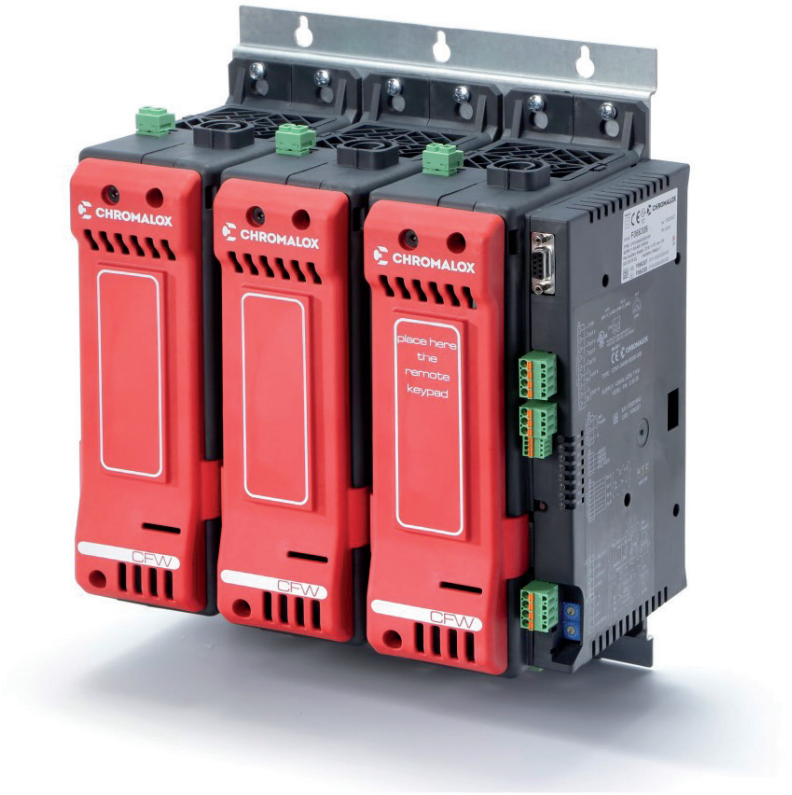
Programming Instruction Manual

CFW

Modular SCR Power Controller with Independent PID control



CHROMALOX
Advanced Thermal Technologies

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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 precisely follow all of the instructions in it and in its attachments. Chromalox 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 Chromalox's authorization.

Important Safeguards

⚠WARNING

HIGH VOLTAGE (up to 690 VAC) is used in the operation of this equipment; DEATH ON CONTACT may result if personnel fail to observe safety precautions.

Learn the areas containing high-voltage connections when installing or operating this equipment.

⚠WARNING

Be careful not to contact high-voltage connections when installing or operating this equipment.

Before working inside the equipment, turn power off and ground all points of high potential before touching them.

⚠CAUTION

The owner/installer must provide all necessary safety and protection devices and follow all current electrical wiring standards and regulations. Failure to do so may compromise the integrity of the controller and/or cause product failure resulting in a safety risk to operational and service personnel.

⚠CAUTION

This controller utilizes a heat sink which is designed to cool the unit during operation. Under no circumstance should air flow around the controller be compromised in any way. Failure to do so may result in the overheating of the controller, product failure, product temperatures and even fire.

⚠WARNING

During continuous operation, the heat sink can reach very high temperatures, and keeps a high temperature even after the unit is turned off due to its high thermal inertia.

Higher voltages may be present. DO NOT work on the power section without first cutting out electrical power to the panel. Failure to do so may cause serious injury or death.

⚠WARNING

ELECTRIC SHOCK HAZARD: Any installation involving control equipment must be performed by a qualified person and must be effectively grounded in accordance with the National Electrical Code to eliminate shock hazard.

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 3 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 CFW-OP or a PC connected in USB/RS232/RS485, with specific C-PWR application software.

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.

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

Field of Use

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

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

Chromalox 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

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.

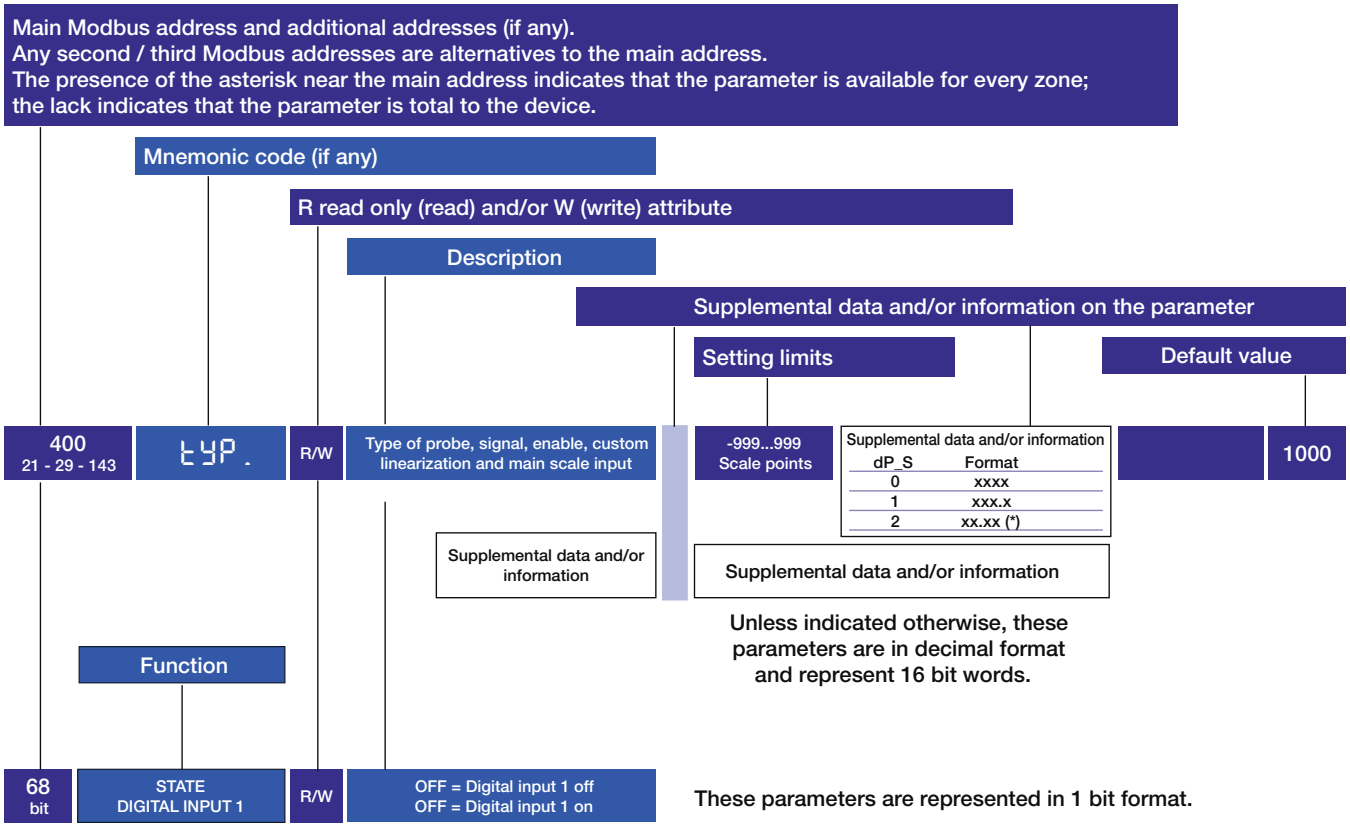
Some sections may contain a functional diagram showing interaction among the parameters described;

- 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:

For reference:

1. CFW-M refers to master module. A CFW1 is by default CFW-M.
2. CFW-E1 refers to expansion module 1. A CFW2 would include CFW-M (as module 1) and CFW-E1 (as module 2)
3. CFW-E2 refer to two expansion modules. A CFW3 would include CFW-M (as module 1) and CFW-E2 (as module 2 and 3).



Communications

The modular power controller's flexibility permits replacement of previous-version such as Chromalox (CFW), C4 and C4-IR 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:

- CFW compatible mode: as if there were at most 3 separate instruments (recommended for retrofitting projects and/ or replacement of damaged instruments);

- CF4/CFW mode: as a single instrument with the same functions as at most 3 separate instruments, but with possibility of interaction among the various parameters, inputs and outputs (recommended for new projects).

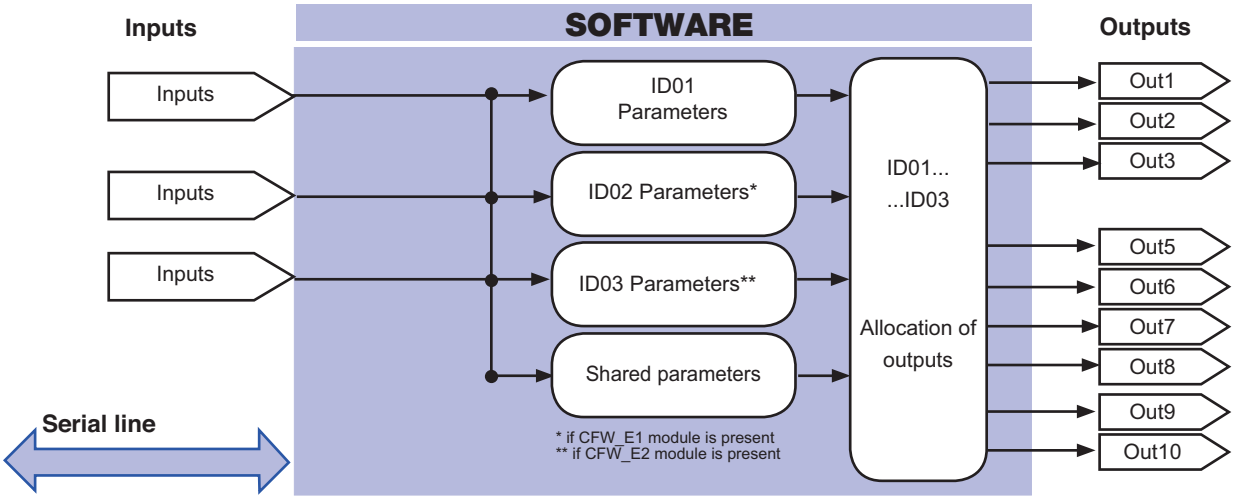
New shared parameters, are accessible for both modes and permit more advanced functions such as:

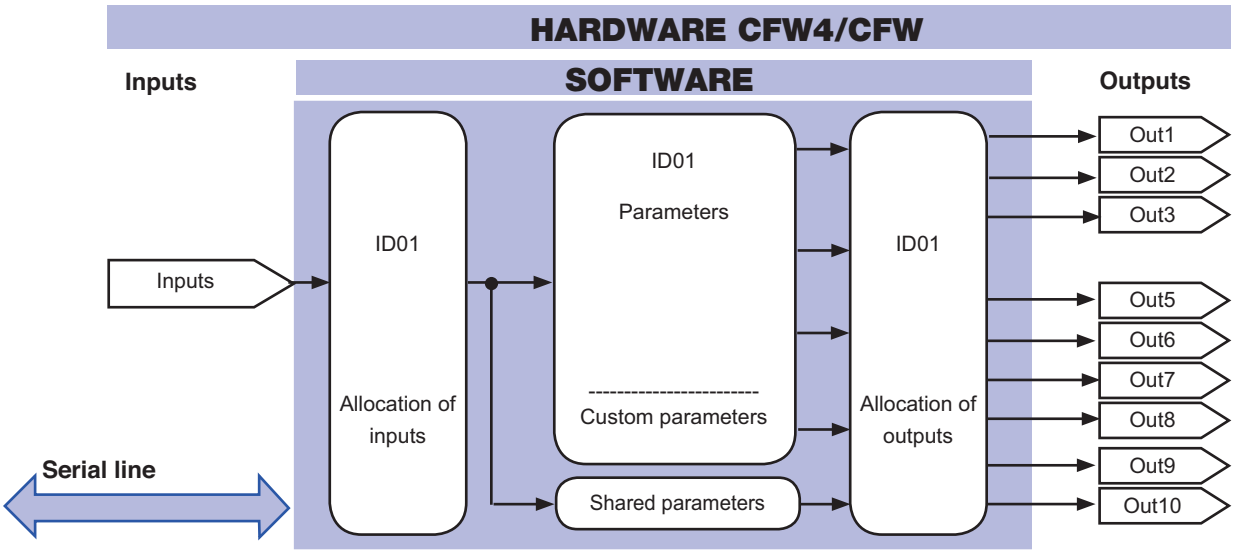
604	FLt.2	R/W	Digital Filter for Auxiliary Input	0.0...20.0 sec	0.1

In addition to having a CUSTOM group of parameters for dynamic addressing, CFW mode lets you use a single communication network node in-stead of 4 nodes as in Compatible mode.

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

CFW Compatible Mode Diagram





Serial Communication (Modbus)

There are two Modbus addressing modes for variables and configuration parameters:

- C4 compatible mode
- C4

The modes are selected with dip-switch-7.

C4 Compatible Mode (Dip-Switch—ON)

This lets you use supervision programs created for C4 modules.

Memory is organized into 4 groups:
- Zone 1 for the variables of the mudule CFW-M
- Zone 2 for the variables of the mudule CFW-E1
- Zone 3 for the variables of the mudule CFW-E2

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, if expansions are present, are sequential.

Examples:
if the rotary switches have value 14, node 14 addresses Zone 1 (CFW-M), node 15 Zone 2 (CFW-E1), node 16 Zone 3 (CFW-E2).

The power Ou.P for Zone 1 has address Cod 2, the Ou.P for Zone 2 has address Cod+1, 2, etc...

Parameter out.5, which defines the function of output OUT 5 on the CFW, has address Cod 611.

C4/CFW Mode (Dip-Switch—OFF)

This lets you optimize the efficiency of serial communication by integrating 3 zones in the C4. Memory is organized into 4 groups: 3 already in C4-compatible mode, plus one group defined as custom:

- Custom (additional memory map for dynamic addresses)
- Zone 1 for the variables of the mudule CFW-M
- Zone 2 for the variables of the mudule CFW-E1
- Zone 3 for the variables of the mudule CFW-E2

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 C4/CFW 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).

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.

NOTE: 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... 319). This value is reset at each switch-on.

Examples:
you can access the Ou.P variable in Zone 1 with address Cod, 1+1024 or address Cod, 11 custom variable 12 (address Cod, 211 has value 2+1024);

you can access the Ou.P variable in Zone 2 with address Cod, 2+ 2048 or address Cod, 40 custom variable 41 (address Cod, 240 has value 2+2048);

if you want to read the 3 powers in sequence at the first 3 addresses, set Cod, 200 = 1026, Cod.201 = 2050, Cod,202 = 4098.

Connection

Each CFW has an optically isolated serial port RS485 (PORT 1) with standard Modbus protocol via connectors J8 and J9 (type RJ10).

You can insert a serial interface (PORT 2). There are various models based on the field bus required: Modbus, Profibus DP, CANopen 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).

⚠WARNING

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.

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.

CFW 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).

CFW have a ModBus serial (Serial 1) and optional Fieldbus (Serial 2) serial (see order code) with one of the following

protocols: ModBus, Profibus, CANopen, Ethernet, EtherCAT and EthernetIP.

The following procedures are indispensable for the Modbus protocol.

For the remaining protocols, see the specific manuals.

CFW 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 CFW modules in a serial network, with node address selectable from “01” to “99” in standard mode, or create a mixed CFW/C4 network in C4 compatible mode in which each CFW identifies 3 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

46	Cod	R	Instrument Identification Code	1 ... 99		
45	bAu	R/W	Select Baudrate – Serial 1	Baudrate Table		4
626	bAu2	R/W	Select Baudrate – Serial 2	bAud	Baudrate	4
				0	1200 bit/s	
				1	2400 bit/s	
				2	4800 bit/s	
				3	9600 bit/s	
				4	19200 bit/s	
				5	38400 bit/s	
				6	57600 bit/s	
				7	115200 bit/s	
47	PAr	R/W	Select Parity – Serial 1	Parity Table		0
627	PAr2	R/W	Select Parity – Serial 2	_Par	Parity	0
				0	No Parity	0
				1	Odd	
				2	Even	

Communication Error

If Modbus communication between CFW 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	CEt	R/W	Timeout for communication error	0....121 sec	Value 0 disables the function			
891	CEM	R/W	Mode for communication error	Mode Table for Communication error		0 Zone 1	0 Zone 2	0 Zone 3
				0	Delivered power is not changed			
				1	Delivered power is forced to C.E.P value			
				+16 only for C.M.E.=1: copy of C.E.P. in MANUAL POWER at the restart of the communication (only if in manual mode)				
892	CEP	R/W	Output power when communication error is active	0....121 sec	-100.0...100.0%	0.0 Zone 1	0.0 Zone 2	0.0 Zone 3

Inputs

INA ANALOG INPUT

The modular power controller has an analog input with the functionality of power control.

573	tP.A1	R/W	Analog Input 1	Table of Analog Input	1
837*	tP.A2	R/W	Analog Input 2	1	
844*	tP.A3	R/W	Analog Input 3	1	

*For models 400-600A Only

0	Disable
1	0...10V
2	0...5V / Potentiometer
3	0...20mA
4	4...20mA

Scale Limits

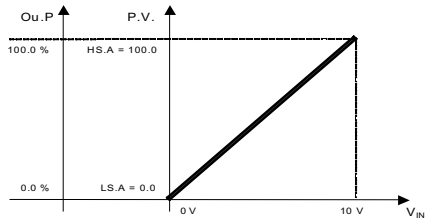
574	LS.A1	R/W	Minimum scale limit analog input 1	-100.0...200.0	0.0
838*	LS.A2	R/W	Minimum scale limit analog input 2	-100.0...200.0	0.0
845*	LS.A3	R/W	Minimum scale limit analog input 3	-100.0...200.0	0.0
575	HS.A1	R/W	Maximum scale limit analog input 1	LS.A1.....200.0	100.0
839*	HS.A2	R/W	Maximum scale limit analog input 2	LS.A2.....200.0	100.0
846	HS.A3	R/W	Maximum scale limit analog input 3	LS.A3.....200.0	100.0

Examples of LS.A and HS.A parameter settings

The default values (LS.A = 0.0 and HS.A = 100.0) can be changed to obtain the required scale of the PV in engineering value corresponding to the minimum and maximum of the physical input (V/mA).

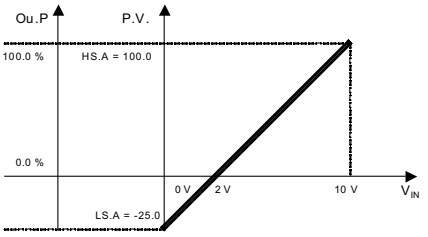
In automatic mode, the engineering value (PV) is attributed to power Ou.P for values between 0.0 and 100.0.

Example:
V_{IN} = 0…10V
tyP. = 1
LS.A = 0.0
HS.A = 100.0



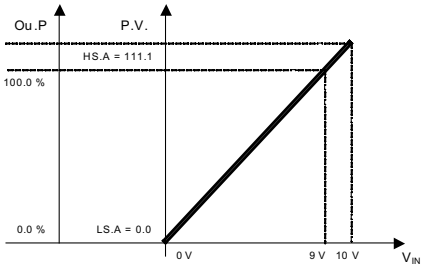
Since the 0…10V input range is reduced 80% above, the scale interval (HS.A – LS.A) must be extended downward so that the useful interval (100.0 – 0.0) is 80% (100.0/125.0 = 0.8).

Example:
V_{IN} = 2…10V
tyP. = 1
LS.A = -25.0
HS.A = 100.0



Since the 0…10V input range is reduced 90% below, the scale interval (HS.A – LS.A) must be extended upward so that the useful interval (100.0 – 0.0) is 90% (100.0/111.1 = 0.9).

Example:
V_{IN} = 0…9V
tyP. = 1
LS.A = 0.0
HS.A = 111.1



Offset Adjustment

577	oFSA1	R/W	Offset connection for analog Input 1	-99.9...99.9		0.0
841	oFSA2	R/W	Offset connection for analog Input 2	-99.9...99.9		0.0
848	oFSA3	R/W	Offset connection for analog Input 3	-99.9...99.9		0.0

Read State

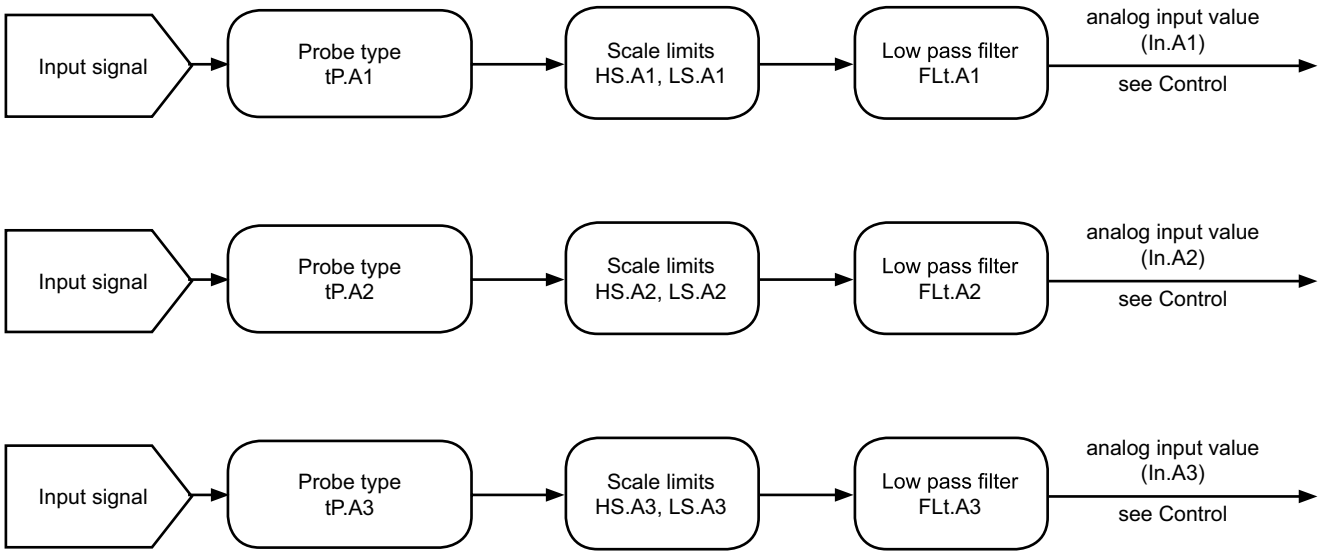
572	InA1	R	Value of the ingegneristico reading analog input 1
836	InA2	R	Value of the ingegneristico reading analog input 2
843	InA3	R	Value of the ingegneristico reading analog input 3

Advanced Settings

Input Filter

576	FLtA1	R/W	Low pass digital filter analog input 1	0.0...20.0 sec.		0.1
840	FLtA2	R/W	Low pass digital filter analog input 2	0.0...20.0 sec.		0.1
847	FLtA3	R/W	Low pass digital filter analog input 3	0.0...20.0 sec.		0.1

Functional Diagram



Main Inputs

The modular power controller has one optional input (IN1) to control, to which you can connect temperature sensors (thermocouples and RTD), linear sensors or custom sensors to acquire process variable (PV) values. This type of input is optional.

To configure, you always have to define the type of probe or sensor (tYP), the maximum and minimum scale limit (Hi.S – Lo.S) for the process variable value, and the position of the decimal point (dP.S).

If the sensor is a thermocouple or resistance thermometer, the minimum and maximum limits can be defined on the specific scale of the sensor. These limits define the width of the proportional control band and the range of values settable for the setpoint and alarm setpoints.

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

You can read the state of the main input (Err) in which an input error is reported: when the process variable goes beyond the upper or lower scale limit, it assumes the value of the limit and the corresponding state reports the error condition:

Lo = process variable < minimum scale limit

Hi = process variable > maximum scale limit

Err = Pt100 in short circuit and input value below minimum limit, 4...20mA transmitter interrupted or not powered

Sbr = Tc probe interrupted or input value above maximum limit If noise on the main input causes instability of the acquired value, you can reduce its effect by setting a low pass digital filter (Flt). The default setting of 0.1sec is usually sufficient.

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

Probes and Sensors

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

TC Sensors					0
Type	Type of Probe	Scale	Without Dec. Point	With Dec. Point	
0	TC J	°C	0/1000	0.0/999.9	
1	TC J	°F	32/1832	32.0/999.9	
2	TC K	°C	0/1300	0.0/1300.0	
3	TC K	°F	32/2372	32.0/999.9	
4	TC R	°C	0/1750	0.0/1750.0	
5	TC R	°F	32/3182	32.0/999.9	
6	TC S	°C	0/1750	0.0/1750.0	
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	
10	TC N	°C	0/1300	0.0/1300.0	
11	TC N	°F	32/2372	32.0/999.9	
28	TC	custom	custom	custom	
29	TC	custom	custom	custom	

Sensor: RTD 3-Wire				
Type	Probe Type	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: 50mV Voltage				
Type	Probe Type	Scale	Without Dec. Point	With Dec. Point
34	0...60 mV	Linear	-1999/9999	-199.9/999.9
35	0...60 mV	Linear	Custom linearization	Custom linearization
36	12...60 mV	Linear	-1999/9999	-199.9/999.9
37	12...60 mV	Linear	Custom linearization	Custom linearization

Sensor: 20mA Current				
Type	Probe Type	Scale	Without Dec. Point	With Dec. Point
38	0...20 mA	linear	-1999/9999	-199.9/999.9
39	0...20 mA	linear	Custom linearization	Custom linearization
40	4...20 mA	linear	-1999/9999	-199.9/999.9
41	4...20 mA	linear	Custom linearization	Custom linearization

Sensor: 1V Voltage				
Type	Probe Type	Scale	Without Dec. Point	With Dec. Point
42	0...1 V	linear	-1999/9999	-199.9/999.9
43	0...1 V	linear	Custom linearization	Custom linearization
44	200 mv..1 V	linear	-1999/9999	-199.9/999.9
45	200 mv..1 V	linear	Custom linearization	Custom linearization

Sensor: Custom				
Type	Probe Type	Scale	Without Dec. Point	With Dec. Point
46	Cust. 20mA	-	-1999/9999	-199.9/999.9
47	Cust. 20mA	-	Custom linearization	Custom linearization
48	Cust. 60mV	-	-1999/9999	-199.9/999.9
49	Cust. 60mV	-	Custom linearization	Custom linearization
50	PT100-JPT	-	custom	custom
99	Input Off			

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

Tc tipo:
J, K, N 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, 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. (per 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 e 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		0

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

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

(*) Not available for TC, 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		1,000

Engineering value associated to maximum level of the signal generated by the sensor connected to the input: for example 1,300 (°C) with type K thermocouple.

Setting the Offset

519 23	oFS.	R/W	Offset connection 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

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.

Error Code Table	
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 max. limits)

349	D.P.V.	R	Read of engineering value of process variable (PV) filtered by FLd

Advanced Settings

Input Filter

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		0.1

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:

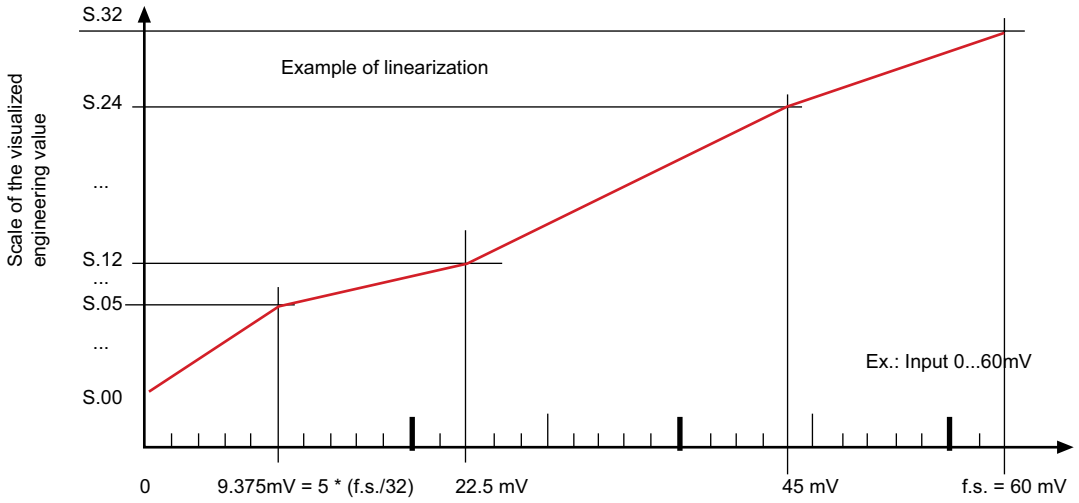
dV = (full-scale value – start of scale value) / 32

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.

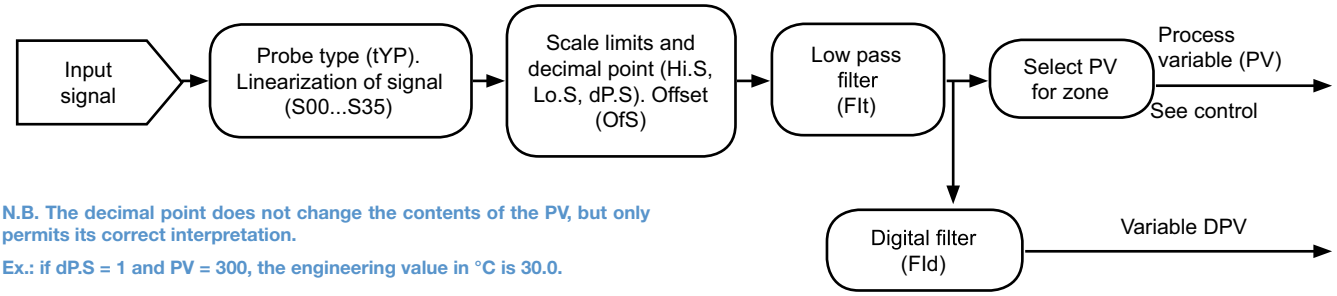
86	S.00	R/W	Engineering value attributed to Point 0 (minimum value of input scale)	(-1999 ... 9999)		0.0
87	S0.1	R/W	Engineering value attributed to Point 1	(-1999 ... 9999)		0.0
	....		Intermediate Vales			
118	S.32	R/W	Engineering value attributed to Point 32 (max. value of input scale)	(-1999 ... 9999)		0.0

NOTE: 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 from Sensors

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 ffull scale (S.33+1) ... 99.99)		
295	S.35	R/W	Engineering value attributed to input signal corresponding to 50°C.	mV a 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.

Current Value In Load

The RMS current value is read in variable Ld.A of each zone.

If zone 1 has a 3-phase load, variable Ld.At contains the average value of the three RMS currents. The Ld.A of the first three zones contain the RMS current value on lines L1, L2 and L3, respectively.

Accuracy is better than 1% in start modes ZC, BF and HSC.

Accuracy is better than 3% in PA mode with conduction angle >90°, and better than 10% for lower conduction angles.

The circulating current in the load is acquired with a 0.2ms sampling time.

In addition, there are the following parameters for a zone with single-phase load:

I.tA1 instantaneous ammeter value
I1on current with active control
o.tA1 ammeter input offset correction
Ft.tA ammeter input digital filter

There are also the following parameters if zone 1 has a three-phase load:

I.tA1, I.tA2 and I.tA3 instantaneous ammeter value on line L1, L2 and L3
I1on, I2on and I3on current with active control
o.tA1, o.tA2 and o.tA3 ammeter input offset correction on line L1, L2 and L3

Ft.tA ammeter input digital filter

If diagnostics detects a fault condition on the load, the red ER LED will flash in synch with yellow LED O1 or O2 or O3 for the zone in question.

The condition POWER FAULT in OR with HB alarm can be assigned to an alarm or identified in the state of a bit in variables STATUS, STATUS1, STATUS2 and STATUS3.

In STATUS3 you can identify the condition that activated the POWER_FAULT alarm.

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

SSR SHORT SSR module in short circuit

NO VOLTAGE power failure or interrupted fuse

NO CURRENT due to SSR module open or fuse or load interrupted

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

The default value of the maximum limit or ammeter full-scale depends on the model:

Model	H.tA
40A	80.0
60A	120.0
100A	200.0
150A	300.0
200A	400.0
250A	500.0
300A	600.0
400A	800.0
600A	1200
External CT	1000.0

Scale Limits

746	LtA1	R	Minimum limit of CT ammeter input scale (phase 1)					
747	LtA2	R	Minimum limit of CT ammeter input scale (phase 2)			with 3-Phase Load		
748	LtA3	R	Minimum limit of CT ammeter input scale (phase 3)			with 3-Phase Load		
405	HtA1	R	Minimum limit of CT ammeter input scale (phase 1)					
413	HtA2	R	Minimum limit of CT ammeter input scale (phase 2)			with 3-Phase Load		
414	HtS3	R	Minimum limit of CT ammeter input scale (phase 3)			with 3-Phase Load		

Setting the Offset

220	otA1	R/W	Offset correction CT input (phase 1)	-99.9 ...99.9 Scale points		0.0 zone 1	0.0 zone 2	0.0 zone 3
415	otA2	R/W	Offset correction CT input (phase 2)	-99.9 ...99.9 Scale points	With 3-Phase Load	0.0		
416	otA3	R/W	Offset correction CT input (phase 3)	-99.9 ...99.9 Scale points	With 3-Phase Load	0.0		

External CT

339	rtA1	R/W	Offset correction for external CT input	1...655		200 zone 1	200 zone 2	200 zone 3

Read State

227 473-139-755	ItA1	R	Instantaneous CT ammeter input value (phase 1)		
490 494	ItA2	R	Instantaneous CT ammeter input value (phase 2)		With 3-Phase Load
491 495	ItU3	R	Instantaneous CT ammeter input value (phase 3)		With 3-Phase Load
468	I1on	R	CT filtered ammeter input value with output activated (phase 1)		
498	I2on	R	CT filtered ammeter input value with output activated (phase 2)		With 3-Phase Load
499	I3on	R	CT filtered ammeter input value with output activated (phase 3)		With 3-Phase Load
709	ItAP	R	Peak ammeter input during phase softstart ramp		
716	coSF	R	Power factor in hundredths		
753	LdA	R	Current RMS on load		
754	LdAt	R	Current RMS on 3-phase load		

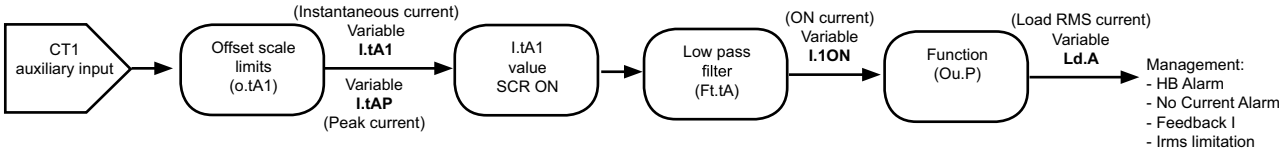
Advanced Settings

Input Filter

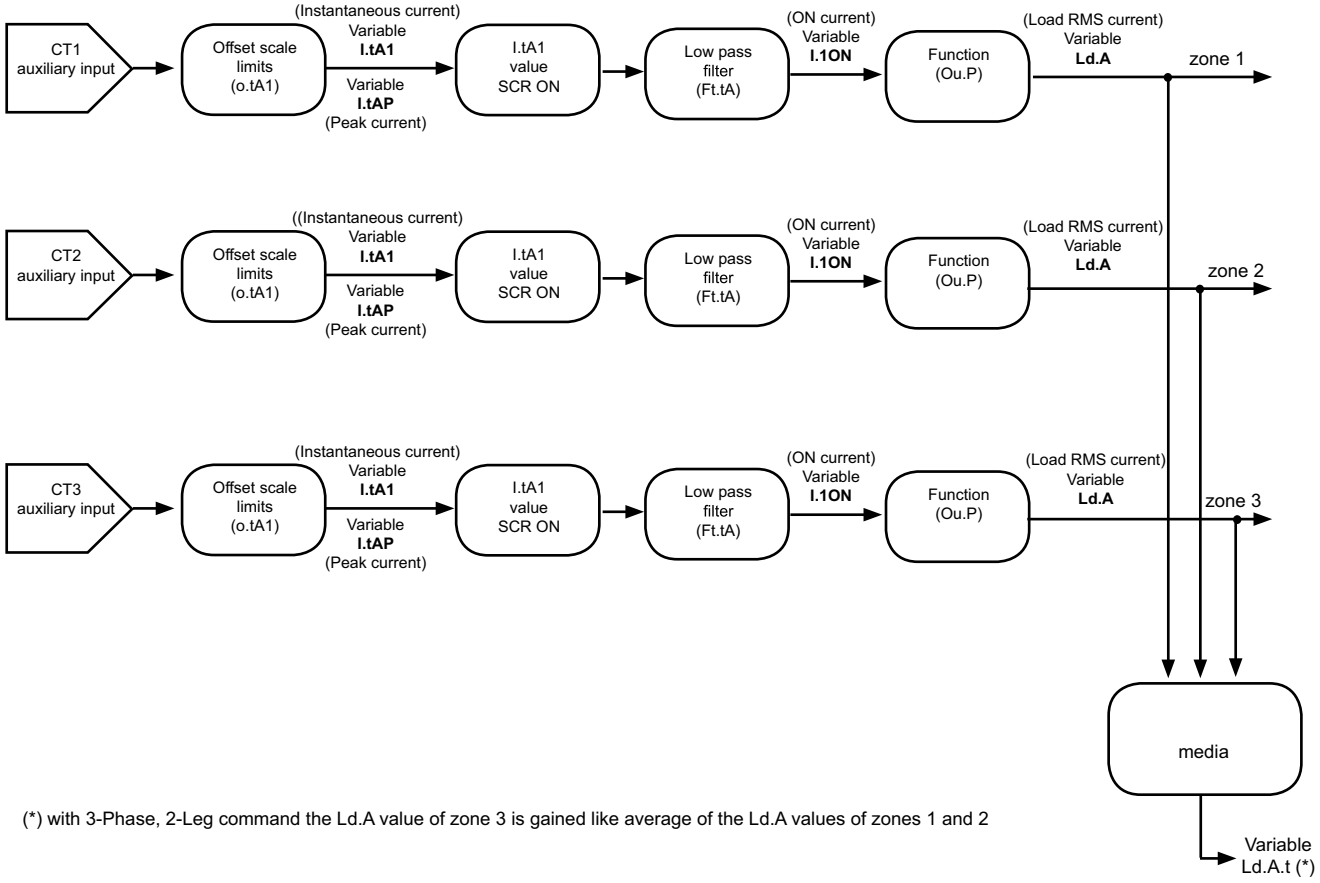
219	Ft.tA	R/W	CT input digital filter		0.0 ... 20 sec		0.1 zone 1	0.1 zone 2	0.1 zone 3
Sets a low pass filter on the CT auxiliary input, running the average of values read in the specified time interval. If = 0 , excludes the average filter on sampled values.									

Functional Diagrams

Monophase load



Threephase load



(*) with 3-Phase, 2-Leg command the Ld.A value of zone 3 is gained like average of the Ld.A values of zones 1 and 2

Voltage Value on Load

RMS voltage is read in variable Ld.V of each zone. If zone 1 has a 3-phase load, variable Ld.V.t in the first zone contains the average RMS value of voltages on three load L1, L2 and L3.

Voltage on the load is acquired with sampling on each cycle, 20ms at 50Hz (16.6ms at 60Hz). Accuracy is better than 1%.

The istantaneous RMS voltage value and with activated output,for single zone can be read in the variables Ld.VIS and Ld.Von; Ld.Von values are filtered by Ft.tVL (with option VLOAD) or Ft.tV (without option VLOAD).

If the option VLOAD is not present, the Load RMS voltage value is calculated from the line voltage and from the output power values.

Read State

751	Ld.V	R	Voltage on load
710	Ld.VIS	R	Load voltage instantaneous
711	Ld.Von	R	Load voltage with output activated
752	LdV.t	R	R Voltage on 3-phase load

if the option VLOAD is present there are available the following parameters:

Scale Limit

439	Lt.VL	R	Minimum limit of TV_LOAD voltmeter input scale
443	Ht.VL	R	Maximum limit of TV_LOAD voltmeter input scale

Setting the Offset

444	ot.VL	R/W	Offset correction for TV_LOAD input	-99.9 ...99.9 scale points		0.0 zone 1	0.0 zone 2	0.0 zone 3

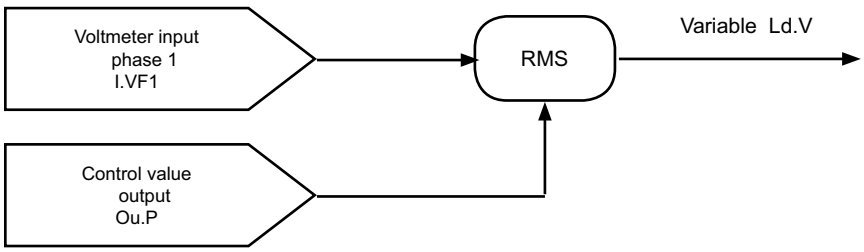
Advanced Settings

Input Filter

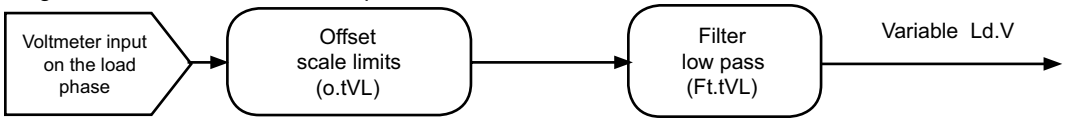
442	Ft.tVL	R/W	Digital filter ingress transformer voltmetrics TV_LOAD	0.0 ..20.0 sec		0.1 zone 1	0.1 zone 2	0.1 zone 3

Functional Diagram

Single-Phase Load without VLOAD option

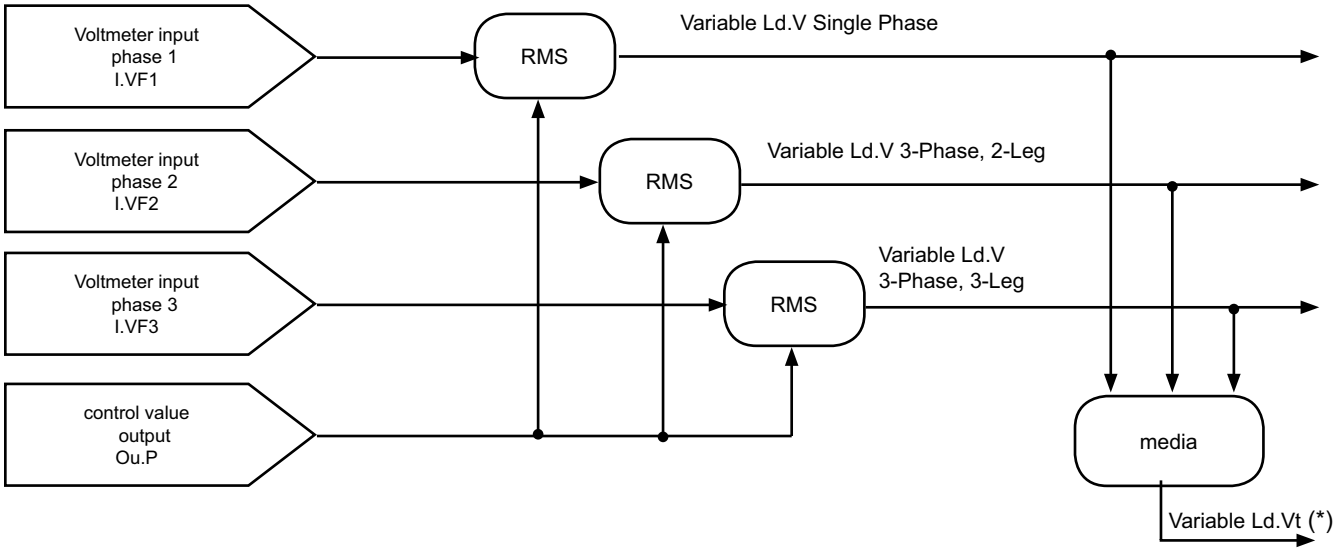


Single-Phase Load with VLOAD option

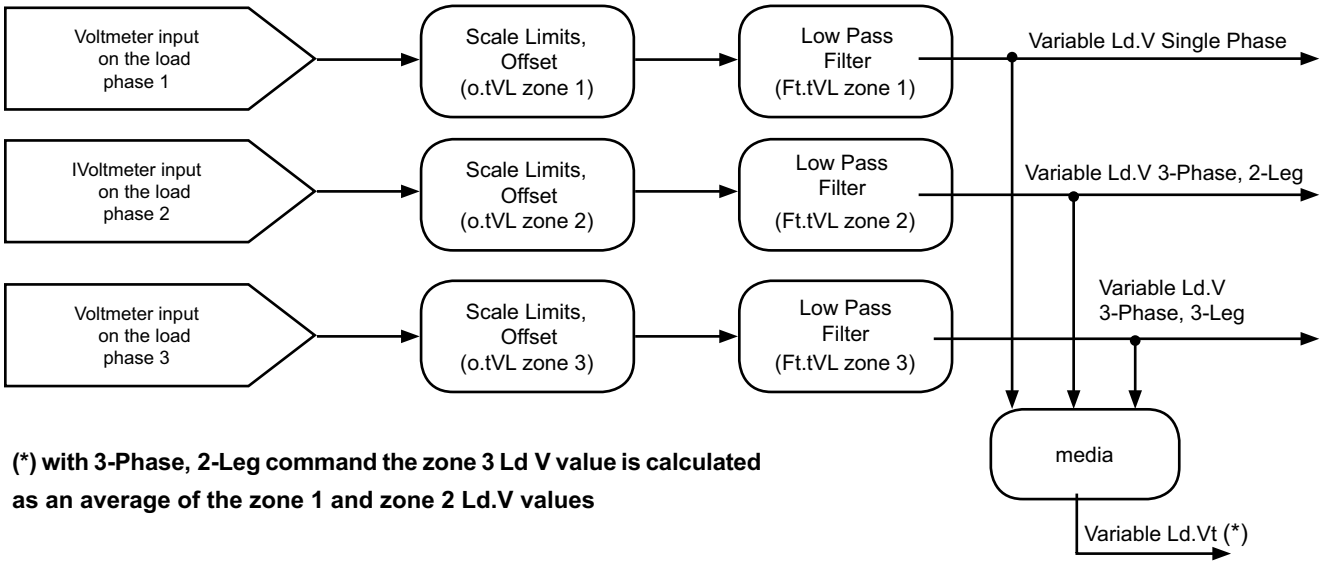


Functional Diagram

Three-Phase Load without VLOAD option



Three-Phase Load with VLOAD option



(*) with 3-Phase, 2-Leg command the zone 3 Ld V value is calculated as an average of the zone 1 and zone 2 Ld.V values

Line Voltage Value

There are the following parameters if zone 1 has a single-phase load:

I.tV1 instantaneous voltmeter value of line

I.VF1 filtered voltmeter value

o.tV1 voltmeter input offset correction

Ft.tV voltmeter input digital filter

There are the following parameters if zone 1 has a 3-phase load:

I.tV1, I.tV2 and I.tV3, the instantaneous voltmeter value on line L1, L2 and L3, respectively.

RMS voltage values refer to voltage between 1/L1 and 3/L2 terminals.

I.VF1, I.VF2 and I.VF3 filtered voltmeter value on line L1, L2 and L3

o.tV1, o.tV2 and o.tV3 voltmeter input offset correction on line L1, L2 and L3.

Each phase has a voltage presence check that shuts off the module in case of incorrect values.

3-phase loads have an imbalance diagnostic, with consequent shut-down of the load and signal via LEDs.

A “voltage status” parameter contains information on the status of line voltage, including mains frequency identified 50/60Hz.

3-phase loads have diagnostics for correct phase connection, lack of a voltage, or imbalance of the three line voltages.

Scale Limits

453	LtV1	R	Minimum limit of TV voltmeter input scale (phase 1)						
454	LtV2	R	Minimum limit of TV voltmeter input scale (3-phase, 2-leg)			with 3-Phase Load			
455	LtV3	R	Minimum limit of TV voltmeter input scale (3-phase, 3-leg)			with 3-Phase Load			
410	HtV1	R	Maximum limit of TV voltmeter input scale (phase 1)						
417	HtV2	R	Minimum limit of TV voltmeter input scale (3-phase, 2-leg)			with 3-Phase Load			
418	HtV3	R	Minimum limit of TV voltmeter input scale (3-phase, 3-leg)			with 3-Phase Load			

Setting the Offset

411	otU1	R/W	Offset correction TV input (phase 1)	-99.9 ...99.9 Scale points		0.0 zone 1	0.0 zone 2	0.0 zone 3
419	otU2	R/W	Offset correction CT input (3-phase, 2-leg)	-99.9 ...99.9 Scale points	With 3-Phase Load	0.0		
420	otU3	R/W	Offset correction CT input (3-phase, 3leg)	-99.9 ...99.9 Scale points	With 3-Phase Load	0.0		

Read State

232 485	ItU1	R	Value of voltmeter input (phase 1)	
492	ItU2	R	Value of voltmeter input (3-phase, 2-leg)	With 3-Phase Load
493	ItU3	R	Value of voltmeter input (3-phase, 3-leg)	With 3-Phase Load
322	UF1	R	Value Filtered of voltmeter input (phase 1)	
496	UF2	R	Value Filtered of voltmeter input (3-phase, 2-leg)	With 3-Phase Load
497	UF1	R	Value Filtered of voltmeter input (3-phase, 3-leg)	With 3-Phase Load

702			Voltage status	
315	FrEq	E	Voltage frequnecy in tenths of Hz	

Table Voltage Status	
Bit	
0	frequency_warning
1	10% umbalanced_line_warning
2	20% umbalanced_line_warning
3	30% umbalanced_line_warning
4	rotation 123_error
5	triphase_missing_line_error
6	60Hz

Advanced Settings

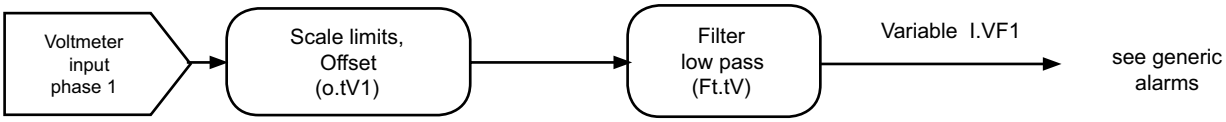
Input Filter

412	FtU	R/W	Digital filter for voltmeter transformer TV input	0.0 ..20.0 sec		2.0 zone 1	2.0 zone 2	2.0 zone 3

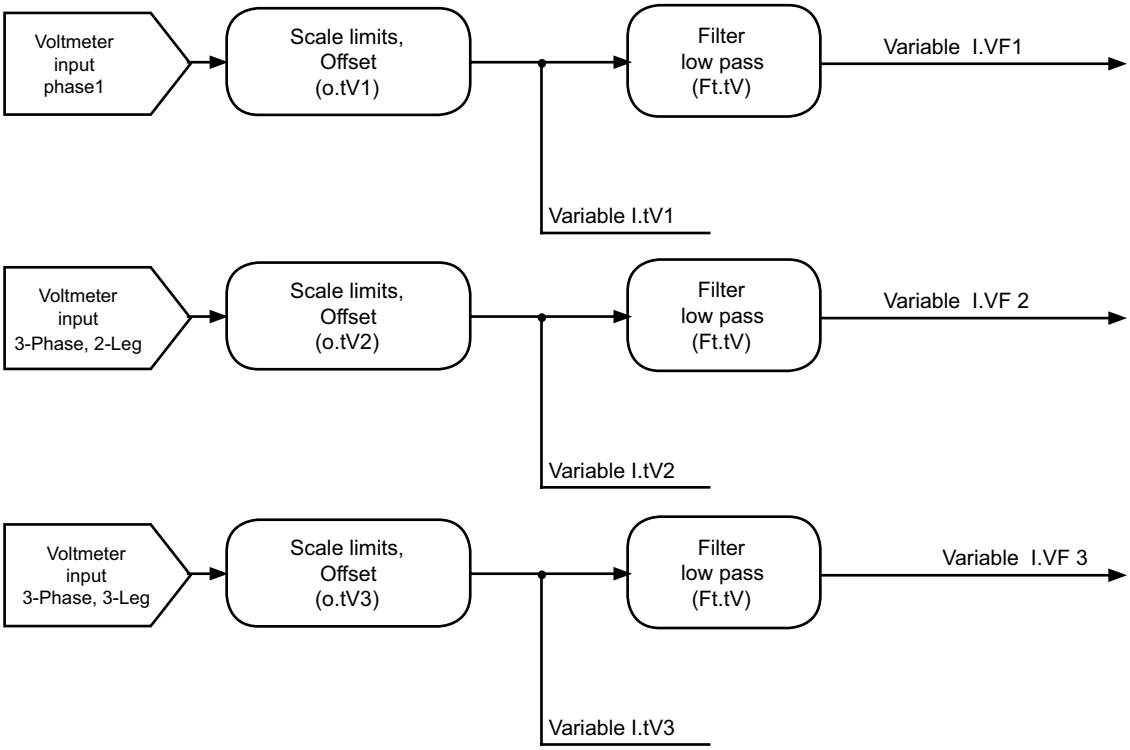
Sets a low pass filter on the auxiliary TV input, running the average of values read in the specified time interval. If = 0 , excludes the average filter on sampled values.

Functional Diagram

Line Voltage Value Single Phase



Line Voltage Value 3-Phase



Power On Load

Power on the load in each zone is read in variable Ld.P and the corresponding energy value in variables Ld.E1 and Ld.E2.

These energy values show the value accumulated since the first power on or since the last reset (commands at bits 114 and 115); non-volatile memory is updated every two hours and the disconnection of the power off.

Load impedance in each zone is read in variable Ld.I.

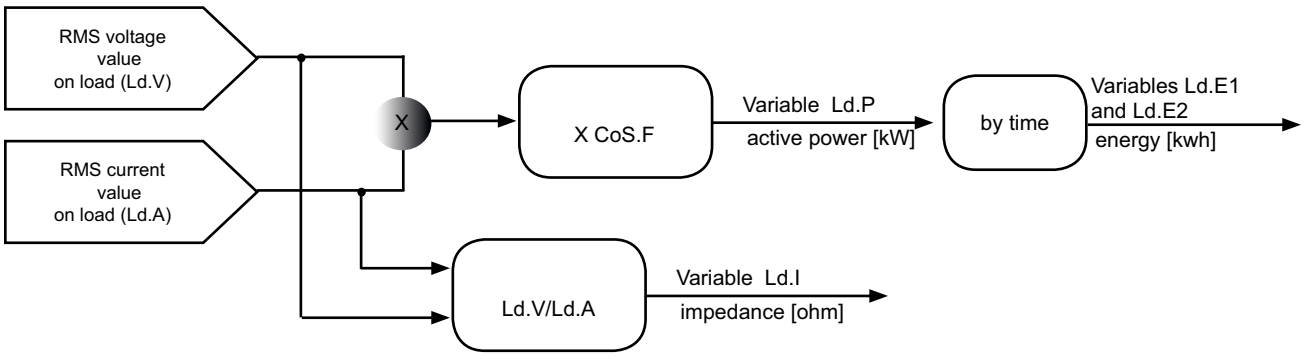
If zone 1 has a 3-phase load, variable Ld.P.t shows power and Ld.I.t total impedance, the corresponding energy value in variables Ld.E1.t and Ld.E2.t.

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

880 719 LSW only	LdP	R	Power on load		Data in DWORD (32 bit) format for address 880* LSW data in WORD (16 bit) format for address 719*
882 720 LSW only	LdPt	R	Power on Load 3-Phase		Data in DWORD (32 bit) format for address 882 LSW data in WORD (16 bit) format for address 720
749	Ld I	R	Impedance on load		
750	Ld It	R	Impedance on load 3-phase		
531	LdE 1	R	Energy on load		Data in DWORD (32 bit) format
541	LdE1t	R	Energy on 3-phase load		Data in DWORD (32 bit) format
510	LdE2	R	Energy on load		Data in DWORD (32 bit) format
541	LdE1t	R	Energy on 3-phase load		Data in DWORD (32 bit) format
114 bit	LdE 1	R/W	OFF = - ON = Reset Ld.E1		
115 bit	LdE2	R/W	OFF = - ON = Reset Ld.E1		

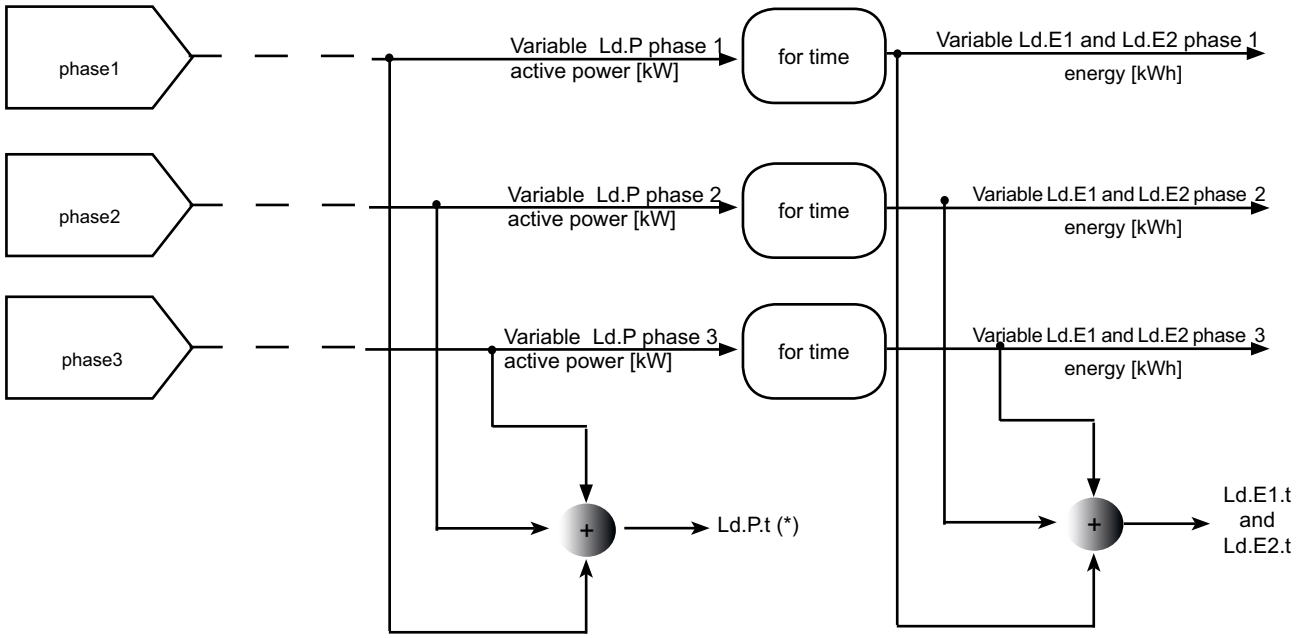
Functional Diagram

Single-phase load

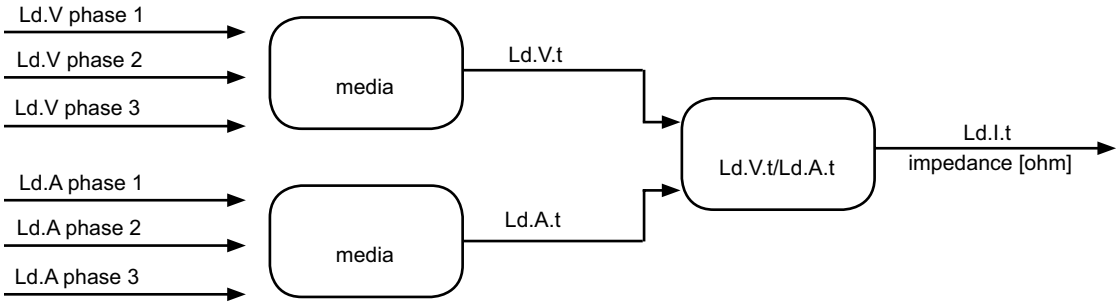


Functional Diagram

3-phase load



(*) with BI-PHASE command the Ld.A value of zone 3 is gained like average of the Ld.A values of zones 1 and 2



Auxiliary Analog Inputs (LIN/TC)

The CFW has 4 inputs defined as auxiliary (IN2 for zone 1, IN3 for zone 2, IN4 for zone 3, IN5 for zone 4) to which TC or linear temperature sensors can be connected.

The presence of these inputs is optional

Input values are available in variables In.2/In.3/In.4/In.5 and can be read or used to activate assigned alarm signals.

When an auxiliary input is present, you have to define the following parameters:

- sensor type (AI.2, AI.3, AI.4, AI.5);
- its function (tP.2); (only for IN2 input)
- decimal point position (dP.2, HS.3 – LS.3, HS.4
- LS.4, HS.5 – LS.5);
- scale limits (HS.2 – LS.2);
- offset correction value (oFS.2, oFS.3, oFS.4, oFS.5).

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, Flt.3, Flt.4, Flt.5,) that can be used to reduce noise on the input signal.

194	AI.2	R/W	Select type of auxiliary sensor input 2
553	AI.3	R/W	Select type of auxiliary sensor input 3
554	AI.4	R/W	Select type of auxiliary sensor input 4
555	AI.5	R/W	Select type of auxiliary sensor input 5

Auxiliary Input Sensors				
Type	Type of Probe/Sensor	W/O Decimal Pt	With Decimal Pt	0
1	TC J °F	32/1832	32.0/999.9	
2	TC K °C	0/1300	0.0/999.9	
3	TC K °F	32/2372	32.0/999.9	
4	TC R °C	0/1750	0.0/999.9	
5	TC R °F	32/3182	32.0/999.9	
6	TC S °C	0/1750	0.0/999.9	
7	TC S ° F	32/3182	32.0/999.9	
8	TC T °C	-200/400	-199.9/400.0	
9	TC T °F	-328/752	-199.9/752.0	
34	0...60 mV	-1999/9999	-199.9/999.9	
35	0...60 mV	Custom linearization	Custom linearization	
36	12...60 mV	-1999/9999	-199.9/999.9	
37	12...60 mV	Custom linearization	Custom linearization	
99	Input Off			

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

Auxiliary Input Functions				
		Limits for setting LS.2 & HS.2		
tP.2	Aux. Input Function	Min.	Max.	0
0	None	-1999	9999	
1	Remote setpoint	Absolute Lo.S, relative -999	Absoluto Hi.S, relative +999	
2	Manual analog remote	-100.0%	+100.0%	
3	Reset power analogic	-100.0%	+100.0%	
8	Analogic remote manual from main input			
16	Remote manual from analogic input			
32	Remote manual from PWM input			
(*) see: Settings – Control Setpoint (**) see: Controls –PID Parameters				

677	dP2	R/W	Decimal point posiction for the auxiliary input scale 2	Decimal Point Table		0
568	dP3	R/W	Decimal point posiction for the auxiliary input scale 3			0
569	dP4	R/W	Decimal point posiction for the auxiliary input scale 4			0
570	dP5	R/W	Decimal point posiction for the auxiliary input scale 5			0

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

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

Scale Limits

404	LS2	R/W	Minimum limit of auxiliary input scale 2	Min...max input scale selected in AI.2 and tP.2	0
556	LS3	R/W	Minimum limit of auxiliary input scale 3	Min...max input scale selected in AI.3	0
557	LS4	R/W	Minimum limit of auxiliary input scale 4	Min...max input scale selected in AI.4	0
558	LS5	R/W	Minimum limit of auxiliary input scale 5	Min...max input scale selected inAI.5	0
603	HS2	R/W	Minimum limit of auxiliary input scale 2	Min...max input scale selected in AI.2 and tP.2	1000
559	HS3	R/W	Minimum limit of auxiliary input scale 3	Min...max input scale selected in AI.3	1000
560	HS4	R/W	Minimum limit of auxiliary input scale 4	Min...max input scale selected in AI.4	1000
561	HS5	R/W	Minimum limit of auxiliary input scale 5	Min...max input scale selected inAI.5	1000

Setting the Offset

605	oFS2	R/W	Offset for auxiliary input correction 2	-999 ...999 Scale points		0
565	oFS3	R/W	Offset for auxiliary input correction 3	-999 ...999 Scale points		0
566	oFS4	R/W	Offset for auxiliary input correction 4	-999 ...999 Scale points		0
567	oFS5	R/W	Offset for auxiliary input correction 5	-999 ...999 Scale points		0

Read State

602	In2	R	Value of auxiliary input 2
547	In3	R	Value of auxiliary input 3
548	In4	R	Value of auxiliary input 4
549	In4	R	Value of auxiliary input 5

606	Er2	R	Error code for self-diagnosis of auxiliary input 2	Error Code Table	
550	Er3	R	Error code for self-diagnosis of auxiliary input 3	0	No error
551	Er4	R	Error code for self-diagnosis of auxiliary input 4	1	Lo (value of process variable is < LS.x)
552	Er5	R	Error code for self-diagnosis of auxiliary input 5	2	Hi (value of process variable is > HS.x)
				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 max. limits)

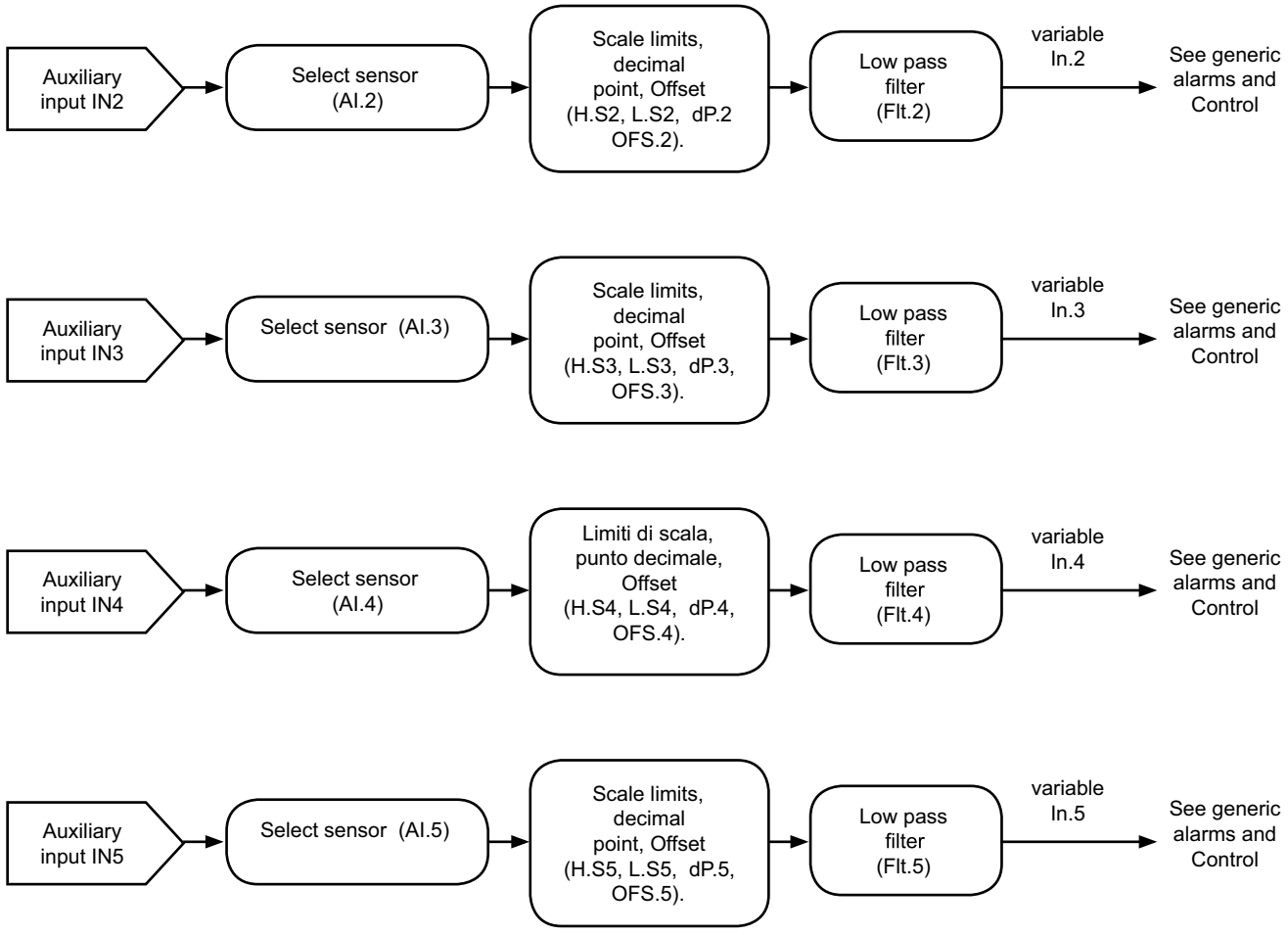
Advanced Settings

Input Filter

604	FLt2	R/W	Digital filter for auxiliary input 2	0.0 ..20.0 sec		0.1
562	FLt3	R/W	Digital filter for auxiliary input 3	0.0 ..20.0 sec		0.1
563	FLt4	R/W	Digital filter for auxiliary input 4	0.0 ..20.0 sec		0.1
564	FLt5	R/W	Digital filter for auxiliary input 5	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 (40 - 300A Models)

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

140	d 1 6 .	R/W	Digital Input Function
618	d 1 6 . 2	R/W	Digital Input 2 Function

Digital Input Functions Table			0	Activation
0	No functions (input off)			
1	MAN/AUTO controller		0	On leading edge
2	LOC / REM			On leading edge
3	HOLD			On state
4	AL1, ..., AL4 alarms memory reset			On state
5	SP1 / SP2 selection			On leading edge
6	Software on/off			On leading edge
7	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 (*)			
14	Reference calibration of retroaction selected by Hd.6			
15	Calibration threshold alarm HS			

(*) For d 1 6 . only
(**) IN d 1 6 . alternative to serial

694	d 1 6 3	R/W	Digital Input 3 Function

Digital Input Functions 3 Table			0
0	No functions (input off)		
1	PWM Input		

+ 16 for inverse logic input

Read State

68 bit	State of Digital Input 1	R	OFF = Digital input 1 off R ON = Digital input 1 on
92 bit	State of Digital Input 2	R	OFF = Digital input 2 off R ON = Digital input 2 on
67 bit	State of Digital Input 3	R	OFF = Digital input 3 off R ON = Digital input 3 on
317		R	Sate of INPUT DIG digital inputs bit.0 = state INDIG1 bit.1 = state INDIG2 bit.2 = state INDIG3
518	In.PWM	R	PWM input value 0.0...100.0%

Functions Related to Digital Inputs

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

Digital Inputs (400 - 600A Models)

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

140	d I6.	R/W	Digital Input Function
618	d I6.2	R/W	Digital Input 2 Function
694	d I6.3	R/W	Digital Input 3 Function
712	d I6.4	R/W	Digital Input 4 Function

Digital Input Functions Table		Activation	
0	No functions (input off)	On leading edge	0
1	MAN / AUTO controller	On leading edge	
4	AL1, ..., AL4 alarms memory reset	On state	
6	Software ON/OFF	On leading edge	0
7	PWM input(**)	On leading edge	
10	Power_Fault alarms memory reset	On leading edge	
12	AL1 .. AL4 and Power_Fault alarms reset memory	On state	0
13	Enable at software ON (*)	On state	
14	Reference calibration of retroaction selected by Hd.6	On leading edge	
15	Calibration threshold alarm HB	On leading edge	
64	Reset alarms FUSE_OPEN / SHORT_CIRCUIT_CURRENT	On state	
65	Reference calibration of retroaction selected by Hd.6 for CFW-M	On leading edge	
66	Reference calibration of retroaction selected by Hd.6 for CFW-E1	On leading edge	
67	Reference calibration of retroaction selected by Hd.6 for CFW-E2	On leading edge	
68	Calibration threshold alarm HB for CFW-M	On leading edge	
69	Calibration threshold alarm HB for CFW-E1	On leading edge	
70	Calibration threshold alarm HB for CFW-E2	On leading edge	
71	MAN / AUTO CFW-M	On leading edge	
72	MAN / AUTO CFW-E1	On leading edge	
73	MAN / AUTO CFW-E2	On leading edge	
74	ON / OFF Software CFW-M	On leading edge	
75	ON / OFF Software CFW-E1	On leading edge	
76	ON / OFF Software CFW-E2	On leading edge	

+ 16 for inverse logic input
+ 32 to force logic state 0 (OFF)
+ 48 to force logic state 1 (ON)
(*) for diG.1 only
(**) for diG.1 only (PWM1 max 100Hz), diG.2 (PWM2 max 1Hz), diG.3 (PWM3 max 1Hz)

385	tPd I6	R/W	Defining type of digital inputs

Table defining type of digital inputs		0
0	PNP Digital Inputs	
1	NPN or voltage-free contact digital inputs	

Advanced Settings

NOTE: if the digital input is used to command the power % (Ou.P) on the load (PWM input function, diG = 7), it is important to set Timeout parameter PWm.t to a value equal to or higher than the period of the PWM control signal used to guarantee this reaction time even in static conditions of low input (Ou.P=0%) or high input (Ou.P=100%).

Timeout for PWM Input

356	PWMt 1	R/W	Timeout for PWM input 1	0.01 ... 10.00 sec.		1.00
357	PWMt 2	R/W	Timeout for PWM input 2	0.01 ... 10.00 sec.		1.00
362	PWMt 3	R/W	Timeout for PWM input 3	0.01 ... 10.00 sec.		1.00

Input Filter - PWM Input

438	FtPWM1	R/W	Digital low-pass filter PWM input 1	0.0 ..20.0 sec		0.1
372	FtPWM2	R/W	Digital low-pass filter PWM input 2	0.0 ..20.0 sec		0.1
373	FtPWM3	R/W	Digital low-pass filter PWM input 3	0.0 ..20.0 sec		0.1

Read State

68 Bit	State of Digital Input 1	R	OFF = Digital input 1 off R ON = Digital input 1 on
92 Bit	State of Digital Input 2	R	OFF = Digital input 2 off R ON = Digital input 2 on
67 Bit	State of Digital Input 3	R	OFF = Digital input 3 off R ON = Digital input 3 on
66 Bit	State of Digital Input 4	R	OFF = Digital input 4 off R ON = Digital input 4 on

317		R	Sate of INPUT DIG digital inputs	bit.0 = state INDIG1 bit.1 = state INDIG2 bit.2 = state INDIG3 bit.2 = state INDIG4
518	In.PWM 1	R	PWM 1 input value	0.0...100.0%
435	In.PWM 2	R	PWM 2 input value	0.0...100.0%
457	In.PWM 3	R	PWM 3 input value	0.0...100.0%

Functions Related to Digital Inputs

- MAN / AUTO controller..... see AUTO/MAN CONTROL
- Reset memory latch..... see GENERIC ALARMS AL1 .. AL4
- Software OFF / ON ..... see SOFTWARE SHUTDOWN
- Calibration of feedback reference ..... see FEEDBACK
- Calibration of HB alarm setpoint ..... see HB ALARM

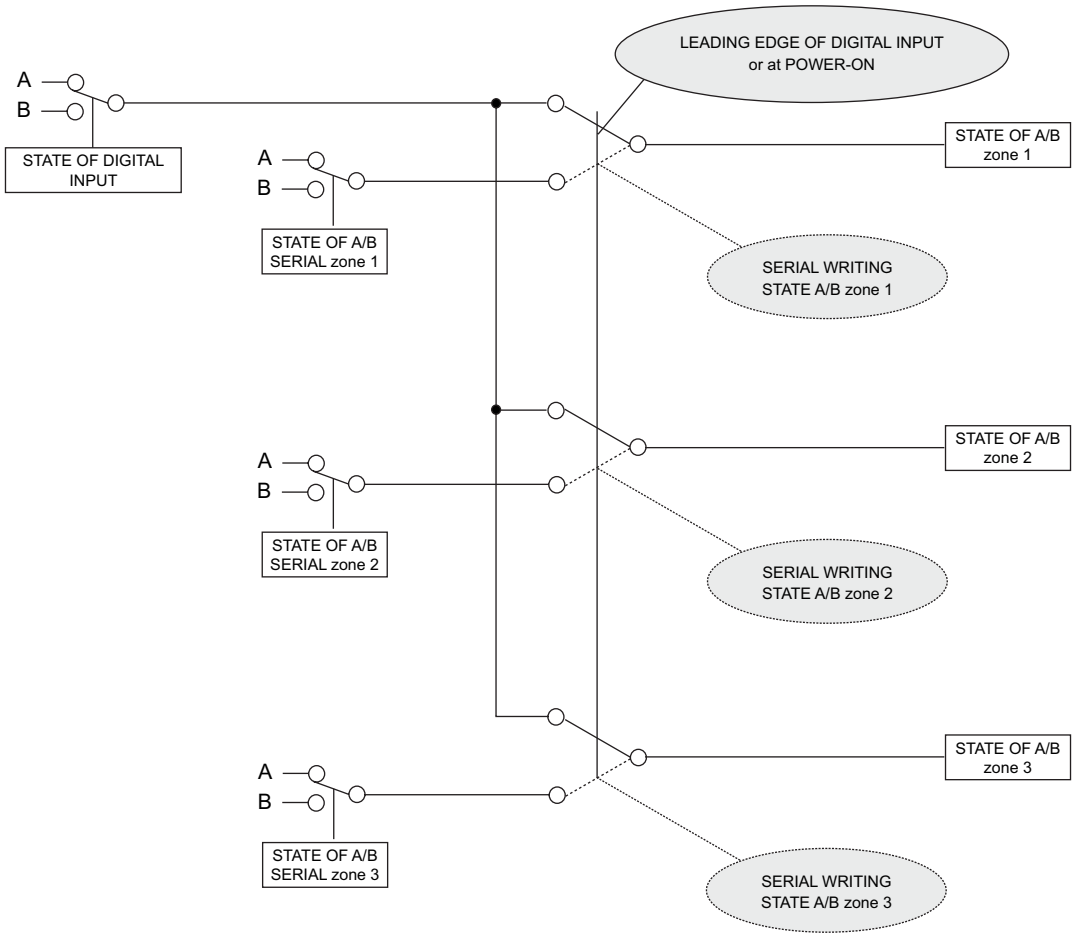
Using a Function Associated with Digital Input and Via Serial

At power-on or on the leading edge of digital input 1 or 2, all zones assume the state set by the digital input. For each zone, this state can be changed by writing via serial.

The setting via serial is saved in eeprom (STATUS_W_EEP, address 698).

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

(*) continuous or one-shot
(**) only for zone 1 (CFW-M)

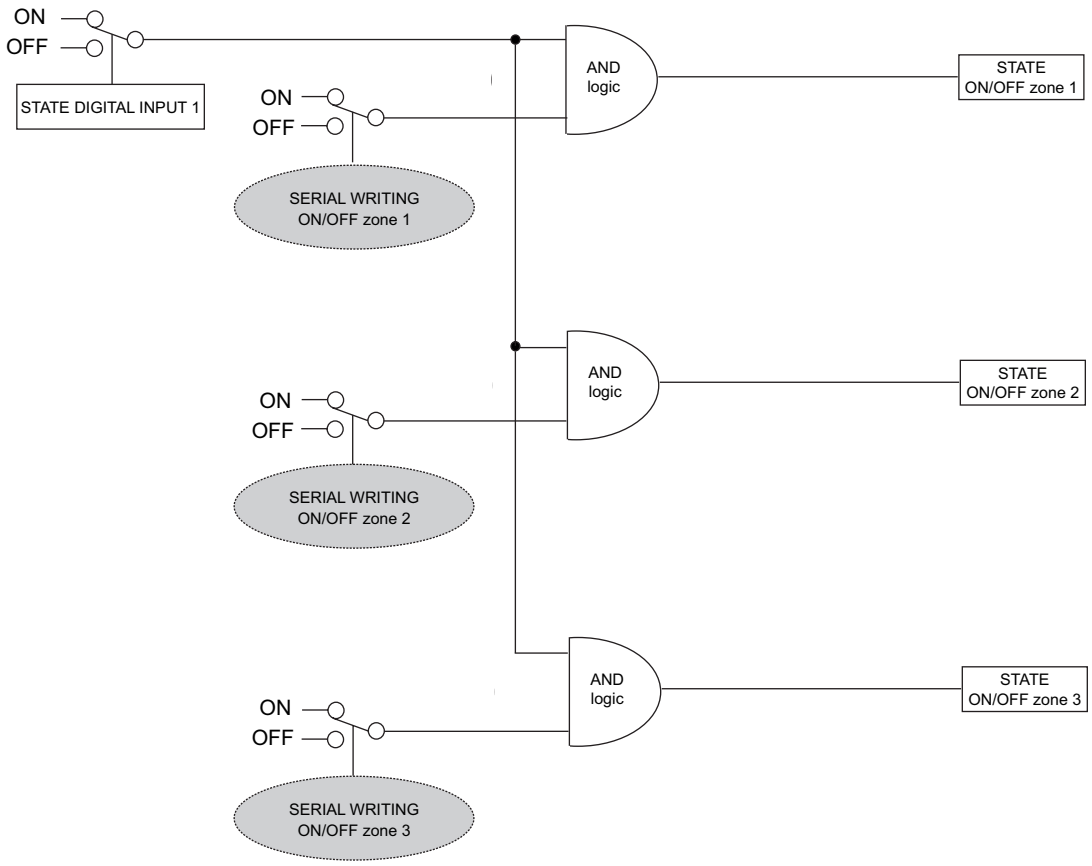


Using a Function of Digital Input 1 to Enable at Software ON

Software ON can be configured either by enabling a digital input or by writing via serial. Enabling by digital input 1 (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.

State A/B	Setting dIG	Address for writing via serial	
		Access at 16 bit	access at 1 bit
ON/OFF software	13	word 305 bit 3	bit 11



Alarms

Generic Alarms AL1, AL2, AL3 and AL4

Four generic alarms are always available and can perform various functions.

Typically, alarm AL.1 is defined as minimum and AL.2 as maximum.

These alarms are set as follows:

- select the reference variable to be used to monitor the value (parameters A1.r, A2.r, A3.r and A4.r): the origin of the variable can be chosen from the process variable PV (generally linked to the main input), the ammeter input, the voltmeter input, the auxiliary analog input, or the active setpoint.
- set the value of the alarm setpoint (parameters AL.1, AL.2, AL.3 and AL.4).

This value is used for comparison with the reference variable value: it can be absolute or indicate a shift from the variable in case of deviation alarm.

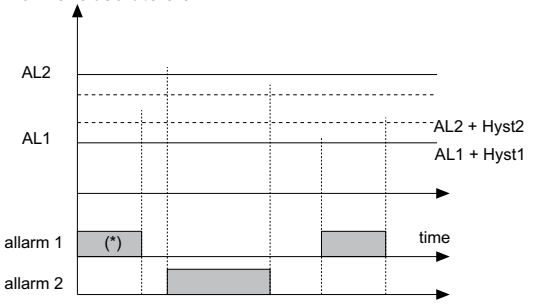
- set the hysteresis value for the alarm (parameters Hy.1, Hy.2, Hy.3 and Hy.4):

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

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

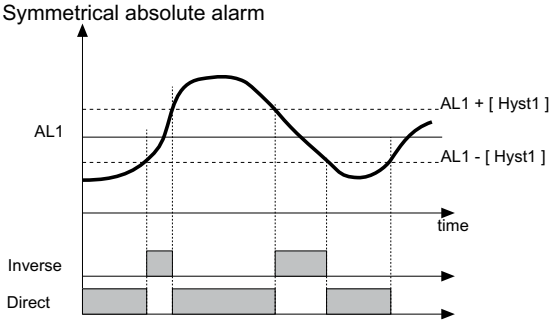
The above concepts are better explained in the following figures:

Normal absolute alarm



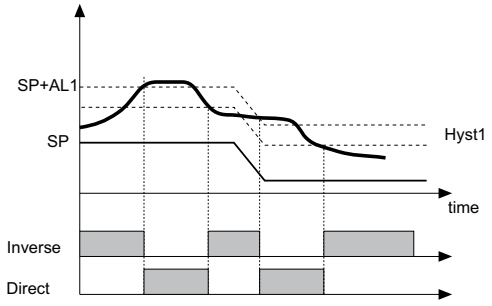
For AL1 reverse absolute alarm (low) with positive Hyst1, AL1 t = 1 (*) = OFF if disabled at switch on
For AL2 direct absolute alarm (high) with negative Hyst2, AL2 t = 0

Symmetrical absolute alarm



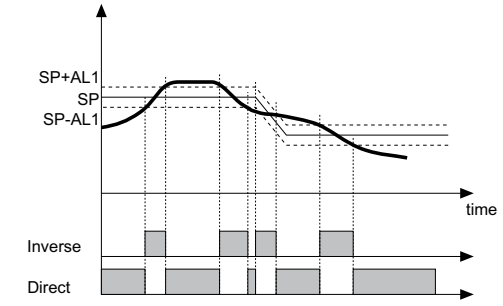
For AL1 = symmetrical inverse absolute alarm with Hyst1, AL1 t = 5
For AL1 = symmetrical direct absolute alarm with Hyst1, AL1 t = 4
Minimum hysteresis = 2 scale points

Allarme relativo al setpoint di tipo normale



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

Allarme relativo al setpoint di tipo simmetrico



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	A1r	R/W	Select Reference Variable Alarm 1	Table of Alarm Reference Setpoints		
				Type	Variable to be Compared	Reference Setpoint
216	A2r	R/W	Select Reference Variable Alarm 2	0	PV (process variable)	AL
				1	in.tA1 (In.tA1 OR In.tA2 OR In.tA3 With 3-phase load)	AL
217	A3r	R/W	Select Reference Variable Alarm 3	2	In.tV1 (In.tV1 OR In.tV2 OR In.tV3 With 3-phase load)	AL
				3	SPA (active setpoint)	AL (absolute only)
218	A4r	R/W	Select Reference Variable Alarm 4	4	PV (variabile di processo)	AL (absolute only, refer to SP1 (with functional multiset)
				5	In.2 auxiliary input	AL
				6	In.3 auxiliary input	AL
				7	In.4 auxiliary input	AL
				8	In.5 auxiliary input	AL
				9	In.A analg input	AL
				10	In.Pwm PWM input	AL
				N.B. for codes 1, 2, 5, 6, 7, 8, 9 and 10 the reference to the alarm is in scale points and not to the decimal point (dP.x)		

215	A1r	R/W	Select Reference Variable Alarm 1			0
216	A2r	R/W	Select Reference Variable Alarm 2			0
217	A3r	R/W	Select Reference Variable Alarm 3			
218	A4r	R/W	Select Reference Variable Alarm 4			0
						0

Alarm Setpoints

12 475-177	AL1	R/W	Alarm setpoint 1 (scale points)	-999...999 if alarm symetrical 0...999 if alarm relative and symetrical	500
13 476-178	AL2	R/W	Alarm setpoint 2 (scale points)	-999...999 if alarm symetrical 0...999 if alarm relative and symetrical	100
14 52-479	AL3	R/W	Alarm setpoint 3 (scale points)	-999...999 if alarm symetrical 0...999 if alarm relative and symetrical	700
58 480	AL4	R/W	Alarm setpoint 4 (scale points)	-999...999 if alarm symetrical 0...999 if alarm relative and symetrical	800

Alarm Hysteresis

27 187	HY1	R/W	Hysterisis 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	HY2	R/W	Hysterisis 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	HY3	R/W	Hysterisis for Alarm 3	±999 Scale points	0...999 sec. Se +32 in A1.t 0...999 min. Se +64 in A1.t	-1
59	HY4	R/W	Hysterisis 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
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

Table of Alarm behavior				0
AL.x.t	Direct (High Limit) Inverse (Low Limit)	Absolute Relative	Normal Symmetrical (Window)	
0	direct	absolute	normal	0
1	inverse	absolute	normal	
2	direct	relative	normal	
3	inverse	relative	normal	0
4	direct	absolute	symmetrical	
5	inverse	absolute	symmetrical	
6	direct	relative	symmetrical	0
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 Normal/Symmetrical	R/W
72 bit	AL4 Normal/Symmetrical	R/W
73 bit	AL4 Disabled at Switch-On	R/W
74 bit	AL4 With Memory	R/W

Enable Alarms

195	AL.n	R/W	Select Number of Enabled Alarms

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

Table of Enabled Alarms					0
AL.nr	Alarm 1	Alarm 2	Alarm 3	Alarm 4	
0	disabled	disabled	disabled	disabled	
1	enabled	disabled	disabled	disabled	
2	disabled	enabled	disabled	disabled	
3	enabled	enabled	disabled	disabled	
4	disabled	disabled	enabled	disabled	
5	enabled	disabled	enabled	disabled	
6	disabled	enabled	enabled	disabled	
7	enabled	enabled	enabled	disabled	
8	disabled	disabled	disabled	enabled	
9	enabled	disabled	disabled	enabled	
10	disabled	enabled	disabled	enabled	
11	enabled	enabled	disabled	enabled	
12	disabled	disabled	enabled	enabled	
13	enabled	disabled	enabled	enabled	
14	disabled	enabled	enabled	enabled	
15	enabled	enabled	enabled	enabled	

Reset Memory Latch

140	diG.	R/W	Digital Input Function
618	diG.2	R/W	Digital Input Function 2
694*	diG.3	R/W	Digital Input Function 3
712*	diG.4	R/W	Digital Input Function 4

* For 400 to 600A models only.

Digital Input Functions Table		0
0	No function (input off)	
1	MAN /AUTO controller	
2	LOC / REM	0
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 (*)	
14	Reference calibration of retroaction selected by Hd.6	
15	Calibration threshold alarm HB	

+ 16 for inverse logic input
+ 32 to force logic state 0 (OFF)
+ 48 to force logic state 1 (ON)

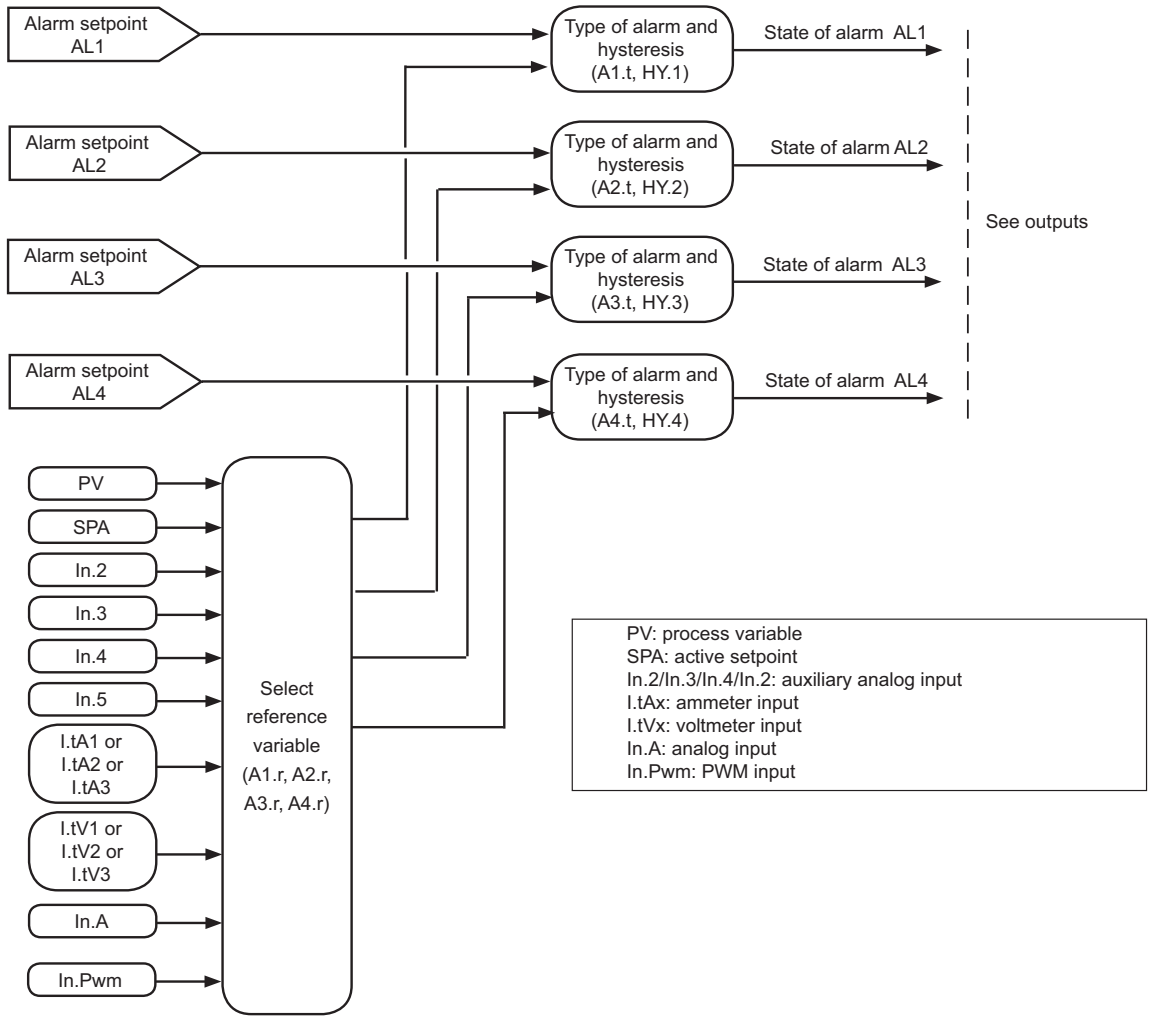
79 bit	Reset Memory Latch	R/W	

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 Alarms 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



Loop Break Alarms

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.

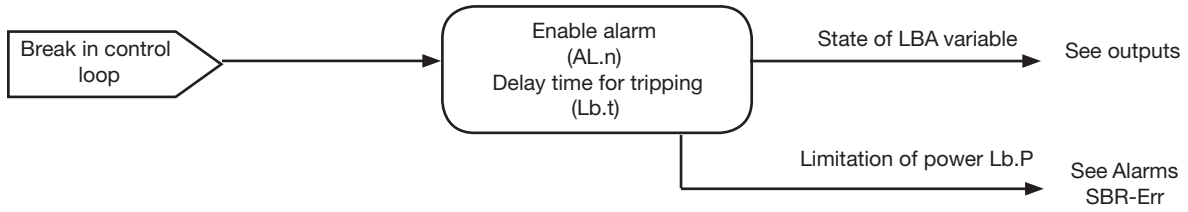
Enable Alarm

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 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 measure the current delivered by means of a current transformer.

The following three fault situations may occur:

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

Function: HB Alarm Setpoint Self-Learning

This function permits self-learning of the alarm setpoint.

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

The function can be activated via control from serial line, digital input (see parameter dIG or dIG.2) or by key (see HW/SW Information-Key Features).

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

When the Teach-in function is activated in mode PA NO infrared lamps, the existing RMS current value is shown at 100% of power, which, multiplied by parameter Hb.P, determines the HB alarm setpoint. Before activating the function, it is necessary that the CFW is switched on with power, it is recommended, above 50%.

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

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

- softstart at maximum power (default 100%), 5 sec. delay
- reduction of power to 50%, 30%, 20%, 15%, 10%, 5%, 3%, 2%, 1%, between every value 5 sec. delay
- return to normal operation.

Maximum conduction value in this phase can be limited by means of the PS.Hi parameter.

If requested, MUST be activated only with Hd.6=0 (the required Hd.6 value can be set only after calibration).

In case of HSC firng mode, the Heater Break alarm teach-in function doesn't calibrate at 5%, 3%, 2% and 1% in order to avoid

high peak currents due to the low impedence at very low temperature of the IR lamp filament.

Enable Alarm

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

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

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

56	Hb.t	R/W	Delay time for activation of HB Alarm	0 ... 999 sec	The value must exceed the cycle time of the 0 ... 999 sec output to which the HB alarm is associated. 25.0
112 bit	Calibration HB alarm setpoint for Zone	R/W	Delay time for activation of HB Alarm		NB: In case of 3-phase load, you can set a different value for parameter A.Hb1, A.Hb2, A.Hb3 for each zone (ex.: to control an unbalanced 3-phase load).

Alarm Setpoints

55	A.Hb1	R/W	HB alarm setpoint (scale points ammeter input - Phase 1)		10.0 Zone 1	10.0 Zone 2	10.0 Zone 3
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		
737	HbP	R/W	Percentage HB alarm setpoint of current read in HB calibration	0.0 ... 100.0%	80.0 Zone 1	80.0 Zone 2	80.0 Zone 3
742	HbtA	R/W	CT read in HB calibration		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
452	HbtV	R/W	TV read in HB calibration		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
743	HbPw	R/W	Ou.P power in calibration		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
758	IrtAd	R/W	HB calibration with IR lamp current at 100% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
759	IrtA1	R/W	HB calibration with IR lamp current at 50% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
760	IrtA2	R/W	HB calibration with IR lamp current at 30% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
761	IrtA3	R/W	HB calibration with IR lamp current at 20% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
767	IrtA4	R/W	HB calibration with IR lamp current at 15% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
768	IrtA5	R/W	HB calibration with IR lamp current at 10% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
769	IrtA6	R/W	HB calibration with IR lamp (only in mode PA) current at 5% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
382	IrtA7	R/W	HB calibration with IR lamp (only in mode PA) current at 3% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
383	IrtA8	R/W	HB calibration with IR lamp (only in mode PA) current at 2% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
384	IrtA9	R/W	HB calibration with IR lamp (only in mode PA) current at 1% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
445	IrtV0	R/W	HB calibration with IR lamp Voltage at 100% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
446	IrtV1	R/W	HB calibration with IR lamp Voltage at 50% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
447	IrtV2	R/W	HB calibration with IR lamp Voltage at 30% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
448	IrtV3	R/W	HB calibration with IR lamp Voltage at 20% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3

449	IrtV4	R/W	HB calibration with IR lamp Voltage at 15% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
450	IrtV5	R/W	HB calibration with IR lamp Voltage at 10% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
451	IrtV6	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 5% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
390	IrtV7	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 100% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
391	IrtV8	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 100% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
392	IrtV9	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 1% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3

Read State

744	Hbtr	R	HB alarm setpoint as function of power on load
26 bit	HB ALARM STATE OR POWER_FAULT	R	OFF = Alarm off ON = Alarm on
76 bit	State of HB alarm phase 1TA	R	
77 bit	State of HB alarm phase 3TA	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)

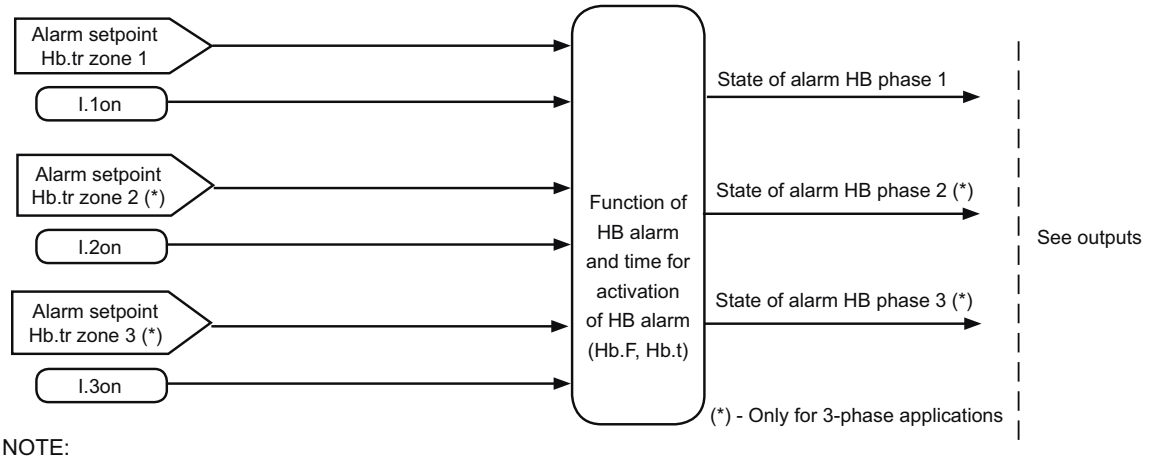
Table of alarm states ALSTATE	
Bit	
4	HB alarm time ON
5	HB alarm time OFF
6	HB alarm

318		R	States of alarm ALSTATE IRQ

States of alarm table	
Bit	
0	State AL.1
1	State AL.2
2	State AL.3
3	State AL.4
4	State AL.HB (if 3-phase or phase 1/2/3) or Power Fault
5	State AL.HB PHASE 1 (if 3-phase)
6	State AL.HB PHASE 2 (if 3-phase)
7	State AL.HB PHASE 3 (if 3-phase)

Functional Diagram

HB Alarm

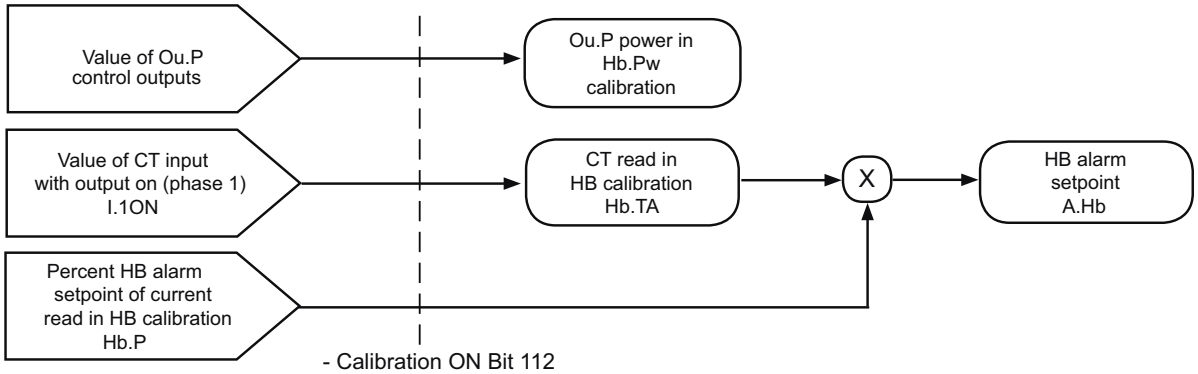


NOTE:
the value of setpoint Hb.tr for the HB alarm is calculated in two different ways, depending on the selected function mode:

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

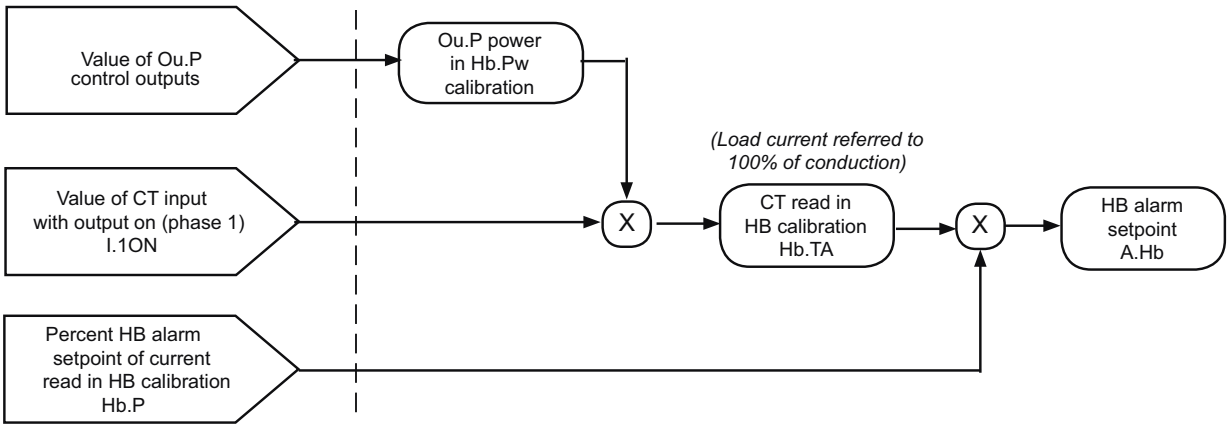
if PA mode ..... Hb.tr = A.Hb * $\sqrt{(Ou.P)}$

HB Calibration in modes ZC - BF - HSC



- Calibration ON Bit 112
- dIG/dIG.2 Function
- Key Function

HB Calibration in mode PA



- Calibration ON Bit 112
- dIG/dIG.2 Function
- Key Function

SBR - ERR ALARM 400 - 600A Models (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 Probed Alarm Settings	0

_rEL	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: OTHER FUNCTION	0.0

Read State

85	Err	R	Error code in self-diagnostics of main input	See: Table of error codes
9 bit	STATE OF INPUT IN SBR	R	OFF = - ON = Input in SBR	

Power Fault Alarms (SSR Short, No_Voltage, SSR_Open and No_Current)

660	hd.2	R/W	Enable POWER_FAULT alarms	Table of Power Fault Alarms			0 Zone 1	0 Zone 2	0 Zone 3

Hd.2	SSR Short	NO_VOLTAGE	NO_CURRENT
0			
1	X		
2		X	
3	X	X	
4			
5	X		
6		X	
7	X	X	
8			X
9	X		X
10		X	X
11	X	X	X
12			X
13	X		X
14		X	X
15	X	X	X

661	dG.t	R/W	Refresh rate SSR Short The alarm activates after 3 faults.	1...999 sec				0
662	dG.F	R/W	Time filter for NO_VOLTAGE, SSR_ OPEN and NO_CURRENT alarms.	1...999 sec	Set a value not less than cycle time	10 Zone 1	10 Zone 2	10 Zone 3
105 bit	Reset SSR_SHORT / NO_VOLTAGE / NO_CURRENT alarms	R/W						

Read State

96 bit	State of alarms SSR_SHORT phase 1	R
97 bit	State of alarms SSR_SHORT phase 2	R
98 bit	State of alarms SSR_SHORT phase 3	R
99 bit	State of alarms NO_VOLTAGE phase 1	R
100 bit	State of alarms NO_VOLTAGE phase 2	R
101 bit	State of alarms NO_VOLTAGE phase 3	R
102 bit	State of alarms NO_CURRENT phase 1	R
103 bit	State of alarms NO_CURRENT phase 2	R
104 bit	State of alarms NO_CURRENT phase 3	R

Overheat Alarm

Each power module has one temperature sensor for the internal heat sink and two additional temperature sensors connected to the LINE and LOAD terminals.

Temperature levels are shown in variables INNTC_SSR, INNTC_LINE and INNTC_LOAD.

The over_heat alarm trips when at least one of the temperatures exceeds a set threshold.

Is also saved in INNTC_SSR_MAX the maximum temperature reached by INNTC_SSR.

This condition may be caused by obstructed ventilation slits or by a stopped cooling fan.

With the over_heat alarm active, the control disables control outputs OUT1, OUT2 and OUT3.

There is an additional maximum temperature protection that hardware disables the SSR controls.

655		R	INNTC_SSR		10.0 ....120.0 °C	Overheat Alarm
534		R	INNTC_LINE		10.0 ....120.0 °C	Overheat Alarm
535		R	INNTC_LOAD		10.0 ....120.0 °C	Overheat Alarm
679		R	INNTC_SSR_MAX		0.0 ....120.0 °C	

Fuse_Open and Short_Circuit_Current Alarms

The FUSE_OPEN alarm trips when the internal high-speed fuse (optional) blows or, on CFW-Xtra models, when the overcurrent protection device switches off.

The SHORT_CIRCUIT_CURRENT alarm trips when peak current on the load exceeds the maximum limit (corresponding to twice the rating) during the softstart ramp or at first power-on (with softstart ramp disabled).

If configured (parameter Fr.n other than zero), the device restarts automatically in softstart for a maximum of Fr.n attempts, beyond which it remains deactivated while awaiting manual reset with front panel key BUT or with the control via serial (bit 109).

For CFW-Xtra models, the number of times the overcurrent protection device switches off is shown in FO.c1 and FO.c2

The FO count. c1 can be reset via the command via serial (bit116).

456	Frn	R/W	Number of restarts in case of FUSE_OPEN / SHORT_CIRCUIT_CURRENT			0.0
109 bit	RESET FUSE_OPEN /SHORT_ CIRCUIT_CURRENT ALARMS	R/W	OFF = - ON = Reset FUSE_OPEN / SHORT_CIRCUIT_CURRENT alarms			
116 bit	RESETTING FO.c1	R/W	OFF = - ON = Reset count FO.c1			

*Address 116 bit is 40-300A Only

Read State

634		R	State 4 (STATUS4)		Table of Instrument state 4
434*	FOc1	R	Counter 1: FUSE_OPEN events		
436*	FOc2	R	Counter 2: FUSE_OPEN events		

*Address 434 & 436 bit are 40-300A Only

Overcurrent Fault Protection – 40 to 300A Models

This function eliminates the need for an external extra-rapid fuse to protect the device. In case of load short-circuit, the internal IGBT device is instantaneously switched off and the alarm status is signaled.

- The overcurrent fault protection function DOES NOT replace any of the safeties on the system (such as magnetothermic switches, delay fuses, etc.).
- These caracteristic protects the controller (and therefore also the load) by replacing the high-speed fuse needed to protect the control SCRs against faults (without creating any additional cost to replace the fuse and reducing machine downtime).
- The overcurrent fault protection has 2 function states:
  - Normal (On-Off control of load power)
  - Fuse-Open: CFW is open (a short occurred during normal operation).

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 perform the heating control function (Heat) for zone 1, zone 2, and zone 3, 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).

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, and zone 3, 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).

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 section)

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

rEL = alarm states AL1, AL2, AL3, AL4 in case of broken probe, Err, Sbr (see Generic Alarms Section)

Allocation of Reference Signals

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

NOTE: Parameters rL.1, ..., rL.6 for each zone can be considered as internal states.

Ex.: To assign alarm AL1 to physical output OUT5, assign rL.1-Zone1=2 (AL1-alarm 1) and than assign parameter out.5=1 (rL.1-Zone1)

+ 32 for logic level denied in output
+ 128 to force output to zero
NOTE: continuous COOL OUTPUTS can be assigned codes 0, 1, 64 and 65 only, with cycle time fixed at 100 ms

Table of Reference Signals		0 Zone 1	0 Zone 2	0 Zone 3
	Function	1 Zone 1	1 Zone 2	1 Zone 3
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			
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			

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

Value	Function	2 Zone 1	2 Zone 2	2 Zone 3
2	AL1 - alarm 1			
3	AL2 - alarm 2			
4	AL3 - alarm 3	35 Zone 1	35 Zone 2	35 Zone 3
5	AL.HB or POWER_FAULT w/ HB alarm (TA1 OR TA2 OR TA3)			
6	LBA - LBA alarm			
7	IN1 - repetition of logic input DIG1			
8	AL4 - alarm 4	4 Zone 1	4 Zone 1	4 Zone 1
9	AL1 or AL2			
10	AL1 or AL2 or AL3			
11	AL1or AL2 or AL3 or AL4	160 Zone 1	160 Zone 2	160 Zone 3
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			
27	FUSE_OPEN/SHORT_CIRCUIT_CURRENT			
28	Overtemperature alarm			
29	Communication error			
30	Device not read			

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

(*) state definite in zone 1 (CFW-M)

						DIP 5 = OFF (Resistive load)		
152* 9	Ct.1	R/W	OUT 1 (Heat) cycle time	1 ...200 sec (0.1 ...20.0 sec)	Set 0 for BF/HSC function See POWER CONTROL	0 Zone 1	0 Zone 2	0 Zone 3
						DIP 5 = ON (Inductive load)		
						4 Zone 1	4 Zone 2	4 Zone 3
159*	Ct.2	R/W	OUT 2 (Cool) cycle time	1 ...200 sec (0.1 ...20.0 sec)		20 Zone 1	20 Zone 2	20 Zone 3

Read State

308 319		R	State of rL.x MASKOUT_RL
12 Bit	STATE rL.1	R	OFF = Signal off ON = Signal on
13 Bit	STATE rL.2	R	OFF = Signal off ON = Signal on
14 Bit	STATE rL.3	R	OFF = Signal off ON = Signal on
15 Bit	STATE rL.4	R	OFF = Signal off ON = Signal on
16 Bit	STATE rL.5	R	OFF = Signal off ON = Signal on
17 Bit	STATE rL.6	R	OFF = Signal off ON = Signal on

Table of signal reference 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

Allocation of Physical Outputs

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

Table of output allocations		
0	Output disabled	1
1	Output rL.1 zone 1	2
2	Output rL.1 zone 2	3
3	Output rL.1 zone 3	4
4	Output rL.1 zone 4	5
5	Output rL.2 zone 1	6
6	Output rL.2 zone 2	7
7	Output rL.2 zone 3	8
8	Output rL.2 zone 4	9
9	Output rL.3 OR rL.5 zone 1	17
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.		18*
In case of auxiliary continuous outputs, the same output functions can not be used on other outputs.		50**

*Address 18 is for 40-300A Models **Address 50 is for 400-600A Models

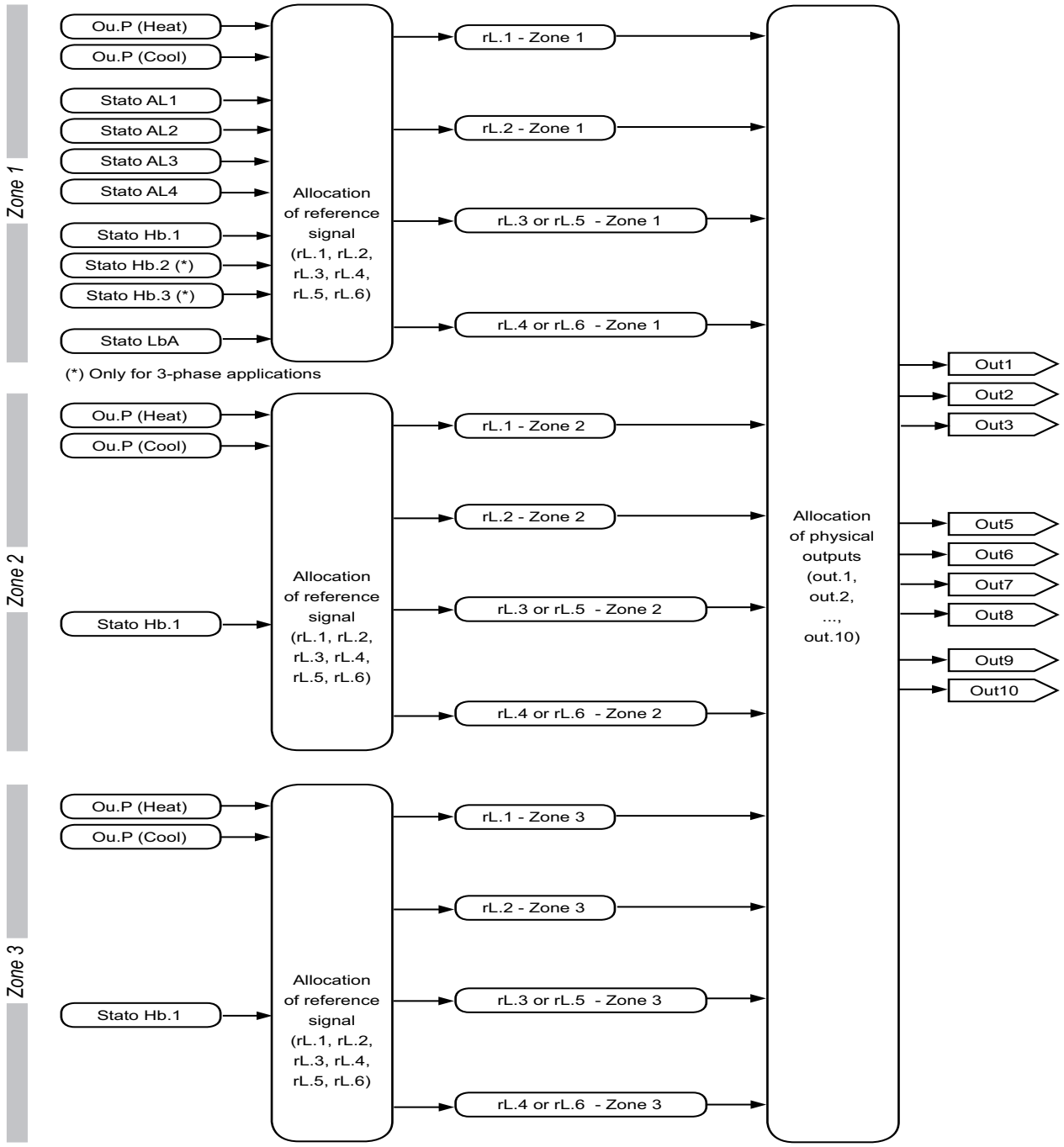
Read State

82 Bit	State of output OUT 1	R	OFF = Output off ON = Active Output
83 Bit	State of output OUT 2	R	OFF = Output off ON = Output on
84 Bit	State of output OUT 3	R	OFF = Output off ON = Output on
85 Bit	State of output OUT 4	R	OFF = Output off ON = Output on
86 Bit	State of output OUT 5	R	OFF = Output off ON = Output on
87 Bit	State of output OUT 6	R	OFF = Output off ON = Output on
88 Bit	State of output OUT 7	R	OFF = Output off ON = Output on
89 Bit	State of output OUT 8	R	OFF = Output off ON = Output on
90 Bit	State of output OUT 9	R	OFF = Output off ON = Output on
91 Bit	State of output OUT 10	R	OFF = Output off ON = Output on

664		R	State of outputs

Bit	Table of output state
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



Analog Outputs - 400 to 600A Models

The 3 optional analog outputs let you retransmit the value of analog quantities. The engineering value of the quantity is limited to the set scale values and a reparameterization is applied based on the type of output selected.

Example 1:
To retransmit the current of the CFW-M load with range 0 – 600 A with output Analog1 (0-10V), set: tP.AO1=2, rF.AO1=17, LS.AO1 = 0,0 A, HS.AO1 = 600,0 A

Example 2:

To retransmit the power of the single-phase load of the CFW-M with range 0 – 500 kW with output Analog1 (0-20mA), set: tP.AO1=0, rF.AO1=21, LS.AO1 = 0.0 kW, HS.AO1 = 500.0 kW

865	tPA01	R/W	Output type analog 1
866	tPA02	R/W	Output type analog 2
867	tPA03	R/W	Output type analog 3

Table of Analog output types		1
0	0...20 mA output	
1	4...20 mA output	
2	0...10 V output	
3	2...10 V output	
	+16 Inverse output	

868	rFA01	R/W	Attribution reference output analog 1
869	rFA02	R/W	Attribution reference output analog 2
870	rFA03	R/W	Attribution reference output analog 3

Table of Reference Signals		Scale Setting limits			0
		Min	Max	Limit of Meas.	
0	NONE	0	65535	-	0
1	Ou.P (control output) of CFW-M	0.0	100.0	%	
2	Ou.P (control output) of CFW-E1	0.0	100.0	%	0
3	Ou.P (control output) of CFW-E2	0.0	100.0	%	
4	In.A1 (analog input 1)	0.0	100.0	%	
5	In.A2 (analog input 2)	0.0	100.0	%	
6	In.A3 (analog input 3)	0.0	100.0	%	
7	In.PWM1 (PWM 1 input)	0.0	100.0	%	
8	In.PWM2 (PWM 2 input)	0.0	100.0	%	
9	In.PWM3 (PWM 3 input)	0.0	100.0	%	
10	I.VF1 (line voltage) of CFW-M	0.0	6553.5	V	
11	I.VF1 (line voltage) of CFW-E1	0.0	6553.5	V	
12	I.VF1 (line voltage) of CFW-E2	0.0	6553.5	V	
13	Ld.V (voltage on load) of CFW-M	0.0	6553.5	V	
14	Ld.V (voltage on load) of CFWE1	0.0	6553.5	V	
15	Ld.V (voltage on load) of CFWE2	0.0	6553.5	V	
16	Ld.V.t (voltage on 3-phase load)	0.0	6553.5	V	
17	Ld.A (current on load) of CFW-M	0.0	6553.5	A	
18	Ld.A (current on load) of CFW-E1	0.0	6553.5	A	
19	Ld.A (current on load) of CFW-E2	0.0	6553.5	A	
20	Ld.A.t (current on 3-phase load)	0.0	6553.5	A	
21	Ld.P (power on load) of CFW-M	0.0	6553.5	kW	
22	Ld.P (power on load) of CFW-E1	0.0	6553.5	kW	
23	Ld.P (power on load) of CFW-E2	0.0	6553.5	kW	
24	Ld.P.t (power on 3-phase load)	0.0	6553.5	kW	
25	Serial line value	0.0	6553.5	-	

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	Lo.L....HI.L		0

Remote Setpoint

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

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

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

+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)

	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)

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

Shared Settings

25 20-28-142	Lo.L	R/W	Lower settable limit SP, SP.1, SP.2, SP remote	Lo.S....Hi.S		0
26 21-29-143	Hi.L	R/W	Upper settable limit SP, SP.1, SP.2, SP remote	Lo.S....Hi.S		1000

10 bit	LOCAL/REMOTE	R/W	Instrument State (STATUS_W)	Table of Instrument Settings	0
305		R/W	Instrument State		

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

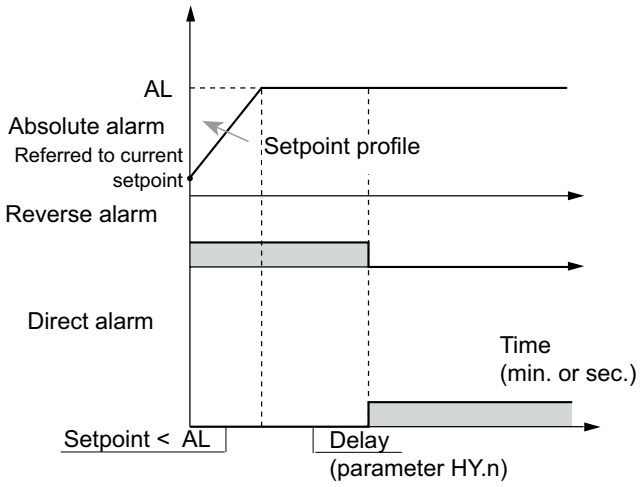
1 137-481	SPA	R	Active Setpoint
4		R	Deviation (SPA-PV)

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	HoE	R/W	Select specialized control functions	Table of Specialized Control	0

	Enable	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

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

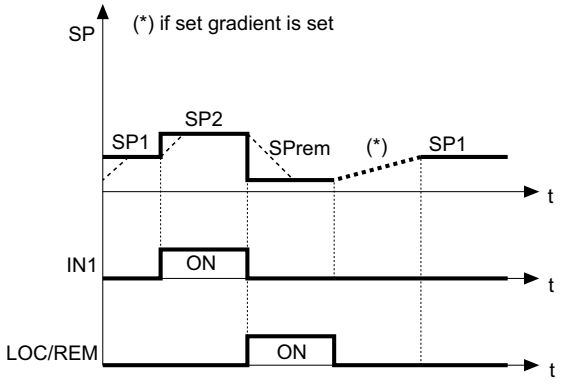
+8 enable GS.2

Multiset

The MULTISET function determines the local setpoint by selecting the value from Setpoint (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.



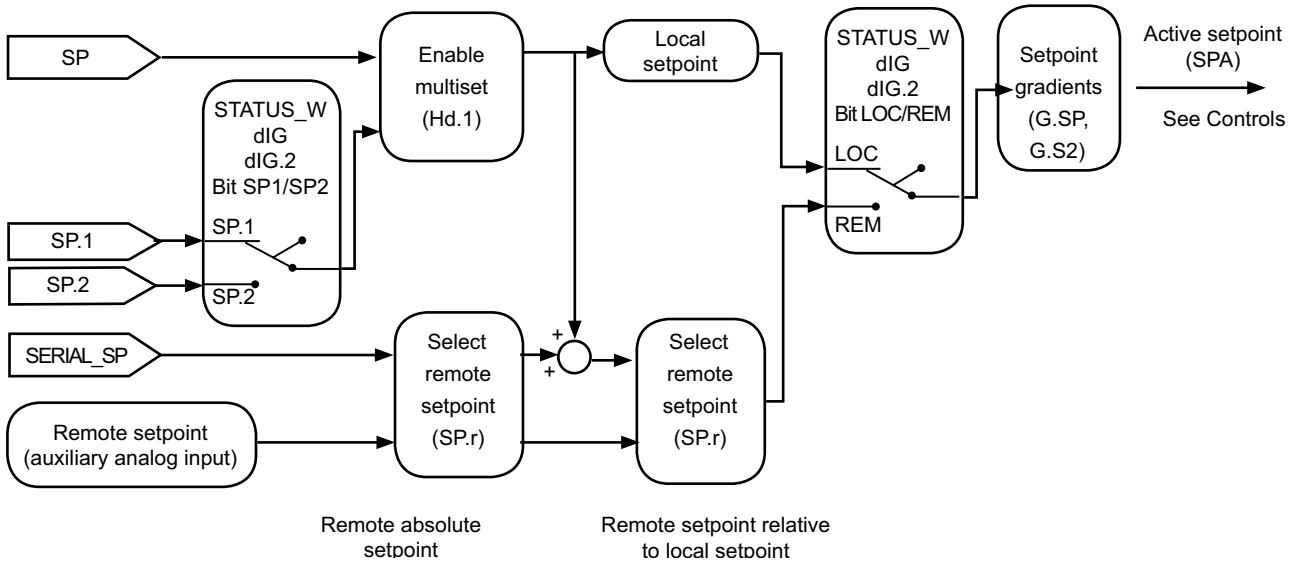
191	Hd.1	R/W	Enable multiset: control instruments via serial		Multiset table	0.0

	Enable Multiset	Enable Virtual Instrument
0		
1	X	
2		X
3	X	X

230 482	SP.1	R/W	Setpoint 1	Lo.L...HI.L		100
231 483	SP.2	R/W	Setpoint 2	Lo.L...HI.L		200
140	diG.	R/W	Digital Input Function	See: Table of digital input functions		0
618	diG.2	R/W	Digital Input 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 (STATUS_W)	Table of instrument settings		0

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

Functional Diagram



Controls

PID Heat/Cool Control

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

Control Actions

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

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

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

Proportional, derivative and integral action

Increasing the proportional band reduces oscillation but increases deviation.

Reducing the proportional band reduces deviation but causes oscillation of the controlled variable (excessively low proportional band values make the system unstable).

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

An increase in Integral Action corresponds to a decrease in Integral Time, tends to annul deviation between the controlled variable and the setpoint at rated operating speed.

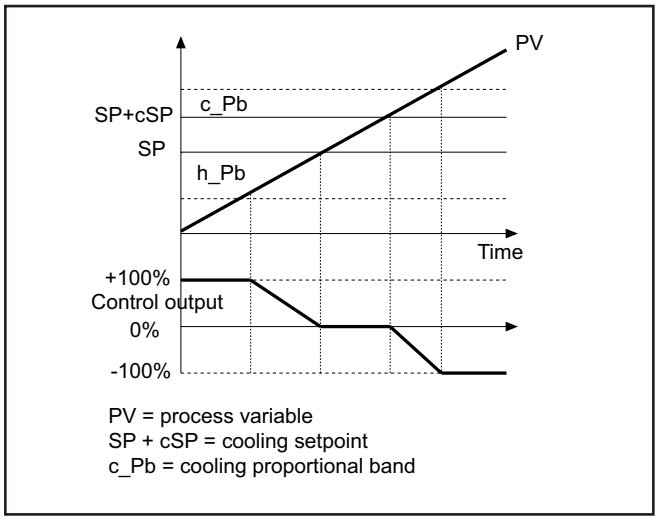
If the Integral Time value is too long (weak Integral Action), there may be persistent deviation between the controlled variable and the setpoint.

For more information on control actions, contact Chromalox.

Heat/Cool Control with Separate or Superimposed Band

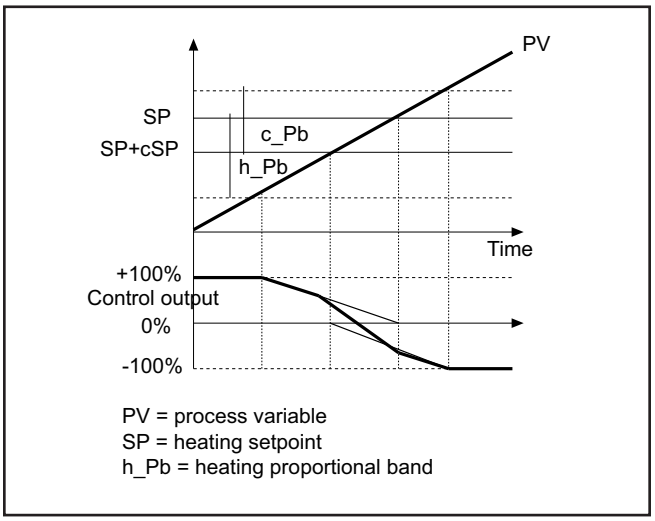
Output with separate band

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



Output with superimposed band

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



Heat/Cool Control with Relative Gain

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

Apply the following values when setting cycle times:
Air T Cool cycle = 10 sec.
Oil T Cool cycle = 4 sec.
Water T Cool cycle = 2 sec.

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

PID Parameters 40-300A

617*	SPU	R/W	Reference power

Table of Selections		0 Zone 1	0 Zone 2	0 Zone 3
0	Power from analog input (In.A)			
1	Power from main input (PV)			
2	Power from aux input (In.2)			
3	Power from aux input (In.3)			
4	Power from aux input (In.4)			
5	Power from aux input (In.5)			
6	Power from PID (PID_POWER) (**)			
7	Power from digital input (In.Pwm)			
9	Power from CFW-M (FW_POWER) (**)			
10	Power from CFW-E1 (FW_POWER) (**)			
11	Power from CFW-E2 (FW_POWER) (**)			
12	Power from analog input 2 (in.A2)	400 to 600 Models Only		
13	Power from analog input 3 (in.A3)			
14	Power from digital input 2 (in.Pwm2)			
15	Power from digital input 3 (in.Pwm3)			

(**) function “slave” zone

(*):
- 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.

PID Parameters 40-300A

180	Ctr	R/W	Control Type

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

Select sample time for derivative action.
+0 sample 1 sec.
+16 sample 4 sec.
+32 sample 8 sec.
+64 sample 240 msec.
+128 No Reset of integral component at setpoint change

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

5 148-149	h.Pb	R/W	Proportional band for heating or hysteresis ON/OFF	0.0 ...999.9% f.s.		1.0
7 150	h. It	R/W	Integral Heating Time	0.0 ...99.99 min		4.00

8 151	h.dt	R/W	Deriviative Heating Time	0.0 ...99.99 min		1.00
6	c.Pb	R/W	Proportional band for cooling or hysteresis ON/OFF	0.0 ...999.9% f.s.		1.0
76	c.It	R/W	Integral Cooling Time	0.00 ...99.99 min		4.00
77	c.dt	R/W	Deriviative 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.nE	R/W	Select Cooling Fluid	0....2	Relative Gain (rG)	0

0	Air	1
1	Oil	0.8
2	Water	0.4

Read State

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

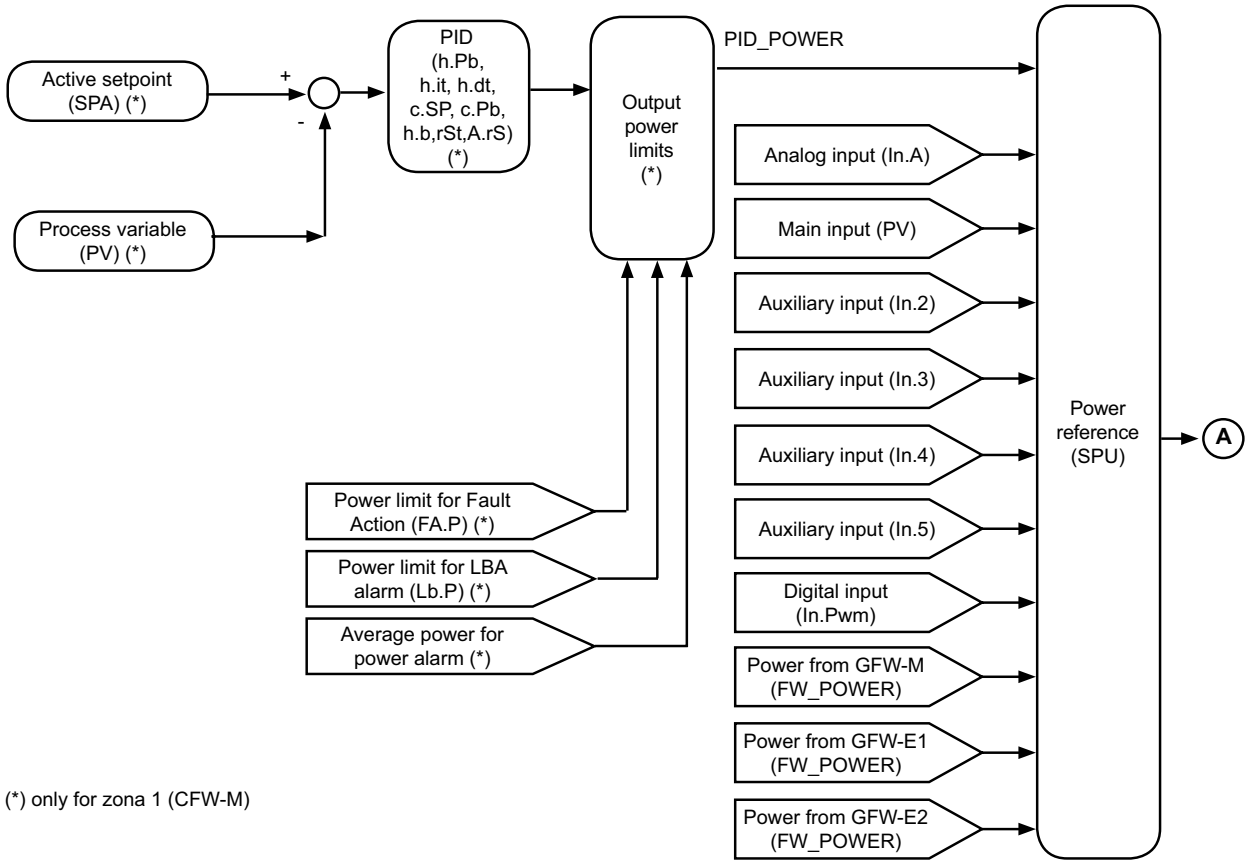
Advanced Settings

39 484	cSP	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	PrS	R/W	Reset power (value added directly to PID output)	-100.00....100.0 %		0.0
79	ArS	R/W	Antireset (limits integral action of PID)	0 ...9999 scale points		0
80	FFd	R/W	Feedforward (value added to PID output after processing)	-100.00....100.0 %		0.0
42 146	hPh	R/W	Maximum limit heating power	0.0 ...100.0 %		100.0
254	hPL	R/W	Min. limit heating power (not available for double heat/cool action)	0.0 ...100.0 %		0
43	cPH	R/W	Maximum Limit Cooling Power	0.0 ...100.0 %		100.0
255	cPL	R/W	Min. limit cooling power (not available for double heat/cool action)	0.0 ...100.0 %		0.0

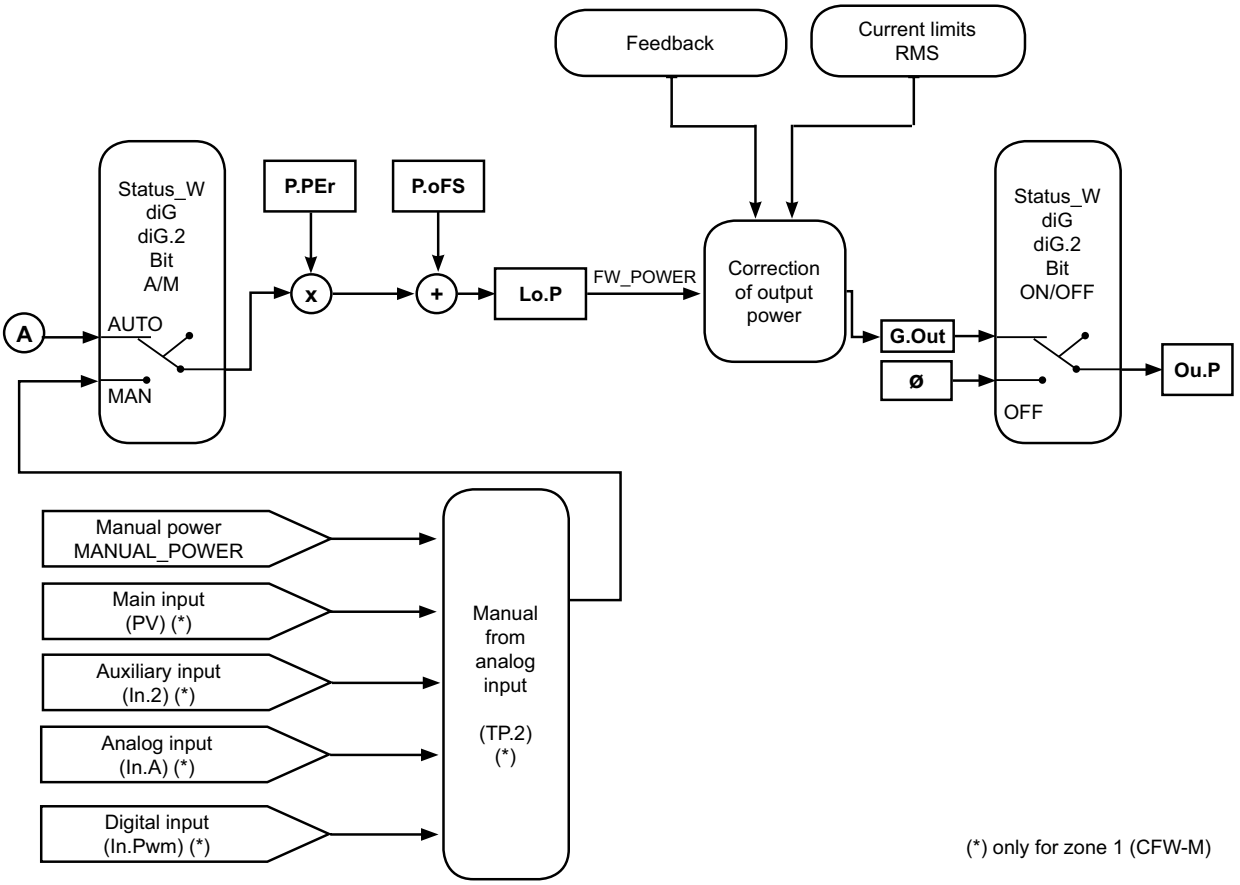
765*	PPEr	R/W	Percentage of output power	0.0 ...100.0 %		100.0 Zone 1	100.0 Zone 2	100.0 Zone 3
766*	PoFS	R/W	Offset of output power	-100.0 ...100.0 %		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
763*	GoUt	R/W	Gradient for control output	0.0 ...200.0% sec	set to 0 to disable	00.0 Zone 1	0.0 Zone 2	0.0 Zone 3
764*	LoP	R/W	Minimum trigger output	0.0 ...50.0 %		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3

*400 to 600Amp

Functional Diagram - 40 to 300A models

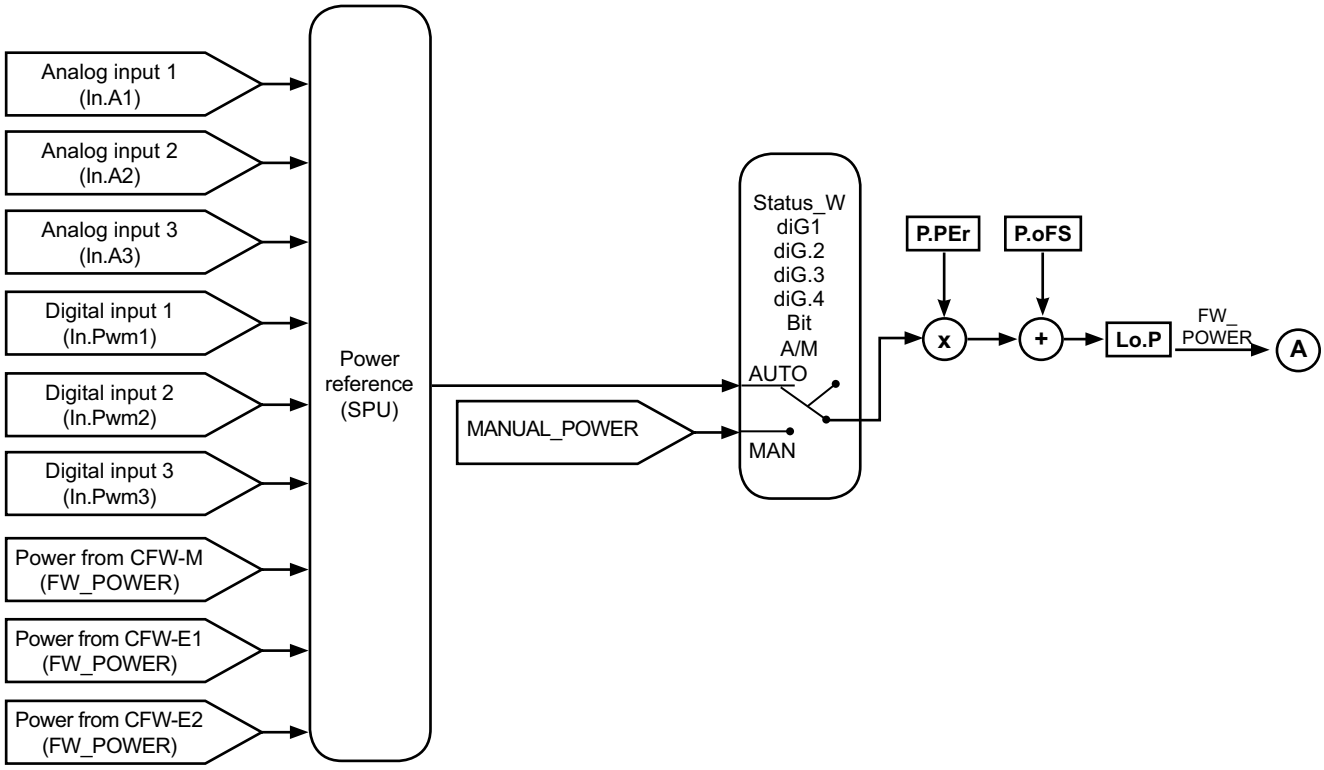


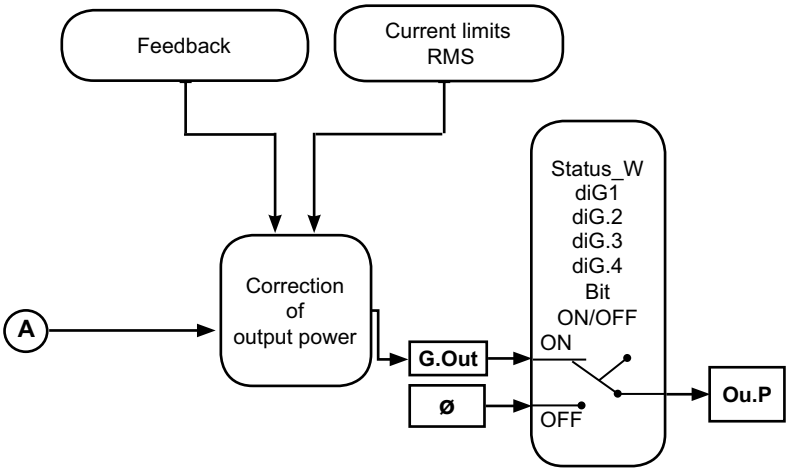
(*) only for zona 1 (CFW-M)



(*) only for zone 1 (CFW-M)

Functional Diagram - 400 to 600A models





Automatic / Manual Control

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

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

252*		R/W	MANUAL_POWER	-100.0... 100.0%		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
2 132-471	Ou.P	R	Value of control outputs (+Heat / -Cool)	(W-only in manual mode at address 252)				0
140	d iG	R/W	Digital Input Function	See: Table of digital input functions				0
618	d iG2	R/W	Digital Input Function 2					
1 bit	AUTO/ MAN	R/W	OFF = Automatic ON = Manual					
305		R/W	State (STATUS_W)	See: Table of instrument settings				0
694*	d iG3	R/W	Digital input function 3	-100.0 ... 100.0%		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
712*	d iG3	R/W	Digital input function 4	-100.0 ... 100.0%		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3

* 400 to 600A Models only

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	d iG	R/W	Digital Input Function	See: Table of digital input functions	0
618	d iG2	R/W	Digital Input Function 2		
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	r IF	R/W	Line Voltage	0.0 ...999.9		0.0

Compensation of the voltage transformer read to maintain output power at a constant level.

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

18 136-249	SPr	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)

Start Mode

699*	Pont	R/W	Start modes at Power-On	Table of booting methods	0.0 Zone 1	0.0 Zone 2	0.0 Zone 3

*Digital input states always have priority

0	Function at previous state
1	Software shutdown
2	Software startup

Start Mode

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

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

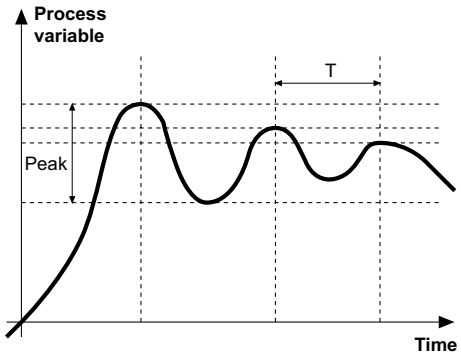
(V max - V min) is the scale range.

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.



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	StU	R/W	Enable selftuning, autotuning, softstart

(*) +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.

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	

140	d iG	R/W	Digital Input Function		See: Table of digital input functions	0.0
618	d iG2	R/W	Digital Input 2 Function			0.0
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			Autotuning and selftuning enable state (FLG_PID)			0

3	Selftuning On
4	Softstart On
6	Autotuning On

305		R/W	Instrument state		Table of instrument settings	0 Zone 1	0 Zone 2	0 Zone 3

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).

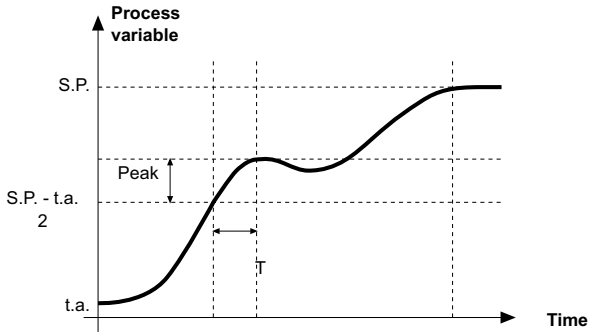
The controller supplies the maximum power set until reaching an intermediate point between starting value and the setpoint, then resets power. The PID parameters are calculated by evaluating superelongation and the time needed to reach the peak (N.B.: This action is not considered in ON/OFF control).

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

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.

31	Stu	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	d iG	R/W	Digital Input Function	See: Table of digital input functions	0.0
618	d iG2	R/W	Digital Input 2 Function		0.0
3 bit	SELFTUNING	R/W	OFF = Selftuning in Stop ON = Selftuning in Start		
305		R/W	Instrument state	Table of instrument settings	0

Read State

0 bit	SELFTUNING STATE	R	OFF = Selftuning in Stop ON = Selftuning 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)		0

Bit	
3	Selftuning On
6	Autotuning On

Soft Start

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

31	StU	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.

147	SoF	R/W	Softstart Time	0.0 ...500.0 min	0.0
30 bit	RESTART SOFTSTART	R/W	OFF = ON = Restart of Softstart		

Read State

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

Start Mode

699	Pont	R/W	Start modes at Power-On		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 enabled only if assigned to SW shut-down 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 signals them of reference rL.4 and rL.6 that they come forced ON
5) Reset of HB alarm.
6) Reset of LBA alarm.
7) The Heat and Cool bit on the state word STATUS 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) In case of Geflex, the state of alarms (AL1...AL4, ALHBTA1...ALHBTA3) is reset.
10) Alarms AL 1… AL 4 can be enable or disable through the parameter oFF.t.

140	d IG	R/W	Digital Input Function	See: Table of digital input functions	0.0
618	d IG2	R/W	Digital Input 2 Function		0.0
11 bit	SOFTWARE LAUNCH/SHUTDOWN	R/W	OFF = ON ON = OFF		
700	oFFt	R/W	Modes at software shutdown	0	Outputs rL.1- rL.2 - rL.3 - rL.5 = OFF Outputs rL.4 - rL.6 = ON Alarms AL.1 -AL.2 -AL.3 - AL.4 disabled
				1	Outputs rL.1- rL.2 - rL.3 - rL.5 = OFF Outputs rL.4 - rL.6 = ON Alarms AL.1 -AL.2 -AL.3 - AL.4 enabled
				+16	Restart of the Softstart at the switch-on soft-ware (ON Software)
694*	d IG3	R/W	Digital Input 3 Function	See: Table of digital input functions	0.0
712*	d IG4	R/W	Digital Input 4 Function	See: Table of digital input functions	0.0

* for 400 to 600A Models only

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		
67* bit	State of Digital Input 3	R	OFF = Digital input 3 off ON = Digital input 3 on		
66* bit	State of Digital Input 4	R	OFF = Digital input 4 off ON = Digital input 4 on		
305		R/W	Status	See: Table of instrument settings	0

Other Functions

Fault Action Power (40 to 300A Only)

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	HoE	R/W	Select Specialized Control Functions		See: Hot runners table - Setpoint Settings	0
228	FA.P	R/W	Fault Action Power (supplied in conditions of broken probe)		-100.0 ..100.0 %	0.0

Read State

26 bit	HB ALARM STATE OR POWER_FAULT	R	OFF = Alarm off ON = Alarm on
80 bit	State of Power alarm	R	OFF = Alarm off ON = Alarm on

Power Alarm

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

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.

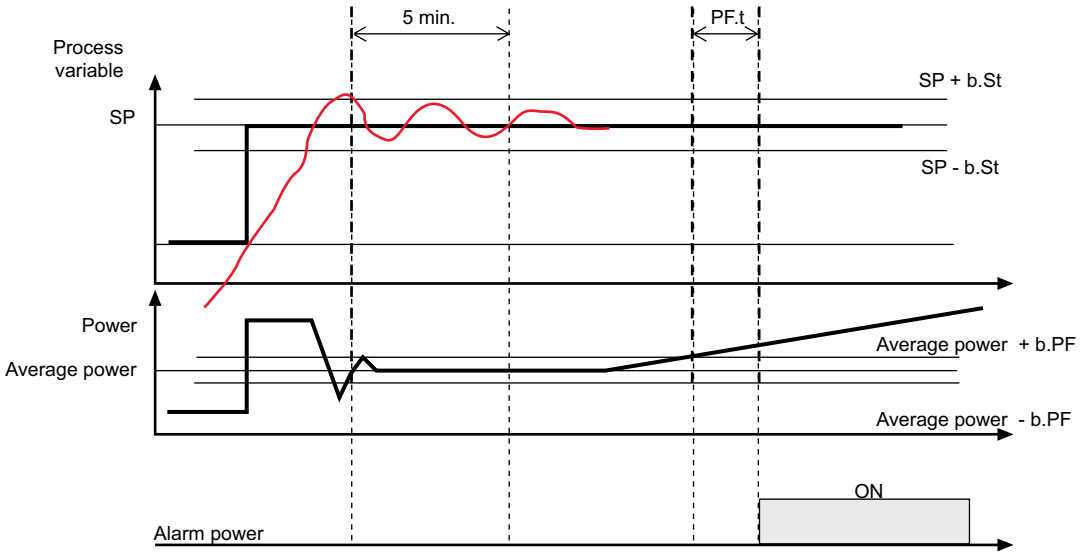
Set the band (b.ST) within which the process variable is considered stable after 300 sec. have elapsed.

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:

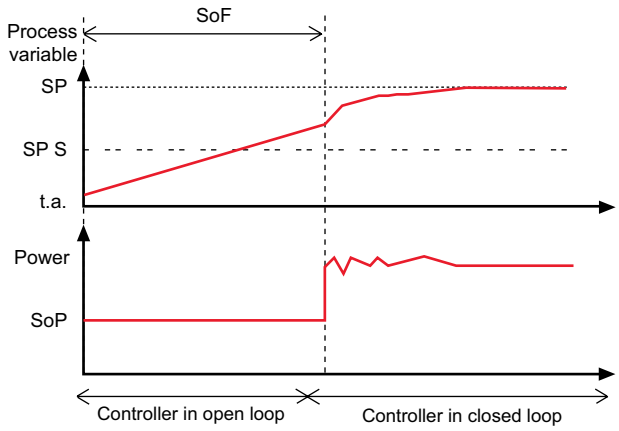
261	bSt	R/W	Stability Band (specialized control alarm power function)	0.0 ...100.0 % f.s.			0.0
262	bPF	R/W	Alarm Power Band (specialized control alarm power function)	0.0 ...100.0 %			0.0
260	PFt	R/W	Delay Time for alarm power activation (specialized controls)	0 ...999 sec			0
160	rL1	R/W	Allocation of reference signal	See: Generic alarms –Table of reference signals	0 Zone 1	0 Zone 2	0 Zone 3
*40 to 300A models only							
163	rL2	R/W	Allocation of reference signal		1 Zone 1	1 Zone 2	1 Zone 3
*40 to 300A models only							
166	rL3	R/W	Allocation of reference signal - OR output		2 Zone 1	2 Zone 2	2 Zone 3
170	rL4	R/W	Allocation of reference signal - AND Output		35 Zone 1	35 Zone 2	35 Zone 3
171	rL5	R/W	Allocation of reference signal - OR output		4 Zone 1	4 Zone 2	4 Zone 3
172	rL6	R/W	Allocation of reference signal - AND Output		160 Zone 1	160 Zone 2	160 Zone 3

Softstart for Preheating

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

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

With softstart time SoF = 0, preheat condition PV <SP.S with settable power SO.P is continuously checked.



31	StU	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.

263	SPS	R/W	Softstart setpoint (preheating of hot runners)	Lo.L....HI.L		0
264	SoP	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 Zone 1	0 Zone 2	0 Zone 3
163	rL2	R/W	Allocation of reference signal		1 Zone 1	1 Zone 2	1 Zone 3
152 9	Ct.1	R/W	OUT 1 (Heat) cycle time	1 ...200 sec (0.1 ...20 sec)	Set 0 for GTT function 2 See POWER CONTROL		2

400 to 600A Models only.

Operating Hour Meter

The device shows in OH. c (Operating Hours Counter) the number of operating hours (line voltage present and nonzero power); updating in non-volatile memory occurs every two hours and the disarming of the line voltage.

396	OHc	R/W	Hours of Operation	Data format: Dword (32 bit)

					DIP 5 = OFF (Resistive load)		
152* 9	Ct.1	R/W	OUT 1 cycle time	1 ...200 sec (0.1 ...20.0 sec)	(*)	0 Zone 1	0 Zone 2	0 Zone 3
					DIP 5 = ON (Inductive load)		
						4 Zone 1	4 Zone 2	4 Zone 3

*Set to 0 for BF/HSC functions
See power management

Power Control

SSR Control Modes

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

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

ZC zero crossing: this type of operation reduces EMC emissions. This mode controls power on the load via a series of conduction ON and non conduction OFF cycles.

The cycle time is constant and can be set from 1 to 200 sec (or from 0.1 to 20.0 sec).

BF burst firing: this mode controls power on the load via a series of conduction ON and non conduction OFF cycles. The ratio of the number of ON cycles to OFF cycles is proportional to the power value to be supplied to the load. The repeat period or cycle time is kept to a minimum for each power value.

Parameter bF.Cy defines the minimum number of conduction cycles, settable from 1 to 10.

In case of 3-phase load without neutral or closed delta, BF.Cy >= 5 has to be set to ensure correct operation (balancing of current in the 3 loads).

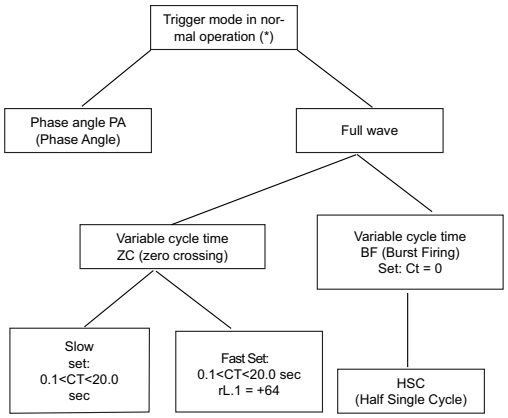
HSC Half Single Cycle: this mode corresponds to a BF that includes ON and OFF half-cycles. It is useful for reducing flicker with short-wave IR loads (and is applied only to single-phase or 3-phase with neutre or open delta loads).

Start mode is set with parameter Hd.5

Control of maximum rms current (whose value is set in parameter Fu.tA) can always be enabled with parameter Hd.5 in every power-on mode.

The cycle time can be set with two different resolutions in seconds or tenths of a second based on the type of heat or cool function assigned to outputs rL1 and rL2. The use of short cycle times (< 2-3 sec) is always recommended in case of control with SSRs.)

703	Hd5	R/W	Enable trigger modes



(*) Hd.5 = 133 For CFW with Control Option = 0
Hd.5 = 141 Option for CFW with current limit Control option = 1 or 2 or 3

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

Table of trigger modes						Dip 5 - OFF Resistive Load		
	Ramp or softsart	Trigger mode in normal operation(*)	BF Mode	RMS in Softstart	Current control in normal operation	133/141 Zone 1	133/141 Zone 2	133/141 Zone 3
0	NO	ZC/BF	-	NO	NO	Dip 5 - ON Inductive Load		
1	YES	ZC/BF	-	NO	NO	32 Zone 1	32 Zone 2	32 Zone 3
2	NO	PA	-	NO	NO			
3	YES	PA	-	NO	NO			
4	NO	ZC/BF	HSC	NO	NO			
5	YES	ZC/BF	HSC	NO	NO			
6	NO	PA	-	NO	NO			
7	YES	PA	-	NO	NO			
8	NO	ZC/BF	-	YES	NO			
9	YES	ZC/BF	-	YES	NO			
10	NO	PA	-	YES	NO			
11	YES	PA	-	YES	NO			
12	NO	ZC/BF	HSC	YES	NO			
13	YES	ZC/BF	HSC	YES	NO			
14	NO	PA	-	YES	NO			
15	YES	PA	-	YES	NO			
16	NO	ZC/BF	-	NO	YES			
17	YES	ZC/BF	-	NO	YES			
18	NO	PA	-	NO	YES			
19	YES	PA	-	NO	YES			
20	NO	ZC/BF	HSC	NO	YES			
21	YES	ZC/BF	HSC	NO	YES			
22	NO	PA	-	NO	YES			
23	YES	PA	-	NO	YES			
24	NO	ZC/BF	-	YES	YES			
25	YES	ZC/BF	-	YES	YES			
26	NO	PA	-	YES	YES			
27	YES	PA	-	YES	YES			
28	NO	ZC/BF	HSC	YES	YES			
29	YES	ZC/BF	HSC	YES	YES			
30	NO	PA	-	YES	YES			
31	YES	PA	-	YES	YES			

707	FUtA	R/W	Max. limit of RMS current in normal op	0.0 ...999.9 A	Model	40A	60A	100A	150A	200A	250A	300A
					Default Zone 1...3	40.0	60.0	100.0	150.0	200.0	250.0	300.0

				0.0...3275.0A		Model 200A		
						200.0 Zone 1	200.0 Zone 12	200.0 Zone 3
						Model 400A		
						400.0 Zone 1	400.0 Zone 2	400.0 Zone 3
						Model 600A		
						600.0 Zone 1	600.0 Zone 2	600.0 Zone 3

						DIP 5 = OFF (Resistive load)		
704*	bFcY	R/W	Min. number of cycles in BF mode	1 ...10		1 Zone 1	1 Zone 2	1 Zone 3
						DIP 5 = ON (Inductive load)		
						5 Zone 1	5 Zone 2	5 Zone 3

SOFTSTART or START RAMP

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

The softstart ramp starts from a zero conduction angle and reaches the angle set in parameter PS.HI in the time set in parameter PS.tm, from 0.1 to 60.0 sec.

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

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

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

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

630*	PSH1	R/W	Maximum phase of phase softstart ramp	0.0 ...100.0%		100.0 zone 1	100.0 zone 2	100.0 zone 3
705*	PStn	R/W	Duration of phase softstart ramp	0.1 ...60.0 s		10.0 zone 1	10.0 zone 2	10.0 zone 3
629*	PSoF	R/W	Min. non-conduction time to reactivate phase softstart ramp	0 ...999 s		2 zone 1	2 zone 2	2 zone 3

706*	PStA	R/W	Maximum peak current limit	0.0 ...999.9 A	Model	40A	60A	100A	150A	200A	250A	300A
					Default Zone 1...3 CFW	110.0	170.0	280.0	420.0	560.0	700.0	840.0
					Default Zone 1...3 CFWxtra	110.0	170.0	230.0				

108* bit	Restart of phase softstart ramp	R/W	OFF = Restart not enabled ON = Restart enabled					
106* bit	State of phase softstart ramp	R	OFF = Ramp not active ON = Ramp active					
107* bit	State of phase softstart ramp	R	OFF = Ramp not ended ON = Ramp ended					

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

Delay Triggering

In firing modes ZC and BF, with inductive loads, this function inserts delay triggering in the first cycle.

The delay is expressed in degrees settable in parameter dL.t, from 0 to 90 degrees. The function is enabled with parameter Hd.5 (+32).

The function activates automatically if there are OFF conditions for a time exceeding the one settable in dL.oF (if =0 the function is as if disabled).

- Optimized Delay-Triggering value for transformer monophase: 60°
- Optimized Delay-Triggering value for 3-phase transformer: 90°, 90°, 40

						60 zone 1	60 zone 2	60 zone 3
708*	dLt	R/W	Delay triggering (first trigger only)	0 ... 90°		90 zone 1	90 zone 2	90 zone 3
738*	dLoF	R/W	Minimum non-conduction time to reactivate delay triggering II Parameter. The parameter is no longer used dL.oF from SW version 2.10	0 ... 10000ms		10 zone 1	10 zone 2	10 zone 3

Feedback Modes

The CFW has the following power control modes:
V-voltage
V2-squared voltage
I-current
I2-squared current
P-power
A control mode is enabled with parameter Hd.6.

Voltage feedback (V)
To keep voltage on the load constant, this compensates possible variations in line voltage with reference to the rated voltage saved in riF.V. (expressed in Vrms).

The voltage value maintained on the load is (ref.V*P%_pid_man/100) and is indicated in the Modbus 757 register.

Voltage feedback (V2)
To keep voltage on the load constant, this compensates possible variations in line voltage with reference to the rated voltage saved in riF.V. (expressed in Vrms).

The voltage value maintained on the load is (rif.V* V (P%_pid_man/100)), and is indicated in the Modbus 757 register.

Current feedback (I)
To keep current on the load constant, this compensates possible variations in line voltage and/or variations in load impedance with reference to the rated current saved in riF.I. (expressed in Arms).

The current value maintained on the load is (rif.I*P%_pid_man/100), and is indicated in the Modbus 757 register.

Current feedback (I2)
To keep current on the load constant, this compensates possible variations in line voltage and/or variations in load impedance with reference to the rated current saved in riF.I. (expressed in Arms).

The current value maintained on the load is (rif.I* V (P%_pid_man/100)), and is indicated in the Modbus 757 register.

Power feedback P
To keep power on the load constant, this compensates both variations in line voltage and variations in load impedance with reference to the rated power saved in riF.P. (expressed in kWatt).

The current value maintained on the load is (rif.P*P%_pid_man/100), and is indicated in the Modbus 757 register.

IMPORTANT!

Feedback calibration can be activated from the digital input (parameters DIG and DIG.2) or by serial control (ref. bit113), and if requested MUST be activated only with Hd.6=0 (the required Hd.6 value can be set only after calibration) and preferably with maximum power on the load (ex. P_man or P_pid at 100%).

If you change function mode (PA, ZC, BF, HSC), you have to re-run the Feedback calibration procedure.

Voltage V (or current I or power P) feedback corrects the % of conduction with a maximum settable value in parameter Cor. V (or Cor.I or Cor.P).

For non-linear loads (ex.: Super Kanthal or Silicon Carbide) the automatic calibration procedure is NOT NECESSARY. Set the value of parameters ref.V, ref. I, ref. P based on the specific nominal of the load shown on the datasheet (ref. CFW Installation Guide).

730*	HdB	R/W	Enable feedback modes	Table of feedback modes	0 Zone 1	0 Zone 2	0 Zone 3

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

731*	CorV	R/W	Maximum correction of voltage feedback	0.0 ...100.0%	100.0 Zone 1	100.0 Zone 2	100.0 Zone 3
732*	Cor1	R/W	Maximum correction of current feedback	0.0 ...100.0%	100.0 Zone 1	100.0 Zone 2	100.0 Zone 3
733*	CorP	R/W	Maximum correction of power feedback	0.0 ...100.0%	100.0 Zone 1	100.0 Zone 2	100.0 Zone 3
734*	rIFV	R/W	Voltage feedback reference	0.0 ...999.9 V	0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
735*	rIFV	R/W	Voltage feedback reference	0.0 ...999.9 V	0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
884* 736* LSW only	rIFP	R/W	Power feedback reference	0.0...320.00 kW	0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
741*	FbIt	R/W	Feedback response speed	0.1 ...5.0 % / 60msec	0.3 Zone 1	0.3 Zone 2	0.3 Zone 3
113* bit	Calibration of voltage feedback reference	R/W	OFF = Calibration not enabled ON = Calibration enabled				

Read State

856* 757* LSW only	ArIF	R	Reference of feedback	0.0 ...999.9 V	Setpoint of V, I, P to maintain on load Data in DWORD (32 bit) format for address 886* LSW data in WORD (16 bit) format for address 757*
				0.0 ... 3275.0 A	
				0.0 ...1500.00 kW	

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 (maximum current is 73A 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
I2+I3 = 41A
I1+I2+I3 = 73A

The combinations 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 & zone 3.

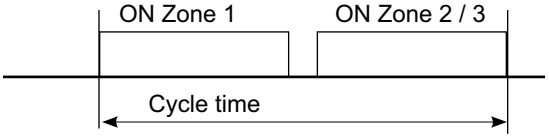
In the single cycle time for the enabled zones, the delivery of power may be reduced to respect the maximum current limit.

The time distribution for activation of the zones is calculated at the start of each cycle:

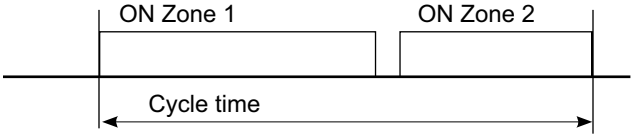
Ptot = P1+ P2 (if P2>P3) + P3 (if P3>P2)

Simultaneity is allowed for zones 2 and 3.

If P1= 100%, P2= 100%, P3= 100%
Ptot=200%; since Ptot>100%, the conduction time of the zone x is obtained by Px * (100/Ptot)
P1,2,3 delivered = 100%*0.5 = 50%



If P1= 100%, P2= 50%, P3= 0%
Ptot=150%; since Ptot>100%, the conduction time of the zone x is obtained by Px * (100/Ptot)
P1 delivered = 100%*0.66 = 67%
P2 delivered = 50%*0.66 = 33%
P3 delivered = 0%*0.66 = 0%



680	hd3	R/W	Enable heuristic power control	Table for enabling heuristic power			0
					Zone 1	Zone 2	Zone 3
				0			
				3	X	X	
				5	X	X	
				6	X	X	
				7	X	X	X

NOTE: Only for CFW with CTs present and outputs OUT1...OUT3 with slow cycle time (1...200sec)

681	IHEU	R/W	Maximum current for heuristic power control	0.0 ...999.9 A (40 to 300A Models)		0.0
				0.0 ...3275.0 A (400 to 600A Models)		

Heterogeneous Power Control

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 3 is disconnected, followed by zone 2, etc.

682	hd4	R/W	Enable hetergogeneous power control	Table for enabling heterogeneous power			0
					Zone 1	Zone 2	Zone 3
				0			
				1	X		
				2	X		
				3	X	X	
				4	X		
				5	X	X	
				6	X	X	
				7	X	X	X

683	IHEt	R/W	Maximum current for hetergo-geneous power control	0.0 ...999.9 A (40 to 300A Models)		0.0
				0.0 ...3275.0 A (400 to 600A Models)		

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	hd1	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

224	S In	R/W	Control Inputs from Serial	0 ... 255		0 Zone 1	0 Zone 2	0 Zone 3

Inputs	In.A	In.5	In.4	In.3	In.2	-	In.1	AL4	AL3	AL2	AL1
Bit	10	9	8	7	6	5	4	3	2	1	0

225	SOu	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	SL1	R/W	Control LEDs and digital inputs from serial	0 ... 1023		0

	Inputs		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	SERIAL IN1
	6	Input In.2	348	word	SERIAL IN2
	7	Input In.3	578	word	SERIAL IN3
	8	Input In.4	579	word	SERIAL IN4
	9	Input In.5	580	word	SERIAL IN5
	10	Input In.TA	581	word	SERIAL INA
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
	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

Hardware & Software Information (40 to 300A Models)

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 auxiliary input
606	Er2	R	Self-diagnosis error code for auxiliary input 2
550	Er3	R	Self-diagnosis error code for auxiliary input 3
551	Er4	R	Self-diagnosis error code for auxiliary input 4
552	Er5	R	Self-diagnosis error code for auxiliary input 5

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	CHd	R	Hardware configuration codes

Table of hardware configuration codes	
bit	
0	= 1 OUTPUT COOL absent
1	= 1 OUTPUT COOL relay
2	= 1 OUTPUT COOL logic
3	= 1 OUTPUT COOL continuous 0...20mA / 0...10V
4	= 1 OUTPUT COOL triac 250Vac 1A
5	-
6	= CFW-M no power
7	= 1 CFW-M 40A
8	= 1 CFW-M 60A
9	= 1 CFW-M 100A
10	= 1 CFW-M 150A
11	= 1 CFW-M 200A
12	= 1 CFW-M 250A
13	= 1 CFW-M Xtra

508	CHd1	R	Hardware configuration codes 1

Table of hardware configuration codes 1	
bit	
0	= 1 INPUT AUX absent
1	= 1 INPUT AUX TC / 60mV
2	-
3	= 1 FIELDBUS ETH4 (ProfiNet)
4	= 1 FIELDBUS ETH5 (Ethernet IP)
5	= 1 FIELDBUS ETH6
6	= 1 FIELDBUS absent
7	= 1 FIELDBUS Modbus
8	= 1 FIELDBUS Profibus
9	= 1 FIELDBUS CanOpen
10	= 1 FIELDBUS
11	= 1 FIELDBUS Ethernet
12	= 1 FIELDBUS Euromap66
13	= 1 FIELDBUS ETH3
14	= 1 FIELDBUS ETH2 (Ethercat)
15	= 1 FIELDBUS ETH1 (Ethernet Real Time)

543	CHd2	R	Hardware configuration codes 2

Table of hardware configuration codes 2	
bit	
0	= 1 CFW-E1 no power
1	= 1 CFW-E1 40A
2	= 1 CFW-E1 60A
3	= 1 CFW-E1 100A
4	= 1 CFW-E1 150A
5	= 1 CFW-E1 200A
6	= 1 CFW-E1 250A
7	= 1 CFW-E1 Xtra
8	= 1 CFW-E2 no power
9	= 1 CFW-E2 40A
10	= 1 CFW-E2 60A
11	= 1 CFW-E2 100A
12	= 1 CFW-E2 150A
13	= 1 CFW-E2 200A
14	= 1 CFW-E2 250A
15	= 1 CFW-E2 Xtra

543	CHd3	R	Hardware configuration codes 3

Table of hardware configuration codes 3	
bit	
0	= 1 CFW-M 300A
1	= 1 CFW-E1 300A
2	= 1 CFW-E2 300A

Hardware & Software Information (400 to 300A Models)

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

122	UPd	R	Software version code

190	CHd	R	Hardware configuration codes

Table of hardware configuration codes	
bit	
0	= 1 OUTPUT AUX absent
1	= 1 OUTPUT AUX relay
2	= 1 OUTPUT AUX logic
5	= 1 OUTPUT AUX continuous 12bit 20mA/10V
6	= CFW-M no power
7	= 1 CFW-M 200A
8	= 1 CFW-M 400A
9	= 1 CFW-M 600A
10	= -
11	= -
12	= -
13	= -
14	= 1 EXTERNAL CT (for all models: 1PH/2PH/3PH)
13	= 1 CFW-M Xtra
12	= 1 CFW-M 250A

508	CHd1	R	Hardware configuration codes 1

Table of hardware configuration codes 1	
bit	
2	-
3	= 1 FIELDBUS ETH4 (ProfiNet)
4	= 1 FIELDBUS ETH5
5	= 1 FIELDBUS ETH6
6	= 1 FIELDBUS absent
7	= 1 FIELDBUS Modbus
8	= 1 FIELDBUS Profibus
9	= 1 FIELDBUS CanOpen
10	= 1 FIELDBUS DeviceNet
11	= 1 FIELDBUS Ethernet
12	= 1 FIELDBUS Euromap66
13	= 1 FIELDBUS ETH3
14	= 1 FIELDBUS ETH2 (Ethercat)
15	= 1 FIELDBUS ETH1 (Ethernet IP)

543	CHd2	R	Hardware configuration codes 2

Table of hardware configuration codes 2	
bit	
0	= 1 CFW-E1 no power
1	= 1 CFW-E1 200A
2	= 1 CFW-E1 400A
3	= 1 CFW-E1 600A
4	= -
5	= -
6	= -
7	= -
8	= 1 CFW-E2 no power
9	= 1 CFW-E2 200A
10	= 1 CFW-E2 400A
11	= 1 CFW-E2 600A
12	= -
13	= -
14	= -
15	= -

693 697	UPdF	R	Fieldbus software version
695	CodF	R	Fieldbus node
696	bAUF	R	Fieldbus baudrate

Profibus		Canopen		Eithernet	
bAu.F	baudrate	bAu.F	baudrate	bAu.F	baudrate
0	12.00 Mbit/s	0	1000 Kbit/s	0	100 Mbit/s
1	6.00 Mbit/s	1	800 Kbit/s	1	10 Mbit/s
2	3.00 Mbit/s	2	500 Kbit/s		
3	1.50 Mbit/s	3	250 Kbit/s		
4	500.00 Kbit/s	4	125 Kbit/s		
5	187.50 Kbit/s	5	100 Kbit/s		
6	93.75 Kbit/s	6	50 Kbit/s		
7	45.45 Kbit/s	7	20 Kbit/s		
8	19.20 Kbit/s	8	10 Kbit/s		
9	9.60 Kbit/s				

894	FSIZE	R/W	I/O data dimension for fieldbus

Table of Jumper State		On
0	12 words input + 12 words output	
1	24 words input + 24 words output	

346		R/W	Jumper State

Table of Jumper State		Off	On
Bit			
0	Jumper State S1		
1	Jumper State S2		
2	Jumper State S7-1: (*)		
3	Jumper State S7-2: (*)		
4	Jumper State S7-3: (*)		
5	Jumper State S7-4: (*)		
6	Jumper State S7-5:	Resistive Load	Inductive Load
7	Jumper State S7-6:	-	Configuration parameters of default
8	Jumper State S7-7:		

S7-1	S7-2	S7-3	S7-4	FUNCTION MODES
OFF	OFF	OFF	OFF	3 single-phase loads
OFF	ON	OFF	OFF	3 independent single-phase loads in open delta
ON	ON	OFF	OFF	3-phase load open delta / star with neutral
ON	ON	ON	OFF	3-phase load closed delta
ON	OFF	OFF	ON	3-phase star load without neutral
ON	OFF	OFF	OFF	3-phase star load without neutral with BIFASE control
ON	OFF	ON	OFF	3-phase closed star load with BIFASE control

120		R	Manufacturer - Trademark	Name of manufacturer	5000
121		R	Device ID (CFW)	Product ID	214

197	LdSt	R/W	RN LED Status Function
619	Ld2	R/W	ER LED status function
620	Ld3	R/W	Function of LED DI1
621	Ld4	R/W	Function of LED DI2

Table of RN LED Functions		16
Value	Function	12
0	RUN	
1	MAN/AUTO Controller	
2	LOC/REM	6
3	HOLD	
4	Selftuning ON	
5	Autotuning ON	11
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	
14	Repeat digital input INDIG3	
+ 16	LED Flashing if Active (Code 8 Excluded)	

622	Ld5	R/W	Function of LED O1
623	Ld6	R/W	Function of LED O2
624	Ld7	R/W	Function of LED O3
625	Ld8	R/W	Function of LED Button

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

LED status refers to the corresponding parameter, with the following special cases:

- LED RN (green) on: hotkey functionality
- LED RN (green) + LED ER (red) both flashing rapidly: autobaud in progress
- LED ER (red) on: error in one of main inputs (Lo, Hi, Err, Sbr)
- LED ER (red) flashing: temperature alarm ((OVER_HEAT or TEMPERATURE_SENSOR_BROKEN) or alarm of SHORT_CIRCUIT_CURRENT or SSR_SAFETY or FUSE_OPEN (only for singlephase configuration).
- LED ER (red) + LED Ox (yellow) both flashing: HB alarm or POWER_FAIL in zone x
- All LEDs flashing rapidly: ROTATION123 alarm (only for threephase configuration)
- All LEDs flashing rapidly except LED DI1: jumper configuration not provided
- All LEDs flashing rapidly except LED DI2: 30%_UNBALANCED_ERROR alarm (only for threephase configuration)
- All LEDs flashing rapidly except LED O1: SHORT_CIRCUIT_CURRENT alarm (only for threephase configuration)
- All LEDs flashing rapidly except LED O2: TRIPHASE_MISSING_LINE_ERROR alarm (only for threephase configuration)
- All LEDs flashing rapidly except LED O3: SSR_SAFETY alarm (only for threephase configuration)
- All LEDs flashing rapidly except LED BUT: FUSE_OPEN alarm (only for threephase configuration)

305*		R/W	Current state (STATUS_W)
698		R	State saved in eeprom (STATUS_W_EEP)

Table of state settings		0 Zone 1	0 Zone 2	0 Zone 3
Bit		0 Zone 1	0 Zone 2	0 Zone 3
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 (*)			

(*) Only for zone 1 (CFW-M)

467*		R	State (STATUS)

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

469*		R	State 1 (STATUS 1)

Table of State 1	
bit	
0	AL.1 or AL.2 or AL.3 or AL.4 or ALHB.TA1 or ALHB.TA2 or ALHB.TA3 or Power Fault
1	Input Lo
2	Input Hi
3	Input Err
4	Input Sbr
7	LBA
8	AL.1
9	AL.2
10	AL.3
11	AL.4
12	ALHB.TA1
13	ALHB.TA2
14	ALHB.TA3
15	Selftuning active
14	AUTO/MAN
15	LOC/REM

632*		R	State 2 (STATUS 2)

Table of State 2	
bit	
0	AL.1
1	AL.2
2	AL.3
3	AL.4
4	AL.HB1
5	AL.HB2
6	AL.HB3
7	AL.Lo
8	AL.Hi
9	AL.Err
10	AL.Sbr
11	AL.LBA
12	AL.Power

633*		R	State 3 (STATUS 3)

Table of State 3	
bit	
3	AL.SSR short 1
4	AL.SSR short 2
5	AL.SSR short 3
6	No voltage 1
7	No voltage 2
8	No Voltage 3
9	No current 1
10	No current 2
11	No current 3

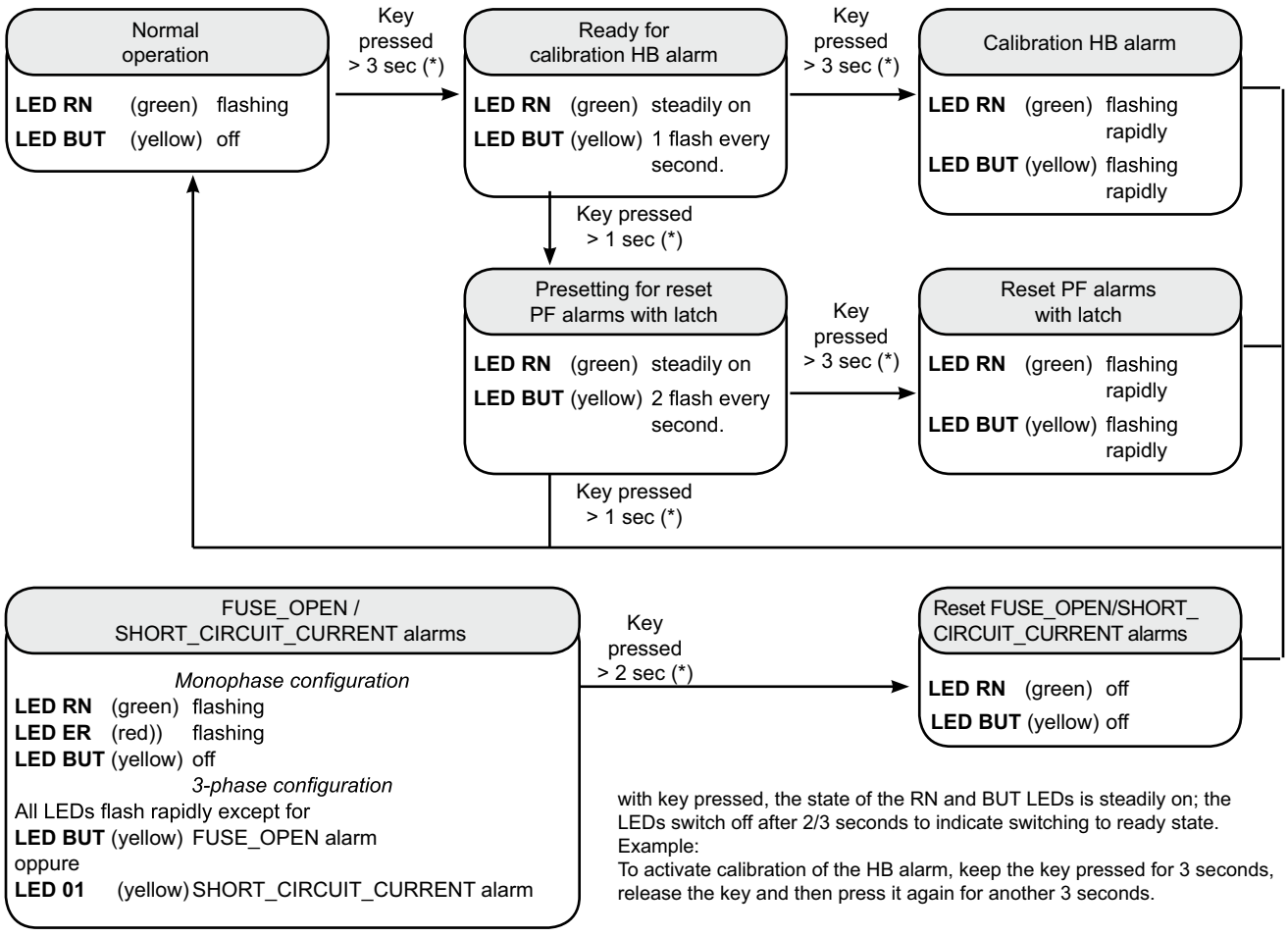
634*		R	State 4 (STATUS 4)

Table of State 4	
bit	
0	Temperature sensor broken
1	over heat
2	phase_softstart_active
3	phase_softstart_end
4	frequency_warning or monophase_missing_line_warning
5	60Hz
6	short_circuit_current in softstart di fase
7	peak_current limiter in softstart di fase
8	RMS current limiter a regime
9	SSR_Safety (24V fan presence or SSR hardware over temperature)
10	Fuse open
11	Current polarity check
12	over_peak_HSC_current_limiter in softstart
13	Current transformer sensor broken

702		R	Voltage Status

Table of voltage status	
bit	
0	frequency_warning
1	10% unbalanced_line_warning
2	20% unbalanced_line_warning
3	30% unbalanced_line_warning
4	rotation123_error
5	three-phase_missing_line_error
6	60Hz

Functional Diagram



with key pressed, the state of the RN and BUT LEDs is steadily on; the LEDs switch off after 2/3 seconds to indicate switching to ready state.
Example:
To activate calibration of the HB alarm, keep the key pressed for 3 seconds, release the key and then press it again for another 3 seconds.

Instrument Configuration Sheet (40 to 300A Models)

Programmable Parameters

			Definition of Parameter		Note	Assigned Value
Installation of Modbus Serial Network						
46	Cod	R	Instrument identification code			
45	bAu	R/W	Select Baudrate - Serial 1			
626	bAu2	R/W	Select Baudrate - Serial 2			
47	PAr	R/W	Select Parity - Serial 1			
627	PAr2	R/W	Select Parity - Serial 2			
Analog Input						
573	tPA	R/W	Analog Input			
574	LSA	R/W	Minimum scale limit analog input			
575	HSA	R/W	Maximum scale limit analog input			
577	oFSA	R/W	Offset correction for analog input			
572	InA	R	Value of the engineering reading analog input			
576	FLtA	R/W	Low pass digital filter analog input			
Main Input						
400	tyP	R/W	Probe, signal, enable, custom linearization and main input scale			
403	dPS	R/W	Decimal point position for input scale			
401	LoS	R/W	Min. scale limit for main input			
402	H IS	R/W	Max. scale limit for main input			
519 23	oFS	R/W	Main input offset correction			
0 470	PV	R/W	Read of process variable (PV) engineering value			
349	DPV	R	Read of engineering value of process variable (PV) filtered by FLd			
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 (min. value of input scale)			
87	S.01	R/W	Engineering value attributed to Point 1			
88	S.02	R/W	Engineering value attributed to Point 2			
89	S.03	R/W	Engineering value attributed to Point 3			
90	S.04	R/W	Engineering value attributed to Point 43			
91	S.05	R/W	Engineering value attributed to Point 5			
92	S.06	R/W	Engineering value attributed to Point 6			
93	S.07	R/W	Engineering value attributed to Point 7			
94	S.08	R/W	Engineering value attributed to Point 8			
95	S.09	R/W	Engineering value attributed to Point 9			
96	S.10	R/W	Engineering value attributed to Point 10			
97	S.11	R/W	Engineering value attributed to Point 11			
98	S.12	R/W	Engineering value attributed to Point 12			
99	S.13	R/W	Engineering value attributed to Point 13			
100	S.14	R/W	Engineering value attributed to Point 14			
101	S.15	R/W	Engineering value attributed to Point 15			
102	S.16	R/W	Engineering value attributed to Point 16			
103	S.17	R/W	Engineering value attributed to Point 17			
104	S.18	R/W	Engineering value attributed to Point 18			
105	S.19	R/W	Engineering value attributed to Point 19			
106	S.20	R/W	Engineering value attributed to Point 20			
107	S.21	R/W	Engineering value attributed to Point 21			

108	5.22	R/W	Engineering value attributed to Point 22		
109	5.23	R/W	Engineering value attributed to Point 23		
110	5.24	R/W	Engineering value attributed to Point 24		
111	5.25	R/W	Engineering value attributed to Point 25		
112	5.26	R/W	Engineering value attributed to Point 26		
113	5.27	R/W	Engineering value attributed to Point 27		
114	5.28	R/W	Engineering value attributed to Point 28		
115	5.29	R/W	Engineering value attributed to Point 29		
116	5.30	R/W	Engineering value attributed to Point 30		
117	5.31	R/W	Engineering value attributed to Point 31		
118	5.32	R/W	Engineering value attributed to Point 32 (max. value of input scale)		
293	5.33	R/W	Engineering value attributed to minimum value of the input scale		
294	5.34	R/W	Engineering value attributed to maximum value of the input scale.		
295	5.35	R/W	Engineering value of input signal corresponding to temp. of 50°C.		

Load Current Value

746*	LtA1	R	Minimum limit of CT ammeter input scale (phase 1)					
747	LtA2	R	Minimum limit of CT ammeter input scale (phase 2)		with 3-Phase Load			
748	LtA3	R	Minimum limit of CT ammeter input scale (phase 3)		with 3-Phase Load			
405	HtA1	R	Minimum limit of CT ammeter input scale (phase 1)					
413	HtA2	R	Minimum limit of CT ammeter input scale (phase 2)		with 3-Phase Load			
414	HtS3	R	Minimum limit of CT ammeter input scale (phase 3)		with 3-Phase Load			
220	otA1	R/W	Offset correction CT input (phase 1)			0.0 zone 1	0.0 zone 2	0.0 zone 3
415	otA2	R/W	Offset correction CT input (phase 2)					
416	otA3	R/W	Offset correction CT input (phase 3)					
227 473-139	itA1	R	Instantaneous CT input value (phase 1)					
490	itA2	R	Instantaneous CT input value (phase 2)		With 3-Phase Load			
491	itA3	R	Instantaneous CT input value (phase 3)		With 3-Phase Load			
468*	I1on	R	CT input value with output on (phase 1)					
498	I2on	R	CT input value with output on (phase 2)		With 3-Phase Load			
499	I3on	R	CT input value with output on (phase 3)		With 3-Phase Load			
219*	FttA	R/W	CT input value with output on (phases 1,2, 3)					
709	itAP	R	Peak ammeter input during phase softstart ramp					
716*	coSF	R	Power factor in hundredths					
753	LdA	R	Current RMS on load					
754	LdAt	R	Current RMS on 3-phase load					

Value of Load Voltage

751*	Ld.V	R	Voltage on load	
710*	Ld.VIS	R	Load voltage instantaneous	
711*	Ld.Von	R	Load voltage with output activated	
752	LdV.t	R	Voltage on 3-phase load	

Line Voltage Value

453*	LtV1	R	Minimum limit of TV voltmeter input scale (phase 1)				
454	LtV2	R	Minimum limit of TV voltmeter input scale (3-phase, 2-leg)		with 3-Phase Load		
455	LtV3	R	Minimum limit of TV voltmeter input scale (3-phase, 3-leg)		with 3-Phase Load		
410*	HtV1	R	Maximum limit of TV voltmeter input scale (phase 1)				
417	HtV2	R	Minimum limit of TV voltmeter input scale (3-phase, 2-leg)		with 3-Phase Load		
418	HtV3	R	Minimum limit of TV voltmeter input scale (3-phase, 3-leg)		with 3-Phase Load		
411*	otU1	R/W	Offset correction voltmeter transformer input TV (phase 1)				
419	otU2	R/W	Offset correction voltmeter transformer input TV (3-phase, 2-leg)	With 3-Phase Load			
420	otU3	R/W	Offset correction CT input (3-phase, 3leg)	With 3-Phase Load			
232* 485	ItU1	R	Value of voltmeter input (phase 1)				
492	ItU2	R	Value of voltmeter input (3-phase, 2-leg)	With 3-Phase Load			
493	ItU3	R	Value of voltmeter input (3-phase, 3-leg)	With 3-Phase Load			
322*	tVF1	R	Value Filtered of voltmeter input (phase 1)				
496	tVF2	R	Value Filtered of voltmeter input (3-phase, 2-leg)	With 3-Phase Load			
497	tVF1	R	Value Filtered of voltmeter input (3-phase, 3-leg)	With 3-Phase Load			
412*	FttU	R/W	Digital Filter TV auxiliary input (phase 1,2,3)				
315*	FrE9	R	Voltage frequency in tenthz of Hz				

Power On Load

719*	LdP	R	Power on load
720	LdPt	R	Power on Load 3-Phase
749*	Ld1	R	Impedance on load
750	Ld1t	R	Impedance on load 3-phase
531	LdE1	R	Energy on load
541	LdE1t	R	Energy on 3-phase load
510	LdE2	R	Energy on load
541	LdE1t	R	Energy on 3-phase load
114 bit*	LdE1	R/W	OFF = - ON = Reset Ld.E1
115* bit	LdE2	R/W	OFF = - ON = Reset Ld.E1

Auxiliary Analog Input (LIN/TC)

194	A12	R/W	Select type of auxiliary input sensor 2
553	A13	R/W	Select type of auxiliary input sensor 3
554	A14	R/W	Select type of auxiliary input sensor 4
555	A15	R/W	Select type of auxiliary input sensor 5
181	tP2	R/W	Definition of auxiliary analog input function
677	dP2	R/W	Decimal point position for auxiliary input scale
568	dP3	R/W	Decimal point position for auxiliary input scale 3
569	dP4	R/W	Decimal point position for auxiliary input scale 4
570	dP5	R/W	Decimal point position for auxiliary input scale 5
404	LS2	R/W	Minimum limit auxiliary input scale
556	LS3	R/W	Minimum limit auxiliary input scale 3
557	LS4	R/W	Minimum limit auxiliary input scale 4
558	LS5	R/W	Minimum limit auxiliary input scale 5
603	HS2	R/W	Maximum limit auxiliary input scale 2

559	HS3	R/W	Maximum limit auxiliary input scale 3			
560	HS4	R/W	Maximum limit auxiliary input scale 4			
561	HS5	R/W	Maximum limit auxiliary input scale 5			
605	oFS2	R/W	Offset correction for auxiliary input 2			
565	oFS3	R/W	Offset correction for auxiliary input 3			
566	oFS4	R/W	Offset correction for auxiliary input 4			
567	oFS5	R/W	Offset correction for auxiliary input 5			
602	In2	R	Value of auxiliary input 2			
547	In3	R	Value of auxiliary input 3			
548	In4	R	Value of auxiliary input 4			
549	In5	R	Value of auxiliary input 5			
606	Er2	R	Self-diagnosis error code of auxiliary input 2			
550	Er3	R	Self-diagnosis error code of auxiliary input 3			
551	Er4	R	Self-diagnosis error code of auxiliary input 4			
552	Er5	R	Self-diagnosis error code of auxiliary input 5			
604	FLt2	R/W	Digital filter for auxiliary input 2			
562	FLt3	R/W	Digital filter for auxiliary input 3			
563	FLt4	R/W	Digital filter for auxiliary input 4			
564	FLt5	R/W	Digital filter for auxiliary input 5			

Digital Input

140	d iG.	R/W	Digital Input Function		
618	d iG.2	R/W	Digital Input Function 2		
694	d iG.3	R/W	Digital Input Function 3		
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	
67 bit	STATE OF DIGITAL INPUT 3	R	OFF = Digital input 3 off ON = Digital input 3 on	
518	**InPWM**		PWM input value	

Generic Alarms AL1, AL2, AL3 and AL4

215	A 1r	R/W	Select reference variable alarm 1		
216	A2r	R/W	Select reference variable alarm 2		
217	A3r	R/W	Select reference variable alarm 3		
218	A4r	R/W	Select reference variable alarm 4		
12 475-177	AL 1	R/W	Setpoint alarm 1 (scale points)		
13 476-178	AL2	R/W	Setpoint alarm 2 (scale points)		
14 52-479	AL3	R/W	Setpoint alarm 3 (scale points)		
58 480	AL4	R/W	Setpoint alarm 4 (scale points)		
27 187	HY 1	R/W	Hysteresis for alarm 1		
30 188	HY2	R/W	Hysteresis for alarm 2		
53 189	HY3	R/W	Hysteresis for alarm 3		
59	HY4	R/W	Hysteresis for alarm 4		
406	A 1t	R/W	Alarm type 1		
407	A2t	R/W	Alarm type 2		
408 54	A3t	R/W	Alarm type 3		

409	A4t	R/W	Alarm type 4				
46 bit	AL1 direct/inverse		R				
47 bit	AL1 absolute/relative		R				
48 bit	AL1 normal/symmetrical		R				
49 bit	AL1 disabled at switch on		R				
50 bit	AL1 with memory		R				
54 bit	AL2 direct/inverse		R				
55 bit	AL2 absolute/relative		R				
56 bit	AL2 normal/symmetrical		R				
57 bit	AL2 disabled at switch on		R				
58 bit	AL2 with memory		R				
36 bit	AL3 direct/inverse		R				
37 bit	AL3 absolute/relative		R				
38 bit	AL3 normal/symmetrical		R				
39 bit	AL3 disabled at switch on		R				
40 bit	AL3 with memory		R				
70 bit	AL4 direct/inverse		R				
71 bit	AL4 absolute/relative		R				
72 bit	AL4 normal/symmetrical		R				
73 bit	AL4 disabled at switch on		R				
74 bit	AL4 with memory		R				
25 20-28-142	LoL	R/W	Lowest settable limit SP, SP remote and absolute alarms				
26 21-29-143	HIL	R/W	Highest settable limit SP, SP remote and absolute alarms				
195	ALn	R/W	Select number of enabled alarms				
140	diG	R/W	Digital input function				

618	d IG2	R/W	Digital input function 2			
79 bit	Reset Alarm Latch	R/W	OFF = - ON = Reset alarm latch			
4 bit	State of Alarm 1	R	OFF = Alarm off ON = Alarm on			
5 bit	State of Alarm 2	R	OFF = Alarm off ON = Alarm on			
62 bit	State of Alarm 3	R	OFF = Alarm off ON = Alarm on			
69 bit	State of Alarm 4	R	OFF = Alarm off ON = Alarm on			
318		R	State of alarm ALSTATE IRQ			

LBA Alarm (Loop Break Alarm)

195	ALn	R/W	Select number of enabled alarms			
44	Lbt	R/W	Delay time for LBA alarm activation			
119	LbP	R/W	Limit of supplied power in presence of LBA alarm			
81 bit	Reset LBA alarm	R	OFF = - ON = Reset alarm LBA			
8 bit	State of LBA alarm	R	OFF = LBA off ON = LBA alarm on			

Heater Break Alarm

195	ALn	R/W	Select number of enabled alarms			
57*	HbF	R/W	HB alarm function			
56*	Hbt	R/W	Delay time for HB alarm activation			
55*	AHb1	R/W	HB alarm setpoint (ammeter input scale points - Phase 1)			
502	AHb2	R/W	HB alarm setpoint (ammeter input scale points - Phase 2)			
503	Ahb3	R/W	HB alarm setpoint (ammeter input scale points - Phase 3)			
737*	HbP	R/W	Percentage HB alarm setpoint (ammeter input scale points - Phase 3)			
112* bit	Calibration HB alarm setpoint	R	OFF = Calibration not enabled ON = Calibration enabled			
742*	HbtA	R/W	CT read in HB calibration		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
452*	HbtV	R/W	TV read in HB calibration		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3

743*	HbPw	R/W	Ou.P power in calibration		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
758*	IrtAd	R/W	HB calibration with IR lamp current at 100% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
759*	IrtA1	R/W	HB calibration with IR lamp current at 50% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
760*	IrtA2	R/W	HB calibration with IR lamp current at 30% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
761*	IrtA3	R/W	HB calibration with IR lamp current at 20% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
767*	IrtA4	R/W	HB calibration with IR lamp current at 15% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
768*	IrtA5	R/W	HB calibration with IR lamp current at 10% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
769*	IrtA6	R/W	HB calibration with IR lamp (only in mode PA) current at 5% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
382*	IrtA7	R/W	HB calibration with IR lamp (only in mode PA) current at 3% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
383*	IrtA8	R/W	HB calibration with IR lamp (only in mode PA) current at 2% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
384*	IrtA9	R/W	HB calibration with IR lamp (only in mode PA) current at 1% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
445*	IrtV0	R/W	HB calibration with IR lamp Voltage at 100% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
446*	IrtV1	R/W	HB calibration with IR lamp Voltage at 50% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
447*	IrtV2	R/W	HB calibration with IR lamp Voltage at 30% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
448*	IrtV3	R/W	HB calibration with IR lamp Voltage at 20% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
449*	IrtV4	R/W	HB calibration with IR lamp Voltage at 15% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
450*	IrtV5	R/W	HB calibration with IR lamp Voltage at 10% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
451*	IrtV6	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 5% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
390*	IrtV7	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 100% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
391*	IrtV8	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 100% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3

392*	IrtV9	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 1% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
744	HbtR	R	HB alarm setpoint as function of power on load				
26* bit	Stare of HB alarm or POWER_Fault	R/W	OFF = Alarm off ON = Alarm on				
76* bit	State of HB Alarm phase 1	R					
77 bit	State of HB Alarm phase 2	R	with 3-phase load				
78 bit	State of HB Alarm phase 3	R	with 3-phase load				
504		R	States of alarm HB ALSTATE_HB (for 3-phase loads)				
512*		R	States of alarm ALSTATE (for single-phase loads)				
318		R	State of alarm ALSTATE IRQ				

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	FAP	R/W	Fault action power (supplied in condition of broken probe)			
85	Err	R	Self-diagnosis error code for main input			
9 bit	State of Input in SBR	R	OFF = - ON = Input in SBR			

Power Fault ALARMS (SSR_SHORT, NO_VOLTAGE and NO_CURRENT)

660*	hd2	R/W	Enable POWER_FAULT Alarms			
661	dCt	R/W	Refresh rate in TA (Only For C4 1TA)			
662*	dCF	R/W	Filter in Time For NO_VOLTAGE, SSR_OPEN and NO_CURRENT alarms (Only For C4 1TA)			
105 bit	Reset SSR_OPEN/SSR_SHORT,NO_ VOLTAGE/NO_CURRENT Alarms	R/W				
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	

Alarm due to overload

655*		R	INNTC_SSR
534*		R	INNTC_LINE
535*		R	INNTC_LOAD
679*		R	INNTC_SSR_MAX

Fuse Open and Short Circuit Current Alarms

456	Frn	R/W	Number of restarts in case of FUSE_OPEN / SHORT_CIRCUIT_CURRENT		0.0
109 bit	RESET FUSE_OPEN /SHORT_ CIRCUIT_CURRENT ALARMS	R/W	OFF = - ON = Reset FUSE_OPEN / SHORT_CIRCUIT_CURRENT alarms		
116 bit	RESETTING FO.c1	R/W	OFF = - ON = Reset count FO.c1		

*Address 116 bit is 40-300A Only

634*		R	State 4 (STATUS4)	Table of Instrument state 4
434*	FOc1	R	Counter 1: FUSE_OPEN events	
436*	FOc2	R	Counter 2: FUSE_OPEN events	

*Address 434 & 436 bit are 40-300A Only

Outputs

160*	rL1	R/W	Allocation of reference signal		
163*	rL2	R/W	Allocation of reference signal		
166*	rL3	R/W	Allocation of reference signal		
170*	rL4	R/W	Allocation of reference signal		
171*	rL5	R/W	Allocation of reference signal		

172*	rL6	R/W	Allocation of reference signal		
152* 9	Ct1	R/W	OUT 1 (Heat) Cycle time		
159*	Ct2	R/W	OUT 2 (Cool) Cycle time		
308 319		R	State 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		

Allocation of Physical Outputs

607	out1	R/W	Allocation of physical output OUT 1		
608	out2	R/W	Allocation of physical output OUT 2		
609	out3	R/W	Allocation of physical output OUT 3		
610	out4	R/W	Allocation of physical output OUT 4		
611	out5	R/W	Allocation of physical output OUT 5		
612	out6	R/W	Allocation of physical output OUT 6		
613	out7	R/W	Allocation of physical output OUT 7		
614	out8	R/W	Allocation of physical output OUT 8		
615	out9	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	OFF = Uscita disattiva ON = Uscita attiva
83 bit	State of output OUT2	R	
84 bit	State of output OUT3	R	

85 bit	State of output OUT4	R	
86 bit	State of output OUT5	R	
87 bit	State of output OUT6	R	
88 bit	State of output OUT7	R	
89 bit	State of output OUT8	R	
90 bit	State of output OUT9	R	
91 bit	State of output OUT10	R	
664		R	State outputs (MASKOUT_OUT)

Setpoint Settings

138 16-472	SP	R/W	Local setpoint
181	tP2	R/W	Auxiliary analog input function
18 136-249	tP2	R/W	Remote setpoint (SET Gradient for manual power correction)
25 20-28-142	LoL	R/W	Lowest settable limit SP, SP remote and absolute alarms
26 21-29-143	H IL	R/W	Highest settable limit SP, SP remote and absolute alarms
10 bit	LOCAL / REMOTE	R	OFF = Enable local setpoint ON = Enable remote setpoint
305*		R/W	Instrument state (STATUS_W)
1 137-481	SPA	R/W	Active Setpoint
4		R	Deviation (SPA - PV)

Setpoint Control

234 22	GSP	R/W	Set Gradient
259	GS2	R/W	Set Gradient for SP2
265	Hot	R/W	Select hot runner functions
191	hd1	R/W	Enable multiset instrument control via serial
230 482	SP1	R/W	Setpoint 1
231 483	SP2	R/W	Setpoint 2

140	d IG 1	R/W	Digital input function			
618	d IG2	R/W	Digital input function 2			
75 bit	SELECT SP1 / SP2	R	OFF = Select SP1 ON = Select SP2			
305*		R/W	Instrument state			

PID Heat/ Cool Control

617*	SPU	R/W	Enable zone process variable			
180	Ctr	R/W	Control Type			
5 148-149	SPU	R/W	Enable zone process variable			
7 150	h It	R/W	Integral heating time			
8 151	hdt	R/W	Deriviative heating time			
6	cPb	R/W	Proportional band for cooling or hysteresis ON/OFF			
76	c It	R/W	Integral cooling time			
77	cdt	R/W	Derivative cooling time			
513	CnE	R/W	Select cooling fluid			
152 9	Ct 1	R/W	Cycle time OUT 1 (Heat)			
159	Ct2	R	Cycle time OUT 2 (Cool)			
2* 132-471	OuP	R	Value control outputs (+Heat / -Cool)			
39 484	cSP	R/W	Cooling setpoint relative to heating setpoint			
78	rSt	R/W	Manual reset (value added to PID input)			
516	PrS	R/W	Reset power (value added directly to PID output)			
79	ArS	R/W	Antireset (limits integral PID action)			
80	FFd	R/W	Feedforward (value added to PID output after processing)			
42 146	hPH	R/W	Maximum limit heating power			
254	hPL	R/W	Min. limit heating power (not available for double action heat/cool)			

43	cPH	R/W	Maximum limit cooling power			
255	cPL	R/W	Min. limit cooling power (not available for double action heat/cool)			
765*	PPEr	R/W	Percentageof output power			
766*	PoFS	R/W	Offset output power			
763*	GoUt	R/W	Gradient for output control			
764*	LoP	R/W	Offset output power			

Automatic/Manual Control

252*		R/W	MANUAL_POWER			
2 132-471	OuP	R/W	Value control outputs (+Heat / -Cool)			
140	d IG	R/W	Digital input function			
618	d IG2	R/W	Digital input function 2			
1 bit	AUTO/MAN	R/W	OFF = Automatic ON =Manual			
305		R/W	Instrument state			

Hold Funtion

140	d IG	R/W	Digital input function			
618	d IG2	R/W	Digital input function 2			
64 bit	HOLD	R/W	OFF = hold off ON = hold on			

Manual Power Correction

505*	r IF	R/W	Line voltage			
506*	cor	R/W	Manual power correction based on line voltage			
18 136-249	SPr	R/W	Remote setpoint (SET Gradient for power correction			

Autotuning

31	StU	R/W	Enable selftuning, autotuning, softstart			
140	d IG	R/W	Digital input function			
618	d IG2	R/W	Digital input function 2			

29 bit	AUTOTUNING	R/W	OFF = Stop Autotuning ON = Start Autotuning
28 bit	AUTOTUNING STATE	R/W	OFF = Autotuning in Stop ON = Autotuning in Start
68 bit	DIGITAL INPUT STATE 1	R/W	OFF = Digital input 1 off ON = Digital input 1 on
92 bit	DIGITAL INPUT STATE 2	R/W	OFF = Digital input 2 off ON = Digital input 2 on
296		R/W	Enable autotuning and selftuning state (FLG_PID)
305*		R/W	Instrument state

Selftuning

31	StU	R/W	Enable selftuning, autotuning, softstart
140	dIG	R/W	Digital input function
618	dIG2	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	DIGITAIL INPUT STATE 1	R/W	OFF = Digital input 1 off ON = Digital input 1 on
92 bit	DIGITAIL INPUT STATE 2	R/W	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	StU	R/W	Enable selftuning, autotuning, softstart
147	SoF	R/W	Softstart time
63 bit	SOFTSTART STATE	R/W	OFF = Softstart off ON = Softstart on

Software Shutdown

699*	Pont	R/W	Start mode at Power-On

Software Power On

140	d IG	R/W	Digital input function			
618	d IG2	R/W	Digital input function 2			
700	oFFt	R/W	Software OFF			
11 bit	SOFTWARE ON/OFF	R/W	OFF = On ON =Off			
68 bit	DIGITAIL INPUT STATE 1	R/W	OFF = Digital input 1 off ON = Digital input 1 on			
92 bit	DIGITAIL INPUT STATE 2	R/W	OFF = Digital input 2 off ON = Digital input 2 on			
305*		R/W	State (STATUS_W)			

Fault Action Power

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

Power Alarm

261	bSt	R/W	Stability band (hot runners power alarm function)			
262	bPF	R/W	Power alarm band (hot runners power alarm function)			
260	PFt	R/W	Power alarm delay times			
160*	rL 1	R/W	Allocation of reference signal			
163*	rL2	R/W	Allocation of reference signal			
166*	rL3	R/W	Allocation of reference signal - Output OR			
170*	rL4	R/W	Allocation of reference signal - Output AND			
171*	rL5	R/W	Allocation of reference signal - Output OR			
172*	rL6	R/W	Allocation of reference signal - Output AND			

Preheating Softstart

31	StU	R/W	Enable selftuning, autotuning, softstart			
263	SPS	R/W	Softstart Setpoint (preheating hot runners)			
264	SoP	R/W	Softstart power (preheating hot runners)			
147	SoF	R/W	Softstart time			
63 bit	SOFTSTART STATE	R/W	OFF = Softstart in Stop ON = Softstart in Start			

Operating Hour Meter

396	OHc	R/W	Hours of Operation	

Trigger Modes

703*	HdS	R/W	Enable Trigger Modes				
707*	FutA	R/W	Max. limit of RMS current in normal operation				
704*	bFCy	R/W	Minimum number of cycles of BF modes				

Soft Start

630*	PSH1	R/W	Maximum phase of phase softstart ramp				
705*	PStN	R/W	Duration of phase softstart ramp				
629*	PSoF	R/W	Min. non-conduction time to reactivate phase softstart ramp				
706*	PStA	R/W	Maximum peak current limit during phase softstart ramp				
108* bit	Restart of phase softstart ramp	R/W	OFF = Restart not enabled ON = Restart enabled				
106* bit	State of phase softstart ramp	R	OFF = Ramp not active ON = Ramp active				
107* bit	State of phase softstart ramp	R	OFF = Ramp not ended ON = Ramp ended				

Delay Triggering

708*	dLt	R/W	Delay triggering (first trigger only)				
738*	dLoF	R/W	Minimum non-conduction time to reactivate delay triggering II				

Feedback Modes

730*	Hd6	R/W	Enable feedback modes				
731*	CorV	R/W	Maximum correction of voltage feedback				
732*	Cor1	R/W	Maximum correction of current feedback				
733*	CorP	R/W	Maximum correction of power feedback				
734*	r1FV	R/W	Voltage feedback reference				
735*	r1FV	R/W	Voltage feedback reference				
736*	r1FP	R/W	Power feedback reference				
741*	Fb1t	R/W	Feedback response speed				
113* bit	Calibration of voltage feedback reference	R/W	OFF = Calibration not enabled ON = Calibration enabled				
757*	Ar1F	R	Feedback		Setpoint of V, I, P to maintain on load		

Heuristic Power Control

680	hd3	R/W	Enable heuristic power control		
681	IHEU	R/W	Maximum current for heuristic power control		

Heterogeneous Power Control

682	hd4	R/W	Enable heterogeneous power control		
683	IHEt	R/W	Maximum current for heterogeneous power control		

Virtual Instrument Control

191	hd1	R/W	Enable multiset instrument control via serial		
224*	S1n	R/W	Control Inputs from Serial		
225	S0u	R/W	Control Outputs from Serial		
628	SL1	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	Er2	R	Self-diagnosis error code for auxiliary input 2	
550	Er3	R	Self-diagnosis error code for auxiliary input 3	(40 to 300A Only)
551	Er4	R	Self-diagnosis error code for auxiliary input 4	(40 to 300A Only)
552	Er5	R	Self-diagnosis error code for auxiliary input 5	(40 to 300A Only)
190	CHd	R	Hardware configuration codes	
508	CHd1	R	Hardware configuration codes 1	
543	CHd2	R	Hardware configuration codes 2	
835	CHd3	R	Hardware configuration codes 3	(40 to 300A Only)
693 697	UPdF	R	Fieldbus software version	
695	CodF	R	Fieldbus node	
696	bAUF	R	Fieldbus baudrate	
346		R	State of jumper	
120		R	Manufacturer - Trade Mark	
121		R	Device ID (C4)	
197	LdSt	R/W	RN LED Status Function	
619	Ld2	R/W	ER LED status function	
620	Ld3	R/W	Function of LED DI1	
621	Ld4	R/W	Function of LED DI2	
622	Ld5	R/W	Function of LED O1	
623	Ld6	R/W	Function of LED O2	
624	Ld7	R/W	Function of LED O3	
625	Ld.8	R/W	Function of LED O4	

305*		R/W	State (STATUS_W)			
467*		R	State (STATUS)			
469*		R	State 1 (STATUS1)			
632*		R	State 2 (STATUS2)			
633*		R	State 3 (STATUS3)			
634*		R	State 4 (STATUS4)			
702		R	Voltage Status			

Instrument Configuration Sheet (400 to 600A Models)

Definition of Parameter				Note	Assigned Value
Installation of Modbus Serial Network					
46	Cod	R	Instrument identification code		
45	bAu	R/W	Select Baudrate - Serial 1		
626	bAu2	R/W	Select Baudrate - Serial 2		
47	PAr	R/W	Select Parity - Serial 1		
627	PAr2	R/W	Select Parity - Serial 2		
890	CEt	R/W	Timeout for communication error		
891*	CEr	R/W	Mode for communication error		
892*	CEP	R/W	Output power when communication is active		
Analog Input					
573	tPA	R/W	Analog Input 1		
837	tPA2	R/W	Analog Input 2		
844	tPA3	R/W	Analog Input 3		
574	LSA	R/W	Minimum scale limit analog input		
838	LSA2	R/W	Minimum scale limit analog input 2		
845	LSA3	R/W	Minimum scale limit analog input 3		
575	HSA 1	R/W	Maximum scale limit analog input 1		
839	HSA2	R/W	Maximum scale limit analog input 2		
846	HSA3	R/W	Maximum scale limit analog input 3		
577	oFSA 1	R/W	Offset correction for analog input 1		
841	oFSA2	R/W	Offset correction for analog input 2		
848	oFSA3	R/W	Offset correction for analog input 3		

572	InA1	R	Value of the engineering reading analog input 1
836	InA2	R	Value of the engineering reading analog input 2
843	InA3	R	Value of the engineering reading analog input 3
576	FLtA1	R/W	Low pass digital filter analog input 1
840	FLtA2	R/W	Low pass digital filter analog input 2
847	FLtA3	R/W	Low pass digital filter analog input 3

Main Input

400	tyP	R/W	Probe, signal, enable, custom linearization and main input scale
403	dPS	R/W	Decimal point position for input scale
401	LoS	R/W	Min. scale limit for main input
402	HIS	R/W	Max. scale limit for main input
519 23	oFS	R/W	Main input offset correction
0 470	PV	R/W	Read of process variable (PV) engineering value
349	DPV	R	Read of engineering value of process variable (PV) filtered by FLd
85	Err	R	Self-diagnosis error code for main input
24	FLt	R/W	low pass digital filter for input signal

Load Current Value

746*	LtA1	R	Minimum limit of CT ammeter input scale (phase 1)
747	LtA2	R	Minimum limit of CT ammeter input scale (phase 2)
748	LtA3	R	Minimum limit of CT ammeter input scale (phase 3)
405*	HtA1	R	Minimum limit of CT ammeter input scale (phase 1)
413	HtA2	R	Minimum limit of CT ammeter input scale (phase 2)
414	HtS3	R	Minimum limit of CT ammeter input scale (phase 3)
220*	otA1	R/W	Offset correction CT input (phase 1)
415	otA2	R/W	Offset correction CT input (phase 2)

416	otA3	R/W	Offset correction CT input (phase 3)					
393	rtA	R/W	Offset correction for external CT input					
227 485-139-755	ItA1	R	Instantaneous CT input value (phase 1)					
490 494	ItA2	R	Instantaneous CT input value (phase 2)					
491 495	ItA3	R	Instantaneous CT input value (phase 3)					
468	I1on	R	CT ammeter input value with output activated (phase 1)					
498	I2on	R	CT ammeter input value with output activated (phase 2)					
499	I3on	R	CT ammeter input value with output activated (phase 3)					
709	ItAP	R	Peak ammeter input during phase softstart ramp					
716	coSF	R	Power factor in hundredths					
753*	LdA	R	Current RMS on load					
754	LdAt	R	Current RMS on 3-phase load					
219	Ft.tA	R/W	CT ammeter input digital filter					

Value of Load Voltage

751*	Ld.V	R	Voltage on load					
710*	Ld.VIS	R	Load voltage instantaneous					
711*	Ld.Von	R	Load voltage with output activated					
752*	LdV.t	R	R Voltage on 3-phase load					
439*	Lt.VL	R	Minimum limit of TV_LOAD voltmeter input scale					
443*	Ht.VL	R	Maximum limit of TV_LOAD voltmeter input scale					
444	ot.VL	R/W	Offset correction voltmeter transformer input TV_LOAD					
442	Ft.tVL	R/W	Digital filter voltmeter input TV_LOAD		0.0 ..20.0 sec		0.1 zone 1	0.1 zone 2	0.1 zone 3

Line Voltage Value

453*	LtV1	R	Minimum limit of TV voltmeter input scale (phase 1)
454	LtV2	R	Minimum limit of TV voltmeter input scale (3-phase, 2-leg)
455	LtV3	R	Minimum limit of TV voltmeter input scale (3-phase, 3-leg)
410	HtV1	R	Maximum limit of TV voltmeter input scale (phase 1)
417	HtV2	R	Minimum limit of TV voltmeter input scale (3-phase, 2-leg)
418	HtV3	R	Minimum limit of TV voltmeter input scale (3-phase, 3-leg)
412*	FttU	R/W	Digital filter TV auxiliary input (phase 1,2,3)

Power on Load

880 719 LSW	LdP	R	Power on load
882 720 LSW	LdPt	R	Power on Load 3-Phase
749*	Ld1	R	Impedance on load
750	Ld1t	R	Impedance on load 3-phase
531*	LdE1	R	Energy on load
541	LdE1t	R	Energy on 3-phase load
510*	LdE2	R	Energy on load
541	LdE1t	R	Energy on 3-phase load
114 bit	LdE1	R/W	OFF = - ON = Reset Ld.E1
115 bit	LdE2	R/W	OFF = - ON = Reset Ld.E1

Digital Inputs

140	diG1	R/W	Function of digital input 1
618	diG2	R/W	Function of digital input 2
694	diG3	R/W	Function of digital input 3
712	diG4	R/W	Function of digital input 4
385	tPdiG	R/W	Defining the type of digital inputs

356	PuNt 1	R/W	Timeout for input PWM 1
357	PuNt2	R/W	Timeout for input PWM 2
362	PuNt3	R/W	Timeout for input PWM 3
438	FtPLN1	R/W	Digital low pass filter input PWM 1
372	FtPLN12	R/W	Digital low pass filter input PWM 2
373	FtPLN3	R/W	Digital low pass filter input PWM 3
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
67 bit	State of Digital Input 3	R	OFF = Digital input 3 off ON = Digital input 3 on
66 bit	State of Digital Input 4	R	OFF = Digital input 4 off ON = Digital input 4 on
317		R	State of digital inputs INPUT DIG
518	In.PWM 1	R	PWM 1 input value
435	In.PWM 2	R	PWM 2 input value
457	In.PWM 3	R	PWM 3 input value

Alarms

215*	A 1r	R/W	Select reference variable alarm 1
216*	A2r	R/W	Select reference variable alarm 2
217*	A3r	R/W	Select reference variable alarm 3
218*	A4r	R/W	Select reference variable alarm 4
12* 475-177	AL 1	R/W	Setpoint alarm 1 (scale points)
13* 476-178	AL2	R/W	Setpoint alarm 2 (scale points)
14* 52-479	AL3	R/W	Setpoint alarm 3 (scale points)
58* 480	AL4	R/W	Setpoint alarm 4 (scale points)
27 187	HY 1	R/W	Hysteresis for alarm 1

30* 188	HY2	R/W	Hysteresis for alarm 2			
53* 189	HY3	R/W	Hysteresis for alarm 3			
59*	HY4	R/W	Hysteresis for alarm 4			
406*	A 1t	R/W	Alarm type 1			
407*	A2t	R/W	Alarm type 2			
408* 54	A3t	R/W	Alarm type 3			
409*	A4t	R/W	Alarm type 4			
46* bit	AL1 direct/inverse	R				
47* bit	AL1 absolute/relative	R				
48* bit	AL1 normal/symmetrical	R				
49* bit	AL1 disabled at switch on	R				
50* bit	AL1 with memory	R				
54* bit	AL2 direct/inverse	R				
55* bit	AL2 absolute/relative	R				
56* bit	AL2 normal/symmetrical	R				
57* bit	AL2 disabled at switch on	R				
58* bit	AL2 with memory	R				
36* bit	AL3 direct/inverse	R				
37* bit	AL3 absolute/relative	R				
38* bit	AL3 normal/symmetrical	R				
39* bit	AL3 disabled at switch on	R				
40* bit	AL3 with memory	R				
70* bit	AL4 direct/inverse	R				
71* bit	AL4 absolute/relative	R				
72* bit	AL4 normal/symmetrical	R				

73* bit	AL4 disabled at switch on		R				
74* bit	AL4 with memory		R				
195*	AL n	R/W	Select number of enabled alarms				
140	d IC	R/W	Digital input function				
618	d IC2	R/W	Digital input function 2				
694	d IC3	R/W	Digital input function 3				
712	d IC4	R/W	Digital input function 4				
79* bit	Reset Alarm Latch	R/W	OFF = - ON = Reset alarm latch				
4* bit	State of Alarm 1	R	OFF = Alarm off ON = Alarm on				
5* bit	State of Alarm 2	R	OFF = Alarm off ON = Alarm on				
62* bit	State of Alarm 3	R	OFF = Alarm off ON = Alarm on				
69* bit	State of Alarm 4	R	OFF = Alarm off ON = Alarm on				
318*		R	State of alarm ALSTATE IRQ				

Heater Break Alarm

195*	AL n	R/W	Select number of enabled alarms				
57*	HbF	R/W	HB alarm function				
56*	Hbt	R/W	Delay time for HB alarm activation				
112* bit	Calibration HB alarm setpoint	R	OFF = Calibration not enabled ON = Calibration enabled				
55*	AHb 1	R/W	HB alarm setpoint (ammeter input scale points - Phase 1)				
502	AHb2	R/W	HB alarm setpoint (ammeter input scale points - Phase 2)				
503	Ahb3	R/W	HB alarm setpoint (ammeter input scale points - Phase 3)				
737*	HbP	R/W	Percentage HB alarm setpoint (ammeter input scale points - Phase 3)				
742*	HbtA	R/W	CT read in HB calibration				
452*	HbtV	R/W	TV read in HB calibration				

743*	HbPw	R/W	Ou.P power in calibration				
758*	IrtAd	R/W	HB calibration with IR lamp current at 100% conduction				
759*	IrtA1	R/W	HB calibration with IR lamp current at 50% conduction				
760*	IrtA2	R/W	HB calibration with IR lamp current at 30% conduction				
761*	IrtA3	R/W	HB calibration with IR lamp current at 20% conduction				
767*	IrtA4	R/W	HB calibration with IR lamp current at 15% conduction				
768*	IrtA5	R/W	HB calibration with IR lamp current at 10% conduction				
769*	IrtA6	R/W	HB calibration with IR lamp current at 5% conduction				
382*	IrtA7	R/W	HB calibration with IR lamp current at 3% conduction				
383*	IrtA8	R/W	HB calibration with IR lamp current at 2% conduction				
384*	IrtA9	R/W	HB calibration with IR lamp current at 1% conduction				
445*	IrtV0	R/W	HB calibration with IR lamp Voltage at 100% conduction				
446*	IrtV1	R/W	HB calibration with IR lamp Voltage at 50% conduction				
447*	IrtV2	R/W	HB calibration with IR lamp Voltage at 30% conduction				
448*	IrtV3	R/W	HB calibration with IR lamp Voltage at 20% conduction				
449*	IrtV4	R/W	HB calibration with IR lamp Voltage at 15% conduction				
450*	IrtV5	R/W	HB calibration with IR lamp Voltage at 10% conduction				
451*	IrtV6	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 5% conduction				
390*	IrtV7	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 100% conduction				
391*	IrtV8	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 100% conduction				
392*	IrtV9	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 1% conduction				

744*	HbtP	R	HB alarm setpoint as function of power on load
26* bit	Stare of HB alarm or POWER_Fault	R/W	
76* bit	State of HB Alarm phase 1 TA	R	
77 bit	State of HB Alarm phase 2 TA	R	
78 bit	State of HB Alarm phase 3 TA	R	
504		R	States of alarm HB ALSTATE_HB (for 3-phase loads)
512*		R	States of alarm ALSTATE (for single-phase loads)
318		R	State of alarm ALSTATE IRQ

Power Fault ALARMS (SSR_SHORT, NO_VOLTAGE and NO_CURRENT)

660*	hd2	R/W	Enable POWER_FAULT Alarms
661	dCt	R/W	Refresh rate in TA (Only For C4 1TA)
662*	dCF	R/W	Time filter for alarms NO_VOLTAGE, SSR_OPEN and NO_CURRENT
105 bit	Reset SSR_OPEN/SSR_SHORT,NO_ VOLTAGE/NO_CURRENT Alarms	R/W	
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	

Alarm due to overload

655*		R	INNTC_SSR
534*		R	INNTC_LINE
535*		R	INNTC_LOAD
679*		R	INNTC_SSR_MAX

Fuse Open and Short Circuit Current Alarms

456	Frn	R/W	Number of restarts in case of FUSE_OPEN / SHORT_CIRCUIT_CURRENT		
109 bit	RESET FUSE_OPEN /SHORT_ CIRCUIT_CURRENT ALARMS	R/W	OFF = - ON = Reset FUSE_OPEN / SHORT_CIRCUIT_CURRENT alarms		
116 bit	RESETTING F0.c1	R/W	OFF = - ON = Reset count FO.c1		
634*		R	State 4 (STATUS4)		

Allocation of Reference Signal

160*	rL1	R/W	Allocation of reference signal		
163*	rL2	R/W	Allocation of reference signal		
166*	rL3	R/W	Allocation of reference signal		
170*	rL4	R/W	Allocation of reference signal		
171*	rL5	R/W	Allocation of reference signal		
172*	rL6	R/W	Allocation of reference signal		
152*	Ct1	R/W	OUT 1 (Heat) Cycle time		
159*	Ct2	R/W	OUT 2 (Cool) Cycle time		
308 319		R	State rL.x MASKOUT		
12* bit	STATE rL.1	R	OFF = Signal off ON = Signal on		
13* bit	STATE rL.2	R	OFF = Signal off ON = Signal on		
14* bit	STATE rL.3	R	OFF = Signal off ON = Signal on		
15* bit	STATE rL.4	R	OFF = Signal off ON = Signal on		
16* bit	STATE rL.5	R	OFF = Signal off ON = Signal on		
17* bit	STATE rL.6	R	OFF = Signal off ON = Signal on		

Allocation of Physical Outputs

607	out 1	R/W	Allocation of physical output OUT 1		
608	out2	R/W	Allocation of physical output OUT 2		
609	out3	R/W	Allocation of physical output OUT 3		
610	out4	R/W	Allocation of physical output OUT 4		
611	out5	R/W	Allocation of physical output OUT 5		
612	out6	R/W	Allocation of physical output OUT 6		
613	out7	R/W	Allocation of physical output OUT 7		
614	out8	R/W	Allocation of physical output OUT 8		
615	out9	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	OFF = Output off ON = Output on
83 bit	State of output OUT2	R	OFF = Output off ON = Output on
84 bit	State of output OUT3	R	OFF = Output off ON = Output on
85 bit	State of output OUT4	R	OFF = Output off ON = Output on
86 bit	State of output OUT5	R	OFF = Output off ON = Output on
87 bit	State of output OUT6	R	OFF = Output off ON = Output on
88 bit	State of output OUT7	R	OFF = Output off ON = Output on
89 bit	State of output OUT8	R	OFF = Output off ON = Output on
90 bit	State of output OUT9	R	OFF = Output off ON = Output on
91 bit	State of output OUT10	R	OFF = Output off ON = Output on
664		R	State outputs (MASKOUT_OUT)

Analog Output

865	tPA01	R/W	Analog output Type 1			
866	tPA02	R/W	Analog output Type 2			
867	tPA03	R/W	Analog output Type 3			
868	rFA01	R/W	Attribution reference analog output 1			
869	rFA02	R/W	Attribution reference analog output 2			
870	rFA03	R/W	Attribution reference analog output 3			
871	LSA01	R/W	Minimum scale limit analog output 1			
872	LSA02	R/W	Minimum scale limit analog output 2			
873	LSA03	R/W	Minimum scale limit analog output 3			
874	HSA01	R/W	Maximum scale limit analog output 1			
875	HSA02	R/W	Maximum scale limit analog output 2			
876	HSA03	R/W	Maximum scale limit analog output 3			
727	SERIAL_OUTA1	R/W	Serial line value for analog output 1			
728	SERIAL_OUTA2	R/W	Serial line value for analog output 2			
729	SERIAL_OUTA3	R/W	Serial line value for analog output 3			
877	OutA01	R	Analog output value 1			
8778	OutA02	R	Analog output value 2			
879	OutA03	R	Analog output value 3			

Control

617	SPU	R/W	Power reference			
2* 132-471	OuP	R	Value control outputs			
765*	PPEr	R/W	Percentage of output power			
766*	PoFS	R/W	Offset of output power			

763*	GoUt	R/W	Gradient for output control			
764*	LoP	R/W	Minimum ignition output			

Automatic/Manual Control

252*		R/W	MANUAL_POWER			
2* 132-471	OuP	R/W	Value control outputs (+Heat / -Cool)			
140	d IG1	R/W	Digital input function 1			
618	d IG2	R/W	Digital input function 2			
694	d IG3	R/W	Digital input function 3			
712	d IG4	R/W	Digital input function 4			
1 bit	AUTO/MAN	R/W	OFF = Automatic ON =Manual			
305		R/W	State (STATUS_W)			

Manual Power Correction

505	r IF	R/W	Line Voltage			
506	Cor	R/W	Correction of manual power based on line voltage			
18 136-249	SPr	R/W	Remote setpoint (SET gradient for manual power correction)			
305		R/W	State (STATUS_W)			

Start Mode

699*	Pont	R/W	Start mode at Power-On			

Software Shutdown

140	d.G1	R/W	Digital Input Function 1			
618	d.G2	R/W	Digital Input Function 2			
694	d.G3	R/W	Digital Input Function 3			

712	d.C4	R/W	Digital Input Function 4					
11 bit	SOFTWARE ON/OFF	R/W	OFF = Software OFF ON = Software ON					
700	OFFt	R/W	Software OFF					
68 bit	DIGITAL INPUT STATE 1	R/W	OFF = Digital Input 1 OFF ON = Digital Input 1 ON					
92 bit	DIGITAL INPUT STATE 2	R/W	OFF = Digital Input 2 OFF ON = Digital Input 2 ON					
67 bit	DIGITAL INPUT STATE 3	R/W	OFF = Digital Input 3 OFF ON = Digital Input 3 ON					
66 bit	DIGITAL INPUT STATE 4	R/W	OFF = Digital Input 4 OFF ON = Digital Input 4 ON					
305		R/W	State (STATUS_W)					

Heating Output (Fast Cycle)

160*	rL 1	R/W	Allocation of reference signal					
152*	Ct 1	R/W	OUT 1 (Heat) Cycle time					

Operating Hour Meter

396*	OHc	R/W	Hours of operation					

SSR Trigger Mode

703*	HdS	R/W	Enable Trigger Modes					
707*	FutA	R/W	Max. limit of RMS current in normal operation					
704*	bFCy	R/W	Minimum number of cycles of BF modes					

Soft Start Trigger Mode

630*	PSH 1	R/W	Maximum phase of phase softstart ramp					
705*	PStn	R/W	Duration of phase softstart ramp					
629*	PSoF	R/W	Min. non-conduction time to reactivate phase softstart ramp					
706*	PStA	R/W	Maximum peak current limit during phase softstart ramp					
108* bit	Restart of phase softstart ramp	R/W	OFF = Restart not enabled ON = Restart enabled					
106* bit	State of phase softstart ramp	R	OFF = Ramp not active ON = Ramp active					

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

Delay Triggering

708*	dLt	R/W	Delay triggering (first trigger only)

Feedback Modes

730*	Hd6	R/W	Enable feedback modes
731*	CorV	R/W	Maximum correction of voltage feedback
732*	Cor1	R/W	Maximum correction of current feedback
733*	CorP	R/W	Maximum correction of power feedback
734*	r1FV	R/W	Voltage feedback reference
735*	r1FV	R/W	Voltage feedback reference
884* 736* LSW only	r1FP	R/W	Power feedback reference
741*	Fb1t	R/W	Feedback response speed
113* bit	Calibration of voltage feedback reference	R/W	OFF = Calibration not enabled ON = Calibration enabled
886* 757* LSW only	Ar1F	R	Feedback

Setpoint of V, I, P to maintain on load

Heuristic Power Control

680	hd3	R/W	Enable heuristic power control
681	IHEU	R/W	Maximum current for heuristic power control

Heterogeneous Power Control

682	hd4	R/W	Enable heterogeneous power control
683	IHEt	R/W	Maximum current for heterogeneous power control

Virtual Instrument Control

191	hd1	R/W	Enable multiset instrument control via serial			
224*	SIn	R/W	Control Inputs from Serial			
225	SOu	R/W	Control Outputs from Serial			
628	SLI	R/W	Control LEDs and digital inputs from serial			

HW/SW Data

122	UPd	R	Software version code			
190	Chd	R	Hardware configuration codes			
508	CHd1	R	Hardware configuration codes 1			
543	CHd2	R	Hardware configuration codes 2			
835	CHd3	R	Hardware configuration codes 3			
693 697	UPdF	R	Fieldbus software version			
695	CodF	R	Fieldbus node			
696	bAUF	R	Fieldbus baudrate			
346		R	State of jumper			
120		R	Manufacturer - Trade Mark			
121		R	Device ID (C4)			
197	LdSt	R/W	RN LED Status Function			
619	Ld2	R/W	ER LED status function			
620	Ld3	R/W	Function of LED DI1			
621	Ld4	R/W	Function of LED DI2			
622	Ld5	R/W	Function of LED O1			
623	Ld6	R/W	Function of LED O2			
624	Ld7	R/W	Function of LED O3			
625	Ld.8	R/W	Function of LED O4			

305*		R/W	State (STATUS_W)			
698*		R	Status saved in eeprom (STATUS_W_EEP)			
467*		R	State (STATUS)			
469*		R	State 1 (STATUS1)			
632*		R	State 2 (STATUS2)			
633*		R	State 3 (STATUS3)			
634*		R	State 4 (STATUS4)			
702		R	Voltage Status			

Limited Warranty:
Please refer to the Chromalox limited warranty applicable to this product at
http://www.chromalox.com/customer-service/policies/termsofsale.aspx.

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