

# ESG2002A07A-WT

# Electronic Governor Instruction



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## Foreword

This manual mainly introduced the working principle of the electronic speed control system, system composition, Regulation, operation, maintenance and simple troubleshooting method, suitable for a certain understanding, to the engine and the electronic governor routine installation, use and repair personnel. Recommend the product specification in the workplace, and strictly follow the method given here to operate.

# Caution

- Speed sensor to the electronic control system shall not be shared with other systems, or they may cause serious consequences.
- You can't rely on the electronic speed control system to prevent engine overspeed, and overspeed protection device installed independently, effectively in the engine system.
- Before starting the engine should confirm the fuel injection pump rod in oil cut-off position, push and pull the fuel rack should be flexible and no jam.

# $1\,$ The Principle Of The Electronic Governor System

Electronic governor, with its simple structure, high reliability, convenient operation, easy function extension and high cost performance, applies to all kinds of diesel generating sets, vehicles and marine diesel engines. Its normal type is all-electronic single pulse speed and close loop position structure, provided with functions of non-corresponding or corresponding control, speed and rated speed during running maximum fuel supply control, emergency stop and etc.

It is also capable of adding other control functions according to the customer's particular requirements.



Figure 1.1 Electronic governor system

# **2** The Structure Of The Electronic Governor System

## 2.1 Speed Control

### 2.1.1 The basic electronic characteristics

۶	SUPPLY	VOLTAGE :	DC 24V	(Scope 18V~32V)	or DC12V	(Scope9V~16V)
۶	SUPPLLY (	CONSUMPTION :	< 0.1A	(static state)		
≻	SPEED FLU	UCTUATION RATIO :	$\leq \pm 0.25$	%		

➤ STEADY STATE SPEED DROOP : 0~5% Adjustable

- > AMBIENT TEMP. :  $-40^{\circ}C \sim +85^{\circ}C$
- ► RELATIVE HUMIDITY : <95%

### 2.1.2 The outline and installing size of the C2002 speed control

The speed control is installed on the control box or fixed other peripheral equipment in the engine. It should be installed in the place of air drying and temperature suitable. If it be installed in the place of more water and humidity, the speed control should be mounted vertically. Its outline and installing size refers to figure 2.1





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### 2.1.3 C2002 speed control ler's connection diagram for normal generator set refers to figure 2.1.3



#### Figure 2.1.3 Connection diagram of the C2002 speed control for normal generator set

Torminal	Wire harness		
Terminar	Less than 6 meters	More than 6 meters	
1, 2 shall connect with the actuator winding end	1 mm <sup>2</sup>	2.5 mm <sup>2</sup>	
3、4 shall connect with a speed sensor ( the minimum operation signal are both 2.5V AC)	0.5 mm <sup>2</sup>	1 mm <sup>2</sup>	
5、6 shall connect with the battery (reference to the controller voltage value)	1 mm²	2.5 mm <sup>2</sup>	
7、9 shall connect with the Speed Potentiometer			
7, 12 shall connect with the idle switch	The signal points are millampere level current, so it can be used $0.5 \text{ mm2} \sim 1 \text{ mm2}$ wire harness to connect. In a strong magnetic field environment, you shall use the shield lines to connect, shielding net shall connect the grounded end of the controller effectively.		
10, 11 shall connect with the droop switch			
13 is the access terminal (as input signals for synchronizer, load distribution, ramp generator access points which for the combined machine or extraordinary setting)			
14 is the auxiliary power output for +10V DC, load should be less than 20mA			

The Electromagnetic Actuator connects to Terminals 1 and 2 and battery connects to Terminals 5 and 6. Terminals 1, 2, 5, and 6 should be #16 AWG (1 mm sq) or larger. Long cables require an increased wire size to minimize voltage drops. The battery positive (+) input, Terminal 6, should be fused for 15 amps as illustrated.



☑ The correct wiring diagram



Magnetic speed sensor connects to Terminal 3 and 4 MUST BE TWISTED AND/OR SHIELDED for their entire length. The speed sensor cable shield should only be connected to Terminal 4. The shield should be

insulated to insure no other part of the shield comes in connect with engine ground, otherwise stray speed signals may be introduced into the speed control to stop the engine.

- ◆ The remote potentiometer connects to Terminal 7 and 9. If it resistance is 5K ♣, speed adjusting range is 2400HZ.
- Speed droop connects to Terminal 10 and 11. When the Terminal 10 and 11 is off, speed droop is 0; When the Terminal 10 and 11 is closed, speed droop range is 0-5%.
- Rated and idle speed switch connects to Terminal 7 and 12. The switch close for idle, the switch off for rated speed.
- Terminal 13 receives input signal from load distribution device, automatic synchronizer device and other governor system auxiliary device.
- Terminal 14 output +10 volt regulated supply.

### 2.2 Electromagnetic Actuator

- 2.2.1 Basic characteristics
- ☑ WORKING VOLTAGE: DC24V(范围 16V~32V)
- ☑ WORKING TORQUE: 0.8N M
- ☑ WORKING STROKE: 15mm
- $\square$  AMBIENT TEMP: -40 °C ~ +95 °C
- $\square$  RELATIVE HUMIDITY: < 95%
- ☑ LOCATION: ACCORDING TO THE POSITION OF THE ENGINE OIL PUMP IN THE OPTIONAL RIGHT



2. 2. 2 A07A–WT Electromagnetic Actuator (Figure 2. 2)

Figure 2.2 The outline and installing size of the A07A-WT electromagnetic actuator

### 2.3 Speed Pick-up

The Speed Pick-up of the Electromagnetic Governor is Speed Pick-up of magnetoelectricity, inner structure of which are made of sensor, loop, alnico and plug. Its structure refers to figure 2.3. The gap between the magnetic speed sensor and the ring gear teeth should not be any smaller than 0.02 in. (0.45 mm). Usually, backing out the speed sensor 3/4 turn after touching the ring gear tooth will achieve a satisfactory air gap.



Figure 2.3 Speed sensor structure diagram

\* We can provide rotate speed sensors according to customer orders..

Cautions: the use of speed sensor to the electronic control system shall not be shared with other system, otherwise it may cause very serious consequences!

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# **3** Installing and Debugging

## 3.1 Installing Of The Electronic Governor

The C2002 speed control is rugged enough to be placed in a control cabinet or engine mounted enclosure with other dedicated control equipment. If water, mist or condensation may be in contact with the controller, it should be mounted vertically. This will allow the fluid to drain away from the speed control.

### Warning !

An overspeed shutdown device, independent of the governor system, should be provided to prevent loss of engine control which may cause personal injury or equipment damage. Do not rely exclusively on the governor system of electric actuator to prevent overspeed. A secondary shut off device, such as a fuel solenoid, should be used.

## 3.2 Connection Diagram Of The ESG2002 Series Electronic Governor System



图 3.1 Connection diagram of the ESG2002A07A-WT series electronic governor system

### 3.3 Adjustments before Starting Engine

Check to insure the GAIN and STABILITY adjustments, normally this value is set mid position by factory.

Leave factory conditions of Red State Switch is , namely RSW-1, RSW-3 = OFF, RSW-2 = ON.

Rated and idle speed of the speed control had been set by factory. Normally, this value is near from the user's engine working rotate speed value. In practice, after some adjustments, controller can achieve rated and idle speed, and the stability would be very well.

### 3.4 Adjustment of the Controller after Starting

3.4.1 Crank the engine with D.C. power applied to the governor system. Start fuel quantity varies with environmental temperature of engine start. Though adjusting start fuel quantity potentiometer; exhaust smoke from the engine can be adjusted to the best state.

3.4.2 The governor system should control the engine at low idle speed. If the engine is unstable after starting, turn the **GAIN** and **STABILITY** adjustments counterclockwise until the engine is stable.

3.4.3 The governed speed set point is increased by clockwise rotation of the **SPEED** adjustment control. Remote speed adjustment can be obtained with an optional Speed Trim Control.

3.4.4 Once the engine is at the operating speed and at no load, the following governor performance adjustments can be made.

3.4.4.1 Rotate the **GAIN** adjustment clockwise until instability develops. Gradually move the adjustment counterclockwise until stability returns. Move the adjustment one division further counterclockwise to insure stable performance.

3.4.4.2 Rotate the **STABILITY** adjustment clockwise until instability develops. Gradually move the adjustment counterclockwise until stability returns. Move the adjustment one division further counterclockwise to insure stable performance.

3.4.4.3 Gain and stability adjustments may require minor changes after engine load is applied. Normally, adjustments made at no load achieve satisfactory performance. A strip chart recorder can be used to further optimize the adjustments.

3.4.5 After the governor speed setting has been adjusted, place the optional external selector switch in the **IDLE** position. The idle speed set point is increased by clockwise rotation of the **IDLE** adjustment control.

When the engine is at idle speed, the speed control applies droop to the governor system to insure stable operation.

3.4.6 Through the above adjustments engine still unable to stability, it needs to be adjusted Red State Switch now, figure 3.4.6 four cases (a: RSW-1, RSW-3 = ON, RSW-2 = OFF; b: RSW-1, RSW-2 = OFF, RSW-3 = ON; c:

RSW-1, RSW-2 = ON, RSW-3 = OFF; d: RSW-1, RSW-3 = OFF, RSW-2 = ON). After every adjusting Red State Switch go on the 3.4.4.1 and 3.4.4.2 adjusting procedure again. If it is still unable to stability, should inspect engine and fuel pump for service condition. And then, contact with manufacturer.



Figure 3.4.6 Red State Switch

## 3.5 Speed Droop Operation

3.5.1 Droop is typically used for the paralleling of engine driven generators.

3.5.2 Place the optional external selector switch in the **DROOP** position, that is connected Terminals 10 and 11. Droop is increased by clockwise rotation of the **DROOP** adjustment control. When in droop operation, the engine speed will decrease as engine load increases. The percentage of droop is based on current change from no load to full load of the actuator.

3.5.3 After the droop level has been adjusted, the rated engine speed setting may need to be reset. Check the engine speed and adjust the speed setting accordingly.

### 3.6 Accessory Input

3.6.1 When the Auxiliary Terminal 13 accepts input signals from load sharings, auto synchronizers and other governor system accessories are directly connected to this terminal. It is recommended that this connection form accessories should be shielded as it is a sensitive input terminal.

3.6.2 When an accessory is connected to Terminal 13, the speed will decrease and the speed adjustment must be reset.

## 3.7 Accessory Output

The +10Volt regulated supply, Terminal 14, can be utilized to provide power to our governor

system accessories. Up to 20mA of current can be drawn from this supply. Ground reference is Terminal 7.

Caution - a short circuit on this terminal can damage the speed control.

# **4** System Troubleshooting

# 4.1 Fault judgment of the electronic governor

The fault of the electronic governor will cause the engine performance degradation which may lead the engine shut down. If you can judge this is the fault of the electronic governor , you just shall change the electronic governor ; if there are something trouble with the engine and the auxiliary system which incarnate the engine speed less than the using requirement , and then the problem can't solve even you replace the electronic governor. Thus you shall analyze the problem comprehensively and validate to determine it.

Symptom	Test	Probable Fault	
		Voltage between Terminals 5 and 6 Should be 12V	
	Battery	DC or 24V DC, And pay attention to electronic	
		governor power (POWER) light is on.	
	Pick-up	1. The setting of the speed pick up is not correct	
Engine con not start		and the space is too big $_{\circ}$	
Elignie can not start		2 Speed sensor cable bolt, Measuring the DC	
		resistance should be $830-970\Omega_{\circ}$	
	Actuator	1.Actuator or linkage binding.	
		2. Actuator cable bolt, measuring actuator coil	
		resistance, resistance between $4 \sim 5$ ohms	
A atuator door not	Dottory	Starting when measuring the battery voltage, if less	
Actuator does not	Battery	than 14V battery undervoltage, need to recharge. $\circ$	
energize fully	Actuator	Actuator or linkage binding.	
		1. Adjust the stability and the gain of the control	
	Speed Controller	according to 3.4.4	
Unsteady engine		2. Voltage between Terminals 14 and 7 Should be	
speed		10±0.5V	
speed		Check the actuator and the oil pump's rack and	
	Actuator	make sure their connect is not loose	
	Speed Controller	1. The number of engine gear is wrong and the rate	
		2. The gain is set too low and sensitive degree is not	
		enough, which bring about too high instant speed	
E		5. Defective speed controller	
Engine Overspeed		1. Actuator of linkage binding	
	Actuator	2. If zero position of the actuator is not according	
		to actuator of the oil pump, actuator cannot cut up	
		the oil to the oil pump after losing power	
	Pick-up	If error speed sensor signal happens, please Check	
		wiring.	
Close the engine before	Pick-un	If error speed sensor signal happens, please Check	
running speed	i iek-up	wiring.	

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# 4.2 Insufficient Magnetic Speed Sensor Signal

When the speed sensor signal is stronger, it can resist the external pulses , the speed sensor can measure the outputted signal which is more than 3volts .When the voltage is less than 3volts, you shall reduce the tooth gap between the speed actuator and engine ,which can improve the amplitude of the signal. The gap shall less than 0.45mm. If the voltage is still less than 3 volts, you shall check the whether the magnetism of the speed actuator is too weak.

## 4.3 Electromagnetic interference (EMI)

The electronic governor system can be adversely affected by large interfering signals that are introduced through the cabling or through direct radiation into the control circuits. To avoid the medium interference, all the speed controller produced by Our company include the filter and shielding designs that can protect the sensitive circuits from the external interference.

It is difficult to predict the value of the interference. You shall consider all the possible range of the interference such as the radio communications of the space field, wireless walkie-talkie, and wireless radio transmitter and also including the use of magneto, solid-state ignition systems, and voltage adjuster or battery chargers.

When you doubt that space field or other systems will affect the speed governor system operation by conduction or direct radiation during the using period, we suggest that you shall use the double shielded cables as the external cables of the controller. Also ensure that one terminal of the shielded cable which includes the 360 degree of the speed actuator shall connect to the shell of the controller. And mount the speed control on a grounded metal back plate or place it in a sealed metal box to avoid the electronic interference. There will be a good effect when using the metal cover or the metal container. The most common anti-interference measure is to use the shielding wire. If using the generator with brush, you can't ignore the electronic spark interference, so you shall use the special shielding measure to the huge interference environment. If you can't solve this kind of problems, please contact with our engineers. They will give you some more suggestions.



Address 1: Room 802-803, No.2 Building, Block A, No.555, Lansong Road, Pudong District, Shanghai City, P.R. China Zip code : 200127 Sales line : 021-68065446 Address 2: No.49 Mingzhu Road, Binhai Industiral Zone , Jinhai Town, Qidong City , Jiangsu Province, China Zip code: 226236 Fax: 0513-83833619 Sales line : 021-68065446 Service line : 13917597386 Website: www.fortrust.cn E-mail : sales @fortrust.cn