Written in Jun, 2009

User's Manual for Generator Control Unit

GCU®(GENERATOR CONTROL UNIT)

MODEL : MP4

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ENGINE GENERATOR CONTROL ENTERPRISE

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Cautions for your safety

1. Please be well informed of user's manual and drawings of the product in order to operate safely.
2. Please follow all safety instructions to prevent potential accidents and dangers.
3. There are two types of cautions; "Warning" and "Caution", where each meaning are as follow:

⚠ Warning	Potential injury or death may arise in case of violation of safety instructions
⚠ Caution	Potential injury or product damage may arise in case of violation of safety instructions

4. Meanings of picture signals appear in the manuals are as follow:

⚠	Please be careful as it may cause product damage
	Please be careful as it may cause electrocution

5. Please keep this manual close to the product

⚠ Warning

1. Please do not perform wiring work when power is on or in operation as it may cause electrocution.
2. Please do not disassemble the product even when power is off, as the charging current inside the product may still cause electrocution.
3. Please do not touch with wet hands as it may cause electrocution.
4. Please do not touch when sheath of electric wire is damaged as it may cause electrocution.
5. Please do grounding of electric wire to prevent electrocution.

⚠ Caution

1. Please permit a correct power supply to prevent product damage and fire
2. Please be sure no foreign substances enter into the product as they may cause short circuit or fire.
3. Please connect wire with correct load to input and output sockets to prevent product damage and fire.
4. Please connect wire as instructed to prevent product damage and fire.
5. Only technicians or properly trained personnel may use this product as irrational use of this product may cause injuries or damages to the product and devices connected to the product.
6. As this product comprises of electrical components, please separate the product before performing the test which requires high voltage such as inner voltage test or insulation resistance test.
7. Please use fuse and electric wire with correct capacity to prevent fire.
8. Please hold this product firmly as it is used for engine generator with high vibration.
9. Please make sure there are no untangled parts before installation.

1. Outline

GCU-DG4 is a diesel engine generator controller with engine protection function. It is specially optimized for Korean environment which allows easy and convenient use.

2. Features

2.1. Ability to use commercial power or non-electrical interface with automatic operating signal
2.2. Ability to adjust waiting time for start and stop when on automatic operation.
2.3. When starting manually start button needs to be pressed for more than 3 seconds for the safety
2.4. Double protection of starter motor by detecting engine RPM and oil pressure switch
2.5. Engine warm-up plug for small engine

2.6. Built-in alarm sound
2.7. Stop Solenoid anti burn out design
2.8. Generator stop function upon no detection of MPU signal or power during normal operation
2.9. Over speed test switch
2.10 RPM METER output.
2.11. Easy-to-understand operation lamp
2.12. Circuit protection design regarding to SURGE
2.13. SILICON MODLING for earthquake-proof and waterproof

3. Specification and Functions

3.1. Control power supply: 8 ~ 35Vdc, Power consumption: Below 5W on idle, 240W maximum
3.2. Speed sensor: Operating electricity detection method (standard) → 0~75 Hz ,7~300 Vac
MPU detection method → 0~7,000 Hz ,4~30 Vac
3.3. Commercial power voltage: 220 Vac platform
3.4. RPM METER output : 5V, 500uA
3.5. Automatic operation signal: Selection between non-electrical interface and commercial power
3.6. Engine start waiting time : 1 ~ 30 sec. (S. D. T - Start delay time)
3.7. Engine stop waiting time : 1sec ~ 120sec (C. D. T - Cooldown delay time)
3.8. Automatic start and stop time (CYCLE CRANKING TIME) : 7 sec.

4. Conditions of Use

4.1. Operation temperature: -10° ~ 40°C
4.2. Storage temperature: -24° ~ 45°C
4.3. Relative humidity: 0% ~ 90% non-congelation
4.4. Vibration:
amplitude-0.35mm, frequency-0~30Hz
4.5. Maximum operating altitude: 3,000m
4.6. Maximum storage altitude: 4,500m
4.7. Maximum delivery altitude: 10,668m

5. Descriptions of LED Display

Name	Function	LED Color
Control Power	Light on upon input of active power	GREEN
Automatic Signal	Light on upon input of commercial power	GREEN
Operating Engine	Light on when engine speed is greater than IDLE SPEED	GREEN
Automatic	Light on upon selection of automatic mode	GREEN
Manual Start	Light on upon selection of manual mode	RED
Over speed	Light on upon when engine speed is above OVER SPEED setting	RED
Over temperature	Light on when engine temperature is too high	RED
Start Failure	Light on when engine does not start after third try of start on automatic mode	RED
Low Oil Pressure	Light on upon low oil pressure in engine	RED
Emergency stop	Light on upon input of emergency stop	RED
Reserve breakdown	Light on upon input of signal into AFR socket(reserve)	YELLOW
Over voltage	Light on upon input of signal into OVR socket	YELLOW
Over current	Light on upon input of signal into OCR socket	YELLOW
Low Voltage	Light on upon input of signal into UVR socket	YELLOW
Stop	Light on upon generator stops	YELLOW

6. Structure

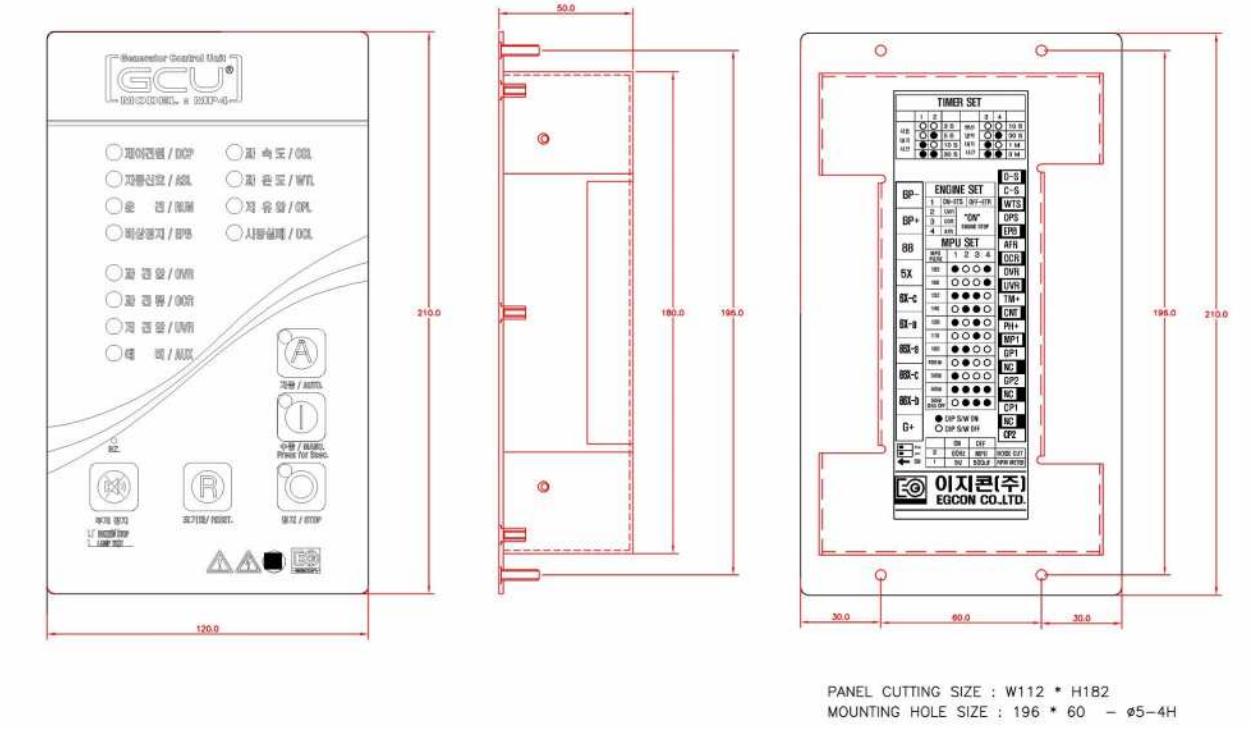
6.1. Dimension : W120 * H210 * D48 (mm)
6.2. Cut-out : W112*H182
6.3. Mounting Holes : W60*H196 / 5Φ-4H
6.4. Color : Dark gray
6.5. Weight : 700g

7. Preparation Before Use

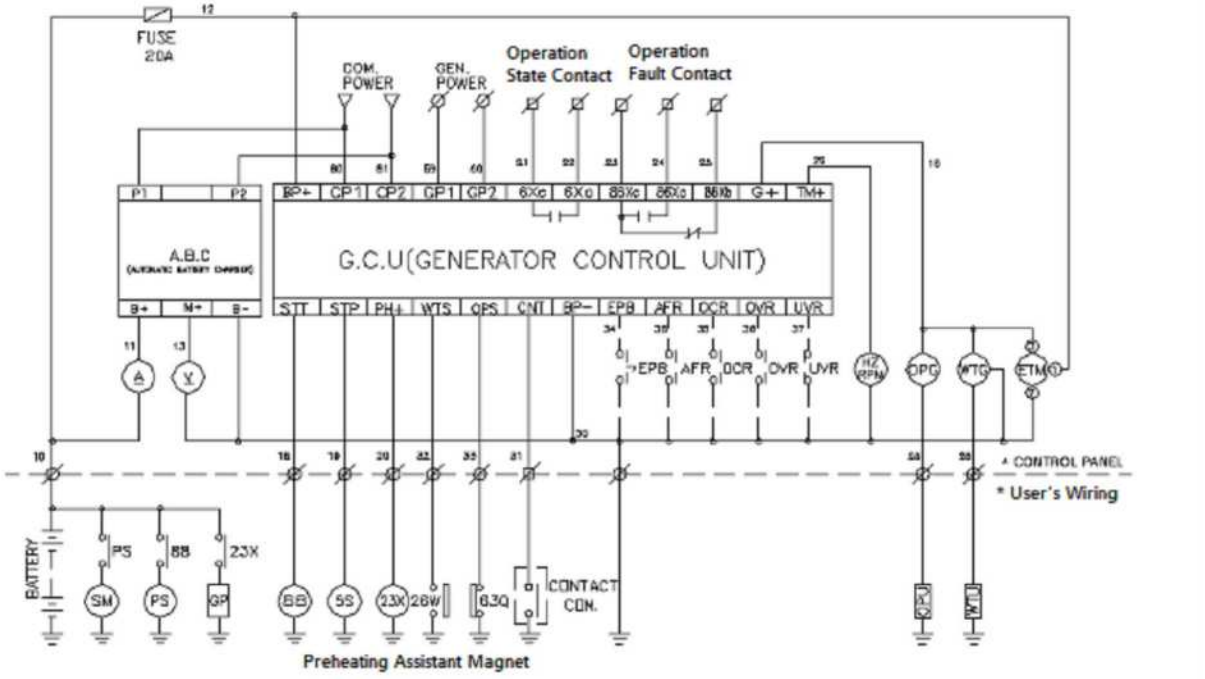
7.1. Connect circuits into input/output sockets of GCU-MP4 by referring to circuit diagram 1.

⚠ Caution When directly inputting commercial power, CNT socket must be connected with BP- socket in order to detect outage signal.

※ Upon input of power, control power lamp is on and lamp near wrong wiring flickers.



PANEL CUTTING SIZE : W112 * H182
MOUNTING HOLE SIZE : 196 * 60 - ø5-4H



8. Signals and Marks

- GCU : GENERATOR CONTROL UNIT
- ETS : Supplying power to solenoid when stopped
- ETR : Supplying poer to solenoid when in operation
- 86X : Breakdown indicating relay
- 6X : Operation indicating relay
- 23X : Preheating relay
- 52G : ACB
- SM : Starting motor
- PS : Pinion solenoid
- 88 : Start assistant magnet
- IDLE SPEED : Lowest speed of engine without the assistance of engine starting motor
- MPU : MAGNETIC PICKUP
- RPM : Rotating speed indicator
- 5S : Stop solenoid
- 88X : Start Output Relay
- EPB : Emergency Stop Button
- OPS : Oil Pressure Switch
- WTS : Coolant Temperature Switch
- RPM : Revolution speed meter
- 63Q : Oil pressure switch
- 26W : Coolant temperature switch, relay
- 48X : Start failure relay
- 62X : Operation relay
- 14X : IDLE SPEED relay

9. Connection Sockets and Capacity

Socket Name	Description	Rated Capacity
BP+, BP-	Control power input	DC 8~35V , 15A
88	Start output	BP+ voltage output, Max 15A
5x	Stop output	BP+ voltage output, Max 15A
PH+	Preheating output	BP+ voltage output, Max 5A
CP1, CP2	Commercial power input platform	1P 220Vac
GP1, GP2	Generator power input platform	0~75 Hz ,7~300 Vac
MP1, GP2	Input socket when using voltage for engine speed detection	0~7,000 Hz ,4~20 Vac
CNT	Automatic start interface(commercial power UVR input)	Automatic mode work upon DC- connection
TM+	RPM METER connetion socket	Connect RPM METER "+" socket
86X-a, 86X-c	Breakdown indicating interface	Dry contact , NORMAL OPEN, AC300V, 5A
86X-b, 86X-c	Breakdown indicating interface	Dry contact , NORMAL CLOSE, AC300V, 5A
6X-a, 6X-c	Engine operation indicating interface	Dry contact , NORMAL OPEN, AC300V, 5A
WTS	Input of over temperature switch	NORMAL OPEN , connect DC+ or DC-
OPS	Input of oil pressure switch	NORMAL CLOSE, connect DC+ or DC-
EPB	Input of emergency stop switch	NORMAL OPEN , connect DC-
AFR	SPARE input socket	NORMAL OPEN , connect DC-
OVR	Over voltage input socket	NORMAL OPEN , connect DC-
OCR	Over current input socket	NORMAL OPEN , connect DC-
UVR	Low voltage input socket(operates when generator speed is above 80% of speed of normal operation)	NORMAL CLOSE, connect DC-
G+	Output of gauge power above IDEL SPEED	BP+ voltage output, Max 5A

▶ CNT socket must be connected with DC- power when receiving commercial power by commercial outage signal and when receiving outside interface input by outage signal, commercial power must not connected to CP1 and CP2 sockets.

10. Manual Start Test

10.1. By pressing manual start button on GCU for about 3 seconds battery "+" is out from 88 which makes engine to start by making start assistant magnet to operate.

10.2. Manual start lamp will be on.

▶ Power of starter motor will be cut when engine operation signal reaches above 30% of normal operation.

▶ Power of starter motor will be cut immediately upon operation of oil pressure switch, even if there is no engine operation input.

▶ Operation lamp will be on if engine is operating normally and operation signal entered into GP1/GP2 socket or MP1/GP2 socket is more than 30% of normal speed.

▶ Low oil pressure lamp is on and engine will be stopped if oil pressure switch is not operating for more than 3 seconds when engine is operating above 30% of normal speed (IDLE SPEED).

▶ Start output will be out for 7 seconds and start output will be cut when there are no engine operation signal and oil pressure switch signal.

▶ Output of starter motor will be cut and engine will operate normally when there are no input of engine operation signal (less than 30% of normal speed) and oil pressure switch is operating.

▶ When operation lamp is on, battery "+" is out from G+ socket and operation power of gauge is approved and 6X will work, resulting in giving operation signal remotely.

10.3. Engine Stop

▶ Press stop switch

▶ Stop lamp is on

ETR: Will operate when power is connected to fuel solenoid and will stop when power is blocked.

ETS: Will stop if power is supplied to fuel solenoid when engine is stopped. If oil pressure switch is OFF power output will be blocked and when there is no OFF signal of oil pressure switch power will be out for certain period of time (≒ 20 sec.) and then be blocked.

10.4 Engine will be stopped when pressed EPB or upon operation of engine protection circuit (over speed, over temperature, low oil pressure) or OVR during the normal operation.

11. Automatic Operation Test

11.1. Set operation mode to automatic.

11.2. Engine will not start if AC power is approved in CP1 and CP2 or CNT socket is turned "OFF".

11.3. Engine will start after S.D.T(waiting time for start 1~30 sec) when AC power is cut to

CP1 and CP2 or CNT socket is turned "ON".

11.4. Engine will not start and S.D.T time will be initialized when AC power of CP1 and CP2 is cut or CNT socket is turned on, and power is returned before S.D.T time.

11.5. Battery "*" output is out from PH+(engine pre-heating output) and be cut above 30% of operation speed of the engine when AC power of CP1 and CP2 sockets is cut or CNT socket is turned "ON".

11.6. GCU sends start output for 7 sec and repeats 7 sec-stop 3 times when there is input of less than 30% of engine operation speed after the start output. Start failure lamp will be on and engine will stop when there is no input that is more than 30% of engine operation speed during the triple trial.

11.7. Start output is cut when start output is sent and oil pressure switch is ON.

11.8. Operation lamp will be on when engine operates normally.

11.9. When commercial power is returned(power is supplied in CP1/CP2 socket or CNT socket is OPEN) during normal operation of engine, engine will stop after cooling down the engine and will prepare for re-outage during the C.D.T time(engine cool down period : 1~120 sec)

NO	Automatic Operation Input Signal		Engine Condition	Note
	CNT	Commercial Power		
1	ON	Supply	Stop	
2	ON	Blackout	Operate	
3	OFF	Supply	Stop	
4	OFF	Blackout	Stop	

12. Engine Generator Protection Device Operation Test(Identical for Both Manual and Automatic Operation)

▶ It is possible to RESET after running protection device by performing buzzer stop before RESET.

12.1. Emergency Stop(EPB - EMERGENCY PUSH BUTTON)

(1) Start engine.

(2) Check if operates lamp of GCU is on and RPM METER shows normal RPM.

(3) Press EPB.

(4) EPB lamp will be on and buzzer will sound and engine will stop.

(5) Press buzzer stop, release EPB and press RESET.

12.2. Over Speed Test (OVER SPEED TEST)

▶ Over speed test is possible in all situation.

▶ When pressed OST(Over Speed Test) button when engine is stopped buzzer will sound and RPM METER will show the OS value that is currently set.

▶ If OS ADJ variable resistance is changed when pressed buzzer stop and changed OS setting value, RPM METER will show different value and set value will be changed.

▶ Press RESET.

▶ Changed OS value will be applied.

(1) Start engine.
(2) Check if operation lamp of GCU is on and RPM METER show normal RPM.
(3) Press OST(Over Speed Test) button.
(4) EPB lamp will be on and buzzer will sound and engine will stop.
(5) Press buzzer stop and press RESET.

12.3. Low Oil Pressure (OPL - LOW OIL PRESSURE)

▶ Oil pressure switch has relationship with starter motor and ETS TYPE stop output.
▶ When oil pressure switch operates after engine started, output of starter motor is blocked and when oil pressure switch is closed, stop output of ETS TYPE gets blocked after certain period of time.

(1) Start engine.
(2) Check if operation lamp of GCU is on and RPM METER shows normal RPM.
(3) Connect OPS socket.
(4) Low oil pressure lamp is on and buzzer sounds and engine will stop.
(5) Press buzzer stop and RESET.

12.4. Over temperature (WTL - HIGH WATER TEMPERATURE)

(1) Start engine.
(2) Check if operation lamp of GCU is on and RPM METER shows normal RPM.
(3) Connect WTS socket.
(4) Over temperature lamp is on and buzzer sounds and engine will stop.
(5) Press buzzer stop and RESET.

12.5. Start Failure (OCL - OVER CRANKING)

(1) Change mode to automatic.
(2) Cut commercial power or connect CNT socket.
(3) Start output is set after S.D.T.
(4) If engine operation speed is below 30% of normal speed during the 7 sec start time, repeat 7 sec start and 7 sec stop for 3 times.
(5) Start failure lamp will be on and buzzer will sound and engine will stop.
(6) Press buzzer stop and RESET.

12.6. Over Voltage (OVR - OVER VOLTAGE)

(1) Start engine.
(2) Check if operation lamp of GCU is on and RPM METER shows normal RPM.
(3) Press TEST button of OVR.
(4) Over voltage lamp is on and buzzer sounds and engine will stop.
(5) Press buzzer stop and RESET.

12.7. Over current (OCR - OVER CURRENT)

(1) Start engine.
(2) Check if operation lamp of GCU is on and RPM METER shows normal RPM.
(3) Press TEST button of OCR.
(4) Over current lamp is on and buzzer sounds and engine will stop/still run depend on the DIP S/W setting.
(5) Press buzzer stop and RESET.

12.8. Low Voltage (UVR - UNDER VOLTAGE)

▶ Input of low voltage relay will be overridden when below 80% of normal speed and will be recognized only above 80% of normal speed.

(1) Start engine.
(2) Check if operation lamp of GCU is on and RPM METER shows normal RPM.
(3) Press TEST button of UVR.
(4) Over current lamp is on and buzzer sounds and engine will stop/still run depend on the DIP S/W setting.
(5) Press buzzer stop and RESET.

12.9. Reserve Breakdown (AFR - AUX FAULT)

(1) Start engine.
(2) Check if opeation lamp of GCU is on and RPM METER shows normal RPM.
(3) Press TEST button of AFR.
(4) Over current lamp is on and buzzer sounds and engine will stop/still run depend on the DIP S/W setting.
(5) Press buzzer stop and RESET.

13. Description of DIP S/W and other buttons

13.1. O/S T : Over speed test(OVER SPEED TEST) PUSH BUTTON

▶ When this button is pressed GCU will indicate currently set over speed value and stop the engine regardless of the acutal speed input.

▶ If you want to change OVER SPEED SETTING value in this situation chages value by changing OS ADJ variable resistance and press RESET. By doing this OVER SPEED SETTING will be set to the value you have changed.

13.2. O/S ADJ : Over speed adjustment(OVER SPEED ADJ.)

▶ It is a regulator to regulate the speed of over speed protection circuit.

▶ Adjustment range is in between 1800~2500RPM.

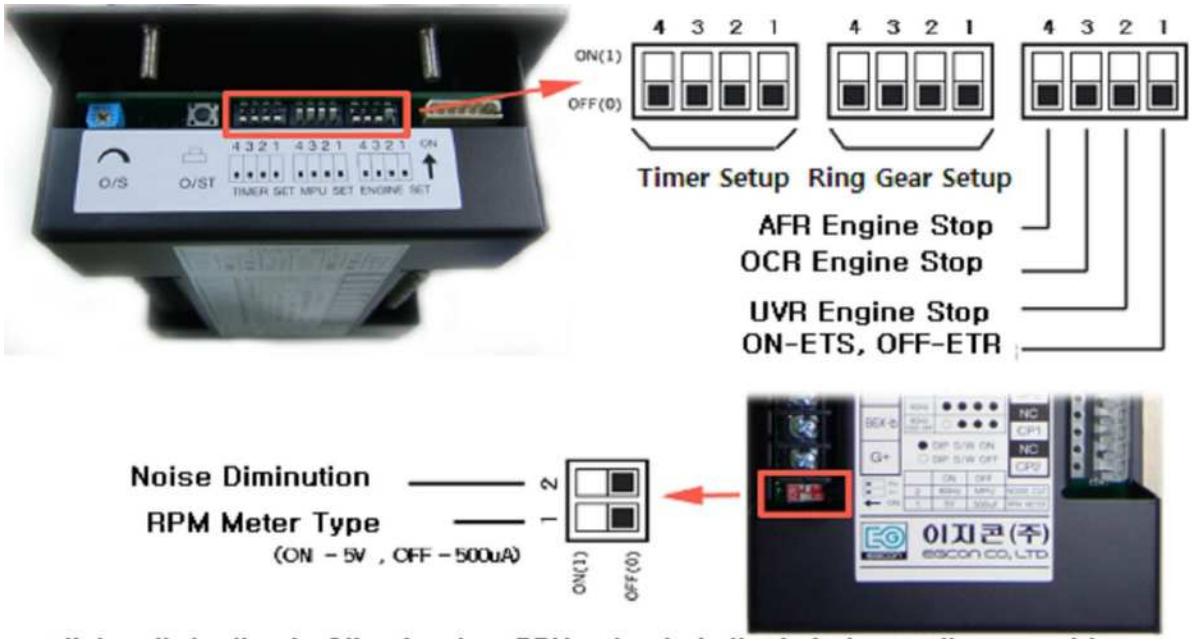
13.3. S. D. T : Adjusting waiting time for the start(1 ~ 30sec)

▶ It is a waiting time to prevent the engine start due to an instant power failure in automatic mode. Preheating circuit will be in operation during the time.

13.4. C. D. T : Adjusting waiting time for stop standby(1sec ~ 120sec)

▶ It operates for the certain period of time in the case of return of commercial power in automatic mode in order to prepare for re-blackout. Also it is to stop the engine by cooling down.

13.5. DIP S/W Setup



*** Noise diminution is ON only when RPM value is indicated abnormally caused by high frequency noise of generator load, and should be always used as OFF.(when using magnetic pickup, ON is unavailable)**

Timer Setup DIP S/W							
	4	3	Hours		2	1	시간
Cool Down Period (CDT)	○	○	10 sec	Start-Standby Period (SDT)	○	○	3 sec
	●	○	30 sec		●	○	5 sec
	○	●	1 min		○	●	10 sec
	●	●	3 min		●	●	30 sec

Ring Gear Setup DIP S/W					
DIP S/W No. / MPU PULSE	4	3	2	1	Note
182	●	○	○	●	Number of Ring Gears
160	●	○	○	○	
152	○	●	●	●	
140	○	●	●	○	
128	○	●	○	●	
110	○	●	○	○	
108	○	○	●	●	
400Hz	○	○	●	○	Generator Frequency
50Hz	○	○	○	●	
60Hz	●	●	●	●	

▶ If DIP S/W settings above is incorrect it is recognized as 60Hz.

● : DIP S/W ON

○ : DIP S/W OFF

▶ The changed items above are applied upon restart of power.

Engine Stop Function Setup			
DIP S/W No.	Functions		Notes
1	● = ETS	○ = ETR	
2	UVR	ON ENGINE STOP	
3	OCR		
4	AFR		

● : DIP S/W ON

○ : DIP S/W OFF

▶ Items regarding to engine stop method among above are applied upon restart of power.

▶ Changes in generator protection devices(OCR, UVRM AFR) are not applied when changed during the operation of generator. In order to have thme applied you need to change them before you press RESET button or before you change automatic/manual mode.

14. Cause of Breakdown and Solutions

Symptom	Cause	Solution
When there is no power(Control power lamp is not on)	DC circuit breaker is open	Close DC circuit breaker
	DC fuse is disconnected	Replace fuse with the same capacity
	Wrong wiring	Correct wiring referring to the circuit diagram
	Flat battery	Recharge battery at least 5 hours
Cannot start(Starter motor is not working)	Flat battery	Recharge battery at least 5 hours
	Breakdown battery at least 5 hours	Replace start-assistant magnet
	Breakdown of starter motor	Replace starter motor
	Wrong or no wiring	Correct wiring by referring to the circuit diagram
Cannot start(starter motor is working)	Breakdown of preheating plug	Replace preheating plug
	Wroing DIP S/W setting	Correctly select ETR and ETS by inquiring the manufacturer of the engine.
Cannot stop	Wrong DIP S/W setting	Correctly select ETR and ETS by inquiring the manufacturer of the engine.
RPM meter is not working while generator in operation	Wrong or no wiring of PICKUP	Correct wiring by referring to the circuit diagram.
RPM meter is not working while generator is in operation	Wrong or no wiring of PICK-UP	Correct wiring by referring to the circuit diagram
	Wrong or no wiring in generator voltage GS1 or GS2	Correct wiring by referring to the circuit diagram
No automatic operation of generator upon commercial power outage	No connection of DC- into CNT socket	Connect DC- into CNT socket

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ENGINE, GENERATOR CONTROL ENTERPRISE

EGCON®

엔진, 발전기 제어 전문기업

PRODUCTS ITEM

- □ AVR / 자동전압조정기
- □ ABC / 자동밧데리충전기
- □ GCU / 발전기기제어장치
- □ ECU / 엔진제어장치
- □ ESD / 엔진속도검출기
- □ EPD / 엔진보호장치
- □ SCR / 동기검출기
- □ BCU / ACB 제어장치
- □ ACU / ATS 제어장치
- □ MPU / 속도검출센서
- □ GCP / 발전기 운전반
- □ ECP / 엔진 운전반
- □ ATS / ATS 운전반
- □ FGP / 별치형 운전반

AVR
MODEL : 635/631

ABC
MODEL : SMP

ABC
MODEL : SMF

ECU
MODEL : DG1

GCU
MODEL : MP2

DMM
MODEL : 961

ACU
MODEL : MP3

ETS
MODEL : Y, B TYPE

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