 ...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	**Relative gain (rG)** 0 Air 1 1 Oil 0,8 2 Water 0,4	0
152 9	Ct.1	R/W	OUT 1 (Heat) cycle time	1 ...200 sec (0,1 ...20 sec)	Set 0 for GTT function *See POWER CONTROL*	2
159	Ct.2	R/W	OUT 2 (Cool) cycle time	1 ...200 sec (0,1 ...20 sec)		20

Read state

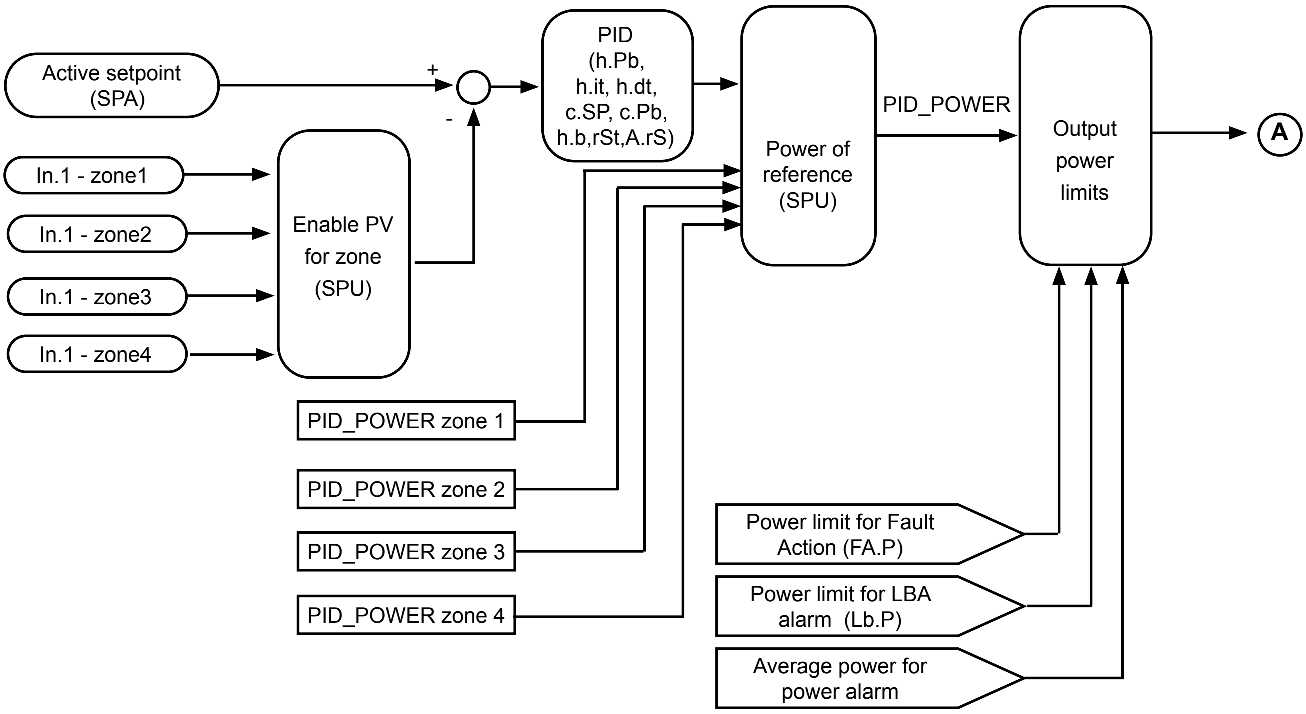
The following registers are accessible via serial line:

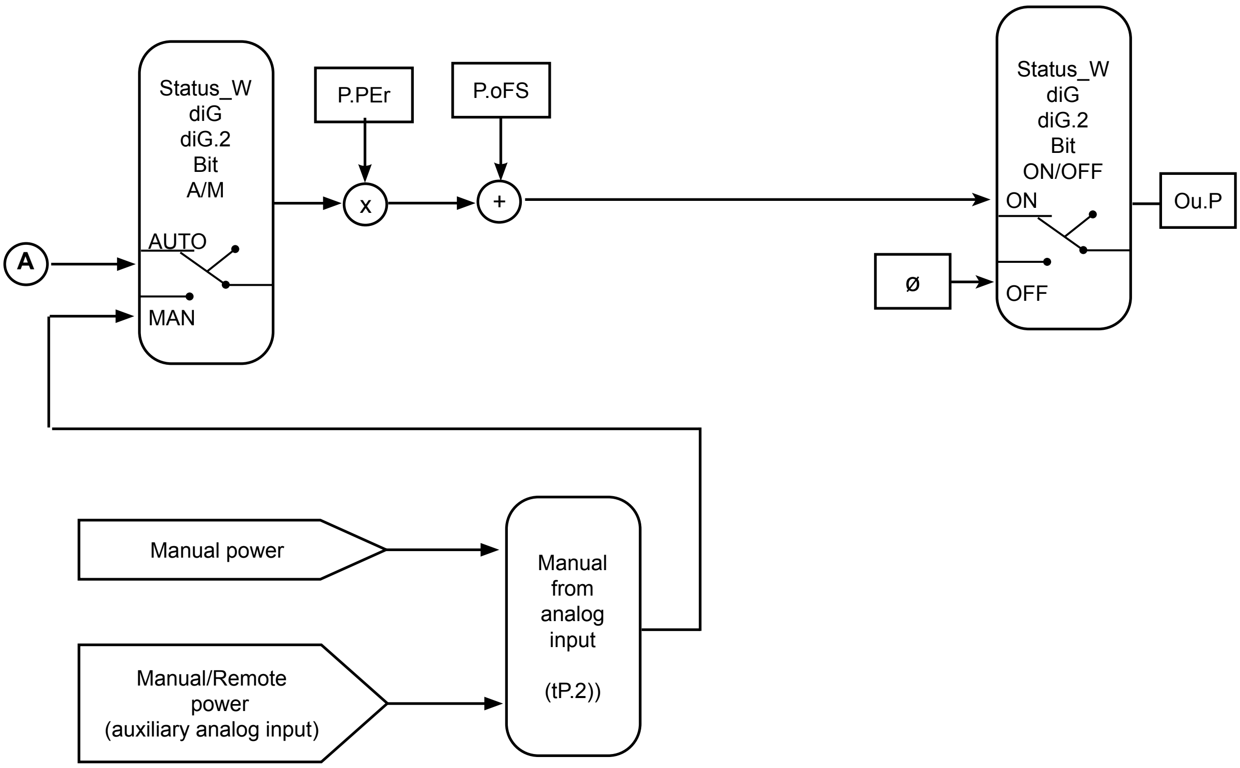
2 132 - 471	Ou.P	R	*Value of control outputs* (+Heat / -Cool)	(W – only in manual mode at address 252)

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)	-100,0.... ....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)	-100,0.... ....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 ...200.0 %		100.0
766	P.oFS	R/W	Offset of output power	-100.0 ...100.0 %		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.

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 function 2			0
1 bit	AUTO/MAN	R/W	OFF = Automatic ON =Manual			
305		R/W	Instrument state	*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 function 2			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* Compensation of the voltage transformer read to maintain output power at a constant level.	0.0 ...999,9		0,0
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)

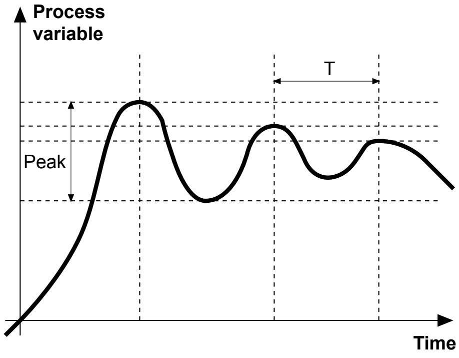
+4 set gradient in digit/sec.
+8 correction of manual power based on line voltage
+16 disable saving of local setpoint _SP
+32 disable saving of local manual power (at switch-off returns to last value saved)

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 variable. 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 parameters (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 response 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
6	-	-	-
7	-	-	-
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)	Autotuning and selftuning enable status table	

bit	
3	Selftuning on
6	Autotuning on

305		R/W	Instrument state	Table of instrument settings	0

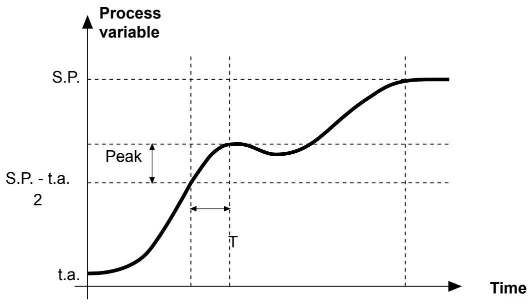
bit	
0	-
1	Select SP1/SP2
2	Start/Stop Selftuning
3	Select ON/OFF
4	Select AUTO/MAN
5	Start/Stop Autotuning
6	Select LOC/REM

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



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

S.tu	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
6	-	-	-
7	-	-	-
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	*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)	Autotuning and selftuning enable status table 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 (“SoF” 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*	*Selftuning, autotuning, softstart table*		0
263	SP.S	R/W	*Softstart setpoint* (preheating hot runners)			0
264	So.P	R/W	Softstart power (preheating hot runners)	-100,00.... ....100,0 %		0,0
147	SoF	R/W	Softstart time	0.0 ...500,0 min		0,0

Selftuning, autotuning, softstart table

S.tu	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
6	-	-	-
7	-	-	-
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.

Read state

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

START MODE

699	P.On.t	R/W	Start modes at Power-On	Tabella stato di abilitazione autotuning e selftuning	0

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_STRUMENTO 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) The state of alarms (AL1...AL4, ALHBTA1...ALHBTA3) is reset.

140	diG.	R/W	Digital input function	*See: Table of digital input functions*		0
618	dIG.2	R/W	Digital input 2 function			0
11 bit	SOFTWARE LAUNCH/ SHUTDOWN	R/W	OFF = On ON =Off			
700	OFF.t	R/W	Modes at software shutdown	*Table of software shutdown methods*		0

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 of the Softstart at the switch-on software (ON Software)

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		
305		R/W	Instrument state	*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	*See: Hot runners table - Setpoint Settings*	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			

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	

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:

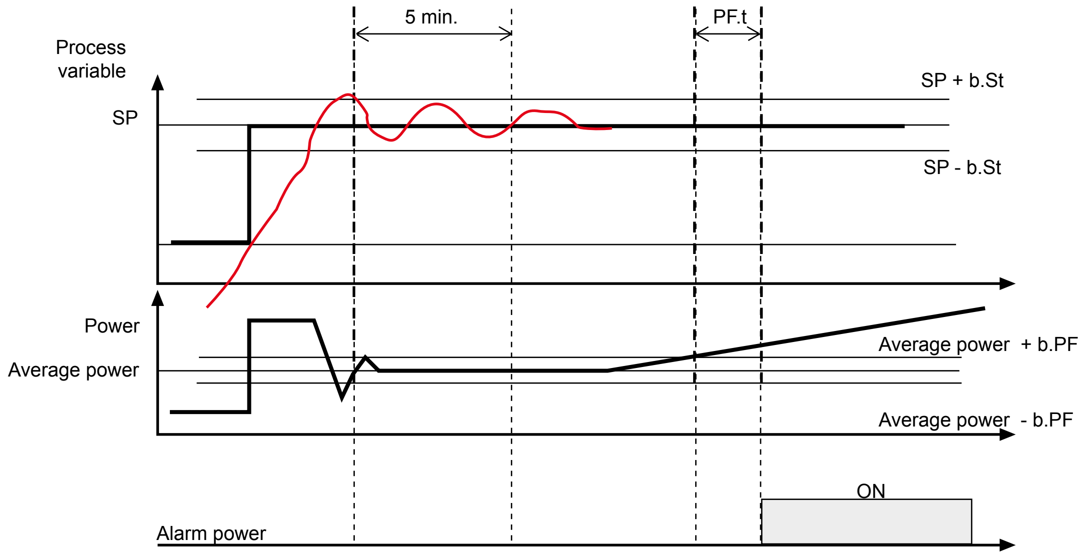
- if the PV has not yet stabilized, either the average power over the last 5 minutes or FAP power is supplied (depending on the setting of the HOT parameter).
- if the PV has stabilized the average power over the last 5 minutes is supplied.

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.



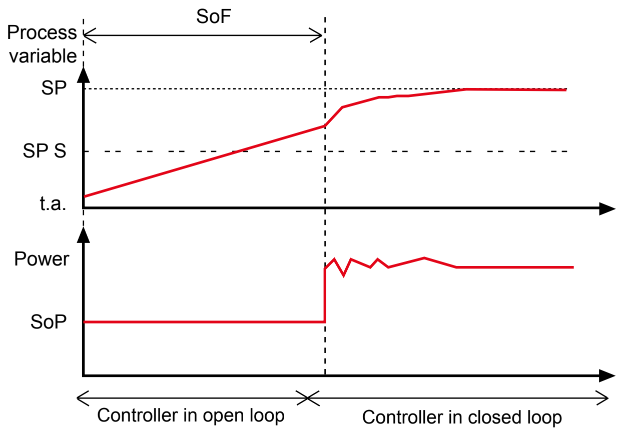
The parameters for alarm power are:

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.



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

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

263	SP.S	R/W	*Softstart setpoint* (preheating of hot runners)			0
264	So.P	R/W	Softstart power (preheating of hot runners)	-100,00.... ....100,0 %		0,0
147	SoF	R/W	Softstart time	0.0 ...500,0 min		0,0

Read state

63 bit	STATE OF SOFTSTART	R	OFF = Softstart in Stop ON = Softstart in Start

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 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

The following models are available:

GFX4 30 kW with full scale 16A in all four zones
GFX4 60 kW with full scale 32A in all four zones
GFX4 80 kW with full scale 40A in all four zones, 57A for single zone

There are two power control modes,
- with settable cycle time (Ex: Ct.1 = 2sec if power Out.P = 50,0% output on for 1 second and output off for 1 second)
- with variable cycle time with power delivery optimised in packets with minimum duration of 20ms (GTT function) (Ex: Ct.1 = 0 if power Out.P = 50,0% output on for 20ms and output off for 20ms).

In the first case, you can set the cycle time with two different resolutions, in seconds or in tenths of a second, based on the type of heating (heat) or cooling (cool) function assigned to outputs rL1 and rL2.

It is advisable to use short cycle times (< 2-3 sec.) in case of control by means of solid state devices (SSR).

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.

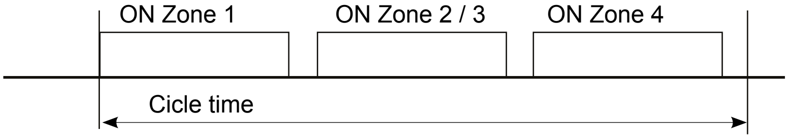
This function acts by enabling the control to search for the most appropriate input combinations.

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

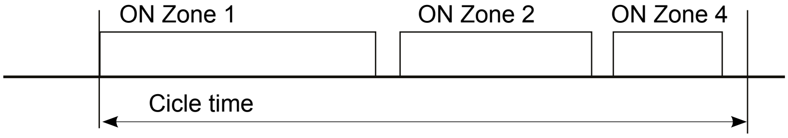
The combination corresponding to current values below the limit value are:
I1+I2 = 48A
I2+I3 = 41A
The one with lower current is given by zone 2 and zone 3.

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*	*Table for enabling heuristic power*	0

	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 with CTs present and outputs OUT1...OUT4 with slow cycle time (1...200sec) all HEAT or all COOL.
In case of GFXTERMO4, the 4 CTs must be connected to outputs OUT1...OUT4.

681	I.HEU	R/W	Maximum current for heuristic power control	*Heuristic power table*		0,0

0,0 ... 64,0 for GFX4 30 kW
0,0 ... 128,0 for GFX4 60 kW
0,0 ... 160,0 for GFX4 80 kW
0,0 ... 999,9 for GFXTERMO4

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*	*Table for enabling heterogeneous power*	0

	ZONE 1	ZONE 2	ZONE 3	ZONA 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

NOTE: Only for GFX4 with CTs.
In case of GFXTERMO4, the 4 CTs must be connected to outputs OUT1...OUT4.

683	I.HEt	R/W	Maximum current for heterogeneous power control	*Heterogeneous power table*		0,0

0,0 ... 64,0 for GFX4 30 kW
0,0 ... 128,0 for GFX4 60 kW
0,0 ... 160,0 for GFX4 80 kW
0,0 ... 999,9 for GFXTERMO4

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	*Table for multiset/ virtual instrument*		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

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

Table of hardware configuration codes

bit		Value indicated by GFX-OP (*)
0	= 1 OUTPUT COOL absent	0
1	= 1 OUTPUT COOL relay	r
2	= 1 OUTPUT COOL logic	d
3	= 1 OUTPUT COOL continuous 0...20mA / 0...10V	t
4	= 1 OUTPUT COOL triac 250Vac 1A	c
5	-	
6	= 1 GFX4 absent (GFXTERMO4 present)	te
7	= 1 GFX4 30 kW	30
8	= 1 GFX4 60 kW	60
9	= 1 GFX4 80 kW	80
10	= 1 GFX4 without TA	0
11	= 1 GFX4 with 1 TA	1
12	= 1 GFX4 with 4TA	4
13	= 1 GFXTERMO4 without TA	0
14	= 1 GFXTERMO4 with 4TA	4

(*) In correspondence to the SV value on the GFX-OP display, the digits indicate bit values as follows:
- THOUSANDS and HUNDREDS
(Power GFX4 / GFXTERMO4) correspond to bits 6 to 9
- TENS (COOL outputs) correspond to bits 1 to 4
- ONES (Number of CT) correspond to bits 10 to 14

508	C.Hd1	R	*Hardware configuration codes 1*

Table of hardware configuration codes1

bit		Value indicated by GFX-OP (*)
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

(*) 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

693 697	Upd.F	R	Fieldbus software version
695	Cod.F	R	Fieldbus node
696	Bau.F	R	Fieldbus baudrate

Profibus	
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	
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	
0	125 Kbit/s
1	250 Kbit/s
2	500 Kbit/s

Ethernet	
0	100 Mbit/s
1	10 Mbit/s

346	- - -	R	*Jumper state*	*Table of jumper state*	

bit	
0	Jumper state S1
1	Jumper state S2
2	Jumper state S7-1: function modes
3	Jumper state S7-2: function modes
4	Jumper state S7-3: function modes
5	Jumper state S7-4
6	Jumper state S7-5: 60Hz (*)
7	Jumper state S7-6: CFG forced
8	Jumper state S7-7: Simulation 4 GFX

(*) For GFX4 and GFXTERMO4 with CT, the 50/60Hz value is acquired automatically

S7-1	S7-2	S7-3	FUNCTION MODES
0	0	0	4 single-phase
1	0	0	3-phase star + 1 single-phase
0	1	0	3-phase triangle + 1 single-phase
1	1	0	2-phase star
0	0	1	2-phase triangle

120		R	Manufact - Trade Mark (Gefran)	Constructor's name	5000
121		R	Device ID (GFX4)	Product ID	198

197	Ld.st	R/W	*RN LED status function*	*Table of RN LED functions*	16
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

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)

622	Ld.s	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

EXCEPTIONS:
- If diagnostics has been activated (parameters Hb.F and hd.2) and an alarm is active, the red ER error LED and the yellow OX output LED for the zone with the alarm will flash in sync.
- In case of an OVER_HEAT (STATUS_INSTRUMENT 4 bit1) alarm, the red ER error LED will flash.

305		R/W	Current instrument state (STATUS_W)	*Table of instrument settings*	0
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	AL.Lo
2	AL.Hi
3	AL.Err
4	AL. Sbr
5	heat
6	cool
7	AL.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	AL.HB1
13	AL.HB2 (only for 3-phase load)
14	AL.HB3 (only for 3-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 3-phase load)
6	AL.HB3 (only for 3-phase load)
7	Input Lo
8	Input Hi
9	Input Err
10	Input Sbr
11	LBA
12	AL.Power

633		R	Instrument state 3

Table of instrument state 3

bit	
0	SSR_OPEN1
1	SSR_OPEN2 (only for 3-phase load)
2	SSR_OPEN3 (only for 3-phase load)
3	SSR_SHORT1
4	SSR_SHORT2 (only for 3-phase load)
5	SSR_SHORT3 (only for 3-phase load)
6	NO_VOLTAGE1
7	NO_VOLTAGE2 (only for 3-phase load)
8	NO_VOLTAGE3 (only for 3-phase load)
9	NO_CURRENT1
10	NO_CURRENT2 (only for 3-phase load)
11	NO_CURRENT3 (only for 3-phase load)

634		R	Instrument state 4

Table of instrument state 4

bit	
0	Sensor_broken
1	Over_heat

INSTRUMENT CONFIGURATION SHEET

PROGRAMMABLE PARAMETERS

Definition of parameter				Note	Assigned value
INSTALLATION OF MODBUS SERIAL NETWORK					
901	EEP.E	R/W	EEPROM saving		
46	Cod	R	Instrument identification code		
45	bAu	R/W	Select Baudrate - Serial 1		
47	PAr	R/W	Select parity - Serial 1		
626	bAu.2	R/W	Select Baudrate - Serial 2		
627	PAr.2	R/W	Select parity - Serial 2		
MAIN INPUT					
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		
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		
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.		

CT AUXILIARY INPUT

405	H.tA1	R/W	Maximum scale limit of current transformer CT input (phase 1)			
413	H.tA2	R/W	Maximum scale limit of current transformer CT input (phase 2)			
414	H.tA3	R/W	Maximum scale limit of current transformer CT input (phase 3)			
220	o.tA1	R/W	Offset correction for current transformer CT input (phase 1)			
415	o.tA2	R/W	Offset correction for current transformer CT input (phase 2)			
416	o.tA3	R/W	Offset correction for current transformer CT input (phase 3)			
227 473 - 139	I.tA1	R	Instantaneous value of CT input (phase 1)			
490	I.tA2	R	Instantaneous value of CT input (phase 2)			
491	I.tA3	R	Instantaneous value of CT input (phase 3)			
468	I.1on	R	Value of CT input with active output (phase 1)			
498	I.2on	R	Value of CT input with active output (phase 2)			
499	I.3on	R	Value of CT input with active output (phase 3)			
219	Ft.tA1	R/W	Digital filter for CT input (phases 1, 2 and 3)			
661	dG.t	R/W	Sampling interval for CT input			

VOLTAGE VALUE ON LOAD (Voltmeter)

410	Ft.tA1	R/W	Maximum scale limit of voltage transformer VT input (phase 1)			
417	H.tV2	R/W	Maximum scale limit of voltage transformer VT input (phase 2)			
418	H.tV3	R/W	Maximum scale limit of voltage transformer VT input (phase 3)			
411	oF.tV1	R/W	Offset correction of TV input (phase 1)			
419	oF.tV2	R/W	Offset correction of TV input (phase 2)			
420	oF.tV3	R/W	Offset correction of TV input (phase 3)			
232 485	I.tV1	R	Value of voltmeter input (phase 1)			
492	I.tV2	R	Value of voltmeter input (phase 2)			
493	I.tV3	R	Value of voltmeter input (phase 3)			
412	Ft.tV1	R/W	Digital filter for TV auxiliary input (phase 1, 2, 3)			

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 e 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			
25 20 - 28 - 142	Lo.L	R/W	Lowest settable limit SP, SP remote and absolute alarms			
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			
26 21 - 29 - 143	Hi.L	R/W	Highest settable limit SP, SP remote and absolute alarms		
195	AL.n	R/W	Select number of enabled alarms		
140	diG.	R/W	Digital input function		
618	dIG.2	R/W	Digital input function 2		
79 bit	Reset alarm latch	R/W			
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			
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.Hb	R/W	HB alarm setpoint (ammeter input scale points - Phase 1)		
502	A.Hb2	R/W	HB alarm setpoint (ammeter input scale points - Phase 2)		
503	A.Hb3	R/W	HB alarm setpoint (ammeter input scale points - Phase 3)		
26 bit	STATE OF HB ALARM or POWER_FAULT	R	OFF = Alarm off ON = Alarm on		
76 bit	State of HB alarm phase 1TA	R			
77 bit	State of HB alarm phase 2TA	R			
78 bit	State of HB alarm phase 3TA	R			
504		R	States of alarm HB ALSTATE_HB (for 3-phase loads)		
512		R	States of alarm ALSTATE (for single-phase loads)		

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, SSR, OPEN and NO_CURRENT)

660	hd.2	R/W	Enable POWER_FAULT alarms		
661	dG.t	R/W	Refresh rate In.TA - (only for GFX4 1TA)		
662	dG.F	R/W	Filter in time for NO_VOLTAGE, SSR_OPEN and NO_CURRENT alarms (GFX4-1TA excluded)		
663	dG.P	R/W	Min. acquisition power In.TA and for NO_CURRENT (only for GFX4 1TA)		
105 bit	Reset SSR_OPEN /SSR_ SHORT / NO_VOLTAGE / NO_CURRENT alarms	R/W			
93 bit	State of alarm SSR_OPEN phase 1	R			
94 bit	State of alarm SSR_OPEN phase 2	R			
95 bit	State of alarm SSR_OPEN phase 3	R			
96 bit	State of alarm SSR_SHORT phase 1	R			
97 bit	State of alarm SSR_SHORT phasee 2	R			
98 bit	State of alarm SSR_SHORT phase 3	R			
99 bit	State of alarm NO_VOLTAGE phase 1	R			
100 bit	State of alarm NO_VOLTAGE phase 2	R			
101 bit	State of alarm NO_VOLTAGE phase 3	R			
102 bit	State of alarm NO_CURRENT phase 1	R			
103 bit	State of alarm NO_CURRENT phase 2	R			
104 bit	State of alarm NO_CURRENT phase 3	R			

ALARM due to overload

655		R	INPTC
675		R	INPTC_DER

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			
308 319		R	State of 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	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			
82 bit	State of output OUT1	R				
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				

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)		
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		
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 function 2		
75 bit	SELECT SP1 / SP2	R/W	OFF = Select SP1 ON = Select SP2		
305		R/W	Instrument state		

PID HEAT/ COOL CONTROL

902	APP.t	R/W	Application type		
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		
152 9	Ct.1	R/W	Cycle time OUT 1 (Heat)		
159	Ct.2	R/W	Cycle time OUT 2 (Cool)		
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.H	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		

AUTOMATIC/MANUAL CONTROL

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 function 2		
1 bit	AUTO/MAN	R/W	OFF = Automatic ON = Manual		
305		R/W	Instrument state		

HOLD FUNCTION

140	diG.	R/W	Digital input function			
618	dIG.2	R/W	Digital input function 2			
64 bit	HOLD	R/W	OFF = Disable hold ON = Enable hold			

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 manual power correction)			

AUTOMATIC/MANUAL CONTROL

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 function 2			
1 bit	AUTO/MAN	R/W	OFF = Automatic ON =Manual			
305		R/W	Instrument state			

HOLD FUNCTION

140	diG.	R/W	Digital input function			
618	dIG.2	R/W	Digital input function 2			
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 function 2			
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			

SELFTUNING

31	S.tu	R/W	Enable selftuning, autotuning, softstart			
140	diG.	R/W	Digital input function			
618	dIG.2	R/W	Digital input function 2			
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			

SOFTSTART

31	S.tu	R/W	Enable selftuning, autotuning, softstart			
263	SP.S	R/W	Softstart setpoint (preheating hot runners)			
264	So.P	R/W	Softstart power (preheating hot runners)			
147	SoF	R/W	Softstart time			
629	P.SoF	R/W	Softstart time for phase			
630	P.S.Hi	R/W	Max. Softstart phase			
63 bit	SOFTSTART STATE	R	OFF = Softstart in Stop ON = Softstart in Start			

SOFTWARE SHUTDOWN

140	diG.	R/W	Digital input function		
618	dIG.2	R/W	Digital input function 2		
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		

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			

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

31	S.tu	R/W	Enable selftuning, autotuning, softstart		
263	SP.S	R/W	Softstart setpoint (preheating hot runners)		
264	So.P	R/W	Softstart power (preheating hot runners)		
147	SoF	R/W	Softstart time		
63 bit	STATE OF SOFTSTART	R	OFF = Softstart in Stop ON = Softstart in Start		

HEATING OUTPUT (fast cycle)

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

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		

HW/SW DATA

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		R	Fieldbus software version
695		R	Fieldbus node
696		R	Fieldbus baudrate
346	- - -	R	State of jumper
120		R	Manufact - Trade Mark (Gefran)
121		R	Device ID (GFX4)
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
467		R	Instrument state
469		R	Instrument state 1
632		R	Instrument state 2
633		R	Instrument state 3
634		R	Instrument state 4

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