mecc alte

POWER FROM WITHIN

ATS115 PLUS CONTROLLER

SMARTECH

TECHNICAL MANUAL

This Page Intentionally Left Blank

Revision	Date	Notes
01	01/09/2014	First version of the manual, drawn up for the 01.00 version of the controller.
02	16/09/2014	Second issue
03	29/09/2014	Added ATS115Plus device
04	24/02/2015	Valid for the 01.03 revision of the controller. Added paragraph 12.5.7 Modified paragraphs: 5.4 - 10.4 - 11.5.2.1 - 11.5.4.2 - 12.5.4 - 12.5.7 - 12.6 - 12.8 - 13.1 - 13.2 - 13.3
05	06/03/2015	Valid for the 01.04 revision of the controller. Modified paragraphs: 5.4 - 5.6 - 13.5 (warning 31 and 32)
06	11/05/2016	Valid for the 01.12 revision of the controller. Modified paragraphs: 5.4 - 5.9.1 - 5.10 - 7 - 8 -11.5.3.1 - 11.5.4.2 - 12.1 - 12.6 - 14.2.3
07	15/01/2018	Valid for the 01.16 revision of the controller. Added paragraph 14.2.5 and 14.2.6 Modified paragraphs: 5.10 - 11.4.5 - 11.5.1.3 - 11.5.4.2 - 14.2.1
08	10/05/2019	Valid for the 01.19 revision of the controller. Modified paragraphs: 4.2 - 5.4 - 11.5 - 12.1 - 12.3 - 12.6 - 12.8 - 12.5.1 - 12.5.4 - 12.5.7 - 13 - 13.1 - 13.2 - 13.3 - 13.4 - 13.013 - 13.014 - 13.048 - 13.7xx
09	09/10/2019	Modified paragraphs: 10.4, 11.5.3.9, 11.5.3.10, 12.1, 12.2.2, 12.5.3, 12.5.8
10	16/09/2020	Valid from version 01.21 and later of the board. Modified paragraphs: 5.4 and 12.6

A

D

S

1. Introduction

1.1 General Info

Before using the device, read this manual carefully.

1.2 Reference documents

[1] Mecc Alte EAAM0479xxXA (ATS115 Parameters table)

[2] Mecc Alte EAAS0480xxXA (ATS115 Modbus registers)

[3] Mecc Alte EAAS0341xxEN (Serial communication and SMS procedure)

[4] Mecc Alte EAAM0458xxEN (BoardPRG3.xx Software Manual)

[5] Mecc Alte EAAP0457xxXA (USB driver Installation Guide)

1.3 General considerations and prerequisites

For the appropriate use of this manual it is required knowledge of the use and installation of generator groups.

⚠ WARNING !!!

All interventions must be carried out only by qualified personnel, because there are dangerous voltages on the terminals of the device; prior to performing any operation on them, make sure you have opened the circuit breakers and generator set switches, or that you have removed their fuses.
Do not remove or modify any of the connections while the generator is operating.
Do not, for any reason, disconnect the terminals of the current transformers (CTs).
Incorrect interventions on the connections may cause disconnection of the users from the mains or from the generator.

The device uses a large number of configurable parameters and it is therefore impossible to describe all their possible combinations and effects.

In this document there is not a detailed description of all programming parameters: to this purpose see [1]. The document [1] must be considered integral part of this manual.

The devices are supplied with a generic "default" configuration; it is the installer responsibility to adjust the operating parameters to the desired specific application.

Mecc Alte makes considerable efforts for a continuous improvement and upgrading of its own products; therefore, they are subject to modifications both in hardware and software, without prior notice. Some of the features described in this manual may consequently differ from those present in your device.

1.4 SW3 Switches

IMPORTANT Both SW3 switches must remain in OFF position.

The SW3 switches are reserved for the access to special features that are not part of the normal operation of the device.

If the device is powered with one of the two switches in ON position, it will not turn on. In order to restore the normal operation, you need to cut the power, turn the switches OFF and power it again.

In case the device does not turn on when powered, the first thing you have to do is to check the position of the switches.

1.5 Notes on the configuration of the device parameters

Although most of the parameters and features can be accessed and configured by directly operating on the device, **some particular features or configurations, due to their nature, can only be set or changed through the the Mecc Alte Board Programmer4 PC Software** (hereinafter called "BoardPrg4"), which can be downloaded for free from the Mecc Alte website www.meccalte.com

It greatly simplifies the configuration of the device and its use is strongly recommended. It also allows you to save the current configuration of the device on a file and to reuse it on other identical devices,

The program also allows the configuration, saving or loading of the characteristic curves of non-standard analogue sensors with resistive or live output.

BoardPrg4 can be used on all Mecc Alte devices; the connection to the PC can be realized both directly, via RS232 serial port, USB, or remotely via modem, RS485 serial port or Ethernet network. To use the program refer to document **Error. Reference source not found.**

1.6 Definitions

ACB ("A Circuit Breaker"): the following is used to identify the ATS115 controller circuit breaker to connect the users to source A.

BCB ("B Circuit Breaker"): the following is used to identify the ATS115 controller circuit breaker to connect the users to source B.

SOURCE A: the following is used to identify the generator or mains connected on one side of the ACB circuit breaker.

SOURCE B: the following is used to identify the generator or mains connected on one side of the BCB circuit breaker.

ARREST: the following is used to identify an anomaly that makes impossible the normal operation of the plant.

WARNING: the following is used to identify an anomaly that requires an operation by the operator.

DIF ("Digital Input Function"): the following is a code for the configuration of the digital inputs.

DVF ("Digital Input Virtual Function"): the following is a code for the configuration of the digital virtual inputs.

DOF ("Digital Output Function"): the following is a code for the configuration of the digital outputs.

AIF ("Analogue Input Function"): the following is a code for the configuration of the analogue inputs.

AVF ("Analogue Virtual Function"): the following is a code for the configuration of the virtual analogue inputs.

EVT ("Event"): the following is an event code.

ST ("Status"): the following code shows the status of a dimension or a condition of the device or of one of its functions.

1.7 Conventions

In this document a vertical bar on the right margin indicates that the chapter or the paragraph has been adjusted respect to the previous document's version. Changes in the fields of a table are highlighted with a grey background colour.

1.8 Software revisions

Several parts of this manual refer to the controller software revisions. These revisions are marked with the assigned Mecc Alte code (shown on the rear panel of the controller). The software code version has the following format: EB0250231XXYY, where "XX" is the main revision number and "YY" is the secondary. Thus, the code EB02502310100 refers to the controller software release "01.00". The software revision is also displayed on page "S.05" of the LCD display.

The software codes available at the release date are:

- EB0250244xxyy: ATS115.

2. Views of the device

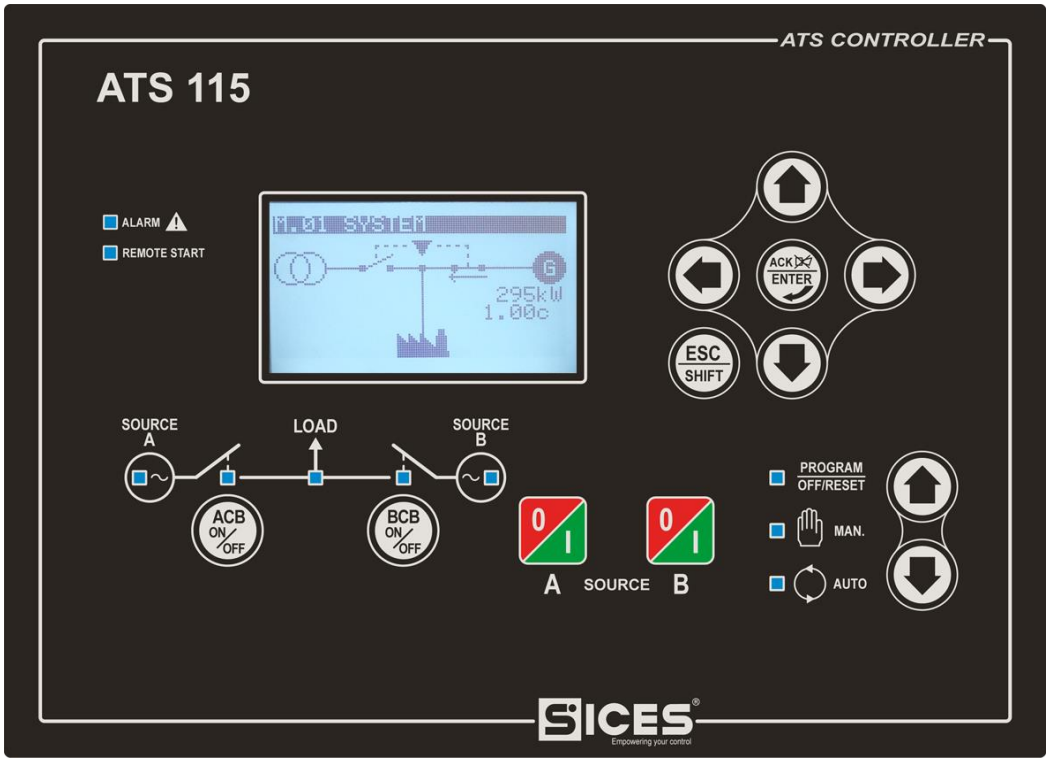


Fig. 1 ATS115-ATS115Plus Front View

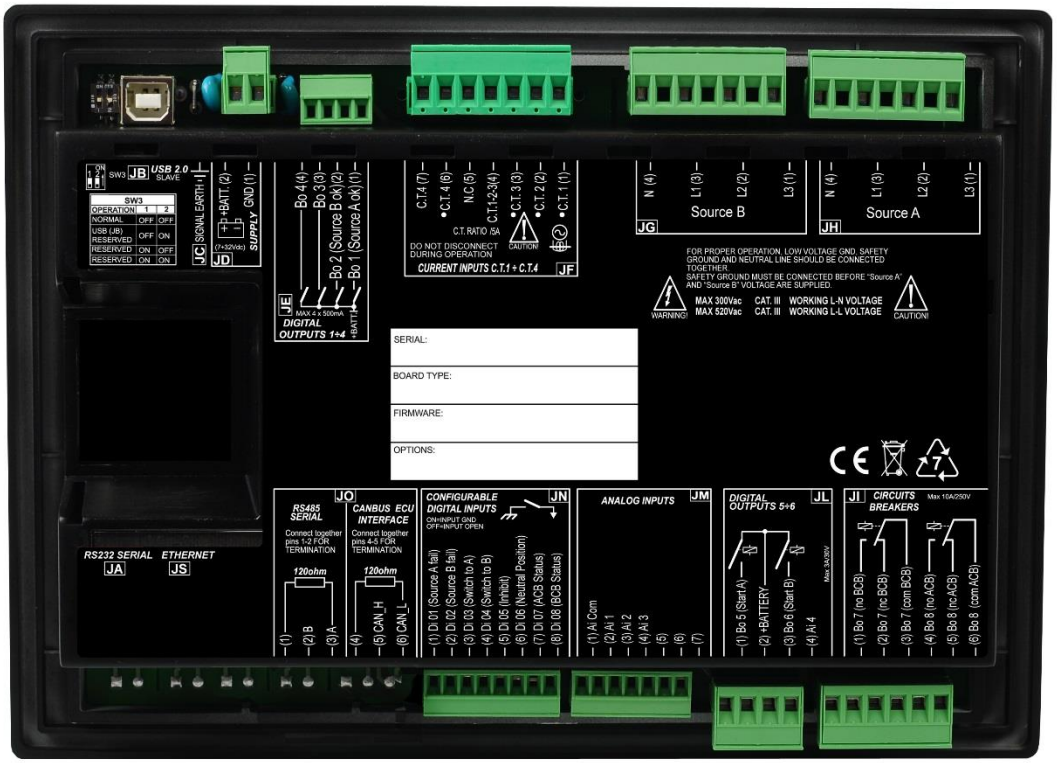


Fig. 2 ATS115 Back view

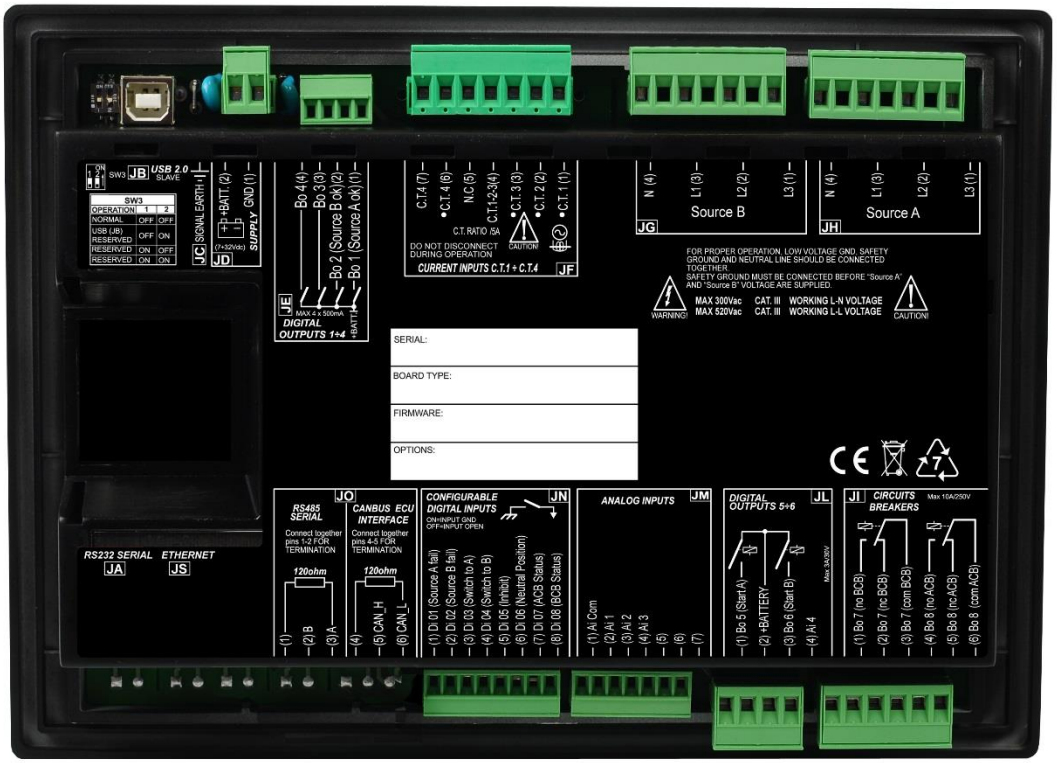


Fig. 3 ATS115Plus Back view

3. Technical features

Supply power voltage Vbatt:	7..32VDC with continuous operation. Protection against polarity reversal with built-in self-resetting fuse. Operation during engine start is guaranteed up to Vbatt =5VDC indefinitely. The device identifies the plant operation at 12 or 24V, to manage its alarms when powered up and whenever OFF/RESET mode is selected.
Power consumption in stand-by:	300mA @ Vbatt =13.5VDC display lamp on 280mA @ Vbatt =13.5VDC display lamp off 170mA @ Vbatt =27 VDC display lamp on 160mA @ Vbatt =27 VDC display lamp off
Maximum power consumption in operating condition (relays, alarm, LCD lamp and digital inputs enabled; static outputs disabled):	Max 700mA @ 7 VDC 400mA @ 27 VDC 450mA @ 13.5 VDC
Electric measurements for mains/generator set voltage and currents:	Analogue/digital conversion at 12bit; sampling frequency 10kHz. True RMS measurements (TRMS). Measurement of the L-N phase voltages and of the L-L concatenated voltages; measurements of the neutral voltages referred to the power supply minus of the device. Input impedance of the voltage measurements: >280kohm L-L >270kohm L-GND >210kohm N-GND >150kohm L-L Measurement of three currents with electrical return and C.T. report. In common, plus a fourth independent current for Neutral current measurement or differential protection or mains voltage measurement. It is required the use of current transformers with a secondary current of 1 to 5A (5A recommended) and minimum power of 1VA. It is mandatory to connect the return poles of the current transformers to the supply minus of the device.
Maximum mains/generator voltages allowed:	MAX 300Vac in CAT.IV for measures L-N MAX 520Vac in CAT.IV for measures L-L
Maximum currents allowed:	5Aac nominal values; possible sinusoidal transient voltage surges up to 20Aac with progressive loss of the measurement accuracy depending on the amplitude of the surge.
Frequency measurements:	Nominal frequencies of 50 or 60Hz. Obtained from the L1 phase voltage both for the mains and for the generator. Mains frequency minimum sensitivity: 35Vrms L-N @ 50Hz For the generator the sensitivity is decreasing with the frequency for the recognition of the started engine and for greater disturbances rejection: 13Vrms L-N @ 5Hz 80Vrms L-N @ 50Hz

Digital inputs:	8 digital inputs; GND supply minus activation. When opened, the voltage on the input terminals is Vbatt. Activation/deactivation threshold 2.5VDC Typical current with closed contact: 6.5mA @ Vbatt= 13.5VDC 12mA @ Vbatt= 27VDC
Relay outputs:	Two relays with positive common input, max 3A @30VDC for starter motor and fuel solenoid valve. Surge protection diodes incorporated. The common plus also acts as input for the emergency stop. The voltage measure at the common input is displayed on page S.14 of the display (EM-S) Two relays with dry changeover contacts for remote control switching, max. 10A @250Vac. All the relay outputs can be reset regardless of the parameter.
SSR outputs:	Four independent configurable outputs to battery plus, max 500 continuous mA each; internal limitation to approximately 4A max. on transients <150us and then thermal protection intervention. Protection against overload, short-circuit and surge and integrated reverse polarity. The output voltage is supplied through the positive supply terminal of the JD (2) +BATT. device.
Analogue inputs for resistive sensors:	Three inputs for resistive sensors plus one input for measuring and compensation of the reference potential of their common minus. Resistance measuring range: rated 0..500 ohm with < 0.2% error 0..2kohm with < 1% error The three measurement inputs can also be used as digital inputs with GND activation. Voltage compensation range of the reference point: -2.7..+5VDC. The acquired measures are visualized on the S.11 page of the display.
Analogue inputs for resistive sensors:	An analogue input to acquire voltage measures from 0 to 32V or as digital input with +Vbatt start up. The acquired measure is visualized on the S.11 page of the display (JL-4).
Display:	Graphic transflective LCD, size 70x38mm, resolution 128x64
Operating conditions:	From -25°C to +60°C
Dimensions:	247(L)x187(H)x40(P)mm
Weight:	600g
Dimensions of the mounting place:	218x159mm

3.1 Measurement resolution

Mains voltages and generator	1Vrms Accuracy <0.5% F.S.
Current	Min. 0.1A (it depends on the C.T. ratio), accuracy <0.2% F.S.
Mains frequencies and generator	0.1Hz ± 50ppm, 35ppm/C typical
Powers	Min. 0.1 kW/kVA/kvar (it depends on the C.T. ratio)
Power Factor	0.01

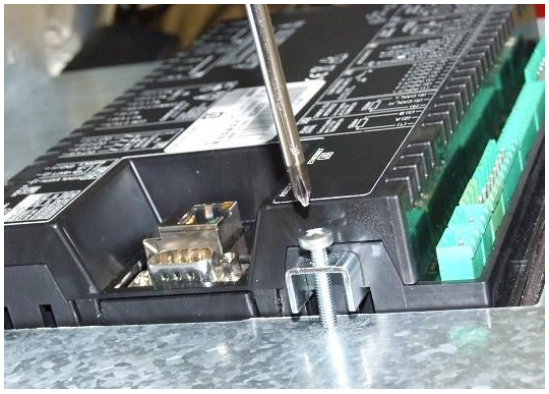
Energy	1 kWh/kvar

4. Installation

4.1 Mounting

The device must be mounted permanently on an electrical panel or cabinet. The back of the device must be accessed only through the use of keys or tools, and only by authorized personnel to perform maintenance operations. The device must be mounted so as to make it impossible to remove it without using tools.

The dimensions of the mounting slot are 218x159mm. The device is mounted with four hooks with locking screws: once you have put the device in place, insert the hooks in the side slots and tighten the screws. Be careful not to overtighten the screws to avoid damaging the coupling slots on the casing of the device.



4.2 Wiring

Due to high voltages associated to the measurement circuits of the controller, all the conductive parts of the electrical panel must necessarily be connected to the protective earth by means of permanent connections.

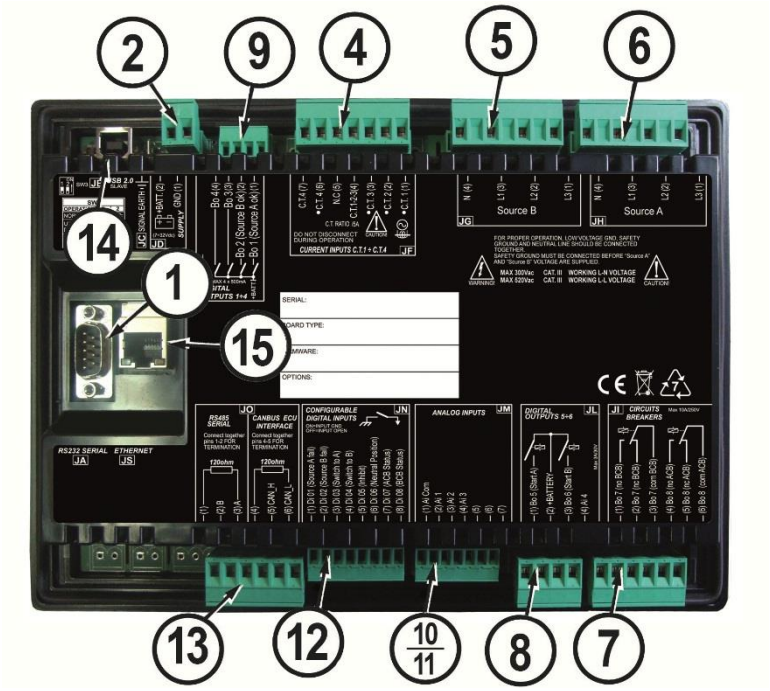
The installation of an overcurrent protection device is required for each phase of the mains and generator voltage inputs. 1A fuses can be conveniently used.

The conductor cross-section of the protective earth of the electrical panel must be at least equal to the section of the wires used for wiring the mains or generator voltage to the panel. In addition, it must comply with the limit value of the overcurrent protection used.

For CAT.III applications, the maximum phase-to-neutral voltage allowed is 300Vac, while the phase-to-phase voltage is 520Vac. Maximum voltage with respect to the protective earth is 300Vac.

The device can operate in CAT.III only if the supply minus terminal of the device and the neutral terminal of the generator are connected to the protective earth.

5. Connections and IN/OUT configuration



No.	NOME	DESCRIPTION	CONNECTOR	NOTES
1	JA	RS232 Interface	9 Male Poles Canon	Optional
2	JD	Power supply	2 Poles x2,5mm² Screw terminal	
4	JF	Currents Input	7 Poles x2,5mm² Screw terminal	
5	JG	Source B Voltages	4 Poles x2,5mm² Screw terminal	
6	JH	Source A Voltages	4 Poles x2,5mm² Screw terminal	
7	JI	Remote control switches	6 Poles x2,5mm² Screw terminal	
8	JL	A /B Start commands	4 Poles x2,5mm² Screw terminal	
9	JE	Auxiliary Outputs	4 Poles x1,5mm² Screw terminal	
10	JM	Analogue Inputs	7 Poles x1,5mm² Screw terminal	
11				
12	JN	Digital Inputs	8 Poles x1,5mm² Screw terminal	
13	JO	ECU J1939 Can-bus	6 Poles x2,5mm2 Screw terminal	Not used
		RS485 Interface		Optional

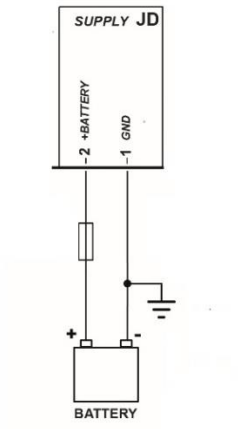
14	**JB**	USB	USB B	
15	**JS**	Ethernet	RJ45	Optional

5.1 Functional earth (JC)

The connection to the functional earth JC is mandatory, in order to guarantee the proper operation of the device and the compliance with the EU Electromagnetic Compatibility Directive.

The connection is functional and not protective; therefore the cross-section of the wire can be smaller. Connect the other end of the wire to a metal screw of the electrical panel (which must be grounded) next to the **JC** or to a grounding line, using, in any case, the shortest cable possible.

5.2 Device Supply (JD)



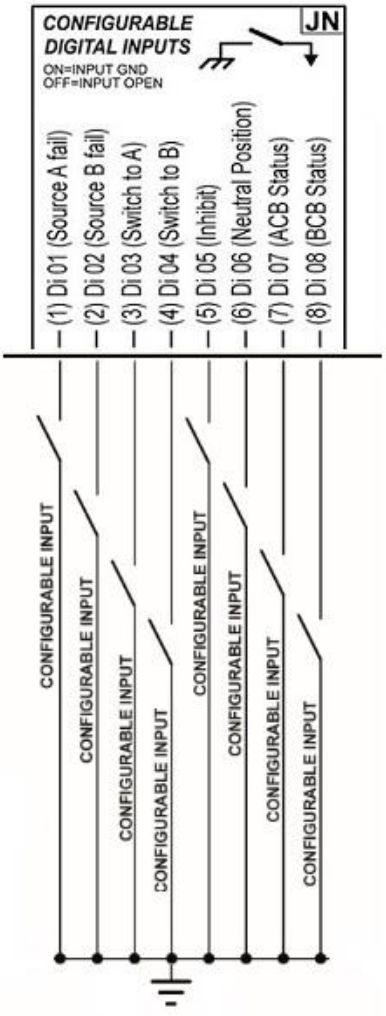
The **JD** connector is the supply connector: connect an uninterruptible power supply (usually the engine starter battery) to the **1-GND** terminal (minus) and to the **2-+BATT** terminal (plus).
The minus terminal **1-(GND)** is the reference and the common return of the digital inputs, of the outputs and of the current and voltage measurements. **It must be connected to the protective earth.** Systems requiring isolation between battery minus and protective earth are nonetheless usable, but they may generate operating problems and could require special precautions, such as the use of insulating voltage transformers for the Mains and Generator voltage measurements.

Although the device is protected by a built-in self-resetting fuse, the use of a fuse for the protection of the supply positive line **2-+BATT** is recommended.

The current delivered by the JE outputs flows through the positive input 2-+BATT, therefore you need to pay attention to the dimensioning of the fuse.
The device automatically recognizes when it is powered if the battery nominal voltage of the generator is 12 or 24V for managing the related logics and alarms. The recognition also takes place every time you switch to mode **OFF/RESET**.

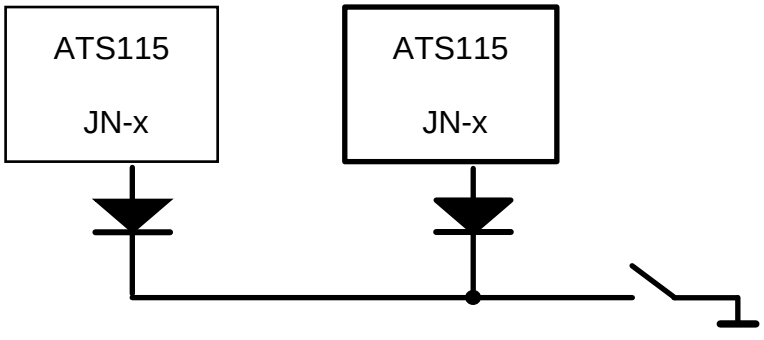
Note: connect the positive voltage only after the connections are all established and the fuses opened.

5.3 JN Digital Inputs



ATS115 has 8 digital inputs, which can be activated by connecting them to GND. When left floating, the input brings itself to +Vbatt. Avoid situations where intermediate or undefined voltage levels can occur.

The same command signal of an input can be shared by several different devices (for instance one signal that goes to two ATS115). In this case it is recommended to separate the inputs with diodes, as shown in the figure below. This is to prevent the wrong activation of the input when one of the devices is being turned off.



5.4 Digital Inputs Configuration

In addition to the 8 JN inputs, if not used as measurement inputs, you can also use the JM analogue inputs as digital inputs (refer to par. 5.11) and, with different methods, the JL-4 terminal too (Ai4 signal, refer to par. 05).

In addition, there are 16 "virtual" inputs available, which are not present on the controller or on the expansion, but they are obtained as a result of the logical combination of physical or virtual inputs, outputs, alarms or logical states by means of proper programming via BoardPrg3. The virtual inputs can be configured as feature and can be used in the same way as the physical inputs; refer to par. **Error. Reference source not found.** [4].

By default, all the digital inputs on the ATS115 are considered "active" when the related terminal is connected to the supply minus of the controller; they are considered "not active" when the related terminal is not connected to anything. **The logic state of the input can be reversed with respect to the physical state by selecting the "Reversed polarity" box on the input configuration page on BoardPrg3.** The box only appears if the function selected is different from DIF.0000 – "Unused".

You can also reverse the logic state (still individually for each input), by operating directly on the controller, using the parameters P.2000 (for the inputs 1...8 on the controller), P.2100 (for the analogue inputs when used as digital).

Said parameters have a bit for each input:

- A bit set to zero means that the related input is "active" when it is connected to the negative supply of the controller.
- A bit set to one means that the related input is considered "active" when it is not connected to anything (it will turn in "not active" when it is connected to the negative supply of the controller).

As default, all the bits are set to 0.

Each input (both physical and virtual) has three parameters associated:

- One parameter that configures its function (P.2001 for input 1).
- One parameter that configures any delay (P.2002 for input 1).
- One parameter that configures a text message to display (P.2003 for input 1).

See document [1] for the parameters list.

The inputs management, both ATS115 physical and virtual digital inputs, is identical.

The parameters which configure the delay and the message for an input are used by the controller only for certain features of the inputs. The table below shows when they are used.

NOTE: in BoardPrg3 the boxes for the delay and for the message are always displayed, even if they are not used by the controller.

The identification codes of the inputs functions starting with 3xxx concern operating states, those that start with 4xxx trigger alarms (alarms or warnings).

Input Function	Name	F/W revision	Delay	Message	Description
DIF.0000	Not used				Input not used.
DIF.1001	ACB close command.				It only acts in MAN and in TEST. It is used to command the manual closing of the ACB. If there isn't a configured input with the "1002" function, this inputs works as toggle switch: it commands the circuit breaker closing when it is open and the opening when it is closed.
DIF.1002	ACB open command.				It only acts in MAN and in TEST. It is used to command the manual opening of the ACB.
DIF.1031	BCB close command.				It only acts in MAN and in TEST. It is used to command the manual closing of the BCB. . If there isn't a configured input with the "1032" function, this inputs works as toggle switch: it commands the circuit breaker closing when it is open and the opening when it is closed.
DIF.1032	BCB open command.				It only acts in MAN and in TEST. It is used to command the manual opening of the BCB.
DIF.2001	Alarms reset command.				When the input becomes active, the controller executes a complete reset of all anomalies. This is the same as changing the controller mode to OFF-RESET and back again to the desired mode.
DIF.2002	Immediate switch				When the input becomes active, the controller switches on the other source.
DIF.2003	Neutral Position.				When the input becomes active, the controller forces the opening of both circuit breakers (ACB and BCB), as "Neutral Position".
DIF.2032	Request for REMOTE START.	01.07	Yes		If the input is active, the controller status changes from AUTO to REMOTE START (controller should be at rest in AUTO mode). When it becomes inactive, the status changes back to AUTO.
DIF.2121	Priority source (0=A / 1=B)	01.08			When the input is not "active", the priority source is A. When the input is "active" the priority source is B.
DIF.2271	Remote OFF.				When this input is active, the working mode of the controller is forced on OFF-RESET, and there is no way of using the buttons to change it. 12.1 **Note: when this input is deactivated, if there are not inputs** configured **with 2272 and 2273 functions, the operating mode comes back to the one present before the activation of the input.**
DIF.2272	Remote MAN.				When this input is active, the operation mode of the controller is forced into MAN and you cannot use the buttons on the panel to change it.
DIF.2273	Remote AUTO.				When this input is active, the operation mode of the controller is forced into AUTO and you cannot use the buttons on the panel to change it.
DIF.2281	Switch on source A.				It only acts in AUTO. When the input is "active", the controller switch on the source A.
DIF.2282	Switch on source B.				It only acts in AUTO. When the input is "active", the controller switch on the source B.
DIF.2501	Genset operation inhibition.				When this input is "active", the start of the source configured as generator is inhibited. For this function, "Delay" and "Message" parameters are not used, whatever is their value.
DIF.2503	Source A – Inhibited to take the Load	01.03			When this input is activated, the ACB closing is automatically prevented (Genset only).
DIF.2504	Source B – Inhibited to take the Load	01.03			When this input is activated, the BCB closing is automatically prevented (Genset only).
DIF.2701	Enable REMOTE START request.	01.07			If this function is defined for one input, "REMOTE START" function is inhibited if the input is not active.
DIF.2704	Disable the protections on the 4th current.				When this input is "active", the auxiliary current protection (usually used for the differential protection) is disabled.
DIF.2705	Disable the protections on the analogue measures.				When this input is "active", the thresholds set on analogue measures with the bit 13 ON on the third configuration parameter (see par. 5.11.6) do not cause the intervention of the related protections.
DIF.2706	Enables serial port commands.			.	If this input is not "active", the commands sent by means of Modbus registers HOLDING REGISTER 101 and 102 are not accepted

DIF.2707	Enable priority source selection.			.	If this input is not configured or is configured and active, it enables the selection of the priority source. If it is configured and not active, it disables the selection of the priority source.
DIF.3001	ACB breaker status.		Yes		This configured input is used to activate warnings in case of dissonance between the controller command to the ACB and the ACB status.
DIF.3002	BCB breaker status.		Yes		This configured input is used to activate warnings in case of dissonance between the controller command to the BCB and the BCB status.
DIF.3101	External sensor source A.				When the input is “active” the source A is considered to be “in tolerance”.
DIF.3102	External sensor source B.				When the input is “active” the source B is considered to be “in tolerance”.
DIF.3201	Generic status (page 1).			Yes	When this input is “active”, the controller displays the text set for the parameters related to the input in the page S.06.
DIF.3202	Important generic status (page 1).			Yes	When this input is “active”, the controller immediately displays the text set for the parameters related to the input in the page S.06.
DIF.3203	Generic status (page 2).			Yes	When this input is “active”, the controller displays the text set for the parameters related to the input in the page S.07.
DIF.3204	Important generic status (page 2).			Yes	When this input is “active”, the controller immediately displays the text set for the parameters related to the input in the page S.07.
DIF.3205	Generic status (page 3).			Yes	When this input is “active”, the controller displays the text set for the parameters related to the input in the page S.08.
DIF.3206	Important generic status (page 3).			Yes	When this input is “active”, the controller immediately displays the text set for the parameters related to the input in the page S.08.
DIF.4001	Generic warning.		Yes	Yes	If the input is active, a warning is issued: the message shown is the one set by means the related “text” parameters.
DIF.4004	Generic alarm.		Yes	Yes	If the input is active, an alarm is issued: the message shown is the one set by means the related “text” parameters.
DIF.4021	Warning (forces ACB open).		Yes	Yes	When the input is “active” a warning is issued: the message shown is the one set in the parameters associated to the input. The controller forces ACB opened.
DIF.4024	Alarm (forces ACB open).		Yes	Yes	When the input is “active” an alarm is issued: the message shown is the one set in the parameters associated to the input. The controller forces ACB opened.
DIF.4031	Warning (forces BCB open).		Yes	Yes	When the input is “active” a warning is issued: the message shown is the one set in the parameters associated to the input. The controller forces BCB opened.
DIF.4034	Alarm (forces BCB open).		Yes	Yes	When the input is “active” an alarm is issued: the message shown is the one set in the parameters associated to the input. The controller forces BCB opened.
DIF.4203	Source A fault warning.		Yes		When this input is “active” a warning is issued (with a fixed description depending on the language) to detect a problem on the source A.
DIF.4204	Source B fault warning.		Yes		When this input is “active” a warning is issued (with a fixed description depending on the language) to detect a problem on the source B.

By default, the functions of the inputs on the controller are the following:

Terminal	Input	Parameter	Default function
JN-1	Input 1	P.2001	DIF.4203 – Source A fault.
JN-2	Input 2	P.2004	DIF.4204 – Source B fault.
JN-3	Input 3	P.2007	DIF.2281 – Switch on source A.
JN-4	Input 4	P.2010	DIF.2282 – Switch on source B.
JN-5	Input 5	P.2013	DIF.2501 – Genset operation inhibition.
JN-6	Input 6	P.2016	DIF.2003 – Neutral position.
JN-7	Input 7	P.2019	DIF.3001 – ACB status.
JN-8	Input 8	P.2022	DIF.3002 – BCB status.

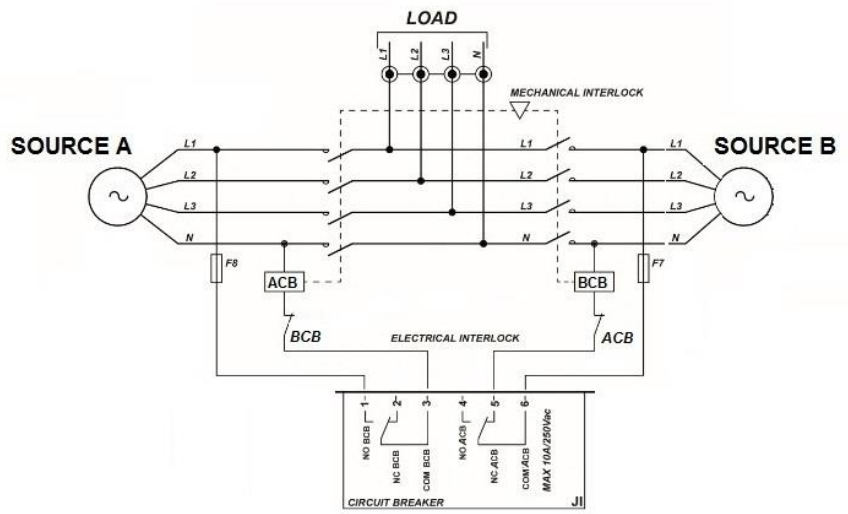
5.5 Virtual digital inputs

In addition to the 8 digital physical inputs, the controller also manages 16 virtual digital inputs. They are managed by the controller just as if they were physical inputs (with no limitation), but the status of the virtual inputs is not acquired from the hardware, but it is determined through the software. In fact, every digital input can have an AND/OR logic associated, which determines its status (see par. 5.10).

A practical example of use. Suppose you want to activate a warning if the mains voltage exceeds the tolerance thresholds. Let's use the virtual digital input #1 (as example).

- Using the BoardPrg3 software, we associate an AND/OR logic configured as AND to the virtual digital input #1, with the following list of conditions:
  - ST.064 ("Status of the ACB")
  - ST.017 ("Source A out of tolerance or absent").
- Therefore, the virtual digital input will be active when the ACB is closed and the source A is out of tolerance.
- Let's set the DIF.4001 function ("Generic warning") within the P.2151 parameter.
- Let's set the desired delay (for example 0.5 s) within the P.2152 parameter.
- Let's set the alarm message (for example "Source A voltage warning") within the P.2153 parameter.

5.6 Outputs for the JI loads switch command



The controller uses two 10A@250Vac dry contact relays to control the loads changeover. On the JI connector there is a dry contact changeover for each of the two relays.

Terminal	Outputs	Type	Parameter	Default function
JI-1 (NO)	BCB	Relay 10 A	P.3008	BCB relay normally open contact.
JI-2 (NC)				BCB relay normally closed contact.
JI-3 (COM)				BCB relay common contact.
JI-4 (NO)	ACB	Relay 10 A	P.3007	ACB relay normally open contact.
JI-5 (NC)				ACB relay normally closed contact.
JI-6 (COM)				ACB relay common contact.

The ACB command is used to connect the loads to the source A. The BCB command is used to connect the loads to the source B.

You should use the normally closed contact of the ACB (by configuring the source A as Mains) and the normally opened contact of the BCB (by configuring the source A as Genset): in this way, even if the controller is not powered, the loads remain connected to the source A.

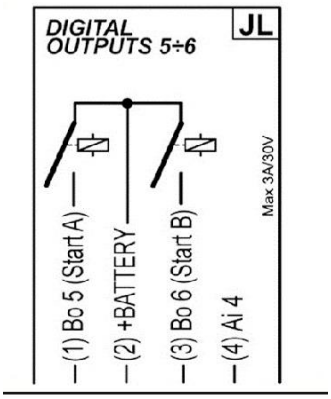
Two different systems can be used for the loads switching:

- SWITCH: with only one command, the loads are switched to the source A or B. Use the JI-01 and JI-03 terminals to control the SWITCH: in this way, with the controller unpowered, the loads are automatically changed over to the source A. The ACB output (terminals 4…6 of the JI) is not used, therefore it can be associated to a different function. Configure the P.0307 parameter with the time the SWITCH needs for the changeover: in this way the controller avoids reversing the command before the changeover is completed (this operation risks to wedge in the SWITCH). Reset the P.0306 parameter, because the pause between the mains and the genset and vice versa is ensured by the SWITCH.
- Two separate breakers (preferably mechanically and electrically interlocked). The command for the breaker that connects the loads to the source B (BCB) must be taken between terminals 1 and 3 of the JL connector. In this way, with the controller unpowered, the contact opens and the BCB breaker separates the source B from the loads. The command for the breaker that connects the loads to the source A (ACB) must be taken between terminals 4 and 6 of the JL connector. In this way, with the controller unpowered, the contact closes and the ACB breaker connects the loads to the source A (normally mains). Set the P.0307 parameter to zero (the command can always be reversed immediately) and set the pause interval that you want during the switch in the P.0306 parameter. Two additional outputs can be used for the breakers minimum coils management: the two functions are “2001 - Minimum coil ACB (NC)” and “2031 - Minimum coil BCB”. These outputs are associated to the management logics that depend on the plant configuration. ATS115 uses logics that avoid the not-synchronized simultaneous closing of ACB and BCB; however, an external protection logic shall be used for this purpose.

For the changeover management see par. 12.5.

If there is only one switch, the ACB output (terminals 4...6 of the JI) is not used, therefore it can be associated to a different function (see par. 5.9.9).

5.7 Genset start commands (JL)



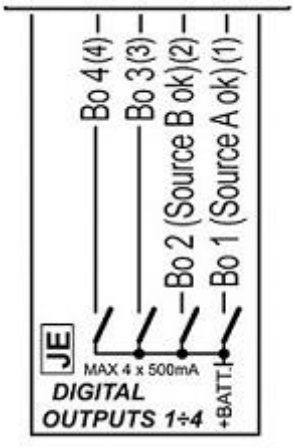
By default, the **JL** connector is configured for two relay outputs connections that can be used as start demands of the source A (**START A – JL.1**) and of the source B (**START B – JL.3**) when connected to a genset. If they are not used as engine start command, two outputs are reconfigurable by parameter for other purposes.

This connector allows the connection to the 5…6 outputs. They are positive 3A @30VDC relay outputs with internal diode for the opening overvoltage damping. When the outputs are operating, the relays lead to the output terminal the voltage supplied to the JL-2 terminal (**it must be a positive voltage**, usually the controller voltage positive).

The status of the START A and START B outputs is displayed on page S.10 (0= output inactive, 1= output active).

Terminal	Output	Type	Parameter	Default function
JL-1	Output 5 (START A)	Relay 3 A	P.3005	DOF.1001 – Start command A.
JL-2	Common (+)			
JL-3	Output 6 (START B)	Relay 3 A	P.3006	DOF.1002 – Start command B.

5.8 Auxiliary Outputs (JE)



The device runs four digital outputs, entirely programmable. When activated, they bring themselves to the positive supply voltage on the **JE** supply terminal.
The rated capacity of each output is 500mA; the total power is, therefore, of 2A. **Never exceed these values during standard operation.**

The outputs are independent and individually protected from overloads, short circuits, polarity reversal and overheating. The overload protection limits the current peaks to an instantaneous 4A value, in order to allow the activation of loads that require a transient current greater than the rated. If this condition persists, after 150us the thermal protection cuts in progressively, until the output turning off.

With inductive loads (power relays, electromagnetic actuators), although some are already present inside, it is advisable to use diodes for the damping of opening overvoltages.

All the current delivered by the outputs must be made available through the **JE 2-+BATT; make sure that any protection fuse on the supply plus has capacity and response time suitable to power and protect both the outputs and the ATS115 in any condition of use.**

The default functions of the JE outputs set on the controller are:

Terminal	Output	Parameter	Default function
JE-1	Output 1	P.3001	DOF.3032 – Source A in tolerance.
JE-2	Output 2	P.3002	DOF.3033 – Source B in tolerance.

Terminal	Output	Parameter	Default function
JE-3	Output 3	P.3003	DOF.0000 – Not used.
JE-4	Output 4	P.3004	DOF.0000 – Not used.

5.9 Digital output configuration

The four JE auxiliary outputs, the outputs JL_1, JL_3, JI_4 e JI_1 are completely configurable individually.

The status of the digital outputs is displayed on page S.10 (0= output inactive, 1= output active): at line 1…4 the connector JE-1..JE-4 outputs, at line START A, B the JL-1 and JL-3 outputs and at line ACB, BCB the JI-4 and JI-I outputs.

By default, all the outputs are activated when their function requires it (for example the output of the source A start command runs when the genset connected to the source A has to be activated).

Using the BoradPrg3, you can reverse the activation by simply ticking the “reverse polarity” box on the top of the configuration page of every single output.

By operating directly on the controller, you can reverse anyway the logic of the outputs (still individually for each output) including by means of the P.3000 parameter for the outputs on the controller (a total of 8 bit):

- A zero-bit means that the output is normally on standby, it starts operating when the related feature requires it.
- A one-bit means that the output is normally operating, it goes on standby when the related function requires it.

The mapping of the outputs on the controller is:

BIT	Value	Output
0	1	Output 1
1	2	Output 2
2	4	Output 3
3	8	Output 4
4	16	Output 5 (JL-1)
5	32	Output 6 (JL_3)
6	64	Output ACB (JI_4)
7	128	Output BCB (JI_1)

Basically, if you want to invert an output logic, you need to add the related value in the related parameter: for example, if you want to invert the output 3 and 4 on the controller, you need to set P.3000 = 12 (that is 4+8).

As default, all bits are set to zero.

5.9.1 Functions configurable on the digital outputs

The digital outputs can be used directly as command for devices outside the controller, or for reporting certain operating conditions.

The configuration can be carried out using parameters from P.3001 to P.3008.

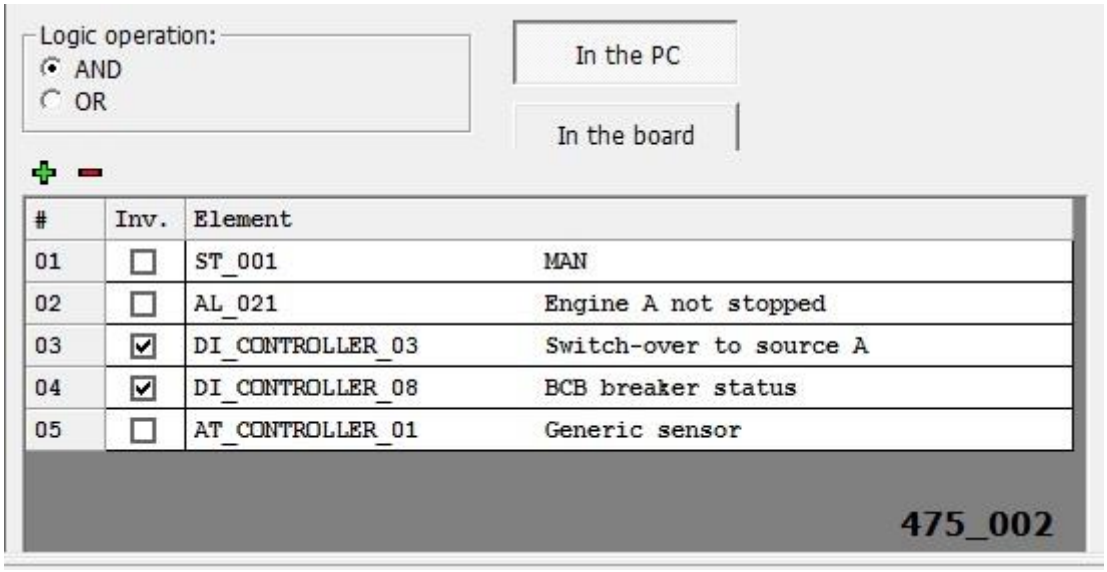
See below the outputs configurable on the digital outputs:

Code	Description	Firmware revision	Notes
DOF.0000	Not used.		
DOF.0102	Managed by the serial ports.		The controller does not command the output with its own internal logics, but with the commands that receives through the serial ports.
DOF.0103	AND/OR logics.		The status of the output is the result of the combination of the AND/OR logics, see par. 5.10.
DOF.1001	Source A start command.		It runs to demand the start of the source A (Genset) - see par. 12.3
DOF.1002	Source B start command.		It runs to demand the start of the source A (Genset) - see par. 12.3
DOF.2001	ACB (NC) under voltage coil.		See par. 12.5
DOF.2002	ACB opening coil.		See par. 12.5
DOF.2003	ACB closing coil.		See par. 12.5
DOF.2004	ACB stable closing command.		See par. 12.5
DOF.2031	BCB under voltage coil.		See par. 12.5
DOF.2032	BCB opening coil.		See par. 12.5
DOF.2033	BCB closing coil.		See par. 12.5
DOF.2034	BCB stable closing command		See par. 12.5
DOF.3001	Off/reset.		It is active when the controller is on OFF / RESET mode.
DOF.3002	Manual.		It is active when the controller is on MAN mode.
DOF.3003	Automatic.		It is active when the controller is on AUTO mode.
DOF.3004	Test.	01.07	It is activated when the controller is in TEST mode.
DOF.3005	Remote start.	01.07	It is activated when the controller is in REMOTE START mode.
DOF.3011	Not on OFF/RESET mode.		It is active when the controller is on MAN or AUTO mode.
DOF.3012	One of the automatic modes.		It is active when the controller is in an automatic operation mode, which is AUTO or REMOTE START.
DOF.3032	Source A in tolerance.		It is active when the source A parameters are in the normal operation window.
DOF.3033	Source B in tolerance.		It is active when the source B parameters are in the normal operation window.
DOF.3034	Voltage present on source A.		It is active when there is voltage, but the source A parameters are not in the normal operation window.
DOF.3035	Voltage present on source B.		It is active when there is voltage, but the source B parameters are not in the normal operation window.
DOF.3036	ACB status closed.		It is active when the controller detects the closing status on the ACB breaker.
DOF.3037	BCB status closed.		It is active when the controller detects the closing status on the BCB breaker.
DOF.3040	Both breakers opened.		It is active when both ACB and BCB breakers are simultaneously open.
DOF.3151	Faults reset.		It is active for a second when the controller executes the faults RESET.
DOF.3152	Outside siren.		It is active together with the internal siren.
DOF.3154	Acknowledge of the anomalies		The controller activates this output for one second when the internal sequence for the identification of anomalies is carried out.
DOF.4001	Warnings.		It is active in case of warnings
DOF.4005	Alarms (alarm).		It is active in case of alarms.
DOF.4035	Breakers faults.		It is active in case of faults on the status of the ACB and BCB breakers: 013: ACB breaker (source A) not closed. 014: BCB breaker (source B) not closed. 023: ACB breaker (source A) not opened. 024: BCB breaker (source B) not opened.

5.10 AND/OR Logics

Basically, AND/OR logics are a list of Boolean conditions (true/false, on/off, 1/0), which can be configured by the operator (programming), that the controller evaluates and the result of which can be assigned to a digital output or to a virtual digital input (see par. 5.9 and par. 5.5). In order to use the AND/OR logics with a digital output, use the DOF.0103 function.

Note: the AND/OR logics cannot be configured directly from the controller panel, but through a PC equipped with the BoardPrg3 software.



The operator has to decide first if the list of conditions must be evaluated as AND (all must be checked) or as OR (it is enough to check one condition). **You cannot have AND/OR logics mix (this option can be done using digital virtual inputs; see below).**

You can add up to 30 conditions. Each condition can be denied individually: in the previous figure, for instance, the controller will check that the digital input 3 and the digital output 8 are both **inactive**. Here are the conditions that can be added:

- DI_XXX: logic states of all the digital inputs (physical or virtual).
- DO_XXX: logic states of all the digital outputs.
- AL_XXX: warnings/locks present.
- ST_XXX: internal states of the controller.
- AT_XXX: states concerning the thresholds on analogue measures (see par. 5.11.6).

The following table shows the list of the internal states available for the AND/OR logics.

Status	Revision	Description
ST.000		OFF_RESET
ST.001		MAN
ST.002		AUTO
ST.003	01.07	TEST
ST.004	01.07	AVVIAMENTO REMOTO
ST.006	01.19	Identification ongoing anomalies
ST.007	01.19	Reset ongoing anomalies
ST.008		Warnings cumulative
ST.011		Locks cumulative

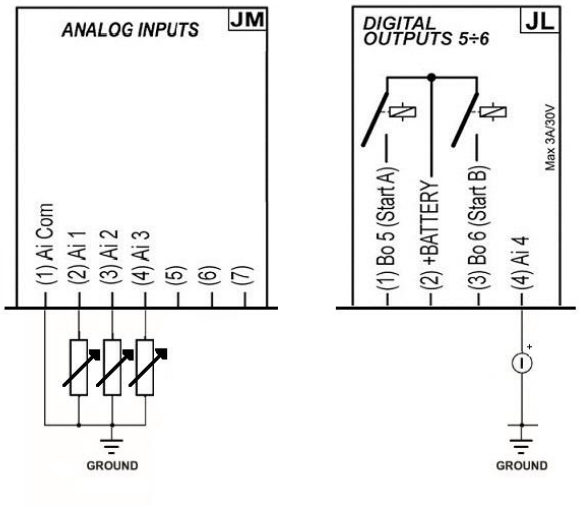
ST.012		Unacknowledged warnings cumulative
ST.015		Unacknowledged locks cumulative
ST.016		Source A voltage/frequency present.
ST.017		Source A out of tolerance or absent
ST.018		Delay for source A within tolerance.
ST.019		Source A in tolerance
ST.020		Delay for source A out of tolerance or absent
ST.024		Source B voltage/frequency present
ST.025		Source B out of tolerance or absent
ST.026		Delay for source B within tolerance.
ST.027		Source B in tolerance
ST.028		Delay for source B out of tolerance or absent
ST.064		ACB status
ST.065		BCB status
ST.068		Impulse closing command for ACB
ST.069		Impulse closing command for BCB
ST.070	01.20	ACB minimum voltage coil
ST.071	01.20	ACB opening pulse
ST.072	01.20	ACB closure pulse
ST.073	01.20	BCB minimum voltage coil
ST.074	01.20	BCB opening pulse
ST.075	01.20	BCB closure pulse
ST.080		Inhibition of the start from contact
ST.081		Inhibition of the start from clock/calendar
ST.082		Source B (off = A) working hour
ST.083	01.12	Last running source (off= A / on=B)
ST.127	01.16	Daylight Save Time
ST.224	01.16	Calendar 1
ST.225	01.16	Calendar 2
ST.226	01.16	Calendar 3
ST.227	01.16	Calendar 4
ST.228	01.16	Calendar 5
ST.229	01.16	Calendar 6
ST.230	01.16	Calendar 7
ST.231	01.16	Calendar 8
ST.232	01.16	Calendar 9
ST.233	01.16	Calendar 10
ST.234	01.16	Calendar 11
ST.235	01.16	Calendar 12
ST.236	01.16	Calendar 13
ST.237	01.16	Calendar 14
ST.238	01.16	Calendar 15
ST.239	01.16	Calendar 16
ST.240	01.16	Timer 1
ST.241	01.16	Timer 2
ST.242	01.16	Timer 3
ST.243	01.16	Timer 4
ST.256	01.19	CAN 0 BUS-OFF
ST.257	01.19	CAN 0 ERR-PASSIVE
ST.258	01.19	CAN 0 ERR-ACTIVE
ST.259	01.19	No communication on CAN 0
ST.304	01.19	START / STOP A button
ST.305	01.19	START / STOP B button
ST.306	01.19	ACB button
ST.307	01.19	BCB button
ST.308	01.19	MODE UP button
ST.309	01.19	MODE DOWN button
ST.310	01.19	UP button
ST.311	01.19	DOWN button
ST.312	01.19	LEFT button
ST.313	01.19	RIGHT button
ST.314	01.19	ENTER button
ST.315	01.19	EXIT button
ST.316	01.19	SHIFT button

ST.317	01.19	ACK button

Using the virtual digital inputs, it is possible to create mixed AND/OR logics (composed by both AND and OR). Suppose you want to activate the digital output #1 when the digital inputs #1 and #2 are both active, or when digital input #3 is active.

First, we have to associate to the virtual digital input #1 (for instance) an AND/OR logic configured as AND, which checks that the first two inputs are both active. Then we have to associate to the digital output #1 an AND/OR logic configured as OR, which checks that the virtual digital input #1 or the digital input #3 are active. In practice, the virtual digital input #1 is used as "support" for the AND condition. In this case, you don't need to associate a function to the virtual digital input.

5.11 Analogue Inputs (JM-2, JM-3, JM-4, JL-4)



The device is provided with three inputs designed for the connection to the resistive-type sensors JM-2, JM-3, JM-4. All analogue inputs are completely configurable and can be used to acquire the generic values or as digital inputs.

Terminal	Input	Default function
JM-2	Input 1	AIF.0000 – Not used.
JM-3	Input 2	AIF.0000 – Not used.
JM-4	Input 3	AIF.0000 – Not used.
JL-4	Input 4	AIF.0000 – Not used.

Each input used as analogue is associated to a set of 8 parameters to define the type of function, an alternative denomination and a series of thresholds and generic configurations that can be used for different functions. For any detail, see par. 5.11.6.

For all of these measurements it is possible to define, by means of the BoardPrg3 program, some settable curves, using at least two couples of resistance/value points of the measure, see par.5.11.6.

It is also possible to configure the three inputs JM-2, JM-3 and JM-4 individually as additional digital inputs that are activated when connected to ground. They will be displayed in the menu of the digital inputs configuration and they will be managed in the same way of the other inputs; see par. 5.11.6.

The three voltage values on the terminals and their value of the sensors resistance and of the JM-1 voltage measured are displayed on page S.11; if an input is not configured, there will be dashes on the display.

If one or more inputs are configured as digital, their status is displayed on page S.10 (0 = input inactive, 1 = input active). The inputs which are not configured as digital are displayed with a dash.

5.11.1 Input JM-1 Analogue Reference

It is not a real measure input: it is used together with the three inputs for resistive sensors. Its purpose is to compensate for the lack of equipotentiality between the electric earthing of the device (GND terminal) and the electric panel and the electric earthing of the genset, usually generated by the voltage drop on the connection cables. In particular, this happens when the connections between electric panel and engine are long and when there is a power flow in the battery minus and ground connections, for example due to the presence of the battery charger device inside the electric panel.

The system is able to efficiently compensate for both positive and negative potentials, ranging between -2.7VDC and +4VDC, with sensors resistance values of 100 ohm. The range of compensation increases for lower resistance values and decreases for higher resistance values, being optimized for the resistance values present in normal operating conditions of the system.

The measure of the voltage with respect to the GND terminal is displayed on page S.11, under item JM1; the measuring range of the system, and consequently the value indicated, can be higher than the one useful for the compensation, as mentioned above.

The input measures the potential of the common ground point (negative) of the resistive sensors, which for the sensors on the engine is directly represented by the engine itself or by the chassis of the genset. Therefore, JM-1 can be connected to a grounding system or to a bolt on the engine.

If the minus of one or more sensors is isolated from the engine or from the genset chassis, you need to connect the JM-1 to the return of the sensor and also to the negative electric ground of the engine or to the negative limit of the battery.

Note: this connection should be made using a dedicated wire having the shortest length possible. Avoid to make the wire pass near high power cables.

5.11.2 Input JM-2 (AI 1)

The input has a useful resistance measurement range between 0 and 1500 ohm; within this range the measurement error guaranteed is less than 1%, with a voltage to the JM-1 terminal with respect to the GND=0. Higher resistance values can be measured, although with gradually decreasing precision.

It can be configured with the P.4001 parameter as:

- AIF.0000 Not used
- **AIF.0100 When used as digital input, it is active when connected to GND, not active when left floating (for its use see par. 5.4)**
- AIF.2001 Generic sensor (page 1)
- AIF.2003 Generic sensor (page 2)
- AIF.2005 Generic sensor (page 3)
- AIF.2051 Generic sensor

The configuration of the sensor as type 0, 100 can be done directly from the device keyboard; all the others need the use of the BoardPrg3 program to define or load the characteristic curve of the sensor (see par.6).

The configurations AIF.2001, AIF.2002 and AIF.2005 “Generic sensor (page x)” allow to select in which page of the display menu E the measure acquired will be displayed (page 1 = first page available, page 2 = second page available, etc.).

5.11.3 Input JM-3 (AI 2)

The input has a useful resistance measurement range between 0 and 2000 ohm; within this range the measurement error guaranteed is less than 1%, with a voltage to the JM-1 terminal with respect to the GND=0. Higher resistance values can be measured, although with gradually decreasing precision.

It can be configured with the P.4009 parameter as:

- AIF.0000 Not used
- **AIF.0100 When used as digital input, it is active when connected to GND, not active when left floating (for its use see par. 5.4)**
- AIF.2001 Generic sensor (page 1)
- AIF.2003 Generic sensor (page 2)
- AIF.2005 Generic sensor (page 3)
- AIF.2051 Generic sensor

The configuration of the sensor as type 0, 100 can be done directly from the device keyboard; all the others need the use of the BoardPrg3 program to define or load the characteristic curve of the sensor (see par.6).

The configurations AIF.2001, AIF.2002 and AIF.2005 “Generic sensor (page x)” allow to select in which page of the display menu **E** the measure acquired will be displayed (page 1 = first page available, page 2 = second page available, etc.).

5.11.4 Input JM-4 (AI 3)

The input has a useful resistance measurement range between 0 and 1700 ohm; within this range the measurement error guaranteed is less than 1%, with a voltage to the JM-1 terminal with respect to the GND=0. Higher resistance values can be measured, although with gradually decreasing precision.

It can be configured with the P.4017 parameter as:

- AIF.0000 Not used
- **AIF.0100 When used as digital input, it is active when connected to GND, not active when left floating (for its use see par. 5.4)**
- AIF.2001 Generic sensor (page 1)
- AIF.2003 Generic sensor (page 2)
- AIF.2005 Generic sensor (page 3)
- AIF.2051 Generic sensor

The configuration of the sensor as type 0, 100 can be done directly from the device keyboard; all the others need the use of the BoardPrg3 program to define or load the characteristic curve of the sensor (see par.6).

The configurations AIF.2001, AIF.2002 and AIF.2005 “Generic sensor (page x)” allow to select in which page of the display menu **E** the measure acquired will be displayed (page 1 = first page available, page 2 = second page available, etc.).

5.11.5 Input JL-4 (AI 4)

The input AI 4 (on the terminal JL_4) can be configured as auxiliary analogue input in voltage, with measurement range 0-32VDC with respect to the controller supply negative (GND).

It can be configured with the P.4017 parameter as:

- AIF.0000 Not used

- **AIF.0100 When used as digital input, it is active when connected to GND, not active when left floating (for its use see par. 5.4)**
- AIF.2001 Generic sensor (page 1)
- AIF.2003 Generic sensor (page 2)
- AIF.2005 Generic sensor (page 3)
- AIF.2051 Generic sensor

The configuration of the sensor as type 0, 100 can be done directly from the device keyboard; all the others need the use of the BoardPrg3 program to define or load the characteristic curve of the sensor (see par.6).

The configurations AIF.2001, AIF.2002 and AIF.2005 "Generic sensor (page x)" allow to select in which page of the display menu **E** the measure acquired will be displayed (page 1 = first page available, page 2 = second page available, etc.).

5.11.6 Analogue inputs configuration

You can apply a conversion curve to all the physical analogue inputs JM-2, JM-3, JM-4 and JL-4 (not to the virtual analogue inputs).

Each analogue input, both physical and virtual, is associated to eight parameters; here below as example the ones related to input JM-2; for the parameters of the analogue virtual inputs, see document [1] or the I/O BoardPrg3 configuration page.

NOTE: On BoardPrg3 the parameters are all displayed only when the input is actually configured as analogue input and not, for example, as digital.

We have:

- One parameter which configures its function (P.4017 for input JM-2).
- One parameter which configures any message to be shown on the display (P.4018 for input JM-2).
- Two thresholds consisting of three parameters each:
  - One parameter which configures the threshold value (P.4019 and P.4022 for input JM-2).
  - One parameter which configures the delay for managing the "out of threshold" (P.4020 and P.4023 for input JM-2).
  - One parameter which configures the checking options and the actions in case of "out of threshold" (P.4021 and P.4024 for input JM-2).

The parameter containing the message for a certain analogue input (in the example above, what is written in the P.4002 parameter) is displayed and used by the controller every time the thresholds are used to activate warnings and/or alarms (see below); it is also used for the following functions of the analogue inputs: AIF.2001, AIF.2003 and AIF.2005 of the type "Generic sensor (page X)". In this case the measure acquired will be displayed according to the X value (1, 2 or 3) on pages M.09, M.10, M.11, preceded by the message configured.

Note: You can also use the AIF.2051 function instead of the previous three. In this case, the measure acquired will not be displayed on M.09, M.10, M.11; however, it can be still used with the thresholds to manage digital outputs and activate warnings/locks.

The two thresholds are completely independent among each other. The third parameter of each threshold is a "bit" parameter that allows to associate to each threshold the following options:

- Bit 1. If this bit is "OFF", the controller checks if the measure is higher than the threshold. If this bit is "ON", the controller checks if the measure is lower than the threshold.

- Bit 2. If this bit is “OFF”, the controller sets to OFF the internal status related to this analogue measure if the measure is “out of threshold”. If this bit is “ON”, the controller sets to ON the internal status related to this analogue measure if the measure is “out of threshold”.
- Bit 5. If this bit is “ON”, the controller issues a warning if the measure is “out of threshold”.
- Bit 8. If this bit is “ON”, the controller issues a lock command if the measure is “out of threshold”.
- Bit 10. If this bit is “ON”, the controller checks that ACB is closed to activate any warning/lock configured with previous bits.
- Bit 11. If this bit is “ON”, the controller checks that the GCB is closed, to activate possible warnings/locks configured with the previous bits.
- Bit 14. If this bit is “ON”, to activate any warning/lock configured with the previous bits, the controller checks the status of any digital input configured with the function “DIF. 2705 - Disable the protections on the analogue measures”. The warnings/locks will be activated if no digital input is configured as such, or if they are all OFF.

You can set any combination of these bit.

Using the two thresholds and the AND/OR logics together, you can activate a digital output regarding the value of an analogue measure, with hysteresis. Suppose you want to activate a digital output if the frequency exceeds 50.5 Hz. First of all you have to maintain a minimum hysteresis on the threshold, otherwise, when the frequency is close to the threshold, the output will continue to switch on and off, due to minimum variations of the frequency itself. Then, suppose you want to activate the output if the frequency exceeds 50.5 Hz and deactivate the output if the frequency is lower than 50.3 Hz. In order to do that we can use, for example, the virtual analogue input #1 (see par. 5.5), which has been configured to contain the frequency.

Set the parameters as follows:

- P.4051 (function #1): 4001 (AIF.4001).
- P.4052 (message #1): “”.
- P.4053 (threshold #1): 50.5 Hz
- P.4054 (delay #1): 0.5 sec
- P.4055 (configuration #1): 0002 (bit 0 OFF, bit 1 ON)
- P.4056 (threshold #2): 50.3 Hz
- P.4057 (delay #2): 0.5 sec
- P.4058 (configuration #2): 0001 (bit 0 ON, bit 1 OFF)

The first threshold is used to activate the internal status related to the analogue input. Looking at the configuration parameter you can see that:

- Bit 0 OFF (check that the measure is higher than the threshold).
- Bit 1 ON (activate the internal status in “out of threshold” condition).

The second threshold is used to deactivate the internal status related to the analogue input. Looking at the configuration parameter you can see that:

- Bit 0 ON (check that the measure is lower than the threshold).
- Bit 1 OFF (deactivate the internal status in “out of threshold” condition).

With the previous programming, the controller activates the internal status related to the analogue input when the measure is greater than 50.5 Hz for 0,5 seconds; it deactivates the internal status when the measure is less than 50.3 Hz for 0,5 seconds.

Using the AND/OR logics (see par. 5.10) you can “copy” the internal status on a physical output.

5.12 Virtual analogue inputs

The controller also manages 8 virtual analogue inputs. They are managed by the controller just as if they were physical inputs (with no limitation), but the status of the virtual inputs is not acquired from the hardware, but it is determined through the software. In fact, by means of the “function” parameter of each virtual analogue input, it is possible to “copy” one of the internal measures made available by the controller in the analogue input:

- AVF.4001 - "Source A frequency"
- AVF.4006 - "L1-L2 Source A voltage"
- AVF.4007 - "L2-L3 Source A voltage"
- AVF.4008 - "L3-L1 Source A voltage"
- AVF.4009 - "L-L Source A medium voltage"
- AVF.4012 - "Source B frequency"
- AVF.4017 - "L1-L2 Source B voltage"
- AVF.4018 - "L2-L3 Source B voltage"
- AVF.4019 - "L3-L1 Source B voltage"
- AVF.4020 - "L-L Source B medium voltage"
- AVF.4023 - "Current phase L1"
- AVF.4024 - "Current phase L2"
- AVF.4025 - "Current phase L3"
- AVF.4026 - " Auxiliary current (including N)"
- AVF.4031 - "Active power L1"
- AVF.4032 - "Active power L2"
- AVF.4033 - "Active power L3"
- AVF.4034 - "Total active power"
- AVF.4041 - "Total apparent power"
- AVF.4047 - "Total reactive power"
- AVF.4058 - "Total power factor"
- AVF.4059 - "Total Cosfi"
- AVF.4063 - "Partial active energy of the Source A"
- AVF.4065 - "Partial reactive energy of the Source A"

- AVF.4069 - "Partial active energy of the Source B"
- AVF.4071 - "Partial reactive energy of the Source B"
- AVF.4105 - "Battery voltage measured by the controller"
- AVF.4112 - "Source A operating hours"
- AVF.4113 - "Source B operating hours"
- AVF.4116 - "Engine partial operating hours left before maintenance”

You cannot use these functions to configure physical analogue inputs.

The purpose of the virtual analogue inputs is double:

- Allowing the issuing of warnings/locks related to the internal measures available.
- Activating digital outputs based on the value of the internal measures available.

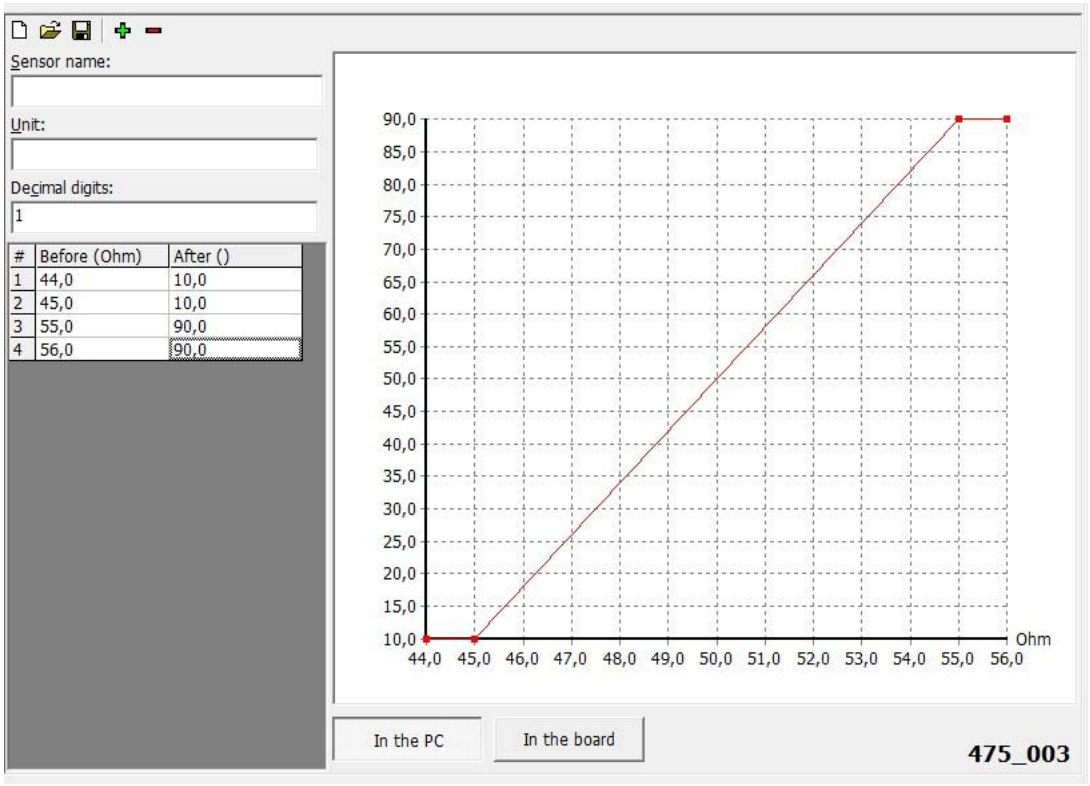
See example in par. 5.11.6.

6. Conversion curves

The conversion curves are a tool which allow you to convert a numerical value into another numerical value. They can be used to convert the value acquired from a resistive analogue input (physical) to the real unit of measure of the sensor.

Note: the conversion curves cannot be configured directly from the controller board, but through the Board Prg3 software equipped on a PC.

Once created, the curves can be saved to be reused in the future, including on other ATS115 controllers.



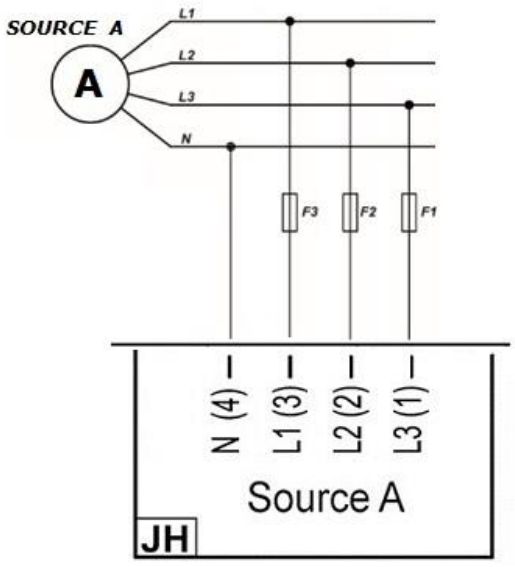
The figure above shows a conversion curve associated to a resistive analogue input. The analogue input has been configured with the AIF.2051 function – “Generic sensor”. In this configuration, the converted value will amount at 10 for a resistance value equal to 45 Ohm or lower, 90 for a value equal to 55 Ohm or higher; for frequency values ranging between 45 Ohm and 55 Ohm, the converted value will be between 10 and 90.

You can add up to 32 points in the graph, creating also non-linear curves. As in the example, the curve configured has two horizontal segments at the beginning and at the end, obtained by putting two equal values in the “After” column, which correspond to two different values in the “Before” column. This is not obligatory, but it allows to set a saturation limit on one or both ends of the curve. In fact, the controller board extends the first and last segments of the curve to infinity. Being horizontal, whatever value the measure “to convert” assumes, you will obtain the same value of the “converted” measure. In the previous example, for any measure lower than 45 Ohm, the converted value will be set at 10. In the example above, if you removed the first point (44 Ohm 10), the horizontal segment would not be at the beginning of the curve: in this case, if the resistance dropped below 45 Ohm, the converted value would drop below 10.

The BoardPrg3 software allows (by means of the first buttons on the left top) to save the curve on file, in order to be able to use it again in other applications. So, it is possible to create an archive of the conversions associated to the sensors used.

In case the curve is associated to a physical analogue input configured with the AIF.2001, AIF.2003 and AIF.2005 (“Generic sensor”) functions, the converted measure will be displayed on pages M.09, M.10 and M.11: in this case, it is possible to specify (through the conversion curve) how many decimal digits the displayed value will have, as well as its unit of measure).

7. Connection to SOURCE A



The connection to the SOURCE A is made through the JH connector of the controller.

Tri-phase connection:

- Connect phase L1 (or R) to terminal 3 of JH connector.
- Connect phase L2 (or S) to terminal 2 of JH connector.
- Connect phase L3 (or T) to terminal 1 of JH connector.
- Connect neutral (if any) (N) to terminal 4 of JH connector.

Single-phase connection:

- Connect phase (L) to terminal 3 of JH connector.
- Connect neutral (N) to terminal 4 of JH connector.

The tri-phase/single-phase selection is allowed by the P.0101 parameter.

For CAT.III application, the maximum applicable voltage is 300 Vac (phase-to-neutral) and 520 Vac (phase-to-phase). The maximum voltage to ground is 300 Vac.

The controller board uses the L1 phase (terminal JH-3) to measure the source A frequency.

If you need to connect higher voltages, you must use voltage transients (VTs) with a secondary voltage that does not exceed the previous limits. The primary and secondary nominal VT voltages are configurable with P.0103 and P.0104 parameters. It is recommended to use the VTs that, at nominal voltage, give about 400 Vac on the secondary (not to reduce de measure precision of the controller).

It is optionally possible to order a version of the device with max 100Vac (phase-phase) voltage inputs to be used with VT with 100V secondary ones. In this case it is necessary to configure P.0152 parameter for 100V working.

Warning! Do not connect devices provided with optional 100V max inputs directly to mains or to 400V bus not to damage the device.

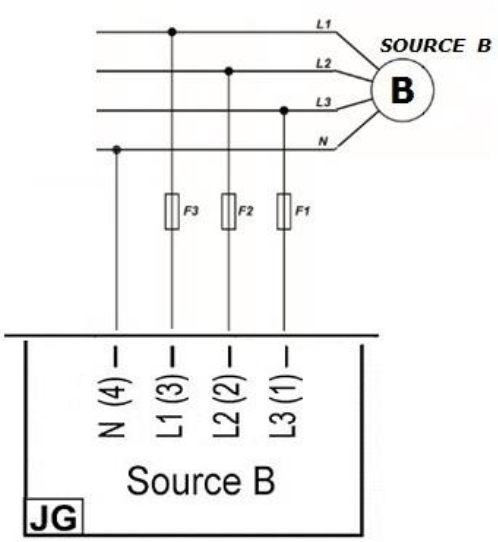
7.1 Measurement of the SOURCE A neutral

The device, in three-phase connection, can work both with and without neutral connection; the selection is made through the P.0120 parameter.

If the system is configured with neutral connection, the neutral voltage is measured in relation to GND. The values of the V1-N, V2-N and V3-N phase voltages and the VN neutral voltage in relation to GND for the mains are displayed on page M.03.

If the device is configured not to measure the neutral voltage, then page M.03 will not be displayed.

8. Connection to SOURCE B



The connection to the SOURCE B (mains or genset) is made through the JG connector of the controller.

Tri-phase connection:

- Connect phase L1 (or R) to terminal 3 of JG connector.
- Connect phase L2 (or S) to terminal 2 of JG connector.
- Connect phase L3 (or T) to terminal 1 of JG connector.
- Connect neutral (if any) (N) to terminal 4 of JG connector.

Single-phase connection:

- Connect phase (L) to terminal 3 of JG connector.
- Connect neutral (N) to terminal 4 of JG connector.

The tri-phase/single-phase selection is allowed by the P.0201 parameter.

For CAT.III application, the maximum applicable voltage is 300 Vac (phase-to-neutral) and 520 Vac (phase-to-phase). The maximum voltage to ground is 300 Vac.

The controller board uses the L1 phase (terminal JG-3) to measure the source B frequency.

If you need to connect higher voltages, you must use voltage transients (VTs) with a secondary voltage that does not exceed the previous limits. The primary and secondary nominal VT voltages are configurable with P.0203 and P.0204 parameters. It is recommended to use the VTs that, at nominal voltage, give about 400 Vac on the secondary (not to reduce de measure precision of the controller).

It is optionally possible to order a version of the device with max 100Vac (phase-phase) voltage inputs to be used with TV with 100V secondary ones. In this case it is necessary to configure P.0151 parameter for 100V working.

Warning! Do not connect devices provided with optional 100V max inputs directly to 400V generator voltage not to damage the device.

8.1 Measurement of the SOURCE B neutral

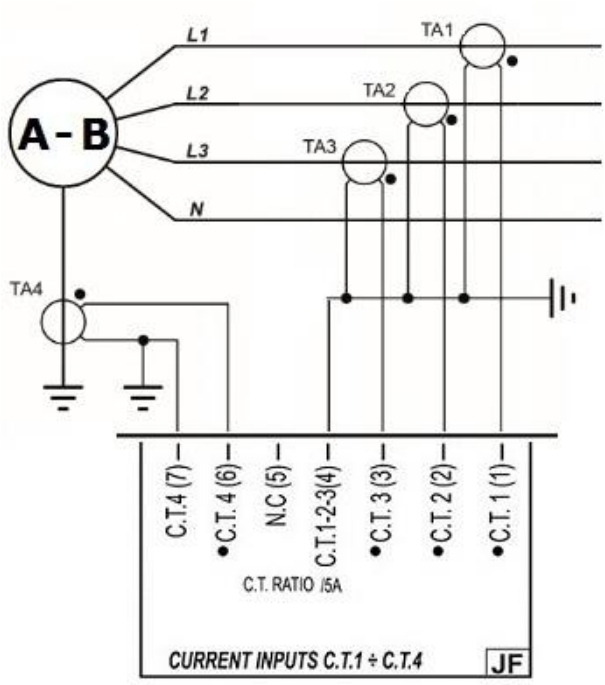
The device, in three-phase connection, can work both with and without neutral connection; the selection is made through the P.0220 parameter.

If the system is configured with neutral connection, the neutral voltage is measured in relation to GND.

The values of the V1-N, V2-N and V3-N phase voltages and the VN neutral voltage in relation to GND for the mains are displayed on page M.05.

If the device is configured not to measure the neutral voltage, then page M.05 will not be displayed.

9. Current Transformer (CT) connection



The current measurement shall be made exclusively by means of current transformers (CTs). **Do not connect mains voltage conductors to JF.**

Currents transformers having a maximum nominal current of approximately 5 Ac on the secondary side can preserve the measurement precision of the controller. Any current measurement needs a power of about 1VA; however, 5VA CTs are recommended to compensate for leaks along the connection cables.

The maximum current that the device can measure directly is of 5.3Ac, beyond which the measurement circuit gets saturated. The controller board is still able to measure, but with gradually decreasing precision down to about 15 Ac,

only for transient situations, such as overcurrents or short circuit currents on the system, using an algorithm to compensate for the saturation of the measurement circuits.

The CTs for the measurement of the three currents have only one terminal clip for the JF-4 return current; the fourth auxiliary current has a return separated from the other three through the JF-7 terminal clip.

The measurement is carried out by shunt.

IMPORTANT: the returns of all CTs (including the auxiliary JF-7) must also be connected to the genset starting battery minus.

If the CTs has to be connected to other devices in addition to the ATS115, then the ATS115 must be the last in the series. In order to acquire the currents of the three phases of the generator, the JD connector is used:

- Connect one CT terminal connected to the L1 phase to terminal JF-1.
- Connect one CT terminal connected to the L2 phase to terminal JF-2.
- Connect one CT terminal connected to the L3 phase to terminal JF-3.
- Connect all three TA returns to terminal JF-4.

For single-phase connection, terminals JF-2 and JF-3 should not be connected.

The parameters P.0302 and P.0310 are used to set the current values of the CTs primary and secondary.

Using the P.0311 parameter you can define whether the CTs on the three phases are positioned on the source A or B (as shown in the drawing above) or on the load, in order to measure the power absorbed by the mains too. This also has an effect on the operation sequence and on the display of symbols and currents and power/energy measures that appear on the menu pages M.01, M.06, M.07, M.08 and M.09.

9.1 Auxiliary current

The device allows for acquiring a fourth measure of current, available for example for a differential protection. By default, the fourth measure is not used.

The board is configured for the connection of a current transformer (C.T.) with 5A secondary for the measure of the current: if it is required to use a toroid (instead of a C.T.), it is necessary to ask for the special option in phase of order (E6202111000XX).

The parameters P.0312 and P.0313 define the currents of the CT primary and secondary for the auxiliary current.

The P.0311 parameter defines where the auxiliary current is measured:

0- On the Source A
1- On the Source B
2- On the Loads

The P.0314 parameter allows you to select if and how the auxiliary current is used:

0- Not used
1- General use
2- Neutral

Settings 1 and 2 allow to establish a threshold (parameters P.0367 and P.0368) and to define what action should be taken when it exceeds. The “2-Neutral” setting on the generator also allows to implement the current differential protection (see 9.2).

It is possible to configure a digital input with the DIF.2704 function – “Disable the protections on the 4th current”: If the input is active, the thresholds, even if set, are ignored and no faults are generated in case the thresholds are exceeded.

The activation of the protection creates a warning, but it does not issue any switch.

9.2 Differential current

To use the current differential protection, the CT of the auxiliary current should measure the neutral current the P.0134 parameter should be set as “2 - Neutral”.

In that way, the device calculates the vector sum of all the four currents measured. Therefore, it detects and calculates any imbalance, allowing to implement, by means of the parameters P.0377 and P.0378, a threshold for the maximum current differential protection.

The activation of the protection creates a warning, but it does not issue any switch.

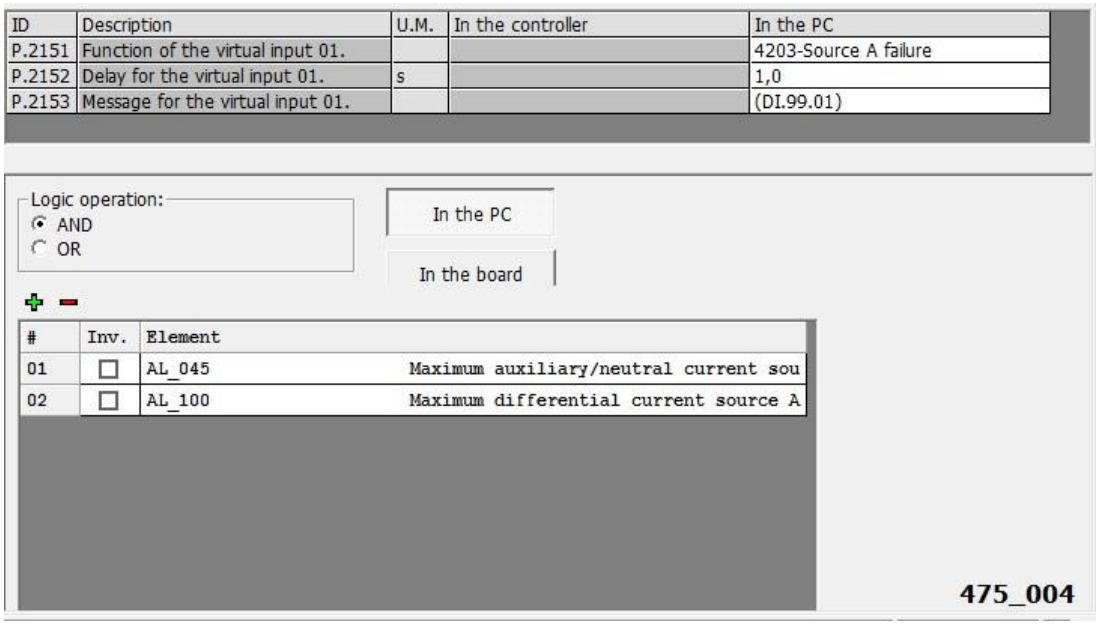
9.3 Auxiliary and/or differential maximum current action

Currently, the controller does not issue any action in case of activation of the protections for the auxiliary and/or differential maximum current.

The action to issue must be configured using the AND/OR logics associated to virtual inputs. In the example below, when the warning “Source A auxiliary/neutral maximum current” or “Source A differential maximum current” is activated the warning “Source A fault” is signalled through the virtual input 1, which automatically demands the switch on the other source too (if available).

Similarly combining the same logic to the virtual analogue input 2, the result will be the same for the source B.

If the protection is activated on both sources, the controller keeps the mains circuit breaker closed as priority, while it keeps both circuit breakers opened if the system is configured with two gensets.



10. Communications

The device is supplied with many communication ports for the connection to PC, modem, networks etc. Some of these ports are optional and could therefore not be present on the device in your possession.

Normally, the device is only equipped with the USB connection type B for the PC FW upgrade and for the parameters programming (JB connector).

According to the versions and options demanded, it can be equipped with:

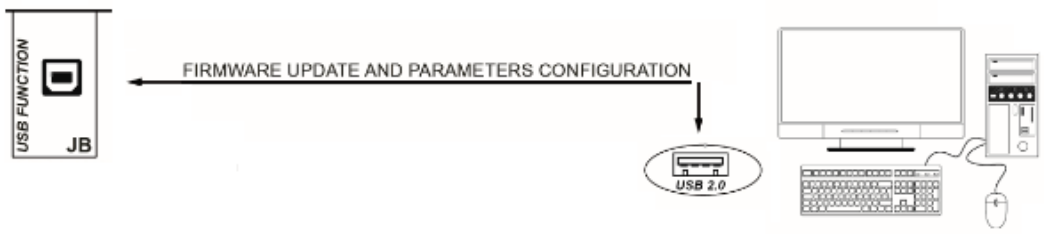
- RJ45 connector for Ethernet 10/100 connections.

- RS232 serial connection (max 12m), see par. 10.1.

- RS485 insulated serial connection; 1200m max connection length, in optimal conditions. The 120 Ohm terminal resistor is included; in order to insert it, you just need to connect the 1 and 2 JO pins between them. It is recommended the use of shielded cable with 120 Ohm impedance (for example BELDEN 3105A Multi-conductor-EIA Industrial RS-485PLT/CM). See par. 10.3

For the details concerning the communications see the specific paragraphs and the document [2].

10.1 USB (JB)



The USB protocol specifications do not allow its permanent use in the industrial sector, due to limited length of the cable and to the relatively elevated sensitivity to electrical disturbances, including the PC side. **For this reason, the USB connection cable must be inserted only when it is necessary to operate on the device and it must be removed from the JB connector when the operation is finished.**

The USB connection to a PC is used for two purposes:

- Enabling the device firmware
- Parameters programming

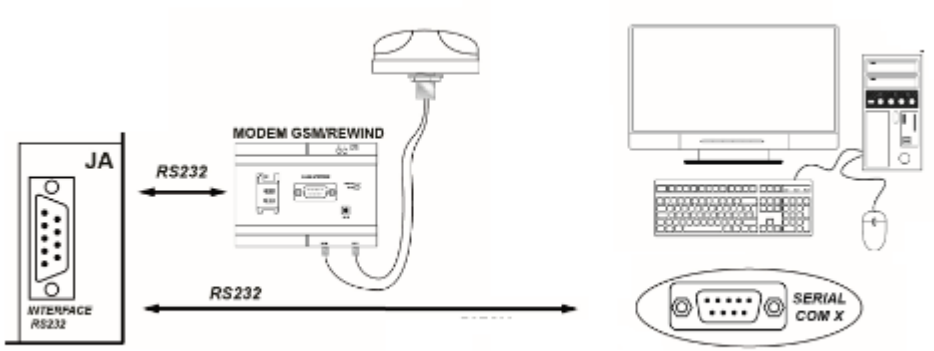
The firmware insertion/replacement of the device is a specific Mecc Alte operation; in addition to the operating FW to insert, it requires a particular procedure and specific programs and normally this procedure must not be carried out by the installer, except in specific situations previously agreed on with Mecc Alte.

The USB port can be used for programming the parameters with the BoardPrg4 program, as an alternative to the serial RS232/RS485 connection or to Ethernet.
The PC to be connected must have the **CDC_Sices_Win.inf** driver installed, which is supplied by Mecc Alte; for driver installation refer to document [5].
After that, the PC will acknowledge the ATS115 as new serial port, usable just as if it was a RS232 serial.

The configuration parameters are:

P.0478	Modbus address (USB)
P.0479	Order of the Modbus registers (USB)

10.2 RS232 Serial port 1 (JA) - Optional



The RS232 JA connector (serial port 1) can be used for interfacing with an external device provided with RS232 interface, such as a modem or a PC. The maximum distance of the connection is 12m.

The connection can be used for programming the parameters of the device through the BoardPrg3 program, or for connecting to a supervising program, such as Mecc Alte SS3.

For the functions and protocols implemented, refer to document [2]. Below the diagram of the connector:

- JA_01: not connected
- JA_02: RXD
- JA_03: TXD
- JA_04: DTR
- JA_05: GND
- JA_06: DSR
- JA_07: RTS
- JA_08: not connected
- JA_09: not connected

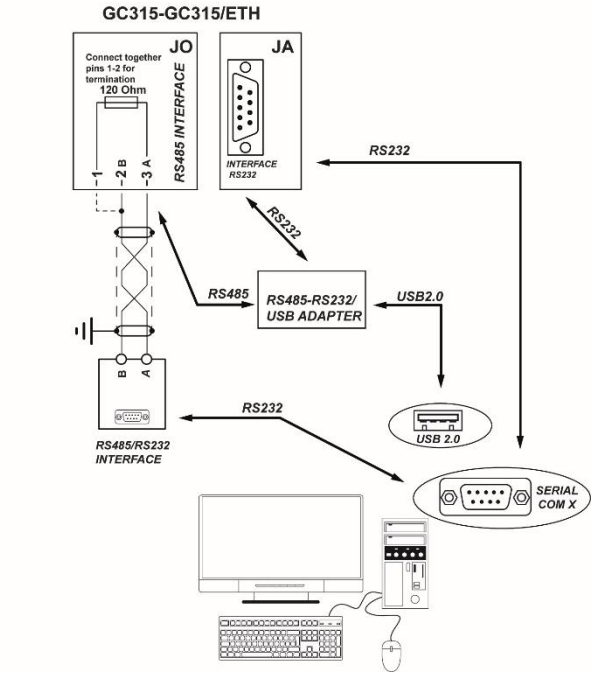
To configure the use of the serial port 1, you need to configure the parameters:

P.0451	Usage of the serial port (1)
P.0452	Modbus address (1)
P.0453	Baud rate (1)
P.0454	Settings (1)

P.0470 Order of the Modbus registers (1)

The description of these parameters is in document [3].

10.3 RS485 Serial port 2 (JO-1, JO-2, JO-3) - Optional



The device can be equipped with a RS485 connector (serial port 2), which is insulated and separated from serial port 1 (RS232) and can be used to connect via Modbus to a PC or other devices.

For the details concerning the RS485 connection, its use and the programming of the parameters, refer to document [3].

Connections:

JO-3 Connection RS485 A

JO-2 Connection RS485 B

The RS485 connection needs a 120 Ohm terminal resistor on both ends of the cable. The device has the resistor included; to enable it, you just need to jumper connect JO-1 and JO-2 to each other.

You cannot connect a modem on the serial port 2; as for the rest, you can use it for the same connections as the RS232 serial port, using RS485/RS232 or RS485/USB adaptors where necessary.

The isolation ensures the safe operation of the connection, including between remote devices and devices with earth potentials different from that of the ATS115.

The maximum length of the connection is 1200m; however, it depends on the transmission baud rate set. A specific shielded cable should be used (see par. 4.2) with grounded shielding mesh.

To configure the use of the serial port 1, you need to configure the parameters:

P.0472 Modbus address (2)

P.0473 Baud rate (2)

P.0474 Settings (2)
P.0475 Order of the Modbus registers (2)

The description of these parameters is found in document [3].

10.4 ETHERNET port 10 100Mbps (JS) - Optional

ATS115 is equipped with a RJ45 for the data exchange connection via Ethernet network.
For the details regarding the network connection and the protocol, refer to document [2].

It is possible to connect the device to a LAN network, or directly to a PC (point to point connection).
The connection allows the use of the Mecc Alte SS3 SWs, the configuration of the BoardPrg4 program and all the available features using the TCP/IP protocol.

The connection of the device inside a LAN also allows to maintain updated the internal calendar with UTC, besides the possibility to assign a public IP address (static or dynamic) directly to the device itself.

These are the parameters which must be configured:

Parameter	Name	Default
P.0500	IP Address. Set it only if DHCP protocol is not required (otherwise this field is filled by the DHCP server): set the IP address assigned to the controller.	192.168.0.1
P.0501	Subnet mask. Set it only if DHCP protocol is not required (otherwise this field is filled by the DHCP server): set the value used by the network the controller is connected to.	255.255.255.0
P.0502	Network Gateway. Set it only if DHCP protocol is not required (otherwise this field is filled by the DHCP server): set the value used by the network the controller is connected to.	0.0.0.0
P.0503	Modbus/TCP Port. Indicate the port on which the controller can accept incoming Modbus/TCP communications. The port 502 is standard for Modbus/TCP protocol: change it only when required.	502
P.0505	Order of the Modbus registers. When 32-bit information is required, it establishes if the 16 more significant bits must be sent first, or those less significant.	0-LSWF
P.0504	Web server Port. Indicate the port on which the controller can accept incoming HTTP communications. The port 80 is standard for HTTP protocol: change it only when required. **Currently not supported.**	80

P.0509	NTP server address. Set the IP address of the server that provides updated date/time.	0.0.0.0
P.0508	NTP Server port. Set the port on which the NTP server is listening. The port 123 is standard for NTP protocol: change it only when required.	123
P.0510	Primary DNS server. Set it only if DHCP protocol is not required (otherwise this field is filled by the DHCP server): set the IP address of the primary DNS server (server who provides the translation service among names and IP addresses).	0.0.0.0
P.0511	Secondary DNS server. Set it only if DHCP protocol is not required (otherwise this field is filled by the DHCP server): set the IP address of the secondary DNS server (server who provides the translation service among names and IP addresses).	0.0.0.0
P.0514	DHCP server address. Set to “255.255.255.255” if DHCP protocol is required (any other value disables that protocol).	255.255.255.255
P.0513	DHCP server port. Set the port on which the DHCP server is listening. The port 67 is standard for DHCP protocol: change it only when required.	67
P.0456	Plant name. If DHCP protocol is used, the controller can be contacted from the Network using this name.	

11. Main functions

11.1 Front panel

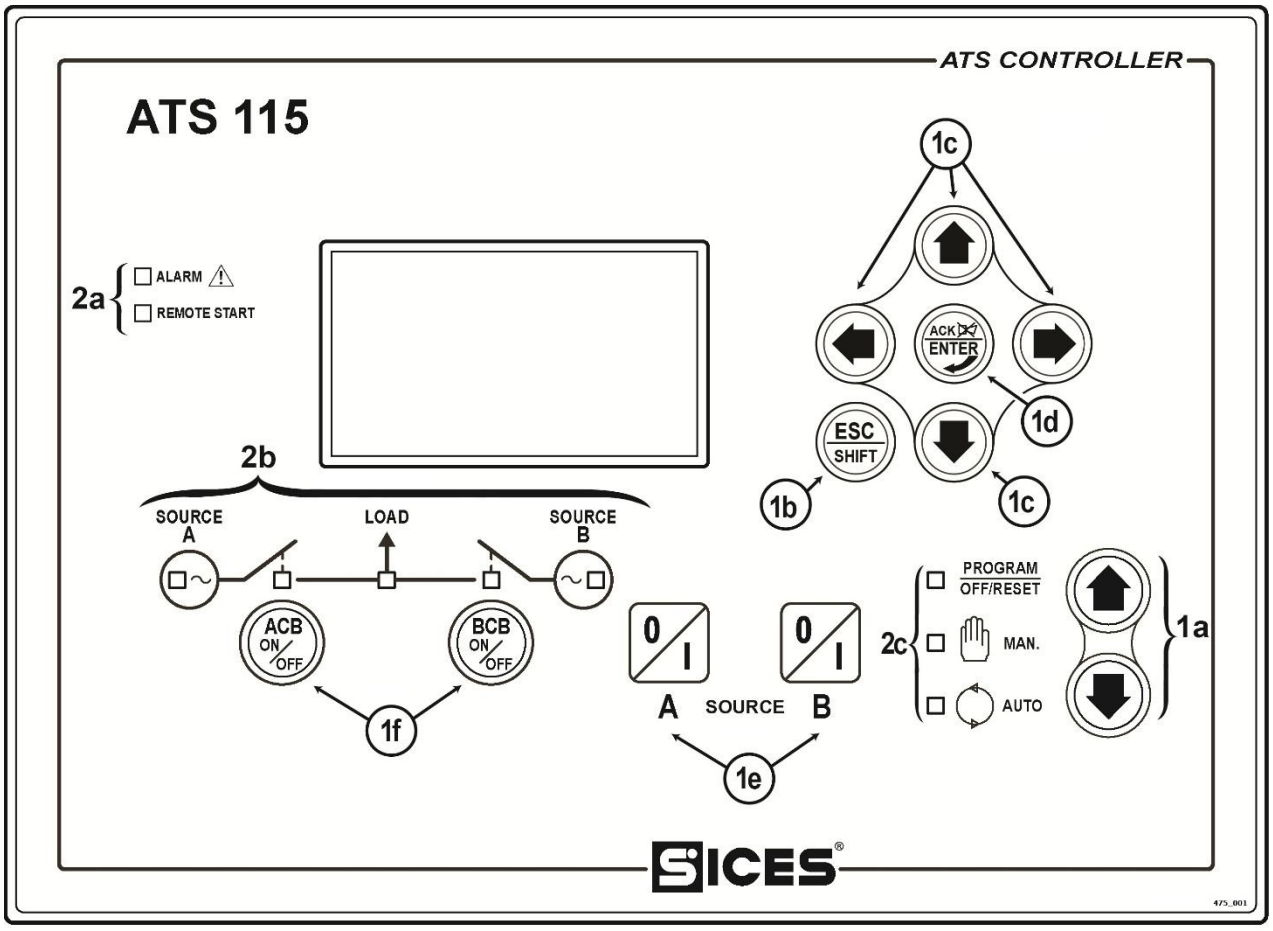


Fig. 1 – ATS115 Front Panel

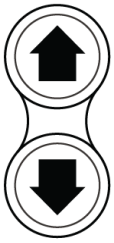
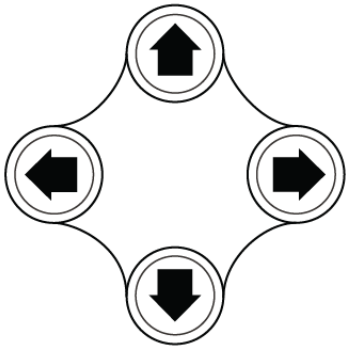
KEY ATS115

1 - Pushbuttons
2 - Indicators

The controls consist of 12 buttons (**1a, 1b, 1c, 1d, 1e, 1f**).

The front panel also has some light indicators (**2a, 2b, 2c**).

11.2 Pushbuttons (ref. to fig. 1)

Pushbutton		Function
MODE UP  **MODE DOWN** **Ref. 1a**	**OFF/RESET** ***PROGRAM***	The genset is disabled; warnings and locks are cancelled. You can program the parameters.
	MAN (Manual)	The controller is set for a manual use of the genset. Press the **START/STOP A** button to start/stop the source A, when set as genset. Press the **START/STOP B** button to start/stop the source B, when set as genset. With source present and in tolerance: Press the **ACB** button for the manual opening/closing of the loads circuit breaker/contactor on source **A**. Press the **BCB** button for the manual opening/closing of the loads circuit breaker/contactor on source **B**.
	AUTO (Automatic)	The controller is set for the automatic switch management of the loads supply source. It also operates in case of faults on one of the two sources.
ESC SHIFT **Esc/SHIFT** **Ref. 1b**		In programming mode, it can cancel the change made to a variable value, go back to the previous menu, or exit the programming mode. If it is pressed for two seconds in any menu, it allows to exit the programming mode recording the current position for a future access. When pressed in any menu, it displays the engine status on the upper line. In **OFF/RESET** mode, depending on the selected page, if pressed together with the **ENTER** button for at least 5 seconds, it can reset counters, reload the default values of the programming parameters or cancel the history logs. When used during the keyboard regulation functions, it aborts the function.
 **LEFT/RIGHT**		Navigation buttons of the multifunctional display. These allow to select the previous or next page on the display in all modes, except in the **PROGRAM** mode. In the **PROGRAM** mode, they are used to position the cursor when entering the strings. The horizontal navigation buttons, used in combination with the **ESC/SHIFT** button, allow to adjust the contrast. To decrease the contrast (lighten), press the combination of buttons **ESC/SHIFT** + **LEFT** .

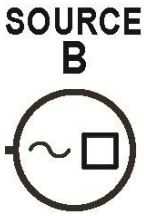
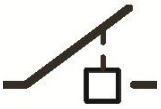
Pushbutton	Function
Ref. 1c	To increase the contrast (darken), press the combination of buttons **ESC/SHIFT**  + **RIGHT**  . In **PROGRAM** and **HISTORY LOGS** mode, they allow to scroll the menus and the variables/settings. While programming, the value of the variable can be increased/decreased. Used in combination with the **ESC/SHIFT**  button, it allows to scroll through the menu ten entries at a time or to increase/decrease the variables ten units at a time.
 **ENTER/ACK** **Ref. 1d**	In the **PROGRAM** menu, you can enter the programming mode and open a submenu, change a variable or a parameter, and confirm the operation. In the **LOG** menu, you can activate the **HISTORY LOG** function and open the selected log, “acknowledge” any fault errors on the memory at the power-up. Upon the occurrence of an alarm or lockout, the pressing of the button recognizes the presence of an error and turns off the siren. A further press of the button resets any alarm signals if the operating conditions have returned to normal. Lockout signals can only be reset by activating the "OFF/RESET" mode.
 **ACB** **Ref. 1f**	In “**OFF/RESET**” and “**AUTO**” modes, the pushbutton is disabled. In “**MAN**” mode, it is used to open/close the source A contactor to loads. The closing of the loads to the source A is only possible when the related electric measures are in tolerance.
 **BCB** **Ref. 1f**	In “**OFF/RESET**” and “**AUTO**” modes, the pushbutton is disabled. In “**MAN**” mode, it is used to open/close the source B contactor to loads. The closing of the loads to the source B is only possible when the related electric measures are in tolerance.
 **A** **START / STOP SOURCE A** **Ref. 1e**	In **MAN** mode, it can manage the start and stop of the source A when it is set as genset (if source A corresponds to mains, there are no effects). At the controller power-up, pressing it together with the **START / STOP B** button, it allows to access special functions. If it is pressed when the controller is in **OFF/RESET** mode, it executes the **LAMP TEST** of all light indicators.

Pushbutton	Function
 **START / STOP SOURCE B** **Ref. 1e**	In **MAN** mode, it can manage the start and stop of the source B when it is set as genset (if source B corresponds to mains, there are no effects). At the controller power-up, pressing it together with the **START / STOP A** button, it allows to access special functions.

11.3 Indicators (ref. to fig. 1)

LED OFF	LED steady ON	LED flashing
☐	▣	⧈

	Signalling		Function
☐ PROGRAM / OFF/RESET **Ref. 2c**	**PROGRAM OFF/RESET**	▣	It states that the operation mode is OFF/RESET.
		⧈	It states that you are accessing the PROGRAMMING menu.
		☐	The controller is in another operating mode.
☐  MAN. **Ref. 2c**	**MANUAL**	▣	It states that the operation mode is MANUAL.
		☐	The controller is in another operating mode.
☐  AUTO **Ref. 2c**	**AUTO**	▣	It states that the operation mode is AUTOMATIC.
		⧈	Flashing at 90%, it specifies that the operating mode is REMOTE START.
		☐	The controller is in another operating mode.
SOURCE A 	**SOURCE A LIVE**	▣	Source A voltages are present and steadily in tolerance. The digital input **EXTERNAL SENSOR SOURCE A** is active from the set time (DIF.3101).
		☐	Source A are absent. The digital input **EXTERNAL SENSOR SOURCE A** is inactive (DIF.3101).
		⧈	It flashes at 50% during transition between the previous two states.
			Flashing at 25%, the mains voltages are on but below the tolerance range.

Ref. 2b			Flashing at 75%, the mains voltages are on but above the tolerance range.
 **Ref. 2b**	**SOURCE B LIVE**	▣	Source B voltages are present and steadily in tolerance. The digital input **EXTERNAL SENSOR SOURCE B** is active from the set time (DIF.3102).
		□	Source B are absent. The digital input **EXTERNAL SENSOR SOURCE B** is inactive (DIF.3102).
		▣	It flashes at 50% during transition between the previous two states.
		▣	Flashing at 25%, the mains voltages are on but below the tolerance range.
		▣	Flashing at 75%, the mains voltages are on but above the tolerance range.
 **Ref. 2b**	**ACB**	□	The ACB breaker is set to be opened.
		▣	The ACB breaker is set to be closed.
		▣	It flashes 25% if it is opened when it is set to be closed.
		▣	It flashes 75% if it is closed when it is set to be opened.
 **Ref. 2b**	**BCB**	□	The BCB breaker is set to be opened.
		▣	The BCB breaker is set to be closed.
		▣	It flashes 25% if it is opened when it is set to be closed.
		▣	It flashes 75% if it is closed when it is set to be opened.
 **Ref. 2a**	**ALARM**	▣	It states the presence of at least one lock.
		▣	It states the presence of at least one warning, which has not been identified yet with the "**ACK/ENTER**" button.
		□	There are no locks or warnings.

☐ REMOTE START Ref. 2a	REMOTE START	▣	The controller is in automatic mode by remote start (by means of an input set with the DIF.2273 function).
		☐	No remote request.

11.4 Multifunctional display

11.4.1 LCD lighting

The backlight lamp is managed by the controller, which switches it off if no buttons are pressed in a programmable time (P.0492). Press any button to switch the lamp ON again (it is recommended to use the ESC/SHIFT button, that has no function alone). This function can be disabled by setting parameter P.0492 to 0.

11.4.2 Contrast adjustment

Depending on the environmental temperature conditions, the contrast may require adjustment in order to view the display correctly.

Press in sequence the ESC/SHIFT + LEFT buttons to reduce the contrast (lighten); press the ESC/SHIFT + RIGHT buttons to increase it (darken).

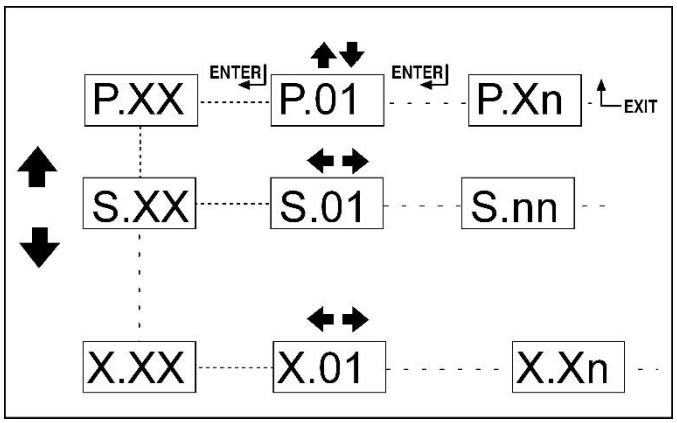
11.4.3 Mode navigation (ref. to fig. 2)

The display has different display modes composed by various pages.

Mode	Description	Page identifier
PROGRAMMING	Programming	P.XX
STATUS	Status info	S.XX
SYSTEM	Electrical measurements	M.XX
HISTORY	History logs	H.XX

Generally, the navigation among modes takes place via buttons **UP** **Ref. 1c** and **DOWN** **Ref. 1c**.

Fig. 2 - Mode navigation



To view the pages within the mode, use the buttons **LEFT**  **Ref. 1c** and **RIGHT**  **Ref. 1c**.

In some modes (e.g.: mode P.xx and mode H.xx) to view the pages, the **ENTER**  button, and then the **UP**  **Ref. 1c** and **DOWN**  **Ref. 1c** buttons must be pressed to navigate through pages.

If the **UP**  and **DOWN**  buttons have to be used to manage the functions within the mode, the **ENTER**  button must be pressed to activate said functions, and the **ESC/SHIFT**  button

to deactivate them.

11.4.4 Display area layout (ref. to fig. 3)

KEY:
1 – Status bar
2 – Data area

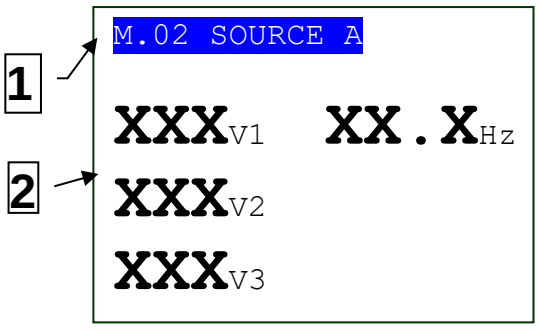


Fig. 3 – Display areas

11.4.5 Top status bar (ref. to fig. 4)

The top status bar contains information on navigation, times and/or some status information.

KEY:
1a – Mode identifier
1b – Page identifier
1c – Page title

2 – System status

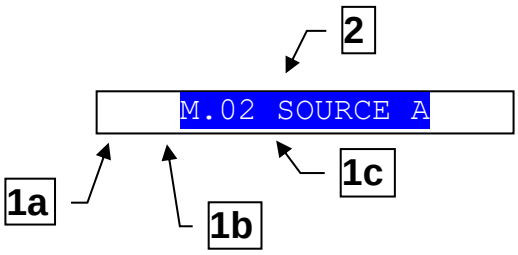


Fig. 4 – Top status bar

The current mode is shown in the relevant field of the top status bar (**1a**).

The mode identifier (**1a**), and the page identifier (**1b**) identify and refer to the page so there is no chance of error. The title (**1c**) provides a description in the current language of the content of the page.

Pressing the **ESC/SHIFT** button, the controller replaces the title (while the button is held) with a status message. By double clicking the **ESC/SHIFT** button, the title is replaced with a status message so long as you remain on that page. If the bit 6 of parameter P.0495 is activated, the controller automatically replaces the title with a status message if there is at least one pending status message with a waiting time (countdown); if the operator selects a new page, the controller shows the title for two seconds, then it shows the status message again.

The system status **(2)** displays part of the information of the page **S.01** (STATUS) that is useful to the operator, as it can be displayed even if other pages or display mode are being accessed.

11.5 Display mode

11.5.1 Programming (P.xx)

The controller manages a high number of parameters that allow the manufacturer, the installer or the final user to configure it in order to adapt it to specific system requirements. This document does not contain the parameters list (even though many of them are quoted in the description of the controller functions); the list is available in the document [1], where they're described in detail. In this document the general programming structure and the operating procedure to read and/or modify parameters are described.

To access the parameters change mode, scroll the **UP** and **DOWN** buttons to menu P.03 - Programming and press **ACK/ENTER** to start.

To exit the programming menu and to return to the main screen press the **ESC** button.

⚠ WARNING: The assignment of an incorrect value to one or more parameters can cause malfunctions or damages to things or injuries to people. The parameters must be changed by qualified personnel only. Parameters can be protected by password (ref. to par. 11.5.1.2).

11.5.1.1 Organization

This mode allows to display and change the programming parameters.

KEY:
1 – Status bar
2 – Current menu
3 – Current parameter
4 – Parameter value

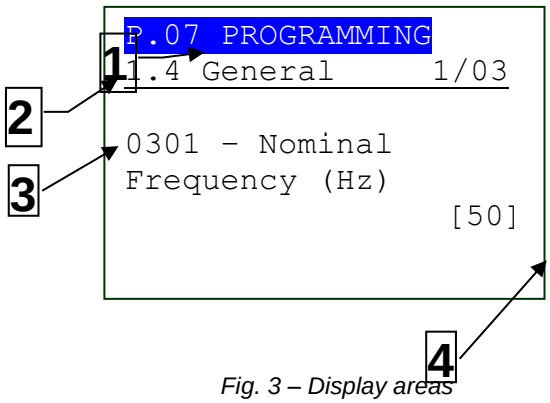


Fig. 3 – Display areas

Each programming parameter Ref. 3 has a 4-digit numeric code associated (e.g. P.0301) to identify the variables regardless of the language used. The current value of the parameter is displayed below the description Ref.4 (between brackets).

The first line Ref.2, below the upper status bar, allows to identify the current menu using the ID number of the menu and the associated text. A pair of numbers is displayed on the right of this line, 2/ 06 in the example in fig. 3.

The first indicates which entry in the menu is selected or which page is displayed; the second indicates how many entries or pages can be displayed in the current menu/submenu.

When pressing the **ESC/SHIFT** button, the first line Ref.1 is temporarily replaced by a status message concerning the engine sequence.

11.5.1.2 Protection password

If the password is lost, you can reconfigure it using the higher level password. Contact our service centre if the "MANUFACTURER" password is lost.

The first page (**000-Access Code**) of the **SYSTEM** menu requires the setting of the access code if one or several passwords have been assigned (available with the path P.03 PROGRAMMING\ 1.SYSTEM\ 1.1 Security\ 1.1.1 Authentication).

The password is not assigned if equal to 0 (only valid for **Manufacturer, Installer and User** passwords).

The pages corresponding to the Password setting are displayed only if you are authorized to make changes in the **SYSTEM** sub-menu (with the path P.03 PROGRAMMING\ 1.SYSTEM\ 1.1 Security\ 1.1.2 Password).

In programming mode, in case the page for the password change is not displayed when you enter the Password, press **ESC** to return to the previous menu and try to open the page again. The set access code remains in memory for about 10 minutes after the programming has been completed. Then it must be entered again to access the programming mode.

The access to the programming mode can be controlled by 4 different PASSWORD levels, listed in priority order.

1. ***Manufacturer password***
2. ***Installer password***
3. ***User password***
4. ***Serial ports password***

1. As **MANUFACTURER**, it is possible to display and change all the three passwords (MANUFACTURER, INSTALLER and USER) and change all parameters concerning configuration, protections and sequences.

2. As **INSTALLER**, it is possible to display and change the INSTALLER and USER passwords and change all parameters concerning the configuration, but the parameters that need the MANUFACTURER password.

3. As **USER**, it is possible to display and change the USER password only, and access the parameters that allow to adjust sequence times and basic configurations, without changing the plant operation principle in any way.

4. The "**Serial Ports**" password can only be set and/or seen through the user panel; when set, this password prevents any command from the serial line.

Each parameter of the controller is associated to a user type (in the document [1] "Mecc Alte EAAM0479xxXA - Parameter Table ATS115" this association is shown in the "ACC" column with a "C" for Manufacturer, "I" for Installer and "U" for User).

A parameter associated to the manufacturer can be modified only by the manufacturer. A parameter associated to the installer can be modified by the manufacturer and the installer. A parameter associated to the user can be modified by the manufacturer, the installer and the user.

According to the general rule, parameters can be changed only when the controller is on "OFF_RESET". Except for some parameters that can be changed regardless of the status of the controller, including with the engine running. Generally, if a parameter cannot be changed, it will be enclosed between < and >; instead, if it can be modified, it will be enclosed between [and] : that is valid also for the restrictions due to password.

If the operator has to change a parameter, he/she must put first the proper password in the P.0000 parameter ("1.1.1 - Authentication"), so that the controller can recognize it as "Manufacturer", "Installer" or "User". The parameter is available, with the controller in OFF/RESET-PROGRAM mode, at path: **P.03 PROGRAMMING\1.SYSTEM\1.1 Security\1.1.1 Authentication**. After completing this operation, it will be possible to change the required parameters. The access code entered remains saved in P.0000 for about 10 minutes since the end of programming. After this time, the code is automatically reset to zero and must be re-entered to access the programming again.

It is possible to customize the passwords for the three types of users, through the parameters P.0001 (manufacturer), P.0002 (installer) and P.0003 (user), available with the path **P.03 PROGRAMMING\1.SYSTEM\1.1 Security\1.1.2 Password configuration**. The value "0" for these parameters means no password set. The following examples show all the combinations for the passwords assignment.

Example 1: P.0001=0 P.0002=0 P.0003=0

Any operator is seen as a "manufacturer", with no need of setting anything in "P.0000-Access code". Therefore all the parameters are changeable from anyone (this is the default mode).

Example 2: P.0001=0 P.0002=0 P.0003="uuu"

No parameter modification is allowed. When entering the "uuu" code in "P.0000 -Access code", the operator is identified as "User" but, since no password is associated to "Installer" and "Manufacturer", the controller acknowledges him/her as "Manufacturer". After entering the code, all parameters are changeable.

Example 3: P.0001=0 P.0002="iii" P.0003="uuu"

No parameter modification is allowed. When entering "uuu" in "P.0000 - Access code", the operator is identified as "User" and allowed to change all parameters associated to the user. By entering "iii" instead, the operator is identified

as "Installer" but, since no password is associated to the manufacturer, the controller identifies him/her as "Manufacturer". After entering the code all parameters are changeable.

Example 4: P.0001="ccc" P.0002="iii" P.0003="uuu"

No parameter modification is allowed. When entering "uuu" in "P.0000 - Access code", the operator is identified as "User" and allowed to change all parameters associated to the user. By entering "iii" instead, the operator is identified as "Installer" and allowed to change all parameters associated to the installer and the user. By entering "ccc", the operator is identified as "Manufacturer" and allowed to change all controller parameters.

Example 5: P.0001="ccc" P.0002=0 P.0003=0

As no password is associated to the User and the Installer, programming the relevant parameters is allowed without entering anything in "P.0000 - Access code". To change the parameters associated to Manufacturer, simply enter "ccc" in "P.0000-Access code".

Example 6: P.0001=0 P.0002="iii" P.0003=0

As no password is associated to the User, programming the relevant parameters is allowed without entering anything in "P.0000 - Access code". By entering "iii" in "P.0000 - Access code", the operator is identified as "Installer" but, since no password is associated to the manufacturer, the controller still identifies him/her as "manufacturer". After entering the code all parameters are changeable.

Example 7: P.0001="ccc" P.0002="iii" P.0003=0

As no password is associated to the User, programming the relevant parameters is allowed without entering anything in "P.0000 - Access code". By entering "iii" in "P.0000 - Access code", the operator is identified as "Installer" and allowed to change all parameters associated to the installer and the user. By entering "ccc" in P.0000, the operator is identified as "Manufacturer" and allowed to change all controller parameters.

Example 8: P.0001="ccc" P.0002=000 P.0003="uuu"

No parameter modification is allowed. When entering "uuu" in "P.0000 - Access code", the operator is identified as "User" but, since no password is associated to the installer, the controller still identifies him/her as "Installer". The parameters associated to the installer and the user can therefore be changed. By entering "ccc", the operator is identified as "Manufacturer" and allowed to change all controller parameters.

The parameter value can always be read, but it can be modified only in case the "P.0000" contains a proper password. Parameters P.0001, P.0002, P.0003 and P.0469 (serial ports password) are excluded: they are not even displayed in case the "P.0000" does not contain a proper password.

The P.0469 parameter – "Serial ports password" can only be displayed and/or changed through the operator panel, and with at least the Installer rights.

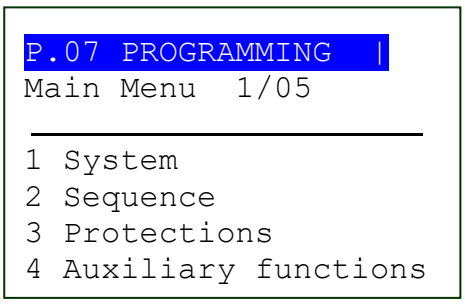
When accessing the programming and setting the password ("P.0000), parameters P.0001, P.0002 and P.0003 may not be displayed immediately. To enable the visualisation, return to the previous menu and then re-enter.

In case the code set as password is forgotten, the access can only be recovered with the higher level password. Otherwise (or in the event the manufacturer password is lost), you need to send the controller back to the factory to have its associated programming functions unlocked.

This is the reason why we recommend to set at least the "Manufacturer" password (P.0001): in fact, in case someone else sets up this password, or a lower level one (even unwillingly) without providing information, no parameter modification will be possible anymore. Instead, knowing the "manufacturer" password, it will be possible to cancel or change the other passwords.

11.5.1.3 Operating procedure

This procedure will describe the keyboard and the display use.



- The 1-SYSTEM menu allows to show how the controller connects to sources (mains or genset) and the kind of plant. The correct setting of these parameters is paramount as almost all protection activation thresholds are expressed as a percentage of these parameters. In it there is the 1.6-INPUTS/OUTPUTS menu that allows to set how the controller has to use the different inputs and outputs available (combining each of them to the required function).
- Working sequence configuration can be modified through the 2-SEQUENCE menu. In this menu it is possible to set threshold percentages and acquisition times, plus enabling/disabling operation sequences related functions.
- Protections management is accessible through the 3-PROTECTION menu. As to this, it is important to know that, in order to enable/disable a protection, you just have to the associated time, leaving the threshold unchanged: by setting the time to zero, the protection is disabled. However, this general rule provides some exceptions. Refer to the chapter on faults (par.13), which describes the method to disable each of the faults.
- All operations not related to system configuration, sequence, protections and inputs/outputs can be performed through the menu 4-AUXILIARY FUNCTIONS. This menu contains other menus used for configuring engine auxiliary functions, calendars, timers, history logs and serial communication.

11.5.1.4 Access to programming

The programming is accessible with the controller in any operation state, while parameters can only be modified, in general, with the board on **OFF/RESET**.
To enter the programming mode, use the UP ▲ and DOWN ▼ buttons till the base PROGRAMMING mode (P.03) screen is displayed.

When in a mode that limits the use of vertical scrolling buttons, it could be necessary to press the **ESC** button one or several times (this situation can occur while displaying history logs or during some particular operations, such as setting the fuel pump control mode).

Then, press **ENTER** to access the programming.

The menu or the variable selected before the last exit from programming are automatically displayed when starting the procedure (the main menu is displayed the first time you access). This is true if the programming procedure has been previously left by changing the operation mode of the controller in MAN or AUTO, or after the maximum time with no programming operation, or keeping the **ESC** button pressed for more than two seconds.

11.5.1.5 Menu selection

Current menu name, selected menu item and number of menu items are always displayed in the second line. Menu items (submenus) are displayed in the following lines. The item selected is displayed in REVERSE. Use the ▲ and ▼ buttons to cyclically scroll through the menu to lower and upper index items (i.e. pressing ▲ from the first item to the last one and vice versa).

Press **ENTER** to access the selected (highlighted) submenu. Press **ESC** to leave the menu (back to the previous menu or to the base screen if exiting programming in the main menu).

11.5.1.6 Parameters selection

Current menu name (for example the "1-SYSTEM" menu), selected menu item and number of menu items are always displayed in the second line. The following lines are used to display a single parameter. In particular:

- The unambiguous parameter code (three decimal digits), followed by the description in the current language, is shown in the fourth and fifth line.
- The sixth line shows, between brackets, the variable value aligned to the right side "< >".
- For some parameters, the eighth line shows a value which is related, in some way, to the actual parameter value. For example, in the case of the genset rated power, it shows the rated plant current, which is derived from the rated genset voltage (P. 0102) and from the parameter itself (rated power, P.0106). Sometimes, this additional measure can be displayed when the parameter is a percentage of other values, in order to show its absolute value.

Use the ▲ and ▼ buttons to cyclically scroll the menu to the lower and the upper index items. Press the **ENTER** button to enable the parameter modification procedure (see the following paragraph). Press the **ESC** button to leave the menu (going back to the previous menu).

11.5.1.7 Modify a parameter

You may only modify the parameters displayed between square brackets ([ ]). A parameter between major/minor symbols (< >) cannot be modified. In this case, it could be necessary to set an appropriate password or to stop the genset.

In case of changeable parameter, press the **ENTER** button; the square brackets ([ ]) enclosing the value will blink to signal that the modification is in progress. In order to confirm the new value, press again the **ENTER** button; to abort the change and go back to the original value, press the **ESC** button.

The types of parameters are the following:

- **Bits**: Some parameters are managed with bits. Each bit set to 1 enables a function and each bit set to 0 disables a function. Each bit is assigned to a value. The parameter must be set at the result of the sum of the values associated to the functions you require to enable. 8 bits can be used. The description of these parameters is shown in a table like the one below:

Bit	Value	Description
0	1	Enable function 1
1	2	Enable function 2
2	4	Enable function 3
3	8	Enable function 4
4	16	Enable function 5
5	32	Enable function 6
6	64	Enable function 7

7	128	Enable function 8

In case the operator wants:

• To disable all functions the relevant parameter must be set to 0.

• To enable all functions the value to be set is the sum 1+2+4+8+16+32+64+128 = 255.

• To enable, for example, the functions 3, 4, 6 and 8 the value to be set is the sum 4+8+32+128 = 172 (where 4 is the value associated to the function 3; 8 to the function 4; 32 to the function 6; 128 to the function 8).

- **Numerics**: the value can be modified by pressing the ▲ and/or ▼ buttons, in order to increase or decrease one unit from the most rightwards decimal digit (if you press the above buttons together with SHIFT, the figure will be increased or decreased by ten units at a time). The change is cyclical: increasing the maximum value will lead to the minimum one and vice versa.
- **Numerics selected in a pre-defined list** (for example the number of phases of the genset): as for the numeric parameters, considering that the ▲ and/or ▼ buttons allow to pass to the following/previous value in the pre-defined list (pressing the above buttons together with SHIFT, you go to the value ten units after/before the current one).
- **Numerics selected in a number-string couples list** (e.g. the type of pressure sensor): as the previous point.
- **Time**: as numerical parameters, with one exception: the controller manages the increase/decrease maintaining valid values (example: increasing from “00.59”, the value goes to “01.00” and not to “00.60”).
- **Strings** (e.g. telephone numbers): in this case the display shows also a cursor indicating the currently selected character in the string. The ▲▼ buttons work on the selected character (passing to the one after/before in the ASCII table or to the one 10 units before/after if pressing the above buttons plus SHIFT). The ◄► buttons allow to select the character to be changed.

You can only set the ASCII characters from 32 (Space) to 127 (Escape). It is not possible to set extended ASCII characters (over 127) and the control ones (from zero to 31).

- **Hexadecimal strings** (e.g. output bitmaps): as for the string parameters, but the selectable characters are only “0-9” and “A-F” (only capitals for the latter).

11.5.1.8 Set up limits

The operator has not to worry about checking that the set up value is acceptable for the controller since it is not possible to set up not acceptable values.

This goes for individual parameters; however, it is possible to set two or more parameters in incongruent or incompatible ways. It is up to the operator to prevent this from occurring.

11.5.1.9 Exit programming

There are three ways to exit programming mode:

- Press the **EXIT** button 'n' times to scroll back to the main menu, then press it again to exit programming. The main menu will be displayed on the next access to programming.
- Press and hold the **ESC** button for two seconds from any position will cause instantaneous exit from programming. The next access will get you to the same point.
- Turn the operation mode of the controller into **AUTO** or **MAN**. The next access will get you to the same point.

11.5.1.10 Loading default values

WARNING: This procedure permanently reloads all factory parameters according to access rights.

Sometimes, it may be useful to reload parameters factory values. To do so, first access programming, then press and hold the **ACK/TEST** and **ESC/SHIFT** buttons simultaneously for five seconds. The reload of factory values will be confirmed by a message on the display.

Factory values are reloaded only for parameters for which you have granted access rights.

11.5.2 Status information (S.xx)

In this mode, information on the system status is provided. You can scroll through pages using the LEFT and RIGHT horizontal buttons.

11.5.2.1 S.01 STATUS

Page **S.01 (STATUS)** shows system status information. Part of this information is shown on the top status bar. It contains:

- Breakers status (ACB closed, ACB and BCB opened, BCB closed etc.).
- Working mode of the controller (MAN, AUTO, etc.).
- Possible start inhibitions of the source/s configured as genset/s.
- Source A status (absent, low, high etc.) and type (mains/genset).
- Source B status (absent, low, high etc.) and type (mains/genset).
- Possible activation of the “Neutral Position” or the switch status (it signals the presence of at least one inhibition to the active switch, whether it is connected to digital inputs or to serial port, on at least one of the two sources).

Some of these data are shown together with an elapsing time; for example, during the wait for the engine cooling down, the residual time is shown.

11.5.2.2 S.02 FAULTS

Page **S.02 (FAULTS)** is automatically shown in case a new fault arises. For every anomaly:

- A letter that identifies the type:
  - “A”: alarm (interlock)
  - “W”: warning
- A three digit numeric code that uniquely identifies the anomaly. This code flashes until it is acknowledged pressing the “ACK” pushbutton.
- An alphanumeric description, which depends on the language currently selected and which, in some cases, can be customized using the controller parameters.

Each fault uses one or two rows of the LCD display. The fault shown in the highest position is the most chronologically recent. If the space available is not enough to display all the faults, only the most recent ones will be displayed. In order to see the others, it is required to:

- Press the ENTER key
- Use the ▲▼ keys to scroll the anomalies
- Press EXIT to leave the mode

11.5.2.3 S.03 SERIAL COMMUNICATION

Page **S.03 (SERIAL COMMUNICATION)** is dedicated to the status of the serial communication to the serial ports. In case of functional problems, please check the content of this page.

Received communication error counters are displayed. If the condition causing the malfunction has been removed, you can reset the error counters on this page. To activate the error reset function, press the **ACK/ENTER** button and scroll with the **UP** and **DOWN** buttons for the errors to be reset. Hold down **ACK/ENTER + ESC/SHIFT** for a few seconds until the message "RESET/DEFAULT" is displayed. To exit the error selection, use the **ESC/SHIFT** button.

The type of connection (direct, via modem, via GSM) and the related status (on standby, communicating etc.) are always displayed. In case of the GSM modem, the information related to the radio signal strength and the provider is shown too.

11.5.2.4 S.04 ETHERNET

Page **S.04 (ETHERNET)** is dedicated to the status of the connection and of the communication via Ethernet. It displays the addresses currently used on the controller and the MAC address associated. In case of working problems, check the information in this page.

The possible statuses related to the communication via Ethernet are:

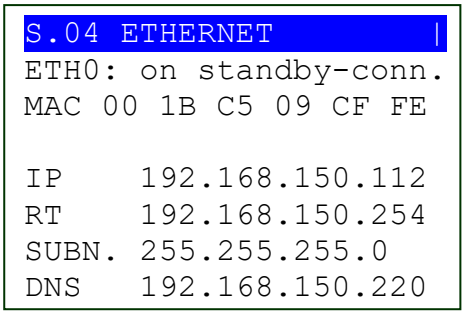
- *On standby*: no communication and Ethernet cable disconnected;

- *On standby-connected*: no communication and cable connected to the Ethernet network;

- *Communicating*: communication and cable connected to the Ethernet network.

The addresses displayed are:

- *IP*: IP address used by the controller;
- *RT*: gateway address (or router);
- *SUBN*: subnet mask value;
- *DNS*: DNS server address.



Note: This page is displayed only if the controller is equipped with the Ethernet optional module.

11.5.2.5 S.05 CONTROLLER

Page **S.05 (CONTROLLER)** is dedicated to the ATS115 and contains:

- The language currently used by the device. It allows you to select among the ones installed (see par.0)
- Current date and time in long format (flashing if the clock is not valid)
- The measure of the source (power-up battery) voltage of the controller
- The unambiguous serial number of the controller board (called ID CODE)
- The code of the software currently loaded on the controller board (see par. 1.8)

11.5.2.6 S.06-07-08 GENERAL STATUS

Digital inputs can be configured as “generic status” using the following functions:

- “DIF.3201” and “DIF.3202”: displayed page S.06.
- “DIF.3203” and “DIF.3204”: displayed at page S.07.
- “DIF.3205” and “DIF.3206”: displayed at page S.08.

In this way, you can acquire and visualize the statuses that do not strictly depend on the logic of the controller and that do not refer to warnings or arrests.

The pages are automatically (and individually) hided if there aren’t inputs configured with the previous functions.

When an input configured with the functions “DIF.3202”, “DIF.3204” and “DIF.3206” (important status) is activated, the controller forces the related page on the display, so that the operator see immediately what happened.

Each configured input uses a line on the display: the controller displays the text configured for that input (P.2003 for the input 1) followed by the status of the input (1/0). If the available space is not enough to visualize all statuses, the controller shows them making the pages rotate every two seconds; holding the SHIFT button down, the pages rotation is locked on the one currently displayed.

The operator can divide these statuses in three pages (gathering them according to their functions in order to avoid to have too many of them per page), using different functions for the digital inputs.

11.5.2.7 S.09 DIGITAL INPUTS

Page **S.09 (DIGITAL INPUTS)** displays the status of the digital inputs of the controller. Both physical and virtual inputs (16) are displayed.

The status of the inputs can be displayed in three different ways, which can be selected pressing the ENTER button:

- Visualization of the inputs logic statuses (which can differ from the physical status if some reversals are set with the parameters P.2000 and P.2050). Input statuses are displayed normally (not in “reverse”). For each active input a “1” is displayed; for each inactive input a “0” is displayed.
- Visualization of the inputs physical statuses. Statuses are displayed in “reverse”. For each active input a “1” is displayed; for each inactive input a “0” is displayed. Physical statuses do not have sense for virtual digital inputs.
- Visualization per function. Each line of the display shows one of the functions associated to the inputs, followed by the input (logic) status that uses this function. This is useful to check the status of a particular function without previously knowing which input is using it. For example, it is possible to check immediately the ACB status without knowing which input receives its feedback. If the lines on the display are not enough to show all the configured functions, the controller shows them making the pages rotate every two seconds; holding the SHIFT button down, the pages rotation is locked on the one currently displayed.

11.5.2.8 S.10 DIGITAL OUTPUTS

Page **S.10 (DIGITAL OUTPUTS)** shows the status of all the digital outputs of the controller.

The status of the outputs can be displayed in three different ways, which can be selected pressing the ENTER button:

- Visualization of the outputs logic statuses (which can differ from the physical status if some reversals are set with the parameters P.3000 and P.3020). Input statuses are displayed normally (not in “reverse”). For each active input a “1” is displayed; for each inactive input a “0” is displayed.
- Visualization of the outputs physical statuses. Statuses are displayed in “reverse”. For each active input a “1” is displayed; for each inactive input a “0” is displayed.
- Visualization per function. Each line of the display shows one of the functions associated to the outputs, followed by the outputs (logic) status that uses this function. This is useful to check the status of a particular function without previously knowing which output is using it. For example, it is possible to check immediately the ACB status without knowing which output receives its feedback. If the lines on the display are not enough to show all the configured functions, the controller shows them making the pages rotate every two seconds; holding the SHIFT button down, the pages rotation is locked on the one currently displayed.

11.5.2.9 S.11 ANALOGUE INPUTS

Page **S.11 (ANALOGUE INPUTS)** shows the value of the analogue inputs Ai1, Ai2, Ai3 of the controller (the JM connector), of the emergency stop (EM-S) and of the fourth analogue input Ai4 (JL_4). For each input the measure is displayed in Volt, for terminals JM-2, JM-3 and JM-4 the measure is displayed in Ohm too.

11.5.3 Electrical measurement (M.xx)

This mode displays all the information on the controller measurements on the electric lines. You can scroll through pages using the LEFT and RIGHT buttons.

11.5.3.1 M.01 SYSTEM

Page **M.01 (SYSTEM)** displays a wiring diagram of the system, showing:

- The mains. The symbol of the mains is solid if the mains is within the tolerance range, flashing if the mains is missing or if it exceeds the tolerance range.
- The generator. The symbol of the generator is in “reverse” if the generator is powered.
- The loads. The symbol of the loads is displayed in “reverse” if the loads are powered by the Source A or B.
- The ACB and BCB breakers. The symbol of the breaker shows:
  - The open/closed status.
  - The difference between status and breaker command (in this case the two contact points of the breaker flash).
  - The possibility of using the synchronization to close the breaker if the synchronization can be used, the two contact points of the breaker are empty squares, otherwise they are full squares).
- The power flows are displayed with arrows in the three branches of the system. The arrow points in the direction of the power. It flashes (to indicate a faulty situation) in case of reversed power on the generator and in case of negative power to the loads.
- The active power and the power factor measurements.
- A flashing little square next to the Source A or B to indicate which is the priority source now.

11.5.3.2 M.02 SOURCE A

This page shows the phase-phase concatenated voltages and the frequency of the Source A (configurable as mains or genset), in addition to the rotation direction of the phases (clockwise or counter clockwise). For three-phase systems, the concatenated voltages are displayed; for the one-phase systems, the single phase voltage is displayed (the others are replaced by dashes) and the rotation direction is not displayed.

To the bottom right there is an icon that allows the immediate identification of the fact that the page is related to the MAINS or the GENSET measures, according to the setting of the parameter P.0100 – "Source A".

11.5.3.3 M.03 SOURCE A (second page)

This page shows the phase phase-neutral voltages and the frequency of the Source A (configurable as mains or genset), in addition to the rotation direction of the phases (clockwise or counter clockwise). For three-phase systems, the concatenated voltages are displayed; for the one-phase systems, the single phase voltage is displayed (the others are replaced by dashes) and the rotation direction is not displayed.

To the bottom right there is an icon that allows the immediate identification of the fact that the page is related to the MAINS or the GENSET measures, according to the setting of the parameter P.0100 – "Source A".

The page only exists if the system is set to use the neutral connection on SOURCE A. (see par. 8.1).

11.5.3.4 M.04 SOURCE B

This page shows the phase-phase concatenated voltages and the frequency of the Source B (configurable as mains or genset), in addition to the rotation direction of the phases (clockwise or counter clockwise). For three-phase systems, the concatenated voltages are displayed; for the one-phase systems, the single phase voltage is displayed (the others are replaced by dashes) and the rotation direction is not displayed.

To the bottom right there is an icon that allows the immediate identification of the fact that the page is related to the MAINS or the GENSET measures, according to the setting of the parameter P.0200 – "Source B".

11.5.3.5 M.05 SOURCE B (second page)

This page shows the phase phase-neutral voltages and the frequency of the Source B (configurable as mains or genset), in addition to the rotation direction of the phases (clockwise or counter clockwise). For three-phase systems, the concatenated voltages are displayed; for the one-phase systems, the single phase voltage is displayed (the others are replaced by dashes) and the rotation direction is not displayed.

To the bottom right there is an icon that allows the immediate identification of the fact that the page is related to the MAINS or the GENSET measures, according to the setting of the parameter P.0200 – "Source B".

The page only exists if the system is set to use the neutral connection on SOURCE B. (see par. 8.1).

11.5.3.6 M.06 CURRENTS

This window displays the three phase currents measured by the controller (for single-phase systems the second and the third are replaced by dashes). It is possible to specify where to measure the current, according to the way in which the CTs have been installed on the plant.

To the bottom right each time a letter A or B is displayed in order to specify the real source on which the currents are measured, together with the related symbol of the mains or the genset properly set (P.0100 or P.0200 respectively for the Source A or B).

Using the P.0303 parameter – "C.T. Connection":

- 0 - "On Source A": the CTs are installed on the ACB breaker. The currents measured are the ones supplied by the Source A. At the right bottom corner the letter A and the mains or genset symbol, according to the value set in

P.0100 parameter, are displayed.

- 1 - "On Source A": the CTs are installed on the BCB breaker. The currents measured are the ones supplied by the Source B. At the right bottom corner the letter B and the mains or genset symbol, according to the value set in P.0200 parameter, are displayed.

- 2 - "On Loads": the CTs are installed on the Loads lines (downline the ACB/BCB breakers). The currents measured are the ones supplied by the Source A if the ACB is closed, or by the Source B if the BCB is closed. In case the ACB breaker is closed, at the right bottom corner the letter A and the mains or genset symbol, according to the value set in P.0100 parameter, are displayed. Instead, if the BCB breaker is closed, the letter B and the mains or genset symbol, according to the value set in P.0200 parameter, are displayed.

- The currents are measured if the primary and secondary CTs values are not set to zero (respectively in the parameters P.0302 – "C.T. Primary Source/Load" and P.0310 – "C.T. Secondary Source/Load").

If the ATS115 has been configured correctly, it is possible to measure the negative-sequence current, the auxiliary current, the neutral current and the differential current. Consequently, they will be displayed on the right side of the screen, identified by the following symbols:

- **I–** : negative-sequence current.
- **Ax** : auxiliary current.
- **An** : neutral current.
- **A∑** : differential current.

The neutral and differential current are displayed only when the measure is available, or if the P.0314 parameter (Usage of auxiliary current) has been set to "2 - Neutral", if the CTs of the auxiliary current have the same report of the primary and the secondary and if the CTs are connected to the same line (both on the generator or on the loads, or if the loads are supplied with power from the genset).

The auxiliary current is displayed only if the P.0314 parameter (Usage of auxiliary current) has been set to a value different from "0 - Not used".

The page only exists if the primary and the secondary CTs values for the phase current and for the auxiliary current are set to a value different from zero (respectively in the parameters P.0302 – "C.T. Primary Source/Load" and P.0310 – "C.T. Secondary Source/Load", P.0311 – "Primary of C.T. for auxiliary current" and P.0312 – "Secondary of C.T. for auxiliary current").

11.5.3.7 M.07 POWERS 1

This page shows the active powers (kW), the power factors and the loading types on single or total phases (for single-phase systems, the information related to phases 2 and 3 are replaced by dashes). At the right bottom corner the Source (A or B) together with its related icon (genset or mains) are displayed, in order to indicate which are the powers under consideration (see note in 11.5.3.7).

The powers, the power factors and the loading types are not measured if the C.T. value is set to zero in the parameter P.0302 – "C.T. Primary Source/Load".

11.5.3.8 M.08 POWERS 2

This page shows the reactive powers (kvar) and the apparent powers (kVA) on single or total phases (for single-phase systems, the information related to phases 2 and 3 are replaced by dashes). At the right bottom corner the Source (A or

B) together with its related icon (genset or mains) are displayed, in order to indicate which are the powers under consideration (see note in 11.5.3.7).

The powers are not measured if the C.T. value is set to zero in the parameter P.0302 – “C.T. Primary Source/Load”.

11.5.3.9 M.09 COUNTERS A

This page shows the active and reactive power counters (partial and total) and the working hours (partial and total) counted by the controller relating to the Source A, that is **when the loads are connected to the Source A**.

The active power is counted only if positive (it is not counted in case of reversed power). The reactive power is counted in module (the counter goes up both with capacitive loads and inductive loads).

On this page you can reset to zero the partial counters individually. To this purpose, it is necessary to:

- Press **ENTER**: one of the counters will be highlighted.
- Use the vertical scrolling buttons **UP** and **DOWN** to select the counter to reset to zero.
- Press and hold the **ENTER** and **EXIT** buttons for five seconds.
- Press the **EXIT** key.

Attention: from version 1.20, if a password has been configured in parameter P.0001 ("user" protection level), it will not be possible to reset the counters until this password is entered (login) in parameter P.0000 (" Access code").

11.5.3.10 M.10 COUNTERS B

This page shows the active and reactive power counters (partial and total) and the working hours (partial and total) counted by the controller relating to the Source B, that is **when the loads are connected to the Source B**.

The active power is counted only if positive (it is not counted in case of reversed power). The reactive power is counted in module (the counter goes up both with capacitive loads and inductive loads).

On this page you can reset to zero the partial counters individually. To this purpose, it is necessary to:

- Press **ENTER**: one of the counters will be highlighted.
- Use the vertical scrolling buttons **UP** and **DOWN** to select the counter to reset to zero.
- Press and hold the **ENTER** and **EXIT** buttons for five seconds.
- Press the **EXIT** key.

Attention: from version 1.02, if a password has been configured in parameter P.0001 ("user" protection level), it will not be possible to reset the counters until this password is entered (login) in parameter P.0000 (" Access code").

11.5.3.11 M.11-12-13 EXTERNAL MEASUREMENTS

The analogue inputs can be configured as “generic measurements” using the following functions:

- “AIF.2001”: in this case they are displayed at page M.11.
- “AIF.2003”: in this case they are displayed at page M.12.
- “AIF.2005”: in this case they are displayed at page M.13.

In this way, the operator can display the measures that do not concern the operating logic of the controller directly, gathering them on more pages according to their logic function, not to have too many measures on the same page.

The pages are automatically (and individually) hided if there are not inputs configured with the previous functions.

Each configured input uses a line on the display: the controller displays the text configured for that input, followed by the measure acquired (and eventually converted) by the input itself. In case of setting a unite of measure in the conversion curve, this will be displayed too. If the available space is not enough to display all the measures, the controller will show them making a two-second rotation; by holding down the SHIFT button, the rotation will be locked on the ones currently displayed.

11.5.4 History Logs (H.xx)

When in operation, except for the **OFF/RESET** mode, the controller performs periodical or on-event recordings that can be partially configured with programming parameters.

The controller manages three types of archive:

1. **Events**
2. **Fast analogues**
3. **Slow analogues**

The history logs can be accessed in any controller working status. To access the archive visualization, press the ▲ and ▼ buttons until the **HISTORY LOGS (H.01)** page is displayed.

When in a mode limiting the use of vertical scroll buttons, you may require to press repeatedly the ESC button.

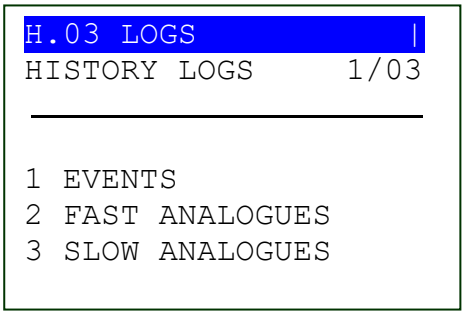
By pressing ESC/SHIFT while on the main page of the HISTORY LOGS mode, the upper status bar will display a status message related to the engine sequence, while the last line of the display will show the following message:

ENTER: visual.log

Then press ENTER to enable the mode (moving to page “H.03”).

At the start of the procedure, the menu of the various archives functions is displayed.

11.5.4.1 Log selection



The first line always shows the numerical indication of the selected function and the number of functions in the menu. The following display lines are used in order to show the selectable functions. The selected item is highlighted in reverse (REVERSE).
Use the ▲ and ▼ buttons to cyclically scroll the menu to the lower and to the upper index items (i.e. pressing ▲ allows to go directly from the first item to the last one and vice versa).

Press ENTER to enable the selected function (the one highlighted in reverse); press the ESC button to return to page “H.01”.

11.5.4.2 Events page

When the previously configured events occur, the controller adds a record in this archive. The full capacity is 126 records. If the archive is full and a new event occurs, the less recent is overwritten (so there are always the last 126 events stored). For each event, besides a numerical code identifying it, it records the following data: date/time of the event, operating mode of the controller, source A or B operating, ACB and BCB status in that moment. If the event is a fault, the measures described for the analogue log are stored too. Configuring the events to be recorded is possible with parameter **P.0441**.

Bits management:

Bit	P.0441 Value	Firmware revision	Description
1	1	01.00	Controller modes
2	2	01.00	Source A status
3	4	01.00	Source B status
4	8	01.00	Circuit breakers status
5	16	01.00	Circuit breakers controls
6	32	01.19	Source A start/stop requests
7	64	01.19	Source B start/stop requests

Below you will find a table showing the codes of all possible events:

Cod.	Firmware revision	Recording cause
EVT.1001	01.00	Controller in OFF_RESET mode
EVT.1002	01.00	Controller in MAN mode
EVT.1003	01.00	Controller in AUTO mode
EVT.1004	01.03	Controller in TEST mode
EVT.1005	01.02	Controller in REMOTE START mode
EVT.1010	01.00	Source A failure
EVT.1011	01.00	Source A on
EVT.1012	01.00	Source A in tolerance
EVT.1013	01.00	Inhibition activated (from configurable input)
EVT.1014	01.00	Inhibition not activated (from configurable input)
EVT.1020	01.00	Source B failure
EVT.1021	01.00	Source B on
EVT.1022	01.00	Source B in tolerance
EVT.1030	01.00	ACB close command
EVT.1031	01.00	ACB open command
EVT.1032	01.00	ACB closed (from digital input)
EVT.1033	01.00	ACB open (from digital input)

EVT.1035	01.00	BCB close command
EVT.1036	01.00	BCB open command
EVT.1037	01.00	BCB closed (from digital input)
EVT.1038	01.00	BCB open (from digital input)
EVT.1040	01.00	Neutral position
EVT.1041	01.19	Source A manual start required
EVT.1042	01.19	Source A manual stop required
EVT.1043	01.19	Source A automatic start required
EVT.1044	01.19	Source A automatic stop required
EVT.1045	01.19	Source A automatic start required by digital input
EVT.1047	01.19	Source A automatic start required by remote start
EVT.1049	01.19	Source A automatic start required by calendar (periodic)
EVT.1051	01.19	Source A automatic start required by SMS
EVT.1053	01.19	Source A automatic start required in case of BCB breaker fault
EVT.1061	01.19	Source B manual start required
EVT.1062	01.19	Source B manual stop required
EVT.1063	01.19	Source B automatic start required
EVT.1064	01.19	Source B automatic stop required
EVT.1065	01.19	Source B automatic start required by digital input
EVT.1067	01.19	Source B automatic start required by remote start
EVT.1069	01.19	Source B automatic start required by calendar (periodic)
EVT.1071	01.19	Source B automatic start required by SMS
EVT.1073	01.19	Source B automatic start required in case of ACB breaker fault
EVT.1074	01.00	Reset
EVT.1075	01.00	Clock/Calendar not valid (but used by some functions)
EVT.1076	01.00	Date/time update
EVT.1077	01.00	New controller power-on
EVT.1084	01.03	Switch on Source A inhibited
EVT.1085	01.03	Switch on Source A non-inhibited
EVT.1086	01.03	Switch on Source B inhibited
EVT.1087	01.03	Switch on Source B non-inhibited
EVT.1088	01.16	Daylight Save Time on
EVT.1089	01.16	Standard Time on

The following table shows the alarm codes. To identify the alarm type, you must put the first digit displayed before the digits that identify the alarm's cause.

Alarm types are:

W: Warnings (serial visualization: 2XXX)
A: Alarms (serial visualization: 5XXX)

Example:

When simulating an emergency stop, the archive window will display: 0048: A048 Emergency stop.

The same event, read in serial, will be displayed as: 5048, where the first digit defines the type (5 = Alarm), followed by the cause code (048= Emergency Stop).

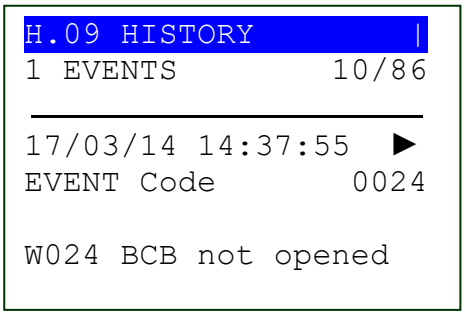
Code	Firmware revision	Type	Description
001	01.00	W	Source A out of tolerance
002	01.00	W	Source B out of tolerance
007	01.00	W	Source A operating speed fault
008	01.00	W	Source B operating speed fault
013	01.00	W	ACB not closed
014	01.00	W	BCB not closed
021	01.00	W	Source A stop fault
022	01.00	W	Source B stop fault
023	01.00	W	ACB not opened
024	01.00	W	BCB not opened
031	01.00	W	Source A fault (contact)
032	01.00	W	Source B fault (contact)
037	01.00	W	Low battery voltage
038	01.00	W	High battery voltage
045	01.00	W	Max auxiliary/neutral current source A
046	01.00	W	Max auxiliary/neutral current source A
048	01.00	A	Emergency stop
051	01.00	W	Controller high temperature
055	01.00	W	Phase sequence fault source A
056	01.00	W	Phase sequence fault source B
057	01.00	W	Clock/Calendar not valid
100	01.00	W	Max differential current source A
101	01.00	W	Max differential current source B

Some alarm codes are displayed only if determined digital inputs and/or analogue values thresholds are configured in the device:

Code	Firmware revision	Type	Description
305	01.00	W	From threshold #1 analogue input #1.
306	01.00	W	From threshold #2 analogue input #1.
307	01.00	W	From threshold #1 analogue input #2.
308	01.00	W	From threshold #2 analogue input #2.
309	01.00	W	From threshold #1 analogue input #3.
310	01.00	W	From threshold #2 analogue input #3.
311	01.00	W	From threshold #1 analogue input #4.
312	01.00	W	From threshold #2 analogue input #4.
313	01.00	W	From threshold #1 virtual analogue input #1.
314	01.00	W	From threshold #2 virtual analogue input #1.
315	01.00	W	From threshold #1 virtual analogue input #2.
316	01.00	W	From threshold #2 virtual analogue input #2.
317	01.00	W	From threshold #1 virtual analogue input #3.
318	01.00	W	From threshold #2 virtual analogue input #3.
319	01.00	W	From threshold #1 virtual analogue input #4.

320	01.00	W	From threshold #2 virtual analogue input #4.
321	01.00	W	From threshold #1 virtual analogue input #5.
322	01.00	W	From threshold #2 virtual analogue input #5.
323	01.00	W	From threshold #1 virtual analogue input #6.
324	01.00	W	From threshold #2 virtual analogue input #6.
325	01.00	W	From threshold #1 virtual analogue input #7.
326	01.00	W	From threshold #2 virtual analogue input #4.
327	01.00	W	From threshold #1 virtual analogue input #8.
328	01.00	W	From threshold #2 virtual analogue input #8.
701	01.00	W	From input 1
702	01.00	W	From input 2
703	01.00	W	From input 3
704	01.00	W	From input 4
705	01.00	W	From input 5
706	01.00	W	From input 6
707	01.00	W	From input 7
708	01.00	W	From input 8
723	01.00	W	From input 9 (JM-2)
724	01.00	W	From input 10 (JM-3)
725	01.00	W	From input 11 (JM-4)
726	01.00	W	From input 12 (JL-4)
727	01.00	W	From virtual digital input #01.
728	01.00	W	From virtual digital input #02.
729	01.00	W	From virtual digital input #03.
730	01.00	W	From virtual digital input #04.
731	01.00	W	From virtual digital input #05.
732	01.00	W	From virtual digital input #06.
733	01.00	W	From virtual digital input #07.
734	01.00	W	From virtual digital input #08.
735	01.00	W	From virtual digital input #09.
736	01.00	W	From virtual digital input #10.
737	01.00	W	From virtual digital input #11.
738	01.00	W	From virtual digital input #12.
739	01.00	W	From virtual digital input #13.
740	01.00	W	From virtual digital input #14.
741	01.00	W	From virtual digital input #15.
742	01.00	W	From virtual digital input #16.

For the visualization of each event, the controller uses at least three pages on the display: if the event displayed is one of the 21 latest faults, the pages used become seven. The main page has the following format:



The second line of each event page shows which event is currently displayed (10) and the partial event stored (86). Once the total number of events available is reached, the partial value will remain fixed at the limit value (126) up to a possible log resetting. The example above shows the event 10 of the 86 stored (out of 126 available).

The fourth line of each event page displays the record date/time; on the right, it also displays two arrows indicating the availability of further pages to the right or to the left of the present page for the current event.

The lines from the fifth to the eighth show different information, depending on the selected page:

- The first page displays the numeric code of the event (**W024 in the example**) and the clear description of the event, in this case warning **W** ("**W024 BCB not opened**").
- The second page displays the statuses of the system when the event is recorded: controller operating mode and sources A and B status.
- The third page displays the switch statuses (ACB and BCB) when the event is recorded.
- The fourth page displays all the analogue values related to mains when the event is recorded:

Source A Hz (Source A frequency)
Source A V 12 (Source A L1-L2 phase-to-phase voltage)
Source A V 23* (Source A L2-L3 phase-to-phase voltage)
Source A V 31* (Source A L3-L1 phase-to-phase voltage)

- The fifth page displays all the analogue values related to mains when the event is recorded:

Source B Hz (Source B frequency)
Source B V12 (Source B L1-L2 phase-to-phase voltage)
Source B V23* (Source B L2-L3 phase-to-phase voltage)
Source B V31* (Source B L3-L1 phase-to-phase voltage)

- The sixth page displays all the analogue values related to loads, that is currents and powers, when the event is recorded:

A1 (L1 phase current)
A2* (L2 phase current)
A3* (L3 phase current)
kW T (Total active power of the system)
kvar T (Total reactive power of the system)
kVA T (Total apparent power of the system)
P.F. T (Total power factor and type of load: i=inductive, c=capacitive)

- The seventh page displays all the analogue values when the event is recorded:

Analogue sensor 1 JM-2 (Ohm)
Analogue sensor 2 JM-3 (Ohm)
Analogue sensor 3 JM-4 (Ohm)
Analogue sensor 4 JL-4 (Vdc)
Battery voltage (Vdc)

* In single-phase, the second and the third voltage/current are displayed with dashes.

The latest event is the one that has the highest number. Using the ▲ and ▼ keys all the recordings are displayed ciclically.

Using the ◄ and ► keys it is possible to go through the pages related to the event.

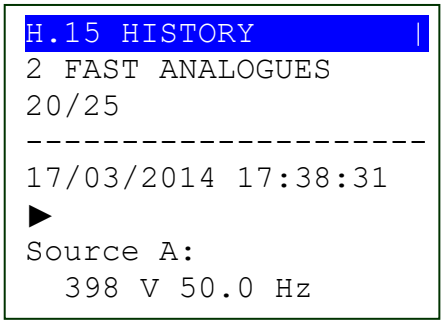
11.5.4.3 Pages for analogue measures

At a configurable recording frequency by means of the parameters P.0442 (seconds) and P.0443 (minutes), the controller records the following analogue measures with engine on and/or off:

- Source A phase-to-phase voltages and frequency.
- Source B phase-to-phase voltages and frequency.
- Currents.
- Active, reactive and apparent powers, power factor and type of total plant load.
- Starting battery voltage and analogue sensors.

Each recording is associated with its date/time. The measures not acquired (because the controller was not set to acquire them) are replaced by dashes.

To visualize all recordings, the controller uses four pages of the display. The main page has the following format:



The second line of each page shows which record is currently displayed (20) and the partial record stored (25). Once the total number of records available is reached, the partial value will remain fixed at the limit value up to a possible log resetting. The example above shows the record 29 of the 40 stored (out of 42 available).

The fourth line of each page displays the recording date/time; on the right it also displays two arrows indicating the availability of further pages to the right or to the left of the present page for the current record.

The lines from the fifth to the eighth show different information, depending on the selected page.

- The first page displays all the analogue values related to mains when the event is recorded:

Source A Hz (Source A frequency)
Source A V 12 (Source A L1-L2 phase-to-phase voltage)
Source A V 23* (Source A L2-L3 phase-to-phase voltage)
Source A V 31* (Source A L3-L1 phase-to-phase voltage)

- The fifth page displays all the analogue values related to mains when the event is recorded:

Source B Hz (Source B frequency)
Source B V12 (Source B L1-L2 connected voltage)

Source B V23* (Source B L2-L3 connected voltage)
Source B V31* (Source B L3-L1 connected voltage)

- The sixth page displays all the analogue values related to loads, that is currents and powers, when the event is recorded:

A1 (L1 phase current)
A2* (L2 phase current)
A3* (L3 phase current)
kW T (Total active power of the system)
kvar T (Total reactive power of the system)
kVA T (Total apparent power of the system)
P.F. T (Total power factor and type of load: i=inductive, c=capacitive)

- The seventh page displays all the analogue values when the event is recorded:

Analogue sensor 1 JM-2 (Ohm)
Analogue sensor 2 JM-3 (Ohm)
Analogue sensor 3 JM-4 (Ohm)
Analogue sensor 4 JL-4 (Vdc)
Battery voltage (Vdc)

* In single-phase, the second and the third voltage/current are displayed with dashes.

The latest event is the one that has the highest number. Using the ▲ and ▼ keys all the recordings are displayed cyclically.

Using the ◄ and ► keys it is possible to go through the pages related to the event.

11.5.4.4 Fast analogue logs

The fast analogues are recorded at a configurable pace by means of the P.0442 parameter (interval in seconds) and the default interval is 60 seconds. This archive provides a total storage capability of 42 records that covers a half hour time. Every following record overwrites the previous one. The controller records the analogue values described in par. 11.5.4.3.

11.5.4.5 Slow analogue logs

The slow analogues are recorded at a configurable pace by means of the P.0443 parameter (interval in minutes) and the default interval is 30 minutes. This archive provides a total storage capability of 64 records that covers a half hour time. Every following record overwrites the previous one. The controller records the analogue values described in par. 11.5.4.3.

11.5.4.6 Locked recordings

Analogue and events recordings are temporarily OFF when the key switch is in "OFF/RESET" mode.

When the records are locked, a lock appears on the second line, after the text "HISTORY LOGS" in all the history log windows.
In this situation, the controller internal counters keep on decreasing the time left to the next recording expiry.

When the operation mode shifts from "**OFF/RESET**" to "**MAN**" or "**AUTO**", the controller checks if some recording counters expired. If so, the recorded date and time of the status change are stored; otherwise, the count continues till the next recording is stored.

Example:

Parameters are set for the event recording each 40 seconds.

Time/Date: 12:45 17/03/14 Switch from "**MAN"/"AUTO**" mode to "**OFF/RESET**" mode:

Recordings are "Locked".

Time/Date: 13:10 17/03/14 Switch from "**OFF/RESET**" mode to "**MAN/AUTO**" mode.

25 seconds passed, the recording will be run in 15 seconds in analogue mode (40 seconds).

11.5.4.7 Exit logs visualization

There are two ways to exit the log visualization:

- Press the **ESC** button 'n' times to go back to page H.01.
- Change the operating mode of the controller.

In both cases, page H.01 will be displayed; move to other display modes using the ▲ and ▼ buttons.

11.5.4.8 Language selection

ATS115 allows to select the language to be used for all the text messages shown on the multifunctional display. Currently, four languages are supported: Italian, English, French and Russian (the default one is English).

At the page S.05 it is possible to select the desired language.

12. Working sequence

12.1 Operating modes

ATS115 allows three operating modes:

- **OFF_RESET**: the gen-set is off (or in the arrest phase), the faults are all cancelled and it is possible to access the programming to modify the parameters. The breakers status depends on the plant setting; generally, the BCB breaker is open, while the ACB breaker is closed, in order to connect the loads to mains.
- **MAN**: the genset power-up and the loads changeover on the source A or B have to be performed by the operator (the controller does not perform these operations automatically). As the protections are activated, the controller can perform them automatically in case of need. The controller allows the access to programming, but only some parameters can be changed.
- **AUTO**: the group start and stop and the ACB and BCB breakers management have to be performed by the controller (the operator cannot intervene). All operations are enabled. The controller allows the access to programming, but only some parameters can be changed.
- **TEST**: this operation mode is nearly identical to AUTO. The only difference is that the engine is anyway (automatically) started even with mains and/or automatic intervention inhibition contact ON. The parameters P.0122 and P.0222 "Enabling test loading", allows indicating to the controller if it must automatically change-over the loads to the generator (respectively on source A or B). When the controller goes back to AUTO mode (when the test is finished), the loads are automatically changed-over to the mains and the engine is stopped with normal procedure. The controller automatically switches from TEST to AUTO in case existing conditions require an automatic intervention by the genset. The operator is not allowed to manually operate the ACB and BCB switches. Accessing programming is allowed, though only some parameters can be modified.
- **REMOTE START**: nearly identical to AUTO. The only difference is that the engine is anyway (automatically) started even with mains and/or automatic intervention inhibition contact ON; the loads are changed-over to the generator. AUTO mode supersedes TEST mode (i.e., it can interrupt or replace the periodic test). It is also overriding with respect to the AUTO (once the remote start is activated, any request for automatic intervention is ignored). The

operator is not allowed to manually operate the ACB and BCB switches. Accessing programming is allowed, though only some parameters can be modified.

The operating mode can be selected in three different ways:

- Using the “MODE ▲” and “MODE ▼” buttons of the controller board. The buttons must be pressed consecutively and held for at least half a second to force mode change. The buttons are if at least one of the inputs described below exists and is active.
- Using one or several inputs configured with the following functions:
  - DIF.2271 “OFF/RESET by remote control”.
  - DIF.2272 “MAN by remote control”.
  - DIF.2273 “AUTO by remote control”.

When one of these inputs is active, the controller operating mode is forced and it is no longer possible to use the buttons on the panel, nor the controls of the serial ports to change it (the first line of the display shows a key-shaped icon).

When none of these inputs is active, you are able to use the buttons and the serial ports controls again to change the operating mode.

If there are multiple active inputs at the same time, the priority is given to the input that forces the OFF/RESET mode, followed by the one that forces the MAN mode and finally the one that forces the AUTO mode.

You don’t need to use all three inputs. For example, you can use a single input to force the AUTO status: when the input is active the controller is always in AUTO mode, and when it is deactivated, the controller remains in AUTO mode, but you can use the buttons to change to MAN or to OFF/RESET.

If only one input is used to force the OFF/RESET mode, the controller acts differently: when the input is active, the controller is always in OFF/RESET, and when the input goes back to standby, the controller goes back to the mode present before the input activation.

- Sending Modbus commands through serial ports, the USB port, the ETHERNET port or through the modems. The command is only managed if none of the above described inputs is active. The commands can be protected by a password (P.0004) which must be entered before any command and can be deactivated through a digital input (DIF.2706). To send the command it is necessary to write in sequence (within 5 seconds):
  - HOLDING REGISTER 101: write the password configured with the parameter P.0004.
  - HOLDING REGISTER 102: write the value:
  - “1” to require the OFF/RESET mode.
  - “2” to require the MAN mode.
  - “3” to require the AUTO mode.

To activate the **TEST** mode, it is first of all necessary that the Controller is in AUTO, the source is configured as “1-Generator” and that there are no requests of starting. To enable the **TEST** mode, the controller is first set to AUTO without any automatic start request. All possible TEST function activation modes are described below. The TEST mode is signalled by the flashing of the AUTO indicator light on the panel (50% on – 50% off). You can shift to TEST mode by properly configuring the following parameters:

- P.0418: Weekly test schedule on source A

- P.0419: Test start time source A

- P.0420: Test duration source A

- P.0438: Weekly test schedule on source B

- P.0439: Test start time source B

- P.0440: Test duration source B

These parameters allow for weekly programming of the time intervals for TEST mode engine start (to keep it efficient). In this case, shifting to TEST mode automatically occurs at set days and times. The controller returns to AUTO when the TEST time interval ends.

To activate **REMOTE START** mode, instead, the controller must first of all be in AUTO or in TEST mode. In addition, in case an input is configured with code DIF.2701 – "Enable remote start request" in the parameters of any input, this input shall be active. You may shift to REMOTE STARTUP in the following cases:

- Configuring a digital input of the controller to acquire the "Remote start request" with code DIF.2032. When this input is active, the controller shifts to REMOTE STARTUP; it deactivates when reverting to AUTO.
- By means of a proper command via SMS (refer to document [3]). In this case, the controller shifts to REMOTE START as soon as it receives the SMS and returns to AUTO when it receives the opposite command. In this case, you need to configure an input for acquiring the contact enable remote startup request, code DIF2701, and the input shall be active (normally wired on a panel for enabling remote commands).
- From a pc connected to serial ports, USB serial port, Ethernet port or via modem (with Modbus protocol RTU or Modbus/TCP). The controller shifts to REMOTE START once it receives the command, returns to AUTO when it receives the opposite one (it remains in REMOTE START if the serial connection interrupts before receiving the opposite command). In this case, it is possible to configure an input with DIF.2701 function ("enable remote start request"): if the input exists, it should be active (normally wired on a switch at control panel front to enable the remote commands). The commands can be protected by a password (P.0004) which must be entered before any command and can be deactivated through a digital input (DIF.2706). To send the command it is necessary to write in sequence (within 5 seconds):
- HOLDING REGISTER 101: write the password configured with the parameter P.0004.
- HOLDING REGISTER 102: write the value (only to source configured ad generator):
  - "10" to require the REMOTE START mode to source A. It starts source A and closes ACB breaker.
  - "20" to return to AUTO to source A. It opens ACB breaker and stops source A.
  - "11" to require the REMOTE START mode to source B. It starts source B and closes BCB breaker.
  - "21" to return to AUTO to source B. It opens BCB breaker and stops source B.
- Using parameters P.0428, P.0429 and P.0430 it is possible to define on a weekly basis hourly operation intervals when the genset shifts automatically to REMOTE START. In particular, parameter P.0428 allows to set the week days in which this function is active and the remaining two allow you to set an hour range valid for all selected days. The range start time (P.0429) refers to the days set in P.0428, while the range end time (P.0430) refers to the same day, if its value is higher than P.0428, or to the following day if lower (across midnight). Moreover, setting P.0429 and P.0430 to the same value defines a full day's range.

In those plants configured with two generators, the remote starting might require the starting of one of the two sources based on the following priority criteria:

- Work time band configured in parameters P.0425 and P.0426.
- Working hours configured in parameter P.0424.

- At least one configured input with digital function DIF.2121.
- Priority source configured in parameter P.0427.
- First generator available (normally generator A).

The “OFF/RESET”, “MAN” and “AUTO” lights state the current selected mode, while the REMOTE START light indicates that the Controller has been started in automatic mode or from remote.

The controller records each operating variation in the event log, if enabled with bit 0 of the P.0441 parameter:

- EVT.1001: records the shift to OFF/RESET mode.
- EVT.1002: records the shift to MAN mode.
- EVT.1003: records the shift to AUTO mode.
- EVT.1004: records the shift to TEST mode.
- EVT.1005: records the shift to REMOTE START mode.

There are some functions for the digital outputs configuration related to the working modality:

- DOF.3001 - “OFF/RESET”. The controller is active when this output is in OFF/RESET mode.
- DOF.3002 - “MAN”. The controller is active when this output is in MAN mode.
- DOF.3003 - “AUTO”. The controller is active when this output is in AUTO mode.
- DOF.3004 - “TEST”. The controller activates this output when it is in TEST mode.
- DOF.3005 - “Remote Start”. The controller activates this output when in AVVIAMENTO REMOTO mode.
- DOF.3011 - “Not in OFF/RESET”. The controller activates this output when it is in AUTO or MAN mode.
- DOF.3012 - “One of the automatic modes”. The output is activated when the controller is in one of the automatic operation modes, that is AUTO, TEST or REMOTE START.

In addition, the controller makes its own operation mode available for the AND/OR logics by means of the following internal statuses:

- ST.000 - “OFF/RESET”.
- ST.001 - “Manual”.
- ST.002 - “Automatic”.
- ST.003 - “Test”.
- ST.004 - “Remote start”.

Starting from version 1.20, if you set the bit 15 of parameter P.0497, when the controller is switched on it returns to the operating mode before power-off (for example, if the board was in AUTO before power off, AUTO will be restored at the next power-on). Moreover, with this option, if the controller was in MAN, it will return to MAN again, and no operations on the circuit breakers are performed (so the current breakers position and command are kept).

12.2 SOURCE A and SOURCE B

The ATS115 controller has to know the status of the two sources A and B, basically because it has to decide which of the two breakers ACB or BCB has to be closed.

Generally, ATS115 uses its three-phase sensors (JG and JH connectors) to measure and manage the status of the two sources. If, for any reason, one or both controller sensors cannot be used, they must be disabled setting to zero the parameter concerning the nominal voltage (P.0102 for SOURCE A and P.0202 for SOURCE B).

Digital inputs (instead of or in addition to internal sensors) can be used as configured in the following way:

- DIF.3101 – "Source A external sensor".
- DIF.3102 – "Source B external sensor".

Generally, a relay with alternating coil connected between two phases of the BUS is used: its normally open contact connects the controller input to the supply negative, in order to activate the relay and the input with the BUS working.

Using an input instead of the internal sensor (internal sensor disabled), the logic is as follows:

- Input active: voltage on source.
- Input inactive: no voltage on source.

Using an input in addition to the internal sensor (internal sensor enabled) instead, the controller uses the input to decide if the source is operating, even if its internal sensor is not measuring it (OR logic). In this case too, the input active shows the voltage presence.

12.2.1 Internal sensor

To connect SOURCE A and SOURCE B voltages see par. 7 and par. 0.

If the internal sensor can be used to acquire the frequency and voltage measures (JG and JH connectors), there are different values which influence its management. The following table shows the parameters concerning both sources. In the rest of the paragraph the SOURCE A will be the one taken under consideration.

SOURCE A	SOURCE B	Unite of measure	Description
P.0301		Hz	Nominal frequency
P.0101	P.0201		Number of phases
P.0102	P.0202	Vac	Nominal voltage (phase-to-phase for the three-phase system)
P.0106	P.0206	%	Voltage threshold
P.0107	P.0207	%	Frequency threshold
P.0108	P.0208	%	Min. frequency threshold
P.0109	P.0209	%	Max. frequency threshold
P.0110	P.0210	%	Hysteresis measures
P.0111	P.0211	%	Min. voltage threshold
P.0112	P.0212	%	Max. voltage threshold
P.0113	P.0213	%	Voltage unbalance threshold
P.0114	P.0214		Required phases sequence
P.0115	P.0215	Sec	Delay in tolerance
P.0116	P.0216	Sec	Delay out of tolerance
P.0121	P.0221		Thresholds to VLN

To define the sources (SOURCE A and B) status, the controller can execute up to four different controls, which can be individually disabled. Below they are described individually (also with examples): remember that voltage and frequency controls cannot be both disabled (in this case the source is always considered off).

12.2.1.1 Frequency control

To disable this control, it is enough to verify one of the following conditions:

- P.0108 = 0 %.
- P.0109 = 0 %
- P.0109 = 200%.
- P.0108 >= P.0109

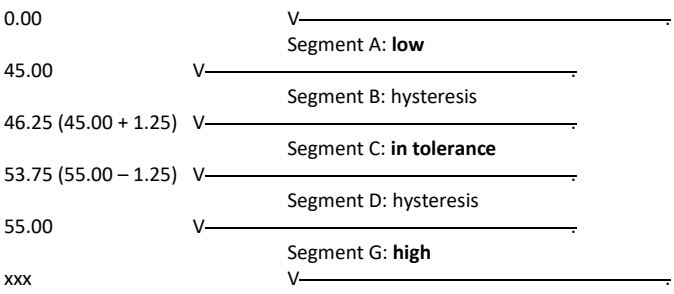
Let's make a practical example on the different threshold used, with the default values for the parameters mentioned above.

Parameter	Description	Default value	Frequency in Hz
P.0301	Nominal frequency	50 Hz	50.00
P.0108	Min. frequency threshold	90.0 %	45.00
P.0109	Max. frequency threshold	110.0 %	55.00
P.0110	Hysteresis measure	2.5 %	1.25

The hysteresis is calculated as the half of the difference between P.0109 and P.0108. It is limited to the maximum value set with the parameter P.0110. The hysteresis is applied:

- Up to the minimum frequency threshold (between 45.00 Hz and 46.25 Hz).
- Down to the maximum frequency threshold (between 53.75 Hz and 55.00 Hz).

Considering these values the following segments are identified:



If the frequency is in the segments "B", "D" it maintains the previous status (hysteresis). For example, if the frequency was in the "C" segment and it is in the "D" segment, it is still considered "In tolerance". Instead, if it was in the "A" segment and now it is in the "B" segment, it is considered "Low". The frequency is considered "Off" only if the measurement is 0 Hz.

12.2.1.2 Voltages control

To disable this control, it is enough to verify one of the following conditions:

- P.0111 = 0 %.
- P.0112 = 0 %
- P.0112 = 200%.

- P.0111 >= P.0224

Let's make a practical example on the different threshold used, with the default values for the parameters mentioned above.

Parameter	Description	Default value	Voltage in volt
P.0102	Nominal voltage	400 V	400
P.0106	Voltage threshold	20.0 %	80
P.0111	Min. voltage threshold	80.0 %	320
P.0112	Max. voltage threshold	110.0 %	440
P.0110	Hysteresis measures	2.5 %	10
P.0121	Thresholds to VLN	1 – Yes	2 – No

The hysteresis on the thresholds is calculated as the half of the difference between P.0112 and P.0111. It is limited to the maximum value set with the parameter P.0110. The hysteresis is applied:

- Down to the voltage threshold (between 70 V and 80 V).
- Up to the minimum voltage threshold (between 320 V and 330 V).
- Down to the maximum voltage threshold (between 430 V and 440 V).

Considering these values the following segments are identified:

0 V
Segment A: **off**
70 (80-10) V
Segment B: hysteresis
80 V
Segment C: **low**
320 V
Segment D: hysteresis
330 (320+10) V
Segment E: **in tolerance**
430 (440-10) V
Segment F: hysteresis
440 V
Segment G: **high**
xxx V

If the voltage is in the segments "B", "D", "F" it maintains the previous status (hysteresis). For example, if the voltage was in the "E" segment and it is in the "D" segment, it is still considered "In tolerance". Instead, if it was in the "C" segment and now it is in the "D" segment, it is considered "Low".

These statuses are managed at single-phase level.

Note: the parameter P.0121 / P.0221 performs the checks on thresholds and hysteresis also on phase voltages (on phase-to-phase voltages they are always enabled).

12.2.1.3 Unbalance check

In three-phase systems, the source can be considered 'out of tolerance' in case the absolute value of the three phase-to-phase voltages differs of a greater quantity than the threshold set.

To disable this check, simply set the parameter P.0113 and/or the parameter P.0213 to zero.

Here follows an example about the different thresholds used, including the default values for said parameters:

SOURCE A	SOURCE B	Description	Default value	Voltage in volt
P.0102	P.0202	Nominal voltage	400 V	400
P.0113	P.0213	Voltage unbalance threshold	10.0 %	40

In this case, the two phase-to-phase voltages absolute value differs of more than 40 V, the source is considered out of tolerance (the led flashes with 25% on). In case all phase-to-phase voltages absolute values are lower than 40 V, the source is considered in tolerance. No hysteresis is managed for this check.

12.2.1.4 Rotation direction check

In three-phase systems, the source can be considered 'out of tolerance' if the phases rotation direction differs from the setting of the parameters P.0114 and/or P.0214 “Phase sequence required”.

SOURCE A	SOURCE B	Description	Default value	Voltage in volt
P.0114	P.0214	Required phase sequence	0 – None	1 – Per hour

To disable this check, simply set the parameter P.0114 and/or the parameter P.0214 to zero.

In case a “clockwise” rotation direction is required, please set “1” in P.0114 and/or in P.0214; in case the rotation direction is “counter-clockwise”, the source is considered “out of tolerance” (the led flashes with 25% on).

In case a “counter-clockwise” rotation direction is required, please set “2” in P.0114 and/or P.0214; in case the rotation direction is “clockwise”, the source is considered “out of tolerance” (the led flashes with 25% on).

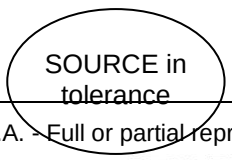
12.2.1.5 Internal sensor status

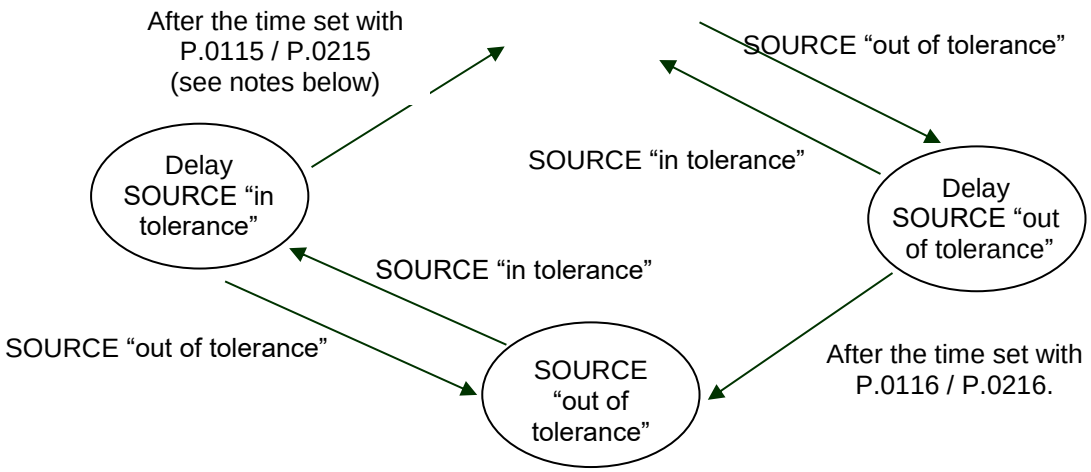
In order to diagnose the “global” status of the sources (SOURCE A and B), the following algorithms are used, shown in their computing order:

- In case the status of all existing voltages (1 or 3) and the frequency are “Absent”, the global status too is “Absent”.
- In case the status of all existing voltages (1 or 3) and the frequency are “In tolerance”, the global status too is “In tolerance”.
- In case the status of at least one voltage or frequency is “High”, the global status too is “High”.
- In case none of the previous conditions occurs, the global status is “Low”.

12.2.2 Global status of the sources (SOURCE A and B)

Whatever the method to acquire the instant status of the sources (SOURCE A and B) is for the plant operating logics, the global status of the sources (SOURCE A and B), is described in four phases:





The use of the “source presence delay” (configured with parameter P.0115 / P.0215) depends on the presence of one or more generators supplying the loads, and on the configuration of parameter P.0345. It is a bit-managed parameter. At the moment two bits are defined:

- Bit 0: used when the controller is in OFF/RESET mode. In this mode, the controller does not normally manage the “source presence delay” (to re-power the loads as soon as possible, since they are not powered by the generators). By setting bit 0 of P.0345 to “1”, the controller manages the "source presence delay".
- Bit 1: used when the controller is in AUTO mode. In this mode, the duration of the “source presence delay” depends on the presence of generators supplying the loads, and on the value of this bit:
  - At least one generator supplying the loads: the duration of the “source presence delay” is set by parameter P.0115 / P.0215.
  - No generator supplying the loads and bit 1 of P.0345 is “1”: the duration of the “source presence delay” is set by parameter P.0115 / P.0215.
  - No generator supplying the loads and bit 1 of P.0345 is “0”: the duration of the “source presence delay” is 0 seconds.

12.2.3 Events and communications

The controller records any change of the SOURCE A and SOURCE B status in the events logs, if it is enabled with bit 1 and 2 of the P.0441 parameter:

- EVT.1010: Lack of voltage on SOURCE A.
- EVT.1011: Voltage on SOURCE A but “out of tolerance”.
- EVT.1012: Voltage on SOURCE A and “in tolerance”.
- EVT.1020: Lack of voltage on SOURCE B.
- EVT.1021: Voltage on SOURCE B but “out of tolerance”.
- EVT.1022: Voltage on SOURCE B and “in tolerance”.

There are some functions available for the configuration of the outputs related to the SOURCE A and SOURCE B status:

- DOF.3032 - “SOURCE A in tolerance”. The controller activates this output when voltages and frequency on SOURCE A are in tolerance from the time configured.
- DOF.3033 - “SOURCE B in tolerance”. The controller activates this output when voltages and frequency on SOURCE B are in tolerance from the time configured.
- DOF.3034 - “Voltage on SOURCE A”. The controller activates this output when it measures voltage (even if out of tolerance) on SOURCE A.
- DOF.3035 - “Voltage on SOURCE B”. The controller activates this output when it measures voltage (even if out of tolerance) on SOURCE B.

Moreover, the controller makes the status of the SOURCE A and the SOURCE B available for the AND/OR logics through the following internal statuses:

- ST.016 - "SOURCE A voltage/frequency present"
- ST.017 - "SOURCE A out of tolerance or absent"
- ST.018 - "SOURCE A delay in tolerance"
- ST.019 - "SOURCE A in tolerance"
- ST.020 - "SOURCE A delay out of tolerance or absent"
- ST.024 - "SOURCE B voltage/frequency present"
- ST.025 - "SOURCE B out of tolerance or absent"
- ST.026 - "SOURCE B delay in tolerance"
- ST.027 - "SOURCE B in tolerance"
- ST.028 - "SOURCE B delay out of tolerance or absent"

12.3 Genset

ATS115 controller does not manage the engine power-up sequence, but make an output available to require its intervention for each source. After that, it lies in wait for the normal genset conditions, supervising its voltage and frequency. Once receiving this input command, the external control unit will start the engine control sequence. If the normal genset conditions are not reached by the time set in the parameter P.0115/P.0215 – “Presence delay Source A/B” the warning W007 / W008 – “Source A/B lack of normal conditions” will come out. Press ACK to acknowledge the warning.

Similarly, in order to stop the genset, ATS115 controller does not manage the engine stop, but simply remove the output and wait for the voltage absence of the genset side. It is possible to delay the deactivation of this output through the parameter P.0119/P.0219 – “Delay before stop Source A/B” (no delay is set by default). The external control unit, which no longer receives this input command, will start the engine stop sequence. If the engine stop is not revealed (frequency voltage absence) by the time set in the parameter P.0118/P.0218 – “Stop cycle duration Source A/B” the warning W021 / W022 – “Source A/B stop failure” will come out. Press ACK to acknowledge the warning.

The two digital outputs to require the start and stop of the sources A and B (associated to relays 5 and 6 by default) are configurable setting the output function DOF.1001 – “Source A start command” and DOF.1002 – “Source B start command”.

The manual and automatic start sequences and engine start command outputs are managed only if the source is set as genset (value 1 in parameters P.0100 and P.0200).

In MAN, the keys “SOURCE A 0/1”  and “SOURCE B 0/1”  on the front panel of the controller act as “toggle” on the output set with the function DOF.1001 – “A start command” and DOF.1002 – “B start command” (activating and deactivating them at each key pressing). In case of error, the start command is removed. In order to repeat it again and to acknowledge the warning, press the ACK button and the key related to the source required.

It is possible to control the starting of the source A or source B manually with a control through the serial ports. These commands are enabled only if the source is configured as generator. These commands can be enabled by a digital input configured with function DIF.2706 "Enable controls from the serial ports": if this input exists, it should be active. To start the source manually, it is necessary to write (within 5 seconds) the Modbus registers in sequence:

- HOLDING REGISTER 101: write the password configured with the parameter P.0004.
- HOLDING REGISTER 102: write the value:
- “10” to require the start of source A.
- "20" to require the stop of source A.
- “11” to require the start of source B.
- "21" to require the stop of source B.

12.4 Automatic intervention of the generator inhibited

In AUTO mode, the automatic start of the source/s set as genset can be inhibited anyway by two causes:

- Operating time bands.
- Digital input.

When there is an inhibition active, a flashing lock is displayed in the top right corner of the display.

12.4.1 Contact inhibition

The controller can use a digital input programmed for inhibiting the genset automatic operation (function DIF.2501 – “Genset operating inhibition”). If the input is “active”, the engine is never automatically started, not even if the plants condition require it.

Using the parameter P.0357 it is possible to set a delay between the input physical activation and this function logic activation: that delay can only be applied to a controller in AUTO mode, otherwise the delay is null.

Using the parameter P.0358 it is possible to set a delay between the input physical deactivation and this function logic deactivation: in case the genset is already running, the delay is reduced two seconds (firm).

When a function with value DIF.2501 is coupled with a digital input, the acquisition of this input depends on the time set in P.0357 and/or in P.0358; the acquisition time related to the digital input is ignored.

The controller also makes available, for the use of AND/OR logics, the internal status ST.080 - "Contact starting inhibition”.

The controller records any change of the inhibition status in the events log, if it is enabled with bit 6 of the P.0441 parameter:

- EVT.1013: Inhibition activated (from configurable input)
- EVT.1014 Inhibition not activated (from configurable input)

12.4.2 Clock inhibition

Using parameters P.0421, P.0422 and P.0423, it is possible to define weekly hour operation ranges, in which the genset is enabled to work. In particular, the parameter P.0421 allows to set the genset weekly operation days. The remaining two allow to set an hour range valid for all selected days. The range start time (P.0422) refers to the days set in P.0421, while the range end time (P.0423) refers to the same day, if its value is higher than P.0422, or to the following day if lower (across midnight). Moreover, setting P.0422 and P.0423 to the same value a full day range is set.

The controller also makes available, for the use of AND/OR logics, the internal status ST.081 - "Clock/Calendar starting inhibition".

12.5 Breakers management

12.5.1 Digital outputs

There are four different command for the **ACB** breaker management:

- DOF.2001 - "Minimum voltage coil for ACB". This function can be used to supply the minimum voltage coil (if any) of the circuit breaker. The controller disables this output when it wants to close the breaker and enables it when it wants to open the breaker: the real closing command will be activated with at least 0.5 seconds after the enabling of this output. If the source A is configured as Mains, it is therefore necessary to configure the output using the reverse polarity and use a contact which is **normally closed**, so that when the controller is not supplied, the under voltage coil is enabled and the breaker can be closed. If the breaker should open without any explicit command from the controller (for example for the trip of its protections), it is possible to configure a delay between the breaker opening and the activation of this command (P.0341, for default set to zero): this function is useful for some small size breakers to acquire the TRIP contact (which resets immediately as soon as the breaker is commanded in opening).

- DOF.2002 - "ACB Opening coil". The controller enables this output when it wants to open the breaker: the output goes back on standby once the breaker feedback shows that it is open (or when the opening time-out expires).

- DOF.2003 - "ACB Closing coil". The controller enables this output when it wants to close the breaker (ensuring that the function DOF.2001 «if available» has been active for at least 0.5 seconds): the output goes back on standby once the breaker shows that it is closed (or when the closing time-out expires, or if the synchronism condition is no longer met).

- DOF.2004 - "ACB steady opening command". The controller enables this output when it wants to open the breaker (ensuring that the function DOF.2001 «if available» has been active for at least 0.5 seconds): the output stays active even if the breaker is closed. The controller disables this function when it wants to open the breaker: the output stays open even if the breaker is open. Use this output with remote control switches, not with the motorized breakers.

Four different commands can be used to manage **BCB** breakers:

- DOF.2031 - "Minimum voltage coil for BCB". This function can be used to supply the minimum voltage coil (if any) of the circuit breaker. The controller disables this output when it wants to close the breaker and enables it when it wants to open the breaker: the real closing command will be activated with at least 0.5 seconds after the enabling of this output. If the source B is configured as Mains, it is therefore necessary to configure the output using the reverse polarity and use a contact which is **normally closed**, so that when the controller is not supplied, the under voltage coil is enabled and the breaker can be closed. If the breaker should open without any explicit command from the controller (for example for the trip of its protections), it is possible to configure a delay between the breaker opening and the activation of this command (P.0342, for default set to zero): this function is useful for some small size breakers to acquire the TRIP contact (which resets immediately as soon as the breaker is commanded in opening).

- DOF.2032 - "BCB Opening coil". The controller enables this output when it wants to open the breaker: the output goes back on standby once the breaker feedback shows that it is open (or when the opening time-out expires).
- DOF.2033 - "BCB Closing coil". The controller enables this output when it wants to close the breaker (ensuring that the function DOF.2031 «if available» has been active for at least 0.5 seconds): the output goes back on standby once the breaker shows that it is closed (or when the closing time-out expires, or if the synchronism condition is no longer met).
- DOF.2034 - "BCB steady opening command". The controller enables this output when it wants to open the breaker (ensuring that the function DOF.2031 «if available» has been active for at least 0.5 seconds): the output stays active even if the breaker is closed. The controller disables this function when it wants to open the breaker: the output stays open even if the breaker is open. Use this output with remote control switches, not with the motorized breakers.

12.5.2 Digital inputs

The controller digital inputs can be used for different purposes, for the loads switch management.

12.5.2.1 Acquiring breakers status

The features of inputs DIF.3001 - "ACB breaker status" and DIF.3002 - "BCB breaker status" are used by the controller to acquire the feedback connection input, respectively of breakers ACB and BCB. The controller uses these inputs for:

- Issuing failed opening or failed closing warnings.
- Its own operating sequence.
- Detecting the breakers status when it is remotely controlled.
- Displaying the breakers status on the front panel LEDs.

The delay associated to the input is used as maximum time for opening or closing the breaker. Generally, the controller performs automatically three breaker opening and/or closing attempts before signalling the warning of breaker opening and/or closing failure.

In theory, the controller could work even without this feedback. In this case, the controller considers the breaker as closed once the closing command is issued; it considers it as open once the opening command is issued. Actually, it is always better to connect the feedback.

In case the source A is set as mains, by means of the P.0304 parameter it is possible to specify if the ACB breaker is supplied by the mains voltage. Therefore, in lack of mains, ACB opens but the controller does not activate the related warning of ACB closing failure.

In case the source B is set as mains, by means of the P.0304 parameter it is possible to specify if the BCB breaker is supplied by the mains voltage. Therefore, in lack of mains, BCB opens but the controller does not activate the related warning of BCB closing failure.

12.5.3 OFF/RESET logic management

In OFF/RESET mode, both ACB and BCB are in standby (meanwhile, "ACB Under voltage coin enabling" and "BCB Under voltage enabling" are in standby too). According to the configuration of the plant, the breakers work in different ways:

- Plant with one genset and one mains, the breaker related to the mains source is closed, while the one related to the genset is opened (i.e. P.0100 set to 0 - Mains and P.0200 set to 1 - Genset: ACB is closed while BCB is opened).
- Plant with two gensets (P.0100 and P.0200 set to 1 - Genset), both breakers ACB and BCB are opened.
- Plant with two gensets and two mains (P.0100 and P.0200 set to 0 - Mains), ACB breaker is closed, while BCB is opened.

Starting from version 1.20, if you set the bit 14 of parameter P.0497, after power-on and while the controller is in OFF-RESET mode any command to the circuit breakers will be inhibited (so the current breakers position and command are kept until the operating mode is switched to MAN or AUTO).

12.5.4 MAN logic management

ACB and BCB commands are activated only if all the following conditions are checked:

- If the source (SOURCE A or B) voltage and frequency have been in tolerance for a proper time.
- If there are not stops or deactivations.
- If there are not forcing or digital input fails.

Generally, in MAN mode the loads are switched on the source set as mains, or are not supplied in case of two gensets. The operator can decide which breaker must be opened or closed and it interacts with the controller with manual opening and closing commands.

Two types of commands are provided:

- Using the controller keys

The keyboard has two separated keys for the opening and closing of the ACB and BCB breakers. After starting the engine manually, the possibilities are:

- Pressing the ACB button with BCB closed and ACB opened, the controller opens the BCB breaker and consequently close the ACB breaker (with Source A present and in tolerance).
- Pressing the ACB button with BCB opened, the controller alternatively opens and closes the ACB breaker.
- Pressing the BCB button with ACB closed and BCB opened, the controller opens the ACB breaker and consequently close the BCB breaker (with Source B present and in tolerance).
- Pressing the BCB button with ACB opened, the controller alternatively opens and closes the BCB breaker.

If the genset engine of the source/s has not been activated manually, but its voltages and frequencies are in tolerance, the controller allows the breakers opening/closing anyway.

If using a switch, both ACB and BCB buttons work in the same way switching the loads between the sources alternatively.

- Using the digital inputs of the controller (to connect external buttons that allow to open/close the breakers manually). See below the functions available:
- Function DIF.1001 – “ACB Manual closing request”.
- Function DIF.1002 – “ACB Manual opening request”.
- Function DIF.1003 – “BCB Manual closing request”.
- Function DIF.1004 – “BCB Manual opening request”.

These functions are accepted only if the controller is in MAN mode.

All these commands work on the “not active” to “active” pass of the input, not on the steady “active” status.

Each breaker can use either commands or just the closing one. Using the only closing command, it works as “toggle”: it manages the breaker opening when closed and the breaker closing when open.

The use of both commands associated to two different inputs allows the switch between sources. Indeed, the input with the function DIF.1001 can be used only when the loads are connected to the source A; the input with the function DIF.1001 can be used only when the loads are connected to the source B.

- Using the commands received from the serial ports. The commands can be protected by a password (P.0004) which must be entered before any command and can be deactivated through a digital input (DIF.2706). You need to write in sequence (within 5 seconds) in order to send the commands:

- HOLDING REGISTER 101: write the password configured with parameter P.0004.
- HOLDING REGISTER 102:
- "31" to open ACB.
- "33" to close ACB.
- "41" to open BCB.
- "43" to close BCB.

12.5.5 AUTO logic management

ACB and BCB commands are activated only if all the following conditions are checked:

- If the source (SOURCE A or B) voltage and frequency have been in tolerance for a proper time.
- If there are not stops or deactivations.
- If there are not forcing or digital input fails.

In **AUTO** mode, loads are switched on the first source available, according to the plant configuration and the conditions above. Loads are switched on the other source only when the source is out of tolerance. The switch uses a further timing in case of source set as genset: to manage the breaker closing, the time P.0117 or P.0217 "Delay before supply" must be passed since the group power-up, that is since the genset measures are out of tolerance.

More details on the automatic switch sequence at par. 12.6.

12.5.6 Power switch management

Usually, for the power switch management, the **ACB** and **MCB** outputs of the **JI** connector are used, that is two relays with potential-free change-over contacts. The clamps 1, 2, 3 of this connector are related to the breaker for closing the loads on the source B (BCB), the others clamps 4, 5, 6 for closing the loads on the source A (ACB). It is possible to set the controller to command two separated breakers or a switch.

- Separated breakers. You need to set the parameter P.0306 (Contactors swap delay) to a proper value. This parameter shows the minimum time between one breaker opening and the other one closing. It is possible to use two outputs for the breakers under voltage coils: the two functions are DOF.2001 – "ACB (NC) Undervoltage coil" and DOF.2031 – "BCB Under voltage coil". These outputs are associated to the management logics that depend on the plant configuration used.
  ATS115 uses logics that avoid the non-synchronized simultaneous closing of **ACB** and **BCB**; anyway a wired external logic used for this purpose is necessary.

- Switch. You need to set the parameter P.0306 (Contactors swap delay) to zero, avoiding a useless wait for the sources changeover. Moreover, it is possible to set in P.0307 (Contactors holding time): it won't be possible (neither manually nor automatically) to invert the switch command if the time in P.0307 (Contactors holding time) has not passed from the previous command. That is useful, because inverting the command to some types of switches during the operating phase (before the switch is complete) they may get locked, requiring a manual operation for the unlocking.

The LEDs on the panel, called ACB and BCB, turn on when the related breaker is closed; they turn off when it is open. In particular:

- LED on: the breaker is closed.
- LED off: the breaker is open.

- LED flashing (on for 25% of time): the controller ordered the breaker closing, but it is open.
- LED flashing (on for 75% of time): the controller ordered the breaker closing, but it is closed.

Moreover, setting a **time different from zero** to the inputs connected to the breakers status (parameters P.2001…), the controller activates a warning if the command and the status of each breaker keep on conflicting for that time. By the way, it is possible to connect also the status of one of the breakers (in case of need): the signalisation of conflicting command/status and the possible warnings will be managed only for that breaker.

12.5.7 Inhibition to automatic supply of the source (genset)

In all the automatic operation modes of the controller, the source circuit breaker configured as genset (ACB or GCB or both) can be forced to open for different causes, even if the plant logic requires its closing. This allows the use in plants where there can be more gensets in parallel on the busbar and the controller has to close only when the plant manages to supply the load. Please find below a description of these causes:

- It is possible to use a digital input configured with the function DIF.2503 – “Source A inhibited to take the Load”. When this input is activated, the controller commands the opening of ACB.
- It is possible to use a digital input configured with the function DIF.2504 – “Source B inhibited to take the Load”. When this input is activated, the controller commands the opening of BCB.
- It is possible to use a serial port command. This command is temporary (it lasts 30 seconds): it has to be continuously confirmed if you want to keep the ACB and/or BCB open. The commands can be protected by a password (P.0004) which must be entered before any command and can be deactivated through a digital input (DIF.2706). You need to write in sequence (within 5 seconds) in order to send the commands:
- HOLDING REGISTER 101: write the password configured with parameter P.0004.
- HOLDING REGISTER 102:
- “31” to inhibit the automatic supply on source A (forced ACB open).
- “33” to remove the inhibition to the automatic supply on source A.
- “41” to inhibit the automatic supply on source B (forced BCB open).
- “43” to remove the inhibition to the automatic supply on source B.

The controller records any variation of the switch inhibition status in the history log, if it has been enabled by bit 3 and 4 of parameter P.0441:

- EVT.1084 - " Switch on source A inhibited"
- EVT.1085 - " Switch on source A non-inhibited "
- EVT.1086 - " Switch on source B inhibited "
- EVT.1087 - " Switch on source B non-inhibited "

12.5.8 Events and signalisation

The controller records any variation of the command and the status of the ACB breaker in the history log, if enabled by the bit 3 and 4 of the P.0441 parameter:

- EVT.1030: ACB closing command.
- EVT.1031: ACB opening command.
- EVT.1032: ACB closed.
- EVT.1033: ACB open.

The controller records any variation of the command and the status of the BCB breaker in the history log, if enabled by the bit 3 and 4 of the P.0441 parameter:

- EVT.1035: BCB closing command.
- EVT.1036: BCB opening command.
- EVT.1037: BCB closed.
- EVT.1038: BCB open.

The controller makes available the ACB commands and status, for the AND/OR logics, with the following internal status:

- ST.064 - "ACB status"
- ST.068 - "ACB steady closing command"
- ST.070 - “ACB minimum voltage coil”.
- ST.071 - "ACB opening pulse”.
- ST.072 - "ACB closure pulse”.

The controller makes available the ACB commands and status, for the AND/OR logics, with the following internal status:

- ST.065 - "BCB status"
- ST.069 - "BCB steady closing command "
- ST.073 - “BCB minimum voltage coil”.
- ST.074 - "BCB opening pulse”.
- ST.075 - "BCB closure pulse”.

12.6 Automatic sequence

In **AUTO** mode and depending on the plant configuration, the switch sequence between sources follows slightly different logics. The external events that affects the operating logic are not only connected to the source presence/absence (measured by voltage, frequency or external sensor), but also to the working hours configuration (see par. 14.2) and to the following functions related to digital inputs.

- DIF.2281 – “Switch on source A”.
- DIF.2282 – “Switch on source B”.
- DIF.4203 – “Source A fault”.
- DIF.4204 – “Source B fault”.

It is also possible to force the use of one source by the commands received from the serial ports. The commands can be protected by a password (P.0004) which must be entered before any command and can be deactivated through a digital input (DIF.2706). Write in sequence (within 5 seconds) in order to send the commands:

- HOLDING REGISTER 101: write the password configure with parameter P.0004.
- HOLDING REGISTER 102:

- "71" forces the use of source A.
- "72" forces the use of source B.
- "74" cancels all forcing at the operation modes (A, B or N).

- System configured with one mains and one genset

This system can be configured setting the source A as mains and the source B as genset and vice versa, indifferently. For the sake of simplicity, in the rest of the paragraph the Source A will be referred as mains and the Source B as genset.

In standby, that is without any fault or forcing, and with mains present, loads are always connected to the source A set as mains (the breaker referred to the ACB mains source is closed, while the one referred to the BCB genset is opened).

The controller requires the start of the genset (source B) when the mains is no longer available (mains out of tolerance) or in presence of the fault source A input (DIF.4203 active) or if the switch (forcing) is required on the source B (DIF.2282 active). Only when the genset B reaches the operating conditions and the time set in P.0217 – "Delay before supply" passes, the controller opens the ACB breakers and closes the BCB breaker, switching the loads on the genset.

The Controller requires the generator to be started (source B) when the mains is no longer available (mains out of tolerance thresholds) or if the input of source A is faulty (DIF.4203 active) or if the switching (forcing) is required on source B (DIF.2282 active). In case of source A faulty from digital input or if parameter P.0308 set to "1-At mains failure", the controller immediately opens the switch ACB. In all the other cases, only when the generator B has reached the full speed conditions and the time configured in parameter P.0217 has passed –"delay before supplying", the controller opens the switch ACB and closes BCB inverting the loads on the generator.

Using the parameter "Breaker opening instant" (P.0308 for source A or P.0309 for source B) is therefore possible to protect the loads moving up the opening of the breaker to the moment in which the mains is no longer in tolerance.

Once the mains A comes back in tolerance (with proper times) or the mains A is no longer out of order (DIF.4203 absent) or the forcing request on source B has been removed (DIF.2282 absent), the controller switches the loads on the mains again (it opens the BCB and closes the ACB) and simultaneously starts the engine stop cycle.

If the switch (forcing) is required on both sources (DIF.2281 and DIF.2282 active simultaneously), the loads are disconnected from the sources; the controller opens both ACB and BCB breakers.

When both sources are out of order (DIF.4203 and DIF.4204 active simultaneously), both related warnings and loads are disconnected from the sources; the controller opens both ACB and BCB breakers.

The parameter P.0427 "Enable priority" has no effects on this system configuration. Any input configured with digital function DIF.2707 "Enable priority source selection" has no effect on this plant configuration. Any input configured with digital function DIF.2121 "Priority source" has no effect on this plant configuration.

System configured with two gensets

This system is configured setting both sources A and B as genset. The controller switches on the other source only when an event (breakdown or forcing) occurs, and it stays steady on it until the opposed event occurs. Each changeover must be associated to the start of the new source and to the stop of the one that is no longer necessary.

Generally, in OFF/RESET and MAN mode, both ACB and BCB breakers are open. When the controller is in AUTO, without breakdown or forcing, it requires the automatic start of the source A. Once reached the operating conditions and passed the time set in the parameter P.0117 – "Delay before supply", the controller closes the ACB breakers. If the operating conditions on the source A are not reached, the controller tries to start the source B too and closes the BCB breaker, only if the genset B is in tolerance; otherwise, loads remain disconnected.

Supposing to have reached the steady condition of source B in tolerance and BCB breaker closed, the controller requires the start of the source A only in case of the source B breakdown (DIF.4204 active) or if the switch (forcing) on the source A (DIF.2281 active) is explicitly required. In case of source B breakdown by digital input, the controller opens the BCB immediately; otherwise, it waits for the source A to be ready. If the operating conditions on the source A are not reached, the controller stays on the source B; otherwise, it switches the loads on A (it opens the BCB and closes the ACB) and simultaneously starts the engine stop cycle.

If the switch (forcing) is required on both sources (DIF.2281 and DIF.2282 active simultaneously), the loads are disconnected from the sources; the controller opens both ACB and BCB breakers.

When both sources are out of order (DIF.4203 and DIF.4204 active simultaneously), both related warnings and loads are disconnected from the sources; the controller opens both ACB and BCB breakers.

The parameter P.0427 “Enable priority” allows to set which one of the two gensets is priority (allowing the user to define the supply source desired). It acts only in case no breakdown or forcing on sources. Setting the value “1 – Source A”, the controller activates the genset A and stops B, consequently opening the BCB breaker and closing the ACB; instead, setting the value “2 – Source B”, the controller activates the genset B and stops A, consequently opening the ACB breaker and closing BCB.

When the digital input, configured with the function DIF.2121, is not active, the controller will active the generator A and will stop B. As a result, it will open the BCB breaker and will close ACB; on the contrary, when the digital input is active, the controller will active the generator B and will stop A. As a result, it will open the ACB breaker and will close BCB. While setting value “1-Source A” the controller will activate generator A and will stop B. As a result, i twill open the BCB switch and will close ACB; on the contrary, by setting value “2-Source B” the controller will activate generator B and will stop A. As a result, it will open the ACB switch and will close BCB.

The parameter P.0427 “Enable priority” and/or a configured input with digital function DIF.2121 allow to establish which of the two generators is the priority one (allowing the user to define the preferred supply source). They only act if not disabled by any digital input configured with function DIF.2707 (input configured and not active), if there are no faults or forcing on the sources. If both of them are configured, the function connected to the digital inputs DIF.2121 prevails on the parameter P.0427.

On page M.01 a flashing little square next to Source A or B indicates which the priority source is in this moment.

- System configured with two mains

This system is configured setting both sources A and B as mains. The source A is always considered the referential one, therefore the loads are always connected to it (the ACB breaker is closed while BCB is opened). It switches on the other source only when an event (breakdown or forcing) occurs, and it stays steady on it until the opposed event occurs.

The controller switches on the source B when in tolerance, but only when the source A is no longer available (mains out of tolerance) or in presence of the fault source A input (DIF.4203 active) or if the switch (forcing) is required on the source B (DIF.2282 active). The controller opens the ACB breaker and closes BCB. In case of source A breakdown by digital input, the controller opens the ACB immediately.

The controller switches back on the source A when in tolerance, but only when the source B is no longer available (mains out of tolerance) or in presence of the fault source B input (DIF.4204 active) or if the switch (forcing) is required on the source A (DIF.2281 active). The controller opens the ACB breaker and closes BCB. In case of source B breakdown by digital input, the controller opens the BCB immediately.

If the switch (forcing) is required on both sources (DIF.2281 and DIF.2282 active simultaneously), the loads are disconnected from the sources; the controller opens both ACB and BCB breakers.

When both sources are out of order (DIF.4203 and DIF.4204 active simultaneously), both related warnings and loads are disconnected from the sources; the controller opens both ACB and BCB breakers.

The parameter P.0427 “Enable priority” allows to set which one of the two mains is priority (allowing the user to define the supply source desired). It acts only in case both mains are present and in tolerance and there are no breakdown or

forcing on sources. Setting the value "1 – Source A", the controller opens the BCB breaker and closes ACB; instead, setting the value "2 – Source B", the controller opens the ACB breaker and closes BCB.

When the digital input, configured with function DIF.2121, is not active the controller will activate generator A and will stop B. As a result, it will open BCB switch and will close ACB; on the contrary, when the digital input is active, the controller will activate generator B and will stop A, so it will open ACB switch and will close BCB. While setting value "1-Source A" the controller will activate generator A and will stop B. As a result, it will open BCB switch and will close ACB; on the contrary, by setting value "2-Source B" the controller will activate generator B and will stop A. As a result, it will open switch ACB and will close BCB.

The parameter P.0427 "Enable priority" and/or a configured input with digital function DIF.2121 allow to establish which of the two mains is the priority one (allowing the user to define the preferred supply source). They only act if not disabled by any digital input configured with function DIF.2707 (input configured and not active), if there are no faults or forcing on the sources. If both of them are configured, the function connected to the digital inputs DIF.2121 prevails on the parameter P.0427.

On page M.01 a small flashing square next to Source A or B indicates which the priority source is in this moment.

12.7 Immediate switch

The immediate switch function DIF.2002 allows to change the required source to supply the loads at every input related activation.

The function is enabled:

- Only with controller in AUTO.
- If at least and input is configured with the function DIF.2002 - "Immediate switch".
- If both sources are available and in tolerance.
- If the system is configured with two mains or gensets (it does not support mixed systems: one mains and one genset).
- If there are not damages on the source A or B (no input is set with the function DIF.2281 or DIF.2282).
- If there are not forcing requests on the source A or B (no input is set with the function DIF.4203 o DIF.4204).
- If there are not working start times set on the source A and B (parameter P.0425 different from P.0426 and both different from zero).
- If no priority is enabled (parameter P.0427 = 0).

12.8 Neutral position

In MAN and AUTO mode, when the input configured with the function DIF.2003 – "Neutral position" is active, both ACB and BCB breakers are immediately opened. The controller displays this status in the last line of the window "S.01" (forcing it immediately) and in a digital output if configured with the function DOF.3040 – "Both breakers open".

It is also possible to force the circuit breakers on this position by means of the commands received by the serial ports. The commands can be protected by a password (P.0004) which must be entered before any command and can be deactivated through a digital input (DIF.2706). You need to write in sequence (within 5 seconds) in order to send the commands:

- HOLDING REGISTER 101: write the password configured with parameter P.0004.
- HOLDING REGISTER 102:
- "73" forces the use of the Neutral position (the Load remains disconnected from both source A and B).
- "74" cancels all forcing at the operation modes (A, B or N).

The controller records every variation of the neutral position status in the history log, if enabled with the bit 3 of the P.0441 parameter:

- EVT.1040: Neutral position.

13. Anomalies

This chapter describes all the malfunctions managed by the controller. Some act as protection for the loads, for the generator or for the engine. Others are warnings of particular events in the system management. Before describing them in detail, here are some definitions:

There are two types of malfunctions:

- **Warnings**: they state situations which are not dangerous at the moment, but that have to be signalled because, if ignored, they may degenerate in one of the following categories.
- **Alarm** (blocks): they block the system operation. They are dangerous for the loads and/or for the engine/genset.

When there is an anomaly, the controller performs the following actions:

- It activates the internal horn and, if configured, the external one too. To that purpose, you can configure an output of the controller with the function DOF.3152 – “External horn”. The output is controlled together with the inside beeper; the purpose is that of using a more powerful beeper or a lamp.
- It forces the page S.02 MALFUNCTIONS on the multifunctional display. This page shows the numeric code and the current language text related to all active malfunctioning.
- It activates the flashing of the “ALARM” indicator light, if the anomaly belongs to the warnings category; it turns it on if the anomaly belongs to the As category.
- If the anomaly is not a warning, the controller disconnects the genset and stops the engine (with or without the cooling cycle).

Up to version 01.18 (but even with higher versions if bit 0 of P.0497 is not activated), the controller follows these rules:

- An alarm can be activated only if no other alarms are already active (there are some exceptions to this rule and will be underlined in the rest of the paragraph).
- To issue a warning, no alarm must be present. Some other warnings can be active.

Starting from version 01.19, if you set the bit 0 of P.0497, the controller doesn’t follow the previous rules; thus any alarm can always be activated (no matter if other alarms are still activated).

After an anomaly the operator has three choices:

- Silence the horn.
- Acknowledge the anomaly: it means informing the controller that the operator has acknowledged it.
- Reset the anomaly: it means informing the controller to work as the anomaly has never been activated.

13.1 Silencing the horn

The horn can be suppressed in three ways:

- Pressing the START pushbutton. This operation does not detect the anomaly, which continues to flash on the display.
- With a digital input configured with DIF.2004 function (“Alarm acknowledgement control”). The acoustic signalling is suppressed when the input passes from “not active” to “active”.

- Using a command from the serial port. The commands can be protected by a password (P.0004) which must be entered before any command and can be deactivated through a digital input (DIF.2706). To send the command it is necessary to write in sequence (within 5 seconds):

- HOLDING REGISTER 101: write the password configured with the parameter P.0004.
- HOLDING REGISTER 102: enter the value “51”.

The parameter P.0491 (Horn duration) influences the management of the controller horn

- If set to zero, the horn will be never activated.
- If set to 999, the horn will be activated when a new anomaly arises, and deactivated when the operator presses the ACK button.
- If set to a value between 1 and 998, the horn will be activated when a new anomaly arises and deactivated when pressing the ACK button, or after P.0491 seconds from activation.

Silencing the horn does not mean acknowledging the anomaly: in fact, it continues to flash on page S.02 MALFUNCTIONS.

13.2 Anomaly acknowledgement

The anomaly (sequence ISA2C) can be identified in three ways:

- By pressing the ACK key on the board panel. If you push this key when the hooter is on, it stops the hooter: it should be pressed a second time to “recognize” the anomaly.
- With a digital input configured with DIF.2004 function (“Alarm acknowledgement control”). They are acknowledged when the input passes from “not active” to “active”.
- Using a command from the serial port. The commands can be protected by a password (P.0004) which must be entered before any command and can be deactivated through a digital input (DIF.2706). To send the command it is necessary to write in sequence (within 5 seconds):

- HOLDING REGISTER 101: write the password configured with the parameter P.0004.
- HOLDING REGISTER 102: enter the value “52”. NB: this control also cancels the hooter in case it is active.

When the anomaly has been acknowledged, it stops flashing on page S.02 MALFUNCTIONS. Once acknowledged, in case of a warning, it is automatically cancelled, if its cause is no longer present.

Instead, if the cause disappears before the anomaly is acknowledged, it will remain on the display.

13.3 Anomaly reset

An anomaly can be cancelled only when the cause that activated it is no more present.

The controller automatically resets all the acknowledged warnings when their cause is no longer active.

On the contrary, to cancel unloads, deactivations and alarms, it is necessary to follow one of the below procedures:

- By moving the key switch on OFF/RESET position.
- Using a digital input configured with the feature DIF.2001 - “Alarm reset command”. When the input becomes “active”, the controller carries out a reset of all faults.
- Using a command from the serial port. The commands can be protected by a password (P.0004) which must be entered before any command and can be deactivated through a digital input (DIF.2706). To send the command it is necessary to write in sequence (within 5 seconds):

- HOLDING REGISTER 101: write the password configured with the parameter P.0004.
- HOLDING REGISTER 102: enter the value “53”.
- By using an “SMS”.

13.4 Events and communications

All malfunctioning is recorded (each one with its own code) in the events log.

There are some functions for the configuration of the digital outputs related to the malfunctions:

- DOF.3151 (“reset of anomalies”). The board activates this output for one second when the internal sequence for the cancellation of anomalies is carried out. With this procedure, it is also possible to reset externally managed anomalies.
- DOF.3152 (“external horn”). This output is activated and deactivated along with the internal hooter. It can be used to control a more powerful hooter and/or a lamp.
- DOF.3154 (“faults acknowledgement”). The controller activates this output for one second when the internal sequence of faults acknowledgement is carried out. This procedure can be used to acknowledge also some possible faults managed by other devices externally.
- DOF.4001 - “Warnings”. The output is “active” if there is at least one warning.
- DOF.4004 - “Alarms (interlocks)”. The output is “active” if there is at least one alarm.
- DOF.4035 - “Breakers anomaly”. The output is “active” if there is at least one warning related to the breakers ACB or BCB.

In addition, the controller makes the SOURCE A and SOURCE B status available to the AND/OR logics by means of the following internal statuses:

- ST.006: the internal status will be activated for a second after a command of faults acknowledgement.
- ST.007: the internal status will be activated for a second after a command of faults reset.
- ST.008 - "Warnings cumulative"
- ST.011 - "Alarms cumulative"
- ST.012 - "Unacknowledged warnings cumulative"
- ST.015 - "Unacknowledged alarms cumulative"

13.5 Malfunctions list

NOTE: since you cannot define in advance neither which digital or analogue inputs will be used (the controller or the additional modules ones), nor what function they will perform, the list below refers to the parameters of the first configurable input, as example. The symbol **(*)** or the indication “or equivalent for the other inputs” next to a parameter shows that it varies according to the particular input configured.

01 – Genset A out of tolerance

Type: **Warning**

Category: **Genset protection**

Related parameters: **P.0116** Failure delay source A

To disable: **P.0116 = 0**

Enabled in: **AUTO, MAN**

This protection is only enabled if the source A is a genset. It activates if the voltage and the frequency of the source A, once reached the operating conditions, exit the tolerance range for the time P.0116.

02 – Genset B out of tolerance

Type: **Warning**

Category: **Genset protection**

Related parameters: **P.0216** Failure delay source B

To disable: **P.0216 = 0**

Enabled in: **AUTO, MAN**

This protection is only enabled if the source B is a genset. It activates if the voltage and the frequency of the source B, once reached the operating conditions, exit the tolerance range for the time P.0216.

07 – Source A operating conditions failure

Type: **Warning**

Category: **Genset protection**

Related parameters: **P.0115** Presence delay Source A

To disable: **P.0115 = 0**

Enabled in: **AUTO, MAN**

This protection is only enabled if the source A is a genset. It activates if the voltage and the frequency of the source A do not enter steadily in the tolerance range by the P.0115 time since the engine start acknowledgment.

08 – Source B operating conditions failure

Type: **Warning**

Category: **Genset protection**

Related parameters: **P.0215** Presence delay Source B

To disable: **P.0215 = 0**

Enabled in: **AUTO, MAN**

This protection is only enabled if the source B is a genset. It activates if the voltage and the frequency of the source B do not enter steadily in the tolerance range by the P.0215 time since the engine start acknowledgment.

13 – ACB breaker not closed

Type: **Warning**

Category: **Generic**

Related parameters: **P.2001** Function of the input 1 or equivalent for other inputs
P.2002 Delay for the input 1 or equivalent for other inputs

To disable: **P.2002 = 0** (for the input 1 or equivalent for other inputs)

Enabled in: **MAN, AUTO**

This protection is only enabled if one of the digital inputs of the controller is set to acquire the ACB status (function DIF.3001 – “ACB breaker status” in P.2001 or equivalent for other inputs) and if it has been set a time different from

zero for that input (parameter P.2002 or equivalent). It activates only when ACB has to close and the acquired status is "not active" consecutively for the time set. It automatically activates after three consecutive attempts.

14 – BCB breaker not closed

Type: **Warning**

Category: **Generic**

Related parameters: **P.2001** Function of the input 1 or equivalent for other inputs
P.2002 Delay for the input 1 or equivalent for other inputs

To disable: **P.2002 = 0** (for the input 1 or equivalent for other inputs)

Enabled in: **MAN, AUTO**

This protection is only enabled if one of the digital inputs of the controller is set to acquire the BCB status (function DIF.3002 – "BCB breaker status" in P.2001 or equivalent for other inputs) and if it has been set a time different from zero for that input (parameter P.2002 or equivalent). It activates only when BCB has to close and the acquired status is "not active" consecutively for the time set. It automatically activates after three consecutive attempts.

21 – Source A stop failure

Type: **Warning**

Category: **Genset protection**

Related parameters: **P.0118** Stop cycle duration Source A (s)

To disable: **P.0118 = 0**

Enabled in: **AUTO, MAN**

This protection is only enabled if the source A is a genset. It activates if the engine is not identified as stopped by the time set in P.0118 (stop command).

22 – Source B stop failure

Type: **Warning**

Category: **Genset protection**

Related parameters: **P.0218** Stop cycle duration Source B (s)

To disable: **P.0218 = 0**

Enabled in: **AUTO, MAN**

This protection is only enabled if the source B is a genset. It activates if the engine is not identified as stopped by the time set in P.0218 (stop command).

23 – ACB breaker not opened

Type: **Warning**

Category: **Generic**

Related parameters: **P.2001** Function of the input 1 or equivalent for other inputs
P.2002 Delay for the input 1 or equivalent for other inputs

To disable: **P.2002 = 0** (for the input 1 or equivalent for other inputs)

Enabled in: **MAN, AUTO**

This protection is only enabled if one of the digital inputs of the controller is set to acquire the ACB status (function DIF.3001 – "ACB breaker status" in P.2001 or equivalent for other inputs) and if it has been set a time different from zero for that input (parameter P.2002). It activates only when ACB has to open and the acquired status is "active" consecutively for the time set. It automatically activates after three consecutive attempts.

23 – BCB breaker not opened

Type: **Warning**

Category: **Generic**

Related parameters: **P.2001** Function of the input 1 or equivalent for other inputs
P.2002 Delay for the input 1 or equivalent for other inputs

To disable: **P.2002 = 0** (for the input 1 or equivalent for other inputs)

Enabled in: **MAN, AUTO**

This protection is only enabled if one of the digital inputs of the controller is set to acquire the BCB status (function DIF.3002 – "ACB breaker status" in P.2001 or equivalent for other inputs) and if it has been set a time different from zero for that input (parameter P.2002). It activates only when BCB has to open and the acquired status is "active" consecutively for the time set. It automatically activates after three consecutive attempts.

31 – Source A fault (by contact)

Type: **Warning**

Category: **Generic**

Related parameters: **P.2001** Function of the input 1 or equivalent for other inputs
P.2002 Delay for the input 1 or equivalent for other inputs

To disable: **P.2002 = 0** (for the input 1 or equivalent for other inputs)

Enabled in: **MAN, AUTO**

This protection is only enabled if one of the digital inputs of the controller is set to acquire the external contact of Source A fault (function DIF.4203 - "Source A out of order" in parameter P.2001 or equivalent for other inputs). It activates if the input set becomes "active".

32 – Source B fault (by contact)

Type: **Warning**

Category: **Generic**

Related parameters: **P.2001** Function of the input 1 or equivalent for other inputs
P.2002 Delay for the input 1 or equivalent for other inputs

To disable: **P.2002 = 0** (for the input 1 or equivalent for other inputs)

Enabled in: **MAN, AUTO**

This protection is only enabled if one of the digital inputs of the controller is set to acquire the external contact of Source B fault (function DIF.4204 - "Source B out of order" in parameter P.2001 or equivalent for other inputs). It activates if the input set becomes "active".

37 – Low battery voltage

Type: **Warning**

Category: **Battery protection**

Related parameters: **P.0362** Low battery voltage threshold (%)
P.0363 Low battery voltage delay

To disable: **P.0363 = 0**

Enabled in: **MAN, AUTO**

This protection is always enabled. It activates if the battery voltage remains lower than the threshold P.0362 consecutively for the time P.0363.

The threshold P.0362 is showed as percentage with respect to the nominal voltage of the battery, which is not configurable but selected automatically by the controller between 12 and 24VDC. The selection is made when the controller is powered and every time the OFF/RESET mode is forced. The controller considers to be powered by a 12V battery if, in the previous situations, it measures a battery voltage not higher than 17V; otherwise, it considers a 24V nominal voltage.

38 – High battery voltage

Type: **Warning**

Category: **Battery protection**

Related parameters: **P.0364** High battery voltage threshold (%)
P.0365 High battery voltage delay

To disable: **P.0365 = 0**

Enabled in: **MAN, AUTO**

This protection is always enabled. It activates if the battery voltage remains higher than the threshold P.0364 consecutively for the time P.0365.

The threshold P.0364 is showed as percentage with respect to the nominal voltage of the battery, which is not configurable but selected automatically by the controller between 12 and 24VDC. The selection is made when the controller is powered and every time the OFF/RESET mode is forced. The controller considers to be powered by a 12V battery if, in the previous situations, it measures a battery voltage not higher than 17V; otherwise, it considers a 24V nominal voltage.

45 – Source A max. auxiliary current

Type: **Warning**

Category: **Source A protection**

Related parameters: **P.0311** Primary of C.T. for auxiliary current
P.0312 Secondary of C.T. for auxiliary current
P.0313 Connection for auxiliary current
P.0314 Usage of auxiliary current
P.0367 Auxiliary/Neutral current threshold
P.0368 Auxiliary/Neutral current delay

To disable: **P.0368 = 0**

Enabled in: **MAN, AUTO**

This protection is enabled only if the controller is configured to use the input for the auxiliary/neutral current (parameter P.0314 different from zero). It activates if the auxiliary current measure remains higher than the threshold P.0367 consecutively for the time P.0368. It is possible to disable this protection without changing the parameters by activating a digital input set with the function DIF.2704 – “Disable auxiliary current protections” (parameter P.2001 for the input 1 or equivalent for other inputs).

Note: la protezione lavora quando la scheda misura le correnti della sorgente A.

46 – Source B max. auxiliary current

Type: **Warning**

Category: **Source B protection**

Related parameters: **P.0311** Primary of C.T. for auxiliary current
P.0312 Secondary of C.T. for auxiliary current
P.0313 Connection for auxiliary current

P.0314 Usage of auxiliary current
P.0367 Auxiliary/Neutral current threshold
P.0368 Auxiliary/Neutral current delay

To disable: **P.0368 = 0**

Enabled in: **MAN, AUTO**

This protection is enabled only if the controller is configured to use the input for the auxiliary/neutral current (parameter P.0314 different from zero). It activates if the auxiliary current measure remains higher than the threshold P.0367 consecutively for the time P.0368. It is possible to disable this protection without changing the parameters by activating a digital input set with the function DIF.2704 – "Disable auxiliary current protections" (parameter P.2001 for the input 1 or equivalent for other inputs).

Note: the protection works when the controller measures the currents on the source B.

48 – Emergency stop

Type: **Alarm**

Category: **Generic**

Related parameters: **P.0361** Emergency stop delay

To disable: **-**

Enabled in: **MAN, AUTO**

This protection is always enabled and it cannot be disabled. It activates if the input for the emergency stop remains "not active" consecutively for the time set in the parameter P.0361 (setting a value equal to zero, the alarm is immediate as soon as the input is not active).

It is possible to force the emergency stop alarm manually with a control through the serial ports. These commands can be enabled by a digital input configured with function DIF.2706 "Enable controls from the serial ports": if this input exists, it should be active. To activate the emergency stop alarm, it is necessary to write (within 5 seconds) the Modbus registers in sequence:

- HOLDING REGISTER 101: write the password configured with the parameter P.0004.
- HOLDING REGISTER 102: enter the value "99".

55 – Source A phase sequence fault

Type: **Warning**

Category: **Source A protection (Genset)**

Related parameters: **P.0101** Source A number of phases
P.0114 Required phases sequence source A

To disable: **P.0114 = 0**

Enabled in: **MAN, AUTO**

This protection is only enabled if the source A is a genset. It represents the maximum difference in absolute value acceptable between any two phase currents. This protection is enabled only with three-phase system and only with reached operating conditions (the voltages and the frequency must be in tolerance range) and the load must be switched on the source B (it prevents the closing of the load on the source A). The parameter P.0114 allows to select the phase sequence required (0 = disable the function, 1 = clockwise cycle, 2 = counter clockwise cycle). The protection activates when the phases cycle sense of the source A does not comply with the one set, with a filter time of 0,5 seconds.

56 – Source B phase sequence fault

Type: Warning

Category: **Source B protection (Genset)**

Related parameters: **P.0201** Source B number of phases
P.0214 Required phases sequence source B

To disable: **P.0214 = 0**

Enabled in: **MAN, AUTO**

This protection is only enabled if the source B is a genset. It represents the maximum difference in absolute value acceptable between any two phase currents. This protection is enabled only with three-phase system and only with reached operating conditions (the voltages and the frequency must be in tolerance range) and the load must be switched on the source A (it prevents the closing of the load on the source B). The parameter P.0214 allows to select the phase sequence required (0 = disable the function, 1 = clockwise cycle, 2 = counter clockwise cycle). The protection activates when the phases cycle sense of the source B does not comply with the one set, with a filter time of 0,5 seconds.

57 – Clock not working

Type: **Warning**

Category: **Generic**

Related parameters: **P.0421** Generator enable days
P.0422 Generator enable start time
P.0423 Generator enable stop time
P.0424 Switch-over interval
P.0425 Source A enable start time
P.0426 Source B enable start time

To disable: **-**

Enabled in: **MAN, AUTO**

This warning is always enabled. It activates if the controller identified the clock status as not working and the functions that use the clock, such as the enable time (P.0421, P.0422, P.0423), the switch-over interval (P.0424) or the enable start time (P.0425 e P.0426), are set. Set the clock in order to disable it.

100 – Source A max. differential current

Type: **Warning**

Category: **Source A protection**

Related parameters: **P.0377** Maximum differential current threshold (Aac)
P.0378 Maximum differential current delay

To disable: **P.0378 = 0**

Enabled in: **MAN, AUTO**

This protection is enabled only if the load is switched on the source A and the controller is set to measure the differential current. It activates if the differential current remains higher than the threshold P.0377 consecutively for the time P.0378.

101 – Source B max. differential current

Type: **Warning**

Category: **Source B protection**

Related parameters: **P.0377** Maximum differential current threshold (Aac)
P.0378 Maximum differential current delay

To disable: **P.0378 = 0**

Enabled in: **MAN, AUTO**

This protection is enabled only if the load is switched on the source B and the controller is set to measure the differential current. It activates if the differential current remains higher than the threshold P.0377 consecutively for the time P.0378.

305...312 – Analogue input #xxx.

313...328 – Analogue input #xxx.

Type: **Warning**
Related parameters: **P.4002...P.4008 (for the input 1 or equivalent for other inputs)**
To disable: **P.. AUTO.**

These malfunctions are activated by the thresholds on the analogue measurements. See [1] to check the correspondence between alarm code and analogue input.

See 5.11.6 for the thresholds configuration to activate these malfunctions.

701...708 – Digital input #xxx.

723...726 – Analogue input configured as digital #xxx.

727...742 – Virtual digital input #xxx.

Type: **Warning**
Related parameters: **P.2001 P.2002 P.2003 (for the input 1 or equivalent for other inputs)**
To disable: **P.2002 = 0 (for the input 1 or equivalent for other inputs)**
Enabled in: **MAN, AUTO.**

These malfunctions are activated by the digital inputs are set with the following functions:

- DIF.4001 – “Generic warning”. If the input remains “active” consecutively for the time set, a warning is activated: the text displayed is the one set in the parameters related to the input.
- DIF.4004 – “Generic block”. If the input remains “active” consecutively for the time set, a block is activated: the text displayed is the one set in the parameters related to the input.
- DIF.4021 and DIF.4024. The controller will activate this anomaly if the digital input is uninterruptedly active for the configured time span. These anomalies force the opening of the ACB circuit breaker.
- DIF.4031 and DIF.4034. The controller will activate this anomaly if the digital input is uninterruptedly active for the configured time span. These anomalies force the opening of the BCB circuit breaker.
- See [1] to check the correspondence between alarm code and analogue input.

14. Other functions

14.1 Counters

The controller manages internally the following counters:

- Partial active power counter (kWh) (resettable), increased when the loads are connected to the source A.
- Total active power counter (kWh), increased when the loads are connected to the source A.
- Partial reactive power counter (kWh) (resettable), increased when the loads are connected to the source A.
- Total reactive power counter (kWh), increased when the loads are connected to the source A.
- Partial working hours counter (hh) (resettable), increased when the loads are connected to the source A.
- Total working hours counter (hh) (resettable), increased when the loads are connected to the source A.
- Partial active power counter (kWh) (resettable), increased when the loads are connected to the source B.
- Total active power counter (kWh), increased when the loads are connected to the source B.
- Partial reactive power counter (kWh) (resettable), increased when the loads are connected to the source B.
- Total reactive power counter (kWh), increased when the loads are connected to the source B.
- Partial working hours counter (hh) (resettable), increased when the loads are connected to the source B.
- Total working hours counter (hh) (resettable), increased when the loads are connected to the source B.

All these counters are displayed on the controller front panel and can be read via serial port (with the ModBus protocol). Some of these counters can be reset by the operator following a proper procedure, or via serial port (they are marked in the list with “resettable”). All these counters are saved in a non-volatile memory, so they store their values also when the controller is powered off. Non-volatile memories have limited life cycles, therefore it is important to reduce the memory writing to minimum. For this reason, a counter may not be immediately saved as its value changes; consequently, before powering the controller off, it is important to ensure to know when and how the counters were saved.

Counters are saved (all together and simultaneously) in the following conditions:

- Every time the controller is in OFF/RESET mode.
- For each hour the controller is powered.

Furthermore, counters are saved when they are reset to zero (individually or globally) via front panel or serial port. Note that some counters have a decimal part (for example the minutes-counters associated to hours-counters), which is also saved in a non-volatile memory. Powering off the controller in an uncontrolled way can cause the loss of the decimal part. It is enough to switch the controller to OFF-RESET to force data saving, before switching off the power.

14.1.1 Counters reset

The resetting procedure is common for all the counters, but it only applies to some of them, based on the page displayed on the multifunctional display. See in paragraph 11.5.3.9 and 11.5.3.10 the description of the display pages that contain the counter to reset to zero.

14.2 Clock

The controller is provided with a standard hardware clock. It is shown in detail in the page S.05 CONTROLLER. It can be set through the programming menu 4.7.1 – Date/Time or the serial port, and it is used for many functions:

- History logs recordings (see par. 11.5.4).
- Weekly planning of time intervals in which the source, set as genset, can be used.
- Hourly planning of time intervals in which the switch-over between sources should happen.
- Daily planning of the start working hour for each source.

14.2.1 Automatic clock upgrade

If the controller is equipped with an Ethernet connection, the controller clock can be automatically upgraded by the connection to a NTP server (see par.10.4). The controller consults the server every 5 minutes and records the event "EVT.1076 – Date and Hour changed" in the history log, only if the difference between the new data received and the actual one is higher than a minute. The server returns the date and the hour of the reference time zone (that is the UCT time, "Coordinated Universal Time"), from which the controller can calculate and upgrade the internal calendar, considering its time zone and legal time.

For this purpose, there are the following parameters:

- P.0409: Legal time.
- "0 - No" Legal time not in use: Time is not changed.
- "1 - Yes" Legal time in use: It adds an hour to the one received.
- "2 - Automatic (Europe only)": It automatically calculates if the legal hour is in use. It only works for Europe, since starting from 2002 it has been unified (it activates at 01:00 in the last Sunday of March and deactivates at 01:00 in the last Sunday of October).
- "3-Automatic (via calendar)": the activation/deactivation of the daylight save time is configurable by calendars 15 and 16.
- P.0410: Time zone (1=15 min / 4=1 hour).
  The setting limits are from -47 to + 48 and they allow to manage all hour ranges of the Earth in quarters of hour.

14.2.2 Weekly planning of the working hours

In some applications, it can inhibit the automatic working of the source/s configured as genset/s in hour or days in which its intervention is not necessary. For example, if there is nobody in a factory on Sunday, letting the genset work for lack of mains is useless (actually, it is a waste of fuel). This function precisely aims to set in which days and hour ranges the automatic intervention of the genset is adequate. The planning is weekly: it is possible to set in which days the genset can intervene. In addition to the days, it is possible to set a unique hour range of automatic intervention authorisation, that will be the same for all days selected.

This planning inhibits the intervention of the source/s set as genset (by means of the parameters P.0100 and P.0200 – Source type), while it has no effects on the ones set as mains.

The parameters that allow to make these configurations are:

- P.0421 – "Generator enable days": It allows to specify in which days of the week the genset can automatically intervene. It is a bit-configurable parameter, each of them corresponds to a day of the week. In order to obtain the value of the parameter, sum up the "value" of the following table for the interested days.

Bit	Value	Day
0	1	Sunday
1	2	Monday
2	4	Tuesday
3	8	Wednesday

4	16	Thursday
5	32	Friday
6	64	Saturday

- P.0422 – “Generator enable start time”: It allows to set the start of the range in which the automatic intervention is approved, in hours and minutes.
- P.0423 – “Generator enable stop time”: It allows to set the stop of the range in which the automatic intervention is approved, in hours and minutes.

Generally, P.0422 will be set at a value lower than P.0423. Instead, if it contains a higher value, the controller considers the selected range as over midnight: in this case, the hour set in P.0422 refers to the days selected in P.0421, while the hour set in P.0423 refers to the following days.

For example, intending to enable the genset automatic intervention only from Monday to Friday, from 08:00 to 18:00, it is necessary to set:

P.0421 = 62 (2+4+8+16+32)

P.0422 = 08:00

P.0423 = 18:00

The controller makes available, for AND/OR logics, also the internal status ST.081 - "Clock/calendar start inhibition”.

14.2.3 Hourly planning of the switch-over interval

The hourly planning of the switch-over interval defines every how many hours of work the source change is required. For example, it can be useful, if the plant manages the switching between two gensets to share the working hours between the two gensets in the day time. The parameter which allows to set this configuration is:

- P.0424 – “Switch-over interval”: It allows to set in which interval time the switch of the source is required.

The time counting starts following to a new setting of the parameter P.0424 and it is not reset with the controller in OFF/RESET mode. Only when the source is working (exactly when the related breaker is closed) the time counting is performed. The switch-over of the source will be carried out with the controller in AUTO mode.

14.2.4 Daily planning of the working hours

In some applications, it can set default working hours for both sources. For example, if the cost of the energy absorbed by the mains is higher in some hour ranges, it could be appropriate to use the genset in that period. This function can precisely set at what time of the day the sources must be activated.

The parameters that allow to make these configurations are the following:

- P.0425 – “Source A enable start time”: It allows to set the start of the range in which the automatic intervention of the source A is required, in hours and minutes.
- P.0426 – “Source B enable start time”: It allows to set the start of the range in which the automatic intervention of the source B is required, in hours and minutes.

Setting both P.0425 and P.0426 parameters equal to zero, the function is disabled.

In case of fault of the source required, the controller will automatically switch on the other. It will return on the one required once the malfunction is restored.

For example, intending to enable the intervention of the source A from midnight to midday and of the source B from midday to midnight, it is necessary to set:

P.0425 = 00:00

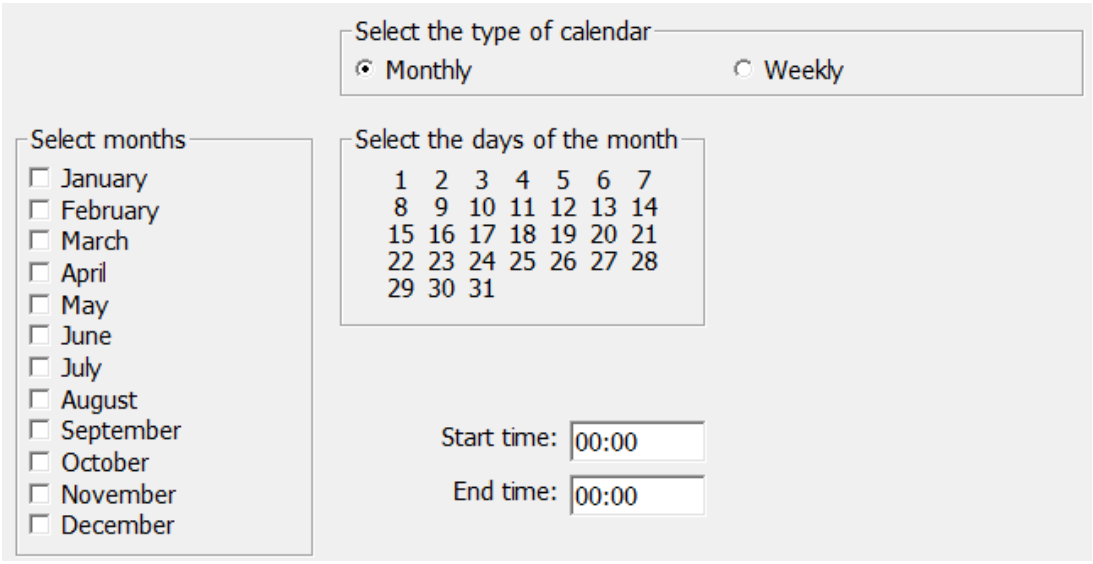
P.0426 = 12:00

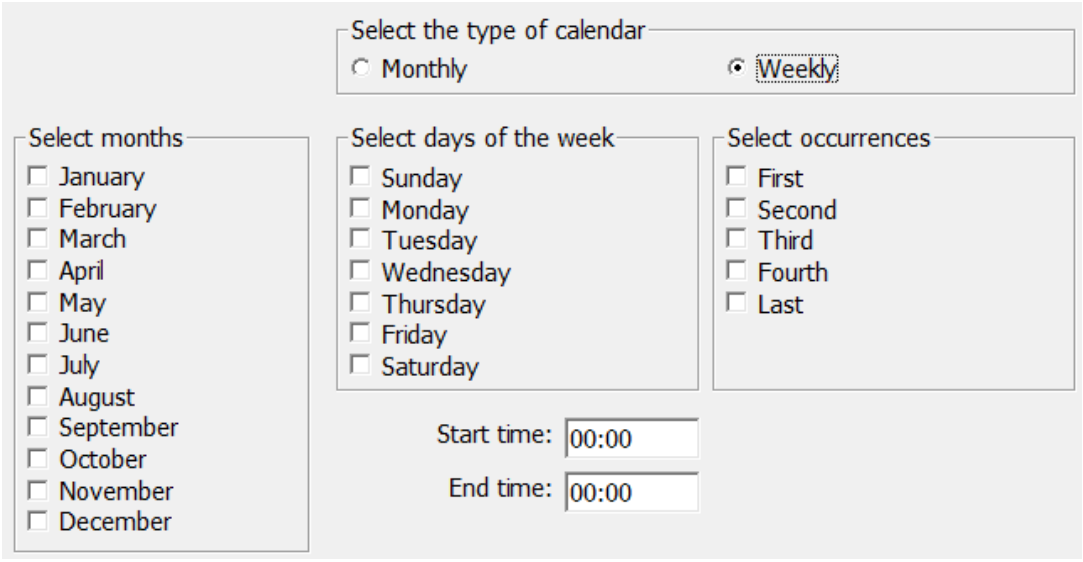
The controller makes available, for AND/OR logics, also the internal status ST.082 - "Working hour for Source B (OFF = A)", in order to identify the actual hour range and the source is required.

14.2.5 Configurable calendars

The controller provides 16 calendars fully configurable. They allow to select days and time-slots, inside which the controller activates an internal bit. This bit could then be used by AND/OR logics to activate a digital output or to create more complex logics. All calendars are identical: calendars 15 and 16, however, can be used for the activation/deactivation of the daylight save time (if parameter P.0409 is set to "3").

Each calendar can be individually selected as "monthly" or "weekly":





Using BoardPrg3 software, it is very easy to select whether a calendar is "weekly" or "monthly". If you want to use the parameters of the controller, you must act on the parameter P.1900. It is a bit-field parameter; one bit is provided for each calendar:

BIT	Value	Hexadecimal	Calendar
0	1	0001	Calendar 1

1	2	0002	Calendar 2
2	4	0004	Calendar 3
3	8	0008	Calendar 4
4	16	0010	Calendar 5
5	32	0020	Calendar 6
6	64	0040	Calendar 7
7	128	0080	Calendar 8
8	256	0100	Calendar 9
9	512	0200	Calendar 10
10	1024	0400	Calendar 11
11	2048	0800	Calendar 12
12	4096	1000	Calendar 13
13	8192	2000	Calendar 14
14	16384	4000	Calendar 15
15	32768	8000	Calendar 16

The parameter must be set with the sum of the values for all the calendars that must be selected as “weekly” (in hexadecimal notation). In fact, a bit set to “1” selects the “weekly” mode.

Both calendar types allow to select in which months the controller activates the internal bit (at least one month must be selected, it is even possible to select all months). Using the parameters of the controller, this selection is done by means parameter P.1901 (for the calendar 1 or equivalent for other calendars). This is also a bit-field parameter:

BIT	Value	Hexadecimal	Month
0	1	0001	January
1	2	0002	February
2	4	0004	March
3	8	0008	April
4	16	0010	May
5	32	0020	June
6	64	0040	July
7	128	0080	August
8	256	0100	September
9	512	0200	October
10	1024	0400	November
11	2048	0800	December

The parameter must be set with the sum of the values of the required months (in hexadecimal notation).

For “monthly” calendars, is then possible to select the days of the month for the activation of the internal bit (at least one day must be selected, it is even possible to select all days). Using the parameters of the controller, this selection is done by means parameter P.1902 (for the calendar 1 or equivalent for other calendars). This is also a bit-field parameter:

BIT	Value	Hexadecimal	Day of month
0	1	00000001	1
1	2	00000002	2
2	4	00000004	3
3	8	00000008	4

4	16	00000010	5
5	32	00000020	6
6	64	00000040	7
7	128	00000080	8
8	256	00000100	9
9	512	00000200	10
10	1024	00000400	11
11	2048	00000800	12
12	4096	00001000	13
13	8192	00002000	14
14	16384	00004000	15
15	32768	00008000	16
16	65536	000100000	17
17	131072	00020000	18
18	262144	00040000	19
19	524288	00080000	20
20	1048576	00100000	21
21	2097152	00200000	22
22	4194304	00400000	23
23	8388608	00800000	24
24	16777216	01000000	25
25	33554432	02000000	26
26	67108864	04000000	27
27	134217728	08000000	28
28	268435456	10000000	29
29	536870912	20000000	30
30	1073741824	40000000	31

The parameter must be set with the sum of the values of the required days (in hexadecimal notation).

For “weekly” calendars, is then possible to select the days of the week for the activation of the internal bit (at least one day must be selected, it is even possible to select all days). Using the parameters of the controller, this selection is done by means parameter P.1902 (for the calendar 1 or equivalent for other calendars). This is also a bit-field parameter:

BIT	Value	Hexadecimal	Day of week
16	65536	00010000	Sunday
17	131072	00020000	Monday
18	262144	00040000	Tuesday
19	524288	00080000	Wednesday
20	1048576	00100000	Thursday
21	2097152	00200000	Friday
22	4194304	00400000	Saturday

The parameter must be set with the sum of the values of the required days (in hexadecimal notation).

Selecting a day of the week (Sunday for example), it is then possible to select if all “Sundays” in the month must be used or only some of them. Using the parameters of the controller, this selection is done by means parameter P.1902 (for

the calendar 1 or equivalent for other calendars). This is also a bit-field parameter:

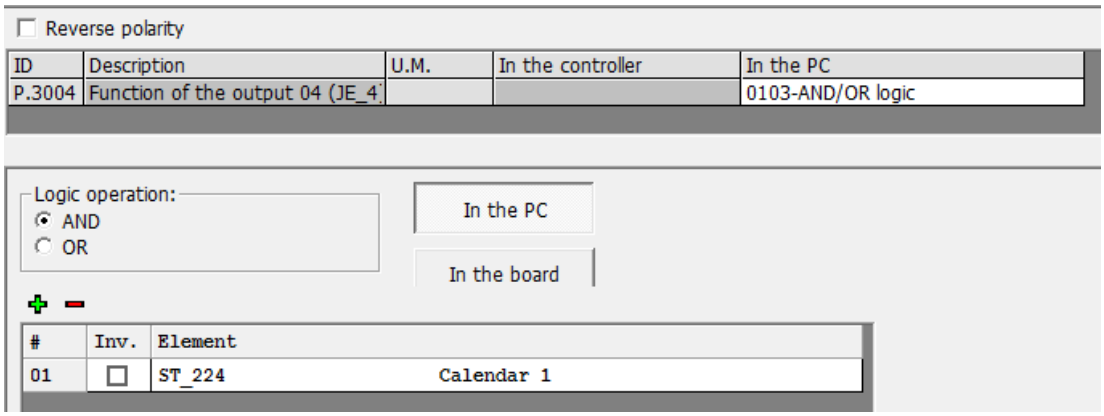
BIT	Value	Hexadecimal	Occurrence
0	1	00000001	First occurrence
1	2	00000002	Second occurrence
2	4	00000004	Third occurrence
3	8	00000008	Forth occurrence
4	16	00000010	Last occurrence

The parameter must be set with the sum of the values of the required occurrences (in hexadecimal notation). **Note: for "weekly" calendars, the days of week and their occurrences in the month are selected by the same parameter, using different bits.**

If the "occurrence" bits are all "0", then the selected days of week will be managed in any week of the month; otherwise they will be managed for the selected occurrences only. The "last" option is useful because, depending on the month and on the year, a certain day of the week can be present 4 or 5 times in a month: using the "last" option you can do an action exactly in the last occurrence in the month. A typical example is the management of the daylight save time; in Italy, it is activated on the last Sunday of October, and deactivated on the last Sunday of March. Those Sundays can be the 4° or the 5° occurrence in the month, depending on the first day of the month. Using the "last" option, the problem is solved.

Finally, for both "weekly" and "monthly" calendars, it is possible to select a time-slot (valid for all selected days). The controller will activate the internal bit only inside the selected time-slot. Using the parameters of the controller, the time-slot can be selected by means P.1903 and P.1904 (for the calendar 1 or equivalent for other calendars). If those parameters are set with the same values, the full day is selected. If the start time is lower than the end time, the time-slot is not across midnight; otherwise, the internal bit is activated after the start time of the selected days, and it is deactivated after the end time of the day after the selected one.

Using the AND/OR logics, it is possible to activate a digital output into selected days and time-slot (selected using a calendar):



This is an example for the configuration of the daylight save time for Italy, using calendars 15 and 16:

- Calendar 15.
  - Select "weekly" (bit 14 of P.1900 = "1").
  - Last Sunday of October:
    - Select "October" (P.1957 = "0200").
    - Select "Sunday", "Last" (P.1958 = "00010010").
  - The activation should happen at 02:00:

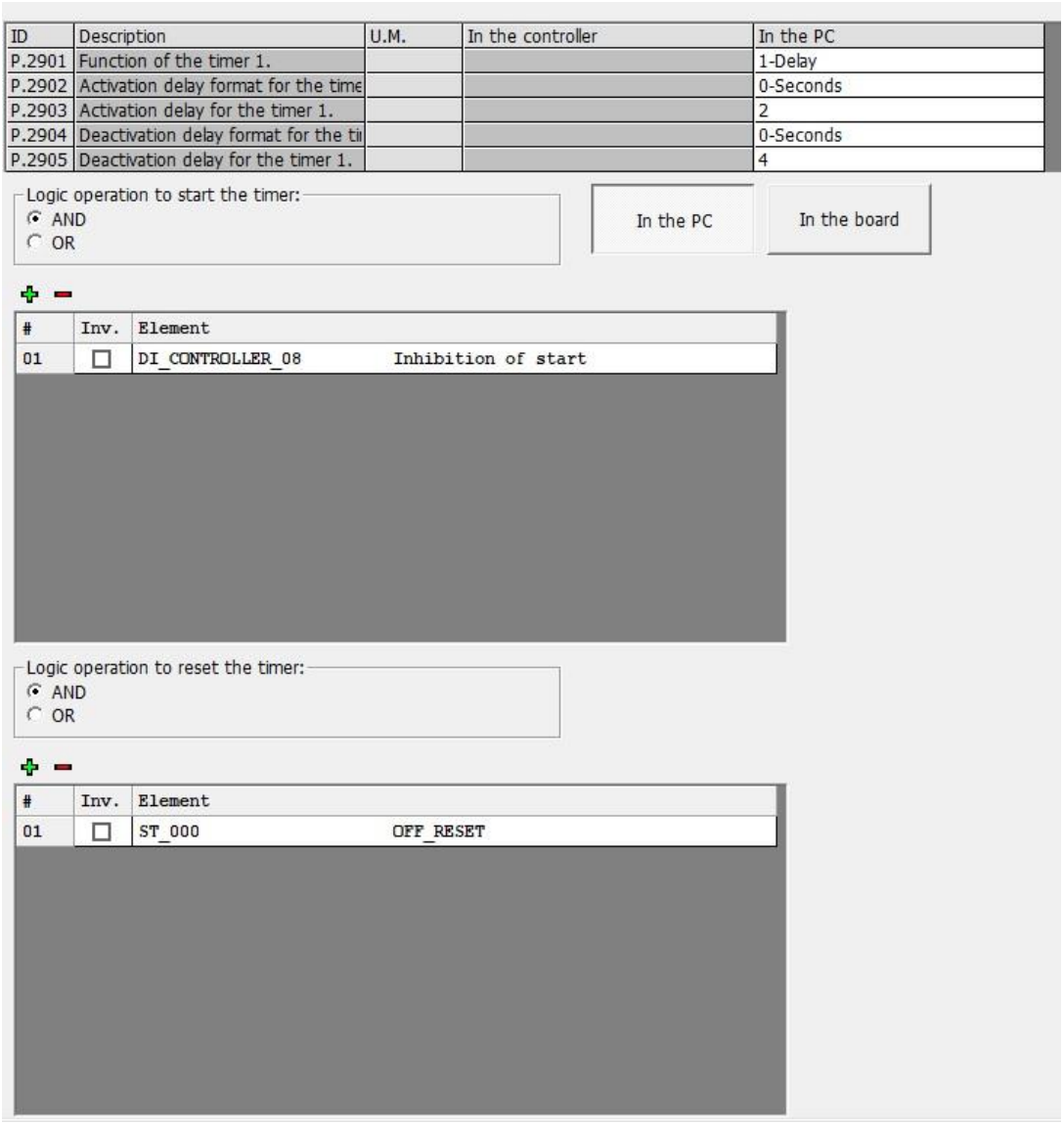
- Select “2:00” as start time (P.1959).
- Select “2:01” as end time (P.1960).
- Calendar 16.
  - Select “weekly” (bit 15 of P.1900 = “1”).
  - Last Sunday of March:
- Select “March” (P.1961 = “0004”).
- Select “Sunday”, “Last” (P.1962 = “00010010”).
  - The activation should happen at 03:00:
- Select “3:00” as start time (P.1963).
- Select “3:01” as end time (P.1964).

14.2.6 Configurable timers

The controller provides 4 generic timers fully configurable, that can be used inside the AND/OR logics to create complex sequential logics. Each timer, in fact, activates/deactivates an internal bit that can be used by the AND/OR logics.

The four timers are identical.

For each timer it is possible to select (by means an AND/OR logic) an “activation condition” that starts the timer. In the same way, it is possible (but not mandatory) to select (by means an AND/OR logic) a “reset condition” that resets the timer. When the “reset condition” is true, the internal bit of the timer is forced to “0”.



Moreover, each timer provides the following five parameters (the list refers to the timer 1):

- P.2901: function of the timer 1.
- P.2902: Activation delay format for the timer 1.
- P.2903: Activation delay for the timer 1.
- P.2904: Deactivation delay format for the timer 1.

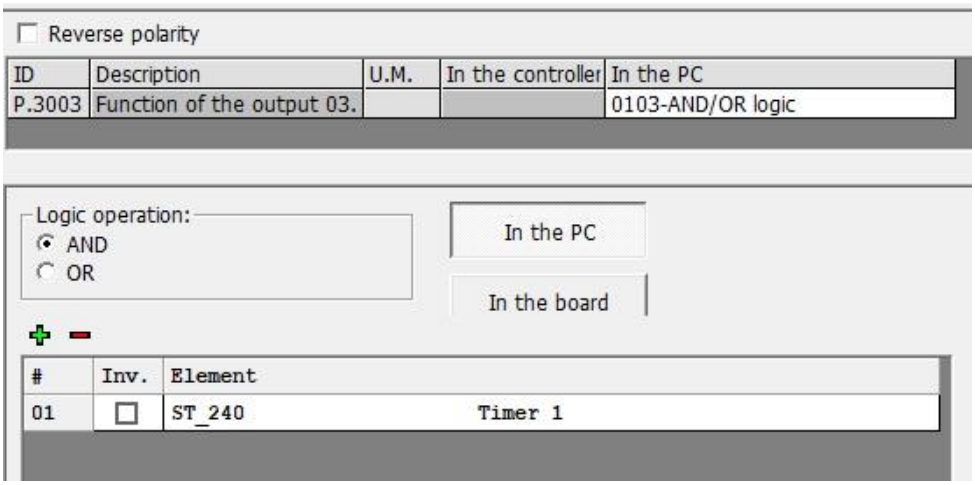
- P.2905: Deactivation delay for the timer 1.

In addition to the function, two delays are configurable for any timer; for each of them it is possible to select the time base ("0 – Seconds", "1 – Minutes", "2 – Hours") and the delay value.

Each timer can work in four different modes, selectable by means parameter P.2901 (for the timer 1 or equivalent for the other timers):

- 0 – Not used. In this case the internal bit related to the timer is always reset.
- 1 – Delay.
  - The internal bit is reset while the "reset condition" is true.
  - The internal bit is set with the delay P.2902 – P.2903 from when the "activation condition" becomes true.
  - The internal bit is reset with the delay P.2904 – P.2905 from when the "activation condition" becomes false.
- 2 – Pulse.
  - The internal bit is reset while the "reset condition" is true.
  - The internal bit is set for the time configured with P.2902 – P.2903 each time the "activation condition" changes from false to true.
  - The internal bit is set for the time configured with P.2904 – P.2905 each time the "activation condition" changes from true to false.
- 3 – Free run
  - The internal bit is reset while the "reset condition" is true.
  - The internal bit is reset while the "activation condition" is false.
  - While the "activation condition" is true, the internal bit is managed as a square wave: it is set for the time configured with P.2902 – P.2903, then it is reset for the time configured with P.2904 – P.2905, and so on.
- 4 – Set/Reset
  - The internal bit is reset while the "reset condition" is true.
  - The internal bit is set if the "activation condition" is true and the "reset condition" is false.
  - The internal bit keeps its previous status if the "activation condition" is false and the "reset condition" is false.

The following example manages a digital output related to the internal bit of the timer 1:



14.3 Non-volatile memory

The controller has a non-volatile memory inside, used to store various information such as parameters, counters etc. The memory is divided in different areas. When the controller is powered, it performs a check on the data stored in each area: if even just one area is incorrect, it displays an error message with a numerical code (in hexadecimal form); each bit to 1 of said code corresponds to an area of the memory that is not valid. Here is a table listing the areas and their bit.

Area	Version	Bit	Value	Description
1	1.00	0	1 (0001)	Coefficients for the calibration of the measuring inputs of the controller.
2	1.00	1	2 (0002)	Various information (language selected, LCD display contrast).
3	1.00	2	4 (0004)	Counters.
4	1.00	3	8 (0008)	Reserved.
5	1.00	4	16 (0010)	Parameters.
6	1.00	5	32 (0020)	Text parameters (e.g. configurable messages related to the inputs)

If, for example, the value between brackets is “0004”, it means that only the counters area is not valid. If the value is “0022”, it means that the parameters areas (0020) and the current language area (0002) are not valid.

If any of the areas is not valid, the normal operating sequences are not carried out until the operator presses the “ENTER + EXIT” buttons: in fact, the situation must be taken note of, because it may cause malfunctions (for example, imagine what would happen if the invalid area was the one of the parameters). Only when the operator presses “ENTER + EXIT”, the controller reloads the default settings for the data stored in the invalid areas: this means that, if the controller is turned off without pressing “ENTER + EXIT”, next time you turn it on you will get the invalid memory report again.

MECC ALTE SPA (HQ)

Via Roma
20 – 36051 Creazzo
Vicenza – ITALY

T: +39 0444 396111
F: +39 0444 396166
E: info@meccalte.it
aftersales@meccalte.it

MECC ALTE PORTABLE

Via A. Volta
1 37038 Soave
Verona – ITALY

T: +39 0456 173411
F: +39 0456 101880
E: info@meccalte.it
aftersales@meccalte.it

MECC ALTE POWER PRODUCTS

Via Melaro
2 – 36075 Montecchio
Maggiore (VI) – ITALY

T: +39 0444 1831295
F: +39 0444 1831306
E: info@meccalte.it
aftersales@meccalte.it

ZANARDI ALTERNATORI

Via Dei Laghi
48/B – 36077 Altavilla
Vicenza – ITALY

T: +39 0444 370799
F: +39 0444 370330
E: info@zanardialternatori.it

UNITED KINGDOM

Mecc Alte U.K. LTD
6 Lands' End Way
Oakham
Rutland LE15 6RF

T: +44 (0) 1572 771160
F: +44 (0) 1572 771161
E: info@meccalte.co.uk
aftersales@meccalte.co.uk

SPAIN

Mecc Alte España S.A.
C/ Rio Taibilla, 2
Polig. Ind. Los Valeros
03178 Benijofar (Alicante)

T: +34 (0) 96 6702152
F: +34 (0) 96 6700103
E: info@meccalte.es
aftersales@meccalte.es

CHINA

Mecc Alte Alternator
(Nantong) Ltd
755 Nanhai East Rd
Jiangsu Nantong HEDZ 226100
People's Republic of China

T: +86 (0) 513 82325758
F: +86 (0) 513 82325768
E: info@meccalte.cn
aftersales@meccalte.cn

INDIA

Mecc Alte India PVT LTD
Plot NO: 1, Talegaon
Dhamdhere S.O.
Taluka: Shirur,
District: Pune - 412208
Maharashtra, India

T: +91 2137 673200
F: +91 2137 673299
E: info@meccalte.in
aftersales@meccalte.in

U.S.A. AND CANADA

Mecc Alte Inc.
1229 Adams Drive
McHenry, IL, 60051

T: +1 815 344 0530
F: +1 815 344 0535
E: info@meccalte.us
aftersales@meccalte.us

GERMANY

Mecc Alte Generatoren GmbH
Bucher Hang 2
D-87448 Waltenhofen

T: +49 (0)831 540755 0
E: info@meccalte.de
aftersales@meccalte.de

AUSTRALIA

Mecc Alte Alternators PTY LTD
10 Duncan Road, PO Box 1046
Dry Creek, 5094, South
Australia

T: +61 (0) 8 8349 8422
F: +61 (0) 8 8349 8455
E: info@meccalte.com.au
aftersales@meccalte.com.au

FRANCE

Mecc Alte International S.A.
Z.E. la Gagnerie
16330 St. Amant de Boixe

T: +33 (0) 545 397562
F: +33 (0) 545 398820
E: info@meccalte.fr
aftersales@meccalte.fr

FAR EAST

Mecc Alte (F.E.) PTE LTD
10V Enterprise Road, Enterprise 10
Singapore 627679

T: +65 62 657122
F: +65 62 653991
E: info@meccalte.com.sg
aftersales@meccalte.com.sg

mecc alte

www.meccalte.com

The world's largest independent producer of alternators 1 – 5,000kVA

FATS115Plus Technical Manual
Code: EAAM047510EN
Rev. 10 | Date: 16/09/2020