INDIAN RAILWAYS ROLLING STOCK WORKSHOP CHARBAGH, LKO SUMMER TRAINING REPORT

TOPIC: USE OF MICROPROCESSOR/MICROCONTROLLER IN DSL LOCOMOTIVE

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16493 TKD WDM3A
16493 WDM 3A

Fig. ROLLING STOCKWORKSHOP Charbagh, Lucknow

1.0 INTRODUCTION

In DSL Locomotive Microcontrollers/Microprocessors are basically used in Governors. The Basic function of the Micro controller based Governor (MCBG) is to
control the Engine speed, based on throttle handle position (Notch). Secondly, it is to control load on the engine electrically through an interface
with E-Type of excitation /microprocessor control, for maintaining a pre defined constant horsepower at each notch. Thirdly, limits the fuel based on
air manifold pressure. It also shut down the engine, in case of low lube oil,

engine over speed. The user can set the parameters through a LAPTOP/PC
of his choice with in the permissible limits. MCBG also logs the data of system faults, the timing of locomotive engine speeds i.e. Notch positions
and the details of parameters changes with a date and time stamp.
LAX-MCBG-8 Micro controller based Governor, has a self-diagnostics facility and displays various parameters of the engine on a Vacuum florescent Display. In case of any fault, it initiates an appropriate action instantly, displays the fault message to the locomotive crew, and records the
fault in the memory, to help the maintenance crew in rectifying the fault.
MCBG has number of user programmable parameters, which allows the crew to configure the governor to various types of diesel Engines and also
allows to fine tune the system parameters to suit the individual requirements.
The error logs can be read through a LAPTOP.
In accordance to RDSO Specification number MP.0.17.00.01 March 2007
(Revision 02), **The Micro Controller Based Governor** Type LAX-MCBG-
8 is developed. MCBG LAX-MCBG-8 is constructed in modular design to
facilitate for ease serviceability, each module has a specific function to perform, and can be plugged into the module housing. Each module is independently housed in a metal box with a specific identification

Fig 1.1 NOTCH

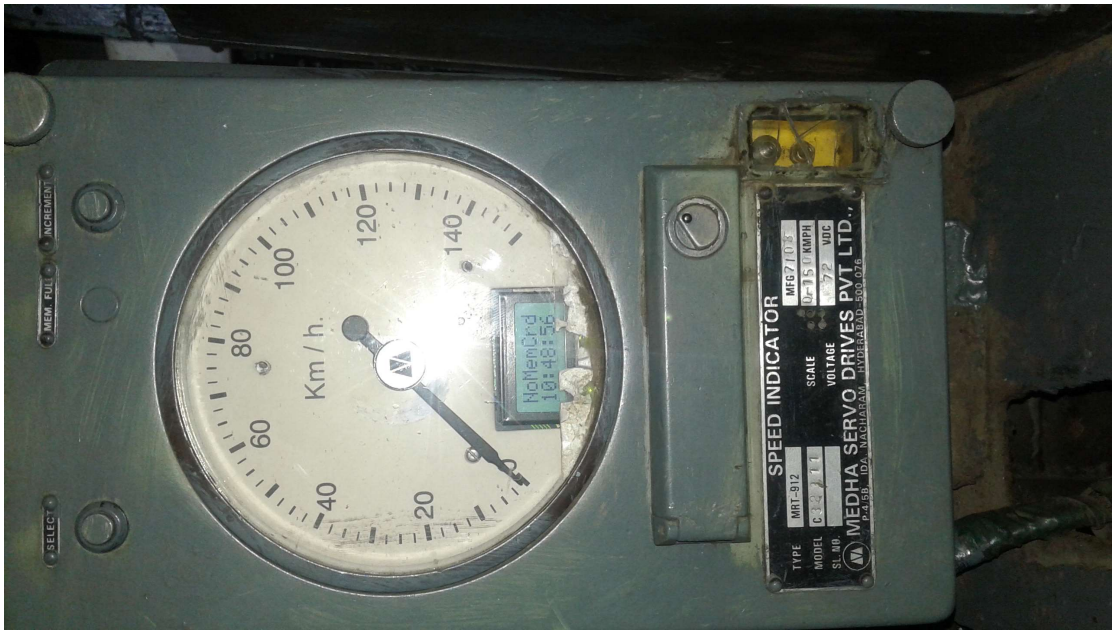


Fig 1.2 Speed Indicator

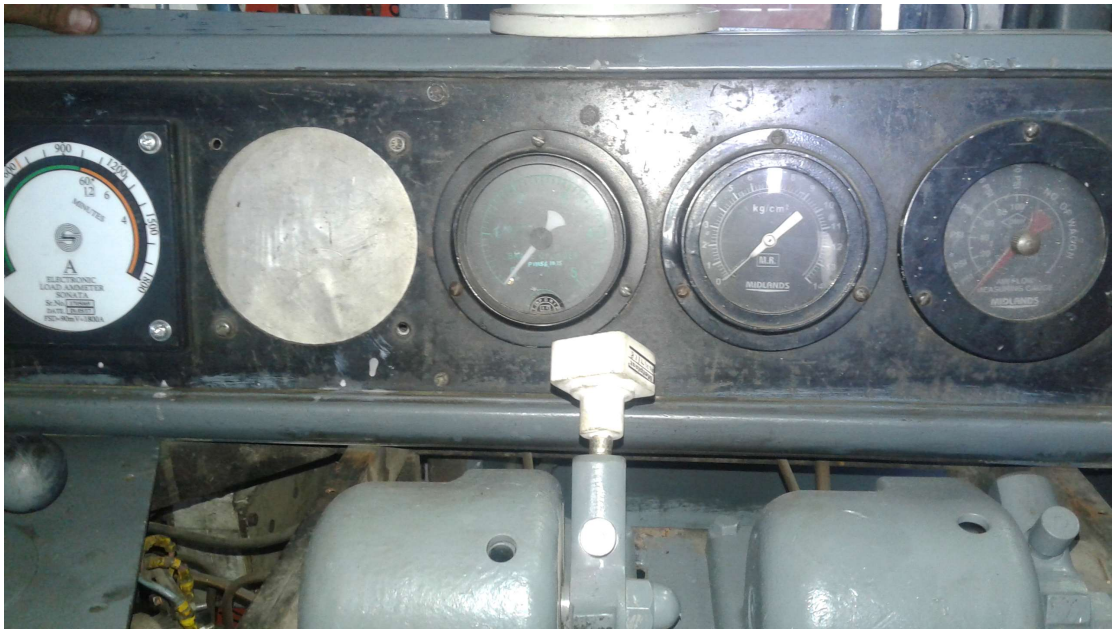


Fig 1.3 Various Pressure Indicator

2.0 SYSTEM DESCRIPTION

The Micro Controller based Governor consists of the sub assemblies named
as
1. Control Unit
2. Actuator Unit.
3. Set of Cables

2.1 CONTROL UNIT

The Control unit is mounted on the short hood side of the driver CAB or any other location suitable. The Control unit houses all the necessary electronics for functioning and control the actuator along with the display. Vacuum Fluorescent display is used for better visibility. The Control unit consists of the following modules and a Mother Board to facilitate the interconnections between the modules.

A. Mother Board LAX- G -MB
B. Power supply module LAX- G- PS
C. Load Control & Digital Input Card LAX-G-LD
D. Main Control &Analog Card LAX- G- MA
E. Display & Motor Module LAX- G- DM

2.2 ACUTATOR UNIT

The Actuator unit is mounted on the locomotive Engine at the present position of the Wood Ward Governor. The Sub parts of the Actuator are DC Stepper motor with a reduction gearbox and a special mechanism to convert the rotary motion to linear movement and a spring to drive back the fuel rack to no fuel position. By default the Actuator Rack is at no fuel position always. During cranking, if the engine speed is more than 100 RPM (programmable value), the Control unit gives a command to the actuator to move the fuel to 14 mm (programmable value) and once the engine picks up firing automatic control takes over and maintains the engine speed at idle notch. In case of any faults, controller sets the shut down which will enable the spring to take rack back to No fuel position. Dual Linear LVDT sensors are provided on the piston of the actuator to sense the position of the fuel rack.

All pressure sensors are mounted on the Actuator unit. The pressure pipes can directly be connected to the Actuator unit to monitor the Boost Air pressure, Lube-oil pressure and Fuel oil pressure. The pressure sensors are so chosen to withstand the locomotive ambient temperature and vibrations. The Linear actuation is designed to take the load required to move the entire rack system of locomotive. There are two lube oil sensors working in parallel and the controller will select one among the sensors and proceeds further. In case of any failure in one of the sensors, it logs the fault in the memory. If both the sensors fail then Engine will be shut down and an error message is displayed and an error is logged in the memory.

The mounting dimensions of the Actuator unit are exactly same as that of Wood Ward base Governor. The same linkages can be used for MCBG LAX-MCBG-8 and Wood Ward Governor.

As per the requirement two MS connectors are provided on the actuator for electrical connections between the Control unit and Actuator.


MICRO CONTROLLER BASED GOVERNOR
ACTUATOR UNIT
MODEL MAU 751A
MEDHA SERVO DRIVES PVT. LTD.
FUEL OIL
LUBE OIL
BOOST AIR
M48


MOTOR & CLUTCH
POWER & PRESSURE
TRIP TITLE
FRP CABLE
LDCON
16372

Fig 2.1 Actuator Unit

2.3 CABLES

The cables used in the system are of inner PTFE sheathing and outer Fire Retardant Low Smoke sheathing with each cable shielded and an overall shielding to protect from the external noise. Two out of three cables are terminated with the specified MS connectors. The other cable is terminated with one side MS connector and other side with M5 terminal lugs. The connectors are polarized and selected as per RDSO specifications for interchangeability.

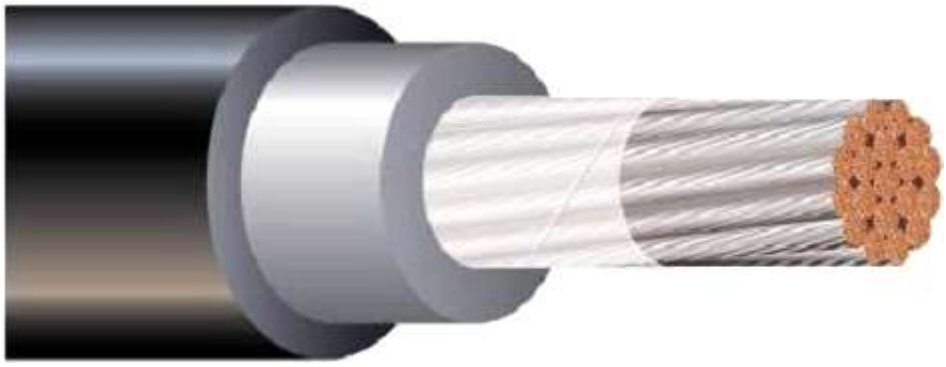


Fig 2.2 Cables

3.0 FUNCTIONAL DESCRIPTION

Micro controller based Governor MCBG LAX-MCBG-8 has a Control unit and an Actuator unit mated with the connectors and cables. The sub parts of the Control unit are discussed below:
A. Mother Board LAX- G -MB
B. Power supply module LAX- G- PS
C. Load Control & Digital Input Card LAX-G-LD
E. Main Control &Analog Card LAX- G- MA
F. Display & Motor Module LAX- G- DM

3.1.1 Mother Board – LAX- G- MB

This motherboard holds all the modules of the system and facilitates the interconnection between the modules, actuator unit and locomotive/engine Inputs and Outputs. This card is an interface card between the Driver's Acknowledge buttons, reset button, Over speed test switch, Power ON-OFF switch, Boost Air By-pass switch signals to the mother Board. This card is a junction between the MCBG circuit and Human interface signals.

3.1.2 Power Supply module –LAX- G- PS

This Power supply unit is designed on switch mode principle, and

converts the 72 V DC nominal supply of locomotive Battery voltage to 12V and 5 V DC required for the system. It is designed to withstand the harsh environment of locomotive workings and delivers the consistent output even if the input voltage varies from 50V to 90 V. It has over and under voltage, reverse-polarity, and short circuit protections along with the surge suppressors to meet the standards of IEC in addition to the filter card. It is capable of delivering the power to the system while Cranking where the voltage falls to 22V for duration of 0.8 seconds.

3.1.3 Load Control and Digital Input Card –LAX-G- LD

The Load control and Digital Input card generates the voltage from 24.4V to 68.8 V (user programmable) and interface to the E –Type of excitation system. It receives the control signal from MCC and generates the load control voltage and monitors the out voltage through an optically isolated device. The load control out put is short circuit protected. It converts the load control voltage into simulated LCP Hrs: Min formats and sends the information to the display. It also monitors the Locomotive Battery voltage and initiates the shut down operation in case of over voltage. This card also reads the locomotive inputs through optically isolated devices. It also reads the digital inputs of the MCBG control Unit and interacts with the Main control and Analog control card. Mutual hand shaking protocols are provided in these cards for error free communication.

3.1.6 Main Control and Analog Card – LAX- G- MA

This card is high-speed processor. It consists of peripheral Integrated circuits and necessary software built in to the MCC to interface between the cards of the entire system and has a non-volatile memory to store the data as well as the retention of the user settable parameters.

The Main Control and Analog card receives the data from Load Control and Digital Input card and all the analog inputs like engine speed, Pressure sensors, fuel rack position, pressure signals from Lube oil, Fuel, oil, and Boost air pressures and computes the required fuel rack position to maintain the specified Engine speed and provides the out put signals to Display and Motor card. The Display and Motor Control Card in turn drives the stepper motor in the actuator unit to position the rack at the required level. The LAX-G-MA monitors the position of the fuel rack continuously and ensures the rack position at every instant. The LAX-G-MA also monitors the Boost Air Bypass switch, over speeds test key switch along with the acknowledge switch and initiates appropriate action.

The LAX-G-MA will provide the load control action through the Load Control and Digital Input Card (LAX-G-LD) for E Type excitation system. With this arrangement the LAX-G-MA card generates a signal to the (LAX-G-LD) card, which provides the output of 24.4 V to 68.8 V at a nominal Locomotive battery voltage of 72V. The LCP card monitors the load control out put voltage and generates the simulated LCP position which is displayed in Hrs: Min, format on the display.

The Main control an Analog card has real time clock and a nonvolatile memory and is used for retention of user settable parameters and error logging with date and time stamp. It has a serial interface to interact with the LAPTOP for setting the different parameters.

The Main control an Analog card initiates the Engine shut down signal at any instant in case any major fault which may lead to the over speeding of the engine speed.

The Main control card directly reads the engine speed through an isolation circuits and takes action to maintain the speed of the engine at every 25msec. This information is transferred to the Stepper Control card and in turn it sets the fuel rack to the required level. The whole principle works on close loop system and ensures the actions taken.

The user can select Tacho generator output in case of conventional locomotives and Engine Speed sensor output in case of Microprocessor based locomotives. A Four-pin connector is provided to take Engine Speed Sensor output from Microprocessor based system.

Fig 3.1 Main control and Analog Card

3.1.8 Display & Motor Module - VEN G DMM

This module consists of two parts, Vacuum Fluorescent display card and Stepper motor driver card. The vacuum fluorescent Display is of 20 characters and 4 line display. The display card is designed to provide the necessary signals to the VFD display at every 25-milli sec on receipt of the information from the MCC. This display drive card and VFD display are housed in an enclosure and mounted at a specific place in the control unit for easy view. The display format is shown in Annexure A.

The Stepper driver card is designed on IGBT technology. This Card receives the command from the Main control card and initiates the drive to the DC stepper motor in the actuator unit. It constantly monitors the stepper motor currents and protects the motor from surges and over heat. It generates the appropriate currents and voltages during the shut down sequence. An appropriate Heat sink is provided for thermal protection.

Fig 3.2 Vacuum Fluorescent display

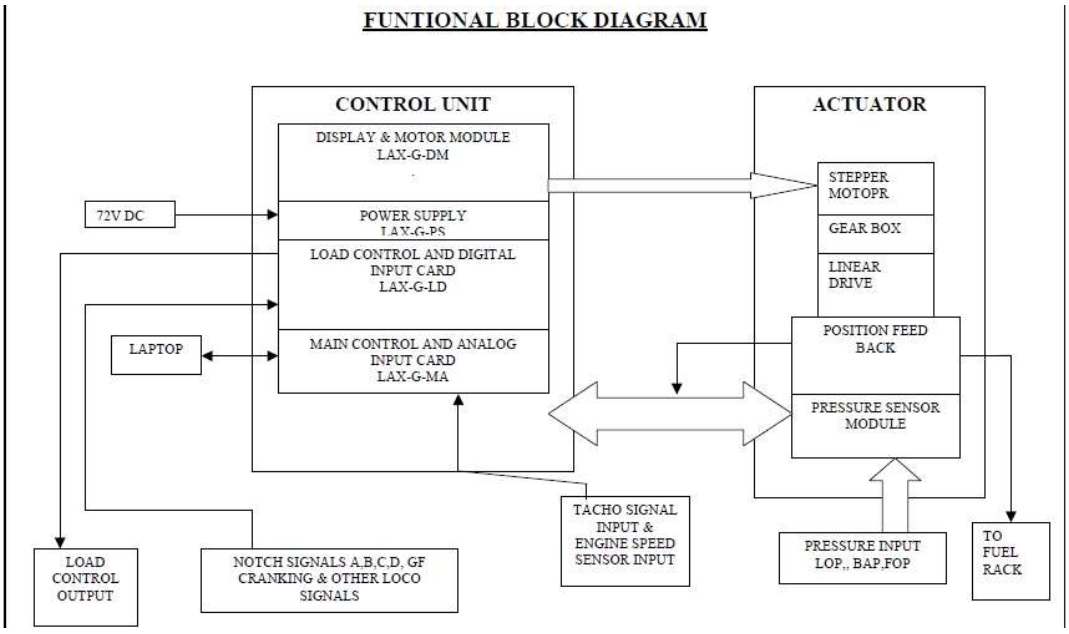


Fig 3.3 Functional Block Diagram

4.0. PRINCIPLE OF OPERATION

The main objectives are the MCBG is to maintain the speed of engine constant at a given notch independent of load. If excessive load appears on the engine MCBG will unload the load through load control of the E-type excitation system till the engine speed is maintained. It limits the movement of fuel rack as a function of Boost Air Pressure, notch wise engine speed, and lube oil pressure with respect to engine speed. Incase of assigned major faults, the system should shut down automatically.

The secondary objectives are to check the mechanical over speed trip and Electronic over speed trip tests through a Key switch. It logs the faults in a non-volatile memory and displays the faults on priority basis. It has a provision to Bypass the Boost Air Pressure based fuel limiting. It allows crew to change the user assigned settable parameters through the LAPTOP.

The Main control card in the control unit continuously measures the RPM of the engine from a tacho generator or from engine speed sensor (in case of microprocessor locos) connected to the locomotive engine through a gear. The input RPM is selected by a switch, which has two options Tacho generator output in case of conventional loco and Engine speed sensor output in case of microprocessor, based loco. The main control card automatically calculates RPM based on the position of the switch. The desired engine RPM is determined from the selection of notch on throttle handle, by reading the status of control wires of speed signals of A, B, C and D are read by the Main control card. A PID programmable algorithm compares the set RPM and actual measured RPM of the engine and maintains the error between the two speeds to zero, by controlling the fuel rack through the Actuator unit. The PID parameters can be optimized for each class of locomotive engines through the user settable parameters, so as to maintain the engine RPM constant free from hunting. Whenever the notch changes, RPM is varied linearly based on acceleration and deceleration rates, specified in user settable parameters. Lube Oil pressure is continuously monitored and in case of the low lube oil pressure specified in the user settable parameters, the engine shuts down.

A load control output is provided to maintain the constant horsepower output of the engine at each notch. The load control out put generated by MCBG will control the load through the E-Type of excitation system, by controlling the generator field excitation, from minimum to maximum or minimum to maximum at a rate specified through the user settable parameters. To achieve this, Notch wise fuel rack limit

can be dictated through the user settable parameters. Booster Air Pressure linked load control facility is also provided.
Booster Air pressure is measured, through a pressure sensor fitted in the Actuator unit, to limit the fuel rack sensor as a function of Boost Air pressure. This ensures the fuel supply to the engine proportional to the supply of the boost air pressure resulting incomplete combustion, prevents black smoke, excessive engine temperature, fuel wastage. Through the user settable parameters the fuel limit Vs Booster air pressure can be entered. A toggle switch is provided on the control unit to bypass the facility. When in bypass mode, the RPM variations between different notches is adjusted linearly based on acceleration and deceleration rates specified in user settable parameters.
Lube oil pressure is measured through the two pressure sensors fitted in parallel in the Actuator unit and the pressure is constantly monitored and the engine goes into shut down mode, if the pressure is below the specified limit, which are programmable through user settable parameters. The time delays during acceleration and deceleration can be programmed to build up the pressure from notch to notch and during cranking of the engine.
It is obviously necessary to test the system electronically, to whether the system responds to the speed and trips at specified limit in case of eventuality. There is a provision in the locomotive mechanically to trip the engine, in case the electronic trip facility fails. The MCBG is allowed to test these two facilities by an option given on the control unit through a key switch, to prevent unauthorized test. The trip RPM is programmable through user settable parameters and the electronic over speed trip should be less than the mechanical over speed trip. During this the MCBG will suspend the regular functions and constantly increases the speed and displays the trip speed on the display. MCBG LAX-MCBG-8 will shut down the engine if mechanical over speed trip fails to occur, by 5 RPM of mechanical over speed trip limit and displays the RPM at which tripped and whether the test is successful or failure.
MCBG LAX-MCBG-8 has a built in self test facility, and fail safe features. In case of any malfunction in the system, it sets the shut down command to the actuator. It logs the faults in to the memory and the data can be down loaded to the LAPTOP.
The actuator is designed with fail-safe feature. During power off conditions it puts the rack to no fuel position with the help of spring.

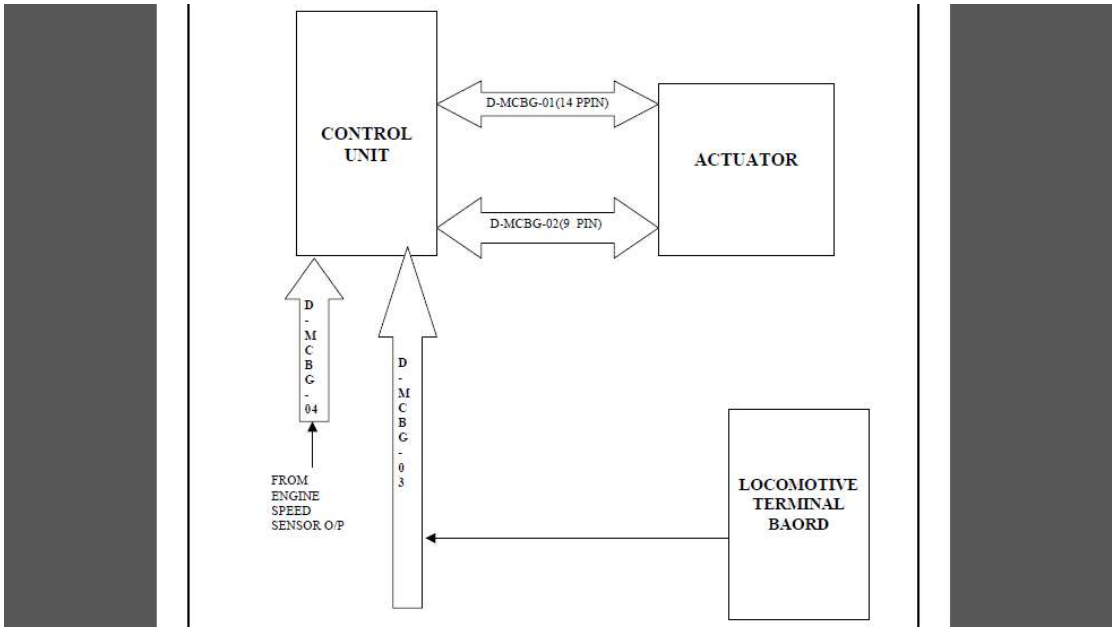


Fig 4.1 INTERCONNECTION DIAGRAMS MCBG LAX 789

5.0 SYSTEM SPECIFICATIONS

1. Operating Voltage:
Locomotive Battery supply voltage Nominal 72 V DC
Minimum 50 V DC
Maximum 90 V DC
Voltage dips to 22V DC for 0.8 sec are allowed during cranking.

2. Engine Speeds:
Speed settings are through LAP TOP. Provisions are made to set the speeds in steps for eight notches. Speed settings are user settable and are given in the table I of RDSO specifications No. Mp.0.17.00.01

3. Governor response Time:
The time taken form IDLE speed to Full speed will be 15 to 20 seconds, and each step notch speeds are in same proportions. The notch down speed timings are also user programmable.

4. Load Control voltage:
Provisions to load control to maintain the constant horsepower output of the engine at each speed setting. Load control is achieved using equivalent of load control potentiometer LCP for interfacing with existing E type excitation system on the locomotive. The wind up

voltage and unwind voltage generation timings are programmable.
Load control timings:
From max to min field position change will be 8.5 to 11 Seconds.
From min to max 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 Boost Air pressure at any point of time. Provisions are made for loading any curve (BAP Vs Fuel Rack Limit) through the user settable parameters. A toggle switch is provided on control unit to bypass BAP.

6. Pressure sensors
1. Lube oil pressure sensors – 2 numbers
   Working range 0 to 10 BAR
2. Booster Air pressure sensor – 1 number
   Working range 0 to 10 BAR
3. Fuel Oil Pressure – 1 number
   Working range 0 to 10 BAR

7. Display.
   A vacuum fluorescent display of 20 character X 4 line display is provided. It will display
   a. Lube oil pressure in Kg/sq. cm
   b. Fuel oil pressure in Kg/sq. cm
   c. Booster Air pressure in Kg/sq. cm
   d. Notch position
   e. Engine RPM
   f. Fuel rack position in mm
   g. LCP position in Hrs: Min format.
   h. All faults on priority.

8. Actuator Unit
   Rack travel 34 mm (adjustable)
   Working capacity grater than 16.3 Nm

6.0 **SALIENT FEATURES**

· Hunt free Engine speed.
· Fuel efficient and less pollution by controlling effectively the combustion of fuel
· Load control interface with Excitation system for Constant Horsepower at each notch.
· User settable parameters for optimization of performance of different class of locomotive.

· High torque DC stepper motor is used for better control of position of the fuel rack.
· Digital PID control requires no adjustments, once the class, like WDG2, WDM4 etc., of the locomotive is decided. No need of individual tuning for each engine. The PID parameters are same for the same class of locomotive and can be entered numerically through user settable parameters.
· Display shows all the engine parameters continuously and as and when any specific events for attention.
· On line fault diagnostics and fault message display
· Data logging of Errors and the durations of notch timings with date and stamp on non-volatile memory. Memory can be down loaded through RS 232 C communication port through a Laptop at any time.
· User settable parameters through a LAPTOP with user friendly menu driver options:
For Notch wise RPM
For Notch wise Horsepower
For Lube oil pressure at each Notch RPM and time delays in building up of pressures.
For Booster Air pressure Vs fuel limit
For PID control settings
· A high compression strength spring is provided to drive back the fuel rack to NO fuel when the power failure occurs and during any malfunction occurs in the system
· Self test diagnostic facilities and Electronic and Mechanical over speed test facilities are provided.
· All module are plugged type, for better serviceability
· Minimized wiring for better reliability

7.0 **FAIL SAFE FEATURES**

1. Automatic shut down of engine in case of :
   A. Lube oil sensor failure
   B. Tacho (Engine speed) signal failure
   C. Power supply failure
   D. Engine over speed
   E. Main control card failure
   F. Digital Input card failure
   G. Fuel rack sensor failure

Note: If fuel rack sensor fails, the system automatically detects the fault and displays the message and eventually locomotive runs on stepper motor controller, which indirectly measures the

fuel rack length, till the fuel rack sensor is replaced. We recommend to use the fuel rack sensor for better control and higher reliability.
2. Booster air pressure sensor failure will automatically Disable the air pressure based fuel limit
3. Runs on default parameters if Memory fails

8.0 **SYSTEM INSTALLATION AND COMMISSIONING**

The two sub assemblies of the micro controller based governor MCBG LAX-MCBG-8 are as follows:

The control unit is to be mounted on short hood side just below the existing location of Pressure dials. A supporting mounting plate is provided to hold the control unit on the wall of the locomotive.

The actuator unit is to be mounted in place of wood ward Governor on the wood ward-mounting base. Necessary Hardware is supplied along with the unit for fitment of the Actuator unit.

Two cables (D-MCBG-01 & D-MCBG-02) are provided for interconnection between the control unit and Actuator. One cable (DMCBG-
03) is provided from Control unit to locomotive terminal board (TB). All cables have shielded cores with inner PTFE sheathing and outer
FRLS sheathing. The two cables have to be laid between the Actuator and control unit are terminated with MS connectors and are labeled with cable name. These cables are one to one connections between the two ends of MS connectors. The other cable is provided with one side connector and the other side wires are terminated with M5 lugs and each wire is ferruled. These wires are to be connected to the locomotive TB. The MS connectors on the unit will match with the corresponding connector on the cable. The connectors are as per RDSO specification and are polarized and one cannot match with other connector. The connector details are given in MCBG Cable Connection Details.

The control unit has 4 MS connectors for following:
1. Input and output signals to Terminal (Cable no:D-MCBG-03)
2. Control unit to Actuator (Cable no:D-MCBG-01 & D-MCBG-02)
3. Control unit to Engine Speed sensor (D-MCBG-04)

8.2 COMMISSIONING

Firstly connect the cables properly as shown in the Inter connection Diagram and switch on the power supply. THANKS FOR CHOSING LAXVEN message will be displayed for one second and then PLEASE CRANK THE ENGINE display appears. This indicates that the system has completed self check and ready for further processing.

A small calibration procedure is required to match the actual rack with the actuator rack. Both the readings of actuator and fuel rack of locomotive are to be matched. This procedure has to be followed whenever there is change in the cards and actuator unit. Connect the PC to the control unit and through RS 232 port and calibrate the fuel rack lengths in steps of 5 mm and verify the lengths traveled in the fuel rack. If there is any change adjust the fuel rack. Check up to its maximum and minimum and ensure that there is free movement of rack all along its length. Follow the mechanical procedures for adjustments. **If Zero adjustments of fuel racks are not done properly the governor functioning will not be precise while on load.**

Now the engine is ready for cranking. Press the START Button of the locomotive. The fuel rack will move automatically to a programmed value when the engine speed attains cranking rpm (programmable) , the display will show all the parameters like, engine RPM, fuel rack position, Notch position, load control output and faults if any.

9.0 USER SETTABLE PARAMETERS & PC INTERFACE

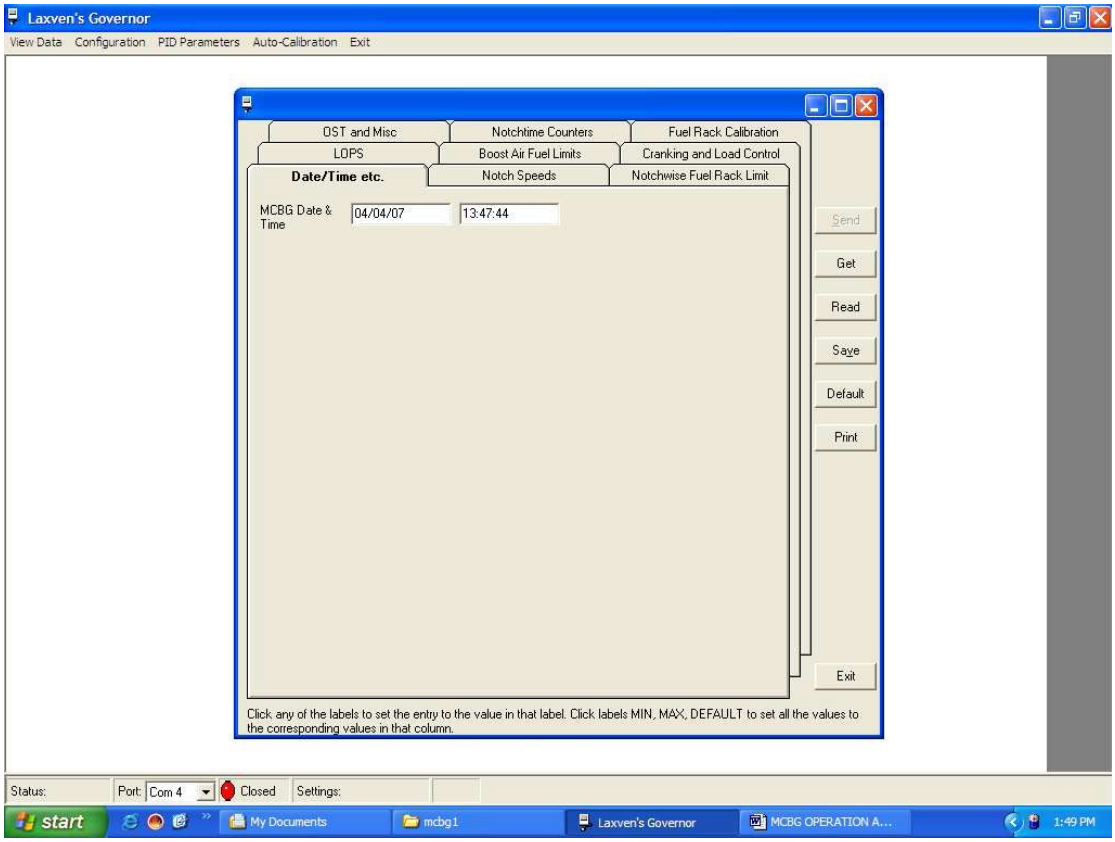
The user settable parameters can be modified only through LAPTOP/PC by shed staff. Laxven's Governor Software given along with the equipment has to be installed on LAPTOP/PC.
For modifying the parameters, the control unit lock has to be opened and connect cable-4 (Control unit to LAPTOP/PC) to Connector provided on the front fascia of the Control unit.
Open Laxven's Governor Software and the screen will look as follows

SELECTION OF COMPORT:

To Select the Serial communication port of LAPTOP to communicate with
MCBG click on the menu bar named Port on the bottom of the screen. After
selecting the COM port number, Click to RED button to open. Once the port is open, Red turns to GREEN. During the port open the communication
is established and once the communication is finished Green turn to Red. Operator should keep watching the color of the port while transmitting or receiving the data. A message appears on the screen PLEASE OPEN PORT
if the port is closed.
By selecting the CONFIGURTION menu, multiple folded screens appears.
Select the required objective parameters by clicking on the required folded
screen. User has an option to select any single objective of parameter to configure. With the help of GET button, each objective set parameters of the
MCBG are transferred to LAPTOP/PC and are shown in multiple folded screens. Open each objective parameter and modify the required parameter if
necessary. User is guided to select the value of the parameter with in the specified value of minimum and maximum displayed on the screen. A

message appears on the screen if any of the parameter value is out of range.
After ensuring all the parameters, user has to click SEND button to transfer
the modified parameters to MCBG.
The above objective parameters can be loaded only when the locomotive is
at Zero Engine Speed. Once the loco is cranked, the user cannot access these
parameters.
To down load the Error log data, user has to select the menu VIEW DATA
on the screen. The data can be viewed on the screen by clicking GET and can be saved to the note pad with the help of SAVE button.

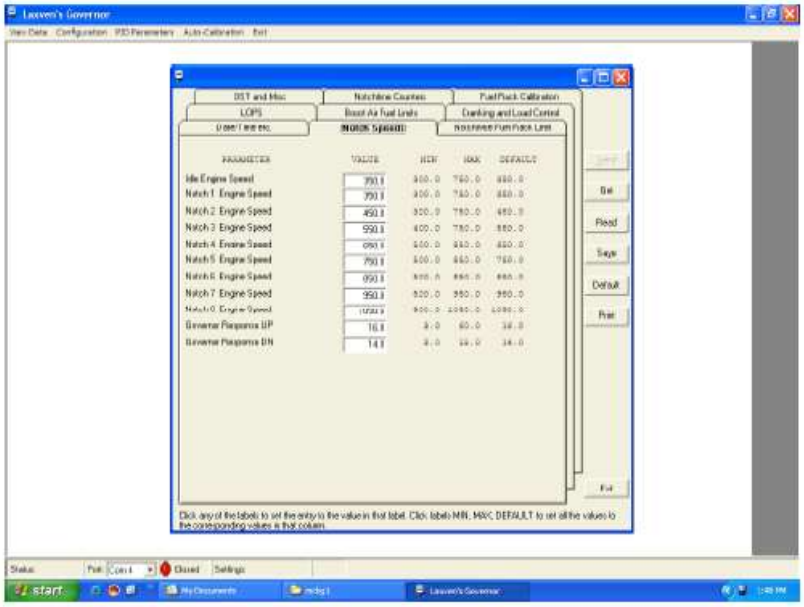
To Set Date and Time, click on the DATE/TIME folded screen. Following
screen will appear.



The LAPTOP date and time will appear in the Date and Time columns. Only LAPTOP date and time can be loaded into MCBG. In case the user wishes to change the Date and Time, LAPTOP date and time has to be

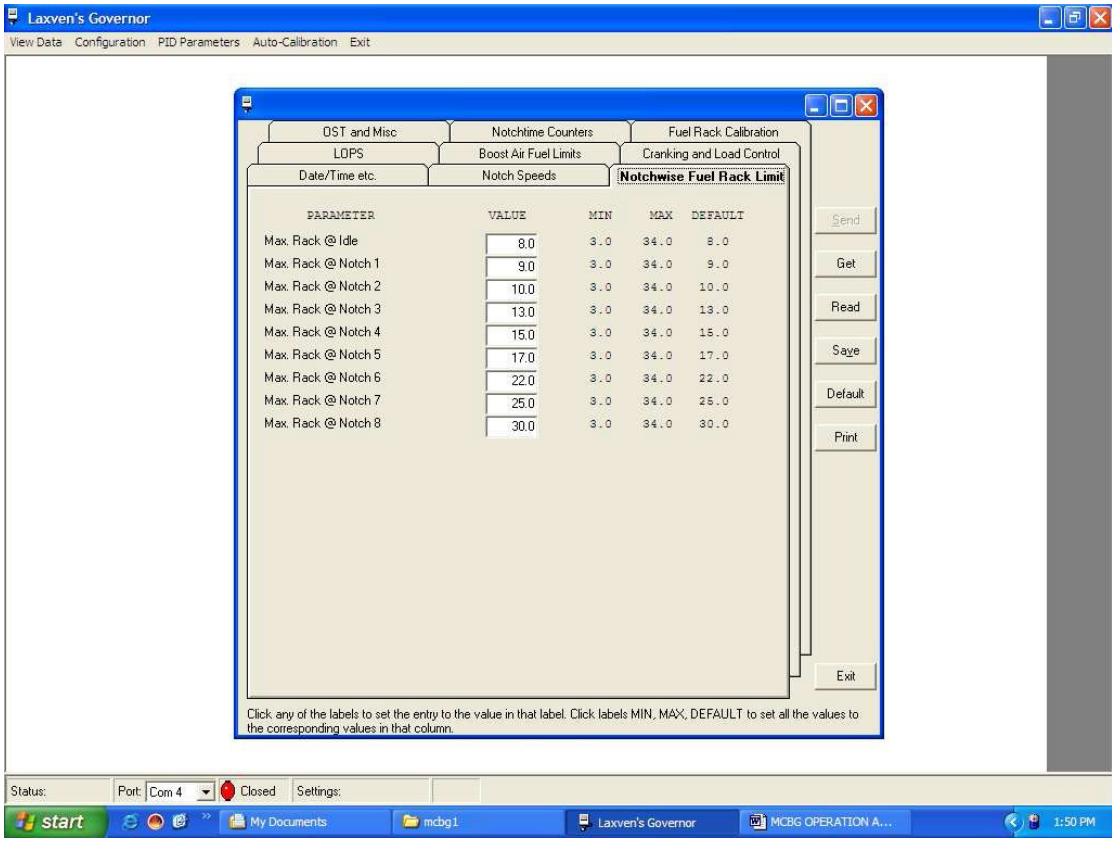
changed accordingly.

To Adjust Notch-wise Engine RPM and Engine Response time, click on NOTCH SPEEDS folded screen. The following Screen appears.
The default values are shown in the last column. If user wishes to load the default values, he can do so by clicking on the default value. The modified value will be shown in the parameter box.



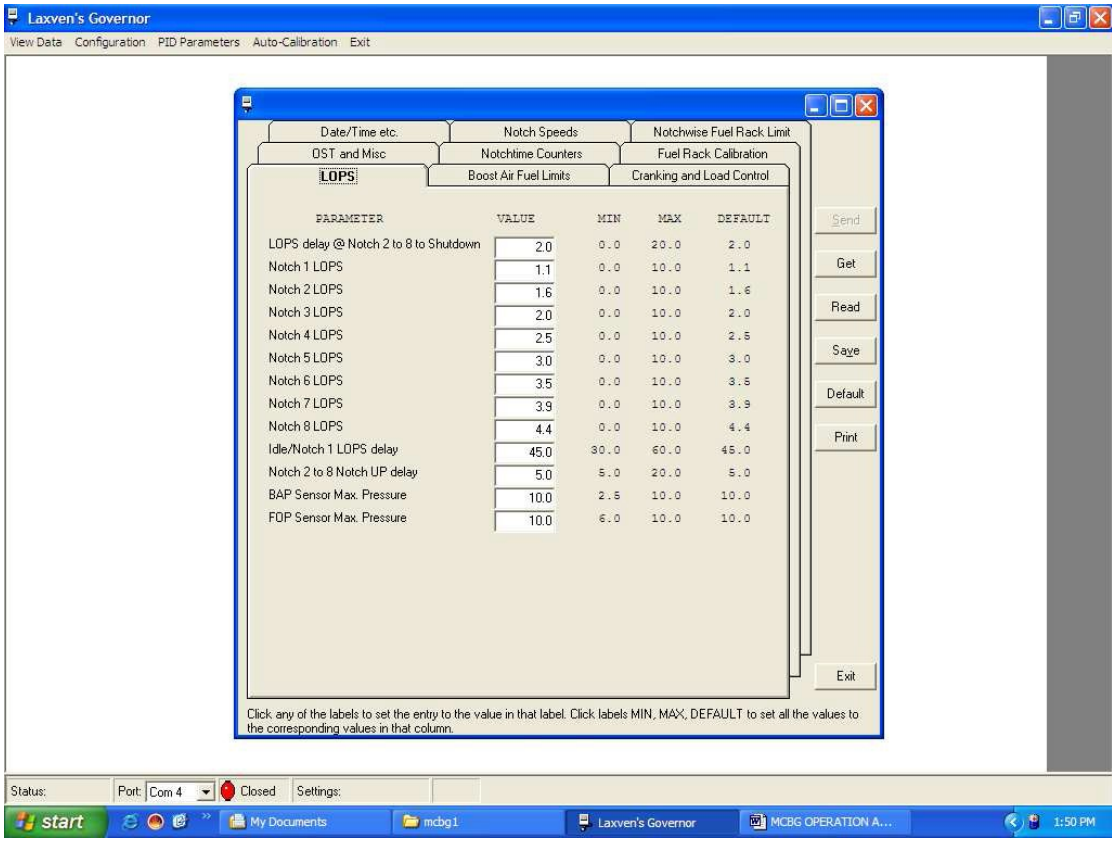
If the user wishes to change only one value of his choice, he can type the value in the corresponding parameter box within the permissible minimum and maximum values shown. If the user does not want to change any of the parameters in this window, he can switch to some other
folded objective screen.

To Adjust Notch-wise Fuel Rack limit, click on NOTCH WISE FUEL RACK LIMIT objective folded screen. The following Screen appears.
The default values are shown in the last column. If user wishes to load the default values, he can do so by clicking on the default value. The modified value will be shown in the parameter box.



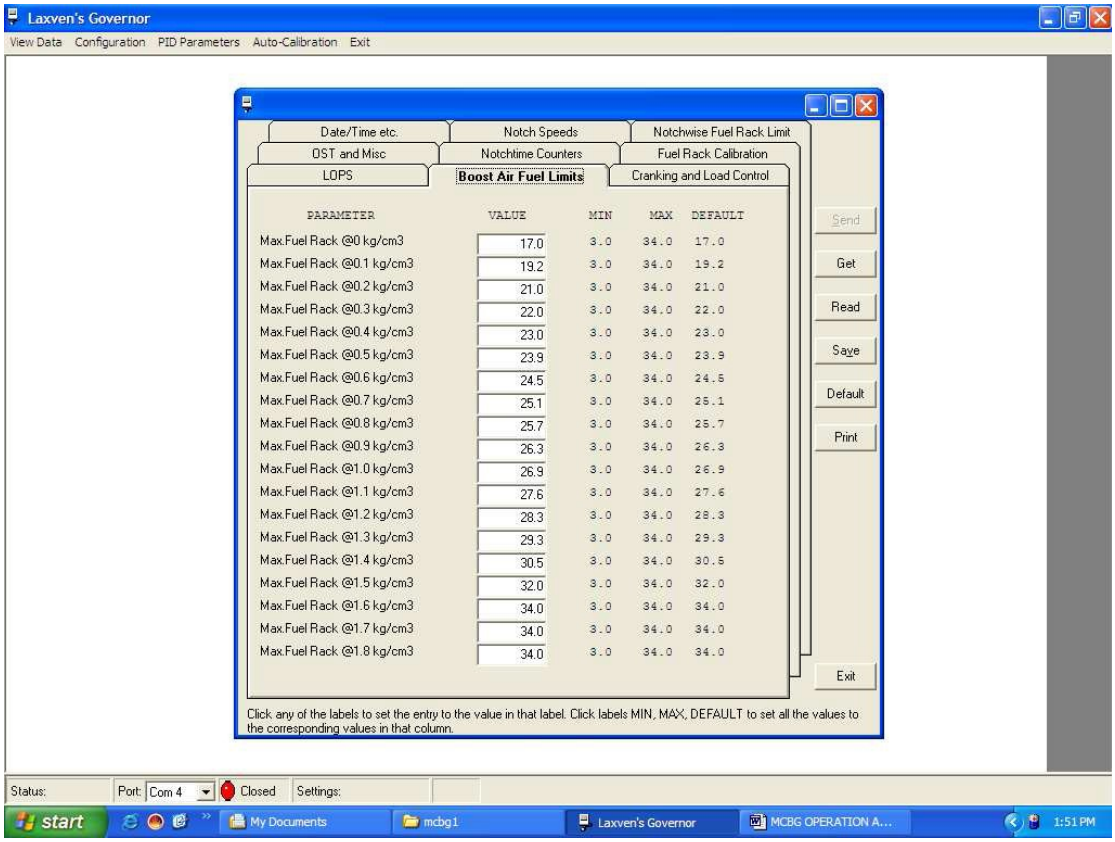
If the user wishes to change only one value of his choice, he can type the value in the corresponding parameter box within the permissible minimum and maximum values shown. If the user does not want to change any of the parameters in this window, he can switch to some other
folded objective screen.

To Adjust Notch-wise Lube oil settings and Lube oil timings, click on LOPS objective folded screen. The following Screen appears.
The default values are shown in the last column. If user wishes to load the default values, he can do so by clicking on the default value. The modified value will be shown in the parameter box.



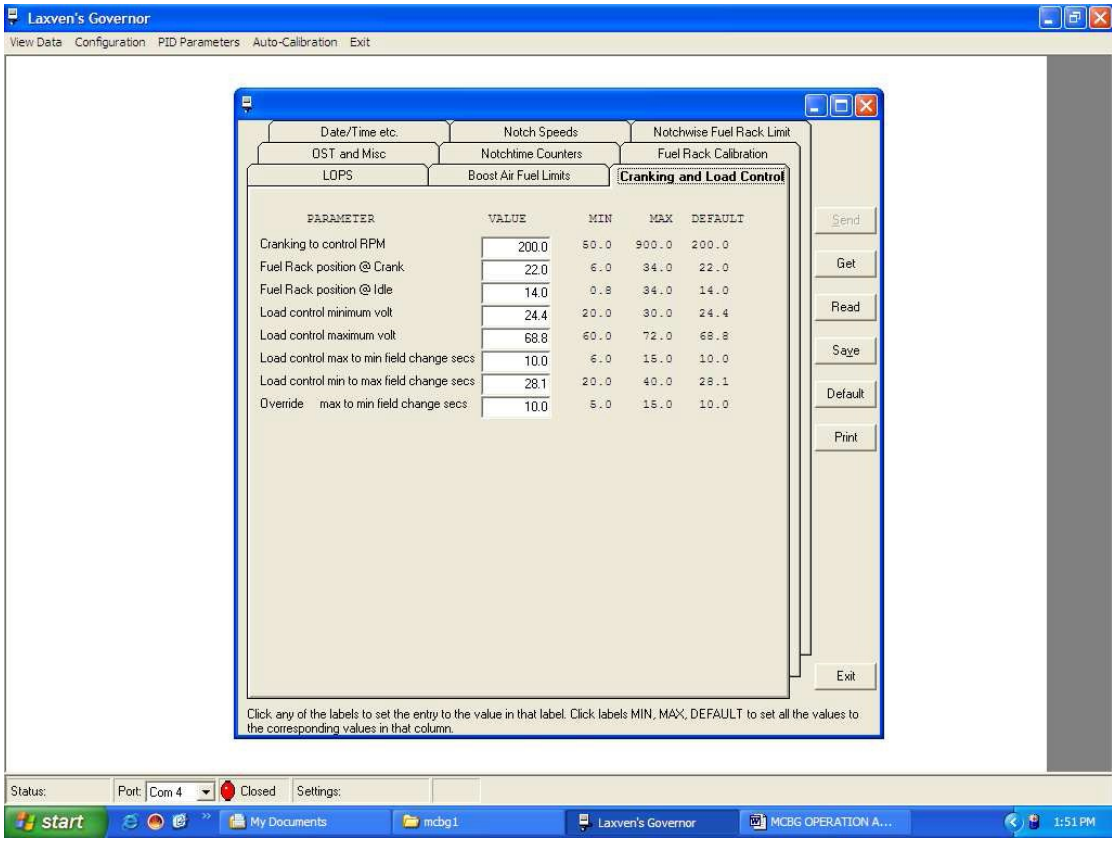
If the user wishes to change only one value of his choice, he can type the value in the corresponding parameter box within the permissible minimum and maximum values shown. If the user does not want to change any of the parameters in this window, he can switch to some other
folded objective screen.

To Adjust BAP based fuel limit settings, click on BOOST AIR FUEL LIMIT objective folded screen. The following Screen appears.
The default values are shown in the last column. If user wishes to load the default values, he can do so by clicking on the default value. The modified value will be shown in the parameter box.



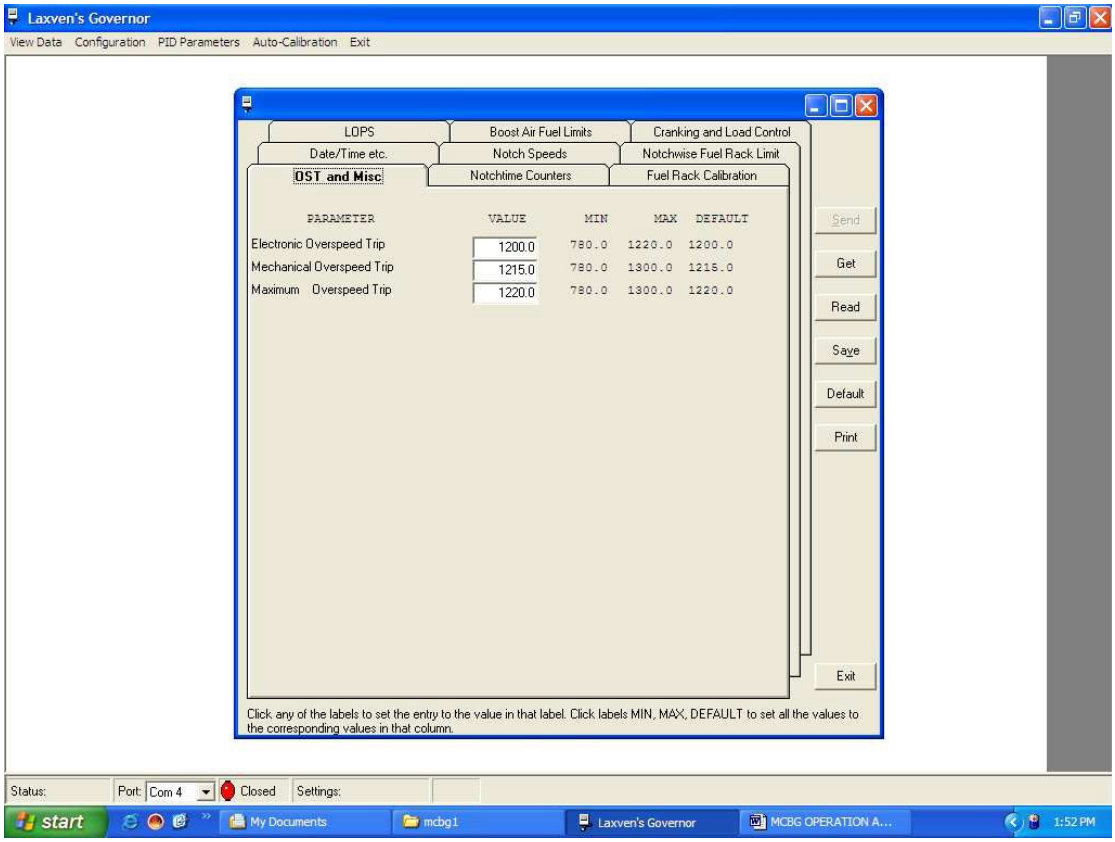
If the user wishes to change only one value of his choice, he can type the value in the corresponding parameter box within the permissible minimum and maximum values shown. If the user does not want to change any of the parameters in this window, he can switch to some other
folded objective screen.

To Adjust Load control timings and Cranking parameters, click on CRANKING AND LOAD CONTROL objective folded screen. The following Screen appears.
The default values are shown in the last column. If user wishes to load the default values, he can do so by clicking on the default value. The modified value will be shown in the parameter box.



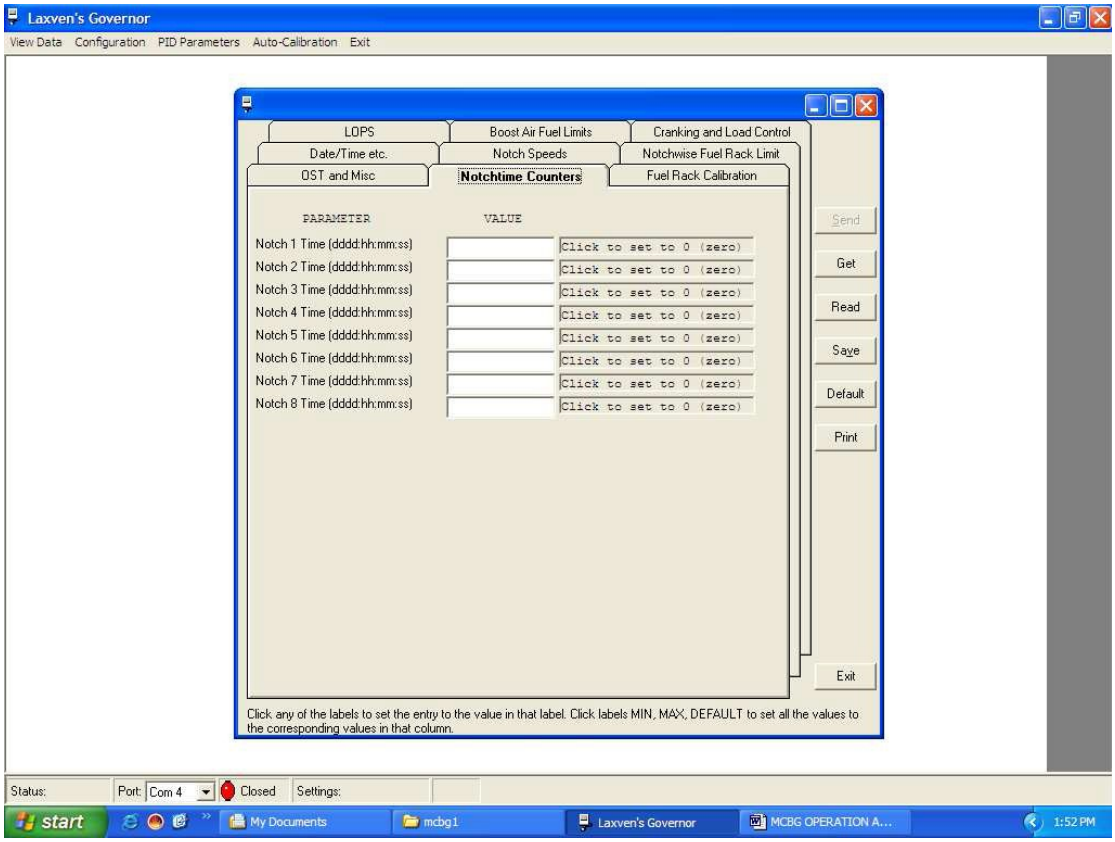
If the user wishes to change only one value of his choice, he can type the value in the corresponding parameter box within the permissible minimum and maximum values shown. If the user does not want to change any of the parameters in this window, he can switch to some other
folded objective screen.

To Adjust Over speed trip limits, click on OST AND MISC. objective folded screen. The following Screen appears.
The default values are shown in the last column. If user wishes to load the default values, he can do so by clicking on the default value. The modified value will be shown in the parameter box.



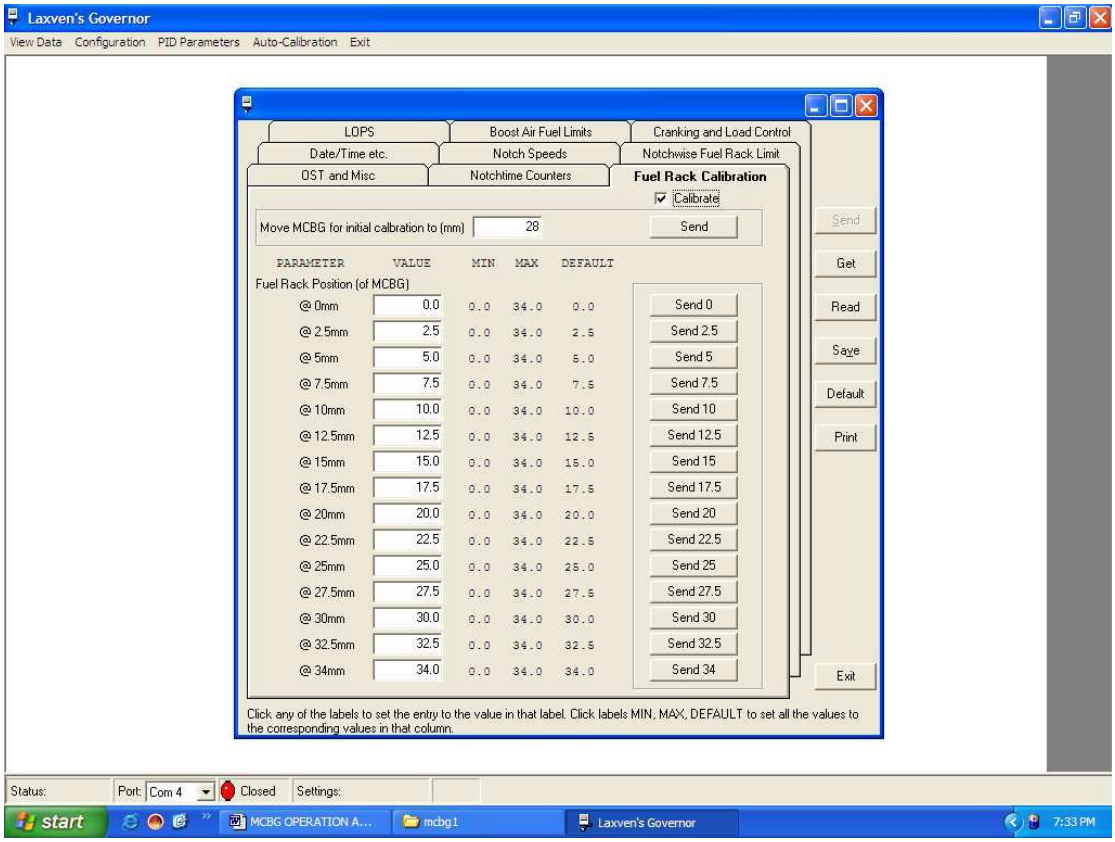
If the user wishes to change only one value of his choice, he can type the value in the corresponding parameter box within the permissible minimum and maximum values shown. If the user does not want to change any of the parameters in this window, he can switch to some other
folded objective screen.

To Know the Engine run timings on different notches, click on NOTCH TIME COUNTERS objective folded screen. The following Screen appears.



The Notch Timings are stored in a Non-Volatile memory and can only be viewed. If the user wishes to reset these timings, click on “CLICK TO SET TO ZERO” for each notch.

To check the rack movement all along its length without any obstruction, a separate folded screen is provided. The user can check the rack movement by clicking on FUEL RACK CALIBRATION and click on CALIBRATE Tab.

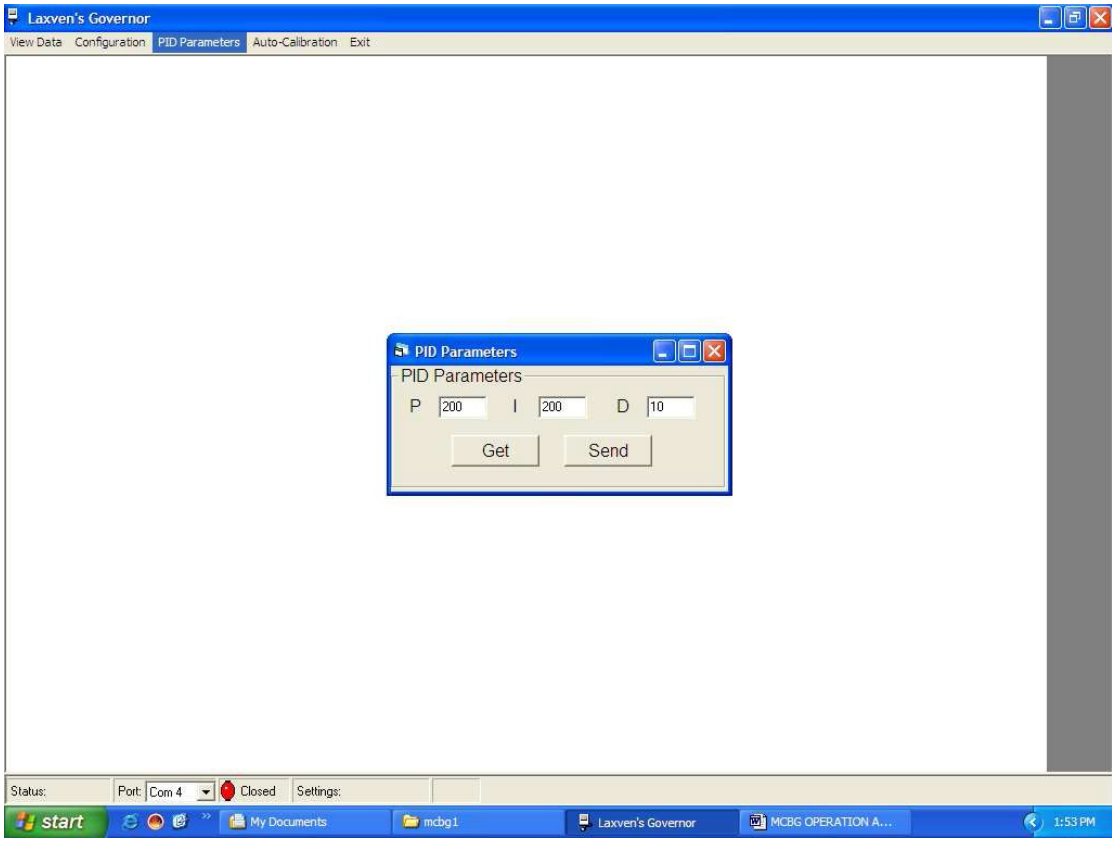


The user can move the rack to the predefined length in multiples of 2.5mm by clicking on SEND XX.X. The user can also move MCBG rack to any length as per his wish by typing the required length in mm in the box provided “Move MCBG for initial calibration to (mm)”.

If there is any difference between MCBG rack and Fuel rack, adjust mechanically fuel rack linkage.

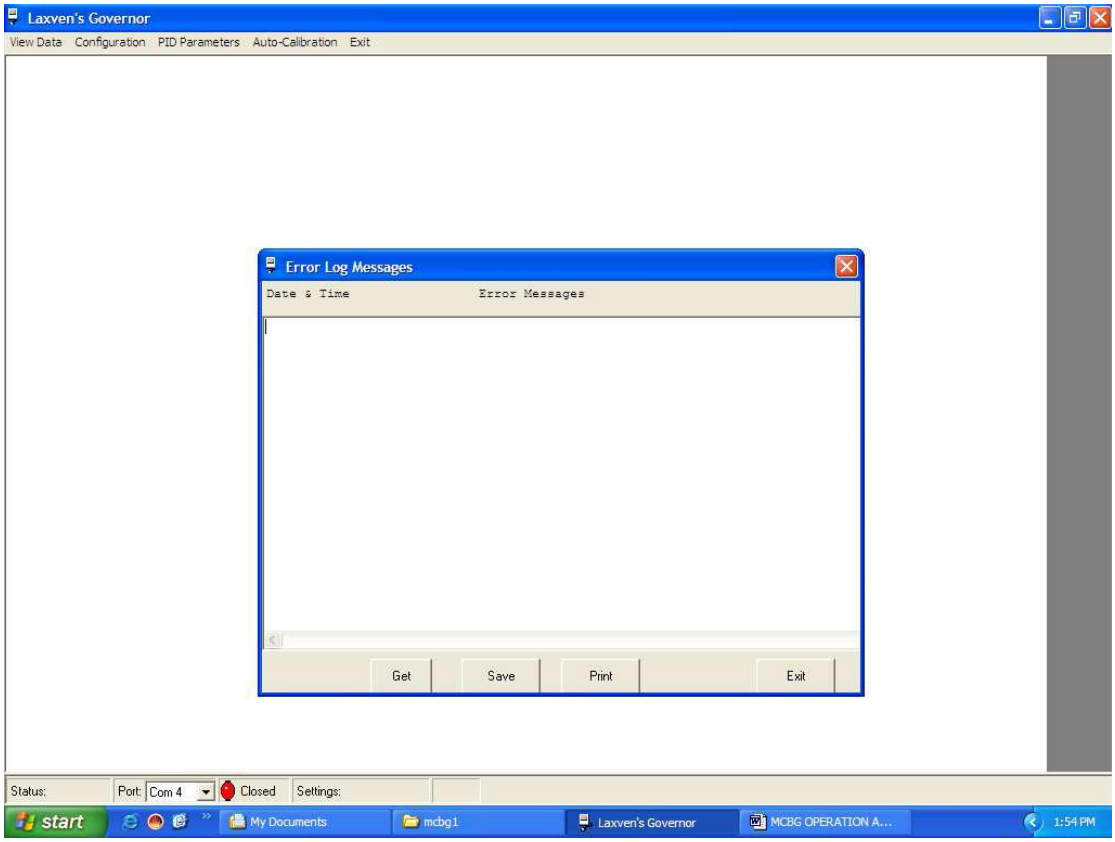
There is a separate provision for adjustment of PID parameters. They can be accessed while Engine is Running/Stop. Fine tuning of Engine performance can be done by adjusting these PID values to suit to an individual engine.

By clicking PID PARAMETERS, the following screen appears, where the user can enter the PID parameters.



If proper adjustment of PID values is not loaded, Engine performance will be poor and may not even crank. The user should have initial knowledge of loading PID values for specific loco.

To View the Error log Data, click on VIEW DATA. The following screen appears.



The user can view the error data by clicking on GET button. The errors will be listed on the screen with date and time stamp. The data can be saved on to a notepad file for future analysis by clicking SAVE button.