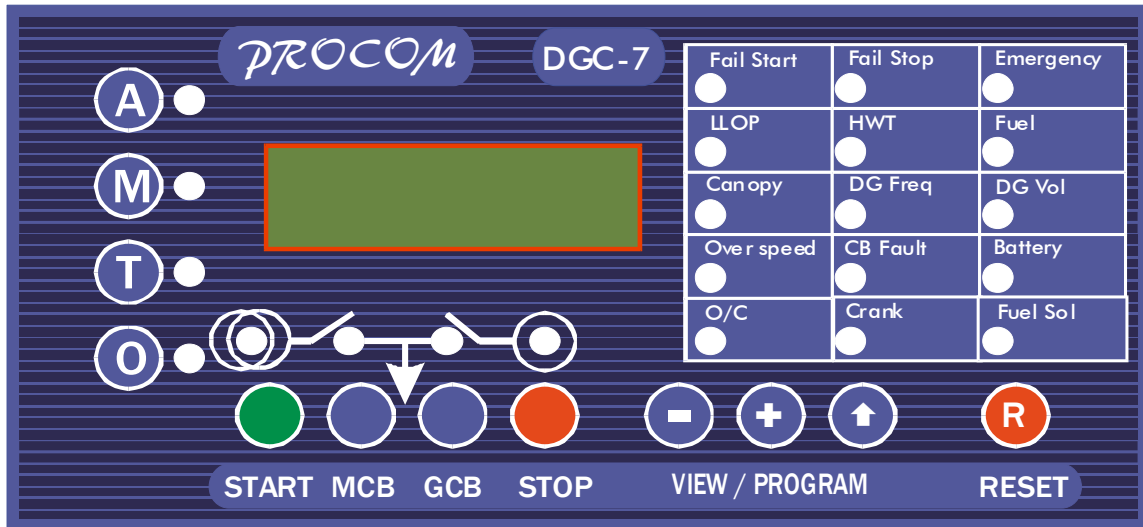




OPERATING INSTRUCTION: DGC-7



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DGC-7

Digital Genset Controller

1 Introduction

- The Microprocessor / microcontroller based DGC-7 automatic generator start and supervisory device is designed keeping in view the ease of operation.
- Housed in 192 x 96 flush mounted enclosure, is a compact, feature rich & easy to use AMF.
- All the functions of AMF units are built in to the one single compact device, resulting in simplified panel wiring and size reduction.
- True RMS measurement of voltage with high measurement accuracy.
- Liquid Crystal Display (LCD) with backlit for easy setting and reading
- Withstand a dip of auxiliary supply to 0V for greater than 1 Sec. This avoids malfunctioning of AMF because of voltage dip during engine cranking.
- DGC-7 is available in many variants to suit the diversified and varying system requirements.

2 Salient features of the DGC-7

2.1 Protection & Supervision:

- 3 phase Under & Over, voltage, frequency and voltage unbalance protection for EB supply (True RMS measurement for Voltage)
- Phase under & over, voltage and frequency protection of Generator supply(True RMS measurement for voltage)
- User programmable Cranking attempt.
- User programmable Crank Time and delay between two successive cranks
- User programmable load transfer to DG delay.
- Generator over speed supervision
- Mains Restoration supervision
- DC Battery Voltage supervision (Under & Over voltage)
- External fault detection (5 digital inputs)
- Two Circuit breaker check back inputs.
- External engine running signal
- External signal for remote operation
- DG Fail to start supervision and indication
- DG fail to stop supervision and indication
- Unit remains fully operational even if battery voltage falls to zero volts for one sec.

2.2 Measurement & Display.

DGC-7, equipped with 16 Segment, 2line LCD display, displays:

- EB voltages of RYB phase and frequency
- Generator voltage and frequency
- DC battery voltage
- Run Hour time
- Programmed values

The display shows the mains voltage parameters while the mains is healthy and automatically switches over to display the generator parameters while the generator is running.

2.3 LED Indication

- Load on generator (GON)
- Load on EB (MON)
- EB healthy/Unhealthy
- Generator On
- Selected mode (Auto, Manual, Test or Off)
- DG Fail to start (FST- fault)
- DG Fail to stop (FSP- fault)
- Emergency (Shut down Command)
- LLOP (Fault)
- HWT(Fault)
- Fuel (Fault)
- DG frequency(Fault)
- DG Voltage (Fault)
- DG Over Speed (Fault)
- Circuit breaker latched (Fault)
- Battery (Warning)
- Over Current (Annunciation, active only in model with Current feature)
- Crank (Annunciation)
- Fuel Sol (Annunciation)
- Auto (A) (Annunciation)
- Manual (M) (Annunciation)
- Test (T) (Annunciation)
- Off (O) (Annunciation)

2.4 Timers

Following timers are incorporated in the DGC-7

- EB Voltage Unhealthy supervision time (variable)
- EB Frequency Unhealthy supervision time(variable)
- EB Voltage Unbalance supervision time (variable)
- Generator Voltage unhealthy supervision time (variable)
- Generator frequency unhealthy supervision time (variable)
- Max. cranking time (variable)
- Crank gap time (variable)
- No of crank attempts (variable)
- Load change over to DG delay

- Mains restoration time (variable)
- DG recooling time (variable)
- Stop Solenoid on time (variable)
- Fuel supervision time (variable)
- LLOP supervision time (variable)
- HWT supervision time (variable)
- Generator over speed supervision timer (Variable)
- Auxiliary Supply Under/Over Voltage supervision & warning time (Fixed)
- Circuit breaker check back timer (fixed 10 Sec)
- Hooter Reset Time(variable)
- Canopy Temperature supervision time (Variable)

3 Operating Mode:

3.1 Auto Mode:

DGC-7 monitors the Mains supply, if Mains supply varies beyond set limit of under/over voltage or under/over frequency or voltage unbalance, for more than their individual supervision time delays; DGC-7 releases the MCB contactor (To protect the contactor in very low conditions and failure to start fault) and starts the generator.

To start the generator DGC-7 gives a cranking signal via potential free contact to starting motor, Crank command is withdrawn if it is detected that the engine has started either by external engine start input or by build up of generator voltage.

Max duration of crank command is user settable.

The maximum number of cranks is user programmable and if generator fails to start after the maximum programmed crank attempts are issued, fails to Start LED starts blinking indicating start failure fault and the hooter is switched on. After successful start of the generator, it is allowed to warm up for a user programmed time before the load is transferred to it.

While the generator is running DGC-7 monitors it for external fault (LLOP, HWT, Emergency ,Fuel and Canopy temperature) and internal faults of voltage and frequency un-healthiness.

On persistence of any fault for more than the supervision time delay programmed for that fault, generator is stopped by the DGC-7 & hooter is switched on.

On restoration of healthy EB supply for the set time duration the generator is stopped after re-cooling it for the user set re-cooling time.

Load changeover is done automatically by DGC-7.

3.2 Manual Mode:

Generator can be put into manual mode by selection of this mode. In this mode DGC-7 will ignore the mains unhealthy condition and shall not start the generator automatically. The generator has to be started manually by manually pressing “Start” key. The “Start” key shall not operate if GCB contact is closed, to provide protection to generator. Once the generator is started the load can be switched to generator by pressing “GCB” key. At any given time either of GCB or MCB can be operational. Attempt to switch on GCB while MCB is on will be ignored and vice versa. Both MCB and GCB key have dual function of either switching ON or

OFF the respective contactor. A press shall toggle the state. Continuously pressing these keys shall keep toggling the status. To stop the generator, switch off the GCB contactor and press “STOP” key. Any attempt to stop the generator, while the GCB contact is engaged, shall be ignored. While the generator is running DGC-7, protects the generator by monitoring all internal and external faults.

3.3 Off Mode:

This mode is selected to completely shut down the system. By default the load is transferred to Mains, but mains contactor can also be switched off manually.

3.4 Test Mode:

This mode helps the engineer to test the health of the engine. The engine can be started, as in auto mode, even when the mains voltage is healthy. The load is not transferred to the generator. In case of mains failure, while in this mode, the load is automatically transferred to the generator. Please note that the generator will not automatically switch off in this mode. To switch of the generator select either Auto, Manual or Off mode. “GCB” & “MCB” keys are active in this mode. DGC-7 protects the generator by monitoring all internal and external faults.

3.5 Remote Mode:

Remote mode is a subset of Auto mode. Till the Pin 11(REM pin) of DGC-7 is left open the unit works in Auto mode. In case REM pin is pulled low to battery negative DGC-7 is put in remote mode. In remote mode the unit shall not initiate the generator start process till REM pin is pulled low. On release of this pin along with mains unhealthy, the engine start process will be initiated. The generator shall stop either on mains become healthy or REM pin again going low. The engine shall stop after the re-cooling time. While the generator is running DGC-7, protects the generator by monitoring all internal and external faults.

Please note: Operating mode cannot be changed if the unit has stopped on a fault condition or the engine is cranking

4 Programming mode:

Programming mode can be entered any time by simultaneously pressing **+** & **■** keys. While in program mode, the first row of LCD displays parameter name under programming and second row contains the parameter value.. The following table details the various programmable parameters:

4.1 Setting table

Sl. No	Parameter Name on First Row of LCD	Explanation of parameter	Factory setting	Setting Range
1	Mains O/V	Max. Permissible voltage, above this the voltage is treated unhealthy & Generator is started.	270V	80-270V
2	Mains U/V	Min. permissible voltage, below this the voltage is treated unhealthy & Generator is started	180V	80-270V
3	Mains Sup Delay	Time for which the mains voltage has to be unhealthy (under or over voltage as defined above in 1 & 2) before starting the generator.	10Sec	0-999Sec
4	Mains O/F	Max. permissible mains frequency, above this frequency the mains is treated unhealthy & Generator is started.	55Hz	40-65Hz
5	Mains U/F	Min. permissible mains frequency, below this frequency the mains is treated unhealthy & Generator is started.	45Hz	40-65Hz
6	Mains Freq Delay	Time for which the mains frequency has to be unhealthy (under or over voltage as defined above in 4 & 5) before starting the generator..	10Sec	0-999 Sec.
7	Mains Vol Unbal	Max. permissible voltage difference between two phases of mains. Above this the voltage is treated to be unbalanced and generator is started.	40	10-100 Disable*
8	Unbalance Delay	Duration for which unbalance can be tolerated before starting the Generator.	10Sec	0-999Sec
9	Generator O/V	Max. permissible generator voltage, above this the generator voltage is treated unhealthy & the generator is stopped. Generator contactor is released and mains contactor is closed. Hooter shall be activated and DG Vol LED shall start flashing.	270V	80-270V
10	Generator U/V	Min. permissible generator voltage, below this the generator voltage is treated unhealthy & the generator is stopped. Generator contactor is released and	180V	80-270V

		mains contactor is closed. Hooter shall be activated and DG Vol LED shall start flashing.		
11	Gen Sup Delay	Duration for which generator over/under voltage condition can be tolerated before stopping the Generator.	10Sec	0-999Sec
12	Generator O/F	Max. permissible generator frequency, above this the generator frequency is treated unhealthy & the generator is stopped. Generator contactor is released and mains contactor is closed. Hooter shall be activated and DG Vol Freq shall start flashing.	55Hz	40-65Hz Disable*
13	Generator U/F	Min. permissible generator frequency, below this the generator frequency is treated unhealthy & the generator is stopped. Generator contactor is released and mains contactor is closed. Hooter shall be activated and DG Freq LED shall start flashing.	45Hz	40-65Hz Disable*
14	Gen Freq Delay	Duration for which generator over/under frequency condition can be tolerated before stopping the Generator.	10Sec	0-999 Sec.
15	No Of Crank	The maximum number of crank that shall be issued to start the generator	3	0-10
16	Crank Time	Maximum crank time	5Sec	0-25 sec
17	Crank Delay	The delay between two successive cranks	5Sec	0-100Sec
18	Change Over Delay	Generator warm up time. The load is transferred to generator after expiry of this time	10Sec	0-999Sec
19	Mains Rest Delay	The time for which mains should be continuously healthy before stopping the generator.	30Sec	0-999Sec
20	Gen Recool Time	The time for which generator is allowed to run on no load before switching off	30Sec	0-999Sec
21	Stop Sol On Time	The time for which stop solenoid will be kept active while stopping the engine	30Sec	0-999Sec
22	Fuel Delay	Duration for which the Fuel fault should be continuously present to be	2 Sec	0-999Sec

		recognized as a fault and action initiated		
23	LLOP Delay	Duration for which the LLOP fault should be continuously present to be recognized as a fault and action initiated	2 Sec	0-999Sec
24	HWT Delay	Duration for which the HWT fault should be continuously present to be recognized as a fault and action initiated	2 Sec	0-999Sec
25	Canopy Delay	Duration for which the Canopy Temperature fault should be continuously present to be recognized as a fault and action initiated	2 Sec	0-999Sec
26	Generator O/S	The maximum generator voltage frequency beyond which over speed is detected	65Hz	40-80Hz Disable*
27	Gen O/S Delay	Time for which over speeding is allowed	2 Sec	0-999Sec
28	DC O/V	Max. Permissible Auxiliary supply voltage. If auxiliary voltage is higher than this for 10sec the Battery LED starts blinking (only warning).	30V	10-40V Disable*
29	DC U/V	Min. Permissible Auxiliary supply voltage. If auxiliary voltage is lower than this for 10sec the Battery LED starts blinking (only warning).	10V	10-40V Disable*
30	Hooter Reset Tim	Duration for which the hooter shall be on, if not externally reset, while announcing a fault.	30Sec	0-999Sec

** This parameter can be disabled while programming. If disables it's not active*

4.2 **Programming Solenoid Mode:** For changing the solenoid mode first press © (reset) button, than simultaneously press +ve and –ve button while the reset button is pressed. The first row of LCD shall display “ FuelSolType”. There are two possible modes.

- a. **Mode 0:** In this mode fuel solenoid contact changes from NO to close at the time of cranking and remains close till the genset is running. For stopping the generator this contact opens.
- b. **Mode 1:** In this mode fuel solenoid contact remains open at the time of cranking and till the genset is running. For stopping the generator this contact closes for a user programmed time.

Don't change the mode while generator is running. It's a good practice to switch off and than switch on the battery supply after changing the mode.

5 Protection against Contactors Latching: A latched contactor is one of the major reasons of system failure. DGC-7 provided protection against latching of contactors. PROCOM takes feedback from the contactors, pin 13 & 19, and doesn't allow the next contactor to be engaged while the first is engaged. If the contactor doesn't closes or releases in 10 Sec (10 Sec to allow the proper operation of motorized contactors) a fault condition is generated along with the alarm. The corresponding LED, GCB /MCB start flashing.

6 Annunciations LED's Description:

S, No.	LED Nomenclature	Description
1	Fail Start	This LED blinks when the engine fails to Start.
2	Fail stop	This LED blinks when the engine fails to Stop.
3	Emergency	This LED blinks when the engine is Stopped by pulling emergency pin (Pin no. 17) low to immediately stop the engine.
4	LLOP	This LED blinks when the engine is stopped on LLOP fault.
5	HWT	This LED starts blinking when the engine is stopped on HWT fault.
6	Fuel	This LED blinks when the engine is stopped on Low Fuel fault
7	Canopy	This LED blinks when the engine is stopped on high canopy fault
8	DG Freq	This LED blinks when the engine is stopped on DG frequency fault
9	DG Vol	This LED blinks when the engine is stopped on DG Voltage fault
10	Over Speed	This LED blinks when the engine is stopped on DG over speed fault
11	CB Fault	This LED blinks if either GCB or MCB has latched up
12	Battery	This LED blinks when the auxiliary supply is outside the limits. Warning only.
13	O/C	This LED light up when DG is shutdown due to over current. This is active only in model with Current feature
14	Crank	This LED light up while the engine is being cranked.
15	Fuel Sol	This LED light up while the fuel solenoid is active
16	Mains	Steady while mains healthy else starts blinking
17	MCB	Steady when MCB is engaged. Blinks when MCB contactor develops fault
18	GCB	Steady when GCB is engaged. Blinks when GCB contactor develops fault
19	Generator	Steady while generator is running
20	Auto(A)	This LED is On if the unit is in Auto Mode

21	Manual (M)	This LED is On if the unit is in Manual Mode
22	Test Mode(T)	This LED is On if the unit is in Test Mode
23	Off (O)	This LED is On if the unit is in OFF Mode

7 Switches Description:

S.No.	Switch Symbol	Switch Function	Description
1	↑	Next	Normal operation mode: In this mode, next is used to change the parameters being displayed on LCD. Programming Mode: Next key is used to select the next parameter to be programmed.
2	+	Increment	This key is only active during programming mode and is used to increment the value of the parameter under programming.
3	-	Decrement	This key is only active during programming mode and is used to decrement the value of the parameter under programming.
4	R	Reset	Reset keys resets the Hooter and Fault signals. The first press shall reset the hooter and next shall reset the faults. A long press of 1 Sec shall reset both.
5	+ & -	Programming Mode Entry	If both the keys are pressed simultaneously the unit will enter in programming mode.
6	START		To start generator in manual mode
7	STOP		To stop generator in manual mode
8	MCB		In manual mode this transfers the load to Mains but switching on Mains contact Breaker
9	GCB		In manual mode this transfers the load to Mains but switching on Mains contact Breaker
10	(A)		To select Auto Mode
11	(M)		To select Manual Mode
12	(T)		To select Test Mode
13	(O)		To select Off Mode

- *(A), (M), (T) & (O) are Radio buttons and only one can be active at a time. Pressing an inactive switch will reset the active mode and select the new mode.*

8 **Faults:**

There are two categories of faults

- 1) Internal Faults
- 2) External faults

8.1 **Internal Faults:**

Internal faults are the faults, which do not need any external signals and are detected by the system itself. They are:

- i) Generator Fails to Start.
- ii) Generator Voltage Unhealthy
- iii) Generator Frequency Unhealthy.
- iv) Generator Over speed.
- v) Generator Fails to Stop.
- vi) Battery under or over voltage (Warning only).

8.2 **External Faults:**

Those faults which cannot be sensed by the unit itself (these faults are not reflected by the generator voltage) and are to be provided externally. They are:

- i) LLOP
- ii) HWT
- iii) Canopy Temperature
- iv) Fuel
- v) Emergency

8.3 **Fault Reset:**

- i) **Internal Faults & LLOP fault:** All internal faults and LLOP fault can be reset by pressing (R) (Reset Key) after the generator is stopped.
- ii) **External Fault except LLOP fault :** These faults cannot be reset till the engine is running and fault conditions persists. Once these conditions are satisfied the fault can be reset by pressing (R) (Reset Key).

Type of Contacts: All contacts are normally open (NO) type except the Mains Circuit breaker contact which is Normally Closed (NC) type.

9 **Lamp Test :**

Switching on the power of the unit with RESET key pressed shall force all the annunciation LEDs to blink till the key is kept pressed

10 **Optional Features:** DGC-7 can be supplied with following optional features:

10.1 Potential free Annunciations:

6 Potential free contacts for annunciation: These annunciations can be interfaced with System SCADA for remote monitoring of the genset. The following annunciations are provided:

- i) ANN1: Fail to start
- ii) ANN2: Fail to stop
- iii) ANN3: LLOP and or HWT
- iv) ANN4: Fuel
- v) ANN5: Engine fault (Engine over/under voltage, under/over frequency or over speed)
- vi) ANN6: Mains Unhealthy (Voltage, frequency or unbalance)

10.2 Communication:

Half Duplex, RS232 communication running in slave mode: The communication can be used for the following:

- Programming the parameters
- Reading instantaneous parameters
- Reading system conditions
- Reading fault status.

10.3 Other Models:

10.3.1 UPS voltage and room temperature monitoring with DG start and Stop control

10.3.2 Single phase over Current Measurement, Display and Protection.

10.3.3 Canopy Temperature measurement , display and controls

10.3.4 Custom design

11 Terminal description

Terminal Number	Description
1	Mains R Phase Voltage
2	Mains Y Phase Voltage
3	Mains B Phase Voltage
4	Mains Neutral
5	Generator voltage
6	Generator Neutral
7	N.C
8	N.C.
9	N.C
10	N.C
11	Remote
12	Engine Running(Started)
13	HWT
14	Fuel

15	Canopy Temperature
16	Emergency
17	LLOP
18	MCB Check Back
19	GCB Check Back
20	Auxiliary supply +ve
21	Auxiliary supply -ve
22,23	Mains Circuit Breaker
24,25	Generator Circuit Breaker
26,27	Crank
28	Hooter
29	Common for hooter and fuel
30	Fuel
31	ANN1 (Optional)
32	ANN2 (Optional)
33	Common for ANN1 & ANN2
34	ANN3 (Optional)
35	ANN4 (Optional)
36	ANN5 (Optional)
37	ANN6 (Optional)
38	Common for ANN3 – ANN6

12

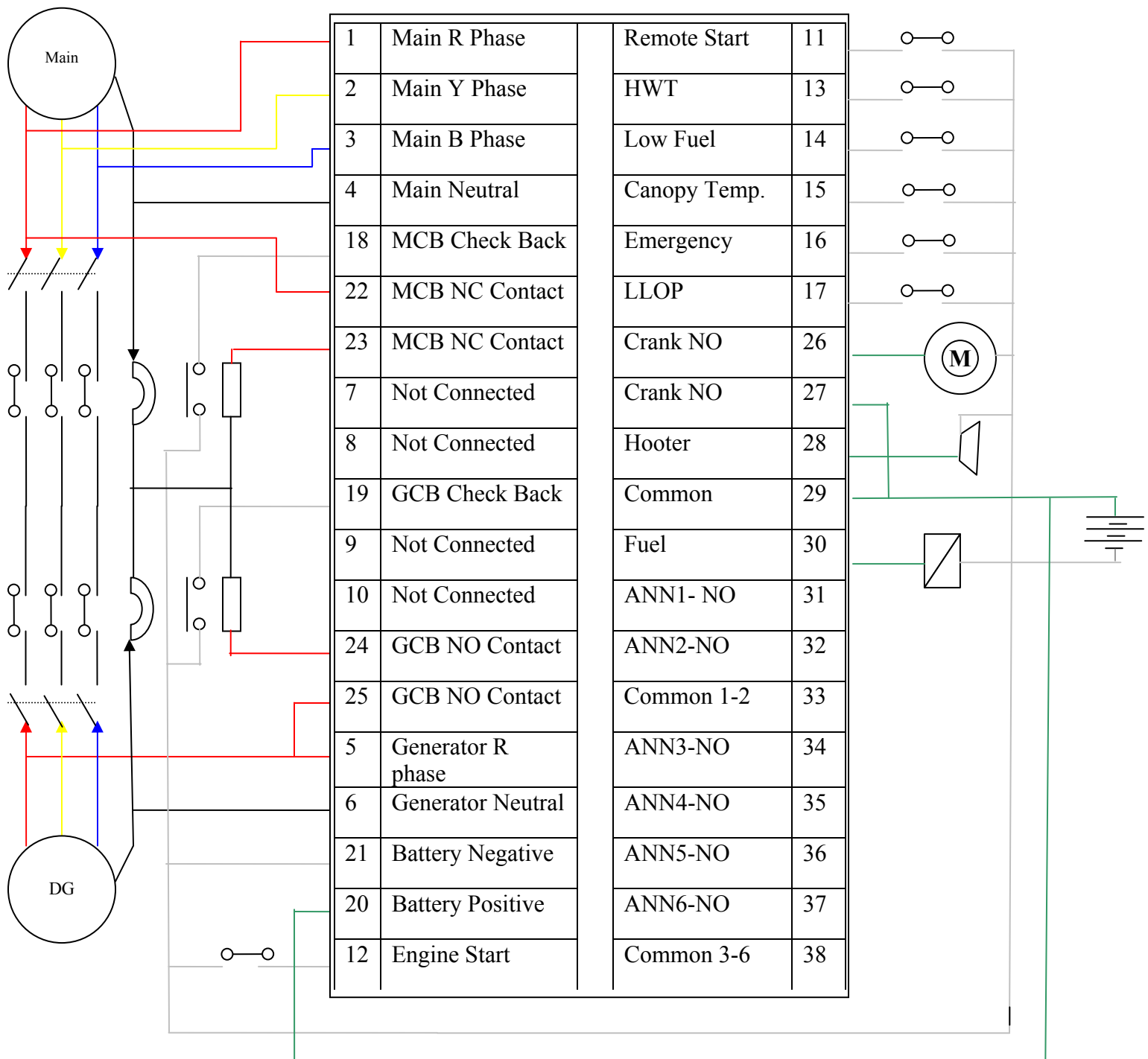
Specifications

AC voltage withstand	330 VAC continuously (Phase to neutral)
Measurement Accuracy	1%
Surge 1.2/50Usec	2.5KV
Battery Voltage	Suitable for 12V/24 VDC System
Min. voltage to power on	9V
Min Running Voltage after Power on	5V
Max. Battery Voltage	35V
DC Interruption time	1 Sec.
Contact(MCB)	NC, 230V / 6A
Contact(GCB)	N0, 230V / 6A
Contact(Hooter)	N0, 230V / 6A
Contact(Fuel)	N0, 230V / 6A
Contact(Crank)	N0, 230V / 6A
Contact(Ann 6 Nos)	N0, 230V / 1A
Cut out Dimensions	186mm X 90mm
Depth	120mm
Digital Input Level	Battery Voltage (Negative)

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Model Selection :

1. Basic model	DGC-7
2. Basic Model + Annunciation	DGC-7A
3. Basic Model + Communication	DGC-7C
4. Basic Model + Annunciation+ Communication	DGC-7AC



It is our endeavour to constantly upgrade our products, hence specifications are subject to changes without any notice.