Programming Instruction Manual

ACPC

Modular SCR Power Controller

CHROMALOX
Advanced Thermal Technologies

PK576
0037-75600
July 2023

Table of Contents

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 ACPC-OP or a PC connected in USB/RS232/RS485, with specific C-PWR application soft-ware.

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:

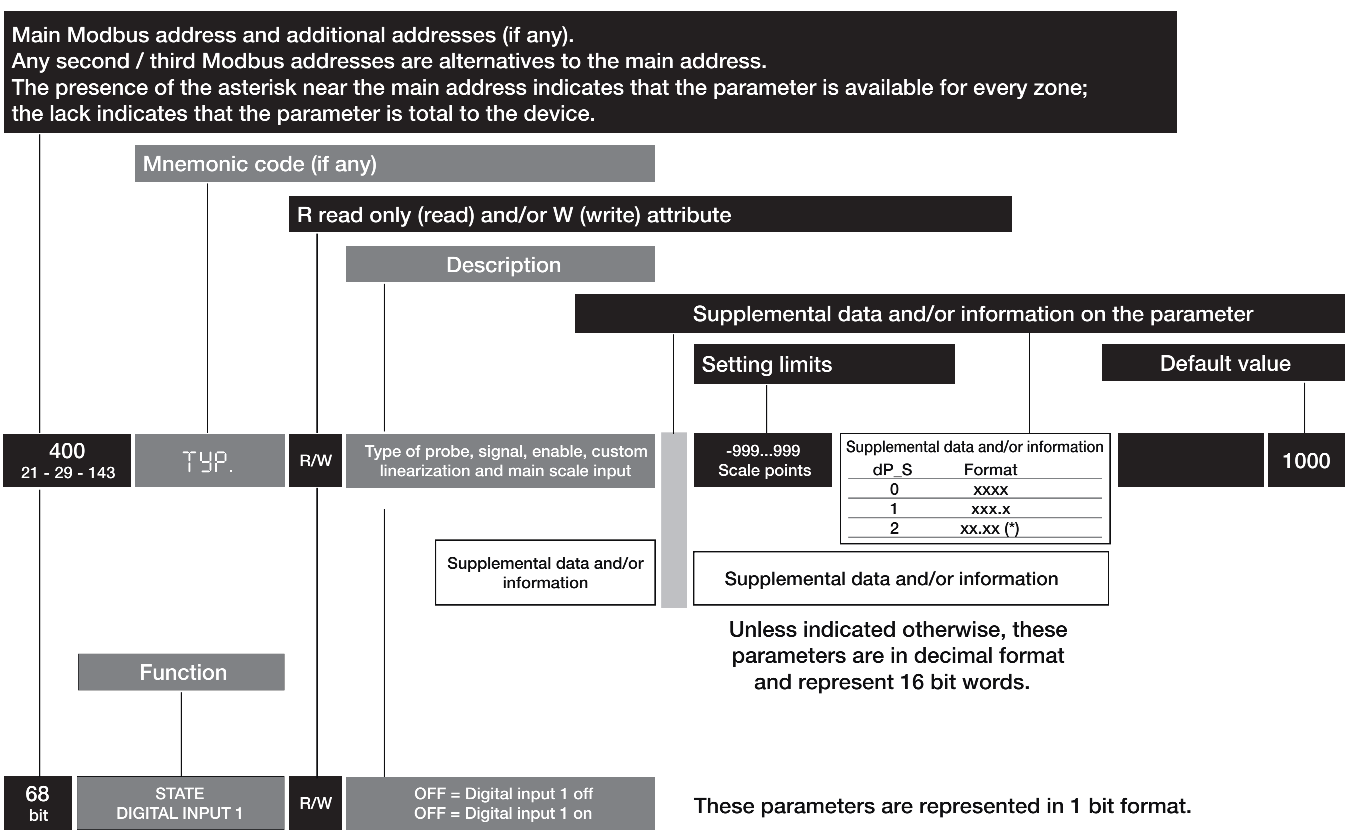
this section is addressed to users and/or installers who want to use the controller in special applications or in applications requiring the high performance offered by the instrument.

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. ACPC-M refers to master module. A ACPC1 is by de-fault ACPC-M.
2. ACPC-E1 refers to expansion module 1. A ACPC2 would include ACPC-M (as module 1) and ACPC-E1 (as module 2)
3. ACPC-E2 refer to two expansion modules. A ACPC3 would include ACPC-M (as module 1) and ACPC-E2 (as module 2 and 3).



Communications

The modular power controller's flexibility permits replacement of previous-version such as Chromalox (ACPC), 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 dif-ferent modes:

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

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

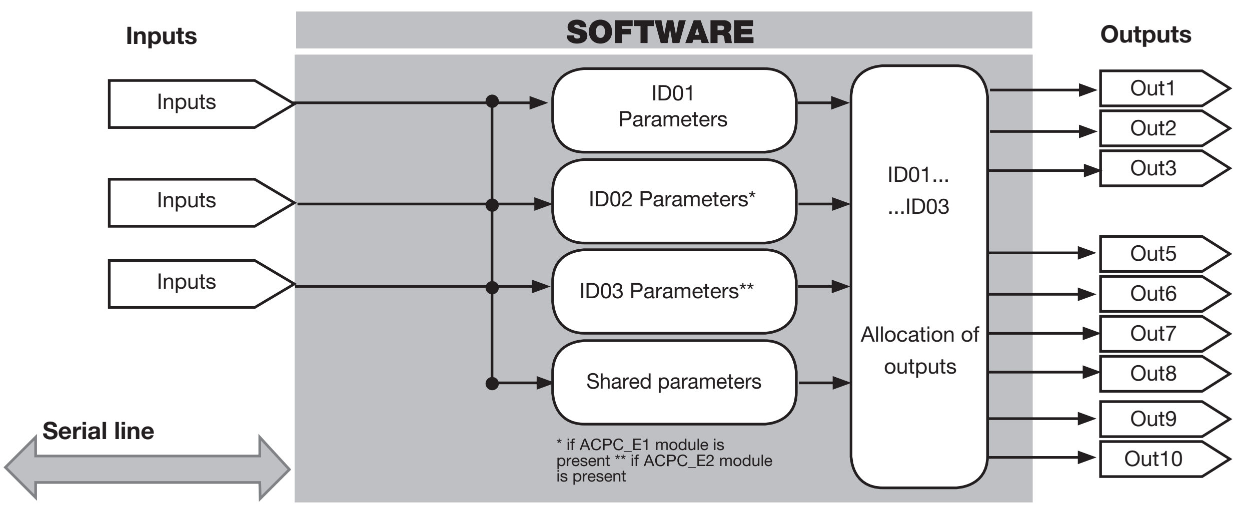
New shared parameters, are accessible for both modes and permit more advanced functions such as:

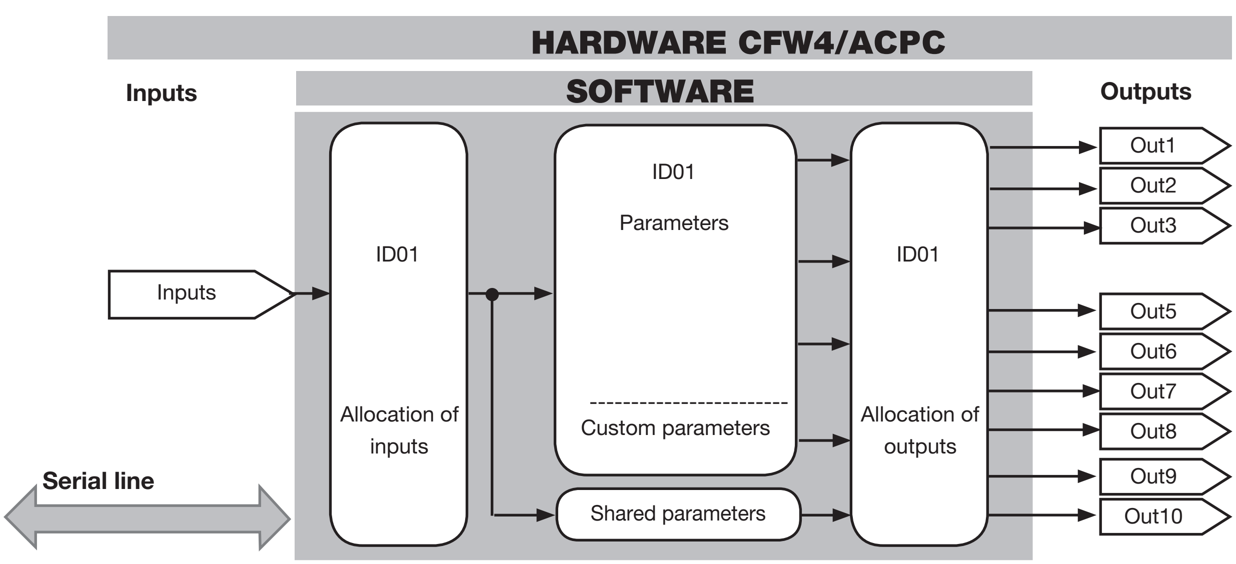
604	FLT.2	R/W	Digital Filter for Auxiliary Input	0.0...20.0 sec	0.1

In addition to having a CUSTOM group of parameters for dynamic addressing, ACPC 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).

ACPC 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 module ACPC-M
- Zone 2 for the variables of the module ACPC-E1
- Zone 3 for the variables of the module ACPC-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 (ACPC-M), node 15 Zone 2 (CFW-E1), node 16 Zone 3 (ACPC-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 ACPC, has address Cod 611.

C4/ACPC 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 ACPC-M
- Zone 2 for the variables of the mudule ACPC-E1
- Zone 3 for the variables of the mudule ACPC-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/ACPC 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 ACPC 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.

ACPC 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 ad-dress (ID) set on the rotary switches (tens + ones).

ACPC 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.

ACPC 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 ACPC modules in a serial network, with node address selectable from “01” to “99” in standard mode, or create a mixed ACPC/C4 network in C4 compatible mode in which each ACPC identifies 3 zones with sequential node address start-ing 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 ACPC 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.

				Table of Analog Input		
573	TP.A	R/W	Analog Input 1	0	Disable	1
837*	TP.A2	R/W	Analog Input 2	1	0...10V	1
844*	TP.A3	R/W	Analog Input 3	2	0...5V / Potentiometer	1
				3	0...20mA	
				4	4...20mA	

*For models 400-600A Only

*For models 400-600A Only

Scale Limits

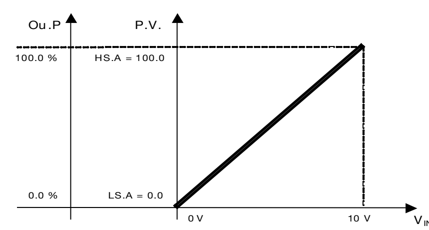
574	LS.A	R/W	Minimum scale limit analog input 1	-100.0...200.0		0.0
838*	LS.A2	R/W	Minimum scale limit analog input 2	-100.0...200.0		0.0
845*	LS.A3	R/W	Minimum scale limit analog input 3	-100.0...200.0		0.0
575	HS.A	R/W	Maximum scale limit analog input 1	LS.A1......200.0		100.0
839*	HS.A2	R/W	Maximum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

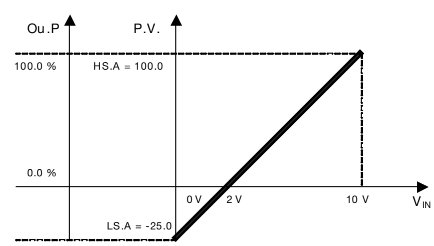
In automatic mode, the engineering value (PV) is attributed to power Ou.P for values between 0.0 and 100.0.

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



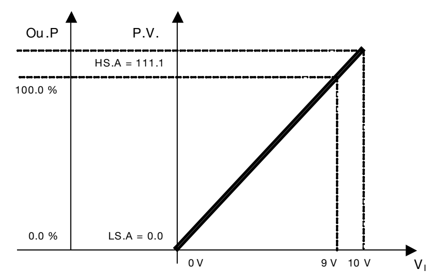
Since the 0…10V input range is reduced 80% above, the scale interval (HS.A – LS.A) must be extended downward so that the useful interval (100.0 – 0.0) is 80% (100.0/125.0 = 0.8).

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	OFSA	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

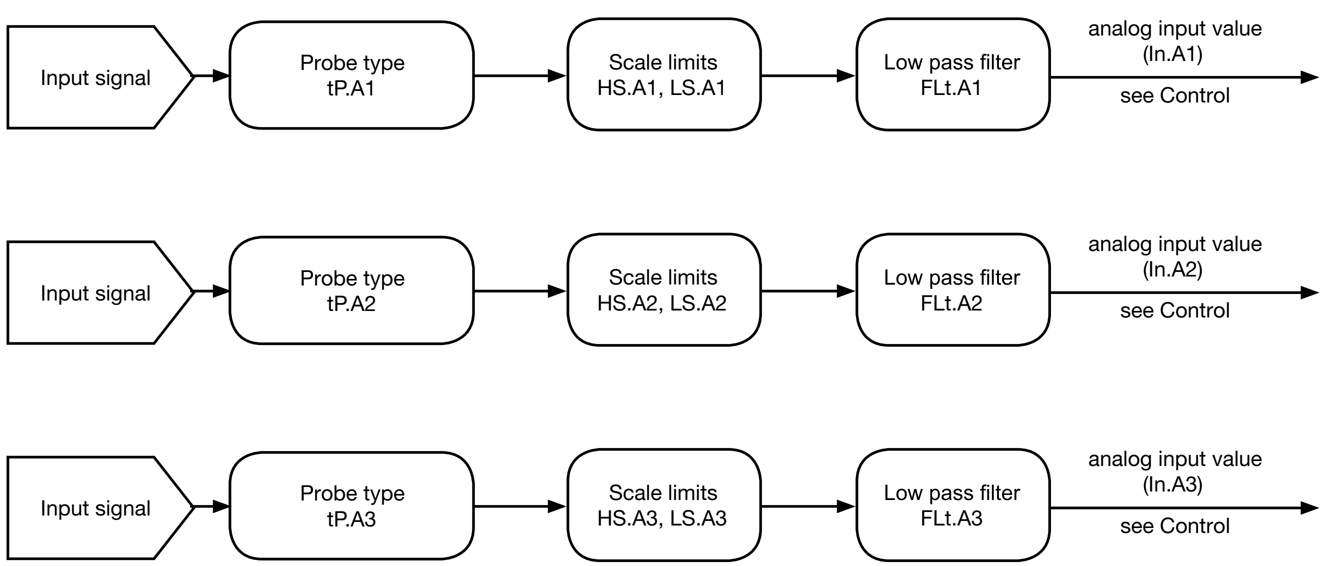
572	INA	R	Value of the ingegneristico reading analog input 1
836	INA2	R	Value of the ingegneristico reading analog input 2
843	INA3	R	Value of the ingegneristico reading analog input 3

Advanced Settings

Input Filter

576	FLTA	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



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 conduc-tion angle >90°, and better than 10% for lower conduc-tion 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	LOA	R	Current RMS on load		
754	LOAT	R	Current RMS on 3-phase load		

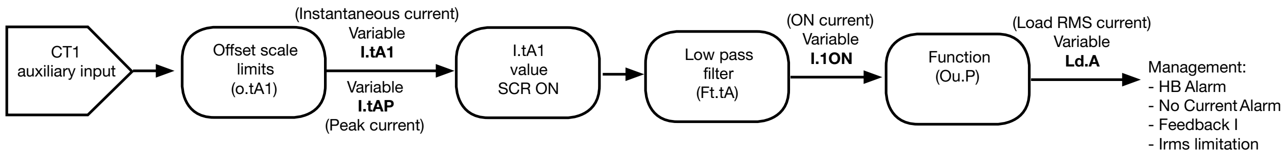
Advanced Settings

Input Filter

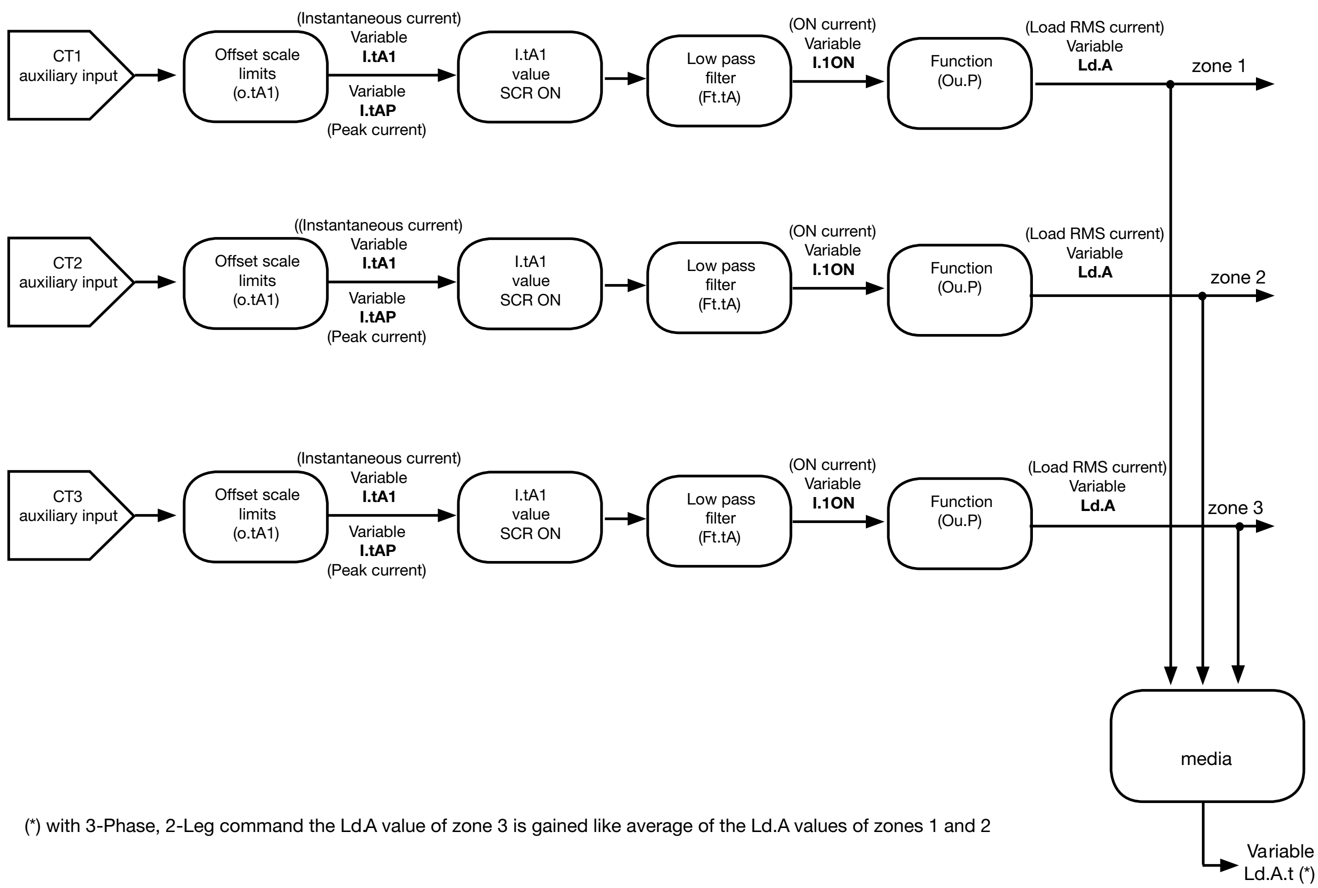
219	Ft.tA	R/W	CT input digital filter		0.0 ... 20 sec		0.1 zone 1	0.1 zone 2	0.1 zone 3
Sets a low pass filter on the CT auxiliary input, running the average of values read in the specified time interval. If = 0 , excludes the average filter on sampled values.									

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	LD V.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

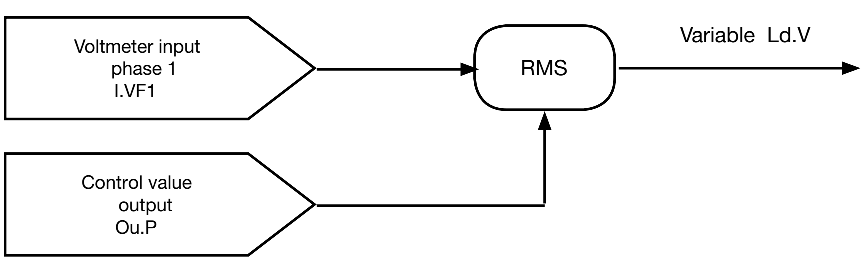
Advanced Settings

Input Filter

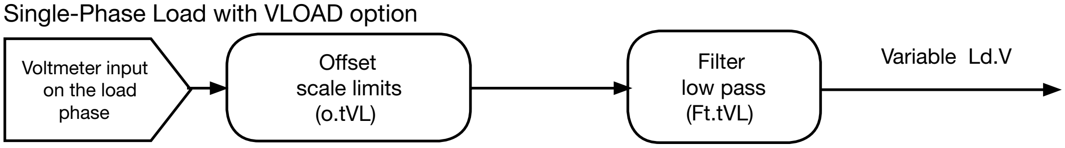
442	FT.T VL	R/W	Digital filter ingress transformer voltmetrics TV_LOAD		0.0 ..20.0 sec		0.1 zone 1	0.1 zone 2	0.1 zone 3

Functional Diagram

Single-Phase Load without VLOAD option

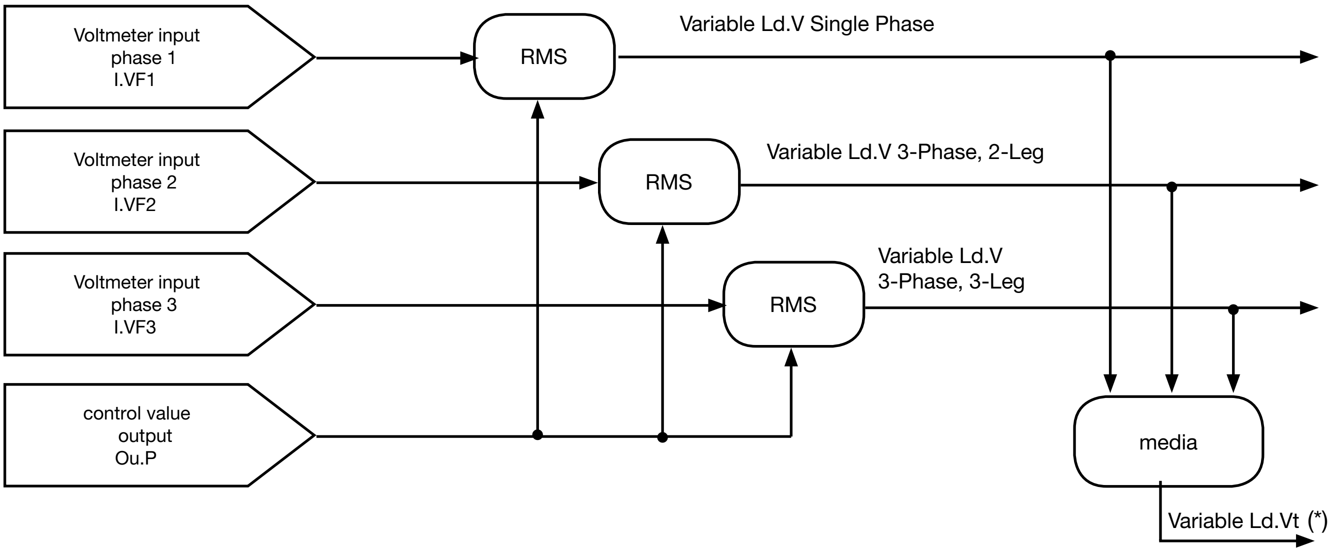


Single-Phase Load with VLOAD option

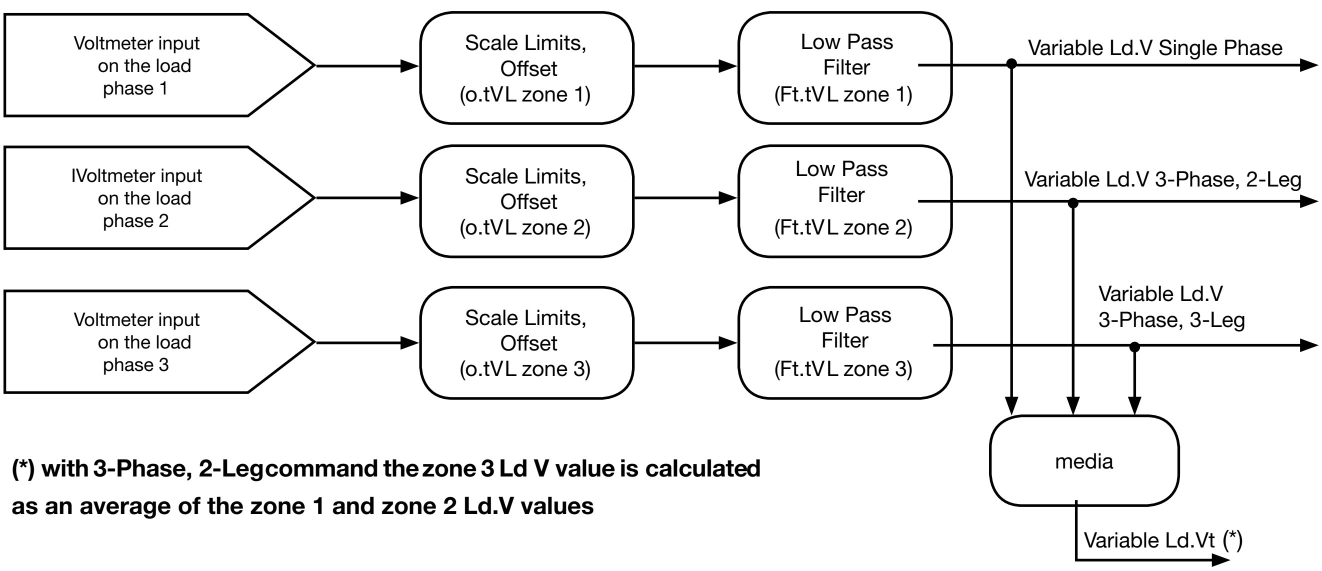


Functional Diagram

Three-Phase Load without VLOAD option



Three-Phase Load with VLOAD option



(*) with 3-Phase, 2-Legcommand 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	LT V1	R	Minimum limit of TV voltmeter input scale (phase 1)				
454	LT V2	R	Minimum limit of TV voltmeter input scale (3-phase, 2-leg)			with 3-Phase Load	
455	LT V3	R	Minimum limit of TV voltmeter input scale (3-phase, 3-leg)			with 3-Phase Load	
410	HT V1	R	Maximum limit of TV voltmeter input scale (phase 1)				
417	HT V2	R	Minimum limit of TV voltmeter input scale (3-phase, 2-leg)			with 3-Phase Load	
418	HT V3	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	I VF1	R	Value Filtered of voltmeter input (phase 1)		
496	I VF2	R	Value Filtered of voltmeter input (3-phase, 2-leg)		With 3-Phase Load
497	I VF1	R	Value Filtered of voltmeter input (3-phase, 3-leg)		With 3-Phase Load

702			Voltage status
315	FREQ	E	Voltage frequency 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

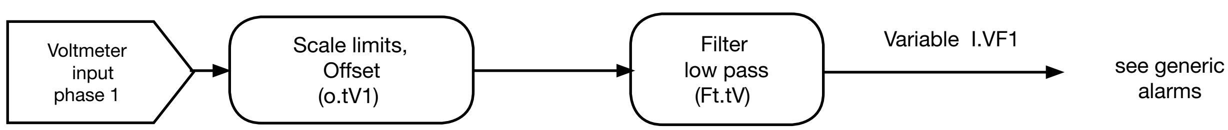
Input Filter

412	FTT U	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

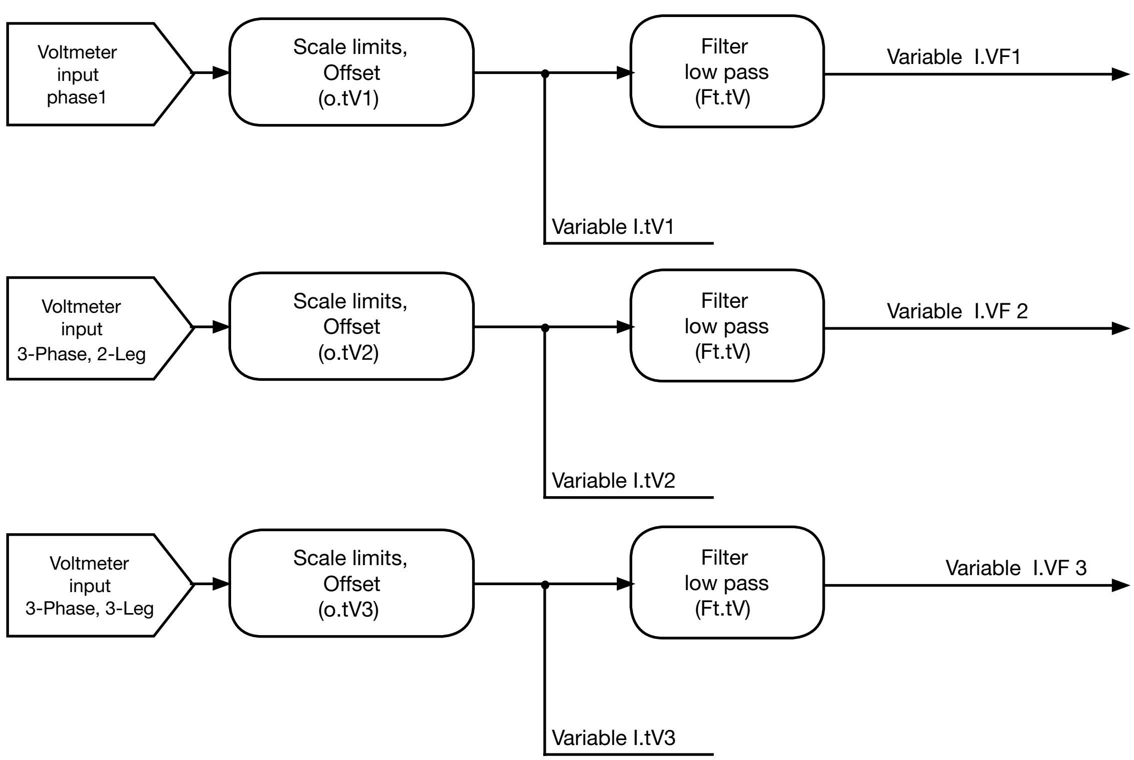
Sets a low pass filter on the auxiliary TV input, running the average of values read in the specified time interval. If = 0 , excludes the average filter on sampled values.

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.

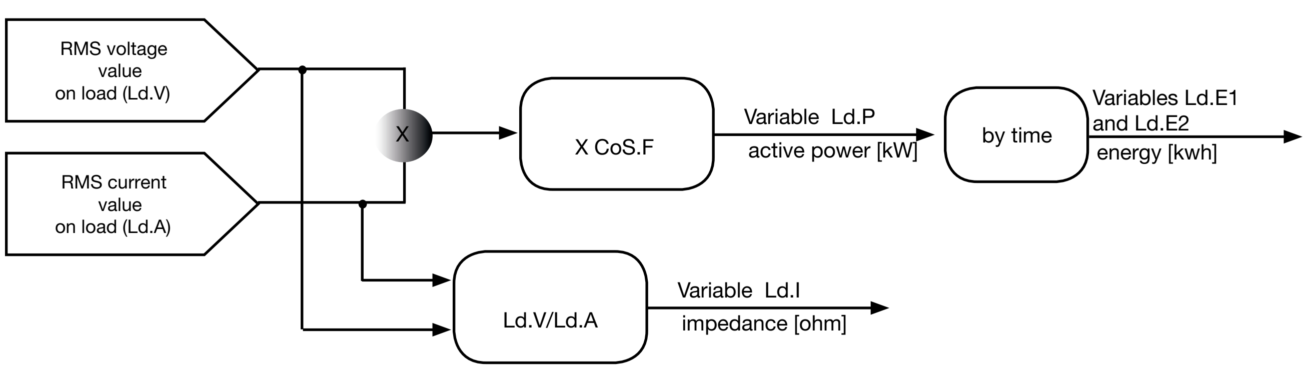
If zone 1 has a 3-phase load, variable Ld.P.t shows power and Ld.I.t total impedance, the corresponding energy value in variables Ld.E1.t and Ld.E2.t.

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	LDI	R	Impedance on load	
750	LDIT	R	Impedance on load 3-phase	
531	LDE1	R	Energy on load	Data in DWORD (32 bit) format
541	LD8T	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	LD8T	R	Energy on 3-phase load	Data in DWORD (32 bit) format
114 bit	LDE1	R/W	OFF = - ON = Reset Ld.E1	
115 bit	LDE2	R/W	OFF = - ON = Reset Ld.E1	

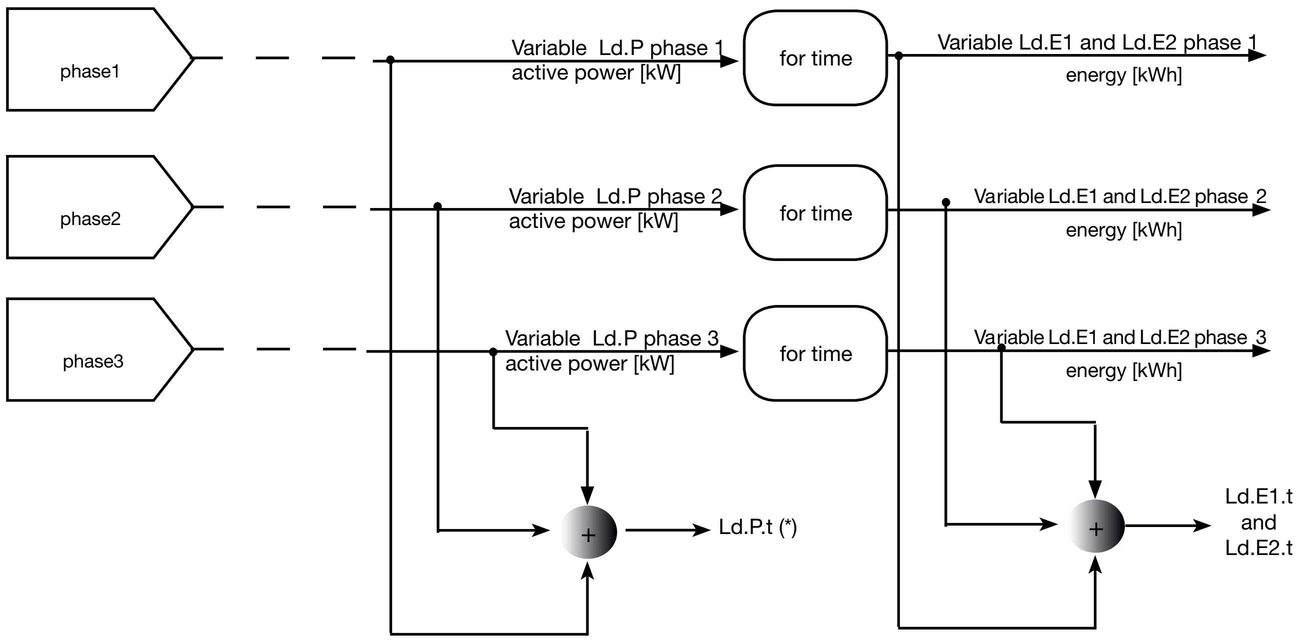
Functional Diagram

Single-phase load

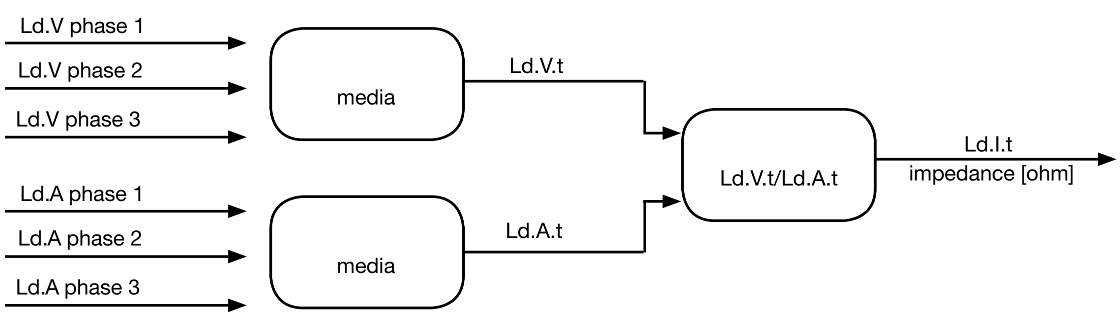


Functional Diagram

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



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	DIG.	R/W	Digital Input Function
618	DIG2	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 DIG. only

(**) IN DIG . alternative to serial

694	DIG3	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	dIG.	R/W	Digital Input Function	0
618	dIG.2	R/W	Digital Input 2 Function	0
694	dIG.3	R/W	Digital Input 3 Function	0
712	dIG.4	R/W	Digital Input 4 Function	0

	Digital Input Functions Table	Activation
0	No functions (input off)	On leading edge
1	MAN / AUTO controller	On leading edge
4	AL1, ..., AL4 alarms memory reset	On state
6	Software ON/OFF	On leading edge
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
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 ACPC-M	On leading edge
66	Reference calibration of retroaction selected by Hd.6 for ACPC-E1	On leading edge
67	Reference calibration of retroaction selected by Hd.6 for ACPC-E2	On leading edge
68	Calibration threshold alarm HB for ACPC-M	On leading edge
69	Calibration threshold alarm HB for ACPC-E1	On leading edge
70	Calibration threshold alarm HB for ACPC-E2	On leading edge
71	MAN / AUTO ACPC-M	On leading edge
72	MAN / AUTO ACPC-E1	On leading edge
73	MAN / AUTO ACPC-E2	On leading edge
74	ON / OFF Software ACPC-M	On leading edge
75	ON / OFF Software ACPC-E1	On leading edge
76	ON / OFF Software ACPC-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	TP.DG	R/W	Defining type of digital inputs	0

	Table defining type of digital inputs
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	FTP WM1	R/W	Digital low-pass filter PWM input 1		0.0 ..20.0 sec		0.1
372	FTP WM 2	R/W	Digital low-pass filter PWM input 2		0.0 ..20.0 sec		0.1
373	FTP WM 3	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

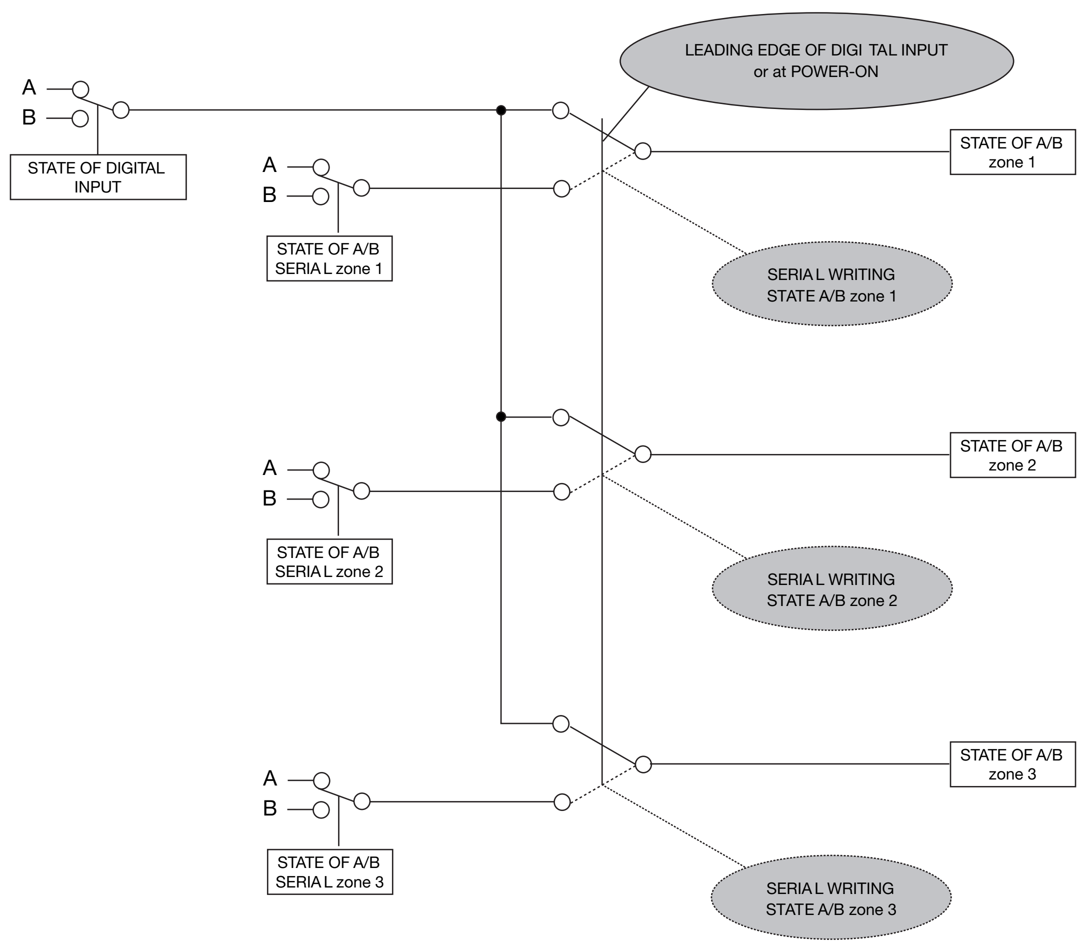
Using a Function Associated with Digital Input and Via Serial

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 (ACPC-M)

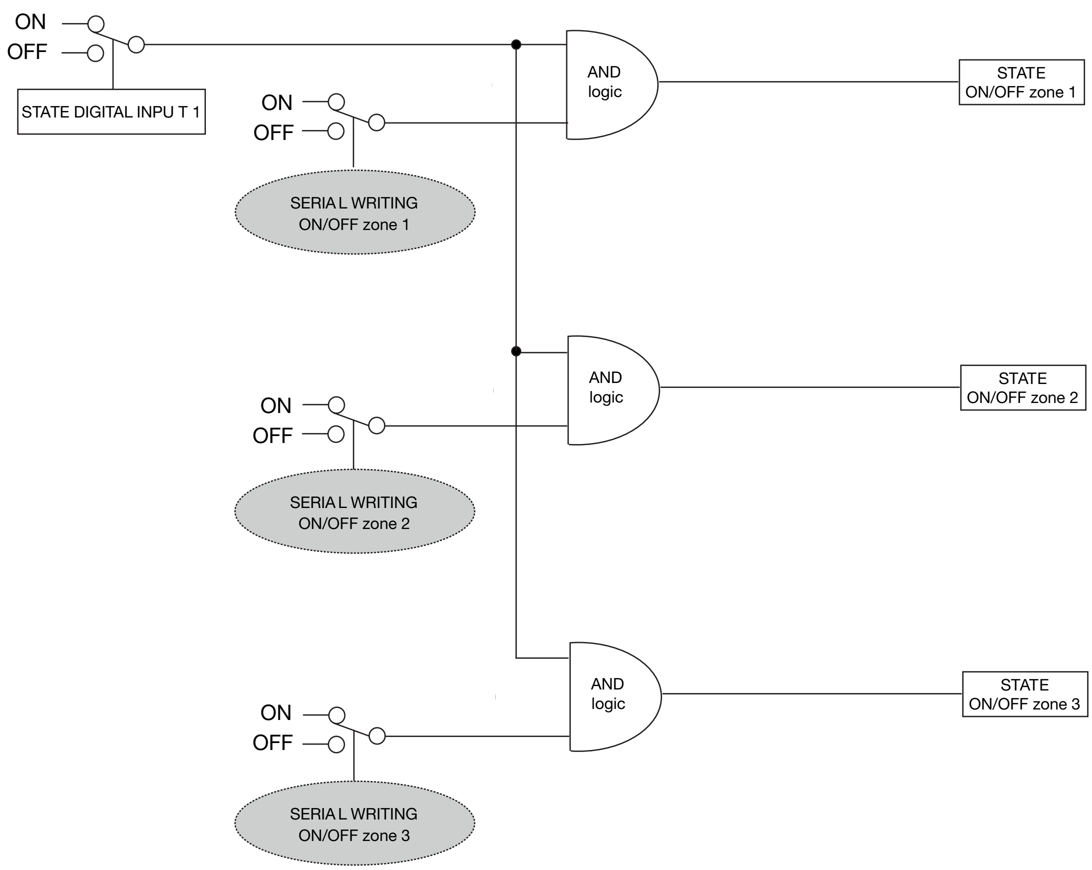


Using a Function of Digital Input 1 to Enable at Software ON

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.

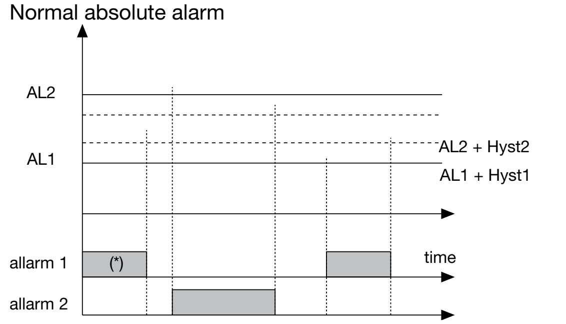
- set the hysteresis value for the alarm (parameters Hy.1, Hy.2, Hy.3 and Hy.4):

  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.

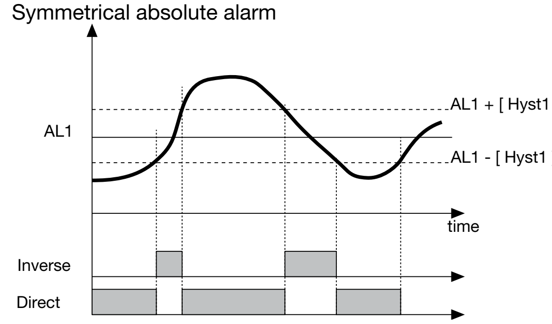
The above concepts are better explained in the following figures:

Normal absolute alarm



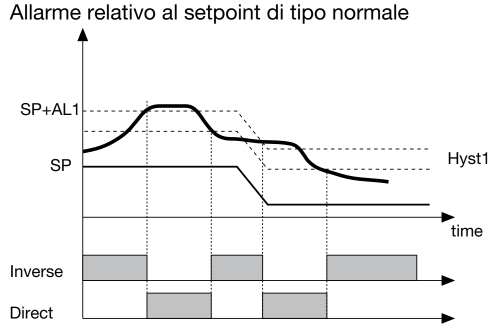
For AL1 reverse absolute alarm (low) with positive Hyst1, AL1 t = 1 (*) = OFF if disabled at switch on
For AL2 direct absolute alarm (high) with negative Hyst2, AL2 t = 0

Symmetrical absolute alarm



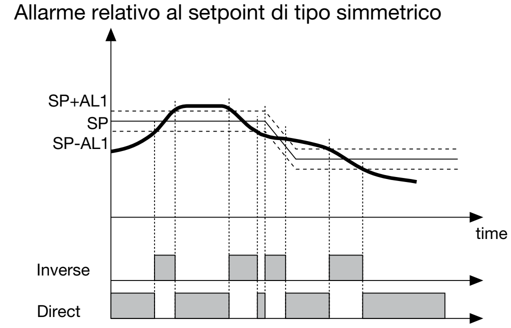
For AL1 = symmetrical inverse absolute alarm with Hyst1, AL1 t = 5
For AL1 = symmetrical direct absolute alarm with Hyst1, AL1 t = 4
Minimum hysteresis = 2 scale points

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	0
216	A2R	R/W	Select Reference Variable Alarm 2	0
217	A3R	R/W	Select Reference Variable Alarm 3	0
218	A4R	R/W	Select Reference Variable Alarm 4	0

Table of Alarm Reference Setpoints

Type	Variable to be Compared	Reference Setpoint
0	PV (process variable)	AL
1	in.tA1 (In.tA1 OR In.tA2 OR In.tA3 With 3-phase load)	AL
2	In.tV1 (In.tV1 OR In.tV2 OR In.tV3 With 3-phase load)	AL
3	SPA (active setpoint)	AL (absolute only)
4	PV (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)

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		0

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

Table of Enabled Alarms				
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	0G.	R/W	Digital Input Function	0
618	0G.2	R/W	Digital Input Function 2	0
694*	0G.3	R/W	Digital Input Function 3	
712*	0G.4	R/W	Digital Input Function 4	

* For 400 to 600A models only.

Digital Input Functions Table	
0	No function (input off)
1	MAN /AUTO controller
2	LOC / REM
3	HOLD
4	AL1, ..., AL4 latch alarm reset
5	SP1 / SP2 selection
6	Software on/off
7	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)

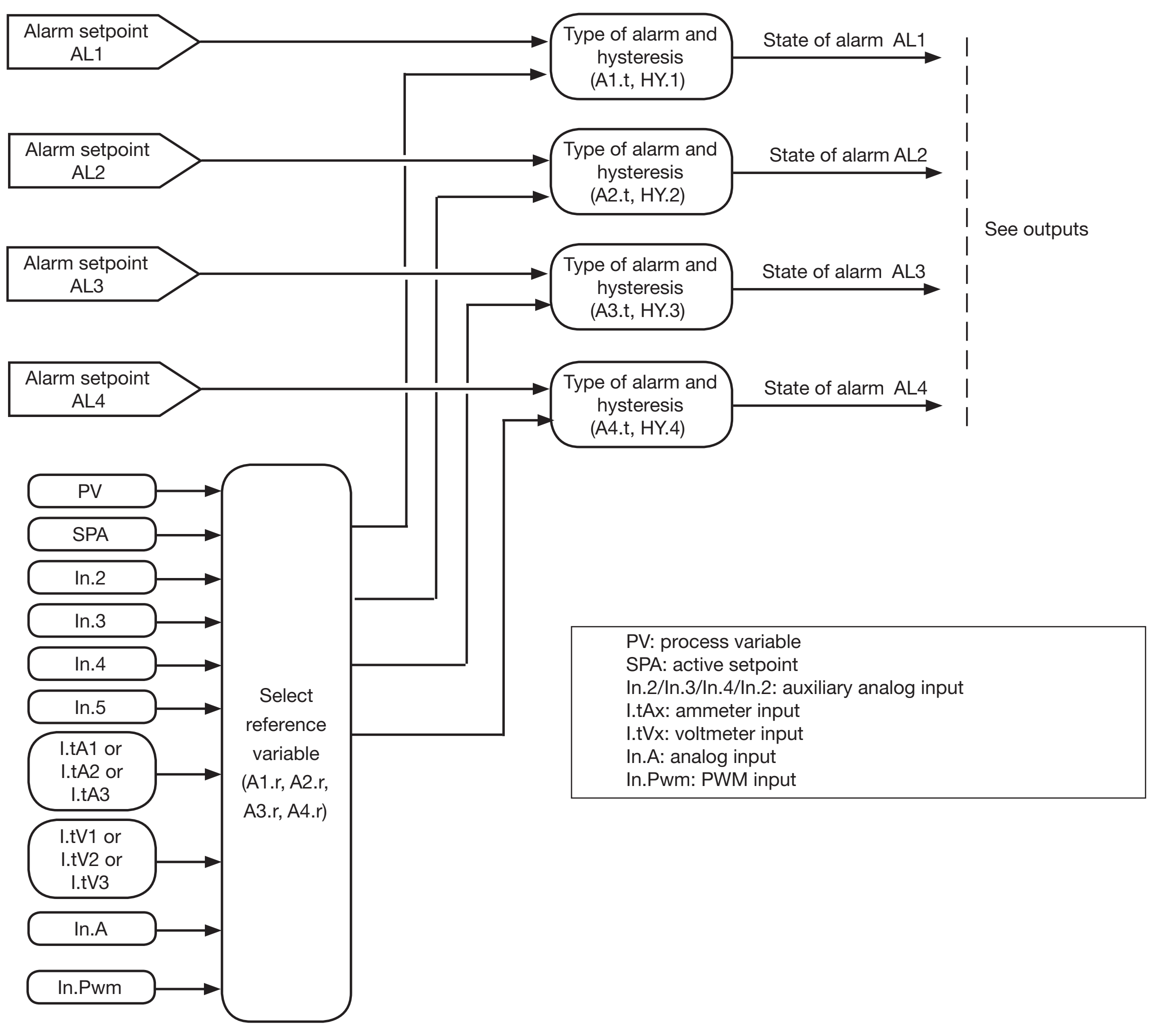
79 bit	Reset Memory Latch	R/W	

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

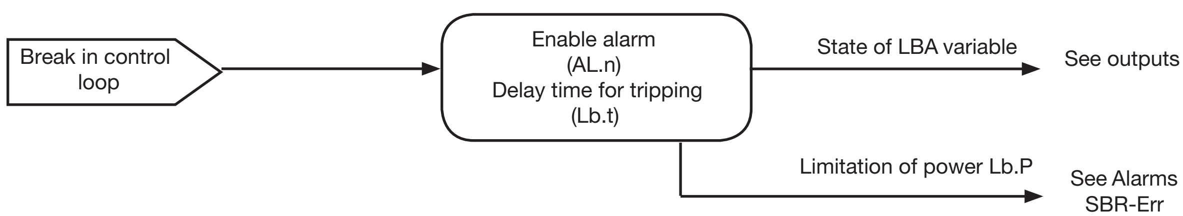
195	AL.n	R/W	Select number of enabled alarms		See Table of Enabled Alarms		0
44	Lb.t	R/W	Delay time for tripping LBA Alarm		0.0 ... 500.0 min	If Lb.t = 0, the LBA alarm is disabled	30.0
119	Lb.P	R/W	Limitation of power delivered in presence of LBA alarm		-100.0 ..100.0%		25.0

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 ACPC 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	AHB	R/W	HB alarm setpoint (scale points ammeter input - Phase 1)		10.0 Zone 1	10.0 Zone 2	10.0 Zone 3
502	AHB2	R/W	HB alarm setpoint (scale points ammeter input - Phase 2)	With 3-phase load	10.0		
503	AHB3	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	HBT V	R/W	TV read in HB calibration		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
743	HBP W	R/W	Ou.P power in calibration		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
758	IRTA0	R/W	HB calibration with IR lamp current at 100% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
759	IRTA	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	IRT V0	R/W	HB calibration with IR lamp Voltage at 100% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
446	IRT V1	R/W	HB calibration with IR lamp Voltage at 50% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
447	IRT V2	R/W	HB calibration with IR lamp Voltage at 30% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
448	IRT V3	R/W	HB calibration with IR lamp Voltage at 20% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3

449	IRT V4	R/W	HB calibration with IR lamp Voltage at 15% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
450	IRT V5	R/W	HB calibration with IR lamp Voltage at 10% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
451	IRT V6	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	IRT V7	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	IRT V8	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	IRT V9	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

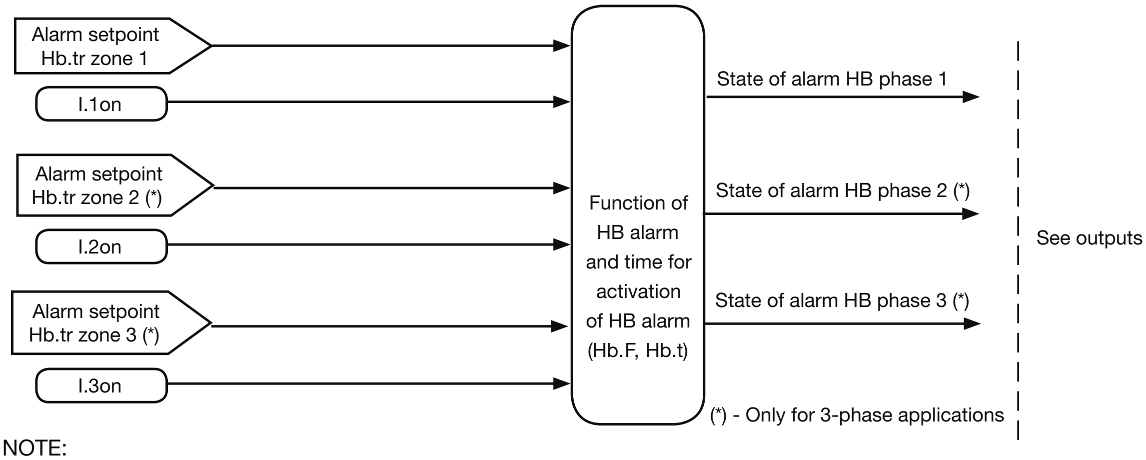
318		R	States of alarm ALSTATE IRQ

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

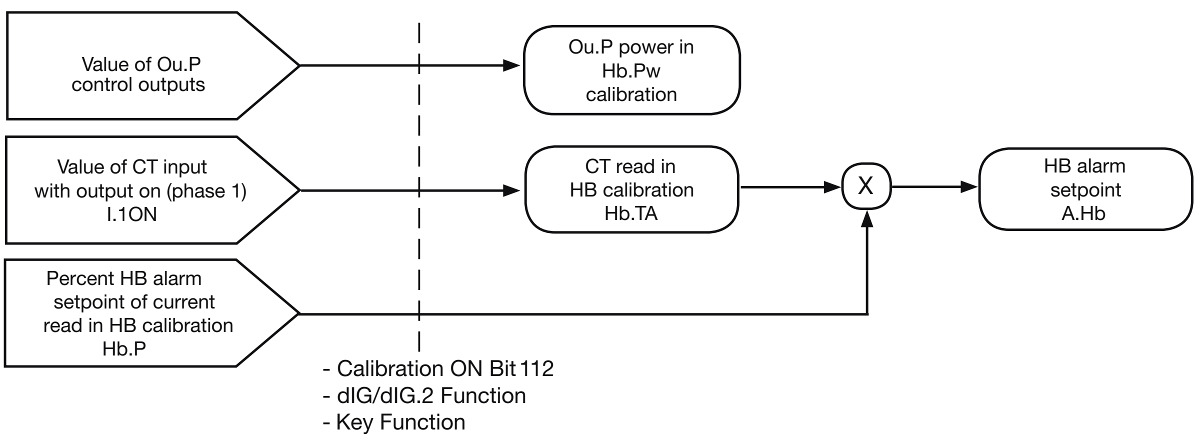


NOTE:
the value of setpoint Hb.tr for the HB alarm is calculated in two different ways, depending on the selected function mode:

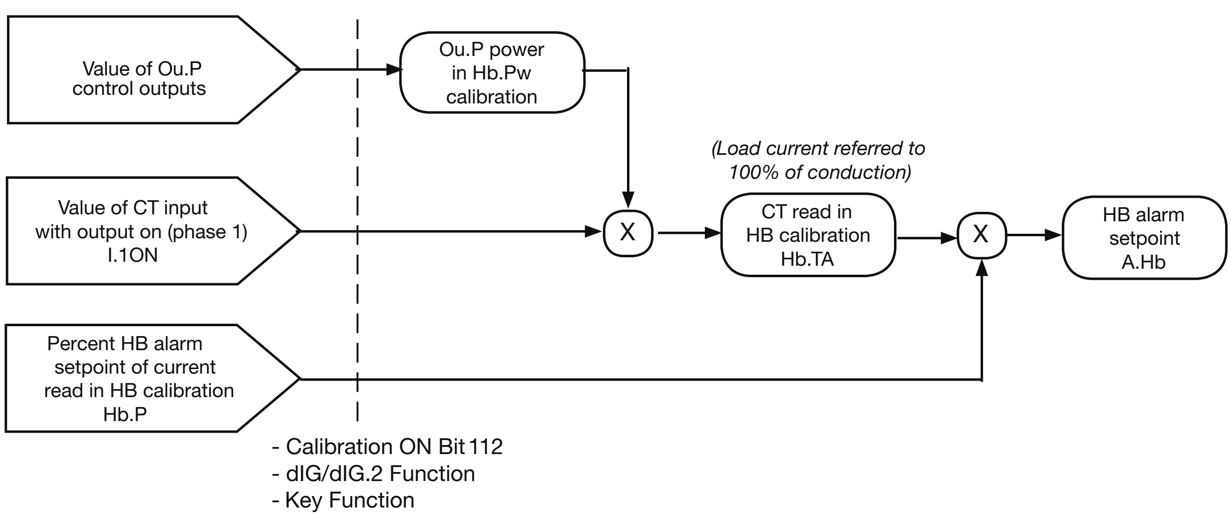
if ZC, BF, HSC mode: .... Hb.tr = A.Hb

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

HB Calibration in modes ZC - BF - HSC



HB Calibration in mode PA



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 ACPC-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 ACPC-Xtra models, the number of times the over-current 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.0	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*	FO0	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: ACPC 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

0 Zone 1	0 Zone 2	0 Zone 3
1 Zone 1	1 Zone 2	1 Zone 3

Table of Reference Signals

	Function
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

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

166	AL.3	R/W	Allocation of reference signal	Value	Function	2 Zone 1	2 Zone 2	2 Zone 3
				2	AL1 - alarm 1			
170	AL.4	R/W	Allocation of reference signal	3	AL2 - alarm 2			
				4	AL3 - alarm 3			
171	AL.5	R/W	Allocation of reference signal	5	AL.HB or POWER_FAULT w/ HB alarm (TA1 OR TA2 OR TA3)	35 Zone 1	35 Zone 2	35 Zone 3
				6	LBA - LBA alarm			
172	AL.6	R/W	Allocation of reference signal	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 (ACPC-M)

						DIP 5 = OFF (Resistive load)		
152* 9	Ct1	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	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

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	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		1
0	Output disabled	2
1	Output rL.1 zone 1	
2	Output rL.1 zone 2	3
3	Output rL.1 zone 3	
4	Output rL.1 zone 4	4
5	Output rL.2 zone 1	
6	Output rL.2 zone 2	5
7	Output rL.2 zone 3	
8	Output rL.2 zone 4	6
9	Output rL.3 OR rL.5 zone 1	
10	Output rL.3 OR rL.5 zone 2	7
11	Output rL.3 OR rL.5 zone 3	
12	Output rL.3 OR rL.5 zone 4	8
13	Output rL.4 AND rL.6 zone 1	
14	Output rL.4 AND rL.6 zone 2	9
15	Output rL.4 AND rL.6 zone 3	
16	Output rL.4 AND rL.6 zone 4	17
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**

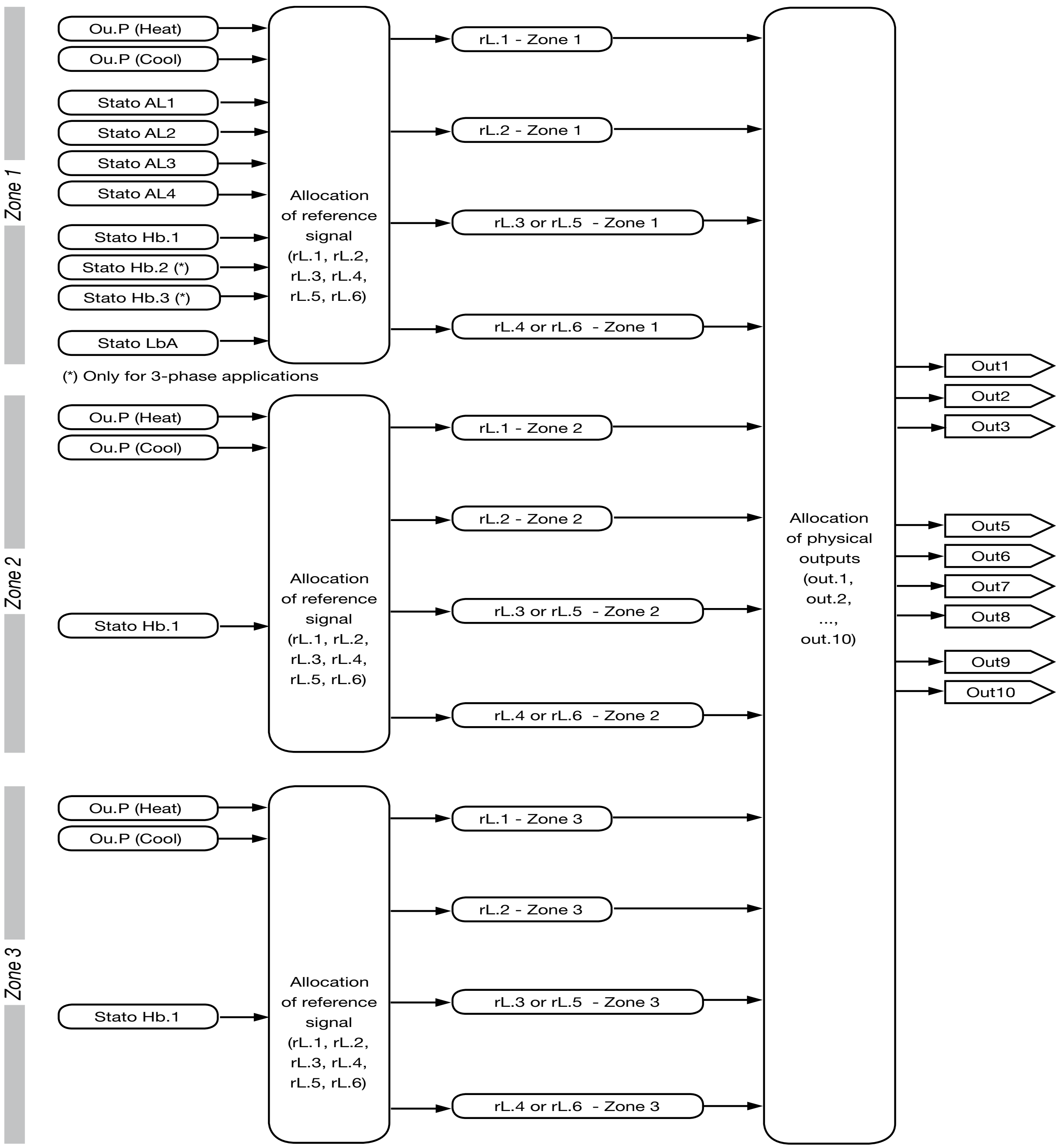
*Address 18 is for 40-300A Models **Address 50 is for 400-600A Models

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 ACPC-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 ACPC-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	TPAO	R/W	Output type analog 1	1
866	TPAO2	R/W	Output type analog 2	
867	TPAO3	R/W	Output type analog 3	

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

868	RFAO	R/W	Attribution reference output analog 1	0
869	RFAO2	R/W	Attribution reference output analog 2	0
870	RFAO3	R/W	Attribution reference output analog 3	0

	Table of Reference Signals	Scale Setting limits Min	Max	Limit of Meas.
0	NONE	0	65535	-
1	Ou.P (control output) of ACPC-M	0.0	100.0	%
2	Ou.P (control output) of ACPC-E1	0.0	100.0	%
3	Ou.P (control output) of ACPC-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 ACPC-M	0.0	6553.5	V
11	I.VF1 (line voltage) of ACPC-E1	0.0	6553.5	V
12	I.VF1 (line voltage) of ACPC-E2	0.0	6553.5	V
13	Ld.V (voltage on load) of ACPC-M	0.0	6553.5	V
14	Ld.V (voltage on load) of ACPC-E1	0.0	6553.5	V
15	Ld.V (voltage on load) of ACPC-E2	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 ACPC-M	0.0	6553.5	A
18	Ld.A (current on load) of ACPC-E1	0.0	6553.5	A
19	Ld.A (current on load) of ACPC-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 ACPC-M	0.0	6553.5	kW
22	Ld.P (power on load) of ACPC-E1	0.0	6553.5	kW
23	Ld.P (power on load) of ACPC-E2	0.0	6553.5	kW
24	Ld.P.t (power on 3-phase load) Serial	0.0	6553.5	kW
25	line value	0.0	6553.5	-

Controls

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.

Address	Code	R/W	Description	Range	Notes	Default / Zone 1	Zone 2	Zone 3
252*		R/W	MANUAL_POWER	-100.0... 100.0%		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
2 132-471	OUP	R	Value of control outputs (+Heat / -Cool)	(W-only in manual mode at address 252)		0		
140	DG	R/W	Digital Input Function	See: Table of digital input functions		0		
618	DG2	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*	DIG3	R/W	Digital input function 3	-100.0 ... 100.0%		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
712*	DIG3	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

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%.

Address	Code	R/W	Description	Range	Notes	Default
505	RIF	R/W	Line Voltage	0.0 ...999.9		0.0

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

Address	Code	R/W	Description	Range	Notes	Default
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)

+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			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 shutdown function.
3) In case of switch-on after SW shutdown, any ramp for the set (set gradient) starts from the PV.
4) Outputs OFF: except for 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	DIG	R/W	Digital Input Function	See: Table of digital input functions		0.0
618	DIG2	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	0
				1	Outputs rL.1- rL.2 - rL.3 - rL.5 = OFF Outputs rL.4 - rL.6 = ON Alarms AL.1 -AL.2 -AL.3 - AL.4 enabled	
				+16	Restart of the Softstart at the switch-on software (ON Software)	
694*	DG3	R/W	Digital Input 3 Function	See: Table of digital input functions		0.0
712*	DG4	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	HOT	R/W	Select Specialized Control Functions		See: Hot runners table - Setpoint Settings		0
228	FAP	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.

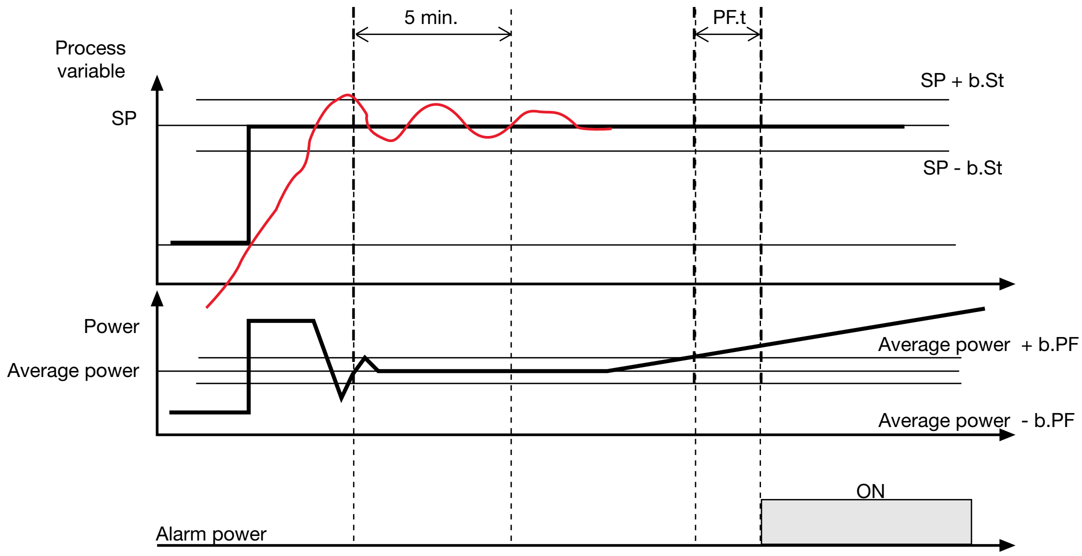
Set the band (b.ST) within which the process variable is considered stable after 300 sec. have elapsed.

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, 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

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	RL1	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	CT1.	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 ACPC 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).

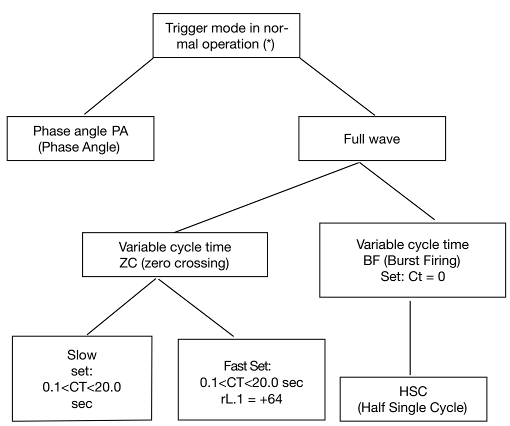
HSC Half Single Cycle: this mode corresponds to a BF that includes ON and OFF half-cycles. It is useful for reducing flicker with short-wave IR loads (and is applied only to single-phase or 3-phase with neutre or open delta loads).

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 ACPC with Control Option = 0 Hd.5 = 141 Option for ACPC 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

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

Dip 5 - OFF Resistive Load		
133/141 Zone 1	133/141 Zone 2	133/141 Zone 3
Dip 5 - ON Inductive Load		
32 Zone 1	32 Zone 2	32 Zone 3

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

		Model 200A		
0.0...3275.0A		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*	PSHI	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*	PSTM	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 ACPC	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 ACPC 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 data-sheet (ref.** ACPC **Installation Guide).

730*	HD6	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*	COR V	R/W	Maximum correction of voltage feedback	0.0 ...100.0%		100.0 Zone 1	100.0 Zone 2	100.0 Zone 3
732*	COR	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*	RF V	R/W	Voltage feedback reference	0.0 ...999.9 V		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
735*	RF V	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	RFP	R/W	Power feedback reference	0.0...320.00 kW		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
741*	FBT	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	RRF	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.

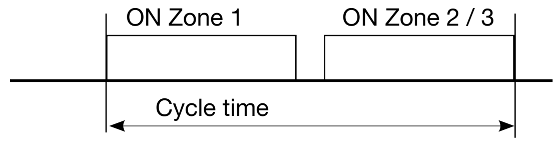
In the single cycle time for the enabled zones, the delivery of power may be reduced to respect the maximum current limit.

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

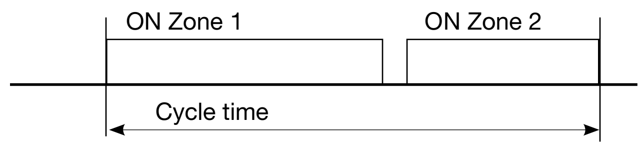
Ptot = P1+ P2 (if P2>P3) + P3 (if P3>P2)

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 ACPC with CTs present and outputs OUT1...OUT3 with slow cycle time [illegible]

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 hetergogeneous 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	SIn	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	SLI	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	= ACPC-M no power
7	= 1 ACPC-M 40A
8	= 1 ACPC-M 60A
9	= 1 ACPC-M 100A
10	= 1 ACPC-M 150A
11	= 1 ACPC-M 200A
12	= 1 ACPC-M 250A
13	= 1 ACPC-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	CHO2	R	Hardware configuration codes 2

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

543	CHO3	R	Hardware configuration codes 3

Table of hardware configuration codes 3	
bit	
0	= 1 ACPC-M 300A
1	= 1 ACPC-E1 300A
2	= 1 ACPC-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	UPO	R	Software version code

190	CHO	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	= ACPC-M no power
7	= 1 ACPC-M 200A
8	= 1 ACPC-M 400A
9	= 1 ACPC-M 600A
10	= -
11	= -
12	= -
13	= -
14	= 1 EXTERNAL CT (for all models: 1PH/2PH/3PH)
13	= 1 ACPC-M Xtra
12	= 1 ACPC-M 250A

508	CH01	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	CH02	R	Hardware configuration codes 2

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

693 697	UP0F	R	Fieldbus software version
695	C00F	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	F9 ZE	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 (ACPC)	Product ID	214

197	LOST	R/W	RN LED Status Function	16
619	LD2	R/W	ER LED status function	12
620	LD3	R/W	Function of LED DI1	6
621	LD4	R/W	Function of LED DI2	11

Table of RN LED Functions	
Value	Function
0	RUN
1	MAN/AUTO Controller
2	LOC/REM
3	HOLD
4	Selftuning ON
5	Autotuning ON
6	Repeat Digital Input D1
7	Serial 1 Dialog
8	State of OUT 2 Zone 1
9	Softstart Running
10	Indication of SP1...SP2 (SP1 with pilot input inactive and LED Off)
11	Repeat Digital Input D2
12	Input in Error (LO, HI, ERR, SBR)
13	Serial 2 Dialog
14	Repeat digital input INDIG3
+ 16	LED Flashing if Active (Code 8 Excluded)

622	LO5	R/W	Function of LED O1
623	LO6	R/W	Function of LED O2
624	LO7	R/W	Function of LED O3
625	LO8	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)	Table of state settings	0 Zone 1	0 Zone 2	0 Zone 3
698		R	State saved in eeprom (STATUS_W_EEP)		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 (*)

(*) Only for zone 1 (ACPC-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

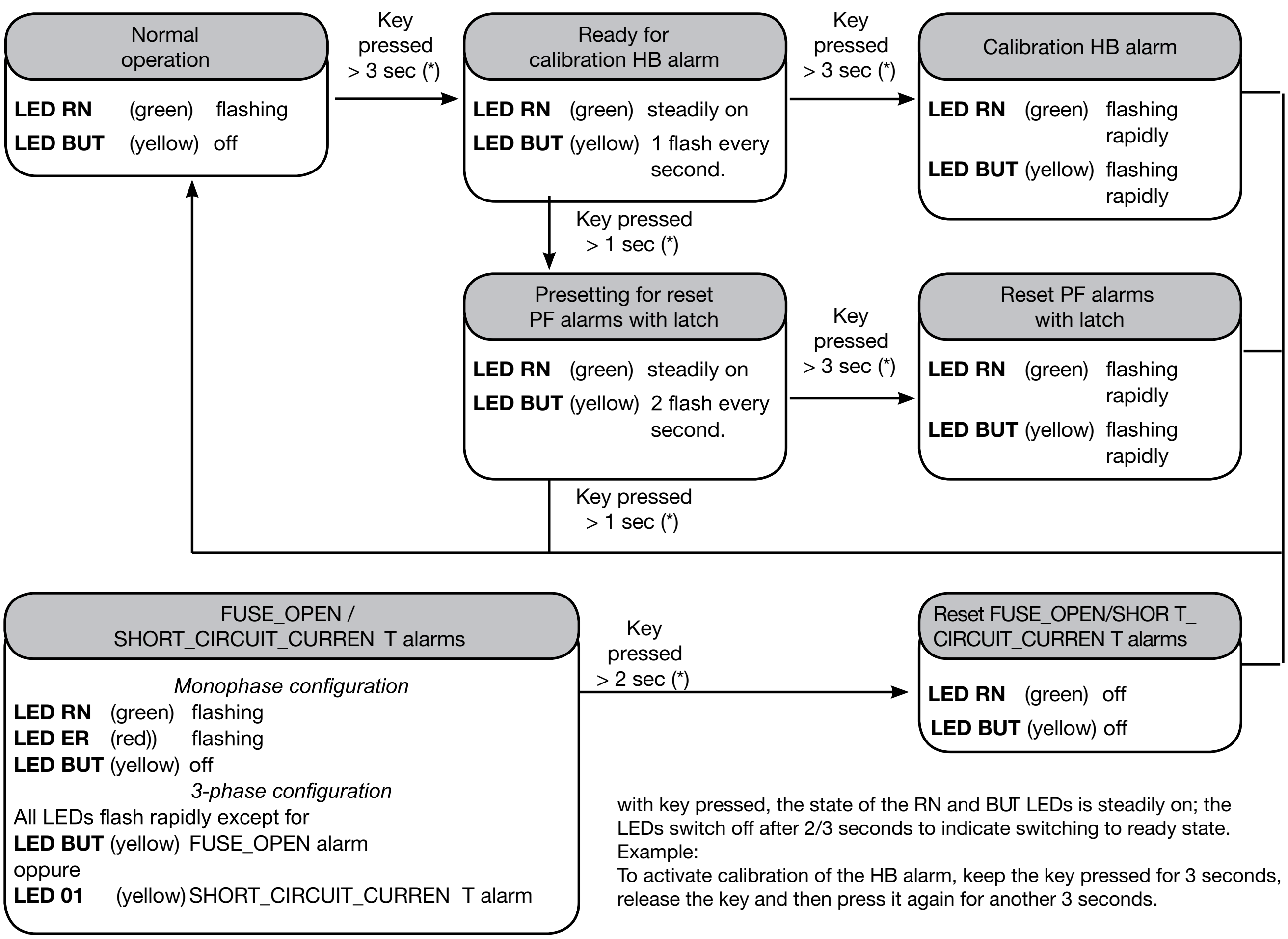
469*		R	State 1 (STATUS 1)	Table of State 1

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

Installation of Modbus Serial Network

Definition of Parameter				Note	Assigned Value
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

Definition of Parameter				Note	Assigned Value
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

Definition of Parameter				Note	Assigned Value
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		

179	FL0	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	S.22	R/W	Engineering value attributed to Point 22			
109	S.23	R/W	Engineering value attributed to Point 23			
110	S.24	R/W	Engineering value attributed to Point 24			
111	S.25	R/W	Engineering value attributed to Point 25			
112	S.26	R/W	Engineering value attributed to Point 26			
113	S.27	R/W	Engineering value attributed to Point 27			
114	S.28	R/W	Engineering value attributed to Point 28			
115	S.29	R/W	Engineering value attributed to Point 29			
116	S.30	R/W	Engineering value attributed to Point 30			
117	S.31	R/W	Engineering value attributed to Point 31			
118	S.32	R/W	Engineering value attributed to Point 32 (max. value of input scale)			
293	S.33	R/W	Engineering value attributed to minimum value of the input scale			
294	S.34	R/W	Engineering value attributed to maximum value of the input scale.			
295	S.35	R/W	Engineering value of input signal corresponding to 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	LOA	R	Current RMS on load		
754	LOAT	R	Current RMS on 3-phase load		

Value of Load Voltage

751*	LO. V	R	Voltage on load	
710*	LO. VIS	R	Load voltage instantaneous	
711*	LO. VON	R	Load voltage with output activated	
752	LO V.T	R	Voltage on 3-phase load	

Line Voltage Value

453*	LT V1	R	Minimum limit of TV voltmeter input scale (phase 1)	
454	LT V2	R	Minimum limit of TV voltmeter input scale (3-phase, 2-leg)	with 3-Phase Load
455	LT V3	R	Minimum limit of TV voltmeter input scale (3-phase, 3-leg)	with 3-Phase Load
410*	HT V1	R	Maximum limit of TV voltmeter input scale (phase 1)	
417	HT V2	R	Minimum limit of TV voltmeter input scale (3-phase, 2-leg)	with 3-Phase Load
418	HT V3	R	Minimum limit of TV voltmeter input scale (3-phase, 3-leg)	with 3-Phase Load
411*	OTU1	R/W	Offset correction voltmeter trans-former input TV (phase 1)	
419	OTU2	R/W	Offset correction voltmeter trans-former 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*	! VF1	R	Value Filtered of voltmeter input (phase 1)	
496	! VF2	R	Value Filtered of voltmeter input (3-phase, 2-leg)	With 3-Phase Load
497	! VF1	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*	FREQ	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*	LdI	R	Impedance on load	
750	LdIT	R	Impedance on load 3-phase	
531	LdE1	R	Energy on load	
541	Ld8T	R	Energy on 3-phase load	
510	LdE2	R	Energy on load	
541	Ld8T	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 Input

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			
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	A1R	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	AL1	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	HY1	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	A1T	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	DIG2	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*	HBT V	R/W	TV read in HB calibration		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
743*	HBP W	R/W	Ou.P power in calibration		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
758*	IRTA0	R/W	HB calibration with IR lamp current at 100% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
759*	IRTA	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*	IRT V0	R/W	HB calibration with IR lamp Voltage at 100% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
446*	IRT V1	R/W	HB calibration with IR lamp Voltage at 50% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
447*	IRT V2	R/W	HB calibration with IR lamp Voltage at 30% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
448*	IRT V3	R/W	HB calibration with IR lamp Voltage at 20% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
449*	IRT V4	R/W	HB calibration with IR lamp Voltage at 15% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
450*	IRT V5	R/W	HB calibration with IR lamp Voltage at 10% conduction		0.0 Zone 1	0.0 Zone 2	0.0 Zone 3
451*	IRT V6	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*	IRT V7	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*	IRT V8	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*	IRT V9	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*	H02	R/W	Enable POWER_FAULT Alarms		
661	OGT	R/W	Refresh rate in TA (Only For C4 1TA)		
662*	OGF	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.0	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*	FO.c	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	OUT10	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)

Automatic/Manual Control

252*		R/W	MANUAL_POWER			
2 132-471	OUP	R/W	Value control outputs (+Heat / -Cool)			
140	DIG	R/W	Digital input function			
618	DIG2	R/W	Digital input function 2			
1 bit	AUTO/MAN	R/W	OFF = Automatic ON =Manual			
305		R/W	Instrument state			

Hold Funtion

140	DIG	R/W	Digital input function			
618	DIG2	R/W	Digital input function 2			
64 bit	HOLD	R/W	OFF = hold off ON = hold on			

Manual Power Correction

505*	RIF	R/W	Line voltage			
506*	COR	R/W	Manual power correction based on line voltage			
18 136-249	SPR	R/W	Remote setpoint (SET Gradient for power correction			

Software Shutdown

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

Software Power On

140	DIG	R/W	Digital input function			
618	DIG2	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*	RL1	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			

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*	PSHI	R/W	Maximum phase of phase softstart ramp				
705*	PST m	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*	H06	R/W	Enable feedback modes					
731*	COR V	R/W	Maximum correction of voltage feedback					
732*	COR	R/W	Maximum correction of current feedback					
733*	CORP	R/W	Maximum correction of power feedback					
734*	RF V	R/W	Voltage feedback reference					
735*	RF V	R/W	Voltage feedback reference					
736*	RFP	R/W	Power feedback reference					
741*	FBT	R/W	Feedback response speed					
113* bit	Calibration of voltage feedback reference	R/W	OFF = Calibration not enabled ON = Calibration enabled					
757*	RRF	R	Feedback		Setpoint of V, I, P to maintain on load			

Heuristic Power Control

680	H03	R/W	Enable heuristic power control			
681	IHEU	R/W	Maximum current for heuristic power control			

Heterogeneous Power Control

682	H04	R/W	Enable heterogeneous power control			
683	IHET	R/W	Maximum current for heterogeneous power control			

Virtual Instrument Control

191	H01	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	
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

				Note	Assigned Value
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

				Note	Assigned Value
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	HSA1	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	OFSA1	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*	LOA	R	Current RMS on load	
754	LOAT	R	Current RMS on 3-phase load	
219	FT.TA	R/W	CT ammeter input digital filter	

Value of Load Voltage

751*	LO. V	R	Voltage on load						
710*	LO. VIS	R	Load voltage instantaneous						
711*	LO. VOn	R	Load voltage with output activated						
752*	LO V.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.T VL	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*	LT V1	R	Minimum limit of TV voltmeter input scale (phase 1)	
454	LT V2	R	Minimum limit of TV voltmeter input scale (3-phase, 2-leg)	
455	LT V3	R	Minimum limit of TV voltmeter input scale (3-phase, 3-leg)	
410	HT V1	R	Maximum limit of TV voltmeter input scale (phase 1)	
417	HT V2	R	Minimum limit of TV voltmeter input scale (3-phase, 2-leg)	
418	HT V3	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*	LDI	R	Impedance on load	
750	LDIT	R	Impedance on load 3-phase	
531*	LDE1	R	Energy on load	
541	LD8T	R	Energy on 3-phase load	
510*	LDE2	R	Energy on load	
541	LD8T	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	PUMT1	R/W	Timeout for input PWM 1	
357	PUMT2	R/W	Timeout for input PWM 2	
362	PUMT3	R/W	Timeout for input PWM 3	
438	FTPLM	R/W	Digital low pass filter input PWM 1	
372	FTPLM2	R/W	Digital low pass filter input PWM 2	
373	FTPLM3	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*	A1R	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	AL1	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	HY1	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*	A1T	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*	ALn	R/W	Select number of enabled alarms
140	DIG	R/W	Digital input function
618	DIG2	R/W	Digital input function 2
694	DIG3	R/W	Digital input function 3
712	DIG4	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*	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
112* bit	Calibration HB alarm setpoint	R	OFF = Calibration not enabled ON = Calibration enabled
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)
742*	HBTA	R/W	CT read in HB calibration
452*	HBT V	R/W	TV read in HB calibration

743*	HBP w	R/W	Ou.P power in calibration				
758*	IRTA0	R/W	HB calibration with IR lamp current at 100% conduction				
759*	IRTA	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*	IRT V0	R/W	HB calibration with IR lamp Voltage at 100% conduction				
446*	IRT V1	R/W	HB calibration with IR lamp Voltage at 50% conduction				
447*	IRT V2	R/W	HB calibration with IR lamp Voltage at 30% conduction				
448*	IRT V3	R/W	HB calibration with IR lamp Voltage at 20% conduction				
449*	IRT V4	R/W	HB calibration with IR lamp Voltage at 15% conduction				
450*	IRT V5	R/W	HB calibration with IR lamp Voltage at 10% conduction				
451*	IRT V6	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 5% conduction				
390*	IRT V7	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 100% conduction				
391*	IRT V8	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 100% conduction				
392*	IRT V9	R/W	HB calibration with IR lamp (only in mode PA) Voltage at 1% conduction				

744*	HBTR	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	DGT	R/W	Refresh rate in TA (Only For C4 1TA)			
662*	DGF	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 FO.0	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	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	OUT10	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	TPAO	R/W	Analog output Type 1			
866	TPAO2	R/W	Analog output Type 2			
867	TPAO3	R/W	Analog output Type 3			
868	RFAO	R/W	Attribution reference analog output 1			
869	RFAO2	R/W	Attribution reference analog output 2			
870	RFAO3	R/W	Attribution reference analog output 3			
871	LSAO	R/W	Minimum scale limit analog output 1			
872	LSAO2	R/W	Minimum scale limit analog output 2			
873	LSAO3	R/W	Minimum scale limit analog output 3			
874	HSAO	R/W	Maximum scale limit analog output 1			
875	HSAO2	R/W	Maximum scale limit analog output 2			
876	HSAO3	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	OUTAO	R	Analog output value 1			
8778	OUTAO2	R	Analog output value 2			
879	OUTAO3	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	DIG1	R/W	Digital input function 1			
618	DIG2	R/W	Digital input function 2			
694	DIG3	R/W	Digital input function 3			
712	DIG4	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	RIF	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	DG	R/W	Digital Input Function 1			
618	DG2	R/W	Digital Input Function 2			
694	DG3	R/W	Digital Input Function 3			

712	0G4	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*	RLI	R/W	Allocation of reference signal			
152*	CTI	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*	PSHI	R/W	Maximum phase of phase softstart ramp					
705*	PSTM	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*	COR V	R/W	Maximum correction of voltage feedback					
732*	COR	R/W	Maximum correction of current feedback					
733*	CORP	R/W	Maximum correction of power feedback					
734*	RF V	R/W	Voltage feedback reference					
735*	RF V	R/W	Voltage feedback reference					
884* 736* LSW only	RFP	R/W	Power feedback reference					
741*	FBT	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	RRF	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	SL1	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	LOST	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.

Chromalox, Inc.
1347 Heil Quaker Boulevard
Lavergne, TN 37086
(615) 793-3900
www.chromalox.com