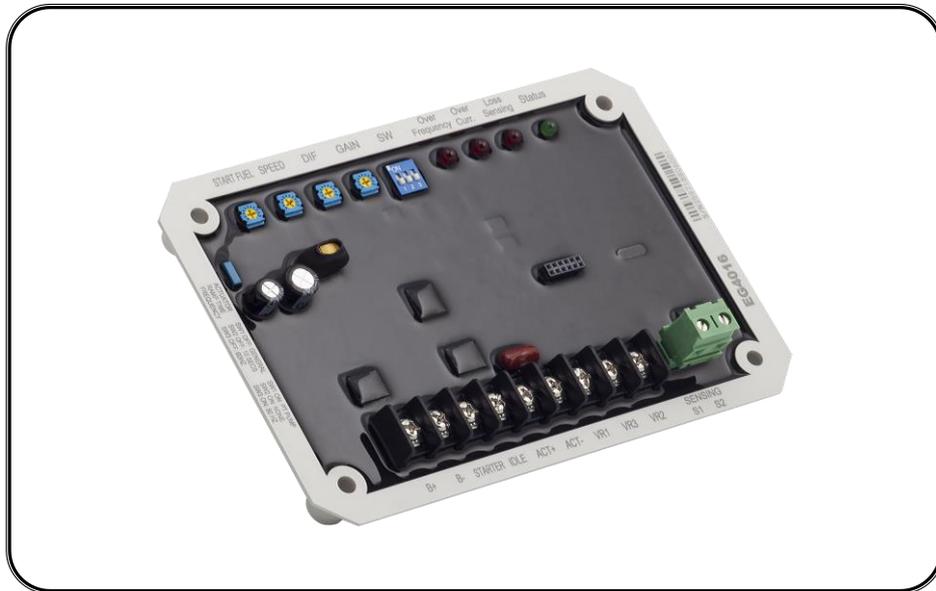


EG4016

Digital Generator Governor Controller User Manual



Digital Governor for use in Gas and Diesel Generators with smoke and IDLE controls.
Senses generator frequency, no magnetic pickup unit (MPU) is required.
Applicable to all types of generator engines and also supports External, Internal, and PT Pump mounted actuators.



KUTAI ELECTRONICS INDUSTRY CO., LTD.

TEL : +886-7-8121771

FAX : +886-7-8121775

Website : www.kutai.com.tw

Headquarters : No.3, Ln. 201, Qianfu St., Qianzhen Dist., Kaohsiung City 80664, Taiwan



SECTION 1 : SUMMARY

The EG4016 uses the generator frequency to control engine speed. It works without a magnetic pickup (MPU), a digital circuit detects the reference frequency from the generators output. Digital governors are not influenced by frequency drift caused by temperature. For example over a temperature range from -40 to +80 °C the frequency drift is only +/- 0.1 Hz.

EG4016 uses advanced PID algorithms, together with GAIN and DIF pots to simplify adjustments and governor response. The EG4016 can be used in all types of engine actuators that work with less than 15Amps and Cummins PT PUMP. LED indicators allow users to easily determine operational and fault conditions making it easy to install and calibrate.

SECTION 2 : SPECIFICATION

Sensing Input (S1, S2)

Voltage 1 – 600 Vac
Frequency 5 – 100 Hz

Operating Voltage (DC+, DC-)

Voltage 10 – 32 Vdc

Reverse Voltage Protection

Max. -50 Vdc

Actuator Output (ACT+, ACT-)

Current Continuous 9A, Max 15A for 10 seconds

Steady State Speed Band

+/- 0.25 % (with stable load)

IDLE Speed Frequency

25 Hz @ 50 Hz mode
30 Hz @ 60 Hz mode

Temperature Drift Frequency Range

0.1 Hz @ -40 to +80 °C

External Frequency Control (VR1, VR2, VR3)

Frequency adjustment range
+/- 2 Hz 5K ohms 1watt potentiometer

EMI Suppression

Internal electromagnetic interference filtering
and common mode ferrite beads

Static Power Dissipation

Min. 120 mA @ 12 Vdc
Min. 60 mA @ 24 Vdc

Protection Functions

Loss Sensing Protection
Actuator Short Circuit Protection activate to stop the output
Overspeed Protection activate to stop the output
Max. 57 Hz @ 50 Hz system
Max. 67 Hz @ 60 Hz system

VR Adjustment

START FUEL Maximum Starting Fuel
SPEED 50 Hz : 45 to 55 Hz
60 Hz : 55 to 65 Hz
DIF PID Differential adjustment
GAIN PID Actuator output gain adjustment

DIP Switch

SW1 Actuator type OFF : External or Internal mount
ON : PT PUMP mount
SW2 Ramp time OFF : 10 seconds ramp time
ON : Immediate
SW3 frequency selection OFF : 60 Hz
ON : 50 Hz

Environment

Operating Temperature -40 to +80 °C
Storage Temperature -40 to +85 °C
Relative Humidity Max. 95%
Vibration 5 Gs @ 60 Hz

Dimensions

162.0 (L) x 112.0 (W) x 43.0 (H) mm
6.38 (L) x 4.40 (W) x 1.69 (H) inch

Weight

330 g +/- 2%
0.73 lbs +/- 2%

SECTION 3 : APPEARANCE / DIMENSIONS / INSTALLATION DRAWING

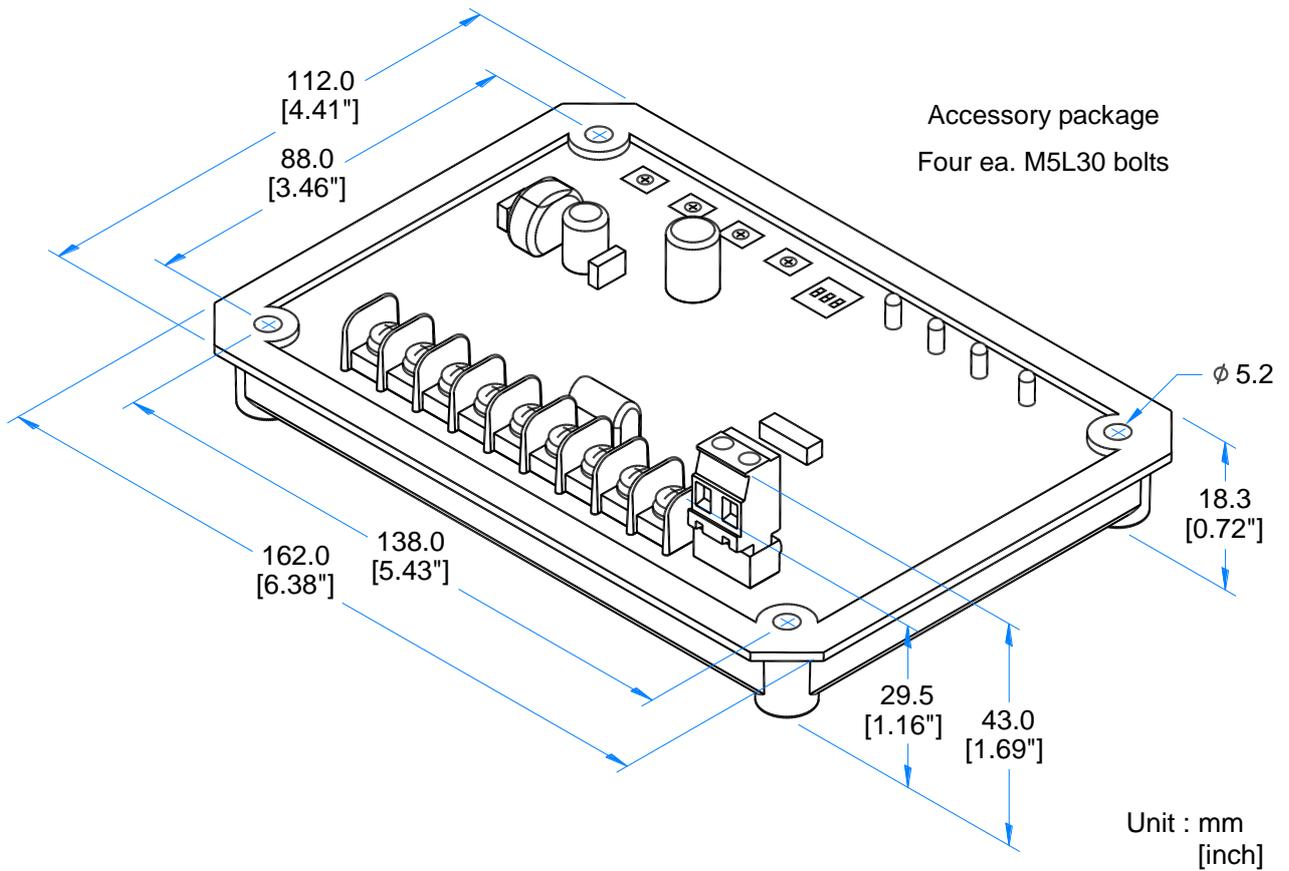
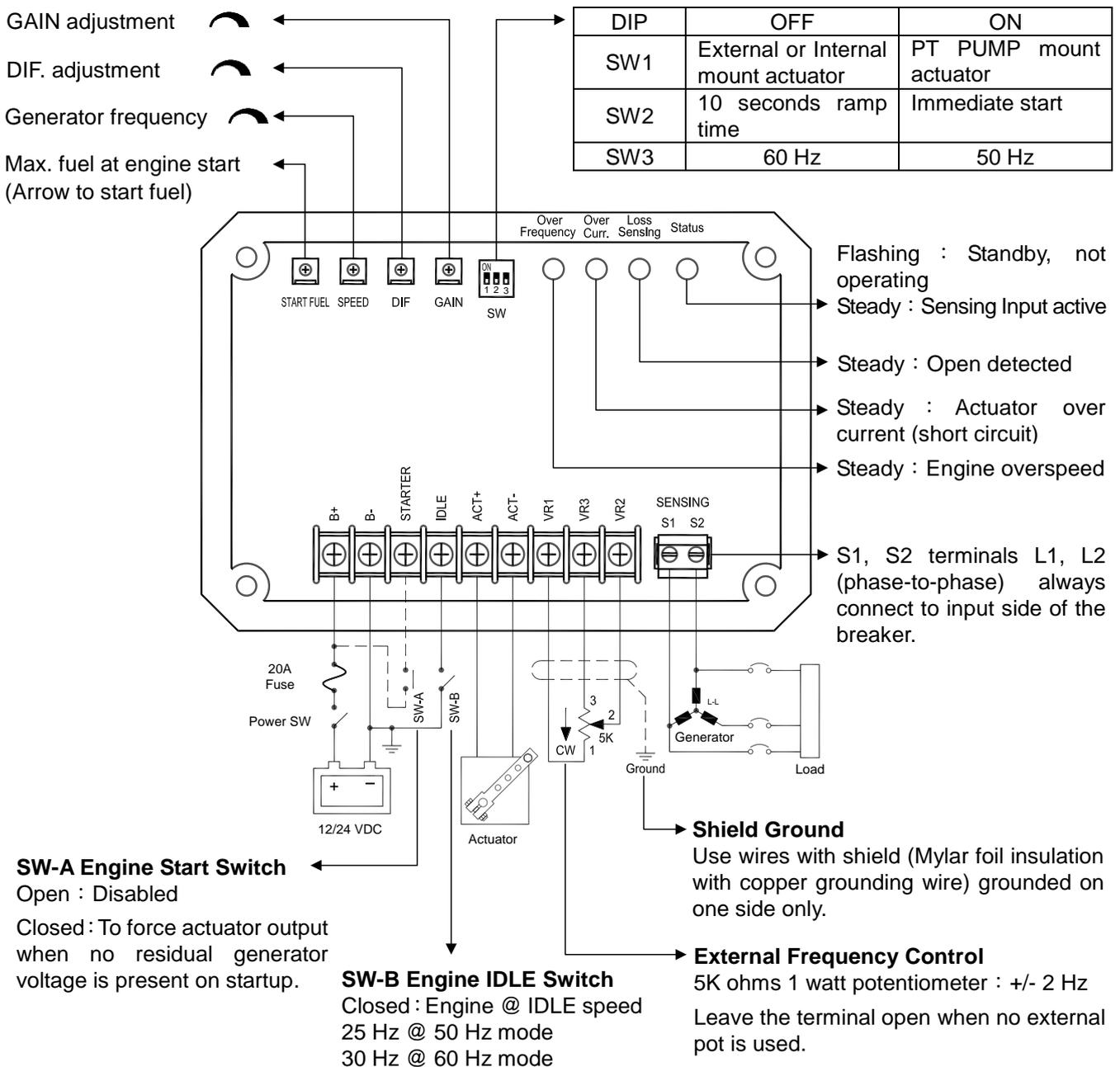


Figure 1 Outline Drawing

SECTION 4 : ALARMS AND WIRING DIAGRAM

ATTENTION

1. Installation personnel must receive training. Defective installations may cause damage and injury to personnel.
2. Always install an independent shutdown device. If by chance power is lost the generator can stop and avoiding damage to equipment and personnel.
3. Install a second engine shutdown device is suggested, such as an emergency fuel switches or air intake damper in order to immediate stop the engine if there is a system failure.
4. Always use a 20A slow-blow fuse between the battery and the governor.
5. Use #AWG10 (2.58 mm²) or a higher between the battery and the actuator.
6. SENSING wire to (S1, S2) must be # AWG18 (1.02 mm²) with an insulation voltage rating of 600V or higher.



SECTION 5 : INSTALLATION

5.1 Inspections before starting engine

- 5.1.1 Check that all wiring is correct. Before starting the engine, turn on the power source to the unit (Power SW) and close the engine start switch (SW-A). The actuator will be forced to its maximum on position confirming that the wiring between the battery and the actuator are working normally. This also confirms the actuator is working smoothly without getting stuck. Repeat several times to check the operation.
- 5.1.2 Adjust the START FUEL potentiometer to the maximum position. If there is excessive black smoke during engine cranking then reduce START FUEL to an appropriate level. However, a setting too low will prevent the engine from starting.
- 5.1.3 Set GAIN, DIF potentiometers (pots) to a central position.
- 5.1.4 If the external frequency control potentiometer is used, it should be adjusted to its central position. Keep these terminals open when not in use.
- 5.1.5 DIP SW 1, 2, 3 should be set to the desired modes of the system.
- 5.1.6 Idle setting. With SW-B closed the engine will enter IDLE speed (25 Hz or 30 Hz). When SW-B is opened the engine will go directly to the rated speed (50 Hz or 60 Hz). Select according to generator requirement.
- 5.1.7 Use an analog frequency meter while making adjustments to make it easier to measure changes in generator frequency.
- 5.1.8 We recommend installing a fuel switch that can immediately shutdown the engine when the system is not operating normally.

5.2 Starting the engine

- 5.2.1 After turning on the unit power (Power SW) start the engine.
- 5.2.2 When the starter motor begins to turn terminals S1, S2 will detect the starting frequency and the actuator will be forced to its maximum engine start output (pulled to all the way on). After the engine is started (frequency > 18 Hz), the controller will automatically adjust the actuator according to frequency.

- 5.2.3 If the residual voltage of the generator is too low (< 1 Vac @ 5 Hz) terminals S1, S2 cannot detect the starting frequency and the actuator will have no output, thus preventing the engine from starting. In this situation connect the engine start switch (SW-A) directly to the starter motor. Alternatively, when the engine is starting close the engine start switch (SW-A). The actuator will open to full output when the engine is cranking helping the engine to start smoothly.

5.3 IDLE (IDLE) operation

Engine is started and SW-B is closed : the engine will enter IDLE speed (25 Hz or 30 Hz). When the engine IDLE Speed countdown is completed SW-B will open and the engine will reach the rated frequency (50 Hz or 60 Hz).

Engine is started and SW-B is opened : engine will go directly to the rated operating frequency.

5.4 Engine Speed Ramp Time

- 5.4.1 DIP SW2 OFF - the ramp up time from IDLE frequency to rated frequency is 10 seconds.
- 5.4.2 DIP SW2 ON - the generator will immediately go to rated frequency.

5.5 Unstable engine speed

If the engine speed is unstable when running adjust the GAIN pot counter-clockwise (CCW) until the engine stabilizes.

5.6 Generator frequency adjustment

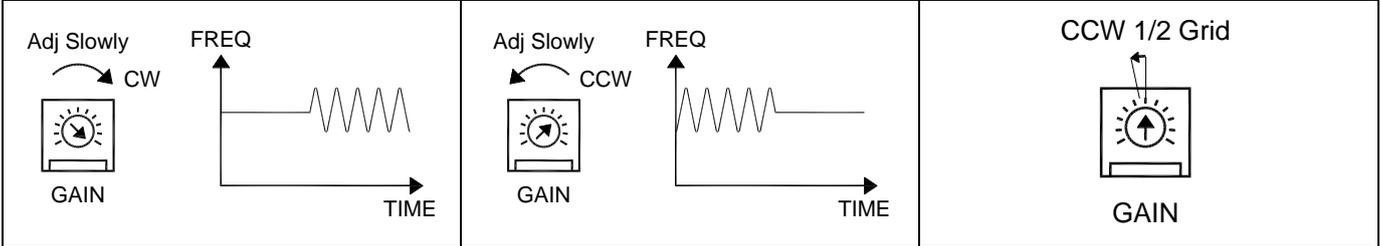
When the engine speed is stable, then adjust the SPEED potentiometer on the governor or the external 5K frequency pot to your rated frequency (50 or 60 Hz).

5.7 Restart the generator

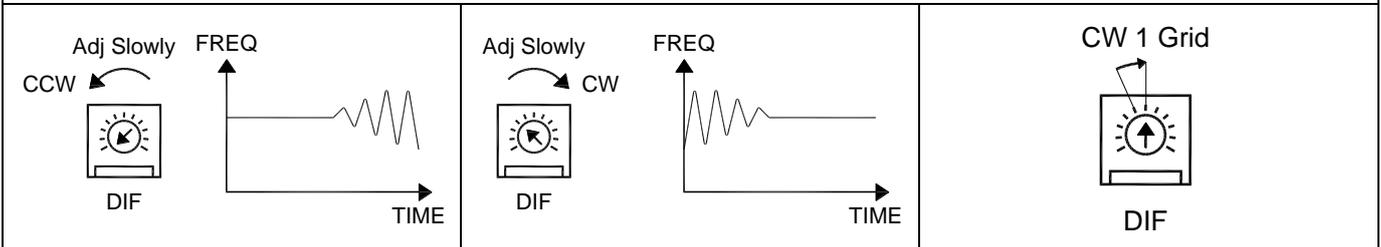
Shutdown the generator and restart to confirm that the governor is controlling engine speed and starts smoothly. If it is stable during this period then go to < SECTION 6. Optimal Engine Response Adjustment Procedure > below – but if not stable repeat Step 5.1.

SECTION 6 : OPTIMAL ENGINE RESPONSE ADJUSTMENT PROCEDURE

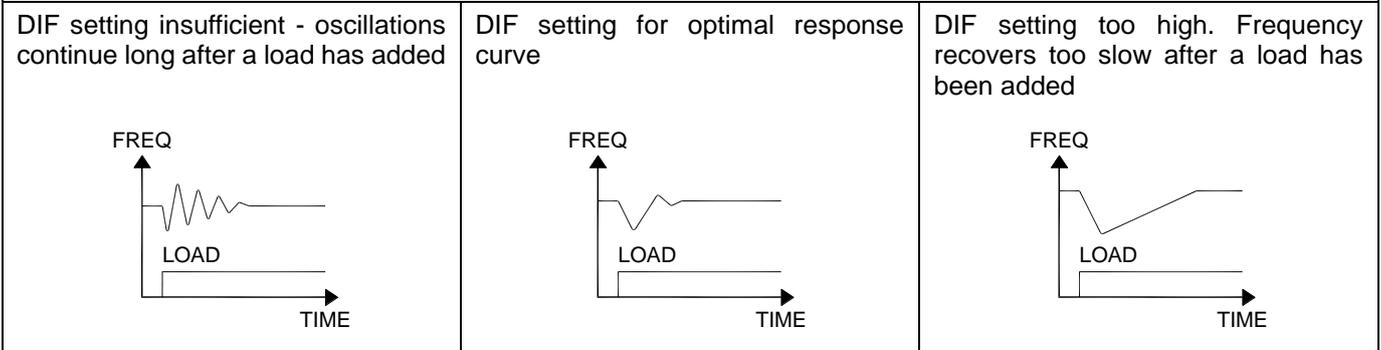
- 6.1 After Step 5. Installation is completed and engine start operation is smooth, carry out the following adjustments with generator in a no-load condition.
- 6.2 Slowly adjust the GAIN potentiometer clockwise (CW) until frequency swings rapidly, then slowly adjust in a counter-clockwise direction (CCW) until the frequency is stable. Wait for the frequency to stabilize, then adjust a further turn counter-clockwise (CCW).



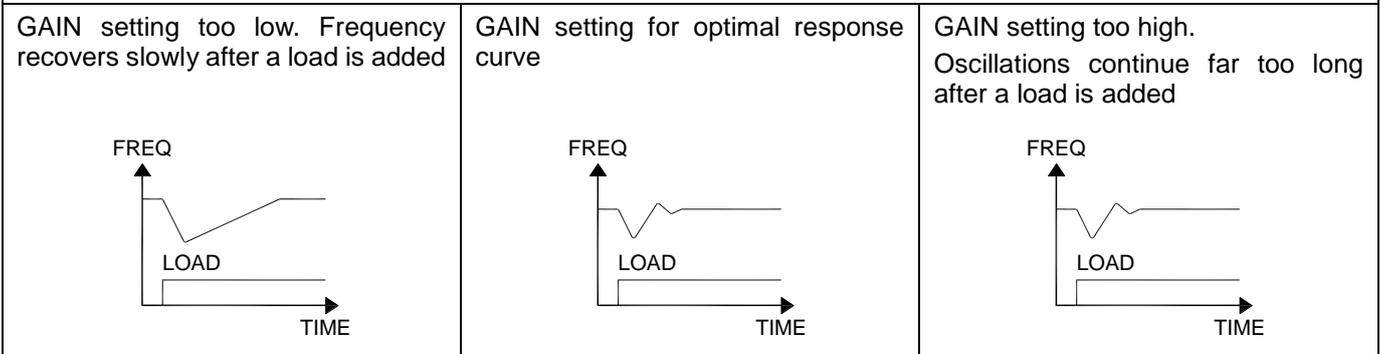
- 6.3 Slowly adjust the DIF pot (CCW) until the frequency goes from stable to oscillating, then slowly adjust (CW). The oscillations will gradually stabilize. Wait for the frequency to stabilize then turn (CW) approximately one more time.



- 6.4 Push (or tap) the arm of the actuator with your hand or add a load to the generator and observe how the frequency recovers. If normal it should return quickly to stability. If further adjustments are required then repeat Steps 6.2 and 6.3 to readjust.
- 6.5 Optimal response curve and the DIF potentiometer adjustment.



- 6.6 Optimal response curve and the GAIN adjustment



SECTION 7 : TROUBLESHOOTING

PROBLEM	CORRECTIVE ACTION
7.1 Engine Overspeed	<ol style="list-style-type: none"> 1. Engine overspeed caused by inappropriate setting of GAIN & DIF potentiometers. Adjust settings according to procedure in Step. 5. 2. Check whether or the wiring for the voltage detection inputs (S1, S2) is normal, and whether or not the residual voltage produced is > 1 Vac. 3. Check whether actuator is stuck in lowest position, causing overspeed. 4. If all of the checks above are normal then change the EG4016 controller.
7.2 Actuator cannot open completely to maximum output	<ol style="list-style-type: none"> 1. Check if the battery voltage is below 10 Vdc. 2. Check if the actuator has overheated. 3. Check whether the actuator specs. match the driving power supply voltage. 4. Check that the linkage between the actuator and the fuel valve is not impeded. 5. For actuator installation refer to “Electronic Governor Controller Concept” http://www.kutai.com.tw/en/electronic-governor.html
7.3 Actuator does not operate	<ol style="list-style-type: none"> 1. Check the power switch and the fuse. 2. Using an ohm meter measure ACT+, ACT- terminals will measure the internal resistance of the actuator (pay attention to measurement polarity). If the actuator is damaged it is possible that the measured resistance level will not meet the specifications of the actuator. Change the actuator to meet system requirements. 3. Confirm that the actuator has been installed in accordance with Step 5.1.1
7.4 Over Current (short circuit) protection lamp illuminated	<ol style="list-style-type: none"> 1. Check whether or not the actuator is short-circuited. 2. Check whether the actuator has a parallel diode. Ensure that the ACT+ is connected to the N (Cathode) pole of the diode, and ACT- is connected to the P (Anode) pole.
7.5 Engine will not start	<ol style="list-style-type: none"> 1. Check whether START FUEL is set to a level where the engine can start. 2. Turn START FUEL potentiometer to maximum setting (clockwise). If it cannot be opened to the maximum then reference Step 7.2 above. 3. Check whether there is sufficient fuel and the fuel switch is open. 4. It is possible that air could be trapped in the fuel line. 5. Check the fuel time for leaks. Try manually operating the engine.
7.6 Excessive black smoke during engine cranking	<ol style="list-style-type: none"> 1. Reduce the START FUEL setting. Reduce the maximum start fuel to an appropriate level to supply enough fuel for engine start.
7.7 Engine speed oscillates irregularly	<ol style="list-style-type: none"> 1. Measure voltage between B+ and B- on the EG4016. If voltage is insufficient (< 10 Vdc) it could possibly cause irregular operation. Change the battery. 2. RFI caused by improper shielding. Fix shield grounding wire.
7.8 Engine speed continually swings after a load is added	<ol style="list-style-type: none"> 1. Gain adjustment is not good. Re-adjust Gain setting according to Step SECTION 6. Optimal Engine Response Adjustment Procedure.
7.9 Frequency oscillates in a small range	<ol style="list-style-type: none"> 1. Check the linkage between the actuator and the fuel valve, either too tight or if there is a gap (too loose). Correct any problems with the linkage.
7.10 Radio Frequency Interference (RFI) causing irregular engine speed oscillations	<ol style="list-style-type: none"> 1. Install EG4016 in a grounded metal case in order to shield from RFI.

※ Appearance and specifications of products are subject to change for improvement without prior notice.