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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 | <ol style="list-style-type: none"> 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 | <ol style="list-style-type: none"> 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 | 4.5. Maximum operating altitude: 3,000m |
| 4.2. Storage temperature: -24° ~ 45°C | 4.6. Maximum storage altitude: 4,500m |
| 4.3. Relative humidity: 0% ~ 90% non-congelation | 4.7. Maximum delivery altitude: 10,668m |
| 4.4. Vibration: amplitude-0.35mm, frequency-0~30Hz | |

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.

8. Signals and Marks

- GCU : GENERATOR CONTROL UNIT
- ETS : Supplying power to solenoid when stopped
- ETR : Supplying power 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 connection 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 operation 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 actual speed input.
- ▶ If you want to change OVER SPEED SETTING value in this situation changes 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.

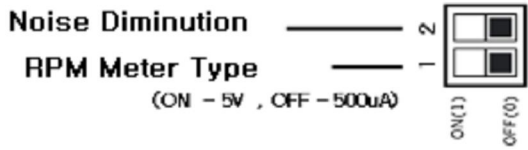
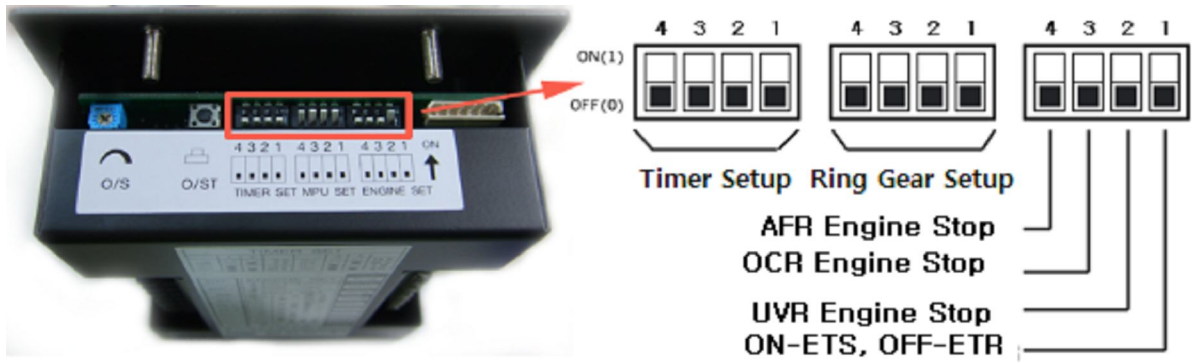
13.3. S. D. T : Adjusting waiting time for the start(1 ~ 30sec)

- ▶ 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 | ○ | ○ | 10 sec | Start-Sta | ○ | ○ | 3 sec |
| Down | ● | ○ | 30 sec | | ndby | ● | ○ |
| Period (CDT) | ○ | ● | 1 min | Period (SDT) | ○ | ● | 10 sec |
| | ● | ● | 3 min | | ● | ● | 30 sec |

| Ring Gear Setup DIP S/W | | | | | |
|-------------------------|---|---|---|---|----------------------|
| DIP S/W No. | 4 | 3 | 2 | 1 | Note |
| MPU PULSE | | | | | |
| 182 | ● | ○ | ○ | ● | Number of Ring Gears |
| 160 | ● | ○ | ○ | ○ | |
| 152 | ○ | ● | ● | ● | |
| 140 | ○ | ● | ● | ○ | |
| 128 | ○ | ● | ○ | ● | |
| 110 | ○ | ● | ○ | ○ | |
| 108 | ○ | ○ | ● | ● | Generator Frequency |
| 400Hz | ○ | ○ | ● | ○ | |
| 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 | | |
| <p>● : DIP S/W ON ○ : DIP S/W OFF</p> <p>▶ 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.</p> | | | |

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 |

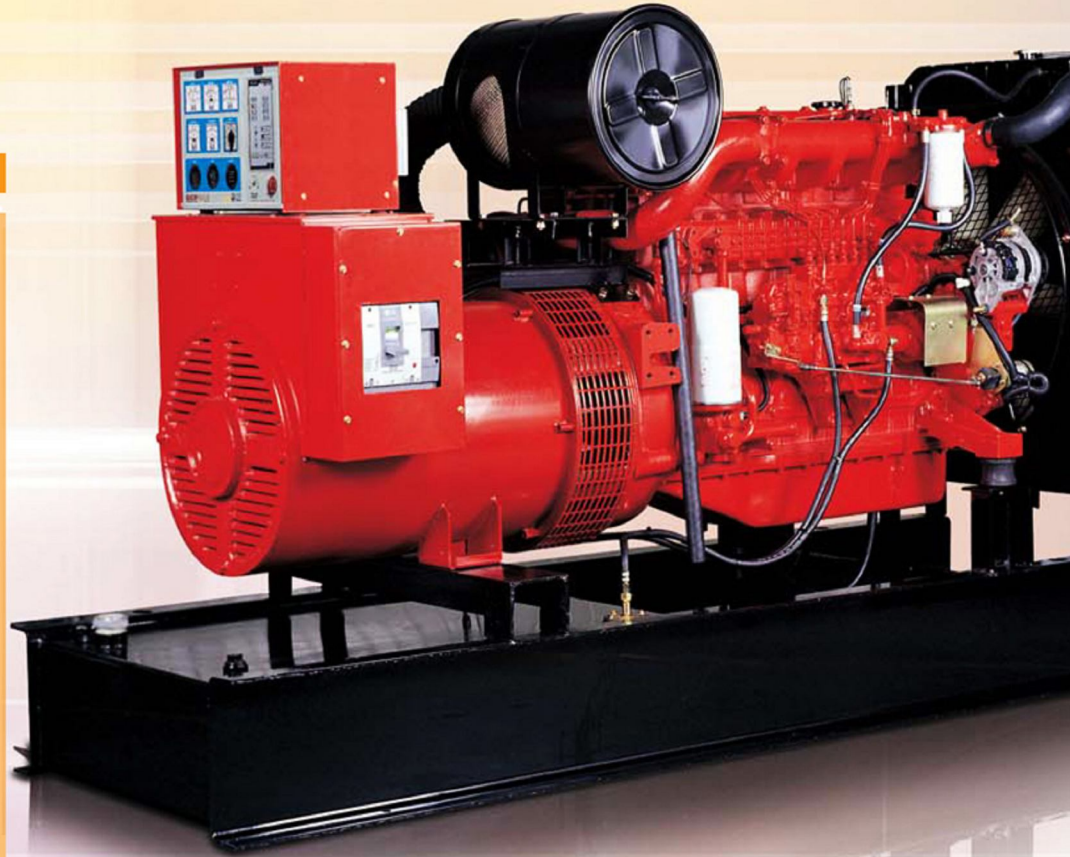
ENGINE, GENERATOR CONTROL ENTERPRISE

EGCON[®]

엔진, 발전기 제어 전문기업

PRODUCTS ITEM

- AVR / 자동전압조정기
- ABC / 자동배터리충전기
- GCU / 발전기제어장치
- 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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