

Installation and Operating Manual GEN-KEY

Key-operated Automatic Start Unit



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Warning: The unit contains no user-serviceable items. However the GEN-KEY does contain exposed parts carrying high voltages (derived from the alternator). Any servicing must be carried out by technicians specifically trained on this type of equipment.



Section 1 Introduction

The GEN-KEY Unit provides basic control and protection in the operation of a generator set. The unit allows starting and stopping of the engine and indicates status and fault conditions. The unit monitors:

- Engine temperature,
- Oil pressure,
- Charging generator output and
- Alternator output (voltage and frequency).

It controls:

- Engine fuel supply, via a solenoid
- Starter motor, via a relay.
- Preheating, via a relay (where applicable)
- Alarm horn

In the event that the engine fails to start on a first attempt, up to two more start attempts are made.

If a fault is detected, the unit shuts down the engine and indicates the failure by flashing a relevant fault LED.

An On/Off key switch controls module operation and an Engine Start button initiates engine cranking.

Remote fuel and start inputs provide for remote control of the engine. The unit incorporates a preheat control output.

Two user-defined inputs are included. Spare 1 lights a red LED on the panel and shuts down the engine. Spare 2 only lights a red LED on the panel.

Section 2 Installation

2.1 Unpacking

Carefully unpack the unit and check for damage. Retain the packing in case of future need, e.g. for returning the unit for calibration.

Check the contents, as follows:

- One GEN-KEY unit.
- Two Keys
- Operating Manual.
- Screw clamp electrical connectors
- Panel mounting clamps.

Report any shortage or damage to your local sales office as soon as possible.

2.2 Unit Configuration

Set the DIP switches on the rear panel to control the mode of operation of the GEN-KEY as follows. To access the DIP switches, lift the hatch beneath the label on top of the unit.

Switch	Function	On position	Off position
1	Horn duration	Continuous	60 seconds
2	Preheat	Enable	Disable
3	Nominal alternator frequency	50 Hz	60 Hz
4	Nominal alternator voltage	115V	230V

For engine start detection, the GEN-KEY assumes that the engine has started when any of the inputs is present.

Warning : The generator can be started remotely via the Remote Start/Stop input if the Remote Fuel Input is high, irrespective of the position of the Key switch on the front panel of this unit. When using the remote start feature, the installer should connect audible and visible warning devices to meet local safety codes and ensure that personnel are warned prior to commencing a remote starting sequence.



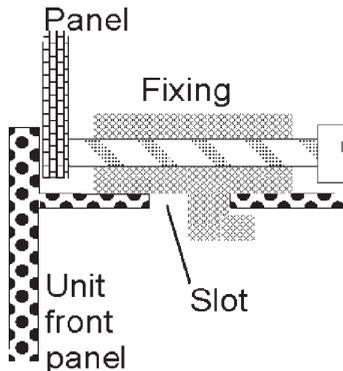
Warning: Beware of the high voltages connected to this unit.

2.3 Mechanical Installation

The unit is designed for panel mounting. Fixing is by two screw fixings.

1. Remove the fixings from the unit, if fitted, and unscrew the screws in the fixings.
2. Insert the unit in the panel cut-out from the front.
3. Insert the fixings in the slotted at the diagonal corners of the unit and tighten the fixing screws to secure the unit against the panel. See Figure 2.1. Ensure that the unit is properly secured.

Figure 2.1 Fixing



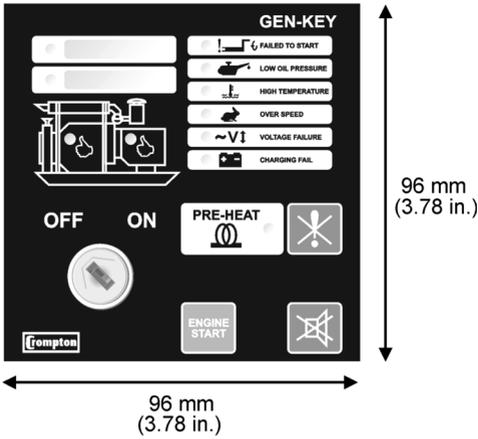


Figure 2.2 Front panel size

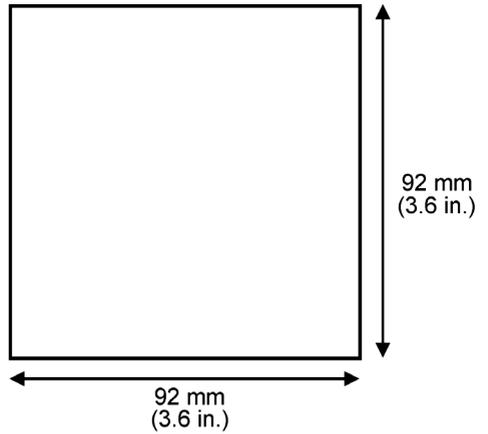


Figure 2.3 Cut-out

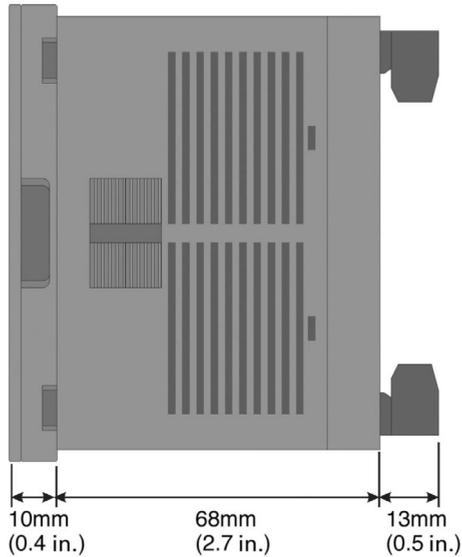


Figure 2.4 Side view

2.4 Electrical Connections

Warning: Beware of the high voltages connected to this unit.

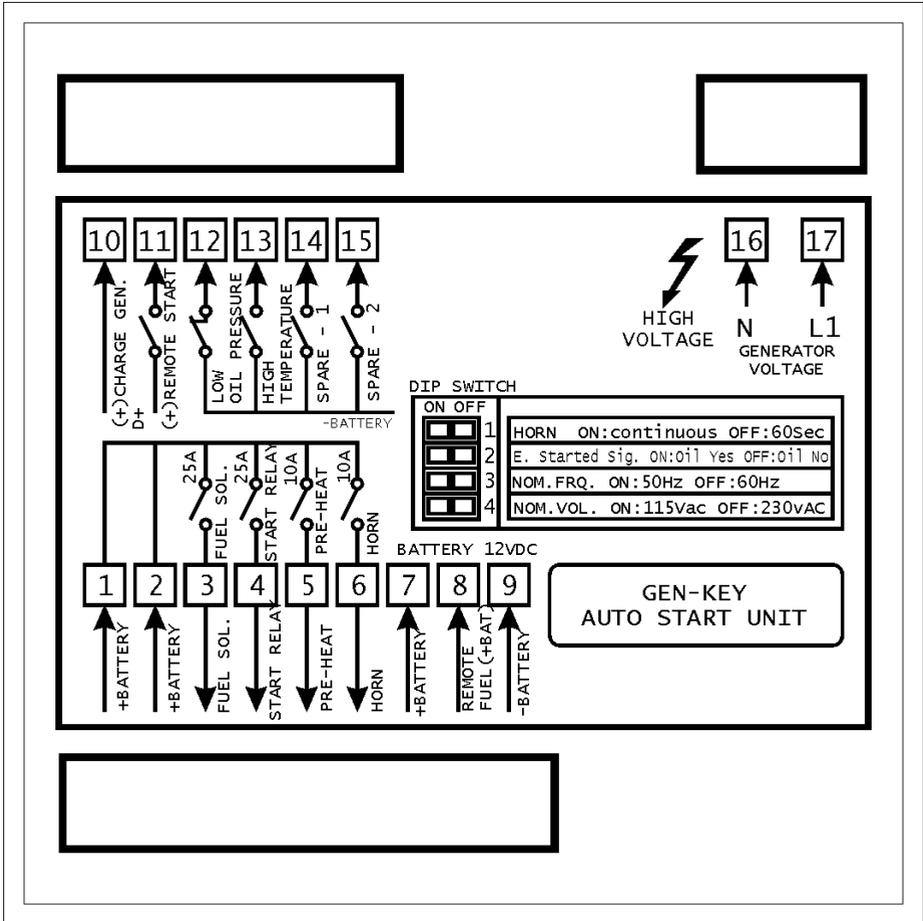


Figure 2.5 Rear view

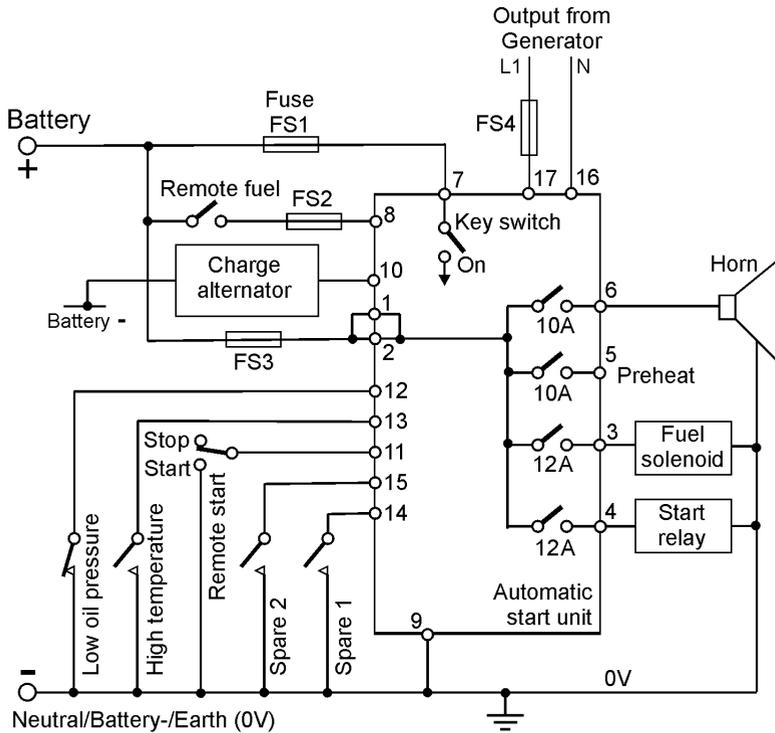


Figure 2.6 Connections schematic

Connect the unit as shown in Figure 2.6. Be sure to connect the battery supply the right way round. Note that the mains and generator neutral must be connected to the battery negative.

The fuses should be as follows:

- FS1 1A
- FS2 1A
- FS3 As necessary to power the horn and solenoids.
- FS4 1A

Table 1 shows the connections and recommended cable sizes. Table 2 describes the functions of the connections.

Table 1 Unit wiring

Pin	Description	Cable size (mm)	Notes
1,2	Positive battery supply input	2.5	Supplies horn and external solenoids
3	Output to Fuel solenoid	2.5	+ DC supply from pins 1 & 2
4	Output to Start relay	2.5	+ DC supply from pins 1 & 2
5	Output to Preheat	2.5	+ DC supply from pins 1 & 2
6	Output to horn	2.5	+ DC supply from pins 1 & 2
7	Positive battery supply to Unit	1.0	+12V or +24V
8	Input from remote fuel switch	0.5	Switch to +batt to enable remote start/stop. See Section 2.4.2 Remote Control.
9	Negative battery supply to Unit	1.0	0V
10	Charge generator output	1.0	Pin 10 must be left unconnected if not used. See Section 2.4.1 Charge Generator current.
11	Input from Remote Start/Stop switch	0.5	Switch to 0V to start. See Section 2.4.2 Remote Control.
12	Input from Low Oil Pressure switch	0.5	Switch to 0V.
13	Input from High Temperature switch	0.5	Switch to 0V.
14	Input from Spare switch 1.	0.5	Switch to 0V.
15	Input from Spare switch 1.	0.5	Switch to 0V.
16	Neutral input from alternator	1.0	Do not connect unless alternator under/over voltage or speed function is used.
17	L1 input from alternator	1.0	

Table 2 Connection functions

Pin	Function
1,2	Positive battery input. Feeds external solenoids and indicators.
3	Output to Fuel solenoid. +DC from pins 1 & 2. Controls fuel to engine.
4	Output to Start relay. +DC from pins 1 & 2. Controls starter motor.
5	Output to Preheat solenoid. +DC from pins 1 & 2. Controls engine preheating, if required.
6	Output to horn. +DC from pins 1 & 2. Alarm output.
7	Battery + supply to Unit. Nominal 12V or 24V according to version.
8	Input from remote Fuel switch. Switch to battery + to enable remote start/stop. Refer to Section 2.4.2 Remote Control.
9	Battery – (0V) supply to Unit.
10	Charge generator excitation current. Can be used to detect when engine has started. See Section 2.4.1 Charge Generator current.
11	Input from remote Start/Stop switch. To enable this input, either the key switch must be On or the Remote Fuel switch input must be at battery +. Refer to Section 2.4.2 Remote Control
12	Input from Low Oil Pressure switch. Normally closed (switched to 0V). Open when oil pressure is normal. Can be used to detect when engine has started.
13	Input from High Temperature switch. Switched to 0V when engine temperature exceeds thermostat setting.
14	Spare 1 input. When switched to 0V, lights an indicator on the panel and shuts down the engine.
15	Spare 2 input. When switched to 0V, lights an indicator on the panel.
16	Output from alternator. Unit uses speed/frequency of alternator output to detect when engine has started.
17	

2.4.1 Charge Generator current

The unit uses the Charge Generator Current input to detect when the engine is running. The GEN-KEY connection effectively replaces the usual charge indicator lamp. It supplies current to the rotor coil from the battery until the engine is running, at which time the Charge Generator powers the rotor via the diode trio. The GEN-KEY circuits sense the resultant voltage at pin 10. This is initially low at near Battery -, as the circuit supplies a high current to the rotor coil, rising to near Battery + once the engine is running. Figure 2.7 shows the arrangement.

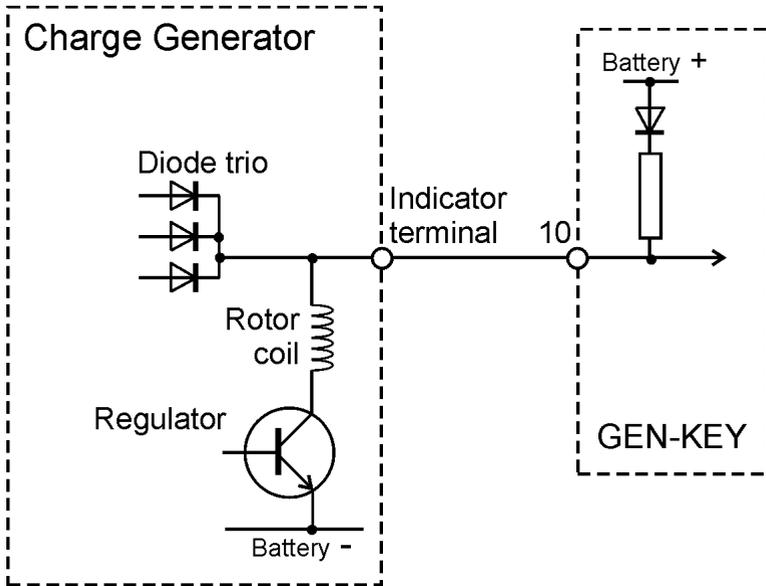


Figure 2.7 Input from Charge Generator

2.4.2 Remote Control

Remote control can be achieved using a remote double-pole switch connected as shown in Figure 2.8.

WARNING: Arrangements must be made to prevent remote starting of the engine while engine maintenance is being carried out. This can be achieved by using a key switch as the remote double-pole switch, such that the key can be removed to prevent remote starting.

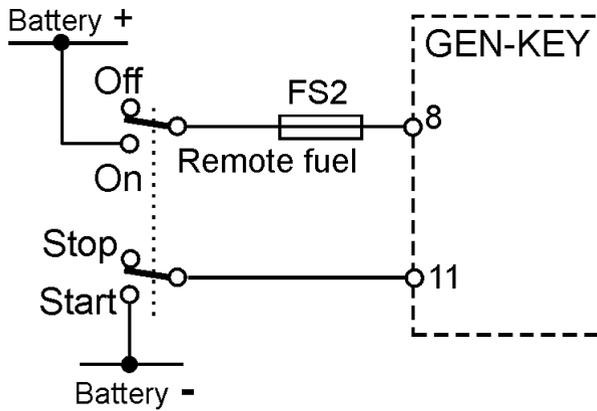


Figure 2.8 Remote Control

Section 3 Commissioning

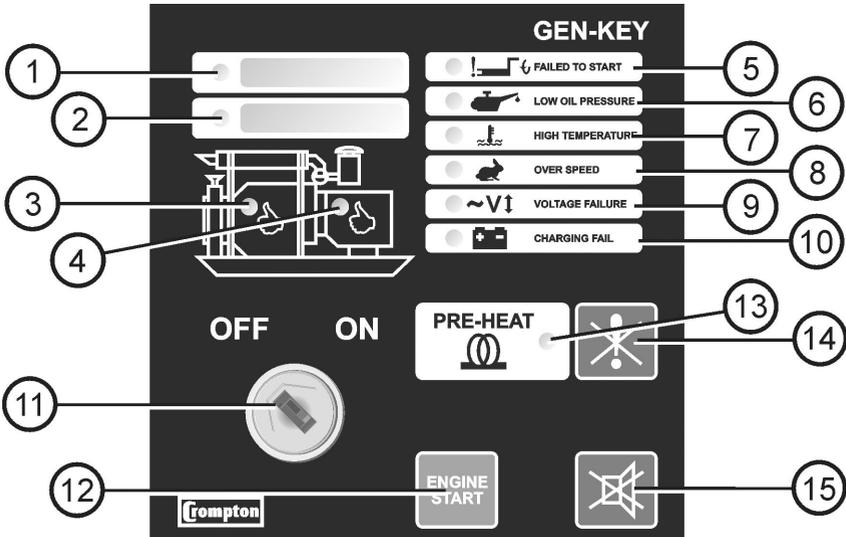
Warning: Beware of the high voltages connected to this unit.

1. Check that the unit is correctly wired and that the wiring is of a standard and rating compatible with the system.
2. Check that the correct fuses are fitted.
3. Take temporary steps to prevent the engine from starting – for example, disable the fuel solenoid (disconnect pin 3).
4. After a visual inspection to ensure it is safe to proceed, connect the battery.
5. Turn the key switch to On.
6. Press the Engine Start button.
7. Check that the engine start sequence commences. After preheating, the starter motor should, on three occasions, run for 5 seconds and pause for 10 seconds between attempts.
8. Check that the Failed to Start indicator lights.
9. Turn the key switch to Off.
10. Restore the engine to operational state (reconnect the fuel solenoid).
11. Turn the key switch to On.
12. Press the Engine Start button on the panel.
13. Check the start sequence, as follows:
 - the Preheat indicator lights for approximately 10 seconds, then
 - the starter motor runs
 - the engine starts
 - the starter motor disengages once the engine is running.

If not, check that the engine is fully operational (fuel available etc.) and check the wiring to the Unit.
14. Check that the engine runs up to its operating speed. If not and an alarm is present, check that the alarm is valid and then check the input wiring.
15. Turn the key switch to Off. The engine should stop. Allow time for the engine to come to rest.
16. Set the remote Start switch (if fitted) to On and check that the engine starts.
17. Set the remote Start/stop switch to Off and check that the engine stops.

Section 4 Operation

4.1 Controls and Indicators



- 1 Spare 1 LED. Configurable input 1 contact closed. Engine shut down.
- 2 Spare 2 LED. Configurable input 2 contact closed. Engine not shut down.
- 3 Green LED. On means engine is running. Detected according to the setting of DIP switch 2. Flashing means engine is ready to start.
- 4 Green LED. Alternator generating correct output voltage and frequency.
- 5 Red LED. Engine failed to start after pre-set number of attempts to start and the start sequence terminated. Latched alarm. Restart locked out until reset.
- 6 Red LED. Low oil pressure. Engine shut down. Latched alarm. Restart locked out until reset.
- 7 Red LED. High engine temperature. Engine shut down. Latched alarm. Restart locked out until reset.
- 8 Red LED. Engine over-speed. Engine shut down. Latched alarm. Restart locked out until reset.

- 9 Red LED. Generator voltage failure. Engine shut down. Latched alarm. Restart locked out until reset.
- 10 Red. Charge Generator Failure. Does not shut down the engine.
- 11 Key switch. On connects supply to GEN-KEY. Off disconnects supplies and shuts off the engine.
- 12 Engine Start button Initiates engine start sequence provided Key Switch is On.
- 13 Preheat LED. Lights during 10 seconds preheat period, if preheating is enabled (see section 2.2).
- 14 Reset button. Resets the latched alarms. Allows a new attempt at starting the engine.
- 15 Silence horn.

4.2 Starting the Engine

1. Set the key switch to ON.
2. Press the Engine Start button on the panel or the remote Start button. The engine should start. The sequence is as follows:
 - The Preheat LED lights for approximately 10 seconds while the engine ignition system preheats (where applicable).
 - The starter motor runs
 - The engine starts

Once the engine is running,

- The starter motor disengages.
- The green engine and alternator LEDs (3) and (4) light.
- The alarm indicators remain off.

4.3 Stopping the Engine

Set the key switch on the panel to OFF. The engine will stop and all indicators on GEN-KEY will go off.

Section 5 Fault Finding

Warning: Beware of the high voltages connected to this unit. Disconnect the unit from all electrical supplies before attempting any maintenance. Before carrying out any maintenance on the engine, set the key switch to off and remove the key.



Indicators on the panel will light if a fault is detected. See Section 4.1 Controls and Indicators. Fault conditions latch so that further operation is prevented. If a fault is indicated, proceed as follows:

1. Find and fix the fault.
2. Press the Reset button to enable a restart.
3. Press the Engine Start button.

Symptom	Possible remedy
Unit is inoperative	Check the battery and wiring to the unit. Check the DC supply. Check the DC fuse.
Low oil pressure fault after engine has fired.	Check engine oil pressure. Check oil pressure switch and wiring. Check that oil pressure switch is of the normally closed type (opens on low oil pressure).
High engine temperature fault after engine has fired.	Check engine temperature and cooling. Check switch and wiring. Check that temperature switch is of normally open type (closes on high temperature).
Failed to Start fault. Engine failed to start after three attempts.	Check fuel solenoid and wiring, fuel and battery. Reset the GEN-KEY and restart the engine. Check for battery + output at pin 3, Fuel Solenoid. Check that alternator output is connected between pins 16 and 17. Refer to engine manual.
Preheat inoperative.	Check preheating DIP switch (see section 2.2) Check wiring to engine heater plugs. Check battery supply. Check battery + is present at pin 5 of the GEN-KEY during preheat phase.
Starter motor inoperative.	Check wiring to starter relay. Check battery supply. Check battery supply is present on the Start output pin 4 of the GEN-KEY

Section 6 Specification

Inputs

DC Supply	GEN-KEY-12V	12V (8 to 16V) DC
	GEN-KEY-24V	24V (16 to 32V) DC
Operating Current	GEN-KEY-12V	300mA maximum
	GEN-KEY-24V	400mA maximum
Cranking Dropout	Battery voltage can be 0V DC for max. 100 ms during cranking (battery voltage should be at least nominal voltage before cranking)	
Generator Voltage	35 to 300V AC L-N, 10 to 110Hz Neutral and battery negative must be grounded.	
Contact Sensing	Emergency Stop (NC) Oil Pressure Switch (NC) Temperature Switch (NO) Remote Start/Stop input (NO) Configurable input 1 (NO) Configurable input 2 (NO)	

Outputs

Relay Contacts	Start relay (12 Amp DC at 12/24V) Fuel relay (12 Amp DC at 12/24V) Horn relay (10 Amp DC at 12/24V) Preheat relay (10 Amp DC at 12/24V)
Charge Generator	Excitation current 200mA, maximum 3 Watts.

Display

Failure Annunciators	Failed to start Low Oil Pressure High Temperature Over Speed Voltage Failure Charging Fail Configurable Input 1 Configurable Input 2
Status Annunciators	Engine Running Generator Ready Preheating

Measurement Accuracy

Generator Voltage	2% of full scale, 35 - 300V AC
Generator Frequency	0.5% of full scale, 10-110 Hz alternator Voltage

Environmental

Operating Temperature	-25°C to +70°C (-13°F to +158°F)
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Humidity	<93% RH, non condensing
Environmental Rating	Standard, Indoors, Altitude less than 2000m
Mode of operation	Continuous

Standards

EMC	BS EN 50081-2, BS EN 50082-2
Electrical Safety	EN 61010-1
Installation Category	II
Pollution Degree	II

Mechanical

Enclosure	DIN 43700 Style housing, 96mm x 96mm Bezel, 92mm
Panel Thickness	10mm (0.4 in) Maximum
Protection Class	IP30 front panel, IP20 rear panel
Weight	Approximately 0.5 Kg

Programming Selections (DIP Switches)

Generator voltage:	115V or 230V, selectable
Generator frequency:	50Hz or 60 Hz, selectable
Horn duration	60 seconds or continuous, selectable
Pre-heating	10 seconds or disabled, selectable

Preset Operating Parameters

Starting sequence:	Up to three attempts with 5 seconds driving the starter motor and with a 10 seconds rest between each attempt.
Oil bypass delay:	30 seconds allowed for build-up of oil pressure
Control on delay:	No engine faults will be reported during the first 10 seconds of starting, except for engine temperature.
Generator voltage	Generator output voltage must be outside the allowed operating range (-25/+15% of designated value) for 5 seconds before a fault is reported.
Generator speed	Generator speed must be outside the allowed operating range (+3% of designated value) for 5 seconds before fault is reported.
Speed Upper Limit (50 Hz. Nominal)	53 Hz
Speed limit for Engine Starting Signal (50 Hz. Nominal)	30 Hz
Speed Upper Limit (60 Hz. Nominal)	63 Hz.
Speed limit for Engine Starting Signal (60 Hz. Nominal)	40 Hz.
Voltage Lower Limit (115 VAC or 230 VAC)	-25%
Voltage Upper Limit (115 VAC or 230 VAC)	+15%
Voltage Limit for Engine Starting Signal (115 or 230 VAC)	50%
Engine Started Signals	Generator Voltage Generator Frequency Charge Generator Oil Pressure
Accessories:	Spare keys are available for these units. The order code for these is SPARE-KEY-GK.



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The Information contained in these installation instructions is for use only by installers trained to make electrical power installations and is intended to describe the correct method of installation for this product. However, Tyco Electronics has no control over the field conditions which influence product installation.

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Tyco Electronics UK Limited
Crompton Instruments

Freebournes Road, Witham, Essex, CM8 3AH, UK
Tel: +44 1376 509 509 Fax: +44 1376 509 511

<http://energy.tycoelectronics.com>