WOODWARD

easYgen-1700

Operation Manual | Genset Control

easYgen-1700

Version 2.0.0.3

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Manual (original)

This is no translation but the original Technical Manual in English.

Designed in Germany and Poland; manufactured in China.

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1 General Information

1.1 About this Manual

1.1.1 Revision History

Rev.	Date	Editor	Changes
E	2023-08	MK	**Operation Manual** updated title page
D	2021-03	MK	**Operation Manual** corrected first page
C			**Software Revision 2.0.0.3 and ToolKit-SC version 1.5.1.3**
B	2019-05	PW	**Software Revision 2.0.0.1 and ToolKit-SC version 1.5.0.4**
A	2018-11	PC	**Describes device implemented software version 1.1 and ToolKit-SC version 1.4.0.2**

1.1.2 Symbols Used in this manual

Safety instructions

Safety instructions are marked with symbols. The safety instructions are always introduced by signal words that express the severity of the danger.

DANGER!

This combination of symbol and signal word indicates an immediately dangerous situation that can cause death or severe injuries if not avoided.

WARNING!

This combination of symbol and signal word indicates a possibly dangerous situation that can cause death or severe injuries if it is not avoided.

CAUTION!

This combination of symbol and signal word indicates a possibly dangerous situation that can cause slight injuries if it is not avoided.

NOTICE!

This combination of symbol and signal word indicates a possibly dangerous situation that can cause property and environmental damage if it is not avoided.

Tips and recommendations

This symbol indicates useful tips and recommendations as well as information on efficient and trouble-free operation.

Additional markings

To highlight instructions, results, lists, references, and other elements, the following markings are used in these instructions:

Marking	Explanation
▶	Step-by-step instructions
⇨	Results of action steps
▷	References to sections of these instructions and to other relevant documents
•	Listing without fixed sequence
»Buttons«	Operating elements (e.g. buttons, switches), display elements (e.g. signal lamps)
»Display«	Screen elements (e.g. buttons, programming of function keys)
[Screen xx / Screen xy / Screen xz] ...	Menu path. The following information and setting refer to a page on the HMI screen or ToolKit located as described here.
TKit HMI	Some parameters/settings/screens are available only either in ToolKit **or** on the HMI/display.

Dimensions in Figures

All dimensions with no units specified are in **mm**.

1.2 Copyright And Disclaimer

Disclaimer

All information and instructions in this manual have been provided under due consideration of applicable guidelines and regulations, the current and known state of the art, as well as our many years of in-house experience. Woodward assumes no liability for any damages due to:

- Failure to comply with the instructions in this manual
- Improper use / misuse
- Willful operation by non-authorized persons

- Unauthorized conversions or non-approved technical modifications
- Use of non-approved spare parts

The originator is solely liable for the full extent for damages caused by such conduct. The obligations agreed-upon in the delivery contract, the general terms and conditions, the manufacturer’s delivery conditions, and the statutory regulations valid at the time the contract was concluded, apply.

Copyright

1.3 Service And Warranty

Opening the device will nullify any warranty!

CAUTION!

Any unauthorized modifications or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment.

Any such unauthorized modifications

- constitute "misuse" and/or "negligence" as per the product warranty
- thereby exclude warranty coverage for any resulting damage, and
- invalidate product certifications or listings.

Our Customer Service is available for technical information. Please see page 2 for contact details.

In addition, our employees are interested in any new information and experiences that arise from usage and could be valuable for improving our products.

Warranty terms

Please enquire about the terms of warranty from your nearest Woodward representative.

To find your closest Customer Service representative, go to: ⟹ http://www.woodward.com/Directory.aspx

1.4 Safety

1.4.1 Intended Use

The easYgen unit has been designed and constructed solely for the intended use described in this Operation Manual and – with even more details – in the Technical Manual.

- Intended use requires operation of the control unit within the range outlined in the written specifications.
- Steps to be taken for commissioning are outlined in the Technical Manual.
- Intended use includes compliance with all instructions and safety notes presented in this manual.
- Any use which exceeds or differs from the intended use shall be considered improper use.
- No claims for any kind for damage will be considered if such claims result from improper use.

NOTICE!

Damage due to improper use!

Improper use of the remote panel unit may cause damage to the control unit as well as to the connected components.

Improper use includes, but is not limited to:

- Operation outside the specified operating conditions.

1.4.2 Personnel

WARNING!

Hazards due to insufficiently qualified personnel!

If unqualified personnel perform work on or with the control unit hazards may arise which can cause serious injury and substantial damage to property.

- Therefore, all work must only be carried out by appropriately qualified personnel.

This manual specifies the personnel qualifications required for the different areas of work, listed below:

- Well trained for electrical installations.
- Aware of the local safety regulations.
- Experienced in working with electronic measuring and control devices.
- Allowed to manage the controlled (engine/generator) system.

The workforce must only consist of persons who can be expected to carry out their work reliably. Persons with impaired reactions due to, for example, the consumption of drugs, alcohol, or medication are prohibited.

When selecting personnel, the age-related and occupation-related regulations governing the operating location must be observed.

1.4.3 General hazard warnings

Hazards by system controlled

DANGER!

Moving parts and dangerous electricity!

Be aware that the remote control of a system that is managing life-threatening engine-generator-electricity parts must be adapted to the local situation!

The following safety notes cover both the device itself and basics of the overall genset system. The dedicated genset-system safety instruction must be considered, too!

Prime mover safety

WARNING!

Hazards due to insufficient prime mover protection

The engine, turbine, or any other type of prime mover must be equipped with an overspeed (over-temperature, or over-pressure, where applicable) shutdown device(s) that operates independently of the prime mover control device(s) to protect from runaway or damage to the engine, turbine, or any other type of prime mover. Failure to comply with this also poses the risk of personal injury or loss of life if the mechanical-hydraulic governor(s) or electric control(s), the actuator(s), fuel control(s), the driving mechanism(s), the linkage(s), or the controlled device(s) fail.

2 System Overview

General notes

The easYgen is a stand-alone genset controller with measuring, monitoring, and breaker control functionality. It comes with an easily mountable plastic housing covering a thoroughly tested electronic-electrical system.

Display and buttons of the HMI offer access to states and values, as well as access to the application. Password protection enables the assignment of multiple operation access levels. Remote access, monitoring, visualization, and configuration are possible via integrated interfaces. Communication between easYgens using PLC control or as a network member offers an enhanced system management range; additionally supported by easy to implement accessories.

For even higher challenges in genset control, the easYgen series offers further solutions encompassing complex and ambitious applications.

For dedicated protection tasks, ask Woodward for its protection (relay) solutions.

Operation Modes

- See “3.3 Operation Modes”

2.1 HMI Status Screens

HMI comes with status screens:

- Status
- Engine
- Gen(erator)
- Load
- Mains
- Alarm
- Log
- Others
- About
- ... and the home screen

  in a loop

2.2 ToolKit-SC Status Screens

General notes

ToolKit-SC enables dedicated access to status information summarized into the following screens:

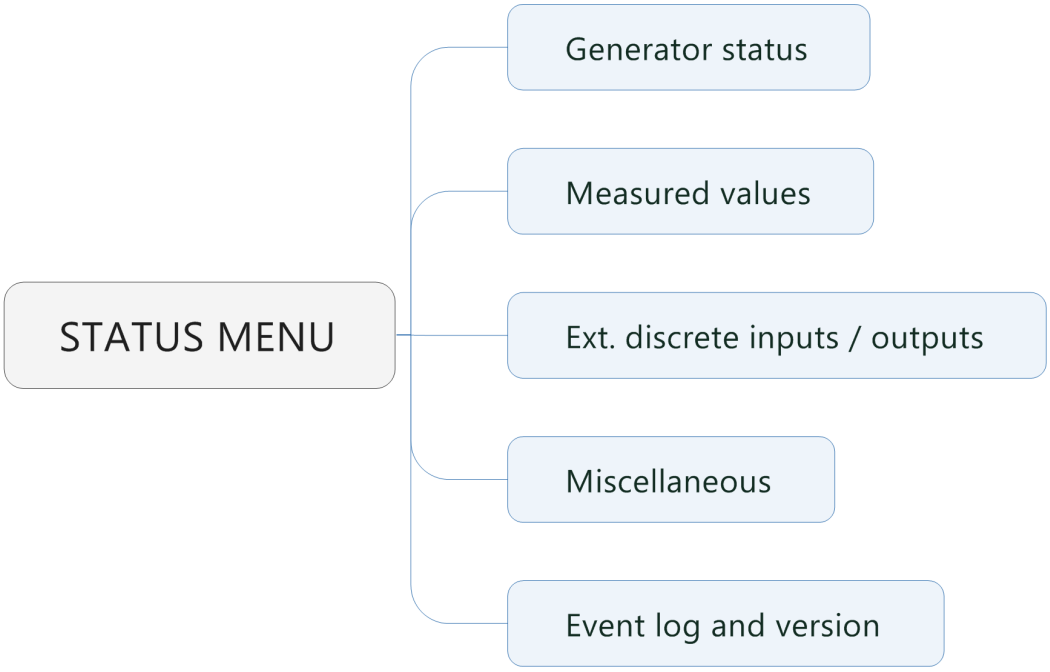

Fig. 1: easYgen-1700 status screens

Generator Status

[PARAMETER / STATUS MENU / Generator status]

Items	Parameters	Description
Engine/Sensor info	Engine speed, Engine temp, Oil pressure, Fuel level, Battery volt, Charger volt	
More info	Fuel temp, Inlet temp, Exhaust temp, Coolant pressure, Fuel pressure, Turbo pressure, Total fuel consume, Coolant level, Oil temp	Selection of ECU data via J1939.
Status and delay	Gen status, Breaker status, Remote start	
Alarms		Display of current alarms and warnings
Digital inputs	1 start request in AUTO, 2 High temperature, 3 Low oil pressure, 4 User defined, 5 User-defined, 6 User-defined, 7 Lamp test, 8 User defined, Emergency stop	
Accumulation	Active power (kW), Reactive power (kvar), Apparent power (kVA)	
Digital output	Fuel relay, Start relay	
Status	Stop mode, Manual mode, Test mode, Auto mode, Mains available, Mains Closed, Gen available, Gen closed, Alarm indicator, Running indicator	
Current date and time	Date (yyyy-mm-dd), Time (hh:mm:ss)	

Measured Values

[PARAMETER / STATUS MENU / Measured values]

Items	Parameters	Description
Electricity quantity		
Mains	L1, L2, L3, L1-2, L2-3, L3-1, L1Phase, L2Phase, L3Phase, Frequency	
Generator	L1, L2, L3, L1-2, L2-3, L3-1, L1Phase, L2Phase, L3Phase, Frequency	
Current (A)	L1, L2, L3	
Active power (kW)	L1, L2, L3, Total	
Reactive power (kvar)	L1, L2, L3, Total	
Apparent power (kVA)	L1, L2, L3, Total	
Power factor	L1, L2, L3, Avg	

Ext. Discrete Inputs/Outputs

[PARAMETER / STATUS MENU / Ext. discrete inputs/outputs]

Items	Parameters	Description
Ext. discrete inputs 1-16		
Input {X}	(contact open/closed)	{X}: 1 or 16
Ext. discrete outputs 1-16		
Output {Y}	(Hi/Low)	{Y}: 1 or 16

Miscellaneous

[PARAMETER / STATUS MENU / Miscellaneous]

Items	Parameters	Description
Total A	Run time, Starts, Total energy	
Total B	Run time, Starts, Total energy	
Earth fault current	Percent	
Next maintenance time	Maintenance 1 to 3	

Event Log and Version

[PARAMETER / STATUS MENU / Event log and version]

Items	Parameters	Description
Module Info	Model, Hardware Version, Software Version, Issue Date	
Event log	**Fixed view of:** No., Event type **Columns "move behind" visible part of the screen:** Event Item, Date, Time, Gens Uab (V) ..., Gens Ua (V) ..., Gens f(Hz), Current Ia (A) ..., Power (kW), Speed (r/min),	Event log report table. Showing the 99 latest events

Items	Parameters	Description
	Temp. (°C), Press. (kPa), Volt. (V)	
	Read log Clear Export to Txt	Push buttons to manage logged data

3 Operation

3.1 Front Panel: Operating and Display Elements

Fig. 2: easYgen-1700

Icons	Keys	Description
STOP	STOP	Auto/Manual mode: Stop running generator Stop mode: Reset alarm Lamp test (press at least 3 seconds)
		Notes During stopping process, press this button again to stop generator immediately.
I	**I** (START)	MANual mode: Start genset
MAN	MAN (Manual Mode)	Press this key and controller enters into MANual mode
AUTO	AUTO (Automatic Mode)	Press this key and controller enters into AUTO mode
	Mute "Horn"/Alarm acknowledge	Press once: Alarming sound OFF Press second time: • Alarm is acknowledged

Icons	Keys	Description
		• Alarm LED changes from twinkling to permanently illuminated
	Gen Open/Close	MANual mode: Switch Generator breaker ON or OFF
	Mains Open/Close	MANual mode: Switch Mains breaker ON or OFF
	Up/Increase	1) Screen scroll 2) Settings menu: Up cursor and increase value in
	Down/Decrease	1) Screen scroll 2) Settings menu: Down cursor and decrease value 3) Lamp test
	Left	1) Screen scroll 2) Settings menu: Left move cursor
	Right	1) Screen scroll 2) Settings menu: Right move cursor
	Set/Confirm	Select viewing area
	Exit	1) Returns to the main menu 2) In settings menu returns to the previous menu
	Warning	
	Alarm	
	Running	
	Genset	
	Busbar	
	Mains	

In MANual mode:

Pressing  and  (START) simultaneously will force the generator to crank. Successful start will not be judged according to crank disconnect conditions, the operator needs to crank the starter motor manually; Once the engine has fired, the operator must relase the button. Only then the start output will be deactivated, safety on delay will start.

WARNING!

Users can change passwords. Please make note of the new password after changing it. If you forget the password, please contact Woodward services and send all device information on the “ABOUT” page of the controller for legitimation.

3.2 Warning/Alarm Signaling

The Alarm type and Warning are visualized through flashing of the LED lights »Alarm« and »Warning« located beside the display.

Alarm Indicator LED	Warning Indicator LED	Alarm Type
Slow flashing	Slow flashing	Warning
Fast flashing	Off	Shutdown or Trip Alarm
Fast flashing	Slow flashing	Shutdown or Trip Alarm with Warning
ON (permanently illuminated)	Off	Common Alarm, acknowledged
ON (permanently illuminated)	ON (permanently illuminated)	Shutdown or Trip Warning, Alarm acknowledged

3.2.1 Alarm Acknowledgment

General notes

The alarm acknowledge handling is valid for following alarm classes

- Warning
- Shutdown
- Trip/Stop
- Trip

Mute Horn

Any new active alarm activates the horn and is made visible by the flashing Alarm LED.

After pressing the mute/acknowledge button the horn is deactivated and the Alarm LED changes from flashing to constant active and stays active as long as any alarm is present. An additional active alarm reactivates the horn and the Alarm LED starts flashing again.

Stop by alarm

The operation mode automatically changes to STOP if a stopping alarm is active (»Shutdown« or »Trip/Stop«).

Acknowledge alarm

The alarm reset is done with additional (2nd time) pressing the mute/acknowledge button (Alarm LED is no longer flashing).

3.3 Operation Modes

General notes

The easYgen offers three operation modes:

- AUTO
- MANUAL (MAN)
- STOP
- ... and an internal (non) operating phase during the start of the device itself

The operation mode can be initiated – provided the current settings allow for this function:

- directly by pressing the respective button on the front panel
- directly by click on the respective button on the ToolKit-SC remote screen
- via discrete inputs
- via interface

3.3.1 Operation Mode AUTO

General notes

In operation mode AUTO, both genset and breakers are under easYgen control. The start and stopping of the engine are managed automatically, along with open, close, and breaker transition.

- supply load by mains
- supply load by generator
- transition load supply from mains to generator or from generator to mains
- start the engine
- stop the engine

Load supply transition from mains to genset

Situation

- Mains becomes abnormal when one or more parameter are outside their working range and one of the following occurs:
  - »Overvoltage«
  - »Undervoltage«

- »Overfrequency«
- »Underfrequency«
- »Mains voltage asymmetry«
- »Mains phase rotation fail«

The start procedure includes breaker handling, engine start, and signaling/warning.

Load supply transition from genset (back) to mains

All of the above listed parameters are (back) in normal range.

The stop procedure includes breaker handling, engine stand-by, and signaling/warning.

3.3.2 Operation Mode MANual

General notes

In operation mode MANual, both genset and breakers are independent of each other under easYgen control.

The starting and stopping of the engine are managed using the same procedure as in AUTO mode but without breaker control. Breakers can be opened and closed without taking care of load, genset, or mains state!

CAUTION!

Take care for genset and supply.

3.3.3 Operation Mode STOP

General notes

In operation mode STOP, the breakers are open and the engine is not running.

This is a configurable operation mode, only. This is NO emergency STOP!

3.4 START/STOP Operation

3.4.1 Start engine to supply load

General notes

☼ **Pre-Condition**

Mode	Energy	Breakers	Genset
AUTO	Mains is "normal"	GCB is open	Not running
		MCB is closed	Ready for operation

Situation

- Mains becomes abnormal when one or more parameter are outside their working range and one of the following occurs:
  - »Overvoltage«
  - »Undervoltage«
  - »Overfrequency«
  - »Underfrequency«
  - »Mains voltage asymmetry«
  - »Mains phase rotation fail«

The AUTO Start procedure runs sub procedures with own timers.

If the mains is back during the process, re-connecting the mains has priority.

The remaining time of each of the timers initiated displays.

When started via “Remote Start (off Load)” input, the starting procedure is the same as shown below but the generator close relay is deactivated.

Because there is no mains control, only the "Start engine" section (green background) is relevant.

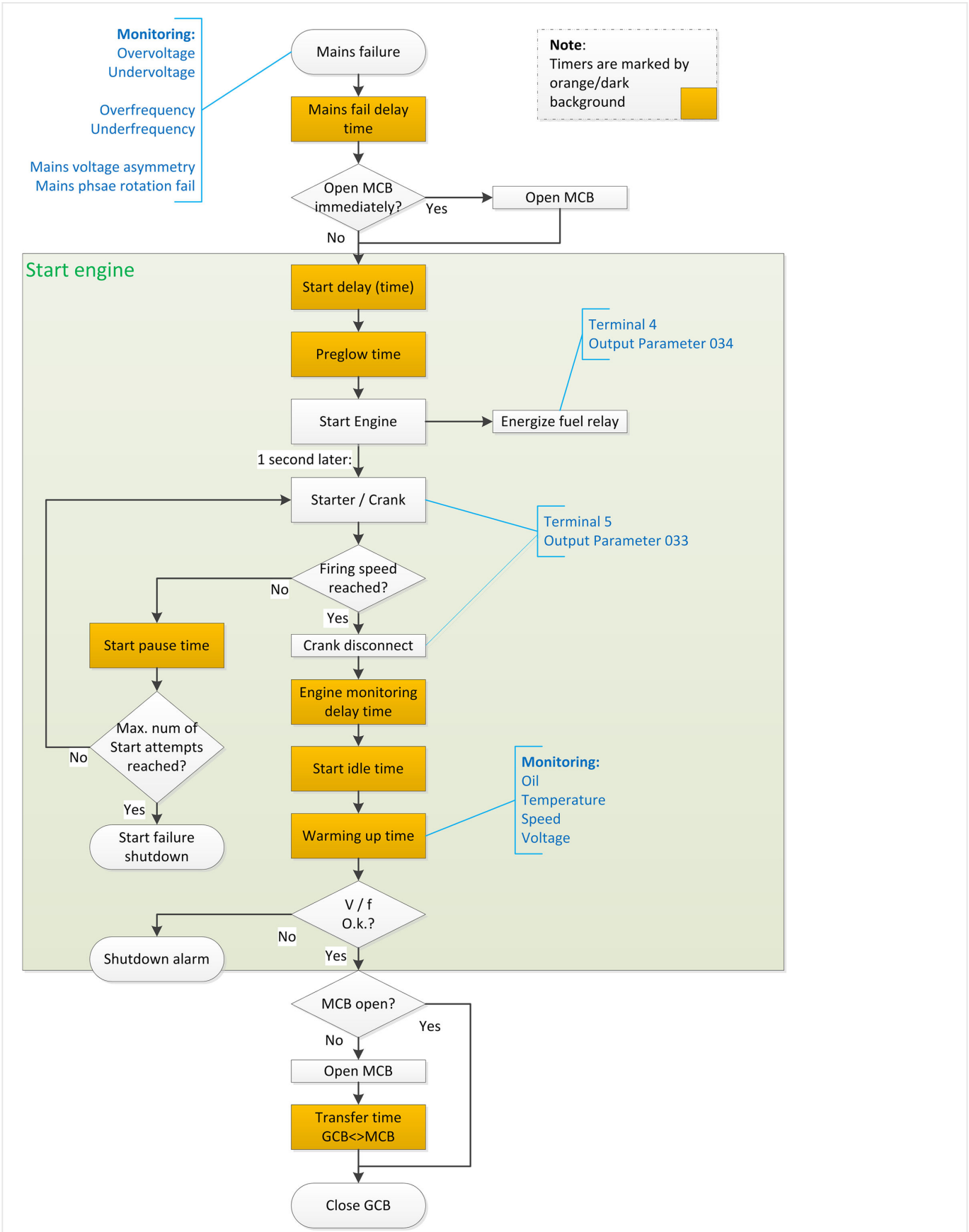

Fig. 3: Transition Mains to Genset including engine start procedure

3.4.2 Stop engine after mains supplying load (again)

General notes

☼ **Pre-Condition**

Mode	Energy	Breakers	Genset
AUTO	Mains is "abnormal"	GCB is closed	Running Delivering power
		MCB is open	

Situation

- Mains becomes normal when all of the parameters below are inside their working ranges:
  - »Overvoltage«
  - »Undervoltage«
  - »Overfrequency«
  - »Underfrequency«
  - »Mains voltage asymmetry«
  - »Mains phase rotation fail«

The AUTO Stop procedure is going through sub procedures with own timers.

If the mains becomes abnormal during the process, remaining with generator load has priority.

The remaining time of each of the timers initiated displays.

When started via “Remote Stop (off Load)” input, the starting procedure is the same as shown below but the generator close relay is deactivated.

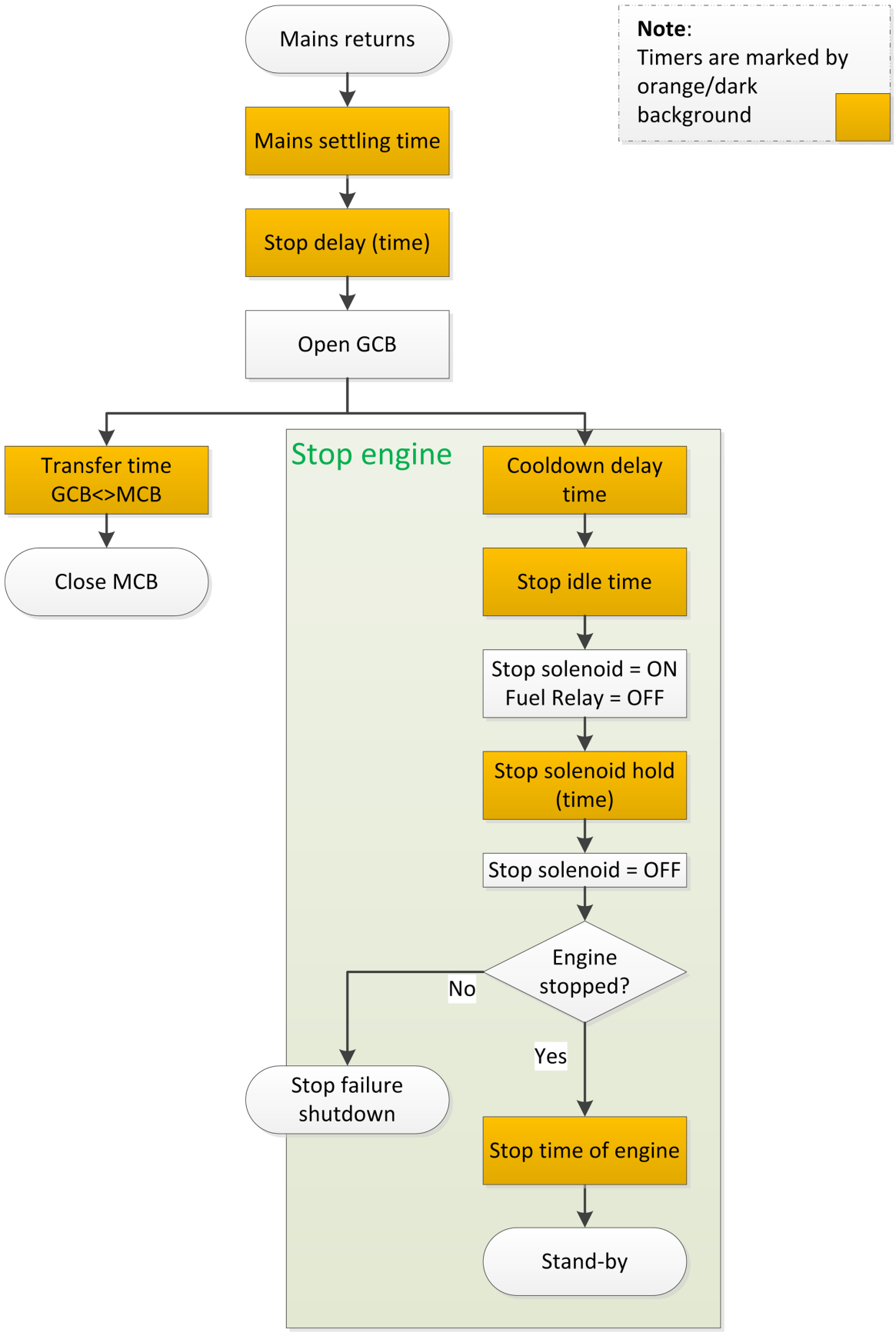

Fig. 4: Transition genset to mains including engine stop/stand-by procedure

3.4.3 MANual START/STOP

Engine control is separated from breaker management. Breaker(s) must be manually opened/closed (supply should be in normal range).

⚙ **MANual Start**

1. ▷ Press the MAN button 

▶ The LED next to the button will illuminate to confirm the operation

2. ▷ Press the START button  to start the genset as described above. I case of abnormal conditions, such as overheating, low oil pressure, over speed and abnormal voltage during generator running occur, the controller can protect genset by stopping quickly.

⚙ **MANual Stop**

1. ▷ Pressing 

can stop the running generator as described above.

3.5 Transition Procedures

3.5.1 Disconnect during cranking

There are three conditions under control to abort the starting of the engine:

- speed sensor
- generator frequency
- engine oil pressure

They can be used separately or in combinations.

We recommend selecting all three at the same time: engine oil pressure together with speed sensor, and generator frequency. This allows for an immediate separation of the starter motor from the engine. Additionally, crank disconnect can be checked exactly.

When set to speed sensor, ensure that the number of flywheel teeth is the same as setting.

Sensor not used? Make sure not to select a sensor that is not in use. Otherwise, an error message might occur.

If the speed sensor (»Firing speed RPM«) is not selected, the rotating speed displayed on the controller is calculated from generator frequency and the number of poles.

If the generator frequency (»Firing speed Hz«) is not selected, the relative power quantity will neither be registrated nor displayed (e.g. water pump application).

HMI only! In ToolKit-SC frequency, speed, and oil pressure can be enabled/ disabled separately; HMI is using a table »Firing speed« instead:	
No.	**Setting description**
0	Gen frequency
1	Speed sensor
2	Speed sensor + Gen frequency
3	Oil pressure
4	Oil pressure + Gen frequency
5	Oil pressure + Speed sensor
6	Oil pressure + Speed sensor + Gen frequency

3.5.2 Manual Breaker Transition

When the controller is in MANual mode, the procedures to switch supply between mains and genset will be started by a manual process when the breaker switch is pressed.

CAUTION!

Neither mains nor generator state is taken into account. Breaker open/close works independent from the load.

If the generator or the mains are "out of range", the load can be damaged!

⚙

> Both breakers GCB and MCB open:

1. ▷ Taking load

Press the breaker switch 

▶ The respective breaker is closed.
The closing signal will last for the »Closing time«

During this time, all other breaker signals are suppressed.

⚙ **Unload**

> One of the breakers is closed - open this breaker.

1. ▷ Press the breaker switch  of the closed breaker

▶ The respective breaker will be opened.
The opening signal will last for the »Opening time«

During this time, all other breaker signals are suppressed.

⚙ **Transfer load**

> One of the breakers is closed - close the other breaker.

1. ▷ Press the breaker switch  of the open breaker

▶ The other (closed) breaker is opened.
The opening signal will last for the »Opening time«

During this time, all other breaker signals are suppressed.

2. ▷ After this, the other breaker (selected by pressed button) will be closed

▶ Closing signal will last for the »Closing time«

During this time, all other breaker signals are suppressed.

3.6 Trouble Shooting

Symptoms	Possible Solutions
Controller has no power.	Check starting batteries; Check controller connection wiring; Check DC fuse.
Genset shutdown	Check if the water/cylinder temperature exceeds the limits; Check the genset AC voltage; Check DC fuse.
Controller emergency stop	Check if emergency stop button works properly; Check whether the starting battery's positive pole is connected to the emergency stop input; Check whether the circuit is open.
Low oil pressure alarm after crank disconnect	Check the oil pressure sensor and its connections.

Symptoms	Possible Solutions
High water temp. alarm after crank disconnect	Check the temperature sensor and its connections.
Shutdown Alarm in running	Check the switch and its connections according to the information on LCD; Check auxiliary input ports.
Fail to start	Check the fuel oil circuit and its connections; Check the starting batteries; Check the speed sensor and its connections; Refer to the engine manual.
Starter no response	Check the starter connections; Check the starting batteries.
Genset running while ATS not transfer	Check the ATS; Check the connections between ATS and controllers.
RS485 communication is abnormal	Check the connections; Check if the COM port setting is correct; Check RS-485 connections of A and B are reverse connected; Check if the RS485 transfer model is damaged; Check if the communication port of the computer is damaged.
ECU communication failed	Check the CAN connections for high and low polarity; Check if the 120 Ω resistor is connected properly; Check if the type of engine is correct; Check if the connections from the controller to the engine and the output ports settings are correct.
ECU warning or shutdown	Get information from the LCD of the alarm page; If there is a detailed alarm, check the respective engine. If there is no detailed alarm, please refer to the relevant section of the engine manual as specified in the SPN alarm code.

4 Appendix

4.1 Alarms and Warnings

4.1.1 Alarm Classes

Alarm class	Visible in the display	LED and horn	Open GCB	Shut-down engine	Engine blocked until acknowledge
Warn	**X**	**X**			
	This alarm does not interrupt the operation of the unit. An output of the centralized alarm occurs and the “Horn” command is issued. Alarm text + flashing LED + Relay centralized alarm (horn)				
Shutdown	**X**	**X**	Immediately	Immediately	**X**
	The GCB is opened and the engine is stopped. Alarm text + flashing LED + Relay centralized alarm (horn) + GCB open + Engine stop.				
Trip/shut	x	x	Immediately	Cool down time	**X**
	The GCB is opened immediately and the engine is stopped after cool down. Alarm text + flashing LED + Relay centralized alarm (horn) + GCB open + Cool down + Engine stop.				
Trip	**X**	**X**	**X**		
	The GCB is opened but does not interrupt the operation of the unit. Alarm text + flashing LED + Relay centralized alarm (horn) + GCB open.				
Indication	**X**				
	This alarm does not interrupt the operation of the unit. A message output without a centralized alarm occurs. Alarm text				

4.1.2 Warnings

No	Type	Description
1	Overspeed	When the controller detects that the engine speed has exceeded the pre-set value, it will initiate a warning alarm.
2	Underspeed	When the controller detects that the engine speed has fallen below the pre-set value, it will initiate a warning alarm.
3	Loss of speed signal	When the controller detects that the engine speed is 0 and the selected action is “Warn”, it will initiate a warning alarm.
4	Gen. overfrequency	When the controller detects that the genset frequency has exceeded the pre-set value, it will initiate a warning alarm.
5	Gen. underfrequency	When the controller detects that the genset frequency has fallen below the pre-set value, it will initiate a warning alarm.
6	Gen. overvoltage	When the controller detects that the generator voltage has exceeded the pre-set value, the controller will initiate a warning alarm.
7	Gen. undervoltage	When the controller detects that the genset voltage has fallen below the pre-set value, it will initiate a warning alarm.
8	Gen. overcurrent	When the controller detects that the genset current has exceeded the pre-set value and the selected action is “Warn”, it will initiate a warning alarm.
9	Fail to stop	After “Stop solenoid hold” delay, if genset does not stop completely, it will initiate a warning alarm.

No	Type	Description
10	Charge alternator low voltage	When the controller detects that charger voltage has fallen below the pre-set value, it will initiate a warning alarm.
11	Battery undervoltage	When the controller detects that start battery voltage has fallen below the pre-set value, it will initiate a warning alarm.
12	Battery overvoltage	When the controller detects that start battery voltage has exceeded the pre-set value, it will initiate a warning alarm.
13	Maintenance due	When count down time is 0 and the selected action ist “Warn”, it will initiate a warning alarm.
14	Gen. reverse power	If reverse power detection is enabled, when the controller detects that the reverse power value (power is negative) has fallen below the pre-set value and the selected action is “Warn”, it will initiate a warning alarm.
15	Overload	If over power detection is enabled, when the controller detects that the over power value (power is positive) has exceeded the pre-set value and the selected action is “Warn”, it will initiate a warning alarm.
16	ECU warning alarm	If an error message is received from ECU via J1939, it will initiate a warning alarm.
17	Gen. loss of phase	If loss of phase detection is enabled, When controller detects the generator loss phase, it will initiate a warning alarm.
18	Gen. phase rotation mismatch	When the controller detects a phase rotation error, it will initiate a warning alarm.
19	Breaker open/close fail	When the controller detects that the breaker close or open failure occurs, and the selected action is “Warn”, it will initiate a warning alarm.
20	Temperature sensor wire break	When the controller detects that the temperature sensor is open circuit and the selected action is “Warn”, it will initiate a warning alarm.
21	High temperature	When the controller detects that engine temperature has exceeded the pre-set value, it will initiate a warning alarm.
22	Low temperature	When the controller detects that engine temperature has fallen below the pre-set value, it will initiate a warning alarm.
23	Oil pressure sensor wire break	When the controller detects that the oil pressure sensor is open circuit and the selected action is “Warn”, it will initiate a warning alarm.
24	Low oil pressure	When the controller detects that the oil pressure has fallen below the pre-set value, it will initiate a warning alarm.
25	Fuel level sensor wire break	When the controller detects that the level sensor is open circuit and the selected action is “Warn”, it will initiate a warning alarm.
26	Low fuel level	When the controller detects that the fuel level has fallen below the pre-set value, it will initiate a warning alarm.
27	Analog input 4 Wire break	When the controller detects that the flexible sensor 1 is open circuit and the selected action is “Warn”, it will initiate a warning alarm.
28	Analog input 4 High limit	When the controller detects that the sensor 1 value has exceeded the pre-set value, it will initiate a warning alarm.
29	Analog input 4 Low limit	When the controller detects that the sensor 1 value has fallen below the pre-set value, it will initiate a warning alarm.
30	Analog input 5 Wire break	When the controller detects that the flexible sensor 2 is open circuit and the selected action is “Warn”, it will initiate a warning alarm.
31	Analog input 5 High limit	When the controller detects that the sensor 2 value has exceeded the pre-set value, it will initiate a warning alarm.
32	Analog input 5 Low limit	When the controller detects that the sensor 2 value has fallen below the pre-set value, it will initiate a warning alarm.
33	Discrete input xyz	When digit input port is set as warning and the alarm is active, it will initiate a warning alarm.

No	Type	Description
34	GSM Communication fail	When select GSM enable but the controller couldn’t detect GSM model, controller sends corresponding warning signal.
35	Ground fault	If earth fault detection is enabled, the controller will initiate a shutdown alarm it it detects that the earth fault current has exceeded the pre-set value and the selected action is “Warn”, it will initiate a warning alarm.

4.1.3 Shutdown Alarms

When controller detects shutdown alarm, it will send signal to open breaker and shuts down generator.

No	Type	Description
1	Emergency stop	When the controller detects an emergency stop alarm signal, it will initiate a shutdown alarm.
2	Overspeed	When the controller detects that the generator speed has exceeded the pre-set value, it will initiate a shutdown alarm.
3	Underspeed	When the controller detects that the generator speed has fallen below the pre-set value, it will initiate a shutdown alarm.
4	Loss of speed signal	When the controller detects that the engine speed is 0 and the selected action is “Shutdown”, it will initiate a shutdown alarm.
5	Gen. overfrequency	When the controller detects that the genset frequency has exceeded the pre-set value, it will initiate a shutdown alarm.
6	Gen. underfrequency	When the controller detects that the genset frequency has fallen below the pre-set value, it will initiate a shutdown alarm.
7	Gen. overvoltage	When the controller detects that the generator voltage has exceeded the pre-set value, the controller will initiate a shutdown alarm.
8	Gen. undervoltage	When the controller detects that the genset voltage has fallen below the pre-set value, it will initiate a shutdown alarm.
9	Fail to stop	If the engine does not fire after the pre-set number of attempts, it will initiate a shutdown alarm.
10	Gen. overcurrent	When the controller detects that the genset current has exceeded the pre-set value and the selected action is “Shutdown”, it will initiate a shutdown alarm.
11	Maintenance due	When count down time is 0 and the selected action is “Shutdown”, it will initiate a shutdown alarm.
12	ECU shutdown alarm	If an error message is received from ECU via J1939, it will initiate a shutdown alarm.
13	ECU communication fail	If the module does not detect the ECU data, it will initiate a shutdown alarm.
14	Gen. reverse power	If reverse power detection is enabled, the controller will initiate a shutdown alarm, when it detects that the reverse power value (power is negative) has fallen below the pre-set value and the selected action is “Shutdown”.
15	Overload	If over power detection is enabled, the controller will initiate a shutdown alarm, when it detects that the over power value (power is positive) has exceeded the pre-set value and the selected action is “Shutdown”.
16	Temperature sensor wire break	When the controller detects that the temperature sensor is open circuit and the selected action is “Shutdown”, it will initiate a shutdown alarm.
17	High temperature	When the controller detects that engine temperature has exceeded the pre-set value, it will initiate a shutdown alarm.
18	Oil pressure sensor wire break	When the controller detects that the oil pressure sensor is open circuit and the action select “Shutdown”, it will initiate a shutdown alarm.

No	Type	Description
19	Low oil pressure	When the controller detects that the oil pressure has fallen below the pre-set value, it will initiate a shutdown alarm.
20	Level sensor wire break	When the controller detects that the level sensor is open circuit and the action select “Shutdown”, it will initiate a shutdown alarm.
21	Analog input 4 Wire break	When the controller detects that the flexible sensor 1 is open circuit and the action select “Shutdown”, it will initiate a shutdown alarm.
22	Analog input 4 High limit	When the controller detects that the sensor 1 value has exceeded the pre-set value, it will initiate a shutdown alarm.
23	Analog input 4 Low limit	When the controller detects that the sensor 1 value has fallen below the pre-set value, it will initiate a shutdown alarm.
24	Analog input 5 Wire break	When the controller detects that the flexible sensor 2 is open circuit and the action select “Shutdown”, it will initiate a shutdown alarm.
25	Analog input 5 High limit	When the controller detects that the sensor 2 value has exceeded the pre-set value, it will initiate a shutdown alarm.
26	Analog input 5 Low limit	When the controller detects that the sensor 2 value has fallen below the pre-set value, it will initiate a shutdown alarm.
27	Discrete input	When digit input port is set as shutdown and the alarm is active, it will initiate a shutdown alarm.
28	Ground fault	If earth fault detection is enabled, the controller will initiate a shutdown alarm it it detects that the earth fault current has exceeded the pre-set value and the selected action is “Shutdown”.
29	Low coolant level	Controller initiates shutdown alarm when digital input port has been configured as low coolant level shutdown (is active).
30	Detonation shutdown (Gas engine)	Controller initiates shutdown alarm when digital input port has been configured as detonation shutdown (is active).
31	Gas leak shutdown	Controller initiates shutdown alarm when digital input port has been configured as gas leak shutdown (is active).

4.1.4 Trip and Stop Alarms

Upon initiation of the trip and stop condition, the controller will de-energize the ‘Close Generator’ Output to remove the load from the generator. Once this has occurred, the controller will start the Cooling delay and allow the engine to cool down before shutting it down.

No	Type	Description
1	Gen. overcurrent	When the controller detects that the genset current has exceeded the pre-set value and the selected action is “Trip and Stop”, it will initiate a trip and stop alarm.
2	Maintenance due	When count down time is 0 and the action select “Trip and Stop”, it will initiate a trip and stop alarm.
3	Gen. reverse power	If reverse power detection is enabled, the controller will initiate a trip and stop alarm if it detects that the reverse power value (power is negative) has fallen below the pre-set value and the action select “Trip and Stop”.
4	Overload	If over power detection is enabled, the controller will initiate a trip and stop alarm if it detects that the over power value (power is positive) has exceeded the pre-set value and the selected action is “Trip and Stop”.
5	Discrete input	When the digit input port is set to “Trip and Stop” and the alarm is active, it will initiate a trip and stop alarm.

No	Type	Description
6	Ground fault	If earth fault detection is enabled, the controller it will initiate a trip and stop alarm if it detects that the earth fault current has exceeded the pre-set value and the action select “Trip and Stop”.

4.1.5 Trip Alarms

On initiation of the trip condition the controller will de-energize the ‘Close Generator’ Output without stop the generator.

No	Type	Description
1	Gen. overcurrent	The controller will initiate a trip alarm if it detects that the genset current has exceeded the pre-set value and the selected action is “Trip”.
2	Gen. reverse power	If reverse power detection is enabled, the controller will initiate a trip alarm if it detects that the reverse power value (power is negative) has fallen below the pre-set value and the selected action is “Trip”.
3	Overload	If over power detection is enabled, the controller will initiate a trip alarm if it detects that the over power value (power is positive) has exceeded the pre-set value and the selected action is “Trip”.
4	Discrete Input	When digit input port is set to “Trip” and the alarm is active, it will initiate a trip alarm.
5	Ground fault	If earth fault detection is enabled, the controller will initiate a trip alarm if it detects that the earth fault current has exceeded the pre-set value and the selected action is “Trip”.

5 Glossary and List of Abbreviations

CB	Circuit Breaker
CT	Current Transformer
DI	Discrete Input
DO	Discrete (Relay) Output
ECU	Engine Control Unit
FMI	Failure Mode Indicator
GCB	Generator Circuit Breaker
GOV	(speed) Governor; rpm regulator
HMI	Human Machine Interface e.g., a front panel with display and buttons for interaction
I	Current
MCB	Mains Circuit Breaker
MPU	Magnetic Pickup Unit
N.C.	Normally Closed (break) contact
N.O.	Normally Open (make) contact
NC	Neutral Contactor
OC	Occurrence Count
Operation	In (general) operation. State when the genset is running according to the selected mode, all parameters are in allowed values and ranges, and without OPEN requests or alarms. Somehow "waiting for next occurrence".
P	Real power
P/N	Part Number
PF	Power Factor
PT	Potential (Voltage) Transformer
Q	Reactive power
S	Apparent power
S/N	Serial Number
SPN	Suspect Parameter Number
V	Voltage

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