1. WARNING

To prevent personal injury or equipment damage, only qualified technicians/operators should install, operate or service this device.

2. CAUTION

Megger and high potential test equipment should not be used.
Incorrect use of such equipment could damage components contained in the unit.

3. APPLICATION

It has been designed to start, stop and protect diesel engine generator automatically or manually.

4. FEATURES

4.1. Dry contact as an automatic operation signal is able to be used.
4.2. Includes OPG(Oil Press. Gauge), WTG(Water Temp. Gauge), DCV(DC Voltage), engine hour meter.
4.3. Engine is stopped by EPB, over speed, low oil pressure, high water temperature and over voltage.
4.4. Display by inputting to a relay externally, and engine stop function.
4.5. There are OVR, UVR, OCR and a reserved terminal of malfunction input.
4.6. Auto-starting can be performed for three times.
4.7. Over speed is easily set on the field and PB of over speed test is inside.
4.8. Receives voltage of generator or MPU(Magnetic Pickup) signal as an engine run signal.
4.9. Protects starter motor by detecting idle speed signal or oil pressure switch.
4.10. Operation state is easily recognizable by indicator lamp.
4.11. On Auto-start, preheating is able to be performed through the engine preheating plug before starting.
4.12. Simplified circuit by using microprocessor.
4.13. Surge voltage protecting circuit.
4.14. Durable against damp and vibrating environment by silicon molding.
4.15. Convenient front mounting.
4.16. Selectively use ETR or ETS(modes to stop engine).
4.17. Easy engine generator control by including manipulation ability, alarm sound, alarm lamp in ECU.
4.18. Dry contacts of engine operation signal and malfunction signal included.

4.19. Stop Solenoid circuit included to prevent from being burnt down.

5. BASIC SPECIFICATIONS

5.1. Power Input : 12/24Vdc ± 20%

5.2. Method of Detecting Generator Voltage(default) → 0~75 Hz ,220Vac(7~300 Vac)
Method of Detecting MPU(optional) → 0~7,000 Hz ,4~30 Vac

5.3. Auto-operation signal : dry contact

5.4. Spent Time to Start/Stop On Auto-Start(CYCLE CRANKING TIME) : 7 sec.

6. STRUCTURE

6.1. Dimension : W220 * H135 * D43 (mm)

6.2. Cut-Out : W202*H130

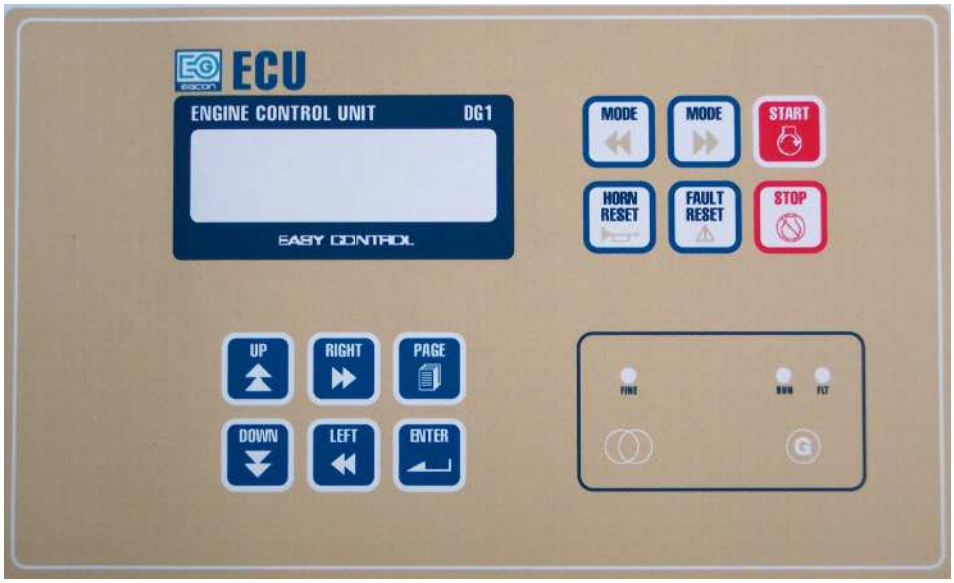
6.3. Mounting holes : W212*H60 / 5Φ * 4Holes

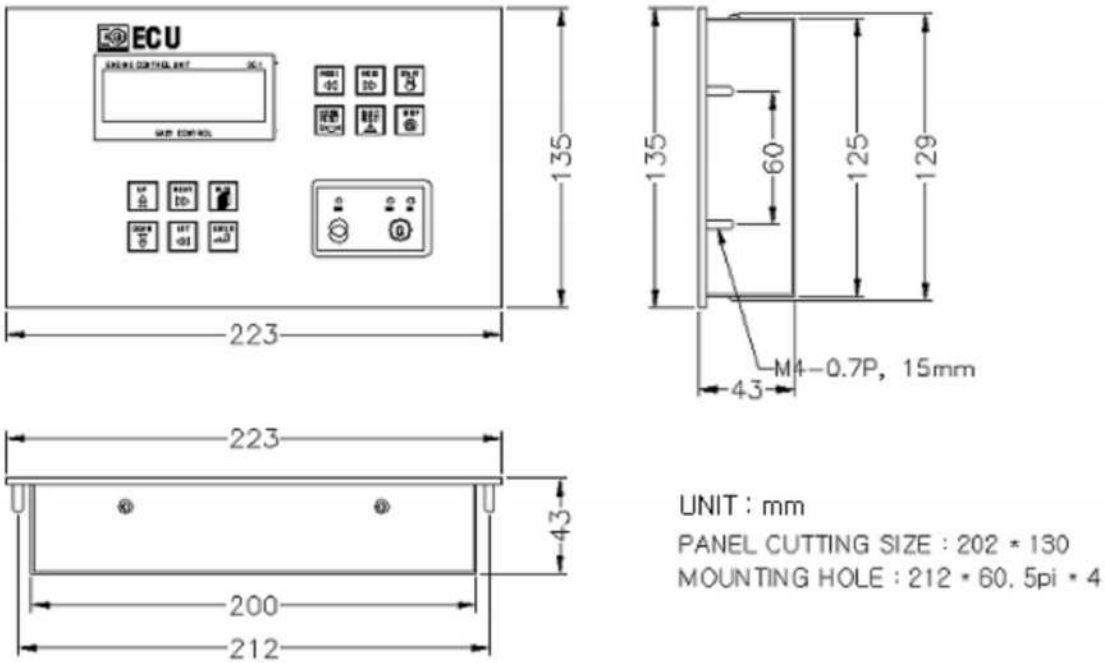
6.4. Color : dark gray

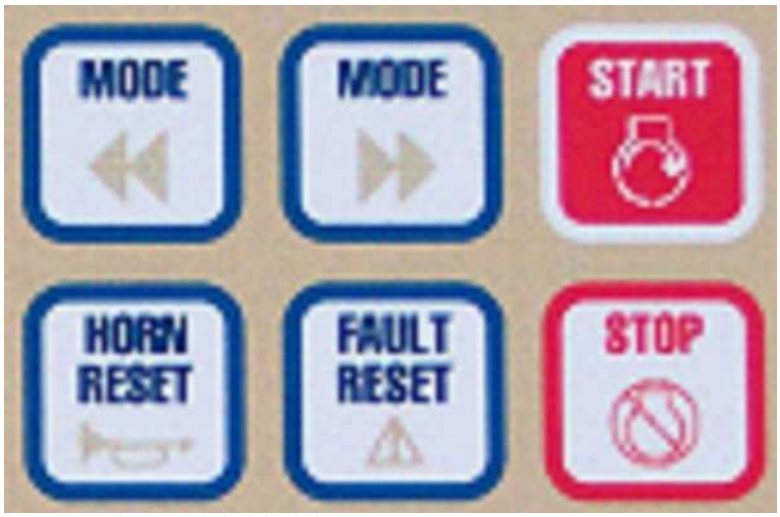
6.5. Weight : about 700g

7. STRUCTURE

7.1. FRONT VIEW







7.2. ECU Operation mode and Initializing button

7.2.1. Operation mode in order of OFF -> MANU -> AUTO

7.2.2. Operation mode in order of AUTO -> MANU -> OFF

7.2.3. Generator starting KEY in Manu mode

7.2.4. Generator STOP KEY on operation in Manu, Auto Mode

7.2.5. Stop BUZZER sound when malfunction

7.2.6. ECU initialization when malfunction

7.3. SET UP KEY

7.3.1. KEY to enter Setting Menu Only in OFF mode

7.3.2. KEY to go upward in Setting Menu

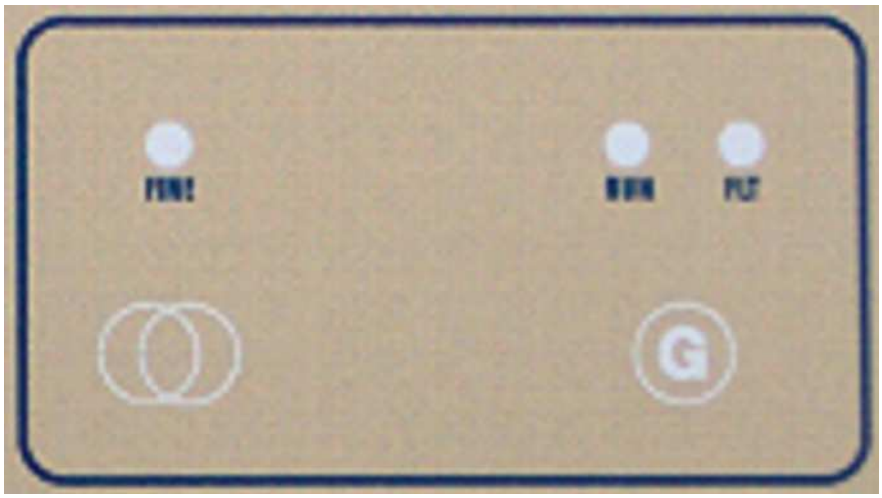
7.3.3. KEY to go downward in Setting Menu

7.3.4. KEY to enter a menu to set

7.3.5. KEY to come out of Menu after setting

7.3.6. KEY to input Setting value(when pressed, cursor appears and input is possible) and to finish after inputting setting value by UP/DOWN KEY

7.4. INDICATOR LAMP



7.4.1. FINE LAMP : turned on when CNT terminal OPENs (GREEN)

7.4.2. RUN LAMP : turned on when generator operation signals are input (GREEN)

7.4.3. FAULT LAMP : turned on when errors occur during the generator operation (RED)

7.5. Engine error and Protective relay setting matters

	ENGINE STOP		86X	BUZZER	NOTE
	ENABLE	DISABLE			
Low oil pressure	BASE ON (Stop)	BASE OFF (Stop selectively)	○	○	
High Water temperature			○	○	
Over speed			○	○	
Start failure			○	○	
Over voltage			○	○	
Low voltage	OFF (Stop selectively)		○	○	
Over current	OFF (Stop selectively)		○	○	
AFR	OFF (Stop selectively)		○	○	
AFR1	OFF (Stop selectively)		○	○	
AFR2	OFF (Stop selectively)		○	○	
AFR3	OFF (Stop selectively)		○	○	
AFR4	OFF (Stop selectively)		○	○	

8. KINDS OF TIME SETTING

8.1. SDT(Waiting time to start) - 1sec ~ 59sec [Initial value : 03 Sec]

8.2. CDT(Waiting time to stop) - 1sec ~ 59min 59sec [Initial value : 05 Sec]

8.3. OFT(Waiting time of detecting oil pressure error from Idle Speed signal after starting) - 1sec ~ 59sec [Initial value : 05 Sec]

8.4. UDT(Waiting time of detecting low voltage from Idle Speed signal after starting) - 1sec ~ 59sec [Initial value : 05 Sec]

8.5. OST(Time of blocking start output when oil pressure switch is on after starting) - 1sec ~ 59sec [Initial value : 05 Sec]

8.6. STOP(Stop output time at ETS mode) [Initial value : 05 Sec]

8.6.1. Maximum 20sec when no oil pressure switch

8.6.2. 1 ~ 59sec after oil pressure switch CLOSE

8.7. OPE. UVR : Waiting time of detecting UVR(low voltage) during operation - 1sec ~ 59sec

8.8. OPE. OVR : Waiting time of detecting OVR(over voltage) during operation - 1sec ~ 59sec

8.9. Time setting mode is to press PAGE Key and to set at LCD screen

9. EXTERNAL INPUT/OUTPUT TERMINALS AND CONNECTORS

9.1. TERMINALS

9.1.1. STT : Start output

9.1.2. STP : Stop output

9.1.3. DC+ : "+" input of power input

9.2. CONNECTORS

9.2.1. BP+, BP- : Power input

9.2.2. GP1, GP2 : Generator power 220Vac, 50/60Hz input

9.2.3. MP1, MP2 : Magnetic pickup(MPU) input

9.2.4. CNT : Automatic operation contact(AUTO Mode BP - operate when input)

9.2.5. PH+ : Preheat output(BP+output)

9.2.6. G+ : Output when generator and engine operate(BP+output)

9.2.7. 86X-c, 86X-a : Malfunction signal contact(NORMAL OPEN)

9.2.8. 86X-c, 86X-b : Malfunction signal contact(NORMAL CLOSE)

9.2.9. 6X-c, 6X-a : Operation signal contact(NORMAL OPEN)

9.2.10. WTS : High water temperature switch input(NORMAL OPEN)

9.2.11. OPS : Oil pressure switch input(NORMAL CLOSE)

9.2.12. EPB : Emergency stop switch input(NORMAL OPEN)

9.2.13. AFR : Reserve error input(NORMAL OPEN)

9.2.14. OCR : Over current relay input(NORMAL OPEN)

9.2.15. UVR : Under voltage relay input(NORMAL CLOSE)

9.2.16. AFR1~4 : Reserved error input(NORMAL OPEN)

9.2.17. OPU : Oil pressure sensor input

9.2.18. WTU : Coolant temperature sensor input

9.2.19. NC : NO CONNECTION (Terminal not to use)

10. LCD SCREEN DISPLAY

10.1. Battery power is supplied - Buzzer sounds for 2sec

10.2. Below start-up screen is displayed for 2sec

```
        ECU-DG1
  ENGINE CONTROL
        VER 0.1A
    EGCON CO.,LTD.
```

10.3. Initial state - Commercial power is normal and MPU mode is selected.
(When oil pressure switch and high water temperature switch are seleted to use)

```
MODE:OFF      DC:26.0V
COM:ON        00000RPM
GEN:STOP      OP:ON
ETM:000H0     WT:OFF
```

10.4. At the start-up screen - If Page Key is pressed,
Page Key operates only in OFF mode

```
      SETTINGS
1.TIME SETTING
2.ENGINE SETTING
3.PASSWORD SETTING
```

10.5. SETTING MODE state - if DOWN KEY is pressed

4	.	H	z	&	F	R	E	Q		S	E	T	T	I	N	G				
5	.	P	I	C	K	-	U	P		S	E	T	T	I	N	G				
6	.	V	O	L	T	A	G	E		S	E	T	T	I	N	G				
7	.	E	R	R	O	R		I	N	P	U	T		T	Y	P	E			

10.6. SETTING MODE state - if DOWN KEY is pressed.

8	.	S	E	N	S	O	R		S	E	L	E	C	T						
9	.	P	R	O	T	E	C	T		S	E	T	T	I	N	G				

11. SETTING modification

11.1. SETTING MODE STATE- At No.1 (TIME SETTING) menu, if "RIGHT ▶" pressed

```
  1.TIME SETTING
>.SDT          03SEC
2.CDT    00MIN 05SEC
3.OST          05SEC
```

11.2. SETTING MODE STATE - At No.1 menu, if "DOWN ▼" is pressed

```
4.OFT          05SEC
5.UDT          05SEC
6.STOP         07SEC
```

11.3. Changing S.D.T (Start waiting time)

11.3.1. Using UP/DOWN key, choose S.D.T and press ENTER Key.

11.3.2. Cursor is positioned at 0.

11.3.3. Using UP/DOWN key, change number.

11.3.4. To change next number, press RIGHT key.

11.3.5. Cursor is positioned at No.3.

11.3.6. Using UP/DOWN key, Change number.

11.3.7. When completing to change, press ENTER key.

11.3.8. Change other times in the same way.

```
  1.TIME SETTING
>.SDT          03SEC
2.CDT    00MIN 05SEC
3.OST          05SEC
```

11.3.9. After setting, press LEFT key to move to the above setting screen.

```
    SETTINGS
1.TIME SETTING
2.ENGINE SETTING
3.PASSWORD SETTING
```

11.4. Changeable Items in SETTING Menu

11.4.1. 1. TIME SETTING

	1	.	T	I	M	E		S	E	T	T	I	N	G					
>	.	S	D	T									0	3	S	E	C		
2	.	C	D	T			0	0	M	I	N		0	5	S	E	C		
3	.	O	S	T									0	5	S	E	C		

4	.	O	F	T									0	5	S	E	C		
5	.	U	D	T									0	5	S	E	C		
6	.	S	T	O	P								0	7	S	E	C		

11.4.1.1. SDT(Start waiting time) – [Initial value : 03 Sec]

11.4.1.2. CDT(Stop waiting time) – [Initial value : 05 Sec]

11.4.1.3. OFT(Waiting time of detecting oil pressure error from Idle Speed signal after starting) – [Initial value : 05 Sec]

11.4.1.4. UDT(Waiting time of detecting low voltage from Idle Speed signal after starting) – [Initial value : 05 Sec]

11.4.1.5. OST(Range of start output blocking time when oil pressure switch is on after starting) – [Initial value : 05 Sec]

11.4.1.6. STOP(ETS mode stop output time) – [Initial value : 05 Sec]
Maximum 20sec at no input of oil pressure switch
1 ~ 59sec after oil pressure switch is OFF

11.4.2. 2. ENGINE SETTING

	2	.	E	N	G	I	N	E		S	E	T	T	I	N	G			
1	.	T	Y	P	E	:		E	T	R									
2	.	O	P	S		M	O	D	E	:	C	O	N	T					
3	.	W	T	S		M	O	D	E	:	C	O	N	T					

11.4.2.1. TYPE : ETR, ETS [Initial value – ETS]

11.4.2.2. OPS MODE : CONT, VAL, NONUSE [Initial value – CONT]

11.4.2.3. WTS MODE : CONT, VAL, NONUSE [Initial value – CONT]

11.4.3. 3. PASSWODRD SETTING

```
  3 . P A S S W O R D   S E T T I N G
> . S e t t i n g _ P W : N O N U S E
2 . P o w e r O N _ P W : N O N U S E
3 . P a s s w o r d :     1 1 1 1
```

11.4.3.1. Setting_PW : NONUSED, USE – [Initial value : NONUSED]

– When "USE" is set, if "PAGE" is pressed in OFF mode, password is identified.

11.4.3.2. PowerON_PW : NONUSED, USE – [Initial value : NONUSED]

– When "USE" is set and initial power is input, Password is identified.

11.4.3.3. PASSWORD – 1111

11.4.3.4. PASSWORD screen and how to input

```
      - - P A S S W O R D - -
            _ _ _ _
  E n t e r   k e y   P r e s s . . .
```

11.4.3.4.1. When using PASSWORD is set, above screen is displayed.

11.4.3.4.2. Press ENTER KEY.

11.4.3.4.3. Using UP/DOWN KEY, change number.

```
      - - P A S S W O R D - -
            1 _ _ _
  R I G H T   k e y   P r e s s . . .
```

11.4.3.4.4. If the first number is changed, change the remaining numbers by using "RIGHT" KEY.

```
      - - P A S S W O R D - -
            1 1 1 1
  E n t e r   k e y   P r e s s . . .
```

11.4.3.4.5. After choosing numbers to the 4th by using UP/DOWN key,

press ENTER KEY to confirm PASSWORD.

11.4.3.4.6. This screen is printed when a wrong PASSWORD is input.

```
      --PASSWORD--
        1114
  FAIL  Press ENTER..
  Cancel  Press PAGE.
```

11.4.3.4.7. If ENTER key is pressed, screen is changed to PASSWORD setting, and if PAGE key is pressed, screen displays MAIN PAGE.

11.4.3.4.8. When power is supplied, if you don't know PASSWORD at the password setting, impossible to go to MAIN PAGE.

11.4.4. 4. Hz&Freq SETTING

```
  4.Hz&Freq SETTING
2.60HZ
```

11.4.4.1. 1, 50Hz

11.4.4.2. 2. 60Hz

11.4.4.3. 3. PICK UP [Initial value]

11.4.5. 5. PICK-UP SETTING

```
  5.PICK-UP SETTING
>.GEAR NUMBER:121EA
```

11.4.5.1. Input the number of engine ring gear - [Initial value : 121 EA]

6. VOLTAGE SETTING (* NOT USED AT THE PRESENT VERSION*)

```
 6.VOLTAGE  SETTING
1.GEN  UVR:   180.0V
2.OPE.UVR:        5SEC
3.GEN  OVR:   235.0V
```

```
 6.VOLTAGE  SETTING
4.OPE  OVR:       5SEC
5.OVER  SPEED:2150RPM
```

11.4.5.1. 1. GEN UVR : 000.0 ~ 299.9Vac (Initial value : 180.0Vac)

11.4.5.2. 2. OPE. UVR : 0 ~ 9sec (Initial value : 5sec)

11.4.5.3. 3. GEN OVR : 000.0 ~ 299.9Vac (Initial value : 235.0Vac)

11.4.5.4. 4. OPE. OVR : 0 ~ 9sec (Initial value : 5sec)

11.4.5.5. 5. OVER SPEED : 0000 ~ 2999 rpm (Initial value : 2150 rpm)

11.4.6. 7 ERROR INPUT

```
 7.ERROR  INPUT  TYPE
1.TYPE:EXT.  CON
```

TYPE : INT. VAL - Use OVR, UVR relays as an internal measured value.

TYPE : EXT. CON - Use external relays of OVR, UVR. (* Initial value *)

11.4.7. 8. SENSOR SELECT

	8	.	S	E	N	S	O	R		S	E	L	E	C	T				
1	.	O	P		M	O	D	E	L	:		V	D	O					
2	.	W	T		M	O	D	E	L	:		D	O	N	G	N	A	M	

11.4.7.1. OP MODEL : VDO, DONGNAM (Choosing oil pressure sensor, initial value - VDO) - Make sure to use VDO

11.4.7.2. WT MODEL : VDO, DONGNAM, EG CON (Choosing coolant temperature sensor, initial value - DONGNAM)

11.4.8. 9. PROTECT SETTING

	9	.	P	R	O	T	E	C	T		S	E	T	T	I	N	G		
1	.	B	A	S	E	:		O	N										
2	.	U	V	R	:			O	F	F									
3	.	O	C	R	:			O	F	F									

	9	.	P	R	O	T	E	C	T		S	E	T	T	I	N	G		
4	.	A	F	R	:			O	F	F									
5	.	A	F	R	1	:		O	F	F									
6	.	A	F	R	2	:		O	F	F									

	9	.	P	R	O	T	E	C	T		S	E	T	T	I	N	G		
7	.	A	F	R	3	:		O	F	F									
8	.	A	F	R	4	:		O	F	F									

11.4.8.1. BASE : ON, OFF [Initial value : ON]

11.4.8.2. UVR : ON, OFF [Initial value : OFF]

11.4.8.3. OCR : ON, OFF [Initial value : OFF]

11.4.8.4. AFR : ON, OFF [Initial value : OFF]

11.4.8.5. AFR1 : ON, OFF [Initial value : OFF]

11.4.8.6. AFR2 : ON, OFF [Initial value : OFF]

11.4.8.7. AFR3 : ON, OFF [Initial value : OFF]

11.4.8.8. AFR4 : ON, OFF [Initial value : OFF]

12. LCD start-up screen according to setting

12.1.

Sensing speed of generator	Voltage
Oil pressure	CONT(Choosing switch of oil pressure)
Coolant temperature	CONT(Choosing switch of coolant temperature)

M	O	D	E	:	M	A	N	U		D	C	:	2	6	.	0	V		
C	O	M	:	O	N								0	0		H	z		
G	E	N	:	S	T	O	P			O	P	:	O	N					
E	T	M	:	0	0	0	H	0		W	T	:	O	F	F				

12.2.

Sensing speed of generator	MPU(Magnetic pickup)
Oil pressure	CONT(Choosing switch of oil pressure)
Coolant temperature	CONT(Choosing switch of coolant temperature)

M	O	D	E	:	M	A	N	U		D	C	:	2	6	.	0	V		
C	O	M	:	O	N					0	0	0	0	0	R	P	M		
G	E	N	:	S	T	O	P			O	P	:	O	N					
E	T	M	:	0	0	0	H	0		W	T	:	O	F	F				

12.3.

Sensing speed of generator	Voltage
Oil pressure	VAL (Oil pressure sensor)
Coolant temperature	VAL (Coolant temperature sensor)

M	O	D	E	:	M	A	N	U		D	C	:	2	6	.	0	V		
C	O	M	:	O	N								0	0		H	z		
G	E	N	:	S	T	O	P			O	P	:	0	0	.	0	0	K	G
E	T	M	:	0	0	0	H	0		W	T	:				0	0	°	C

12.4.

Sensing speed of generator	MPU(Magnetic pickup)
Oil pressure	VAL (Oil pressure sensor)
Coolant temperature	VAL (Coolant temperature sensor)

M	O	D	E	:	M	A	N	U		D	C	:	2	6	.	0	V		
C	O	M	:	O	N					0	0	0	0	0	R	P	M		
G	E	N	:	S	T	O	P			O	P	:	0	0	.	0	0	K	G
E	T	M	:	0	0	0	H	0		W	T	:				0	0	°	C

12.5.

Sensing speed of generator	Voltage
Oil pressure	NONUSE
Coolant temperature	NONUSE

M	O	D	E	:	M	A	N	U		D	C	:	2	6	.	0	V		
C	O	M	:	O	N								0	0		H	z		
G	E	N	:	S	T	O	P			O	P	:	N	O	N	U	S	E	
E	T	M	:	0	0	0	H	0		W	T	:	N	O	N	U	S	E	

12.6.

Sensing speed of generator	MPU(Magnetic pickup)
Oil pressure	NONUSE
Coolant temperature	NONUSE

M	O	D	E	:	M	A	N	U		D	C	:	2	6	.	0	V		
C	O	M	:	O	N					0	0	0	0	0	R	P	M		
G	E	N	:	S	T	O	P			O	P	:	N	O	N	U	S	E	
E	T	M	:	0	0	0	H	0		W	T	:	N	O	N	U	S	E	

13. PREPARATIONS BEFORE USE

13.1. Connect the circuit to in/output terminals of ECU-DG1 like below [Drawing1].

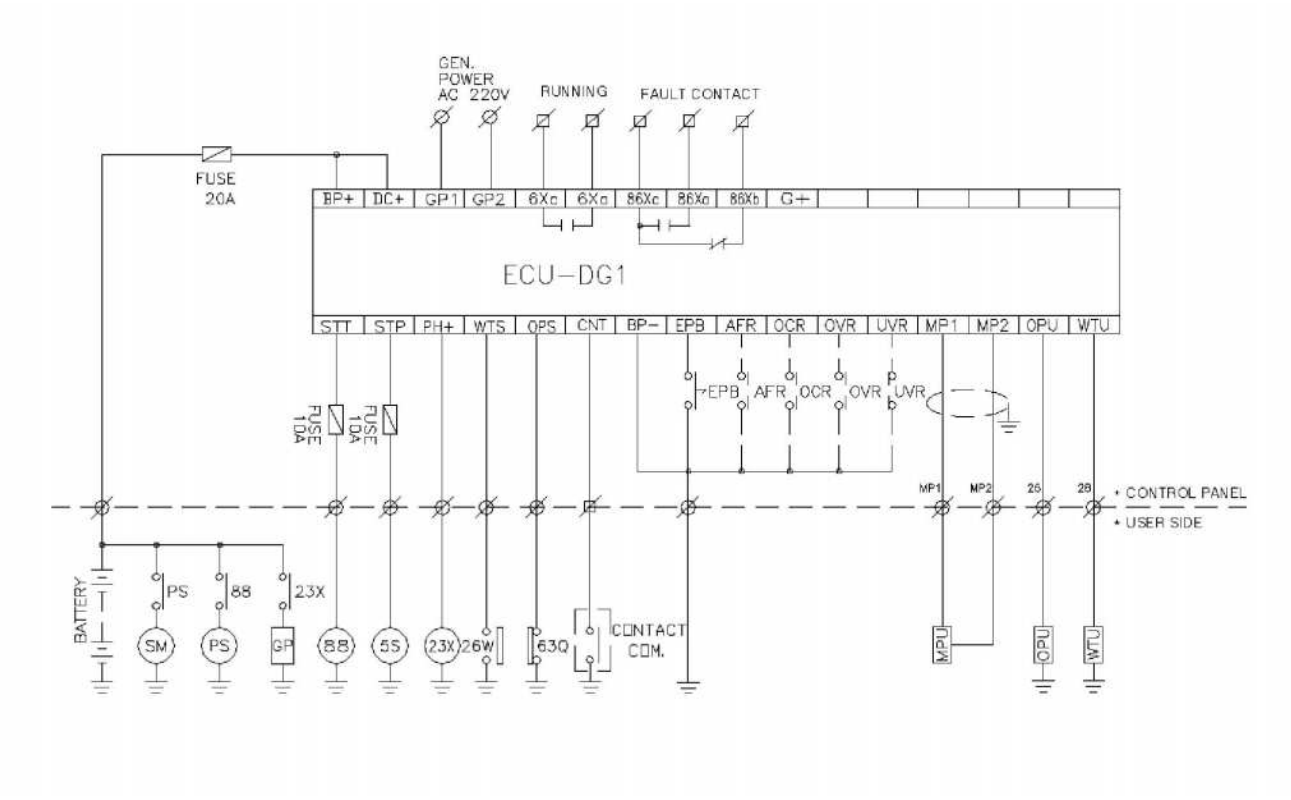
13.2. Set up the basic settings of ECU-DG1 in accordance with engine.

▶ Engine stop mode - ETS/ETR

▶ When engine speed sensing is set as voltage or MPU type, set it in accordance with the number of engine ring gear.

13.3. Supply power.

13.4. If ECU in/output terminals' connections are different from Drawing1, the alarm sounds and the different connections from Drawing1 are displayed on LCD as faults.



[DRAWING 1]

14. MANUAL START TEST

14.1. Set ECU-DG1 as MANU by using the mode setting button.

14.2. Displayed items from below LCD screen : MANU mode, sensing generator speed by MPU, Commercial power is normal, and oil pressure switch, and high water temperature switch contact is selected.

M	O	D	E	:	M	A	N	U		D	C	:	2	6	.	0	V			
C	O	M	:	O	N					0	0	0	0	0	R	P	M			
G	E	N	:	S	T	O	P			O	P	:	O	N						
E	T	M	:	0	0	0	H	0		W	T	:	O	F	F					

14.3. Press START button and engine starts.

- If only starter motor operates and engine does not start, check engine stop mode.
- When engine starts normally without error, the present RPM is indicated, and after OFT, OST times, When oil pressure switch operates normally and when the state is GEN : RUN, LCD screen is changed to OP : OFF.
- When engine speed is different from indicated RPM value, after engine stops, reset after confirming engine gear number of PICK-UP SETTING of SETTING mode No.5.
- If normally operating time of engine is more than 6min, ETM will increase.

M	O	D	E	:	M	A	N	U		D	C	:	2	6	.	0	V			
C	O	M	:	O	N					0	1	7	9	7	R	P	M			
G	E	N	:	R	U	N				O	P	:	O	F	F					
E	T	M	:	0	0	0	H	0		W	T	:	O	F	F					

* ETM : 000H1 - Operating time is 6min. or more.
* ETM : 001H3 - Operating time is an hour and 18min. or more.

▶ When engine operation signal is more than 30% of rated rotating speed, the power of starter motor is cut off.

▶ If oil pressure switch operates owing to detecting oil pressure switch even without engine operating input when engine starts, the power of starter motor is cut off after OST time.

▶ If operating signal of more than 30% of rated speed is input to GP1/GP2 terminal or MP1/MP2 terminal with normal operation of engine, RUN lamp is indicated.

▶ If oil pressure switch does not operate for more than OFT time at more than 30%(IDLE SPEED) of rated speed, faults detecting engine of low oil pressure stops.

▶ If no engine operating signal and no oil pressure switch signal, starting output is maintained for 7sec, and then cut off.

▶ If engine operating signal has no input(less than 30% of rated speed) and oil pressure switch operates, output of starter motor is cut off and engine

operates normally.

▶ If RUN lamp is turned on, battery "+" is output from G+ terminal, and operating power of gauge is supplied, and 6X operates, and so operating signal is sent remotely.

14.4. ENGINE STOP

▶ Press STOP button or press MODE button to be off, and the engine stops.

ETR : If electricity is supplied to fuel solenoid, engine operates. If electricity is cut off to fuel solenoid, engine stops.

ETS : Engine stops when electricity is supplied to Fuel solenoid.

If oil pressure switch is OFF, the power output is cut off after STOP time. If oil pressure switch is not off, the power outputs only for about 20sec. and cut off.

14.5. When engine operates normally, if EPB is pressed, and if engine protection circuit(over speed, high water temperature, low oil pressure) or generator protection circuit(OVR) runs, engine stops.

14.6. Displayed items : MANU mode, sensing generator speed by MPU, commercial power is normal, setting as using sensor after oil pressure and high water temperature sensors are connected.

M	O	D	E	:	M	A	N	U		D	C	:	2	6	.	0	V		
C	O	M	:	O	N					0	0	0	0	0	R	P	M		
G	E	N	:	S	T	O	P			O	P	:	0	0	.	0	0	K	G
E	T	M	:	0	0	0	H	0		W	T	:				0	0	°	C

14.7. Press START button, and engine starts.

- If only starting motor run and engine does not start, engine stop mode needs to be confirmed.
- When engine starts normally without error, the present RPM is indicated, and after OFT, OST times, if oil pressure sensor operates normally and screen displays GEN : RUN, screen is changed to OP : XX.XX KG.
- When engine speed is different from indicated RPM figure, after engine stops, reset after confirming engine gear number of PICK-UP SETTING of SETTING mode No.5.
- If normally operating time of engine is more than 6min., ETM will increase.

M	O	D	E	:	M	A	N	U		D	C	:	2	6	.	0	V		
C	O	M	:	O	N					0	1	7	9	7	R	P	M		
G	E	N	:	R	U	N				O	P	:		5	.	4	4	K	G
E	T	M	:	0	0	0	H	0		W	T	:				0	0	°	C

▶ When engine operation signal is more than 30% of rated speed, the power of starter motor is cut off.

▶ When engine starts, if oil pressure is over 3 Bar(3kg/㎠) detected from oil pressure sensor, the power of starting motor is cut off after OST time even without engine operation input.

▶ If operating signal of more than 30% of rated speed is input to GP1/GP2 terminal or MP1/MP2 terminal resulting from normal operation of engine, RUN lamp is indicated.

▶ When oil pressure sensor does not operate for more than OFT time at more than 30%(IDLE SPEED) of rated speed, if the figure is below 1Bar(1Kg/㎠), fault detecting engine of low oil pressure stops.

▶ In case of no engine operating signal and no oil pressure sensor signal, start output is maintained just for 7sec and then cut off.

▶ If engine operating signal has no input(less than 30% of rated speed) and oil pressure sensor is detected, output of starting motor is cut off and engine operates normally.

▶ If RUN lamp is turned on, battery "+" is output from G+ terminal, and operating power of gauge is supplied, and 6X operates, and so, operating signal is sent remotely.

14.8. ENGINE STOP

▶ Press STOP button or press MODE button to be off, and the engine stops.

ETR : If electricity is supplied to fuel solenoid, engine operates. If electricity is cut off to fuel solenoid, engine stops.

ETS : Engine stops when electricity is supplied to Fuel solenoid.

If oil pressure sensing value is below 1Bar(1Kg/㎠), the power input is cut off after STOP time. If oil pressure sensing value is not

1Bar(1Kg/㎠), the power input is output only for about 20sec. and cut off.

14.9. When engine operates normally, if EPB is pressed, if engine protection circuit(over speed, over temperature, low oil pressure) or generator protection circuit(OVR) runs, engine stops.

15. Automatic operation test

15.1. Select AUTO MODE.

15.2. If CNT terminal is "OPEN", engine does not start.

15.3. If CNT terminal is "CLOSE", after S.D.T(start waiting time/1sec ~ 59sec) time, engine starts.

15.4. If CNT terminal is "CLOSE" and if CNT terminal is "OPEN" before S.D.T time, engine doesn't start and S.D.T time is initialized.

15.5. If CNT terminal is "CLOSE", battery "+" is output from PH+(engine preheating output) and Engine ouput is cut off at more than 30% of engine operating speed.

15.6. If more than 30% of engine operating speed is not input after start output is put out, GCU repeats to put out and to pause start output for 7sec. respectively for three times overall. If more than 30% of engine operating speed is eventually not input for the three times, engine is stopped, being recognized to fault.

15.7. If start output is put out and oil pressure switch is ON, start output is cut off after OST time.

15.8. When engine operates normally, RUN LAMP is indicated.

15.9. If commercial power returns(CNT terminal OPEN) during engine normal operation, engine stops after preparing for re-off for C.D.T TIME(engine cooling time/1sec ~ 59min 59sec) and after cooling engine.

NO	Auto-operation input signal	Engine state	Note
	CNT		
1	OPEN	Stop	
2	CLOSE	Run	

16. Operating test of the engine and generator protecting devices (same at manual or automatic)

▶ After protecting device operates, RESET can be RESET after Buzzer stop.

16.1. EPB (EMERGENCY PUSH BUTTON)

16.1.1. Start engine.

16.1.2. Confirm whether RUN lamp of ECU is turned on or RPM METER indicates normal RPM.

16.1.3. Press EPB.

16.1.4. EPB lamp is turned on, buzzer sounds, and engine stops.

16.1.5. Press Buzzer Stop, Release EPB, and press RESET.

```
* * * E R R O R _ _ M E S S A G E * * *
                                        
                E P B   E R R O R       
  H O E N       R S E S T   P R E S S   
```

- Screen when EPB(EMERGENCY PUSH BUTTON) is input

```
* * * E R R O R _ _ M E S S A G E * * *
                                        
                E P B   E R R O R       
  F A U L T     R S E S T   P R E S S   
```

- Screen after HORN RESET P/B is input

```
M O D E : O F F       D C : 2 6 . 0 V   
C O M : O N           0 0 0 0 0 R P M   
G E N : S T O P       O P : O N         
E T M : 0 0 0 H 0     W T : O F F       
```

- Screen after inputting FAULT RESET P/B
- MODE OFF is initialized.

16.2. OVER SPEED TEST

▶ Over speed test can be performed at any state.

▶ OVER SPEED SETTING value is changed.

- SETTING MANU

6. VOLTAGE SETTING

6.5 : Changing value to the value to be wanted at OVER SPEED

- Initial value : 2150RPM

16.2.1. Start Engine.

16.2.2. Confirm RUN lamp indication and RPM of ECU.
16.2.3. Press OST (OVER SPEED TEST) PB.
16.2.4. OSL lamp is indicated, Buzzer sounds, Engine stops.
16.2.5. LCD screen displays OVER SPEED ERROR_MESSAGE.
16.2.6. Press Buzzer Stop, and RESET.

16.3. OPL(LOW OIL PRESSURE)

▶ Oil pressure switch is related to Stop Output of starter motor and ETS TYPE.

▶ After Engine starts, if Oil Pressure Switch operates, Output of the Starter motor is cut off. When Engine stops, if Oil Pressure Switch is "OFF", stop output is cut off in case of ETS TYPE.

16.3.1. When setting for Oil Pressure Switch
16.3.1.1. Start Engine.
16.3.1.2. Confirm RUN lamp indication RPM of ECU.
16.3.1.3. Earth OPS terminal.
16.3.1.4. Buzzer sounds, Engine stops.
16.3.1.5. LCD screen displays OPS ERROR_MESSAGE.
16.3.1.6. Press Buzzer stop, and RESET.

16.3.2. When setting for Oil Pressure Sensor
16.3.2.1. Start Engine.
16.3.2.2. Confirm RUN lamp indication and RPM of ECU.
16.3.2.3. Faults are detected when OPU connecting terminal OPENs or when Engine oil sensing value in operation is below 1Bar(1Kg/㎠).
16.3.2.4. Buzzer sounds, and Engine stops.
16.3.2.5. LCD screen displays OPS ERROR_MESSAGE.
16.3.2.6. Press Buzzer Stop, and RESET.

16.4. WTL (Over temperature - HIGH WATER TEMPERATURE)

16.4.1. When setting for Over temperature Switch
16.4.1.1. Start Engine.
16.4.1.2. Confirm RUN lamp indication and RPM of ECU.
16.4.1.3. Earth WTS terminal.
16.4.1.4. Buzzer sounds, and Engine stops.
16.4.1.5. LCD screen displays WTS ERROR_MESSAGE.
16.4.1.6. Press Buzzer stop, and RESET.

16.4.2. When setting for temperature sensor
16.4.2.1. Start Engine.
16.4.2.2. Confirm RUN lamp indication and RPM of ECU.

16.4.2.3. Faults are detected when WTU connecting terminal OPENs or when temperature sensing value is more than 105℃.
16.4.2.4. Buzzer sounds, and engine stops.
16.4.2.5. LCD screen displays WTS ERROR_MESSAGE.
16.4.2.6. Press Buzzer Stop, and RESET.

16.5. OCL (Start Failure [Only in Auto-mode] - OVER CRANKING)
16.5.1. Change Mode to Auto-mode.
16.5.2. Block out commercial power or earth CNT terminal.
16.5.3. Start output is put out after S.D.T time.
16.5.4. If Engine operating speed for 7 sec of starting time is not more than 30% of rated speed, repeat 7sec. start and 7sec. stop three times.
16.5.5. OCL lamp is turned on, buzzer sounds, and engine stops.
16.5.6. LCD screen displays OVER CRANK ERROR_MESSAGE.
16.5.7. Press Buzzer Stop, and RESET.
16.6. OVER VOLTAGE, UNDER VOLTAGE, OVER CURRENT, AFR FAULT operate in the same way .as above ENGINE FAULT case.
16.7. 9. When PROTECT SETTING is ON, if faults are input, engine stops.
16.8. 9. When PROTECT SETTING is OFF, if Engine does not stop; only alarm and 86X operates; RESET after buzzer stops, Engine operates continually.

17. ABBREVIATIONS
17.1. ECU-DG1 : ENGINE CONTROL UNIT
17.2. MPU : MAGNETIC PICKUP
17.3. ETS : ENERGIZED TO STOP , (fuel line is closed when engine stops)
17.4. ETR : ENERGIZED TO RUN, (fuel line is opened when engine runs)
17.5. RPM : TACHOMETER
17.6. 5S : Stop Solenoid
17.7. 86X : Operation relay in case of heavy faults input
17.8. 14X : IDLE SPEED relay
17.9. PB S/W : PUSH BOTTOM SWITCH
17.10. EPB : EMERGENCY PUSH BOTTOM SWITCH