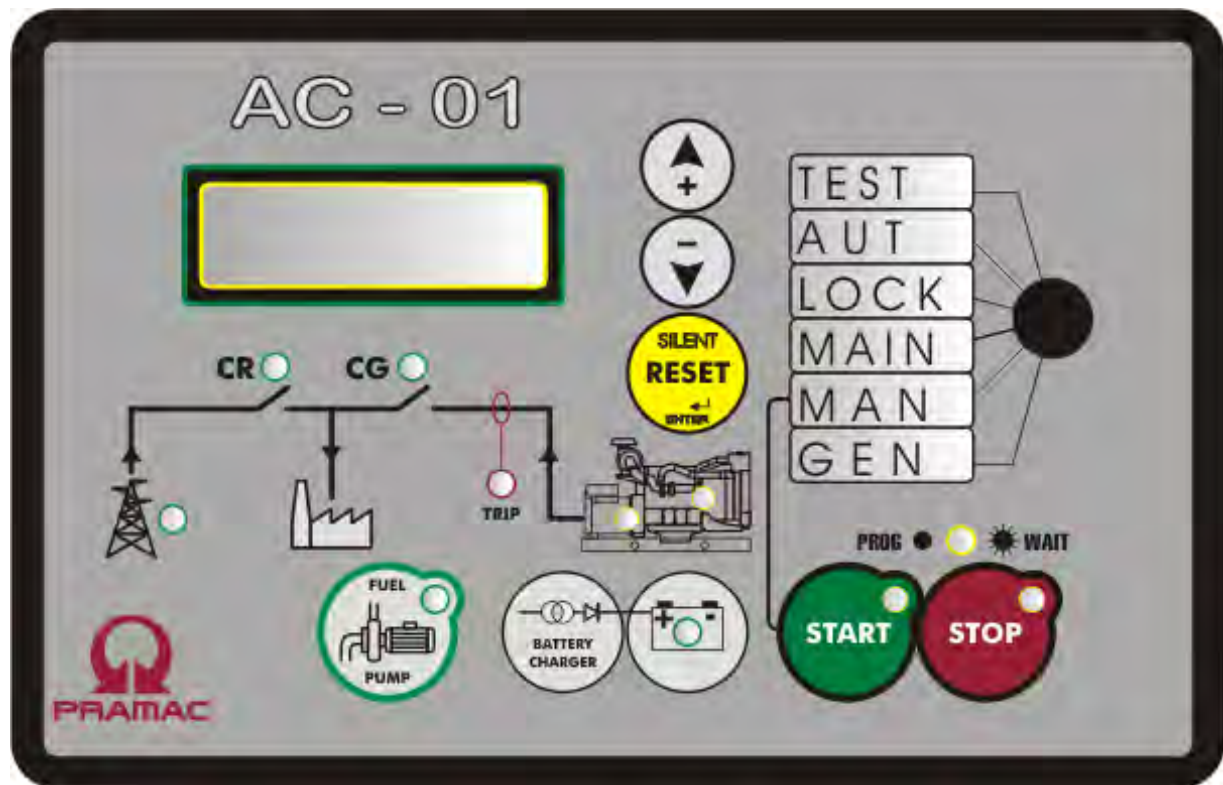


# AC-01 Rel 6.0

## AUTOMATIC MICROPROCESSOR CONTROL PANEL FOR STAND-BY GENERATOR



### MANUAL OF:

- INSTALLATION
  - USE
- MAINTENANCE

# INDEX

## 1. USER MANUAL ..... 4

### INTRODUCTION ..... 4

1.1 PURPOSE.....	4
1.2 OPERATIONAL PRINCIPLE .....	5
1.3 VIEW OF THE AC01 UNIT .....	6
1.4 FUNCTIONAL DESCRIPTION OF THE CONTROL PANEL COMPONENT.....	6
1.4 FUNCTIONAL DESCRIPTION OF THE CONTROL PANEL COMPONENT.....	7
1.5. COMMANDS AND OPERATIONAL MODES .....	10
1.6 PROGRAMMING.....	11
1.7. VARIOUS CONTROLS.....	11
LED TEST.....	11
ALARM SILENCING.....	11
1.8. SPECIAL FUNCTIONS.....	11
1.9 SIMPLE MAINTENANCE WORK .....	12

### 2. TECHNICAL MANUAL ..... 13

2.1 CONSTRUCTIONAL DESCRIPTION OF THE CONTROL PANEL .....	13
2.2. OPERATION.....	14
2.3 DETAILED DESCRIPTION OF HOW THE CONTROL UNIT WORKS.....	14
2.4 MANUALLY CONTROLLED FUNCTIONS .....	16
2.4.1 POWER SUPPLY FROM MAINS (manual command) .....	16
2.4.2 MANUAL STARTING.....	16
2.4.3 POWER SUPPLY FROM GENERATOR.....	16
2.4.4 MANUAL STOPPAGE .....	16
2.5 VARIOUS FUNCTIONS AND UTILITIES.....	17
2.5.1 CC12 AND 24V POWER SUPPLY CIRCUITS.....	17
2.5.2 COMMAND RELAYS.....	17
2.5.3 MOTOR STARTED READING .....	17
2.5.4. MOTOR PRE-HEATING.....	17
2.5.5 AUTOMATIC BATTERY CHARGER .....	18
2.6 MOTOR AND ALARM PARAMETER READING.....	19
2.6.1 POSITIVE MOTOR PROTECTION INPUTS .....	19
2.6.2 ANALOGUE MOTOR PARAMETER READING INPUTS (PRESSURE, TEMPERATURE AND FUEL LEVEL).....	19
2.6.3. OIL PRESSURE .....	20
2.6.4. MOTOR TEMPERATURE .....	20
2.6.5. FUEL LEVEL(15).....	21
PROGRAMMING.....	21
2.6.6 FUEL PUMP COMMAND .....	21
2.7. MEASURING THE GENERATOR'S AND MAINS PARAMETERS .....	22
Mains control .....	22
Three phase.....	22
Mains control .....	22
Network control.....	22
Connections.....	26
2.8 INPUT / OUTPUT.....	28
2.9. FUNCTIONS OF BUILT - IN WEEKLY CLOCK.....	29
2.9.1. WEEKLY CLOCK .....	29
2.9.2. CLOCK FOR AUTOMATIC TESTING .....	29
2.9.3. AUTOMATIC STOPPING OR STARTING .....	29
2.10 REMOTE COMMAND AND CONTROLS.....	30
2.10.1 EJP FUNCTION.....	30
2.10.2 SCR FUNCTION OR FORCED STARTING WITH OUTPUT (default).....	30
2.10.3 LOCK FUNCTION (default) .....	30
2.10.4 TEST FUNCTION (default) .....	30
2.10.6. FUNCTION FOR TWO UNITS WORKING ALTERNATELY .....	31
2.10.7. MAINS POWER SUPPLY EMERGENCY BACKUP.....	31

FILE	VER	DATA ULT. VERSIONE	LINGUA	PAGINA
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ITA	Page 2 of 56

2.10.8. POWER SUPPLY PLANT WITH TWO GENERATORS, ONE ON STANDBY .....	31
<b>2.11. SPECIAL FUNCTIONS.....</b>	<b>32</b>
2.11.1. PROGRAMMING.....	32
2.11.2. MOTOR PRE-HEATING (out 28) ( Default ).....	32
2.11.3. SPARKPLUGS PRE-HEATING (out 28) .....	32
2.11.4. STARTING MOTOR (out 28).....	32
2.11.5. GAS SOLENOID VALVES (for gas motors) (out 28).....	32
2.11.6. RESET (out 28) .....	33
2.11.7. DOUBLE STARTING (out 28) UNI 9490 NFPA NFS61.940 .....	33
Note: for the adjustment to the rules of safety fireproof, the "FORCED RUNNING" can be required, to see 2.10.5.....	33
2.11.8. ANTI-THEFT PROTECTION .....	33
2.11.9. ALARM HISTORY RECORDS .....	34
<b>2.12. PROGRAMMING .....</b>	<b>35</b>
2.12.1. SETTINGS.....	35
2.12.2. PARAMETERS.....	36
2.12.3. TIME SETTINGS.....	36
2.12.4. THRESHOLDS .....	37
2.12.5. VARIOUS SETTINGS.....	38
2.12.6. REMOTE CONTROL SETTINGS.....	39
<b>2.13. SELF-PROGRAMMING.....</b>	<b>40</b>
<b>2.14. CONNECTIONS AND RELATIVE DESCRIPTIONS .....</b>	<b>41</b>
2.14.1. VIEW OF THE AC01MP CONNECTION UNIT .....	41
2.14.2. CONNECTIONS ON THE MP02 POWER UNIT .....	42
<b>2.15. TECHNICAL CHARACTERISTICS .....</b>	<b>43</b>
IP 55 .....	43
<b>2.16. DIMENSIONS .....</b>	<b>44</b>
2.16.1. DRILLING TEMPLATE OF THE AC01 UNIT .....	44
2.16.2. DIMENSIONS OF THE MP 02 POWER UNIT .....	44
2.16.2.....	45
ADJUSTMENT TO THE LANGUAGES .....	45
<b>2.17. OPTIONAL EXPANSIONS.....</b>	<b>46</b>
2.17.1. REMOTE SIGNALS – INTERNET – INTRANET - ETHERNET .....	46
2.17.2. REMOTE CONTROL.....	46
COMMUNICATION PROTOCOL .....	48
<b>2.18. INSTALLATION .....</b>	<b>50</b>
2.18.1. POSITIONING .....	50
2.18.2. EARTH CONNECTIONS (PE).....	50
2.18.3. POWER CONNECTIONS.....	51
2.18.4. CONNECTIONS TO THE BATTERY .....	51
2.18.5. STARTING AND STOPPING .....	51
2.18.6. STOPPAGE WITH SOLENOID VALVE.....	52
2.18.7. MOTOR CONTROLLING PROBES .....	52
2.18.8. ELECTRICAL STRENGTH TEST.....	52
<b>2.19. SERVICE PROCEDURES.....</b>	<b>53</b>
2.19.1. SERVICING PROCEDURE .....	53
2.19.2. SERVICING PROCEDURE WITH THROUGH MAINS (GENERATOR DISABLED) .....	53
2.19.3. BATTERY REPLACEMENT PROCEDURE .....	53
2.19.4. AC01 BOARD REPLACEMENT PROCEDURE .....	54
2.19.5. MP02 POWER BOARD REPLACEMENT PROCEDURE .....	54
<b>3. MAINTENANCE .....</b>	<b>55</b>
3.1. ELECTRICAL MAINTENANCE .....	55
3.2. EFFICIENCY TEST .....	55
3.3. MOTOR SAFETY DEVICES.....	55
3.4. GENERATOR SAFETY DEVICES .....	55
3.5. OVERLOAD SAFETY DEVICE 51 .....	55
3.6. BATTERY EFFICIENCY.....	55
3.7. SWITCHING SCALING TEST .....	56
3.8. TROUBLE SHOOTING.....	56

**N.B.: THE INFORMATION CONTAINED IN THIS DOCUMENT MAY BE CHANGED DUE TO TECHNICAL IMPROVEMENTS WITHOUT NOTICE**

FILE	VER	DATA ULT. VERSIONE	LINGUA	PAGINA
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ITA	Page 3 of 56

# 1. USER MANUAL

## INTRODUCTION

We congratulate you for having purchased the AC01 control panel for handling your generator unit. As you read through this manual you will realise the outstanding performance and variety of applications offered by this supremely technological unit.

This electronic microprocessor module not only completely controls the generator and its switching but is also pre-arranged for the direct serial communication with a PC or, using a GSM unit your generator can be completely remote controlled from miles away.

The AC01 unit is equipped with a complete set of digital testers that are required to monitor all mains, generator and motor parameters.

To make the control of the unit absolutely comprehensible the manual is split up into two parts, namely:

The first **USER MANUAL** part has been prepared to provide a clear and simple guide to help you use the generator rapidly, completely and safely.

### 1.1 PURPOSE

The manual has been prepared specifically for the user of the generator unit.

Information required for the following is provided:

1. to learn the operational principle of the unit;
2. to interpret the indications given on the electronic control panel;
3. to control it for the various operational requirements;
4. to perform the basic checks required to ensure the efficiency of the generator itself.

Technical or adjustment matters are not dealt with as these involve the installation engineer when setting up the system.

FILE	VER	DATA ULT. VERSIONE	LINGUA	PAGINA
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ITA	Page 4 of 56

### HOW A STAND-BY GENERATOR UNIT WORKS

Fig. 1 illustrates the system components that consist of a public mains **R**, a generator unit **G-M**, a **QGE** command and control panel with a built-in mains contact maker **CR**, a generator unit contact maker **CG** and the **AC01** module that controls the system.

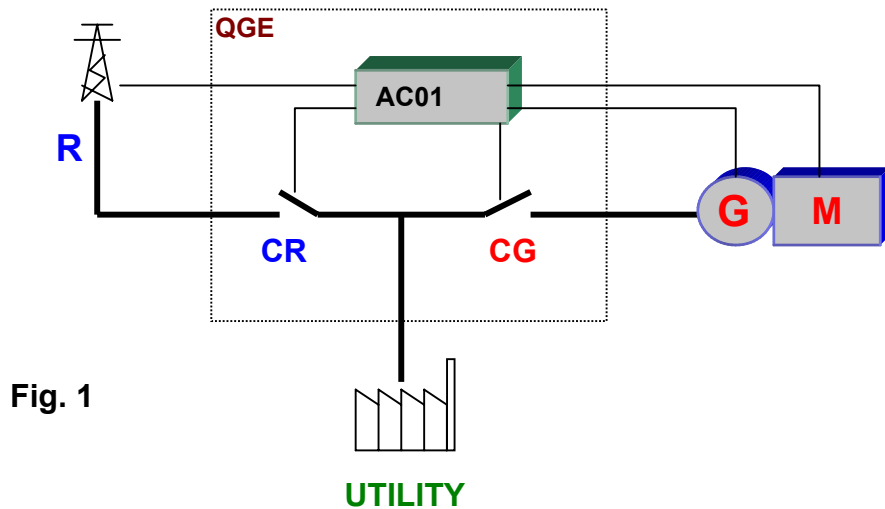


Fig. 1

Supposing that the mains **R** is within the normal limits, the **CR** mains contact maker is closed therefore the utility is powered from the mains. The **AC01** module controls the **R** mains and if there should be a drop in voltage, a phase should be missing or the phases should be dissymmetrical, the control panel:

1. opens the **CR** mains contact maker;
2. starts the **G-M** generator unit, which when the established operating conditions are reached, the **AC01** module closes the **CG** contact maker that then powers the utility from the generator unit **G**;

NOTE: When running, the **M** motor and **G** generator are safeguarded against possible anomalies, which if encountered, cause the generator to stop immediately and the cause for the alarm is saved and displayed (i.e. low oil pressure, overload and so on);

3. When the **R** mains is restored within the normal limits, the **AC01** after an adjustable delay, opens the contact maker of the **CG** generator and one second later closes the **CR** contact maker, thus powering the utility from the mains again;
4. The generator continues to run for at least another minute to cool down after which it stops automatically;

NOTE: Even when the generator is stopped, some safety devices relating to the fuel and water level are enabled and if an anomaly is detected an alarm status is triggered. The switching of the mains/generator is also constantly controlled and if there should be an overload on the mains contact maker an alarm buzzer is triggered.

To ensure the perfect efficiency of the generator a battery charger automatically holds the battery perfectly efficient. An automatic fuel filling system constantly keeps the correct level in the daily tank. A pre-heating system maintains the motor at the ideal temperature so that it is ready to start whenever necessary.

FILE	VER	DATA ULT. VERSIONE	LINGUA	PAGINA
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ITA	Page 5 of 56

### 1.3 VIEW OF THE AC01 UNIT

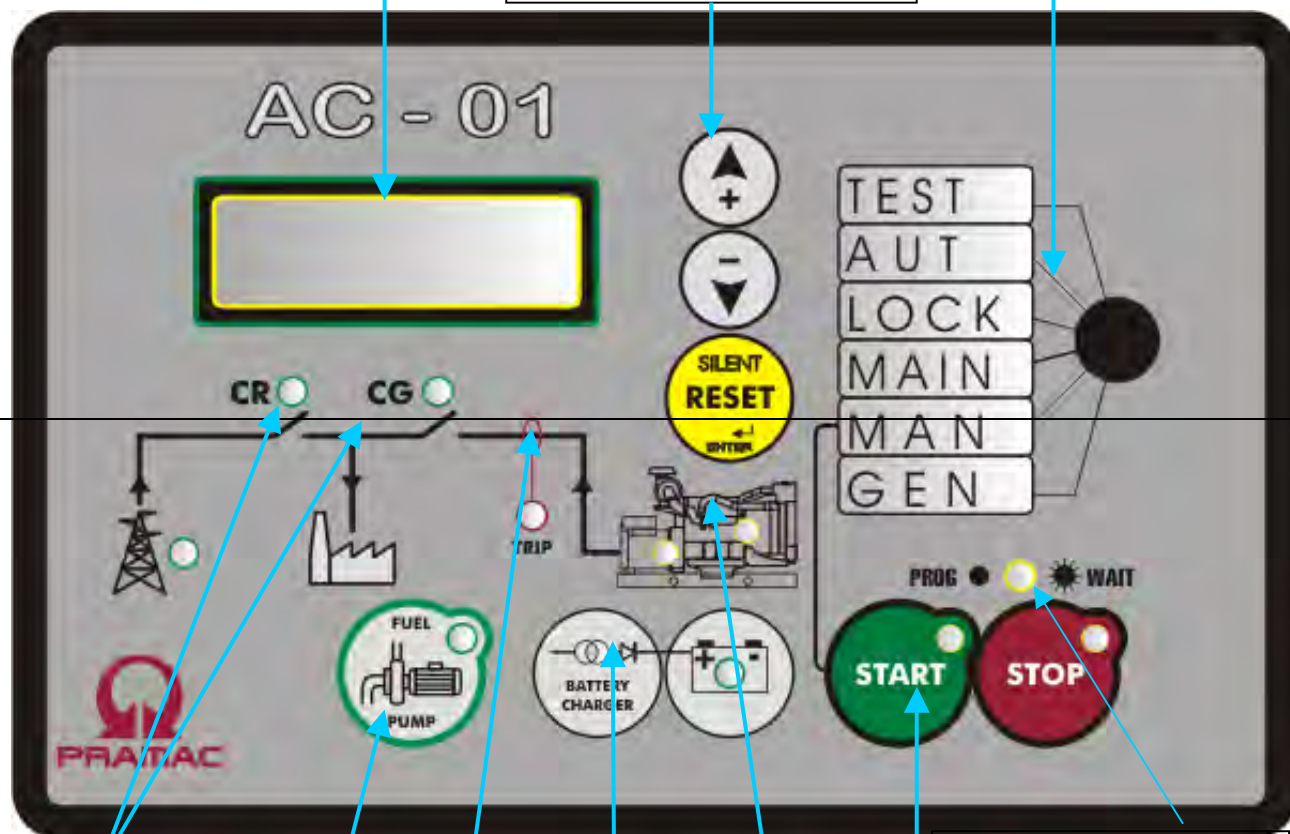
Functional description of the block diagrams.

1. Alphanumeric display of visualization of all the measures and the literal description of the type of alarm (es. Reserve Fuel).

2. Commutator of programming:

- 1 Automatic test. (T)
- 2 Automatic running. (A)
- 3 Block (Locked) excluded logic.
- 4 Feeding forced from mains (CR)
- 5 Manual starting.
- 6 Feeding forced from generating (CG).

3. Button + / - of selection measures and button of reset for restoration functions or unlock alarm.



4. Mains and switching mains/gen-set situation

5. Manual command fuel pump

6. Intervention of the differential protection

7. Fed battery charger and battery

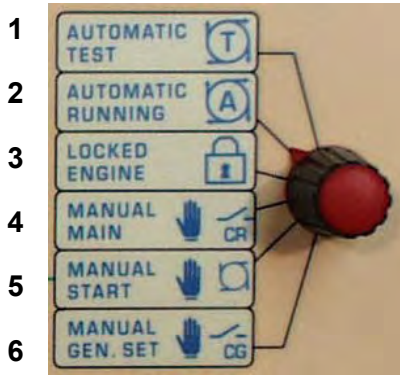
8. Signalings gen-set running and alarm motor

9. Buttons for the manual command of work or stop

10. The flash indicates that the microprocessor is elaborating a function.

FILE	VER	DATA ULT. VERSIONE	LINGUA	PAGINA
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ITA	Page 6 of 56





### Description of the components.

Programming switch.

Type of operational mode selection

1. Automatic test (T)
2. Standard automatic run mode (A)
3. Locked status – electronics disabled, used for maintenance.
4. Utility power supply forced from mains (CR).
5. Enable start push button to start in manual mode.
6. Utility power supply forced from generator (CG).



Display reading selection push buttons.

These are used to select the reading page required and to program the weekly timer.

**DIFFERENTIAL TEST, with the switch in BLOCK, to operate for 2" the buttons+/- "TEST LED" and while the led are turned on, to press RESET to have the differential protection.**

**Reset/Enter** push button used to reset the functions and to eliminate an alarm status (RESET) and also to confirm parameters entered in the programming phase (ENTER)

To push one time to exclude the acoustic alarm (SILENT) and to fix the signalling of alarm, two times to reset.

## DESCRIPTION OF THE VARIOUS READING PAGES

RETE	V12	389
HZ	50.0	I1 22

When the mains are connected these readings are automatically displayed that indicate the mains voltage and frequency. The current on the phase 1 is displayed if the CT are connected and reseted on the load.

RETE	V12	V23	V13
	389	388	394

The three line voltages between one phase and another are displayed for the detailed control of the mains...

RETE	V1N	V2N	V3N
	224	221	224

It indicates the three star voltages between phase and neutral

RETE	I1	32
I2	33	I3 31

The three currents of phase enable to verify the situation about the load on the single phase of the mains. This page is displayed if the CT are connected and reseted on the load.

RETE	0KVar
7KVA	7KW

The powers indicate the state and the load type on the mains:

**KVA**=kilovoltampere=apparent power; **KW**=kilowatt=real power; **KVar**=kilovar=reactive power. This page is displayed if the CT are connected and reseted on the load.

RETE	COS.	L 1.00
FREQ	50.0HZ	

**Cosfi**= power factor = phase displacement angle between voltage and current, with the normal load it indicates L 0,xx, if with capacitive load it indicates C 0,xx. This page is displayed if the CT are connected and reseted on the load

When the gen-set is running the gen-set voltage, the frequency and the current on the phase 1 are displayed.

GEN.	V12	389
HZ	50.1	I1 32

GEN.	V12	V23	V13
	389	388	392

For a control more detailed of the **gen-set**, the three **linked voltages** are visualized between phase and phase.

GEN.	V1N	V2N	V3N
	222	221	221

It indicates the three **starry voltages** between phase and neutral of the **gen-set**.

GEN.		I1	32
I2	0	I3	0

The three current of phase allow to verify the state of the load on the single phase of the **gen-set**.

GEN.		0KVAr
	7KVA	7KW

The powers indicate the state and the type of load on the **gen-set**:  
**KVA** = kilovoltampere = apparent power; **KW** = kilowatt = real power;  
**KVAr** = kilovar = reactive power.

GEN.	COS.	L 1.00
FREQ		50.0HZ

Cosfi= **power factor** = phase displacement angle between voltage and current, with the normal load it indicates L 0,xx, if with capacitive load it indicates C 0,xx. (**ATTENTION!** In this last case it means that the automatic rephasing is inserted of the plant, that during the operation of the **gen-set** Has absolutely to be disconnected: **DANGEROUS CONDITION**)

GEN.	
KWh	13953

The kilowatthour indicates the supplied power from the **gen-set**.

BATTERY	CHARGER
27.2V	1.4A

The voltage of the battery and the current of load are brought in case of present mains, firm group and of inferior tide to 2 A. La tension doesn't have to overcome the 13,5 Vs in case of 12Vdc batteries and the 27V for the 24Vdc batteries; when the group is running the voltage are superior since conditioned by the generator battery charger.

1500RPM	LC 92%
PO 4.4bar	TM 83°C

**RPM**: motor revolutions. **LC**: percentage of the fuel in the tank.

**PO**: oil pressure. **TM**: motor temperature.

**Attention!** LC, PO, TM are displayed only if the the respective probes are connected

CONTAORE	
4 h 7m 40S	

**Hour counter totalizator**: the value remains memorized even if the battery is not connected.

IN	123456789ABCD
	0011111111101

State of the **inputs**: it is displayed by the technicians in phase of test of the plant.

OUT	123456789ABC
	01010000

State of the **outputs**: it is displayed by the technicians in phase of test of the plant.

SUCCEEDED ST.	135
FAILED ST.	1

Counter succeeded and failed starts

MON	18:02:05
-----	----------

**Weekly clock**: every time is reseted that the battery is interrupted, and it serves for the operation of the automatic test, of the automatic block and of the reserve **gen-sets**.

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 8 of 56



DIFFER 0,00 ( 0,03 ) A  
DELAY ( 0,06 ) S

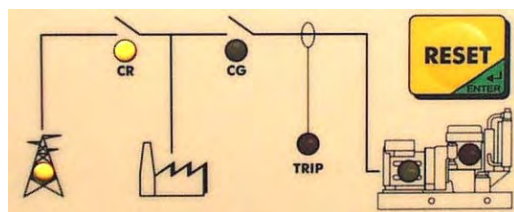
It indicates how much hours miss to the request of **maintenance 1**. Among parenthesis the interval of maintenance. This page is only visualized if the application of maintenance is activated.

MAINTENANCE	1
TRA	237h ( 500)

MAINTENANCE	2
TRA	794h ( 1000)

Advertising page brings name and telephone number of the producer or the technician.  
This page is only visualized if it is compiled in the settings

Nome Cliente  
Numero telefono



The pylon represents the public mains and the turned on led indicates that the three phases are in the established parameters, while when it is turned off it indicates the contrary one. The leds CG and CR indicate what contactor is closed to feed the use. The led TRIP indicates the intervention of the differential protection, if flashing protection it means that there is a superior dispersion to 50% than the foreseen value. The led on the generator indicates that the group is running.

The led indicates feeded battery charger and feeding of AC01 module from the battery

A green rectangular button with rounded corners, featuring the word "START" in bold yellow capital letters. The button has a dark green border and a small dark green circle in the top right corner.

The button of **arrest (Stop)**, always trained, it has to be pressed up to the suit arrest of the motor. The led indicates that the command of arrest is in progress.

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	ija/02	05/03/2003	ENG	Page 9 of 56

## 1.5. COMMANDS AND OPERATIONAL MODES

The operational modes that can be selected with the programming switch are six, namely:

- 1.5.1 **Automatic test:** This starts to test the generator without disconnecting the mains power supply from the utility. When the switch is turned back to automatic mode the generator stops following a delay of roughly one minute (it is used for periodic tests or to check the running efficiency following maintenance).
- 1.5.2 **Automatic mode;** if there should be a failure in the mains the circuit board responds by opening the mains contact maker. If the generator fails to start another 4 starting attempts are made. 10 seconds after it has started the generator powers the utility. While running the generator and motor are constantly controlled and a possible anomaly is immediately displayed (examples: fuel reserve, water level, overload, min. voltage etc.) and the relative stopping cycle is triggered. Once the mains is re-connected, following the set time, the utility is switched back to the mains and the generator is stopped following a delay of roughly one minute to allow it to cool down (this is the normal operational situation).
- 1.5.3 **Lock:** this sets the generator in a locked status. It completely disables every possibility of starting while the mains power the utility. This mode is used to work on the system in complete safety, being certain that the generator will not start even if the mains should be disconnected (it is used during maintenance).
- 1.5.4 **Manual mains:** this enables the forces the power supply from the mains even if the command and control electronics are faulty (it is used when the generator is left inoperative).
- 1.5.5 **Manual starting:** this enables the generator to be started manually using the start push button. The control is direct without the involvement of electronic components. It ensures the operation of the generator even when the electronics are faulty (it is used for the manual emergency controls or for maintenance purposes).



### WARNING

*When the programming switch is in this position all the utility circuits of the generator are powered such as the solenoid valves, electronic rpm regulators etc. If the switch is forgotten in this position with the generator stopped the starting battery would run flat very quickly.*

- 1.5.6 **Manual generator:** this enables the forced power supply from the generator (it is available for manual procedures or in the case of problems with the automatic functions).

### STOP

This is enabled whatever the situation.

It is to be held down until the motor stops completely

### EMERGENCY STOP

If pressed, the red mushroom push button in the middle of the door stops the generator immediately, instantaneously opening the contact maker of the generator (CG) thus locking it.

To release the emergency status set the programming switch in Lock position and then turn the emergency push button and pull up.

### FUEL PUMP CONTROL (if foreseen)

The AC01 module electronically controls the fuel level. It automatically controls the fuel pump so that the daily tank requirements are constantly ensured. A push button enables the direct control of the pump with only a maximum safety level safety function.



### WAIT/PROG

A newly conceived and remarkably useful LED has been fitted on the AC01 module to assist the operator, namely the WAIT/PROG LED. This LED flashes each time the timer is triggered informing the operator what is happening even over a lengthy timer period. All LEDs are provided with a general description that make the control panel easily comprehensible.

### SUMMARY

The unit is normally programmed in AUTOMATIC mode.

When any jobs are to be performed on the generator it is to be set in the LOCKED status.

If the generator is not to start even if the mains is disconnected it is to be set in the MANUAL MAINS status. The reason for this is that if, while the generator is not working, there should be a failure in the electronics, the power supply from the mains would be ensured in any case.

### HOW TO PROCEED IF THE GENERATOR SHOULD FAIL TO WORK.

A possible alarm status will be shown on the display. Whatever the anomaly, the cause is to be found first and foremost then press the RESET push button. The causes and the solutions differ depending on the type of anomaly involved:

1. Electrical anomalies due to min./max. voltage and frequency. If the anomaly should persist after the RESET push button has been pressed then request technical assistance;

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 10 of 56

2. Anomaly due to low oil pressure, high motor temperature, low water or oil level, fuel reserve. Check the relative levels (water, oil, fuel) and top-up if necessary then reset;
3. Anomaly of the battery dynamo. In this case request technical assistance;
4. Alarm due to local or remote emergency stop status. Set the programming switch on LOCKED mode and turn and pull the emergency push button enabled then reset;
5. Alarm due to failed starting. Try starting with manual control and inform the supplier;
6. The generator overload protection switch has tripped. It is to be reset manually by a qualified engineer (see **simple maintenance jobs** section).

## 1.6 PROGRAMMING

If the electronic module should be disconnected from the power supply, the established weekly timer programming is deleted, consequently all the functions foreseen for the internal timer would fail to work at the time and on the day programmed therefore the weekly timer is to be re-programmed.

Access the page below to re-program it.

Press ENTER, the day flashes. Using the +/- keys modify the day and press ENTER to confirm. The time flashes. Using the +/- keys modify the time and confirm with ENTER. The same goes for the minutes and seconds. You cannot change page until programming is complete.



## 1.7. VARIOUS CONTROLS

### LED TEST

Hold the +/- push buttons down together for 2 seconds. All the LEDs barring the start, stop and battery charger LED will light up.

### ALARM SILENCING

With the state of alarm the red led of alarm on the motor flashes and the sonorous is active alarm. Pressing once the SILENT button the acoustic alarm is interrupted, the red led on the motor remains turned on to fixed light

### FUNCTIONS RESET

Pressing the RESET button two times the conditions of alarm are annulled, all the functions are restored and the red led on the motor is turned off.

### PROTECTION DIFFERENTIAL TEST (if active)

To activate the TEST LED and with the turned on led to press RESET, the TRIP has to intervene with the detached load.

## 1.8. SPECIAL FUNCTIONS

The AC01 is set up for special operating functions, such as: automatic testing or cut-out, routine maintenance, remote control, etc.

When these are active, a page comes up on the display when they are activated, indicating which function is active.

GEN OPERATION  
CUT-OUT

There are functions that affect how the unit operates and that require direct intervention to allow the unit to be used:

### GE CUT-OUT

The cut-out function is mainly used when the unit is run in a built-up area, and emergency standby is not required outside of working hours. During the cut-out hours, if the mains power supply fails the unit does not react, and should it be necessary to start up the unit during this time, this can only be done manually.

### SERVICE REQUEST

This does not change the operating status, but raises an acoustic alarm to mark the set time, and a message reading SERVICE appears on the display ALARM MAINTENACE 1 or ALARM MAINTENANCE 2, pressing RESET the function is restored.

### REMOTE CONTROL

The unit can run under remote control by using remote communication (PC or modem or GSM), and this can be activated automatically.

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 11 of 56

## USER SAFETY PROCEDURE

**WARNING**

**It is strictly prohibited for anyone to touch powered parts.**

**1.9.1. ELECTRICAL MAINTENANCE**

All jobs must be performed by skilled personnel.

The control unit is equipped externally with all the possible command, control and reset functions.

Proceed as follows to access the equipment within the control panel:

1. Set the programming switch on LOCKED mode.
2. Check if the unit has stopped completely.
3. Disconnect the mains line that powers the control panel and switch the main ON/OFF switch of the mains off.
4. Check if the mains has been effectively disconnected, which can be seen by the mains OK LED switched off and by the display switched to the mains that must indicate zero.
5. Open the control panel and check for any anomalies in the:
  - fuses;
  - automatic switches;
  - thermal relays.

Once maintenance has been completed repeat the procedure in reverse order to reset the unit.

**Overload fault**

This may cause the unit's trip switch to open (lever in central "TRIPPED" position). This must be reset by pushing the lever down to the OFF position and then returning it to the ON position. Where switches have been installed inside the electrical board, follow the ELECTRICAL MAINTENANCE procedure before opening the board.

**1.9.2. MECHANICAL MAINTENANCE**

If the generator should fail to start due to an anomaly in the fuel circuit and also in an emergency status, the following tips may prove useful.

**How to restore the fuel circuit:**

1. Set the programming switch on Manual Start mode without starting the generator. In this way the 15/54? that powers the fuel interception solenoid valve is activated.
2. Once you have filled up with fuel, operate the hand pump situated on the motor until the circuit is restored, which can be seen by the pump becoming harder to move.
3. Start in manual mode (It is advisable to restrict the starting attempts to 10 seconds each with a pause of 15 seconds in-between to allow the battery to recover efficiently). Once the unit has started and is running regularly reset the automatic functions.

**1.9.3. PERIODIC CHECKS**

To keep the unit efficient some periodic checks must be made together with those scheduled by the manufacturer of the motor and by the installation engineer:

1. check the electrolytic level of the battery every 15 days following installation and request the assistance of an engineer if an excessive consumption is noticed. Following the initial period check every 30 - 60 days;
2. In generators complete with motor pre-heating system check if the motor is warm each time a check is made otherwise request technical assistance. (WARNING: a cold motor at low temperatures could have difficulty in starting or outputting once started);
3. If the generator is rarely triggered due to the lack of mains power supply execute an automatic test for at least 2 minutes.
4. if new electrical machines are installed in the system powered by the generator, request technical assistance to check the suitability of the CG/CG mains/generator switching to the new load.

**SUMMARY:**

**On a periodic basis check the electrolytic level of the clear batteries. Touch the motor to feel if it is warm (if equipped with pre-heating system) and execute an automatic test.**

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 12 of 56

## 2. TECHNICAL MANUAL

### 2.1 CONSTRUCTIONAL DESCRIPTION OF THE CONTROL PANEL

The control panel is entirely manufactured in compliance with the following European standards:

ANS low voltage electrical control panels

EN 60439-1

EMC electromagnetic compatibility directive

89/336/EEC

Each control panel or device is completely tested and supplied with test certificate, declaration of conformity and EC marking in compliance with 626 safety standards.

The control panel is manufactured in a steel sheet cabinet, 15-20/10 that is skilfully treated and painted with standard grey silicon epoxy powder, Ral 7032, and has a standard protection rating of IP 42.

#### EXTERNAL COMPOSITION

The control panel consists of the following:

1. AC01 electronic circuit board that houses the control logic, control and reading of the operational parameters of the generator;
2. Emergency stop mushroom push button (optional) ;
3. Nameplate with operational standards;
4. Nameplate with safety instructions.

#### INTERNAL COMPOSITION

1. numbered cables placed within PVC sheathing;
2. 10 x 38 fuses with disconnectable fuse boxes;
3. battery charger transformer of adequate capacity;
4. automatic generator protection switch (if provided);
5. switch with tetrapolar contact makers of adequate capacity for the power of the unit, interlocked mechanically and electrically and scaled in AC1 in compliance with standard **ISO DIS 8528-4** ;
6. three amperometric transformers for measuring the generator and mains current;
7. terminal for the mains and generator inputs, the utility output and any auxiliary connections;
8. safety fuse gauges and connection terminals nameplate.

Switching is controlled directly by CG and CR relays built in the MP-AC01 module, which directly command switching via unpowered contacts.

#### **IMPORTANT**

*The CG and CR command contacts are normally closed to allow the command circuits, in the case of certain anomalies, to force the mains contact maker to close. For example by disconnecting the battery and also the power supply to the battery charger transformer the mains contact maker is forced to close.*

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 13 of 56

## 2.2. OPERATION

### READINGS

All readings are shown on the display on two lines of 16 alphanumerical characters.

All the reading pages are controlled using the +/- push buttons, which run in both directions.

The reading pages available are the following:

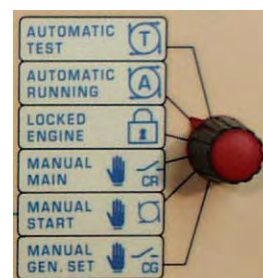
- mains status, volts, hertz and amperes of phase 1
- R, S, T line mains voltage.
- RN, SN TN mains star voltage.
- Current on the three phases mains;
- KVA, KW, KWA<sub>r</sub> mains powers;
- Power factor, cosφ HZ mains;
- Generator status, volts, hertz and amperes of phase 1
- X, Y, Z line generator voltage.
- XN, YN, ZN generator star voltage;
- Current on the three phases gen-set;
- KVA, KW, KWA<sub>r</sub> gen-set powers;
- Kilowatthour gen-set;
- Power factor, cosφ, HZ;
- Differential trip switch, programmed current, dispersion current and programmed time;
- Battery, voltage and charging current;
- Status of the inputs;
- Status of the output;
- Start counter;
- Weekly timer for programming the automatic test.
- Operation active, automatic test, forced start, pilot GE, cut-out, etc.;
- Supplier's name and telephone number;
- Maintenance, with programmed hours and working hours remaining before service.

If an alarm is triggered it will be shown on the display. For example a low oil pressure, fuel reserve, high battery voltage alarm, etc.

## 2.3 DETAILED DESCRIPTION OF HOW THE CONTROL UNIT WORKS

All operational modes are controlled by the AC01 control panel equipped with a programming switch to select the following functions:

1. **TEST**
2. **AUTOMATIC MODE**
3. **LOCK MODE**
4. **POWER SUPPLY FROM MAINS.**
5. **MANUAL START.**
6. **POWER SUPPLY FROM GENERATOR.**



### 1 TEST

- 1.A. it performs all the automatic functions with the exception of the switching function.
- 1.B. it tests the efficiency of the whole system without disconnecting the mains power supply to the utility.
- 1.C. all safety devices are enabled while the test is running.
- 1.D. if the mains should be disconnected while the test is running the generator starts immediately .
- 1.E. the test ends automatically when the mains power supply is restored or following a programmed external command.

### 2 AUTOMATIC MODE

- 2.A. A special three-phase voltage relay is capable of working at a voltage of 8Kv to safeguard the mains against:
  - sagging of over -20% of the rated voltage (this can be modified);
  - excessive rise in the rated voltage of over +15% (this can be modified);
  - missing phase;
  - incorrect angle between the phases (phase displacement).
- 2.B. If one of the above-mentioned anomalies should occur the CR mains contact maker is immediately opened to safeguard its integrity also in the case of excessive voltage sagging.
- 2.C. When the mains is disconnected a **starting delay** timer is triggered (programmable time). It makes the system insensitive to brief mains disconnections. A buzzer will sound in this case.

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 14 of 56



- 2.D. Following the STARTING DELAY phase 4 starting cycles of 5 seconds each start, split up by pauses of 5 seconds (these may be programmed).
- 2.E. At the end of the start cycles if the gen-set has not started, there is the FAILED START signalling, if the gen-set starts but it doesn't reach the speed values, after 120" there will be the min voltage or frequency alarm.
- 2.F. With the motor running at a steady state the voltage output by the generator is read. When this is within the established parameters the generator delay timer is triggered (this may be adjusted from 1 sec. to 30 min. approx.). At the end of this timing the generator (CG) contact maker is closed on.
- 2.G. By means of a normal VDO probe for reading the motor temperature the minimum temperature beyond which the load output is enabled can be programmed. This is to prevent operating at a low temperature in the case of the failure or failed pre-heating of the motor.
- 2.H. While the generator is running two pre-alarm safety devices are enabled, oil pressure and motor temperature. When these trip a buzzer sounds. The following safety devices and indications, when tripped, are displayed and trigger the programmable functions described:

No.	DESCRIPTION ON DISPLAY	LED COLOUR	BUZZER	IMMED. STOP	DELAYED STOP
<i>MOTOR</i>					
1	Failed starting		A		
2	Failed stoppage		A		
3	Low oil level		A		
4	Low oil pressure		A	YES	
5	Minimum oil pressure (pre-alarm)		A		
6	High oil temperature		A		SR
7	Low water level		A		
8	Very high water temperature		A	YES	
9	High water temperature (pre-alarm)				
10	Battery charger generator		A	YES	
11	Lack fuel		A		
12	Low fuel level (pre-alarm)		A		
13	Starting	R			
14	Stoppage	R			
15	Fuel pump running (ON)	V			
16	Minimum temperature		A		
<i>BATTERY</i>					
17	Battery connected	V			
18	Excessive battery voltage		A		
19	Low battery voltage		A		
20	Battery charging	V			
21					
<i>GENERATOR</i>					
22	Excessive voltage (59)		A	YES	
23	Low voltage (27)		A		SR
24	Overload (51)		A		SR
25	Short-circuit (50)		A		SR
26	Maximum frequency (81)		A	YES	
27	Minimum frequency (81)		A		SR
28	Phase sequence		A		
29	Inverted power		A		SR
30	Generator connected	G			
30	Generator contact maker closed (ON)	G			
32	Differential trip switch (earthing fault)		A		SR
33					
<i>MAINS</i>					
34	Mains connected	V			
35	Excessive voltage (59)	V OFF			
36	Low voltage (27) displacement	V OFF			
37	Overload (51)		A		SR
38	Phase sequence		A		
39	Mains contact maker closed	G			
<i>VARIOUS</i>					
40	Emergency push button pressed		A	YES	
41	CR mains contact maker anomaly	G	A		
42	CG generator contact maker anomaly	G	A		



2.I When an alarm is triggered and the generator is stopped, the following occurs:

- The alarm triggered appears on the display.
  - The generator contact maker is immediately opened.
  - Activation of the immediate stop SI or delayed SR after the phase of cooling motor (if enabled stop)
  - Activation of the acoustic alarm and lighting of the flashing red led on the drawing of the engine.
  - The alarm cause is saved.
  - The LOCKED status is triggered until the alarm is reset, the first impulse to SILENT /RESET/ACK button it silents the acoustic alarm, it recognizes the alarm with function ACK (function ISA M) and the alarm led from flashing it becomes fixed, to restore the functions excluding the block for alarm, to press a second time the RESET button and alarm red led will be turned off.
- 2.J. When the voltage returns within the rated parameters the switch back to mains delay timer is triggered that enabled the mains to settle before switching back the load.
- 2.K. Once the load is switched, the motor cooling phase of roughly 1 minute begins. At the end of this phase the immediate or delayed stoppage phase is enabled.
- 2.L. Pre-arrangement for a new cycle
- 2.M. With the mains connected the overload safety device (51) of the mains contact maker is enabled (EXCLUSIVE), which when tripped, triggers the buzzer without interfering with the mains output, warning the operator that the rated current of the CR contact maker has been exceeded.
- 2.N. To the command of the contactors CR and CG it is done the control of the real closing, contrarily there is the alarm (it is activated inserting the ADJUSTABLE DELAY).
- 2.O. If there is a stop not trained (DELAY STOP TO ZERO) the Ge supplies with any alarm, the gen-set can be stopped only manually
- 2.P. The change of the switching from CG to CR or from CR to CG, it is alternated by a break of 1", to avoid a malfunction of the mechanical interlock

### 3 LOCKED STATUS

- 3.A. It immediately stops the generator if this is running.
- 3.B. It disconnects the power supply from all starting circuits.
- 3.C. it ensures safety throughout maintenance.

It deactivates the fuel pump and the preheating in order there is not any components in voltage during the maintenance.

## 2.4 MANUALLY CONTROLLED FUNCTIONS

The manual operational mode is considered as an emergency back-up mode for the automatic functions. It also ensures the operating efficiency with the micro-controller in an abnormal condition. The programming switch ensures the direct commands that are not backed-up by electronic logics. This means that when the START push button is pressed for example, the starting motor will be operated for as long as the push button is held down.

The following functions are possible:

1. Forced power supply from the mains CR;
2. Manual starting, the generator CG contact maker is opened;
3. The mains CR contact maker is opened and the power supply is forced from the generator;
4. Manual stoppage;

### 2.4.1 POWER SUPPLY FROM MAINS (manual command)

This enables the mains power supply permanently and disables all the electronic functions with the exception of the battery charger and the EMERGENCY stop function.

### 2.4.2 MANUAL STARTING

Enable the start button, and the 15/54 relay that provides power to all the unit's services (solenoid valves, actuator, etc.) will be activated simultaneously.

### 2.4.3 POWER SUPPLY FROM GENERATOR

Once the unit is running in normal mode, switching the commutator to GENERATOR POWER SUPPLY causes the contactor for the Generator unit to close, and the unit then draws power from the generator.

While the unit is supplying power all the trip switches are active. However, since these are entirely controlled electronically, any fault in this system could render it inactive.

### 2.4.4 MANUAL STOPPAGE

The stop push button is enabled at all times. Press it until the motor stops completely.

By moving the jumper 1 on the MO2 module the stop push button is enabled only when the programming switch is in MANUAL START mode.

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 16 of 56

## 2.5 VARIOUS FUNCTIONS AND UTILITIES

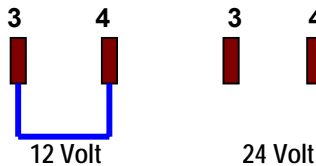
### 2.5.1 CC12 AND 24V POWER SUPPLY CIRCUITS

The AC01 module is arranged to operate at 12 and 24V. By bridging connections 3 and 4 all the functions are adapted, including the control threshold of the battery charger for the 12V voltage and the same without bridge for the 24V power supply voltage.

The first level safety device against excessive power supply voltages are fitted in the MP02 module: it is capable of operating constantly up to 40V, it can also withstand transitory voltages above 250V. A second level safety device is also fitted against inverted polarity of the power supply, which prevents the circuits in which it is encountered from being powered. Any anomalies cause the F1 fuse to trip (25A) that cuts-out all the electronic circuits.



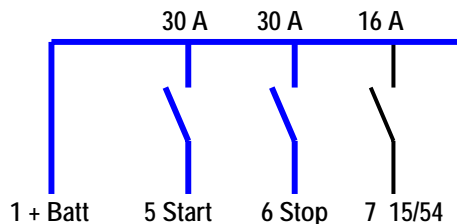
**WARNING** if, after having powered the control panel the battery LED should fail to light up, check the **POLARITY OF THE BATTERY** before operating any commands. Possible connection errors could cause electronic anomalies in the MP02 module if commands are operated with the poles inverted.



On the selected voltage, the AC01 is automatically shaped for the alarm voltages for min battery voltage, contemporarily also the battery charger is shaped.

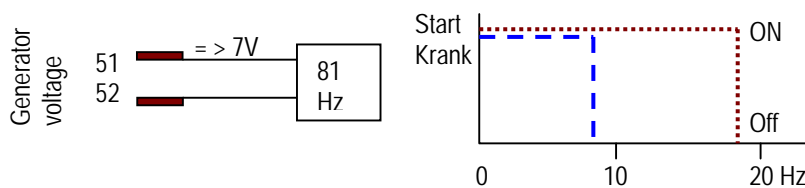
### 2.5.2 COMMAND RELAYS

Two 30A relays command the starting and stopping and one 16A relay the utilities 15/54. Two 10A relays with free contacts command the contact makers of the mains and generator (CG-CR) switching. An additional relay with contact that can be configured in NA/NC is pre-arranged to command the opening of the generator switch. It is designed to trip the differential or for overloads.



### 2.5.3 MOTOR STARTED READING

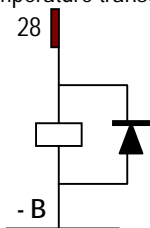
This requires no external signal. The control is achieved on the frequency of the generator. During the motor starting phase, once 540 rpms are reached which correspond to 18Hz programmable, the 1<sup>st</sup> motor started signal is received. If due to an anomaly the generator is not powered (at least 7V) the starting phase is stopped once and for all by the second safety control established when the oil is pressurised, which triggers a delay of 3 seconds that stops the starting phase.



**N.B.** For the safety engine, if the oil pressure switch is not connected, the gen.set can not to start

### 2.5.4. MOTOR PRE-HEATING

A feeding is foreseen for the engine preheating system; the AC01 has a transistorised command which controls a contactor in direct current to deactivate automatically the preheating when the gen-set is running or above the max programmed temperature (OFF), and to activate it automatically when the engine temperature is inferior than least value (ON) (this function is enabled only when the temperature transducers is connected to terminal 16).



The contactor commando the preheating system.

#### PROGRAMMING

Preheating command (to activate out 28 = preheating in different settings). Two levels are established in thresholds setting: ON, activation; OFF, stop.

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 17 of 56

## 2.5.5 AUTOMATIC BATTERY CHARGER

The automatic battery charger is the double semi-wave type with phase choker, totally controlled by the micro-controller. It keeps the starting battery charged with a max. load of 8A and the charge is self-adjusted to compensate for consumption and for when the battery automatically runs flat. The voltage of the battery and the charging current can be displayed on the AC01 unit.

The electronics are built in the MP02 unit whereas the battery charger transformer is fitted externally.

It is equipped with:

- Automatic cut-out of the charge during the starting phase;
- Electronic restriction of the current to prevent excessive loads;
- Electronic restriction of the voltage to limit the maximum load levels (2,3 V/E) 13,5/27V.
- Protection against short-circuits.
- Protection against inverted polarity.
- Protection against excessive input voltage.
- Auto programming of the voltmeter thresholds on the battery voltage
- Protection with low battery voltage for excessive discharge
- Programmable values also for batteries Nichel Cadmio.

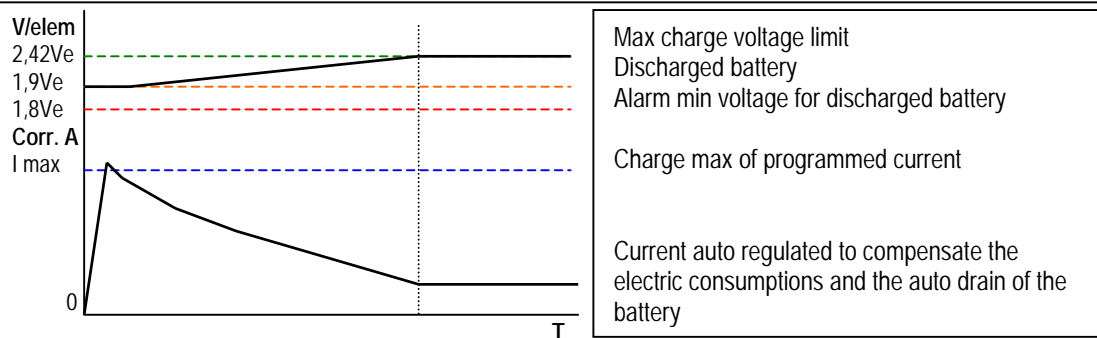
### Technical features

Programmed work voltages	12 V	24 V
Work frequency	50 and 60 Hz	50 and 60 Hz
Max programmable current	From 1 to 8 A	From 1 to 8 A
Max voltage threshold	14,5 V	29V
Alarm voltage threshold	10,8 V	21,6 V
<b>Battery charger transformer</b>	<b>Min</b>	<b>Max</b>
Voltage II° for battery 12V	17 Vac	20 Vac
Power in VA/A for battery 12V	50VA / 3 A	150VA / 8 A
Voltage II° for battery 24V	29 Vac	32 Vac
Power in VA/A r batt. 24V	100VA / 3 A	250VA / 8 A

## PROGRAMMING

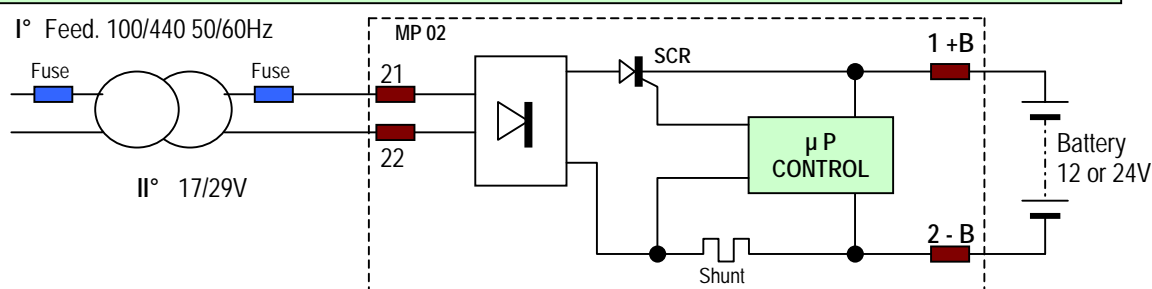
To set the value of max current of charge on the power of the installed transformer

### CHARGE DIAGRAM FOR PLUMB BATTERIES



Ve = Volt for component    12V Battery = 6 components    24V Battery = 12 components

### FUNCTIONAL BLOCK DIAGRAM



FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 18 of 56

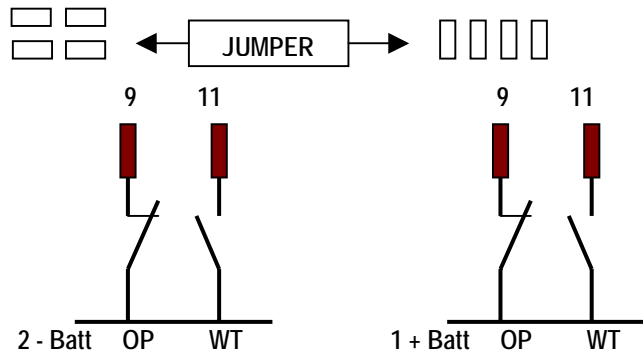
## 2.6 MOTOR AND ALARM PARAMETER READING

### 2.6.1 POSITIVE MOTOR PROTECTION INPUTS

Some modern motors are equipped with positive outputs to indicate the Low Oil Pressure and High Motor Temperature anomalies. The AC01 is pre-arranged to communicate with these motors by modifying the JUMPERS on the MP02 unit.

#### NEG. INPUTS

#### POS. INPUTS

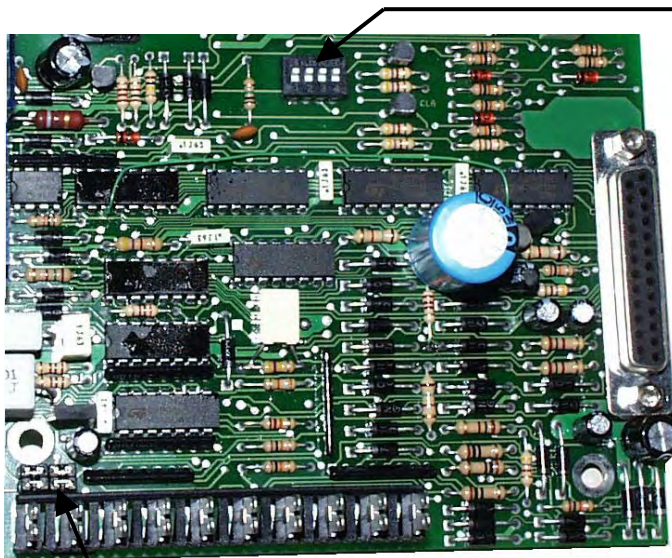


Modifying the jumpers placed on the electronic unit of the power module, the AC01 can work with positive inputs.

IT IS NOT REQUIRED ANY PROGRAMMING SOFTWARE.

### 2.6.2 ANALOGUE MOTOR PARAMETER READING INPUTS (PRESSURE, TEMPERATURE AND FUEL LEVEL)

The three inputs 15-16-17 used to read the pressure, temperature and fuel level can be configured using the SW2 switch (on the MP02 unit) for motors type MTU that output 0-10V for the above-mentioned readings.



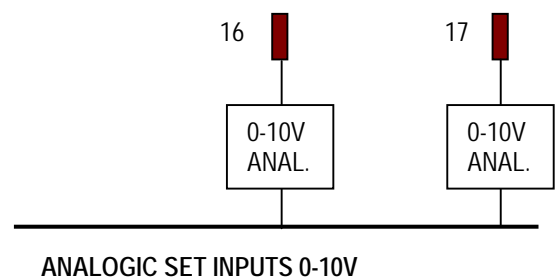
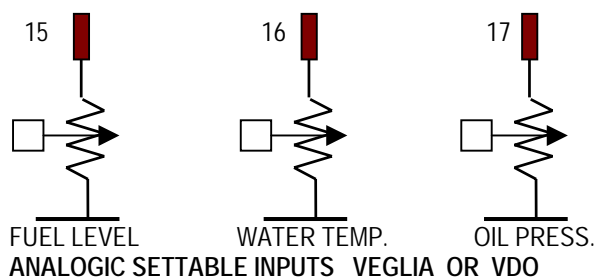
#### SW2 ANALOGUE INPUTS

N°	DESCRIPTION	OFF	ON
1	FUEL LEVEL		NEGATIVE
2	MOTOR.TEMP	0-10V	NEGATIVE
3	OIL PRESSURE	0-10V	NEGATIVE
4			

#### JUMPER INPUT

When SW2 is configured to "ON", normal motor probes (transducers) of a VDO or VEGLIA type can be used (which can be configured from the Misc. Settings Menu). Since they are not linear, the working fields available are restricted by the limits of the transducers. Where the probe is not installed, no indication will appear on the display automatically.

When individually configured as "OFF" the three inputs operate at between 0 and 10V, and are connected directly to the MTU motors and others of the same concept for taking motor measurements. The reading scale can be changed from the Measurements Menu.

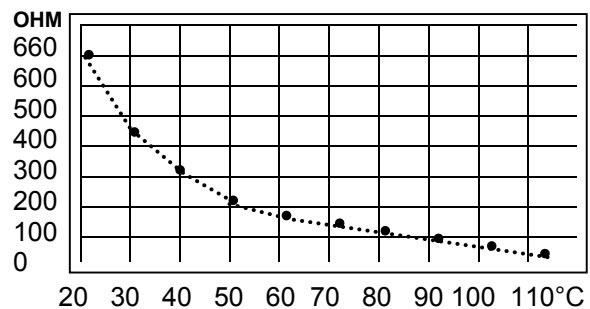


FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 19 of 56

### COMPARISON AMONG THE DIFFERENT TRANSDUCERS

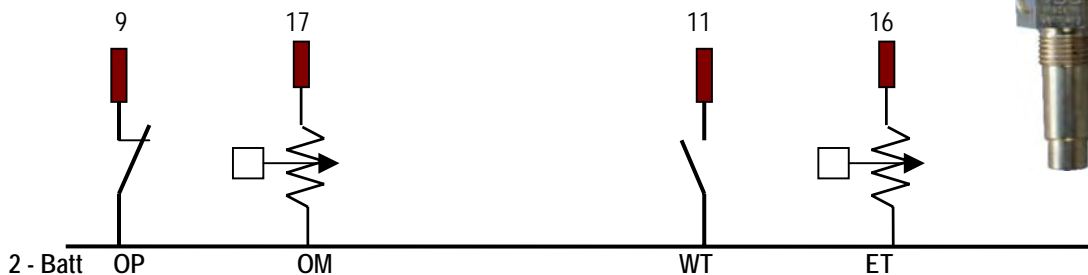
TRANSDUCERS	VALUE	VEGLIA OHM	VDO OHM
OIL PRESSURE	0 - 10 BAR	300 - 0	0 - 200
WATER TEMP.	20 - 120°	2200-200	660-20
OIL TEMP.	20 - 150°	2200-100	660-10
FUEL LEVEL	0 - 100%	200 - 0	0 - 200

### VDO TEMPERATURE TRANSDUCER



VDO pressure transmitter more  
0-8 bar alarm contact

Thermistor (varying resistance) + thermostat  
(contact NO) VDO for instrument and pilot  
lamp



### 2.6.3. OIL PRESSURE

This measurement is provided by 8 bar transducers. Different values can be set from the Measurements Menu. An acoustic alarm can be activated to indicate minimum oil pressure, and this is set at 0,5 bar above the pressure at which the oil pressure switch intervenes.

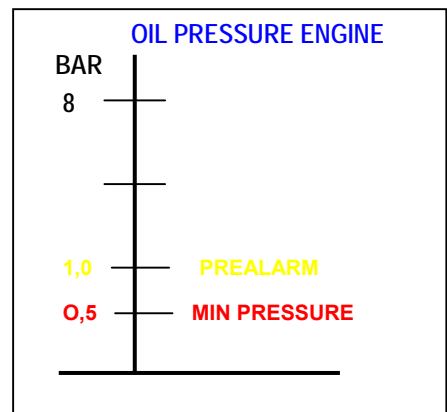
#### PROGRAMMING

From the Menu various settings, to select for 17 analogic input the kind of transducer Veglia, VDO or MTU.

If the transducer is 10 bar, to correct the reading value from the Menu measures.

#### ATTENTION! NOT CHANGE THE VALUE OF ZERO WHEN THE MOTOR IS RUNNING

To align eventually the zero reading, to go to page "REG. ZERO PO" and with the stopped engine (0 pressure) to push ENTER. The transducer reading in that instant will be as zero.

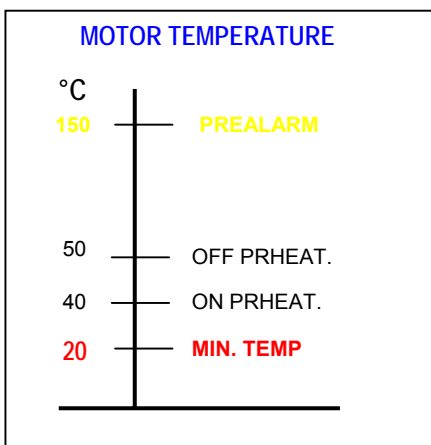


### 2.6.4. MOTOR TEMPERATURE

This measurement is provided by Veglia or VDO water temperature transducers, up to 120°C. Different values can be set from the Measurements Menu.

The following are activated and can be set using the transducers fitted:

1. pre-alarm high temperature, normally set on a 150°C scale base (1);
2. pre-heating control (activate out 28 = pre-heating in misc. settings) – two levels are set, one for activation (ON) and one for stopping (OFF);
3. minimum temperature (can be activated from misc. settings), when the motor temperature is below the set value the generator command (42-43-44) is deactivated, to allow the motor to warm up without any load, until the minimum temperature is exceeded.



(1) If you wish to set the high temperature pre-alarm, bear in mind that the value indicated is affected by the wiring and a tolerance in the transducers that may be as much as 7°C. The temperature must therefore be set using the measurements menu, and checked using a thermometer.

The setting entered must take the level at which the maximum temperature thermostat intervenes into account, as this causes the unit to stop (WT11). The pre-alarm temperature must be set at least 3°C lower than the thermostat.

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 20 of 56

### 2.6.5. FUEL LEVEL(15)

The measure is foreseen for the level transducers Veglia or VDO from 0 to 200 Ohm, for different values it needs the manual setting, the scale is in % from 0 to 110% max .

#### PROGRAMMING

From the menu various setting, to select for the analogic input 15, the kind of transducer Veglia or VDO.

#### ADJUSTMENT PROGRAMMING TO ANY TYPE OF FLOAT

The programming of the measure of the fuel level is effected with the float outside of the tank.

To activate the switch 4 to enter in the programming menu.

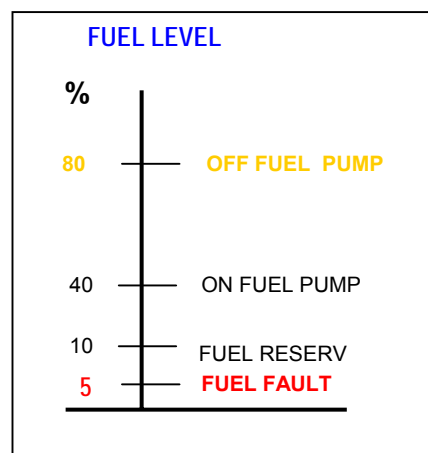
To go to page "REG. ZERO LC" (in the pages REGOLAT. MEASURES).

To put the measuring stick in the position of void. Press ENTER.

To go to page "REG. LETT. LC" To put the measuring stick in the position of full. Press ENTER.

The unit will calculate automatically the run of the float aligning the reading.

Turn back the switch 4 on OFF.



### 2.6.6 FUEL PUMP COMMAND

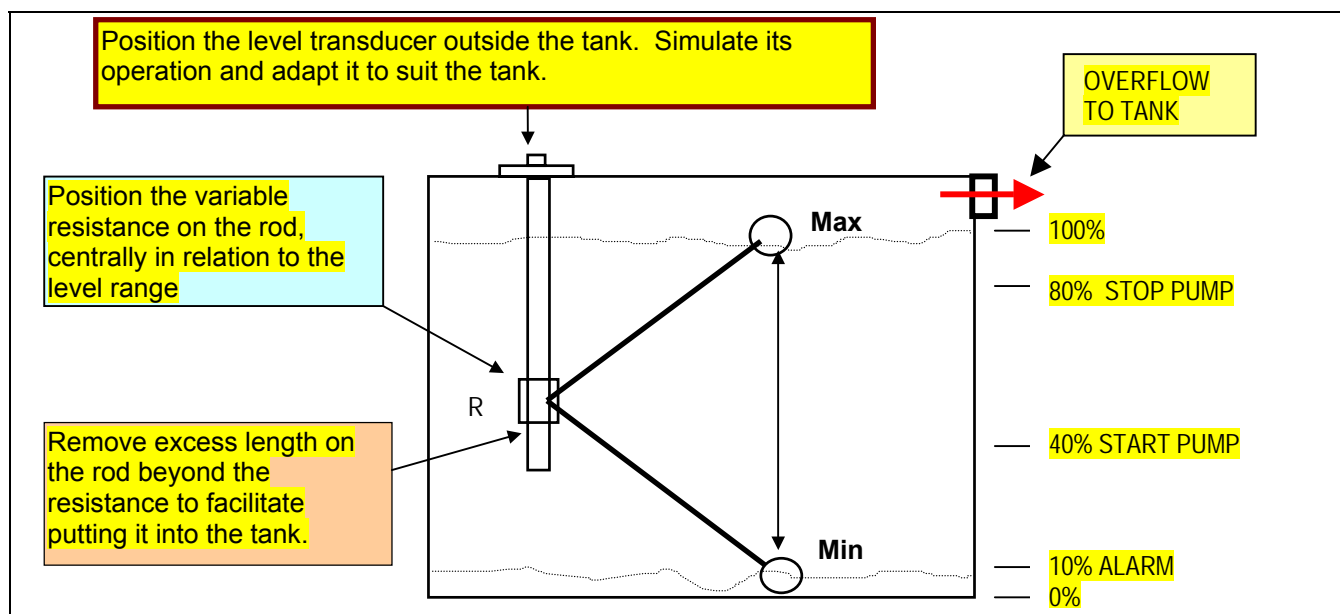
The AC01 control panel is pre-arranged to command the fuel pump that fills the daily tank. The fuel level probe, (VDO) that commands the digital tester that indicates the percentage of fuel inside the tank, electronically establishes the following levels:

DESCRIPTION	INDICATION	FUNCTIONS	LEVEL %
Pump stoppage	Pump LED OFF	Pump OFF	80%
Pump starting	Pump LED ON	Pump start	40%
Fuel reserve	Display	Buzzer (DEFAULT)	10%
Lack fuel	Display	Delayed alarm and stop	5%

The tripping thresholds can be programmed.

The failed installation of the level probe or the circuit breakage automatically excludes the operation of the pump and display indication.

When the level probe is being installed the real upward and downward excursion of the level rod must be taken into account.





## 2.7. MEASURING THE GENERATOR'S AND MAINS PARAMETERS

The voltmeter measurements indicate the actual real value (RMS) and are at a precision of 1%. The unit has a deviation of .....V +/- to measure temperatures between -20 and +70°C.

### SINGLE / THREE PHASE MAINS SENSOR

The three phase mains sensor is made with three 500 K OHM resistance dividers with high insulation voltage capable of withstanding any excessive voltages of up to 8Kv for 1 second. It is sensitive to the minimum and maximum voltage on the single phase and to the phase displacement angle of the three phases. All parameters can be modified, the sensibility to the sequence of the phases can be activated. Main characteristics:

Mains control	Three phase
Functions	27 - 59 - 60 - 81 - 47
Working voltage	100 - 600 V ac
Minimum adjustable voltage	(OFF) 60 - 400V (27)
Maximum adjustable voltage	110 - 600V (OFF) (59)
Tripping differential voltage	30V on MIN - 15V on MAX
Insulation voltage on L1-L2-L3-L4	=> 8 KV for 1s
Working frequency	50-60 Hz
Minimum and maximum programmable frequency	Min 35 - 55 Hz Max 51 - 75 Hz (81) (OFF)
Phase sequence	L1 - L2 - L3 can be activated

When the software is used to configure the sensor, in biphas, the control is activated only on connections L1 - L2.

Mains control	Biphase
Use voltage	100 - 600 V ca
Min adjustable voltage	(OFF) 60 - 400V (27)
Max adjustable voltage	110 - 600V (OFF) (59)
Intervention differential voltage	30V on MIN - 15V on MAX

When the software is used to configure the sensor, in single phase, the controls on connections L1 - L4 are activated.

Network control	Single phase
Voltages used	70 - 340 V ac
Adjustable minimum voltage	70 - 280V (27)
Adjustable maximum voltage	110 - 300V (59)
Intervention voltage differential	20V on MIN - 10V on MAX

Bringing the MIN V GEN, MIN HZ, MAX V and MAX HZ values over the programmed maximum, the OFF function can be activated to deactivate the control.

### (\*) FUNCTIONS

- 27 Min voltage
- 59 Max voltage
- 60 Dissymmetry
- 81 Protection for min/max frequency
- 47 Sequence phases
- 50 Instant current or short-circuit
- 51 Max current with programmable delay
- 87G Protection differential of breakdown to earth
- 32 Protection by energy's inverse or directional power protection

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 22 of 56

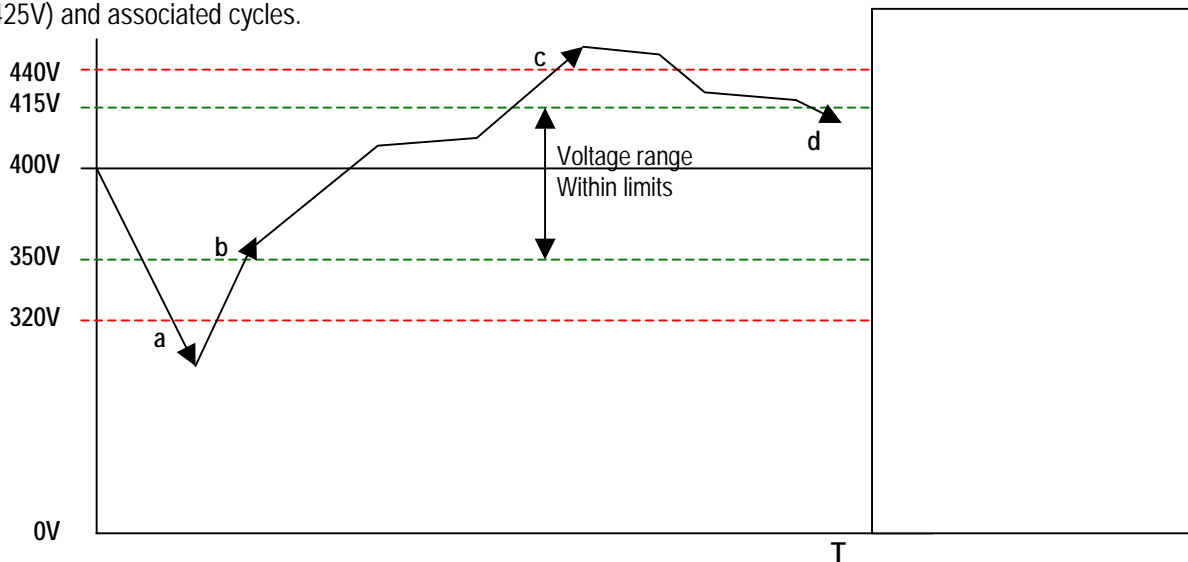


## FUNCTIONING

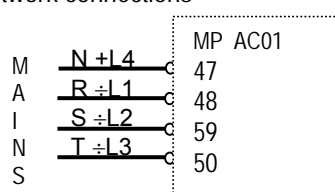
When there is a lowering of the voltage (a), lower than the programmed value (es. Min V=320V) the CR mains contactor is open (If setting OPEN CR=BY FAILURE MAINS) and after possible delays, it will have the cycle of start of gen-set (and the open CR if setting OPEN CR=BY START).

When the voltage increases after overcome the +30V differential threshold (b), we have the normal condition of value within the limits (320 + 30= 350V) which activates all the cycle of return mains.

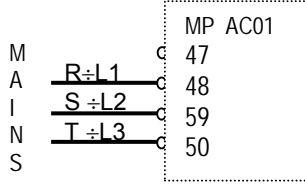
If there is an increasing over the programmed value (c) (es. Max V 440V) it is had equally the cycle of start GE, and with the lowering of the voltage under 15V differential threshold (d) it has the same condition of voltage within the limits (440 – 15= 425V) and associated cycles.



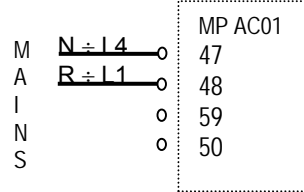
## Network connections



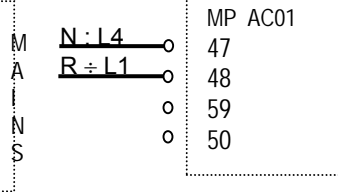
THREE-PHASE CONN.  
WITH NEUTRAL



THREE-PHASE CONN.  
WITHOUT NEUTRAL



BIPHASE CONN.

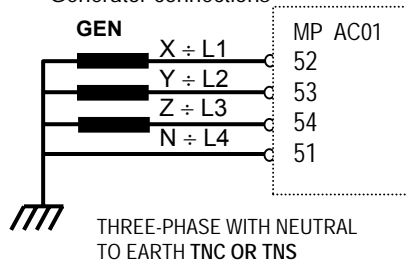


SINGLE-PHASE CONN.

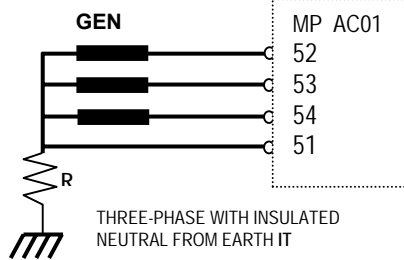
## THREE-PHASE / SINGLE-PHASE GENERATOR SENSOR

The generator sensor is sensitive to the maximum and minimum voltage in single-phase, and to the sequence in three phases. It can work within a range of 60 to 600 V, with the same characteristics as the network sensor.

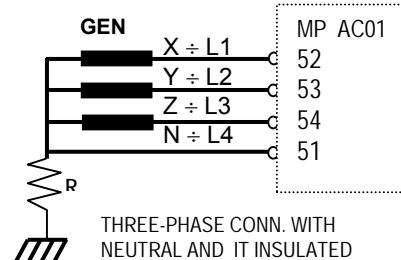
## Generator connections



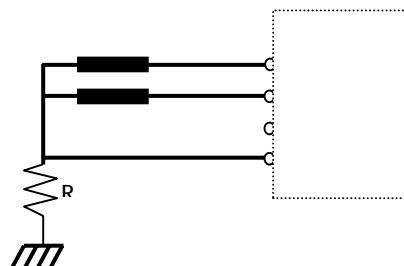
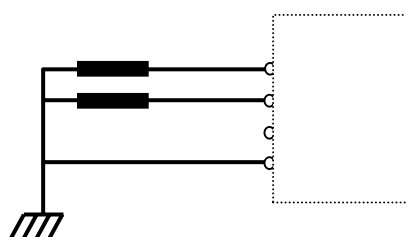
THREE-PHASE WITH NEUTRAL  
TO EARTH TNC OR TNS



THREE-PHASE WITH INSULATED  
NEUTRAL FROM EARTH IT



THREE-PHASE CONN. WITH  
NEUTRAL AND IT INSULATED



SINGLE-PHASE CONNECTION

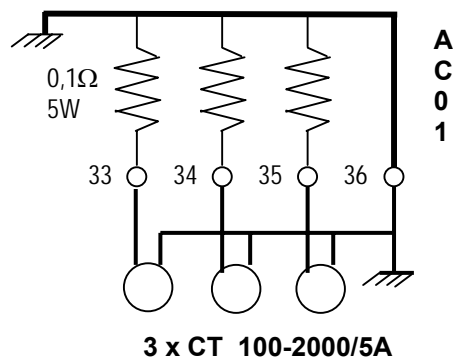
FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 23 of 56

## CURRENT MEASUREMENTS

The three current measurements for CT .../5A are 0,5 class up to 1000 A and 1 class from 1000 to 2000 A. The ammeter circuits are made up of three 0,1 $\Omega$  5W resistances, with a dissipation of 2,5W at maximum current (5 A). They can work at a constant overload of 20% 6 A, and have a short-circuit protection of 15 A for 3" or 20 A for 2".

To ensure protection against overloading and short-circuits the CTs used must have a minimum power of  $\Rightarrow$  4VA. Where the CTs also power other equipment, this power is increased to suit the power these require plus losses in the wires. Consumption table in VA per metre of wire.

SECTION mm2	1,5	2,5	4	6
CONSUMPTION VA	0,685 VA	0,41 VA	0,254 VA	0,169 VA



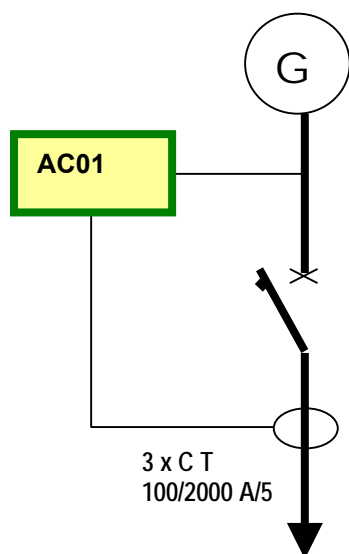
## CONNECTIONS CT

CT PHASE R-L1 33 – 36 CT PHASE S-L2 34 – 36 CT PHASE T-L3 35 – 36

The AC01 is provided for managing generator units that operate automatically or manually, with or without mains power supply/generator switching over. The circuit in which the CTs are installed and the readings shown on the display vary depending on their application. For example:

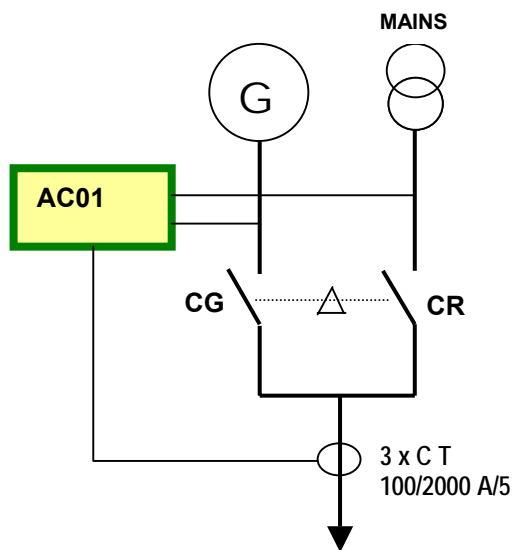
*Isolated generator without mains power supply generator switching, or with separate switching.*

The CTs only read the generator current.



*Emergency generator backing up the mains power supply, with mains power supply generator switching.*

The CTs read the mains power supply and generator currents.



All the generator's electrical readings are displayed, Volt, Hz, Amp, Kw, Kva, Kvar, Power factor. When the mains power supply is connected voltages and frequencies are displayed. The generator's electronic trip switch is active to protect it against overloading and short-circuits.

All the generator's electrical readings are shown, Volt, Hz, Amp, Kw, Kva, Kvar, Power factor. The same readings are carried out on the power supply when the Mains power supply connector (conn 25) is closed. This Connector also activates the electronic cut-out for overloading on the mains power supply contactor (CR).

The type of operation is selected on the basis of the positioning of the current transformers (CT), via "misc. settings" by selecting:

1. for units without switching (CT ON GENERATOR);
2. for units with switching (CT ON SWITCHING).

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 24 of 56



**WARNING** the wiring for the CTs may introduce residual voltages into the AC01 which will generate a value for a non-existent current. To eliminate this go to the measurements menu, zero the current and press Reset. The AC01 starts a self-programming procedure. This should be done without any current on the power circuits. Where the load cannot be eliminated, short-circuit the wires on the CTs.

## ELECTRONIC PROTECTION AGAINST OVERLOADS (51) AND SHORT-CIRCUITS (50) OF THE GENERATOR

The generators are supplied with their power expressed in KVA because the effective capacity limitation on the generator is given by the Amps on the coils. Thus in order to effectively protect a generator the amps must be controlled.

Overloads 51:

If the rated current of the generator is exceeded following a set timing the generator contact maker is opened (at the same time the TRIP 40 and 41 contact is activated), the overload alarm is triggered and the generator is stopped following the motor cooling phase (DEFAULT). (IT CAN BE EXCLUDED REGULATING THE THRESHOLD TO ZERO)

Short-circuit 50:

It trips immediately when the load current exceeds of 2 sec. the parameter set . The generator is stopped in the same way as in the case of overloads. (IT CAN BE EXCLUDED REGULATING THE THRESHOLD TO ZERO)

These are active when the Generator Current contact is closed at 25.

Set under threshold and time settings.



**WARNING** measuring TAs are provided for the 50 function, to protect against shortcircuits, that are able to provide three times the nominal current (5x3 = 15 A) in linear mode without reaching saturation.

## ELECTRONIC PROTECTION AGAINST OVERLOADS OF THE MAINS CONTACT MAKER (CR)

With AC01 shaped with TA (CT) on use (Fig. B), it is possible to control the mains parameters (KW, cosfi...) and the current that circulates on the mains contactor.

While the unit is running with the mains connected an overload safety device is active on the mains contact maker (set at the rated current of the contact maker), which when exceeded, triggers the mains overload buzzer alarm (51).

This is active when the Mains power supply contactor is closed at 24. (IT CAN BE EXCLUDED REGULATING THE THRESHOLD TO ZERO)

Set under the threshold settings for the current, corresponding to the 1st Mains power supply Current setting.

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 25 of 56

## EARTH DIFFERENTIAL PROTECTION (TRIP)

This checks any leakage of current towards earth. When it trips the contact maker between connection 40-41 is opened, the contact can be configured in NO/NC,. If while the unit is running the set current is exceeded by 50% the TRIP LED will flash rapidly.

The display shows the dispersion current, the programmed current, and the programmed delay.

The differential switch is equipped with a test coil that is triggered with the DIFFERENTIAL TEST. Using the command key combination, + / - (test led) and while these are pressed, press the RESET key that will trigger the devices. The TRIP LED remains lit steady and the relay on 40-41 are triggered which remain saved until the RESET command is given.

Technical characteristics:

- Sensitive to wave forms type sinusoidal, choked sinusoidal, pulse and pulse with continuous component up to 6mA.
- Operating frequency 47 – 63 Hz.
- Tripping current  $I_{\Delta n}$  programmable from 0.1 to 5 A or OFF excluded.
- Tripping time programmable from 0,5 to 5 seconds.
- Instantaneous tripping within 60 milliseconds.
- Negative safety (NA) modifying the output contact 40 –41.
- Adjustable to torus with 500 – 750 – 1000/1 shading coils and with test wrapping.
- Reset using the RESET push button enabled with current leakage less than 50%  $I_{\Delta n}$ .

DIFFER 0,00 (0,1) A  
RITARDO (0,1) S



**ATTENTION! It is not a lifesaver**

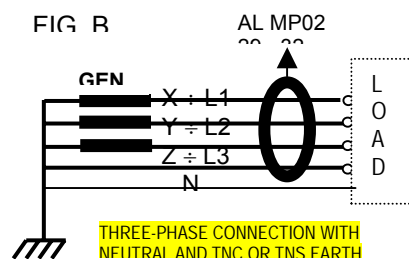
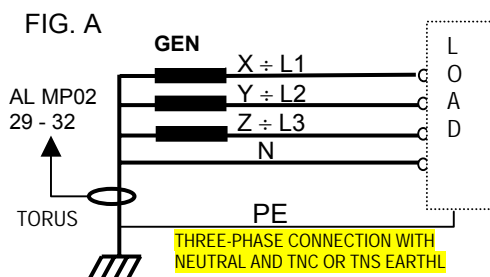
## OPERATING PRINCIPLE

The AC01 uses a toroidal transformer on the load power supply line (fig. B) to constantly monitor the sum of the supply and return currents. When the difference exceeds the set value, this indicates that part of the current is dispersed to earth, and after the relevant delay the load is deactivated via commands 41 and 42.

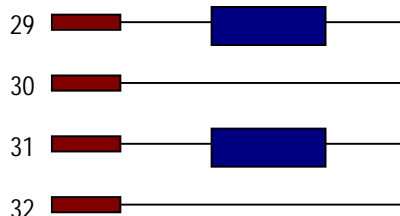
This function is available from AC01MP modules rel. 6.0 or superiors.

## Connections

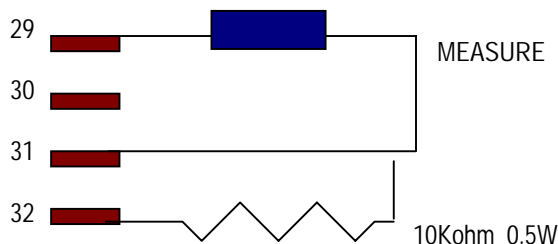
Fig. A shows the 67G earthed fault protection commonly used in generators, since in addition to protect the unit against direct contacts, it also detects leakage to earth from the generator's coils. The insulation between the neutral (N) and the earth (PE) must be checked on setting the unit up, as any link between the two would by-pass the differential trip switch.



### TORUS WITH TEST WRAPPING



### TORUS WITHOUT TEST WRAPPING



ADJUSTABLE TO TORUS WITH SHADING COILS REPORT 500/1 750/1 1000/1

## PROGRAMMING

1. In the menu measurements, to program the shading coils report "REG. DIFFERENTIAL 500/1"; it is fundamental for the correspondence of the reading with the value of foreseen intervention.
2. In the menu thresholds, to program the intervention current.

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 26 of 56

3. In the menu times, to program the intervention delay

## EMERGENCY DEVICE

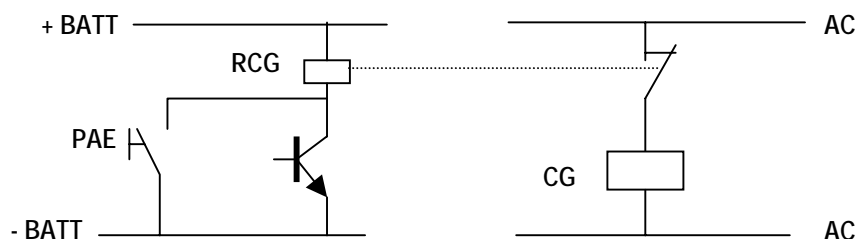
Pre-arrangement for the external emergency command enabled in all operational modes with immediate stoppage of the motor, opening of the generator contact maker and triggering of the alarm.

The emergency device not only controls the control software of the circuit board but is also equipped with an electro-mechanical circuit that totally ensures the stoppage of the unit and the opening of the generator contact maker.



### WARNING

The command is double, the NO contact of the emergency push button is required to ensure the immediate opening of the generator contact maker even in the case of an anomaly in the electronics. In fact to ensure the emergency power supply even in extreme cases the contact that commands the mains and generator contact makers (CG-CR) is normally closed (NC), therefore if the contact maker is to be opened, the command relay must be powered. The motor stoppage on the other hand is ensured by the NC contact (positive safety), which disconnects the power supply from the motor even if the circuit is disconnected or in the case of an anomaly in the electronics (as per standard).



Other operating solutions can be applied to suit the overall design.

## REMOTE SWITCHING OF THE MAINS/GENERATOR

Switching with tetrapolar contact makers of adequate capacity for the power of the unit, mechanically and electrically interlocked and scaled in AC1 in compliance with standard ISO DIS 8528-4 ;

Switching is controlled directly by the RG 42-43-44 and RR 37-38-39 relays built in the MP02 power module, which by means of contacts free from voltages and protected by fuses directly control switching that can be carried out using, remote control switches, motorised commutators or motorised switches.

The CG and CR command contacts are normally closed to allow the command circuits, in the case of particular anomalies, to force the closing of the mains contact maker by simply removing fuse F1 from the MP02 unit and disconnecting the fuse on the battery charger.

## OPERATING STATUS

A page on the display has been set aside to show the unit's status, to facilitate use of the generator. This page shows all status indications such as: automatic test, cut-out, forced starting, remote controlled, pilot generator, standby generator, clock to be set, etc.

These status indications allow the operator to know the status of the unit, and what to do. For example:

- a) clock to be set = the battery has been disconnected and the clock must be reset as some operations need to use the clock;
- b) cut-out = Stop command, the generator cannot react automatically and can only be controlled manually;
- c) forced start = the generator is controlled by forced power supply, and can only be operated manually.

FUNZIONAMENTO  
GRUPPO BLOCCATO

## SERVICE REQUIRED / STOP DUE TO TIME EXPIRED

When the working hours before the next service are entered the alarm state is activated without affecting the operation of the unit, and the display will read "SERVICE REQUIRED".

The hours run are zeroed during servicing by going into the COMPLETED section of the Misc. Settings Menu, and pressing RESET.

If the SERVICE hours field is set at 0000 this function is excluded.

SERVICE ORE 1000  
EFFETTUATE 0251

## CUSTOMISATION

This page can only be seen if programmed. It has two lines, the first can be used to enter a name of up to 16 characters, and the second for a telephone number of up to 16 digits.

AEZ BOLOGNA ITALIA  
0039 051 739099

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 27 of 56

## 2.8 INPUT / OUTPUT

During the starting up phase a number of outputs may be in an abnormal condition. To identify these the status of all the inputs and outputs are indicated on the display.

When a number of alarms are raised at the same time, these are shown on the display. Even after pushing RESET repeatedly it is difficult to define all the alarms raised.

The correspondence table is used to identify all alarms raised and reset.

### INPUT



Correspondence table, when the input or output is on "1", this means that it is active (ON).

N°	DESCRIPTION OF INPUT	CONNECTION	FUNCTION
1	LOW OIL PRESSURE		ALARM
2	DYNAMO		ALARM
3	HIGH MOTOR TEMPERATURE		ALARM
4	HIGH OIL TEMPERATURE		ALARM
5	FUEL RESERVE		ALARM
6	WATER LEVEL		ALARM
7	OVERLOAD, TRIP SWITCH TRIPPED		ALARM
8	EJP – AUTOM TEST – SCR		CONDITIONAL START
9	EMERGENCY		ALARM
A	LOW CCD		FORCED START
B	HIGH CCD		FORCED STOP
C	MAINS CONTACT MAKER ON		MAINS POWER SUPPLY CONTACTOR STATUS
D	GENERATOR CONTACT MAKER ON		GENERATOR CONTACTOR STATUS

### OUTPUT



N°	DESCRIPTION OF OUTPUT	CONNECTION	FUNCTION
1	30A STARTING RELAY	5	
2	30A STOP RELAY	6	
3	10A MAINS POWER SUPPLY CONTACTOR CONTROL RELAY	37-38-39	
4	10A GENERATOR CONTACTOR CONTROL RELAY	42-43-44	
5	16A 15/54 dc SERVICES RELAY	7	
6	FUEL PUMP CONTROL max 200 mA	27	
7	PRE-HEATER/STARTER CONTROL 200mA	28	
8	ALARM CONTROL max 200 mA	8	
9	10A SWITCH OPENING CONTROL	40-41	
A			
B			
C			
D			

## 2.9. FUNCTIONS OF BUILT - IN WEEKLY CLOCK

### 2.9.1. WEEKLY CLOCK

The AC01 generator contactor has a built-in weekly clock that allows the input to be programmed to suit the unit, or the cut-out to be programmed to prevent the unit from starting even during a power failure.

**Where the electronic module loses its mains power supply, the settings for the weekly clock are cancelled, which means that all the functions that depend on the built-in clock will not work on the day and time set, and so the clock must be reset.**

When a function such as automatic test, automatic stop or automatic start is active, should the battery be disconnected, the display will read:

OPERATION

CLOCK TO BE SET

To set is go to the next page.

Press ENTER – the day will flash – use the +/- keys to change the day, press ENTER to confirm. The hour will begin to flash, use +/- to change, confirm using ENTER, and repeat the procedure for the minutes and seconds.

The page cannot be changed until setting the clock has been completed.



### 2.9.2. CLOCK FOR AUTOMATIC TESTING

This allows the unit's operation to be tested automatically. It can be set weekly or every two weeks.

While the test is in progress the operation display reads "Automatic Test". Should the power fail during such a test, the unit immediately switches over to the generator supply, and back again when the mains power supply is restored, once the test time set, has expired.

SETTING under Misc. Settings

*AUTOMATIC TEST*

*EXCLUDED / ACTIVE*

Where active, the following are set – test every 1 or 2 weeks, at time 00:00; duration 00 minutes.

### 2.9.3. AUTOMATIC STOPPING OR STARTING

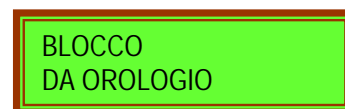
It is possible to activate the unit's automatic cut-out so that it does not intervene automatically as a result of a power failure as well.

While in "Cut-out" mode the operation page on the display reads "GENERATOR CUT-OUT".

*In this mode the unit can only be controlled manually.*

PROGRAMMING in Various Settings

To select BLOCK > enter  
To select the day Monday > enter  
To select the kind of function 0 = excluded  
Total block  
Partial block  
Forced start  
Partial block + forced start



Activate or deactivate this function and enter the cut-out time CUT-OUT ON/OFF 00:00

If ON is active, select the days of the week (MTWTFSS) and the time the cut-out is to end - OFF 00:00

When the unit is working without the mains power supply, the cut-out function determines the times at which the generator is stopped.

Outside of these hours the unit is placed in automatic mode.

**Example: it needs to program that a gen-set works every working days from 7 to 21 and the remaining hours it has to be stopped**

MON	= PAR. BLOCK
TUE	= PAR. BLOCK
WED	= PAR. BLOCK
THU	= PAR. BLOCK
FRI	= PAR. BLOCK
SAT	= TOT BLOCK
SUN	= TOT BLOCK

	AVANTI GENERATOR	
	STOPPED GENERATOR	

BLOCK OFF 7:00

BLOCK ON 21:00

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 29 of 56

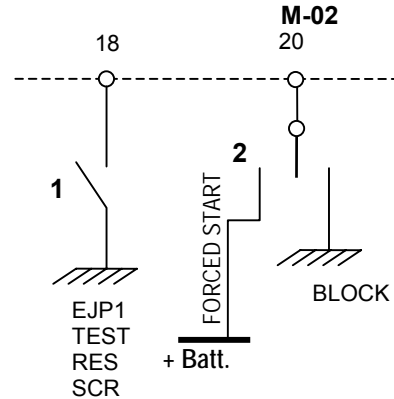


## 2.10 REMOTE COMMAND AND CONTROLS

The following remote commands and controls are available in the terminal board that can be configured on inputs 18-20:

1. Remote locking command to assure that the unit is not started when there is no mains power supply (overnight locking and week-end shutdown for offices etc.).
2. Remote automatic test command (TEST) to remotely start the generator.
3. EJP function command (Programmable).
4. Remote starting command with forced output even in the presence of the mains power supply (SCR).
5. Stand-by generator operation command used to program the two units that run alternately for a set amount of time.

CONN	FUNCTION	PROG 1	PROG 2
18-20	EJP FRANCE	SPECIAL SETTING EJP	TIMES 0-25'
20	SCR forced start with supply.	SPECIAL SETTING SCR	
18-20	RES two generators (one on standby)	SPECIAL SETTING 2 GEN CHANGE	
20	Forced stop	- BATTERY	
18	TST - test	MISC. SETTINGS TEST	



The TEST, BLC AND SCR functions are active simultaneously (standard configuration). When the EJP or RES functions are activated, all the other functions are deactivated.

### 2.10.1 EJP FUNCTION

The special EJP function is fitted only in French systems.

When JP1 is activated, after the set time (times menu) the unit starts up. The EJP2 command causes an immediate switch over from the mains power supply to the generator.

As soon as this input is disabled, if the mains is connected and is within the normal operational limits the output is switched to the mains and the motor is stopped following a cooling delay.

#### FUNCTIONS:

**EJP1 Command:** the unit starts without switching over after the delay set;

**EJP2 Command:** switching over takes place immediately.

When the EJP command is active, the generator operating status display reads: EJP

The TEST - SCR - RES functions are excluded.

### 2.10.2 SCR FUNCTION OR FORCED STARTING WITH OUTPUT (default)

By configuring input 18 for the SCR function, when this is enabled it starts the motor with the consequent forced output from the generator. As soon as this input is disabled, if the mains is connected and is within normal operational limits the output is switched over to the mains and the motor is stopped following a cooling delay.

When the SCR command is active, the generator status display reads: FORCED START

The EJP - RES functions are excluded.

### 2.10.3 LOCK FUNCTION (default)

This forces the board to a locked status by means of an external command. This function proves particularly useful for locking the board overnight or at the week-end.

When the cut-out command is active, the generator status display reads: CUT-OUT.

In this mode only direct manual commands can be used.

The RES function is excluded.

### 2.10.4 TEST FUNCTION (default)

This sets the unit in automatic mode by means of an external command without disconnecting the power supply from the mains. If, while the test is running, the mains should be disconnected the utility is immediately powered by the generator. By disabling the TEST command the generator is automatically stopped after a few minutes.

When the Test function is active, the generator status display reads: AUTOMATIC TEST.

The EJP - RES functions are excluded.

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 30 of 56

## 2.10.5. FORCED RUNNING OR SAFETY FIREPROOF (18) UNI 9490 NFPA NFS61.940

It forces the feeding and it avoids the stop with any type of alarm, the stop can be effected only manually.

Connecting the 18 to –B, the gen-set intervenes for the foreseen commands (mains failure, remote start, test, etc) and during the working the feeding is forced; this is showed on the display and the acoustic alarm is activated. The gen-set is in feeding up to manual stop command. When the command is active (18 to –B), on the display it is displayed "FORCED RUNNING".

If during the running the command to the 18 is removed, the normal functions are activated (automatic stop); in this condition the time of "delay stop" (cooling engine) is programmed to a fixed time of 60".

### Programming

There are two options:

1. bringing to 1(one) the stop time, the command "FORCED RUNNING" is activated only giving a –B to the 18;
2. bringing to 0(zero) the stop time, the command of forced running is permanent, namely to every start the gen-set has the deactivates protections and the stop is only manual, with out any command to the 18 which is available for others running modes.

In setting times, to adjust the time of stop to 0 or 1

Note: for the adjustment to the rules of safety fireproof, the double system of start can be required, to see 2.11.7.

## 2.10.6. FUNCTION FOR TWO UNITS WORKING ALTERNATELY

Connections 18 and 20 are provided for the (RES) standby function. It is used in plants that have a standby unit.

Two applications are provided for:

1. Two units, one in standby, and to provide an emergency supply in case of a power failure;
2. Two units, one is standby, to act as a power source, without a mains power supply.

## 2.10.7. MAINS POWER SUPPLY EMERGENCY BACKUP

When a power failure occurs, the pilot generator starts up. Should it fail to start, or should any fault occur during its operation, the standby generator starts up to provide sufficient power for the user.

Programming: in SPECIAL SETTINGS to select 2 GEN. CHANGE, with the connection to the mains the AC01 is programmed selfit for the function of two gen-set of reserve in emergency to the mains.

## 2.10.8. POWER SUPPLY PLANT WITH TWO GENERATORS, ONE ON STANDBY

The pilot generator starts up when the START command is given via connection 18. The operating time is set on the Times Menu. At the end of this time the standby generator is started and once it is at ful production the signal to the pilot generator is switched off and the power is supplied by the standby generator, with power to the user being interrupted for 1 second. When the set time for the standby generator expires, the pilot generator is activated using the same procedure.

When the unit is running, any fault automatically causes the other generator to be activated.

Programming: in SPECIAL SETTINGS to select 2 GEN. CHANGE

To determine which is the PILOT unit, select on the display the page 2 GEN. CHANGE The display will read Pilot/Standby. When the Reset button is pressed, the Pilot/Standby selection is reversed. Bear in mind that if, for example, GE1 is the pilot unit, GE2 must be the Standby unit, and vice versa.

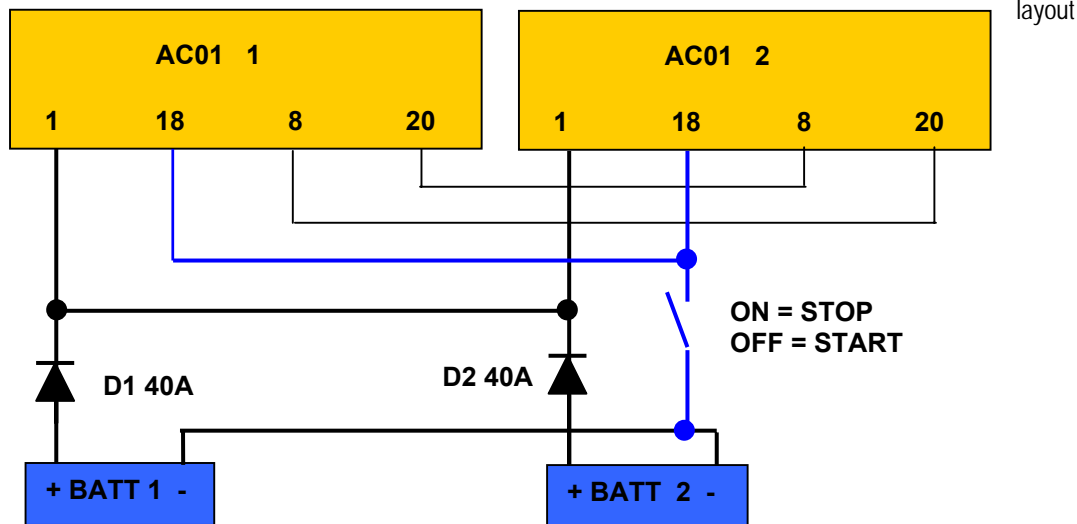
The built-in clock can be used to programme automatic interventions by the two-generator power plant.

When the cut-out function is programmed using the built-in clock, the individual generator is excluded for the hours programmed. Obviously, the times set for the two generators must be compatible.

Since a break in the power supply to the generator AC01 module results in the clock losing its setting, it is advisable to use two 40A diodes (D1 and D2) to provide power. If the built-in clock is not used, these diodes are not necessary.

This circuit with diodes on the battery can only be used for plants without battery charges, powered by the mains power supply.

Connection



FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 31 of 56

When the RES command is active, the status reads:  
GENERATOR STATUS  
STANDBY

The TEST – SCR – EJP functions are excluded.

## 2.11. SPECIAL FUNCTIONS

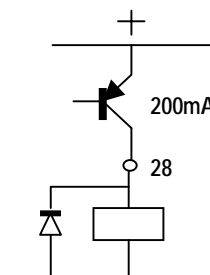
The AC01 has a transistorised output (28) for controlling a dc contactor. A number of functions can be programmed individually for output 28 – MOTOR PRE-HEATING, GLOW PLUG PRE-HEATING, STARTER, RESET, GAS MOTOR CONTROLS AND DOUBLE STARTING.



**WARNING** to protect the transistor from overloading a 1A diode must be fitted in parallel with the contactor's coil, as shown in the layout.

### 2.11.1. PROGRAMMING

MISC. SETTINGS (OUTPUT 28)		TIME SETTINGS
MOTOR PRE-HEATING		THRESHOLD SETTING
GLOW PLUG PRE-HEATING		GLOW PLUG 10 – 120"
STARTER		STARTER 0 – 10"
EV. GAS		EV. GAS 0 – 10"
RESET		RESET 2 – 10"
DOUBLE STARTING		



### 2.11.2. MOTOR PRE-HEATING (out 28) ( Default )

The Motor Pre-heating function can be controlled in two ways:

1. When the unit is running, or the programming switch is set to Cut-out, it is deactivated, otherwise it is always active;
2. If the motor temperature transducer is connected (16), it can be used to programme the activation (40°C) and deactivation (50°C) settings, when the motor temperature has reached the set value.

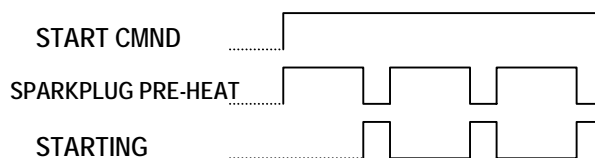
See analogue inputs.

Programming under misc. Settings and threshold settings.

### 2.11.3 SPARKPLUGS PRE-HEATING (out 28)

A transistorised output is provided that may be programmed to command a pre-heating system of the sparkplugs. This output is controlled by the software and if programmed to pre-heat the sparkplugs, each time it is triggered the pre-heating cycle is enabled before each starting cycle.

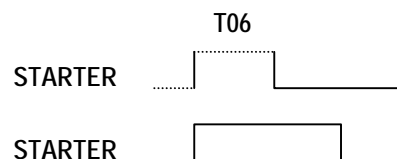
In manual to press OK to activate the sparkplugs pre-heating for the desired time.



### 2.11.4 STARTING MOTOR (out 28)

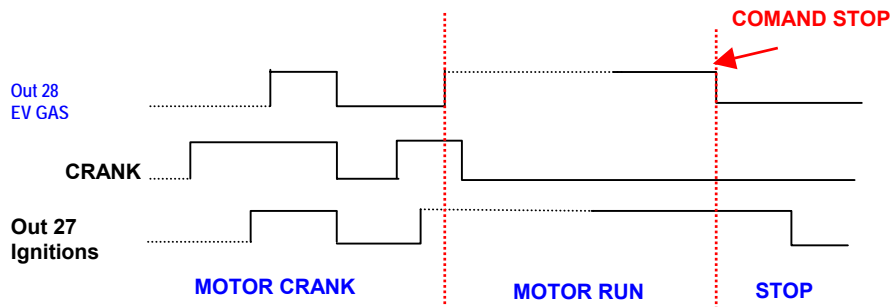
Output 28 can be configured also with the starter function. In this case upon each starting cycle the output is enabled for the set timing.

In manual to press OK to activate the starter for the desired time.



### 2.11.5. GAS SOLENOID VALVES (for gas motors) (out 28)

When the start command is given the actuator is powered (OUT 15/54) and it opens the butterfly valve, after the ignitions are fed (OUT 27) with the gas solenoid valve is opened after the delay set (OUT 28) This allows unburned mixtures to be removed before each start up.



FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 32 of 56

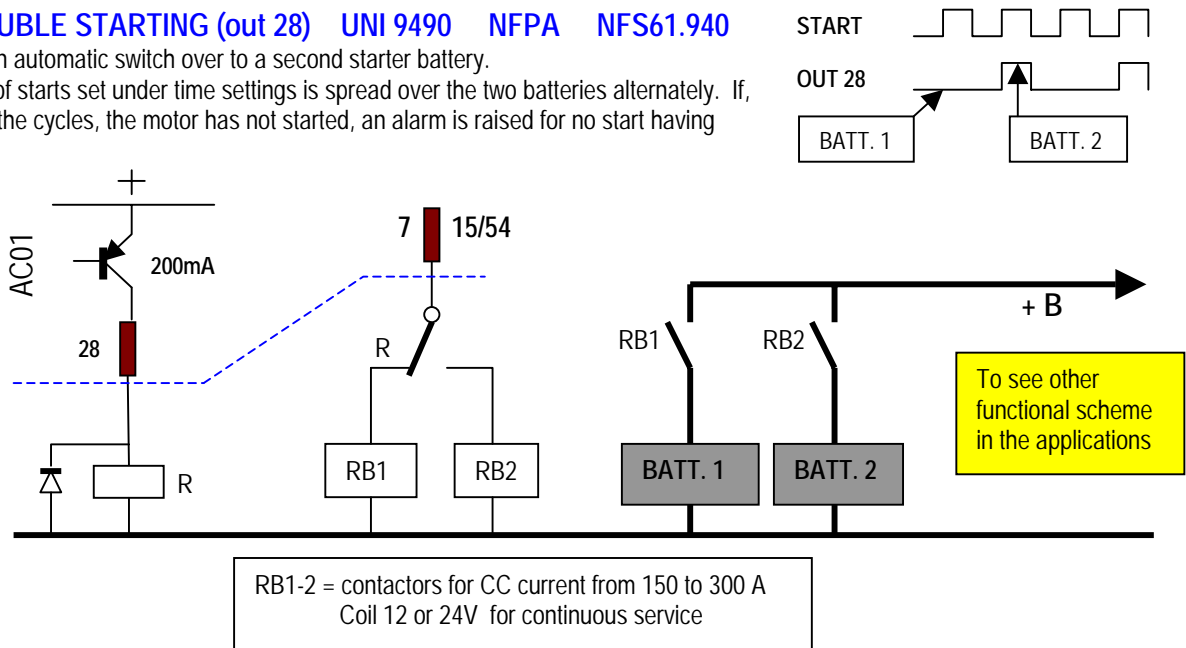
When stopping first the power supply to the gas solenoid valve is interrupted, and then the supply to the ignition and rev regulator is interrupted.  
In manual activate first the start and then the fuel pump button to supply EV GAS and Ignitions.

2.11.6. RESET (out 28)

Plants managed by remote control require a control that can reset circuits or close switches.  
When output 28 is set to RESET, each time the RESET command is given via the button or remote control, output 28 is active.

2.11.7. DOUBLE STARTING (out 28) UNI 9490 NFPA NFS61.940

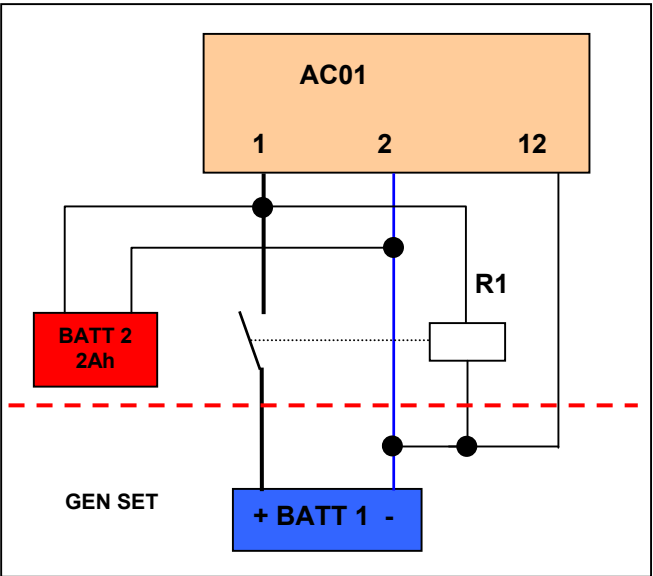
This allows an automatic switch over to a second starter battery.  
The number of starts set under time settings is spread over the two batteries alternately. If, at the end of the cycles, the motor has not started, an alarm is raised for no start having occurred.



Note: for the adjustment to the rules of safety fireproof, the "FORCED RUNNING" can be required, to see 2.10.5

2.11.8. ANTI-THEFT PROTECTION

Only on AC01 with a serial RS232C output.  
This is only active on plants that are fitted with remote controls. If the generator is disconnected an alarm is raised and transmitted via modem or GSM. Each alarm is stored in the alarm history file.  
Operation  
When the generator circuits relating to the 30A R1 relay, that isolates the battery cables are interrupted, and wire 12 that activates the burglary alarm status is disconnected, the power supply to the AC01 is maintained by battery 2 that powers the remote control system and sends the burglary alarm message.  
Programming:  
Under Misc. Settings, set High Oil Temperature alarm (12) to "Anti-Burglary".

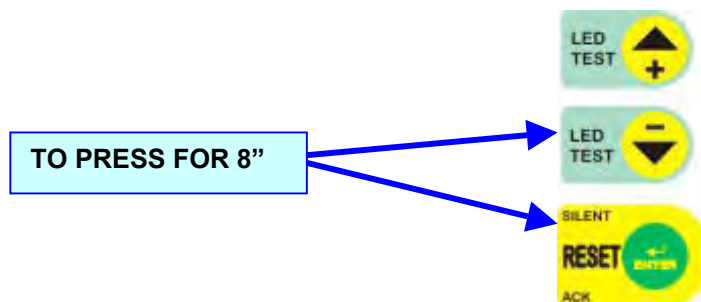


### 2.11.9. ALARM HISTORY RECORDS

This records all the parameters (measurements and alarms) at the time of an alarm being raised, and allows the last 15 to be displayed consecutively.

This is only active when the programming commutator is set to block

This can be displayed by pressing the buttons ( - ) and (ENTER) together for 8 seconds. The operation page will display "HISTORY 1", and histories 1 to 15 can be selected using the +/- buttons, and by confirming the selection using "enter".



EVENT1 = latest history;

EVENT2 = penultimate;

Etc;

The conditions at the time the alarm was raised are displayed.

It is possible flow the pages of the recorded measurements at the time of the event as in the normal functioning.

The Output page is changed with the alarm page which caused the event recording.

This page can be alternated every 4 seconds from the possible state page present during the recording.

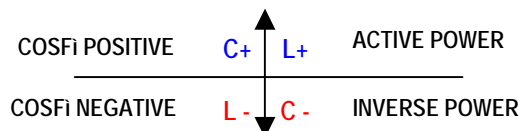
Every 8 seconds a writing "HISTORIAN EVENT N. x" remembers what event we are viewing.

To display another event to press ENTER for to exit, select it with the buttons +/- and to press again ENTER.

To exit from the pages of HISTORIAN turn back the switch in AUTOMATIC or MANUAL or to press together the buttons (ENTER) and (-) A page "CLOSING HISTORIAN" informs of the happened exit.

### 2.11.10 PROTECTION BY INVERSE POWER (32)

In the use of the AC01 with groups predisposed to the working in parallel, it is activable the Inverse Power protection (function relay 32), this begins working if the generator absorbs current rather than to supply it. The survey of the inverse power is effected with a mathematical calculation on the cosfi, in fact only when the cosfi is L - or C - we have power inverse in the generator.



Setting, to go in the menu thresholds and to set inverse power to the -10% of the nominal power, the intervention is delayed of 5", with the intervention the load is not connected and the GE is stopped after the phase of cooling motor.

### 2.11.11 SETTABLE INPUTS

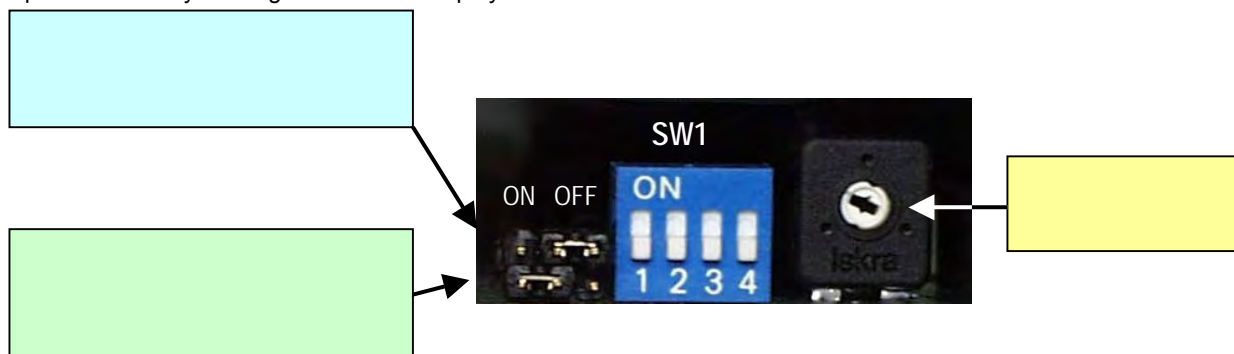
The inputs 12 HIGH OIL TEMPERATURE and the input 23 OVERLOAD can be renamed, the change can be effected only by connection to PC. The alarm intervention is that foreseen for the respective input.

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 34 of 56

## 2.12 PROGRAMMING

**The MO2 module has Jumpers and Switches that provide various functions:**

- J2 in the ON position – overrides the unit's contactor command to the programming commutator in the MANUAL GENSET position. When it is in the OFF position, the generator contactor unit is in automatic mode.
- J1 in the ON position – permanently enables the STOP button. When it is in the OFF position, it is only active in MANUAL START.
- A trimmer is provided to vary the brightness of the display.



### SW PROGRAMMING SWITCH

Six languages can be selected and programming can be activated, using four switches.

SW1	SW2	SW3	SW4	DESCRIPTION
OFF	OFF	OFF		ITALIAN
ON	OFF	OFF		ENGLISH
OFF	ON	OFF		SPANISH
ON	ON	OFF		FRENCH
OFF	OFF	ON		PORTUGUESE
ON	OFF	ON		GERMAN
			OFF	PROGRAMMING EXCLUDED
			ON	PROGRAMMING ACTIVE

#### 2.12.1 SETTINGS

To gain access to the function programming page, turn switch no. 4 of the SW1 switch ON, situated at the side of the AC01 unit.

All the parameters indicated on the display can be modified, both the value indicated (i.e. 380V can be changed to 395 or 378 or any other value) and the ZERO of the same parameter.

Once access has been gained to the programming function the messages that appear on the display will guide you through the possibilities offered by the program that is in *continuous development*, surely you will find on the module more options of programming in comparison to those brought on the manual.

All conditions can be worked on, even while the unit is running.

To gain access to the programming function, after having set the switch ON, use the +/- push buttons to select the block required.

To help you find the block the fields that may be programmed have been split up into four blocks:

1. Parameters;
2. time settings;
3. thresholds;
4. various settings.
5. remote control

Once the block concerned has been selected, press ENTER to display all the fields that may be modified. Use the +/- push buttons to find the field to be modified and once found, press ENTER again and using the +/- keys modify the value and confirm with ENTER.



TIME SETTING	PARAMETER SETTING	THRESHOLD SETTING	VARIOUS SETTINGS	REMOTE CONTROL SETTINGS
Access is gained to the time settings to be modified. Start delay Stop delay Etc.	Access is gained to the parameter fields to be modified. V - A - Hz - W - °C -	Access is gained to the threshold settings at which alarms are tripped Min – max, volt, hz, amper, ecc.	Access is gained to the various alarms and the special applications.	The type of remote control can be programmed on a PC – MODEM or GSM as well as the necessary parameters

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 35 of 56

### 2.12.2 PARAMETERS

The electrical parameters (V-Hz-A-KVA etc) are set in the factory, combining the two modules. The Pressure, Temperature, and Fuel Level indications depend on the tolerances allowed by the various probes. The temperature reading is particularly closely checked and calibrated.

When the MP02 module is changed, the electrical measurements may also need to be adjusted.

Changeable measurements:

N°	DESCRIPTION	VALUE	FIELD	MODIFICATION
1	Regulation generator voltage		0 - 600V	
2	Regulation frequency Hz gen-set		40÷70Hz	
3	Regulation current mains and gen-set		0-3000A	
4	Regulation zero current To bring the current to zero and to press "reset" to confirm the operation			
5	Regulation of the CT...../5°	1000	10-15-20-25-40-50-60-80-100-150-200-250-300-400-500-600-800-1000-1200-1500-2000-3000/5A	
6	Regulation power factor (cos f)			
7	Regulation transducer oil pressure		VDO-MTU-VEGLIA	
8	Regulation zero oil pressure To bring the oil pressure to zero and to press "reset" to confirm the operation			
9	Regulation reading oil pressure			
10	Regulation TM transducer		VDO-MTU-VEGLIA	
11	Regulation zero TM <b>Not to change</b>			
12	Regulation reading TM			
13	Regulation transducer fuel level		VDO-VEGLIA-MANUAL	
14	Regulation zero LC To bring the fuel level to zero and to press "reset" to confirm the operation			
15	Regulation reading LC To bring the fuel level at the most and to press "reset" to confirm the operation			
16	Regulation zero VB			
17	Regulation reading VB			
18	Regulation current CB			
19	Regulation differentials	500/1	500-700-1000/1	

### 2.12.3 TIME SETTINGS

N°	DESCRIPTION	VALUE	FIELD	MODIFICATION
1	Number of starting attempts. This establishes after how many starting attempts the failed starting function is to be enabled.	4	2 - 10	
2	Starting time and pause This establishes the starting time and the pause between one starting attempt and another.	5"	3 - 15"	
3	Mains enabling delay When the mains returns within the established limits following the set time, the output is switched from generator to mains.	60"	5 - 255"	
4	Generator enabling delay The load output is enabled following a set time that is triggered by the motor started signal (minimum 5 secs.)	5	3 - 255"	
5	Starting delay This makes the GE insensitive to micro-disconnections due to a pre-	2"	0 - 255"	

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 36 of 56



	alarm prior to starting.			
6	<b>Stopping delay.</b> This establishes the timing required between GE/MAINS switching and stopping to enable the motor to cool down. <b>If a=0 excluded stop</b>	60"	10 - 255"	
7	<b>Differential tripping</b> When the differential current exceeds the value established for a longer amount of time than this the generator switch or contact maker is opened.	1"	1-30"	
8	<b>Generator overload delay.</b> If the set current is exceeded the time set at the end of which the overload alarm is triggered is overridden only by a possible short-circuit current.	60"	15 - 255"	
9	<b>Sparkplug pre-heating time - PRC</b> This is the time setting of the sparkplug pre-heating prior to starting.	20"	1-255"	
10	<b>EJP Delay</b> This is the starting delay following the 30 mins. command	25'	0-255'	
11	<b>Delay failure CG</b> If it doesn't close, at the end of time, it is required signalled failure CG	OFF	OFF-255"	
12	<b>Delay failure CR</b> If it doesn't close, at the end of time, it is required signalled failure CR	OFF	OFF-255"	
13	<b>Delay change 2 GE in stand-by</b> At the end of the programmed time, it is required the intervention of the other group	4h	1÷24h	
14	<b>Hour counter</b> Pressing reset we have the reset of the hour meter			
15	<b>Starts counter</b> Pressing reset we have the reset of the starts counter			
16	<b>Kilowatthour</b> Pressing reset we have the reset of the kilowatthour			

## 2.12.4 THRESHOLDS

N°	DESCRIPTION	VALUE	Ref.value 400V	Valore rif.400V
1	<b>Three-phase or single-phase</b> This establishes the type of control over the mains power supply input and generator input	Three-phase	Three-phase / Single-phase	
2	<b>Max. mains voltage.</b> The generator is started.	+ 10% Vn	210÷600V	440 V
3	<b>Min. mains voltage.</b> The generator is started.	- 20% Vn	100÷400V	320 V
4	<b>Maximum mains power supply frequency</b> Determines start up of the unit.	+20% Hz n	51÷75 Hz	60 Hz
5	<b>Minimum mains power supply frequency</b> Determines start up of the unit.	-20% Hz n	35÷55 Hz	40 Hz
6	<b>Max. generator voltage.</b> Alarm triggered - stoppage	+ 10% Vn	210÷600V	440 V
7	<b>Min. generator voltage.</b> Alarm triggered + stoppage following cooling delay	- 20% Vn	100÷400V	320 V
8	<b>Max. generator frequency</b> Alarm triggered + stoppage after 3 secs.	+20% Hz n	51÷75 Hz	60 Hz
9	<b>Min. generator frequency</b> Alarm triggered + stoppage following cooling delay	-20% Hz n	35÷55 Hz	40 Hz
10	<b>Max. generator current.</b> This establishes the max. current admitted on generator beyond which an alarm is triggered and generator is stopped following appropriate delay.	Value of max. current on generator. (Gener.nameplate )	1÷2040 A	1200A
11	<b>Generator short-circuit.</b> This is the value of the generator current multiplied 3 or 4 times	I <sub>g</sub> x 3 1024*3=3072	1÷8160A	
12	<b>Motor started Hz value</b> Interrupts automatic starting when this frequency is exceeded.	17 HZ	17÷25 Hz	
13	<b>Max. battery charger current</b>	13,5÷27 V	5,4÷14,4 V	

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 37 of 56

	The buzzer alarm is triggered		10,8÷28,8 V	
14	<b>Maximum current – battery charge</b> Limits the maximum current allowed on the battery charging transformer	6 A	2,0÷8,0 A	
15	<b>Pump level ON</b> This starts the fuel pump.	= > 30%	5÷80%	
16	<b>Pump level OFF.</b> This stops the fuel pump.	= < 80%	60÷99%	
17	<b>Fuel reserve level.</b> An alarm is triggered	= >10%	4÷30% less than 1% OFF	
18	<b>Fuel lack</b> When there is the fuel lack	=<5%	1÷30% less than 1% OFF	
19	<b>Min. oil pressure</b> This triggers the pre-alarm min. oil pressure read by the transducer.	1,5 bar	0,5÷3,0 Bar	
20	<b>Max. motor temperature.</b> This triggers the pre-alarm temperature read by thermostat	Temperature of thermostat - 3°	100÷160 °C over 160°C OFF	
21	<b>Temperature which activates the pre-heating</b> It indicates the temperature which determines the pre-heating	65°	30÷65°C	
22	<b>Temperature which deactivates the pre-heating</b> It indicates the temperature which deactivates the pre-heating	70°	35÷70°C	
23	<b>Low engine temperature</b>	OFF	20÷60°C less than 60°C OFF	
20	<b>Activation differential current.</b> When exceeded the switch or contactor is opened.	300 mA	0,3÷5 A	
21	<b>Maximum mains power supply current</b> Determines the maximum current permitted on the mains power supply side – when exceeded an alarm is raised (protects the Mains Contactor).	Current setting for tripping of the Mains Contactor	1÷2040 A	
22	<b>Working hours between services.</b> When the hours set have expired an alarm is raised or the unit cuts out.	0 = excluded	0÷500 H	
23	<b>Restore energy</b> Determines power supply and stoppage after motor cooling.	- 0 kW = excluded	- 0÷200 KW	

## 2.12.5 VARIOUS SETTINGS

Each alarm can be programmed as follows:

N°	DESCRIPTION	VALUE	FIELD	CHANGE	
1	CT on load or on gen-set		Load Gen-set		
2	Special functions Selects one of the special functions provided on connections 18 and 20	Cut-out	Test E J P S C R 2 GEN. on standby		
3	Pre-heating out (CONNECTION 28) Selects the function – pre-heat motor, pre-heat glow plug, starter, reset, gas or double starting.	Pre-h. motor	Pre-h. Mot. Pre-h. G/Pl. Starter. Reset Gas Double Start		
4	Sequence phases mains It activates the control of the sequence phases on the mains; the failure determines the opening of the relative contactor CR	Off	On/Off		
5	Sequence phases gen-set It activates the control of the sequence phases on the gen-set; the failure determines the opening of the relative contactor CG	Off	On/Off		
6	RPM Engine	1500	1500 or 3000		
FILE		VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW		jia/02	05/03/2003	ENG	Page 38 of 56

7	<b>Automatic test (the clock must be set)</b> Sets the day, weeks, time and duration of the test	Inactive	Active or inactive Weeks 1 or 2 Days 1-7	
8	<b>Time of automatic test</b>	8,00	From 0 to 24 Hrs	
9	<b>Duration of automatic test</b>	10'	0 – 60'	
10	<b>Block</b> To press reset. To select the day of the week. To press again reset and to select the kind of block for that day. To press reset and to select an other day or to press more times down or up to exit		TOT. BLOCK PAR. BLOCK START PAR. BLOCK+START	
11	<b>Block</b> Sets the times at which the unit cannot start up automatically (only manual control can be used)			
12	<b>Advertising page</b> To press reset. To move the cursor. To press again reset and to select the character for the position. To press reset and to select an other position or to press more times down or up to exit.			
13	<b>Antitheft</b> It changes the alarm entry for high oil temperature (12) in "Antitheft", usable only with the remote control.	Temp. Oil	Temp. Oil Antitheft	
14	<b>Opening CR</b> It is effected the opening of the CR or by mains failure or by start		By start By mains failure	

#### 2.12.6. REMOTE CONTROL SETTINGS

1	<b>Baud mains</b> It indicates the speed of execution of the operation effected through the serial	9600K	9600K 19200K 38400K 57600K	
2	<b>Modbus Address</b> It allows to select the address modbus of the equipment	1	1-256	
3	<b>Gen-num</b> It allows to plan an identifier number of the group	1	1-16525	
4	<b>Modem selection</b> It allows to effect the choice among four different kind of modem	Serial	Serial Falcom A2D (GSM) Falcom TWIST (GSM) U.S. Robotics 56K	
5	<b>Telephone number</b> It allows to effect the choice among different telephone numbers previously introduced		Num. Tel. 1 Num. Tel. 2 Num. Tel. 3 SMS Num. Tel. 4 SMS	
6	<b>PIN number</b> Use mode as advertising page			

## 2.13. SELF-PROGRAMMING

The AC01 module is capable of programming itself.

This function is very useful where wrong configuration of a board could give rise to conflicts in operational terms. The self-programming function allows all the setting fields to be reset to comply with a table of standard preset values. These must then be adapted to suit the plant's working parameters, but they do provide a specific starting point for configuring the board.

In order to allow self-programming, shut down the programming commutator, by pressing the "+" and "Enter" keys together for 8 seconds. After this time the display will read "SELF-PROGRAMMING" and the board will configure itself using the parameters shown in the table below:

N°	DESCRIPTION	DEFAULT VALUE	VARIATION
1	TA ratio ...../ 5A	1000	
2	Fuel level (100% = full)	100%	
3	Motor temperature	130 °C	
4	Number of starts	4	
5	Starting and pause times	5"	
6	Mains power supply activation delay	1'	
7	Generator activation delay	5	
8	Starting delay	0"	
9	Stop delay	60"	
10	Differential intervention	0,1"	
11	Generator overload delay	60"	
12	PRC – glow plug pre-heating time	20"	
13	EJP delay	0'	
14	Alternating generator changeover delay	4 h	
15	Three-phase or single-phase	Three-phase	
16	Maximum mains power supply voltage	450V	
17	Minimum mains power supply voltage	320V	
18	Maximum mains power supply frequency	60Hz	
19	Minimum mains power supply frequency	40Hz	
20	Maximum generator voltage	450V	
21	Minimum generator voltage	320V	
22	Maximum generator frequency	60Hz	
23	Minimum generator frequency	40Hz	
24	Maximum generator current (I <sub>g</sub> ).	1024A	
25	Generator short circuit	3072A	
26	Motor start Hz	17 Hz	
27	Maximum battery charge voltage	13,5-27 V	
28	Maximum battery charge current	6 A	
29	Pump level ON	= > 30%	
30	Pump level OFF	= < 80%	
31	Fuel reserve level	= >10%	
32	Minimum oil pressure	1,5 bar	
33	Maximum motor temperature	130°C	
34	Differential activation current	300 mA	
35	Maximum mains power supply current	1000A	
36	Working hours before service request	0 = excluded	
37	Energy return	- 0 KW = excluded	
38	Pre-heating out (CONNECTION 28)	Pre-h. motor	
39	Automatic test (the clock must be set)	Inactive	
40	Time of automatic test	13,00	
41	Duration of automatic test	3'	
42	Automatic cut-out	OFF	
43	Phase sequence	Off	
44	Special functions	Cut-out	
45	Anti-burglary	Oil temp.	
46	Name and telephone number	Not changed	
47	Current transformers	On generator	

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 40 of 56

## 2.14 CONNECTIONS AND RELATIVE DESCRIPTIONS

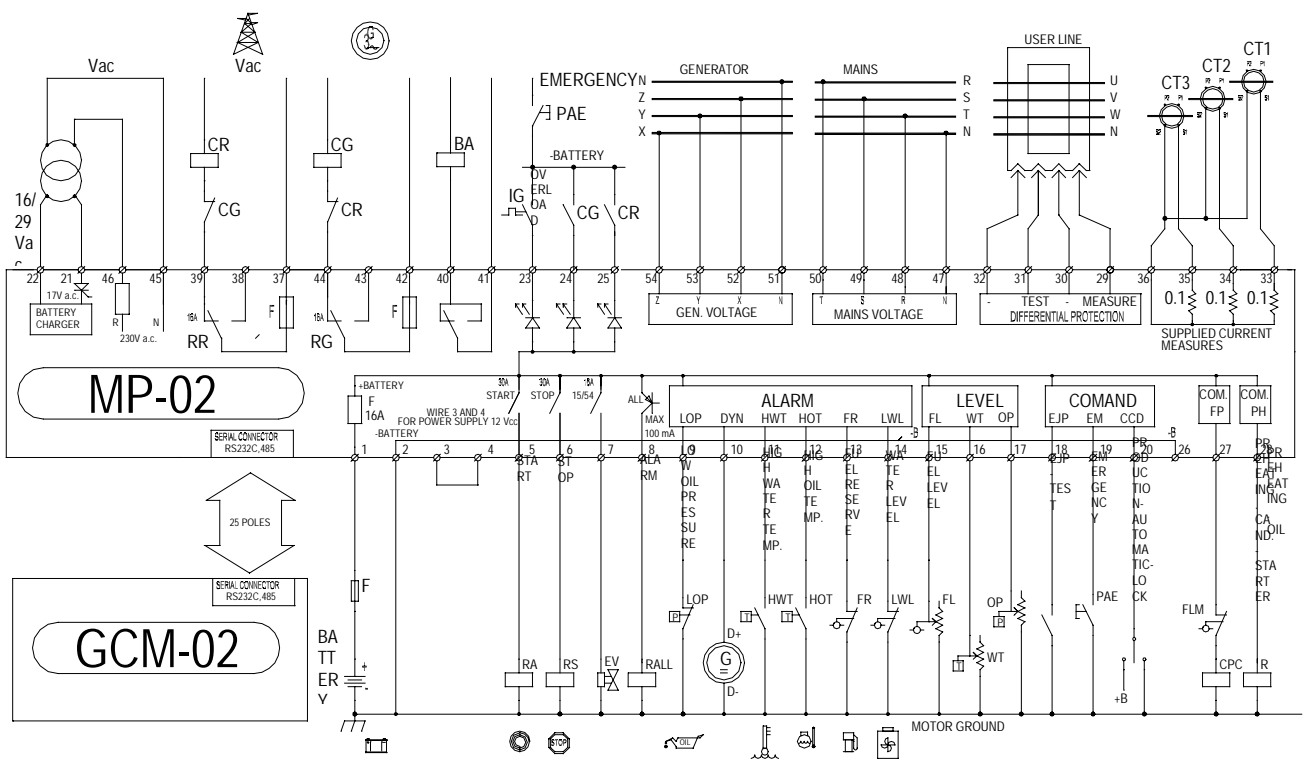
The AC01MP unit is connected by means of FASTON 6,3 mm type terminal board.

### 2.14.1 VIEW OF THE AC01MP CONNECTION UNIT



### BASIC

### INDICATIVE WIRING DIAGRAM



### CONNECTION DIAGRAM

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jyg/02	05/03/2003	ENG	Page 41 of 56

## 2.14.2 CONNECTIONS ON THE MP02 POWER UNIT

This entails 6.3 mm. 54 terminals and a 25 poles connector for connections between the GC AC01 module and the MP02.

The faston connections used for isolated terminals can take conductors of up to 6 mm<sup>2</sup>.

The wiring of the terminal board that is also illustrated on the safety guard respects the numbering indicated in the table below:

Terminal no.	DESCRIPTION	USAGE LIMITS	INPUT/OUTPUT
1	0-32V 16 A (+Batt) board power supply	30 A	I
2	0-32V 16 A (-Batt) board power supply	30 A	I
3	Bridge for 12V power supply		
4	Bridge for 12V power supply		
5	+B 30 A max starting command output	30 A	O
6	+B 30 A max stop command output	30 A	O
7	(15/54) +B 16 A max utilities command output	16 A	O
8	100 mA max. alarm output	200 mA DC	O
9	Lower oil pressure alarm input	Negative/positive	I
10	0-32V battery charger generator input	Negative	I
11	High water temperature alarm input	Negative/positive	I
12	Oil temperature alarm input	Negative	I
13	Fuel reserve alarm input	Negative	I
14	Water level alarm input	Negative	I
15	Fuel level transducer input	0-300Ω	I
16	Motor temperature transducer input	0-300Ω / 0-10V	I
17	Oil pressure transducer input	0-300Ω / 0-10V	I
18	EJP / RES/TEST function input (programmable)	Negative	I
19	Emergency input	Negative	I
20	LOCK/FORCED STARTING function input	Negative/positive	I
	<b>UTILITIES CONNECTIONS</b>		
21-22	Secondary 16/29V ac battery charger transformer	8 A	I
23	Overload alarm contact	10 A	I
24	Main contact maker ON indication input	Negative	I
25	Generator contact maker ON indication input	Negative	I
26-27	12 or 24V fuel pump contact maker command =	200 mA DC	O
26-28	12 or 24V pre-heating contact maker command =	200 mA DC	O
29-30	Toroid for differential protection, reading coil.		I
31-32	Toroid for differential protection, test coil.		I
	<b>AMPEROMETRIC TRANSFORMERS</b>		
33	Input TA / 5 A phase X	3000/5 A	I
34	Input TA / 5 A phase Y	3000/5 A	I
35	Input TA / 5 A phase Z	3000/5 A	I
36	Input TA / 5 A mutual	20 A 2"	I
	<b>SWITCHING COMMAND</b>		
37	Mutual CR	10 A 250V ac	
38	NO 10 A CR command contact	10 A 250V ac	O
39	NC 10A CR command contact	10 A 250V ac	
40	NO/NC configurable contact to command GE switch opening	10 A 250V ac	
41	NO/NC configurable contact to command GE switch opening	10 A 250V ac	
42	Mutual CG	10 A 250V ac	O
43	NO 10A CG command contact	10 A 250V ac	O
44	NC 10A CG command contact	10 A 250V ac	
	<b>POWER SUPPLIES</b>		
45-46	Primary 220Vac battery charger transformer.	100-500Vac	O
47	Mains neutral	0-600Vac	I
48-49-50	Mains R, S, T phases	100-600Vac	I
51	Generator neutral	0-600Vac	I
52-53-54	Generator X, Y, Z phases	100-600Vac	I

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 42 of 56



## 2.15 TECHNICAL CHARACTERISTICS

PROTECTION RATING OF FRONT PANEL :	IP 55
NON-SCRATCH FRONT PANEL WITH DESCRIPTIVE GRAPHICS	LEXAN GE
FUSE BOX:	6,3 X 32 MAX 25A
AC VOLTAGE :	0 / 500V ac
FREQUENCY :	50 / 60Hz
CURRENT	15 to 3000 / 5A
CC VOLTAGE:	12V or 24V +/- 30%
MAX. INPUT CURRENT:	1,2 A
MIN. INPUT CURRENT :	0,7 A
PROTECTION AGAINST INVERTED POLARITY	Built-in
WORKING TEMPERATURE	from -20 to +70° C
RELATIVE HUMIDITY	90% w/o condensation
POLLUTION RATING	1
START/STOP RELAY CAPACITY	30A 30V cc.
15/54 UTILITIES POWER SUPPLY RELAY CAPACITY	16 A 30V cc.
CG/CR CONTACT MAKERS COMMAND RELAY CAPACITY	10A 250V ca.
1st MOTOR STARTED DETECTION VIA ac GENER.	from 5 to 8V on 220v Gener.
2nd MOTOR STARTED DETECTION VIA OIL PRESSURE	from 0,5 to 1 bar delayed by 3 secs.
BUILT-IN AUTOMATIC BATTERY CHARGER	6A max
BATTERY PROTECTION, FUNCTIONS	< V 27 and >V 59
GENERATOR PROTECTION, FUNCTIONS	27 - 59 – 81
PROTECTION AGAINST OVERLOAD AND SHORT-CIRCUIT	50 – 51
GENERATOR VOLTAGE DETECTION	100/500V ac. Three phase
THREE PHASE MAINS DETECTOR WITH DISPLACEMENT	100/500V ac. three phase
MAINS DETECTOR INSULATION	= > 8 KV
MAINS LINE PROTECTION AGAINST MIN AND MAX VOLTAGE AND FREQUENCY, FUNCTIONS	< V 27 and >V 59 81
MOTOR PRE-ALARMS	MIN. PRESS. HIGH TEMP.
DIMENSIONS OF AC01 UNIT	395 x 218 x 40 mm
WEIGHT OF AC01 UNIT	540g.
DIMENSIONS OF GC-MP02 UNIT	L 285 H 210 P 90
WEIGHT OF GC-MP02 UNIT	1000g
COMPLIANCE WITH STANDARDS	EN 60255-1 EN 5081-2 EN 6100-4-2 EN V50140 IEC 1000-4-3-8 ISA M

**Note:**

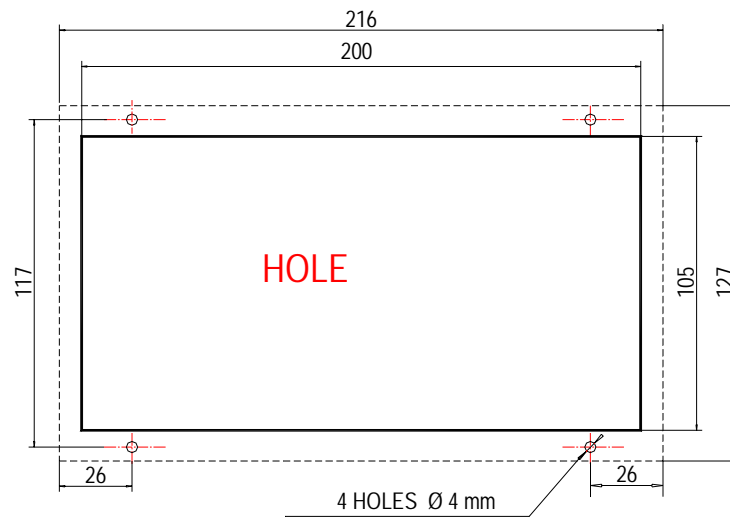
*The technical characteristics are subject to modifications without notice following technical improvements.*

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 43 of 56

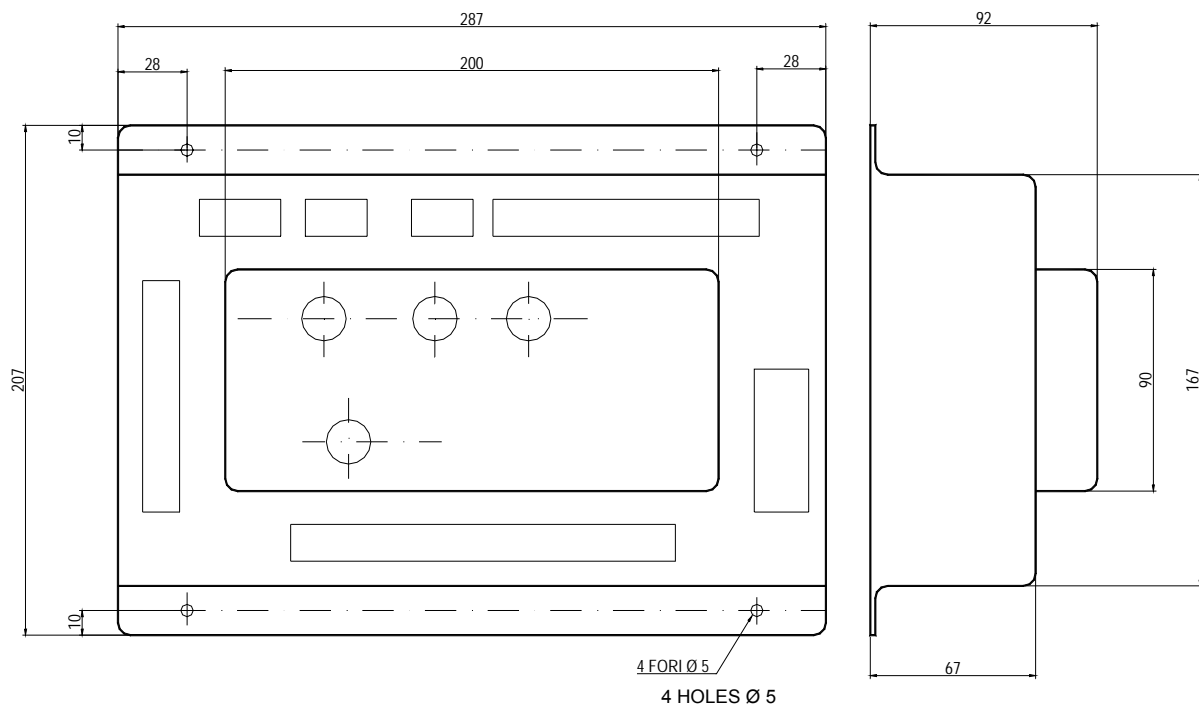


## 2.16 DIMENSIONS

### 2.16.1 DRILLING TEMPLATE OF THE AC01 UNIT



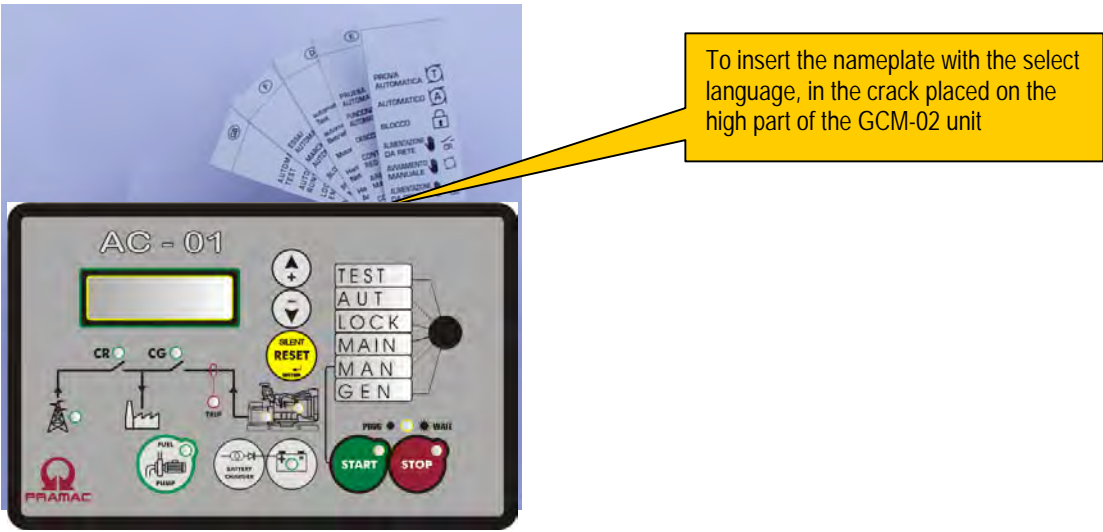
### 2.16.2 DIMENSIONS OF THE MP 02 POWER UNIT



FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 44 of 56

ADJUSTMENT TO THE LANGUAGES

To allow an immediate interpretation of the commutator of switching, a pocket has been foreseen, in which a nameplate is inserted with the writings in the wanted language.

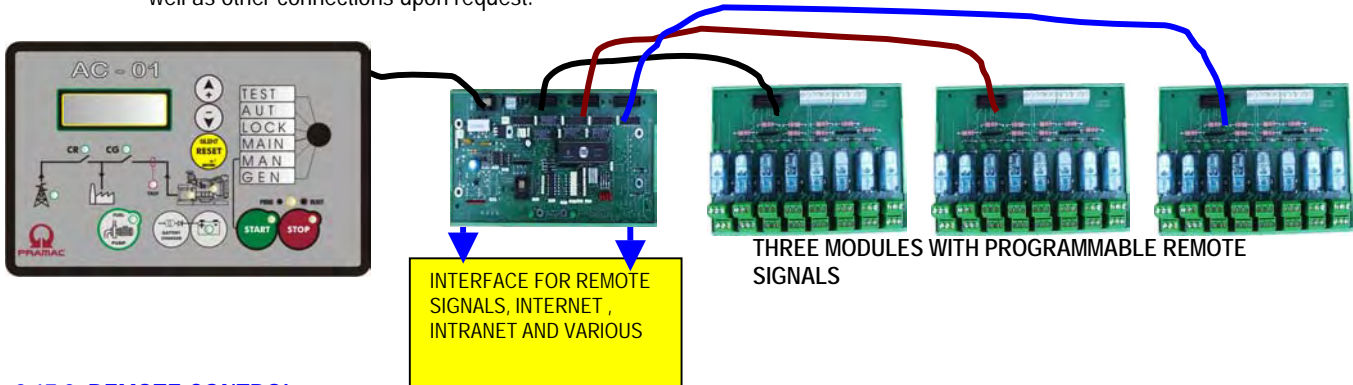


## 2.17. OPTIONAL EXPANSIONS

### 2.17.1. REMOTE SIGNALS – INTERNET – INTRANET - ETHERNET

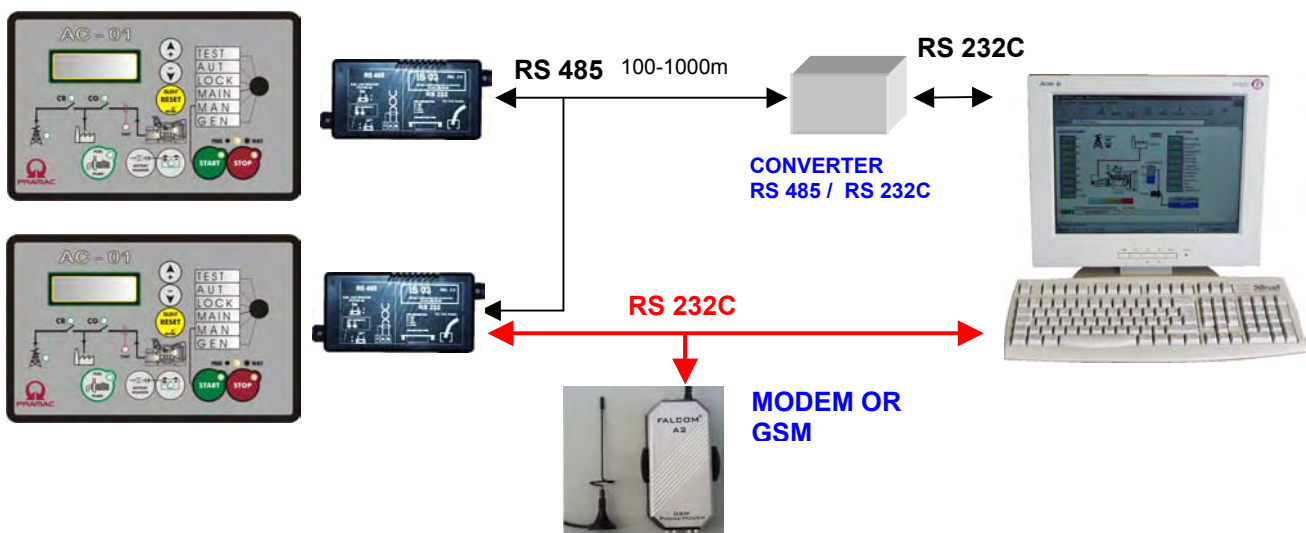
The serial output has an interface board attached to it, which has an independent microprocessor that allows special functions to be installed to suit the client's specifications. The following is provided for:

1. The control of three eight-relay modules, providing a total of 24 remote signals with free contacts. This also allows a single module to be connected, for the remote signals required.
2. The same interface board has outlets that can configured for connecting to the internet, local intranet or Ethernet networks, as well as other connections upon request.



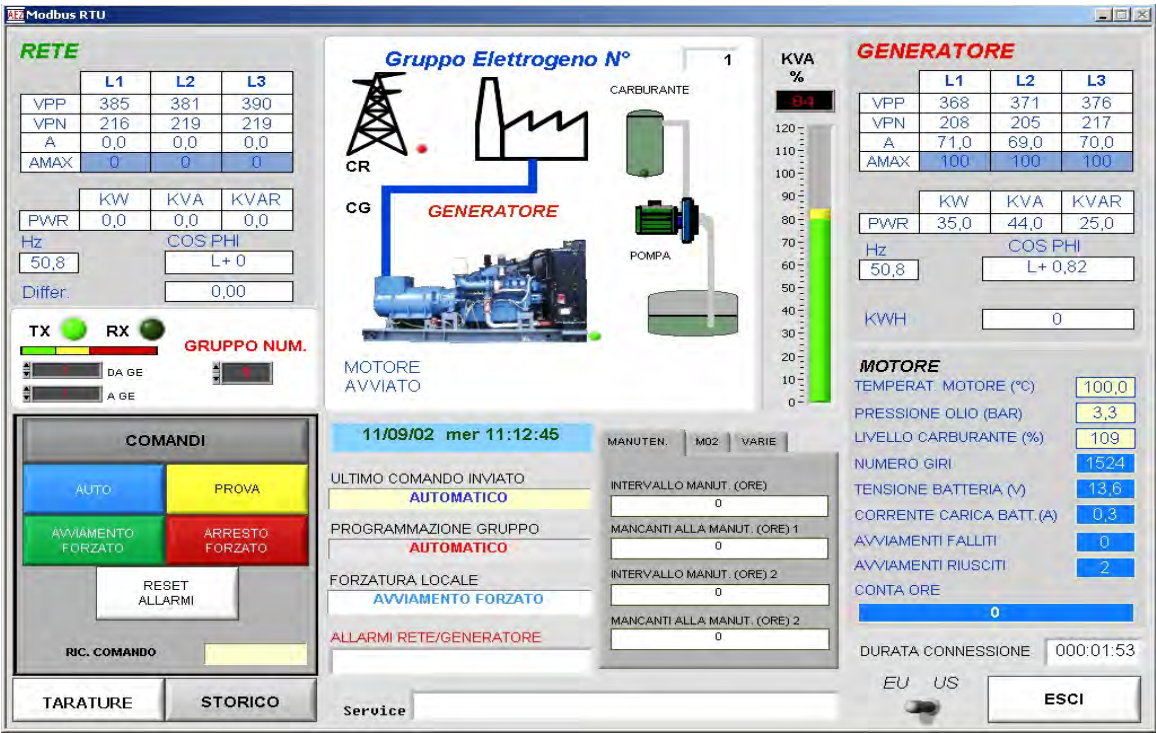
### 2.17.2. REMOTE CONTROL

Upon request an IS 03 serial board can be provided. This is to be fitted to the module and has two serial RS232C and RS485 ports. The RS485 port communicates using a standard MODBUS RTU protocol that can communicate via networks and with PLCs. The RS232C serial port is used to interface with PCs, GSMs and Modems for remote control. It allows the switching status to be monitored, as well as all the parameters (voltage, frequency, current, etc.) and all the alarms. It is also possible to control the following functions – Automatic, Automatic Test, Stop, Start, Forced start with generator supply, and Reset. Each message is recorded in a history document, and up to 60,000 units can be handled, each unit having an individual board. Each unit can address the alarm status to a PC Server and another two numbers for local service centres. The server is able to transmit SMS or fax messages to local service technicians. The control software is only supplied with boards fitted with serial ports.



FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 46 of 56

Through the serial communication all the parameters and commands of the group are under control  
General monitor of the situation plant

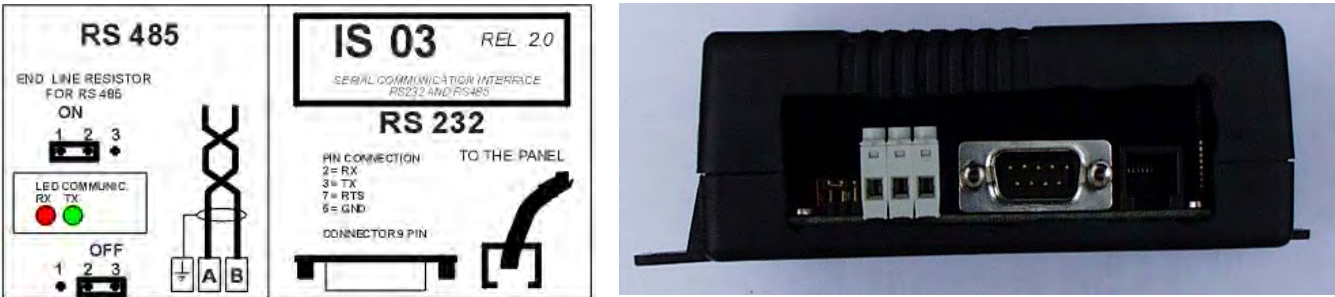


2.17.3 REMOTE CONTROL AND MODEM

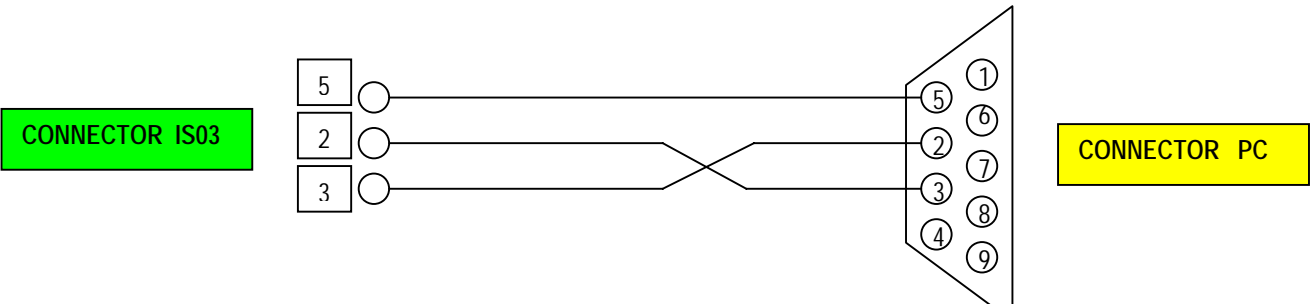
Concerning the AC01 unit, with the release 6.0, the remote control user connector is on left side of the unit (view in frontal way), near to dip-switch which enables settings and languages and to the trimmer which regulates the intensity of the display LCD.

The IS-03 serial interface unit for the serial communication has to be set to work in two different way of serial connection: RS232 and RS485. On this unit there are also a green led and another red, the green is the transmission function (TX) and the red is the receipt, flashing during the operation.

In the following figure is brought the external view of the IS03 unit.

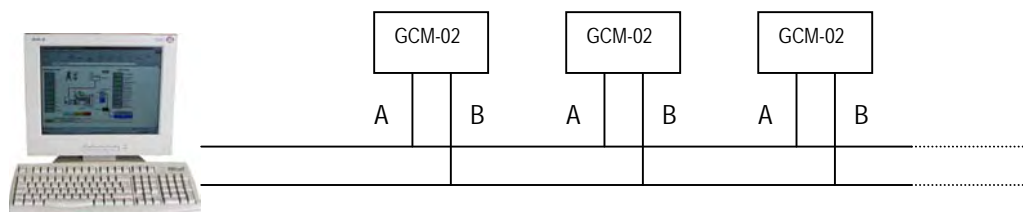


The jumper, opportunely connected, enables the closing of the line of the RS485 serial, inserting the resistance R which closes the line. For the connection from the ISO3 to PC by RS232 interface, it needs a wire null-modem (standard for PC); his configuration is the following:



FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jgg/02	05/03/2003	ENG	Page 47 of 56

The connection of the IS03 to PC by RS485 interface allows the control of more AC01 units, using a bight; for a correct functioning the units should be set to the same speed but with different and consecutive address modbus. his configuration is the following:



## COMMUNICATION PROTOCOL

The standard MODBUS RTU is particular type of protocol, suitable to communicate on a RS485 serial up to max speed of 256 Kb/s. The speed used as standard is however that of 9600 Kb/s. At the end of the manual, in the appendixes section, there are the modbus mapper, they cab be used on serial mains controlled from PLC etc.

**N.B. being the IS03 an interface from the intelligent technology needs to do so that during the lighting this is already connected to the unit because it happens a particular control of handshake that the serial trains to the functioning After all to the manual, in the appendixes section, there are the mappers**

If after the lighting the TX green led is again turned, press reset for to repeat the handshake with the IS03.

## COMMUNICATION BY MODEM OR GSM

During the installation to connect the modem with the prolongs PIN TO PIN (usually supplied with the modem) to our serial.

**IMPORTANT!!!** If it has a modem also trained to the operation GSM it is of fundamental importance to remember also to insert before the start the **SIM card** opportunely trained to the **traffic data**, a standard SIM (not trained to the data communication) it allows only the communication by SMS.

As first operation to feed the modem inside the GCM-02 unit.

In the case of modem GSM needs immediately to insert the number of the PIN of the telephone SIM and subsequently to set in the field of the "serial regulations", they cab be activated elevating the switch 4, the telephone numbers of reference (two normal and two trained for the sms) to which it has to correspond a computer with our software. In case of signalings of alarms before they are contacted the numbers corresponding to the sms and subsequently those with the normal numbers.

It is important for a correct control, to insert gen-set identification number to make possible the controls and the modifications by the remote control use.

The address modbus in standard conditions has to be set to 1; after set the modem that you want use and opportunely connected to the unit.

The U.S. Robotics modem works as a normal modem of telephone line and it is not trained to the function GSM. So, the communication speed is usually set to 9600 Kb/s also if U.S. Robotics could work up to 57600 Kb/s.

When it operates with modem trained also to the use of the function GSM in the case in which the PIN of the SIM inserted resulted wrong the signaling it would appear on the display "Alarm SIM PIN". In this case to come into the range of the serial regulations and to check the correct insertion of the code and eventually to modify it. In the case the code for PUK is asked, due to the wrong digitation for three consecutive times of the code PIN, to remove from the modem the card SIM and to handle the insertion of the code PUK through a normal cellular GSM.

When a modem is used also for to the functions GSM if you are in the functionings screening (that usually active) where the hour and tha day are visualized you can also verify the field (signal radio) present. When the field results to be of smaller value than -91 dBs the communication could result not perfect.

## POSSIBLE ERROR MESSAGES:

- 1) anybody answered from the modem: to verify the correct installation of the modem and his opportune lighting.
- 2) alarm lack SIM: to check to have inserted inside the modem GSM the telephone SIM.
- 3) alarm damaged SIM: it can appear in the case the code PUK has been wrong for 10 times : to replace it.

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 48 of 56

- 4) alarm SIM PUK: it can appear in the case the code has been wrong for three times : to extract it from the modem and to insert the code PUK through the use of a normal telephone GSM.
- 5) alarm erred PIN: to check the correct insertion of the code PIN in the sector of the "serial regulations."

It is obviously possible to check the gen-set through a personal computer with the projected software adequately to the functions of the GCM-02. It is possible in fact, once connected to the interested group, to command to distance the STOP, the START or the AUTOMATIC TEST of the same group. In this case on the display of the GCM-02 following information are visualized respectively:

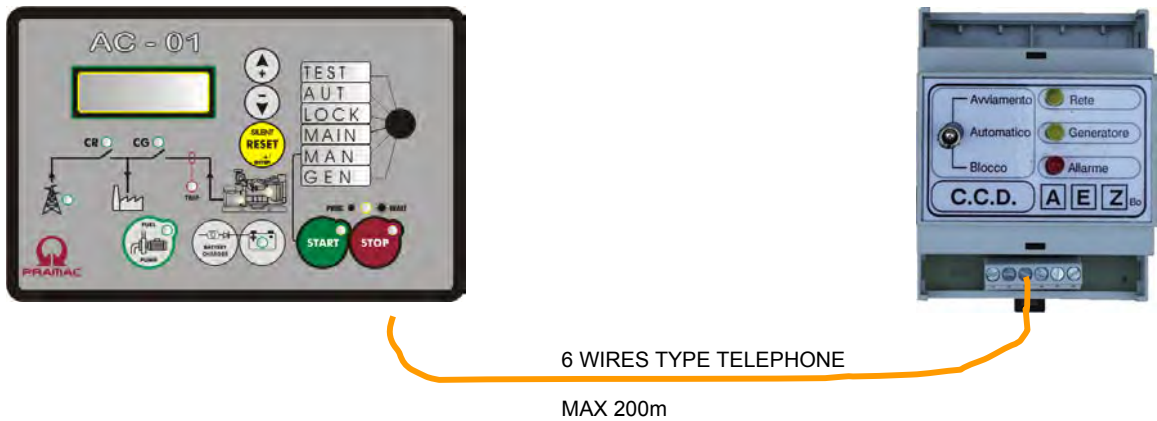
- START FROM SERIAL COMMAND
- STOP FROM SERIAL COMMAND
- AUTOMATIC TEST FROM SERIAL COMMAND

After 250" of absence of serial communication every command sent from PC is annulled and the AC01 it takes back the normal operation.

### REMOTE COMMAND AND CONTROL BY CABLE

With an easy and cheap CCD, of modular structure suitable for the normal civil installations, it is possible to command and control the GE through 6 telephone threads; foreseen functions and commands:

1. AUTOMATIC RUNNING
2. FORCED START WITH SUPPLIED POWER
3. LOCKED GEN-SET
4. SIGNALING OF MAINS OR INSERTED GEN-SET
5. ALARM SITUATION WITH ACOUSTIC ALARM BY BUZZER



FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 49 of 56



## 2.18 INSTALLATION

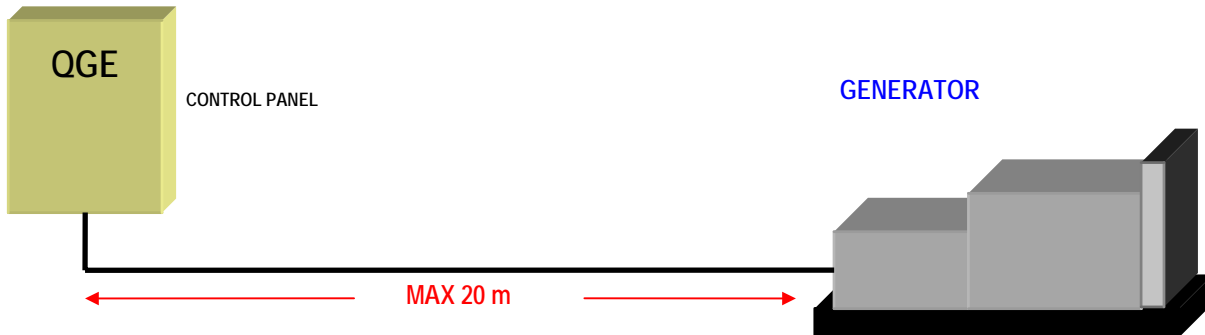
### 2.18.1 POSITIONING

The control panel must have a protection rating (IP) suitable for the area in which it will be installed:  
IP 42 (normal supply) for closed areas;  
IP 55 in the case of possible splashing of water or for control panels exposed to rain.



### WARNING !!!

It is advisable not to install the control panel further away than 20 meters from the generator.



This requirement is due to the excessive currents caused by lightning that hits the public mains causing the voltage inside the control panel to rise excessively if the connection line exceeds 20 meters.

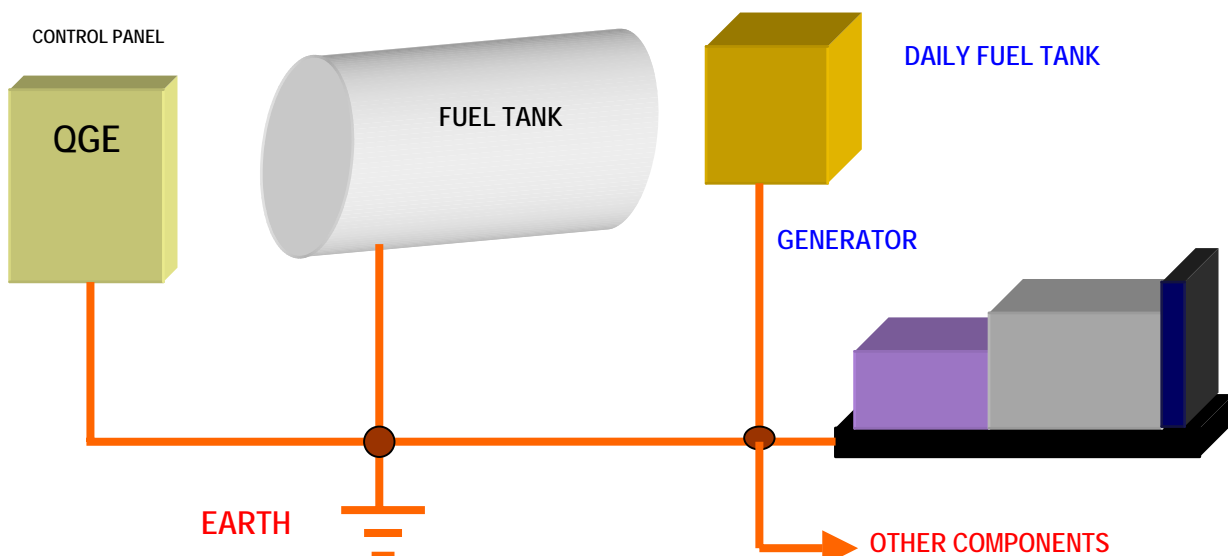
*If there is no other choice than installing the control panel further away than 20 meters, our engineering department can provide you with various technical solutions.*

### 2.18.2. EARTH CONNECTIONS (PE)



### WARNING !!

To ensure the reliability of the system all of its components must be connected to earth.



FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 50 of 56



### 2.18.3 POWER CONNECTIONS

To facilitate installation wiring diagrams and indicative tables for scaling the line and utility wires are supplied.

Bare in mind that all devices and lines must be protected against short-circuits and overloads by law and that for reasons of safety all prevention measures against accidental direct contacts must be taken (see IEC 64-8/4 standard) therefore an automatic switch of adequate capacity is to be installed at the beginning of the mains inlet cable (and selectivity) and a differential switch on the utility line.

EN 60439-1	TABLE A1	VALUES FOR ONE SINGLE WIRE	
SWITCHING IN AMPERE <i>Ith</i>	NUMBER OF THE WIRES	MIN. CROSS SECTION IN <i>sq m</i>	MAX. CROSS SECTION IN <i>sq m</i>
25A	1	2,5	6
40A	1	6	10
60A	1	10	16
90A	1	16	25
110A	1	25	35
125A	1	35	50
160A	1	50	70
200A	1	70	95
260A	1	95	120
350A	1	150	185
400A	1	185	240
500A	2	95	120
630A	2	120	150
800A	2	240	300
1000A	3	240	300
1250A	4	240	300
1600A	5	240	300
2000A	6	240	300
2500A	7	240	300

*For further information contact a reliable installation engineer or our engineering department.*

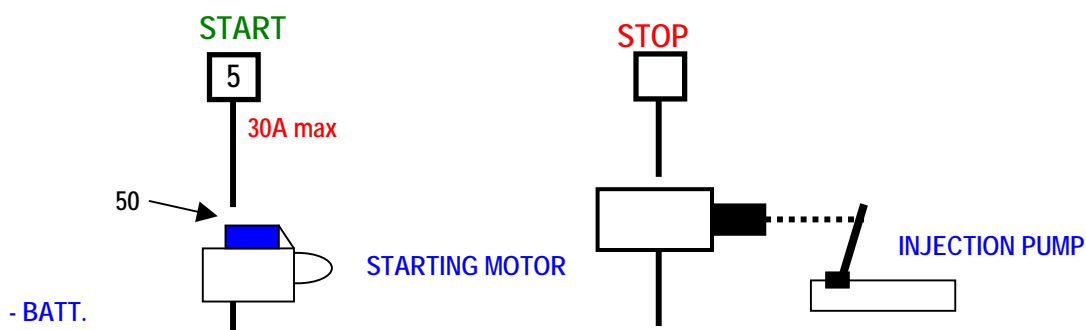
### 2.18.4. CONNECTIONS TO THE BATTERY

To supply power to the AC01MP power module, we advise connecting directly to the battery cables that are connected to the starter motor. The use of motor earths to connect up the -B has often given rise to operating problems.

### 2.18.5 STARTING AND STOPPING

These may directly command devices with currents up to 30 A . Use terminal no. 6 to command electromagnetic switches energised during stoppage.

Fig. : 3



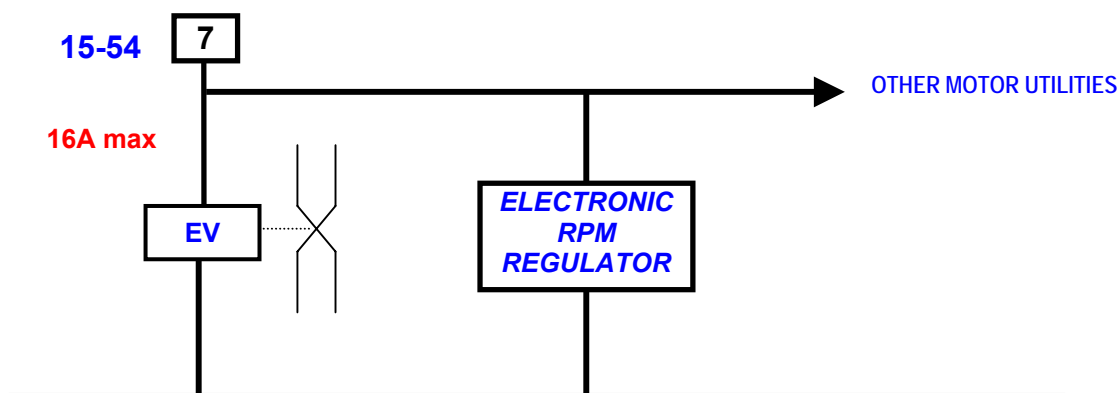
*Operation : with the stopping command the electromagnet is energised and stops the motor. To establish the stoppage of the motor the closure of the oil pressure switch is controlled, which after 20 seconds from when it closed automatically disables the electromagnet thus avoiding settings and adjustments.*

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 51 of 56

## 2.18.6 STOPPAGE WITH SOLENOID VALVE

*Stoppage with SOLENOID VALVE normally energised while the generator is running and while the utilities of the unit are powered.*

Connection 7 is defined 15/54, it emits the +B with a maximum current of 16A as the GE starting is commanded to stop when the stoppage command is received,



## 2.18.7 MOTOR CONTROLLING PROBES

These detect the operational status of the motor. The integrity of the actual motor relies on their efficiency.

They are of two types:

Contact type to command alarm status, such as low oil pressure, high motor temperature, low fuel level etc.;

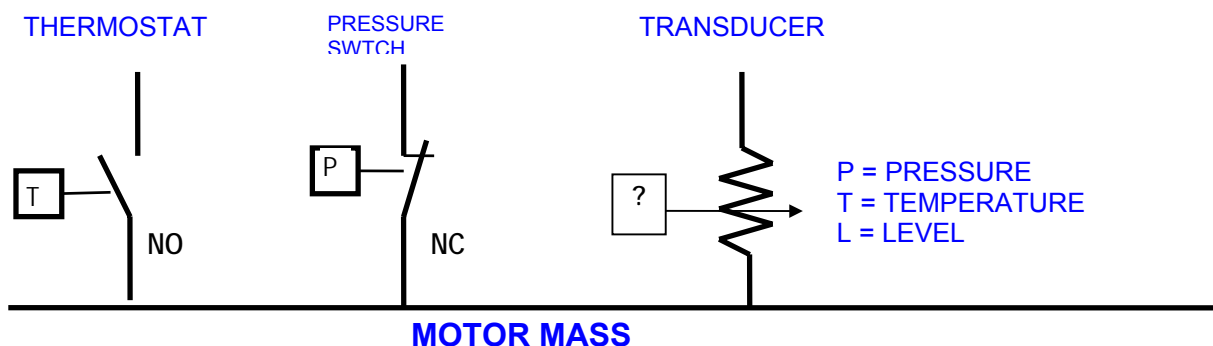
Variable resistance type depending on the parameter to command reading instruments such as thermometers, gauges, levels etc.

The parameters read by the AC01 are performed with VDO probes or compatible types.

PROBE	TYPE	MARK	OHM VALUE	TRIPPING THRESHOLD	MOTOR
OIL PRESSURE SWITCH	NC CONTACT		ZERO OHM	0,5 Bar	
WATER THERMOSTAT	NO CONTACT	V D O	OHM INFINITE	93°C	WATER
OIL THERMOSTAT	NO CONTACT	V D O	OHM INFINITE	120°C	AIR
OIL PRESS. TRANSDUCER	VARIABLE RESISTANCE	VDO	0÷180 OHM	Adjustable pre-alarm threshold	
TEMP. TRANSDUCER	VARIABLE RESISTANCE	VDO	0÷660 OHM	Adjustable pre-alarm threshold	
LEVEL TRANSDUCER	RESISTANCE	VEGLIA	0 ÷ 180 Ohm	Adjustable alarm, pre-alarm, pump control thresholds	

Fig. 5 CONTACT PROBES

VARIABLE RESISTANCE PROBES



## 2.18.8 ELECTRICAL STRENGTH TEST

The control panels that are subject to the electrical strength test are to be prepared baring in mind that the only connection point with the electronic logic is established by the MAINS sensor (inputs 50 – 49- 48) to which a divider is connected that is made up of 3 500 K ohm resistors for high voltage, for phase and connected to earth.

*Therefore the R - S – T - N inputs are to be disconnected.*

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 52 of 56

## 2.19 SERVICE PROCEDURES

### 2.19.1. SERVICING PROCEDURE

#### Before proceeding with the functional test :

1. Disconnect the BATTERY and BATTERY CHARGER fuses.
2. Check the connection of the oil pressure switch. If the connection to earth is not present (-B) by means of the oil pressure switch the motor will not start.

#### Once installation is complete, check its correctness by performing the procedures advised below:

1. Switch the programming commutator to "stop".
2. Close the fuses.
3. Check that the Battery LED comes on. If not, the polarity (+/-) on the battery may be incorrect and need inverting, or the power supply may not be on. **WARNING!!** Do not give commands. Erroneous connections could cause damage to the power module.
4. Programme the AC01 on the basis of the working data and characteristics of the generator:
  - a. Move switch N°4 to "programming ON" and complete the procedure shown on page 30.
  - b. If different from the standard 400V 50Hz set the working voltage and frequency.
  - c. TA ratio ...../5°
  - d. Overload current – enter the nominal current the generator can supply, increased by 5%.
  - e. Short circuit current – enter the overload current multiplied by three.
  - f. If required, activate the special functions (pages 26-30).
  - g. The Terminal Contact wires may introduce residual voltages into the AC01, which generate a value for current that does not exist. To eliminate this, use the Measurements Menu to zero the Current and press Reset. The AC01 carries out self-programming.
  - h. Return switch N° 4 to "OFF".
5. Switch the programming commutator to "ENABLE STARTING".
6. Since the protective devices are also active in Manual mode, check the probes for fuel reserve, motor temperature, etc. against the respective indications by disconnecting the conductors on these, and connecting it to the earth temporarily and checking that the message displayed is correct.
7. Once the alarm check has been completed (in case of faults, see the input/output paragraph), press the START and STOP button quickly, and check the motor for the correct reaction and the power supply to the solenoid valve and actuator (it is not necessary to start the unit).
8. Visually check the power connections between the generator and the panel, making sure that the board detects the "motor started" status via the generator voltage. If this voltage cannot be detected (due to the power connection not being formed properly, or a switch open along the power supply line), the starter motor must remain active for three seconds after the motor has started.
9. With the commutator switched to "ENABLE STARTING", press the start button until the motor has started.
10. Wait 20/30 seconds and switch to POWER SUPPLY FROM GENERATOR.
11. Check the rotation direction of the motors in use (invert two phases if incorrect).
12. Set the programming switch back to Enable Starting, the CG contact maker will open and the load will be disconnected.
13. Command manual stoppage.
14. Set the programming switch on POWER SUPPLY FROM MAINS.
15. After at least 15/20 seconds power the control panel with the mains and check the rotation direction of the motors in use again (invert two phases if incorrect).
16. Set the programming switch in AUTOMATIC mode; check, if by disconnecting the mains, all the starting functions are enabled, power output and generator protection. When the mains is restored there will be a delay before the lines are switched then a further delay to allow the motor to cool down.

**ATTENTION!** If in start phase, the oil pressure switch (9) is not connected and the gen-set doesn't start.

### 2.19.2 SERVICING PROCEDURE WITH THROUGH MAINS (GENERATOR DISABLED)


In cases in which the electrical system is started but not the generator, therefore its circuits and battery are practically not powered, the powering of the electronics by the mains is to be avoided as this does not offer the control and safety devices provided by the battery

Therefore the BATTERY and BATTERY CHARGER fuses are to be disconnected.  
When the generator is enabled again follow the Servicing procedure.

### 2.19.3. BATTERY REPLACEMENT PROCEDURE


- Set the programming switch on Manual Mains mode.
- Disconnect the BATTERY and BATTERY CHARGER fuses.
- Replace the battery and re-connect fuses and reset program.

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 53 of 56

 **WARNING** considering that the battery charger generators output a voltage of between 50 and 150 Volts when disconnected from the battery while the generator is running, which is very destructive for the electronics, the connections must strictly not be touched while the generator is running or the loose cables.

#### 2.19.4. AC01 BOARD REPLACEMENT PROCEDURE

- Disconnect the BATTERY CHARGER and BATTERY fuses
- Set the programming switch on LOCK mode and replace the board.
- Copy the programming of the SW1 and of the JUMPERS situated on the replaced AC01.
- Re-connect fuse F1 to the battery.
- Program the operational voltage and the frequency if different to the standard 400V 50Hz.
  - Ration of the TA ...../5°
  - Overload current, enter the rated current that may be output by the generator plus 5%.
  - Short-circuit current, enter the overload current multiplied by 3.
  - Compare the remaining values with the test board.
- The settings of the type of test TA, the overload and short-circuit current are crucial.
- Re-connect all fuses and check the efficiency.


 **WARNING** the wiring to the terminal contactors may introduce residual voltages into the AC01, which may generate a value for a current that does not exist. To eliminate this go into the measurements menu, zero the current and press Reset. The AC01 starts self-programming. This operation must be carried out without current in the power circuits. Where this charge cannot be eliminated, short circuit the wires to the Terminal Contactors.

#### 2.19.5 MP02 POWER BOARD REPLACEMENT PROCEDURE



**WARNING! It is absolutely prohibited to touch any parts while they are powered.**

- Disconnect the mains and stop the generator if this is running.
- Disconnect the BATTERY CHARGER and BATTERY fuses
- Replace the board paying utmost attention to terminals 3 and 4 of the 12 and 24V voltage.
- If the motor is pre-arranged for positive inputs, program the relative JUMPERS and SWITCHES under the guard of the MP02 board, see the "positive motor protection inputs" and "motor parameter analogue reading inputs" sections.
- Re-connect the battery and battery charger fuses.
- Check the efficiency of the unit.

 **WARNING** the wiring to the terminal contactors may introduce residual voltages into the AC01, which may generate a value for a current that does not exist. To eliminate this go into the measurements menu, zero the current and press Reset. The AC01 starts self-programming. This operation must be carried out without current in the power circuits. Where this charge cannot be eliminated, short circuit the wires to the Terminal Contactors.

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 54 of 56

## 3. MAINTENANCE

The control panel has been designed to operate without the need for maintenance. The following is to be kept under control nevertheless:

every 30-60 days	check the electrolytic level of the battery.
every 30 days	check the water, oil and fuel levels
every 30 days.	check the motor pre-heating temperature (if installed)
every 30 days.	run the unit automatic test
every 6 months	check the battery efficiency

### 3.1 ELECTRICAL MAINTENANCE

See the relative manual for the maintenance of the GENERATOR. The information provided herewith simply relates to the electrical command and control parts of the generator.



#### WARNING !

The control panel is powered by the mains and by the generator. Before accessing it for maintenance purposes disconnect the mains and stop the generator by setting the programming switch on "LOCKED"

### 3.2. EFFICIENCY TEST

Efficiency tests of the various automatic functions to be executed with the AUTOMATIC or TEST programs.

The safety devices against min. voltage, min. frequency, low oil pressure and dynamo are enabled when the generator is running at a steady state and following the programmed tripping of the generator delay that enable the load output. Therefore all simulations are to be performed following this timing.

### 3.3. MOTOR SAFETY DEVICES

Disconnect the wire on the motor from the relative reading probe and connect it to earth for roughly 3 seconds. An buzzer alarm will be triggered the motor will stop and the relative will be displayed.

The functions of each alarm are indicated in the AUTOMATIC RUN MODE section.

### 3.4 GENERATOR SAFETY DEVICES

Manually operate the lever of the accelerator or actuator to modify the revs. in + or - . Consequently the variation of the Hz frequency will be displayed. Continue until the safety threshold is triggered with consequent alarm status and locking.

Minimum and maximum voltage.

Manually turn the VOLT trimmer on the electronic voltage regulator inside the generator. First turn + or – then vice versa altering the voltage output until the safety devices are tripped. Upon completion set the voltage back to the normal value.

### 3.5 OVERLOAD SAFETY DEVICE 51

Supposing that a load sufficient to exceed the maximum current that may be output is not available it is advisable to modify the calibration of the overload to a value lower than the load current available (see **setting** section).

With the generator in automatic mode, disconnect the MAINS and when the CG generator contact maker has closed enable the load. When the set current is exceeded, following the delay timing, the CG contact maker is opened and the relative LED flashes, the alarm is triggered and the generator stops following the motor delay timing.

**Reset the current calibration ( maximum current of generator in "ALARM THRESHOLDS" section ) after the test has been completed.**

### 3.6 BATTERY EFFICIENCY

The battery is kept efficient by the automatic battery charger, which controls its charge avoiding oxidation and sulphating. It controls possible rising in voltage caused by the disconnection of internal components and also voltage sagging causes by anomalies in the battery charger. The storage capacity, or rather the capacity of facing up to the number of starting times sufficient to ensure the running efficiency of the generator is to be checked once a year in the following manner:

Check with the battery fully charged, with a voltage greater than 13,5V for generators with 12V batteries and a voltage greater than 27V for generators with 24V batteries.

With the generator in locked mode, disconnect the electromagnet the safety solenoid valve or the actuator or anything else necessary to prevent the generator from starting. The power supply to the injection pump must be prevented so that upon starting the motor turns without starting.

Set the programming switch on TEST, count 4 starting attempts at a rotation speed that is more or less the same from the first to the fourth command.

The same procedure can be performed by setting the programming switch on ENABLE START mode and manually commanding the starting attempts for 5 seconds with pauses of 10 seconds for at least 5 times one after the other.

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 55 of 56

If starting fails after these 5 attempts (minimum 4) the batteries are to be replaced.

### 3.7 SWITCHING SCALING TEST

If the utility system is modified, check the scaling of the mains/generator line switching. The maximum load current must not exceed the switching limit values indicated on the internal nameplate.

### 3.8 TROUBLE SHOOTING

All control panels are marked with a work order number written on the test nameplate inside the panel. All the technical and constructional data of the control panel are associated with the work order number therefore you must refer to this when requesting technical assistance or spare parts.

The following details must be indicated in any event:

1. type of electronic board (indicate on front panel);
2. battery voltage (12 or 24V);
3. mains voltage (230 or 400V);
4. generator capacity (KVA);
5. frequency (50-60 Hz);
6. indications displayed on AC01 module when the problem occurs;
7. operational mode (AUT. or MAN);

TROUBLE SHOOTING										
Battery LED off	Failed starting	Attempt to start	Brief and rapid starting	Failed starting alarm	Alarm status triggered immediately	Failed generator output	Failed mains output	Failed stoppage	Nothing is working	
										PROBABLE CAUSE
										SOLUTION
•	•	•	•	•						Battery flat
•	•	•	•	•						6A Fuse of battery charger
•	•	•	•	•						Battery flat
•	•	•	•	•						Battery charger
•	•	•	•	•						Battery with inverted polarity
•	•	•	•	•						Check and invert cables
•	•	•	•	•						Loose or oxidised battery connections
•	•	•	•	•						Clean, tighten and lubricate battery terminals
•	•	•	•	•					•	25A battery fuse blown
•	•	•	•	•					•	Replace 25A fuse
				•						The pinion fails to engage in the crown wheel
	•									Replace pinion or whole starting motor
										No connection with oil pressure switch
										Connect and check the connection to earth of the pressure switch.
					•					Excessive speed upon starting
					•					Calibrate the electronic revs. regulator.
					•					Immediate alarm due to fuel reserve
					•					Fill up with fuel or disconnect level device
					•					Immediate alarm due to excessive voltage
					•					Replace the voltage regulator.
					•					Low oil pressure
					•					Replace pressure switch.
						•				High motor temperature
						•				Replace thermostat
							•			CG fuse blown
							•			Replace 10x38 fuse with identical fuse
							•			Remote switch coil burnt
							•			Replace coil
							•			No voltage output by generator
							•			Request assistance
								•		CR fuse blown
								•		Replace fuse with identical fuse
								•		Remote switch coil burnt
								•		Replace coil
									•	Not earth reference on mains sensor
									•	Check earthing of generator control panel and accessories
									•	Defect in stopping system
									•	Clean from dirt, lubricate or replace
									•	Emerg.stop p.button pressed
									•	Turn and pull up to release p.button
									•	Motor too cold
									•	Repair or replace pre-heating system

FILE	VER	LAST ISSUE	LANG.	PAGE
AC01-MT-GB4 NEW	jjg/02	05/03/2003	ENG	Page 56 of 56