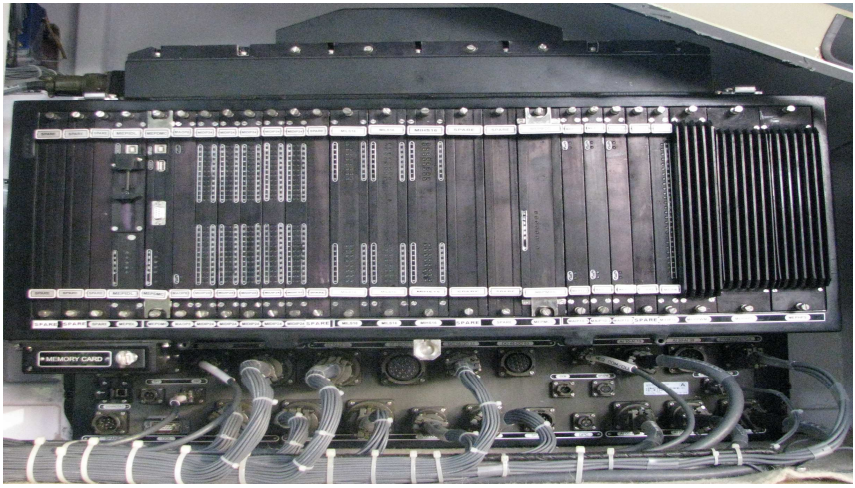
सत्यमेव जयते

(Govt. of India)
(Ministry of Railways)

Trouble Shooting Guide

for Loco pilots on
MICROPROCESSOR BASED CONTROL SYSTEM
MEP660 (Version 3.0)
FITTED ON DIESEL LOCOMOTIVES



(For official use only)

IRCAMTECH/M/GWL/TSG version 3.0/1.0

November 2013

C*entre*
for
A*dvanced*
M*aintenance*
TECH*nology*

उच्च अनुरक्षण प्रौद्योगिकी केन्द्र

Excellence in Maintenance

MAHARAJPUR, GWALIOR – 474005

महाराजपुर, ग्वालियर – 474005

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GO TO CONTENTS

FOREWORD

The failure of Micro Processor Based Control System has a great impact on the reliability of the diesel locomotives. Due to various modifications, Micro Processor Based Control System MEP-660(Ver-2.0) is now being upgraded to version 3.0 with some additional features. Considering population of locomotives fitted with MEP660 Version 3.0 in various Diesel Loco Sheds, it is felt necessary to develop trouble shootings to Loco Pilots & Shed Maintenance staff for disseminating knowledge about new system. The Trouble Shooting guide has been prepared by CAMTECH taking practical troubles related to Microprocessor Based Control System Version 3.0 being faced on line.

I hope that this handbook will definitely enhance the knowledge of concerned staff to do faster restoration of troubles while working on line.

November 2013
CAMTECH, GWALIOR

A R Tupe
Executive Director

GO TO CONTENTS

PREFACE

Control System is the vital part of diesel electric locomotive. Micro Processor based Control System version 2.0 has been recently upgraded to version 3.0 with additional features. Knowledge of new system and trouble shootings is necessary to running/maintenance staff to ensure reliability and availability of locomotives in sheds as well as on line.

This book contains trouble shootings on Micro Processor based control system MEP 660 (Ver-3.0) fitted locomotives for Diesel Loco Pilots. Loco pilots should understand the steps of trouble shooting sequentially to save time during fault findings enroute.

The purpose of this book is to enhance knowledge and competence of loco pilots in dealing with the problems of Diesel locomotive on run. This trouble shooting guide contains the description of MEP-660 (Ver-3.0) Micro processor system so that Loco Pilots can easily understand the difference between Version 2.0 & Version 3.0.

This book will be useful to the maintenance staff and loco inspectors also for counselling running staff about MEP660 (Ver-3.0) Micro processor system.

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.

November 2013 (K.P.Yadav)
CAMTECH GWALIOR Director/Mech

GO TO CONTENTS

CORRECTION SLIPS

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

ICAMTECH/M/GWL/TSG/VER3.0/1.0/. # XX date ----------
Where “XX” is the serial number of the concerned correction slip (starting from 01 onwards).

CORRECTION SLIPS ISSUED

Sr. No. of C.Slip	Date of issue	Page No. and Item no. modified	Remarks

GO TO CONTENTS

Contents

SNo.	Description	Page No
1.0	**INTRODUCTION**	1
1.1	Sub Assemblies removed from Version 2.0	3
1.2	Redesigned Sub Assemblies in Version 3.0	3
1.3	Sub assemblies added in Version 3.0	4
1.4	Modified Logics from Version 2.0	4
1.5	Additional Features in Version 3.0	7
1.6	Add –on Features to Version 3.0	19
1.7	MEP-660 Version 3.0 Specifications	22
2.0	**Main Assemblies of Version 3.0**	23
3.0	**Description of DISPLAY UNIT Type-MDS 739 (Block Diagram)**	26
3.1	Additional Features In display unit	29
4.0	**Display Functions and Navigation**	35
5.0	**Fault Diagnostics**	53
6.0	**User Programmable parameters**	55
7.0	**Step wise Trouble Shooting Charts**	59
8.0	Do's and Don'ts	62
9.0	**Trouble Shootings**	64
Code 1001	Engine shuts down. Low water level and continuous alarm bell ringing	64
1002	Engine Shuts down with over speeding	66
1004 & 1005	LLOB Reset plunger tripped, Engine	67

GO TO CONTENTS

	Shuts down	
1006	Power cutting off with Hot Engine Alarm & Engine Speed restricted to IDLE	69
1007	Engine Speed restricted to Idle due to Power Ground	71
1008	Control Circuit Starting Ground Fault coming & Engine not cranking.	73
1015	Loco over Speeding & not moving in motoring	74
1018	Loco not responding to throttle, GF contactor not picking	75
1019	CCM Failure indication coming	78
1029	Motoring prohibited, Dynamic prohibited due to cranking contactor closed.	80
1061	Battery is not charging, Battery voltage is low	82
1074	Loco is moving with Field shunting and Motoring prohibited in parallel combination.	84
1075	Field Shunting is prohibited	86
1140	Engine is not Cranking due to Cranking contactor stuck up.	89
1153	VCD Applied Penalty Brake. Move Master Controller Handle to IDLE and press Reset to release Brake.	93
2000	No Battery charging, AG failed or AGFB or MB1 tripped.	94
2029	Engine not cranking, when operator attempts cranking while 'Cranking contactor stuck closed'	96

GO TO CONTENTS

1.0 INTRODUCTION:-The Microprocessor Based Locomotive Control system MEP 660 continuously monitors operating levels of various parameters like currents, voltages, temperatures, pressures, RPMs etc. and status of all auxiliary and main contacts of Contactors. The MEP 660 identifies any abnormal working conditions of any equipment that can indicate a fault in that equipment. A fault message, along with any restriction applied due to the fault, is displayed on the display unit for guiding the driver. The fault is recorded in the error log along with date and time stamp. Ten data packs of various locomotive parameters are recorded from 5 seconds prior to the occurrence of fault, one pack of fault instant and one pack of fault second to three seconds after the occurrence of fault @ one data pack every second. These data packs help the maintenance staff later for analysis of the development of the faults and also helps to analyze complicated faults.

ADVANTAGES OF MEP-660 version3.0

1. Switches, Breakers and Operational procedures are same as conventional locomotive therefore easy handling to drivers.
2. Trouble shooting activities by driver is simplified.
3. No reset of GR1, GR2 and GFOLR.These items are not available. Reset procedure is simplified.
4. No need to maintain Timings specified in yellow zone of Load Meter.MEP-660 automatically reduces the excitation to safe zone, if timings are exceeded.
5. No need to regulate dynamic brake @ high speeds. MEP-660 automatically restricts the Load meter to safe zone, based on the loco speed.
6. No slackness of cards on run
7. Automatic isolation of open / short circuited Tr. motor. MEP-660 automatically detects the open / short circuited Tr. Motor and isolate it.

8. More than one traction motor can be isolated as against single Tr. Motor in conventional locos.
9. 2S-2P mode of operation in case of any Tr.Motor isolation to provide more starting torque as against direct parallel mode of operation in conventional loco.
10. Automatic reduction of transition speed in case of any Tr. Motor isolation for quick acceleration as against no transition in conventional loco.
11. Automatic power limitation based on TMs isolated and mode of transition to safe guard Traction motors.
12. Detailed fault indications with audio visual warnings to driver as against 10 to 15 LED indications.
13. No confusion to driver in case of wheel slip. Only Mechanical wheel slip is indicated as wheel slip. Electrical problems are also indicated as wheel slip in the conventional loco. Driver has to identify the nature of wheel slip Electrical / Mechanical.
14. In case of locked axle / pinion slip, system indicates clearly which wheel is locked / pinion slip. Driver has to identify the locked axle / pinion slip in conventional locomotive.
15. Detailed LED indications on control unit to identify the wiring / equipment faults. No such facility in conventional loco.

- **Extra(New)Breakers:-**

MPCB - Microprocessor circuit breaker (Keep Always ON)

PLPB - Pre lubrication Pump Breaker

NEEDS OF MBCS VERSION 3.0

In initial during year 2001 when MEP-660 prototype was developed, 16-bit 87C196 micro controller was selected to suit the existing MEP specifications. At that time the number of I/O s has been provided in the

MEP-660 were 192 (Digital Input–80, Digital Outputs–64, Analog inputs –32, Frequency inputs –16). After a time a stage has come that all the Digital I/Os has been exhausted but the requirements by customer was increasing. In addition to the new Safety logic requirements, data management was also increased. Therefore the existing hardware is enhanced to scatter the new increased I/Os with new philosophy of control.

1.1 SUB-ASSEMBLIES REMOVED FROM VER 2.0:

Unit Name	Model No	Qty
MCOS Unit	MSP 707	01

1.2 REDESIGNED SUB-ASSEMBLIES IN MEP VER 3.0

UNIT NAME	MODEL NO.	QTY.
CONTROL UNIT	MEP660 (Ver-3)	01
Control Cards	MEPMCC,MEPDMC	01+01
Digital input cards	MIDIP24	05+01
Digital output cards	MILS16, MIHS16	02+01
Analog input cards	MAIP10-x	03+01
Frequency input cards	MIFIP16	01
Power supply cards	MEPHPS	02
PWM card	MEPPWM2	01
Memory Card	MMC-16.It is the external memory card(CFM)	01
DISPLAY UNIT	MDS739	01
ADB	MDB719	03+01
RDB	MDB720	01
SPEED SENSOR (TM)	T-818,T817	06

1.3 SUB-ASSEMBLIES ADDED IN MEP VER 3.0

UNIT NAME	MODEL NO.	QTY.
Intelligent Data logger	MEPIDL	01
LRMS card (Optional)	MEPRM	01
End On Train Telemetry (Optional)	**MEPEOT**	**01**
Analog output card	MAOP8	01
PRESSURE SENSOR – EWP	MPS847	01
PIEZO BUZZER, 12V	-	01
GRCO1 -- 2-POLE ASSEMBLY	-	01
Fuel Oil level sensor (Optional)	Type MFL	01
Digital Air Flow Sensor (Optional) Grid Blower Sensor (Optional) Radiator Fan Speed Sensor (Optional)	Type MAF 834	01

1.4 MODIFIED LOGICS FROM VER.2

INTELLIGENT LOW IDLE FEATURE

- Low IDLE feature is provided in Ver.2 to reduce the engine RPM to 350.
  - If the engine runs in IDLE for more than 05 minutes, & in MEP LOW IDLE Flag is enabled, MEP energizes AV and DV digital outputs.
- If the Governor supports this combination, the Governor brings the engine RPM to 350.
- However lube oil pressure **is proportional to engine RPM** and in some locos, diesel engine is getting shut down due to low lube oil pressure.
- To avoid unnecessary line failures, the end user fear to use this feature.

- To overcome this unwanted engine shut down and still get fuel economy Intelligent Low Idle Feature has been introduced.
- In this feature
  - When Engine is running in IDLE for more than 5 minutes, Low IDLE flag is enabled and LOP is more than 1.7Kg/cm² (User settable Parameter), then only MEP goes into Low IDLE mode.
  - MEP energizes AV and DV digital outputs and MCBG brings the engine rpm to 350 rpm.
  - During Low IDLE mode operation, if LOP is less than 1.2 Kg/cm² (User settable), MEP automatically revert back to IDLE mode.
  - MEP de-energizes AV and DV digital output and MCBG brings back engine RPM to 400 and the lube oil pressure increases.
  - LOW IDLE mode is linked to LOP value, engine does not shut down due to low lube oil pressure. So End user need not fear for unnecessary shutdown while working in low IDLE mode. There is sure of fuel savings with this feature.

FIRE ALERTER SYSTEM

- In MEP-Ver.2 also this fire alerter system is available. Due to lack of digital inputs, single input has been connected to MEP. No identification whether the fire is in lead loco or trail loco.
- In Ver. 3, for Fire Alert system two digital inputs are allotted to identify whether it is trail or lead loco.
- The fire alerter provides two potential free contacts which energizes digital inputs FAS FB and TL 11 (MU wire).
- If both FAS FB and TL 11 are high, system display a message “1073 - Fire occurred in loco. Check for fire and extinguish fire. Restrictions: Engine Shutdown”.

- Along with message, power is cut off, engine is shut down and VCDR relay is switched OFF to apply brakes.
- If TL 11 alone is high display shows the message “2031 - Fire alarm occurred. Check loco thoroughly and reset fault. Restrictions: Cranking prohibited”.
- Along with message, power is cut off, engine is shut down. Brake valve gets supply through TL20 wire.

PRE / POST LUBRICATION FEATURE

Pre Lubrication:

- Both the features are implemented in MEP-660 Ver.2 itself. With field experience, slight logics are changed in Ver.3
- Pre Lubrication is avoided if the engine is re-cranked within 30 minutes from the last shut down time. This is because, sufficient lubrication film will available within 30 minutes. If 30 minutes is lapsed, engine cranks after pre lubrication.
- In case of any cranking restrictions, the same is displayed before starting pre-lubrication.
- A countdown timer is shown on the display unit, to indicate the time left for cranking.
- After completion of pre lubrication, display shows “Pre lubrication completed and engine is ready for cranking”.
- Engine cranks normally.

Post Lubrication

- In Ver.2 the Post lubrication is carried out only when the engine shut down through **STOP** push button.
- Where as in MEP Ver.3, post lubrication is carried out for any type of engine shutdown.
- Post lubrication is for 5 minutes (user settable).
- During Post lubrication, display will shows a message “Post lubrication ON. Keep breakers ON”.

IMPROVED LOGIC FOR FSC FAULT DECLARATION:

- In Ver 2.0, to know Field shunt contactors status, only one digital input is allotted. Aux. Contacts of all FS contactors are connected parallel.
- During wheel slip at higher speeds, sometimes FSC stuck open faults are declared even though contacts are in good conditions.
  - In Ver 2.0, these FSC faults frequently we will find in WDM3D locos based on current differences.
  - To avoid the FSC faults frequent logging, loco speed has been increased to **90 KMPH.**
- So in Ver 3.0, 6 individual digital inputs are allotted for individual field shunt contactors.
  - FS contactor stuck open / stuck closed faults are now declared based on the individual contactor feedback signals and not based on TM currents.

1.5 ADDITIONAL FEATURES IN VERSION 3.0

POWER SETTER

- When locos work in Multiple Unit operation, sometimes while hauling empty racks, all the locos work in 4thor 5th notch on level and down gradients.
- When the locomotives work below 7th notch, they are not fuel efficient.
- If one of the loco is made working at 7th / 8th notch and other locos to run at IDLE, this combination may result in overall fuel efficiency.
- This can be done either removing the MU cable or keep ECS in IDLE position in rear locos. But this can be done manually by driver which is inconvenient to him & he may not bother to do.
- Power setter is a feature to bring the rear locos to

IDLE without going to rear locos and removing the MU cables.

- Power Setter Enable Switch is provided like TE Limit Switch. Normally this switch is in 'Disable' position.
- When the driver wants single loco power, he will simply keeps this switch in 'Enable' position.
- Keeping this switch in 'Enable' position, Train Line Wire TL1 is energized in all the locos.
- With MU wire TL 1 status high and wire 16D is OFF, the locomotive will work in IDLE mode only even though throttle signals (TL15, TL12, TL7 and TL3) are available.
- So all the Rear locos work in IDLE, where as lead loco work as per notch position. The driver can work in higher notches and get fuel efficiency.
- While this switch is in 'Enable' position, 'Power Setter Enabled' message is displayed once in every 5 minutes.
- However Dynamic brake works normally in all locos and gets full control.
- When driver wants both the locos power, he simply keeps this switch in 'Disable' Position. All the locos work normally.

EXTENDED DYNAMIC BRAKING FEATURE

- The maximum Dynamic Braking effort in Alco locomotives is in between **30 to 60 Kmph only.**
- Below 30 KMPH, the braking effort reduces since the grid current reduces due to TM armatures speed drops down.
- In some steep gradient sections, the maximum speed is only 30KMPH. So these locos does not provide effective dynamic brake and pneumatic brakes have to be used to control the loco speed.
- To achieve higher braking effort in lower speeds this feature is implemented in ALCO locomotives.

- To increase grid current below 30 KMPH, either the TM armature voltage has to be increased which is not possible due to design characteristics of TM or reduce the grid resistance by shorting certain elements in the resistor elements.
- At 21.5 Kmph (User settable) MEP energize Extended Dynamic Brake Relay (EDBR) to provide supply to 6 EDBC contactors.
- These pneumatic contactors are connected across certain portion of the grid resistors.
- Energizing these 6 contactors, the effective grid resistance is reduced to 0.1875Ω from 0.5 Ω.
- As the resistance is smaller, the grid current increases and results in higher braking effort at low speeds.
- To achieve single stage braking effort, 6 PCs has to be provided in the locomotive.
- It is possible to have two stage reduction of grid resistance to provide effective dynamic brake even below 25 KMPH.

RECTIFIER FUSE BLOWN PROTECTION

- In power rectifiers, fuses are provided in series with each diode.
- In case of any diode short circuited, this fuse will blowout and the diode is isolated from the circuit.
- This fuse is a special type of fuse, having a micro switch.
- The micro switch is operated through a lever whenever the fuse is blown out.
- In Ver.2, the fuse blown status is not monitored by MEP. Only LED indication is given to driver.
- In Ver 3.0, one digital input is allotted for rectifier fuse blown protection and is connected to wire No. 111 in rectifier panel.

- When this input is HIGH, the system declares a fault message “1066 – Rectifier fuse blown, Restrictions: power limited to 4th notch”.
- Along with the message engine rpm and power both will be restricted to 4th notch.
- Whenever wire no. 111 is low, system will declare “1661- Rectifier fuse OK now”.
- After fault recovery, engine rpm and power will raise as per notch position.

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POWER DE-RATION DURING POWER GROUND

- In Ver.2 when the TANGI value is more than 0.4 Amps, MEP declares fault message ‘Power Circuit Ground fault’
- In Ver. 3 the notch power is de-rated if TANGI current is more than 0.4 Amps and still permit the loco to work with de-rated power.
- This feature is very useful to avoid online failures and to protect power circuit from further damages.
- For every 0.1 Amp increment above 0.4 Amps of TANGI current, 20% of that notch power is de-rated.
- The display shows a message “2021 – Power reduce due to power circuit ground”.
- The de-ration continues up to TANGI value reaches 0.9 Amps (user settable) and thereafter system declares a message “1007 - Power circuit ground fault” along with engine Idling and Power cut off.

INTEGRATED SPEEDOMETER

- In Ver 3.0 system, no need of external stand alone speed recorder.
- MEP 660 systems will generate an analog output signal based on the calculated speed from TM RPMs.
- The same signal will be fed to external analog meter to indicate the locomotive speed.

- Even **3 TM speed sensors** are declared faulty; the speedometer indicates the loco speed without any trouble.

TM SPEED SENSOR FAULTS IN STAND STILL CONDITION:

- In Ver 2.0 'Speed sensor x faulty' can be declared while the loco is running only. Type of fault cannot be identified.
- To be more clear in fault declaration, the TM speed sensors are re-designed in MEP-660 Ver.3.
- With new design of TM speed sensor, it is possible to detect TM speed sensor faults due to cable open / short even loco is in standstill position.
  - Normally the sensor output current at Loco stand still is between 4 to 16 mA.
  - If the output current is out of range, the system declares 'Speed sensor X Faulty.'
- Any TM speed sensor faults related to air gap is declared while the loco is moving only.
  - If current output signal is within range and rpm is erratic / not showing, then it will declare 'Speed Sensor x air gap fault.'

PROTECTION AGAINST WATER PUMP FAILURES

- In case of water pump failed, at present in Ver.2, there is no direct detection. Even though indirectly can be identified, there is no protection except power reduction.
- In Ver.03, water pressure sensor is provided to measure the outlet pressure of water pump.
- MEP-660 continuously monitors this water pump pressure along with LWS input and accordingly to Table given below

(**Ref-** .Final Modification sheet No. MP. MOD .EC. 08.58.10 (Rev.- 01) Date : I8.02.11**)**

S.no	WP Pr. (kg/ cm2) at idle	EWT Sensor and check for rate of rise of EWT>90°C for 3 minutes	EOT Sensor and Check for Rate of rise of EOT >100°C for 3 minutes	Action	Display and Fault Logging
1.	≥0.4	Healthy	Healthy	Normal Run	-
2.	≥0.4	Faulty	Healthy	Normal Run	EWT sensor faulty
3.	≥0.4	Healthy	Faulty	Normal Run	EOT sensor faulty
4.	≥0.4	Faulty	Faulty	Normal Run. Turn on R1 and R2	EVVT & EOT sensor faulty*
5.	<0.4#	Healthy	Healthy	Normal Run	Low water pressure
6.	<0.4#	Faulty	Healthy and temp. ≥3 ºC	Engine Shut down	Low Water Level or water pump faulty & EWT sensor faulty
7.	<0.4#	Faulty	Healthy and temp. <3 ºC &LWS is low	Engine Shut down	Low Water Level or water pump faulty & EWT sensor faulty
8.	<0.4#	Faulty	Healthy and temp. <3 ºC &LWS is high	Normal Run	EWT sensor faulty
9.	<0.4#	Healthy and temp. ≥2ºC	Healthy	Engine Shut down	Low Water Level or water pump faulty
10.	<0.4#	Healthy and temp. <2ºC	Healthy & LWS is low	Engine Shut down	Low Water Level or water pump faulty

11.	<0.4#	Healthy and temp. <2ºC	Healthy & LWS is high	Normal Run	-
12.	<0.4#	Healthy	Faulty	Engine Shut down	Low Water Level or water pump faulty & EOT sensor faulty
13.	<0.4#	Faulty	Faulty	Engine Shut down	Low Water Level or water pump faulty & EOT sensor faulty
14.	<0.4#	EWT ≥95ºC	Healthy	Engine Shut down	Low Water Level/ water pump faulty
15.	<0.4#	Faulty/ Healthy	EOT>111 ºC	Engine Shut down	Low Water Level/ water pump faulty

Water pump pr. <O.4 kg/cm2 at idle for 20 sec.
* 'Hot engine' situation will not be declared, although water & lube oil temp. may be high.
However, eventually engine will be shut down due to LLOP.

DATA DOWN LOADING TO PEN DRIVE

- In Ver.2, data can be down loaded to PC/LAPTOP only. It is not possible to down load the data to a pen drive. It is difficult to down load data by an officer who is foot plating.
- In Ver.3, provision has been provided to down load the data from the memory.
- As soon as the pen drive is installed, the following options are prompted to user for selection.
  - Event recorder Data
    - Long Term
    - Short Term
    - Operators configuration

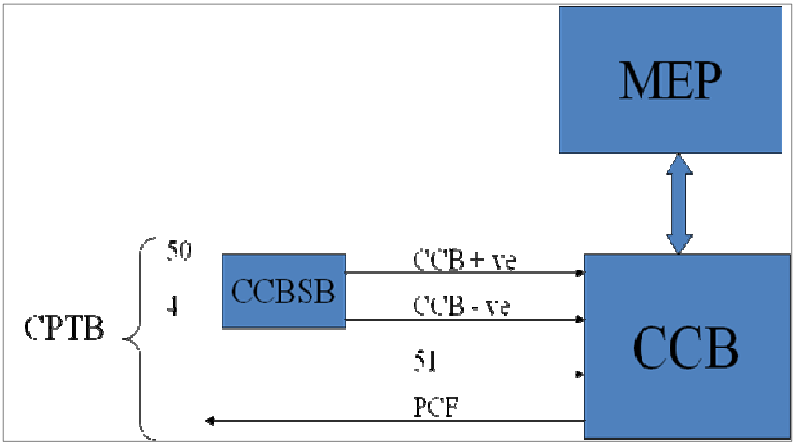
- Faults only
- Faults with FDP

INTERFACE WITH COMPUTER CONTROL BRAKING

- Alco locomotives are so far equipped with IRAB brake system which is analog type pneumatic control.
- Computerized Control Brake system is a new brake system supplied by M/S Knorr Bremes in GM locos.
- Lot of failsafe features are available with CCB and Railway wants to adopt the same brake system in Alco locomotives.
- With adoption of CCB in Alco locomotives, the following brake related equipments are removed.
  - Complete Brake panel is replaced with CCB.
  - AFL P1 | Equalizing pressure signal from CCB
  - AFL P2 | BP pressure signal from CCB
    o Whenever Emergency Brake signal is received from CCB or based on EP & BP pressures, Auto flasher lights are switched ON.
  - BP, BCP pressure sensors. Signals are taken from CCB.
  - BKIV valve
  - Foot pedal Switch.
  - VCD Valve – Penalty brake signal is communicated to CCB
- CCB is connected to the MEP system via RS 485 communication.
- If any fault in CCB, the same will be indicated in MEP 660 Display unit and it will apply brakes.
- In MEP system, only fault message will appear but there is no controlling in CCB related issues.
- CCB provides potential free contacts PCR which is equivalent to PCS. Whenever CCB requires power cut off, these contacts are operated.

- Whenever MEP wants brake application, the brake signal is communicated to CCB and the brakes are applied by CCB through Display unit Air brake self test can be conducted.
- There are 4 wires going to CCB and one RS485 communication cable.

CCB CONNECTIONS

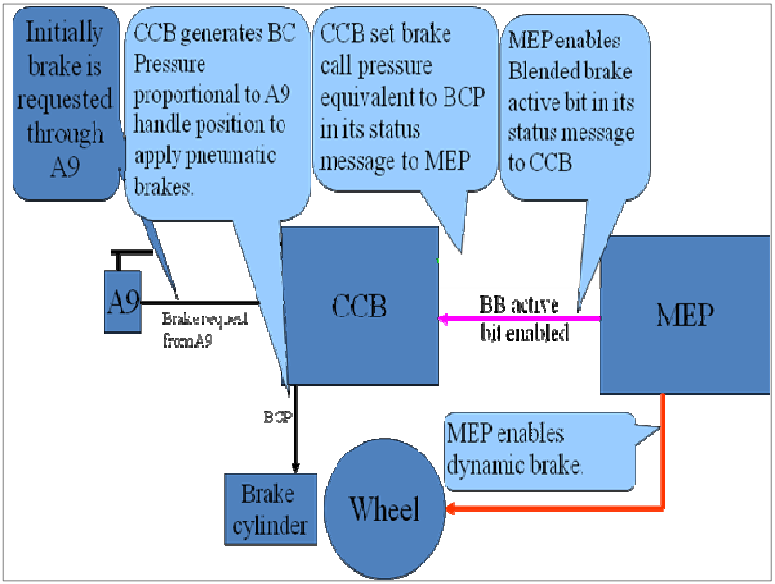


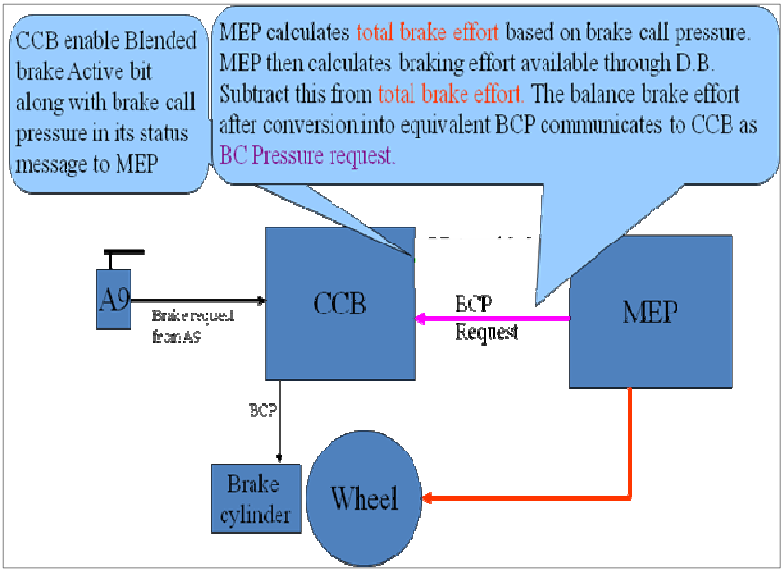
BLENDED BRAKING SYSTEM

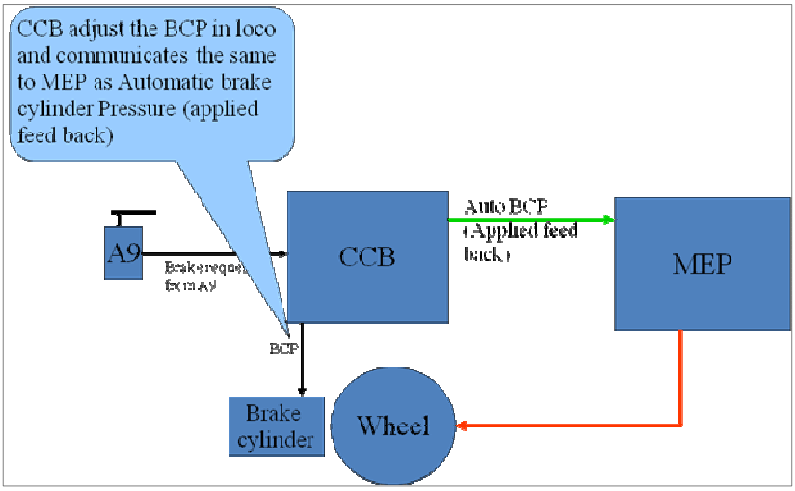
- So far with IRAB brake system on Alco locomotives there is no provision to use both dynamic brake and pneumatic brakes simultaneously.
- With computerized brake system it is possible to use combination of pneumatic brake and dyn brake.
- Pneumatic brakes are substituted to the extent possible by dynamic brake to reduce wheel wear and cool running of wheels.

- In CCB fitted locomotives, Blended Brake switch is proved to enable / disable this feature by driver.
- Blended brake is possible only on lead locomotives. CCB does not permit Blended brake on Trail locos.
- When the BB switch is ON, loco is in coasting and the driver applies brakes through A9**,**
  - Initially all the brake effort is set by CCB through pneumatic brake only.
  - CCB set the brake call pressure information equivalent to BCP pressure which is proportional to A9 handle position.
  - MEP enables dynamic braking and then enables blended brake active bit. In turn CCB enables blended brake active bit. Now both the systems are ready to use blended brake.
  - Once the blended brake active bit is enabled by CCB in its communication, MEP dynamically calculates braking effort provided by dynamic brake and pneumatic brake.
  - MEP subtracts the braking effort available from dynamic brake from the total braking effort derived from requested brake call pressure to arrive at brake cylinder pressure.
  - MEP communicates this pressure to CCB as Brake cylinder pressure request.
  - CCB adjusts the loco brake cylinder pressure accordingly as long as blended brake active bit is exchanged mutually.
    - The above cycle repeats once the driver changes A9 handle position.
    - CCB communicates automatic brake pressure (Applied feedback).
  - Over a period of time dynamic brake effort will substitute for most or all of the locomotive's pneumatic brake effort. CCB will maintain minimum brake cylinder pressure.

- As the dynamic brake effort reduces at lower speeds, MEP continuously calculates the braking effort available through dynamic brake, and accordingly adjust the brake cylinder pressure request.
- CCB disable the blended brake active bit under the following:
  - CCB is set as trail loco.
  - Emergency brake is initiated.
  - Dynamic brake is activated by driver.
  - Bail-Off request by driver.




CCB enable Blended brake Active bit along with brake call pressure in its status message to MEP
MEP calculates total brake effort based on brake call pressure. MEP then calculates braking effort available through D.B. Subtract this from total brake effort. The balance brake effort after conversion into equivalent BCP communicates to CCB as BC Pressure request.
A9
Brake request from A9
CCB
BCP Request
MEP
BCP
Brake cylinder
Wheel

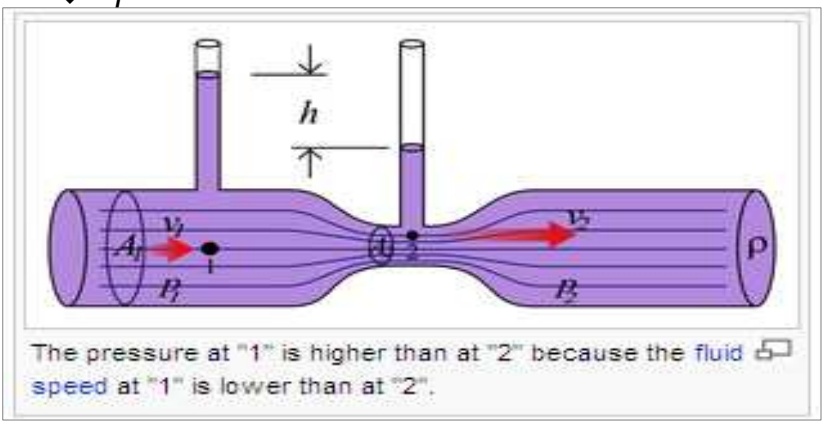

CCB adjust the BCP in loco and communicates the same to MEP as Automatic brake cylinder Pressure (applied feed back)
A9
Brake request from A9
CCB
Auto BCP (Applied feed back)
MEP
BCP
Brake cylinder
Wheel

1.6 ADD-ON FEATURES TO VERSION.3
Loco Remote Monitoring System (LRMS):(Optional)

- In Ver. 2, There is one standalone unit which is having GSM / CDMA chip sets, it will collect the data for every 1 minute from locomotive and will be placed in server which is placed at **our Head Quarters.**
- In Ver. 3, the standalone unit has become into an add on card with all the necessary hardware.
- By using this feature, locomotive position, health condition, fault data pack, event recording etc,. can be monitored remotely.
- Whenever we want to track the locomotive, we have to connect thru web site (www.loconet.in). Thru internet, data can be monitored remotely and same can be downloaded.

Fuel Oil measurement: (Optional)

- *A fuel oil level measuring sensor is added to the fuel tank.*
- *Along with this sensor, ADB4 is also included.*
- *T*

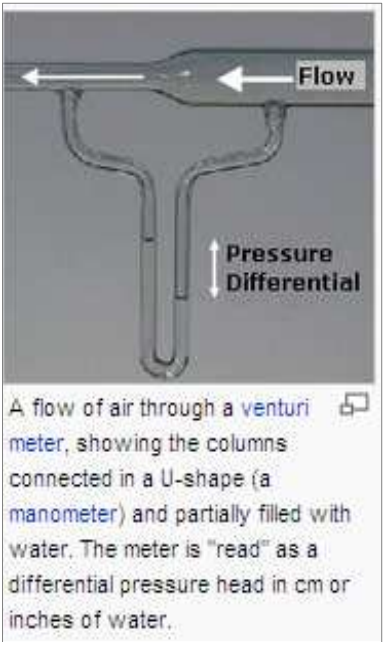


rovides an analog current signal 4 to 20 milliamps proportional to fuel oil level available in the tank.

- The sensor requires to be calibrated after installation because the fuel tank capacity and size changes from loco to loco.
  Fuel level will be indicated in IDLE screen.

Digital Air Flow measurement: (Optional)

- This sensor is same as air flow measuring valve in the existing IRAB system.
- The sensor is a venturi meter type connected in the BP circuit between MR and C2 Relay valve.
- The venturi effect causes pressure difference between input and output of the meter. The pressure difference is proportional to rate of air flow.



A flow of air through a venturi meter, showing the columns connected in a U-shape (a manometer) and partially filled with water. The meter is "read" as a differential pressure head in cm or inches of water.

- It measures the rate of air flow from MR to maintain required BP pressure.
- The rate is converted into LPMs and is indicated to the driver.

TFT Display in both the control stands

- TFT (Thin Film Transistor) LCD display unit is a customer requirement.
- All the existing analog gauges will be replaced with single TFT display.

- Two Such displays will be provided one in each control stand.
- In MEP 660 Ver. 3, required information is communicated via RS 485 communication to both the TFT screens. Dedicated communication provision is made in the Ver 3.0

End of Train Telemetry (EOTT): (Optional)

- This is an add on feature which is Under development.
- There will be a signaling unit fitted at the last coach/wagon which communicates with main unit provided in driver cab.
- This EOT communicates its existence and BP pressure at the last vehicle.
- This unit helps faster reorganization during train parting because communication will be lost.
- If the driver wants fast brake application, he can do so though a switch. The EOT unit vents the BP from the last coach also in proportionate to BP pressure available in the locomotive.
- Later on we can remove the Guard coach, wherever this feature is installed in locomotive.

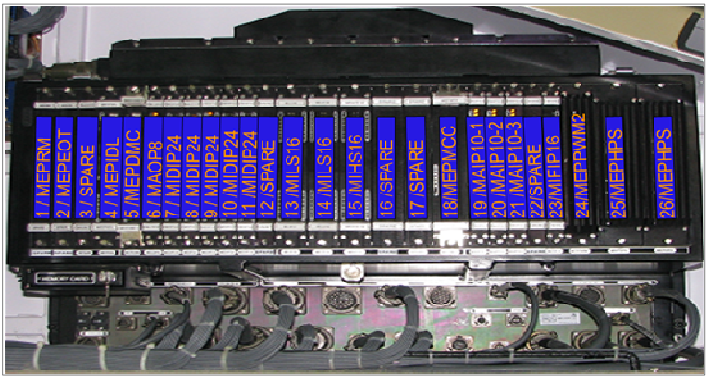
1.7 MEP-660 VERSION 3.0 SPECIFICATIONS

Hardware	Version 2.0	Version 3.0	Expandable
Digital Inputs	80 (16/card –5 cards)	120 (24/Card-5 Cards)	Up to 144
Digital Outputs	48 (16/card-3 Cards)	48 (16/card-3 Cards)	Up to 64
Analog inputs	32 (8/card-4 Cards)	30 (10/card-3 Cards)	Up to 40
Analog outputs	4 (LM,LOP, BAP, FOP)	8 (LM, SPM, FOP, LOP, BAP, ACPC)	02 spare channels
PWM outputs	2	2	6
External Memory	8MB	16MB	
Internal Memory	8MB	32MB	
Communication ports	RS485-MCBG, Display RS232- Config., Data log. USB – Data down load	RS485 – Display (**Dual**),MCBG, CCB,RS232 – ODL, Print USB–Pen Drive, Config. IDL Config., Pen drive (IDL)	

2.0 MAIN ASSEMBLIES OF VERSION 3.0 CONTROL UNIT-V3



- This is the main control equipment in the Microprocessor control system.
- Locomotive is interfaced through connectors and they are unique.
- These are bayonet type as against circular threaded type in V2.
- Internal wiring of these connectors to the back plane is eliminated as compared to Version 2 Control unit.
- The control unit is totally no wire system.
- The total control system is functionally divided into different modules.
- These modules are dust proof and plug in type cards for easy replacement.



- **Control cards 3**
- **Digital Input cards 5+1Spare**

- **Digital Output cards 3+1 Spare**
- **Analog input cards 3+1 Spare**
- Analog output card 1
- Frequency input card 1
- PWM control card 1
- Power supply card 2
- Spare (MEPRM) 1
- Spare (EOTT) 1
- Spare 2

- Within the control unit, air turbulence is created through fans for efficient heat dissipation.
- These fans are mounted in the fan assembly and are fitted on top of the Control unit.
- Supply to these fans is connected from RDB unit through a connector.
- Failure of these fans will cause a fault log.
- Loco works normally without any restrictions.

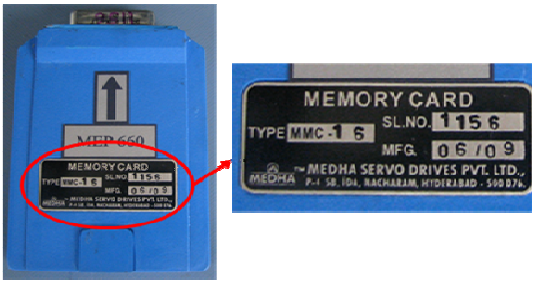
External Memory Box

The memory card module is shifted to left hand corner from right corner.



The memory card capacity is increased to 16 MB as against 8MB.





- Additional connectors are accommodated for present and future up gradations like LRMS, DPC, TFT display etc.
- Card slots have been increased to 26 as against 19 to accommodate additional present and future requirements.
- Pen drive slots have been provided for data down loading.

3.0 Description of DISPLAY UNIT TYPE – MDS 739 (Block Diagram)

- All the external connectors are changed to bayonet type for easy and quick connections.
- The buzzer has been brought out side the display unit



- Display unit is the main interface between the user and the equipment.
- The display has been changed to 256 X 64 pixel graphical VFD as against Alphanumeric VFD in V2.

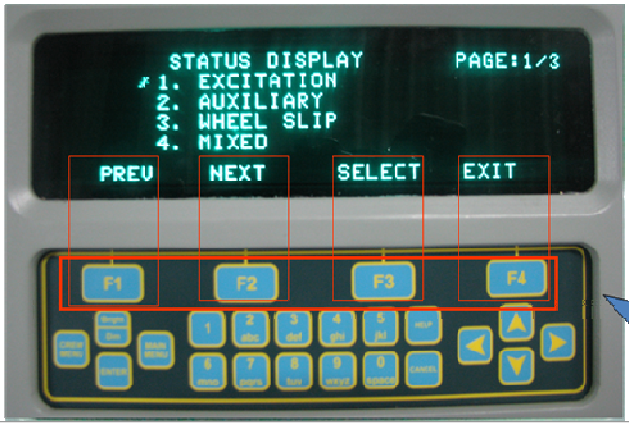


- Being a graphical display, the maximum number of lines are 6 and maximum characters per line is 36.
- Top five lines are used for data display and the bottom most line is used to indicate the commands for function keys.



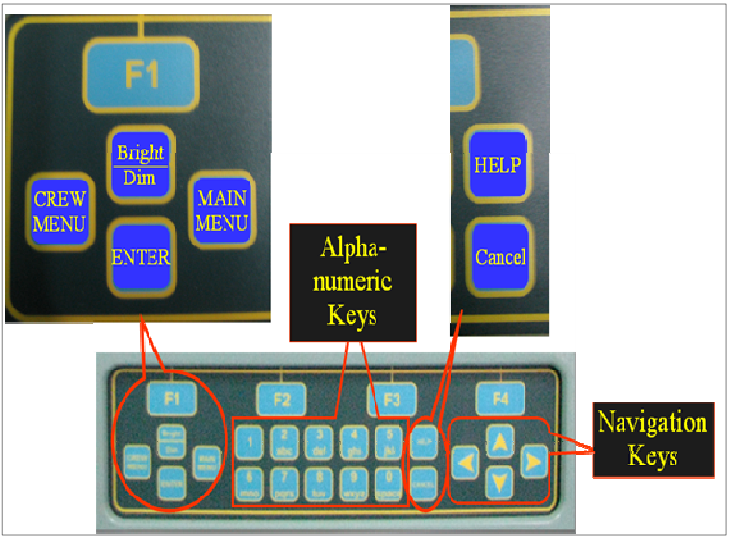
In addition to the number and navigation keys, four function keys F1, F2, F3 and F4 are available on top portion of the key pad.

Action for these keys changes from screen to screen and is indicated against each key on the display screen.



The key board is different from V2

DISPLAY UNIT TYPE – MDS 739



Display unit

Display unit is the main interface between the user and the equipment. The display has been changed to 256 X 64 pixel graphical VFD as against Alphanumeric VFD in Ver 2. All the external connectors are changed to bayonet type for easy and quick connections. The buzzer has been brought outside the display unit. The graphical display is configured for 6linesx40 characters. Top five lines are used for data display and the bottom most line is used to indicate the commands for function keys. In addition to the number and navigation keys, 4 function keys F1, F2, F3 and F4 are available on top portion of the keypad. Action for these keys changes from screen to screen and is indicated against each key on the display screen.

3.1 ADDITIONAL FEATURES IN DISPLAY UNIT

New Test Modes: In addition to Ver.2 test facilities, in Ver.3 few more test facilities are added for easy maintenance. They are:

- Meters Test
  - Load Meter
  - Speed Meter
- PWM Test
  - EPWM
  - APWM
- Radiator Fan Test
- Transition Test
- AEB Test
- Air Brake Test
- Fuel Oil Level calibration test (Optional)
- Blended Brake Test
- Load test and self load test
- Auto test for relays
- Manual test for input and output test.

TM cut out / cut in through Display

- In Ver.2, MCOS switches are available to isolate a defective traction motor.
- In Ver.3, MCOS switches are not available, the same function can execute through Display unit.
- Main Menu
  - 4 TM cut out
    - TM status screen is displayed.
      - Change / F3 TM1 is highlighted. Use arrow keys to select TM
      - Cut out / F3 to change the status.

Configuration through Display Unit

As per user requirement, some of the parameters are given access to configure through Display.

- Date & Time
- Loco Information

- Loco No.
- Loco Type
- Home shed
- T.A. Type
- T.M.Type

- Wheel Diameters
- 8Th notch Limits
  - T.A. Voltage limit
  - T.A. Current limit
  - GHP limit
- AG Voltage limit
- ETS Settings:
  - TS1
  - TS2
  - ETS1
  - ETS2
- Load Meter calibration
- Speed Meter calibration
- Loco speed limit

Fault Data Pack through Display Unit

- In Ver.3 the fault data pack can be viewed through Display. There is no need to down load the data to LAPTOP/PC.

This can be selected through menu / submenu:

- View Active Faults
  - Faults History
    - Faults repetition
      - History / F4
      - Data pack / F4

User defined Display screens

- In Ver. 2 Display unit, all the parameters are grouped into a pre-defined screen formats, which cannot be changed.

- In Ver. 3 Display unit, user can define a screen format with his selected parameters like in GM locomotives.
- Either using Display configuration software or through display one can select the required parameters and define the screen.
- Up to 8 such user screens can be defined.

Maintenance mode with password

- In Ver. 2, faults which are generated during loco testing and schedule attention are also logged in the fault data pack.
- Actually these faults are not necessary to log in memory
- During fault analysis, it is very difficult to understand weather these faults are real or logged during testing by maintenance staff.
- Unnecessarily logging of these faults creating confusion and occupying memory also.
- In Ver. 3, to avoid such confusion and unnecessary memory occupation, ‘Maintenance mode’ option has been provided.
- During schedule attention, the staff has to select this ‘Maintenance Mode’ and perform regular testing.
- During this maintenance mode any faults generated does not log in to memory but will be displayed on display for information to operator.
- Operator should come out of this mode manually after testing.
- Otherwise also the system automatically comes out if loco speed is > 3 kmph.

Loco operation soft keys

- Some digital input channel failure is causing a line failure of the locomotive.

- There is no fault tolerance for these digital input channel failures in Ver.2.
- In order to avoid On-line failures due to some digital input channel failure and clearly identify that the problem is with hardware, self check routine for digital input channels is provided in MEP-660 Ver.3.
- MEPMCC card checks the health status of these channels at regular intervals of128 m.sec.
- If any channel is found defective:
  - System logs a fault that particular digital input is defective.
  - If alternate logic is available, the system allows normal operation of loco.
  - Where alternate logic is not available, system permits loco with some restrictions.
  - Where user selection is essential for that input, soft keys are provided through display to toggle the status of that input in the software.
- The following are the digital input channels where soft keys are provided:
  START, STOP, ECS, VCD Reset., AFL Reset, TE Limit SW.
- Display shows the soft key screen automatically.

Fault History

- In Ver. 3, through display unit we can analyze the fault data pack.
- Under ‘Faults’ option,
  - ‘Faults History’ sub menu.
    - Faults Repetition:
      - How many times each fault is repeated is indicated. Data pack can also be seen for that fault.
    - Faults Since date:

- Faults within period can be selected.
- All Faults:
  - All the faults in the memory can be viewed.

Monthly mileage data

- So far in Ver. 2, cumulative parameters are recorded and can be seen notch wise cumulative figures through display.
  - EKMS, Distance, Time, GHP.
- But in Ver. 3, these parameters can be viewed month wise & notch wise.
- This feature is very helpful in calculating the fuel economy.
- Under 'Collective Data' option
  - 'Monthly data' submenu given.
    - 'Monthly mileage data' option is available.
      - In that screen, Month wise distance in kilometers will displayed.
      - In the bottom right, PRINT option is available to take a snap shot print to PC / Laptop.

DATA RECORDING

Steady State Information Pack:

- When locomotive is working in 7th / 8th notch continuously for 3 minutes, the system log a record in steady state pack, to know loco performance in higher notches.
  - The following Parameters are recorded in this pack--Date, Time, Eng.RPM, LOP, BAP, FOP, EWT, EOT, TAV, TAAI, GHP, loco No., Notch, BATI.
- After 30 minutes again it will log a pack, when working in 7th/8th notch continuously for 3 minutes.

- This steady state information pack will be logged only in internal memory.
- Latest 4800 records will be available in internal memory.

90 sec fault data pack for selected critical faults:

- In Ver. 2, only 8 sec data pack is available for all faults.
  - 5 sec. Data Prior to fault declaration, fault declaration sec. and 2 sec. Data after fault declaration.
- It is very difficult to know the actual status at the time of fault occurrence.
- In Ver. 3, for clarity and better analysis, 90 sec data pack is available for selected faults. For all other faults 10 seconds data pack is available.
  - 60 sec. Data prior to Fault declaration, Fault declaration second, fault instantaneous data and 30 sec. Data after fault declaration.
  - 5 sec. Data prior to fault declaration, Fault sec. Data, fault instantaneous data and 3 sec. Data after fault declaration is available for other faults.
- Any fault can be added or deleted from 90 sec. Data pack.
- Latest 700 records will be available with 90 sec data pack.
  - In the fault analysis software while viewing fault data pack, optional buttons 90sec / 10sec appear for selected faults only to view 90 sec. Data pack.

4.0 DISPLAY FUNCTIONS & NAVIGATION

MAIN MENU

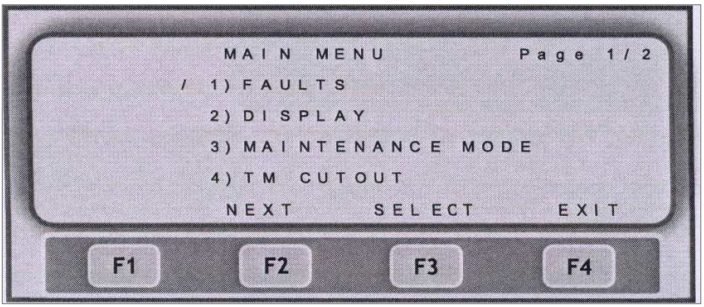


The main menu is accessed by pressing Main Menu Key on the key board. All the display options pertaining to loco maintenance are listed under this main menu. There are 8 sub options defined under main menu. These 8 options are divided into 02 screens as shown below.

The first PAGE 1/2 of Main Menu has the 4 options:

1.Faults, 2.Display, 3.Maintenance Mode 4. TM Cutout

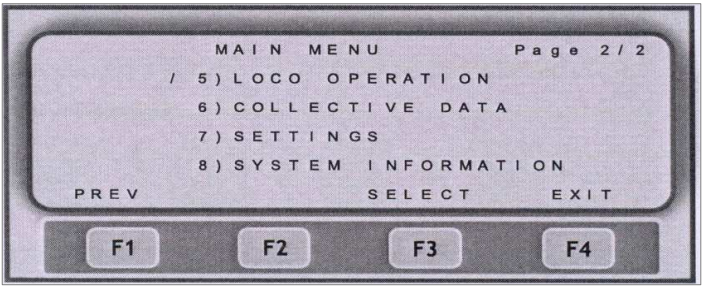
SCREEN 1



The user can press F2 key to go to the Next screen, F3 key to select a particular choice of menu and F4 key to Exit from the screen.

SCREEN 2

To go to PAGE 2/2 of main menu, press 'F2" key on screen 1/2 of main menu.



The screen has next 4 sub options: 5. Loco Operation, 6.Collective Data, 7.Settings, 8. System Information

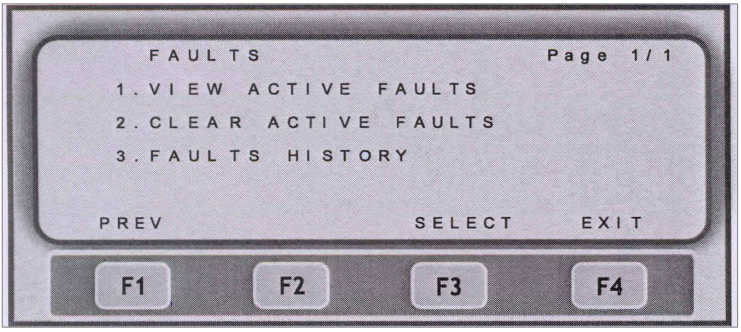
On this screen "F1" key changes to screen 1/2. Pressing "F4" key the screen goes to default screen.
To select any sub option on these two screens, place the cursor against the required option using up/down arrow keys and then press "Enter" key or "F3"key. Immediately the menu screen changes *to* the sub menu of the option selected.

FAULTS

This Fault menu option provides the user the facility *to* view active faults, clear active faults, and also list the logged faults in required sorted order. User can go *to* 'FAULTS' sub menu simply by pressing 'Main Menu' key on the key board. The display shows screen 1/2 of main menu options. On this screen press "1" key or "F3" key or "Enter" key *to* select 'FAULTS' menu. The Faults screen is displayed on pressing the soft key 1, as shown in Fig. The User can select the option of his choice by pressing F3 Key.



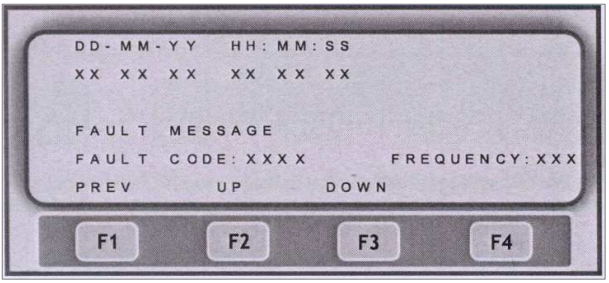
Faults Sub Menu



VIEW ACTIVE FAULTS

The screen *for* 'View Active Faults' is shown in Fig The details regarding the Active Faults is seen in this screen.

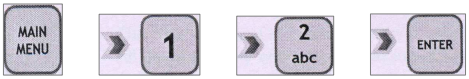


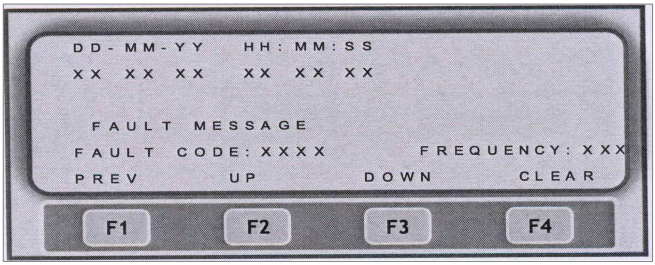


Registered fault, if any are displayed. User can navigate through the faults using down arrow key until 'No more faults logged' message is displayed. Press 'MENU' key *to* select 'Exit' option.

CLEAR ACTIVE FAULTS

The screen for 'Clear Active Faults' is in Fig.

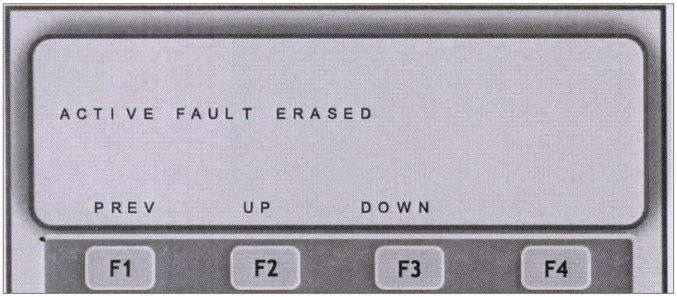




Message is displayed with "CLEAR" option against F4. After noting down the faults, to clear fault Press 'F4' key and down arrow key to see next fault. Based on the severity of the fault, if pass code is prompted, enter the pass code to clear the fault, otherwise the fault gets cleared and next logged fault is displayed. Continue the above till all faults are cleared. Press 'MENU' key to select exit option. The user can go to the Previous screen by pressing F1 Key. After pressing the F4 Key, the password for clearing the High Level Faults has to be entered as shown in the Fig. given below

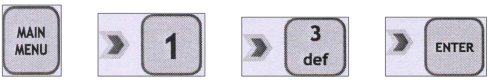


The Active Faults are cleared after entering the password. After pressing F3 Key, the screen with cleared Active Faults is displayed as given below.



FAULTS HISTORY

The screen for 'Faults History' is as given below.



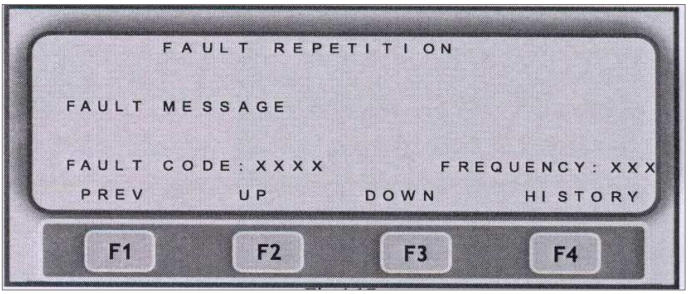


The screen for Faults History displays information on Faults Repetition, Faults since Date and All Faults. The user can select F1 Key to go to the previous screen, F3 Key to select the option of his choice and F4 Key to exit .

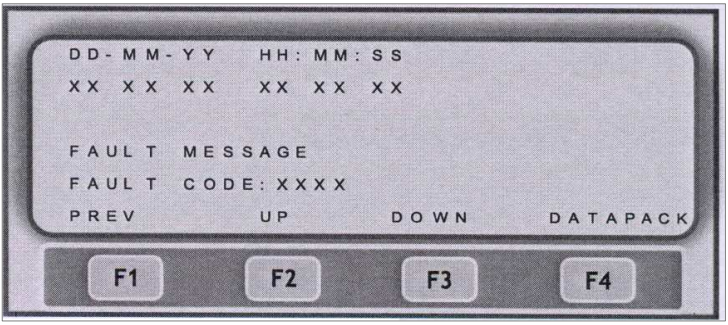
FAULTS REPETITION



The screen for 'Faults Repetition' is as given below.
Fault is indicated with the frequency with 'History' option against F4. By selecting 'History' through 'Data pack' option we can see the individual sec. Data packs by using scroll key.



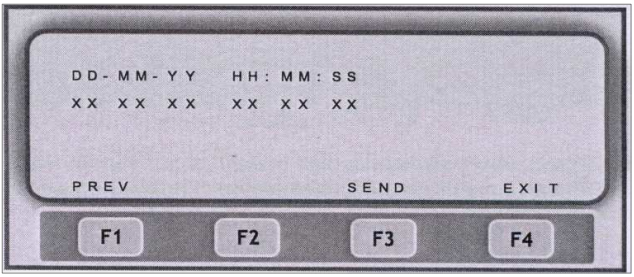
On pressing F4 Key, the screen appears as in Fig





FAULTS SINCE DATE

The screen for 'Faults Since Date' is in Fig. .
By entering particular date and time, the specified range of faults only can see through this option.

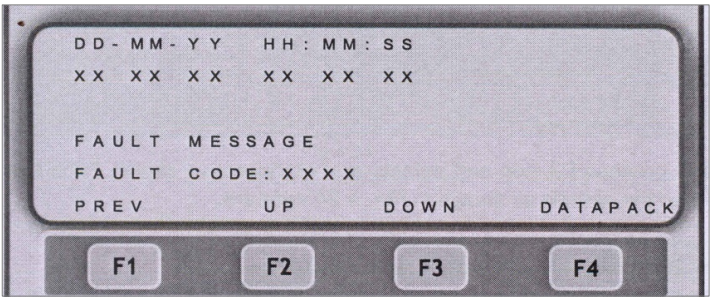


The user can go to the previous screen by pressing F1 Key and Exit from this screen by pressing 'F4.

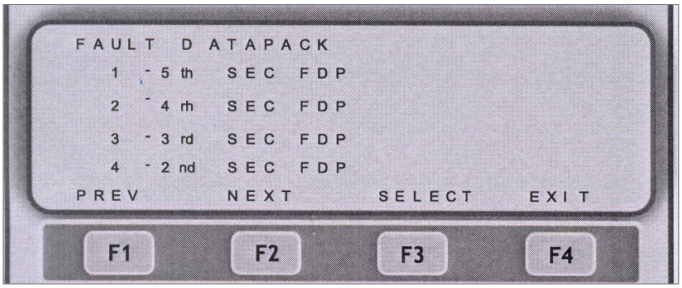
ALL FAULTS SCREEN



The 'All Faults Screen' is shown in Fig..
All faults data packs can see through this option.



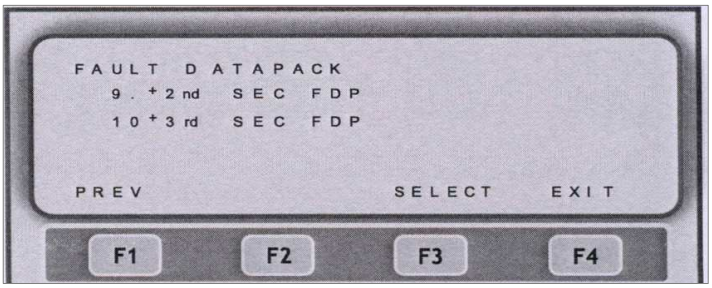
On pressing F4 Key, the screen displaying the Fault Data pack appears as shown in Fig



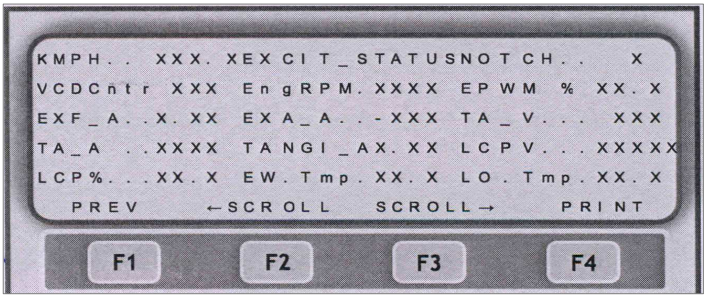
.

More screens on the same level are displayed on pressing F2 Key. These screens are shown in Figs.





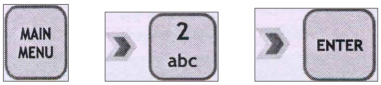
If the user presses F3 Key and selects any of the above shown Fault Data Packs, then the screen as shown in Fig. appears.



The Previous and Next screens can be viewed by pressing F2 and F3 Key.

DISPLA Y SCREENS

The next option under the "MAIN MENU" is "DISPLAY". The



display screens are shown in Figures given below.

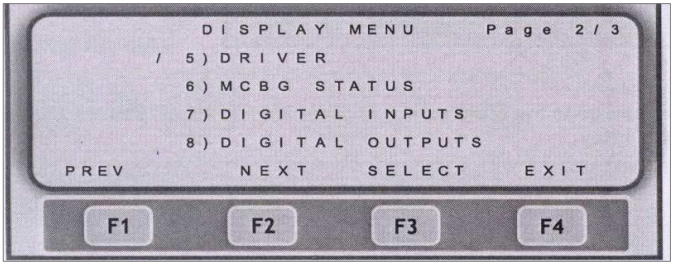
The"DISPLAY" sub menu can be selected from the screen 1/2 of Main Menu. Press "2" key or down arrow key once followed by "F3" key or "Enter" key. This screen displays the screens such as Excitation, Auxiliary, Wheel Slip, Mixed, Driver, MCBG Status, Digital Inputs and Digital Outputs. The User can- select the option of his choice by pressing F3 Key**.**

SCREEN 1



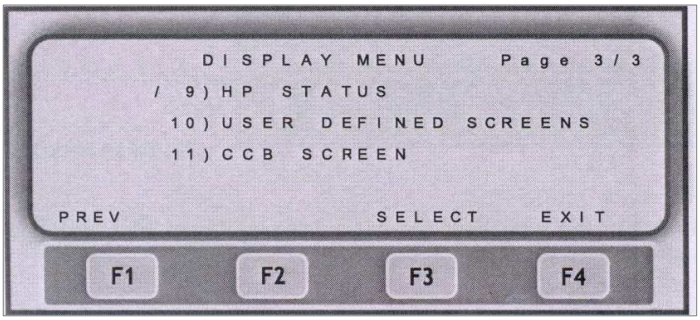
For going to the next screen, F2 has to be pressed. User can press F4 Key to exit from the screen.

SCREEN 2



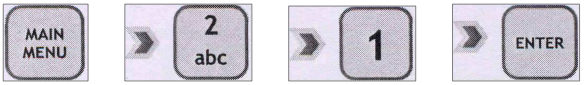
The User can select the option of his choice by pressing F3 Key. For going to the next screen, F2 has to be pressed. Similarly, F1 should be pressed for going to the previous screen. User can press F4 Key to exit from the screen.

SCREEN 3

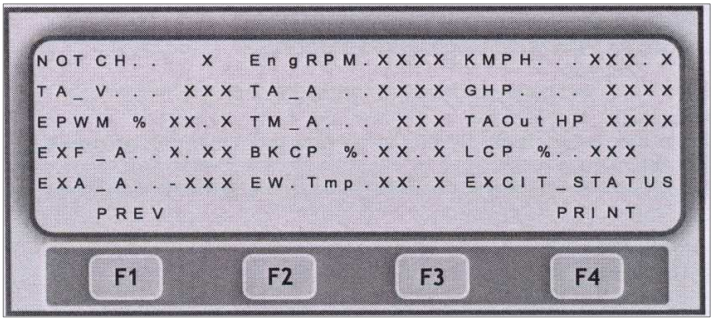


The User can select the option by pressing F3 Key. F1 should be pressed for going to the previous screen. User can press F4 Key to exit from the screen.

DISPLAY MENU SUB SCREENS
EXCITATION SCREEN

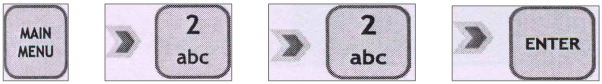


The 'Excitation Screen' is shown in Fig given below.

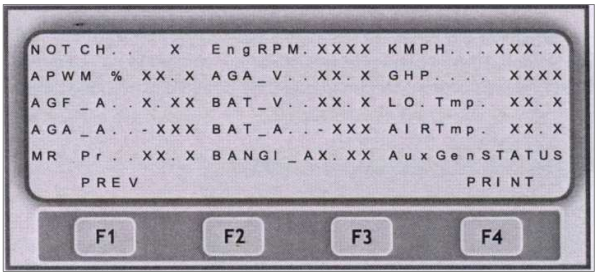


The user can go to the previous screen by using F1 Key or Print the Screen by using F4 Key.

AUXILIARY SCREEN

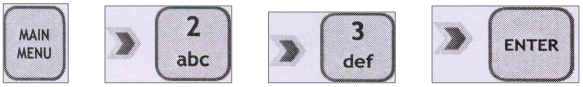


The 'Auxiliary Screen' is displayed below.

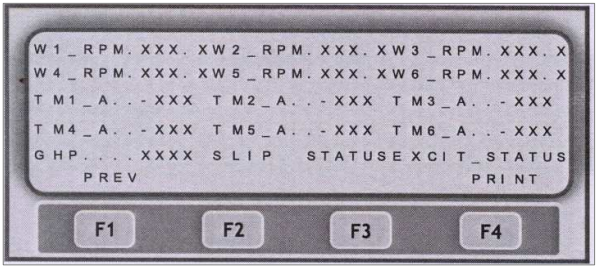


The user can go to the previous screen by using F1 Key or Print the Screen by using F4 Key. .

WHEEL SLIP SCREEN

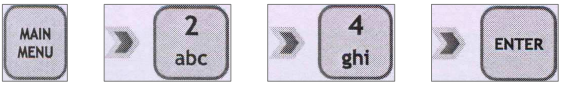


The 'Wheel Slip Screen' is displayed below.

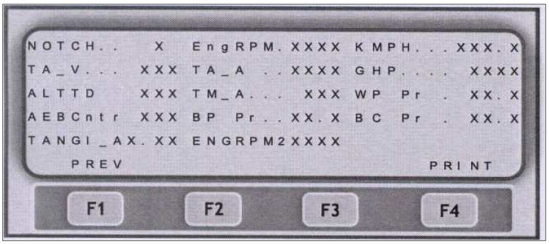


The user can go to the previous screen by using F1 Key or Print the Screen, by using F4 Key.

MIXED SCREEN

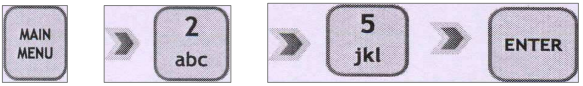


The 'Mixed Screen' is shown in Fig.



The user can go to the previous screen by using F1 Key or Print the Screen by using F4 Key.

DRIVER SCREEN



The 'Driver Screen' is displayed by three different screens which are shown in Figures as given below.

The driver's display mode is same as the default display. Various parameters that are displayed in this option **_re Notch**, Engine RPM, KMPH, TA Amps, TA Volts, Gross HP, BA Amps, AG Volts, Engine Temp, TM Amps, TM field Amps, Brake KW, TM Armature Amps, BKCP Lube Oil Temp, Gross HP, BA Amps, BA Volts, LOP. These parameters are distributed into three display modes. 1. IDLE 2. Motoring 3. Braking

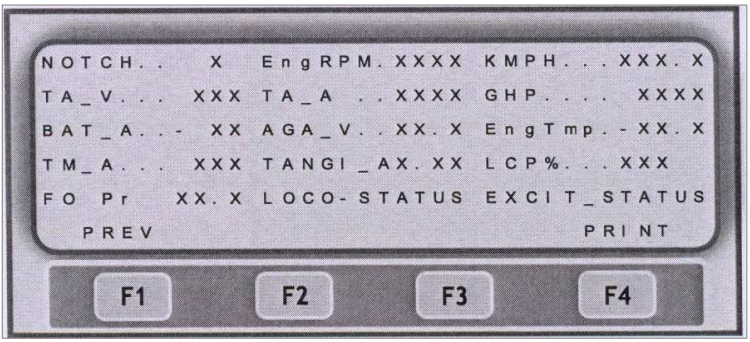
The MEP-660 automatically changes the display to the corresponding mode based on the master handle position.

Idle Screen



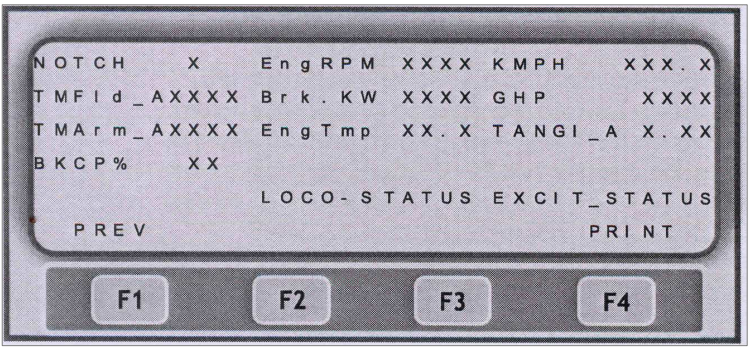
The user can go to the previous screen by using F1. Key or Print the Screen by using F4 Key.

Motoring Screen



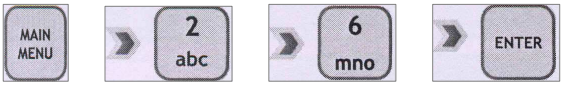
The user can go to the previous screen by using F1 Key or Print the Screen by using F4 Key.

Dynamic Brake Screen

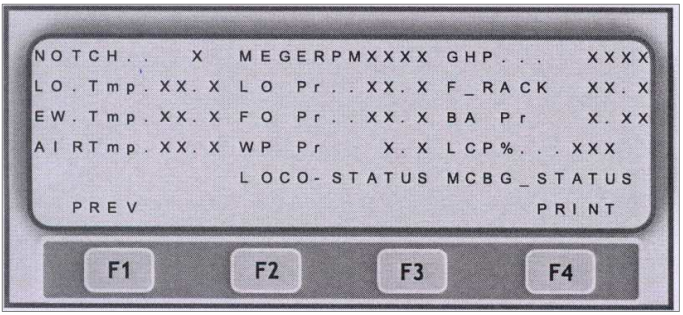


The user can go to the previous screen by using F1 Key or Print the Screen by using F4 Key.

MCBG STATUS SCREEN

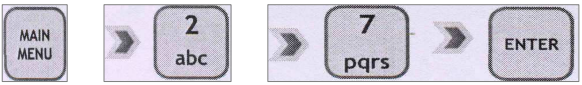


The 'MCBG Status Screen' is as in Fig. given below



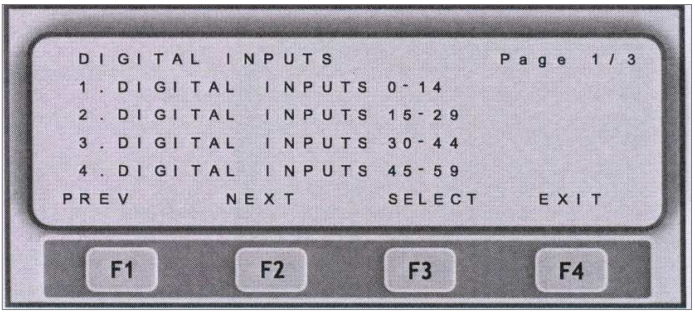
The user can go to the previous screen by using F1 Key or Print the Screen by using F4 Key.

DIGITAL INPUTS



The 03 'Digital Inputs Screen' are as Fig. given below. These screens display the Digital Inputs 00 to 143. This option is very useful to find out the status of any digital input in the locomotive. This display helps in finding out the wiring mistakes *I* the device mistakes. There are 144 digital input channels provided in MEP-660 Ver. 3. The status of these channels is distributed to 10 screens accommodating 15 channels in each screen. For easy navigation a sub menu is displayed indicating the digital input channel groups.

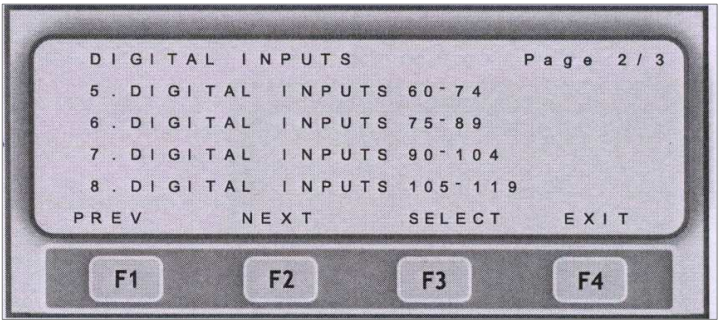
Screen 1



This screen displays Digital Inputs DIOO to DI59. The user can select F1 Key to go to the previous screen

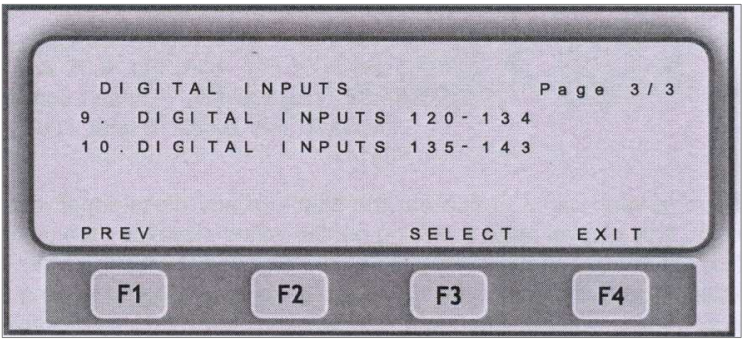
and F2 Key to go to the next screen. To select the choice of Digital Inputs, the user has to press F3 Key. F4 Key has to be pressed to exit from this screen.

Screen 2



This screen displays Digital Inputs DI60 to DI119. The user can select F1 Key to go to the previous screen and F2 Key to go to the next screen. To select the choice of Digital Inputs, the user has to press F3 Key. F4 Key has to be pressed to exit from this screen.

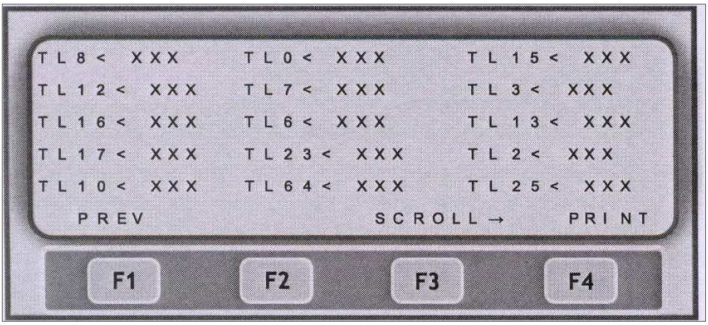
Screen 3

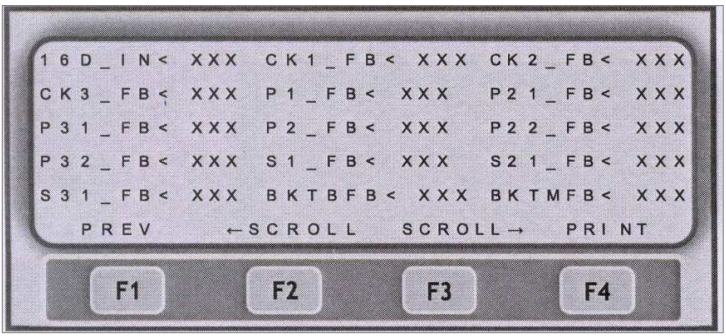


This screen displays Digital Inputs DI120 to DI143. The user can select F1Key to go to the previous screen. To select the choice of Digital Inputs, the user has to press F3 Key. F4 Key has to be pressed to exit.

If user selects any of the Digital Inputs, then the parameter screen appears and on selecting the first option the following screen appears and in that if F3 is

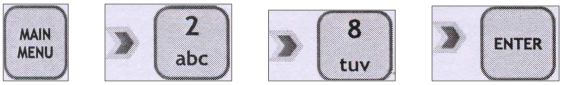
pressed, then the screen appearing is same as selecting Option 2, that is, the screens are inter related. So by selecting F3, all the Digital Inputs screens can be seen as shown in Figures as below.





If F3 is pressed again, then the screen' for option 3 is displayed. This way all the Digital Input screens can be seen by pressing F3 key.

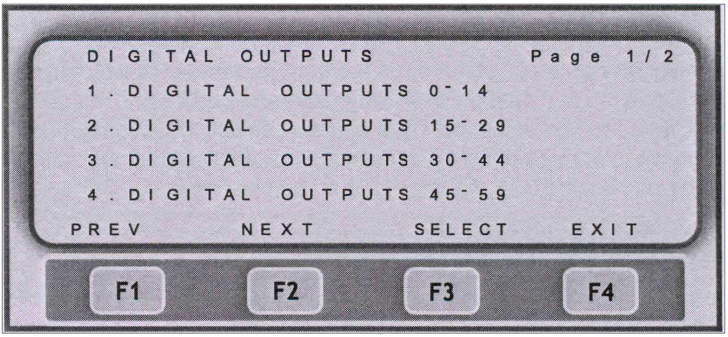
DIGITAL OUTPUTS



The 02 'Digital Outputs Screen' are as below. These screens display the Digital Outputs **DOOO to DO63.** This option is very useful to find out the status of any digital output channel. There are 64 digital output channels provided in Ver.3. All the digital output channels are divided into groups and each group

contains 15 channels. For easy navigation a sub menu is displayed indicating the digital output channel groups.

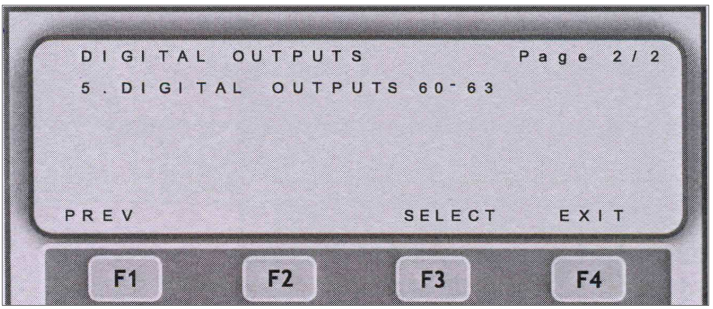
Screen 1



This screen displays Digital Outputs **DOOO to DO59.** The user can select F1 Key to go to the previous screen and F2 Key to go to the next screen. To select the choice of Digital Outputs, the user has to press F3 Key. F4 Key has to be pressed to exit from this screen.

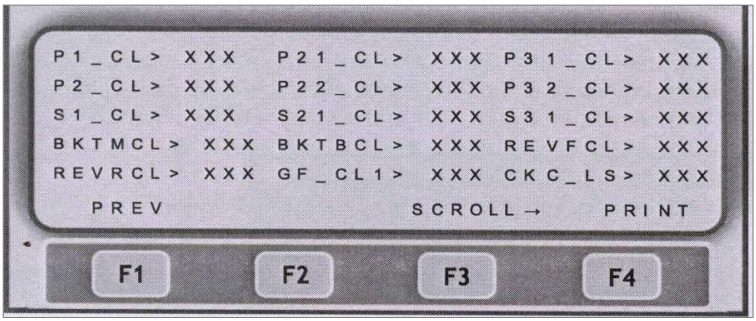
Screen 2

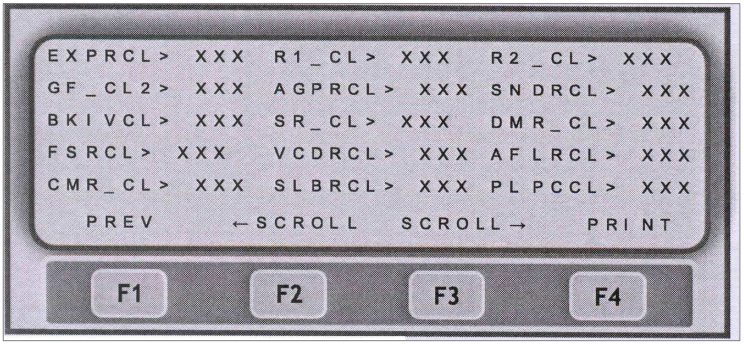
This screen displays Digital Outputs **DOOO to DO63.** The user can select F1 Key to go to the previous screen. To select the choice of Digital Outputs, the user has to press F3 Key. F4 Key has to be pressed to exit from this screen.



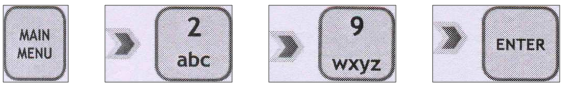
If user selects any of the Digital Outputs, then the parameter screen appears and on selecting the first option the following screen appears and in that if F3 is

pressed, then the screen appearing is same as selecting Option 2, that is, the screens are inter related. So by selecting F3, all the Digital Outputs screens can be seen, as shown in Figs given below.

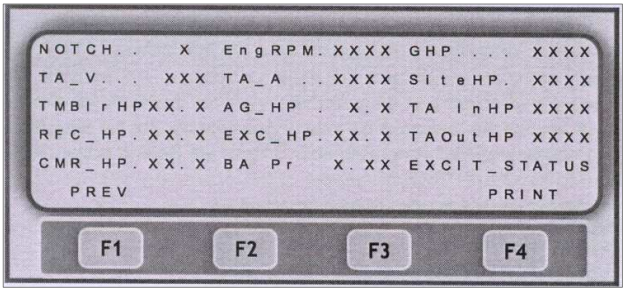




HP STATUS



The 'HP Status Screen' is shown as given below.

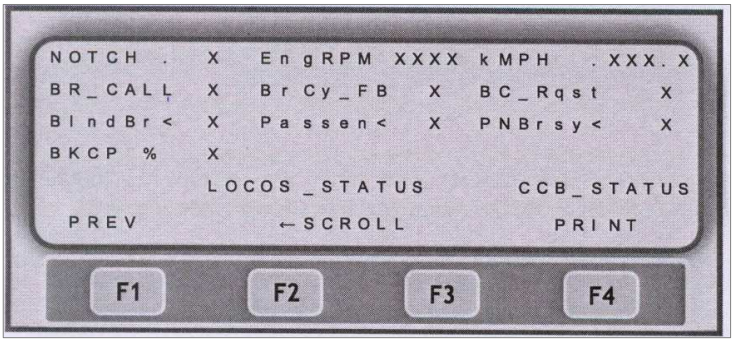


CCB SCREEN



When the loco is equipped with computerized controlled brake system, the parameters related to CCB are collected and displayed in MEP display for user interface. There are two screens which can be selected to monitor. The 'CCB Screens' are as below.





5.0 FAULT DIAGNOSTICS

The Microprocessor Control System is built with an online fault diagnostic system. The system continuously monitors operating levels of parameters of various equipment on loco like currents, voltages, temperatures, pressures, RPMs etc. and identifies any abnormal conditions of working of any equipment, indicating a fault in that equipment

At present about 320 numbers of various faults are identified. On identification of any fault, an appropriate control action is taken instantly by the system to avoid damage to traction equipment.

A fault message, along with any restriction applied due to the fault, is displayed on the display unit for the convenience of the driver.

The faults are classified into three levels such as high, medium and low priority, based on the severity of the effect of the fault on locomotive operation.

The faults, which lead to engine shut down, prohibition of motoring and dynamic braking etc. are high priority faults. The faults leading to reducing power of locomotive, the faults resulting in cutting out of traction motor are also in high priority. All these faults are treated as, high priority faults. The alarm gong (ALG) and the display buzzer are energized either continuously or for 30 second in case of these faults. The driver can silence ALG and buzzer by pressing the acknowledge switch provided on the display unit. Even otherwise, in case of most of these faults, the ALG and buzzer gets switch OFF automatically after 30 secs.

The faults resulting in reduction of power, prohibition of dynamic braking, prohibition of battery charging etc. are treated as medium priority faults. In these cases, the ALG is energized for 5 seconds and the display of fault message and buzzer continues for 15 seconds.

The faults for which fault tolerance is built in the system and other faults are treated as low priority faults. In these cases, ALG do not energize but the fault message is displayed and the buzzer to the display unit is energized for 15 seconds.
For any fault, it is possible to manually clear the fault through the display unit, after attending to it. By pressing the "MENU" key one should select "Faults" menu. After selecting the 'Faults' menu, the sub-menu option "Clear Active Faults" should be selected from the sub-menu options. Now the operating / maintenance staff can navigate through the active faults at that point of time, which are displayed one by one based on their priority,

Three levels of access are defined to clear these faults.
Access level-1: By pressing the 'CLEAR' (F4 function key), the fault displayed on the display unit can be cleared after noting down and attention to the fault. If the displayed fault is an access level-1 fault, the system clears the fault immediately and informs the same on the display unit. Simultaneously the system removes any restrictions imposed on loco operations due to that fault and the next fault message as per the priority is displayed. The operator has to press once again 'CLEAR' (F4 function key) to clear the fault displayed on the display. Likewise the driver or operator can clear all the access level-1 faults.
Access Level-2: Level-2 faults are meant for clearing only by maintenance staff of the locomotive shed. After the pass code is validated, the system prompts for confirmation asking the user to Press 'OK' (F4 function) key against each such fault before clearing the fault.
Access Level-3: Very few faults are identified as very critical which require through inspection / attention on the control system and as well as on loco. Access to clear these faults is' given to those people who have

deep knowledge of the locomotive and as well as microprocessor control system..

In MEP Version 3 user can download internal memory and external memory from USB. At any time, any of these files thus down loaded, can be viewed by the user by the Open File Option from file menu. User can select a file and its path and then click Open to open that file. Select the data file and click Open. Only one file can be opened at any given point of time. Once the file is selected all the faults logged are displayed in tabular form along with date and time of occurrence of fault, error code, and full description of fault. There could be data files relating to many Loco numbers. For opening a data file of a particular loco from the list of all locos, user can enter the desired loco number in the text box. The data files related to that particular loco number then gets sorted out. User can choose the desired file and then click Open to open that particular file. To view the Fault Data Pack of a particular error, double click on that particular error or click on Fault Data Pack button all the 10/90 seconds data packs are displayed in a table.

6.0 USER PROGRAMMABLE PARAMETE RS

The Microprocessor Control System MEP 660 is designed as a very flexible control system. It can be configured for various types of traction equipment on the loco and various types of locomotives also. The user himself can do these configuration settings. For this purpose, a special software is developed, which can be loaded on any PC/LAPTOP/NOTE BOOK/Display Unit. A connector is provided on the MEP 660 system for USB communication with PC for this purpose. The other end of the cable should be connected to the USB port of any PC. The configuration software is very user friendly, being

WINDOWS based and menu driven. Even a new user can also learn to use this software very quickly and with ease.

All the parameters that can be programmed by user are divided into number of functional groups, which can be selected from the menu. For example, if the HP limit group is selected HP limits for each notch is displayed. For each parameter the present set value, unit, minimum and maximum permitted, values, and default values are displayed. Hence the user need not refer to any other literature to use the system. After setting the parameters to the required level, by a mouse click on the "Send" button on the screen or pressing AL T +'S" key, the new values are transmitted to the MEP 660 system. By a mouse click on the "Read config" button on the screen or pressing AL T+'R" key user can verify that system has accepted the correct values. These parameter changes can be done online when the engine is running or even when the loco is moving. The system automatically takes care of proper implementation. Some of the parameter groups available are listed below:

- HP limit for each notch
- Alternator current limit for each notch
- Alternator voltage limit for each notch
- Traction alternator current Vs. efficiency table for 8th notch in steps of 250 Amps
- Traction alternator current Vs. efficiency table for 5th notch in steps of 250 Amps
- Dynamic braking parameters
- Excitation limits of various traction equipment
- Notch wise engine speeds
- Engine temperature levels for different controls
- Transition speeds
- Power ratings of auxiliary equipment

- Auxiliary generator control
- Wheel diameters
- HP Factors
- Transition Settings through flag selection
- Excitation propulsion through flag selection
- Miscellaneous settings like Engine Speed limit, Loco Speed limit, TDR OFF delay time, TA Field Resistance, Total TMS etc.

DATA LOGGING

The MEP 660 system provides continuous data logging of the following parameters at the rate of once in every 10 minutes. The parameters are:

- Notch Position
- Battery Voltage
- Lube Oil pressure
- Booster Air Pressure
- Fuel Oil Pressure
- Loco speed
- Engine Water Temperature
- Engine Oil Temperature
- Battery Charging/Discharging Current.
- Engine Temperature
- Main Reservoir Pressure
- Brake Pipe Pressure
- Traction Alternator Voltage
- Traction Alternator Armature Current .
- Power Ground Leakage Current
- Gross Horse power
- VCD status

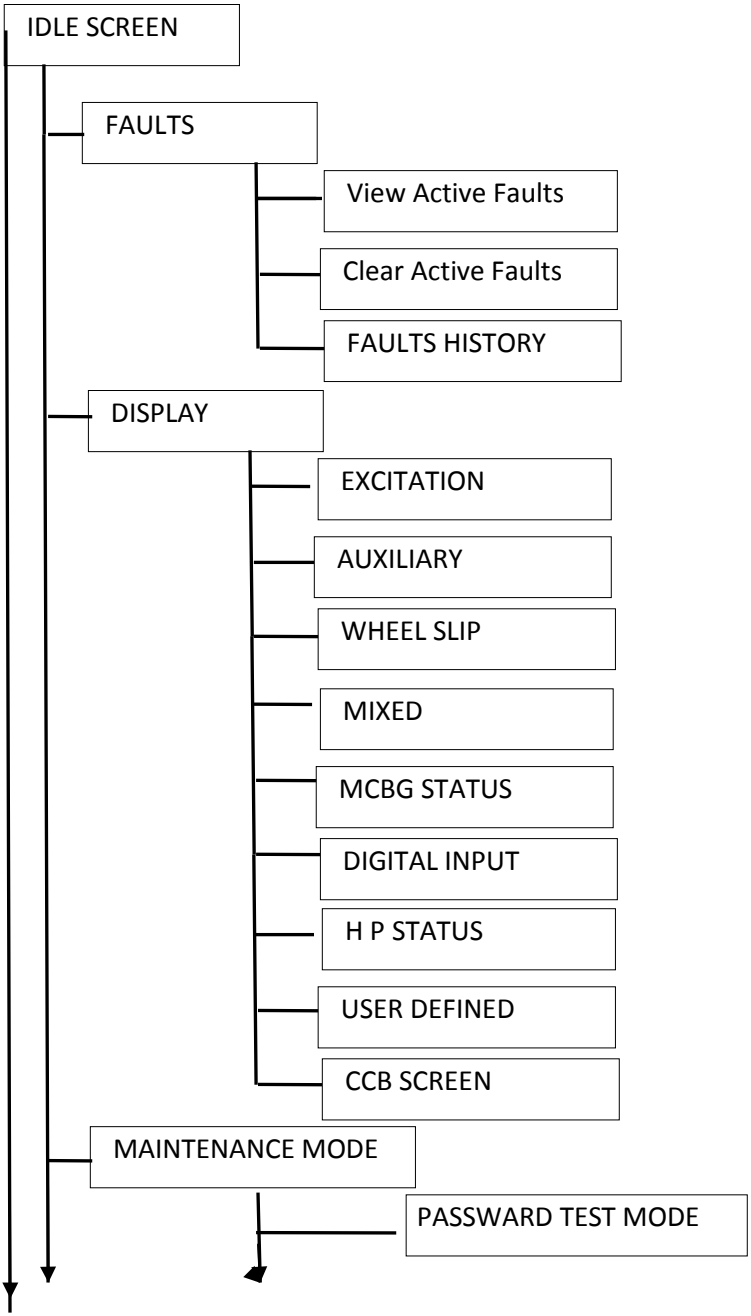
This data can be down loaded in to a Note Book PC by connecting the serial port of the same, through a cable, to the connector provided on MEP 660 system for this purpose. The menu driven software loaded on the note book PC does the job by selecting RDL. The data

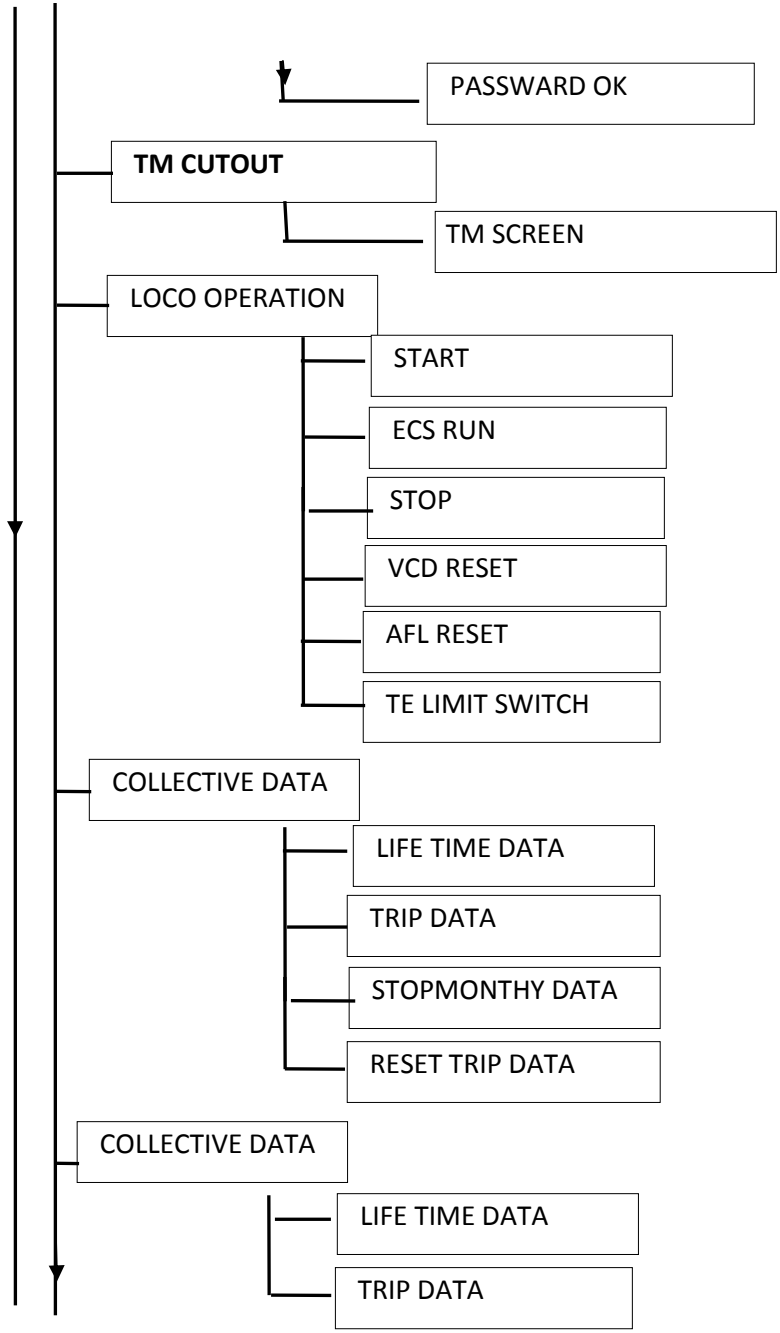
downloaded is automatically saved in a file, with the file name allotted by the system. At any time, any of these files thus downloaded, can be viewed by the user, by selecting the "Data Log" option in "View Data" pull down menu, and selecting the required file from a list of available files, which are displayed by their name along with the date and time stamp, of downloading.

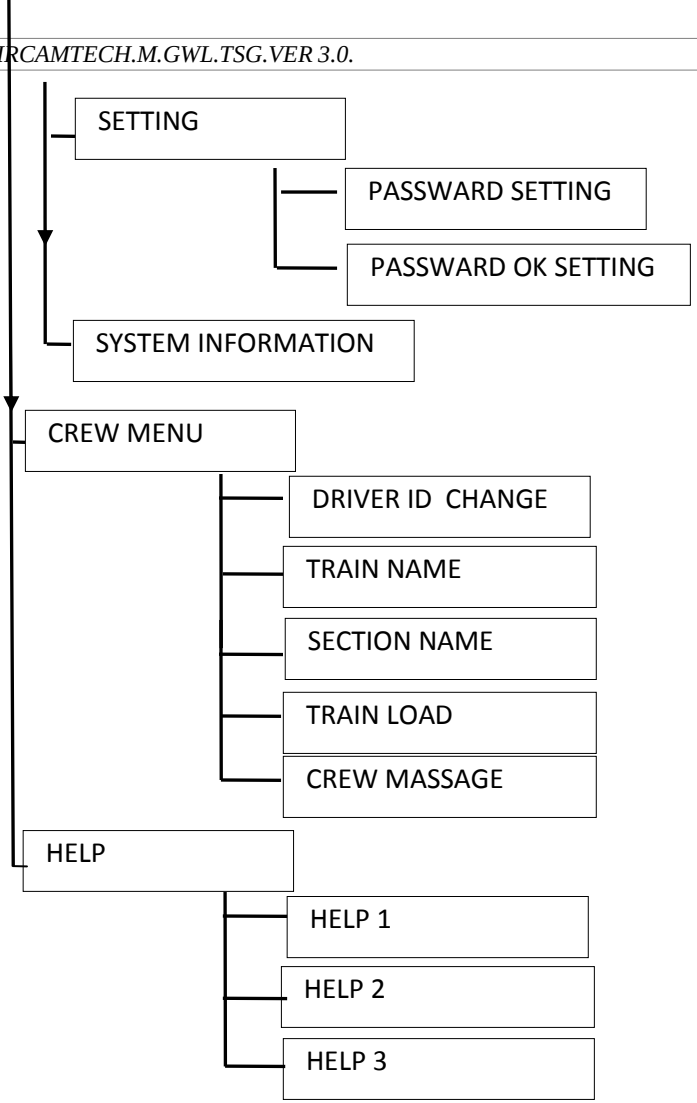
The MEP 660 system also provides cumulative information of locomotive duty cycle, total KW generated, Kilo Meters traveled and number of operating hours etc. This data can be viewed on Trip/Monthly schedules or Cumulative basis.

Real time Data monitoring is possible on a PC while the loco is running. The selected parameters can be viewed either in graphical or in a tabular form. This type of monitoring helps in identifying the faults online.

7.0 STEP WISE TROUBLE SHOOTING CHART




PASSWARD OK
TM CUTOUT
TM SCREEN
LOCO OPERATION
START
ECS RUN
STOP
VCD RESET
AFL RESET
TE LIMIT SWITCH
COLLECTIVE DATA
LIFE TIME DATA
TRIP DATA
STOPMONTHY DATA
RESET TRIP DATA
COLLECTIVE DATA
LIFE TIME DATA
TRIP DATA


SETTING
PASSWARD SETTING
PASSWARD OK SETTING
SYSTEM INFORMATION
CREW MENU
DRIVER ID CHANGE
TRAIN NAME
SECTION NAME
TRAIN LOAD
CREW MASSAGE
HELP
HELP 1
HELP 2
HELP 3

8.0 DOS AND DON'TS

DOS	DON'TS
1. Keep always TE Limit switch in 'Normal' position unless and until required.	1. Do not keep TE Limit switch in 'Limit' position unnecessarily when not required.
2. Make a habit to check position of these TE Limit andMotorCUTOUT/CUTIN status in Display while taking overcharge.	2. Do not start the loco without ensuring the Motor status in Display
3. Switch OFF Circuit breakers MCB1 and MCB2 on control desks while cranking.	3. Do not crank the engine with MCB1 & MCB2 in ON position. Otherwise penalty brakes are applied if BCP is not build up within 94 seconds.
4. Press start button till cranking contactors picks up. (more than 60 sec. if pre lube feature is available.)	4. Do not release the start button in between. Otherwise the time starts again.
5. Switch ON circuit breaker CEB within 30 minutes while checking lube oil level.	5. Do not switch OFF Circuit breaker CEB and then do complete loco checking.
6. Switch OFF circuit breakers MCB1 & MCB2 in case of Rear Locomotive to avoid VCD function.	6. Do not keep MCB1 & MCB2 in ON position in rear locomotive. Otherwise load meter does not respond in rear loco.
7. Keep EPG cutout Switch in OFF position in trail / dead locos.	7. Do not keep the EPG cutout switch in ON position in rear / dead locos. Otherwise MR pressure reduces.
8. Apply loco brakes	8. Do not release loco brakes

through SA9 and ensure BCP is more than 2Kg./Sq.Cm. while loco is stabled	while loco is stabled. Otherwise VCD apply penalty brakes.
9. During continuous wheel slip and total power reduction, act as in the case of wheel slip with conventional Locos.	9. Do not reduce notch for momentary wheel slip and loco is moving.
10. Apply brakes and do fast pumping on 8th notch if loco stalled with message 'TM # Excess current'.	10. Do not reduce notch for the message 'TM# Excess Current' while the loco is moving unless and until warranted by railroad signals.
11. Apply loco brakes when total power is reduced at 95 deg. Centigrade to avoid roll back.	11. Do not release brakes till the locomotive is ready to move. (@ 90 deg. Centigrade of engine temperature.)
12. Press VCD Reset when the VCD Lamp blinks	12. Do not isolate VCD magnet valve cutout cock unless and until the valve is leaking.
13. Reset penalty brakes only when 1.Loco speed is zero and 2.Throttle is in IDLE and 3. VCD lamp stops blinking.	13. Do not try to reset penalty brakes if 1. Loco is moving, or 2. Throttle is in notch / Dy. Brake 3. VCD lamp is blinking.

9.0 Trouble Shooting:

1. Engine shuts down. Low water level and continuous alarm bell ringing.	
Fault Code	**1001**
Fault Message	Low Water Level.
Restrictions	Engine Shuts down.
Alarm Bell	Continuous ON
Reset level	Low, Manual Clear the fault in clear active mode. After manual reset if the fault still present, the fault will be generated again.
Probable Cause	1. LWS operated due to low water level. 2. Faulty micro switch, bellow, float. etc. in the LWS unit. 3. Any open circuit in LWS wiring from LWS to MEP660.
Action by Loco Pilot	1. Check Water level. If water is less add water. Reset the fault. 2. If water is full, Check operation of the LWS by operating the LWS cock.

For Maintenance Staff	i) Check Voltage at wire No. TO1 on backside TB. Observe for any disconnected wires. If so reconnect. ii) If voltage at wire No. TO1 is zero a) Check voltage at wire No. 51 at backside TB. Observe for any disconnected wires at the terminal. If so reconnect. b) If voltage is >65V. i. Either LWS wiring or LWS faulty • Check wiring continuity of wire 51 from backside TB to LWS. • Check wiring continuity of wire No. TO1 from LWS to backside TB. • Check for any disconnected wires at LWS. • If wire continuity is good, LWS micro switch is defective. Replace and check. ii) If the Voltage at back side TB on wire No. TO1 is > 65V • Check the wiring continuity of wire No. TO1 from backside TB to MEP-660 by removing the coupler (DI24-47-ID: B3) - (Pin. C). If no continuity is there, replace the cable.

2. Engine Shuts down with over speeding.	
Fault Code	**1002**
Fault Message	"Engine Over Speed".
Restriction	Engine Shuts down
Alarm Bell	30 seconds
Probable Causes	1. OSTA tripped 2. Faulty wiring from Tacho generator to MEP-660/MCBG Gov. if provided 3. Faulty tacho generator, if provided 4. Faulty governor / sticky racks. Fuel rake stucking or fuel injection pump defective
Action by Loco Pilot	1. If OSTA is tripped, reset it. Crank the engine. 2. Ensure that there are no sticky racks or fuel injection pumps. 3. Check the notch wise engine RPM.

For Maintenance Staff	Check the notch wise engine RPM. A. If the RPM is not correct a) Check up with the governor and set the notch wise engine RPMs with in limits. B. If the displayed RPM is correct a) Check up with tacho generator wiring from tacho generator terminal board to backside TB to MEP-660 for any open circuit or loose connections. b) Check up tacho generator frequency (engine RPM) with conventional RPM meter as used in conventional WDM3A locomotives. c) If notch wise readings are not stable and heavy fluctuation is noticed, check for tacho generator and replace.

3. LLOB Reset plunger tripped, Engine Shuts down.	
Fault Code	**1004 & 1005**
Fault	LLOB trip, Reset plunger.

Message	
Restrictions	Engine Cranking Prohibited
Alarm Bell	Continuous ON
Fault Recovery	Automatic when the fault is cleared and 20 seconds of time is lapsed
Probable causes	1. Low Lube Oil Button might have tripped in the Woodward governor. OR 2. The feedback input wire OPSFB is getting wrong supply.
Action by Loco Pilot	1. Check the Low Lube Oil Button position on the Woodward governor. 2. If tripped (projecting outside). A. Press the button inside to reset. B. Reset the Fault manually and crank the engine. 3. If LLOB is not in tripped position A. Pull the knob outside and reset once again. B. Check the OPS (LLOB) feed back signal level with Number 5 Green and Yellow LEDs on Digital Input card MDIP-16 in 11th slot. With LLOB in normal position, both LEDs are

	OFF. With LLOB in tripped position, both LEDs are ON.
For Maintenance Staff	C. If both LEDs are ON with LLOB in normal position a) Check voltage at wire No. 1B at the back side TB. b) If voltage is > 65V c) Disconnect the wires 1B and identify which wire is getting supply. d) If the wire is from governor amphonal plug, then the micro switch in the Governor is shorted. Replace the micro switch. e) If the wire is from loco side, there may be a wrong feed back from indication panel side. Check up and isolate the supply. **Note:** Most probably this fault is accompanied with a Fault message 'LLOB Trip. Reset Plunger' (Fault code 1005). Driver might have reset the fault on the display with out resetting the LLOB on the Governor

4. Power cutting off with Hot Engine Alarm & Engine Speed restricted to IDLE.

Fault Code	**1006**
Fault Message	**Hot Engine. Can't Power Up.**
Restrictions	Power cutting off & engine RPM raised to 8th notch. Motoring and Dynamic Brake are prohibited.
Alarm bell	Continuous ON
Fault Recovery	Automatic when the engine temperature is less than 90°C.
Probable causes	1. Engine water temperature is increased more than 95°C.
Action by Loco Pilot	1. Check water level in display/ gauge 2. Before this message, message comes as "Engine temperature is high, reduce power" 3. Put GF in Off observing Load & Road & allow the engine to cool till temperature is reduced below 90°C.

5. Engine Speed restricted to Idle due to Power Ground	
Fault Code	**1007**
Fault Message	**Power Circuit Ground Fault.**
Restrictions	Motoring and Dynamic Brake Prohibited. Engine speed restricted to Idle.
Alarm bell	Continuous ON
Fault Recovery	Automatic when the traction alternator neutral to ground leakage current value is reduced below the set limit and Master Handle is brought to IDLE.
Probable causes	1. The fault may be transient or permanent. 2. The Fault is automatically recovered after 15 seconds once the throttle is brought to Idle.(Driver can work further without any trouble.) 3. If the fault is recording for more than 3 times in one hour, it indicates fault is persisting and needs

	attention. 5. ***The fault is logged due to*** A. Moisture in Traction Motors. B. Flash over in Traction Motors C. Cracked insulators on traction Alternators / Traction Motors / Power Rectifier / Dynamic brake grids / BKT / REV / power contactors. D. Any external metal parts touching to power terminals. E. Any power circuit cables are rubbing to body and insulation is damaged.
Action by Loco Pilot	***If the fault is recurring:*** 1. Apply Loco brakes and ensure locomotive brakes are physically applied. 2. Set the display mode to 'Mixed' through Display Menu setup. 3. Set the locomotive operation to motoring mode and notch to 1. 4. Observe the traction alternator leakage current sensor (TANGI) on the display.
For Maintenance	5. If the leakage current is more than set (0.4 Amps) value, then there is a real ground.

Staff	A. Inspect traction alternator power circuit cables for any rubbing to loco body. If so isolate the cables. B. Inspect traction motor cables for any rubbing to loco body. If so isolate the cables. C. Check for any cracked insulators in the equipments as mentioned above. D. Check for any flash over / burnt marks in the power rectifier and connected cables.

6. Control Circuit Starting Ground Fault coming & Engine not cranking.	
Fault Code	**1008**
Fault Message	**"Control Circuit Ground Fault".**
Restrictions	Cranking prohibited.
Alarm bell	Continuous ON
Fault Recovery	Automatic when the control circuit negative to ground leakage current value is reduced below the set limit and 15 seconds lapsed with Master Handle in Idle. Automatic Fault reset is permitted for 3 times in an hour and after that manually reset is required.

Probable causes	1. Any control circuit wiring is grounded. 2. Any equipments like dust blower motors, sander coils, lighting circuit etc. connected in control circuits are having low / zero insulation resistance value.
For Maintenance Staff	1. Identify the control circuit having low/zero Insulation Resistance (IR) value. 2. Isolate the low insulation either replacing the equipment or by insulating the grounded wires. ***Note: This fault is logged during cranking only.***

7. Loco over Speeding & not moving in motoring	
Fault Code	**1015**
Fault Message	Loco over speed. Move Master Controller Handle to IDLE.
Restrictions	Motoring prohibited.
Alarm Bell	30 Seconds.

Reset Level	Low, Manual After manual reset if the fault still present, the fault will be generated again.
Fault Recovery	Automatic when loco speed is below the set limit and Master Handle is brought to IDLE
Probable causes	1. Locomotive speed is high.
Action by Loco Pilot	1. Put throttle handle on Idle. 2. Let the speed of loco come within set limit 3. Do braking by A-9 if required, 4. Maintain the locomotive set speed.

8. Loco not responding to throttle, GF contactor not picking.	
Fault code.	**1018**
Fault message	GF stuck open, . Run Auto / Manual tests Can't Power UP: Electrical Control Problem
Restrictions	NIL
Alarm bell	30 Seconds
Fault recovery	Automatic when GF contactor found closed.

Probable causes	1. Defective GF contactor. 2. GF coil burnt. 3. Defective GFCO 4. Wiring fault from MEP-660 to GF contactor coil. 5. Positive supply to GF contactor operating coil is missing.
Action by Loco Pilot **Action by Loco Pilot**	1. Check wire terminal from MEPP-660 to GF contactor coil. 2. Check operation of GF contactor 3. Check GF contactor coil 4. Check operation of GFCOs 5. Set the Display to 'Manual Tests for Outputs' mode through Test Mode Menu and satisfy the initial conditions required to run manual test as prompted on the display unit. 6. Press 13 + 'F2'+F2 to energize GF contactor. 7. If GF contactor energizes, then A. Check up for proper closing of main contact tips and Auxiliary contacts. B. The status of GF Aux. Contact 1 can be checked through 8 number Green and Yellow LEDs on digital input card MDIP-24 in slot 8. C. The status of GF Aux. Contact 2 can be checked

	through 1 numbered Green and Yellow LEDs on Digital Input card MDIP-24 in slot No. 9. D. All the 4 LEDs should glow. 8. Press 'F3' key to deenegize the GF contactor. A. All the 4 LEDs in both the digital input cards should be OFF.
For Maintenance Staff	B. If LEDs are not as per the sequence and remains always OFF, then a) Check voltage on wire No. 51 at the GF contactor auxiliary contacts 1 and 2 with respect to wire No. 4 b) If the voltage is zero, then 1) Wiring loop of wire No. 51 is open circuited. Identify the open circuit and ensure supply at the terminal 51 on Aux. Contact of GF contactor is available. c) If Voltage is greater than 65V, then 1) Check voltage at the wire terminals FCD and FCE on Auxiliary contacts of GF contactor. 2) If Voltage is zero, then the Aux. Contacts of GF contactors are bad. Check, clean and adjust the auxiliary contacts. If necessary replace them.

For Maintenance Staff	3) If voltage is greater than 65V, then wiring between GF contactor and MEP-660 is open circuited. Identify and replace the cable. C. If the GF contactor is not energizing as per the test sequence, then a) Connect Voltmeter across the operating coil of the GF contactor and switch ON GF contactor by pressing 1 key. b) If the Voltage is more than 65V, then 1) The GF contactor-operating coil is open circuited internally or there may be a physical obstruction in the contactor operation. Check and replace the GF contactor if necessary. c) If the voltage is zero, then d) Check the voltage on coil terminal wire No. 13 and 4. 1) If Voltage is zero, then wire loop 13 connected to GF operating coil is open circuited. Identify and replace. 2) If the voltage is more than 65V, then negative feed is not coming to GF contactor operating coil. 3) This may be due to cable fault or digital output card defective. 4) Check the cable continuity from MEP-660 to GF contactor coil. If necessary replace the cable.

	5) If continuity is available, replace the digital output card. And check the operations of GF contactor.

9. CCM Failure indication coming	
Fault code.	**1019**
Fault message	CEB Breaker OFF.
Restrictions	No restrictions, only indication.
Alarm bell	30 Seconds
Fault recovery	Automatic when CEB breaker is switched ON.
Probable causes	1. Crank Case Exhauster Motor is not getting supply due to CEB tripped or switched OFF. 2. Crank case Exhauster Breaker Feed Back (CEB FB) status is low as sensed by MEP-660.
Action by Loco Pilot	1. Check working of Crank Case Motor personally. 2. Check wire terminal & tap motor slightly. 3. If Breaker is in tripped/OFF position, reset / switch ON the breaker. 4. The high level status of the Crankcase Exhauster Breaker Feed Back is indicated by 23 Numbered Green and Yellow LEDs on digital input card MDIP-24 in slot No. 9. 5. With CEB in ON position, CCEM fail indication

	LEDs on both control desks should be OFF. Both 23 numbered Green and Yellow LEDs on the Digital Input card in slot 9 should be ON. A. If the indications LEDs on both the control desks are ON, then the breaker is defective and the CCEM is not working. Replace the breaker. B. If 23 numbered Green LED is OFF on digital input card in slot 9, then wiring from CEB breaker to MEP-660 open circuited. Check and replace wiring. C. If 23-numberED Green LED is ON and 23-numbered Yellow LED is OFF, the digital input card in slot 9 is defective. Replace and check.

10. Motoring prohibited, Dynamic prohibited due to cranking contactor closed.	
Fault code	**1029**
Fault message	Cranking Contactor CK Stuck Closed.
Restrictions	Motoring Prohibited. Dynamic Brake Prohibited.
Alarm bell	Continuous

Fault recovery	Automatic on releasing of stuck condition as sensed through Auxiliary contacts of CK1/CK2/CK3.
Probable causes	1. CK1/CK2/CK3 contactor main tips are welded. 2. Defective wiring. (Wiring from these auxiliary interlocks disconnected) 3. Defective digital input card MDIP24 in slots7.
Action by Loco Pilot **Action by Loco Pilot**	1. Shut down the engine. 2. Open battery knife switch 3. Check the status of CK1/CK2/CK3 feedback LEDs on the MDIP-24 card in slot 7 and green LEDs numbered16, 17, 18. 4. Whichever the LED is not glowing, corresponding cranking contactor is welded or interlock is bad. 5. LED 16 for CK1, LED 17 for CK2 and LED 18 for CK3. on MDIP24 card in slot 7. 6. Check for any weld condition of the contactors. Release the main tips with a wooden stick & clean it. 7. After the tips are separated, alarm bell stops & the reset message is displayed " Cranking contactor stuck closed FAULT RECOVERED" 8. Now close Battery knife switch

For maintenance staff	9. If there is no welding of contactors, check and clean the concerned N/C interlocks of that particular contactor. 10. If interlock is good, check the voltage between CK#FB and locomotive 4 wire. 11. If the Voltage is more than 65V, A. Check the slackness of the connector of cable ID: A3 at control unit. If slack press the connector towards the control unit and tighten the connector. B. If connector is tight and still the green LED is not glowing a) There is no continuity of CK#FB wire to corresponding pin numbers G, H, J of the connector. Remove the connector and check the continuity. If necessary replace the cable.

11. Battery is not charging, Battery voltage is low.	
Fault code	**1061**
Fault message	Battery Voltage LOW Warning: Loco may stall
Restrictions	Loco may stall
Alarm bell	30 seconds

Reset level	Low, Manual After manual reset if the fault still present, the fault will be generated again.
Fault recovery	Automatic when the battery voltage is more than 62 V for 5 seconds.
Probable causes	1. This is a warning message indicating Batteries are getting discharged. Normally this message is followed by Fault message 'Aux. Gen. output open circuited.' Fault code 1145 or Fault message 'Aux. Gen Field circuit open / shorted' Fault code 1146
Action by Loco Pilot	1. Check for tripped AGFB and MB1 circuit breakers on front panel. 2. Check the tightness of ESS connector at ESS.
For Maintenance Staff	1. If none of the above faults are logged, prior to this fault message: A. Change the display mode to 'Auxiliary' B. Measure Voltage with a voltmeter at the BATV battery voltage sensor (wire No. 51 and 4) and voltage at AGAV Voltage sensor (wire No. 49 and 44D). C. If the measured voltages are tallying with the displayed parameters and really battery

	voltage is low and battery charging current is zero, Then RCD is open circuited. Replace RCD. D. If the measured battery voltage is higher than displayed voltage the voltage sensor or its wiring is defect. Check and identify. 2. If the 'Aux. Gen. output open circuited.' Fault message is also logged trouble shoot to find open circuit in the Aux. Gen. output circuit. Refer Fault code 1145. 3. If Aux. Gen. Field Circuit open / Shorted' message is also logged trouble shoot to find open circuit in the Auxiliary Generator field circuit. Refer fault log No. 1146. 'Aux. Gen. Field Circuit Open or Short'.

12. Loco is moving with Field shunting and Motoring prohibited in parallel combination.	
Fault code.	**1074**
Fault message	Field Shunting Relay FSR Stuck Closed.
Restrictions	Motoring always with field shunting. Motoring in parallel & DB prohibited.
Alarm bell	30 seconds

Fault recovery	Automatic when the stuck closed relay/contactor is detected as open.
Probable causes	1. Defective FSR Relay 2. Defective wiring. 3. Defective output card.
Action by Loco Pilot	1. Ensure engine is running and loco speed is zero and MCh is in idle. 2. Check the status of Green LED 12 to17 on the digital input card in slot 10. 3. If all the LEDs are glowing, check the status of FSR relay. 4. If FSR is energized, a) Check the condition of FSR relay for any dislocated springs. If necessary, got changed the relay.
For Maintenance staff	A. If FSR is energized; Check the voltage across the FSR relay. a. If voltage is zero, FSR relay is bad. Change the relay. b. If voltage is more than 65V, then digital output card MILS16 in slot 14 is defective. Replace the card and check. c. FSRCL wire is getting wrong supply. Check and remove the short circuit. 5. If any of the LEDs are glowing but FSR is in de-energized position check the status of FS contactors.

	A. If any of the FS contactor is in pick up conditions / welded replace the contactor. B. If two contactors are picked up like FS21 and FS24 or FS22 and FS25 or FS23 and FS26 then concerned positive wires FS1 / FS2 / FS3 is getting wrong supply. Identify and rectify. If necessary change the FSR relay. (Its interlocks shunts might be shorting with positive supply.) 6. If none the LEDs are not glowing but the fault is logged, check operation of FS contactors for proper operation. Delayed dropout of any FS contactor can log this fault and later on it is recovered.

Note: This Error message will be generated only if either "Series Field Shunting" or "Parallel Field Shunting" ENABLED flags are set (√).

13. field Shunting is prohibited	
Fault code.	**1075**
Fault message	"Field Shunting Relay FSR circuit open."
Restrictions	Field shunting is prohibited.
Alarm bell	30 seconds
Fault recovery	Automatic when the Master handle is brought to IDLE. Automatic reset is permitted for 3 times after which manual reset is required.
Probable causes	1. Defective FSR relay.

	2. Defective digital output card 3. Defective wiring of FS contactor feed back.
Action by Loco Pilot	Put master handle in Idle position. 1. Set the display mode to 'Manual Test for outputs' under Test Mode menu. 2. Enter 24 and press 'Enter' key to test the FSR operation. 3. Press 'F1' key to switch on FSR relay. 4. FSR relay should pickup and along with that FS contactors also should pick up.
For Maintenance staff **For Maintenance staff**	5. If FSR relay not picking up check Voltage across FSR relay coil with a voltmeter. A. If voltage is more than 65V, then the Relay is defective. Replace the relay. 6. If voltage is zero, check voltage at FSR coil terminal (Wire No. 51) with respect to locomotive 4 wire with a voltmeter. A. If voltage is zero, check the continuity of 51-wire loop connected to FSR relay. Check and replaced the open circuited wires. 7. If Voltage is more than 65V, check the voltage between Locomotive 51 wire and wire FSRCL at FSR relay coil terminal. A. If the voltage is zero:

	a) Check slackness of connector of cable ID: L3 at MEP660 control unit. If slack tighten the connector. b) Check continuity of FSRCL wire from FSR coil terminal to MEP- 660 (Cable ID: L3, Pin-R). If necessary replace the cable. c) If continuity is available, the digital output card MILS16 in slot No. 14 is defective. Replace the card and recheck. 8. If FSR relay is picking up and FS contactors are not picking up: A. Bad interlock of FSR relay. Replace the FSR relay. B. There is no 51-wire supply at FSR relay interlocks. Check up continuity of 51-wire loop. Replace any open circuited wires. 9. If FS contactors are picking up: 10. Check the status of Green LED 12 to17on the Digital input card MDIP24 in slot No. 10. The LEDs should glow. 11. If the Green LEDs 10 are not glowing, check voltage at incoming wire 51 at FS contactor auxiliary contacts with respective to locomotive 4 wire. A. If the voltage is zero, check continuity of 51-wire loop. Replace any open circuited wires/

	wrong connections. 12. If voltage is more than 65V, Check the voltage at FS contactor auxiliary contact with respective locomotive 4 wire. A. If the Voltage is more than 65V, check continuity of wire FSxx FB from FS contactor Auxiliary contact to MEP-660. (Cable ID: D3). If necessary replace the cable.

Note: This Error message is generated only if either “SeriesField Shunting” or “Parallel Field Shunting” ENABLED flags are set (Ö).

14. Engine is not Cranking due to Cranking contactor stuck up.	
Fault code.	**1140**
Fault message	Cranking Contactor Stuck Open. Engine may not Cranking.
Restrictions	Engine cranking prohibited
Alarm bell	For 5 Seconds.
Fault recovery	Automatic when CK1/CK2/CK3 auxiliary contacts open.
Probable causes	1. Defective CKC contactor. 2. Defective output card MLS-16 card in slot 13. 3. Defective output card MIHS-16 card in slot 15.

	4. Connector of cable ID: K3 is slack at MEP-660. 5. Connector of cable ID: M3 is slack at MEP-660. 6. Defective wiring. 7. Defective cranking contactor.
Action by Loco Pilot	This message will be logged during cranking only. 1. Open the battery knife switch. 2. Manually operate and check free operation of CKC contactor and all the three cranking contactors. Ensure there is no mechanical obstruction to operate. 3. Ensure that both Green and Yellow LEDs 16, 17 and 18 on the digital input card MDIP-24 in slot 7 are glowing. 4. If all the three LEDs are glowing: A. Manually open the Auxiliary contacts of CK1, CK2 and CK3. B. Corresponding Green and Yellow LED should go off. 5. Close Battery knife switch and prepare loco for cranking. 6. Press start button

	7. CKC contactor should pick up
For Maintenance staff	C. If corresponding LED is not going OFF, a) Check the supply voltage on the corresponding feedback wire (CK1FB/CK2FB/CK3FB) with respective to locomotive 4 wire. b) If the supply voltage is more than 65V, then wiring mistake. Identify from where the supply is feeding and rectify. 5. Close the battery knife switch and prepare the loco for cranking. 6. Pack the CK1, CK2, and CK3 contacts with an insulating sheet so that auxiliary contacts open when they operate and no battery supply is going to Aux. Machines. 7. Press start button. 8. CKC should pick up. 9. If CKC is not picking up. A. Check the voltage at the operating coil of CKC. B. If the voltage is more than 65 Volts and still CKC is not picking up, then CKC is defective. Replace the CKC. C. If the voltage is zero, then check the voltage at wire No. CKC_H and loco wire No. 4. a. If the voltage is zero

	i. Connector of cable ID: M3 might be slack at control unit. Check and tighten. ii. Check the continuity of wire CKC_H wire from CKC coil to the connector of cable ID: M3, Pin no. P. If necessary replace the cable. iii. Digital out put card MIHS16 is defective. Replace and check. b. If voltage is more than 65V, check the voltage between wire No. 71 and CKC CL terminal at CKC. If the voltage is zero, i. Connector of cable ID: K3 might be slack at control unit. Check and tighten. ii. Check the continuity of the wire CKC CL from the CKC coil to pin number D of the connector of cable ID: K3. If necessary replace the cable. iii. Digital output card MILS 16 card in slot 13 is defective. Replace and check again. D. If the Voltage is more than 65 volts at wire 71, then check the voltage between loco wire 13 and wire CKCCL at CKC coil. E. If the voltage is zero, a. Connector of the cable ID: AY is slack at MEP-660. Tighten the connector. b. Check the continuity of wire CKCCL from CKC coil to MEP660. (Pin-R, Cable: AY) if necessary replace the cable. c. The digital output card MLSD 16 in slot 14 is defective. Replace the card and check up. 10. If CKC is picking up and none of the CK contactors picking up, then the main contacts of the CKC are bad. Change the contactor and check up. 11. If CKC is picking up and any one of the three CK contactors is not picking up, then it is a wiring mistake. Identify and rectify.

15. VCD Applied Penalty Brake. Move Master Controller Handle to IDLE and press Reset to release Brake.	
Fault code.	**1153**
Fault message	VCD Applied Penalty Brake. Move Master Controller Handle to IDLE and press Reset to release Brake.
Restrictions	Motoring not permitted till the master handle is brought to IDLE and loco speed is dropped to zero and blinking LED should stop.
Alarm bell	05 seconds
Fault recovery	Automatic when the loco speed is zero, master handle is brought to IDLE, blinking LED stopped and Pressed VCD reset button.
Probable causes	1. VCD operated due to improper operation of loco. 2. Failed to press VCD reset switch 3. Defective VCD unit (Driver should perform any loco operation or press alerter reset switch once in 94 sec. to avoid penalty brakes).
Action by Loco Pilot	1. Bring the master handle to IDLE, wait till loco speed is dropped to zero, 2. Wait till VCD LED blinking is stopped. 3. Press VCD reset push button to release penalty brakes.

16. No Battery charging, AG failed or AGFB or MB1 tripped	
Fault code	**2000**
Fault message	No Battery charging due to major Faults.
Message code	1062, 1063, 1141, 1142, 1143, 1144, 1145, 1146
Restriction	Battery not charging
Description of Fault	This message is displayed for 5 seconds when Batteries are not charging and battery voltage is less than 60V for every 10 minutes to alert the driver.
Display buzzer ON duration	5 seconds
Alarm Gong ON duration	None
Probable Causes	1. Auxiliary Generator failed to develop voltage and batteries are not charging
Action by Loco pilot	1. Check AGFB circuit breaker and MB1 for tripping. 2. Insure proper tightness of ESS Connector on ESS. The following faults will also be displayed as warning since loco running on batteries.

	1062--- Battery Voltage is high 1063 -- AG field drive short 1141 – AG output high fault 1142 – Battery charging current high . 1143 –AG Output over current fault 1144 – AG field over Current 1145 –AG output open circuit fault. 1146 –AG field circuit open or short

17. Engine not cranking, when operator attempts cranking while 'Cranking contactor stuck closed'	
Fault code	**2029**
Fault message	Cranking Contactor Stuck Closed.
Restrictions:	Cranking Prohibited.
Description of Fault	This message is shown when operator attempts cranking while 'Cranking contactor stuck closed' Fault is already logged in the system.
Displayed message	5 Seconds

17. Engine not cranking, when operator attempts cranking while 'Cranking contactor stuck closed'	
duration	
Display buzzer ON duration	5 Seconds
Alarm Gong ON duration	None
Fault Recovery	Automatically recovers when feedbacks of CK1, CK2 & CK3 main or auxiliary contacts are comes to normal condition as sensed by the system through their respective inputs.
Probable causes	Main tips of cranking contactor CK1, CK2, CK3 might have welded.
Action by Loco Pilot	1. Shut down the engine. 2. Open battery knife switch 3. Check for any weld condition of the contactors. Release the main tips with a wooden stick & clean it. 4. After the tips are separated, alarm bell stops & the reset message is displayed " Cranking contactor stuck closed FAULT RECOVERED" 5. Now close Battery knife switch

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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GO TO CONTENTS