SGC 121

4189341354B

Single Genset Controller

User manual

Improve Tomorrow

1. Introduction

2. Installation

3. Display and menus

4. Modes of operation

5. General functions

6. Engine functions

7. Modbus

8. Inputs and outputs

9. Troubleshooting

1. Introduction

1.1 About

The SGC 121 controller contains all the functions needed to protect and control the genset, the genset contactor, and also a mains contactor. All the values and alarms are shown on the LCD display screen. Operators can control the system from the display.

The SGC 121 has an electronic governing for engines with mechanical fuel systems. With a rotary actuator as add-on for air or fuel charge control, the controller can do electronic governing of the engine within ISO 8528 class G3 limits.

You can use the DEIF Smart connect software to configure the inputs and outputs. You can also configure the parameters on the controller.

1.2 Function overview

This is an overview of the most important functions.

Monitoring
Use the SGC controller to monitor mains, engine and alternator parameters.

Inputs and outputs
- Analogue current/voltage inputs
- Analogue resistive inputs
- Digital switch input
- DG alternator input
- Mains voltage input (AMF)
- Input for fuel reference selection
- Digital outputs
- Analogue input for the E-governor
- E-governor actuator output

Communication
- RS-485 for Modbus communication
- USB interface to PC

Modes of operation
The SGC controller can operate in AUTO mode and manual mode.

In AUTO mode, you can select these functions:
- Island
- Automatic mains failure (AMF)
- Remote start/stop
- Auto exercise
- Engine drive

Display and language functions
- Backlit display
- Supports many languages, including English, Spanish, and Chinese
- 2-level password protection

Alarms and event logs

- Event log for 100 events with real-time clock stamps
- Fuel theft alarm

Electronic governing

The SGC 121 can do electronic governing for engines with mechanical fuel systems when you have installed a rotary actuator.

1.3 About the User manual

1.3.1 General purpose

This document includes important instructions that should be followed during installation and maintenance of the controller.

Only approved personnel can do the installation and maintenance work. The work must comply with all applicable state and local electrical codes. Efficient and safe operation of the controller is only possible if equipment operation and configuration is correct, and maintenance is completed.

1.3.2 Software versions

The information in this document relates to software versions:

Software	Versions
Application software	9.04

1.4 Warnings and safety

1.4.1 Symbols for hazard statements

WARNING

This shows potentially dangerous situations.

If the guidelines are not followed, these situations could result in death, serious personal injury, and equipment damage or destruction.

CAUTION

This shows low level risk situation.

If the guidelines are not followed, these situations could result in minor or moderate injury.

1.4.2 Symbols for general notes

NOTE This shows general information.

More information
This shows where you can find more information.

1.4.3 Electrical safety

You must ground the generator before you install the controller or do maintenance work. Failure to ground the generator can result in injury or death.

Generators produce high electrical voltages. Do not touch terminals, bare wires, and while the generator and related equipment are in operation. If you touch the generator, it can give you an electrical shock and result in death. Do not change the interlocks.

Use the correct size for wires that are used for electrical connections and wirings. This is to make sure that the generator can operate at the maximum electrical current.

1.4.4 Safety during installation and operation

Before you install the controller, make sure that all power voltage supplies are positively turned off at the source. Remove the panel fuse to prevent accidental start of the generator. Disconnect the battery cables for the generator from the negative battery terminal first. This is shown with a NEGATIVE, NEG, or (–). Reconnect the negative cable last. If not, this can give you an electrical shock and possibly kill you.

Remove the electric power supply before you remove the controller or touch other electrical part. High voltage can cause injury or death.

With floors of metal or concrete, use rubber insulation mats placed on wooden platforms, when you do work near the generator or other electrical equipment. Make sure you wear dry clothes and shoes, and that your hands and feet are dry when you operate electric devices or work with wires. Do not wear jewellery. Jewellery can cause a short circuit, which can result in shock or burning.

If an accident caused by electric shock occurs, stop the electrical power source immediately. If this is not possible, use a non-conducting object (for example a rope or a wooden stick) to remove the person with the injuries from the live conductor. Do not touch the person with injuries. If the person with injuries is unconscious, use first aid and get medical help immediately.

1.5 Legal information

Warranty

NOTICE
Warranty The controller is not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

The English version of this document always contains the most recent and up-to-date information about the product. DEIF does not take responsibility for the accuracy of translations, and translations might not be updated at the same time as the English document. If there is a discrepancy, the English version prevails.

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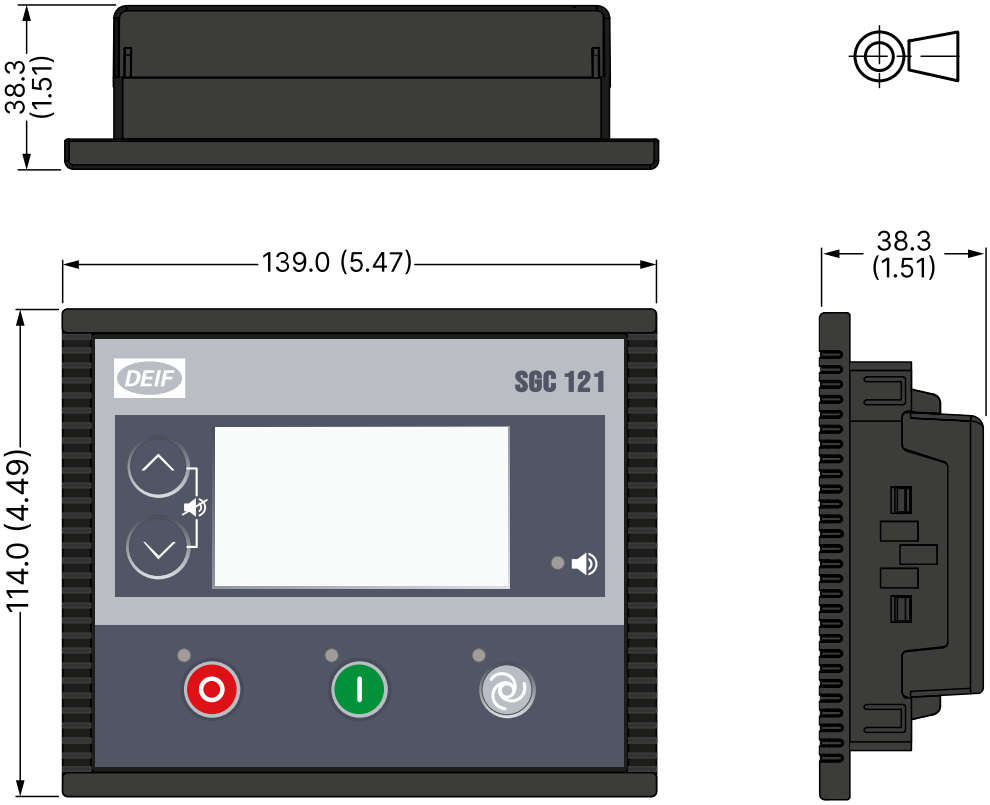
2. Installation

2.1 Dimensions



	Length	Height	Depth
Controller	139.0 mm (5.47 in)	114.0 mm (4.49 in)	38.3 mm (1.51 in)
Panel cut-out	118.0 mm (4.65 in)	93.0 mm (3.66 in)	Tolerance: ± 0.3 mm (0.01 in)

2.2 Tools and materials

Tools required for mounting

Tool	Used for
Safety equipment	Personal protection, according to local standards and requirements
Screwdriver, PH2 or 5 mm flat	Tighten the fixing screw clamps, torque 0.15 N·m (1.3 lb-in)
Wire stripper, pliers and cutters	Prepare wiring and trim cable ties

NOTICE

Too much torque damages the screw clamps and/or controller housing

Do not use power tools during the installation.

Materials required for mounting and wiring

Materials	Used for
Four screw clamps	Mounting the controller in the front panel
Wires and connectors	Wiring third party equipment to the controller terminals
Cable ties	Securing wiring

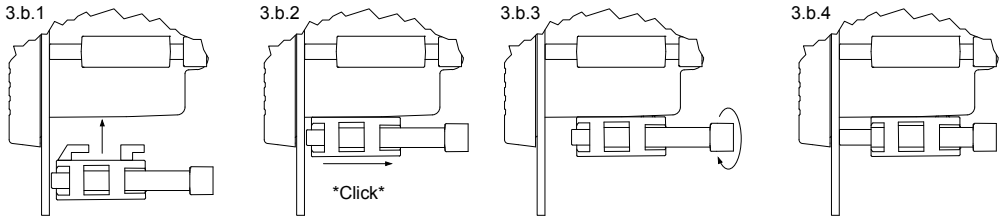
2.3 Mounting

The controller is designed for mounting in the front panel.

Panel cutout:

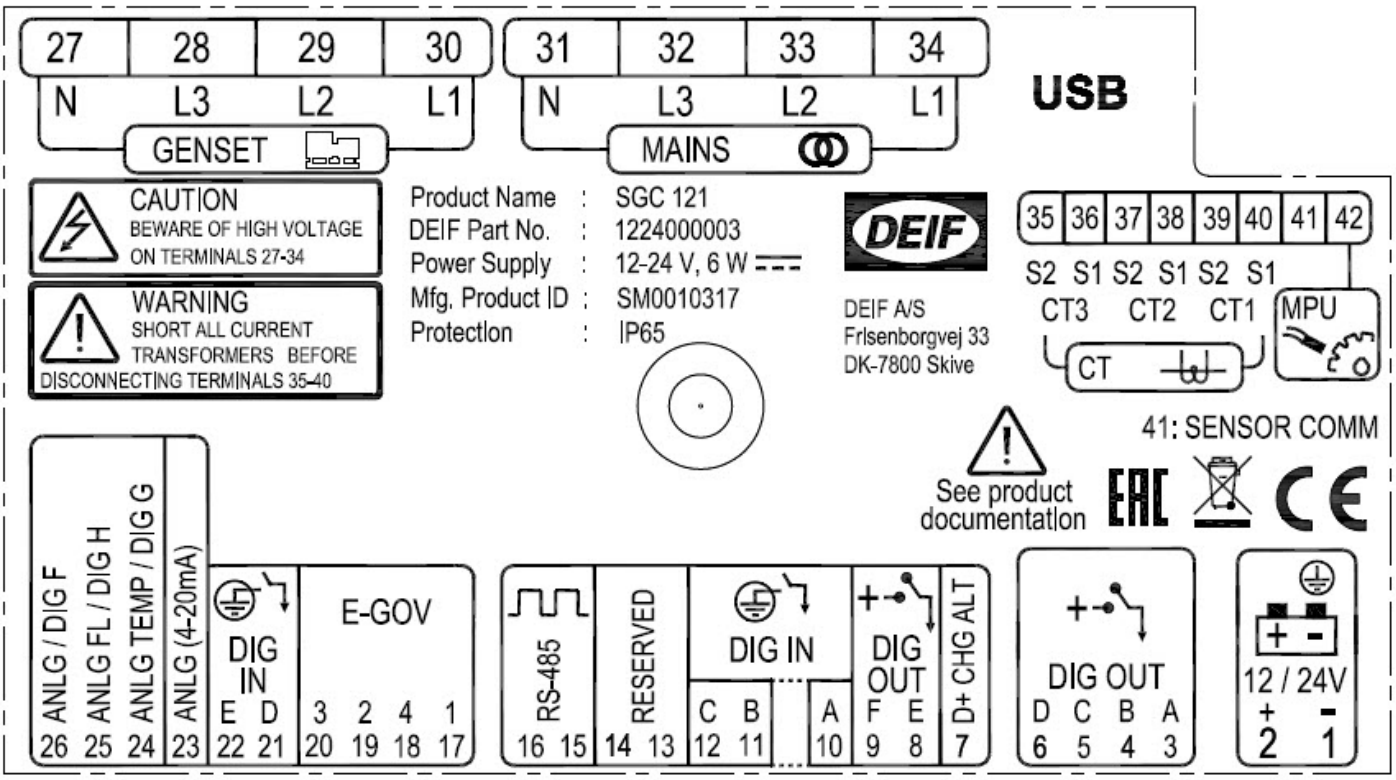
- Length: 118.0 mm
- Height: 93.0 mm
- Tolerance: ± 0.3 mm

1. Insert the controller in the panel.
2. Insert the screw clamps:



3. Tighten the screw clamps to 0.19 Nm. Do not tighten the clamps to more than 0.19 Nm.

2.4 Terminals

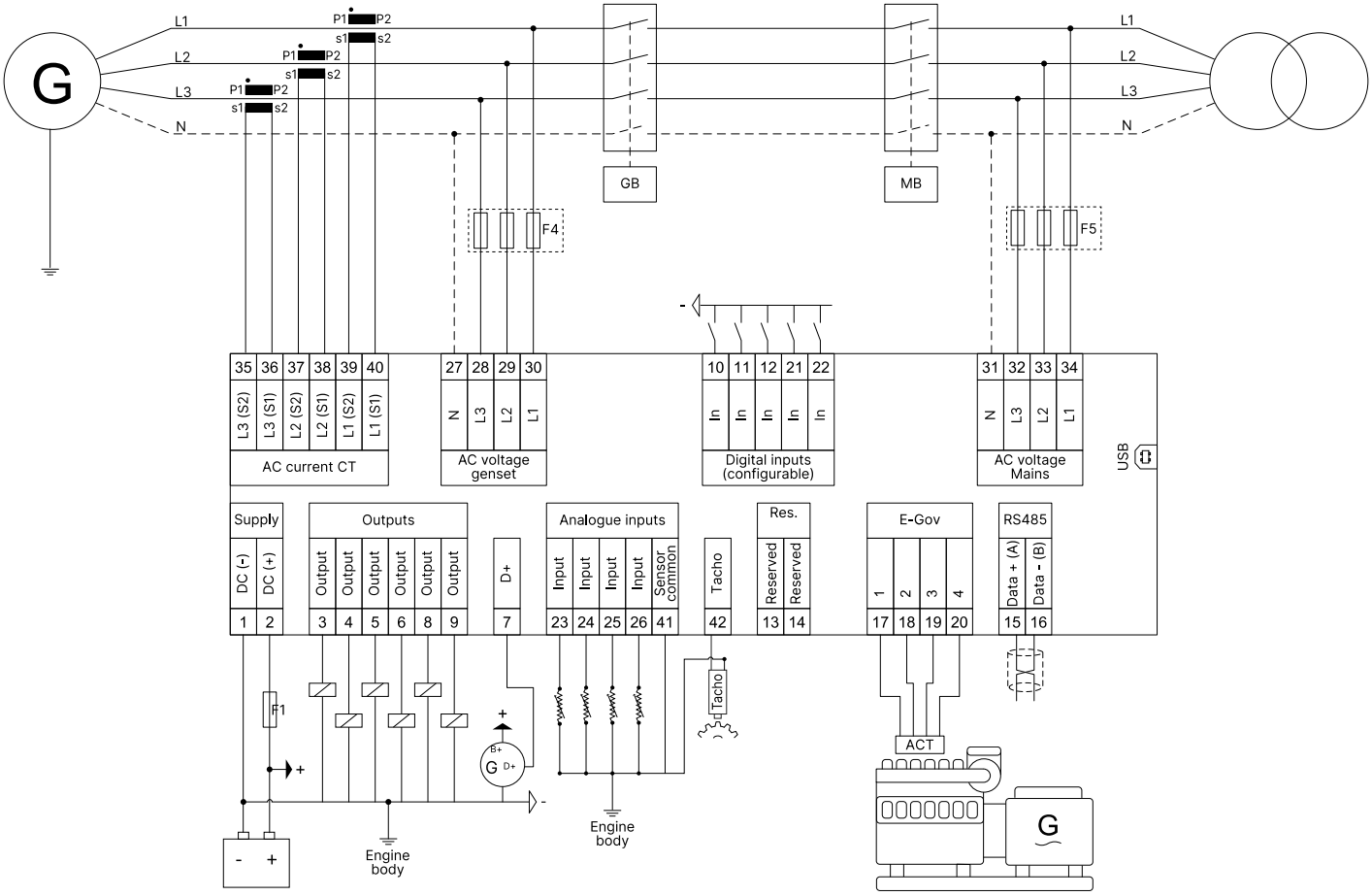


Terminal	Text	Description
1	GND	Power ground
2	BATT +	Power supply positive
3	DIG OUT A	DC output - A
4	DIG OUT B	DC output - B
5	DIG OUT C	DC output - C
6	DIG OUT D	DC output - D
7	D+ CHG ALT	Input for charging alternator control
8	DIG OUT E	DC output - E
9	DIG OUT F	DC output - F
10	DIG IN A	Input from switch A
11	DIG IN B	Input from switch B
12	DIG IN C	Input from switch C
13	Reserved	
14	Reserved	
15	RS-485 B	RS-485 B
16	RS-485 A	RS-485 A
17	E-GOV 1	Output for actuator
18	E-GOV 4	Output for actuator
19	E-GOV 2	Output for actuator
20	E-GOV 3	Output for actuator
21	DIG IN D	Input from switch D
22	DIG IN E	Input from switch E
23	ANLG	Analogue input 4 to 20 mA/2.5 ±2 V
24	ANLG (4 - 20 mA)	Analogue input from the engine temperature sensor
25	ANLG TEMP/DIG G	Analogue input from the fuel level sensor
26	ANLG FL/DIG H	Analogue input from the sensor for the lube oil pressure
27	ANLG/DIG F	Voltage input from generator neutral
28	GENSET N	Voltage input from generator phase L3
29	GENSET L3	Voltage input from generator phase L2
30	GENSET L2	Voltage input from generator phase L1
31	GENSET L1	Voltage input from mains neutral
32	MAINS N	Voltage input from mains phase L3
33	MAINS L3	Voltage input from mains phase L2
34	MAINS L2	Voltage input from mains phase L1
35	MAINS L1	CT input 2 from generator phase L3
36	CT3 S2	CT input 1 from generator phase L3
37	CT3 S1	CT input 2 from generator phase L2
38	CT2 S2	CT input 1 from generator phase L2
39	CT2 S1	CT input 2 from generator phase L1

Terminal	Text	Description
40	CT1 S2	CT input 1 from generator phase L1
41	CT1 S1	Sensor common point
42	SENSOR COMM	MPU input

2.5 Wiring

2.5.1 Typical wiring



NOTE The wiring diagram is only an example. Use the wiring diagram for the specific application during installation.

Fuses:

- F1: 2 A DC max. time-delay fuse/MCB, c-curve
- F4, F5: 2 A AC max. time-delay fuse/MCB, c-curve

Relays

- Protect the breaker relays against 4 kV surges as described in the IEC 61000-4-5 standard.
- Protect relay cards used with the controller against reverse battery voltages.

Digital outputs

If a digital output is connected to a relay, the relay must include freewheeling diodes.

Communication ports

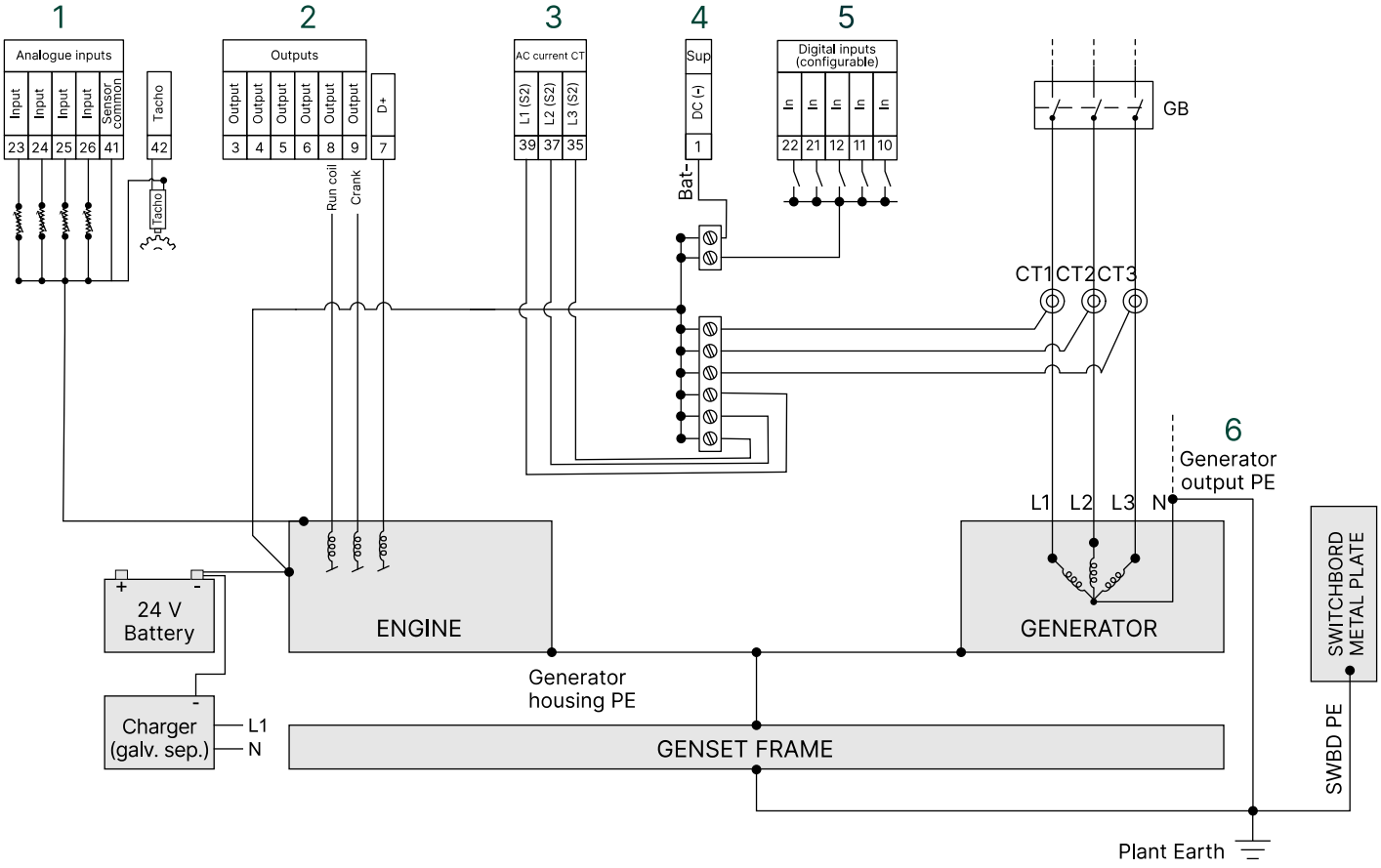
Communication ports for RS-485 (terminals 15 and 16) have built-in 120 Ω resistors.

2.5.2 Wiring guidelines - best practice for grounding

It is important to follow these wiring guidelines to get:

- Reliable readings from the sensors.
- Precise measurement of AC voltage and current.
- Best protection from lightning and other earth faults.

Example: Typical grounding setup

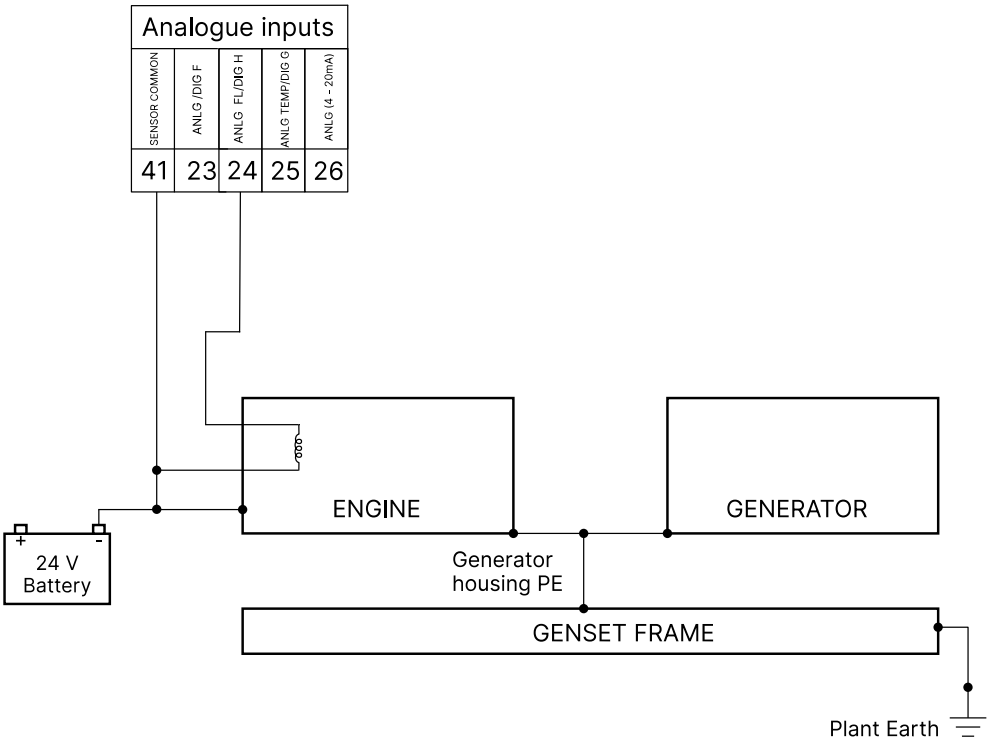


1. Terminal 41 (sensor common point) must be connected to a solidly grounded point on the engine, for example the engine frame. The potential difference to terminal 1 (BAT-) must be less than ± 0.5 V.
2. Do not connect the starter motor relay at the stop solenoid directly to the output terminals on the controller. You can configure any of the outputs as run coil and crank.
3. Current transformers.
4. Power supply DC- (terminal 1) must be connected to BAT- (in this example, the engine).
5. Connect the digital inputs to ground to active the negative switching.
6. The protective earth for the generator output.

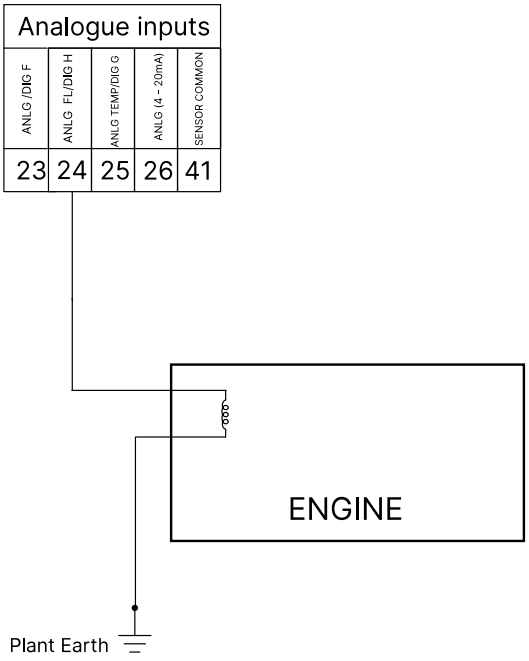
2.5.3 Analogue inputs

Resistive sensor inputs

Wiring for the sensor common point (SCP) for analogue inputs 1 to 4 (terminals 23 to 26).

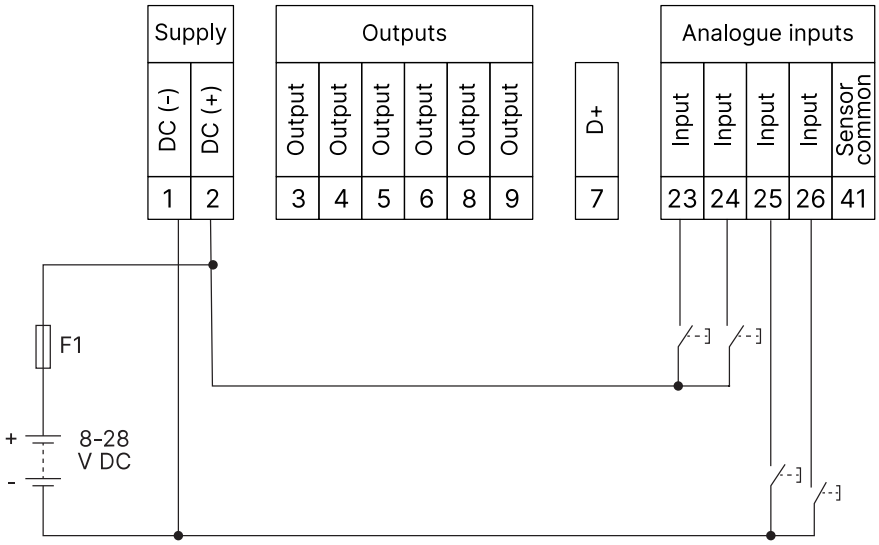


Wiring for the sensor common point (SCP) for analogue input 2 (terminal 24) when you use it as *Fuel level sensor* with reference to *Battery Negative*.



Analogue inputs used as digital inputs

Analogue inputs can be used as digital inputs when wired as shown.

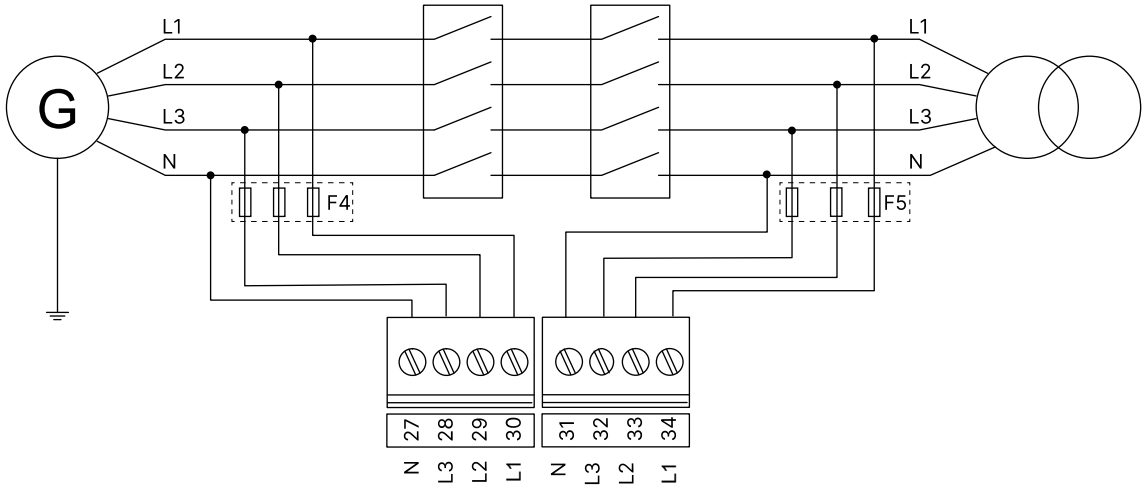


Settings:

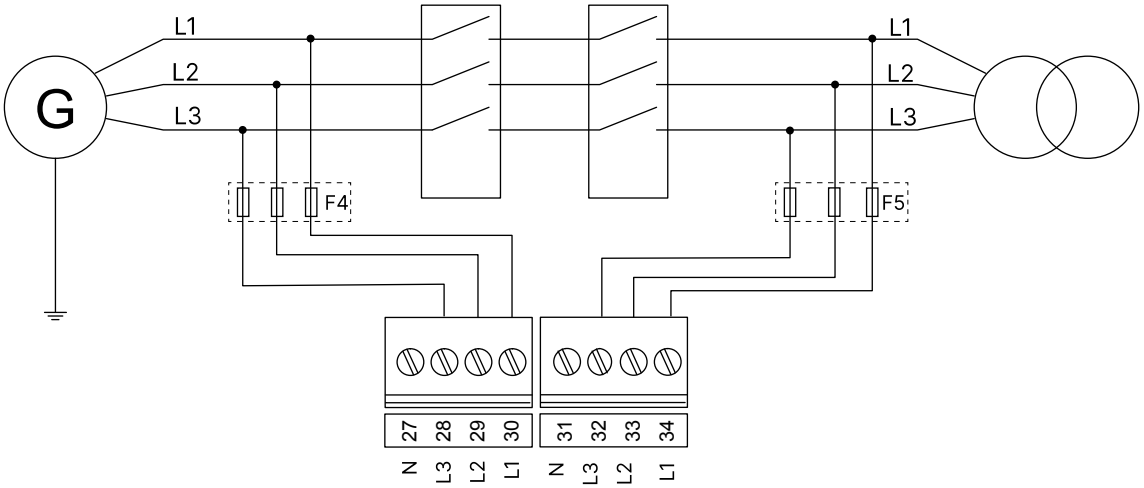
- Polarity: Close to activate
- SW state: Not activated
- Logic status: Low

2.5.4 AC connections

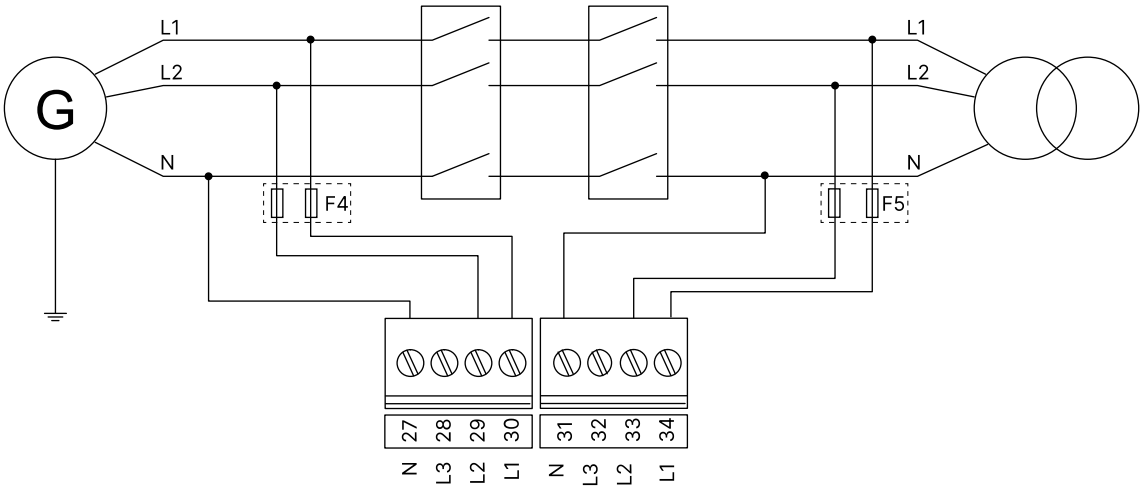
Three-phase application (4 wires)



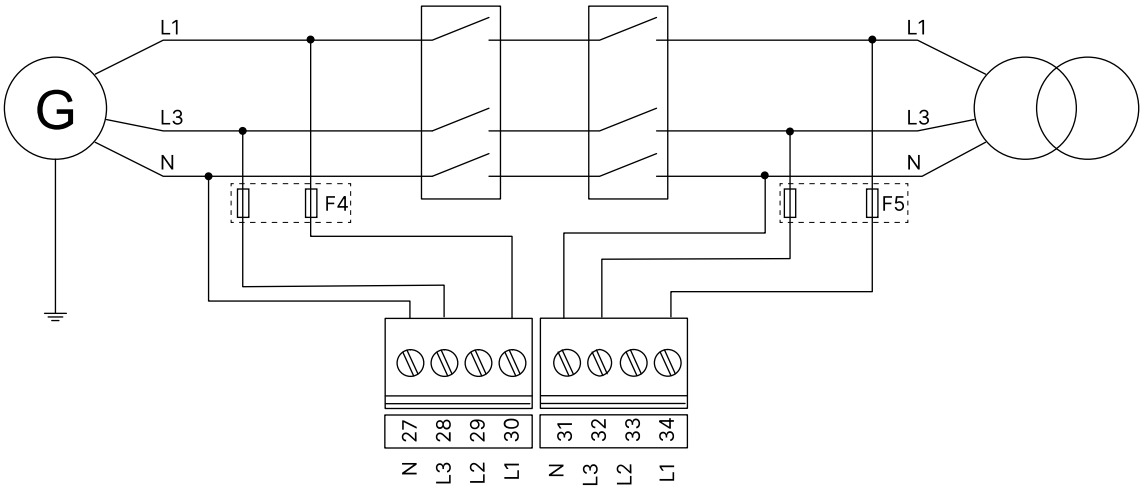
Three-phase application (3 wires)



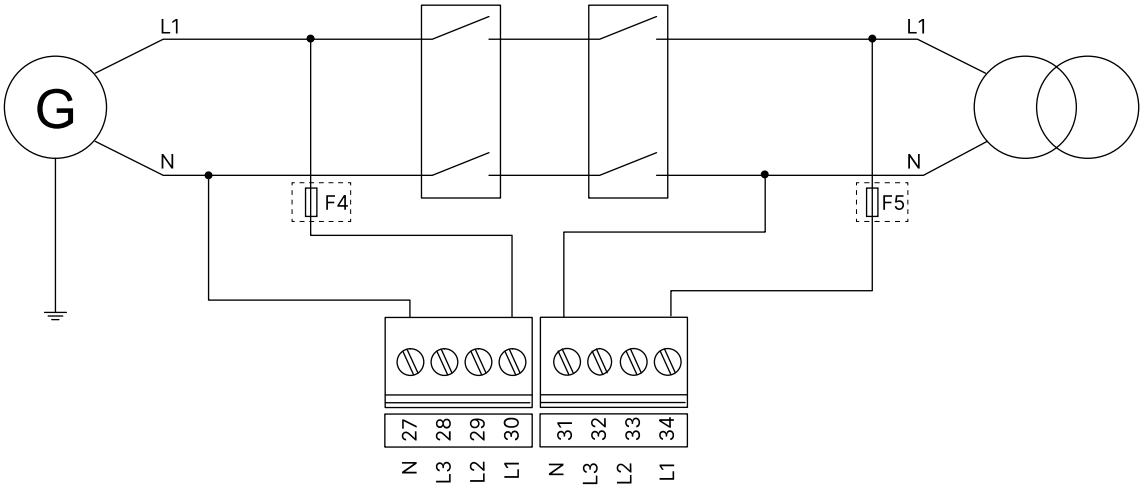
Two-phase application L1/L2 (3 wires)



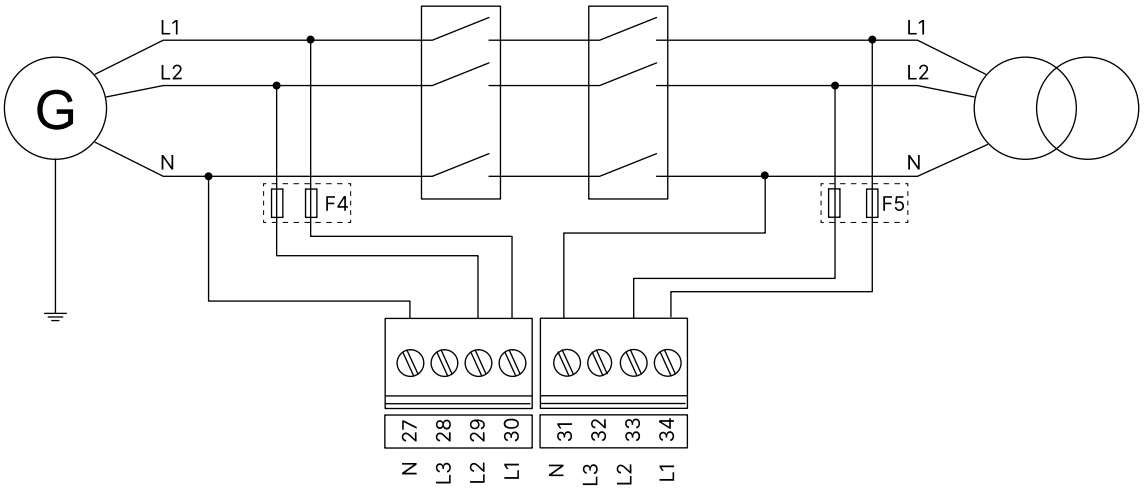
Two-phase application L1/L3 (3 wires)



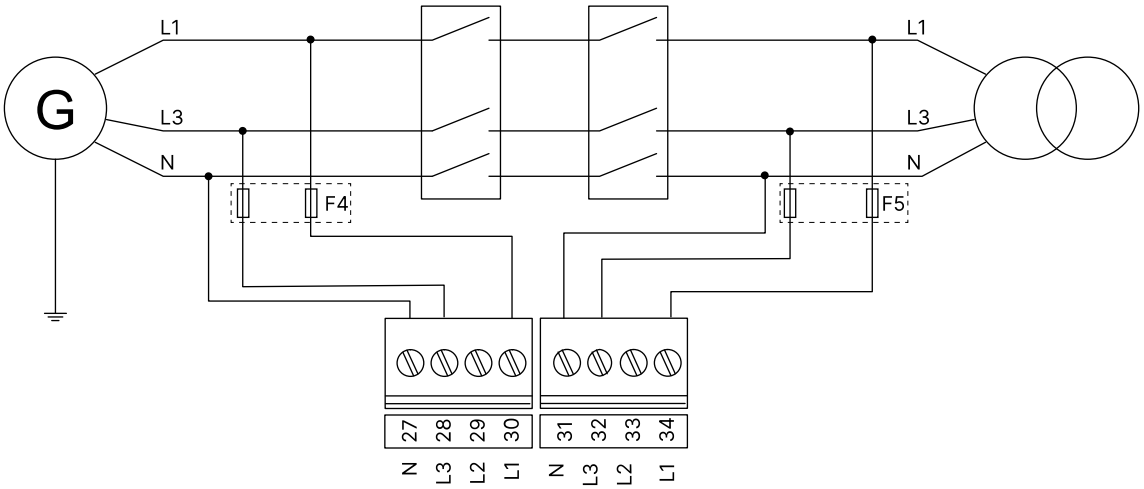
Single-phase application (2 wires)



Split phase application L1/L2 (3 wires)



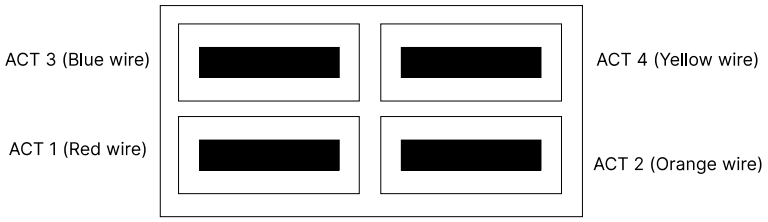
Split phase application L1/L3 (3 wires)



2.5.5 Rotary actuator outputs

The actuator outputs are used when a 4-wired rotary actuator is installed in your application. The integrated electronic governor in the SGC controller is used together with the actuator to create an electronic governing application for mechanical fuel engines. In diesel engines, the shaft output in the actuator is mechanically connected to a stop lever or the throttle level in a fuel injection pump, for example. For petrol and natural gas engines, the shaft output is connected the throttle or charge control valve.

Actuator connector outputs



SGC outputs

- ACT 1 is output terminal 17
- ACT 2 is output terminal 18
- ACT 3 is output terminal 19
- ACT 4 is output terminal 20

2.5.6 Current transformer (CT) ground

Use one of these methods for the CT ground (S2) connections:

1. The S2 terminals are not grounded. The controller detects the current accurately.
2. The S2 terminals are grounded at the GND terminal (terminal 1).
3. The S2 terminals are grounded but not at the GND terminal. This means that the battery ground (GND terminal) and the CT ground are not the same. The maximum allowable offset between the two ground connections is ±0.5 V.

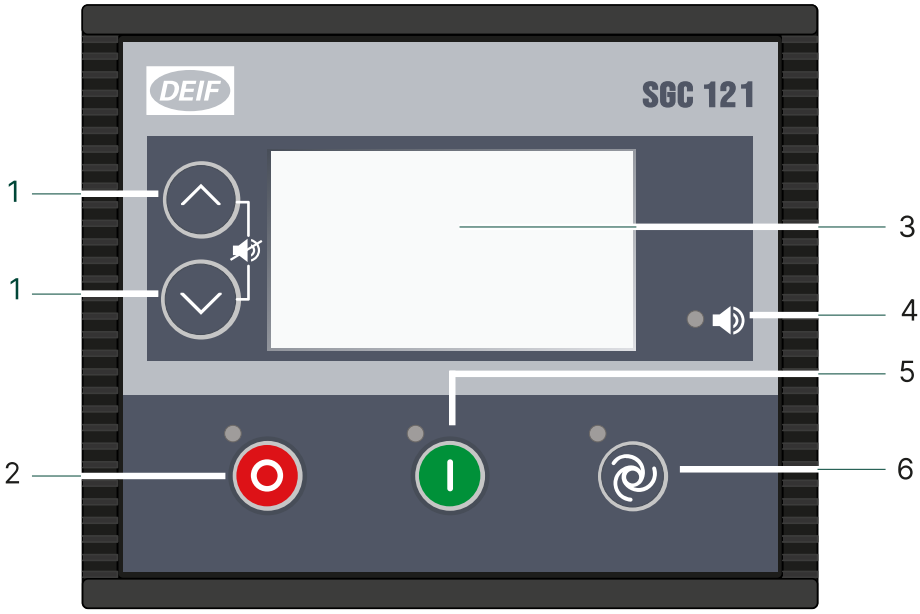
NOTE Use the recommended phase sequence when you connect the current transformer (CT).

2.5.7 Voltage measurement fuses

If the wires/cables must be protected with fuses, use max. 2 A time-delay fuses, dependent on the wires/cables to be protected.

3. Display and menus

3.1 Display, buttons, and LEDs



No.	Name	Function
1	Navigation	Move the selector up and down on the screen. To see the *Event log*, push the *Up* button and the *down* button at the same time and hold.
2	Stop	Stops the genset if manual or auto mode is selected. When you push the button in auto mode, the running mode also changes to manual mode.
2	Configuration	To go to the *Configuration menu*, make sure the controller is in manual mode, and then push and hold the *Stop* button until you see the configuration screen. Push the *Start* button to select a parameter, and to save changes you have made. To go back to manual mode, push and hold the *Stop* button.
2 and 1	Programming	To go to the*Programming menu* , make sure the controller is in manual mode. Then push the *down* button and the *Stop* button at the same time and hold until you see the programming screen. To go back to manual mode, push the *down* button and the *Stop* button at the same time and hold. To see the *Event log*, make sure the controller is in the *Programming menu*. Then push the *Up* button and the *Stop* button at the same time and hold until you see the programming screen. To go back to *Programming mode*, push the *down* button and the *Stop* button at the same time and hold.
3	Display	Graphical
4	Alarm LED	The LED is red when there is an active alarm.

No.	Name	Function
5	Start	Starts the genset if manual mode is selected.
6	Mode selection	Push to select the running mode.

3.2 Display settings

3.2.1 Display

To adjust for ambient lighting, configure the display settings.

Use the smart connect software to configure the contrast in `Module > Display > Contrast`. You can also configure the time for when the page on the display changes in `Timers > General > Screen Changeover Time`.

Parameter	Range	Default
Contrast	0 to 100 %	80 %
Screen Changeover Time	0 to 1800 s	3 s

3.2.2 Power save function

If the power save function is enabled, the controller turns off the backlight after an adjustable timer expires. In the smart connect software, go to `Module > Display` to enable the function. To configure the adjustable delay timer, go to `Timers > General > Power Save Mode Delay`.

Text	Range	Default
Power save mode	Enable Disable	Not enabled
Power Save Mode Delay	5 to 1800 s	30 s

3.2.3 Deep sleep

You can use the deep sleep function to extend the battery life. This function allows you to stop all standard functions on the controller and decreases the power consumption. The controller keeps the same status and alarms as before it went into deep sleep mode. Standard functions are activated when the controller is no longer in deep sleep mode.

In the smart connect software or on the controller, go to `Module > General > Deep Sleep Mode` to enable the deep sleep function. The controller goes into deep sleep mode after an adjustable time of inactivity. You can configure this timer in `Timers > General > Deep Sleep Mode Delay`. Push a button to exit deep sleep mode.

Parameter	Range	Default
Deep Sleep Mode	Enable Disable	Not enabled
Deep Sleep Mode Delay	5 to 1800s	10 s

The controller does not go into deep sleep mode if:

- The controller is in AUTO mode.
- Mains monitoring is enabled and the mains breaker is configured as an output.
- Modbus communication is enabled.

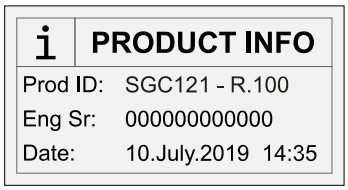
3.3 Monitoring menu

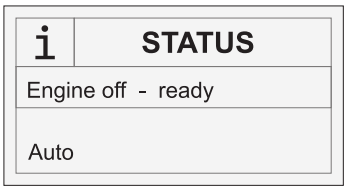
The display views change automatically after an adjustable delay time. You can configure this delay time in the configuration menu.

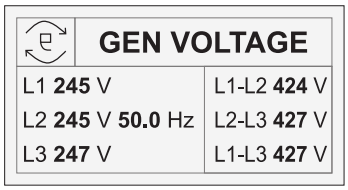
You can also change the views manually on the controller with the *Up* and *Down* buttons.

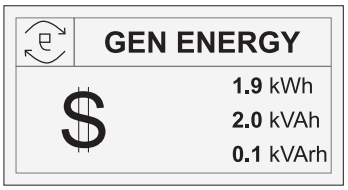
Display view examples

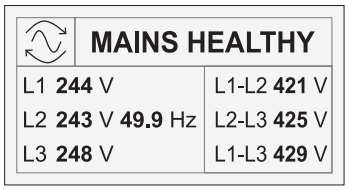
Some of the display views are only shown if you have configured the functions.

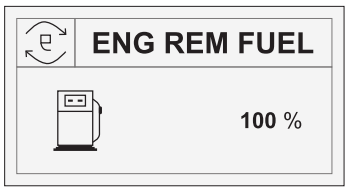


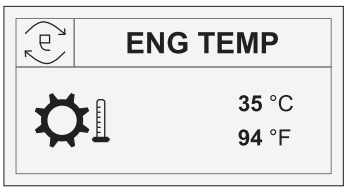


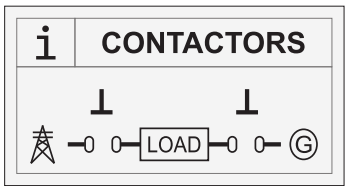


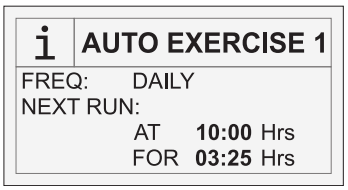








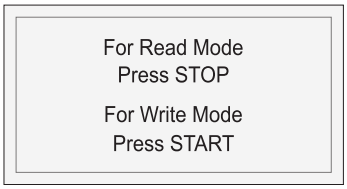




3.4 Configuration menu

To configure a parameter on the controller, follow these steps:

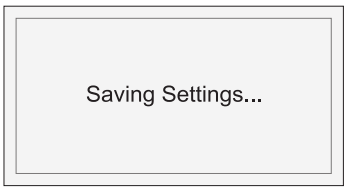
1. Push and hold the *Stop/Config* button for a minimum of three seconds.
2. You will see this screen on the display:



3. Push the *Start* button.

4. You will see this screen on the display:

5. Enter the password:
   a. Use the *Up* and *Down* buttons to change the number.
   b. Select a number with the *Start* button.
6. You can now configure the parameter.
7. To leave the configuration menu, push and hold the *Stop/Config* button.
8. Until the configuration is saved, you will see this screen:



3.5 Configurable parameters

3.5.1 Module

General (GENERAL)

Parameter	Range	Default	Description
Profile name	Profile 1	Profile 1	You can change the name of the profile.
Power on Mode (POWER ON MODE)	Manual Auto	-	The controller is in this running mode when you power on the controller.
Power On Lamp Test (POWER ON LAMP TEST)	Enable Disable	Not enabled	If this parameter is enabled, the LEDs glow red for 2 seconds after a power reset.
Deep Sleep Mode (DEEP SLEEP MODE)	Enable Disable	Not enabled	If this parameter is enabled, the controller goes into deep sleep mode when the controller is not in use for an adjustable time.
Auto-Clear Warning Alarm (AUTO CLEAR WARNINGS)	Enable Disable	Not enabled	If this parameter is enabled, the controller automatically clears an active alarm, when you have resolved the condition that activated the alarm.
Language (LANGUAGE SUPPORT)	English Chinese	English	You can change the display language if the controller supports multiple languages.

Display (DISPLAY)

Parameter	Range	Default	Description
Contrast (CONTRAST)	0 to 100 %	80 %	Configure the display contrast with this parameter.
Power Save Mode (POWER SAVE MODE)	Enable Disable	Not enabled	If this parameter is enabled, the controller turns off the LCD backlight after an adjustable time.

Parameter	Range	Default	Description
			This is only when the engine is not in operation. You can configure the adjustable timer with the smart connect software in `Timers > General > Power Save Mode Delay`

Communication (RS485 COMM)

Level 2	Range	Default	Description
Communication Mode (COMM MODE)	None Modbus	None	Select the communication mode.
Server ID (MODBUS SLAVE ID)	1 to 247	2	Select the server ID for Modbus.
Baud rate (BAUDRATE)	1200 2400 4800 9600 19200 38400 57600 115200	9600 bps	Select the baud rate for the serial communication.
Parity Bit (PARITY)	None Even Odd	None	Select the parity bit for the serial communication.

Auto Exercise – Event 1 (AUTO EXERCISE – 1)

Level 2	Range	Default	Description
Auto Exercise (EVENT 1)	Enable Disable	Not enabled	If you enable this parameter, the controller operates in exercise mode for the adjustable time duration.
Event Occurrence (EVENT OCCURENCE)	Daily Weekly Monthly	Daily	Configure how often the sequences occur.
Event Day (EVENT DAY)	Daily: Runs every day Weekly: Sunday to Saturday Monthly: 1 to 28	Runs every day	Configure the start date for the sequences.
Start Time (START TIME)	00:00 to 23:59 hour	10:00 hour	Configure the start time for the sequences.
Duration (GEN ON DURATION)	00 hr 01 min. to 99 hr 59 min.	10 hours, 10 minutes	Configure for how long the genset operates during the scheduled sequences.
Load Transfer (LOAD TRANSFER)	Enable Disable	Not enabled	If this parameter is enabled, the load is on the genset. If this parameter is not enabled, the load is transferred from the genset to the mains. This is not possible during a mains failure.

Auto Exercise – Event 2 (AUTO EXERCISE – 2)

Parameter	Range	Default	Description
Auto Exercise (EVENT 2)	Enable Disable	Not enabled	If you enable this parameter, the controller operates in exercise mode for the adjustable time duration.
Event Occurrence (EVENT OCCURENCE)	Daily Weekly Monthly	Daily	Configure how often the sequences occur.
Event Day (EVENT DAY)	Daily: Runs every day Weekly: Sunday to Saturday Monthly: 1 to 28	Runs every day	Configure the start date for the sequences.
Start Time (START TIME)	00:00 to 23:59 hour	09:59 hours	Configure the start time for the sequences.
Duration (GEN ON DURATION)	00 hr 01 min. to 99 hr 59 min.	10 hours, 10 minutes	Configure for how long the genset operates during the scheduled sequences.
Load Transfer (LOAD TRANSFER)	Enable Disable	Not enabled	If this parameter is enabled, the load is on the genset. If this parameter is not enabled, the load is transferred from the genset to the mains. This is not possible during a mains failure.

3.5.2 Digital inputs

Digital Input # (DIG IN #)

Parameter	Range	Default	Description
Source (SOURCE)	See **Digital input source selection** in this document	-	Select an input source from the list.
Name (NAME)	Auxiliary Input #	-	You can configure the name of the input.
Polarity (POLARITY)	Close to Activate Open to Activate	Close to Activate	You can select how to activate the input. It can be open or close with reference to ground.
Action (ACTION)	None Notification Warning Electrical Trip Shutdown	None	You can configure what action occurs when the digital input is activated.
Activation (ACTIVATION)	Never From Engine Start From Monitoring On Always	From Monitoring On	You can configure when the controller starts to monitor the digital input.
Activation Delay (ACTIVATION DELAY)	0 to 60 s	1 s	When the timer expires, the configured action occurs.

3.5.3 Analogue inputs

Analogue Input 1 (ENG TEMP / DIG G)

Parameter	Range	Default	Description
Use Input As (SENSOR SELECTION)	Not used Digital Input G	Not used	Select the input.

Parameter	Range	Default	Description
	Engine Coolant Temperature Sensor		
(Digital) Source ((DIG) SOURCE)	See **Digital input source selection** in this document	Not used	Select the source from the list.
Name (NAME)	Auxiliary Input G	-	You can configure the name of the input.
(Digital) Polarity ((DIG) POLARITY)	Close to Activate Open to Activate	Close to Activate	Select the polarity for the input.
(Digital) Action ((DIG) ACTION)	None Notification Warning Electrical Trip Shutdown	None	Select the action when the input is activated.
(Digital) Activation ((DIG) ACTIVATION)	Never From Engine Start From Monitoring On Always	From Monitoring On	Configure from when the digital input is monitored.
(Digital) Activation Delay ((DIG) ACTIVATION DELAY)	1 to 60 s	1 s	If the input is active when the timer expires, the controller actives the action for the digital input.
(ETS) Circuit Fault Action (OPEN CKT ALARM)	None Notification Warning Electrical Trip Shutdown	None	Configure the action for when there is a circuit failure.
(ETS) Engine Temperature Sensor Calibration Table	Resistance: 0 to 1000 Ω Temperature: 25 to 300 °C	-	Configure the resistance and temperature values for 10 measurement points in the calibration table.

Analogue Input 2 (FUEL LVL / DIG H)

Parameter	Range	Default	Description
Use Input As (SENSOR SELECTION)	Not used Digital Input H Fuel Level Sensor	Not used	Select what to use the input as.
(Digital) Source ((DIG) SOURCE)	See **Digital input source selection** in this document	Not used	Select the source from the list.
Name (NAME)	Auxiliary Input H	-	You can configure the name of the input.
(Digital) Polarity ((DIG) POLARITY)	Close to Activate Open to Activate	Close to Activate	Select the polarity for the input.
(Digital) Action ((DIG) ACTION)	None Notification Warning Electrical Trip Shutdown	None	Select the action when the input is activated.
(Digital) Activation ((DIG) ACTIVATION)	Never From Engine Start	From Monitoring On	Configure from when the digital input is monitored.

Parameter	Range	Default	Description
	From Monitoring On Always		
(Digital) Activation Delay ((DIG) ACTIVATION DELAY)	1 to 60 s	1 s	If the input is active when the timer expires, the controller actives the action for the digital input.
(FLS) Low Fuel Level Shutdown (SHUTDOWN)	Enable Disable	Not enabled	If this parameter is enabled, the controller shuts down the engine when the fuel level is less than the shutdown set point (SHUTDOWN THRESHOLD).
(FLS) Shutdown Threshold (SHUTDOWN THRESHOLD)	0 to 78 %	10 %	The controller shuts down the engine when the fuel level is less than this set point.
(FLS) Low Fuel Level Warning (WARNING)	Enable Disable	Enabled	If this parameter is enabled, the controller shows a notification when the fuel level is less than the notification set point (NOTIFICATION THRESHOLD).
(FLS) Warning Threshold (WARNING THRESHOLD)	2 to 80 %	12 %	The controller shows a notification when the fuel level is less than this set point.
(FLS) Fuel Tank Capacity (FUEL TANK SIZE)	2 to 1000 litre	100 litre	Configure the fuel tank capacity.
(FLS) Fuel Theft Warning (FUEL THEFT ALARM)	Enable Disable	Enabled	If this parameter is enabled, the controller activates an alarm when the fuel level is less than the set point for the fuel theft alarm.
(FLS) Fuel Theft Alarm Threshold (FUEL LVL THRESH)	1 to 100 % per hour	50 %	If the fuel consumption per hour is more than this set point, the controller activates an alarm. The percentage is of the nominal fuel consumption.
(FLS) Circuit Fault Action (OPEN CKT ALARM)	None Notification Warning Electrical Trip Shutdown	None	Configure the action for when there is an open circuit failure.
(FLS) Fuel Sensor Reference (FUEL LVL REF)	Battery Negative Engine Body	Engine Body	Select the reference point for the fuel sensor.
(FLS) Fuel Level Sensor Calibration Table	Resistance: 0 to 1000 Ω Fuel level: 0 to 100 %	-	Configure the resistance and fuel level values for the 10 measurement points in the calibration table.

Analogue Input 3 (LOP / DIG F)

Parameter	Range	Default	Description
Use Input As (SENSOR SELECTION)	Not used Digital Input F Lube Oil Pressure	Not used	Select what to use the input as.
(Digital) Source ((DIG) SOURCE)	See **Digital input source selection** in this document	Not used	Select the source from the list.

Parameter	Range	Default	Description
Name (NAME)	Auxiliary Input F	-	You can configure the name of the input.
(Digital) Polarity ((DIG) POLARITY)	Close to Activate Open to Activate	Close to Activate	Select the polarity for the input.
(Digital) Action ((DIG) ACTION)	None Notification Warning Electrical Trip Shutdown	None	Select the action when the input is activated.
(Digital) Activation ((DIG) ACTIVATION)	Never From Engine Start From Monitoring On Always	From Monitoring On	Configure from when the digital input is monitored.
(Digital) Activation Delay ((DIG) ACTIVATION DELAY)	1 to 60 s	1 s	If the input is active when the timer expires, the controller actives the action for the digital input.
(LOP) Circuit Fault Action (OPEN CKT ALARM)	None Notification Warning Electrical Trip Shutdown	None	Configure the action for an open circuit failure.
(LOP) Lube Oil Pressure Sensor Calibration	Resistance: 10 to 100 Ω Pressure: 1.0 to 10.0 bar	-	Configure the resistance and pressure values for the 10 measurement points in the calibration table.

Analogue Input 4 (LOP/DIG I)

Parameter	Range	Default	Description
Use Input As (SENSOR SELECTION)	Not used Digital Input I S4 Sensor (4-20 mA LOP)	Not used	Select what to use the input as.
(Digital) Source ((DIG) SOURCE)	See **Digital input source selection** in this document	Not used	Select the source from the list.
Name (NAME)	Auxiliary Input I	-	You can configure the name of the input.
(Digital) Polarity ((DIG) POLARITY)	Close to Activate Open to Activate	Close to Activate	Select the polarity for the input.
(Digital) Action ((DIG) ACTION)	None Notification Warning Electrical Trip Shutdown	None	Select the action when the input is activated.
(Digital) Activation ((DIG) ACTIVATION)	Never From Engine Start From Monitoring On Always	From Monitoring On	Configure from when the digital input is monitored.
(Digital) Activation Delay	1 to 60 s	1 s	If the input is active when the timer expires, the controller actives the action for the digital input.

Parameter	Range	Default	Description
((DIG) ACTIVATION DELAY)			
(LOP) Circuit Fault Action (OPEN CKT ALARM)	None Notification Warning Electrical Trip Shutdown	None	Configure the action for an open circuit failure.
(LOP) Lube Oil Pressure Sensor Calibration	Current: 4 to 20 mA Pressure: 0.0 to 10.0 bar	-	Configure the current and pressure values for the 10 measurement points in the calibration table.

3.5.4 Outputs

Outputs # (OUT #)

Parameter	Range	Default	Description
Source (SOURCE)	See **Digital output source selection** in this document	-	Select an output source from the list.
On Activation (ON ACTIVATION)	Energise De-energise	De-energise	Select what the status of the output source is when it is active. You can select if it is energised or de-energised.

3.5.5 Timers

Cranking (CRANKING TIMERS)

Parameter	Range	Default	Description
Crank Hold Time (CRANK HOLD TIME)	1 to 15 s	5 s	Configure for how long the engine cranks.
Crank Rest Time (CRANK REST TIME)	2 to 60 s	5 s	The time between each crank.
Manual Start Delay (MANUAL START DELAY)	0 to 300 s	3 s	When this timer expires in manual mode, the engine starts to crank.
Auto Start Delay (AUTO START DELAY)	0 to 43200 s	3 s	When this timer expires in AUTO mode, the engine starts to crank.

General (GENERAL TIMER)

Parameter	Range	Default	Description
Safety Monitoring Delay (SAFETY MONITOR DELAY)	10 to 60 s	10 s	The engine safety parameters are not monitored during the *Safety monitoring delay*. The timer starts after crank disconnect.
Warm-Up Delay (WARM-UP DELAY)	0 to 60 s	3 s	When the alternator voltage and frequency are OK, the load is transferred to the alternator. There's a *warm-up delay* before the load is transferred.
Return To Mains Delay (RETN-TO-MAINS DELAY)	0 to 600 s	5 s	The controller closes the mains breaker when the *return to mains delay* timer expires.

Parameter	Range	Default	Description
Engine Cooling Time (ENG COOL TIME)	0 to 300 s	5 s	When the *engine cooling* timer expires, the engine stops.
Stop Action Time (STOP ACTION TIME)	10 to 120 s	30 s	The time duration for the stop action sequence.
Additional Stopping Time (ADDN STOPPING TIME)	0 to 120 s	10 s	Additional time added to the engine stop sequence.
Load Transfer Delay (LOAD TRANSFER DELAY)	0 to 60 s	1 s	The time it takes to transfer the load to the mains or genset.
Power Save Mode Delay (PWR SAVE MODE DELAY)	5 to 1800 s	30 s	If the controller is not in use, then the backlight turns off when the timer expires.
Screen Changeover Time (SCRN CHNGOVER TIME)	1 to 1800 s	3 s	The display page changes when the timer expires.
Deep Sleep Mode Delay (DEEP SLP MODE DELAY)	5 to 1800 s	10 s	If the controller is not in use, the controller goes into deep sleep mode when the timer expires.
Sounder Alarm Time (SOUNDER ALARM TIMER)	1 to 300 s	5 s	The alarm is activated when the alarm output is activated. The alarm stops when the timer expires.
Auto Exit Config Mode (AUTO EXIT CNFG MODE)	10 to 1800 s	10 s	If the controller is not in use, the controller automatically exits the configuration mode when the timer expires.
Inlet shutoff Valve Pull Signal	0 to 2 s	0.1 s	The output for the pull signal for the inlet shutoff valve is active for this time duration.
Gen Breaker Pulse Timer	0 to 5 s	0.5 s	The time duration for the genset breaker pulse.
Mains Breaker Pulse Timer	0 to 5 s	0.5 s	The time duration for the mains breaker pulse.
Breaker Feedback Timer	1 to 10 s	2 s	The timer for breaker feedback.
Breaker Close Delay	1 to 10 s	2 s	Configure the time to charge the generator breaker spring before the breaker closes.

3.5.6 Generator

Alternator configuration (ALT CONFIG)

Parameter	Range	Default	Description
Alternator Present (ALT PRESENT)	Yes No	No	No: All generator parameters are not enabled. Yes: All generator parameters are enabled.
Number of Poles (NUMBER OF POLES)	2/4/6/8	4	The pole number in the alternator.
AC system (ALT AC SYSTEM)	Single-phase 3-phase	3-phase	Select if it is a single phase genset or a 3-phase genset.

Parameter	Range	Default	Description
Min Healthy Voltage (MIN HEALTHY VOLT)	50 to 350 V phase-neutral	40 V	When the voltage has reached the set point, the genset starts to warm up.
Min Healthy Frequency (MIN HEALTHY FREQ)	10 to 75 Hz	40 Hz	When the frequency has reached the set point, the genset starts to warm up.
Phase Reversal Detection (PHASE REVERSAL DETECT)	Enable Disable	Enabled	If this parameter is enabled, a phase reversal is detected if the phase sequence is not L1-L2-L3.
Phase Reversal Action (PHASE REVERSAL ACTION)	None Notification Warning Electrical Trip Shutdown	None	Configure the action for phase reversal detection.
Auto Load Transfer (AUTO LOAD TRANSFER)	Enable Disable	Enabled	If this parameter is enabled, the load is automatically transferred to the genset when the voltage and frequency are more than their minimum set points and the genset is running. This is only for manual mode.
Alternator Wave Detection (ALT WAVE DETECT)	Enable Disable	Not enabled	Use this function to analyse and verify the genset voltage pattern. The running hours counter and energy meters counter start when the controller has analysed (and verified) the pattern.
Gen PT Enable (GEN PT)	Enable Disable	Not enabled	If the application includes a genset power transformer (PT), enable this parameter.
Gen PT Primary (GEN PT PRIMARY)	100 to 25000	100	Configure the PT primary value.
Gen PT Secondary (GEN PT SECOND)	100 to 700	100	Configure the PT secondary value.

Nominal Values

Parameter	Range	Default	Description
Nominal Voltage	80 to 30000 V	400 V	Configure the nominal voltage value.
Nominal Frequency	5 to 75 Hz	50 Hz	Configure the nominal frequency value.
Nominal Load Current	0 to 8000 A	350 A	Configure the nominal value for the load current.
Nominal 4th Current	0 to 8000 A	800 A	Configure the nominal value for the 4th current.
Nominal Speed	100 to 4000 RPM	1500 RPM	Configure the nominal speed value.
Nominal Power	10 to 8000 kW	200 kW	Configure the nominal power value.
Alternator Nominal Voltage	80 to 30000 V	400 V	Configure the nominal value for the alternator voltage.
Alternator Nominal Frequency	5 to 75 Hz	60 Hz	Configure the nominal value for the alternator frequency.
Alternator Nominal Load Current	0 to 8000 A	350 A	Configure the nominal value for the alternator load current.
Alternator Nominal 4th Current	0 to 8000 A	800 A	Configure the nominal value for the alternator 4th current.

Parameter	Range	Default	Description
Alternator Nominal Speed	100 to 4000 RPM	1800 RPM	Configure the nominal value for the alternator speed.
Alternator Nominal Power	10 to 8000 kW	200 kW	Configure the nominal value for the alternator power.

Voltage Monitoring (VOLT MONITOR)

Parameter	Range	Default	Description
Under-voltage Shutdown (UNDER VOLT SHUTDOWN)	Enable Disable	Not enabled	If this parameter is enabled, the controller shuts down the engine when the voltage is less than the configured set point for under-voltage.
Under-voltage Shutdown Threshold (UV SHUTDOWN THRESH)	50 to 295 V phase-neutral	80 V	When the voltage is less than this set point, the controller shuts down the engine.
Under-voltage Shutdown Delay (UV SHUTDOWN DELAY)	0.1 to 100 s	10 s	If the voltage is less than the set point for under-voltage shutdown (UV SHUTDOWN THRESH) when this timer expires, the controller shuts down the engine.
Under-voltage Warning (UNDER VOLT WARNING)	Enable Disable	Not enabled	If this parameter is enabled, the display shows a warning when the voltage is less than the set point for the under-voltage warning.
Under-voltage Warning Threshold (UV WARNING THRESHOLD)	55 to 300 V phase-neutral	Not enabled	When the voltage is less than the set point, the controller shows a warning message.
Under-voltage Warning Delay (UV WARNING DELAY)	0.1 to 100 s	10 s	If the voltage is less than the set point for under-voltage warning (UV WARNING THRESH) when this timer expires, the controller activates a warning alarm.
Over-voltage Shutdown (OVER VOLT SHUTDOWN)	Enable Disable	Not enabled	If this parameter is enabled, the controller shuts down the engine when the voltage is more than the configured set point for over-voltage.
Over-voltage Shutdown Threshold (OV SHUTDOWN THRESH)	105 to 350 V phase-neutral	120 V	When the voltage is more than the set point, the engine shuts down.
Over-voltage Shutdown Delay (OV SHUTDOWN DELAY)	0.1 to 100 s	10 s	If the voltage is more than the set point for over-voltage shutdown (OV SHUTDOWN THRESH) when this timer expires, the controller shuts down the engine.
Over-voltage Warning (OVER VOLT WARNING)	Enable Disable	Not enabled	If this parameter is enabled, the controller shows a warning message when the voltage is more than the over-voltage set point (OV WARNING THRESHOLD).
Over-voltage Warning Threshold	100 to 345 V phase-neutral	110 V	When the voltage is more than the set point, the engine shows a warning message.

Parameter	Range	Default	Description
(OV WARNING THRESHOLD)			
Over-voltage Warning Delay (OV WARNING DELAY)	0.1 to 100 s	10 s	If the voltage is more than the set point for over-voltage warning (OV WARNING THRESH) when this timer expires, the controller activates a warning alarm.

Frequency Monitoring (FREQ MONITOR)

Parameter	Range	Default	Description
Under-frequency Shutdown (UNDER FREQ SHUTDOWN)	Enable Disable	Not enabled	If this parameter is enabled, the controller shuts down the engine when the frequency is less than the configured set point for under-frequency.
Under-frequency Shutdown Threshold (UF SHUTDOWN THRESH)	10.0 to 59.0 Hz	80 Hz	When the frequency is less than this set point, the controller shuts down the engine.
Under-frequency Shutdown Delay (UF SHUTDOWN DELAY)	0.1 to 100 s	10 s	If the frequency is less than the set point for under-frequency shutdown (UF SHUTDOWN THRESH) when this timer expires, the controller shuts down the engine.
Under-frequency Warning Enable (UNDER FREQ WARNING)	Enable Disable	Not enabled	If this parameter is enabled, the display shows a warning when the voltage is less than the set point for the under-voltage warning.
Under-frequency Warning Threshold (UF WARNING THRESHOLD)	11.0 to 60.0 Hz	90 Hz	When the frequency is less than this set point, the controller shows a warning message.
Under-frequency Warning Delay (UF WARNING DELAY)	0.1 to 100 s	10 s	If the frequency is less than the set point for under-frequency warning (UF WARNING THRESH) when this timer expires, the controller activates a warning alarm.
Over-frequency Shutdown Enable (OVER FREQ SHUTDOWN)	Enable Disable	Not enabled	If this parameter is enabled, the controller shuts down the engine when the frequency is more than the configured set point for over-frequency.
Over-frequency Shutdown Threshold (OF SHUTDOWN THRESH)	26.0 to 75.0 Hz	120 Hz	When the frequency is more than this set point, the engine shuts down.
Over-frequency Shutdown Delay (OF SHUTDOWN DELAY)	0.1 to 100 s	10 s	If the frequency is more than the set point for over-frequency shutdown (OF SHUTDOWN THRESH) when this timer expires, the controller shuts down the engine.
Over-frequency Warning Enable (OVER FREQ WARNING)	Enable Disable	Not enabled	If this parameter is enabled, the controller shows a warning message when the frequency is more than the set point for the over-frequency warning.
Over-frequency Warning Threshold	25.0 to 74.0 Hz	110 Hz	When the frequency is more than this set point, the controller activates a warning alarm.

Parameter	Range	Default	Description
(OF WARNING THRESHOLD)			
Over-frequency Warning Delay (OF WARNING DELAY)	0.1 to 100 s	10 s	If the frequency is more than the set point for over-frequency warning (OF WARNING THRESH) when this timer expires, the controller shuts down the engine.

Current Monitoring (CURRENT MONITOR)

Parameter	Range	Default	Description
CT Ratio (LOAD CT RATIO)	0 to 8000 / 5	150/5	CT ratio.
Over-current Action (OVER CURR ACTION)	None Notification Warning Electrical Trip Shutdown	None	Configure the action for when over-current is detected.
Over-current Threshold (OVER CURR THRESHOLD)	5 to 10000 A	120	The action for over-current is activated when the current is more than this set point.
Over-current Delay (OVER CURR DELAY)	1 to 600 s	1 s	When the delay timer expires, the action for over-current is activated if the current is more than over-current set point.
CT Location (CT LOCATION)	On Alt Output Cable On Load Cable	On Alt Output Cable	Configure the location of the CT. You can place the CT on the line from the genset or on the load cable.

Load Monitoring (LOAD MONITOR)

Parameter	Range	Default	Description
Overload Action (OVERLOAD ACTION)	None Notification Warning Electrical Trip Shutdown	None	The action that occurs when the load is more than the overload set point.
Overload Threshold (OVERLOAD THRESHOLD)	50 to 150 %	90 %	The action for overload is activated when the load is more than this set point.
Overload Monitoring Delay (OVERLOAD MON DELAY)	1 to 600 s	1 s	When the delay timer expires, the action for overload is activated if the load is more than the overload set point.
Unbalanced Load Action (UNBAL LOAD ACTION)	None Warning Electrical Trip Shutdown Notification	None	The action that occurs when the load is more than the unbalanced load set point.
Unbalanced Load Threshold (UNBAL LOAD THRESHOLD)	5 to 200 %	5 %	The action for unbalanced load is activated when the load is more than this set point.

Parameter	Range	Default	Description
Unbalanced Load Delay (UNBAL LOAD DELAY)	1 to 600 s	1 s	When the delay timer expires, the action for unbalanced load is activated if the load is more than the unbalanced set point.
Low Load Enable	Enable Disable	Not enabled	If this parameter is enabled, the configured action for low load is activated.
Low Load Action	None Warning Electrical Trip Shutdown Notification	None	The action that occurs when low load is detected. Low load is detected when the load is less than the set point for low load trip (LOW LOAD TRIP).
Low Load Trip	1 to 99 %	50 %	The set point for low load. When the load is less than this set point, the action for low load is activated.
Low Load Return	2 to 100 %	51 %	If the action for low load is a warning, the controller stops monitoring low load when the load is more than this set point.
Low Load Delay	1 to 3600 s	1 s	If the load is less than the set point for low load when the time expires, the low load action is activated.

3.5.7 Mains

Configuration (MAINS CONFIG)

Parameter	Range	Default	Description
Mains Monitoring (MAINS MONITORING)	Enable Disable	Enabled	If this parameter is enabled, the controller monitors the mains voltage and frequency.
Mains AC System (MAINS AC SYSTEM)	Single-phase 3-phase	3-phase	Select the phase system for the mains.
Phase Reversal Detection (PHASE REVERSAL DETECT)	Enable Disable	Not enabled	If this parameter is enabled, a phase reversal is detected if the phase sequence is not L1-L2-L3.
Phase Reversal Action (PHASE REVERSAL ACTION)	None Notification	None	Configure the action for phase reversal detection.
Partial Healthy Detection (MAINS PARTIAL HEALTHY)	Enable Disable	Not enabled	If this parameter is enabled, a mains failure is not detected if one or two of the phases fail. This is only for a 3-phase system.
Mains PT Enable (MAINS PT)	Enable Disable	Not enabled	Enable this parameter, if the application includes a mains power transformer (PT).
Mains PT Primary (MAINS PT PRIMARY)	100 to 25000	100	Configure the PT primary value.
Mains PT Secondary (MAINS PT SECOND)	100 to 700	100	Configure the PT secondary value.

Voltage Monitoring (VOLT MONITOR)

Parameter	Range	Default	Description
Under-voltage (UV ENABLE)	Enable Disable	Yes	If this parameter is enabled, the controller detects a mains failure when the mains voltage

Parameter	Range	Default	Description
			is less than the under-voltage set point (UV trip).
(UV) Trip (UV TRIP)	50 to 298 V phase-neutral	55 V	If the mains voltage is less than this set point, there is a mains failure.
(UV) Return (UV RETURN)	52 to 300 V phase-neutral	57 V	The mains returns when the mains voltage is more than this set point.
Over-voltage (OV ENABLE)	Enable Disable	Yes	If this parameter is enabled, the controller detects a mains failure when the mains voltage is more than the over-voltage set point (OV trip).
(OV) Return (OV RETURN)	100 to 348 V phase-neutral	280 V	If the mains voltage is more than this set point, there is a mains failure.
(OV) Trip (OV TRIP)	102 to 350 V phase-neutral	270 V	The mains returns when the mains voltage is less than this set point.
(OV) Delay (OV DELAY)	0 to 100 s	10 s	If the voltage is more than the over-voltage set point when this timer expires, the action for over-voltage is activated.

Frequency Monitoring (FREQ MONITOR)

Parameter	Range	Default	Description
Under-frequency (UF ENABLE)	Enable Disable	Yes	If this parameter is enabled, the controller detects a mains failure when the mains frequency is less than the under-frequency set point (UF trip).
(UF) Trip (UF TRIP)	10.0 to 59.0 Hz	45 Hz	If the mains frequency is less than this set point, there is a mains failure.
(UF) Return (UF RETURN)	11.0 to 60.0 Hz	47 Hz	The mains returns when the mains frequency is more than this set point.
Over-frequency (OF ENABLE)	Enable Disable	Yes	If this parameter is enabled, the controller detects a mains failure when the mains frequency is more than the over-frequency set point (OF trip).
(OF) Return (OF RETURN)	25.0 to 74.0 Hz	55 Hz	If the mains frequency is more than this set point, there is a mains failure.
(OF) Trip (OF TRIP)	26.0 to 75.0 Hz	52 Hz	The mains returns when the mains frequency is less than this set point.
(OF) Delay		10 s	If the frequency is more than the over-frequency set point when this timer expires, the action for over-frequency is activated.

3.5.8 Engine

Crank Disconnect (CRANK DISCONN)

Parameter	Range	Default	Description
Start Attempts (START ATTEMPTS)	1 to 9	3	Number of attempts to crank the engine.
Disconnect on Oil Pressure Sensor	Enable Disable	Not enabled	If this parameter is enabled, the crank is disconnected when the oil pressure is more

Parameter	Range	Default	Description
(DISCONN ON LOP SENS)			than the oil pressure set point (DISCONN LOP SENS).
Monitor Pressure Sensor Before Crank (MON LLOP BEF CRANK)	Enable Disable	Not enabled	If this parameter is enabled, the oil pressure is monitored before the engine starts. If the oil pressure is more than the set point (MON LOP BEF CRANK), the engine cannot start.
Pressure Sensor Monitoring Threshold (DISCONN LOP SENS)	0.5 to 10.0 bar	4 bar	Configure the set point for the oil pressure.
Monitor Pressure Switch Before Crank (MON LOP BEF CRANK)	Enable Disable	Not enabled	If this parameter is enabled, the oil pressure is monitored before the engine starts. If the pressure switch is open, the controller activates a high oil pressure alarm.
Disconnect on Oil Pressure Switch (DISCONN ON LLOP SW)	Enable Disable	Not enabled	If this parameter is enabled, the crank disconnects if the oil pressure is high.
Pressure Switch Transient Time (LLOP SW TRANS TIME)	0.0 to 3.0 s	1.5 s	If the oil pressure is high after this timer expires, the crank is disconnected.
Crank Disconnect At Alt Frequency (ALT FREQUENCY)	10 to 70 Hz	20 Hz	If the frequency is more than this set point during cranking, the controller disconnects the crank.
Crank Disconnect At Engine Speed (ENGINE SPEED)	150 to 4000 RPM	600 RPM	If the engine speed is more than this set point during cranking, the controller disconnects the crank.
Disconnect On Charging Alt Voltage (DISC ON CHG ALT VOLT)	Enable Disable	Not enabled	If the charging alternator voltage is more than the alternator set point (CHG ALT THRESHOLD) during cranking attempts, the cranks is disconnected.
Charging Alt Disconnect Volt Threshold (CHG ALT THRESHOLD)	5.0 to 30.0 V	5.0 V	If the charging alternator voltage is more than this set point during cranking, the cranks is disconnected.

Speed Monitoring (SPEED MONITOR)

Parameter	Range	Default	Description
Engine Speed Sense Source (SPEED SENSE SOURCE)	Alternator frequency Magnetic Pickup W-Point Frequency	Alternator frequency	Configure how engine speed is monitored.
Flywheel Teeth (Magnetic Pickup)	1 to 300	110	The number of teeth on the flywheel.
W-Point Frequency @ 1500	0 to 500	274	The frequency at the W-point of the charging alternator.
Under-speed Shutdown (UNDER SPEED SHUTDOWN)	Enable Disable	Not enabled	If this parameter is enabled, the controller shuts down the engine when the speed is less than the configured set point for under-speed.

Parameter	Range	Default	Description
Under-speed Threshold (UNDER SPEED THRESH)	0 to 3600 RPM	1400 RPM	When the speed is less than this set point, the controller shuts down the engine.
Under-speed Delay (UNDER SPEED DELAY)	1 to 60 s	3 s	If the speed is still less than the under-speed set point when the timer expires, the engine shuts down.
Over-speed Threshold (OVER SPEED THRESH)	700 to 4000 RPM	1600 RPM	The set point for over-speed.
Over-speed Delay (OVER SPEED DELAY)	1 to 20 s	3 s	If the speed is still more than the over-speed set point when the timer expires, the controller activates an alarm.
Gross Over-speed Threshold (GROSS OS THRESHOLD)	100 to 200 %	130 %	If the speed is more than this set point, the engine shuts down. The percentage is of the nominal speed.
Initial Low Speed	500 to 1800 RPM	1100 RPM	Use this parameter to reduce the amount of pollution when the engine starts. This is the initial speed of the engine, and is lower than the operating speed.
Idle to Rated Delay Time	0 to 1200 s	10 s	Time for the engine to go from idle speed to rated speed.
Start-up Idle Mode Time	0 to 1200 s	10 s	The engine operates at low speed for this time duration. You can configure the low speed with the *Initial Low Speed* parameter.
Stopping Idle Time	0 to 1200 s	10 s	In idle mode, the engine operates at low speed for this time duration before the engine shuts down.
Idle Mode Pulse Time	0 to 60 s	2 s	The pulse time for the idle mode output.

Battery Monitoring (BATTERY MONITOR)

Parameter	Range	Default	Description
Low Battery Voltage Action (LOW VOLT ACTION)	None Notification Warning Electrical Trip Shutdown	None	Configure the action for when the battery voltage is low.
Low Battery Voltage Threshold (LOW VOLT THRESHOLD)	8.0 to 31.0 V	8.0 V	The action for low battery voltage is activated when the voltage load is less than this set point.
Low Battery Voltage Delay (LOW VOLT DELAY)	5 to 1800 s	30 s	If the battery voltage is less than the low voltage set point (LOW VOLT THRESHOLD) when the timer expires, the controller activates the action for low battery voltage.
High Battery Voltage Action (HIGH VOLT ACTION)	None Notification Warning Electrical Trip Shutdown	None	Configure the action for when the battery voltage is high.

Parameter	Range	Default	Description
High Battery Voltage Threshold (HIGH VOLT THRESHOLD)	9.0 to 32.0 V	15 V	The action for high battery voltage is activated when the voltage load is more than this set point.
High Battery Voltage Delay (HIGH VOLT DELAY)	5 to 1800 s	30 s	If the battery voltage is more than the set point for high voltage (HIGH VOLT THRESHOLD) when the timer expires, the controller activates the action for high battery voltage.

Charging Alternator Monitoring (CHARGE ALT MON)

Parameter	Range	Default	Description
Charging Alternator Fail Action (FAIL ACTION)	None Notification Warning Electrical Trip Shutdown	None	Configure the action for charging alternator failure.
Charging Alternator Fail Threshold (FAIL THRESHOLD)	0.0 to 35.0 V	10.0 V	The action for charging alternator failure is activated when the alternator voltage is more than this set point.
Charging Alternator Fail Delay (FAIL DELAY)	5 to 60 s	10 s	If the alternator voltage is more than the set point for high voltage (FAIL THRESHOLD) when the timer expires, the controller activates the action for charging alternator failure.

Preheat (PREHEAT)

Parameter	Range	Default	Description
Pre-heat Timer (PREHEAT TIMER)	1 to 900 s	10 s	When the pre-heat timer expires, the engine starts to crank.
Engine Temperature (ENG TEMP EN)	Enable Disable	Not enabled	If this parameter is enabled, the pre-heat output is deactivated when the engine coolant temperature is more than the set point for the coolant temperature (ENG TEMP LIMIT).
Engine Temperature Threshold (ENG TEMP LIMIT)	10 to 300 °C	25 °C	The set point for the engine coolant temperature.

Coolant Control

Parameter	Range	Default	Description
Enable (coolant control)	Enable Disable	Not enabled	Enable this parameter to configure the coolant control.
Temperature Control	Heater Control Cooler Control	Heater Control	Select the type of coolant control.
ON Threshold	0 to 250 °C	50 °C	Cooler control: If the cooler temperature is more than the ON threshold, the output for *Coolant Temperature Control* is activated. Heater control: If the heater temperature is less than the ON threshold, the output for *Coolant Temperature Control* is activated.
OFF Threshold	0 to 250 °C	50 °C	Cooler control: If the cooler temperature is less than the OFF threshold, the output for *Coolant Temperature Control* is deactivated.

Parameter	Range	Default	Description
			Heater control: If the heater temperature is more than the OFF threshold, the output for *Coolant Temperature Control* is deactivated.

Automatic Fuel Transfer (AFT FUNCTION)

Parameter	Range	Default	Description
AFT Activation Threshold (AFT ACT THRESHOLD)	0 to 99 %	40 %	If the fuel level is less than this threshold, the auto fuel transfer output is activated.
AFT deactivation threshold (AFT DEACT THRESHOLD)	1 to 100 %	80 %	If the fuel level is more than this threshold, the output for auto fuel transfer is deactivated.
Timeout After Activation (TIMEOUT AFTER ACT)	1 to 1200 s	600 s	If the fuel level is less than the deactivation threshold when this timer expires, the controller activates a timeout alarm and deactivates the fuel transfer output.
Monitor AFT From Engine On (MON AFT ON ENG ON)	Enable Disable	Not enabled	If this parameter is enabled, the controller monitors the fuel level when the engine is running.

Engine Coolant Temperature

Parameter	Range	Default	Description
Shutdown	Enable Disable	Not enabled	If this parameter is enabled, the controller shuts down the engine when the temperature is more than the shutdown set point (Shutdown Threshold).
Shutdown Threshold	27 to 300 °C	27 °C	If the engine temperature is more than this set point, the controller shuts down the engine.
Warning	Enable Disable	Not enabled	If this parameter is enabled, the controller activates a warning alarm when the temperature is more than the warning set point (Warning Threshold).
Warning Threshold	25 to 298 °C	25 °C	If the engine temperature is more than this set point, the controller activates a warning alarm.
Temp. Threshold Type	Greater Than Threshold Less Than Threshold	Greater Than Threshold	Configure if the controller activates a shutdown and/or a warning when the monitored value is less than or more than the set points.

Lube Oil Pressure (LOP)

Parameter	Range	Default	Description
Low Level Shutdown	Enable Disable	Not enabled	If this parameter is enabled, the controller shuts down the engine when the lube oil pressure is less than the shutdown set point (Shutdown Threshold).
Shutdown Threshold	0.0 to 9.8 Bar	2 Bar	If the lube oil pressure is less than this set point, the controller shuts down the engine.
Low Level Warning	Enable Disable	Not enabled	If this parameter is enabled, the controller activates a warning alarm when the lube oil

Parameter	Range	Default	Description
			level is less than the warning set point (Warning Threshold).
Warning Threshold	0.2 to 10.0 Bar	3 Bar	If the lube oil pressure is more than this set point, the controller activates a warning alarm.

3.5.9 Maintenance

Maintenance (MAINT ALARM)

Parameter	Range	Default	Description
Alarm Action (ACTION)	None Notification Warning	Notification	Configure the alarm action for maintenance.
Due At Engine Hours (DUE AT ENGINE HOURS)	10 to 65000 hours	250 hours	The maintenance timer is based on running hours.
Alarm Due Date (ALARM DUE DATE)	dd/mm/yyyy	-	An alarm occurs when it is the due date.

3.5.10 Rotary actuator

General

Parameter	Range	Default	Description
Actuator Application	As E-Governor As Start/Stop Device	As E-Governor	Select the application for the actuator.
Actuator Speed	1 x 25 Hz to 10 x 25 Hz	4 x 25 Hz	The speed of the actuator speed.
Actuator Direction	Clockwise to stop Anti-clockwise to stop	Clockwise to stop	The rotational direction of the actuator.

Engine Start Strategy

Parameter	Range	Default	Description
Cranking Steps	50 to 5000	50	The number of micro-steps the actuator takes to help the engine start process. One micro-step is approximately 0.11°.
PID Trigger Speed	20 to 2800 RPM	100 RPM	The speed governor activates the configured PID gains when the engine speed is more than this set point.
Ramp Up Time	1 to 180 sec	3 sec	The time it takes the controller to increase the engine RPM from the low speed RPM to the target RPM speed.
PID On Time	1 to 180 sec	3 sec	The PID control starts when this timer expires.

Generator E-Gov Configuration

Parameter	Range	Default	Description
Set Speed Selection	Fix Speed (0 % Droop) Load Based Droop	Fixed Speed (0 % Droop)	Select the mode for the governor operation.
Droop	0 to 4 %	0 %	This is only for load based droop. Select the percentage droop.

Parameter	Range	Default	Description
Target Speed	500 to 4000 RPM	500 RPM	Target output speed for the engine.
Proportional Gain (Kp)	0 to 1000	0	Proportional gain for the engine speed governor.
Integral Gain (Ki)	0 to 2000	0	Integral gain for the engine speed governor.
Derivative Gain (Kd)	0 to 1000	0	Derivative gain for the engine speed governor.
Friction Set-off (Dither)	0 to 1000	0	This parameter is used to generate a small vibration in the actuator. A value of 1, generates a vibration amplitude of approximately ±0.11°. The vibration amplitudes increases proportionally to the configured value.
Gain Schedule Trigger	0 to 100 %	0.0 %	If the transient engine speed deviates more than this set point, the regular PID gains are no longer used. Instead, the gains are set based on the unloading and loading factors.
Loading Factor	0 to 1000	0	This value is used as a multiplier factor for the PID gains, when the transient engine speed deviates more than the set point for the *Gain Schedule Trigger*. This factor is used during loading.
Unloading Factor	0 to 1000	0	This value is used as a multiplier factor for the PID gains, when the transient engine speed deviates more than the set point for the *Gain Schedule Trigger*. This factor is used during unloading.

Start/Stop Device Configuration

Parameter	Range	Default	Description
Running Steps	0 to 500	100	The number of micro-steps the actuator takes for each engine rotation. This is only when the actuator application is configured as a start/stop device.

3.5.11 Password ID

ID

Parameter	Input	Range	Description
(PASSWORD 1)	####	Numbers: 0 to 9	The password for level 1 access.
(PASSWORD 2)	####	Numbers: 0 to 9	The password for level 2 access.

3.6 Password

The controller has two password levels that you can configure on the controller. Parameter settings cannot be changed with a lower ranking password, but are shown on the display.

Password level	Access	Factory setting
1	Full access (read and write)	0123
2	Limited access (read)	1234

Change the password on the controller:

1. Go to *Configuration menu*.
2. Log on with the password for level 1.
3. Use the *Up* and *Down* buttons to go to *Misc Settings*. Push the *Start* button to select.
4. Use the *Up* and *Down* buttons to go to the password you want to change. Select the password with the *Start* button.
5. Use the *Up* and *Down* buttons to select the first digit in the new password. Confirm your selection with the *Start* button.
6. Do step 5 again for the three remaining digits.
7. When you have selected all four digits, you will see this display:

4. Modes of operation

4.1 Running mode

The controller has two running modes:

- **AUTO:** The controller operates automatically, and the operator cannot initiate sequences manually.
- **Manual:** The operator has to initiate all sequences. You can do this with the buttons, Modbus commands, or digital inputs.

4.2 AUTO mode

In AUTO mode, you can select these functions:

- Island
- Engine drive
- Automatic Mains Failure (AMF)
- Remote start/stop
- Auto exercise

If the controller is not in AUTO mode, push the mode selection button to change the running mode to AUTO.

4.2.1 Island

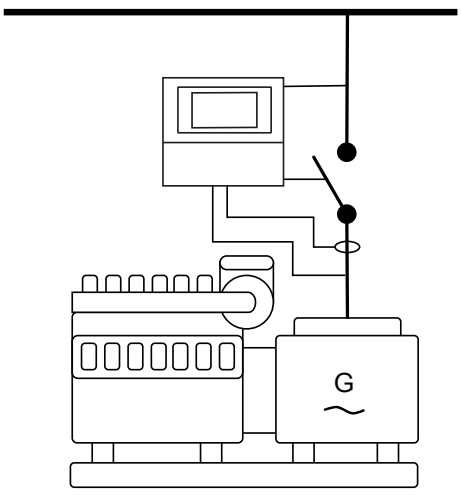
The controller operates in island when:

- Mains monitoring is not enabled.
- Auto exercise is not enabled.

In the smart connect software, go to `Mains > Configuration > Mains monitoring` and make sure that mains monitoring is not enabled. To make sure that auto exercise is not enabled for events 1 and 2, go to `Module > Auto Exercise > Event 1/Event 2`.

The controller automatically starts the genset and closes the generator breaker at a digital start command. When the stop command is given, the generator breaker opens, and the genset is stopped after a cooling down period.

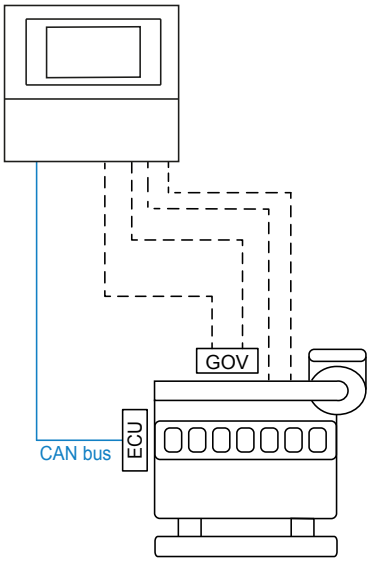
Use a digital input to activate and deactivate the start and stop commands. You cannot use the display buttons in AUTO mode.



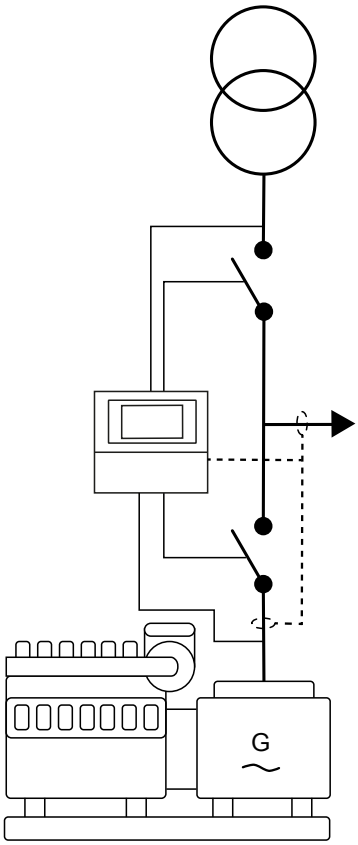
4.2.2 Engine drive

You can use the SGC to control one engine. The controller has all the necessary functions to control and protect an engine.

To use the controller to control an engine drive, go to `Generator > Alternator Configuration` in the smart connect software. Set *Alternator Present* as No.



4.2.3 Automatic mains failure (AMF)



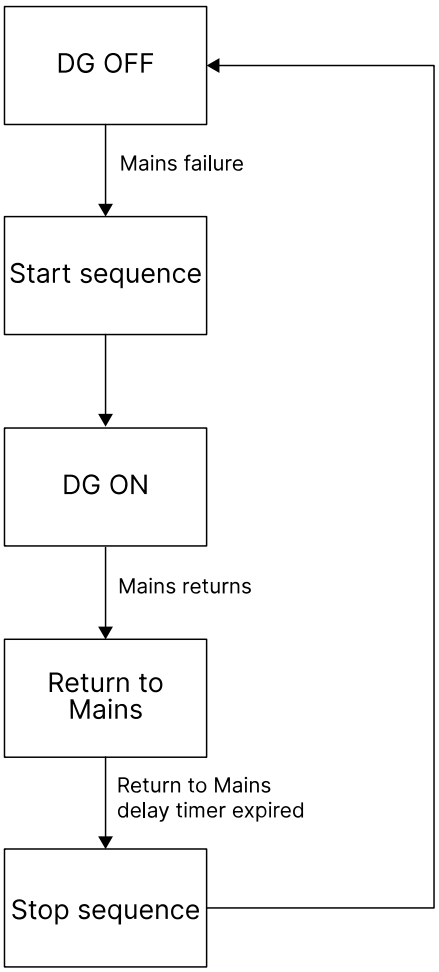
NOTE You can place the CT on the line from the genset or on the load side.

The AMF function is active when:

- Auto exercise is not enabled.

- Mains monitoring is enabled.

In the smart connect software, go to `Mains > Configuration > Mains monitoring` and make sure that mains monitoring is enabled. To make sure that auto exercise is not enabled for events 1 and 2, go to `Module > Auto Exercise > Event 1/Event 2`.



If there is a mains failure, the SGC controller can automatically start the genset and switch to generator supply (see the flowchart above). The controller does this if the mains continues to fail after the *Mains detect delay* timer has expired.

The genset starts as specified by the start sequence. Once the genset loading voltage and frequency are more than their minimum set points, the *Warm-up delay* timer starts. At the end of the warm-up delay, the timer for the load transfer delay starts, and the genset breaker closes. When the mains returns, the controller synchronises the mains breaker to the busbar when the *Return to mains delay* timer has expired. The genset cools and then stops.

If the mains returns, or a stop command or shutdown alarm occurs during the engine crank time, the controller will not send a start command. You must clear all the alarms manually to start the genset again.

Timers

`Timers > Start/Stop`

Parameter	Range	Default
Mains Detect Delay	1 to 300 s	2 s
Warm-Up Delay	0 to 60 s	3 s
Return To Mains Delay	0 to 600 s	5 s
Load Transfer Delay	1 to 60 s	1 s

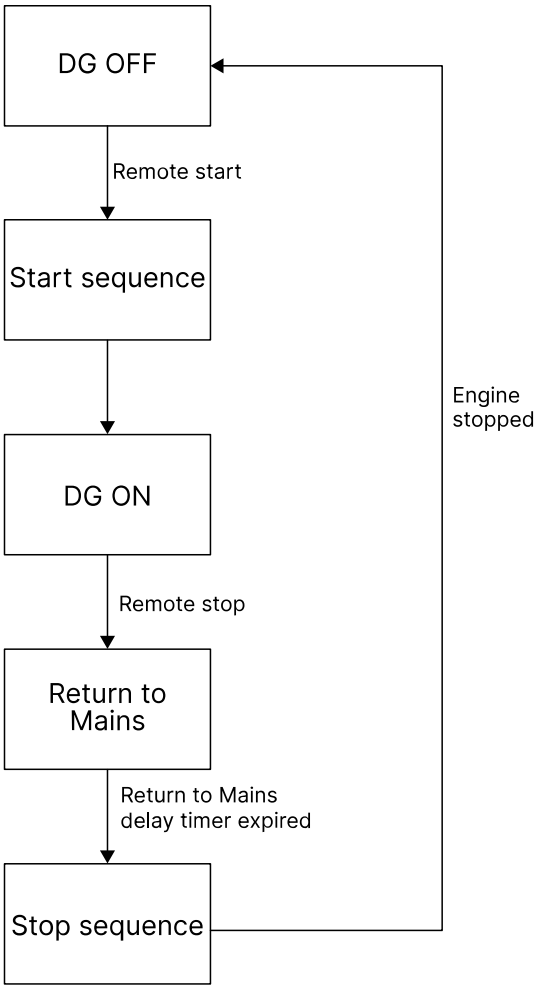
Minimum voltage and frequency set points

`Generator > Alternator Configuration`

Parameter	Range	Default
Min Healthy Voltage	10 to 100 %	40 %
Min Healthy Frequency	10 to 100 %	40 %

4.2.4 Remote start/stop

You can configure digital inputs as remote start/stop inputs (latched type input). You can start and stop the genset remotely by activating the configured remote start/stop inputs.



To configure the remote start/stop inputs, go to *Digital Inputs* in the smart connect software and select the source as *Remote Start/Stop*. You cannot use remote start/stop when mains monitoring is enabled. Go to `Mains > Configuration` and make sure the box next to *Mains Monitoring* is not ticked.

When you activate the remote start input, the controller sends a start command to the genset. Once the genset loading voltage and frequency are more than their minimum set points, the *Warm-up delay* timer starts. At the end of the warm-up delay, the timer for the load transfer delay starts, and the genset breaker closes.

When you activate the remote stop input, the controller opens the genset breaker, and the genset cools and stops.

Minimum voltage and frequency set points

`Generator > Alternator Configuration`

Parameter	Range	Default
Min Healthy Voltage	10 to 100 %	40 %
Min Healthy Frequency	10 to 100 %	40 %

Timers

`Timers > Start/Stop`

Parameter	Range	Default
Warm-Up Delay	0 to 60 s	3 s
Load Transfer Delay	1 to 60 s	1 s

4.2.5 Auto exercise

You can use auto exercise mode to schedule a maximum of two start/stop sequences for the genset. The sequences can occur daily, weekly, or monthly. The load transfer on the mains/genset is also configurable.

The exercise mode is activated when a scheduled sequence starts. The scheduled sequence only starts if there are no alarms. The sequence runs for the adjustable *DG ON duration* time. When the *DG ON duration* timer expires or when you push the *Stop* button, the engine cools down and then stops. The controller is no longer in exercise mode when the engine has stopped. If you have scheduled two sequences to start at the same time, a minute is added to the start time for the second sequence.

The genset does not start if a sequence is scheduled to start when the controller is in manual mode. If you change the running mode to AUTO mode during a scheduled sequence, the genset starts and operates for the remaining duration time.

If the controller is in AMF mode when a sequence is scheduled to start, the controller changes to exercise mode for the *DG ON duration* time. The controller returns to AMF mode once the *DG ON duration* has expired. If a mains failure occurs during a scheduled sequence (exercise mode), the genset continues to run for the *DG ON duration* time, and then returns to the AMF mode. Load is then transferred to the genset. When the mains returns, the genset cools down and stops.

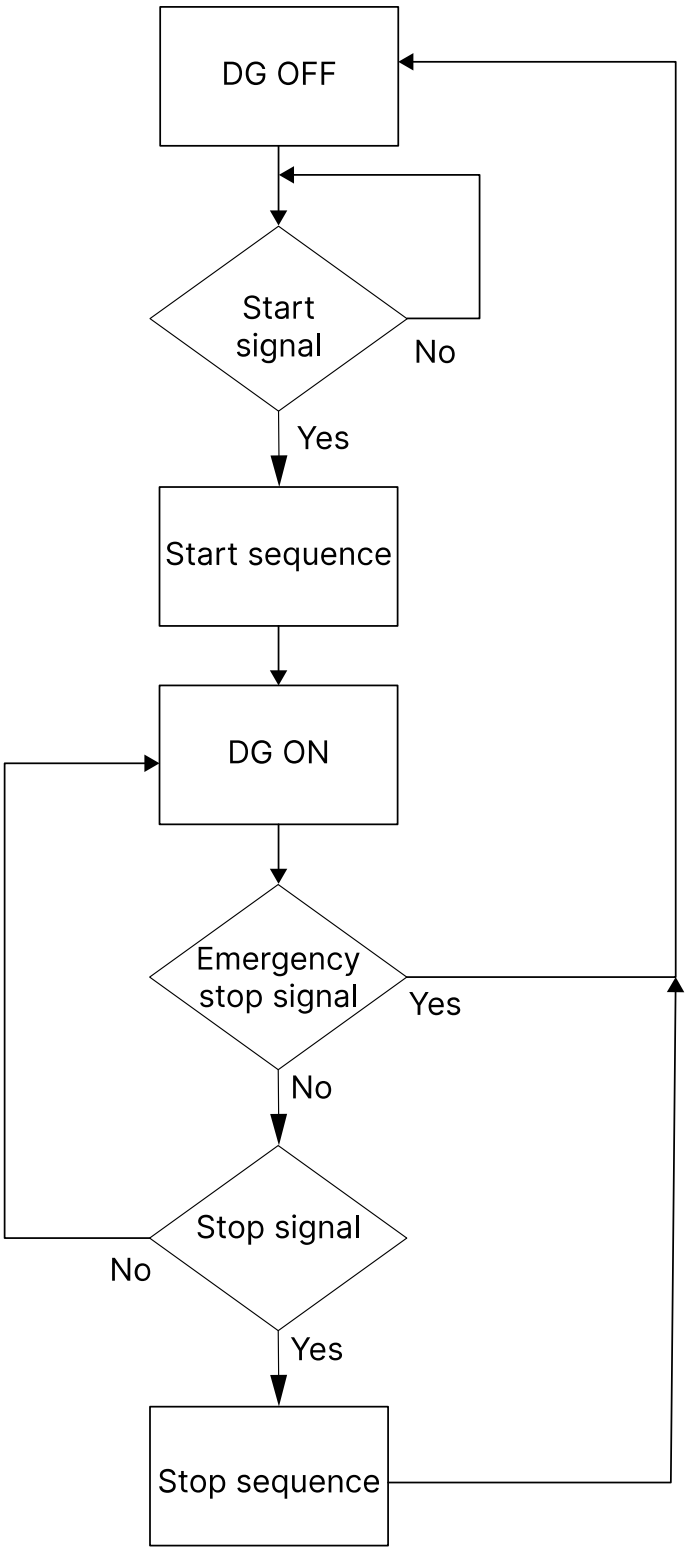
Auto exercise parameters

`Module > Auto Exercise > Event 1/Event 2`

Parameter	Range	Default	Description
Auto Exercise	Enable Disable	Not enabled	Select to activate auto exercise mode during the configured time interval.
Event Occurrence	Daily, weekly, or monthly	Daily	Select how often the exercise sequences occur.
Event Day	Weekly: Sunday to Saturday Monthly: 1 to 28	Sunday 1	Configure the day the sequences occur.
Start Time	00:00 to 23:59 hour	09:59 hour	Select the start time for the sequences.
Duration	99 hours and 59 min.	10 hours and 10 min.	The genset operates for this time duration.
Load Transfer	Enable Disable	Not enabled	If you have enabled this parameter, the load is on the genset. If you have not enabled this parameter, the load is transferred to the mains.

4.3 Manual mode

When you select manual mode, you can control the controller from the display and with digital inputs. To go to manual mode, push the *Mode selection* button.



5. General functions

5.1 AC measurement systems

The AC system can be three-phase, two-phase, single-phase, or split phase.

CAUTION

Incorrect configuration is dangerous

Configure the correct AC configuration. If in doubt, contact the switchboard manufacturer for information.

5.2 Nominal settings

5.2.1 Default nominal settings

`Generator > Nominal Values`

Text	Range	Default	Note
Nominal voltage (phase-neutral)	80 to 200000 V	230 V	Check the minimum and maximum values the SGC can read and display. Remember to include the PT.
Nominal voltage (phase-phase)	80 to 40000 V	400 V	Check the minimum and maximum values the SGC can read and display. Remember to include the PT.
Nominal frequency	5 to 75 Hz	50 Hz	Check the minimum and maximum values the SGC can read and display.
Nominal load current	0 to 8000 A	350 A	Check the minimum and maximum values the SGC can read and display. Remember to include the CT.
Nominal 4th CT current	0 to 8000 A	800 A	Check the minimum and maximum values the SGC can read and display. Remember to include the CT.
Nominal speed	100 to 4000 RPM	1500 RPM	Check the minimum and maximum values the SGC can read and display.
Nominal power (kW)	10 to 8000 kW	200 kW	Check the minimum and maximum values the SGC can read and display. Remember to include the PT.

5.2.2 Alternative nominal settings

`Generator > Nominal Values`

Text	Range	Default	Note
Nominal voltage (phase-neutral)	80 to 200000 V	230 V	Check the minimum and maximum values the SGC can read and display. Remember to include the PT.
Nominal voltage (phase-phase)	80 to 40000 V	400 V	Check the minimum and maximum values the SGC can read and display. Remember to include the PT.
Nominal frequency	5 to 75 Hz	60 Hz	Check the minimum and maximum values the SGC can read and display.

Text	Range	Default	Note
Nominal load current	0 to 8000 A	350 A	Check the minimum and maximum values the SGC can read and display. Remember to include the CT.
Nominal 4th CT current	0 to 8000 A	800 A	Check the minimum and maximum values the SGC can read and display. Remember to include the CT.
Nominal speed	100 to 4000 RPM	1800 RPM	Check the minimum and maximum values the SGC can read and display.
Nominal power (kW)	10 to 2000 kW	200 kW	Check the minimum and maximum values the SGC can read and display. Remember to include the PT.

5.3 Breakers

5.3.1 Breaker types

There are 2 breaker type settings.

Pulse
This setting is for breakers that have 2 separate coils for opening and closing the breaker.

The controller uses these outputs:

- To close the circuit breaker, the *Close Gen breaker* output is activated. The output is active until the *Breaker Close Pulse* timer expires. You can configure a digital input as *Breaker Close Feedback* and a *Breaker Feedback* timer. If the controller does not receive feedback before the *Breaker feedback* timer expires, a *Close Failure* alarm is shown. If *Breaker Close Feedback* is not configured, then an alarm is not shown.
- To open the circuit breaker, the *Open Gen breaker* output is activated. The output is active until the *Breaker Open Pulse* timer expires. You can configure a digital input as *Breaker Open Feedback* and a *Breaker Feedback* timer. If the controller does not receive feedback before the *Breaker feedback* timer expires, an *Open Failure* alarm is shown. If *Breaker Open Feedback* is not configured, then an alarm is not shown.

Continuous
This setting is for breakers that have a single coil for opening and closing the breaker.

The controller uses these outputs:

- To close the circuit breaker, the *Close Gen Output* is activated. You can configure a digital input as *Breaker Close Feedback* and a *Breaker Feedback* timer. If the controller does not receive feedback before the *Breaker feedback* timer expires, a *Close Failure* alarm is shown. If *Breaker Close Feedback* is not configured, then an alarm is not shown.
- To open the circuit breaker, the *Open Gen Output* is activated. You can configure a digital input as *Breaker Open Feedback* and a *Breaker Feedback* timer. If the controller does not receive feedback before the *Breaker feedback* timer expires, an *Open Failure* alarm is shown. If *Breaker Open Feedback* is not configured, then an alarm is not shown.

`Timers > General`

Parameter	Range	Default
Breaker feedback Timer	1 to 10 s	2 s

5.3.2 Breaker spring load timer

To avoid breaker close failures in situations where the breaker close command is given before the breaker spring has been loaded, the spring load timer can be adjusted. You can do this with the *Breaker Close Delay* timer.

Timers > General

Parameter	Range	Default
Breaker Close Delay	0.1 to 30 s	2 s

5.4 Load calculations

For automatic mains failure (AMF) applications, you can place the current transformer (CT) on the line from the genset or on the load cable. The load calculations are based on where the CT is placed.

If the location of the CT is on the *On Alt Output* cable, which means the CT is on the genset side, then the load calculations are based on the genset load. The calculations do not depend on the breaker output or feedback input.

If the CT is placed on the load cable, then the load calculations are based on these conditions:

- If you have configured breaker feedback for the genset breaker and the mains breaker, then the load calculations are based on the breaker feedback. For example, if the controller receives breaker feedback from the mains breaker, then the load calculations are based on the mains load.
- If you have not configured breaker feedback for the breakers, then the load calculations are based on the breaker output. This is only for a continuous breaker type setting.
- If you have not configured breaker feedbacks and the breaker type setting is a pulse, then the load calculations are based on the genset load.
- If you have not configured breaker outputs or breaker feedbacks, then the load calculations are based on the genset load.

5.5 Alarms

You can configure warning and notification alarms on the controller. For example, an alarm for low oil pressure or a warning when the fuel level is low.

An alarm is shown on the display when the measured value is outside the configured limits for that value. The alarm LED turns red and the sounder alarm activates (if configured). You can see the type of the alarm on the alarms page, and why it occurred on the engine status page.

To acknowledge an alarm, push the *Up* and *Down* buttons at the same time.

You can configure the time interval for when an alarm can activate. You can select alarms to activate from when the engine starts, from when monitoring is on, or always. The controller cannot send a start command if a warning, electrical trip, or shutdown alarm is unacknowledged.

Alarm types

No.	Alarm actions	Description
1	Shutdown	The genset stops immediately and no longer supplies the load. The genset ignores the cooling down time.
2	Electrical trip	The genset stops supplying the load and the cooling down time starts. The genset stops when the cooling down has finished. You must acknowledge the elctrical trip alarm before the controller can send a start command.
3	Warning	The genset continues to operate when there is a warning. A warning tells the operator that something has happened during operation. You must acknowledge all warning alarms before you can start the genset.
4	Notification	The controller shows the message on the display. Genset operations are not affected.

Alarms and their causes

No.	Alarms	Cause	Actions
1	Low Oil Pressure (Sensor)	The measured oil pressure is less than the configured value.	Shutdown Warning
	Low Oil Pressure (Switch)	The switch has measured a low oil pressure.	Shutdown Warning Electrical Trip Notification
2	Low Fuel level (Sensor)	The measured fuel level is less than the configured value. This is only detected when the genset is in operation.	Shutdown Warning
	Low Fuel level (Switch)	The switch has measured a low fuel level.	Shutdown Warning Electrical Trip Notification
3	High Eng CLNT Temp (Sensor)	The measured engine coolant temperature is more than the configured value. This is only detected when the genset is in operation.	Shutdown Warning
	High Eng CLNT Temp (Switch)	The switch has measured a high engine coolant temperature.	Shutdown Warning Electrical Trip Notification
4	Low Eng CLNT Temp (Sensor)	The measured engine coolant temperature is less than the configured value.	Shutdown Warning
5	Low Water Level (Switch)	The measured radiator water level is less than the preset threshold.	Shutdown Warning Electrical Trip Notification
6	Over Speed	Genset speed is more than the configured overspeed value. The genset shuts down after overspeed delay.	Shutdown
7	Gross Over Speed	Genset speed is more than the configured value for gross overspeed. The genset shuts down immediately without delay.	Shutdown
8	Under Speed	The engine speed is less than the preset RPM.	Shutdown
9	L1 Phase Over Voltage	Genset (L1) phase voltage is more than the configured over-voltage value.	Shutdown Warning
10	L1 Phase Under Voltage	Genset (L1) phase voltage is less than the configured under-voltage value.	Shutdown Warning
11	L2 Phase Over Voltage	Genset (L2) phase voltage is more than the configured over-voltage value.	Shutdown Warning
12	L2 Phase Under Voltage	Genset (L2) phase voltage is less than the configured under-voltage value.	Shutdown Warning
13	L3 Phase Over Voltage	Genset (L3) phase voltage is more than the configured over-voltage value.	Shutdown Warning
14	L3 Phase Under Voltage	Genset (L3) phase voltage is less than the configured under-voltage value.	Shutdown Warning
15	Over Frequency	Genset output frequency is more than the configured value.	Shutdown Warning
16	Under Frequency	Genset output frequency is less than the configured value.	Shutdown Warning

No.	Alarms	Cause	Actions
17	Emergency Stop	Emergency stop is activated. Or The emergency stop is configured as a digital input, and the input has triggered for longer than the configured time.	Shutdown
18	Charge Fail	The charge alternator voltage is less than the configured value.	Shutdown Warning Electrical Trip Notification
19	Battery Over Voltage	The battery voltage is more than the configured value.	Shutdown Warning Electrical Trip Notification
20	Battery Under Voltage	The battery voltage is less than the preset threshold.	Shutdown Warning Electrical Trip Notification
21	Over Current	Genset current is more than the preset threshold.	Shutdown Warning Electrical Trip Notification
22	Maintenance Due	The timer for engine running hours has expired. An alarm occurs when the running hours or days expires.	Notification Warning
23	Over Load	The measured kW load rating is more than the configured value.	Shutdown Warning Electrical Trip Notification
24	Auxiliary input/User defined name	The auxiliary input has triggered for longer than the configured time.	Shutdown Warning Electrical Trip Notification
25	Fail To Stop	The genset is operating after the controller has sent a stop command.	Shutdown
26	Fuel Theft	The fuel consumption is more than the configured limit.	Warning
27	Unbalanced Load	The load on a phase is more than or less than other phases by a configured value.	Shutdown Warning Electrical Trip Notification
28	No Speed Signal	There is no signal from the engine speed.	Shutdown
29	Fail To Start	The genset has not started after the configured number of start attempts.	Shutdown
30	Engine Temp/ Ckt Open (terminal 24)	The temperature sensor on terminal 24 is not detected (circuit open).	Shutdown Warning Electrical Trip Notification
31	Fuel Level Ckt Open	The fuel level sensor is not detected (circuit open).	Shutdown Warning Electrical Trip Notification

No.	Alarms	Cause	Actions
32	DG Phase Reversal	Alternator phase sequence (L1-L2-L3) is not correct.	Shutdown Warning Electrical Trip Notification
33	Mains Phase Reversal	Error during mains operation.	Notification
34	LOP/Ckt Open (terminal 26)	The oil pressure sensor on terminal 26 is not detected (circuit open).	Shutdown Warning Electrical Trip Notification
35	V-Belt Broken Switch	Failure of the V-belt. The belt drives the charging alternator.	Shutdown Warning Electrical Trip Notification
36	High Oil Pressure (Sensor)	The measured oil pressure is more than the configured value.	Warning
	High Oil Pressure (Switch)	The switch has measured a high oil pressure.	Warning
37	LOP/Ckt Open (terminal 23)	The oil pressure sensor on terminal 23 is not detected (circuit open).	Warning
38	LOP/ Shrt to Bat (terminal 23)	The oil pressure sensor on terminal 23 is not detected (short circuit).	Warning
39	AFT Activation Timeout	If the fuel level is less than the set point for automatic fuel transfer (AFT), the controller activates the AFT alarm and deactivates the AFT output.	Notification
40	Communication Failure	There is an ECU communication failure.	Shutdown Warning Electrical Trip Notification
41	Protect Lamp ON	The protect lamp on the ECU is active. A failure has occurred. See the ECU specific documentation for more information.	Shutdown Warning Electrical Trip Notification
42	Amber Lamp ON	The amber lamp on the ECU is active. A failure has occurred. See the ECU specific documentation for more information.	Shutdown Warning Electrical Trip Notification
43	Red Lamp ON	The red lamp on the ECU is active. A failure has occurred. See the ECU specific documentation for more information.	Shutdown Warning Electrical Trip Notification
44	MIL Lamp ON	The malfunction (MIL) lamp on the ECU is active. A failure has occurred. See the ECU specific documentation for more information.	Shutdown Warning Electrical Trip Notification
45	Eng Preheat Failed	The engine temperature is less than the configured value after the engine heater time has expired.	Warning
46	Ash Load 100 %	The amount of ash in the particular filter is 100%. The percentage is of nominal value.	Notification Warning
47	Low Load	The load is less than the configured set point after the delay timer has expired.	Shutdown Warning Electrical Trip Notification

No.	Alarms	Cause	Actions
48	Fail To Close Gen Output	Breaker close failure. Unable to close the genset breaker.	Shutdown Warning Electrical Trip Notification
49	Fail To Close Mains Output	Breaker close failure. Unable to close the mains breaker.	Shutdown Warning Electrical Trip Notification
50	Fail To Open Gen Output	Breaker close failure. Unable to open the genset breaker.	Shutdown Warning Electrical Trip Notification
51	Fail To Open Mains Output	Breaker close failure. Unable to open the mains breaker.	Shutdown Warning Electrical Trip Notification
52	Gen PH-PH Overvolt	Over-voltage measured for the phase-to-phase generator voltage. This is only for three-phase, 3 wires applications.	Shutdown Warning
53	Gen PH-PH Undervolt	Under-voltage measured for the phase-to-phase generator voltage. This is only for three-phase, 3 wires applications.	Shutdown Warning
54	Reverse Power Detected	Alarm is based on the active power (all phases), to the source, as measured by the controller.	Shutdown Warning Electrical Trip Notification

6. Engine functions

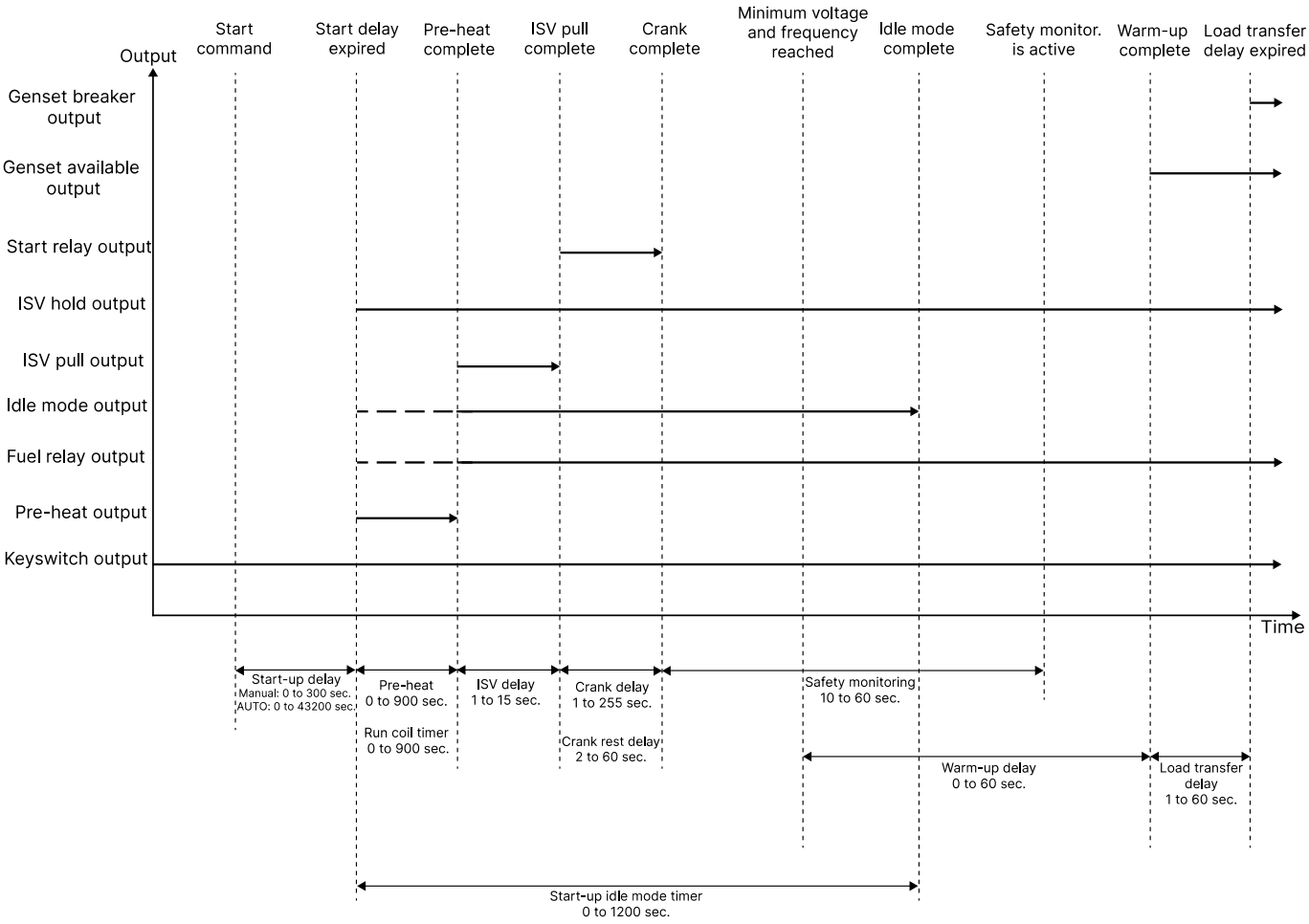
6.1 Engine sequences

The engine start and stop sequences are started automatically if AUTO mode is selected. In manual mode, the operator has to initiate the sequences.

6.2 Engine start functions

6.2.1 Start sequence

The following drawing shows the start sequence of the genset.



Configure the run coil timer to activate the fuel relay output and the idle mode output before pre-heat is completed.

Timers

`Timers > Cranking`

Parameter	Range	Default
Crank Hold Time	1 to 255 s	5 s
Crank Rest Time	2 to 60 s	5 s
Manual Start Delay	0 to 300s	3 s
Auto Start Delay	0 to 43200 s	3 s

Timers > General

Parameter	Range	Default
Safety Monitoring Delay	10 to 60 s	10 s
Warm-Up Delay	0 to 60 s	3 s
ISV Pull Signal Timer	0 to 20 s	0.1 s

Engine

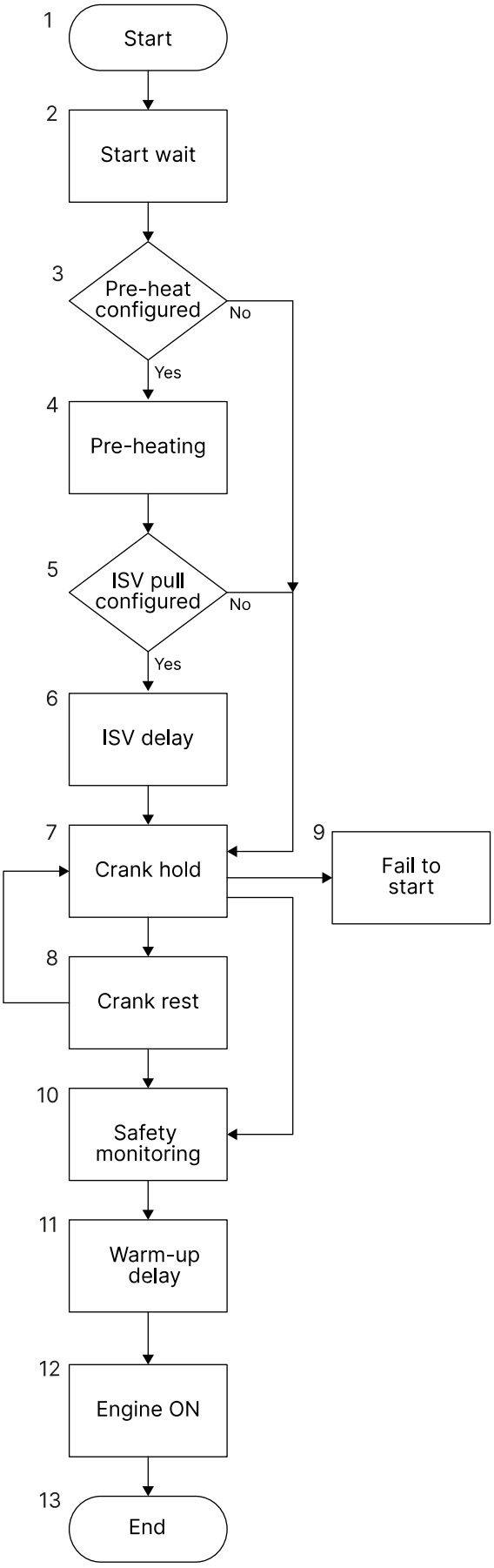
Engine > Preheat

Parameter	Range	Default
Preheat Timer	0 to 1200 s	10 s

Engine > Speed Monitoring

Parameter	Range	Default
Start-up Idle Time	1 to 900 s	1 s

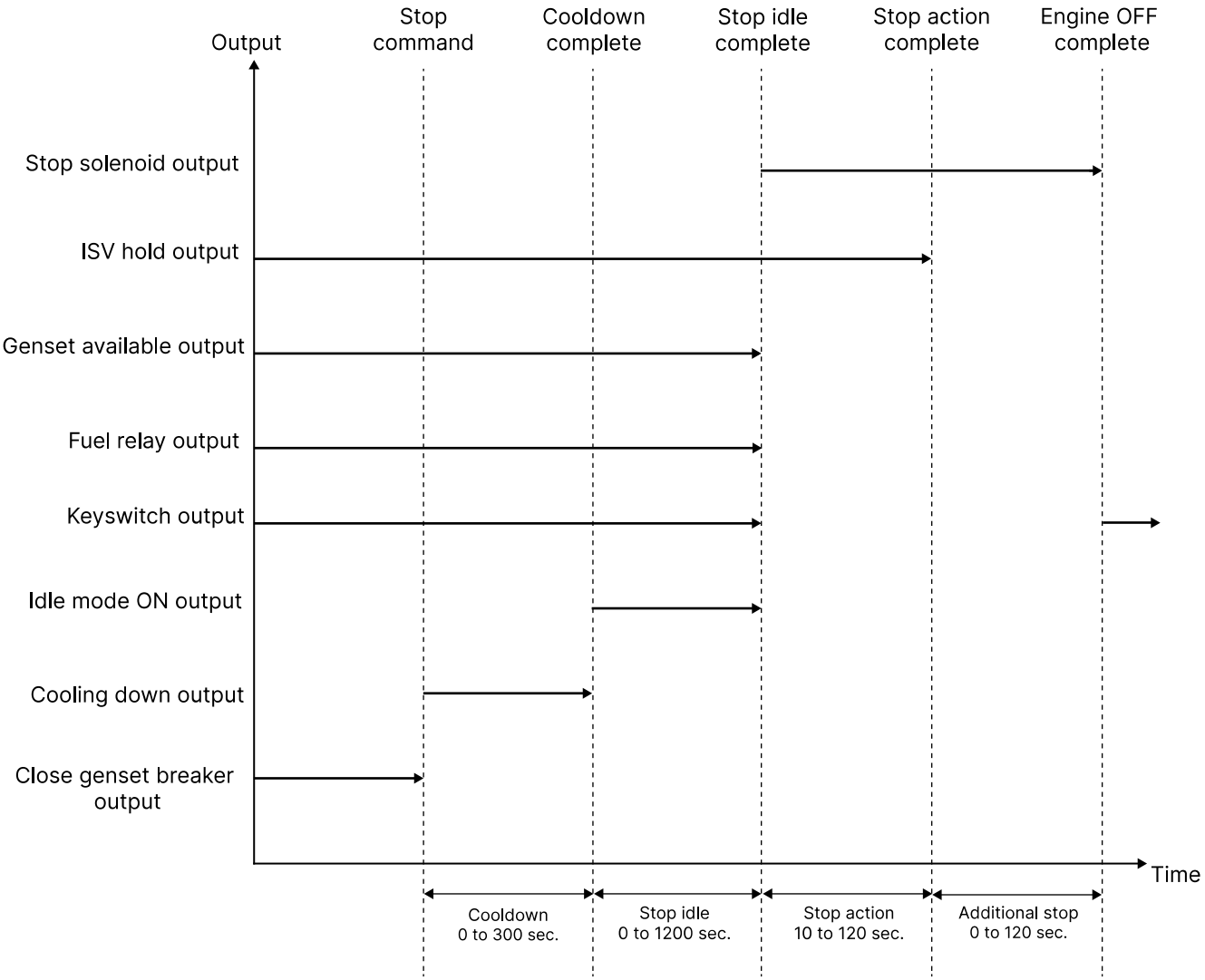
Start sequence flowchart



1. The controller sends a start signal to the genset.
2. The *Start Delay* timer is activated.
3. When the *Start Delay* timer expires, the pre-heating function is activated if this is configured. If pre-heating is not configured, go to step 7 (crank hold).
4. Pre-heating is active for the duration of the pre-heat timer.
5. When the pre-heat timer expires, the controller activates the Inlet Shutoff Valve (ISV) Pull function if this is configured. If this function is not configured, go to step 7 (crank hold).
6. The ISV pull function is active for the duration of the ISV delay timer.
7. The controller activates the start relay output and attempts to crank the engine. The controller starts the crank hold timer.
8. If the crank is not disconnected when the crank hold timer expires, the controller starts the crank rest timer. The rest time is the time between two cranking attempts. When the crank rest timer expires, the controller attempts to crank the engine again (step 7).
9. If the engine does not start after the maximum cranking attempts, the controller shows the *Fail to start* alarm.
10. The *Safety Monitoring Delay* timer starts after the crank disconnects. The engine safety parameters are not monitored for this duration.
11. The warm-up delay timer starts when the *Safety Monitoring Delay* timer expires.
12. The genset starts when the *Warm-up delay* timer expires.

6.3 Engine stop functions

6.3.1 Stop sequence



The stop sequence is activated if a stop command is given. The stop sequence includes the cooling down time if the stop is a normal or controlled stop.

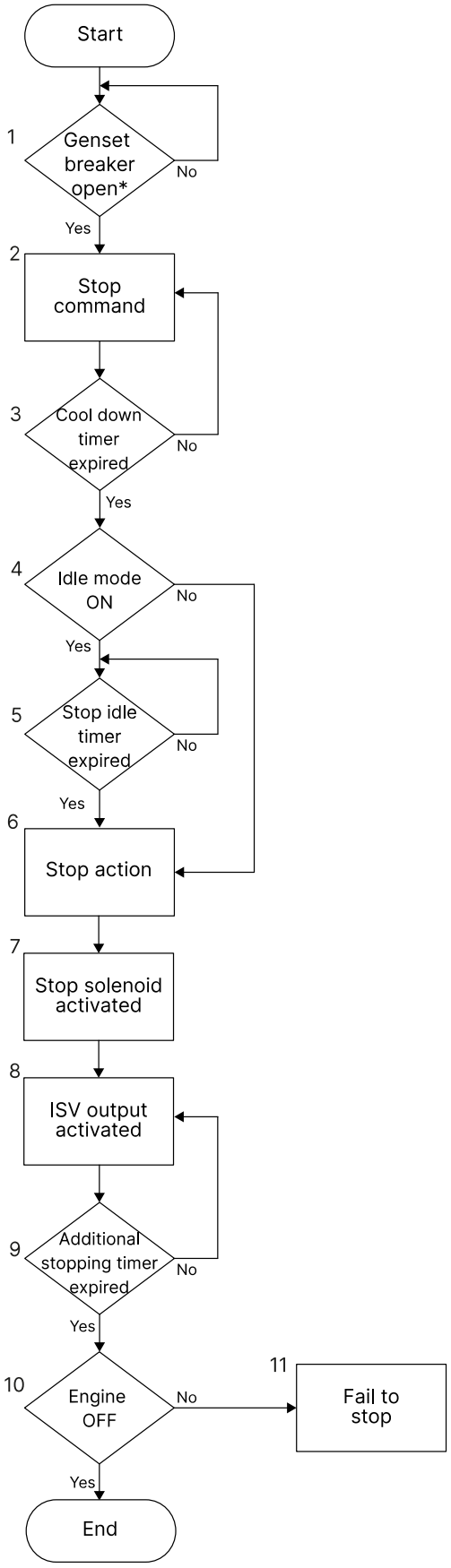
`Timers > General`

Parameter	Range	Default
Engine Cooling Time	0 to 300 s	5 s
Stop Action	10 to 120 s	10 s
Additional Stopping Time	0 to 120 s	10 s

`Engine > Speed Monitoring`

Parameter	Range	Default
Stopping Idle Time	0 to 1200 s	10 s

6.3.2 Stop sequence flowchart



1. The genset breaker opens if there is a breaker in the application.
2. A stop command is given. You can activate the command with a digital input or Modbus. You can only use the display buttons in manual mode.
3. The *Cool down* timer is activated.
4. If the idle mode output is configured, it is activated when the *Cool down* timer expires. If idle mode is not configured, then go to step 7 (stop action).
5. The *Stop Idle* timer is activated.
6. When the *Stop Idle* timer is expired, the *Stop Action* timer is activated. The fuel relay output, keyswitch output, genset available output, and Idle mode ON output are all deactivated before the *Stop action* timer is activated.
7. The *Stop solenoid* output is activated.
8. The output for the Inlet Shutoff Valve (ISV) hold is activated. The output is deactivated when the *Stop Action* timer is expired.
9. When the additional stopping timer is expired, the *Stop Solenoid* output is deactivated, and the engine stops.
10. The engine is stopped.
11. If the engine does not stop when the *Additional Stopping* timer has expired, the controller shows the *Failure to Stop* alarm.

NOTE * If a breaker is configured.

6.4 Idle mode

The purpose of the idle mode function is to allow the engine to operate at idle speed before ramping up to rated speed.

You can activate idle mode using a digital input or a timer. If you have configured an input and a timer for idle mode, then the timer is overruled. The output assigned to idle mode can be continuous or pulse.

Configuration of digital output

1. Go to *Digital Inputs* and select one of the digital input tabs.
2. Select *Idle Mode Enable* as the source.
3. Select the polarity as *Close To Activate* or *Open To Activate*.
4. Go to *Outputs*.
5. Select the source:
   a. To use a continuous signal, select *Idle Mode On* as the source.
   b. To use a pulse signal, select *Idle Mode On Pulse* and *Idle Mode Off Pulse* as two separate sources.
6. If you have selected a pulse signal as an output, you must configure the timer for the pulse.
   a. Go to *Engine* and select *Speed Monitoring*.
   b. Configure the *Idle Mode Pulse Time*.
7. In the *Speed monitoring* tab, configure the *Idle to Rated Delay Time*.

Idle mode is activated when the engine is started and the digital input is activate (open or close to activate). The under-voltage, under-frequency, and under-speed protections are not active during idle running.

The *Idle to Rated Delay* timer starts when the idle mode input is deactivated. The genset starts to ramp up, and when the timer expires, the genset operates at nominal speed. The under-voltage, under-frequency, and under-speed protections are also activated.

Configuration of timers

You can only active idle mode with timers, when the *Idle Mode Enable* is deactivated.

1. Go to *Digital Inputs* and make sure that *Idle Mode Enable* is not selected as the source for a digital input.
2. Go to *Outputs* select the source:
   a. To use a continuous signal, select *Low Idle Mode* as the source.
   b. To use a pulse signal, select *Idle Mode On Pulse* and *Idle Mode OFF Pulse* as two separate sources.
3. If you have selected a pulse signal as an output, you must configure the timer for the pulse.
   a. Go to *Engine* and select *Speed Monitoring*.
   b. Configure the *Idle Mode Pulse Time*.
4. Go to *Engine* and select *Speed Monitoring*.
5. Configure the *Startup Idle Mode Time* timer.

Idle mode is activated when the engine starts. The under-voltage, under-frequency, and under-speed protections are not active during idle running.

The engine operates in idle mode until the *Startup Idle Mode Time* timer expires. When this timer expires, the *Idle to Rated Delay Time* timer starts. The genset ramps up, and operates at nominal speed when the *Idle to Rate Delay Time* timer expires. The under-voltage, under-frequency, and under-speed protections are also activated.

If the controller is manual mode during idle running, and you push the start button, the controller stops the idle running, and starts to ramp up the genset.

Stop sequence for idle mode

You can also activate idle mode during the stop sequence. Go to `Engine > Speed Monitoring > Stopping Idle Time` to configure the timer for the idle stop time. If you set the timer to 0 seconds, idle mode is not activated during the stop sequence. The under-voltage, under-frequency, and under-speed protections are not active in idle mode.

When the stop sequence for the genset is activated, the *Stopping Idle Time* timer starts. When the timer expires, the genset stops.

Idle mode parameters

`Engine > Speed Monitoring`

Parameter	Range	Default
Idle Mode Enable	Enable Disable	Not enabled
Idle Mode On	Enable Disable	Not enabled
Idle Mode On Pulse	Enable Disable	Not enabled
Idle Mode Off Pulse	Enable Disable	Not enabled
Idle to Rated Delay Time	0 to 1200 s	10 s
Start-up Idle Mode Time	0 to 1200 s	10 s
Stopping Idle Mode Time	0 to 1200 s	10 s
Idle Mode Pulse Time	0 to 60 s	2 s

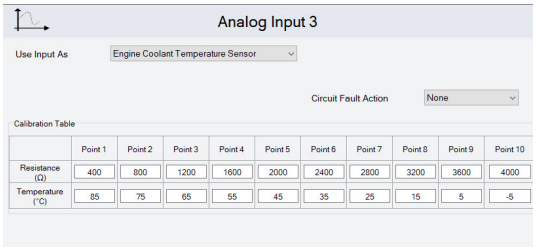
6.5 Coolant temperature

You can use the controller to control the coolant temperature of the engine.

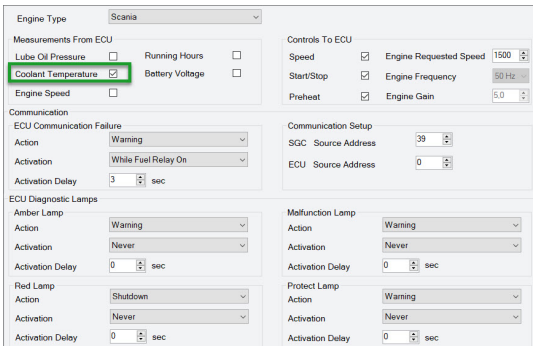
By default, the coolant temperature is not enabled. To use this function, you must configure an analogue input as a temperature sensor or use the Engine Control Unit (ECU).

Configure the coolant temperature sensor with the smart connect software:

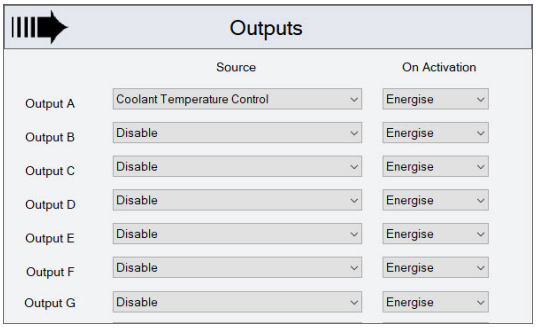
1. If you use an analogue input:
   a. Go the *Analog Inputs* tab and select *Analog Input 3*.
   b. For *Use input As* select *Engine Coolant Temperature Sensor* in the drop-down list.



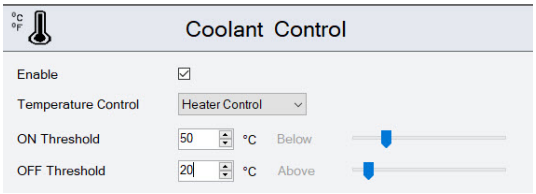
2. If you use an ECU:
   a. Go to the *Engine* tab and select *Engine Control Unit (ECU)*.
   b. For *Engine type* select the correct ECU. Do not select Conventional.
   c. Make sure that the tick box next to *Coolant temperature* is selected.



3. Go to the *Outputs* tab and select the output you want to use.



4. Use the drop-down list next to the output to select *Coolant Heater Control Output* as the source.
5. Go to the *Engine* tab and select *Coolant Control*.
6. Select the tick box next to *Enable* to enable the coolant temperature control.
7. For *Temperature Control*, use the drop-down list to select *Heater Control* or *Cooler control*.
8. Configure the ON and OFF threshold.



Heater control

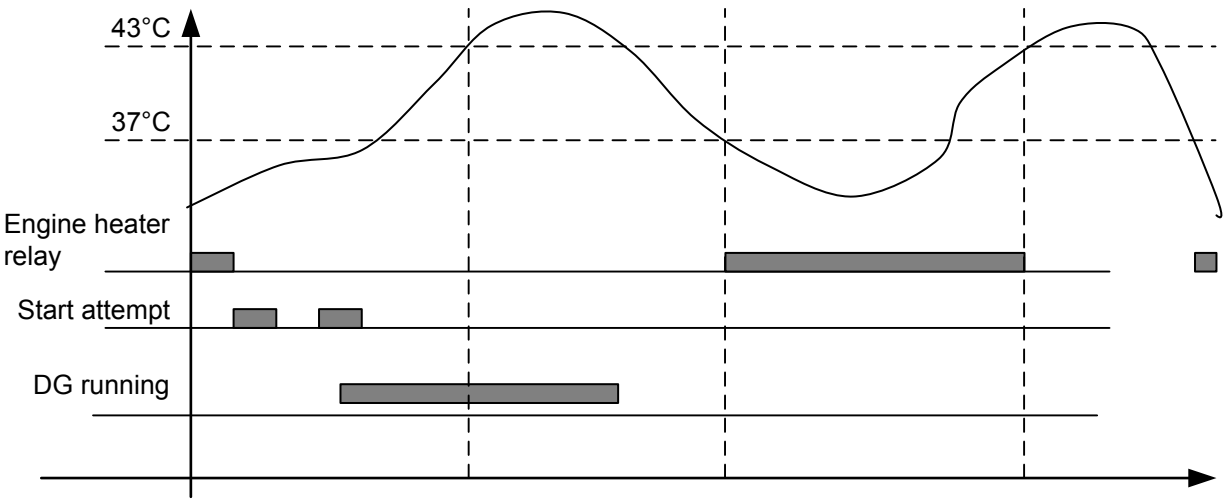
When the coolant temperature is less than the *ON Threshold* value, the output is on. When the coolant temperature is more than the *OFF Threshold* value, the output is off.

Cooler control

When the coolant temperature is more than the *ON Threshold* value, the output is on. When the coolant temperature is less than the *OFF Threshold* value, the output is off.

6.6 Engine pre-heater

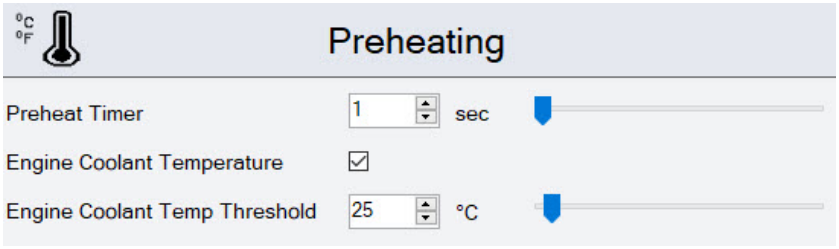
This function is used to control the temperature of the engine before the engine starts. The function is only active when the engine is stopped. A temperature sensor is used to activate an external heating system to keep the engine at a minimum temperature.



The functions includes a set point and a hysteresis. In the example, the set point is 40 °C with a hysteresis of 3 °C. The controller opens the engine heater relay when the engine has reached 43 °C and closes when the engine temperature is 37 °C. You must select a relay for the engine heater. If the engine heater is active, and the manual control command has been activated, the engine heater relay is opened. When the command is activated again, the heater relay closes if the temperature is below the set point.

Configure the preheat function

1. Go to *Analogue Inputs* and then select *Analogue Input 3*.
2. Set the *Use Input As* to *Engine Coolant Temperature Sensor*.
3. Go to *Outputs* and select the source as *Preheat Output*.
4. Go to *Engine* and then select *Preheat*.
5. Configure the preheat parameters.



`Engine > Preheat`

Parameter	Range	Default	Description
Pre-heat Timer	1 to 900 s	10 s	The pre-heat function deactivates when this timer expires.
Engine Coolant Temperature	Enable Disable	Not enabled	If this parameter is enabled, the controller deactivates the pre-heater function when engine temperature is more than the set point

Parameter	Range	Default	Description
			for the engine temperature (Engine Coolant Temp Threshold).
Engine Coolant Temp Threshold	10 to 300 °C	25 °C	The coolant temperature the engine must reach during pre-heat.

6.7 Other functions

6.7.1 Maintenance timer

The controller has one timer to monitor maintenance intervals.

The timer function is based on engine running hours or a due date. When the adjusted timer expires, the controller displays an alarm.

To configure the maintenance timer, push and hold the *Stop* button to go to the *Configuration menu*. Select *Maintenance*.

`Configuration menu > Maintenance`

Parameter text	Range	Default
Alarm Action	None Notification Warning	None
Due At Engine Hours	0 to 65000 hours	250 hours
Alarm Due Date	-	Today's date

6.7.2 Keyswitch

Output function

You can configure the keyswitch function with the smart connect software. Go to *Outputs* and configure one of the outputs as *Keyswitch*.

Wiring

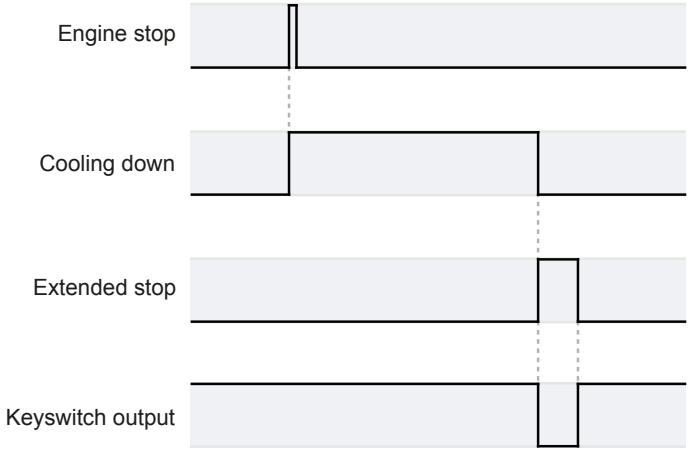
Wire the keyswitch relay output to the ECU power. When the relay is open, the ECU has no power.

How it works

For the first 5 seconds after the SGC controller is powered on, the keyswitch relay is open.

How the keyswitch functions works:

1. There is an engine stop command.
2. The *Cooling down* timer starts.
3. When the cooling down timer expires, the SGC starts the *Extended stop* timer, and opens the keyswitch relay.
4. The relay is open until the extended stop timer expires.


Engine stop
Cooling down
Extended stop
Keyswitch output

7. Modbus

7.1 About

The SGC controller supports a custom protocol based on the standard Modbus over an RS-485 layer. The controller operates in a server mode and responds to commands received from an external Modbus client.

This document will only describe the information required to communicate with the controller using the Modbus protocol. For more information about Modbus in general and the Modbus protocol, refer to the documentation freely available at http://www.modbus.org.

Refer to the Modbus tables, available for download at www.deif.com, to see how the controller data is mapped to the Modbus addresses.

7.2 Modbus connection details

The controller uses Modbus RTU as the transmission mode.

Connection details

- Start bit: 1
- Data bits: 8
- Parity: None
- Stop bit: 1
- Cyclic Redundancy Check (CRC)

Setting up Modbus communication

- Find the server ID from the SMPS and configure the same ID in the controller.
- Enable the controller in the configuration of the SMPS after hardware connections are made.
- Connect the controller terminals 16 and 15 to the SMPS terminals A and B.
- Use a two-core shielded cable for connection.
- Use wires with different colours for terminals 16 and 15.
- Connect the wires correctly to make sure they do not get short with other wires.
- Do not use multi-strand wires for the connection.

7.3 Modbus communication settings

RS-485 communication settings

- Server ID: 1 to 247
- Baud rate: 1200/2400/4800/9600/19200/38400/57600/115200 bps
- Parity: None/Even/Odd
- Stop bit: 1, 2
- Recommended polling frequency: 50 Hz
- No response timeout: 250 ms

Command from Modbus server for function 16

Byte	Field	Comments
0	Server address	As configured in the controller.
1	Function code (0×10)	
2	First register address - high byte	16-bit register address, register address map is described in the Register map.
3	First register address - low byte	

Byte	Field	Comments
4	Number of registers to write - high byte	Number of registers to write must be between 1 to 255
5	Number of registers to write - low byte	
6	Number of data bytes to follow (n)	
7	Value at first register	
...	...	
6+n	Value at last register	
7+n/8+n	Error check CRC	

Standard response from SGC controller server for function 16

Byte	Field	Comments
0	Server address	As configured in the controller.
1	Function code (0×10)	
2	First register address - high byte	16-bit register address, register address map is described in the Register map.
3	First register address - low byte	
4	Number of registers written - high byte	Number of registers that have been written.
5	Number of registers written - low byte	
6/7	Error check CRC	

Command from Modbus client for function 3

Byte	Field	Comments
0	Server address	As configured in the controller.
1	Function code (0×3)	
2	First register address - high byte	16-bit register address, register address map is described in the Register map.
3	First register address - low byte	
4	Number of registers to read - high byte	Number of registers to read must be between 1 to 255
5	Number of registers to read - low byte	
6/7	Error check CRC	

Standard response from SGC controller server for function 3

Byte	Field	Comments
0	Server address	As configured in the controller.
1	Function code (0×03)	
2	Byte count (n)	Equals to number of registers to be read times two. 8-bit even number between 2 to 250.
3	First register - high byte	Number of registers that have been written.
4	First register - low byte	
...	...	
1+n	Last register - high byte	
2+n	Last register - low byte	
3+2n/4+2n	Error check CRC	

8. Inputs and outputs

8.1 Digital inputs

No.	Source	Description
1	Not used	The digital input is not used.
2	User configured	The digital input is configured by the user.
3	Low fuel level switch	The input is activated when the fuel level is less than the configured value. The configured alarm is shown. You can configure the alarm type.
4	Low lube oil pressure switch	The input is activated when the lube oil pressure is less than the configured value. The configured alarm is shown. You can configure the alarm type.
5	High engine coolant temp switch	The input is activated when the engine coolant temperature is more than the configured value. The configured alarm is shown. You can configure the alarm type.
6	Low water level switch	The input is activated when the water level is less than the configured value. The configured alarm is shown. You can configure the alarm type.
7	Emergency stop	When this input is activated, the controller stops the genset immediately without a cool down period.
8	Remote start/stop	This input initiates the start or stop sequence of the genset when the controller is in AUTO mode.
9	Manual start	This input initiates the start sequence of the genset when the controller is in manual mode.
10	Manual stop	This input initiates the stop sequence of the genset when the controller is in manual mode.
11	Activate/deactivate AUTO mode	One of these sequences is initiated if this input is activated in manual mode: 1. Mains monitoring is enabled and there is a mains failure. The operator activates AUTO mode. The controller then automatically initiates the genset start sequence and closes the genset breaker. 2. Mains monitoring is enabled and the mains can supply the load. The operator deactivates AUTO mode. The controller then automatically stops the genset and closes the mains breaker. 3. Mains monitoring is enabled and the mains can supply the load. The operator activates AUTO mode. The controller then automatically stops the genset.
12	Close gen/open mains switch	The genset breaker closes and the mains breaker opens when this input is activated. The genset must be running.
13	Close mains/open gen switch	The genset breaker opens and the mains breaker closes when this input is activated. The genset must be running.
14	Simulate mains	In AUTO mode: • Mains monitoring is enabled and there is a mains failure. The input is activated and used to simulate the return of the mains and the mains breaker closing. • Mains monitoring is enabled and there is a mains failure. The input is deactivated. The controller automatically starts the genset and closes the genset breaker. In manual mode: • Mains monitoring is enabled and there is a mains failure. The input is activated and used to simulate the return of the mains and the mains breaker closing.

No.	Source	Description
		• Mains monitoring is enabled and there is a mains failure. The input is deactivated. The is still a mains failure and the mains breaker opens.
15	V-belt broken switch	When this input is activated an alarm is shown on the display. You can configure the alarm type.
16	Neutral SW signal	This input is for CAN bus.
17	Regeneration SW inhibit signal	This input is for CAN bus.
18	Mains contactor latched	When this input is activated, the mains breaker closes and the genset breaker opens.
19	Gen contactor latched	When this input is activated, the genset breaker closes and the mains breaker opens.
20	Idle mode enable	You can activate idle mode with this input.
21	Alternate nominal switch	If this input is activated, the default nominal settings switch to the alternative nominal settings.

8.2 Digital outputs

No.	Output source	Description
1	Disable	The output is not used.
2	Sounder alarm	This output is high when an alarm is generated. The output is active for the duration of the alarm.
3	Battery over volt	This output is activated when there is an active alarm for battery over-voltage.
4	Battery under volt	This output is activated when there is an active alarm for battery under-voltage.
5	Charge alt shutdown	This output is activated when there is an active shutdown alarm for charge failure.
6	Charge alt warning	This output is activated when there is an active warning alarm for charge failure.
7	Close gen contactor	This output is activated when the digital input for close genset/open mains is activated in manual mode.
8	Close mains contactor	This output is activated when the digital input for close mains/open genset is activated in manual mode.
9	Mains failure	This output is activated when there is a mains failure.
10	Common alarm	This output is activated when one of the alarm types is activated.
11	Common electrical trip	This output is activated when there is an active electrical trip alarm.
12	Common shutdown	This output is activated when there is an active shutdown alarm.
13	Common warning	This output is activated when there is an active warning alarm.
14	Cooling down	This output is activated when the cooldown period of the genset is initiated. The output is activate for the duration of the period.
15	Dig In A	This output is activated when digital input A is activated.
16	Dig In B	This output is activated when digital input B is activated.
17	Dig In C	This output is activated when digital input C is activated.
18	Dig In D	This output is activated when digital input D is activated.
19	Dig In E	This output is activated when digital input E is activated.

No.	Output source	Description
20	Dig In F	This output is activated when digital input F is activated.
21	Dig In G	This output is activated when digital input G is activated.
22	Dig In H	This output is activated when digital input H is activated.
23	Dig In I	This output is activated when digital input I is activated.
24	Emergency stop	This output is activated when the emergency stop is activated.
25	Stop solenoid	This output is activated when the stop solenoid output is high.
26	Fail to start	This output is activated when the fail to start alarm is activated.
27	Fail to stop	This output is activated when the fail to stop alarm is activated.
28	Fuel relay	This output is activate when the fuel relay is active.
29	Gen available	This output is activated when the timer for the warm-up delay expires.
30	L1 phase OV shutdown	This output is activated when the over-voltage shutdown alarm for phase L1 is activated.
31	L1 phase UV shutdown	This output is activated when the under-voltage shutdown alarm for phase L1 is activated.
32	L2 phase OV shutdown	This output is activated when the over-voltage shutdown alarm for phase L2 is activated.
33	L2 phase UV shutdown	This output is activated when the under-voltage shutdown alarm for phase L2 is activated.
34	L3 phase OV shutdown	This output is activated when the over-voltage shutdown alarm for phase L3 is activated.
35	L3 Phase UV Shutdown	This output is activated when the under-voltage shutdown alarm for phase L3 is activated.
36	Gen over current	This output is activated when the controller shuts down the genset because of over-current.
37	High engine coolant temp	This output is activated when the alarm for high engine temperature is activated.
38	Low fuel LVL	This output is activated when the low fuel alarm is activated.
39	Low LOP	This output is activated when the low LOP alarm is activated.
40	Mains high volt	This output is activated when the mains voltage is more than the configured value.
41	Mains low volt	This output is activated when the mains voltage is less than the configured value.
42	Oil pressure open circuit	This output is activated when the alarm for oil pressure (open circuit) is activated.
43	Open gen contactor	This output is activated when: • The close mains/open genset input is activated or • When the load is transferred to the mains in AMF mode.
44	Open mains contactor	This output is activated when: • The close genset/open mains input is activated or • When the load is transferred to the genset.
45	Over freq shutdown	This output is activated when the shutdown alarm for over-frequency is activated.
46	Over speed shutdown	This output is activated when the shutdown alarm for overspeed is activated.

No.	Output source	Description
47	Gross over speed shutdown	This output is activated when the shutdown alarm for gross overspeed is activated.
48	Start relay	This output is activated when the start relay is activated during the engine start sequence.
49	Temp sensor open circuit	This output is activated when the alarm for the temperature sensor (open circuit) is activated.
50	Under freq shutdown	This output is activated when the shutdown alarm for under-frequency is activated.
51	Under speed shutdown	This output is activated when the shutdown alarm for under-speed is activated.
52	Maintenance due	This output is activated when the maintenance alarm is activated.
53	Stop mode	This output is activated when the stop sequence is initiated.
54	Auto mode	This output is activate when the controller is in AUTO mode.
55	Manual mode	This output is activate when the controller is in manual mode.
56	Preheat output	This output is activated when the pre-heater is activated. The output is active for the duration of the pre-heat timer.
57	Automatic fuel transfer	This output is activated when the automatic fuel transfer output is activated.
58	ISV pull signal	This output is high when the start command is given. The output is high for an adjustable time.
59	ISV hold signal	This output is activated when the start command is given. The output is deactivated when the stop command is given and the engine has stopped.
60	Low idle mode	This output is activated when the genset is operating at low idle speed.
61	Coolant control output	This output is activated when the coolant temperature is outside the set points configured for the temperature.
62	Keyswitch	This output is active during the start sequence. It is not active during the stop sequence.
63	Open Gen Breaker Pulse	If this output is activated, a pulse is generated to open the genset breaker.
64	Close Gen Breaker Pulse	If this output is activated, a pulse is generated to close the genset breaker
65	Open Mains Breaker Pulse	If this output is activated, a pulse is generated to open the mains breaker
66	Close Mains Breaker Pulse	If this output is activated, a pulse is generated to close the mains breaker
67	Idle Mode On Pulse	If this output is activated, a pulse is generated to activate idle mode.
68	Idle Mode Off Pulse	If this output is activated, a pulse is generated to deactivate idle mode.

9. Troubleshooting

General troubleshooting

Fault	Action
The controller does not power ON.	• Check the battery voltage. • Check the fuse on the battery supply. • Check continuity between battery positive and controller terminal 2. • Check continuity between battery ground and controller terminal 1.
The controller display freezes or hangs up.	• Reset the controller power.
The controller fails to crank-start the engine.	• Check the battery voltage. • Go to the Configuration menu on the controller. Make sure the start output is configured correctly. Measure the output voltage to make sure the output is working. • Go to the Configuration menu on the controller. Make sure the crank disconnect method and the LLOP switch polarity are configured correctly. Make sure that the lube oil pressure switch and sensor are working correctly. Do a check of the wiring for the switch and sensor.
The emergency stop alarm is shown when the emergency stop is not active.	• Check if the Emergency stop switch is working correctly. Make sure to also do a check of the wiring for the switch. • Go to the Configuration menu. Make sure the emergency stop polarity is configured correctly.
The controller incorreclt shows shutdown or warning alarms.	• Check the switch, sensor and wiring. • Go to the Configuration menu. Make sure the threshold is configured correctly.
The controller shows a charge fail alarm.	• To check if the controller's charging alternator terminal is working: ◦ Disconnect the charging alternator wiring to the controller's terminal 7. ◦ Short terminal 7 to the ground through a DC ammeter. ◦ Crank-start the engine. ◦ The DC ammeter should indicate the current in the range of 200 to 400 mA for ~30 seconds. ◦ If yes, the controller's charging alternator terminal is working OK. • Disconnect and re-connect the charging alternator ind connection to the controller's terminal 7. • Check if the charging alternator is working OK.
The controller shows error C03.	Error C03 can occur if the controller is disconnected from the PC during a configuration. 1. Push and hold the *Stop/Config*  button during a power cycle to reset the controller. 2. Send the configuration file again.
The controller sends a crank-start command immediately after power on.	• Make sure that the controller's output terminal is not directly connected to the starter relay. The controller's output should be given to an intermediate relay which should in-turn power the starter relay. The controller can get permanently damaged and will need to be replaced if this precaution is not taken. • Check start-relay connection with the corresponding controller terminal. • Go to the Configuration menu on the controller. Make sure that the start mode and polarity for the start relay output are configured correctly.

Fault	Action
The engine runs, but the controller shows genset to be OFF.	• Check if the MPU signal (if used), and main alternator voltage signal (L1 phase) are received by the controller terminals. • Check if the LOP and LLOP are working OK. Check the wiring to the controller.
The controller shows incorrect PF value or kW or load current.	• Check wiring of the alternator phase voltage and the CT to the controller. • Check the CT ratio (if kW or current reading is faulty).
The controller shows incorrect mains voltage or incorrect main alternator voltage.	• Check the wiring of the phase to the controller. • If the problem is not resolved, replace the controller and try again.
The controller shows incorrect reading for any of LOP, fuel level or temperature sensors.	• Check the respective sensor and its wiring. • Go to the Configuration menu on the controller. Make sure the sensors are calibrated correctly.

AUTO mode troubleshooting

Fault	Action
The controller does not start the engine when a remote start command is sent from an external device.	• Check the wiring of the remote start signal to the controller's respective digital input terminal. • Go to the Configuration menu on the controller. Make sure the digital input for the remote start is configured correctly. • Check that the controller is in Auto mode. • Make sure that the mains monitoring and site monitoring are not enabled.
Controller does not stop engine even when a remote stop command is sent from an external device.	• Check the wiring of the remote stop signal to the controller's digital input terminal. • Go to the Configuration menu. Make sure the digital input for the remote stop is configured correctly. • Check that the controller is in Auto mode.
While in Auto mode, the controller sends a Start command even if the mains is present.	• Check the wiring of the mains L1, L2 and L3 phase to the controller's input terminal. • Go to the Configuration menu on the controller. Make sure the mains monitoring is configured correctly.

E-governor troubleshooting

Fault	Action
• The actuator chatters after the engine is stopped. • The controllers shows that the genset is operating, when the genset is not operating. • The controller shows a *Fail to stop* alarm when the genset is stopped.	• Go to the Configuration menu, and make sure the configuration for the LLOP and LOP is correct. Make sure the wiring for the LLOP and LOP is correct. • Make sure that the mains voltage wiring is not connected to the genset voltage terminals on the controller.
• The controller does not maintain the target RPM. • The engine RPM is not stable. • The controller cranks the engine, but does not start the engine.	• Make sure that the mechanical linkage assembly is correct. • Go to the Configuration menu and make sure the configuration for the E-governor is correct. • Make sure that the PID control gains are configured correctly. • Make sure that the actuator moves to the full throttle position when the controller cranks the engine.