

## INTRODUCTION

Previously fitted Hydro Electric GE/WW governors are being replaced by this Micro control based Governor. In this Governor, a micro controller controlled DC stepper motor is used to control the fuel rack of diesel engine of the locomotive. This Governor also maintains a preset constant HP at each notch. In addition to these functions, the equipment also does air manifold pressure based fuel limiting, and low lube oil pressure shutdown.

## SYSTEM DETAILS

**Control unit :** The control unit houses all electronic circuits for functioning of the governor & a Vacuum Fluorescent Display. It consists of following modules:

1. Control Card (MEGCC)
2. Input Card (MEGIP)
3. Load and Clutch control Card (MEGLC)
4. Motor Control Card (MEGMC) - 2 Nos.
5. Display Control Card (MEGDSP)
6. Power Supply Module (MEGPSM).



## Actuator Unit

This unit converts the electrical signals from control unit into mechanical movement of fuel rack. When the clutch is disengaged, the spring pulls the fuel rack to "No Fuel" position and the engine is shuts down. Fuel rack position sensor and pressure sensors are also housed in this unit. The electrical signals from these sensors are transmitted to control unit.

## SYSTEM SPECIFICATIONS

### 1} Operating Supply Voltage

Loco battery Supply of Nominal 72 Volts DC. Range 40 V to 90V DC. Dip to 22 V DC for 0.8 Sec permitted during cranking.

### 2} Speed (User Settable)

Provision for setting 8 Speed steps for the 8 notch positions.

### 3} Governor Response time (User Settable)

Time taken for speed adjustment from IDLE to FULL speed will be 15 to 20 seconds. For intermediate notch positions time to adjust engine RPM will be in the same proportion.

### 4} Load control

Provision for load control to maintain constant HP output of the engine at each speed setting. Load control is achieved using equivalent of LCP, for interfacing with the existing E-type excitation system on the locomotive. Load control timing is

- 1) From max. to min. field position change will be 8.5 to 11 sec
- 2) From min. to max. field position change will be 25 to 30 sec.

### 5} Air Manifold Pressure Bias Fuel Limiter

Supply of fuel to engine is limited as per available BAP at any point of time. Provision is made for loading any curve (BAP Vs Fuel Rack Limit) through user settable parameters. A toggle switch is provided on control unit to bypass this feature.

### 6} Pressure Sensors with their working ranges

- a) Boost Air Pressure Sensor - 0 to 3.0 kg/cm<sup>2</sup> .
- b) Fuel Oil Pressure Sensor - 0 to 5.0 Kg/cm<sup>2</sup> .
- c) Lube Oil Pressure Sensor - 0 to 10.0 Kg/cm<sup>2</sup>

### 7} Display

20 characters X 4 line alpha numeric Vacuum Fluorescent Display. 7 various Engine parameters are displayed while engine is running.

#### 8). Actuator Unit.

- a). Working capacity greater than 16.3 Nm.
- b). Rack travel 0 to 30 mm.

#### **SALIENT FEATURES**

1. Functionally plug-in modules
2. Minimum internal wiring to increase reliability.
3. A powerful 16 bit micro controller with stepper motor and digital PID control for precise positioning of fuel rack.
4. Electromagnetic clutch for automatic shutdown.
5. On line tuning of parameters through LAPTOP to optimise the performance.
6. Adaptability for different class of locomotives
7. Security against un-authorized access to governor parameters.
8. User friendly menu driven software for view / set parameters
9. Fuel rack position sensor failure made fault tolerant:
10. Failure of BAP sensor, the governor automatically disables the BAP based rack limitation. (Manual bypass is also available in case of problem with loco).

#### **ADVANCED FEATURES**

##### **Display Parameters:**

- Lube Oil pressure
- Fuel Oil Pressure
- Booster Air Pressure
- Notch
- Engine RPM
- Load Control Position

These parameters are continuously monitored & displayed on the screen.



#### **Faults Diagnosis**

- On-line Fault Diagnostics.
- Display fault Message with Hooter sounding
- Error Log with Real Time and Date in Non Volatile Memory.
- Error log can be Down Loaded to a LAPTOP/ PC
- Notch wise diesel engine run time counter is provided to conduct Load factor trials.

#### **OSTA Test Facilities**

- Electronic OSTA has been provided to shut down the engine in case of engine over speeding. This electronic OSTA trips before the mech.OSTA. This is an additional Facility to test both electronic & Mech OSTA through key lock switch.
- Dry run test through push button.

#### **Fail-Safe Features**

- Tacho signal failure.
- Motor Over current.
- Automatic shutdown of engine during LOP sensor failure.
- Micro Controller, EPROM or Bus driver's failure.
- Software corruption
- Power supply failure.
- Engine over Speed.
- Booster air pressure Sensor failure automatically disables air pressure based fuel limiting.
- Fault Tolerance for fuel rack position sensor failure.
- Engine runs at notch 1 in case of notch input fault.



**Faults Messages** :Faults requiring acknowledgement for clearing of display message

Displayed message	Interpretation
OST TRIPPED or FUEL RACK Drive Motor FAILED.SHUTTING DOWN ENGINE	This is displayed whenever shutdown is enforced due to continuous motor over current may be due to OST obstruction to fuel rack or any other causes.
Low Lube Oil Pressure SHUTTING DOWN ENGINE	This message is displayed when Low Lube Oil Pressure is detected while engine is running and shutdown is enforced.
OST TRIPPED or TACHO FAILED, SHUTTING DOWN ENGINE	If engine bogs down due to OST trip or any other reason or if Tacho fails, engine shut down is enforced and this message is displayed.
OVER SPEED SHUTTING DOWN ENGINE	While normal running of the engine If engine over speed occurs system shut down the engine & display this message.
Electronic OVER SPEED TRIP test FAILED	When electric OST tests fails this message is displayed. OST test failure occurs when engine does not shut down at the set RPM limit for the test.
Mech OVER SPEED TRIP test FAILED	This message is displayed, during mech OST test, if mechanical OST does not trip even after the engine has run at the set RPM limit for the OST, for 10 secs.
OST TRIPPED or FUEL RACK Drive Motor FAILED CAN'T START ENGINE	During cranking, if continuous motor over current occurs due to OST obstruction to rack or any other reason, this message is displayed
LOP Sensor FAILED. SWITCH OFF Power & repair Sensor to -	Whenever lube oil pressure sensor or its circuit or cable fails, this message is displayed after shutting down engine.

-restart engine. FUEL RACK Position Sensor Faulty	When Fuel Rack position sensor or its circuit or cable fails this message is displayed.
OST TRIPPED or FUEL RACK Drive FAILED STOP CRANKING ENGINE	While Cranking the engine, if any obstruction for fuel rack movement is encountered this message is displayed.

### TROUBLE SHOOTING

Faults	Driver Attention
Loco cranking but not starting/ firing.	1.MCBG is not powered ON. 2.MU switch in STOP position. 3.'Press Start Button to Crank Engine' message is not on MCBG screen. 4. 'Lube oil sensor faulty, waiting for recovery' message is on MCBG screen. 5.LWS is operated. 6.OSTA tripped and not reset properly. 7.Fuel Racks do not travel even if Governor shaft moves. Over travel spring in the base is wind up If Fuel racks is not moving press linkage to crank the engine.
BAP less & hauling power poor	Switch ON the Boost air control switch in BAP Bypass mode provided on the front panel of the control unit.
Erratic engine rpm.	Check the Notch input connections at Governor terminal block. Check the connector tightness.
BAP/LOP/FOP FRP sensor faulty message on MCBG Display.	Check the connectors tightness at MCBG Control unit & Actuator unit.

### Important Error Code with Message

1	Tacho Faulty/ or Cable Noisy	12	BAP Sensor Faulty
3	LOP Sensor Faulty, showing High Pressure	16	Cable open or Tacho faulty
4	BAP Sensor Faulty, showing High Pressure	17	LCP Circuit Faulty
5	FOP Sensor Faulty, showing High Pressure	22	LOP Sensor Fault recovered
9	Engine shut down due to Over speed	23	BAP Sensor Fault recovered
11	LOP sensor faulty or cable open	24	FOP Sensor Fault recovered

### DRIVERS INSTRUCTION

When Engine shuts down due to any reason:

- Note down the fault message and record in repair book
- Press acknowledge push button available on front panel of control unit to clear the fault messages.
- Ensure the following message appears on Display before pressing start button. "Press Start Button to Crank Engine Or Engine Shut Down. Press, START Button to Crank Engine" Then crank the Loco.
- In case of LOP sensor faulty loco will not crank. In case of BAP, FOP & FRP sensor failure loco will crank normally. A message will be displayed after Mech OSTA trip "Move fuel rack linkage manually to free them.

### Disclaimer

*The information given in this pamphlet does not supersede any existing provisions laid down in RDSO and Rly. Board's instructions. This document is not statutory and instructions given in it are for the purpose of guidance only. If at any point contradiction is observed, Rly. Board/RDSO's guidelines or Zonal Rly.'s instructions may be followed.*



GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS  
(For Official Use)

### Pamphlet on Micro Controller Based Governor fitted on Alco Loco



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