

**GPS BASED MONITORING OF DIESEL ELECTRIC LOCO
FOR EARLY DETECTION OF
FAILURE AND PREVENTIVE ACTION**

SYNOPSIS

- The MEP system with GPS has been provided in few locomotives for locating the locomotive and data uploading to server through CDMA/GSM network.
- In GPS based MEP system there is provision for analysis of Loco Performance parameters even if loco is working on line.
- All the parameters, which are available in MEP system, can be retrieved through CDMA/GSM network, at any point of time.

SYNOPSIS

- This data has been used for monitoring the health of the locomotives.
- If there is any change in data with the respect to standard one or there is continuous increase or decrease in value of various parameters, the shed can take appropriate preventive action and loco failure in section can be avoided

INTRODUCTION

- All the new locomotives being manufactured at DLW Varanasi and Upgraded loco at DMW Patiala are fitted with Microprocessor Based Control System (MEP)
- The MEP System performs the following functions
 - control the various equipments on the locomotive
 - provide on-line data from various sources
 - provide fault diagnostics along with fault data packs.

INTRODUCTION

- Though the data is available for downloading at any time from the microprocessor of the locomotive, this data normally becomes available to the shed staff only when the locomotive returns to the shed for scheduled maintenance or out of course repairs.
- All the parameters, which are available in MEP system can be retrieved through GPRS network, at any point of time even the loco is working on line.

INTRODUCTION

- This data/information can be used for monitoring the health of the locomotives.
- If there is any change in data with respect to standard one or continuous increase or decrease in value of various parameters, the shed can take appropriate preventive action and loco failure in section can be avoided

PRESENT SYSTEM



- In Micro Processor Based Control System, the data is stored in the long-term memory and short-term memory
- The MEP system also has an event recorder, which stores the fault messages along with other useful data.
- The data pack stored in the memory card of MEP system is downloaded when the locomotives returns back to shed for maintenance.
- This data can be analysed for taking proper action during schedule maintenance.

PRESENT SYSTEM

- This fault data pack is also downloaded for analysis of faults, which are registered during the run of the loco.
- Though the above data and information is available for downloading at any time from the microprocessor of the locomotive, this data normally becomes available to the shed staff only when the locomotive returns to the shed.

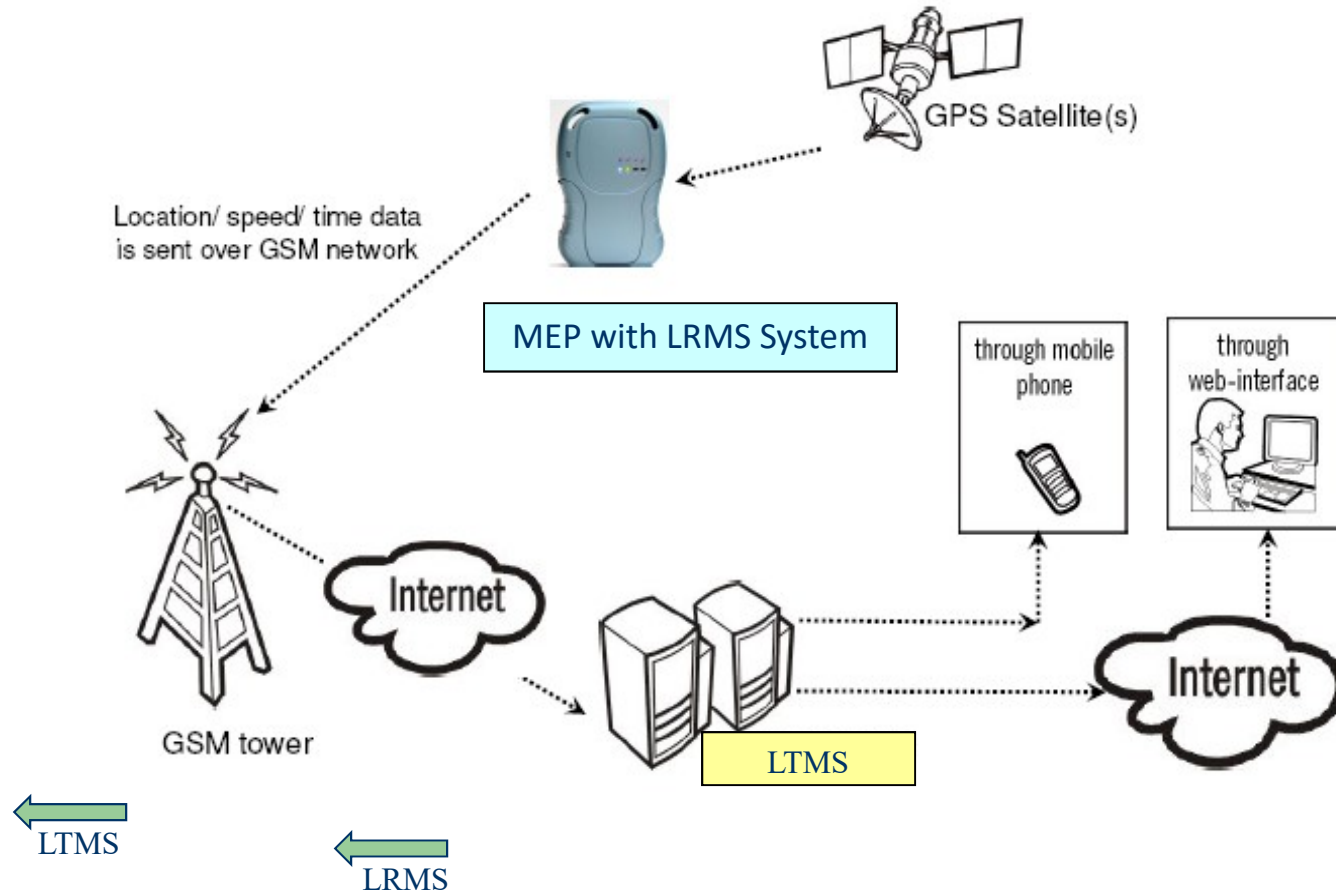
MODIFIED MEP SYSTEM

- Modified MEP system is a network oriented system connecting microprocessor based diesel electric locomotives in the field with centralized server based management system through CDMA/GSM network communication & GPS.
- It mainly consists of LTMS (Locomotive & Train Management system) and LRMS (Locomotive Remote Monitoring System).
- LTMS is a centralized server hosted on the Internet for Indian Railways and is 24 hours 7 days service provider accessed via static IP address.

MODIFIED MEP SYSTEM

- It generates reports like health status, fault status, data pack, event recorder data, life time counters data & other information related to running of locomotives.
- LRMS is a rugged, on board, embedded system mounted in the locomotive and communicates with LTMS through CDMA and GSM network
- This data is used for various applications as per user requirements which Integrates with locomotive computer and GPS receiver to receive appropriate data from locomotive computer.

Block Diagram of System



MOUNTING POSITION OF MEP WITH LRMS AND GPS



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← PS

← BDS

TYPES OF LOCOMOTIVE DATA

Locomotive Data:

LRMS shall interface with the Microprocessor Based Locomotive Control System to receive the following types of data at the specified frequency.

- Locomotive Health Data – once every 10 to 30 minutes
- Fault Data with data packs – as and when faults occur

TYPES OF LOCOMOTIVE DATA

Locomotive Health Data-

It shall be transferred from microprocessor system to LRMS every 10 to 30 minutes. Each data packet shall consist of the following parameters -

- Notch position of Master Controller
- Speed of the locomotive in kmph
- Locomotive GPS position Co-ordinates
- Date and Time Stamps
- Engine Lube Oil Pressure in kg/cm²

TYPES OF LOCOMOTIVE DATA

- Engine Fuel Oil Pressure in kg/cm^2
- Engine Booster Air Pressure in kg/cm^2
- Engine Temperature in $^{\circ}\text{C}$
- Main Reservoir Pressure in kg/cm^2
- Battery Voltage
- Brake Pipe Pressure in kg/cm^2
- Battery charging/discharging Current

TYPES OF LOCOMOTIVE DATA

- Traction Alternator output Voltage
- Traction Alternator output Current
- Power Ground Leakage Current
- Lube Oil Temperature
- Cooling water Temperature
- VCD Application – whether or not VCD applied since last data packet

TYPES OF LOCOMOTIVE DATA

Fault Data with data packets-

It shall be transferred from the Microprocessor Based Control System to the LRMS as and when a new fault occurs. This information shall consist of date / time stamp, Fault code, Fault description, and Fault data packs for three seconds before the fault and five seconds after the fault.

Analysis of Failures of Pune and Kalyan Shed Locomotives

S No	Details	Failure of Kalyan Shed		Failure of Pune Shed		Total	
		Total	May be prevented	Total	May be prevented	Total	May be prevented
1	Power pack assembly	1	-	3	-	4	-
2	Lube oil system		-		-		-
3	Turbo & after cooler system	2	-	4	-	6	-
4	Fuel oil & Injection system	7	2	4	1	11	3
5	Lube oil system	1	1	6	2	7	3
6	Water system	9	2	3	1	12	3
7	Air system	6	2	8	2	14	4
8	Under truck			4		4	
9	RTTM , FTTM, MCBG	-	-	7	1	7	1
10	Electrical Control	9	2	23	2	32	4
11	Others	7		5		12	
TOTAL		42	09	67	09	109	18

Detail of Locomotives Analysed

S No	Loco No	Shed Name	Loco Type	Location	Last Reported Time	Speed (Kmph)	Status	Fault Name	24hrs Faults
1	14974	KZJ	WDG3A	WANI	8/7/2010 21:55	0	Stop	EXPR Circuit Open Fault Recovered	0
2	13602	GY	WDG3A	BANASANDRA	8/7/2010 21:48	75	Running	APU Engine shutdown unexpectedly	0
3	13599	GY	WDG3A	MANMAD	8/7/2010 21:59	0	Stop	Battery Charging Current Sensor Fault Manual RESET	3
4	13594	UDL	WDG3A	GUMADA	8/7/2010 21:47	57	Running	HLD Input Channel (3-4) Stuck at High Fault Recovered	0
5	13593	R	WDG3A	JEYPORE	8/7/2010 21:41	6	Running	P2 Stuck Closed Fault Recovered	0
6	13583	GY	WDG3A	BHUSAWAL	5/7/2010 18:21	0	No Signal	Low Water Level Fault Recovered	0
7	13512	KGM	WDG3A	CHIKKABANA VAR	8/7/2010 21:50	0	Stop	Invalid Notch Command Running at IDLE/Notch1	0
8	13040	PA	WDG3A	PUNE	8/7/2010 21:45	0	Stop	P1 Stuck Closed Fault Recovered	0
9	13037	KGM	WDG3A	NIDVANDA	8/7/2010 21:41	89	Running	Invalid Notch Command Running at IDLE/Notch1	1
10	11310	ET	WDM3D	ITARSI	8/7/2010 19:26	0	No Signal	Low Water Level	5
11	11307	ET	WDM3D	MANIKPUR	8/7/2010 21:42	0	Stop	FSC24 Auxiliary contactor Circuit open fault Recovered	0
12	11247	HWH	WDM3D	LILUAH	8/7/2010 20:49	0	No Data	P32 Stuck Closed Fault Recovered	10
13	11246	HWH	WDM3D	MUNGER	8/7/2010 20:48	0	No Data	P32 Auxiliary Contact circuit Open Run Auto/Manual Tests	0
14	11160	LKO	WDM3D	UTRAHTIA	8/7/2010 21:31	21	No Data	EXPR Circuit Open Fault Recovered	0

DATA ANALYSIS OF DIFFERENT LOCOMOTIVES

➤ **LOCO No. 13037 (Lube Oil Pressure) →**

- Oil pressure of this loco is continuously dropping below the prescribed limit of 1.8 kg/cm² at 80°C of water temperature.
- In this loco lube oil is dropped up to 1.60 kg/cm², even though water temp is only 66°C.
- If loco is allowed to work in same condition for long period, water temp will go up to 80°C to 90 °C, lube oil pressure will further drop and loco will shut down as oil pressure switch will operate

DATA ANALYSIS OF DIFFERENT LOCOMOTIVES

➤ **LOCO No. 13512 (Fuel Oil Pressure)** →

- Fuel oil pressure of loco is continuously dropping below the prescribed limit of 3.2 kg/cm² on 8th notch.
- In this loco Fuel oil is dropped up to 2.10 kg/cm², It indicates that some problem have started in fuel oil system of loco e.g choking of filter or leakages of fuel oil.
- If loco is allowed to work in same condition fuel oil pressure will further drop resulting in less horsepower of loco due to less fuel supply to combustion chamber

DATA ANALYSIS OF DIFFERENT LOCOMOTIVES

➤ **LOCO No. 13599 (Brake Pipe Pressure) →**

- Brake pipe pressure is continuously less than the prescribed limit of 5.0 kg/cm² in this loco.
- It indicated that there is some leakage in the system or setting has been disturbed which will further result in loco failure in section.
- If Loco is not attended and allowed to work in same condition there will be brake binding in train due to disturbance in brake pipe pressure.

DATA ANALYSIS OF DIFFERENT LOCOMOTIVES

➤ **LOCO No. 11247 (Brake Pipe Pressure)** →

In this locomotive brake pipe pressure is more than prescribed limit, which indicates settings have been disturbed and needs immediate attention.

DATA ANALYSIS OF DIFFERENT LOCOMOTIVES

➤ **LOCO No. 13602 (Main Reservoir Pressure) →**

- Main Reservoir pressure of this loco is continuously more than the prescribed limit of 8-10 kg/cm² in loco No 13602. if this loco is allowed to work in same condition, there will be adverse effect on compressor and it may fail due to over loading.

➤ **DAILY SUMMARY OF LOCO →**

OK L F

CONCLUSION AND RECOMMENDATIONS

- MEP system with GPS is very helpful for monitoring the health of the loco when loco is working on line.
- In case of some failures prior indications are available
- The parent shed shall monitor the health of the locomotive, once or twice daily.
- This may result in prevention of some of the failure on line.

CONCLUSION AND RECOMMENDATIONS

- The home shed either can intimate the near by shed or power controller where loco having some defect is working, to take preventive action or to remove the loco from service on first opportunity depending on the gravity of the problem.
- Presently the password to retrieve the data is available with the home shed only for their own loco. Thus the near by shed where the loco is working will not be able to analyse the problem.

CONCLUSION AND RECOMMENDATIONS

- Thus it is recommended to provide the password to all sheds to enable them to check the health of the loco operating in their territory before arrival of same in shed, so that preventive measures can be taken.
- If lube oil level in sump and water level in extension tanks are also available, it will help to take proper preventive action on line
- ALF and Power control shall be advised to fill the prescribed format of loco fitted with MEP and REMMLOT.

THANK YOU

