AGSC - 05

MICROPROCESSOR DEVICE
FOR CONTROL OF AN AUTOMATIC TRIPPING GENSET

GENERAL

AGSC - 05 is an electronic device destined for engines and power plants.

- ☞ Based on microprocessor tchnology
- ☞ Make the managment of the genset easier
- ☞ Can manage the plant under safe conditions
- ☞ Can manage an abandoned plant

MAIN FEATURES

The load transfer can be executed in two modes:

- AUTOMATIC MODE: if one mains failure occurs, the controller transfers the load to the generator until the normal mains condition is restored. When the mains voltage becomes normal again the load is transferred to the mains and an engine cooling cycle starts
- MANUAL MODE: start/stop operations and mains-to-generator load transfer and vice-versa can be done by an operator by use of the control buttons on the front panel.

The controller provides:

- ☞ Complete engine/generator protection and monitoring of alarms and faults. The operator is kept informed by several visual warnings on the front panel.
- ☞ Complete control of engine and power generation plant by monitoring gen set conditions and functional status, and displaying voltages, currents, frequencies, etc.
- ☞ Parameters setup by pushing the control buttons on the front panel. No additional external device is needed.

FRONT PANEL

There are four operator's interface areas:

a) Alarms and faults (on the left)
b) Electrical and functional measurements (at center)
c) Functional status of the card (at the top)
d) Operating status of the gen set (at the bottom).

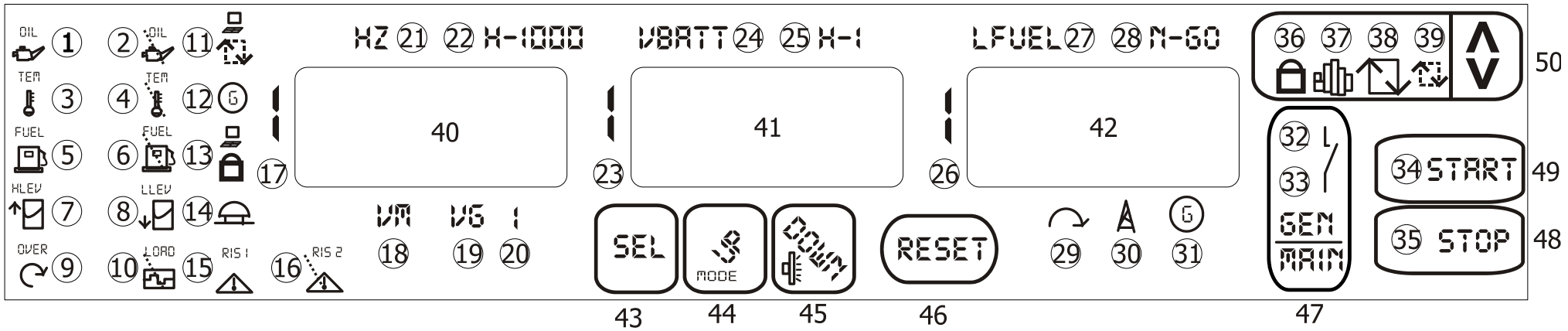
Automatic self-diagnosis

The control unit has a self–diagnosis function, which is executed at every power-on of the electronic card from the battery and is signaled by the triple lighting of all optical signals, together with the emission of three special aural tones by the internal beeper.
The current software version code is shown on the three displays.
When the **RESET** button is pressed, the **LOCKED** mode is forced, and the initial safety stop cycle is skipped.

Alarms and faults

The controller has an independent optical signal (led) for every alarm and fault.
All alarms and faults are tabulated below.
In the table you find legend **Pxx**. it indicates the programming parameter that controls the behavior of the related alarm – fault, such as the applicable delay or the threshold set for the available analog value, etc.. refer to the table regarding the programming steps provided in the following.

FRONT PANEL LAYOUT



	Info	Color
1	oil alarm	Yellow
2	oil fault	Red
3	temperature alarm	Yellow
4	temperature fault	Red
5	fuel reserve	Yellow
6	fuel exhausted	Red
7	high fuel level	Yellow
8	low fuel level	Yellow
9	overspeed	Red
10	overload	Red
11	remote test	Green
12	generating set protection	Red
13	remote start inhibited	Yellow

	Info	Color
14	emergency stop	Red
15	alarm 1	Yellow
16	alarm 2	Red
17	1000x display, left	Red
18	mains three-phase voltage	Green
19	generating set three-phase voltage	Green
20	three-phase current	Green
21	generating set frequency	Green
22	thousands of running hours	Green
23	1000x display, middle	Red
24	battery voltage	Green
25	running hours	Green
26	1000x display, right	Green

	Info	Color
27	fuel level	Green
28	number of engine starts	Green
29	engine running	Green
30	mains voltage on	Green
31	generating set voltage on	Green
32	generating set delivery	Green
33	mains delivery	Green
34	engine starting in progress	Red

	Info	Color
35	engine stop in progress	Red
36	lock mode	Red
37	manual mode	Yellow
38	automatic mode	Green
39	test mode	Green
40	three-digit display, left	Red
41	three-digit display, middle	Red
42	three-digit display, right	Red

	Button	Function
43	SEL	measurement selection – next program step
44	UP	scrolling mode reversal – increases value in program
45	DOWN	aural warning silencing – decreases value in program
46	RESET	resets alarms and faults, restores to operation
47	GCB-MCB	"manual" mode: transfers load from mains to generator and viceversa (toggle)
48	STOP	"manual" mode: stops gen set
49	START	"manual" mode: starts gen set
50	MODE	selects type of gen set operation

INPUTS

N	TERMINAL	DEL (SEC)	DESCRIPTION	NOTES	TYPE
1	M8-35	2	Low oil pressure	Enabled after P29 seconds by the "engine running" status	Alarm
2	M8-36	2	Low oil pressure	Enabled after P29 seconds by the "engine running" status	Fault
3	M8-37	2	High water temperature	Enabled after P29 seconds by the "engine running" status	Alarm
4	M8-38	2	High water temperature	Enabled after P29 seconds by the "engine running" status	Fault
5	M8-41 Or P13 fuel level threshold	6	Fuel reserve	No latch * * if P34 = 1, input for "stop engine" after 3 min	Alarm
6	M8-40	6	Fuel exhausted	Always enabled	Fault
7	M9-44 Or P12 fuel level threshold	2	High fuel level	No latch	Signal
8	M9-45 Or P11 fuel level threshold	2	Low fuel level	No latch	Signal
9	M8-42 Or P09 frequency threshold	0,1	Overspeed	Instantaneous	Fault
10	M8-39 Or P10 current threshold	P30	Generator overload	Delay time for fault set by P30	Fault
11	M9-46	0	Emergency stop	Always enabled	Fault
12	M9-50	2	Spare alarm 1	Input free for alarm	Alarm
13	M9-51	2	Spare alarm 2	Input free for lock	Fault
14	M9-51	2	Max fuel level (service function activated M9-49)	Input free for alarm	Alarm

N	TERMINAL	DEL (SEC)	DESCRIPTION	NOTES	TYPE
15	Voltage threshold p03 or P04 or frequency threshold P05 or P06	3	Generator protection	Min and max generator voltage and/or frequency	Fault
16	Number of attempted starts P19 exceeded	--	Starting failure	Start/stop cycles exceeded	Fault
17	Battery voltage threshold P14 or P15	2	Battery voltage fault	Not memorized max. Or min. Battery voltage. Battery voltage visualization is forced and the related led blinks	Alarm
18	M9-48	--	Inhibition of starting	With input present there is no start/no load transfer	Fault

ELECTRICAL AND FUNCTIONAL MEASUREMENTS OF GEN SET

The device is equipped with 3 high-brightness digital displays, each of them with 3 digits for a numerical range from 0 to 999. Thousands are shown by led "one" on the left side of the display.

The type of actual measurement is indicated by the optical indicators on the upper central part of the front panel. Also the icon of the selected measurement is signaled by a led.

The available measurements are:

- **Vm** = mains three-phase voltage
- **Vg** = generator three-phase voltage and phase neutral
- **I (*)** = load current (CT ratio is set by the P33 software parameter)
- **VA** = supplied power and percent referred to nominal power of generator (power-on load).

- Minimum current value displayed is 5% of value related to current transformer (CT)

The three displays show the voltage or current measurements for mains and generator for phase L1 – L2 – L3.
The power (**kVA** apparent) value and percentage are visualized on the L1 - L3 displays

Measurement resolution is about 1.5%.
Calibration of the card measuring devices is performed at the laboratory by use of a special calibration device. Any adjustment of the calibrations because of special characteristics of the plant (e.g.: to make up for a light unbalance of the voltage supplied by the alternator), must be carried out at the time the system is set into service by acting on the related trimmers located inside the controller.

Other displayed measurements:

Left display

- **f** = generator frequency
- **hx1000** = thousands of engine running hours

Middle display

- **vb** = battery voltage
- **h** = generating set running hours (unit of)
- **bar** (optional) = oil pressure (unit of, actual measurement is displayed on right display)
- **c** = engine water temperature (unit of, actual measurement is displayed on right display)

Right display

- **liv** = fuel level (only if there is level sensor in the tank)
- **nstart** = number of starts since installation
- **oil pressure** (opt) = oil pressure (the related unit of measure is shown on middle display)
- **engine water temp.** (opt) = engine temperature (the related unit of measure shown on middle display).

CONTROLLER OPERATING MODE

There are four controller operating modes available:

LOCKED (ENERGY SAVING)
MANUAL
AUTOMATIC
TEST

Shift between modes occurs according to the procedures described in the following pages (use of buttons MODE and MODE+UP)

GEN SET OPERATING MODE

Led indication of operating mode of gen set

MAINS LIVE
MAINS CONTACTOR STATUS
GENERATOR CONTACTOR STATUS
GENERATOR PRESENCE
ENGINE RUNNING
START CYCLE
STOP CYCLE

The start and stop cycle leds blinking together indicate "starting fault." In case of fault due to failed starting, the concurrent coming on with blinking light of the start and stop leds at the end of the number of set cycles and the aural warning highlight the condition.

Some visual auxiliary status indications are also available, as follows:

- Start command in **"TEST" MODE (external)** (command of weekly test timer from AGSC – 05 logic, if programmed; visual indication blinks to signal this operating condition)

- Gen set operating mode selection:

  - LOCKED
  - MANUAL
  - AUTOMATIC
  - TEST

- **START INHIBITION** (external command to inhibit gen set operation)

OPERATOR'S CONTROL BUTTONS

Each of the areas described above has one or more buttons.

Alarms and faults are operated through the **RESET** button

RESET it resets alarms and faults.

Gen set electrical and functional measurements. The described functions are activated depending on the operating mode selected for the gen set.

Mode selection: manual, or automatic, or test

SEL it allows the selection of the measurement to be shown on the displays

UP it allows reversal of the selection of the operating mode (together with the MODE button)

DOWN it silences the acoustic warning.

Mode selection: locked

SEL it allows going to the next programming step

UP it allows the increase of the selected numerical value during card programming setup

DOWN it allows the decrease of the selected numerical value during card programming setup

MODE Device operating mode.
It allows the selection of one of the four gen set operating modes available
(*LOCKED – MANUAL - AUTOMATIC - TEST*).

To change operating mode press key MODE. The mode changes by one step at every pressure, starting from the first position, "LOCKED," to the fourth position, "TEST".

To avoid wrong or incorrectly timed operations, press the MODE key and concurrently hold the UP key to return to the previous selection or reverse direction of mode change. The mode changes by one step at every pressure, starting from the fourth position, "TEST," to the first position, "LOCKED".

Release the UP key after setting the desired gen set operating mode.

Gen set operating mode

GCB – MCB = Enabled only in manual mode. It allows load transfer from mains to generator and back. (Mains Contactor Breaker – Generator Contactor Breaker)

START = Enabled only in manual mode. It allows gen set start (engine start).

STOP = Enabled only in manual mode. It allows gen set stop (engine stop).

INTERCONNECTION TERMINAL BOARDS

LEGEND:

CT = CURRENT TRANSFORMER
GCB = GENERATOR CONTACTOR BREAKER
MCB = MAINS CONTACTOR BREAKER
NC = NORMALLY CLOSED
NO = NORMALLY OPEN

M1	1	PHASE R, GENERATOR	
M1	2	---	
M1	3	PHASE S, GENERATOR	
M1	4	---	
M1	5	PHASE T, GENERATOR	
M1	6	---	
M1	7	---	
M2	8	COMMON RELAY, MCB	
M2	9	NC RELAY, MCB	
M2	10	NO RELAY, MCB	
M3	11	S1 C.T. PHASE R	
M3	12	S2 C.T. PHASE R (GROUND)	
M3	13	S1 C.T. PHASE S	
M3	14	S2 C.T. PHASE S (GROUND)	
M3	15	S1 C.T. PHASE T	
M3	16	S2 C.T. PHASE T (GROUND)	
M4	17	+ ENGINE RUNNING |	INPUT GEN SET RUN (8-35Vdc)
M4	18	- ENGINE RUNNING |	OPTICALLY ISOLATED
M5	19	TX, SERIAL |	
M5	20	RX, SERIAL |	SERIAL PORT
M5	21	GND |	(not insulated serial interface – use only for service)

M6	22	**COMMON RELAY**
M6	23	RELAY, START
M6	24	RELAY, STOP
M6	25	RELAY, SPEED CONTROLLER SUPPLY
M6	26	RELAY, GEN SET RUNNING (REMOTE SIGNAL)
M6	27	RELAY, CUMULATIVE ALARMS (REMOTE SIGNAL)
M6	28	RELAY, GLOW PLUGS PREHEATING
M6	29	+12Vdc VOLTAGE, ALTERNATOR ENERGIZING
M6	30	+24Vdc VOLTAGE, ALTERNATOR ENERGIZING
M6	31	INPUT, ANALOG, FUEL LEVEL FLOAT
M7	32	+24Vdc, BATTERY
M7	33	+12Vdc, BATTERY
M7	34	INPUT, NEGATIVE, BATTERY
M8	35	INPUT, NEGATIVE, OIL ALARM
M8	36	INPUT, NEGATIVE, OIL FAULT
M8	37	INPUT, NEGATIVE, TEMPERATURE ALARM
M8	38	INPUT, NEGATIVE, TEMPERATURE FAULT
M8	39	INPUT, NEGATIVE, THERMAL PROTECTION
M8	40	INPUT, NEGATIVE, FUEL RESERVE
M8	41	INPUT, NEGATIVE, FUEL EXHAUSTED
M8	42	INPUT, NEGATIVE, OVERSPEED FAULT
M8	43	---
M9	44	INPUT, NEGATIVE, HIGH FUEL LEVEL
M9	45	INPUT, NEGATIVE, LOW FUEL LEVEL
M9	46	INPUT, NEGATIVE, EMERGENCY STOP
M9	47	INPUT, NEGATIVE, REMOTE TEST
M9	48	INPUT, NEGATIVE, STARTING FUNCTION DISABLED
M9	49	INPUT, NEGATIVE, "SERVICE"
M9	50	INPUT, NEGATIVE, SPARE 1
M9	51	INPUT, NEGATIVE, SPARE 2

M10	52	INPUT, POSITIVE, OIL SENSOR,	OPTIONAL (VDO COMPATIBLE)
M10	53	INPUT, NEGATIVE, OIL SENSOR	
M10	54	INPUT, POSITIVE, TEMPERATURE SENSOR	
M10	55	INPUT, NEGATIVE, TEMPERATURE SENSOR	
M11	56	COMMON RELAY, GCB	
M11	57	NC RELAY, GCB	
M11	58	NO RELAY, GCB	
M12	59	PHASE L1, MAINS	
M12	60	---	
M12	61	PHASE L2, MAINS	
M12	62	---	
M12	63	PHASE L3, MAINS	

PARAMETER SETUP

If you want to setup parameters, you need to change the operating mode to LOCKED**.** By pushing buttons RESET and START together for at least 2 seconds you enter the programming phase. The right display shows when this phase is active and you can release the buttons.
The SEL button allows the selection of the required parameter or lets you move to the next step.
If necessary, the concurrent pressure of the SEL and START buttons allows the return to the previous step.
By pressing the STOP button you exit the programming mode, and save the new values.

IMPORTANT NOTE:
When you are in programming mode and you press no button for 30 seconds, the device will force the exit from the mode through an automatic reset of the card (the changed parameters will not be saved). This condition is highlighted by the coming on and off of all the front panel displays and by special aural warnings sounding three times.

The available parameters are listed below:

LEGEND:

GCB	=	GENERATOR CONTACTOR BREAKER
MCB	=	MAINS CONTACTOR BREAKER
UP BUTTON	=	INCREASES NUMERICAL VALUES
DOWN BUTTON	=	DECREASES NUMERICAL VALUES
Xxx/Yyy	=	THREE-PHASE VALUE, OR SINGLE PHASE VALUE, OR OTHER SPECIFIED VALUE

Para.	Description	Meas. Range	Default	Set value	Notes
P01	Minimum mains voltage	0-999v	320/180		For mains present – absent sensor
P02	Maximum mains voltage	0-999v	480/280		For mains present – absent sensor
P03	Minimum generator voltage	0-999v	350/200		For generator min-max voltage alarm
P04	Maximum generator voltage	0-999v	450/260		For generator min-max voltage alarm
P05	Minimum generator frequency	0-65hz	45		For generator min-max frequency alarm
P06	Maximum generator frequency	0-75hz	55		For generator min-max frequency alarm
P07	Generator voltage presence	0-999v	300/170		For generator present sensor
P08	Engine started	0-65hz	10		For engine running sensor
P09	Overspeed	50-70hz	55		For overspeed lock
P10	Generator overload threshold	0-1999a	1999		For lock: *To set the correct value for the overload current threshold you must multiply the value of nominal current by 10 only in case the CTs used are less than or equal to 150/5* ***Ex: Inom=80A, CT 100/5, value P10=800A*** ***Or:*** ***Inom=350A, CT 400/5, value P10=350A***
P11	Low fuel level	0-120%	0		Alarm
P12	High fuel level	0-120%	90		Alarm
P13	Fuel reserve	0-100%	0		Alarm

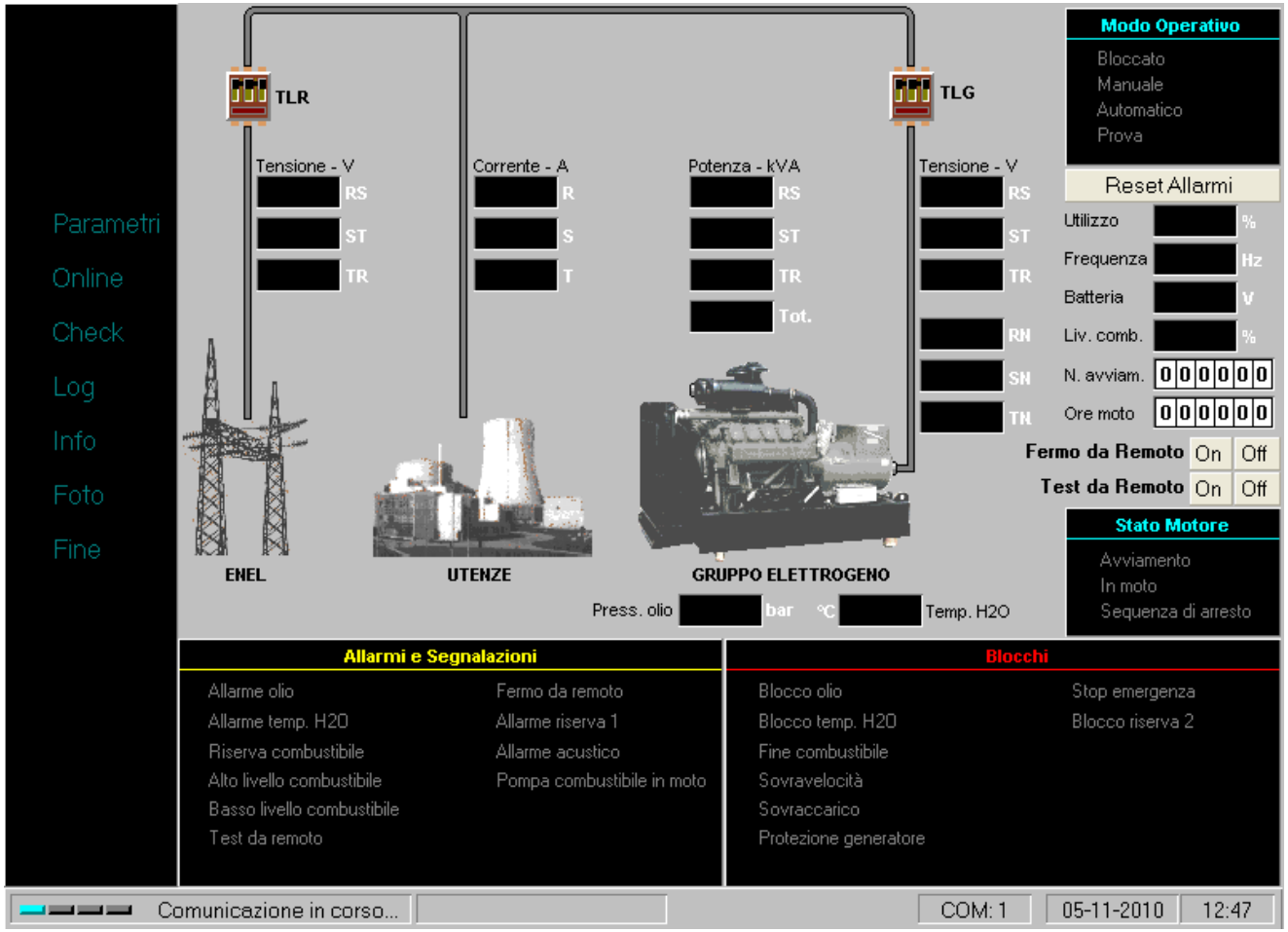
Para.	Description	Meas. Range	Default	Set value	Notes
P14	Minimum battery voltage	0-99.9v	100/220 (12v-24v)		For alarm, value in 1oth of volt
P15	Maximum battery voltage	0-99.9v	170/290 (12v-24v		For alarm, value in 1oth of volt
P16	Spare 1	0-100%	0		Available, currently not used
P17	Spare 2	0-100%	0		Available, currently not used
P18	Stop type	0-1-2-3	0		0=de-energizing 1=energizing 2=de-energizing: the controller freezes measurements 3=energizing: the controller freezes measurements
P19	Number of starting attempts	1-10	3		Number of starting attempts before fault
P20	Acoustic alarm time	0-240s	60		Beeper sounding time
P21	Generator activation delay	1-240s	2		Delay time between mains failure and gen set energizing
P22	Preheating time	1-240s	1		Preheating time (after gen set energizing delay and before command to starter motor)
P23	Time of on-off cycle of starter motor	1-240s	10		On/off time of starter Motor
P24	Generator contactor closing delay	1-240s	4		Delay time to command "generator contactor closed" after "generator on"

Para.	Description	Meas. Range	Default	Set value	Notes
P25	Mains contactor closing delay	1-240(x10)s	6 (x10)		Delay time to "mains contactor closed" after "mains restore". It is set in tens of seconds. E.g. 60 s = P25 = 6
P26	Mains generator interlock time	1-240s	2		Pause between generator contactor release and command to mains contactor
P27	Stop command time	1-240s	30		Stop command time in case of stop when "energized"
P28	Engine cooling time	1-240s	60		Engine idle time. Opening of KG – stop.
P29	Alarm enabled delay time	1-240s	10		Delay time from "engine running" to alarm enabling
P30	Generator overload lock inhibit time	1-240s	1		Delay time for overload acquisition
P31	Interval between two periodic tests (hours)	0-250h	0		0 = disabled
P32	Periodic test duration	0-250m	0		Duration of test condition 0 = disabled
P33	Installed ta type		Inom		Following CT (/5) available: 40, 60, 100, 150, 250, 400, 600, 800, 1000, 1500
P34	Fuel reserve input mode	0-1	0		0=alarm 1=alarm - after 3 min from input present fuel is considered exhausted, with lock and subsequent indication.
P35	Rated power	1-1999kVA	28		Set gen set nominal power for % measurement of power delivered

Para.	Description	Meas. Range	Default	Set value	Notes
P36	Initialization of factory-set parameters	0-can (cancel)	0		Select the "can" value to restore all parameters to default value
P37	Remote control	0-1	0		Inhibits/enables the possibility of receiving start signals for test or delivery 0= enables 1= disables

SERIAL PORT

It is possible to visualize all functional parameters and conditions, statuses, alarms, faults, electrical measurements and operational selections by connecting a personal computer or a serial device for remote control (modem) to serial port M5 (19-20-21), using the software included.



TECHNICAL CHARACTERISTICS

BATTERY SUPPLY	12Vcc, or 24Vcc
SUPPLY RANGE	6Vdc to 35Vdc
OVERVOLTAGE PROTECTION	>36Vdc
STAND-BY CURRENT DRAW (LOCKED)	150mA
MAX CURRENT DRAW IN OPERATING CONDITION	320mA
RANGE OF MAINS ALTERNATING VOLTAGE, SHORT-TIME INTERRUPTION INSENSITIVITY	0 – 500Vac 250ms
NOMINAL MAINS VOLTAGE	400Vac
MEASUREMENT CLASS	1.5%
GENERATOR NOMINAL FREQUENCY	50-60Hz SELECTABLE
RANGE OF GENERATOR ALTERNATING VOLTAGE	0-500Vac
NOMINAL GENERATOR VOLTAGE	400Vac

BATTERY ALTERNATOR ENERGIZATION CURRENT	250mA (+12Vdc or +24Vdc)
CONTACTOR CURRENT CAPACITY AT 250Vac	8A (KR – KG)
NOMINAL CAPACITY OF START - *STOP - PREHEATING SPEED REGULATOR - ENGINE RUNNING - CUM. ALARM*	5A
OPERATING AMBIENT TEMPERATURE	-5 to +60 DEGREES C
STORAGE TEMPERATURE	-30 to +80 DEGREES C
DIMENSIONS	12 DIN MODULES
WEIGHT	0.5 kg
MECHANICAL CHARACTERISTICS	INSTALLATION: RAIL TYPE DIN 50022 FULL DEVICE PROTECTION GRADE IP20 FRONT IP30
RELATIVE HUMIDITY	10 to 95 %
ATMOSPHERIC PRESSURE	70 to 10 kPa

REFERENCE STANDARDS

EN STANDARDS:

- Safety	EN 61010-1 CAT II
- Precision	EN 60688
- Electromagnetic compatibility (immunity)	EN 61000-6-2 (formerly EN 50082-2)
- Electromagnetic compatibility(emission)	EN 61000-6-4 (formerly EN 50081-2)
- Case protection grade (ip rating)	EN 60529