CRONOS **RLG 3000**
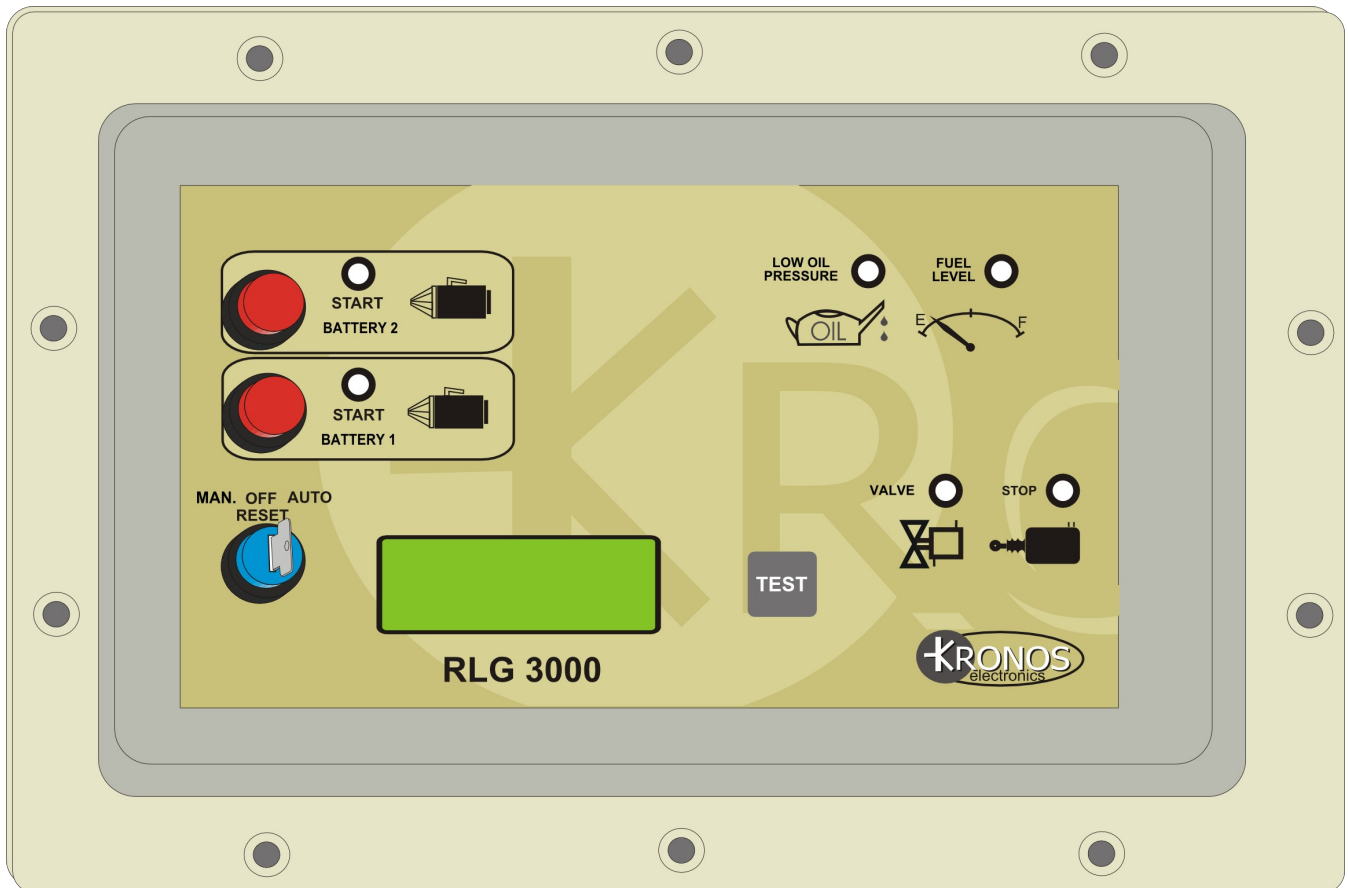# FIRE-FIGHTING ENGINE CONTROL UNIT
(*EN 12845* COMPLIANT)

PLASTIC FRAME ABS DIN 7728

FRAME OUTER DIMENSIONS:
WIDTH 30 cm – HIGHT 20 cm

HOLE CUT DIMENSIONS:
WIDTH 26,7 cm – HIGHT 17,2 cm

Version 1.2

RLG 3000 - UNIT DESCRIPTION

RLG 3000 is a fire-fighting, diesel engine pump auto-start unit, compliant with the **EN 12845** European Union Directive.

The electronic starting unit has been designed and built with modern electronic technology to provide ease of handling, information to the user for all operations and high reliability.

At the front of the unit are:
- Switch with key with MAN(ual) – OFF/RESET – AUTO positions. The key can be removed in all positions.
- Two START buttons -one for each battery set- to start the engine in manual mode.
- TEST button that tests starter motor and batteries, attempting repeatingly to start the engine, but not giving fuel for it to start.
- A two-line character Liquid Crystal Display showing to users the most useful information at every point of the operation in AUTO.
- Indicative LEDs for basic functions.

At the back of the unit are:
- Two dip-switches, one to make the internal hour-meter zero, and another to permit, in addition with the magnetic sensor, the D+ of the alternator to cut-off the starter. (This is besides the directive EN12845).
- A small screwdriver potentiometer, to adjust stopping time for engines that stop by activating a solenoid for a few seconds.
- A small screwdriver potentiometer, to adjust the engine RPM at witch the starter is cut-off by the proximity sensor.
- A row of terminals to connect the RLG 3000 unit with the engine.
- A row of terminals of 4 changeover contacts for remote indication.
- A slow acting fuse of 3A (or a 4A fast) of size 5X20mm. This fuse protects the internal circuitry and all the outputs except the two start commands. No individual output or all used at the same time should exceed 3 Amperes. Some outputs have lower max continuous current, as sown at the schematic at the last page. If more current is needed please use a relay.

User adjustments have been kept to a minimum to maximize the ease of use.

RLG 3000 is a unit capable of handling engines with electric systems of 12 or 24 Volts. All digital inputs are activated with the connection of the negative pole "-" potential (ground – engine body), while the outputs -when activated- give the positive voltage of the battery (12 or 24 V). Remote indication terminals are cold contacts -no voltage. Charger inputs, battery connections and alternator D+ terminal are analogue and internally measured. At terminals 20 and 21 an Emergency Stop button is connected (**N**ormally **C**losed) or else a bridge is needed by the unit to operate.

OPERATION

The key switch in OFF/RESET position. The unit is not active. Only a STOP command may be given if the unit was in start or run mode before the switch was placed in OFF position.

The key switch in MAN position. The user by pressing the 'START BATTERY 1' or 'START BATTERY 2' button can manually start the engine, using the corresponding battery to give power to the starter motor. In manual mode there is no 'starter pinion engaged' control no any other possible malfunction supervised by the unit. The LCD is off. To switch off the engine the key switch must turn back in OFF/RESET position.

AUTOMATIC OPERATION:
The key switch must be in AUTO position. The unit begins by displaying its name on the LCD and if the dip-switch SW1 is OFF, also displays an 'EN 12845' compliance message. The nominal operating voltage is displayed next, 12 or 24 Volts and then the total working hours of the engine. After that, the unit enters stand-by mode, displaying continuously battery voltages and charger currents to the batteries.

Starting procedure begins when one of the two 'closed under pressure' switches, connected in term. 10 and 11, opens. Then, RLG 3000 will make up to 6 attempts to start the engine, 3 with each battery.

The unit makes the first attempt with the first battery and displays: `'BATTERY 1 / ATTEMPT 1'`. The number of every attempt is displayed separately for each battery. Between attempts the message: `'WAIT...'` is displayed.

During each start attempt, RLG 3000 checks the battery providing power, to validate its charge. If found inadequate, the start attempt is interrupted and this battery is not used in the later attempts. The attempts remaining to be done with this battery are added to the other battery. This way the unit can make 6 attempts total, even if one battery is out of charge.

During each start attempt the unit checks that the starter motor pinion has been engaged fully through terminal 14, witch is connected to the output of the starter motor power relay, witch in turn is mechanically connected with the pinion. If the starter motor fails to engage with the engine the message: `'STARTER NOT FULLY ENGAGED!'` appears. This one attempt is canceled. The battery will be used again if its turn comes.

If after 6 attempts, the engine is still not started, the unit displays: `'ERROR: START FAILURE'`. Also the backlight of the display flashes and the sounder (siren, buzzer) connected to term.13 operates intermittently. Then, if a failure to engage has been detected during the last attempt, the message: `'STARTER ENGAGE FAILURE!'` will appear, and will remain on display.

If during start attempts, both batteries are detected without charge, the unit will stop attempting to start and the message: `'EMPTY BATTERIES!'` will appear.

If any of the above happens, the unit will not take further action and will remain asking for user intervention with the siren. The key switch must then be turned to OFF/RESET to reset.

RLG 3000 is using a sensor counting engine revolutions to determine engine start and cut-off the starter motor. As a sensor, many types of DC inductive proximity sensors can be used, two or three-wire, both PNP and NPN, both Normal Closed and Normal Open types. As soon as engine RPM rise over the set point (see 'adjustments' paragraph), the unit quits the start attempt and displays the message:`'ENGINE RUNNING'`. The unit may use the alternator as well to detect if engine has started to cut-off the starter motor (by setting SW1=ON) although this is besides the European directive.

After the engine has started, the display shows continuously on the top row the total hour-meter and on the bottom row animated bars showing normal operation.

The hour-meter counts with resolution of one minute, the time the engine runs and can be set to zero by putting momentarily dip-switch SW2 in ON position when the unit is on stand-by or engine running mode. This way we can check service and maintenance intervals.

If during a start attempt, a battery is found to be inadequately charged, this appears on screen e.g. `'BATTERY 2 OFF!'` after start. In this case the LCD backlight blinks and the sounder operates momentarily the whole time engine is running. When the key switch goes to RESET the unit resets any '*bad*' battery to '*good*' and it will be used again when its turn comes to start the engine.

A battery can be set as 'bad' by the unit for a number of reasons. If the maintenance technician decides that a battery must be removed, taken proper care of course, the unit can operate temporarily with only one battery. *If RLG 300 detects the moment key switch is turned to AUTO, that operates with one battery, does not alternate attempts, makes them all with the battery connected, without checking for its charge state. Starter motor engage detection still applies*.

When, during engine running, a (-) signal appears to any fault control input, this will show immediately on screen, without the engine stopping. The display may show:

`LOW OIL PRESSURE – HIGH TEMPERATURE – BELT BREAK – LOW FUEL LEVEL`

From the moment the engine has started, and for the whole time the unit is working in AUTO, the pressure switches that give the start command (terminals 10 and 11) **are ignored.** The engine **stops only manually** by turning the key switch in OFF / RESET position.

TEST FUNCTION: The unit includes the capability to test the starter as well the strength and durability of the batteries by continuously repeated starting attempts.

With the key switch in AUTO position and the pressure switches closed, TEST button must be pressed continuously for 4 sec. The message:`'TESTING STARTER AND BATTERIES'` displays on screen and the unit begins to make starting attempts, alternating the batteries but without letting the engine start. The stop solenoid is operated during every attempt. Attention: This procedure is stopped by the user by turning the key switch to OFF position. If the unit is left operating in this mode for long **the batteries will become empty** and the starter motor may overheat.

REMOTE INDICATION: Four relays for remote indication operate when: 1-Automatic mode disabled 2-Engine running 3-Start failure 4-Automation fault

ADJUSTMENTS: There are two small potentiometers below the terminals.
The first, that adjusts the stop time, must be set according the time the engine needs to stop and not too much, because the stop actuator solenoid:
a) consumes a lot of current and drains the battery
b) overheats easily – is not designed for continuous operation.

The second potentiometer adjusts the revolutions per minute of the engine's flywheel at witch the starter motor will be cut-off.
To set this correctly, the easiest method is to adjust it in manual mode as follows:
The key switch must be in MAN position. The engine must be prepared so it will not start by keeping the stopping cable pulled (or disconnecting the fuel valve). The potentiometer is adjusted fully anti-clockwise. Then a manual START button must be pressed. The engine's flywheel revolves by the starter motor and the led RUN just next the potentiometer lights up. With the button pressed and the engine revolving, the potentiometer is adjusted clockwise until the LED turns off. The correct adjustment position is just there.
As soon as the engine obtains more RPM, revolving by its own, the starter motor is cut-off and pulled out to disengage.
The engine must now be made able to start again and the key switch turned in the desired position. To verify the correct adjustment a start in automatic mode may be useful.

Parameters while operating in Auto

Start wait from pressure command	4 sec		Starting time	10 sec
Starting attempts	6		Wait between starts time	5 sec

Connection diagram