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MANUAL FOR GC1100: GENSET CONTROLLER

Product Manual Version #0.00

ABSTRACT

This manual is intended as an information guide for operating SEDEMAC's GC1100 genset controller.

Doc #SED-MAN-GC1100-002

Date: 20-Apr-2018

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Safety Instructions

General Instructions

- ✓ This document includes important instructions that should be followed during installation and maintenance of the generator Set controller.
- ✓ For safety reasons, the manufacturer recommends that this equipment be installed and serviced by an authorized service personnel. Follow 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. Many accidents arise due to ignorance or illiteracy towards the elemental rules of safety and precautions.

The following safety notations found throughout this document 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

Electrical Safety

- ✓ Electric shock can cause severe personal injury or death.
- ✓ Ensure the generator set must be grounded before performing any installation or service.
- ✓ Generators produce high electrical voltages, 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, sizes of wire gauge used for electrical connections and wirings must be appropriate to which they will be subjected to.

In Operation Safety

- ✓ Before installing genset controller, ensure that all power voltage supplies are positively turned off at their source. Disconnect the generator's battery cables and remove 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 electric power supply before removing controller or touching other electrical parts.
- ✓ Use extreme caution when working on electrical components. High voltage can cause injury or death.
- ✓ Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when working near generator set 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**.

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- ✓ 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 nonconducting object, like, a rope or wooden stick, to release the victim from the live conductor. If the victim is unconscious, apply first aid and get immediate medical help.

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List of Abbreviation

This list contains the list of acronyms used in this document and it can be used to refer their respective description. This list does not contain units of measure.

Acronym	Description
AC	Alternating Current
ACK	Acknowledge
ALT	Alternator
AMF	Auto Mains Failure
AUX	Auxiliary
BTS	Base Transceiver Station
CHG	Charging
CKT	Circuit
CT	Current Transformer
DC	Direct Current
DG	Diesel Generator
DIG IN	Digital Input
ENG TEMP	Engine Temperature
ETS	Engine Temperature Sensor
FLS	Fuel Level Sensor
GCU	Genset Control Unit
Genset	Generator Set
GND	Ground
HMI	Human Machine Interface
HSD	High Side Driver
HWT	High Water Temperature
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LLOP	Low Lube Oil Pressure
LOP	Lube Oil Pressure
LVL	Level
MCP	Manual Control Panel
MPU	Magnetic Pickup Unit
OV	Over Voltage
PID	Proportional Integral Derivative
PWM	Pulse Width Modulation
RMS	Root Mean Square
RPM	Revolutions Per Minute
R-Y-B	Red-Yellow-Blue
SCP	Sensor Common Point
SMD	State Machine Diagram
TEMP	Temperature
USB	Universal Serial Bus
UV	Under Voltage

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1 Introduction

This document elucidates information necessary for operating SEDEMAC's GC1100 genset controller. It empowers the user with the necessary information for using GC1100 genset controller in an application that involves communication of the genset controller with an external system similar as a server or a remote data communication system.

SEDEMAC's GC1100 boasts its modern technology with robust features of genset controller with user-friendly HMI and full graphics LCD. GC1100 controller is bundled with highly versatile software & extensive I/O's and thereby support a wide variety of industry standard features in diesel/gasoline engine gensets. GC1100 controller's smart software offers flexibility to configure each individual input and output for a specific function or application.

GC1100 controller can be configured through SEDEMAC's laptop / desktop utility, named as SEDEMAC's Smart Config. All parameters can also be configured using the keypad of the genset controller.

1.1 Key Highlights of the Product

- Genset controller with configurable 5 digital inputs, 4 analog inputs – 3 resistive type and 1 current type (Can also be used as digital inputs if configured) and 6 digital outputs
- Auto, Manual and Remote start / stop modes for 1-ph & 3-ph gensets
- RPM sensing using frequency and MPU
- Supports auto exercise and cyclic modes
- Real time clock-based event logs
- PC connectivity via USB port, RS485, CAN
- Configurable fuel theft alarm
- Backlit and full graphics display with power saving feature

1.2 Product Features

Following table gives a brief overview of various product features of the GC1100

Table 1: Features list

Features	Specs for GC1100
Digital Switch Input	5
Analog Resistive Inputs	3
Analog Current Input	1
Mains V-Input (AMF)	Y
DG Alt V-Input, D+ CHG ALT I/O	Y
DG Alt I-Input	Y
Eng. Speed Input via MPU	Y
Digital HSD (0.75A)	6
Real Time Clock for event logs, exerciser	Y
USB I/O port for laptop access	Y
EEPROM for extended event logs OR regional languages	Y
CAN I/O	Y
RS-485 I/O for MODBUS	Y

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DC Battery Supply Voltage (with -32V reverse protection)	8 to 32V
Operating Temperature Range (deg C)	-20 to 65
Ingress Protection with Optional Gasket	IP65
Sensor Common Input with ±2V Sensing Range	Y
Warning auto clear enable / disable	Y
Fuel reference selection input	Y
On the fly mode change when engine is healthy/engine off	Y

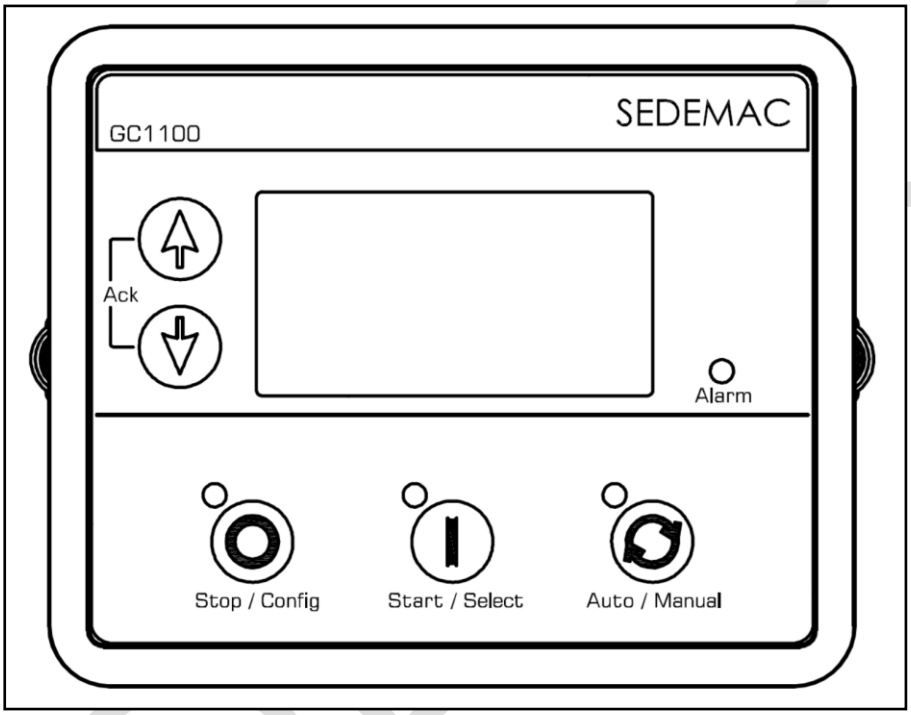

Figure 1: GC1100 genset controller's front fascia

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2 Specifications

2.1 Terminals

GC1100 controller host three types of terminal blocks as shown in Figure 2, Figure 3 and Figure 4 given below:

2.1.1 10.16 mm pitch connector suitable for 2 sq. mm wire

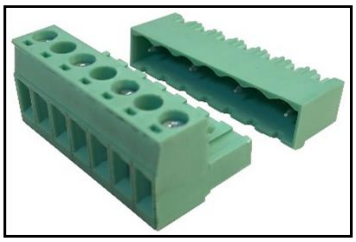

Figure 2: Connectors of 10.16 mm pitch

Table 2: 10.16 mm pitch connector details

Connect or type	Male (On controller) *	SM Part Number	Female (Mating)*	SM Part Number	Quantity (Nos)
4-Pin	5474274	SM0003195	5453499	SM0001163	2

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

2.1.2 5.08 mm pitch connectors suitable for 2 sq. mm wire

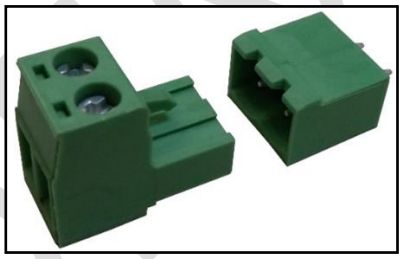

Figure 3: Connectors of 5.08 mm pitch

Table 3: 5.08 mm pitch connectors details

Connector type	Male (On controller) *	SM Part Number	Female (Mating)*	SM Part Number	Quantity (Nos)
2-Pin	5447353	SM0000281	5441980	SM0001164	1

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

2.1.3 3.5 mm pitch connector suitable for 0.5 – 1.5 sq. mm wire

Figure 4: Connectors of 3.5 mm pitch

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Table 4: 3.5 mm pitch connector details

Connector type	Male (On controller) *	SM Part Number	Female (Mating)*	SM Part Number	Quantity (Nos)
4-Pin	5441294	SM0000278	5441430	SM0003731	2
6-Pin	5441317	SM0003346	5449283	SM0003732	1
8-Pin	5441320	SM0003348	5441456	SM0003733	1
10-Pin	5443962	SM0003349	5449306	SM0003734	1

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

2.2 Power Supply Specifications

Following table gives a brief overview of power supply specifications

Table 5: Power supply specifications

Controller's terminal number	1, 2 (Ground and Battery positive respectively)
Supply voltage range	8 to 32 V-DC (Suitable for 12/24 V-DC system)
Cranking drop out period	50 mS
Maximum reverse voltage	-32 V-DC
Battery voltage measurement accuracy	±1 % full scale
Battery voltage measurement resolution	0.1 V
Maximum current	~ 0.2 A @ 12 V-DC (Excluding all current loads for the high side driver's output and Rotary Actuator's output)
Standby current	80 mA @ 12 V-DC
Deep sleep current	20 mA @ 12 V-DC

2.3 Generator Voltages and Frequency Measurements

Following table gives a brief overview of generator voltage and frequency measurements

Table 6: Generator voltage and frequency measurements

Controller's terminal number	27, 28, 29, 30 (N, B, Y, R respectively)
Measurement type	True RMS
Phase to Neutral voltage	20 to 350 V-AC RMS
Phase to Phase voltage	20 to 606 V-AC RMS
Voltage accuracy	±1% of full scale for Ph to N ±1.5% of full scale for Ph to Ph
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	Accuracy: 0.25% of full scale Resolution: 0.1 Hz

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NOTE:	For single genset application, it is mandatory to connect the genset phase and neutral cables to the genset controller's phase R and Neutral terminals respectively

2.4 Load Current Measurements

Following table gives a brief overview of load current measurements

Table 7: Load current measurements

Controller's terminal number	35 and 36 (for phase B), 37 and 38 (for phase Y), 39 and 40 (for phase R)
Measurement type	True RMS
Maximum CT secondary current rating	5 A
Burden	0.25 VA
Accuracy	±1.4 % of full scale nominal (5 A)

NOTE:	Follow the recommended phase sequence while connecting the Current Transformer (CT)

2.5 Mains Voltage and Frequency Measurements

Following table gives a brief overview of Mains voltage and frequency measurements

Table 8: Mains voltage and frequency measurements

Controller's terminal number	31, 32, 33, 34 (N, B, Y, R respectively)
Measurement type	True RMS
Phase to Neutral voltage	20 to 350 V- AC RMS
Phase to Phase voltage	20 to 606 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 2 V-AC RMS for Phase to Phase
Frequency range	3 to 75 Hz
Frequency accuracy	Accuracy: 0.25% of full scale Resolution: 0.1 Hz

NOTE:	For single phase application, it is mandatory to connect the mains phase and neutral cables to the genset controller's phase R and Neutral terminals respectively.

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2.6 Digital Inputs

Following table gives a brief overview of digital inputs

Table 9: Digital inputs

Controller's terminal number	10, 11, 12, 21, 22
Number of inputs	5
Type	Negative sensing (connect switch to ground.)
Open circuit voltage	(V_{BATT} – 1) V-DC
Software configurable options	Low Lub Oil Pressure (LLOP) Switch, High Engine Temperature switch and many more. Please refer Table 21

2.7 Analog Resistive Sensor Inputs

Following table gives a brief overview of analog resistive sensor inputs

Table 10: Analog resistive sensor inputs

Controller's terminal number	24, 25, 26 (Eng_temp, Fuel_Level sensor, LOP respectively)
Number of inputs	3
Type	Ratio-metric sensing
Range	0 to 1000 Ω
Open circuit detection	Above 5.5 KΩ
Accuracy	±2 % of FSD up to 1000 Ω
Connection method	One should connect the sensor output terminals between the genset controller terminal and the battery ground terminal.

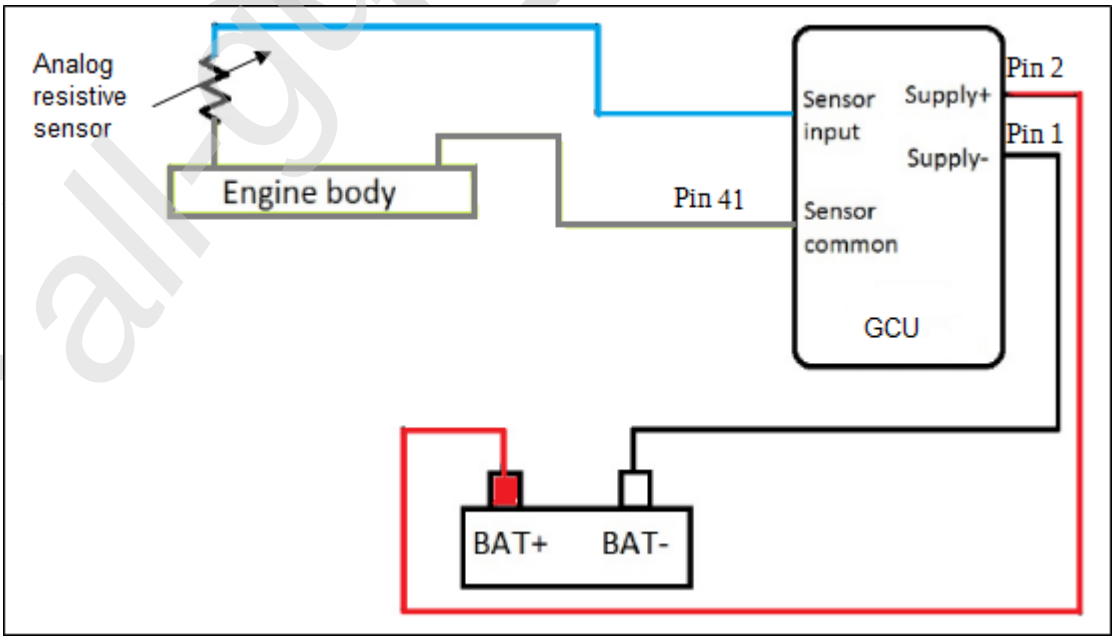

Figure 5: SCP connection

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2.8 Analog Current Input

Following table gives a brief overview of analog current input

Table 11: Analog voltage/current input

Controller's terminal number	23
Type	current sensing
Range	4 to 20 mA
Accuracy	±1.25% of full scale
Resolution	0.1mA

2.9 Magnetic Pick Up Input

Following table gives a brief overview of magnetic pickup input

Table 12: Magnetic pickup input

Controller's terminal number	42
Type	Single ended
Frequency range	10 to 10000 Hz
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 MPU is a sine-wave signal.

2.10 Digital Outputs

Following table gives a brief overview of digital outputs

Table 13: Digital outputs

Controller's terminal number	3, 4, 5, 6, 8, 9
Number of outputs	6
Type	High side driver
Maximum current	0.75 A
Software configurable options	Start relay, Fuel relay and many more. Refer Table 26

	Do not connect “STARTER MOTOR” and “STOP SOLENOID” directly to the controller's output terminals
	Genset & mains contactor latching relays should be compiled against 4kVA surge as per IEC-61000-4-5 standard.

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2.11 D+ CHG ALT

Following table gives a brief overview of D+ CHG ALT

Table 14: D+ CHG ALT

Controller's terminal number	7
Voltage range	0 to V_{BATT} ; V_{BATT} = 8 to 30 V-DC
Excitation	PWM (Current limited to 250 mA Or Average Power should be below 3 watts)
Accuracy	±1% of full scale

The D+ CHG ALT is combine input and output terminal. When the genset starts, the terminal provides controlled power output to excite the charging alternator. Once the charging alternator is excited and starts providing voltage to battery, this terminal is used as input to sense the output voltage of the charging alternator. In case of the charging alternator failure the GCU acts as per the pre-configuration settings.

2.12 Sensor Common Point

Following table gives a brief overview of sensor common point

Table 15: Sensor common point

GCU connector terminal number	41
Range	±2V
Accuracy	±2% of full scale
Resolution	0.1 V

NOTE:	**Important Note**: The sensor common point (SCP) terminal (Pin # 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 analog 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 analog sensor measurements are always available in a wide variety of field conditions.

2.13 Deep Sleep Mode Feature

Deep Sleep Mode is a useful feature to prolong the battery life.

In this mode, normal functions of the controller are suspended, and controller is placed into its lowest power consumption state. 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 in Deep Sleep Mode when there is no user interaction for the pre-set Deep Sleep Mode Delay.

- This mode is disabled in AMF mode.
- In Manual mode, press and hold “START”/“STOP” key for minimum one sec to come out of Deep Sleep mode.

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3 Communication Ports

Following table gives a brief overview of communication ports

Table 16: Communication ports

USB	USB 2.0 Type B used for connection to PC running SEDEMAC Smart config.
RS485 Serial Port	Half Duplex Max Baud Rate 115200 Data connection 2 wire Termination resistor of 120Ω is provided between output pin A & B Common-mode operating range and bus-pin fault protection upto ±70V Maximum distance of line is 1200m
Controller's terminal number for RS485	15, 16
CAN	Baud rate used is 250 kbps Packet size used is 8 bytes Termination resistor of 120Ω is provided
Controller's terminal number for CAN	13, 14

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4 Installation

4.1 Dimensions

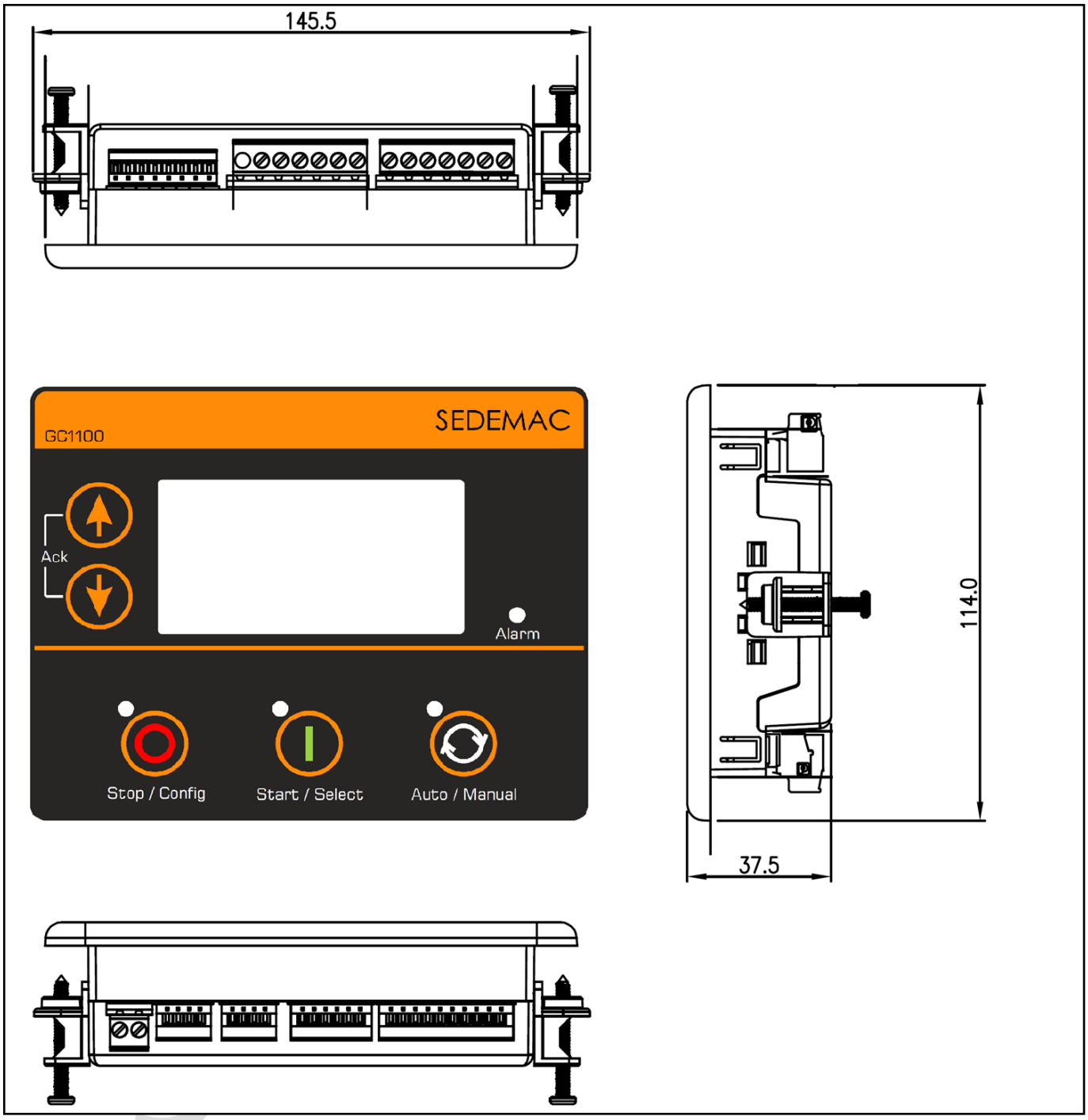

Figure 6: Dimensions of the GC1100 genset controller

Recommended mounting panel cut-out dimensions: 118 mm X 93 mm.

4.2 Mounting on panel

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

Follow the given steps:

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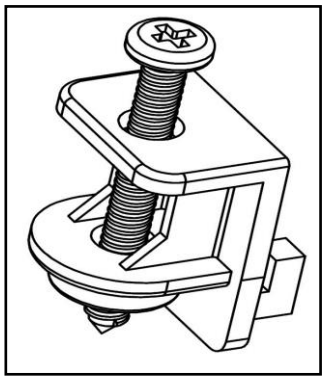

Figure 7: Fixing clip and screw supplied along with controller

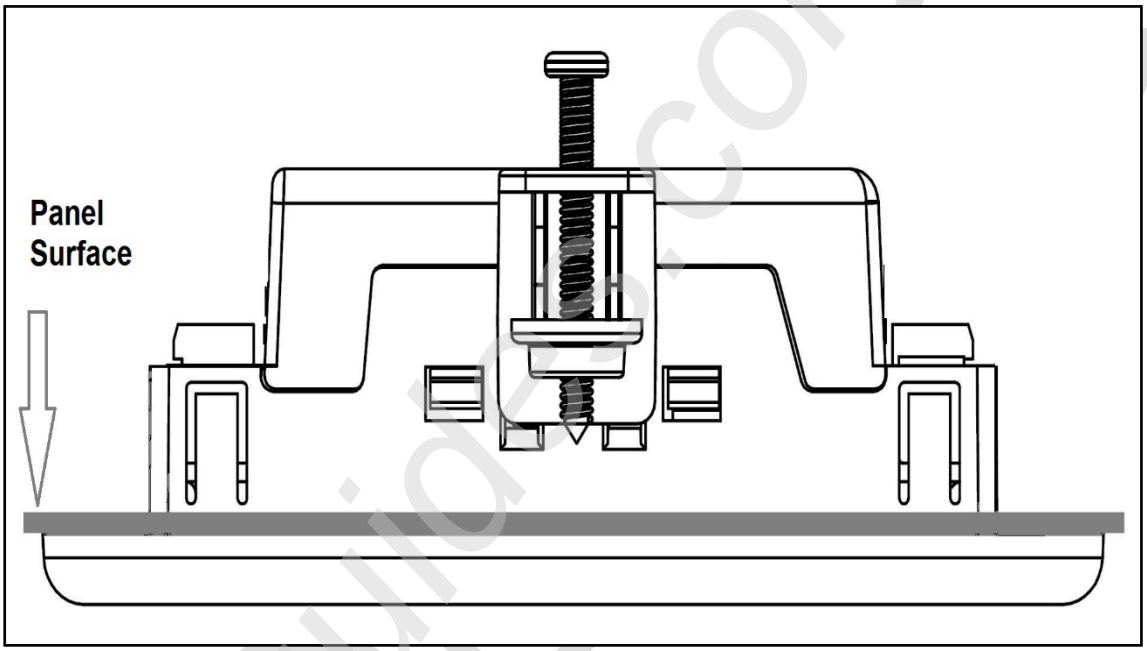

Figure 8: Controller mounting on the panel using the fixing clips

- Insert the fixing clip into the slot provided on the side of the controller.
- Pull the fixing clips backwards (towards the back of the module). Ensure that the fixing clip is properly fitted inside the slot provided on the controller.
- Fix the screws and tighten the screw (turn clockwise) to mount the controller properly into the panel. Ensure that the screw will be always perpendicular to the panel surface. The maximum tightening torque is 0.19 N-m.

CAUTION!	Over tightening of the screws may damage the controller casing.

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4.3 Terminal Description

Following figure shows the rear view of controller.

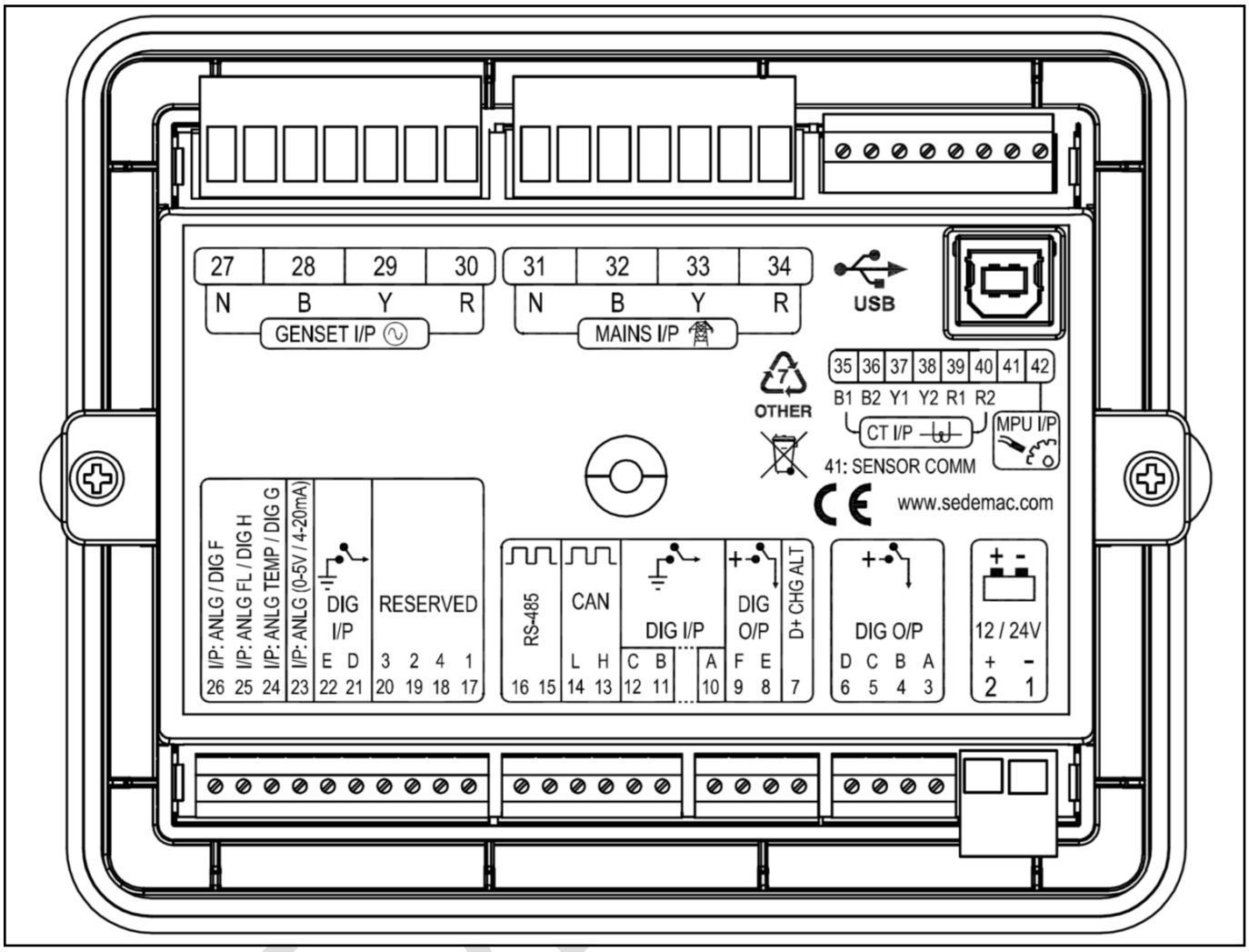

Figure 9: GC1100 genset controller from backside

Table 17: Details of GC1100 terminals

Terminal Sr. No.	Name	Description	Phoenix Female (Mating) Connector Part No.
1	GND	Power Supply Ground	5441980
2	BATTERY +	Power Supply +ve	
3	OUT A	High Side Driver – A	5441430
4	OUT B	High Side Driver – B	
5	OUT C	High Side Driver – C	
6	OUT D	High Side Driver – D	
7	D+ CHG ALT	Charging Alternator Control	5441223
8	OUT E	High Side Driver – E	
9	OUT F	High Side Driver – 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	

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Terminal Sr. No.	Name	Description	Phoenix Female (Mating) Connector Part No.
13	CAN H	CAN High	
14	CAN L	CAN Low	
15	RS485_B	RS485 – B	
16	RS485_A	RS485 – A	
17	Reserved	Reserved	5447560
18	Reserved	Reserved	
19	Reserved	Reserved	
20	Reserved	Reserved	
21	DIG_IN D	Input From Switch – D	
22	DIG_IN E	Input From Switch – E	
23*	ANLG_I_IN	Analog Input 4-20 mA	
24	ANLG_IN ENG_TEMP	Analog Input From Engine Temperature Sensor	
25	ANLG_IN FUEL_LEVEL	Analog Input From Fuel Level Sensor	
26	ANLG_IN LOP	Analog Input From Lube Oil Pressure Sensor	
27	GEN_V–IN NTRL	Voltage Input From Gen Neutral	5453499
28	GEN_V–IN B	Voltage Input From Gen Phase B	
29	GEN_V–IN Y	Voltage Input From Gen Phase Y	
30	GEN_V–IN R	Voltage Input From Gen Phase R	
31	MAINS_V–IN NTRL	Voltage Input From Mains Neutral	5453499
32	MAINS_V–IN B	Voltage Input From Mains Phase B	
33	MAINS_V–IN Y	Voltage Input From Mains Phase Y	
34	MAINS_V–IN R	Voltage Input From Mains Phase R	
35	GEN_CT–IN B1	CT Input 1 From Gen Phase B	5441252
36	GEN_CT–IN B2	CT Input 2 From Gen Phase B	
37	GEN_CT–IN Y1	CT Input 1 From Gen Phase Y	
38	GEN_CT–IN Y2	CT Input 2 From Gen Phase Y	
39	GEN_CT–IN R1	CT Input 1 From Gen Phase R	
40	GEN_CT–IN R2	CT Input 2 From Gen Phase R	
41	SCP	Sensor Common Point	
42	MPU–IN	MPU Input	

* the 0-5V (2.5 ± 2V) input for paralleling is not available for the GC1100 variant, as it does not have e-governing module, which is shown in the print of the back casing.

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4.4 Typical Wiring Diagram

4.4.1 Auto Mains Failure Application

The typical wiring diagram of GC1100 for Auto Mains Failure application on engine with mechanical fuel system:

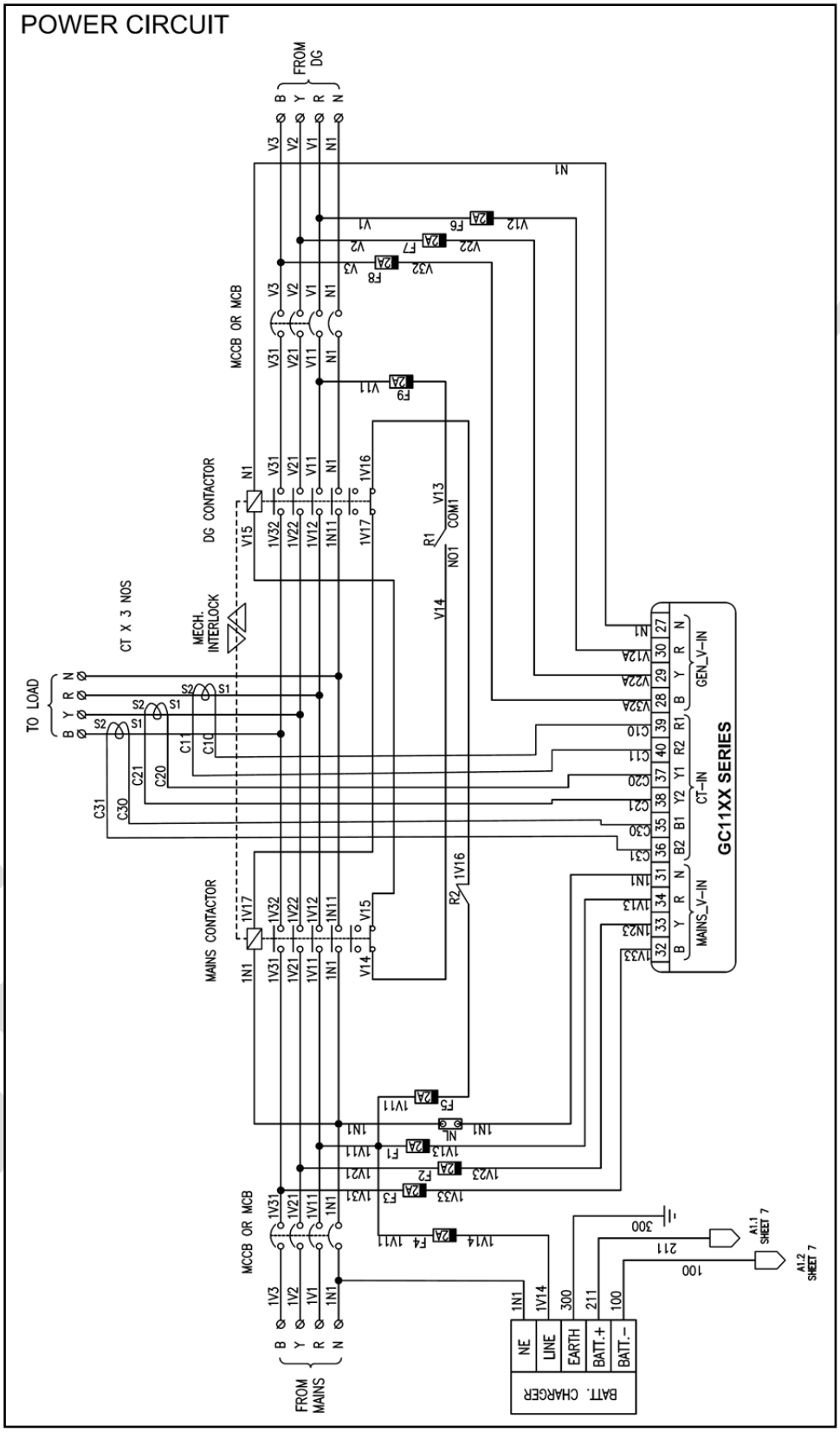

Figure 10: GC1100 genset controller power circuit (used in the Auto Mains Failure Mode)

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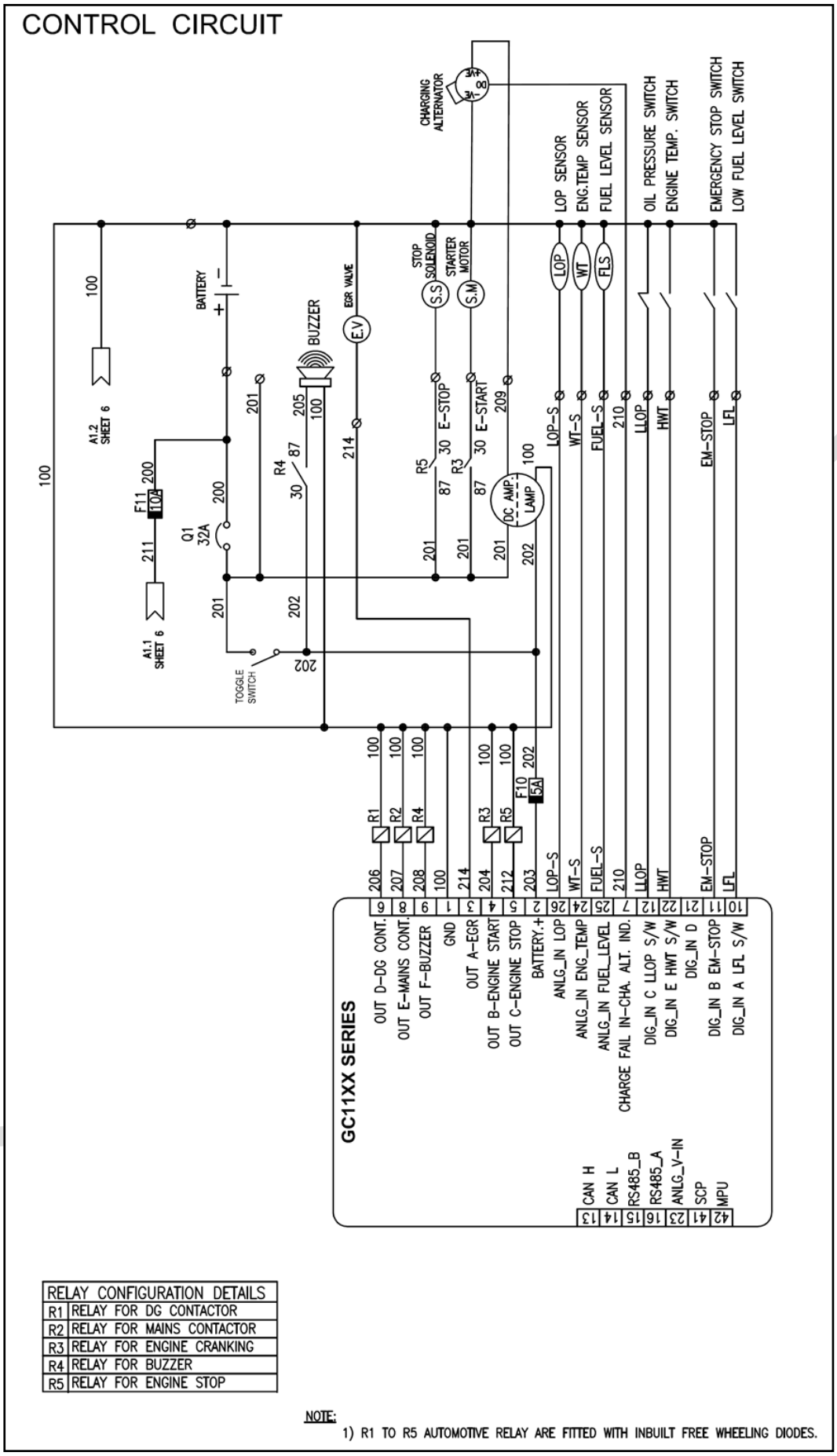

Figure 11: GC1100 genset controller control circuit (used in the Auto Mains Failure mode)

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NOTE:	1) Genset & mains contactor latching relays should be compiled against 4kV surge as per IEC-61000-4-5 standard. 2) Wiring drawing is for representation purpose only. Please refer wiring as per given genset application drawing. 3) Relay cards that used with controller should have protection against reverse battery voltages.

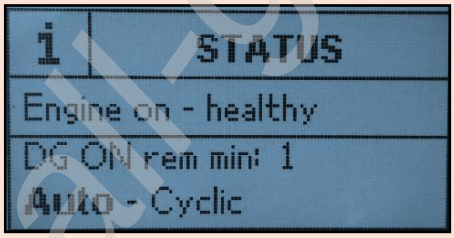
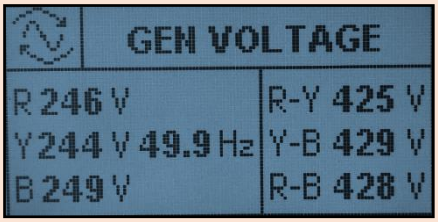
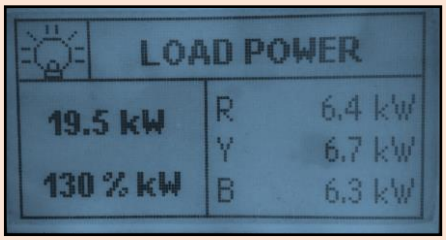
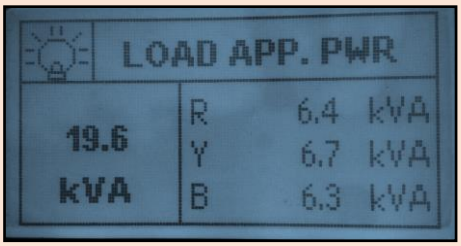
5 Module Display

Following section describes the layout of screens.

5.1 Monitoring Mode

In monitoring mode, screens will scroll automatically after a configurable time which can be configured in configuration menu or you can use the “Navigation UP/DOWN Keys” to scroll/browse the screens.

Table 18: Screens of engine status and operating mode

Engine status and operating mode	
MANUAL	**AUTO**
 (This screen will be visible in Manual mode)	 (This screen will be visible in Auto mode)
STATUS	**GENERATOR VOLTAGE**
	
LOAD POWER	**LOAD APPARENT POWER**
 (The “Y” and “B” phase will be visible only if configured for 3 phase genset)	 (The “Y” and “B” phase will be visible only if configured for 3 phase genset)

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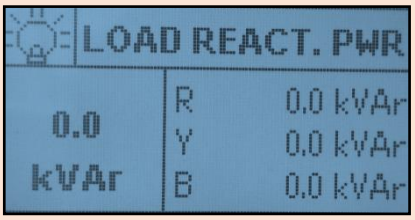
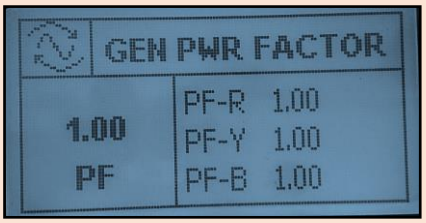
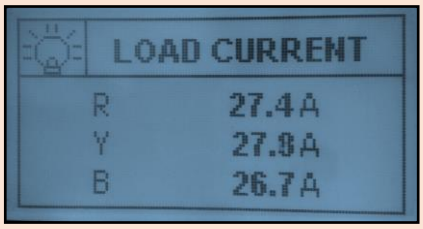
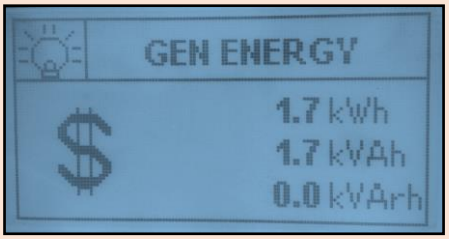
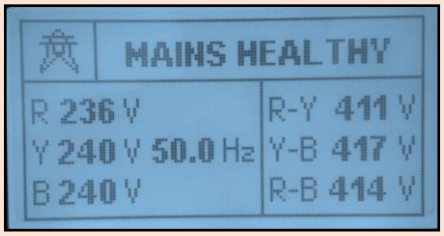
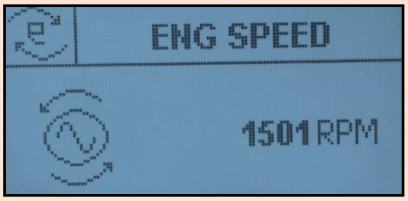
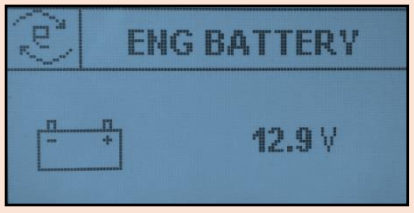
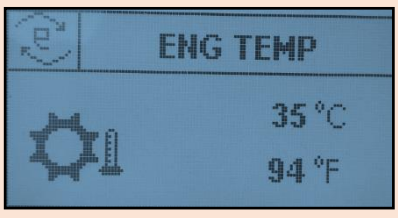
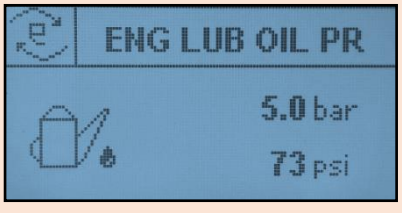
LOAD REACTIVE POWER	GENERATOR POWER FACTOR
 (The “Y” and “B” phase will be visible only if configured for 3 phase genset)	 (The “PF-Y” and “PF-B” will be visible only if configured for 3 phase genset)
LOAD CURRENT	**GEN ENERGY**
 (The “Y” & “B” phase will be visible only if configured for 3 phase genset)	
MAINS STATUS	**ENG SPEED**
	
ENG RUN TIME	BATTERY VOLT
	
ENG TEMP	**LUBE OIL PRESS**
 (This screen will be visible only if “Engine temperature” sensor is configured)	 (This screen will be visible only if “Lube Oil Pressure” sensor is configured)

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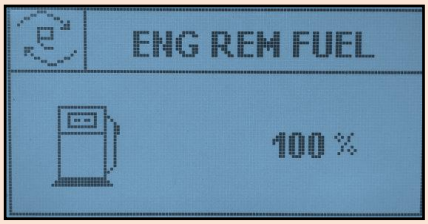
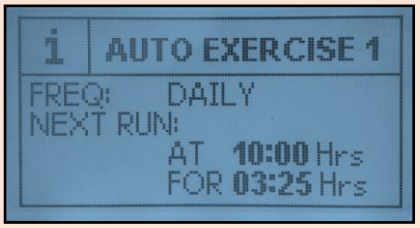
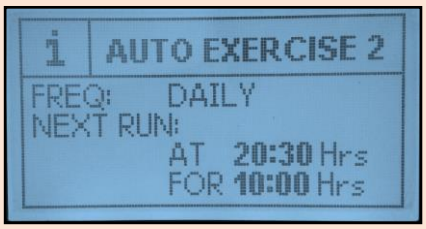
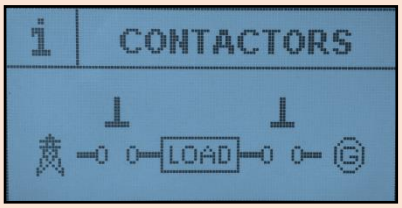
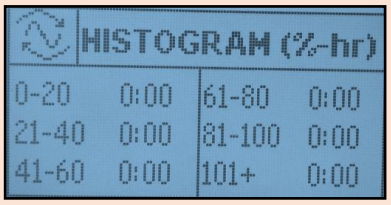
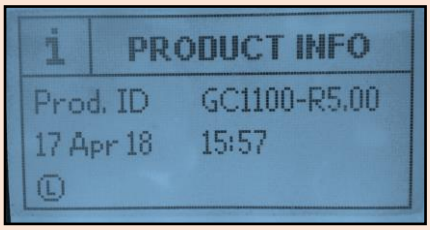
BALANCE FUEL	AUTO EXERCISE 1
 (This screen will be visible only if “Fuel Level” sensor is configured)	 (This screen will be visible only if “Event 1” is enabled from “Auto Exercise 1” in controller's configuration)
AUTO EXERCISE 2	**CONTACTOR STATUS**
 (This screen will be visible only if “Event 2” is enabled from “Auto Exercise 2” in controller's configuration)	 (This screen will be visible only if output related to genset and mains contactor are configured)
LOAD HITSOGRAM	**PRODUCT INFO**
 **(**This screen displays Engine run hours spent in different load regimes)	 (This screen displays product id, date and time)
ALARMS	
	

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6 Description of Control keys

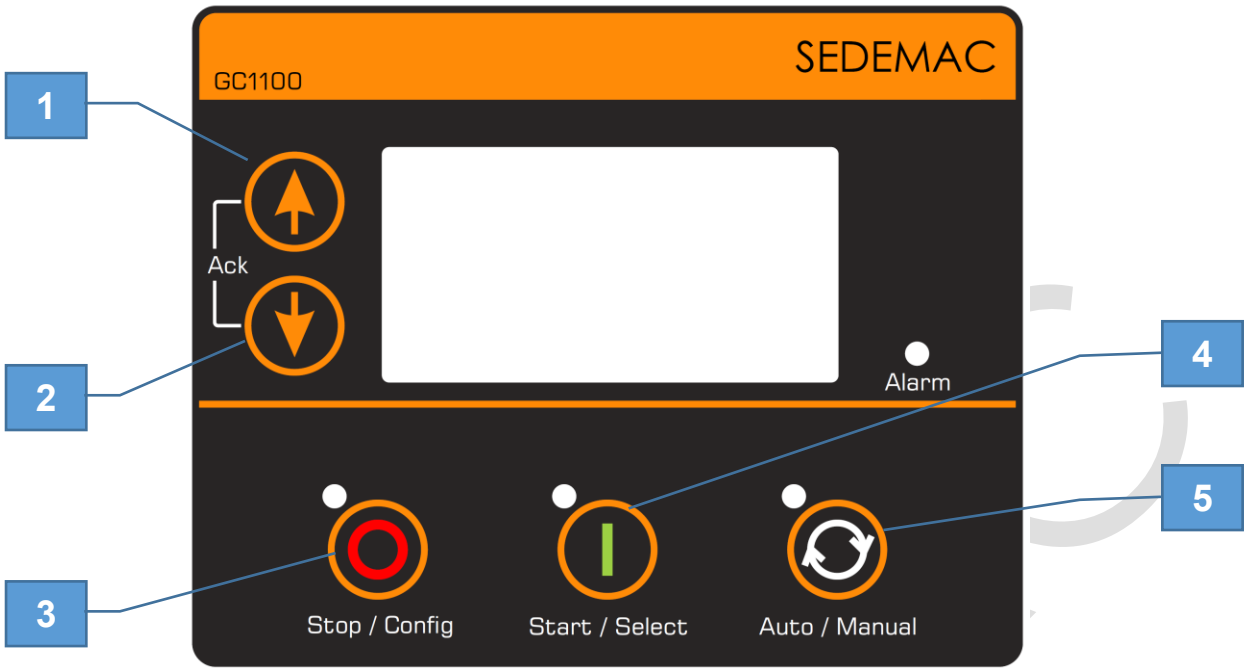

Figure 12: Control keys function

1. Menu Navigation Up key
2. Menu Navigation Down key
3. Stop/Config Key
4. Start/Select Key
5. Auto/Manual mode selection key

6.1 Functions of Control keys

Following table gives a brief overview of different functions of control keys

Table 19: Control keys in different modes

#	Mode	Key input	Function
1	Manual	Start	Starts the engine
2	Manual	Auto	Enters Auto mode
		Stop	Stops the engine when engine is running
		Stop (long pressed)	Enters configuration mode
		Stop + Down (long pressed)	Enters Programming mode
3	Auto	Stop	Stops the engine and enters Manual mode
4	Manual/Auto/ Configuration	Up/Down	Scrolls the screens/parameter
5	Manual/Auto	Up + Down (while on ALARMS screen)	Acknowledges and clears the alarm
6	Configuration	Start	Selects/saves the parameter
7		Up + Down (long pressed)	Enters on event log page
8		Stop (long pressed)	Back to Manual mode
9	Deep sleep	Any Key (for min 1 sec)	

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#	Mode	Key input	Function
10	Event log	Up + Down (long pressed)	Back to configuration mode
11	Programming	Up + Down (long pressed)	Controller enters in Manual mode

7 Configuration Mode

To configure the controller please follow the below mentioned instructions:

- To enter the configuration mode press and hold “STOP” key, at least for 3 seconds. Following screen will appear on the GCU

Figure 13: Configuration mode screen

- If you want to only view the configuration, press “STOP” key of the GCU. If you wish to change the configuration, press “START” key of the GCU

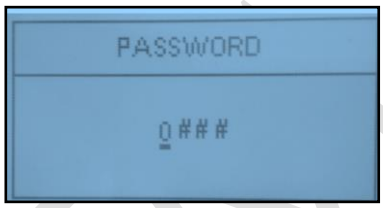

Figure 14: Configuration mode authentication page screen

- The GCU will ask for password (4 digit). Enter the password by using up & down arrow key for digit and “START” key for entering the digit. The 4 digits will start blinking individually as go on selecting. Press “START” button as mentioned earlier to enter the right digit.
- After completion of parameter configuration, press and hold “STOP” key to exit from configuration mode. Before existing from configuration mode controller will show the following screen.

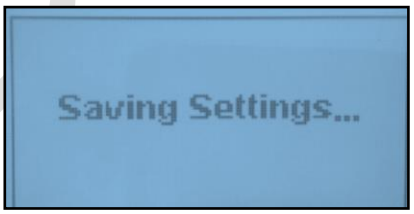

Figure 15: Saving setting screen

SEDEMAC

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7.1 List of Configurable Parameters

Following table gives a brief overview of configurable parameters in GC1100 controller

** Level 2 names in sentence case are written how they display on Smart Config GUI and names in bracket with capital case are written how they display on controller.*

Table 20: Configurable parameters

Level 0	Level 1 (On screen)	Level 2 (On screen) *	Parameters (On screen)
Module (MODULE)	General (GENERAL)	Profile Name (PROFILE NAME)	profile 1
		Power On Mode (POWER ON MODE)	Manual/Auto
		Power On Lamp Test (POWER ON LAMP TEST)	Disable/Enable
		Deep Sleep Mode (DEEP SLEEP MODE)	Disable/Enable
		Load Histogram (LOAD HISTOGRAM)	Disable/Enable
		Auto-Clear Warning Alarm (WARNING AUTO CLEAR)	Disable/Enable
		Language (LANGUAGE)	English/Chinese
	Display (DISPLAY)	Contrast (CONTRAST)	0 – 100 %
		Power Save Mode (POWER SAVE MODE)	Disable/Enable
	Communication (COMMUNICATION)	Communication Mode (COMM MODE)	None/MODBUS – SEDEMAC
		Slave ID (MODBUS SLAVE ID)	1 – 247
		Baudrate (MODBUS BAUDRATE)	1200/2400/4800/9600/ 19200/38400/57600/115200 bps
		Parity Bit (PARITY)	None/Even/Odd
	Auto Exercise Event 1 (AUTO EXERCISE-1)	Auto Exercise (EVENT 1)	Disable/Enable
		Event Occurrence (EVENT OCCURENCE)	Daily/Weekly/Monthly
		Event Day (EVENT DAY)	Runs Every day/Week Days/1 – 28
		Start Time (START TIME)	00:00 – 23:59 hour
		Duration (DG ON DURATION)	0-hour 1 min – 99 hour 59 mins
		Load Transfer (LOAD TRANSFER)	Disable/Enable

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Level 0	Level 1 (On screen)	Level 2 (On screen) *	Parameters (On screen)
	Auto Exercise Event 2 (AUTO EXERCISE-2)	Auto Exercise (EVENT 2)	Disable/Enable
		Event Occurrence (EVENT OCCURENCE)	Daily/Weekly/Monthly
		Event Day (EVENT DAY)	Runs Every day/Week days/1 – 28
		Start Time (START TIME)	00:00 – 23:59 hour
		Duration (DG ON DURATION)	0-hour 1 min – 99 hour 59 mins
		Load Transfer (LOAD TRANSFER)	Disable/Enable
	Cyclic Mode (CYCLIC CONFIG)	Cyclic Mode (CYCLIC MODE)	Disable/Enable
		Genset Off Time (DG OFF DURATION)	1 – 720 min
		Genset On Time (DG ON DURATION)	1 – 720 min
Digital Inputs (INPUTS)	Digital Input X (DIG IN X) X=A/B/C/D/E	Source (SOURCE)	Refer Table 21
		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/Always
		Activation Delay (ACTIVATION DELAY)	1 – 60 sec
Analog Inputs	Analog Input 1 (ENG TEMP/DIG G)	Use Input As (SENSOR SELECTION)	Not used/Digital Input G/ Anlg In Eng Temp
		(Digital) Source ((DIG) SOURCE)	Refer Table 21
		(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 – 60 sec
		(ETS) High Level Shutdown (SHUTDOWN)	Disable/Enable
		(ETS) High Level Shutdown Threshold (SHUTDOWN THRESHOLD)	27 – 300℃

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Level 0	Level 1 (On screen)	Level 2 (On screen) *	Parameters (On screen)
		(ETS) High Level Warning (WARNING)	Disable/Enable
		(ETS) High Level Warning Threshold (WARNING THRESHOLD)	25 – 298℃
		(ETS) Circuit Fault Action (OPEN CKT ACTION)	None/Notification/Warning /Electrical Trip/Shutdown
		(ETS) Engine Temperature Sensor Calibration Table	Refer Table 22
	Analog Input 2 (Fuel LVL/DIG H)	Use Input As (SENSOR SELECTION)	Not used/Digital Input H/ Anlg In Fuel LVL
		(Digital) Source ((DIG) SOURCE)	Refer Table 21
		(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 – 60 sec
		(FLS) Low Fuel Level Shutdown (SHUTDOWN)	Disable/Enable
		(FLS) Low Fuel Level Shutdown Threshold (SHUTDOWN THRESHOLD)	0 – 78 %
		(FLS) Low Fuel Level Notification (NOTIFICATION)	Disable/Enable
		(FLS) Low Fuel Level Notification Threshold (NOTIFICATION THRESH)	2 – 80 %
		(FLS) Fuel Tank Capacity (FUEL TANK CAPACITY)	2 – 1000 litre
		(FLS) Fuel Theft Warning (FUEL THEFT ALARM)	Disable/Enable
		(FLS) Fuel Theft Alarm Threshold (FUEL THEFT THRESHOLD)	1 – 100 % per hour
		(FLS) Circuit Fault Action (OPEN CKT ACTION)	None/Notification/ Warning /Electrical Trip/ Shutdown
		(FLS) Fuel Sensor Reference (FUEL SENSOR REFERENCE)	Engine Body/Battery Negative
		(FLS) Fuel Level Sensor Calibration Table	Refer Table 23
	Analog Input 3	Use Input As	Not used/Digital Input F/

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Level 0	Level 1 (On screen)	Level 2 (On screen) *	Parameters (On screen)
	(LOP/DIG F)	(SENSOR SELECTION)	Anlg In LOP
		(Digital) Source ((DIG) SOURCE)	Refer Table 21
		(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 – 60 sec
		(LOP) Low Level Shutdown (SHUTDOWN)	Disable/Enable
		(LOP) Low Level Shutdown Threshold (SHUTDOWN THRESHOLD)	0.0 – 9.8 bar
		(LOP) Low Level Warning (WARNING)	Disable/Enable
		(LOP) Low Level Warning Threshold (WARNING THRESHOLD)	0.2 – 10.0 bar
		(LOP) Circuit Fault Action (OPEN CKT ACTION)	None/Notification/Warning/ Electrical Trip/Shutdown
		(LOP) Lube Oil Pressure Sensor Calibration Table	Refer Table 24
	Analog Input 4 (LOP/DIG I)	Use Input As (SENSOR SELECTION)	Not used/Digital Input F/ Anlg In LOP (4-20mA)
		(Digital) Source ((DIG) SOURCE)	Refer Table 21
		(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 – 60 sec
		(LOP) Low Level Shutdown (SHUTDOWN)	Disable/Enable
		(LOP) Low Level Shutdown Threshold (SHUTDOWN THRESHOLD)	0.0 – 9.8 bar
		(LOP) Low Level Warning (WARNING)	Disable/Enable
		(LOP) Low Level Warning Threshold	0.2 – 10.0 bar

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Level 0	Level 1 (On screen)	Level 2 (On screen) *	Parameters (On screen)
		(WARNING THRESHOLD)	
		(LOP) Circuit Fault Action (OPEN CKT ACTION)	None/Notification/Warning/ Electrical Trip/Shutdown
		(LOP) Lube Oil Pressure Sensor Calibration Table	Refer Table 25
Outputs (OUTPUTS)	Output X (OUT X) X= A/B/C/D/E/F	Source (SOURCE)	Refer Table 26
		On Activation (ON ACTIVATION)	Energise/De – energise
Timers (TIMERS)	Cranking (CRANKING TIMER)	Crank Hold Time (CRANK HOLD TIME)	1 – 15 sec
		Crank Rest Time (CRANK REST TIME)	2 – 60 sec
		Manual Start Delay (MANUAL START DELAY)	0 – 30 sec
		Auto Start Delay (AUTO START DELAY)	0 – 43200 sec
	General (GENERAL TIMER)	Safety Monitoring Delay (SAFETY MONITOR DELAY)	10 – 60 sec
		Mains Detect Delay (MAINS DETECT DELAY)	1 – 300 sec
		Alternator Detect Delay (ALT DETECT DELAY)	1 – 30 sec
		Warm Up Delay (WARM UP DELAY)	0 – 60 sec
		Return To Mains Delay (RETN-TO-MAINS DELAY)	0 – 600 sec
		Engine Cooling Time (ENG COOL TIME)	0 – 300 sec
		Stop Action Time (STOP ACTION TIME)	10 – 120 sec
		Additional Stopping Time (ADDN STOPPING TIME)	0 – 120 sec
		Load Transfer Delay (LOAD TRANSFER DELAY)	0 – 60 sec
		Power Save Mode Delay (PWR SAVE MODE DELAY)	5 – 1800 sec
		Screen Changeover Time (SCRN CHNGOVER TIME)	1 – 1800 sec
		Deep Sleep Mode Delay (DEEP SLP MODE DELAY)	5 – 1800 sec
		Sounder Alarm Time (SOUNDER ALARM TIMER)	1 – 300 sec
		Auto Exit Config Mode (AUTO EXIT TIMER)	10 – 1800 sec

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Level 0	Level 1 (On screen)	Level 2 (On screen) *	Parameters (On screen)
Generator (GENERATOR)	Alternator Configuration (ALT CONFIG)	Alternator Present (ALT PRESENT)	No/Yes
		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 – 350 Volt Ph-N
		Min Healthy Frequency (MIN HEALTHY FREQ)	10 – 75 Hz
		Phase Reversal Detection (PHASE REVERSE DETECT)	Disable/Enable
		Phase Reversal Action (PHASE REVERSE ACTION)	None/Notification/Warning /Electrical Trip/Shutdown
		Auto Load Transfer (AUTO LOAD TRANSFER)	Disable/Enable
	Voltage Monitoring (VOLT MONITOR)	Under-voltage Shutdown (UNDER VOLT SHUTDOWN)	Disable/Enable
		Under-voltage Shutdown Threshold (UV SHUTDWN THRESHLD)	50 – 295 V Ph-N
		Under-voltage Warning (UNDER VOLT WARNING)	Disable/Enable
		Under-voltage Warning Threshold (UV WARNING THRESHOLD)	55 – 300 V Ph-N
		Over-voltage Shutdown (OVER VOLT SHUTDOWN)	Disable/Enable
		Over-voltage Shutdown Threshold (OV SHUTDWN THRESHLD)	105 – 350 V Ph-N
		Over-voltage Warning (OVER VOLT WARNING)	Disable/Enable
		Over-voltage Warning Threshold (OV WARNING THRESHOLD)	100 – 345 V Ph-N
	Frequency Monitoring (FREQ MONITOR)	Under-frequency Shutdown (UNDER FREQ SHUTDOWN)	Disable/Enable
		Under-frequency Shutdown Threshold (UF SHUTDWN THRESHLD)	10.0 – 59.0 Hz
		Under-frequency Warning (UNDER FREQ WARNING)	Disable/Enable
		Under-frequency Warning Threshold (UF WARNING THRESHOLD)	11.0 – 60.0 Hz

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Level 0	Level 1 (On screen)	Level 2 (On screen) *	Parameters (On screen)
		Over-frequency Shutdown (OVER FREQ SHUTDOWN)	Disable/Enable
		Over-frequency Shutdown Threshold (OF SHUTDWN THRESHLD)	26.0 – 75.0 Hz
		Over-frequency Warning (OVER FREQ WARNING)	Disable/Enable
		Over-frequency Warning Threshold (OF WARNING THRESHOLD)	25.0 – 74.0 Hz
	Current Monitoring (CURRENT MONITOR)	CT Ratio (CT RATIO)	0 – 8000 / 5
		Over-current Action (OVER CURR ACTION)	None/Notification/Warning /Electrical Trip/Shutdown
		Over-current Threshold (OVER CURR THRESHOLD)	5 – 10000 Amp
		Over-current Delay (OVER CURR DELAY)	1 – 600 sec
		CT Correction Factor (Reserved)	0.900 – 1.100
		CT Location (CT LOCATION)	On Load Cable/On Alt Output Cable
	Load Monitoring (LOAD MONITOR)	Generator Rating (GEN RATING)	0 – 8000 kW
		Over-load Action (OVERLOAD ACTION)	None/Notification/Warning /Electrical Trip/Shutdown
		Over-load Threshold (OVERLOAD THRESHOLD)	50 – 150 %
		Over-load Monitoring Delay (OVERLOAD MON DELAY)	1 – 600 sec
		Unbalanced Load Action (UNBAL LOAD ACTION)	None/Notification/Warning /Electrical Trip/Shutdown
		Unbalanced Load Threshold (UNBAL LOAD THRESHOLD)	5 – 200 %
		Unbalanced Load Delay (UNBAL LOAD DELAY)	1 – 600 sec
		Extended Over-Load Trip (EXT OL TRIP)	Disable/Enable
		Ext Over-load Trip Threshold (EXT OL THRESHOLD)	50 – 150 %
Mains (MAINS)	Configuration (MAINS CONFIG)	Mains Monitoring (MAINS MONITORING)	Disable/Enable
		Mains AC system (MAINS AC SYSTEM)	1 Phase/3 Phase
		Phase Reversal Detection	Disable/Enable

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Level 0	Level 1 (On screen)	Level 2 (On screen) *	Parameters (On screen)
		(PHASE REVERSE DETECT)	
		Phase Reversal Action (PHASE REVERSE ACTION)	None/Notification
		Partial Healthy Detection (PARTL HLTHY DETECT)	Disable/Enable
	Under-voltage Monitoring (UNDER VOLT MON)	Enable (ENABLE)	No/Yes
		Trip (TRIP)	50 – 298 V Ph-N
		Return (RETURN)	52 – 300 V Ph-N
	Over-voltage Monitoring (OVER VOLT MON)	Enable (ENABLE)	No/Yes
		Trip (TRIP)	102 – 350 V Ph-N
		Return (RETURN)	100 – 348 V Ph-N
	Under-frequency Monitoring (UNDER FREQ MON)	Enable (ENABLE)	No/Yes
		Trip (TRIP)	10.0 – 59.0 Hz
		Return (RETURN)	11.0 – 60.0 Hz
	Over-frequency Monitoring (OVER FREQ MON)	Enable (ENABLE)	No/Yes
		Trip (TRIP)	26.0 – 75.0 Hz
		Return (RETURN)	25.0 – 74.0 Hz
Engine (ENGINE)	Crank Disconnect (CRANK DISCON)	Start Attempts (START ATTEMPTS)	1 – 9
		Disconnect On Oil Pressure Sensor (DISCONN ON LOP SENS)	Disable/Enable
		Pressure Sensor Monitoring Threshold (DISCONN LOP THRESH)	0.5 – 10.0 bar
		Monitor Pressure Switch Before Crank (MON LLOP BEFR CRANK)	Disable/Enable
		Monitor Pressure Sensor Before Crank (MON LOP BEFR CRANK)	Disable/Enable
		Disconnect On Oil Pressure Switch	Disable/Enable

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Level 0	Level 1 (On screen)	Level 2 (On screen) *	Parameters (On screen)
		(DISCONN ON LLOP SW)	
		Pressure Switch Transient Time (LLOP SW TRANS TIME)	0.0 – 3.0 sec
		Crank Disconnect At Alt Frequency (DISCONN AT ALT FREQ)	10 – 70 Hz
		Crank Disconnect At Engine Speed (DISCONN AT ENG SPEED)	150 – 4000 rpm
		Disconnect On Charging Alt Voltage (DISCON ON CA VOLT)	Disable/Enable
		Charging Alt Disconnect Volt Threshold (CHG ALT VOLT THRESH)	5.0 – 30.0 volt
	Speed Monitoring (SPEED MONITOR)	Engine Speed Sense Source (SPEED SENSE SOURCE)	Magnetic Pickup/Alternator Frequency
		Flywheel Teeth (FLYWHEEL TEETH)	1 – 300
		Under-speed Shutdown (UNDER SPEED SHUTDOWN)	Disable/Enable
		Under-speed Threshold (UNDER SPD THRESHOLD)	0 – 3600 rpm
		Under-speed Delay (UNDER SPD DELAY)	1 – 60 sec
		Over-speed Threshold (OVER SPD THRESHOLD)	700 – 4000 rpm
		Over-speed Delay (OVER SPEED DELAY)	1 – 20 sec
		Gross Over-speed Threshold (GROSS OS THRESHOLD)	100 – 200 %
	Battery Monitoring (BATTERY MONITOR)	Low Battery Voltage Action (LOW VOLT ACTION)	None/Notification/Warning /Electrical Trip/Shutdown
		Low Battery Voltage Threshold (LOW VOLT THRESHOLD)	8.0 – 31.0 volt
		Low Battery Voltage Delay (LOW VOLT DELAY)	5 – 1800 sec
		High Battery Voltage Action (HIGH VOLT ACTION)	None/Notification/Warning /Electrical Trip/Shutdown
		High Battery Voltage Threshold (HIGH VOLT THRESHOLD)	9.0 – 32.0 volt
		High Battery Voltage Delay (HIGH VOLT DELAY)	5 – 1800 sec
	Charging Alternator	Charging Alternator Fail Action (FAIL ACTION)	None/Notification/Warning /Electrical Trip/Shutdown

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Level 0	Level 1 (On screen)	Level 2 (On screen) *	Parameters (On screen)
	Monitoring (CHARGE ALT MON)	Charging Alternator Fail Threshold (FAIL THRESHOLD)	0.0 – 35.0 V
		Charging Alternator Fail Delay (FAIL DELAY)	5 – 60 sec
	Preheat (PREHEAT)	Preheat Timer (PREHEAT TIMER)	1 – 900 sec
		Engine Temperature (ENG TEMPERATURE)	Disable/Enable
		Engine Temperature Threshold (ENG TEMP THRESH)	10 – 300℃
Maintenance (MAINTENANCE)	Maintenance (MAINT ALARM)	Action (ACTION)	Notification/Warning
		Due At Engine Hours (DUE AT ENGINE HOURS)	10 – 65000 hour
	Alarm Due Date (ALARM DUE DATE)	DD/MM/YYYY	
Miscellaneous Settings (MISC SETTINGS)	PASSWORD 1	####	0 – 9 for each digit
	PASSWORD 2	####	0 – 9 for each digit
(RESET COUNTERS)	(MAINS)	(RUN TIME)	(In numbers)
		MAINS kWh	(In kWh)
		MAINS kVAh	(In kVAh)
		MAINS kVArh	(In kVArh)
	(GENSET)	(RUN TIME)	(In hours)
		(NO OF STARTS)	(In numbers)
		(NO OF TRIPS)	(In numbers)
		ENG kWh	(In kWh)
		ENG kVAh	(In kVAh)
		ENG kVArh	(In kVArh)

7.2 Digital Input Sources Selection

Following table gives a brief overview of selection criteria for digital input sources

Table 21: Digital input sources selection

#	Source (On screen)
1	Not Used
2	User Configured
3	Low Fuel Level Switch (Low Fuel LVL Switch)
4	Lube Oil Pressure Switch (Low Lube Oil Press Switch)
5	High Engine Temp Switch

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6	Water Level Switch (Low Water LVL Switch)
7	Emergency Stop
8	Remote Start / Stop
9	Simulate Start
10	Simulate Stop
11	Simulate Auto
12	Close Generator/Open Mains Switch (Close Gen/Opn Mains Swch)
13	Close Mains/Open Generator Switch (Close Mains/Opn Gen Swch)
14	Simulate Mains
15	Reserved
16	V-Belt Broken Switch

Table 22: Engine temperature sensor calibration

Resistance (Ω)	Temperature° C
0 – 1000 (R1-R10)	25 – 300 °C (T1-T10)

Table 23: Fuel level sensor calibration

Resistance (Ω)	Fuel level (%)
0 – 1000 (R1-R10)	0 – 100 % (L1-L10)

Table 24: LOP sensor calibration

Resistance (Ω)	Pressure (Bar)
0 – 1000 (R1-R10)	0.0 – 10.0 Bar (V1-V10)

Table 25: LOP sensor (4-20mA) calibration

Current (mA)	Pressure (Bar)
4 – 20 (I1-I10)	0.0 – 10.0 Bar (V1-V10)

7.3 Digital Output Source Selection

Following table gives a brief overview of selection criteria for digital output source

Table 26: Digital output source selection

#	Output source (On screen)
1	Disable
2	Sounder Alarm
3	Battery Over Volt
4	Battery Under Volt
5	Charge Alt Shutdown
6	Charge Alt Warning
7	Close Genset Contactor (Close Gen Contactor)
8	Close Mains Contactor
9	Mains Failure
10	Common Alarm
11	Common Electric Trip
12	Common Shutdown

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#	Output source (On screen)
13	Common Warning
14	Cooling Down
15	Digital Input A (Dig In A)
16	Digital Input B (Dig In B)
17	Digital Input C (Dig In C)
18	Digital Input D (Dig In D)
19	Digital Input E ((Dig In E)
20	Digital Input F (Dig In F (Anlg In LOP 1))
21	Digital Input G (Dig In G (Anlg In Eng Temp))
22	Digital Input H (Dig In H (Anlg In Fuel LVL))
23	Digital Input I (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	Generator Available (Gen Available)
30	R Phase Over Voltage Shutdown (R Phase OV Shutdown)
31	R Phase Under Voltage Shutdown (R Phase UV Shutdown)
32	Y Phase Over Voltage Shutdown (Y Phase OV Shutdown)
33	Y Phase Under Voltage Shutdown (Y Phase UV Shutdown)
34	B Phase Over Voltage Shutdown (B Phase OV Shutdown)
35	B Phase Under Voltage Shutdown (B Phase UV Shutdown)
36	Generator Over Current (Gen Over Current)
37	High Engine Temp
38	Low Fuel Level (Low Fuel LVL)
39	Low Lube Oil Pressure (Low LOP)
40	Mains High Voltage (Mains High Volt)
41	Mains Low Voltage (Mains Low Volt)
42	Oil Pressure Open Circuit
43	Open Generator Contactor (Open Gen Contactor)
44	Open Mains Contactor
45	Over Frequency Shutdown (Over Freq Shutdown)
46	Over Speed Shutdown
47	Gross Over Speed Shutdown (Gross Over Spd Shutdown)
48	Start Relay
49	Temp Sensor Open Circuit
50	Under Frequency Shutdown (Under Freq Shutdown)
51	Under Speed Shutdown
52	Maintenance Due
53	Stop Mode
54	Auto Mode

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#	Output source (On screen)
55	Manual Mode
56	Preheat Output

8 Module Operation

There are two modes of operation

- Auto Mode
- Manual Mode

8.1 Auto Mode

To enter Auto mode press “AUTO” key. The controller can be used in two configurations while in Auto mode.

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

8.1.1 Auto Mains Failure (AMF)

When the Mains Monitoring is enabled in the Mains configuration and the controller is in the Auto mode, AMF mode gets activated.

In this mode, if the mains healthy condition is present then the genset remains in Stop mode. When the mains unhealthy condition occurs, genset will be cranked. Once the preconfigured engine alternator voltage or frequency or RPM or lube oil pressure is detected, then engine will be on. Controller will latch the genset contactor when genset loading voltage and frequency are above the minimum healthy thresholds. Engine run hours will start incrementing when the genset voltage becomes greater than Min Healthy Voltage. During genset running, if the mains voltage returns, Mains Detect Delay will start first. If the mains is found to be healthy for this delay then Return To Mains Delay timer starts. After this, genset contactor will get opened and after the Load Transfer Delay, mains contactor will get latched and controller will command genset to stop after Engine Cooling Time.

During Crank time, if the mains voltage recovers or any stop command or shutdown alarm occurs controller will not issue start command. To start the genset again, it is necessary to clear all the alarms manually.

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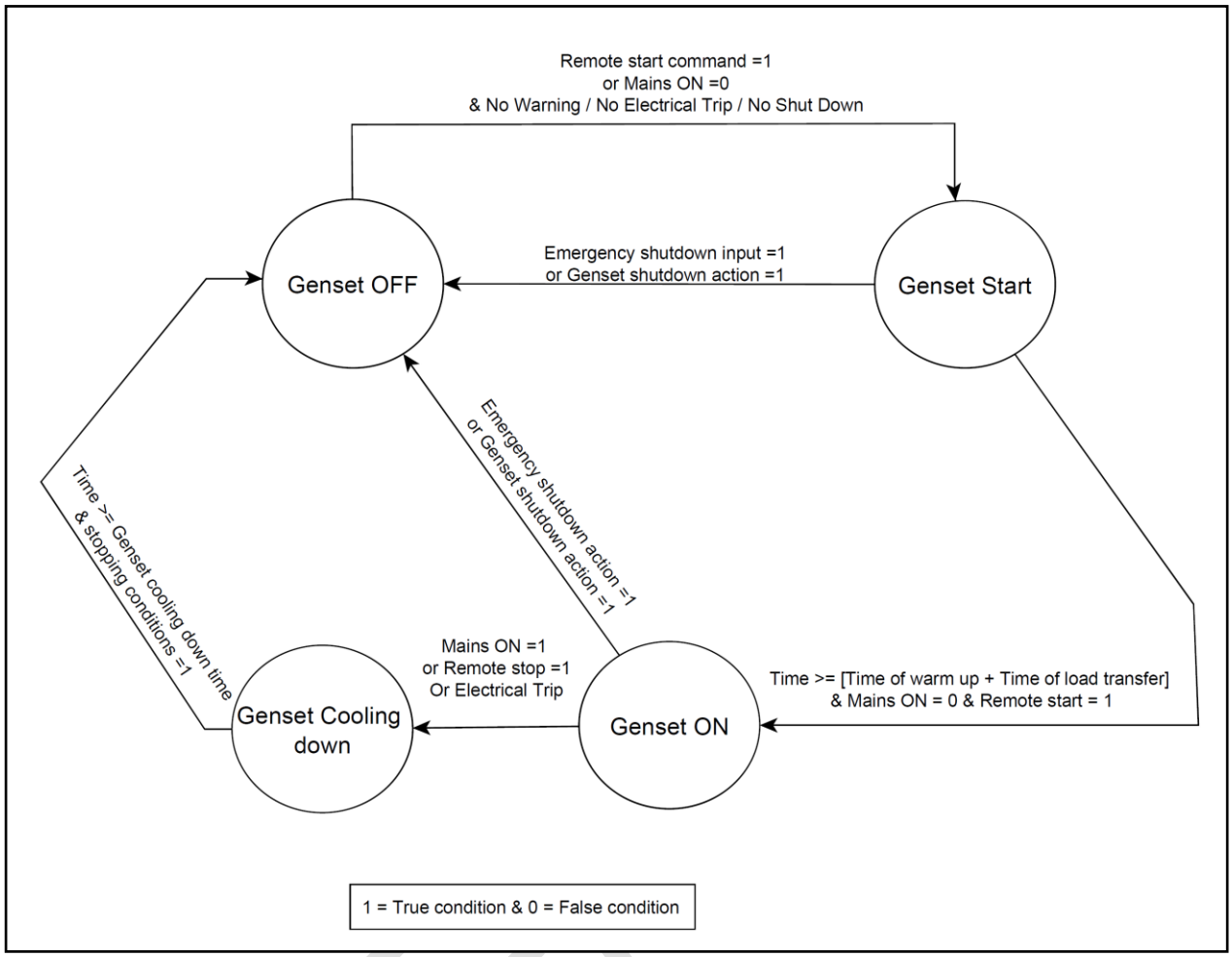

Figure 16: SMD for AMF mode

8.1.2 Remote start/stop

To use the Remote start/stop mode of the controller, first configure one of the digital input as Remote start/stop and put the controller in the Auto mode provided mains monitoring should be disabled.

In this mode, the genset can be commanded to start and stop by continuously activating/deactivating the preconfigured Remote start/stop input. The controller will latch genset contactor when controller confirms that all the engine and genset parameters are within the configured thresholds. When the preconfigured input is deactivated the controller will open the genset contactor.

8.1.3 Auto Exercise Mode

GC1100 controller allows to configure two scheduled sequences to start and stop the genset on preconfigured time.

The Exercise will occur when the controller is in the Auto mode with no shutdown, electric trip or warning alarms. The genset will run for pre-set DG ON DURATION. In this mode, load transfer on mains/genset is configurable. Scheduled sequences can be configured to repeat daily, weekly or monthly.

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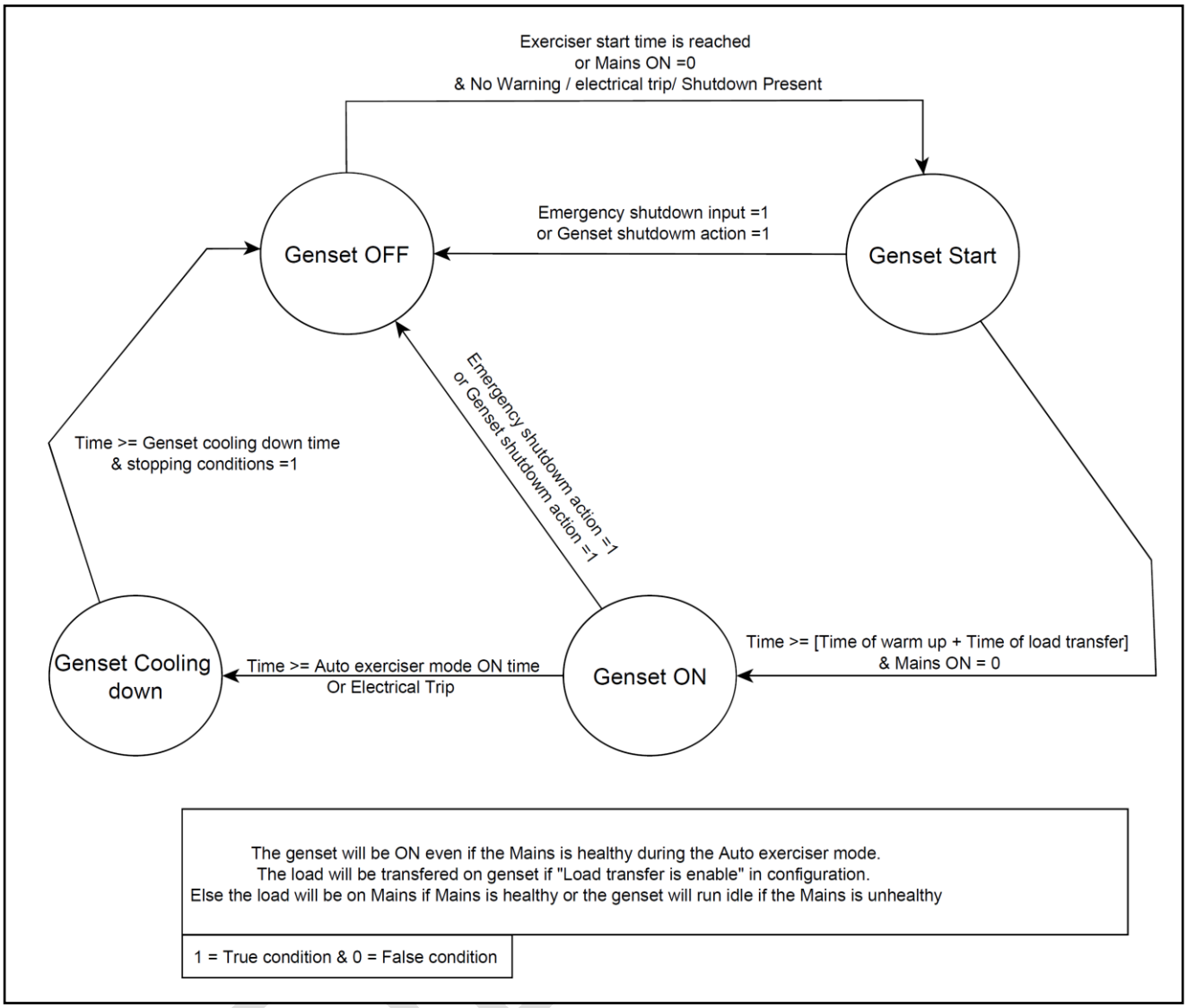

Figure 17: SMD for auto exercise mode

- If the controller is in Auto mode, Exercise will run at scheduled time for pre-set DG ON DURATION. Controller will exit from Exercise mode, if the DG ON DURATION is expired or if Stop key is pressed while scheduled sequence is running.
- If the controller is in Manual mode when the scheduled sequence begins, genset will not be started. If the controller is switched to Auto mode during Exercise is running, genset will start and run for remaining scheduled duration.
- The genset controller will not respond to Remote start command in Exercise mode.
- In AMF mode, if the mains is unhealthy or cutoff or when the genset is running in Exercise mode, genset will first run Exercise and then genset will continues to run in AMF mode. Load will be transferred on genset even if Load Transfer is disabled in Exercise. Genset stops when the mains become healthy.
- If both exercises are scheduled at the same time, then Start time for second exercise will be incremented by 1 min.

8.1.4 Cyclic mode

This mode is used for running the genset for a pre-specified time for a cycle of max 12 hours each. The time of genset to be kept ON & OFF is configurable.

Mains is being monitored in this mode. Load is on mains when mains is healthy. If mains is detected unhealthy, genset will start for DG ON time. Genset contactor will get latched when the genset is

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healthy and the warm up time is elapsed. After completion of the ON time, genset turns OFF taking cooling down time. Then controller will start DG off time.

After completion of DG OFF time, DG ON time will start and this cycle will continue until mains is detected healthy. During any of the times, if mains is detected healthy, both the timers are reset to zero and load will shift to mains after taking return delay. This process continues in cyclic mode.

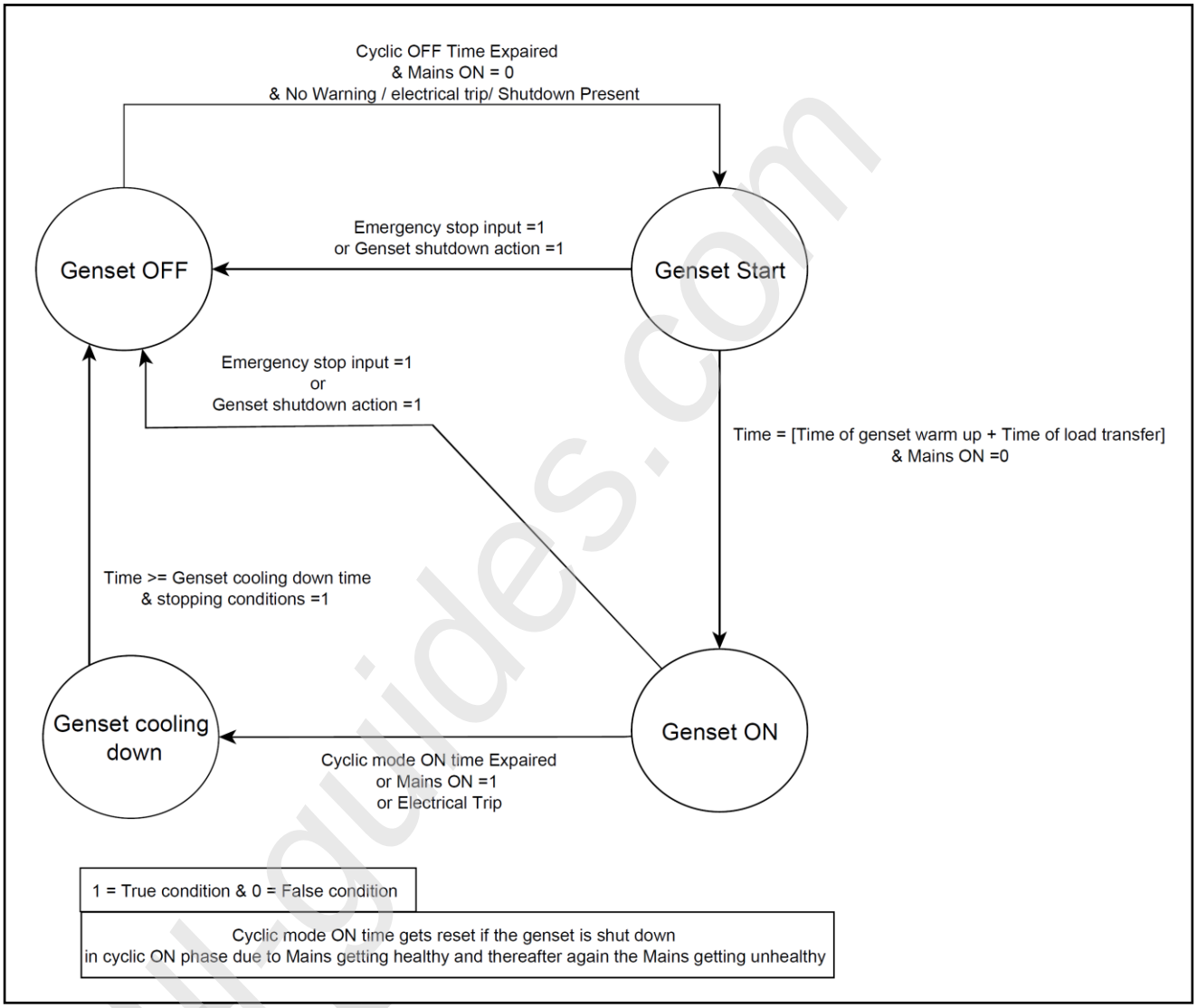

Figure 18: SMD for cyclic mode

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8.2 Manual Mode

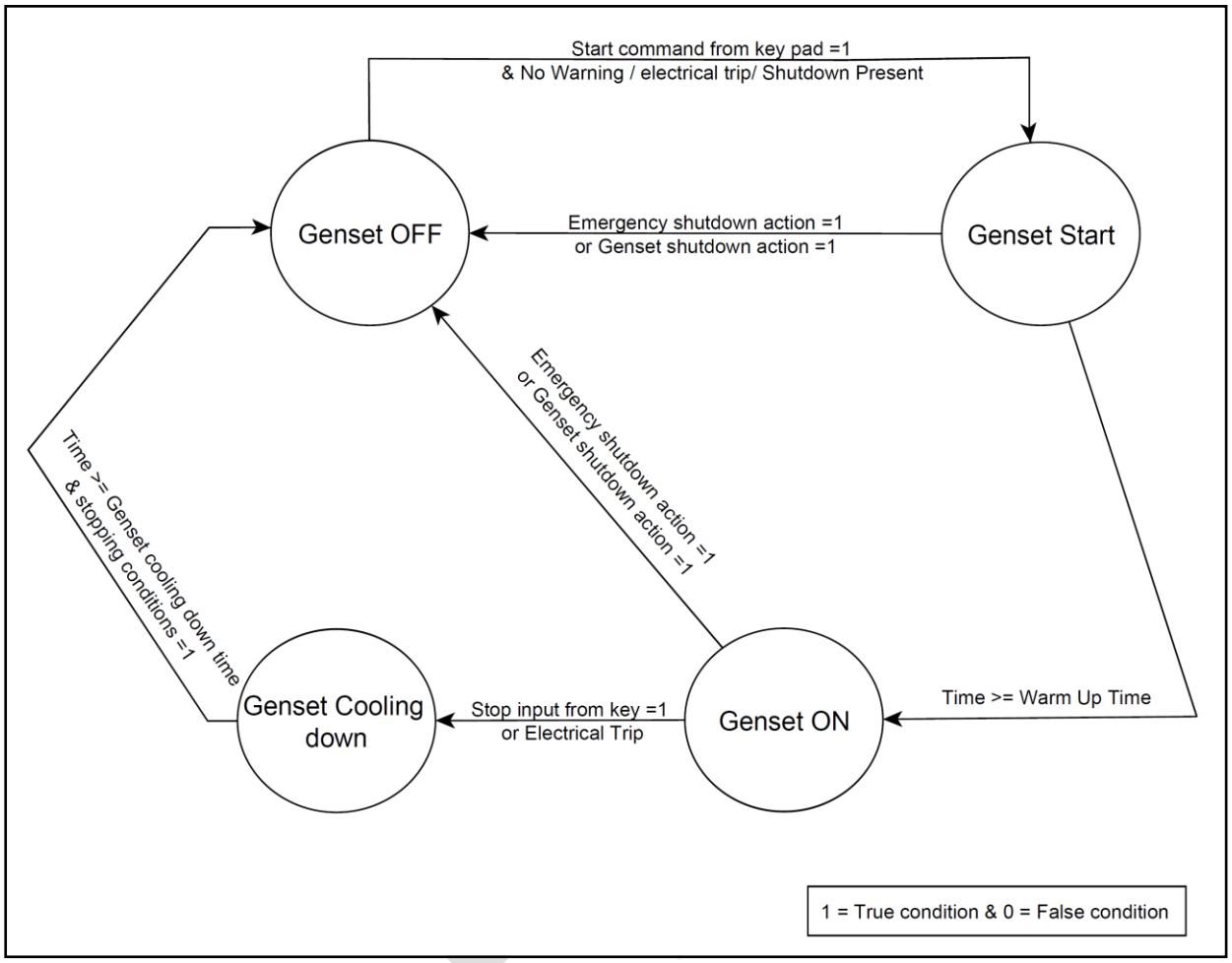

Figure 19: SMD for manual mode

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9 Alarms

GC1100 controller allows to configure several Shutdown/Electrical trip, Warning and Notification alarms such as Low Oil Pressure Shutdown, Over Load Warning and many more.

An alarm condition occurs when the preconfigured parameter is out of pre-set level. On initiation of an alarm, the Alarm LED will start blinking and Sounder alarm will be activated if configured. The controller will display name of alarms along with count on ALARMS screen and the nature of alarm on ENGINE STATUS screen. For acknowledging the alarms, press “UP + DOWN” keys simultaneously. All the alarms have activation from Engine ON i.e. after crank disconnect or Monitoring ON i.e. after completion of safety monitoring timer or Always. The controller will not issue the start command if the Warning, Electrical trip or shutdown alarm left unacknowledged. Table 27 shows the types of alarms whereas Table 28 shows various alarms their probable causes and remedial action.

Table 27: Alarm actions

#	Alarm Actions	Description
1	Notification	Controller will display message on the display screen and this will not affect the genset start stop operation.
2	Warning	Warning alarms serves to draw operator's attention to an undesirable condition without affecting genset's operation in genset ON condition. The genset cannot be started without acknowledging the warning alarms.
3	Electrical trip	In this alarm action type load is taken off from the genset, engine cooling timer begins, after which genset is stopped.
4	Shutdown	In this alarm action type load is taken off from the genset and the genset is immediately stopped by skipping Engine Cooling Time.

Table 28: Alarms and their causes

Sr. No.	Alarms	Causes	Action options
1	Low Oil Pressure Sensor	Indicates that the oil pressure measured is below the pre-set threshold	Shutdown/ Warning
	Low Oil Pressure Switch	Indicates that the oil pressure measured is below the pre-set threshold	Shutdown/ Warning/ Electrical trip/ Notification
2	High Oil Pressure Sensor	Indicates that the oil pressure measured is above the pre-set threshold	Warning
	High Oil Pressure Switch	Indicates that the oil pressure measured is above the pre-set threshold	Warning
3	High Engine Temperature sensor	Indicates that the engine temperature is above the pre-set threshold	Shutdown/ Warning
	High Engine Temperature switch	Indicates that the engine temperature is above the pre-set threshold	Shutdown/ Warning/ Electrical trip/ Notification
4	Low Fuel Level Sensor	Indicates that the amount of fuel level is below the pre-set threshold	Shutdown/ Notification
5	Low Fuel Level Switch	Indicates that the amount of fuel level is below the pre-set threshold	Shutdown/ Warning/ Electrical trip/

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Sr. No.	Alarms	Causes	Action options
			Notification
6	Low Water Level Switch	Indicates that radiator water level is below the pre-set threshold	Shutdown/ Warning/ Electrical trip/ Notification
7	Auxiliary Input/user defined name	Configured auxiliary input has triggered longer than pre-set duration	Shutdown/ Warning/ Electrical trip/ Notification
8	Anlg LOP Ckt Open	The oil pressure sensor is detected as not being present	Shutdown/ Warning/ Electrical trip/ Notification
9	Engine Temp Ckt Open	The temperature sensor is detected as not being present	Shutdown/ Warning/ Electrical trip/ Notification
10	Fuel Level Ckt Open	The fuel level sensor is detected as not being present	Shutdown/ Warning/ Electrical trip/ Notification
11	Fuel Theft	The fuel consumption has exceeded the pre-set threshold	Warning
12	Emergency Stop	Configured as digital input has triggered longer than pre-set duration or when the immediate shutdown is required	Shutdown
13	Fail To Stop	Indicates that genset has not stopped after sending Stop command	Shutdown
14	Fail To Start	Indicates that genset has not started after the pre-set number of Start attempts	Shutdown
15	R Phase Over Voltage	Indicates that genset L1(R) Phase voltage has exceeded the pre-set over voltage threshold.	Shutdown/ Warning
16	Y Phase Over Voltage	Indicates that genset L2(Y) Phase voltage has exceeded the pre-set over voltage threshold	Shutdown/ Warning
17	B Phase Over Voltage	Indicates that genset L3(B) Phase voltage has exceeded the pre-set over voltage threshold	Shutdown/ Warning
18	R Phase Under Voltage	Indicates that genset L1(R) Phase voltage has fallen below pre-set under voltage threshold.	Shutdown/ Warning
19	Y Phase Under Voltage	Indicates that genset L2(Y) Phase voltage has fallen below pre-set under voltage threshold	Shutdown/ Warning
20	B Phase Under Voltage	Indicates that geset L3(B) Phase voltage has fallen below pre-set under voltage threshold	Shutdown/ Warning
21	DG Phase Reversal	Alternator phase sequence (R-Y-B) is not correct	Shutdown/ Warning/ Electrical trip/ Notification

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Sr. No.	Alarms	Causes	Action options
22	Over Frequency	Indicates that genset output frequency has exceeded the pre-set threshold	Shutdown/ Warning
23	Under Frequency	Indicates that genset output frequency has fallen below the pre-set threshold	Shutdown/ Warning
24	Over Current	Indicates that genset current has exceeded the pre-set shutdown threshold	Shutdown/ Warning/ Electrical trip
25	Over Load	Indicates that the measured kW load rating has exceeded the pre-set threshold	Shutdown/ Warning/ Electrical trip/ Notification
26	Unbalanced Load	Load on any phase is greater or less than other phases by a threshold value	Shutdown/ Warning/ Electrical trip/ Notification
27	Over Speed	Indicates that genset speed has exceeded the pre-set over speed threshold	Shutdown
28	Gross over speed	Indicates that genset speed has exceeded the pre-set gross over speed threshold (This threshold is configurable percentage value of over speed threshold)	Shutdown
30	Under Speed	The engine speed has fallen below the pre-set RPM	Shutdown
31	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
32	Charge Fail	The charging alternator voltage has dropped below the supply voltage	Shutdown/ Warning/ Electrical trip/ Notification
33	V-Belt Broken Switch	Indicates that there is failure of the V-belt, which is driving the charging alternator	Shutdown/ Warning/ Electrical trip/ Notification
34	Battery Under Voltage	The battery voltage has fallen below the pre-set threshold	Shutdown/ Warning/ Electrical trip/ Notification
35	Battery Over Voltage	The battery voltage has exceeded the pre-set threshold	Shutdown/ Warning/ Electrical trip/ Notification
36	Filter Maintenance	Indicates that engine running hours has exceeded the pre-set hours limit or maintenance due date has occurred, and filter servicing is required.	Warning/ Notification
37	Mains Phase Reversal	Indicates the mains unhealthy condition	Notification

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10 Troubleshooting

Table 29: Common faults and their remedial actions

Sr. No.	Faults	Remedial Actions
Possible Issues in MANUAL Mode		
1	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.
2	The controller fails to crank-start the engine.	• Check the battery voltage. • Enter “configuration mode” in controller and verify the configuration for the “Start Relay” output. Also, check that “Start Relay” output is working correctly by measuring its output voltage. • Enter “configuration mode” in controller and verify the configuration of “CRANK DISCONNECT” method. • Verify the configuration of “LLOP SWITCH” polarity. Also, ensure that the 3+2n/4+2n switch & sensor are working OK. Check their wiring.
3	The “Emergency Stop” alarm comes up even when the “Emergency Stop” is not pressed.	• Check if the “Emergency Stop” switch is working OK. Check its wiring also. • Enter “configuration mode” in controller and verify the configuration of “EMERGENCY STOP” polarity.
4	The controller generates unnecessary “Shutdown Alarms” or “Warning Alarms”	• Check the respective switch/sensor and wiring. • Enter “configuration mode” in the controller and verify the respective threshold configuration.
5	The controller reports “Charge Fail” alarm.	• To check if the controller's charging alternator terminal is working or not: I. Disconnect the charging alternator wiring to the controller's terminal # 7. II. Short the terminal # 7 to the ground through a DC ammeter. III. Crank-start the engine. The DC ammeter should indicate the current in the range 200 - 400 mA for ~30 seconds. IV. If yes, the controller's charging alternator terminal is working OK. • Disconnect and re-connect the charging alternator and connection to the controller's terminal # 7. • Check if the charging alternator is working OK or not.
6	The controller issues unnecessary “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 “configuration mode” in the controller and verify the configuration for “START MODE” and the “START

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Sr. No.	Faults	Remedial Actions
		RELAY" output polarity.
7	The engine runs, but the controller shows genset to be "OFF".	• Check if the MPU signal (if used), and main alternator voltage signal (R phase) are received by the controller terminals. • Check if the LOP and LLOP are working OK. Also check their wiring to the controller.
8	The controller displays 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).
9	The controller displays 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.
10	Controller displays incorrect reading for any of LOP, Fuel Level, Temperature sensors.	• Check respective sensor and its wiring. • Enter "configuration mode" in the controller and verify the calibration for the respective sensor in configuration.
11	The controller displays incorrect engine RPM.	• Check the MPU connection and configuration (if enabled). • Check wiring of the main alternator's R-phase and neutral to the controller.
12	The controller screen freezes or hangs up.	• Reset the controller power.
Possible Issues in AUTO Mode		
13	The controller does not start the engine even when a "Remote Start" command is sent from an external device such as a telecom PIU.	• Check the wiring of the "Remote Start" signal to the controller's respective digital input terminal. • Enter "configuration mode" in the controller and verify the configuration for the "Remote Start" digital input terminal. • Check that the controller is in "Auto" mode.
14	Controller does not stop engine even when a "Remote Stop" command is sent from an external device such as a telecom PIU.	• Check the wiring of the "Remote Stop" signal to the controller's respective digital input terminal. • Enter "configuration mode" in the controller and verify the configuration for the "Remote Stop" digital input terminal. • Check that the controller is in "Auto" mode.
15	While in Auto mode, controller issues "Start" command even if the mains present.	• Check the wiring of the mains R, Y and B phase to the controller's respective input terminal. • Enter "configuration mode" in the controller and verify the configuration for the "MAINS MONITORING".

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Communications Protocol

11 Introduction to Communication Protocol

GC1100 genset controller support two communication protocol: a custom protocol based on MODBUS over a RS485 layer and a custom protocol over a CAN layer.

12 RS485 MODBUS Based Protocol

GC1100 genset controller implement a custom protocol based on standard MODBUS protocol. It operates in a slave mode and responds to commands received from an external MODBUS master. The details of the protocol are as shown below.

12.1 Connection Details

The RS485 port on GC1100 controller supports the MODBUS RTU protocol.
The format for communication of each byte is as follow:
1 start bit, 8 data bits, least significant bit sent first, 1 parity bit for even/odd parity; no parity bit for no parity, 1 stop bit, Cyclical Redundancy Check (CRC).

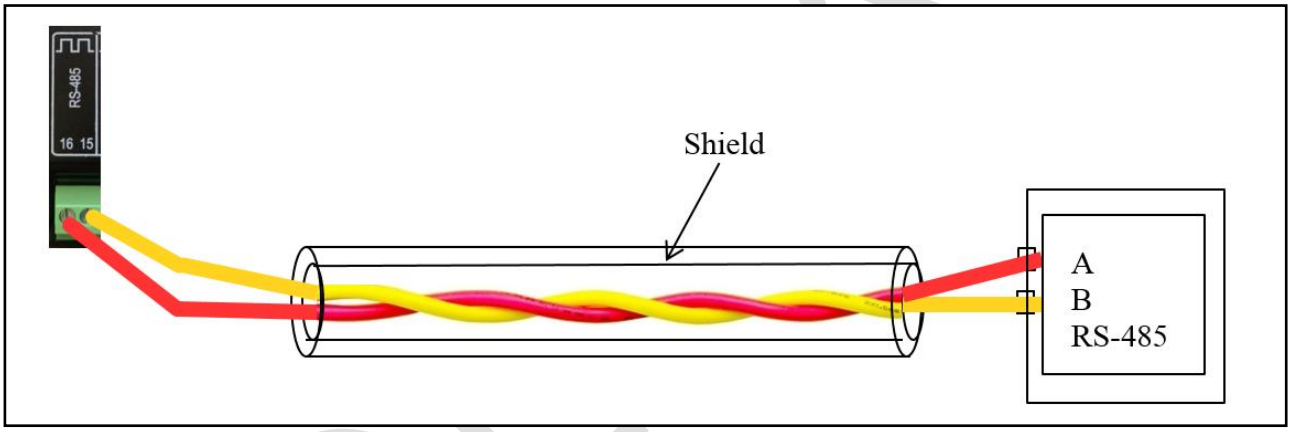

Figure 20: RS485 MODBUS connection with the help of two core shielded twisted pair cable

NOTE:	The transmission mode used by GC1100 controller is MODBUS RTU (not MODBUS ASCII). The byte format for communication is 1 start bit, 8 data bits, with/without parity bit and 1 stop bit. The baud rate is selectable between 1200 kbps to 115200 kbps through the configuration options. Similarly, the slave ID can be selected through the configuration options.

RS485 MODBUS communication configuration setting is as shown in Table 30

Table 30: RS485 MODBUS communication configuration setting

RS485 Communication	
Slave ID	1-247
Baud Rate (bps)	1200/2400/4800/9600/19200/38400/57600/115200
Parity	None/Even/Odd
Stop Bit	1, 2

SEDEMAC GC1100 genset controller operates as a MODBUS slave that responds to certain commands received from the MODBUS master.

RS485 MODBUS communication is initiated by a Master with a query to a Slave. The Slave which is constantly looking for Queries from master will recognise only the Queries addressed to it and will respond either by performing an action or by returning a response. Only the Master can initiate a query.

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12.2 Precautions

- Keep the slave ID of the GC1100 controller and SMPS same, take the slave ID from the SMPS and configure the same ID in GC1100.
- Enable the GC1100 in the configuration of the SMPS after hardware connections are made, so the SMPS can communicate with the GC1100.
- Connect the Pin # 16 & 15 (A & B) of the GC1100 to the pin # A & B of the SMPS respectively and not with any other pin.
- Use two core shielded cable for connection.
- Use different colour wires for Pin # 16 & 15 (A & B) for easy detection and connection.
- Route the Pin # 16 & 15 (A & B) wires properly ensuring they do not get short with any other wires.
- Do not use multi strand wires for the connection.

12.3 Function Code Used

Function code is a part of MODBUS message that defines the action to be taken by the Slave.

SEDEMAC GC1100 supports following functions;

Table 31: Details of function codes

Function Code	MODBUS Name	Description
03	Read holding register	Reads one or more 16-bit from the slave device of read/write location
04	Read input register	Reads one or more 16-bit from the slave device of read/write location
16	Write holding register	Writes one or more 16-bit registers to the slave device

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.

12.3.1 Function 4 (0x04): Read Input Registers

This function is used to read measurement parameters and status from the genset controller. The command-response pattern is as shown in Table 32 and Table 33.

Table 32: Command from MODBUS master for Function 4

Byte	Field	Remarks
0	Slave address	As configured in genset controller
1	Function code (0x04)	
2	First register address – high byte	16-bit register address, register address map is described in Table 38
3	First register address – low byte	
4	Number of registers to read – high byte	Number of registers to read must be between 1 to 255
5	Number of registers to read – low byte	
6/7	Error check CRC	

Table 33: Normal response from genset controller slave for Function 4

Byte	Field	Remarks
0	Slave address	As configured in genset controller
1	Function code (0x04)	
2	Byte count (n)	Equals to number of registers to be read times

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Byte	Field	Remarks
		two. 8-bit even number between 2 to 250
3	First register – high byte	
4	First register – low byte	
...	...	
1+n	Last register – high byte	
2+n	Last register – low byte	
3+2n/4+2n	Error check CRC	

12.3.2 Function 16 (0x10): Write Holding Registers

This function is used to issue certain commands to the controller. The command-response pattern is as shown in Table 34 and Table 35.

Table 34: Command from MODBUS master for Function 16

Byte	Field	Remarks
0	Slave address	As configured in genset controller
1	Function code (0x10)	
2	First register address – high byte	16-bit register address, register address map is described in Table 38
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	

Table 35: Normal response from genset controller slave for Function 16

Byte	Field	Remarks
0	Slave address	As configured in genset controller
1	Function code (0x10)	
2	First register address – high byte	16-bit register address, register address map is described in Table 38
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	

12.3.3 Function 3 (0x03): Read Holding Registers

This function is used to read holding registers that is the commands that have been issued to the controller. The command-response pattern is as shown in Table 36 and Table 37.

Table 36: Command from MODBUS master for Function 3

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

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Byte	Field	Remarks
2	First register address – high byte	16-bit register address, register address map is described in Table 38
3	First register address – low byte	
4	Number of registers to read – high byte	Number of registers to read must be between 1 to 255
5	Number of registers to read – low byte	
6/7	Error check CRC	

Table 37: Normal response from genset controller slave for Function 3

Byte	Field	Remarks
0	Slave address	As configured in genset 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	
4	First register – low byte	
...	...	
1+n	Last register – high byte	
2+n	Last register – low byte	
3+2n/4+2n	Error check CRC	

12.4 Register Map

The register map for input registers is as shown in Table 38

Table 38: Register map for input registers

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 R frequency	0.1	Hz	Unsigned
8	Generator Y frequency	0.1	Hz	Unsigned
9	Generator B 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

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Register Address	Parameter	Scale Factor	Unit/Interpretation	Bits/ Sign
18	Mains L2-L3 voltage	0.1	V	Unsigned
19	Mains L3-L1 voltage	0.1	V	Unsigned
20	Mains R frequency	0.1	Hz	Unsigned
21	Mains Y frequency	0.1	Hz	Unsigned
22	Mains B 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	0.1	kW	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	Deg C	Unsigned
53	Fuel level	0.1	%	Unsigned
54	Fuel in Lit	1	Lit	
55	Charge alternator voltage	0.1	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	Eng run hrs	1	Hrs	Unsigned
61	Eng run min	1	Min	Unsigned
62	Mains run hrs	1	Hrs	Unsigned

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Register Address	Parameter	Scale Factor	Unit/Interpretation	Bits/ Sign
63	Mains run min	1	Min	Unsigned
64	**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
65	**Alarm 2**			
	Under speed	--	--	13/16-16/16
	Over speed	--	--	9/16-12/16
	Fail to start	--	--	5/16-8/16
	Fail to stop	--	--	1/16-4/16
66	**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
67	**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
68	**Alarm 5**			
	Charge alternator failure	--	--	13/16-16/16
	Maintenance	--	--	9/16-12/16
	Reserved	--	--	5/16-8/16
	Reserved	--	--	1/16-4/16
69	**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
70	**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
71	**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

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Register Address	Parameter	Scale Factor	Unit/Interpretation	Bits/ Sign
72	**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
73	**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
74	**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
75	**Alarm 12**	--		
	Fuel level Open Circuit	--	--	13/16-16/16
	V belt broken	--	--	9/16-12/16
	Extended over load trip	--	--	5/16-8/16
	High oil pressure detected	--	--	1/16-4/16
76	**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
77	**DG status**			
	GCU Mode		Config (1)/Run (0)	16/16
	Mains Healthy / unhealthy		True (1) / False (0)	15/16

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Register Address	Parameter	Scale Factor	Unit/Interpretation	Bits/ Sign
	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
78–81	**Current time stamp**	--	Current EPOCH time	

NOTE:	Actual value = Observed value on MODBUS interface multiplied with scale factor

The register map for holding registers is as shown in Table 39

Table 39: Register map for holding registers

Register Offset	Description	Note	Bits/ Sign
0	Command Register	Send (0x01) to Start DG. Send (0x02) to Stop DG. Command Status is updated in Status register.	Unsigned
1	Operating Mode	Send (0x01) to toggle Current mode of operation between the Auto mode and the Manual mode. Auto Mode is to operate DG remotely. Manual is to operate DG through key-press events.	Unsigned

The interpretation of alarm status (registers 54-69 in Table 38) is as shown in Table 40.

Table 40: 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

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Value of Register	Interpretation
5	Notification
6 – 14	Reserved
15	Unimplemented

13 Protocol for CAN-Based Communication

GC1100 genset controller implement a CAN-based protocol that can be used for reading the measurement values, status of alarms and derived computations (such as cumulative power), as well as for sending mode change and start-stop commands to the controller. Details of the communication protocol are as described below.

13.1 Connection Details

Baud rate used for communication is 250 kbps. The 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.

13.2 Structure of Communication

The controller continuously broadcasts measurement values, status of alarms/commands and derived computations. Additionally, a set of commands can be sent to the controller. Response to the commands is a part of the data that is broadcasted. Table 42 shows the structure of the broadcasted message.

Table 41: Structure of communication

Register Offset	Page No.	Value for GC1100	Scale Factor	Unit	Bits/ Sign
0	Page 0	Protocol revision	-	-	Unsigned
1		Generator L1-N voltage	1	V	Unsigned
2		Generator L2-N voltage	1	V	Unsigned
3	Page1	Generator L2-L3 voltage	1	V	Unsigned
4		Generator L1-L2 voltage	1	V	Unsigned
5		Generator L3-N voltage	1	V	Unsigned
6	Page2	Generator L3-L1 voltage	1	V	Unsigned
7		Generator Y frequency	1	Hz	Unsigned
8		Generator R frequency	1	Hz	Unsigned
9	Page 3	Generator power factor L2	1	--	Unsigned
10		Generator B frequency	1	Hz	Unsigned
11		Generator power factor L1	1	--	Unsigned
12	Page 4	Mains L1-n voltage	1	V	Unsigned
13		Generator power factor L3	1	--	Unsigned
14		Generator average power factor	1	--	Unsigned
15	Page 5	Mains L1-L2 voltage	1	V	Unsigned
16		Mains L2-n voltage	1	V	Unsigned
17		Mains L3-n voltage	1	V	Unsigned
18	Page 6	Mains R frequency	1	Hz	Unsigned
19		Mains L2-L3 voltage	1	V	Unsigned
20		Mains L3-L1 voltage	1	V	Unsigned

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Register Offset	Page No.	Value for GC1100	Scale Factor	Unit	Bits/ Sign
21	Page 7	Load L1 current	1	A	Unsigned
22		Mains Y frequency	1	Hz	Unsigned
23		Mains B frequency	1	Hz	Unsigned
24	Page 8	Load L1 watts	1	kW	Unsigned
25		Load L2 current	1	A	Unsigned
26		Load L3 current	1	A	Unsigned
27	Page 9	Load total watts	1	kW	Unsigned
28		Load L2 watts	1	kW	Unsigned
29		Load L3 watts	1	kW	Unsigned
30	Page 10	Load L2 VA	1	kVA	Unsigned
31		Percentage Load	10	kW	Unsigned
32		Load L1 VA	1	kVA	Unsigned
33	Page 11	Load L1 VAR	1	kVAR	Unsigned
34		Load L3 VA	1	kVA	Unsigned
35		Load total VA	1	kVA	Unsigned
36	Page12	Load L2 VAR	1	kVAR	Unsigned
37		Load L3 VAR	1	kVAR	Unsigned
38		Load total VAR	1	kVAR	Unsigned
39-40	Page 13	Generator cumulative energy	0.1	kWh	Unsigned
41-42	Page 14	Generator cumulative apparent energy	0.1	kVAH	Unsigned
43-44	Page 15	Generator cumulative reactive energy	0.1	kVArh	Unsigned
45-46	Page 16	Mains cumulative energy	0.1	kWh	Unsigned
47-48	Page 17	Mains cumulative apparent energy	0.1	kVAH	Unsigned
49-50	Page 18	Mains cumulative reactive energy	0.1	kVArh	Unsigned
51		Oil pressure	1	Bar	Unsigned
52	Page 19	Fuel in LIT	1	Lit	Unsigned
53		Coolant temperature	1	Deg C	Unsigned
54		Fuel level	1	%	Unsigned
55	Page 20	Charge alternator voltage	1	V	Unsigned
56		Battery voltage	1	V	Unsigned
57		Engine speed	1	RPM	Unsigned
58	Page 21	No of starts	1	--	Unsigned
59		No of trips	1	--	Unsigned
60		Eng run hrs	1	Hrs	Unsigned
61	Page 22	Eng run min	1	Min	Unsigned
62		Mains run hrs	1	Hrs	Unsigned
63		Mains run min	1	Min	Unsigned
64	Page 23	Alarm 1			

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Register Offset	Page No.	Value for GC1100	Scale Factor	Unit	Bits/ Sign
		Low oil pressure		E-0001/0001 W-0010/0010 S-0011/0011	13/16-16/16
		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-0101/0101 S-0011/0011	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
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
			--	--	
67	Page 24	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	5/16-8/16

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Register Offset	Page No.	Value for GC1100	Scale Factor	Unit	Bits/ Sign
				E-0100/0100 S-0011/0011	
		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
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
			--	--	
70	Page 25	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
71		Alarm 8	--		

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Register Offset	Page No.	Value for GC1100	Scale Factor	Unit	Bits/ Sign
		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
73	Page 26	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

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Register Offset	Page No.	Value for GC1100	Scale Factor	Unit	Bits/ Sign
		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 over load 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
76	Page 27	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
		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

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Register Offset	Page No.	Value for GC1100	Scale Factor	Unit	Bits/ Sign
		Digital output f	--	1/0	2/16
		Unimplemented	--		1/16
77		DG Status	--		
		GCU 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
78–81	Page 28	Current time stamp			

Table 42: Structure of broadcasted message

Byte number	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

Table 43: Structure of command message

Byte number	Byte contents
0	Command ID
1	Command parameters
2	Reserved
3	Reserved
4	Reserved
5	Reserved
6	Reserved
7	Reserved

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13.3 Packet Structure

Table 44: 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 Current mode of operation between the Auto mode and the Manual mode. Auto Mode is to operate DG remotely. Manual is to operate DG with through key-press events.	Unsigned

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