



(Govt. of India)
(Ministry of Railways)

HAND BOOK
ON
MICRO CONTROLLER BASED GOVERNOR
FITTED ON DIESEL LOCOMOTIVES



(For official use only)
CAMTECH/2012/M/MCBG/1.0

June 2012

*Centre
for
Advanced
Maintenance
TECHnology*



Excellence in Maintenance

MAHARAJPUR, GWALIOR – 474005

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HAND BOOK
ON
MICRO CONTROLLER BASED GOVERNOR
FITTED ON DIESEL LOCOMOTIVES

FOREWORD

Micro Controller based Governor has many advantages over conventional engine governors on diesel electric locomotive. However, since this is new technology, the awareness about its functioning and maintenance is not adequate amongst field staff. Proper knowledge is must for better reliability of this system.

As a step to achieve this, CAMTECH has prepared this handbook. This handbook contains description, functions, displays and setting parameters for MCBG.

I hope that this handbook will provide necessary knowledge to the concerned staff to achieve trouble free service of MCBGs.

29.06.2012
CAMTECH, GWALIOR

(A.R.Tupe)
Executive Director

PREFACE

Governor is the vital part of a diesel electric locomotive. Various types of Governors are used in all diesel electric locomotives. Micro Controller based Governor is recently introduced in Indian Railway. Proper upkeeping and maintenance of MCB Governor is necessary to ensure reliability and availability of locomotives. This handbook on maintenance of MCB Governor of Diesel locomotive has been prepared by CAMTECH with the objective that those involved in maintenance of diesel electric locomotives in diesel loco sheds, must be aware of correct maintenance procedure of MCB Governor and must know how to investigate cause of failure and what remedial action is required.

In preparation of this handbook Shri S.B.Sharma Sr. CTA/M/CAMTECH has given valuable contribution. I am also thankful to officers and staff of Railways and RDSO for their valuable comments.

It is clarified that this handbook does not supersede any existing procedures and practices laid down in the maintenance instructions issued by manufacturers or by RDSO/LKO.

Technological Upgradation and learning is a continuous process. Hence feel free to write to us for any addition / modification in this handbook or in case you have any suggestion to improve the handbook. Your contribution in this direction shall be highly appreciated.

29th June 2012
CAMTECH GWALIOR

(K.P.Yadav)
Director/Mech

CONTENTS

SNO	Description	Page No
1.0	Introduction	1
2.0	System installation	2
3.0	Advantages of MCB Governor	5
4.0	Salient features	7
5.0	Advanced features	8
5.1	Display Parameters	8
5.2	Faults Diagnosis	8
5.3	Test Facilities	9
5.4	Fail-Safe Features	9
6.0	System Specifications	10
7.0	System Description	12
7.1	Control Unit	12
7.1.1	Control Card (MEGCC)	12
7.1.2	Input Card (MEGIP)	15
7.1.3	Motor Control Card (MEGMC)	16
7.1.4	Load and Clutch Control Card	16
7.1.5	Display Control Card	16
7.1.6	Power Supply Card	17
7.2	Actuator Card	20
8.0	Functional Details	22
8.1	Display Message	22
8.2	System Message	22
8.3	System Message that require to be acknowledged	28
8.4	Faults Message	29
8.5	Status Message	34
8.6	User Settable parameter	35
8.7	List of Error Code with message	36

9.0	Setting of Settable Parameters	38
9.1	Brief Description of Configuration software Menu Screens	38
9.2	Configuration	40
10.0	Principle of Operation	53
10.1	Block Diagrams for understanding function of Governor	54
11.0	Maintenance	63
11.1	Fault Finding	64
11.2	Procedure for Calibration of Engine Fuel Pump Racks with Micro Controller Based Electronic Governor (MCBG).	71
11.3	Procedure for Fuel Rack Position (FRP) Auto Calibration	74
12.0	Drivers instruction	78
	Annexure 1.0	80-81

Instruction Bulletins/Modification sheets issued by
Motive Power Directorate of RDSO

CORRECTION SLIPS

The correction slips to be issued in future for this handbook will be numbered as follows:

CAMTECH/M/2012/MCBG/1.0/C.S. # XX date -----

Where “XX” is the serial number of the concerned correction slip (starting from 01 onwards).

CORRECTION SLIPS ISSUED

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MICRO CONTROLLER BASED GOVERNOR

1.0 INTRODUCTION

The micro controller based governor Type MEG-601 is developed using state-of-art technology. A micro controller controlled DC stepper motor is used to control the fuel rack of diesel engine of the locomotive.

The basic function of governor is speed control of engine, based on the throttle handle position (notch).

A secondary function is to control load on the engine electrically, through an interface with E-type excitation system, for maintaining a pre-set constant horsepower at each notch. In addition to these functions, the equipment also does air manifold pressure based fuel limiting, and low lube oil pressure shutdown. A provision for reduction of excitation during wheel slip is also incorporated which can be enabled, if required, through user settable parameters.

The system displays status of various engine parameters continuously on the Vacuum Fluorescent Display.

CONTROL UNIT



ACTUATOR UNIT



The system has built in fault diagnostic facility. In case of any fault, it takes appropriate action immediately, displays appropriate fault for information to driver, and also records the fault with date and time, to help the maintenance staff later. The governor has number of user programmable parameters, which permit the system to be used on various types of locomotives. Configuration of the system through user settable parameters for fine tuning of operation and reading fault messages of Error Log can be done, online on the loco, using a laptop PC, even while the engine is running. The equipment is modular in construction and has functionally separated plug in modules for ease of servicing.

2.0 SYSTEM INSTALATIONS

The two sub assemblies of MCBG are to be mounted as follows:

The control unit is to be mounted on short hood side just below the existing location of Booster Air Pressure, Lube Oil pressure and Fuel Oil Pressure gauges. A supporting mounting plate is provided to hold the control unit on the wall of the locomotive.



Installation of Control Unit in Driver's CAB S/H side in a WDM series Locomotive





Installation of Actuator Unit on a WW Governor base in a WDM series Locomotive



The actuator unit must be mounted in place of present Governor with Wood Ward Governor's mounting base.

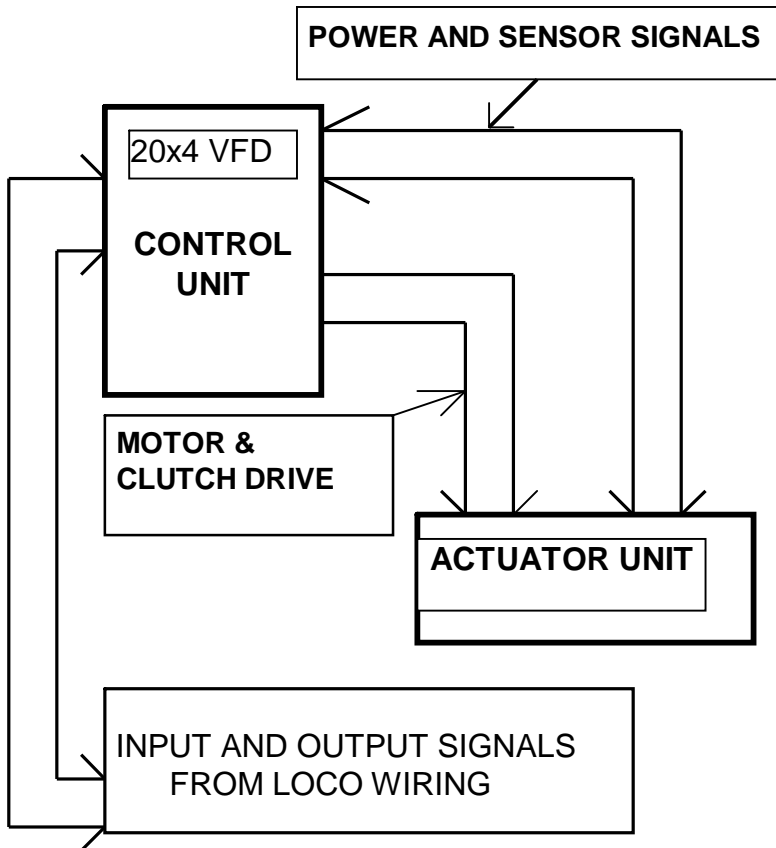
In all, only three cables are used for system connections. All cables have shielded cores with inner PTFE sheathing and outer FRLS (fire retardant low smoke) sheathing. The two cables connecting the Control unit and the Actuator unit are enclosed in metal conduit. The other cable is enclosed with PVC conduit. All the cables connecting between the units have threaded MS connectors and ferrules with cable name on both the ends, for ease of installation. The cable with open ended leads has appropriate ferrules to match with the connections from the existing locomotive wiring. All the units have MS connectors with appropriate nameplates, so that corresponding cables can be connected to them. The MS connectors on the units match only with their corresponding mating connectors on the cable, so that wrong connection of cables is not possible.

The Control Unit has 4 MS Connectors for following:

- a). Power to actuator unit anti sensor signals from actuator unit.
- b). Motor and Clutch drive to actuator unit.
- c). Input/Output Signals to terminal block in Locomotive Wiring.
- d). A spare RS485 Communication Port connector for future use.

The actuator unit has the corresponding connectors for Power & Sensor signals and Motor & Clutch drive.

SYSTEM INTERCOONECTIONS



3.0 ADVANTAGES OF MCB GOVERNOR

- Engine RPM is controlled without hunting.
- Effective control for complete combustion of fuel, thus improving fuel efficiency and reducing pollution.
- Load Control interface with Excitation system for constant Horse Power control.
- User settable engine parameters for optimizing performance for different classes of locos.
- 16-bit micro controller based design.
- Stepper motor used for high precision position control of fuel rack.
- Digital PID control. Requires no adjustment throughout its life, & no potentiometer settings.
- No need of individual tuning for each engine. Once tuned digitally for a given class of loco, say WDM2, or WDG2 etc. the same parameters would be entered numerically for all the engines of that class.
- Continuous display of engine status parameters.
- Online fault diagnostics & fault message display
- Error log with date and time stamp.
- User settable Booster Air Pressure Vs Fuel Limit curve.
- User-friendly menu driven software provided for laptop, to modifying any parameter/down loading ERROR LOG.
- Electro magnetic clutch used for automatic shutdown of engine, in case of power failure and any major malfunctioning of the equipment.
- Electronic and Mechanical Over speed trip testing through key lock Switch.
- Switch to bypass Boost Air Pressure based Fuel Limit Control.
- Functional plug in modules for ease of servicing.
- Wiring minimized for high reliability.
- Zero running maintenance up to 5 years
 - No oil and moving parts.
- No Schedule maintenance up to 48 months –

Against 24 months of conventional governor.

- Minimum overhauling time after 48 months- matter of 1 day against 3 to 4 days.
- Easy break down maintenance without unloading – Being modular system, the defective module can be replaced.
- Display of Engine related parameters for the driver.
- Error log and Fault diagnostics.-Errors with real time and date are recorded in non volatile memory and can be down loaded to a Laptop
- Notch wise run hours are recorded and can be down loaded to Laptop - to facilitate load factor calculation in a section
- Low engine cranking time- 5 to 10 seconds as against 25 to 30 seconds. Saves battery life.
- Precise control of Fuel rack trough stepper motor.
 - Against Hydraulic/Electro hydraulically operated pilot valve.
 - Practically no hunting. Increase fuel efficiency.
- Independent Notch wise engine RPM setting/ - In other governor certain notch RPMS are interdependent on other notch RPMS.
- Independent notch wise Low lube oil shut down Pressures.
- Tuning of governor is digital setting through Laptop. - Against spring adjustments on trial and error.
- Dry run test facility to test free travel of the rack -To test free travel of the fuel rack.
- Mechanical OSTA test facility.
- Electrical OST test facility.

4.0 SALIENT FEATURES

- Functionally plug-in modules.
 - Defective sub-assembly can be replaced in position
- Minimum internal wiring to increase reliability.
- A powerful 16 bit micro controller with stepper motor and digital PID control for precise positioning of fuel rack.
 - Smooth control of fuel rack and no hunting.
- Electromagnetic clutch for automatic shutdown.
 - Immediate return of fuel rack to zero position.
- On line tuning of parameters through LAPTOP to optimise the performance.
 - Very quick tuning of governor without down loading.
- Adaptability for different class of locomotives.
 - All most all parameters are made user settable to suit for different class of locomotives.
- Security against un-authorised access to governor parameters.
- User friendly menu driven software for
 - view / set parameters
 - Down load error log to laptop / PC
- Bigger display:
 - 20 character X 4 line VFD display for clear visibility.
- Fuel rack position sensor failure made fault tolerant:
 - Loco can work without any problem even if fuel rack position sensor failed.
- Failure of Booster Air Pressure (BAP) sensor, the governor automatically disables the BAP based rack limitation.
 - Manual bypass is also available in case of problem with loco.

5.0 ADVANCED FEATURES

5.1 DISPLAY PARAMETERS

- Displays the following Diesel Engine parameters:

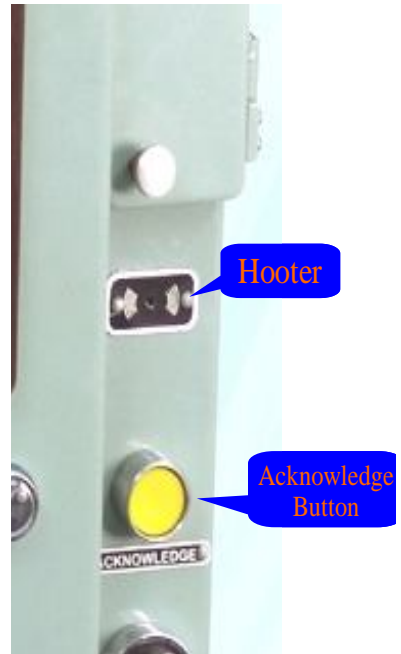
- LOP (Lube Oil pressure)
- FOP (Fuel Oil Pressure)
- BAP (Booster Air Pressure)
- Notch (Notch position)
- Engine RPM
- LCP (Load Control Position)



- These parameters are continuously monitored & displayed on the screen.

5.2 FAULT DIAGNOSIS

- On-line Fault Diagnostics.
- Display fault Message with Hooter Sounding.
- Error Log with Real Time and Date in Non Volatile Memory.
- The driver needs to press the acknowledge button for certain severe faults.
- Error log can be Down Loaded to a LAPTOP/ PC
- Notch wise diesel engine run time counter is provided to conduct Load factor trials.



5.3 TEST FACILITIES

- Being micro controller based governor, 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 feature.
- Facility to test both electronic & mechanical OSTA through key lock switch
- Dry run test through push button.



OSTA
Test KEY

Dry Run
Push button

5.4 FAIL –SAFE FEATURES

- Automatic shutdown of engine in case of
 - Lube oil pressure sensor failure.
 - Tacho signal failure.
 - Motor Over current.
 - 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.
- Runs with default parameters in case of EEPROM failure.

6.0 SYSTEM SPECIFICATIONS

1} Operating Supply Voltage

Loco battery Supply of Nominal 72 Volts DC.

Range 40 V to 90V DC.

Voltage dip to 22 V DC for 0.8 Seconds permitted during cranking.

2} Speed (User Settable)

Provision for setting 8 Engine Speed steps for the 8 notch positions. Speed settings are user settable as per RDSO specifications.

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 horsepower output of the engine at each speed setting. Load control is achieved using equivalent of Load Control Potentiometer (LCP), for interfacing with the existing E-type excitation system on the locomotive.

Load control timing (user settable)

- 1) From maximum to minimum field position change will be 8.5 to 11 seconds.
- 2) From minimum to maximum field position change will be 25 to 30 seconds.

5} Air Manifold Pressure Bias Fuel Limiter

Supply of fuel to engine is limited as per available Booster Air Pressure 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

- a) *Boost Air Pressure Sensor:*
Working range is 0-to 3-kg/cm² gauge.
- b) *Fuel Oil Pressure Sensor*
Working range is 0 to 5 Kg/cm² gauge.
- c) *Lube Oil Pressure Sensor*
Working range is 0 to 10 Kg/cm² gauge

7) Display

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

- a) Notch Position
- b) Engine RPM
- c) Fuel Rack Position in mm.
- d) Boost Air Pressure in kg/cm².
- e) Lube Oil Pressure in kg/cm²
- f) Fuel Oil Pressure in kg/cm²
- g) LCP position in hours: minutes format.

System status messages and fault messages are also displayed as and when required.

8). Actuator Unit.

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

7.0 SYSTEM DESCRIPTION

7.1 CONTROL UNIT

The control unit is mounted on the wall on short Hood side, just below the existing location of Lube oil, Fuel oil and Boost air pressure gauges in the driver's cabin, or any other suitable location. The control unit houses all necessary electronic circuits for functioning of the governor and a Vacuum Fluorescent Display. All modules on control unit are plug in units. The control unit 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 numbers.
5. Display Control Card (MEGDSP)
6. Power Supply Module (MEGPSM)

7.1.1 Control card (MEGCC)

This card consists of a 16 bit micro controller; it's peripheral ICs and necessary system software for the control of governor. Control card interfaces with all other cards in the system. It has a nonvolatile memory (EEPROM) to store user settable configuration data and Error log.

The control card receives various input signals like engine speed signal, notch position signal, fuel rack position signal, pressure signals etc. from Input Card, and computes the required fuel rack position and provides output signals thru Motor control card, to drive Stepper Motor in the Actuator unit, which in turn drives the fuel rack accordingly. The control card also monitors stepper motor current through Motor control card.

The control card also drives Electro magnetic Clutch in the Actuator Unit through Load and Clutch Control Card. It also monitors the status of front panel mounted "Boost Air Pressure Bypass" toggle switch and "Over Speed Test" Key Switch and initiates appropriate action".

CONTROL UNIT



This card has one Digital to Analogue Converter (DAC), to provide Load Control output. This output is amplified in the Load and Clutch Control Card, for interfacing with E-Type excitation system. With this arrangement the micro controller can vary the load control output voltage between 24.4 volts and 68.8 volts. One Analog channel input of this card monitors the load control output voltage fed back from Load and Clutch Control Card.

CONTROL UNIT



This feedback is used for closed loop control of Load Control output. The Load Control output (simulated LCP) position is displayed " in Hrs: Min: format on the display.

This card also has a quartz crystal controlled, and battery backed Real Time Clock (RTC), to register date and time of occurrence of every error that is logged. Control card has two serial interfaces, one RS485 serial interface for communication with the Display Control Card And one RS232 serial interface for communication with lap top PC for programming of user settable parameters and viewing of error log.

7.1.2 Input card (MEGIP).

This card is used for signal conditioning of, engine speed signal from Tacho generator, position and pressure signals from the actuator unit, notch input signals from throttle handle and all other high voltage (72VDC) input signals. This card provides 1.5KV electrical isolation, between locomotive circuits and micro controller circuits. All the inputs are optically isolated; surge protected, and reverses polarity protected.

7.1.3 Motor control card (MEGMC)

This card drives the stepper motor in the actuator unit. Two identical cards are used. Each motor control card drives one Phase of the Two-phase stepper motor. This is a current controlled PWM drive. The stepper motor current level is received from Control Card continuously. The card also detects over current in the motor phase due to any fault. In case of over current it shuts down the drive and at the same time this condition ,is informed to Control Card for necessary control action.

The drive circuit in this card uses 72 volts supply from loco battery. The motor drive works from 22 Volts to 100 Volts of Loco Battery supply voltage.

7.1.4 Load and clutch control card (MEGLC)

This card drives the clutch in the actuator unit and it also provides an interface for load control voltage output to E-type excitation system on the locomotive.

The clutch drive circuit consists of a PWM controller and it generates 24 volts output from 72 volts locomotive battery supply. Clutch control signal from control card is optically isolated on this card from the locomotive battery supply and it is used to switch ON/OFF the clutch power supply. The clutch power supply output is short circuit protected.

Another PWM controller on this card is used to generate Load Control Output. The variable voltage reference signal to this PWM controller, coming from control card, is optically isolated on this card. Proportional to this input reference signal, a load control output of 24.4 volts to 68.8 volts is generated in this card. The load control circuit draws power from 72 volts DC locomotive battery supply. The load control output is short circuit protected. The load control output voltage is proportionally scaled down and fed back to Control Card for closed loop control.

7.1.5 Display Control Card

The main function of this card is to display the data received from micro controller on Vacuum Fluorescent Display (VFD). This Card has it's own micro controller which communicates with control card through serial communication. It has an RS485 interface circuit for this purpose. It also interfaces with the 20character X 4 line alphanumeric Display. This card uses 72 volts locomotive battery voltage to derive separate +5V DC Supply required for VFD.

7.1.6 Power supply card

This card converts the 72 volts locomotive battery voltage to various low voltage supplies required by the system. The power supply card generates following voltages

- + 9 Volts DC for control circuits.
- + 12 Volts DC supply for Motor Control and Load & Clutch Control cards.
- + 9 Volts DC for control circuits.
- + 22 Volts DC for control circuits
- 18 Volts DC for control circuits.

The power supply has various protections for input over voltage, under voltage, reverse polarity and output short circuit. It has built in surge suppressors and filters to withstand surges on locomotive battery supply.

Both Power supply Card and display control card are enclosed in one housing to form a combined module. The nameplate on this module is labeled as MEGDSP & MEGPSM.

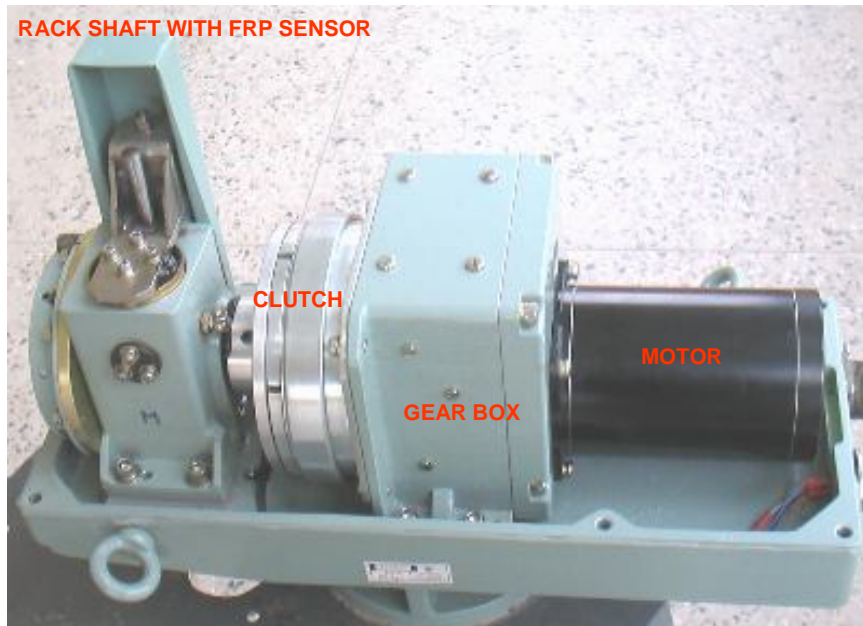
The control unit also has switches for various functions like Over Speed Test, Reset/Start operation and Boost Air Pressure bypass.

Vacuum Fluorescent Display (VFD)

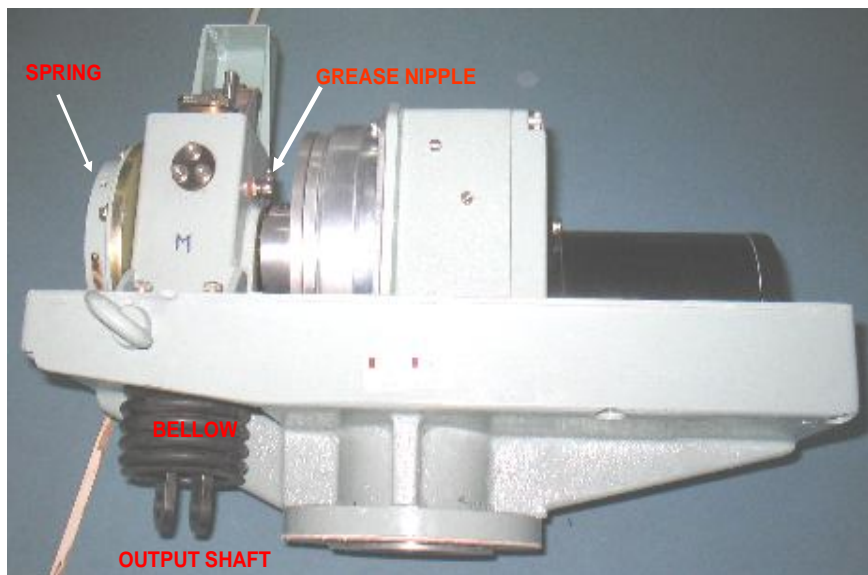
The display is mounted on the Front side of MEGDSP&MEGPSM module. The Door of control unit has a cut out to enable the driver to conveniently read the display. This is a 20 character X 4 line alphanumeric Vacuum Fluorescent Display (VFD). By default, this continuously displays status of engine parameters while the engine is running. Fault and status messages are displayed as and when required.



CONTROL UNIT REAR VIEW



FUEL RACK DRIVE

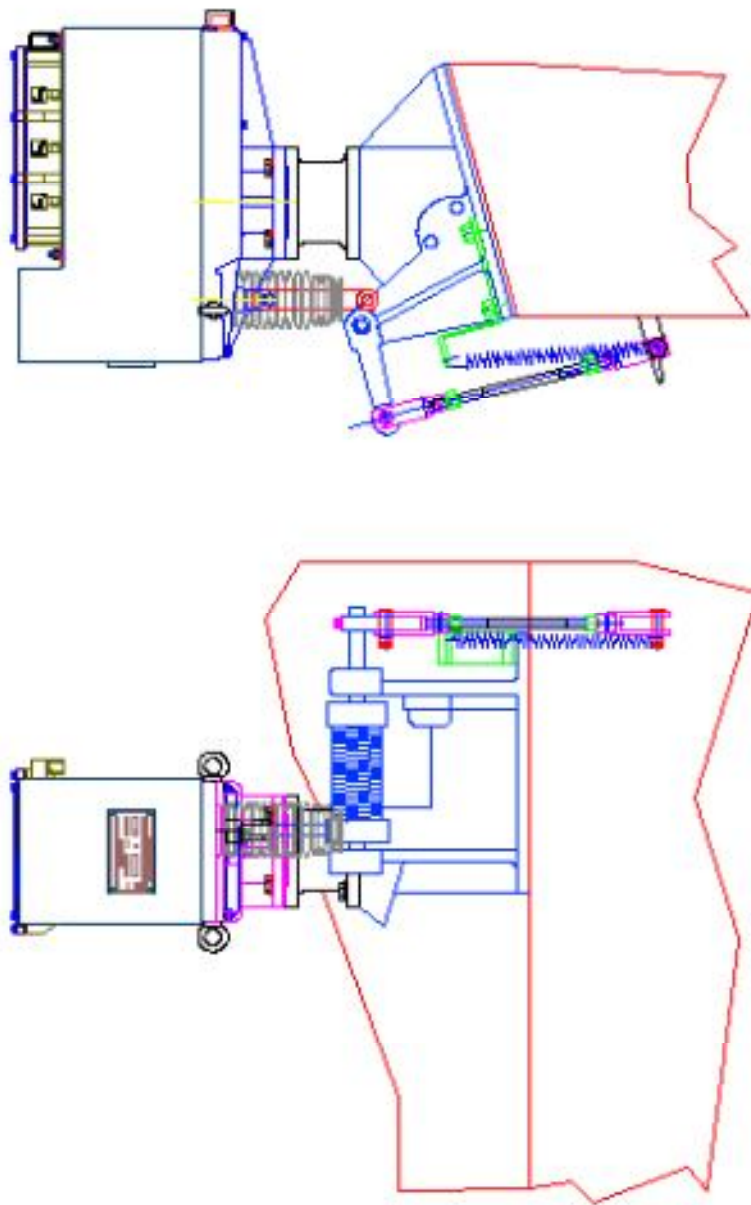


7.2 ACTUATOR UNIT

The actuator unit is mounted on locomotive engine at the present position of the Woodward Governor. The actuator unit, houses the fuel rack drive consisting of stepper motor, gearbox, clutch, and a spring. 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, so that the engine is shut 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.

ACTUATOR UNIT





MOUNTING ARRANGEMENT OF ACTUATOR UNIT TYPE MAU 731

8.0 FUNCTIONAL DETAIL

8.1 DISPLAY MESSAGES

The operation of the MCBG is user friendly as the system displays appropriate operational and fault messages along with an audio alarm. When the engine is running, the display unit will continuously show the following engine parameters. .

- 1) Lube oil pressure in Kg/ cm²
- 2) Boost air-pressure in Kg/cm²
- 3) Fuel oil pressure in Kg/cm².
- 4) Fuel rack position in mm.
- 5) Notch position.
- 6) Engine RPM.
- 7) Load control output in Hours minutes format.

The above parameters are accommodated on 20X4 VFD display unit as shown below

LOP (Kg/cm2)								FOP (Kg/cm2)				BAP (Kg/cm2)						
L	.	L						F	.	F				B	.	B	B	
N			S	S	SS			R	R	.	R			H	H	:	M	M
NOTCH		Engine Speed RPM						FUEL RACK MM				LCP HRS: Minutes						

The various system and fault messages and their interpretation are given in the tables below.

8.2 SYSTEM MESSAGES

SNo	Displayed Message	INTERPRETATION
1.	Power ON Check SUCCESSFUL	This message is displayed whenever the system is Powered ON and peripheral components are found OK.
2.	Press RESET/ RESTART key to START Engine	Whenever the rack is at Zero position and, it is required to be opened for cranking the engine, this message is displayed.

SNo	Displayed Message	INTERPRETATION
3.	BUSY User Settable Parameters Programming ON.	Whenever the Laptop PC communication cable is connected to the control unit this message is displayed.
4.	Setting up FUEL RACK for CRANKING	After pressing the RESET/START Key, while the system opens fuel rack, for cranking the engine, this message is displayed.
5.	READY for CRANKING ENGINE	This message is displayed when fuel rack is opened for cranking.
6.	CRANKING not done	After opening of fuel rack if the engine is not cranked within 20 seconds the system displays this message & moves the fuel rack to no fuel position.
7.	FAILED to CRANK due to LOW ENGINE RPM	During cranking of engine if the engine RPM fails to reach minimum set RPM for the MCBG to take control, (within specified time) this message is displayed.
8.	CRANKING Stopped due to external SHUT DOWN.	While cranking if external shut down occurs this message is displayed.
9.	ENGINE SHUT DOWN Press RESET/START key to RESTART Engine.	When external shut down occurs this message is displayed.

SNo	Displayed Message	INTERPRETATION
10	ENGINE SHUT DOWN due to Low Lube Oil Pressure. Press RESET/ START key to RESTART.	After Low Lube Oil Pressure shutdown this message is displayed.
11	ENGINE SHUT DOWN due to OVER SPEED. Press RESET/ START key to RESTART Engine.	While normal running of the engine if engine over speed occurs system shuts down the engine and display this message.
12	OVER SPEED TRIP test STOPPED.	While OST is in progress if the OST or key switch is turned off this message displayed.
13	If OST tripped Reset Else check Motor Press RESET/ START key to RESTART Engine.	Whenever system detects motor over current, system is shut down with this message. Motor over current may also occur if Fuel rack is moved by MCBG in case CST is not reset after it has tripped.
14	If OST tripped Reset Else check fuel Rack Drive. Press RESET/ START key to RESTART.	While cranking, due to rack obstruction or linkage fault or motor failure or motor drive failure, if the fuel rack does not move to required position, this message is displayed.
15	If OST tripped Reset Else check for TACHO FAULT. Press RESET/	While engine is running if engine bogs down due to OST trip or any other reason or if Tacho fails,

SNo	Displayed Message	INTERPRETATION
	START key to RESTART.	engine is shut .down and this message is displayed.
16	TESTING Electronic OVER SPEED TRIP TRIP LIMIT XXXX ENGINE RPM XXXX	During electronic over speed trip test this message is displayed.
17	TESTING Mechanical OVER SPEED TRIP TRIP LIMIT XXXX ENGINE RPM XXXX.	During mechanical over speed trip test this message is displayed.
18	SHUTTING DOWN ENGINE ENGINE RPM XXXX.	This message is displayed after External shutdown occurs due to energizing of D solenoid.
19	CRANKING ENGINE. ENGINE RPM XXXX.	This message is displayed while engine cranking is in progress. Engine RPM that is built up is continuously displayed.
20	FUEL RACK position Sensor Fault Recovered	When Fuel Rack Position Sensor recovers from fault this message is displayed.
21	Ready for Engine Fuel Rack Calibration. Press RESET key to move Fuel Rack.	This message is displayed when Locomotive Fuel Rack Calibration mode is entered thru setting from LAPTOP/PC for calibration
22	Engine Fuel Rack Calibration ON	This message is displayed when Engine Fuel Pump

SNo	Displayed Message	INTERPRETATION
	Should not Crank Loco Now.	Rack Calibration mode is active.
23	Calibrating Engine Fuel Rack with MCBG.MCBG Rack positioned at xx.x mm Now.	This message is displayed when Engine Fuel Pump Rack Calibration mode is active and fuel rack is moved by the set distance.
24	Rack Position Sensor Calibration ON. Remove Actuator Shaft Link and Press RESET key.	This message is displayed whenever Rack Position Sensor Auto Calibration mode is active' by setting through the Configuration Manager Software running on Laptop/PC.
25	Wait for 10 mins from Power ON, to start Rack Position Sensor Auto Calibration.	This message is displayed whenever Rack Position Sensor Auto Calibration mode is made active by setting through the Configuration Manager Software running on Laptop/PC and Calibration is attempted earlier than 10 minutes time from Power ON.
26	Rack Position Sensor Auto Calibration ON.	This message is displayed whenever the Rack Position Sensor Auto Calibration is in progress.
27	Lube Oil Pressure Sensor Faulty. Waiting for Recovery	This message is displayed whenever the Lube Oil Pressure Sensor is declared faulty and MCBG is waiting for its recovery.
28.	BATTERY weak or	When Loco doesn't get

SNo	Displayed Message	INTERPRETATION
	Tacho Faulty. Stop Cranking	cranked even after holding the start button for a long duration this message is displayed. This message warns to stop the cranking when the start button is kept pressed for a long time to avoid deep discharge of the batteries
29.	Check BATTERY condition. Check for Tacho fault. Press START Button to Restart	When loco doesn't achieve the set RPM within the specified time, this message is displayed. This may be either due to weak batteries, which are not able to crank, or Governor is not getting the Tacho / ESS signal properly. Check the battery voltages and if the batteries are found ok, check the Tacho/ESS signal wiring, Tacho / ESS, if found ok, the problem may be with MEGDIP or MEGCC card.
30.	Reset OST. Check free movement of Fuel Rack Linkage with DRY RUN switch.	While normal running of the engine if engine over speed occurs and Mechanical OSTA is tripped then engine shutdown and after Acknowledge this message will be displayed

8.3 SYSTEM MESSAGES THAT REQUIRE TO BE ACKNOWLEDGED

Following messages remain on the display till they are acknowledged by pressing acknowledge switch on the display unit.

SNo	Displayed Message	INTERPRETATION
1.	Electronic O.S.T. Test Successful TRIP LIMIT XXXX TRIPPED AT XXXX	After Electronic OST test is successful this message is displayed.
2.	Mechanical O.S.T. Test Successful TRIP LIMIT XXXX TRIPPED AT XXXX	After Mechanical OST test is successful this message is displayed.
3.	Mechanical O.S.T Level To be increased Trip Limit XXXX TRIPPED AT XXXX	This message is displayed while Mechanical OST testing, if the OST trip occurs at less than the set level and less than (electronic OST trip set level + 5 RPM).
4.	Rack Position Sensor Calibration Success. Max. Error XX. XX mm. AT xx. xx mm	This message is displayed whenever the Rack Position Sensor Auto Calibration is completed successfully.
5.	Rack Position Sensor Calibration Failed Max. Error xx. xx mm AT xx. xx mm.	This message is displayed whenever the Rack Position Sensor Auto Calibration fails.

8.4 FAULTS MESSAGES

Whenever any fault occurs it is displayed along with the Alarm. For normal faults the alarm buzzer is ON for a short duration and is turned OFF by the system without requiring any acknowledgement. For all major faults like faults leading to engine shutdown and OST test failure it is required to press the acknowledge key for clearing the messages on the display unit.

a) Normal faults (not requiring acknowledgement for clearing of Display-Message).

SNo	Displayed message	INTERPRETATION
1.	Communication FAILED.	This is displayed whenever communication to display module fails.
2.	Boost air pressure fuel limiting BYPASSED	Whenever a) BAP fuel limiting is bypassed with the use of toggle switch provided on control unit or b) Air pressure sensor / circuit fails this message is displayed.
3.	Boost air pressure fuel limiting now ACTIVE	Whenever BAP fuel limiting is made active with the use of toggle switch provided on control unit this message is displayed.
4.	Load Control FAILED.	When load. Control circuit fails this message is displayed.
5.	FUEL RACK SENSOR FAILED	This message indicates fuel rack sensor or its cable or interface circuit failure.
6.	EEPROM FAILED. Running with DEFAULTS PARAMETERS.	Failure of nonvolatile configuration memory (EEPROM) results in this message to be displayed. The engine still runs but with default parameters.

SNo	Displayed message	INTERPRETATION
7.	LUBE OIL Pressure SENSOR Faulty.	If lube oil pressure sensor or its cable or interface circuit fails, this message is shown.
8.	BAP Sensor Faulty.	If BAP sensor or its cable or interface circuit fails, this message is shown.
9.	FOP Sensor Faulty.	If FOP sensor or its cable or its cable or interface circuit fails, this message is shown.
10.	FUEL RACK Drive Motor Over Current Check OST	This message is displayed when motor over current occurs during cranking.
11.	Fuel Rack Position Sensor recovered from fault.	This message is displayed whenever the Fuel Rack Position Sensor recovers from Fault.
12.	LOP Sensor recovered from fault.	This message is displayed whenever the Lube Oil Pressure Sensor recovers from faults.
13.	BAP Sensor recovered from Faults.	This message is displayed whenever the BAP Sensor recovers from fault.
14.	FOP Sensor recovered from Faults.	This message is displayed whenever the FOP Sensor recovers from faults.
15.	Load Control Fault recovered.	This message is displayed whenever Load Control Output circuit of MCBG recovers from fault.
16.	Unable to Calibrate Rack Position Sensor.	This message is displayed whenever Rack Position Sensor Auto Calibration mode is made active by

SNo	Displayed message	INTERPRETATION
		setting through the Configuration manager Software running on Laptop/ PC and due to any major problem the control unit and actuator are not matching with each other.
17.	ESS1speed sensor misbehaving.	This message is displayed when ESS-2 is fault and Engine RPM is varying or ESS-2 signal is fault and ESS-1 signal is malfunctioning.
18.	ESS2speed sensor misbehaving.	This message is displayed when ESS-1 is fault and Engine RPM is varying or ESS-1 signal is fault and ESS-2 signal is malfunctioning
19.	ESS1speed sensor wire open fault.	This message is displayed when the Engine Speed sensor-1 or its cable or interface circuit fails.
20.	ESS2speed sensor wire open.	This message is displayed when the Engine Speed sensor-2 or its cable or interface circuit fails.
21.	ESS1 Sensor Recovered from Faults.	This message is displayed when the Engine Speed sensor-1 signal recovers from fault.
22.	ESS2 Sensor Recovered from Faults.	This message is displayed when the Engine Speed sensor-2 signal recovers from fault.

b) Faults requiring acknowledgement for clearing of display message

SNo	Displayed message	INTERPRETATION
1.	OST TRIPPED or FUEL RACK Drive OBSTRUCTED or 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.
2.	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.
3.	OST TRIPPED or TACHO FAILED SHUTTING DOWN ENGINE	While engine is running 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.
4.	OVER SPEED SHUTTING DOWN ENGINE	While normal running of the engine if engine over speed occurs, system shut down the engine & display this message.
5.	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 test.
6.	Mechanical OVER SPEED TRIP test FAILED	This message is displayed, during mechanical 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.
7.	Switch OFF MB1 & MB2 Wait for 5	If engine is unable to crank for a long time, due to OSTA

SNo	Displayed message	INTERPRETATION
	Minutes. Switch ON MB1 & MB2, to Restart Engine.	trip or any obstruction to Fuel Rack Drive or loose contact in LOP sensor wiring or any other reason, this message is displayed. Prior to the display of this message, the actual cause is displayed every time when cranking fails. Try to diagnose the problem. If unable to do anything else, switch OFF breakers MB1 & MB2. Wait for 5Minutes and then switch ON MB1 &MB2 again to Restart Engine.
8.	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.
9.	Lube Oil Pressure Sensor FAILED. SWITCH OFF Power & repair Sensor to restart engine.	Whenever lube oil pressure sensor or its circuit or cable fails this message is displayed, after shutting down engine.
10	FUEL RACK Position Sensor Faulty	When Fuel Rack position sensor or its circuit or cable fails this message is displayed.
11	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.

8.5 STATUS MESSAGES

SNo	Displayed Message	INTERPRETATION
1.	Notch Fault	If any illegal combination of A, B, C, D solenoid control Inputs, is received, this message is displayed.
2.	BAP Limit	Whenever Boost Air pressure sensing is active and rack is limited due to available boost air pressure this status message is displayed.
3.	HP Limit	Whenever load control action is enforced due to Horse Power Limit set for the Notch, this message is displayed.
4.	RackPosErr	This is displayed whenever fuel rack movement is not as desired while engine is running.
5.	BAPLdCntrl	Whenever load control action is enforced due to Booster Air Pressure is less than the Limit set for the fuel rack position, this message is displayed.

8.6 USER SETTABLE PARAMETERS

Various control parameters of the governor are made user settable. These parameters can be modified through any laptop computer. For this purpose, the "Governor Configuration Manager" software supplied by M/s Medha should be loaded in the laptop. This menu driven software for the parameter setting is extremely user friendly. The software displays the range and default value for any parameter that is selected for viewing or modification. Thus user is not required to carry any documentation for the same. The laptop interfaces with the MCBG through an RS232 serial port. User can set the parameters while the engine is running, which is very useful for tuning of engine and instantly checking its response for any modification.

Following is the list of parameters that are user settable.

- 1) Notch wise engine speed
- 2) Notch wise minimum lube oil pressure for loco shutdown.
- 3) Maximum permissible fuel rack at each notch.
- 4) Boost air pressure wise fuel rack limit.
- 5) Over speed trip setting.
- 6) Engine acceleration and deceleration rates.
- 7) Load control minimum and maximum voltage and response time.
- 8) Fuel rack position for cranking.
- 9) Other miscellaneous parameters like BAP linked load control enable, etc.

The software named Configuration Manager. MEG 601 is used for modifying configuration. The software can be used to Read/Load the user settable parameters from/into the MCBG, as well as read the error log contents from the MCBG.

The software can be installed and run from the setup CD on a LAPTOP/PC. It can be run from the START menu or the short cut created on DESKTOP for running "meg 601 cfg.exe" from the installed directory.

8.7 LIST OF ERROR CODES WITH MESSAGE

Code	Error Description
1.	Tacho Faulty or Cable Noisy
2.	Fuel Rack Pos. Sensor Faulty, showing High Position
3.	LOP Sensor Faulty, showing High Pressure
4.	BAP Sensor Faulty, showing High Pressure
5.	FOP Sensor Faulty, showing High Pressure
6.	Communication Link to Display unit failed
7.	RTC Fault occurred @ Power On
8.	EEPROM Faulty. Default CFG Record Loaded
9.	Engine Shut Down Due to Over Speed
10.	Fuel Rack Pos. Sensor Faulty or Cable Open
11.	LOP Sensor Faulty or Cable Open
12.	BAP Sensor Faulty or Cable Open
13.	FOP Sensor Faulty or Cable Open
14.	Engine Shut Down due to low Lube Oil Pressure
15.	Engine Shut Down due to Motor Over Current
16.	Tacho Faulty or Cable Open
17.	LCP Circuit Faulty
18.	Rack Obstructed by OST or Drive FAIL at CRANK
19.	Fuel Rack Pos. Sensor Fault Recovered
20.	NOTCH Time Count in RTC Faulty
21.	NOTCH Time Count in RTC Faulty & RESE
22.	LOP Sensor Fault recovered
23.	BAP Sensor Fault recovered
24.	FOP Sensor Fault recovered
25.	LCP Circuit Fault recovered
26.	Fuel Rack Pos. Sensor Faulty SHOWING Middle Position
27.	FRP Sensor Tested by Clutch OFF
28.	Electronic Over Speed Test Successful

29.	Tacho Faulty or Cable Open while running
30.	Mechanical OST Tested
31.	Mechanical OSTA Tripped
32.	ESS2 Faulty or Cable Noisy
33.	ESS1 Cable Noisy Fault Recovered
34.	ESS2 Cable Noisy Fault Recovered
35.	Difference between two sensor speeds is high
36.	ESS1 speed sensor misbehaving
37.	ESS2 speed sensor misbehaving
38.	ESS1 speed sensor wire open fault
39.	ESS2 speed sensor wire open fault
40.	ESS1 showing high RPM at zero speed
41.	ESS2 showing high RPM at zero speed
42.	ESS1 Faults Recovered
43.	ESS2 Faults Recovered
44.	Engine Shut Down due to LOP at Low Idle

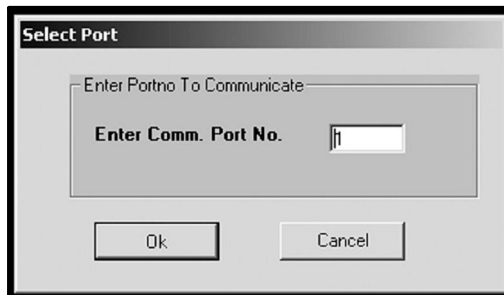
9.0 SETTING OF SETTABLE PARAMETERS

9.1 BRIEF DESCRIPTION OF CONFIGURATION SOFTWARE MENU SCREENS

The menu screen is as shown in the figure below when the software is run

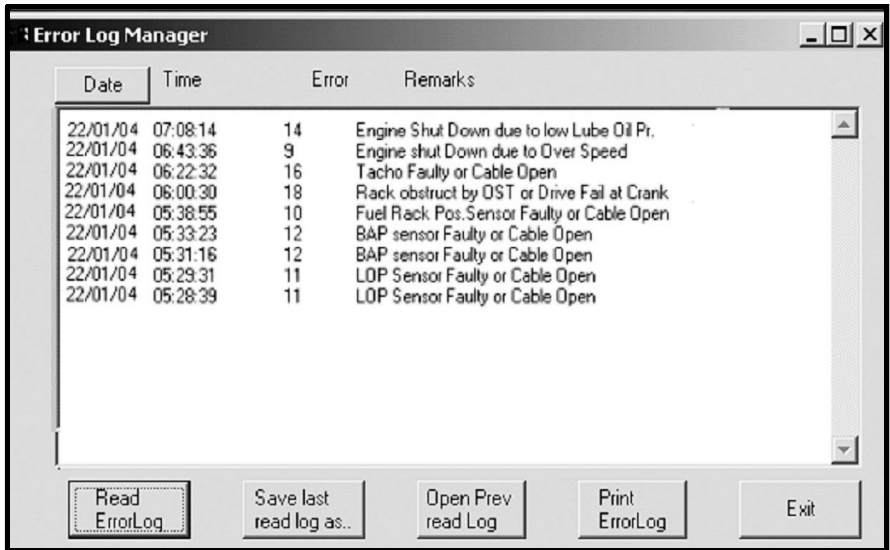


PPC Config: To select the Serial Communication Port for Communication with MCBG on the LAPTOP/PC. Click on this menu to see current port number selection or to make a change. This setting is required to be done only once after the software is installed on the LAPTOP/PC.



Click on the button to select new port number and then click on Ok. To retain existing selection click Cancel.

View Data: On clicking on View Data *ERROR LOG* is shown. Clicking on *Error Log* opens a screen with which one can use for reading the error log for MCBG.



Error Log Manager Screen:

This screen is used to read the error log contents from the MCBG or to view the previously stored error log files.

The error log screen has the following commands.

Read Gov: This commands read the records from the governor on the selected port. If no part has been previously selected then a port is to be selected now. Once the communication has been successful the records will be decoded & displayed for the user analysis.

Read File: A previously stored error log file may now be loaded and viewed for analysis using this command. The error log files are be default saved with extension 'erl'.

Save Last Read Log As: Once the error log from the governor has been read, the save as command may be used to save the read data into a file for viewing again in future. The file-save dialog box will be displayed to select a folder and file name to save the current File with extension 'log' for future viewing (Text format).

Open Prev Read Log: To open and view a previously stored file with 'log' extension (Text Format file). This file can be opened in 'NOTEPAD or WORDPAD for viewing and can be printed out.

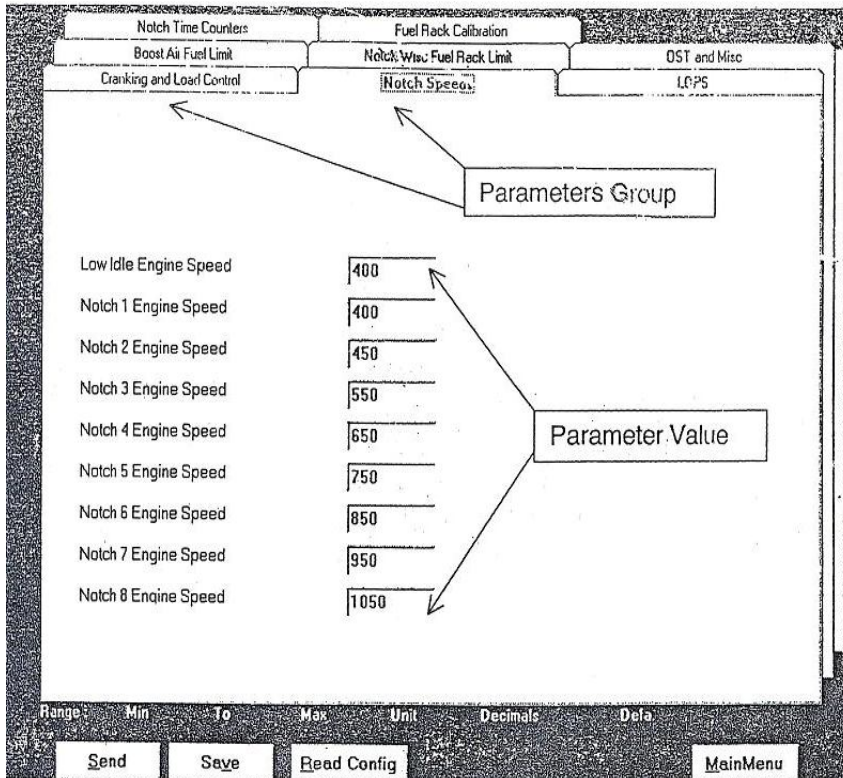
Exit: To return to the main menu screen.

9.2 CONFIGURATION

On selecting this option from the main menu, two selections are shown "Governor" and "FRP Sensor Auto Calibration". Select Governor Option to configure Governor for routine setting. Select "FRP Sensor Auto Calibration" for calibration to match the Actuator and the Control Unit. A password is required for entry in to this menu and is meant for authorized personnel only.

A} The **Governor** option selection shows following screen (Given on Next page)

1. *The Configuration parameters Group:* For convenience all the parameters are sub divided into smaller sub groups. Each sub group can be individually selected.
2. *The command panel:* All the Commands that can be executed are given as buttons at the bottom of the screen. Each command is described below.
3. *The status bar:* Located above the commands, has the following details
 - a. The minimum value
 - b. The maximum 'value
 - c. The number of decimals allowed
 - d. Default Value
 - e. The status indicator indicating Busy when the system is busy.



4. *The Input region:* In this block on the screen the actual parameter value can be entered.

The commands available and their description

1} Send: The send command is used to transmit the changed values to the MCBG control unit. The send command works only when any parameter value is changed. If no changes have been done the command returns an error message. The send command sends only those parameters that have been changed so as to reduce the load on the communication lines and on the controller in MCBG. After the send command is chosen

(If changes are made). The LAPTOP/PC tries to transfer the data to the MCBG through the selected port. If the configuration is successful the message indicating the "configuration is successful" is shown on monitor. After this, user will be asked whether the configuration was successful or not. user has to respond with the dialog box with "Yes" when user sees the configuration successful message. If the user responds to "No" dialog box the software automatically tries to retransmit the data to the MCBG control unit. If cancel is selected the program stops trying to send the data.

2} Save: This button is used, to save the changes made to the screen. The software always initiates the values to the screen with the last saved data.

3} Read Config: This command has to be used when the user wants to read the values currently existing in the MCBG. Executing this command reads the parameters from the MCBG from the selected port and changes the values in the corresponding positions on the PC screen. These values may either be saved or discarded. Once the save option is selected it overwrites the old values in PC memory with the current ones.

4) Main Menu: This command may be used to exit from the selection and return to main menu. If any changes are made user will be prompted by the option of saving them. If the user selects 'No' option then the changed values will be discarded and the previously saved values will be retained.

B) The Fuel Rack Position (FRP) Sensor Auto Calibration option is used to see the configurations to the Actuator unit and the Control unit. For details on FRP Sensor Auto Calibration, refer para procedure for calibration of Engine Fuel Pump Rack.

Each of the sub menus of the "Governor" is given below in detail.

1) Notch Speeds

This screen allows the user to set the notch wise engine RPM.

Notch Time Counters Fuel Rack Calibration

Boost Air Fuel Limit Notch Wise Fuel Rack Limit DST and Misc

Cranking and Load Control **Notch Speeds** LOPS

Low Idle Engine Speed 400

Notch 1 Engine Speed 400

Notch 2 Engine Speed 450

Notch 3 Engine Speed 550

Notch 4 Engine Speed 650

Notch 5 Engine Speed 750

Notch 6 Engine Speed 850

Notch 7 Engine Speed 950

Notch 8 Engine Speed 1050

Range : 950 To 1050 RPM [0 Decimals] Defa. 1050

Send Save Read Config MainMenu

NOTCH	RANGE		DEFAULT
	MINIMUM	MAXIMUM	
IDLE	300	400	400
1.	300	400	400
2.	393	495	450
3.	486	595	550
4.	579	685	650
5.	672	783	750
6.	765	865	850
7.	858	963	950
8.	950	1050	1050

2) Notch wise fuel rack limit

User can set notch wise fuel rack limit in the following menu.

Menu Item	Value
Max.Rack @ LOW IDLE	3.5
Max.Rack @ Notch 1	14.3
Max.Rack @ Notch 2	15
Max.Rack @ Notch 3	16
Max.Rack @ Notch 4	17.5
Max.Rack @ Notch 5	19.5
Max.Rack @ Notch 6	22.5
Max.Rack @ Notch 7	27
Max.Rack @ Notch 8	32

Range : 3 To 34 mm [1 Decimals] Defa. 32

Buttons: Send, Save, Read Config, Main Menu

NOTCH	RANGE		DEFAULT	DECIMALS ALLOWED
	MIN.	MAX		
IDLE	3	34	3.5	1
1.	3	34	14.3	1
2.	3	34	15	1
3.	3	34	16	1
4.	3	34	17.5	1
5.	3	34	19.5	1
6.	3	34	22.5	1
7.	3	34	27	1
8.	3	34	32	1

3) LOPS

Following is the screen for setting the notch wise Lube Oil Pressure Limit (LOPS) values and Time delays for engine shutdown.

Range : 5 To 20 Secs [0 Decimals] Defa. 10

Send Save Read Config Main Menu

Parameter	RANGE		DEFAULT	DECIMALS ALLOWED
	MIN.	MAX		
LOPS delay @ notch 2 to 8 for shut down	0	20	2	0
1.	0	10	1.3	2
2.	0	10	1.7	2
3.	0	10	2.1	2
4.	0	10	2.6	2
5.	0	10	3.0	2
6.	0	10	3.5	2

Parameter	RANGE		DEFAULT	DECIMALS ALLOWED
	MIN.	MAX		
7.	0	10	3.9	2
8.	0	10	4.4	2
Idle/ Notch 1 LOPS delay	30	60	45	0
Notch 2 to 8 Notching UP delay	5	20	10	0

4) Boost air fuel limit

Following is the screen for setting Fuel Rack opening limit as Boost Air Pressure.

Range :	Min	To	Max	Unit	Decimals	Defa.
Max Fuel Rack @ 0.0 Kg/Cm²	17			Max Fuel Rack @ 1.8 Kg/Cm²	32	
Max Fuel Rack @ 0.2 Kg/Cm²	21			Max Fuel Rack @ 2.0 Kg/Cm²	32	
Max Fuel Rack @ 0.4 Kg/Cm²	23			Max Fuel Rack @ 2.2 Kg/Cm²	32	
Max Fuel Rack @ 0.6 Kg/Cm²	24.5			Max Fuel Rack @ 2.4 Kg/Cm²	32	
Max Fuel Rack @ 0.8 Kg/Cm²	25.7			Max Fuel Rack @ 2.6 Kg/Cm²	32	
Max Fuel Rack @ 1.0 Kg/Cm²	26.9			BAP required for Max Fuel Rack	1.7	
Max Fuel Rack @ 1.2 Kg/Cm²	28.3			Low Idle LOPS	1.1	
Max Fuel Rack @ 1.4 Kg/Cm²	30.5					
Max Fuel Rack @ 1.5 Kg/Cm²	32					

Buttons: Send, Save, Read Config, Main Menu

PRESSURE in Kg/ Cm2	RANGE		DEFAULT	DECIMALS ALLOWED
	MIN,	MAX.		
0.0	3	34	17	1
0.1	3	34	19.2	1
0.2	3	34	21	1
0.3	3	34	22	1
0.4	3	34	23	1
0.5	3	34	23.9	1
0.6	3	34	24.5	1
0.7	3	34	25.1	1
0.8	3	34	25.7	1
0.9	3	34	26.3	1
1.0	3	34	26.9	1
1.1	3	34	27.6	1
1.2	3	34	28.3	1
1.3	3	34	29.3	1
1.4	3	34	30.5	1
1.5	3	34	32	1

5) CRANKING AND LOAD CONTROL

PARAMETER	RANGE		DEFAULT	DECIMALS ALLOWED
	MIN.	MAX		
Cranking to control RPM	100	900	200	0
Fuel rack position @ Crank (mm)	6	34	14	1

Load control minimum voltage	20	30	24.4	1
Load control maximum voltage	60	72	68.8	1
Load control max. to min. field change in seconds	6	15	10	0
Load control min. to max. field change in seconds	20	40	28.1	0
Over ride max. to min. field change time in seconds	5	15	10	0

6) OST and Miscellaneous control

Cranking and Load Control

Notch Time Counters

Boost Air Fuel Limit

Notch Speeds

Fuel Rack Calibration

Notch Wise Fuel Rack Limit

LOPS

OST and Misc.

Electronic Over Speed Trip

1200

Mechanical Over Speed Trip

1220

☐ Fuel Rack Calibration ON

☐ LOW IDLE ON

☐ ESS2 Connected

Move MCBG for Calibration to

0.1

Range :

Min

To

Max

Unit

Decimals

Defa.

Send

Save

Read Config

Main Menu

PARAMETER	RANGE		DEFAULT	Decimals allowed
	MIN.	MAX		
Electronic Over Speed Test RPM	1010	1220	1200	0
Mechanical Over Speed Test RPM	1010	1300	1220	0
Fuel Rack Calibration ON	Set this FLAG to enable Engine Fuel Pump Calibration			

7) Notch Time Counters:

When these counters are read from MCBG gives values of running of Locomotive in different notch up to a period of 136 years. These can be set to 0 whenever required.

Notch	Time (Days:Hour:Min:Sec)
Notch 1 Time	0:03:03:34
Notch 2 Time	0:00:01:56
Notch 3 Time	0:00:02:37
Notch 4 Time	0:00:03:42
Notch 5 Time	0:00:04:23
Notch 6 Time	0:00:03:45
Notch 7 Time	0:00:07:37
Notch 8 Time	0:00:08:46

Range : 0 To 4294967296 Secs [0 Decimals] Defa. 0

Buttons: Send, Save, Read Config, MainMenu

PARAMETERS	DEFAULT
Notch 1 Time	0
Notch 2 Time	0
Notch 3 Time	0
Notch 4 Time	0
Notch 5 Time	0
Notch 6Time	0
Notch 7 Time	0
Notch 8 Time	0

8) Fuel Rack Calibration:

Fuel Pump Rack Calibration can be done as explained in Procedure at Annexure I. The following screen shows different values for data entry.

The screenshot shows a software interface for Fuel Rack Calibration. At the top, there are several menu options: Boost Air Fuel Limit, Notch Wise Fuel Rack Limit, DST and Misc, Cranking and Load Control, Notch Speeds, LOPS, Notch Time Counters, and Fuel Rack Calibration. The main area displays a list of notch times in Days:Hour:Min:Sec format:

Notch	Time (Days:Hour:Min:Sec)
Notch 1	0:03:03:34
Notch 2	0:00:01:56
Notch 3	0:00:02:37
Notch 4	0:00:03:42
Notch 5	0:00:04:23
Notch 6	0:00:03:45
Notch 7	0:00:07:37
Notch 8	0:00:08:46

At the bottom, there are fields for Range (0 to 4294967296), Sens (0 Decimals), and Defa (0). Below these are buttons for Send, Save, Read Config, and Main Menu.

Parameter	RANGE		DEFAULT	DECIMALS ALLOWED
	Min.	MAX.		
Fuel Rack Position @ 0 mm of MCBG	0	34	0	1

Parameter	RANGE		DEFAULT	DECIMALS ALLOWED
	Min.	MAX.		
Fuel Rack Position @ 0 mm of MCBG	0	34	5	1
Fuel Rack Position @ 0 mm of MCBG	0	34	10	1
Fuel Rack Position @ 0 mm of MCBG	0	34	15	1
Fuel Rack Position @ 0 mm of MCBG	0	34	20	1
Fuel Rack Position @ 0 mm of MCBG	0	34	25	1
Fuel Rack Position @ 0 mm of MCBG	0	38	30	1
Move MCBG for Calibration	0	30	0.1	1

Set Data Time:

This menu can be used to Set data and Time in MCBG as per system Data and time on Laptop/ PC. MCBG has an RTC that may need setting as MCBG records error log with Data and Time.

Exit:

Click this to exit from Configuration Manager Software and return to Operating System.

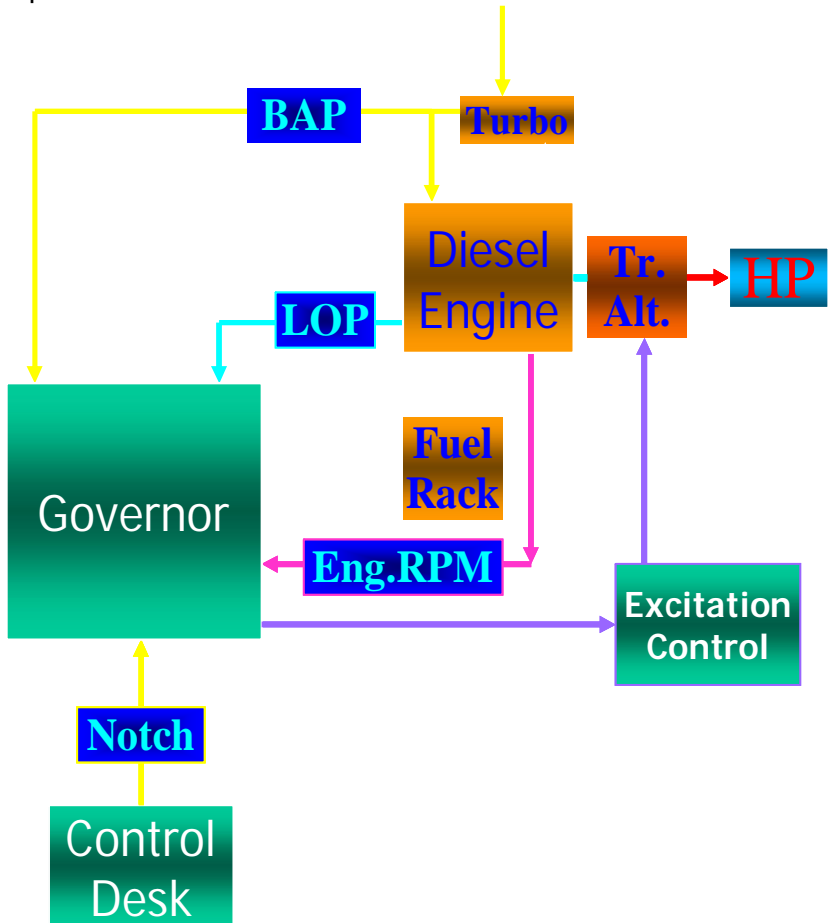
10.0 PRINCIPLE OF OPERATION

The micro controller in control unit continuously measures the frequency signal from the Tacho generator on the locomotive. The engine RPM is calculated from this frequency signal. Desired engine RPM is determined from the selected notch on throttle handle by monitoring status of control wires of speed signals A, B, C and D (Loco wire nos. 15A, 12A, 7IC, and 3A). Comparing these 'two RPMs in a PID control loop the micro controller drives fuel rack of the engine through the Actuator unit, so as to adjust the engine RPM equal to the set RPM for the given notch. PID parameters can be optimized for each class of engines through user settable parameters using a laptop, so as to maintain stable engine RPM free from hunting. When the notch is changed, the speed is varied linearly based on acceleration and deceleration rates, specified in user settable parameters.

Booster air pressure is measured through a pressure sensor to limit the movement of fuel rack as a function of Booster air pressure. This ensures the supply of fuel to the engine proportional to available air pressure at any point of time, and prevents incomplete combustion, black smoke, excessive engine temperature, fuel wastage etc. The fuel limit curve in the form of Booster air pressure Vs Fuel rack limit can be entered through a laptop in user settable parameters. A toggle switch is provided on control unit to bypass this feature, incase there is any blockage in the pipelines or other fault. Even when this feature is bypassed, the speed variation between different notches is adjusted linearly based on acceleration and deceleration rates, configured in user settable parameters.

A load control output is provided to maintain constant horsepower output of the engine at each notch. The load control is done thru E-Type excitation system, by changing -the generator field excitation, from maximum to minimum or vice versa at a rate specified in user settable parameters.

For this purpose Notch wise Fuel rack Limit can be specified through user settable parameters, Booster air pressure linked load control facility is also available, which can be enabled/disabled through the user settable parameters.



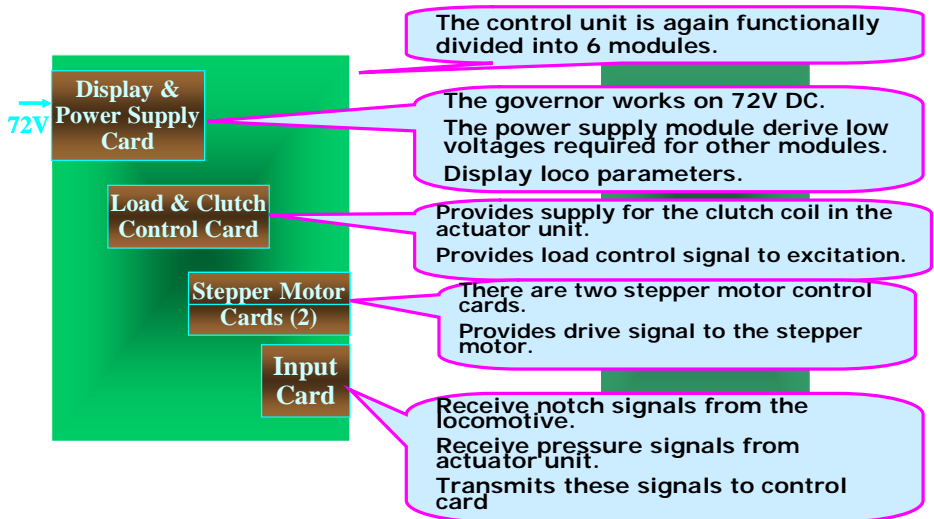
Lube oil pressure is continuously monitored and engine is shutdown if the lube oil pressure is less than the specified pressure at each notch position as set in the user settable parameters. Additional time delay is

allowed for pressure build up during acceleration and at Notch 1. These time delays can be specified through user settable parameters.

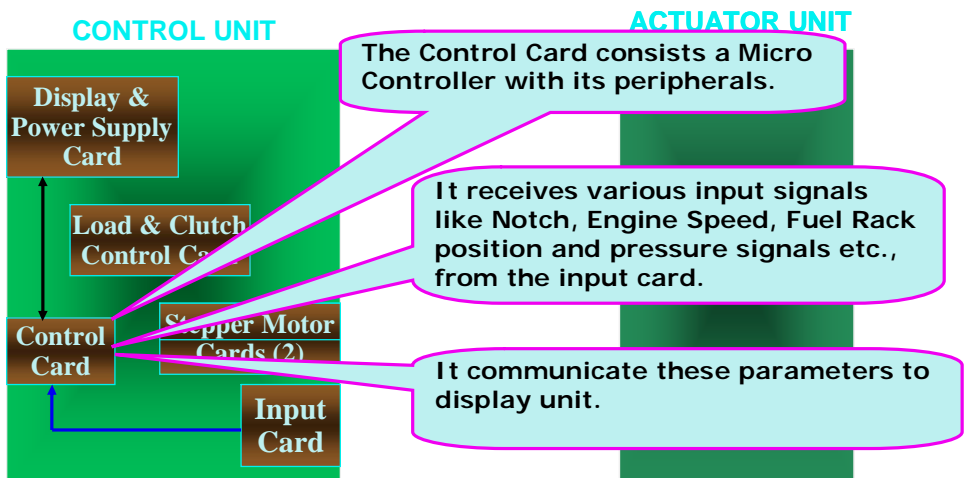
To test over speed trip a three position key switch is provided. One position on this key switch selects a built in feature of MCBG to test electronic over speed trip, which shall be less than that of mechanical 05T. The second position of key switch selects mechanical 05T. This switch will be active only in 8th notch. In electronic over speed test the engine RPM is gradually increased above 8th notch RPM. When the engine RPM reaches the set RPM for electronic OST, the system should shut down the engine. A message on the display indicates whether the test is successful or failed and in case it is successful it indicates the APM at which the electronic 05T has operated. During mechanical 05T test the governor gradually increases the engine RPM to maximum set limit and waits for a specified time. By this time the external mechanical OST device should trip shutting down the engine. Even if it does not trip the Governor reduces the engine RPM to 8th notch RPM. Display indicates whether the test is successful or failed or needs adjustment, and also the RPM at which the OST has operated.

The actuator unit has an electro magnetic clutch, which turns off, autocratically during loss of power and fuel rack is brought to "No Fuel" position, by the spring. It also gets deactivated in case of malfunctioning of the system. This will close fuel rack and shut down the engine. A built in fault diagnostic system continuously monitors the health of various peripherals. In case of major faults the engine is shut down automatically. In other cases appropriate action is taken. In all the cases appropriate message is displayed on the display unit, and the fault is registered with date and time stamp in error log, to help the shed based maintenance staff later, for ease of servicing.

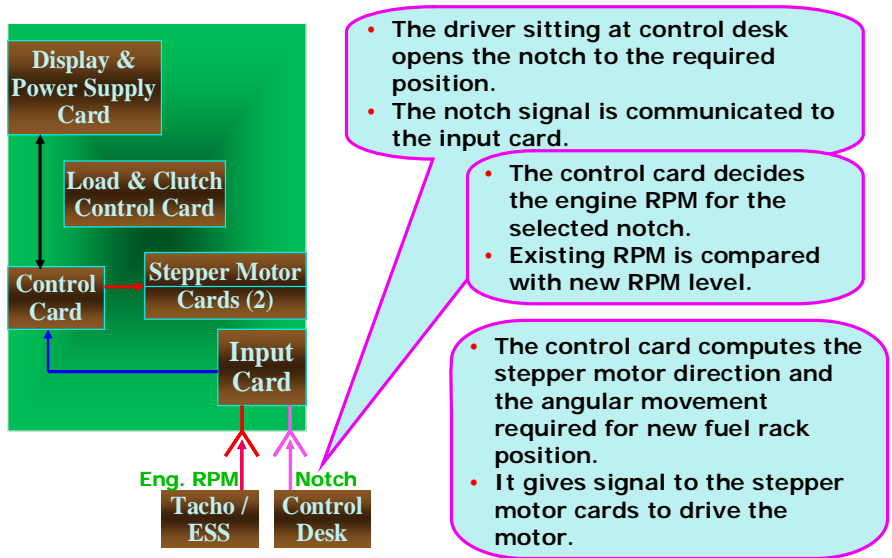
10.1 Block diagrams for understanding Function of Governor



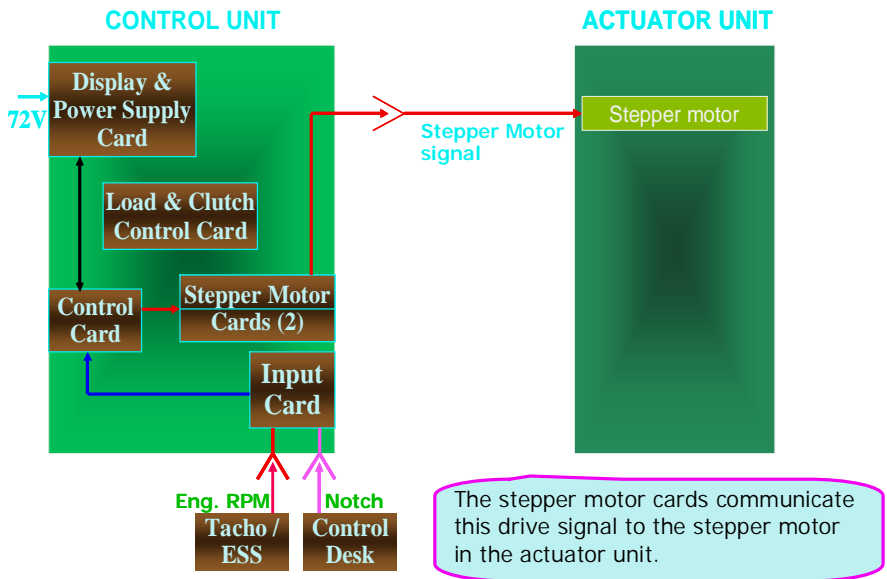
Block Diagram No.1



Block Diagram No.2

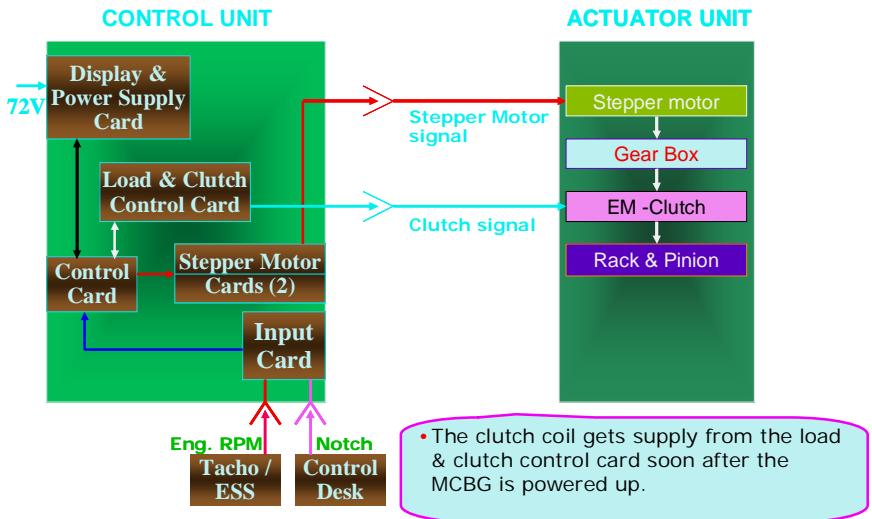
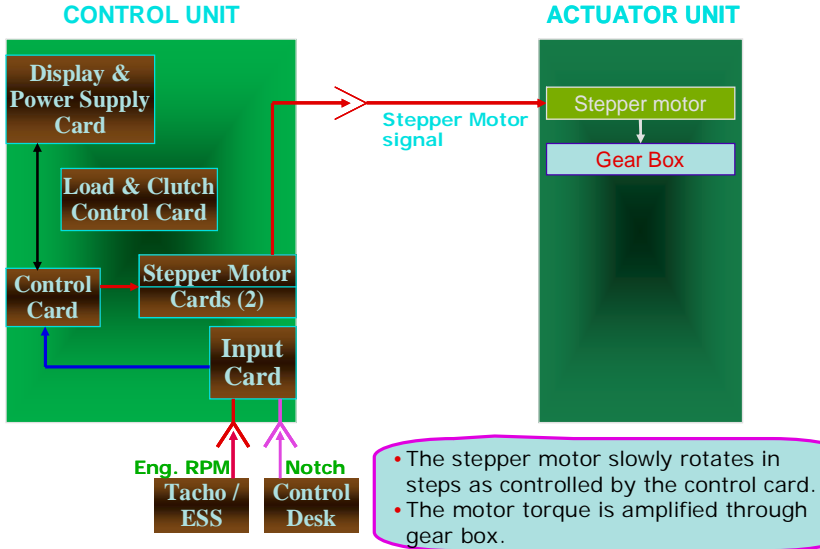


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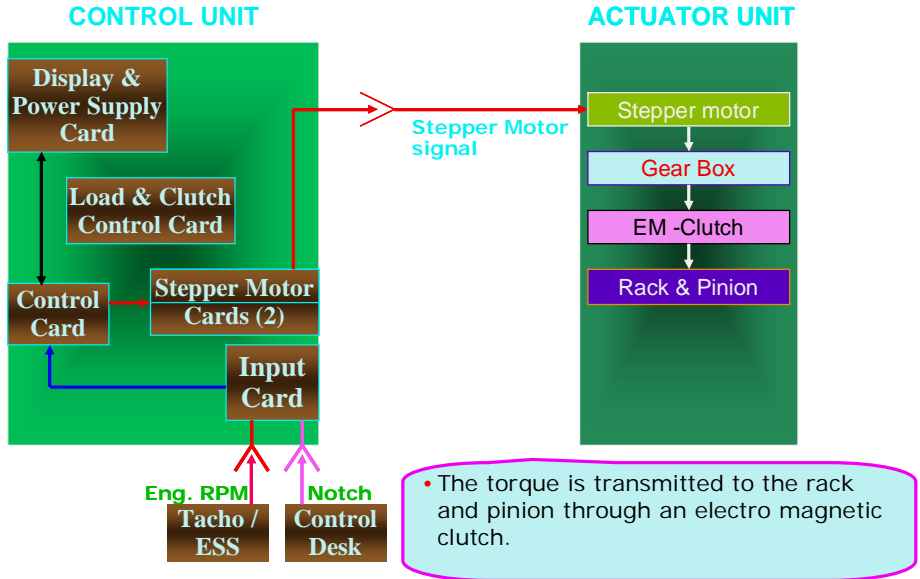
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Block Diagram No.5

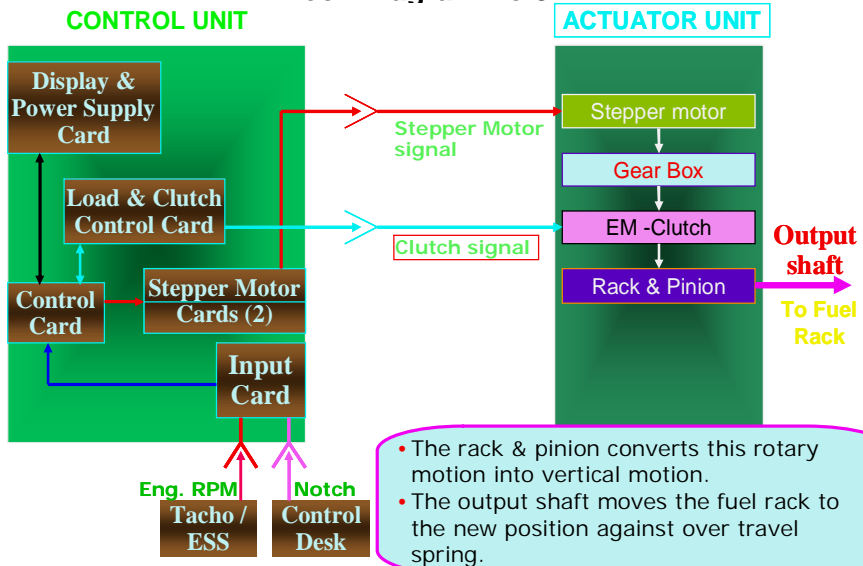


Block Diagram No.6

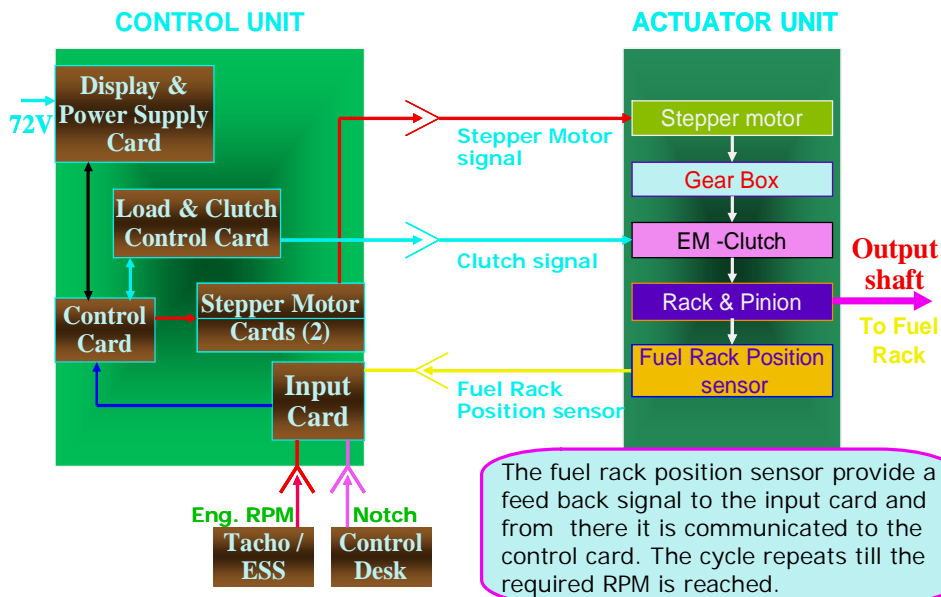
Block Diagram No.7



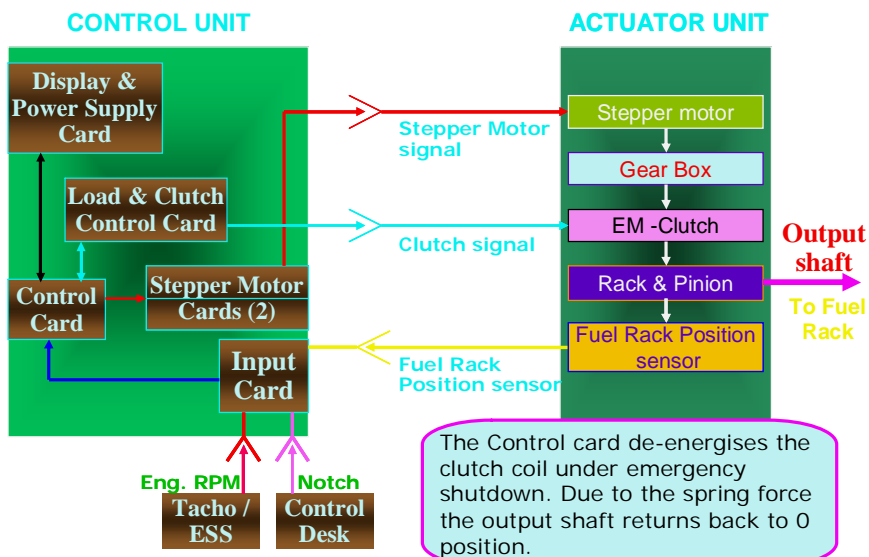
Block Diagram No.8



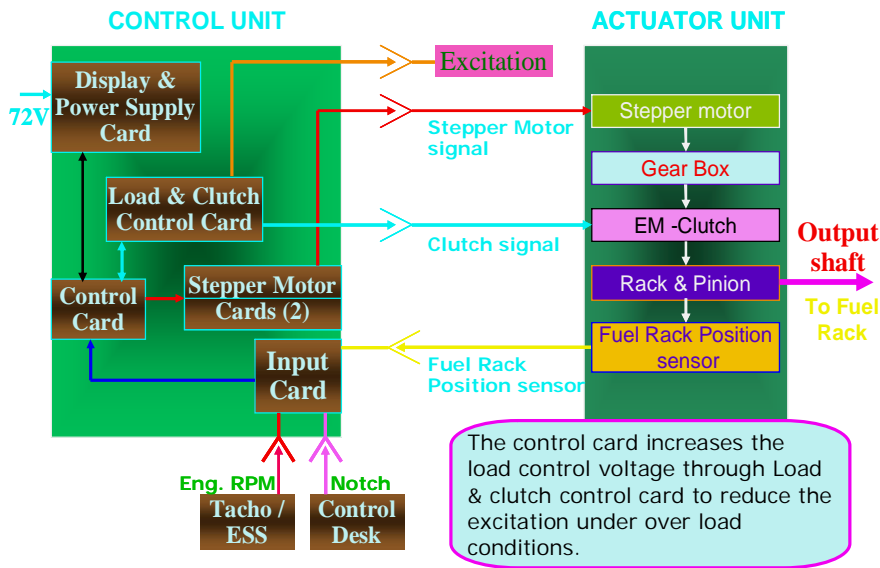
Block Diagram No.9



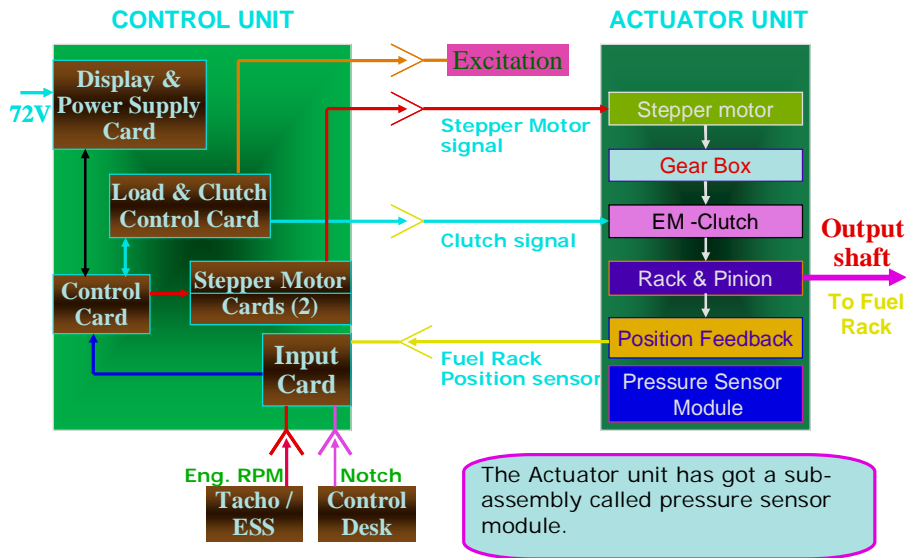
Block Diagram No.10



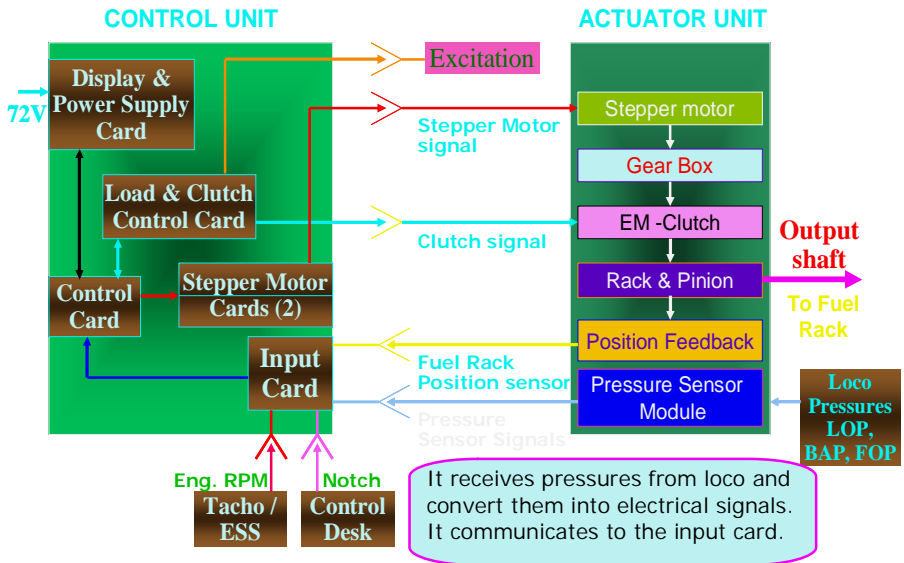
Block Diagram No.11



Block Diagram No.12



Block Diagram No.13



11.0 MAINTENANCE

MCBG is practically maintenance free. The Control unit does not require maintenance once installed. All parts of the Actuator unit are greased with long life high temperature withstanding grease. The Grease Type No. Z 2504 which is supplied by M/S Medha is used in Governor Gear Box. The Actuator unit should be greased once in Five years with above specified grease.

All cards in control unit are housed in environment protected enclosures. All the modules should be seated firmly on motherboard. The modules are provided with knurled screws to secure them in their respective position.

The modules are named as follows.

- a) Display and power supply module: -
MEGDISPLAY&MEGPSM.
- b) Load and clutch control module: MEGLC
- c) Motor Control module: - MEGMC (2 nos.)
- d) Control card module: - MEGCC
- f) Input Card Module MEGIP.

11.1 TROUBLE SHOOTING

The system error log should be read and faults that have occurred can be attended as per guidelines given below.

S No	Fault/ Error Log	Probable cause	Repair/guide lines
1.	Display is blank at power ON.	Absence of power to the control unit or display, or display or display could be defective.	Check 72 volts power on cable going to Control unit. If the power is absent then 'check Cable. If power is present, then open side cover of control unit and verify presence of power before and after the circuit breaker. If incoming power to circuit breaker is present but no output, then circuit breaker is faulty. Else. either the, Power supply card, or the display control card(MEGDSP/ MEGPSM) or VFD module in display unit could be defective
2.	Tacho faulty or display cable noisy	This is caused by erroneous speed signal.	Fuel Rack Position Sensor in actuator unit could be defective. If Tacho any its cable are proper then input card (MEGIP) could be defective, or control card (MEGCC) could be defective.
3.	Lube Oil Pressure Sensor faulty, showing high pressure	This is caused by erroneously high lube oil pressure signal.	LOP Sensor in actuator unit or sensor cable from Control unit to Actuator Unit could be defective, or input card or control card (MEGCC) could be defective.

S No	Fault/ Error Log	Probable cause	Repair/guide lines
4.	Booster Air pressure sensor faulty, showing high pressure	This is caused by erroneously high Boost air pressure signal.	Booster Air pressure sensor in actuator unit could be defective, or sensor cable from Control unit to Actuator Unit could be defective, or input card (MEGIP) or control card could be defective.
5.	Fuel Oil Pressure sensor faulty, showing high pressure	This is caused by erroneously high fuel oil pressure signal.	FOP regulator valve may be faulty, check the FOP through an independent gauge. If it is normal, FOP sensor in actuator unit could be defective. or sensor cable from Control unit to Actuator Unit or input card (MEGIP) or control card (MEGCC) could be defective.
6.	Engine Shut Down due to Over speed	Faulty fuel rack drive	Check fuel rack linkage, motor cable, drive motor, motor drive cards (MEGMC), and Control card (MEGCC).
7.	LOP. Sensor Faulty or Cable Open.	No Lube Oil Pressure Signal	Sensor cable from Control unit to Actuator unit could be open, or LOP sensor or input card (MEGIP), or control card (MEGCC) may be defective.
8.	BAP Sensor Faulty or Cable Open.	No Air Pressure Signal.	Sensor cable from Control unit to Actuator unit could be open, or Air pressure sensor or input card (MEGIP) or control card (MEGCC) may be defective.

S No	Fault/ Error Log	Probable cause	Repair/guide lines
9.	Fuel Oil Pressure Sensor Faulty or Cable Open.	No Fuel Oil Pressure Signal	Sensor cable from Control unit to Actuator unit could be open, or Fuel Oil pressure sensor may be defective or input card (MEGIP) or control card (MEGCC) may be defective.
10.	Engine Shut down due to Low Lube Oil Pressure	Lube Oil Pressure not building up.	LOP pump system may be faulty or its pipelines to Actuator unit choked / damaged. If not, check whether lube oil pressure sensor Fault is declared.
11.	Engine Shut Down due to LOP at Low Idle".	Engine Shut Down due to LOP at Low Idle". LOP not maintaining at Low Idle.	Lube oil pressure pump system may be faulty or its pipelines to Actuator unit choked/damaged. If not, check whether Lube oil pressure sensor Fault is declared.
12.	Tacho Faulty or Cable Open.	No RPM Signal from Tacho Generator.	Tacho cable could be open, or Tacho could be faulty. If not, input card (MEGIP) could be faulty.
13.	LCP circuit. Faulty	Load control circuit Faulty	Check Load Control wire in the cable from control unit to terminal block & into E-type excitation system. Load and Clutch Control Card (MEGLC) could be faulty, or Control Card (MEGCC) could be Faulty.
14.	Rack obstructed by OST or Drive Fail	Improper movement of rack while cranking.	Check for OST or any mechanical obstruction to fuel rack movement. Check for free movement of Fuel

S No	Fault/ Error Log	Probable cause	Repair/guide lines
	at Crank.		Rack thru "Fuel Rack calibration" Menu using a Laptop/ PC, as described in Annexure I.
15.	NOTCH Time Count in RTC Faulty.	Notch Time Count Data stored in non- volatile memory of RTC is corrupted.	RTC chip may be defective. Replace Control card. (MEGCC).
16.	NOTCH Time Count in RTC Faulty & RESET	Notch Time Count Data stored in non-volatile memory of RTC is corrupted & reset to zero	RTC chip may be defective. Replace Control card. (MEGCC).
17.	Electronic Over Speed Test successful	Whenever Electronics OST test successfully Completed.	If Electronic OST test is fail check Tacho/ESS. In case of test successful nothing to do.
18.	Mechanical OST Tested.	Whenever Mech OST test conducted & test is completed Successfully or test fails.	If Mechanical OST test is fail because of less RPM setting is made through OSTA, increase the OSTA setting level to required set level. In case of test successful nothing to do.
19.	Tacho Faulty or Cable Open at cranking	No Engine RPM signal from Tacho generator / ESS.	Battery voltage may be less, or Fuel Rack may be Sticky or Tacho / ESS cable may be open, or Tacho / ESS may be faulty. If not,

S No	Fault/ Error Log	Probable cause	Repair/guide lines
			Input card (MEGIP) may be faulty or Control card (MEGCC) may be faulty.
20.	Difference between two sensor speeds is high.	causes when one engine speed sensor is healthy & another Engine speed sensor pulses missing.	Check for ESS1 or ESS2 mounting gap or any sensor defective or its cable connected from ESS to Interfacing circuit and to MCBG Control unit or MEGIP card or Control card or Power supply card could be defective
21.	ESS1 speed sensor Mis-behaving.	This is caused when ESS-2 is faulty and Engine RPM is varying or ESS-2 signal is faulty and ESS-1 signal is mal-functioning.	Check ESS-2 mounting gap or its cable connected from ESS-2 to Interfacing circuit & to MCBG Control unit or MEGIP card or Control card or Power supply card could be defective, for hunting problem check external spring is provided on the Engine block or ESS1 mounting gap or its cable connected from ESS-1 to Interfacing circuit and to MCBG Control unit or MEGIP card or Control card or Power supply card could be defective or Dead Rack position of Loco are in negative side.
22.	ESS2 speed	This is caused	Check ESS-1 mounting gap or its cable connected from

S No	Fault/ Error Log	Probable cause	Repair/guide lines
	sensor Mis-behaving.	when ESS-1 is faulty and Engine RPM is varying or ESS-1 signal is faulty and ESS-2 signal is malfunctioning.	ESS-1 to Interfacing circuit and to MCBG Control unit or MEGIP card or Control card or Power supply card could be defective, for hunting problem check external spring is provided on the Engine block or ESS-2 mounting gap or its cable connected from ESS-2 to Interfacing circuit and to MCBG Control unit or MEGIP card or Control card or Power supply card could be defective or Dead Rack position of Loco are in negative side.
23.	ESS1 speed sensor wire open fault.	This is caused when the ESS-1 signal fails.	Check for ESS-1 mounting gap or ESS-1 sensor defective or its cable connected from ESS-1 to interfacing circuit and to MCBG Control unit or MEGIP card or Control card or Power supply card could be defective.
24.	ESS2 speed sensor wire open fault.	This is caused when the ESS-2 signal fails.	Check for ESS-2 mounting gap or ESS-2 sensor defective or its cable connected from ESS2 to interfacing circuit and to MCBG Control unit or MEGIP card or Control card or Power supply card could be defective.
25.	ESS2	This is	Check for ESS-2 sensor

S No	Fault/ Error Log	Probable cause	Repair/guide lines
	Faulty or Cable Noisy.	caused by erroneous ESS2 sensor signal.	mounting gap or its cable connected from ESS2 to Interfacing circuit and to MCBG Control unit or MEGIP card or Control card or Power supply card could be defective.
26.	ESS1 Showing high RPM at zero speed.	This is caused by erroneous ESS1 sensor signal during shutting down of engine.	Check for ESS-1 sensor for any defective or its cable connected from ESS1 to Interfacing circuit and to MCBG Control unit or MEGIP card or Control card or Power Supply card could be defective.
27.	ESS2 Showing high RPM at zero speed	This is caused by erroneous ESS2 sensor signal during shutting down.	Check for ESS-2 sensor for any defective or its cable connected from ESS2 to interfacing circuit and to MCBG Control unit or MEGIP card or Control card or Power Supply card could be defective.

11.2 Procedure for Calibration of Engine Fuel Pump Racks with Micro Controller Based Electronic Governor (MCBG).

1. Switch ON “BATTERY” and “CONTROL” breakers (MB1 & MB2), to Power UP MCBG. The MCBG displays “Power ON Check SUCCESSFUL” message momentarily and after that “Press RESET / START key to start Engine” message appears. Press RESET/ START key on MCBG. Now MCBG Actuator output shaft moves to cranking position. It stays there for 20 seconds with a message “Ready for Cranking Engine”. Then the output shaft returns to ‘0’ position with a display “Cranking not done”. Now set all fuel pump racks to ‘0’ position through their eccentric adjustments. Press RESET/ START key on MCBG to move fuel pump racks again and check that all racks are equal.
Repeat this for 2 or 3 times for confirmation, adjusting racks if needed.
2. Open MCBG door lock and open door. Connect a cable from Laptop RS232 connector to the connector provided on Control Card MEGCC of MCBG. The display shows “BUSY”. User settable Parameters Programming ON” message. Click mouse on the icon provided for MCBG Configuration Manager on Laptop screen, to run the software. On Menu Bar, click on “Configuration” and select “Governor” to open configuration menus. Now click on Menu Tab “OST and Misc”. In this menu click on “Fuel Rack Calibration ON” check box, to start the Calibration. When this check box is set, engine can’t be cranked. The fuel rack can only be moved for calibration of the engine.
3. Now note down the fuel pump rack position on the fuel pump nearest to MCBG Actuator. This will be the “Fuel Rack Position @ 0 mm of MCBG”.

4. On Menu Tabs, click on "Fuel Rack Calibration" menu and then against "Move MCBG For Calibration to" enter "28". Click on "SEND" command button for sending this data to MCBG. When "Configuration Successful" message is displayed, remove Laptop cable on MCBG. The message "Ready for Engine Fuel Rack Calibration. Press RESET key to move Fuel Rack" is displayed on MCBG. Press RESET/ START key. Now MCBG output shaft moves by 28 mm precisely and it will stay in that position for 40 secs. MCBG displays "Calibrating Engine Fuel Rack with MCBG. MCBG Rack Positioned @ 28.0 mm Now". Note down the fuel pump rack position on the fuel pump nearest to MCBG Actuator. At the end of 40 secs. MCBG moves back to 0 mm and displays message "Ready for Engine Fuel Rack Calibration. Press RESET key to move Fuel Rack". Press RESET/ START key again and repeat this step 5 to 6 times to ensure that Fuel Rack movement is free without getting stuck up any where. It should repeat the same reading on the fuel pump every time. If any fuel pump rack is stuck up service that first, before calibration, otherwise calibration will be wrong.
5. Now reconnect Laptop cable on MCBG and enter "5" against "Move MCBG for Calibration to". Click on "SEND" command button for sending this data to MCBG. When "Configuration Successful" message is displayed, remove Laptop cable on MCBG. The message "Ready for Engine Fuel Rack Calibration. Press RESET key to move Fuel Rack" is displayed on MCBG. Press RESET/ START" key". Now MCBG output shafts moves by 5 mm precisely and it will stay in that position of 40 secs. MCBG displays "Calibrating Engine Fuel Rack with MCBG. MCBG Rack Positioned @ 5.0 mm Now". Now note down the fuel pump rack position on the fuel pump nearest to MCBG Actuator. At the ends of 40 secs. MCBG moves back to 0mm and display ".Ready for Engine Fuel Rack Calibration" Press RESET key to Fuel

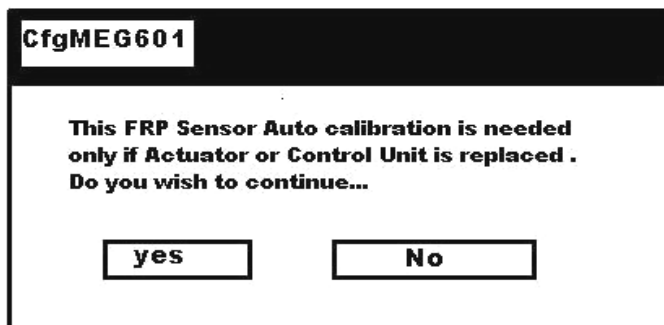
Rack". Press RESET/ START" key again and repeat this step 3 times to ensure that fuel – pump rack reading is repeatable, if not go back to step 4.

6. Now reconnect Laptop cable on MCBG and repeat step 5 by entering "10" against "Move MCBG for Calibration to" to 15 mm, 20 mm, 25 mm and 30 mm repeat step 5 and note down fuel pump rack position on the fuel pump nearest to MCBG Actuator at these points. In case of 30 mm movement, rack touches the maximum limit i.e. mechanical stopper, take the difference between MCBG output shaft movement and the fuel pump rack position for 25 mm and add that to 30 mm to get nearest approx. reading for 30 mm.
7. Now enter all these values against user settable parameters "Fuel Rack Position at 0 mm, 5 mm, 10 mm, 15 mm, 20 mm, 25 mm & 30 mm of MCBG" in "Fuel Rack Calibration" menu. In "OST and Misc" click on "Fuel Rack "Fuel Rack Calibration On" check box again to de-select and end calibration. Click on "SEND" command button for sending this data to MCBG. In case the "Max. Rack @ Notch 8" in "Notch Wise Fuel Rack Limit" menu or "Max. Fuel Rack @ 1.5 kg/cm²" in "Boost Air Fuel Limit" menu are low, a warning message "To avoid engine Bog down, Max. Fuel Rack @1.5 kg/cm² , Max. Rack @ Notch 8, is increased. Check them may appear. Click on "OK.". In case these values are higher than " Fuel Rack Position at 30 mm" a warning message "Max. fuel Rack @ 1.5 kg/cm² = xx. x, Max. Rack @ Notch 8 = xx.x above parameters are limited to Fuel Rack Position maximum limit of xx.x. mm. In this OK.?" May appear. If acceptable click on OK", else click on "Cancel" and recalibrate fuel rack, by adjusting the fuel pumps properly.
8. When "Configuration Successful" message is displayed, click on "Read Config" command button. The data programmed in MCBG is read back. Confirm the values set. Also confirm the values of

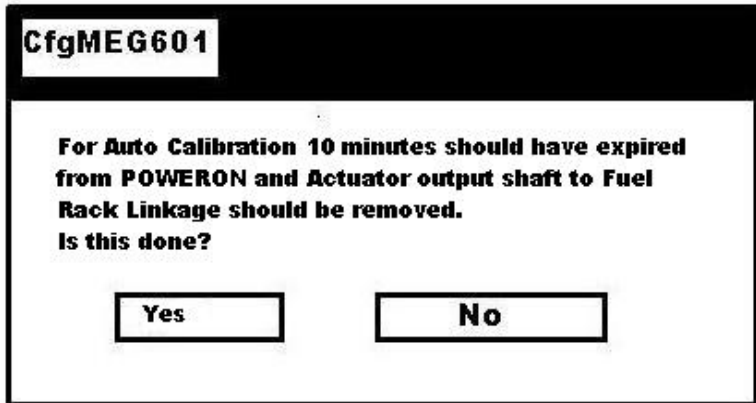
Max. Rack @ Notch 8” in “Notch wise Fuel Rack Limit” menu and “Max. Fuel Rack @ 1.5 Kg/cm²” in Boost Air Fuel Limit” menu. If they are not appropriate set them properly and click on “SEND” command button. When “Configuration Successful” message is displayed, remove Laptop cable on MCBG, close the door and lock it. Press RESET/START key to start Engine” message appears on the display. The MCBG is now calibrated for the engine fuel pump rack and ready for normal operation.

11.3 Procedure for Fuel Rack Position (FRP) Auto Calibration

1. In the main menu screen, there is an option, “Configuration” used for configuring the Governor and to set the engine parameters using the software. Under the “Configuration” menu, there are two options, namely “Governor” and FRP Sensor Auto Calibration”. The option FRP Sensor Auto Calibration” is used to match the Actuator Unit with Control Unit thru software. FRP Sensor Auto Calibration is needed only at the time of commissioning MCBG on loco or, if an Actuator or a Control unit or MEGIP or MEGCC card in control unit has been replaced. Connect Serial port of Laptop/ PC to the Serial port provided on the control Unit.
2. Click on FRP Sensor Auto calibration” option. They the software prompts you for confirmation.



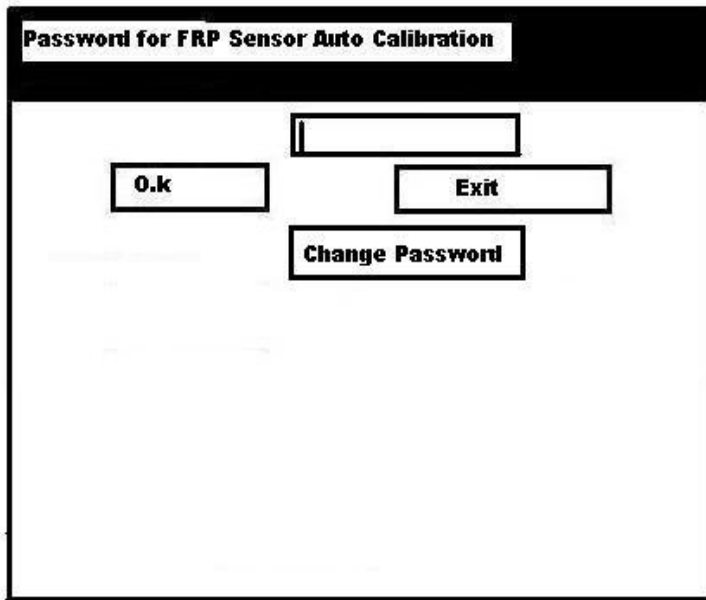
Click “Yes” to continue with the Auto Calibration or “No” to quit the auto calibration. After “Yes” has been clicked, the software again prompts for confirmation.



Click Yes, if 10 minutes of time has been expired from power ON and the Actuator output shaft to Fuel Rack linkage have been removed and to proceed with the auto calibration.

If fuel Rack Linkage to output shaft is not removed, wrong calibration may occur leading to other problems. Hence it is very much essential to remove this linkage before starting calibration.

Then the Software prompts the user for password. The software starts the FRP Sensor Auto Calibration only if a correct password is specified.



The default password provided by MEDHA is “MEG601”. After the password is entered, press “OK” to Star the FRP Sensor Auto Calibration. The MCBG then executes Auto Calibration and declares the worst case error obtained after calibration thru the following message.

“Rack Pos. Sensor Calibration SUCCESSFUL
Max. Error xx.xx mm
At xx.xx mm”

After reading this message, “ACK” switch should be pressed and Actuator output shaft to Fuel Rack linkage should be connected back to normal position, to continue with normal working of MCBG.

In case the calibration is not successful due to any major problem one of the following messages is displayed.

“Rack Pos. Sensor Calibration failed.
Max. Error xx.xx mm
At xx.xx mm”

or

“Unable to calibrate Rack Pos. Sensor”

In this case contact Medha Service team for further assistance.

NOTE: Cranking should not be attempted during Auto Calibration.

There is a provision to change the password for FRP Sensor Auto Calibration. It is highly recommended that user change the password to his choice for security purpose.

This can be done by clicking the “Change Password” option and specifying the old password and the new password.

The image shows a software interface titled "Password for FRP Sensor Auto Calibration". It contains several input fields and buttons. At the top, there is a single-line text input field. Below it, on the left, is an "O.k" button, and on the right is an "Exit" button. In the center is a "Change Password" button. Below the "Change Password" button, there are three stacked text input fields for entering the old and new passwords. At the bottom left, there is another "O.k" button.

NOTE: At the end FRP Sensor Auto Calibration, “Calibration of Engine Fuel Pump Racks” should be carried out as per 11.2.

12.0 DRIVERS INSTRUCTION

When Engine got shutting 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.
- BAP, FOP & FRP sensor failure loco will crank normally.

A message will be display after mechanical OSTA trip
“Move fuel rack linkage manually to free them.

TROUBLE SHOOTING

Faults	Driver Attention
Loco cranking but not starting/firing.	<ol style="list-style-type: none"> 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.

	<p>6. OSTA tripped and not reset properly.</p> <p>7. Fuel Racks do not travel even if Governor Shaft moves. (Over travel spring in the base is wind up)</p> <p>8. If Fuel racks is not moving press linkage to crank the engine.</p>
BAP less and poor hauling power.	Switch ON the Boost air control switch in BAP Bypass mode provided on the front panel of the control unit.
Erratic engine rpm.	<p>Check the Notch input connections at Governor terminal block.</p> <p>Check the connector tightness.</p>
BAP/LOP/FO P/FRP sensor faulty message on MCBG Display.	Check the connectors tightness at MCBG Control unit & Actuator unit.

**Instruction Bulletins/Modification sheets issued by
Motive Power Directorate of RDSO**

1. Instruction Bulletin No: MP.IB.EN.15.92.09 (Rev- 00)
Title : Optimum engine operating line of Alco type 3100GHP locomotive fitted with Medha make MCBG and Medha make microprocessor based control system.
2. Instruction Bulletin No: MP.IB.EN.10.62.09 (Rev- 00)
Title :To avert locomotive failure by pre-empting malfunctioning due to loosening of screws used for fastening of sub card of MEGIP card of Medha make MCBG.
- 3.. Instruction Bulletin No: MP.IB.EN.08.43.08
Title : Review of low idle modification (this modification will henceforth be called intelligent low idle (ILI) modification) on locomotives fitted with Microprocessor propulsion control system and MCBG.
4. Instruction Bulletin No: MP.IB.EN.05.36.08 (Rev 0.00)
Title : Guidelines to check stickiness of control linkage and fuel control shaft assembly of ALCO type locomotives fitted with Medha make of MCBG.
5. Instruction Bulletin No: MP.IB.EN. 02.13.08 (Rev0.00)
Title : Elimination of Booster air pressure (BAP), Fuel oil pressure (FOP) and lube oil pressure (LOP) gauges to DLW part no.11445543, 11440417 and 11440429 respectively from drivers cab of new-built, rebuilt and existing WDG3A and WDM3D locomotives fitted with microprocessor propulsion control system and MCBG.

6. Instruction Bulletin No: MP.IB.EN.01.05.08 (Rev 01)
Title : Revised manifold air pressure bias fuel limit setting to eliminate black smoke from ALCO engine with Medha MCBG.
7. Modification Sheet No: MP.MOD.EN.01.06.10 (Rev 00)
Title :Removal of automatic shut down feature of Mechanical Over Speed Trip Assembly (OSTA) yet retaining its manual shut down feature from ALCO family Diesel Electric locomotives fitted with Medha make MCBG and Medha make Microprocessor Based Control System (MBCS).
8. Modification Sheet No: MP.MOD.EN.02.04.09 (Rev 00)
Title :Improvements in Medha make MCBG and Medha make microprocessor based control system to improve working and to save cost.

OUR OBJECTIVE

To upgrade maintenance technologies and methodologies and achieve improvement in productivity and performance of all Railway assets and man power which inter-alia would cover reliability, availability, utilization and efficiency.

If you have any suggestions and any specific comments, please write to us.

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