USER MANUAL

SGC 120/121

Single Genset Controllers

4189341226B

1. Introduction

1.1 About SGC 120/121

This document presents information necessary for operating DEIF's SGC 120/121 genset controllers.

SGC 120/121 are modern genset controllers with user friendly HMI and full graphics LCD. The controllers come with a highly versatile software. Extensive inputs and outputs support a wide variety of industry standard features in diesel/gasoline genset applications.

SGC 121 includes electronic governing for engines with mechanical fuel systems. With a rotary actuator as add-on for air/fuel charge control, SGC 121 can perform electronic governing of the engine within ISO 8528 class G3 limits.

The DEIF Smart Connect software offers flexibility to configure each individual input and output for a specific function or application. All parameters can also be configured on the genset controller.

1.2 Key functions

- Genset controller with configurable inputs:
  - Five digital inputs
  - Four analogue inputs (configurable as digital inputs)
- Six digital outputs
- Auto, Manual and Remote start/stop modes for 1-phase and 3-phase gensets
- RPM sensing using frequency and MPU
- Supports Auto exercise mode
- Real time clock-based event logs
- PC connectivity via USB port
- RS-485 and CAN ports
- Configurable fuel theft alarm
- Backlit full graphics display
- Integrated electronic governor controller (SGC 121 only)

1.3 Product overview

Following table gives a brief overview of SGC 120/121 features:

Features	Specifications
Digital switch input	5
Analogue resistive inputs	3
Analogue current/voltage input	1
Mains voltage input (AMF)	Yes
DG alternator voltage input, D+ charging alternator I/O	Yes
DG alternator current input	Yes
Engine speed input via MPU	Yes
Digital outputs	6
Real Time Clock for event logs and Auto exercise mode	Yes
USB I/O port for laptop access	Yes
EEPROM for extended event logs OR regional languages	Yes

Features	Specifications
CANbus Engine Interface	Yes
RS-485 Interface for Modbus	Yes
DC battery supply voltage (with -32 V reverse protection)	8 to 28 V
Operating temperature range	-20 to 65 °C
Protection class with gasket (included)	IP65
Warning auto clear enable/disable	Yes
Fuel reference selection input	Yes
On the fly mode change when engine is healthy/engine off	Yes
Analogue 0-5 V input for Speed bias input for E-gov from Load sharing module	Yes*
E-gov actuator output	Yes*

*Note: SGC 121 only.

1.4 Passwords

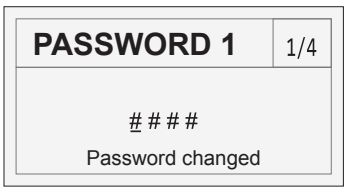
The controller is protected from set-up changes with a four digit password.

There are two password levels:

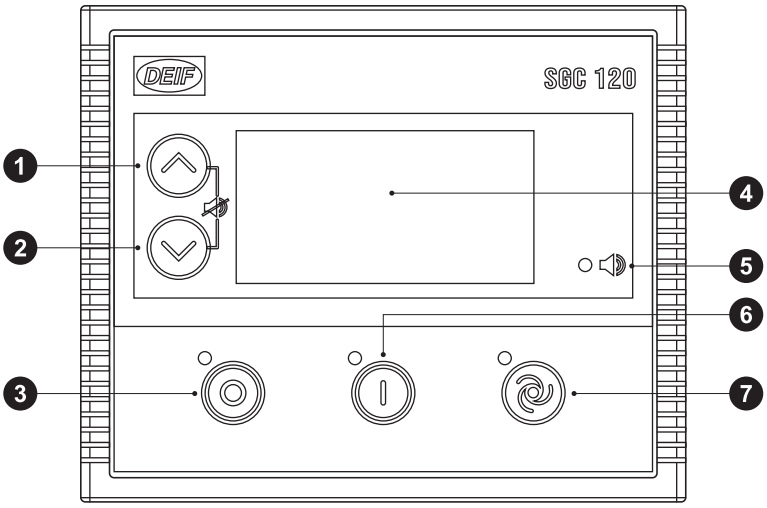
Level	Access	Factory setting
1	Full access (read and write)	0123
2	Limited access (read)	1234

The passwords can be changed on the controller:

1. Go to Configuration mode.
2. Log on with password level 1.
3. Use the *Up* and *Down* buttons to go to Misc Settings, select with the Start button.
4. Use the *Up* and *Down* buttons to go to the password to be changed, select with the Start button.
5. Use the *Up* and *Down* buttons to choose the first digit for the new password, select with the Start button.
6. Repeat for the next three digits.
7. When all four digits are chosen, the display shows



1.5 Overview of controller buttons



1. Menu navigation up button
2. Menu navigation down button
3. Stop/Config button
4. Display
5. Alarm LED
6. Start button
7. Mode selection button

Button functions

In Mode	Button input	Function
Manual	Start	Starts the engine
Manual	Auto	Enters Auto mode
	Stop	Stops the engine
	Stop (long press)	Enters Configuration mode
	Down + Stop (long press)	Enters Programming mode
Auto	Stop	Stops the engine and enters Manual mode
Manual Auto Configuration	Up Down	Scrolls through the views/parameters
Manual Auto	Up + Down (during Alarm view)	Acknowledges and clears the alarm
Configuration	Start	Selects/saves the parameter
Configuration	Up + Down (long press)	Enters the Event log page
Configuration	Stop (long press)	Back to Manual mode
Deep sleep	Any Key (for min. 1 s)	Back to Manual mode
Event log	Up + Down (long press)	Back to Configuration mode
Programming	Up + Down (long press)	Enters Manual mode

1.6 Legal information

Warranty

WARNING

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

Disclaimer

DEIF takes no responsibility for installation or operation of the generator set. If there is any doubt about how to install or operate the engine/generator controlled by the SGC controller, the company responsible for the installation or the operation of the set must be contacted.

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. Safety instructions

2.1 General safety instructions

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

Installation and maintenance must only be carried out by authorised personnel, and always in accordance with all applicable state and local electrical codes. Efficient and safe operation of the controller can be acquired only if the equipment is correctly operated, configured and maintained.

The following notations found in this document can indicate potentially hazardous conditions to the operator, service personnel or the equipment.

NOTE Highlights an essential element of a procedure to ensure correctness.

CAUTION
Indicates a procedure or practice, which could result in damage or destruction of equipment, if not strictly observed.

WARNING
Indicates a procedure or practice, which could result in injuring personnel or loss of life, if not followed correctly.

2.2 Electrical safety

- Electric shock can cause severe personal injury or death.
- Ensure that the genset is grounded before performing any installation or service.
- Generators produce high electrical voltages, and direct contact with it can cause fatal electrical shock. Prevent contact with terminals, bare wires, connections, etc., while the generator and related equipment are running. Do not tamper with interlocks.
- To handle the maximum electrical current, the wires used for electrical connections and wirings must be of appropriate size.

2.3 In operation safety

- Before installing the controller, ensure that all power voltage supplies are positively turned off at the source. Disconnect the generator's battery cables and remove the panel fuse to prevent accidental start up. Disconnect the cable from the battery post, indicated by a NEGATIVE, NEG, or (–) first. Reconnect the negative cable last. Failure to do so will result in hazardous and possibly fatal electrical shock.
- Remove the electric power supply before removing the controller or touching other electrical parts.
- Use extreme caution when working on electrical components. High voltage can cause injury or death.
- With floors of metal or concrete, use rubber insulation mats placed on dry wood platforms when working near the generator or other electrical equipment.
- Do not wear damp clothing (particularly wet shoes) or allow skin surface to be damp when handling electrical equipment.
- Do not operate any electrical device or wires while standing in water, while barefoot, or while hands or feet are wet. It may result in severe electrical shock.
- Do not wear jewellery. Jewellery can cause a short circuit within electrical contacts and cause shock or burning.

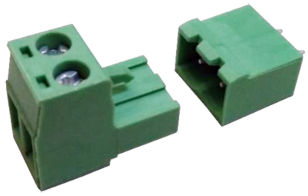
In case of an accident caused by electric shock, immediately shut down the electrical power source. If this is not possible, try to release the victim from the live conductor. Avoid direct contact with the victim. Use a non-conducting object (for example a rope or a wooden stick) to release the victim from the live conductor. If the victim is unconscious, apply first aid and get immediate medical help.

3. Technical specifications

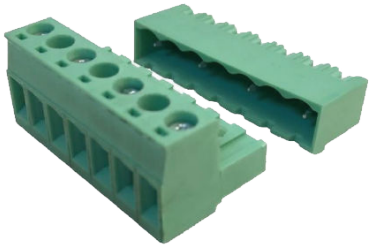
3.1 Terminals

The SGC 120/121 uses three types of terminal blocks:

Connectors of 3.5 mm pitch



Connectors of 5.08 mm pitch



Connectors of 10.16 mm pitch

Table 3.1 Terminals

Connector type	Pitch	Male (on controller)*	Female (mating part)*	Quantity
4-pin	3.5 mm	5441294	5441430	2
6-pin	3.5 mm	5441317	5449283	1
8-pin	3.5 mm	5441320	5441456	1
10-pin	3.5 mm	5443962	5449306	1
2-pin	5.08 mm	5447353	5441980	1
4-pin	10.16 mm	5474274	5453499	2

*Note: Phoenix (Phoenix Contact (I) Pvt. Ltd.)

3.2 Power supply

Category	Specification
Controller terminals	1 (Ground) 2 (Battery or DC+)
Supply voltage range	Nominal voltage: 12/24 V DC Operating range: 8 to 28 V DC
Cranking drop out period	50 ms
Maximum reverse voltage protection	-32 V DC
Measurement accuracy (battery voltage)	±1 % full scale
Resolution	0.1 V
Maximum current consumption	~ 200 mA, 12/24 V DC (excluding the current load for the DC and rotary actuator's outputs)
Standby current consumption LCD backlight off)	124 mA, 12 V DC 123 mA, 24 V DC
Deep sleep current	20 mA, 12/24 V DC

3.3 Genset voltage and frequency measurements

Category	Specifications
Controller terminals	27 (Neutral) 28 (L3) 29 (L2) 30 (L1)
Measurement type	True RMS
Phase-to-neutral voltage	32 to 300 V AC RMS
Phase-to-phase voltage	32 to 520 V AC RMS
Voltage accuracy	±1 % of full scale for phase-to-neutral ±2 % of full scale for phase-to-phase
Voltage resolution	1 V AC RMS for phase-to-neutral 2 V AC RMS for phase-to-phase
Frequency range	5 to 75 Hz
Frequency accuracy	0.25 % of full scale
Frequency resolution	0.1 Hz

NOTE For single phase applications, it is mandatory to connect the genset phase and neutral cables to the genset controller's phase L1 and neutral terminals.

3.4 Genset current measurements

Category	Specifications
Controller terminals	39 and 40 (for phase L1) 37 and 38 (for phase L2) 35 and 36 (for phase L3)
Measurement type	True RMS
Maximum CT secondary current rating	Nominal: -/5 A CT
Burden	0.25 VA
Measurement accuracy	±1.4 % of nominal

NOTE Follow the recommended phase sequence while connecting the current transformer (CT)

3.5 Mains voltage and frequency measurement

Category	Specifications
Controller terminals	31 (Neutral) 32 (L3) 33 (L2) 34 (L1)
Measurement type	True RMS
Phase-to-neutral voltage	32 to 300 V AC RMS
Phase-to-phase voltage	32 to 520 V AC RMS
Voltage accuracy	±2 % of full scale for phase-to-neutral ±2.5 % of full scale for phase-to-phase
Voltage resolution	1 V AC RMS for phase-to-neutral

Category	Specifications
	2 V AC RMS for phase-to-phase
Frequency range	5 to 75 Hz
Frequency accuracy	0.25 % of full scale
Frequency resolution	0.1 Hz

NOTE For single phase applications, it is mandatory to connect the mains phase and neutral cables to the genset controller's phase L1 and neutral terminals.

3.6 Digital inputs

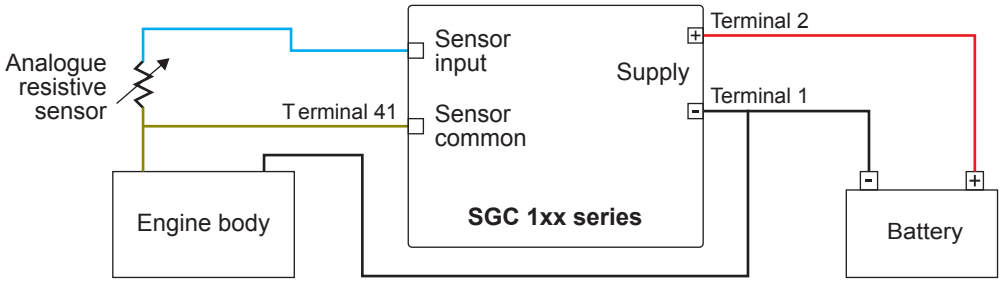
Category	Specifications
Controller terminals	10, 11, 12, 21, 22
Number of inputs	5
Type	Negative sensing (connect to ground for activation)
Software configurable options	Low Lub Oil Pressure (LLOP) Switch, High Water Temperature, and more (see **Controller overview, Configurable parameters** in the **User manual** for more details).

3.7 Analogue resistive sensor inputs

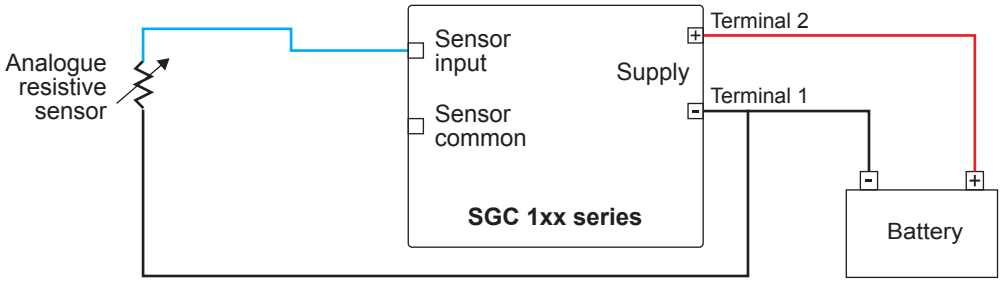
Category	Specifications
Controller terminals	24 (Engine temperature) 25 (Fuel level sensor) 26 (Oil pressure)
Number of inputs	3
Type	Ratio-metric sensing
Range	10 to 5000 Ω (terminal 24) 10 to 1000 Ω (terminal 25 and 26)
Open circuit detection	Above 1.5 kΩ (terminal 24) Above 5.5 kΩ (terminal 25 and 26)
Measurement accuracy	±2 % of full scale (up to 1000 Ω)
Connection method	Connect the sensor output terminals between the genset controller terminal and the battery ground terminal

SCP connection

SCP connections for Analogue inputs 1 to 4*:

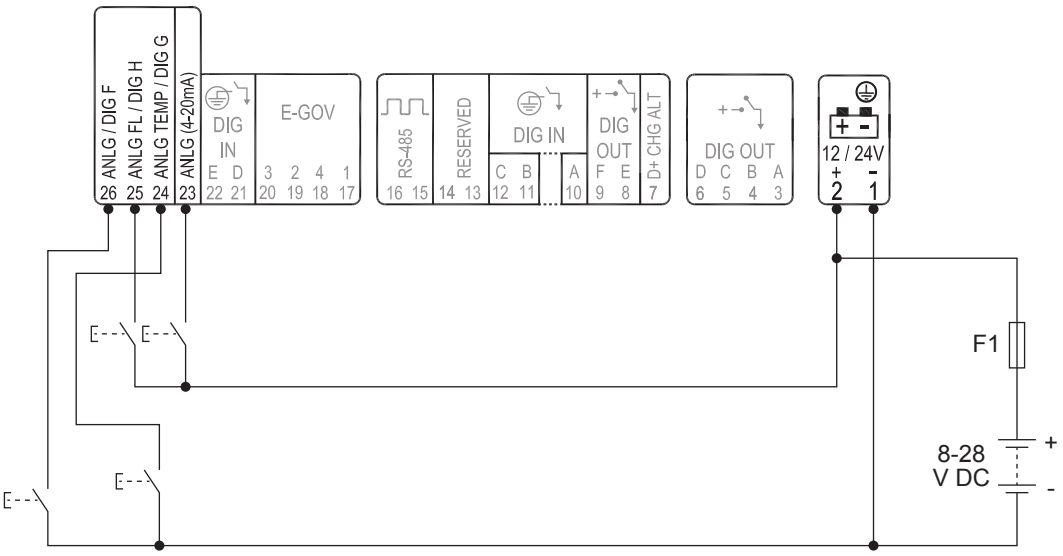


*SCP connections for Analogue input 2 used as *Fuel level sensor* with the reference configured as *Battery Negative*



3.8 Analogue inputs used as digital inputs

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



3.9 Analogue voltage/current input

Category	Specifications
Controller terminal	23
Measurement type	Analogue voltage/current sensing
Range	0 to 5 V DC 4 to 20 mA
Accuracy	±2 % of full scale voltage ±1.25 % of full scale current
Resolution	0.1 V 0.1 mA

3.10 Magnetic pick-up (MPU) input

Category	Specifications
Controller terminal	42
Measurement type	Single ended
Frequency range	10 to 10 kHz
Input voltage range	200 mV to 45 V AC RMS

The Magnetic pick-up (MPU) is an inductive sensor fitted on the engine flywheel for the engine speed sensing. The output of the MPU is a sine-wave signal.

3.11 Digital outputs

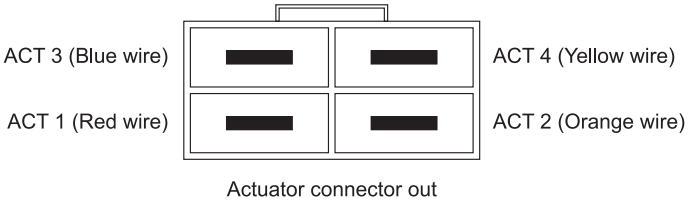
Category	Specifications
Controller terminals	3, 4, 5, 6, 8, 9
Number of outputs	6
Type	DC outputs
Maximum current rating	Max. per output: 500 mA Total max.: 1 A
Software configurable options	Start relay, Fuel relay and many more (see **Controller overview, Configurable parameters** for more details).

NOTE
- Do not connect the starter motor relay and the stop solenoid directly to the controller's output terminals.
- Genset and mains contactor latching relays should be compiled against 4 kVA surge as per IEC-61000-4-5 standard.

3.12 Rotary actuator outputs (SGC 121 only)

Category	Specifications
Controller terminal	17, 18. 19 and 20
Type	Stepper motor drive
Max. current	1 A

The actuator outputs are used only for the Rotary actuator, if installed. The Rotary actuator is a 4-wire actuator that is used for creating an electronic governing application in case of a mechanical fuel system engine. In diesel engines, the Rotary actuator's shaft output gets mechanically connected to the stop lever or the throttle lever of an in-line or rotary fuel injection pump. In case of petrol or natural gas engines, the Rotary actuator's shaft output gets connected to the throttle/charge control valve.



Actuator connector out

It is recommended to follow the connection details of the Rotary actuator connector and SGC 121.

3.13 D+ Charger alternator

Category	Specifications
Controller terminal	7
Voltage range	0 to V_{BATT} V_{BATT} = 8 to 28 V DC
Excitation	PWM (power limited to 3 W, 12 V/250 mA)
Accuracy	±1 % of full scale

The charge fail is a combined input and output terminal. When the genset starts, the terminal provides controlled power output to excite the charging alternator. After the excitation is successfully done, the controller reads the charging alternator's output voltage for monitoring its health. The action for charge fail is configurable.

3.14 Sensor common point

Category	Specifications
Controller terminal	41
Range	±2 V
Accuracy	±2 % of full scale

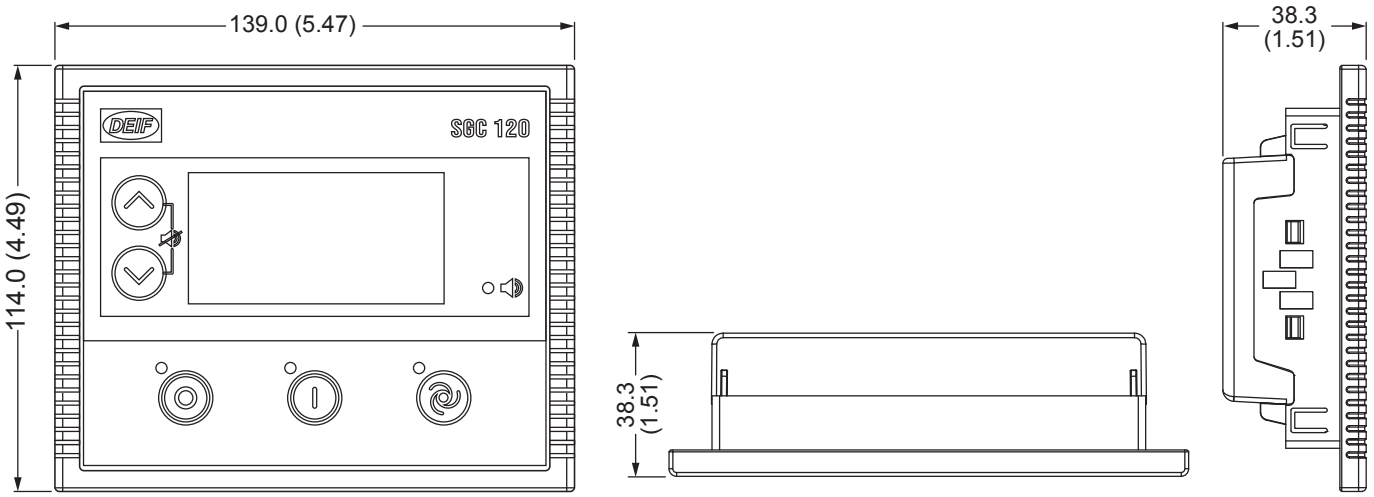
NOTE The sensor common point (SCP) terminal 41 of the controller should be directly connected to an electrically sound point on the engine body. This point on the engine body should serve as a common reference point for all analogue sensors such as those for measuring lube oil pressure, engine temperature and fuel level. The electrical cable used for the connection should not be shared with any other electrical connection. Such a wiring practice is strongly recommended to ensure that there is negligible potential difference, if any, between the engine body and the controller's SCP terminal, and, predictable and accurate analogue sensor measurements are always available in a wide variety of field conditions.

3.15 Communication ports

Category	Specifications
USB	USB 2.0 type B for connection to PC with DEIF Smart Connect software.
RS-485 Serial Port	Half Duplex Max. Baud Rate 115200 Data connection 2-wire Termination resistor of 120 Ω between output terminals A and B (internally mounted) Common mode operating range and bus pin fault protection up to ±70 V Maximum distance of line is 200 m
Controller terminals for RS-485	15 and 16
CAN (SGC 120 only)	Baud rate: 250 kbps Packet size: 8 bytes Termination resistor of 120 Ω is provided
Controller terminals for CAN (SGC 120 only)	13 and 14

4. Installation

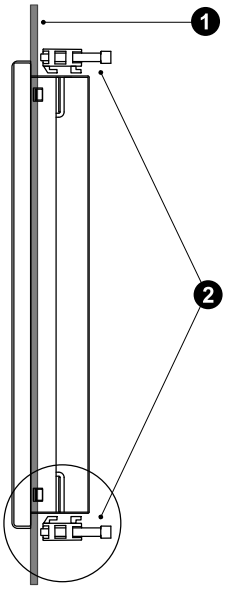
4.1 Dimensions



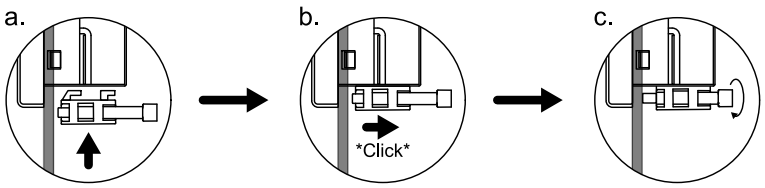
	Length	Height	Depth
Controller	139.0 mm (5.47 in)	114.0 mm (4.49 in)	38.3 mm (1.51 in)
Panel cut-out	118.0 mm (4.65 in)	93.0 mm (3.66 in)	Tolerance: ± 0.3 mm (0.01 in)

4.2 Mounting in panel

To mount the controller into the panel, use the fixing clips provided along with the controller.



1. Panel surface.
2. Mounting clips.

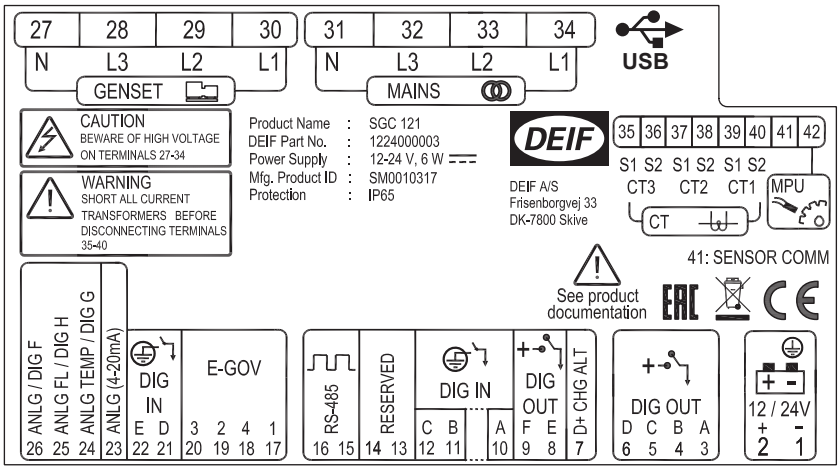


a. Insert the mounting clips into the slots on the controller.
b. Press the mounting clips backwards until they "click" in place.
c. Turn the screws to tighten the mounting clips (max. torque: 0.19 Nm).

CAUTION
Over-tightening the screw may damage the controller casing.

4.3 Terminal details

Rear view of the controllers with terminal details.



Terminal	Text	Description	Phoenix connector
1	GND	Power ground	5441980
2	BATT +	Power supply positive	
3	DIG OUT A	DC output - A	5441430
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	5441223
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	5441249
12	DIG IN C	Input from switch C	
13	CAN H	CAN High	
14	CAN L	CAN Low	
15	RS-485 B	RS-485 B	
16	RS-485 A	RS-485 A	

Terminal	Text	Description	Phoenix connector
17	GOV_ACT–OUT1	Output for actuator (SGC 121 only)	5447560
18	GOV_ACT–OUT4	Output for actuator (SGC 121 only)	
19	GOV_ACT–OUT2	Output for actuator (SGC 121 only)	
20	GOV_ACT–OUT3	Output for actuator (SGC 121 only)	
21	DIG_IN D	Input from switch D	
22	DIG_IN E	Input from switch E	
23	ANLG_I_IN (SGC 120)	Analogue input 4 to 20 mA	
	ANLG_IN (SGC 121)	Analogue input 4 to 20 mA/2.5 ±2 V	
24	ANLG_IN ENG_TEMP	Analogue input from Engine temperature sensor	
25	ANLG_IN FUEL_LEVEL	Analogue input from Fuel level sensor	
26	ANLG_IN LOP	Analogue input from Lube oil pressure sensor	
27	GEN_V–IN NTRL	Voltage input from Generator Neutral	5453499
28	GEN_V–IN L3	Voltage input from Generator phase L3	
29	GEN_V–IN L2	Voltage input from Generator phase L2	
30	GEN_V–IN L1	Voltage input from Generator phase L1	
31	MAINS_V–IN NTRL	Voltage input from Mains Neutral	
32	MAINS_V–IN L3	Voltage input from Mains phase L3	
33	MAINS_V–IN L2	Voltage input from Mains phase L2	
34	MAINS_V–IN L1	Voltage input from Mains phase L1	
35	GEN_CT–IN L3 1	CT input 1 from Generator phase L3	5441252
36	GEN_CT–IN L3 2	CT input 2 from Generator phase L3	
37	GEN_CT–IN L2 1	CT input 1 from Generator phase L2	
38	GEN_CT–IN L2 2	CT input 2 from Generator phase L2	
39	GEN_CT–IN L1 1	CT input 1 from Generator phase L1	
40	GEN_CT–IN L1 2	CT input 2 from Generator phase L1	
41	SCP	Sensor common point	
42	MPU–IN	MPU Input	

4.4 Typical wiring diagrams

Figure 4.1 SGC 120 typical wiring

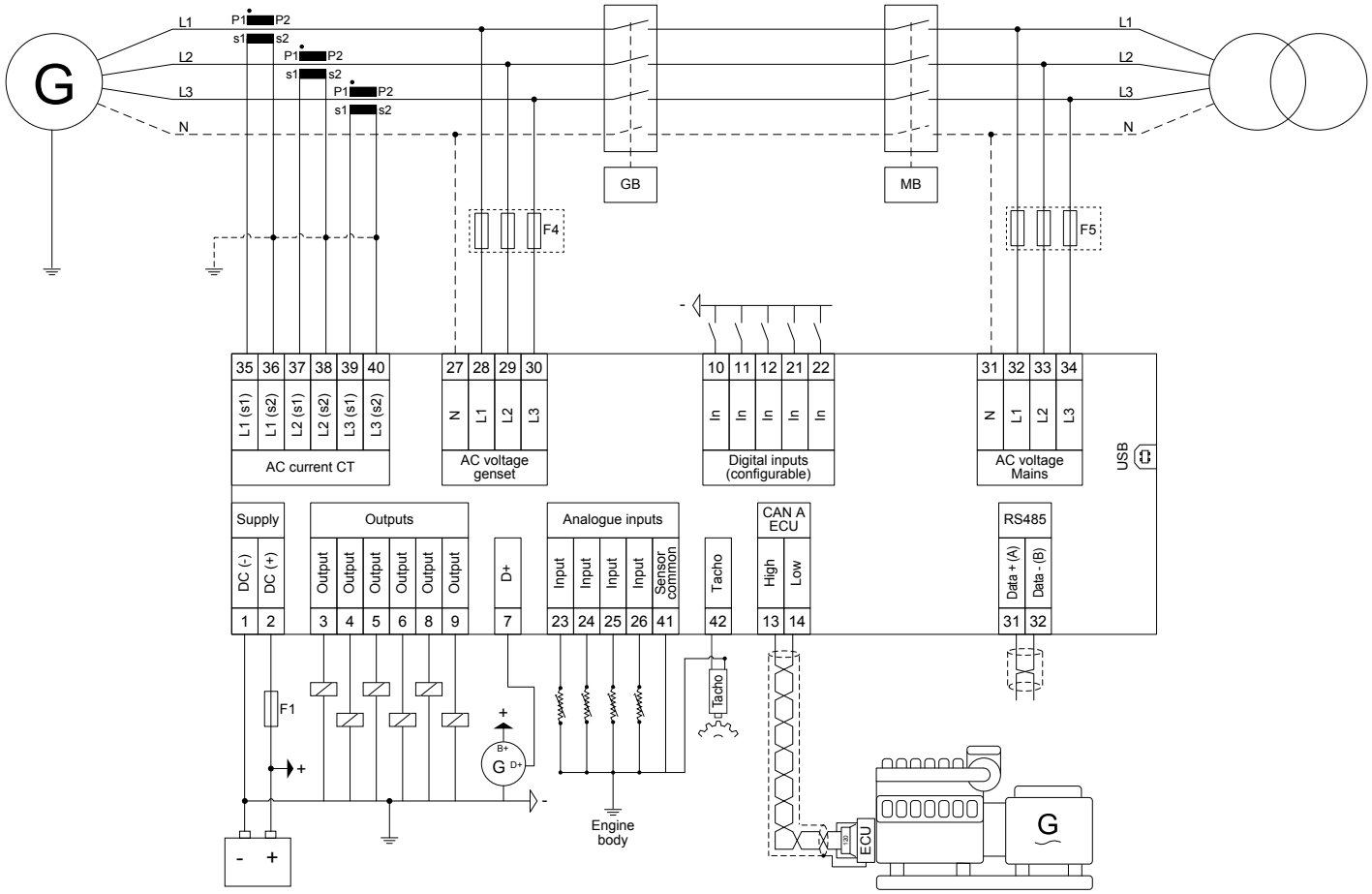
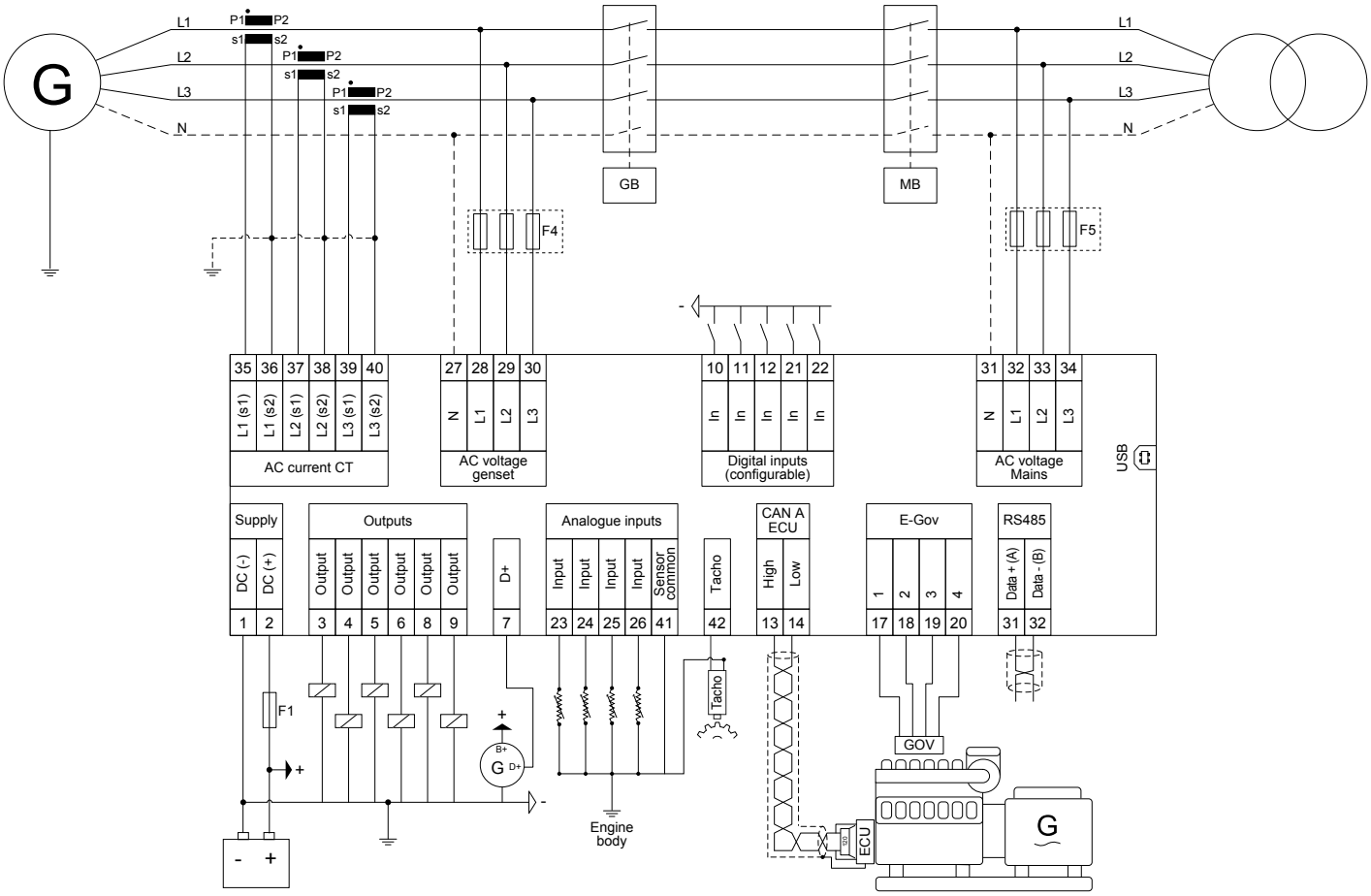


Figure 4.2 SGC 121 typical wiring



NOTE

- Wiring diagrams are examples. Use the application's wiring diagram during installation.
- Genset and mains contactor latching relays should be compiled against 4 kV surge as per IEC-61000-4-5 standard.
- Relay cards used with the controller should be protected against reverse battery voltages.
- Analogue input 2 used for *Fuel level sensor* can be wired with the reference to *Battery Negative*, see **Specifications, Analogue resistive sensor inputs**.
- Communication ports for CAN (terminals 13 and 14) and RS-485 (terminals 31 and 32) have built-in 120 Ω resistors.
- If a digital output is connected to a relay, the relay must include freewheeling diodes.

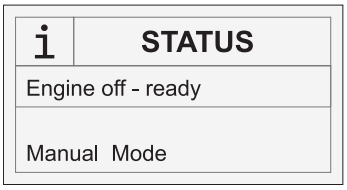
5. Monitoring mode

5.1 Monitoring mode

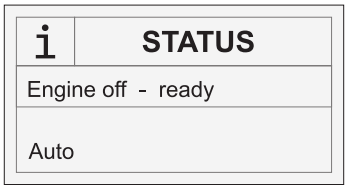
In Monitoring mode, the display views shift automatically after a pre-defined time. This delay time can be configured in the configuration menu.

The views can also be changed manually with the *Up* and *Down* buttons.

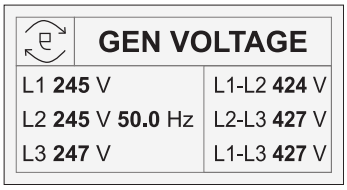
Engine status and operating mode



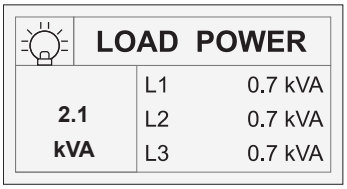
Manual mode



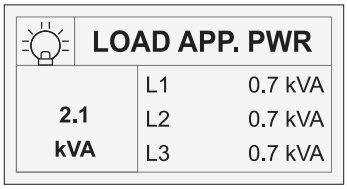
Auto mode



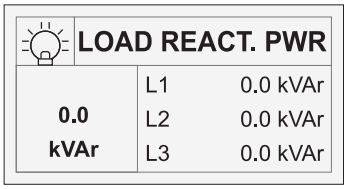
Generator voltage



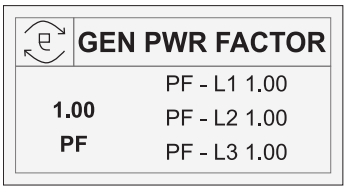
Load power[1]



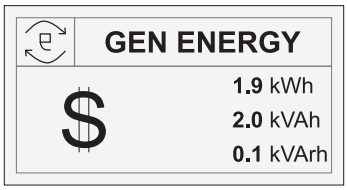
Load apparent power[1]



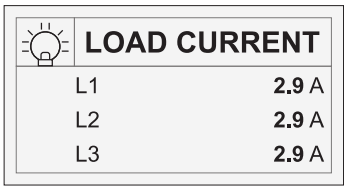
Load reactive power[1]



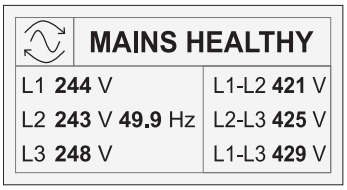
Generator power factor[1]



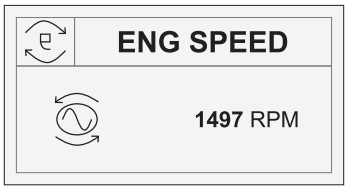
Generator energy



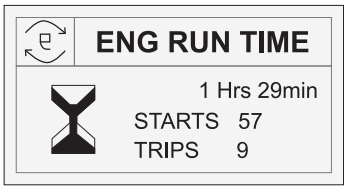
Load current[1]



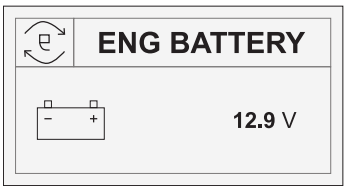
Mains status



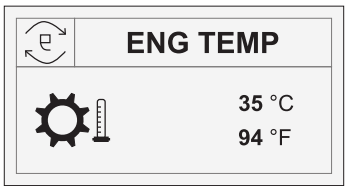
Engine speed



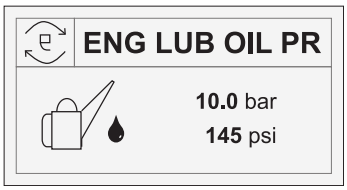
Engine run time



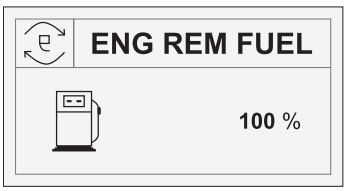
Engine battery voltage

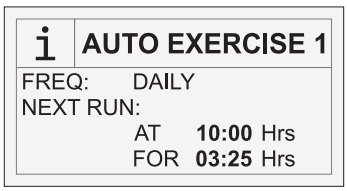


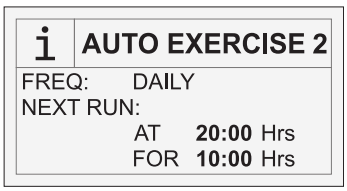
Engine temperature[2]



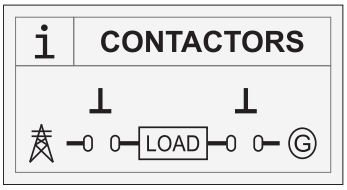
Engine lube oil pressure[2]







Engine fuel balance[2]

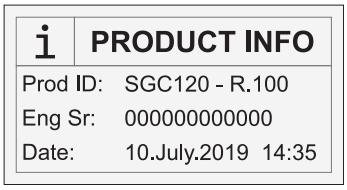


Contactor status[4]

Auto Exercise 1[3]

Alarms (example)

Auto Exercise 2[3]



Product info

[1] L2 and L3 phases are only visible if the controller is configured for a 3-phase genset.

[2] The display is only visible if the corresponding sensor is configured.

[3] The display is only visible if the event is enabled in the controller's configuration.

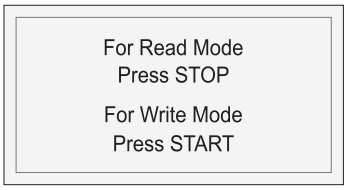
[4] The display is only visible if the output related to genset and mains contactors are configured.

6. Configuration mode

6.1 Configuration mode

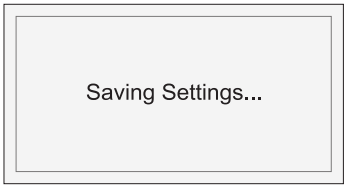
To configure the controller, follow these steps:

1. Press and hold the *Stop/Config* button for at least three seconds.
2. The display shows



3. To see the configuration, press the *Stop/Config* button. To change the configuration, press the *Start* button.
4. The display shows

5. To enter the the four digit password:
   - Scroll through the digits with the *Up* and *Down* buttons.
   - Select a digit with the *Start* button.
6. To leave the Configuration mode, press and hold the *Stop/Config* button.
7. Until the configuration is saved, the display shows



6.2 Configurable parameters

6.2.1 Configurable parameters

The tables give an overview of configurable parameters.

Level 1 (table titles) and Level 2 texts are shown twice:

- DEIF Smart Connect software: Normal sentence case, for example Power on Mode.
- Controller display: Capital case in brackets, for example (POWER ON MODE)

6.2.2 Module

Table 6.1 General (GENERAL)

Level 2	Range
Profile name	Profile 1
Power on Mode (POWER ON MODE)	Manual Auto
Power on Lamp Test (POWER ON LAMP TEST)	Enable Disable
Deep Sleep Mode (DEEP SLEEP MODE)	Enable Disable
Auto-Clear Warning Alarm (AUTO CLEAR WARNINGS)	Enable Disable
Language (LANGUAGE SUPPORT)	English Chinese

Table 6.2 Display (DISPLAY)

Level 2	Range
Contrast (CONTRAST)	0 to 100 %
Power Save Mode (POWER SAVE MODE)	Enable Disable

Table 6.3 Communication (RS485 COMM)

Level 2	Range
Communication Mode (COMM MODE)	None Modbus
Slave ID (MODBUS SLAVE ID)	1 to 247
Baudrate (BAUDRATE)	1200 2400 4800 9600 19200 38400 57600 115200
Parity Bit (PARITY)	None Even Odd

Table 6.4 Auto Exercise – Event 1 (AUTO EXERCISE – 1)

Level 2	Range
Auto Exercise (EVENT 1)	Enable Disable
Event Occurrence (EVENT OCCURENCE)	Daily Weekly

Level 2	Range
	Monthly
Event Day (EVENT DAY)	Daily: Runs every day Weekly: Sunday to Saturday Monthly: 1 to 28
Start Time (START TIME)	00:00 to 23:59 hour
Duration (GEN ON DURATION)	00 hr 01 min. to 99 hr 59 min.
Load Transfer (LOAD TRANSFER)	Enable Disable

Table 6.5 Auto Exercise – Event 2 (AUTO EXERCISE – 2)

Level 2	Range
Auto Exercise (EVENT 2)	Enable Disable
Event Occurrence (EVENT OCCURENCE)	Daily Weekly Monthly
Event Day (EVENT DAY)	Daily: Runs every day Weekly: Sunday to Saturday Monthly: 1 to 28
Start Time (START TIME)	00:00 to 23:59 hour
Duration (GEN ON DURATION)	00 hr 01 min. to 99 hr 59 min.
Load Transfer (LOAD TRANSFER)	Enable Disable

6.2.3 Digital inputs

Table 6.6 Digital Input # (DIG IN #)

Level 2	Range
Source (SOURCE)	See **Digital input source selection** in this document
Name (NAME)	Auxiliary Input #
Polarity (POLARITY)	Close to Activate Open to Activate
Action (ACTION)	None Notification Warning Electrical Trip Shutdown
Activation (ACTIVATION)	Never From Engine Start From Monitoring On

Level 2	Range
	Always
Activation Delay (ACTIVATION DELAY)	0 to 60 s

6.2.4 Analogue inputs

Table 6.7 Analogue Input 1 (ENG TEMP / DIG G)

Level 2	Range
Use Input As (SENSOR SELECTION)	Not used Digital Input G Anlg In Eng Temp
(Digital) Source ((DIG) SOURCE)	See **Digital input source selection** in this document
Name (NAME)	Auxiliary Input G
(Digital) Polarity ((DIG) POLARITY)	Close to Activate Open to Activate
(Digital) Action ((DIG) ACTION)	None Notification Warning Electrical Trip Shutdown
(Digital) Activation ((DIG) ACTIVATION)	Never From Engine Start From Monitoring On Always
(Digital) Activation Delay ((DIG) ACTIVATION DELAY)	1 to 60 s
(ETS) Circuit Fault Action (OPEN CKT ALARM)	None Notification Warning Electrical Trip Shutdown
(ETS) Engine Temperature Sensor Calibration Table	Resistance: 0 to 1000 Ω Temperature: 25 to 300 °C

Table 6.8 Analogue Input 2 (FUEL LVL / DIG H)

Level 2	Range
Use Input As (SENSOR SELECTION)	Not used Digital Input H Fuel Level Sensor
(Digital) Source ((DIG) SOURCE)	See **Digital input source selection** in this document
Name (NAME)	Auxiliary Input H
(Digital) Polarity ((DIG) POLARITY)	Close to Activate Open to Activate
(Digital) Action	None

Level 2	Range
((DIG) ACTION)	Notification Warning Electrical Trip Shutdown
(Digital) Activation ((DIG) ACTIVATION)	Never From Engine Start From Monitoring On Always
(Digital) Activation Delay ((DIG) ACTIVATION DELAY)	1 to 60 s
(FLS) Low Fuel Level Shutdown (SHUTDOWN)	Enable Disable
(FLS) Shutdown Threshold (SHUTDOWN THRESHOLD)	0 to 78 %
(FLS) Low Fuel Level Notification (NOTIFICATION)	Enable Disable
(FLS) Notification Threshold (NOTIFICATION THRESHOLD)	2 to 80 %
(FLS) Fuel Tank Capacity (FUEL TANK SIZE)	2 to 1000 litre
(FLS) Fuel Theft Warning (FUEL THEFT ALARM)	Enable Disable
(FLS) Fuel Theft Alarm Threshold (FUEL LVL THRESH)	1 to 100 % per hour
(FLS) Circuit Fault Action (OPEN CKT ALARM)	None Notification Warning Electrical Trip Shutdown
(FLS) Fuel Sensor Reference (FUEL LVL REF)	Battery Negative Engine Body
(FLS) Fuel Level Sensor Calibration Table	Resistance: 0 to 1000 Ω Fuel level: 0 to 100 %

Table 6.9 Analogue Input 3 (LOP / DIG F)

Level 2	Range
Use Input As (SENSOR SELECTION)	Not used Digital Input F Lube Oil Pressure
(Digital) Source ((DIG) SOURCE)	See **Digital input source selection** in this document
Name (NAME)	Auxiliary Input F
(Digital) Polarity ((DIG) POLARITY)	Close to Activate Open to Activate
(Digital) Action ((DIG) ACTION)	None Notification Warning Electrical Trip

Level 2	Range
	Shutdown
(Digital) Activation ((DIG) ACTIVATION)	Never From Engine Start From Monitoring On Always
(Digital) Activation Delay ((DIG) ACTIVATION DELAY)	1 to 60 s
(LOP) Circuit Fault Action (OPEN CKT ALARM)	None Notification Warning Electrical Trip Shutdown
(LOP) Lube Oil Pressure Sensor Calibration	Resistance: 10 to 100 Ω Pressure: 1.0 to 10.0 bar

Table 6.10 Analogue Input 4 (LOP/DIG I)

Level 2	Range
Use Input As (SENSOR SELECTION)	Not used Digital Input I S4 Sensor (4-20 mA LOP)
(Digital) Source ((DIG) SOURCE)	See **Digital input source selection** in this document
Name (NAME)	Auxiliary Input I
(Digital) Polarity ((DIG) POLARITY)	Close to Activate Open to Activate
(Digital) Action ((DIG) ACTION)	None Notification Warning Electrical Trip Shutdown
(Digital) Activation ((DIG) ACTIVATION)	Never From Engine Start From Monitoring On Always
(Digital) Activation Delay ((DIG) ACTIVATION DELAY)	1 to 60 s
(LOP) Low Level Shutdown (SHUTDOWN)	Enable Disable
(LOP) Low Level Shutdown Threshold (SHUTDOWN THRESHOLD)	0.0 to 9.8 bar
(LOP) Low Level Warning (WARNING)	Enable Disable
(LOP) Low Level Warning Threshold (WARNING THRESHOLD)	0.2 to 10.0 bar
(LOP) Circuit Fault Action (OPEN CKT ALARM)	None Notification Warning Electrical Trip

Level 2	Range
	Shutdown
(LOP) Lube Oil Pressure Sensor Calibration	Current: 4 to 20 mA Pressure: 0.0 to 10.0 bar

6.2.5 Outputs

Table 6.11 Outputs # (OUT #)

Level 2	Range
Source (SOURCE)	See **Digital output source selection** in this document
On Activation (ON ACTIVATION)	Energise De-energise

6.2.6 Timers

Table 6.12 Cranking (CRANKING TIMERS)

Level 2	Range
Crank Hold Time (CRANK HOLD TIME)	1 to 15 s
Crank Rest Time (CRANK REST TIME)	2 to 60 s
Manual Start Delay (MANUAL START DELAY)	0 to 300 s
Auto Start Delay (AUTO START DELAY)	0 to 43200 s

Table 6.13 General (GENERAL TIMER)

Level 2	Range
Safety Monitoring Delay (SAFETY MONITOR DELAY)	10 to 60 s
Mains Detect Delay (MAINS DETECT DELAY)	1 to 300 s
Alternator Detect Delay (ALT DETECT DELAY)	1 to 30 s
Warm-Up Delay (WARM-UP DELAY)	0 to 60 s
Return To Mains Delay (RETN-TO-MAINS DELAY)	0 to 600 s
Engine Cooling Time (ENG COOL TIME)	0 to 300 s
Stop Action Time (STOP ACTION TIME)	10 to 120 s
Additional Stopping Time (ADDN STOPPING TIME)	0 to 120 s
Load Transfer Delay	0 to 60 s

Level 2	Range
(LOAD TRANSFER DELAY)	
Power Save Mode Delay (PWR SAVE MODE DELAY)	5 to 1800 s
Screen Changeover Time (SCRN CHNGOVER TIME)	1 to 1800 s
Deep Sleep Mode Delay (DEEP SLP MODE DELAY)	5 to 1800 s
Sounder Alarm Time (SOUNDER ALARM TIMER)	1 to 300 s
Auto Exit Config Mode (AUTO EXIT CNFG MODE)	10 to 1800 s

6.2.7 Generator

Table 6.14 Alternator configuration (ALT CONFIG)

Level 2	Range
Alternator Present (ALT PRESENT)	Yes No
Number of Poles (NUMBER OF POLES)	2/4/6/8
AC system (ALT AC SYSTEM)	1 phase 3 phase
Min Healthy Voltage (MIN HEALTHY VOLT)	50 to 350 V phase-neutral
Min Healthy Frequency (MIN HEALTHY FREQ)	10 to 75 Hz
Phase Reversal Detection (PHASE REVERSAL DETECT)	Enable Disable
Phase Reversal Action (PHASE REVERSAL ACTION)	None Notification Warning Electrical Trip Shutdown
Auto Load Transfer (AUTO LOAD TRANSFER)	Enable Disable

Table 6.15 Voltage Monitoring (VOLT MONITOR)

Level 2	Range
Under-voltage Shutdown (UNDER VOLT SHUTDOWN)	Enable Disable
Under-voltage Shutdown Threshold (UV SHUTDOWN THRESH)	50 to 295 V phase-neutral
Under-voltage Warning (UNDER VOLT WARNING)	Enable Disable
Under-voltage Warning Threshold (UV WARNING THRESHOLD)	55 to 300 V phase-neutral

Level 2	Range
Over-voltage Shutdown (OVER VOLT SHUTDOWN)	Enable Disable
Over-voltage Shutdown Threshold (OV SHUTDOWN THRESH)	105 to 350 V phase-neutral
Over-voltage Warning (OVER VOLT WARNING)	Enable Disable
Over-voltage Warning Threshold (OV WARNING THRESHOLD)	100 to 345 V phase-neutral

Table 6.16 Frequency Monitoring (FREQ MONITOR)

Level 2	Range
Under-frequency Shutdown (UNDER FREQ SHUTDOWN)	Enable Disable
Under-frequency Shutdown Threshold (UF SHUTDOWN THRESH)	10.0 to 59.0 Hz
Under-frequency Warning Enable (UNDER FREQ WARNING)	Enable Disable
Under-frequency Warning Threshold (UF WARNING THRESHOLD)	11.0 to 60.0 Hz
Over-frequency Shutdown Enable (OVER FREQ SHUTDOWN)	Enable Disable
Over-frequency Shutdown Threshold (OF SHUTDOWN THRESH)	26.0 to 75.0 Hz
Over-frequency Warning Enable (OVER FREQ WARNING)	Enable Disable
Over-frequency Warning Threshold (OF WARNING THRESHOLD)	25.0 to 74.0 Hz

Table 6.17 Current Monitoring (CURRENT MONITOR)

Level 2	Range
CT Ratio (LOAD CT RATIO)	0 to 8000 / 5
Over-current Action (OVER CURR ACTION)	None Notification Warning Electrical Trip Shutdown
Over-current Threshold (OVER CURR THRESHOLD)	5 to 10000 A
Over-current Delay (OVER CURR DELAY)	1 to 600 s
CT Correction Factor	0.900 to 1.100
CT Location (CT LOCATION)	On Alt Output Cable On Load Cable

Table 6.18 Load Monitoring (LOAD MONITOR)

Level 2	Range
Generator Rating (GEN RATING)	0 to 8000 kW
Overload Action (OVERLOAD ACTION)	None Notification Warning Electrical Trip Shutdown
Overload Threshold (OVERLOAD THRESHOLD)	50 to 150 %
Overload Monitoring Delay (OVERLOAD MON DELAY)	1 to 600 s
Unbalanced Load Action (UNBAL LOAD ACTION)	None Warning Electrical Trip Shutdown Notification
Unbalanced Load Threshold (UNBAL LOAD THRESHOLD)	5 to 200 %
Unbalanced Load Delay (UNBAL LOAD DELAY)	1 to 600 s

6.2.8 Mains

Table 6.19 Configuration (MAINS CONFIG)

Level 2	Range
Mains Monitoring (MAINS MONITORING)	Enable Disable
Mains AC System (MAINS AC SYSTEM)	1 phase 3 phase
Phase Reversal Detection (PHASE REVERSAL DETECT)	Enable Disable
Phase Reversal Action (PHASE REVERSAL ACTION)	None Notification
Partial Healthy Detection (MAINS PARTIAL HEALTHY)	Enable Disable

Table 6.20 Voltage Monitoring (VOLT MONITOR)

Level 2	Range
Under-voltage (UV ENABLE)	Enable Disable
(UV) Trip (UV TRIP)	50 to 298 V phase-neutral
(UV) Return (UV RETURN)	52 to 300 V phase-neutral
Over-voltage (OV ENABLE)	Enable Disable

Level 2	Range
(OV) Return (OV RETURN)	100 to 348 V phase-neutral
(OV) Trip (OV TRIP)	102 to 350 V phase-neutral

Table 6.21 Frequency Monitoring (FREQ MONITOR)

Level 2	Range
Under-frequency (UF ENABLE)	Enable Disable
(UF) Trip (UF TRIP)	10.0 to 59.0 Hz
(UF) Return (UF RETURN)	11.0 to 60.0 Hz
Over-frequency (OF ENABLE)	Enable Disable
(OF) Return (OF RETURN)	25.0 to 74.0 Hz
(OF) Trip (OF TRIP)	26.0 to 75.0 Hz

6.2.9 Engine

Table 6.22 Crank Disconnect (CRANK DISCONN)

Level 2	Range
Start Attempts (START ATTEMPTS)	1 to 9
Disconnect on Oil Pressure Sensor (DISCONN ON LOP SENS)	Enable Disable
Monitor Pressure Sensor Before Crank (MON LLOP BEF CRANK)	Enable Disable
Pressure Sensor Monitoring Threshold (DISCONN LOP SENS)	0.5 to 10.0 bar
Monitor Pressure Switch Before Crank (MON LOP BEF CRANK)	Enable Disable
Disconnect on Oil Pressure Switch (DISCONN ON LLOP SW)	Enable Disable
Pressure Switch Transient Time (LLOP SW TRANS TIME)	0.0 to 3.0 s
Crank Disconnect At Alt Frequency (ALT FREQUENCY)	10 to 70 Hz
Crank Disconnect At Engine Speed (ENGINE SPEED)	150 to 4000 RPM
Disconnect On Charging Alt Voltage (DISC ON CHG ALT VOLT)	Enable Disable
Charging Alt Disconnect Volt Threshold (CHG ALT THRESHOLD)	5.0 to 30.0 V

Table 6.23 Speed Monitoring (SPEED MONITOR)

Level 2	Range
Engine Speed Sense Source (SPEED SENSE SOURCE)	Alternator frequency Magnetic Pickup W-Point Frequency
Flywheel Teeth (Magnetic Pickup)	1 to 300
W-Point Frequency@ 1500	0 to 500
Under-speed Shutdown (UNDER SPEED SHUTDOWN)	Enable Disable
Under-speed Threshold (UNDER SPEED THRESH)	0 to 3600 RPM
Under-speed Delay (UNDER SPEED DELAY)	1 to 60 s
Over-speed Threshold (OVER SPEED THRESH)	700 to 4000 RPM
Over-speed Delay (OVER SPEED DELAY)	1 to 20 s
Gross Over-speed Threshold (GROSS OS THRESHOLD)	100 to 200 %

Table 6.24 Battery Monitoring (BATTERY MONITOR)

Level 2	Range
Low Battery Voltage Action (LOW VOLT ACTION)	None Notification Warning Electrical Trip Shutdown
Low Battery Voltage Threshold (LOW VOLT THRESHOLD)	8.0 to 31.0 V
Low Battery Voltage Delay (LOW VOLT DELAY)	5 to 1800 s
High Battery Voltage Action (HIGH VOLT ACTION)	None Notification Warning Electrical Trip Shutdown
High Battery Voltage Threshold (HIGH VOLT THRESHOLD)	9.0 to 32.0 V
High Battery Voltage Delay (HIGH VOLT DELAY)	5 to 1800 s

Table 6.25 Charging Alternator Monitoring (CHARGE ALT MON)

Level 2	Range
Charging Alternator Fail Action (FAIL ACTION)	None Notification Warning Electrical Trip

Level 2	Range
	Shutdown
Charging Alternator Fail Threshold (FAIL THRESHOLD)	0.0 to 35.0 V
Charging Alternator Fail Delay (FAIL DELAY)	5 to 60 s

Table 6.26 Preheating (PREHEAT)

Level 2	Range
Pre-heat Timer (PREHEAT TIMER)	1 to 900 s
Engine Temperature (ENG TEMP EN)	Enable Disable
Engine Temperature Threshold (ENG TEMP LIMIT)	10 to 300 °C

Table 6.27 Engine Control Unit (ECU) (SGC 120 0nly)

Level 2	Range
Engine Type	None Generic J1939 Scania Volvo Iveco Deutz - MVR MTU Cummins
Measurements from the ECU	
Lube Oil Pressure	Enable Disable
Coolant Temperature	Enable Disable
Engine Speed	Enable Disable
Running Hours	Enable Disable
Battery Voltage	Enable Disable
Controls To ECU	
Speed	Enable Disable
Engine Requested Speed	500 to 4000
Start/Stop	Enable Disable
Preheat	Enable Disable
ECU Communication Failure	
Action	None

Level 2	Range
	Notification Warning Electrical Trip Shutdown
Activation	Never From Engine Start From Monitoring On Always While Fuel Relay ON
Activation Delay	1 to 60 s
Communication Setup	
SGC Source Address	0 to 253
ECU Source Address	0 to 253
ECU Diagnostic Lamps (Amber, Red, Malfunction, Protect)	
Action	None Notification Warning Electrical Trip Shutdown
Activation	Never From Engine Start From Monitoring On Always
Activation Delay	0 to 60 s

Table 6.28 Lube Oil Pressure (LOP)

Level 2	Range
Low Level Shutdown	Enable Disable
Shutdown Threshold	0.0 to 9.8 Bar
Low Level Warning	Enable Disable
Warning Threshold	0.2 to 10.0 Bar

Table 6.29 Engine Coolant Temperature (ENG COOL TEMP)

Level 2	Range
High Level Shutdown	Enable Disable
Shutdown Threshold	27 to 300 °C
High Level Warning	Enable Disable
Warning Threshold	25 to 298 °C

6.2.10 Maintenance

Table 6.30 Maintenance (MAINT ALARM)

Level 2	Range
Alarm Action (ACTION)	None Notification Warning
Due At Engine Hours (DUE AT ENGINE HOURS)	10 to 65000 hours
Alarm Due Date (ALARM DUE DATE)	dd/mm/yyyy

6.2.11 Rotary actuator (SGC 121 only)

Table 6.31 General (GENERAL)

Level 2	Range
Actuator Application (ACTUATOR APPLN)	As E-Governor As Start/Stop Device
Actuator Speed (ACTUATOR SPEED)	1 to 10 x 25 Hz
Actuator Direction (ACTUATOR DIRECTION)	Clockwise to Stop Anti clockwise to stop
Governing Mode (GOVERNING MODE)	Fixed Speed Variable Speed

Table 6.32 Engine Start Strategy (ENG START STRGY)

Level 2	Range
Cranking Steps (CRANKING STEPS)	50 to 5000
Initial Low Speed Delay (INIT LOW SPEED DELAY)	0 to 180 s
Initial Low Speed (INIT LOW SPEED)	500 to 1800 RPM
PID Trigger Speed (PID TRIGGER SPEED)	20 to 2800 RPM
Ramp Up Time (RAMP UP TIME)	1 to 180 s
PID On Time (PID ON TIME)	1 to 180 s

Table 6.33 Generator EGov Config (GEN EGOV CNFG)

Level 2	Range
Set Speed Selection (SET SPEED SELECTION)	Fixed (0 % Droop) Load Based Droop
(LBD) Droop (DROOP)	0 to 4 %

Level 2	Range
Target Speed (TARGET SPEED)	500 to 4000 RPM
Proportional Gain (Kp) (PROPORTIONAL GAIN)	0 to 1000
Integral Gain (Ki) (INTEGRAL GAIN)	0 to 2000
Derivative Gain (Kd) (DERIVATIVE GAIN)	0 to 1000
Friction Setoff (FRICTION SETOFF)	0 to 1000
Gain Schedule Trigger (GAIN SCHEDULE TRIGGER)	0.0 to 100.0 %
Loading Factor (LOADING FACTOR)	0 to 1000
Unloading Factor (UNLOADING FACTOR)	0 to 1000

Table 6.34 Engine EGov Config (ENG EGOV CNFG)

Level 2	Range
Target Speed (TARGET SPEED)	500 to 4000 RPM
Proportional Gain (Kp) (PROPORTIONAL GAIN)	0 to 1000
Integral Gain (Ki) (INTEGRAL GAIN)	0 to 2000
Derivative Gain (Kd) (DERIVATIVE GAIN)	0 to 1000
Friction Setoff (FRICTION SETOFF)	0 to 1000
Gain Schedule Trigger (GAIN SCHEDULE TRIGGER)	0.0 to 100.0 %
Loading Factor (LOADING FACTOR)	0 to 1000
Unloading Factor (UNLOADING FACTOR)	0 to 1000

Table 6.35 Start/Stop Device Config (STR/STP DEV CNFG)

Level 2	Range
Running Steps (RUNNING STEPS)	0 to 500

6.2.12 Password ID

Table 6.36 ID

Level 1	Level 2	Range
(PASSWORD 1)	####	Numbers: 0 to 9
(PASSWORD 2)	####	Numbers: 0 to 9

6.3 Digital input source selection

No.	Input source
1	Not used
2	User Configured
3	Low Fuel Level Switch
4	Low Lube Oil Pressure Switch
5	High Engine Coolant Temp Switch
6	Low Water Level Switch
7	Emergency Stop
8	Remote Start/Stop
9	Simulate Start
10	Simulate Stop
11	Simulate Auto
12	Close Gen/Open Mains Switch
13	Close Mains/Open Gen Switch
14	Simulate Mains
15	V-Belt Broken Switch

6.4 Digital output source selection

No.	Output source
1	Disable
2	Sounder Alarm
3	Battery Over Volt
4	Battery Under Volt
5	Charge Alt Shutdown
6	Charge Alt Warning
7	Close Gen Contactor
8	Close Mains Contac
9	Mains Failure
10	Common Alarm
11	Common Electrical Trip
12	Common Shutdown
13	Common Warning

No.	Output source
14	Cooling Down
15	Dig In A
16	Dig In B
17	Dig In C
18	Dig In D
19	Dig In E
20	Dig In F (Anlg In LOP 1)
21	Dig In G (Anlg In Eng Temp)
22	Dig In H (Anlg In Fuel LVL)
23	Dig In I (Anlg In LOP 2)
24	Emergency Stop
25	Stop Solenoid
26	Fail To Start
27	Fail To Stop
28	Fuel Relay
29	Gen Available
30	L1 Phase OV Shutdown
31	L1 Phase UV Shutdown
32	L2 Phase OV Shutdown
33	L2 Phase UV Shutdown
34	L3 Phase OV Shutdown
35	L3 Phase UV Shutdown
36	Gen Over Current
37	High Engine Coolant Temp
38	Low Fuel LVL
39	Low LOP
40	Mains High Volt
41	Mains Low Volt
42	Oil Pressure Open Circuit
43	Open Gen Contactor
44	Open Mains Contactor
45	Over Freq Shutdown
46	Over Speed Shutdown
47	Gross Over Speed Shutdown
48	Start Relay
49	Temp Sensor Open Circuit
50	Under Freq Shutdown
51	Under Speed Shutdown
52	Maintenance Due

No.	Output source
53	Stop Mode
54	Auto Mode
55	Manual Mode
56	Preheat Output

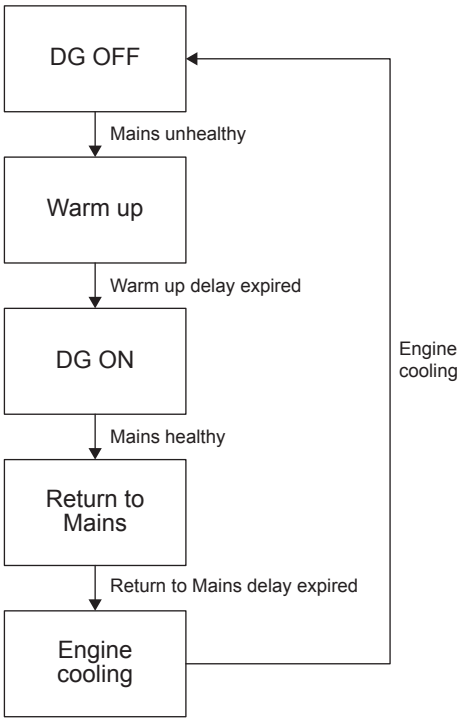
7. Running modes

7.1 Auto mode

Select Auto mode with the *Mode selection* button. In Auto mode the controller can be used in following configurations:

- Automatic Mains Failure (AMF)
- Remote start/stop
- Exercise mode

Automatic Mains Failure (AMF) mode

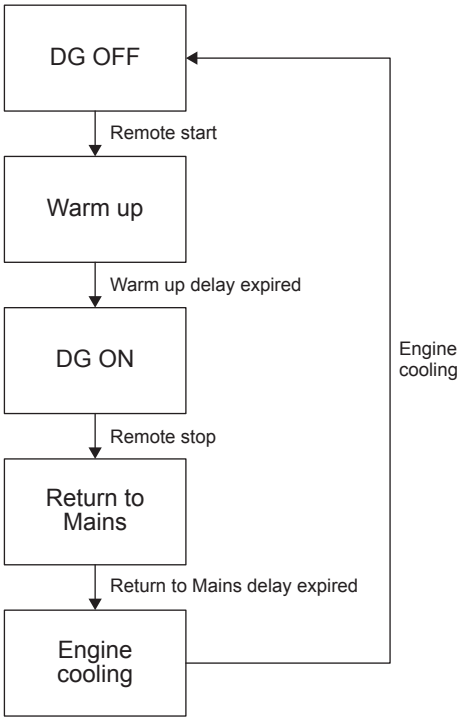


AMF mode is activated when Exercise mode is disabled, and Mains monitoring is enabled.

If the mains is healthy, the genset remains in Stop mode. If the mains is unhealthy for longer than the Mains detect delay time, the controller sends a Start command and the genset starts according to the Start sequence. When the genset loading voltage and frequency are above the Minimum healthy thresholds, the Warm-up delay timer starts. At the end of the Warm-up delay, the Load transfer delay starts and the genset latches.. Engine running hours increase while the genset runs. The running hours stop increasing when a Stop command is received. During genset running mode, if the mains is found healthy, the Return to mains delay timer starts. If the mains is found unhealthy during the Return to mains delay, the genset continues to run. At the end of the Return to mains delay, if mains is still healthy, the genset contactor opens and the mains contactor latches after the Load transfer delay. After opening the genset contactor, Engine cooling time starts. At the end of Engine cooling time, the controller initiates the Stop sequence by giving the Stop command.

If the mains voltage recovers or any stop command or shutdown alarm occurs during the Crank time, the controller will not send a start command. To start the genset again, all the alarms must be cleared manually.

Remote start/stop mode



To use the Remote start/stop mode, configure one of the digital input as Remote start/stop (Latched type input) and set the controller to Auto mode.

In Remote start/stop mode, the genset can be commanded to start and stop by activating the pre-configured Remote start/stop input. If the Remote start command is received, the controller sends a Start command and the genset starts according to the Start sequence. When the genset loading voltage and frequency are above the Minimum healthy thresholds, the Warm-up delay timer starts. At the end of the Warm-up delay, the Load transfer delay starts and the genset latches. Engine running hours increases while the genset runs. The running hours stop increasing when a Stop command is received.

When the Remote stop command is received the controller opens the genset contactor, and the Engine cooling time starts. At the end of the Engine cooling time, the controller initiates the Stop sequence by giving a Stop command.

Do not enable Mains monitoring and Remote start/stop configuration simultaneously.

Exercise Mode

Two scheduled sequences to start and stop the genset can be configured with SGC 120/121.

Exercise mode occurs when the controller is in Auto mode with no shutdown or warning alarms. In this mode, load transfer on mains/genset is configurable. Scheduled sequences can be configured to repeat daily, weekly or monthly.

- If the controller is in Auto mode, Exercise mode runs at the scheduled time for preset DG ON duration time. The controller exits Exercise mode if the DG ON duration time expires or if the *Stop/Config* button is pressed during a scheduled sequence.
- If the controller is in Manual mode when the scheduled sequence begins, the genset will not start. If the controller is switched to Auto mode during the Exercise, the genset will start and run for the remaining scheduled time.
- The genset controller will not respond to a Remote start command in Exercise mode.
- In AMF mode, if the mains is unhealthy or cut off, or when the genset is running in Exercise mode, the genset first runs the Exercise mode and then the AMF mode. Load is transferred to the genset, even if Load transfer is disabled in Exercise mode. The genset stops when the mains becomes healthy.
- If both exercises are scheduled at the same time, the Start time for second exercise is increased by one minute.

Deep sleep mode

Deep sleep mode is a useful feature to extend the battery lifetime. This is done by suspending normal functions of the controller, and place the it in the lowest power consumption state. The controller maintains the status and alarms it had before Deep sleep mode. When the controller wakes up, normal operations are resumed automatically.

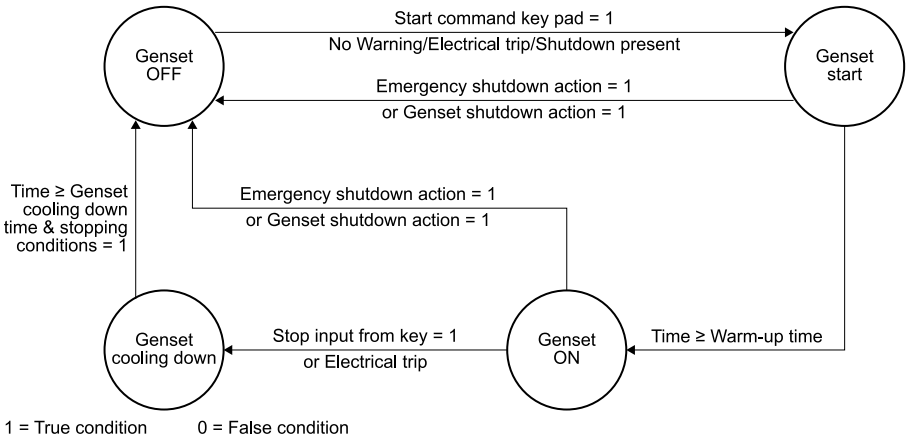
The controller goes to Deep sleep mode when there is no user interaction for the preset Deep sleep mode delay. The controller does not go to Deep sleep mode under the following conditions:

- In Auto (AMF, Remote start/stop and Exercise) modes
- Mains monitoring is enabled, and mains contactor configured as output
- Modbus communication is enabled

To wake the controller from Deep sleep mode, press:

- *Stop/Config* button
- *Start* button
- *Mode selection* button
- *Acknowledge* button

7.2 Manual mode



8. Alarms

8.1 Alarms

With SGC 120/121 it is possible to configure several Shutdown/Electrical trip, Warning and Notification alarms, for example Low oil pressure shutdown, Overload warning, and more.

An alarm occurs when the pre-configured parameter is out of preset level. The Alarm LED flashes and the Sounder alarm activates (if configured). The controller shows the alarm names on the Alarms display and the nature of alarm on Engine status display.

To acknowledge the alarms, press the *Up* and *Down* buttons simultaneously.

All alarms are activated from Engine ON, for example after crank disconnect, or Monitoring ON, for example after the Safety monitoring timer expires, or Always. The controller does not send the start command if Warning, Electrical trip or Shutdown alarms are left unacknowledged.

Alarm types

No.	Alarm actions	Description
1	Shutdown	Load is taken off from the genset and the genset is immediately stopped by skipping the Engine cooling time.
2	Electrical trip	Load is taken off from the genset, the Engine cooling timer begins, after which the genset is stopped.
3	Warning	Warning alarms draw the operator's attention to an undesirable condition without affecting the genset's operation. The genset cannot be started without acknowledging the Warning alarms
4	Notification	The controller shows the message on the display. The genset start/stop operation is not affected.

Alarms and their causes

No.	Alarms	Causes/Indication	Actions
1	Low Oil Pressure (Sensor)	Indicates that the oil pressure measured is below the preset threshold.	Shutdown Warning
	Low Oil Pressure (Switch)	Indicates that the oil pressure measured is low through switch.	Shutdown Warning Electrical Trip Notification
2	High Oil Pressure (Sensor)	Indicates that the oil pressure measured is above the preset threshold.	Warning
	High Oil Pressure (Switch)	Indicates that the oil pressure measured is high through switch.	Warning
3	High Eng Temp (sensor)	Indicates that the engine temperature is above the preset threshold. This condition is detected only when engine is on.	Shutdown Warning
	High Eng Temp (Switch)	Indicates that the engine temperature measured is high through switch.	Shutdown Warning Electrical Trip Notification

No.	Alarms	Causes/Indication	Actions
4	Low Fuel level (Sensor)	Indicates that the amount of fuel level is below the preset threshold. This condition is detected only when engine is on.	Shutdown Warning
	Low Fuel level (Switch)	Indicates that the amount of fuel level measured is low through switch.	Shutdown Warning Electrical Trip Notification
5	Low Water Level (Switch)	Indicates that radiator water level is below the preset threshold.	Shutdown Warning Electrical Trip Notification
6	Auxiliary input/User defined name	Configured auxiliary input has triggered longer than preset duration.	Shutdown Warning Electrical Trip Notification
7	Anlg LOP Ckt Open	The oil pressure sensor is not detected (circuit open).	Shutdown Warning Electrical Trip Notification
8	Engine Temp Ckt Open	The temperature sensor is not detected (circuit open).	Shutdown Warning Electrical Trip Notification
9	Fuel Level Ckt Open	The fuel level sensor is not detected (circuit open).	Shutdown Warning Electrical Trip Notification
10	Fuel Theft	The fuel consumption has exceeded the preset threshold.	Warning
11	Emergency Stop	Configured as digital input has triggered longer than preset or when an immediate shutdown is required.	Shutdown
12	Fail To Stop	It is detected that genset is still running after sending stop command.	Shutdown
13	Fail To Start	Indicates that genset has not started after the preset number of start attempts.	Shutdown
14	L1 Phase Over Voltage	Indicates that genset (L1) phase voltage has exceeded the preset over-voltage threshold.	Shutdown Warning
15	L2 Phase Over Voltage	Indicates that genset (L2) phase voltage has exceeded the preset over-voltage threshold.	Shutdown Warning
16	L3 Phase Over Voltage	Indicates that genset (L3) phase voltage has exceeded the preset over-voltage threshold.	Shutdown Warning
17	L1 Phase Under Voltage	Indicates that genset (L1) phase voltage has fallen below preset under-voltage threshold.	Shutdown Warning
18	L2 Phase Under Voltage	Indicates that genset (L2) phase voltage has fallen below preset under-voltage threshold.	Shutdown Warning
19	L3 Phase Under Voltage	Indicates that genset (L3) phase voltage has fallen below preset under-voltage threshold.	Shutdown Warning
20	DG Phase Reversal	Alternator phase sequence (L1-L2-L3) is not correct.	Shutdown Warning Electrical Trip Notification

No.	Alarms	Causes/Indication	Actions
21	Over Frequency	Indicates that genset output frequency has exceeded the preset threshold.	Shutdown Warning
22	Under Frequency	Indicates that genset output frequency has fallen below the preset threshold.	Shutdown Warning
23	Over Current	Indicates that genset current has exceeded the preset threshold.	Shutdown Warning Electrical Trip Notification
24	Over Load	Indicates that the measured kW load rating has exceeded the preset threshold.	Shutdown Warning Electrical Trip Notification
25	Unbalanced Load	Load on any phase is greater or less than other phases by a threshold value.	Shutdown Warning Electrical Trip Notification
26	Over Speed	Indicates that genset speed has exceeded the preset overspeed threshold. The genset will shut down after Overspeed delay.	Shutdown
27	Gross Over Speed	Indicates that genset speed has exceeded the preset Gross overspeed threshold. The genset will shut down immediately without any delay.	Shutdown
28	Under Speed	The engine speed has fallen below the preset RPM.	Shutdown
29	Extended Over Load Trip	Indicates that there was 100 % load on the genset for one hour in the time interval of 12 hours.	Electrical trip
30	Charge Fail	The charge alternator voltage has dropped below the preset threshold.	Shutdown Warning Electrical Trip Notification
31	V-Belt Broken Switch	Indicates that there is a failure of the V-belt, which is driving the charging alternator.	Shutdown Warning Electrical Trip Notification
32	Battery Under Voltage	The battery voltage has fallen below the preset threshold.	Shutdown Warning Electrical Trip Notification
33	Battery Over Voltage	The battery voltage has exceeded the preset threshold.	Shutdown Warning Electrical Trip Notification
34	Filter maintenance	Indicates that engine running hours has exceeded the preset hours limit or maintenance due date has occurred and filter servicing is required.	Warning Notification
35	Mains Phase Reversal	Indicates the mains unhealthy condition.	Notification

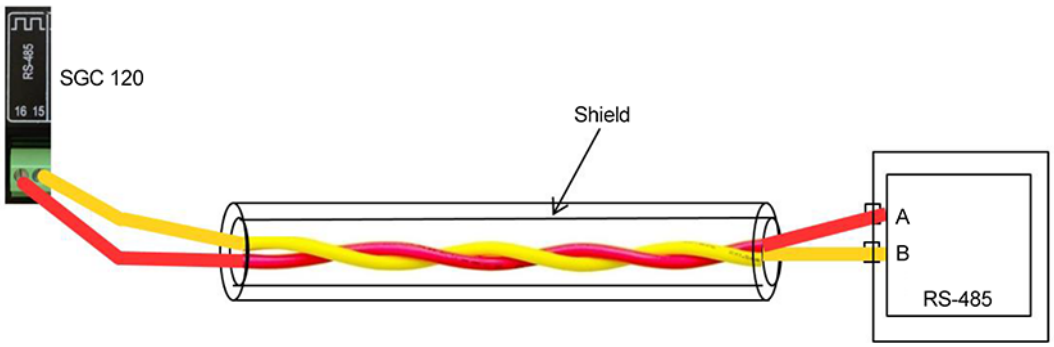
9. Modbus communication protocol

9.1 About the Modbus communication protocol

SGC 120/121 supports a custom protocol based on the standard Modbus over an RS-485 layer. operates in a slave mode and responds to commands received from an external Modbus master.

9.2 Modbus connection details

The transmission mode used by SGC 120/121 is Modbus RTU (not Modbus ASCII). The byte format for communication is 1 start bit, 8 data bits, no parity bits and 1 stop bit, Cyclic Redundancy Check (CRC).



Precautions

- Find the slave 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 different colour wires for terminals 16 and 15 for easy detection and connection.
- Route the wires properly ensuring they do not get short with any other wires.
- Do not use multi strand wires for the connection.

9.3 Modbus functions

This genset controller operates as a Modbus slave that responds to certain commands (or functions, as defined by Modbus standard) received from the Modbus master in appropriate format. Supported functions and respective command-response structure is as shown below. If the command received from the Modbus master is other than the three functions mentioned below, an exception message is generated.

Function code	Modbus name	Description
03	Read holding register	Reads one or more 16-bit registers from the slave device read/write location.
16	Write holding register	Writes one or more 16-bit registers to the slave device.

10. Modbus communication settings

10.1 Modbus communication settings

RS-485 communication settings

- Slave 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 master for Function 16

Byte	Field	Remarks
0	Slave address	As configured in the controller.
1	Function code (0x10)	
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 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	

Normal response from SGC 120/121 slave for Function 16

Byte	Field	Remarks
0	Slave address	As configured in the controller.
1	Function code (0x10)	
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 master for Function 3

Byte	Field	Remarks
0	Slave address	As configured in the controller.
1	Function code (0x3)	
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	Remarks
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	

Normal response from SGC 120/121 slave for Function 3

Byte	Field	Remarks
0	Slave address	As configured in the controller.
1	Function code (0x03)	
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	

10.2 Register map (function code 03)

Register address	Parameter	Scale factor	Unit/ Interpretation	Bits/Sign
0	Protocol revision	-	-	Unsigned
1	Generator L1-N voltage	0.1	V	Unsigned
2	Generator L2-N voltage	0.1	V	Unsigned
3	Generator L3-N voltage	0.1	V	Unsigned
4	Generator L1-L2 voltage	0.1	V	Unsigned
5	Generator L2-L3 voltage	0.1	V	Unsigned
6	Generator L3-L1 voltage	0.1	V	Unsigned
7	Generator L1 frequency	0.1	Hz	Unsigned
8	Generator L2 frequency	0.1	Hz	Unsigned
9	Generator L3 frequency	0.1	Hz	Unsigned
10	Generator power factor L1	0.01	--	Unsigned
11	Generator power factor L2	0.01	--	Unsigned
12	Generator power factor L3	0.01	--	Unsigned
13	Generator average power factor	0.01	--	Unsigned
14	Mains L1-N voltage	0.1	V	Unsigned
15	Mains L2-N voltage	0.1	V	Unsigned
16	Mains L3-N voltage	0.1	V	Unsigned
17	Mains L1-L2 voltage	0.1	V	Unsigned
18	Mains L2-L3 voltage	0.1	V	Unsigned
19	Mains L3-L1 voltage	0.1	V	Unsigned

Register address	Parameter	Scale factor	Unit/ Interpretation	Bits/Sign
20	Mains L1 frequency	0.1	Hz	Unsigned
21	Mains L2 frequency	0.1	Hz	Unsigned
22	Mains L3 frequency	0.1	Hz	Unsigned
23	Load L1 current	0.1	A	Unsigned
24	Load L2 current	0.1	A	Unsigned
25	Load L3 current	0.1	A	Unsigned
26	Load L1 watts	0.1	kW	Unsigned
27	Load L2 watts	0.1	kW	Unsigned
28	Load L3 watts	0.1	kW	Unsigned
29	Load total watts	0.1	kW	Unsigned
30	Percentage Load	1	Lit	Unsigned
31	Load L1 VA	0.1	kVA	Unsigned
32	Load L2 VA	0.1	kVA	Unsigned
33	Load L3 VA	0.1	kVA	Unsigned
34	Load total VA	0.1	kVA	Unsigned
35	Load L1 var	0.1	kvar	Unsigned
36	Load L2 var	0.1	kvar	Unsigned
37	Load L3 var	0.1	kvar	Unsigned
38	Load total var	0.1	kvar	Unsigned
39-40	Generator cumulative energy	0.1	kWh	Unsigned
41-42	Generator cumulative apparent energy	0.1	kVAh	Unsigned
43-44	Generator cumulative reactive energy	0.1	kvarh	Unsigned
45-46	Mains cumulative energy	0.1	kWh	Unsigned
47-48	Mains cumulative apparent energy	0.1	kVAh	Unsigned
49-50	Mains cumulative reactive energy	0.1	kvarh	Unsigned
51	Oil pressure	0.1	bar	Unsigned
52	Coolant temperature	0.1	°C	Unsigned
53	Fuel level	0.1	%	Unsigned
54*	Fuel level in lit	1	--	--
55*	Charge alternator voltage	1	V	Unsigned
56*	Battery voltage	0.1	V	Unsigned
57*	Engine speed	1	RPM	Unsigned
58*	No of starts	1	--	Unsigned
59*	No of trips	1	--	Unsigned
60-61*	Eng run hrs	1	Hrs	Unsigned
62*	Eng run min	1	Min	Unsigned
63*	Mains run hrs	1	Hrs	Unsigned
64*	Mains run min	1	Min	Unsigned

Alarm status

Register address	Parameter	Scale Factor	Unit/ Interpretation	Bits/Sign
65*	**Alarm 1**			
	Low oil pressure	--	--	13/16-16/16
	High coolant temperature	--	--	9/16-12/16
	Low fuel level	--	--	5/16-8/16
	Water level switch	--	--	1/16-4/16
66*	**Alarm 2**			
	Underspeed	--	--	13/16-16/16
	Overspeed	--	--	9/16-12/16
	Fail to start	--	--	5/16-8/16
	Fail to stop	--	--	1/16-4/16
67*	**Alarm 3**			
	Reserved	--	--	13/16-16/16
	Reserved	--	--	9/16-12/16
	Generator low frequency	--	--	5/16-8/16
	Generator high frequency	--	--	1/16-4/16
68*	**Alarm 4**			
	Generator high current	--	--	13/16-16/16
	Generator overload	--	--	9/16-12/16
	Unbalanced load	--	--	5/16-8/16
	Emergency stop	--	--	1/16-4/16
69*	**Alarm 5**			
	Charge alternator failure	--	--	13/16-16/16
	Maintenance	--	--	9/16-12/16
	Reserved	--	--	5/16-8/16
	Reserved	--	--	1/16-4/16
70*	**Alarm 6**			
	Battery low voltage	--	--	13/16-16/16
	Battery high voltage	--	--	9/16-12/16
	Temperature circuit open	--	--	5/16-8/16
	Reserved	--	--	1/16-4/16
71	**Alarm 7**			
	Fuel theft	--	--	13/16-16/16
	Magnetic pick up fault	--	--	9/16-12/16
	Oil pressure open circuit	--	--	5/16-8/16
	Auxiliary input I	--	--	1/16-4/16

Register address	Parameter	Scale Factor	Unit/ Interpretation	Bits/Sign
72	**Alarm 8**			
	Auxiliary input A	--	--	13/16-16/16
	Auxiliary input B	--	--	9/16-12/16
	Auxiliary input C	--	--	5/16-8/16
	Auxiliary input D	--	--	1/16-4/16
73	**Alarm 9**			
	Auxiliary input E	--	--	13/16-16/16
	Auxiliary input F	--	--	9/16-12/16
	Auxiliary input G	--	--	5/16-8/16
	Auxiliary input H	--	--	1/16-4/16
74	**Alarm 10**			
	Gen L1 phase low volt	--	--	13/16-16/16
	Gen L1 phase high volt	--	--	9/16-12/16
	Gen L2 phase low volt	--	--	5/16-8/16
	Gen L2 phase high volt	--	--	1/16-4/16
75	**Alarm 11**			
	Gen L3 phase low volt	--	--	13/16-16/16
	Gen L3 phase high volt	--	--	9/16-12/16
	DG phase rotation	--	--	5/16-8/16
	Mains phase rotation	--	--	1/16-4/16
76	**Alarm 12**			
	Fuel level open circuit	--	--	13/16-16/16
	V belt broken	--	--	9/16-12/16
	Reserved	--	--	5/16-8/16
	High oil pressure detected	--	--	1/16-4/16

Table 10.1 *Interpretation of alarm status results

Value of Register	Interpretation
0	Alarm disabled
1	Alarm not active
2	Warning alarm active
3	Shutdown alarm active
4	Electrical trip alarm active
5	Notification
6-14	Reserved
15	Unimplemented

Input and output status

Register address	Parameter	Scale Factor	Unit/ Interpretation	Bits/Sign
77	**Input/output diagnostics**			
	Digital input A	--	--	16/16
	Digital input B	--	--	15/16
	Digital input C	--	--	14/16
	Digital input D	--	--	13/16
	Digital input E	--	--	12/16
	Digital input F	--	--	11/16
	Digital input G	--	--	10/16
	Digital input H	--	--	9/16
	Digital input I	--	--	8/16
	Digital output A	--	--	7/16
	Digital output B	--	--	6/16
	Digital output C	--	--	5/16
	Digital output D	--	--	4/16
	Digital output E	--	--	3/16
	Digital output F	--	--	2/16
	Unimplemented	--	--	1/16

Register address	Parameter	Scale Factor	Unit/ Interpretation	Bits/Sign
78	**DG status**			
	SGC mode		Config (1) Run (0)	16/16
	Mains healthy/unhealthy	--	True (1) False (0)	15/16
	DG operation mode	--	Scheduler-110 Cyclic-111 Auto-101 Manual-100	14-12/16
	Load on Mains		True (1) False (0)	11/16
	Load on DG	--	True (1) False (0)	10/16
	Current DG status	--	Running Stopped	9/16
	DG stopped normally	--	True (1) False (0)	8/16
	DG stopped with fault		True (1) False (0)	7/16
	DG fail to start	--	True (1) False (0)	6/16
	Gen available		True (1) False (0)	5/16
	Common shut down	--	True (1) False (0)	4/16
	Common electric trip	--	True (1) False (0)	3/16
	Common warning	--	True (1) False (0)	2/16
	Common notification	--	True (1) False (0)	1/16
79	Current time stamp	--	Min Sec	Hexadecimal
80	Current time stamp		Week day Hour	Hexadecimal
81	Current time stamp		Month Day	Hexadecimal
82	Current time stamp		Year	Unsigned

Table 10.2 Example of Time stamp settings

Register address	Time	Hexadecimal		Decimal
79	Min	0x1215	Min = 0x12	18
	Sec		Sec = 0x15	21
80	Week day	0x0414	Week day = 0x04	4
	Hour		Hour = 0x0E	14

Register address	Time	Hexadecimal		Decimal
81	Month	0x0402	Month = 0x04	4
	Day		Day = 0x02	2
82	Year	-	-	2020

The time stamp is 14:18.21, Thursday, 02/04-2020.

10.3 Register map (function code 16)

Register map (function code 16)

Register offset	Description	Note	Bits/Sign
0	DG mode change command	SGC STOP KEY (0x01) SGC START KEY (0x02) SGC AUTO KEY (0x04) SGC ACK KEY (0x40)	Unsigned

11. Engine communication (SGC 120 only)

11.1 Introduction to engine communication

Engine communication enables the SGC controller to communicate with different engine types over CAN bus. Some engine types only allows the SGC to read information from the engine's ECU, while other types also makes it possible to regulate and transmit different commands to the ECU.

Engine communication protocols are typically based on the SAE J1939 standard. It is a very comprehensive standard, and just a small part is relevant for engine communication.

See the ECU user manuals for the ECU protocol technical description and details of each communication value.

Other engines and controllers

For engines and controllers not listed in this document, contact DEIF.

11.2 Default settings

The SGC controller is delivered with a set of default settings for engine communication. These settings are not necessarily correct for the specific engine/generator set. Check all the settings before running the engine/generator set.

11.3 Supported engines

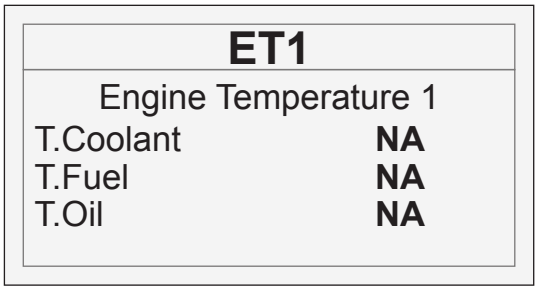
The SGC controller uses the J1939 protocol to communicate with these engines:

Manufacturer	SGC can write commands
Generic J1939	Yes
Cummins	Yes
Deutz - EMR	Yes
Iveco	Yes
MTU	Yes
Scania	Yes
Volvo Penta	Yes

11.4 Engine values on the display

You can configure the SGC controller to show values from the ECU on the display.

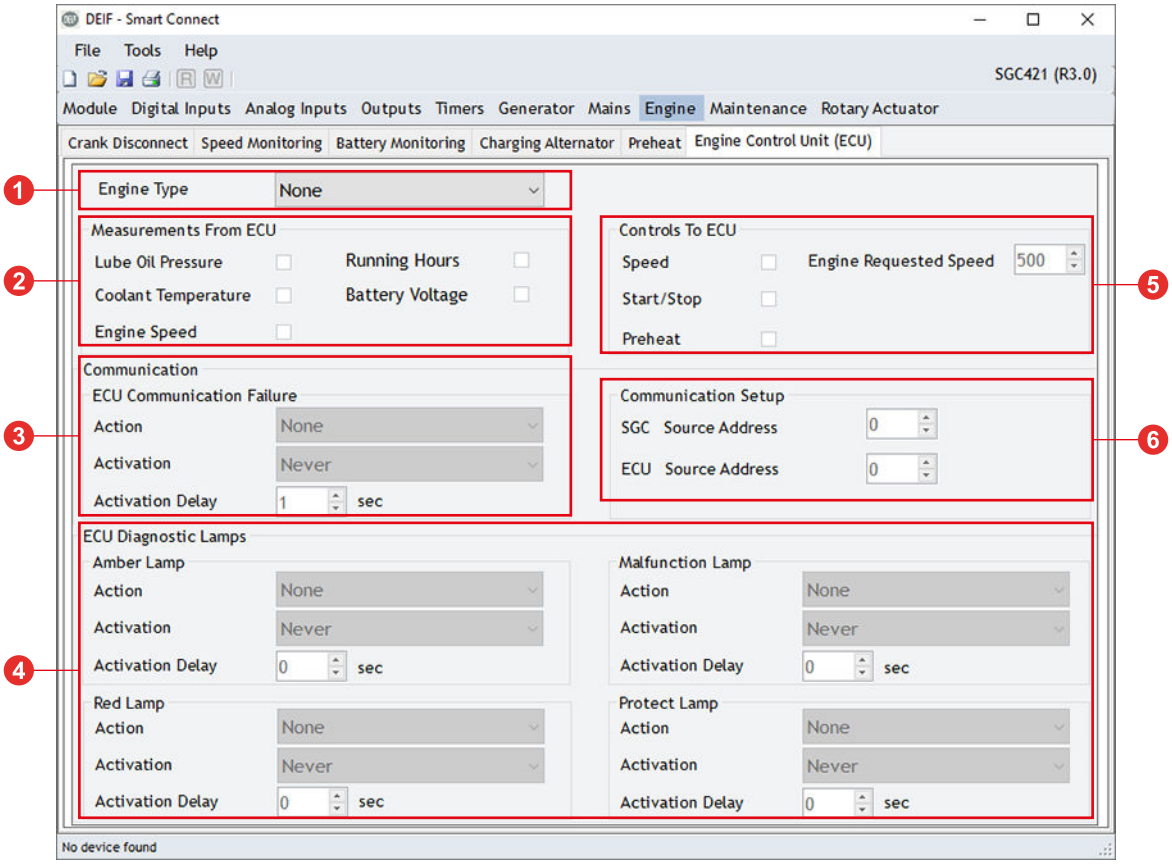
Figure 11.1 Display example



11.5 Engine communication settings

Use the DEIF Smart Connect software to configure engine communication in the SGC controller.

Open DEIF Smart Connect and connect to the SGC controller, then select **Start > Engine > Engine Control unit (ECU)** for the engine communication settings window.



No.	Function
1	Select the engine type from the drop-down list.
2	Select types of measurements from the engine/ECU.
3	Configure the settings for the ECU communication failure alarm.
4	Configure the settings for the diagnostic lamps on the ECU • Amber lamp • Red lamp • Malfunction lamp • Protect lamp See the specific documentation for the engine/ECU for more information.
5	Select the actions that SGC controls for the engine/ECU • Engine speed • Engine start/stop • Engine preheat
6	Configure source addresses for the SGC controller and the engine/ECU. See the specific documentation for the engine/ECU for information about the source address.

11.6 Generic J1939

Basic information

- Engine controller/type: Any controller which uses generic J1939.
- DEIF Smart Connect: Select Generic J1939.
- Complies with the J1939 standard.
- Baud rate: 250 kb/s

Warnings and shutdowns

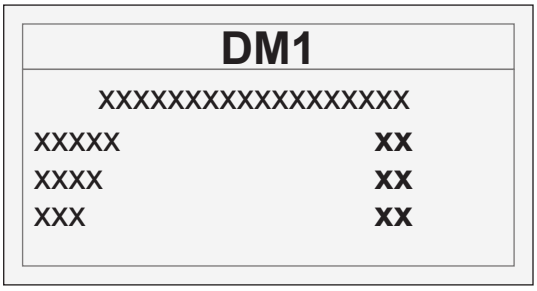
These standard warnings and shutdowns are supported:

- EIC yellow lamp
- EIC red lamp
- EIC malfunction
- EIC protection

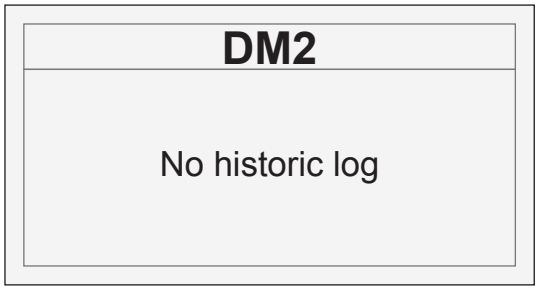
Displaying alarms

The display can show J1939 diagnostic messages DM1 (active alarms) and DM2 (historic alarm log list). You can acknowledge these alarms from the display unit. For some engines, the display has a special alarm display (see the specific engine type).

Press the *Down* button for 4 seconds to see the alarm log. By default, the alarm log shows the DM1 (active alarms). To see the historical alarm list, use *Down* button to select DM2.



Alarm log DM1 shows active alarms



Alarm log DM2 shows historic alarms

- Scroll through the alarm list with the *Up* and *Down* buttons.
- **oc##**: Shows how many times a specific alarm has occurred.
- **CLRALL**: Press ENTER to clear the entire alarm log list. For safety reasons, this requires the master password.

NOTE
If the controller has no translation text for an SPN diagnostic number, Text N/A is shown. For information about particular SPN numbers, see the engine manufacturer's documentation. Alternatively, see SAE J1939-71 for a general description.

J1939 write commands

Command	Description
Speed control	The CAN bus ID for speed control is 0xC000003. J1939 TSC1 (transmission rate is 10 ms).
EIC start/stop	This is a more advanced function than the standard J1939 Start/Stop commands. See the M-Logic commands for details. If the M-Logic command is enabled, the SGC can also send the standard J1939 start/stop command. The controller determines whether to start or stop the engine. The decision is based on the SGC's inputs, logic and calculations.

TSC1 SA Torque Speed Control

Torque Speed Control 1 (TSC1) is the speed control signal from the SGC to the ECU. For known protocols, the SGC uses the expected source address when TSC1 SA is -1 (default value). You can configure the controller for a specific source address (the range is 0 to 255). Ask the engine manufacturer to verify the TSC1 source address.

11.7 Wiring

More information
See the **Installation** chapter for more information about wiring.

12. CAN communication (SGC 120 only)

12.1 About the CAN communication protocol

SGC 120 supports a CAN based protocol, which is used to read measurement values, status of alarms and derived calculations (such as cumulative power), as well as to send mode change and start/stop commands to the controller.

Connection details:

- Baud rate used for communication is 250 kbps
- ID of the controller is fixed to 0x01
- ID scheme for CAN communication is Standard ID (not extended ID)
- Packet size used for communication is 8 bytes

12.2 CAN communication structure

The controller continuously broadcasts measurement values, status of alarms and commands, and derived calculations. Additionally, a set of commands can be sent to the controller. Response to the commands is a part of the data that is broadcast.

Communication structure, page 0

Register offset	Value	Scale factor	Unit	Bits/Sign
0	Protocol revision	-	-	Unsigned
1	Generator L1-N voltage	1	V	Unsigned
2	Generator L2-N voltage	1	V	Unsigned

Communication structure, page 1

Register offset	Value	Scale factor	Unit	Bits/Sign
3	Generator L2-L3 voltage	1	V	Unsigned
4	Generator L1-L2 voltage	1	V	Unsigned
5	Generator L3-N voltage	1	V	Unsigned

Communication structure, page 2

Register offset	Value	Scale factor	Unit	Bits/Sign
6	Generator L3-L1 voltage	1	V	Unsigned
7	Generator L2 frequency	1	Hz	Unsigned
8	Generator L1 frequency	1	Hz	Unsigned

Communication structure, page 3

Register offset	Value	Scale factor	Unit	Bits/Sign
9	Generator power factor L2	1	-	Unsigned
10	Generator L3 frequency	1	Hz	Unsigned
11	Generator power factor L1	1	-	Unsigned

Communication structure, page 4

Register offset	Value	Scale factor	Unit	Bits/Sign
12	Mains L1-N voltage	1	V	Unsigned
13	Generator power factor L3	1	-	Unsigned
14	Generator average power factor	1	-	Unsigned

Communication structure, page 5

Register offset	Value	Scale factor	Unit	Bits/Sign
15	Mains L1-L2 voltage	1	V	Unsigned
16	Mains L2-N voltage	1	V	Unsigned
17	Mains L3-N voltage	1	V	Unsigned

Communication structure, page 6

Register offset	Value	Scale factor	Unit	Bits/Sign
18	Mains L1 frequency	1	Hz	Unsigned
19	Mains L2-L3 voltage	1	V	Unsigned
20	Mains L3-L1 voltage	1	V	Unsigned

Communication structure, page 7

Register offset	Value	Scale factor	Unit	Bits/Sign
21	Load L1 current	1	A	Unsigned
22	Mains L2 frequency	1	Hz	Unsigned
23	Mains L3 frequency	1	Hz	Unsigned

Communication structure, page 8

Register offset	Value	Scale factor	Unit	Bits/Sign
24	Load L1 watts	1	kW	Unsigned
25	Load L2 current	1	A	Unsigned
26	Load L3 current	1	A	Unsigned

Communication structure, page 9

Register offset	Value	Scale factor	Unit	Bits/Sign
27	Load total watts	1	kW	Unsigned
28	Load L2 watts	1	kW	Unsigned
29	Load L3 watts	1	kW	Unsigned

Communication structure, page 10

Register offset	Value	Scale factor	Unit	Bits/Sign
30	Load L2 VA	1	kVA	Unsigned
31	Percentage Load	10	kW	Unsigned
32	Load L1 VA	1	kVA	Unsigned

Communication structure, page 11

Register offset	Value	Scale factor	Unit	Bits/Sign
33	Load L1 VAR	1	kvar	Unsigned
34	Load L3 VA	1	kVA	Unsigned
35	Load total VA	1	kVA	Unsigned

Communication structure, page 12

Register offset	Value	Scale factor	Unit	Bits/Sign
36	Load L2 VAR	1	kvar	Unsigned
37	Load L3 VAR	1	kvar	Unsigned
38	Load total VAR	1	kvar	Unsigned

Communication structure, page 13

Register offset	Value	Scale factor	Unit	Bits/Sign
39-40	Generator cumulative energy	0.1	kWh	Unsigned

Communication structure, page 14

Register offset	Value	Scale factor	Unit	Bits/Sign
41-42	Generator cumulative apparent energy	0.1	kVAh	Unsigned

Communication structure, page 15

Register offset	Value	Scale factor	Unit	Bits/Sign
43-44	Generator cumulative reactive energy	0.1	kvarh	Unsigned

Communication structure, page 16

Register offset	Value	Scale factor	Unit	Bits/Sign
45-46	Mains cumulative energy	0.1	kWh	Unsigned

Communication structure, page 17

Register offset	Value	Scale factor	Unit	Bits/Sign
47-48	Mains cumulative apparent energy	0.1	kVAh	Unsigned

Communication structure, page 18

Register offset	Value	Scale factor	Unit	Bits/Sign
49-50	Mains cumulative reactive energy	0.1	kvarh	Unsigned
51	Oil pressure	1	bar	Unsigned

Communication structure, page 19

Register offset	Value	Scale factor	Unit	Bits/Sign
52	Fuel in lit	1	l	Unsigned
53	Coolant temperature	1	°C	Unsigned
54	Fuel level	1	%	Unsigned

Communication structure, page 20

Register offset	Value	Scale factor	Unit	Bits/Sign
55	Charge alternator voltage	1	V	Unsigned
56	Battery voltage	1	V	Unsigned
57	Engine speed	1	RPM	Unsigned

Communication structure, page 21

Register offset	Value	Scale factor	Unit	Bits/Sign
58	No of starts	1	-	Unsigned
59	No of trips	1	-	Unsigned
60	Eng run hrs	1	hrs	Unsigned

Communication structure, page 22

Register offset	Value	Scale factor	Unit	Bits/Sign
61	Eng run min	1	min	Unsigned
62	Mains run hrs	1	hrs	Unsigned
63	Mains run min	1	min	Unsigned

Communication structure, page 23

Register offset	Value	Scale factor	Unit	Bits/Sign
64	**Alarm 1**			
	Low oil pressure	-	E-0001/0001 W-0010/0010 S-0011/0011	3/16-16/16
	High coolant temperature	-	E-0001/0001 W-0010/0010 S-0011/0011	9/16-12/16
	Radiator water level/low fuel level	-	E-0001/0001 N-0101/0101S-0 011/0011	5/16-8/16
	Water level switch	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	1/16-4/16
65	**Alarm 2**			
	Under speed	-	E-0001/0001 S-0011/0011	13/16-16/16
	Over speed	-	E-0001/0001 S-0011/0011	9/16-12/16
	Fail to start	-	E-0001/0001 S-0011/0011	5/16-8/16
	Fail to stop	-	E-0001/0001 S-0011/0011	1/16-4/16

Register offset	Value	Scale factor	Unit	Bits/Sign
66	**Alarm 3**			
	Reserved	-	1111	13/16-16/16
	Reserved	-	1111	9/16-12/16
	Generator low frequency	-	E-0001/0001 W-0010/0010 S-0011/0011	5/16-8/16
	Generator high	-	E-0001/0001 W-0010/0010 S-0011/0011	1/16-4/16

Communication structure, page 24

Register offset	Value	Scale factor	Unit	Bits/Sign
67	**Alarm 4**			
	Generator high current	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	13/16-16/16
	Generator overload		E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	9/16-12/16
	Unbalanced load	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	5/16-8/16
	Emergency stop	-	E-0001/0001 S-0011/0011	1/16-4/16
68	**Alarm 5**			
	Charge alternator failure	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	13/16-16/16
	Maintenance	-	E-0001/0001 N-0101/0101 W-0010/0010	9/16-12/16
	Reserved	-	1111	5/16-8/16
	Reserved	-	1111	1/16-4/16

Register offset	Value	Scale factor	Unit	Bits/Sign
69	**Alarm 6**			
	Battery low voltage	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	13/16-16/16
	Battery high voltage	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	9/16-12/16
	Temperature circuit open	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	5/16-8/16
	Reserved	-	1111	1/16-4/16

Communication structure, page 25

Register offset	Value	Scale factor	Unit	Bits/Sign
70	**Alarm 7**			
	Fuel theft	-	-	13/16-16/16
	Magnetic pick up fault	-	E-0001/0001 S-0011/0011	9/16-12/16
	Oil pressure circuit	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	5/16-8/16
	Auxiliary input I	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	1/16-4/16

Register offset	Value	Scale factor	Unit	Bits/Sign
71	**Alarm 8**			
	Auxiliary input A		E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	13/16-16/16
	Auxiliary input B		E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	9/16-12/16
	Auxiliary input C		E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	5/16-8/16
	Auxiliary input D		E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	1/16-4/16
72	**Alarm 9**			
	Auxiliary input E	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	13/16-16/16
	Auxiliary input F	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	9/16-12/16
	Auxiliary input G	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	5/16-8/16
	Auxiliary input H	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	1/16-4/16

Communication structure, page 26

Register offset	Value	Scale factor	Unit	Bits/Sign
73	**Alarm 10**			
	Gen L1 phase low volt	-	E-0001/0001 W-0010/0010 S-0011/0011	13/16-16/16
	Gen L1 phase high volt	-	E-0001/0001 W-0010/0010 S-0011/0011	9/16-12/16
	Gen L2 phase low volt	-	E-0001/0001 W-0010/0010 S-0011/0011	5/16-8/16
	Gen L2 phase high volt	-	E-0001/0001 W-0010/0010 S-0011/0011	1/16-4/16
74	**Alarm 11**			
	Gen L3 phase low volt	-	E-0001/0001 W-0010/0010 S-0011/0011	13/16-16/16
	Gen L3 phase high volt	-	E-0001/0001 W-0010/0010 S-0011/0011	9/16-12/16
	DG phase rotation	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	5/16-8/16
	Mains phase rotation	-	E-0001/0001 N-0101/0101	1/16-4/16
75	**Alarm 12**			
	Fuel level open circuit	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	13/16-16/16
	V belt broken	-	E-0001/0001 N-0101/0101 W-0010/0010 E-0100/0100 S-0011/0011	9/16-12/16
	Extended overload trip	-	E-0001/0001 S-0011/0011	5/16-8/16
	High oil pressure detected	-	E-0001/0001 W-0010/0010	1/16-4/16

Communication structure, page 27

Register offset	Value	Scale factor	Unit	Bits/Sign
	Input/output diagnostics			
	Digital input A	-	1/0	16/16
	Digital input B	-	1/0	15/16
	Digital input C	-	1/0	14/16
	Digital input D	-	1/0	13/16
	Digital input E	-	1/0	12/16
	Digital input F	-	1/0	11/16
	Digital input G	-	1/0	10/16
76	Digital input H	-	1/0	9/16
	Digital input I	-	1/0	8/16
	Digital output A	-	1/0	7/16
	Digital output B	-	1/0	6/16
	Digital output C	-	1/0	5/16
	Digital output D	-	1/0	4/16
	Digital output E	-	1/0	3/16
	Digital output F	-	1/0	2/16
	Unimplemented	-	-	1/16

Register offset	Value	Scale factor	Unit	Bits/Sign
77	**DG status**			
	Controller mode	-	Config (1) Run (0)	16/16
	Mains healthy/unhealthy	-	True (1) False (0)	15/16
	DG operation mode	-	Scheduler-110 Cyclic-111 Auto-101 Manual-100	14-12/16
	Load on Mains	-	True (1) False (0)	11/16
	Load on DG	-	True (1) False (0)	10/16
	Current DG status	-	Running Stopped	9/16
	DG stopped normally	-	True (1) False (0)	8/16
	DG stopped with fault	-	True (1) False (0)	7/16
	DG fail to start	-	True (1) False (0)	6/16
	Gen available	-	True (1) False (0)	5/16
	Common shutdown	-	True (1) False (0)	4/16
	Common electric trip	-	True (1) False (0)	3/16
	Common warning	-	True (1) False (0)	2/16
	Common notification	-	True (1) False (0)	1/16

Communication structure, page 28

Register offset	Value	Scale factor	Unit	Bits/Sign
78-81	**Current time stamp**			

Structure of broadcast message

Byte no.	Byte contents
0	Page ID
1	Data at offset 0 - high byte
2	Data at offset 0 - low byte
3	Data at offset 1 - high byte
4	Data at offset 1 - low byte
5	Data at offset 2 - high byte
6	Data at offset 2 - low byte
7	Reserved

Structure of command message

Byte no.	Byte contents
0	Command ID
1	Command parameters
2	Reserved
3	Reserved
4	Reserved
5	Reserved
6	Reserved
7	Reserved

12.3 CAN packet structure

Structure of command message received over CAN:

Command ID	Description	Command parameter (each of 1 Bytes)	Bits/ Sign
1	Start/Stop command	0x01 - Start DG 0x02 - Stop DG Command status is updated in status register	Unsigned
2	Operating mode change command	0x01 - Toggle the current mode of operation between Auto mode and Manual mode Auto mode operates the DG remotely Manual mode operates the DG through key-press events	Unsigned

13. Troubleshooting

13.1 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. • Enter the Configuration mode in the controller and verify the configuration for the Start output. Check that the Start output is working correctly by measuring its output voltage. • Enter the Configuration mode in the controller and verify the configuration of the Crank disconnect method. Verify the configuration of the LLOP Switch polarity. Ensure that the lube oil pressure switch and sensor are working OK. Check their wiring.
The Emergency Stop alarm is shown without the Emergency Stop is activated.	• Check if the Emergency stop switch is working OK, including the wiring. • Enter the Configuration mode in the controller and verify the configuration of the Emergency stop polarity.
The controller generates unnecessary Shutdown alarms or Warning alarms.	• Check the respective switch, sensor and wiring. • Enter the Configuration mode in the controller and verify the respective threshold configuration.
The controller shows 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. Press and hold the *Stop/Config* button during a power cycle to reset the controller. 2. Re-send the configuration file.
The controller sends a Crank-start command immediately after power on.	• Ensure 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 suitable controller terminal. • Enter the Configuration mode in the controller and verify the configuration for Start mode and the Start relay output polarity.

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 respective 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 respective 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. • Enter the Configuration mode in the controller and verify the calibration for the respective sensor in the configuration.

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. • Enter the Configuration mode in the controller and verify the configuration for the Remote start digital input terminal. • Check that the controller is in Auto mode. • Check for Mains monitoring disabled and Site mode disabled.
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 respective digital input terminal. • Enter the Configuration mode in the controller and verify the configuration for the Remote stop digital input terminal. • 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 respective input terminal. • Enter the Configuration mode in the controller and verify the configuration for the Mains monitoring.

SGC 121 only troubleshooting

Fault	Action
The governor actuator chatters even after the engine stops. The controller shows genset ON while genset is at rest. Fail to stop alarm when genset is at rest.	• Enter Configuration mode in the controller and verify the configuration for the LLOP and LOP. Also check the wiring. • Ensure that Mains voltage wiring is not connected by mistake to the controller's genset voltage terminals.
The controller does not maintain the target RPM. The engine RPM is not stable or engine hunts. The controller cranks the engine but does not start the engine.	• Check that the mechanical linkage assembly is OK. • Enter Configuration mode in the controller and verify the configuration for GOVERNOR. • Check the PID control gains. • Check that the actuator moves to full throttle position when the engine is cranked.