

DESCRIPTION | **AUTOMATIC PANEL (AC-02)**

GENERATOR SETS PRAMAC POWER ENGINEERING BASIC SERIES ($\leq 40\text{kVA}$)

Main features:

Automatic control panel for automatic starting of the Genset. The panel is provided with a control unit based on microprocessor mod. **AC-02** for control, monitoring and protection of the generating set. It also manages the change over switching Mains/Genset (when change over contactors are included): the load is transferred from Mains to Genset in case of Mains failure or voltage out of limits, and once the Mains voltage returns into the rated values, the load is transferred from Genset to Mains. All delays are programmable on the AC-02.

Fig.1: Control unit AC-02 with digital display for monitoring all parameters.



Fig. 1

CONTINUOUS USE

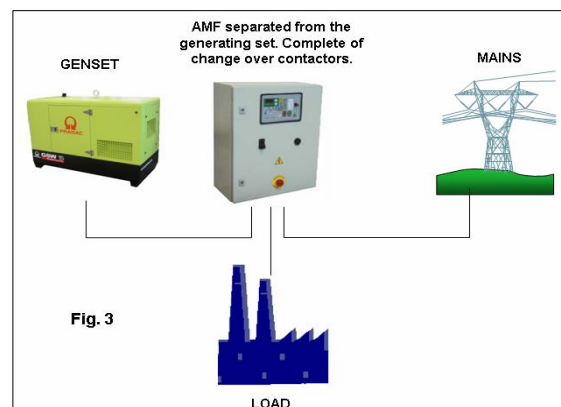
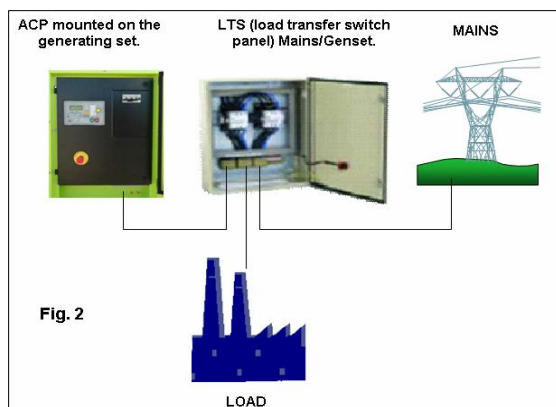
The **ACP** panel can be used as manual panel for continuous running by means of both START/STOP push buttons and the selector switch positioned on MANUAL START mode.

STANDBY USE

There are two versions of control panel available for standby use:

- **ACP + LTS**: complete with an Automatic Control Panel (ACP) completely integrated or mounted on the genset, and a Load Transfer Switch panel (LTS) built in a separated metal cabinet (supplied loose). The LTS panel is delivered with 5m of control cable.
- **AMF**: single control panel complete with all devices for control, monitoring, protection, and change over contactors for the transferring of load. It is supplied loose from the genset for wall mounting. The AMF panel is delivered with 5m of control cable.

Below (fig. 2 and 3) are shown both versions of automatic control panel available for Standby use:



System Operation:

The AC-02 (mounted on the front of the panel) shows continuously the Mains source voltage (**3 phases sensing**); in case of Mains failure or voltage out of margin the AC-02 operates as follows:

1. Opening of the Mains contactor (mounted into the LTS or AMF panel).
2. Starting of the generating set and closing of the genset contactor (mounted into the LTS or AMF panel); since this moment on, the load is supplied by the generating set.
3. When the Mains is restored into the rated values, the AC-02 opens the Genset contactor (after an adjustable delay) and closes the Mains contactor; since this moment on, the power is supplied by the Mains source.
4. The Generating set keeps running for an adjustable period of time to cool down the engine.

MAIN COMPONENTS SUPPLIED WITH THE "ACP" PANEL:

- ▶ CONTROL AND PROTECTION MODULE (AC-02).
- ▶ MAIN CIRCUIT BREAKER.
- ▶ EMERGENCY STOP BUTTON.
- ▶ AUTOMATIC BATTERY CHARGER.
- ▶ DIFFERENTIAL PROTECTION.

MAIN COMPONENTS SUPPLIED WITH THE "AMF" PANEL:

- ▶ CONTROL AND PROTECTION MODULE (AC-02).
- ▶ EMERGENCY STOP BUTTON.
- ▶ AUTOMATIC BATTERY CHARGER.
- ▶ CHANGE OVER CONTACTORS.

CONTROL AND PROTECTION MODULE (AC-02). Complete of:

- 6 positions selector switch for selection of the operation mode of the generating set.
- Manual start push-button.
- Manual stop push-button.
- Push-button silent/reset/enter (unlock of acoustic alarm, programmation, reset).
- Left-Right push-buttons for selection of the measurements reading on the display.
- Alphanumeric three-digital display for monitoring of parameters and description of alarms.
- Visual synoptic for the following indications by means of led's: CR (Mains contactor situation), CG (Genset contactor situation), Mains alive, Genset working, Overload protection.
- Block of led's for failures indication: alternator battery charger, low oil pressure, high water temperature, low water level, low fuel level, local or remote emergency stop, free alarm (ALARM 1), start failure.
- Block of led's for: battery supply, parameter shown on display (flashing when failure).

OPERATION MODE SELECTOR SWITCH

On the front of the AC-02 module there is a 6 positions selector switch to change the type of operating mode:

Automatic test: Automatic starting of the genset without desconnecting the Mains power supply from the utility. When the it switched again to AUTOMATIC position, the genset stops following a delay (1 minute approx.). In case of Mains failure during the running test, the logic system will carry out the load transfer switching by transferring the load from the Mains to the Genset.

Application: useful for periodic tests or running test for maintenance.

Automatic running: when a Mains failure take place, the AC-02 disconnect the load by opening the CR (Mains contactor). If the genset does not run at the first attempt, other 4 attempts will follow the starting sequence. Once the genset is started, and 10 seconds after (approx.) the genset powers the utility by closing the CG (genset contactor). During the genset running, the AC-02 controls any anomaly, failure or alarm (shown on the display); in case of any failure, the genset will stop following the established steps.

When the Mains source returns within the rated values, the load is switched back to Mains and the genset stops after a cooling down period (adjustable delay).

Application: common way of functioning.

Locked engine: the genset stays in a blocked state, and every possibility of starting is dissabled when the Mains is powering the utility. This mode of operation is used to work on the system in complete safety even if there is a Mains failure.

Application: useful for maintenance works.

Manual Mains: this mode enables a forced supply by the Mains by closing the CR (Mains contactor) even if there is a failure on commands or control electronic devices.

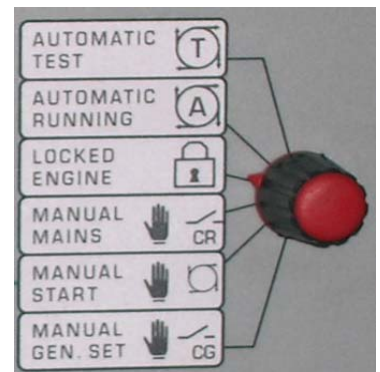
Application: useful for periods of time in which the genset remains disabled.

Manual start: this mode enables the genset to be started and stopped manually by means of both START and STOP push-buttons. The position allows the direct command of the starting without interposition of electronic components, to warrant the operativeness of genset with electronics not in use too.

Application: useful for manual emergency controls, manual operation or maintenance purposes.

Manual genset: this mode enables a forced supply by genset.

Application: useful for manual procedures or in case of problems with the automatic functions.



MANUAL START/STOP PUSH-BUTTON

Once selected the "MANUAL START" position on the selector switch, both START and STOP manual push buttons are enabled to manage the running of the generating set manually by disabling the automatic start in case of Mains failure.



PUSH BUTTON SILENT/RESET/ENTER

Alarm silencing: pushing the button during 2 seconds.

Reset functions: once the acoustic alarma has been silenced, push the button during 2 seconds to reset the alarm status and restore the functions.

Enter: push the button during programming works to confirm.



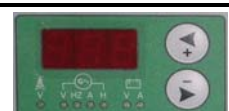
DISPLAY PUSH BUTTONS

Display reading push button. Are used to select the reading page required and to programm the weekly timer as well. With the selector switch in BLOCK position and pushing both +/- buttons during 2 seconds the LED TEST begins.



DIGITAL DISPLAY

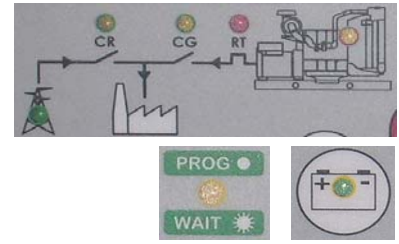
Alphanumeric display for visualization of all parameters measured by the AC-02, and literal descriptions of the type of alarms. See the lists below for more information.



SYNOPTIC FOR STATUS MONITORING

The visual synoptic shows the state of the plant by lighting the following LED's:

- Mains source tower: indication of power supplied by the Mains.
- CR: indication of Mains contactor closed.
- CG: indication of Genset contactor closed.
- RT: indication of overload protection.
- Generator: indication of power supplied by the Generator.
- Battery: indication of AC-02 powered by the battery/ies.
- Prog/Wait: indication of microprocessor in progress.



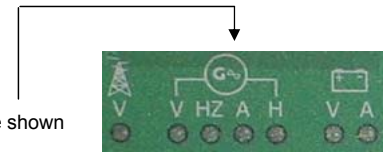
Measurements, alarms and shutdowns shown on display.

Parameters measured on display

- Mains voltage.
- Generator voltage.
- Generator frequency.
- Generator current (1 phase).
- Hours counter.
- Battery voltage.
- Battery charging current.

If an alarm is enabled, it is shown on the display.

The display is complete with a block of led's, placed below the screen of the display, to indicate the measure shown on display as well as any anomaly on the measured parameters by flashing the corresponding led.

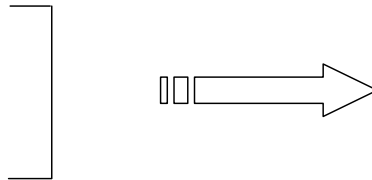


Alarms with signalling (without shutdown).

- Start failure.
- Low water level.
- Hour counter (maintenance requirement).
- Battery overvoltage.
- Battery undervoltage.
- Battery overload.
- Acoustic alarm.

The following alarms are visualized by led's on the front of the AC-02:

- Alternator battery charger.
- Low oil pressure.
- High water temperature.
- Low water level.
- Low fuel level.
- Local or remote emergency stop.
- Free alarm (ALARM 1).
- Start failure.



Alarms with shutdown.

- Low oil pressure.
- High water temperature.
- Alternator battery charger.
- Alarm available.
- Overvoltage.
- Undervoltage.
- Overload.
- High frequency.
- Low frequency.
- Emergency stop button.

MAIN CIRCUIT BREAKER / DIFFERENTIAL PROTECTION

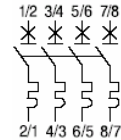
Pramac Generating Sets **Basic Series** are equipped with **GENERAL ELECTRIC** as standard on **MCP** and **ACP** panels. The main circuit breaker is used for protection against overloads and short-circuits, and the differential protection is used to protect against earth leakages in case of direct contacts.



Circuit breaker model: EP & HTI Series.
Differential protection model: FP Series.

CIRCUIT BREAKER: on all the range **25A-125A** (In) of Generating Sets Basic Series supplied by Pramac the circuit breakers follow the features below:

- Series EP60 for 25A-63A and Series Hti for 80A-100A.
- 4 poles (from 25A to 63A) and 3 poles (from 80A to 100A).
- Automatic breaking.
- Modular type.
- Fixed circuit breaker (type of construction).
- B breaking curve.
- Overload (thermal protection relays) not adjustable.
- Short-circuit (magnetic protection relays) not adjustable.



Standard application rule: IEC 60898 (thermal-magnetic circuit breakers).

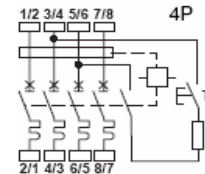
DIFFERENTIAL PROTECTION: on all the range **25A-100A** (In) of Generating Sets Basic Series supplied by Pramac the earth-leakage module is mounted on the panel combined with the automatic circuit breaker.

The differential protection is directly tripped by the differential of current through any of the three phases (differential current between input and output) connected to the device.

Main features:

- Series FP for 25A-100A.
- 4 poles.
- Sensitive ($I_{\Delta n}$): **30mA**.
- Operating frequency: 50/60 Hz.
- Tripping time to $I_{\Delta n}$: <40ms. (instantaneous).
- Tripping time to $I_{\Delta n}$: >150ms. (selective).

Standard application rule: IEC 61008-1 (simple earth-leakage circuit breakers).



NOTE: Pramac reserves all rights to change the earth-leakage thermal-magnetic circuit breakers by other brand with the same characteristics (**Bticino**) according with the availability of material.



EMERGENCY STOP BUTTON

Built on the panel by means of a mushroom red button for an easy and quick access. The machine is directly stopped though the emergency stop button by opening the generating set contactor.



AUTOMATIC BATTERY CHARGER

The battery charger is completely controlled by the microprocessor. It keeps the starting battery charged with a maximum load of 5A by means of a self-adjusted charging to compensate the consumption and avoid the discharge of the battery.

The voltage and current of the battery can be shown on the display of the control unit AC-02.

The transformer is supplied for external fixation (inside the panel) to the AC-02.

The battery charger is equipped with:

- Automatic breaking of the charge during the cranking period and operation of the Genset.
- Electronic current restriction to avoid loads too high.
- Electronic voltage restriction to limit the maximum load levels.
- Protection against short-circuits.
- Protection against inverted polarity.
- Protection against high input voltage.
- Protection against low battery voltage for excessive discharge.

CHANGE OVER CONTACTORS FOR LOAD SWITCHING

Change over contactors are supplied to allow the stand-by use (Emergency to Mains) of the Genset. In this case, and with the selector switch positioned on AUTOMATIC mode, the Genset is able to start automatically by Mains failure following the sequence detailed at the beginning of this document.

Pramac gives the availability of control panels for Emergency use equipped with change over contactors through 2 different types of panels:

- ▶ **LTS:** Load Transfer Switch panel. It must be ordered as an accessory for gensets with ACP control panel mounted. The LTS is delivered loose from the genset in a metal cabinet for wall mounting.
- ▶ **AMF:** Automatic Mains Failure panel. It must be ordered together with pre-wired gensets. The AMF panel is delivered loose from the genset in a metal cabinet for wall mounting.

Both LTS and AMF panels are provided with the following equipment to permit the transferring of load MAINS/GENSET and GENSET/MAINS:

- 4 Poles automatic change over contactors of proper capacity: AC-1 Amperes(IEC).
- Mechanic and electric interlock between Genset and Mains contactors.
- Internal plinth row for connection (control cables) between genset and LTS/AMF panel.
- Internal terminal box to connect (power cables): GENSET - LOAD - MAINS.
- 5 meters of control cable for connection between genset and LTS/AMF panel.
- Emergency stop button.

NOTE

The following equipment is not included on the standard scope of supply:

- Power cables from pre-wired genset to AMF panel.
- Power cables from ACP panel to LTS panel.
- Protection lines for Mains, utilization and auxiliary services.
- Current transformers (CT) for measurement from Mains.