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सत्यमेव जयते

Ministry of Railways
भारतसरकार–रेलमंत्रालय
Research Designs & Standards Organisation
अनुसंधानअभिकल्पऔरमानकसंगठन
LUCKNOW – 226011
लखनऊ–226 011

No. STS/L/SSI

Dated 09.05.2012

1.	AM/Signal, Railway Board, New Delhi
2.	**The CSTE, CSTE/Const., &CSTE/Project**
(i)	Central Rly., Mumbai, CST – 400001
(ii)	Western Rly, Churchgate, Mumbai – 400020
(iii)	Eastern Rly., Fairlie Place, Kolkata 700001
(iv)	South Eastern Rly., Garden Reach, Kolkata
(v)	Northern Rly. Baroda House, New Delhi- 110001
(vi)	North Eastern Rly., Gorakhpur- 273012
(vii)	North East Frontier Rly., Maligaon, Guwahati
(viii)	Southern Rly. Park Town, Chennai – 600003
(ix)	South Central Rly., Secunderabad – 500371
(x)	East Central Railway, Hajipur
(xi)	East Coast Railway, Rail Vihar BDA Rental Colony, Chandrasekharpur, Bhubneshwar
(xii)	North Central Railway, Ganga Complex, Subedarganj, Allahabad.
(xiii)	North Western Railway, Jaipur – 300206
(xiv)	S.W. Railway, New Zonal HQs office, 1st Floor, West Block, Gadag Road, Hubli – 20.
(xv)	West Central Railway, OSD Office, Jabalpur
(xvi)	South East Central Railway, R.E. Office Complex, Bilaspur – 495004
3.	Secretary/S&T (RE), Railway Board, Rail Bhawan, New Delhi.
4.	The CSTE, Metro Railway, 23-A, Jawaharlal Nehru Road, Kolkata – 700071
5.	The CSTE, CORE, Nawab Yusuf Ali Road, Civil Lines, Allahabad
6.	The CSTE, Konkan Railway Corpn. Ltd., BelapurBhavan, Sector-II, CBD, Belapur, New Mumbai – 400614.
7.	The General Manager/S&T, IRCON, PalikaBhavan, Sector XIII, R.K. Puram, New Delhi – 66
8.	The General Manger/S&T, RITES Ltd., RITES BHAWAN, 5th Floor, Plot No. 1, Sector 29, Gurgaon – 122 001.
9.	The Director, IRISET, Tarnaka Road, Lallaguda (P.O.), Secunderabad-500 017
10.	The Principal, Railway Staff Colleger, Vadodara
11.	CAO/IRPMU IRCOT Building, Behind Shanker Market, New Delhi.
12.	ED/QA/S&T/RDSO/LKO

Sub: Document on Electronic Interlocking Systems.

Please find attached the brief document for Electronic Interlocking systems covering system description, maintenance checklists, troubleshooting guide and Do's & Don'ts for following Electronic Interlocking systems:-

1. Microlock-II (ASTS)
2. WESTRACE (Invensys)
3. VHLC (GE)
4. MEI 633 (Medha)

This may kindly be implemented in the field and Railways are requested to provide their comments after implementation and by experience gained, so that the attached document can further be improved by RDSO.

9/5/12

(Alok Katiyar)
Director/Signal-III
for Director General/Signal

Encl : As above

ELECTRONIC INTERLOCKING

1. SYSTEM DESCRIPTION
2. MAINTENANCE CHECKLIST
3. TROUBLESHOTING GUIDE
4. DOs AND DONTs

ELECTRONIC INTERLOCKINGS COVERED

1. MICROLOCK-II (ASTS)
2. WESTRACE (INVENSYS)
3. VHLC (GE)
4. MEI 633 (MEDHA)

SIGNALLING DIRECTORATE
RDSO LUCKNOW

Government of India - Ministry of Railways
Research Designs and Standards Organisation

Preface

Electronic Interlocking is the latest development in the field of interlocking of signaling gears on railways. EI is microprocessor based system having fault tolerant and fail safety techniques. It has found acceptance long back in all advance countries of Europe, Australia, Japan, USA, Germany & France and now in other countries of world like China, Malaysia, Korea, Hong Kong etc.

Till date over Indian Railways, the equipments developed and proven in advance countries were imported for Indian Railways, however after successful trials one indigenous firm has also been approved by RDSO for Electronic Interlocking. Other firms who have initially been importing the equipment has also gone for indigenisation of their products and two firms have already completed this process.

The approval of software embedded safety systems is mainly governed by "Procedure of cross acceptance for software embedded signaling system issued by Railway Board and RDSO Specification. The specification of Electronic Interlocking was first developed in year 1998 (SPN 148/98) and subsequently it became IRS in year 2004 (IRS : S : 102/2004). Since EI was still in nascent stage in IR, it was decided to change specification again to RDSO/SPN. **The latest specification is SPN 192/2005.**

The safety is most important feature of all the signaling equipments, the same has been adequately taken care off in the design of Electronic Interlocking in all over the world. To have such a system which could be put in use across the world, European Committee for electro-mechanical standardization (CENELEC) has issued few specifications for train related systems.
The following three specifications are mostly applicable in safe running of trains:-

SNO.	CENELEC STDS.	DESCRIPTION
1.	EN 50126	Railway applications: the specification and demonstration of reliability, availability, maintainability and safety.
2.	EN 50128	Railway applications: The communications, signaling and processing systems. Software for railway control and protection systems.
3.	EN 50129	Railway applications: Communication, signaling and processing systems. Safety related electronic system for signaling.

TABLE 1

Since, Electronic Interlocking deals with the running of trains involving lives of human beings, it has to be of highest safety level i.e. SIL4 compliant as per CENELEC standards. The same is also required for EIs to be supplied over Indian Railways.

Electronic Interlocking offers many advantages over Panel/RRI, it is easy to install and commission, Modifications in Yard can easily be configured and the system provides easier operation facility by means of Video Display Units for Station Masters. Additionally advanced features like blocking of signals, track circuits, points etc. for safety functions can also be built in to Electronic Interlocking.

ADVANTAGES OF ELECTRONIC INTERLOCKING

- Easy in Installation and Maintenance.
- Any yard layout changes can be carried out with minimum disruption to traffic with minimum NI period.
- Simpler and Fast Operation by means of Computer Based Video Display Units.
- Reduction in Cable requirement when EI is used with Object Controllers.
- Self-event Logging available for analysis of failures as well as of Incidences/Accidents.
- High Reliability due to redundancy in system design
- Exhaustive diagnostic, fault logging and maintenance facilities
- Facility of NMS (network management system) for remote diagnostics
- Provision of direct connectivity for Centralised Traffic Control & Traffic Management Systems in future.
- Easily scalable to TPWS and ETCS for Future.

In Indian Railways, in specification of Electronic Interlocking, different system architectures are given which are accepted and can be supplied to Indian Railways. The relevant clause is reproduced below:-

System Architecture:

One of the following architectures shall be employed in the system as per existing EI specification i.e. RDSO/SPN/192/2005:

(a) Single Hardware architecture with diverse software. In addition, hot/ warm standby processor(s) /system shall be provided with facility of automatic changeover.

In case of Warm standby system, the standby system should start functioning with a time delay of approximately 120 secs. of failure of main system. Preferably, the train operation shall not be affected or otherwise, there shall be no unsafe occurrence due to switching over from main system to standby system.

In case of hot standby system, train operation shall not be affected. It should also be ensured that the fault, which affected the main processor/ system, does not affect the hot standby processor/ system.

(b) Two out of two hardware architecture with identical hardware and identical or diverse software. In addition, warm standby/ hot standby processor(s) / system using similar 2 out of 2 hardware and software architecture shall be provided with facility of automatic changeover.

In case of Warm standby system, the standby system should start functioning with a time delay of approximately 120 secs. Of failure of the main system. Preferably, the train operation shall not be affected or otherwise, there shall be no unsafe occurrence due to switching over from main system to standby system.

In case of hot standby system, train operation shall not be affected. It should also be ensured that the fault, which affected the main processor/ system, does not affect the hot standby processor/ system.

(c) Two out of three hardware architecture with identical hardware and identical or diverse software.

From the clause given above, it can be seen that the different architectures of Electronic Interlocking work on principle of having either diverse hardware or diverse software or both.

MICROLOK-II DESCRIPTION, MAINTENANCE CHECK LIST, TROUBLE SHOOTING AND DOS AND DONTS

CPS	Conditional Power Supply
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
EEPROM	Electrically Erasable Programmable Read – Only Memory
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EN	European Norm
EPROM	Electrically Programmable Read-Only Memory
FMEA	Failure Mode and Effects Analysis
Hz	Hertz
IEC	International Electro technical Commission
I/O	Input / Output
ISO	International Standards Organization
SIL	Safety Integrity Level
VIB	Vital Input Board
VOB	Vital Output Board
NVIO	Non-Vital I/O Board

1. INTRODUCTION

This manual provides the brief description about MICROLOK-II and its supporting hardware.

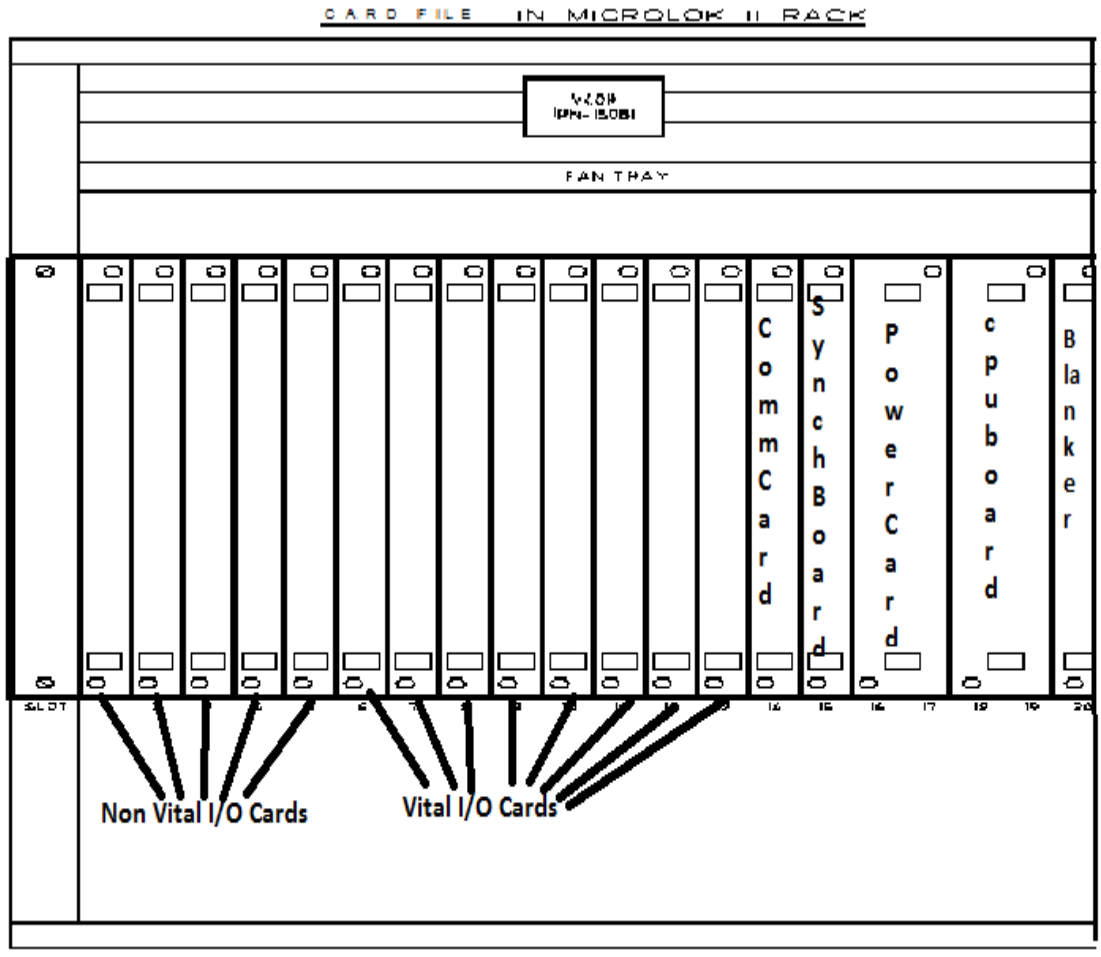
MICROLOK-II

The basic Microlok-II consists of following hardware namely:

a. Card file & VCOR Relay
b. CPU PCB
c. Power Supply PCB
d. Vital Output PCB
e. Vital Input PCB
f. Non-Vital I/O PCB &

The functions of each item are explained below:

a. CARD FILE & VCOR Relay



Each card file consists of 20 slots to house the PCBs along with motherboard. Out of 20 slots, 2 slots (18,19) will be used for CPU, 2 slots (16,17) will be used for Power Supply PCB, and balance 16 will be used for I/O boards. Test point to measure the

+12V, -12V & 5V of the system voltages are provided on the backside of the card file in motherboard.

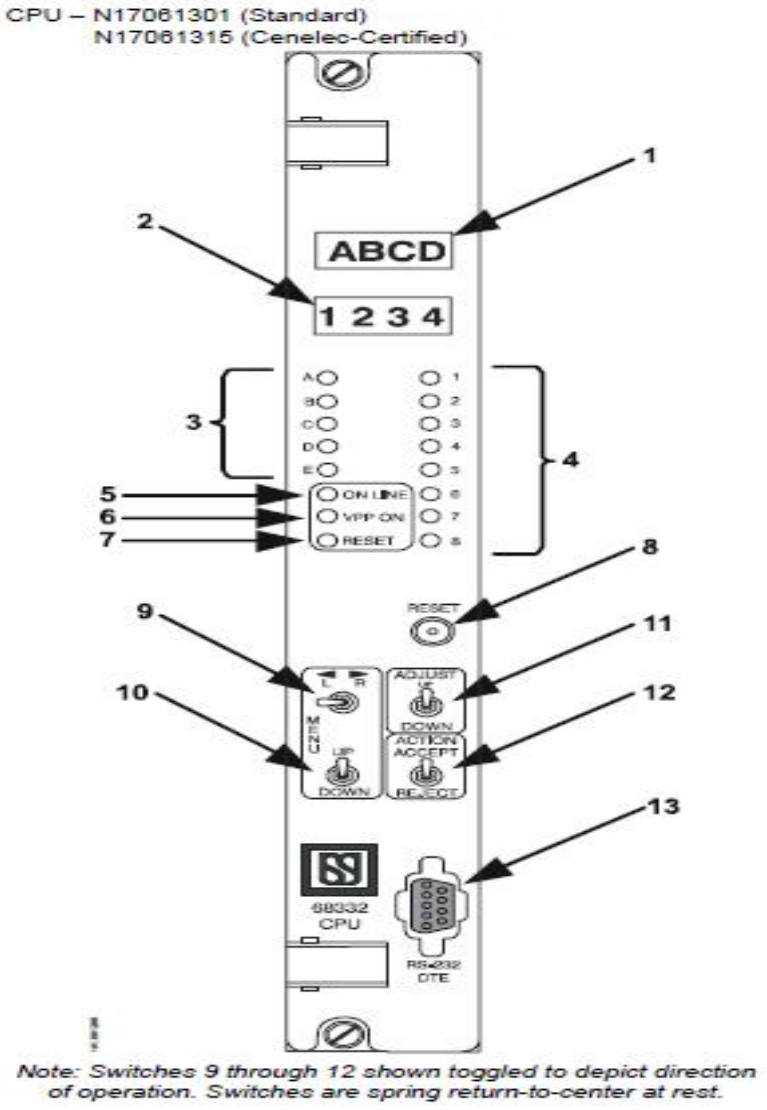
VCOR Relay

- Each system connected to one VCOR relay to ensure the healthy status of system.
- CPU PCB through Power Supply PCB controls the VCOR relay.
- The nominal voltage of VCOR is 12 V and is having 6F/B contacts.

The power to the vital output boards is extended through VCOR relay to ensure safe working of system.

b. <u>CPU PCB</u>

- Each card file will have one CPU PCB and it will be placed in slot 18 & 19 of card file.



Note: Switches 9 through 12 shown toggled to depict direction of operation. Switches are spring return-to-center at rest.

REF FIGURE 2-1	LABEL	DEVICE	PURPOSE
1, 2	(None)	Two, four-character alphanumeric displays. Top display is Red Bottom display is Green	On-site configuration programming menus and options. Normal operating display is: • The upper four character display will continuously scroll the phrase "US&S MICROLOK" • The lower four character display will continuously scroll the application name.
3	A, B, C, D, E	LEDs (Yellow)	Select serial port with CPU front panel switches (0, 10, 11 & 12) via the on-line serial test menu (See Section 14.5) A – Selected serial link is transmitting data. B – Selected serial link has received a valid message. C – Selected serial link has recognized the address in a received message. D – Selected serial link is receiving a DCD signal. E – Selected serial link has detected a receiver error.
4	1, 2, 3, 4, 5, 6, 7, 8	LEDs (Red)	User-defined in application software.
5	ON LINE	LED (Green)	Lit indicates normal system operation (successful diagnostics). If out: reset system.
5	VPP ON (Voltage input Flash programming)	LED (Yellow)	When lit indicates FLASH +5V or _12V programming voltage enabled (via CPU PCB jumper). Lit only during programming on CPUs without PCMCIA card installed. Lit continually on CPUs with PCMCIA card installed.
REF FIGURE 2-1	**LABEL**	**DEVICE**	**PURPOSE**
7	RESET	LED (Red)	When lit indicates that the system is in reset mode. Normal operation = Off

8	RESET	Momentary push button	When pressed, resets the CPU. Also used to place the CPU in the reset mode.
9	MENU L/R	Three-position (spring retrun-to-center) toggle switch	Used to search main program menu items shown on displays.
10	MENU UP/DOWN	Three-position (spring retrun-to-center) toggle switch	Used to select main program menu items shown on displays.
11	ADJUST UP/DOWN	Three-position (spring retrun-to-center) toggle switch	Used to cycle through configuration values shown on displays.
12	ACTION ACCEPT/REJECT	Three-position (spring retrun-to-center) toggle switch	Executes or cancels menu items sown on displays.
13	RS-232 DTE Diagnostic Link Connector	DB9, RS-232 connector (DTE)	Used for connection to PC laptop computer for system monitoring/diagnosis.

c. **POWER SUPPLY PCB**

- Each card file will have one Power Supply PCB and it will be placed in slot 16 & 17 of card file.
- The power supply PCB is basically a DC-DC converter that converts the input of 12V card file supply provided externally to +12V, -12V & 5V supply as required by the system internally.
- The power supply board drives the VCOR relay, based on the 250 Hz signal received from CPU, which ensures the healthy status of the system.

d. **VITAL OUTPUT PCB**

c. POWER SUPPLY PCB

- Each card file will have one Power Supply PCB and it will be placed in slot 16 & 17 of card file.
- The power supply PCB is basically a DC-DC converter that converts the input of 12 V card file supply provided externally to +12V, -12V & 5V supply as required by the system internally.
- The power supply board drives the VCOR relay, based on the 250 HZ signal received from CPU, which ensures the healthy status of the system.

d. VITAL OUTPUT PCB

- Each vital output PCB consists of 16 outputs to drive the output relays as defined in an application program.

- The 24V supply to Vital Output PCB is given through VCOR relay front contact and in case of any problem the VCOR relay will drop and cut the supply to output PCB.
- Normally the output PCB is connected to final output relays, which drives the field gears such as DR, HR, WNR, WRR, etc.

e. VITAL INPUT PCB

- Each vital input PCB consists of 16 inputs to detect the field status of outdoor gears.
- Normally the input PCBs is connected to detect the field gears condition such as TPR, ECPR, NWKR, RWKR, etc.

f. **NON-VITAL I/O PCB**

- Each non-vital I/O PCB consists of 32 inputs and 32 outputs to receive the command from control panel and to drive the indications on the control panel respectively.
- Normally the non-vital PCB is connected to Control cum indication panel only.

Maintenance Check List for MLK-II EI for Signal Maintainer
Periodicity – Once Every Month

To be performed by Maintainer once in a Month

Division:	Station:	No. of Microloks:	Date commissioned:

1 Measuring voltage – (Performed by Signal Maintainer)

Sl. No	Date	12 V DC MLK II Card File Supply		24 V DC MLK II & I/O Supply		Observation	Signature
		At IPS (14.5 to 16 V)	At MLK II Rack *(13.5V to 15.5V)*	At IPS (26 to 28V)	At MLK II & Relay Racks *(25V to 27V)*		
1							

2 Fuse checking

Sl. No	Date	MLK II Card File Supply Fuses (12V DC)	MLK II I/O Supply Fuses (24V DC) (Vital Output, Vital Input & NV I/O Board)	Switching Circuit Fuses	Panel supply Fuses	Converter Cum Isolator Fuses	Observation	Signature
		MLK II Racks	MLK II & Relay Racks	MLK II Rack	Relay Rack	MLK II Rack		
1								

3 Potential voltage between positive and negative with respect to Ground

Sl. No	Date	110V DC side	24V DC/DC Converter side	12V DC/DC Converter side	Observation	Signature
Ideal value should be Zero.						
1 (Positive)						
2 (Negative)						

4 Visual inspections

Sl. No	Date	DC/DC converter FAN	Microlok II Fan tray	Synchronization of MLKII clock time A & B	Check whether all the wirings in the terminals are securely tightened	Observation	Signature
1							

5 System changeover

Sl. No	Date	System changeover		Observation	Signature
		A TO B	**B TO A**		
1					

6 Verification of Log Register

Sl. No.	Verifying Document	Observation		Signature
		YES	NO	
1	User Data Log Folder			
2	Event Data Log Folder			
3	Error Data Log Folder			
4	Failure Register			

Maintenance Check List for MLK-II EI for Signal Supervisor
To be performed by SE/SSE every Quarter

Division:	Station:	No. of Microloks:	Date commissioned:

Sl No.	ACTIONS/OBSERVATIONS	OK/YES	NOT OK/NO	REMARKS
		✓	X	

VISUAL CHECK

1	Check whether Transorbs 5KP30A/Diode is provided across the card file fan supply			
2	Check whether the card file fans are fed from External 24V			
3	Check whether there is no 230V AC electrical connections such as light or bulb connection is taken through EI ladder			
4	Check that there is no voltage potential between "Positive to Earth" and "Negative to Earth" [12V Card file, 24V I/O, 24V/12V Panel]. In case if potential is found that source of leak shall be identified and removed.			

ISOLATION

1	Check whether EI ladder (i.e. used for MLK II and Relay Rack wiring) is totally isolated from CT Rack, Data logger & walls			
2	Check whether MLK II Racks, Relay Racks & Termination Racks are isolated from floors & walls			
3	Check whether DC-DC convertors are isolated from MLK Rack & not connected to earth			
4	Check whether MLK signal ground (A32, E22 & C18) is isolated from earth ground			
5	Check whether spare cores of serial communication cables are connected to signal ground at both ends & are isolated from earth			
6	Check whether 230V power cable is isolated from MLK II area			
7	Check whether converter cum isolators/isolators provided for the serial communication are not bypassed			

SURGE PROTECTION DEVICE

1	Check whether Transzorbs 5KP16A/6KZ16A/Diode is provided for MLK II card file supply			
2	Check whether 110V/24V/12V OBO surge suppressor is provided			
3	Check whether 230V OBO surge arrester is provided for 230V AC Maintenance/Operator PC's			
4	Ensure that for Converter/Isolator, if a shielded twisted pair cable is used, then shield should be connected to protective ground at one end only			
5	Check whether "Class B & C" surge protections are provided wherever IPS supply is not available			

MAINTENANCE ACTIVITY

1	Ensure there is no dust in MLK II Rack, Operator VDU, Maintenance PC and any other equipment such as Data Logger, IPS etc., clean all items using vacuum cleaner carefully. Check after cleaning for loose connection and tighten connections.			
2	Check card file cooling fans are properly working & also check for its direction of air flow (i.e., away from card file)			
3	Check that cooling fan of DC-DC converters are working properly			
4	Check that both Input & Output LED indication in DC-DC converter			
5	Check that there is no failure indication for the communication link (fiber cut/ modem/server/switching device failure)			
6	Measure the voltages of MLK II card file, I/O & Panel, 110AC, 24V EXT and 110V Point supplies DC-DC converters (MLK – 12V) – Range: 13.5V – 15.5V DC-DC converters (MLK – 24V) – Range: 25V - 27V			
7	Check all the fuses visually for its proper working			
8	Ensure Back-up of MLK II system logs (event, error & data logs) are taken on regular basis			
9	Ensure that EI room is well protected			
10	Check the EI time synchronisation with Data Logger Clock.			

MAINTENANCE ACTIVITY

2	Ensure that all the DC-DC converters are working			

	properly in the "n+1" configuration			
3	Check the healthiness of the change over system by make it "ON LINE" from "OFF LINE" (i.e., system "A" "B" or system "B" "A")			
4	Switch ON the OFFF LINE system in diagnostic mode and enable the CPS CLEAR mode if required			

MISCELLANEOUS

1	Verify whether spare fuses/terminals of all types are readily available at site			
2	Check whether Operator VDU, Maintenance PC and Data Logger are working fine, Check the correctness of Data being Received By Data Logger.			
3	Check whether communication between MLK and "Maintenance and Operator PC's is proper			
4	Check whether the "LATEST APPLICATION. Program's CRC, CHECKSUM, INSTALLATION ADDRESS, EXECUTIVE VERSION, APPL. VERSION" are available in the MPC			
5	Ensure that both operator VDU & Maintenance PC are provided with latest "ANTI VIRUS software"			
6	Check whether the all display boards related MLK II system are provided in the EI room			
7	Check whether the "Maintenance Register" is properly maintained.			
8	Minimum tools required at site for the proper maintenance of Microlok II system (i.e., Crimping tool 48/96 Pin, Insertion tool 48/96 Pin, Removal tool 48/96 Pin, Locator tool 48/96 Pin, Digital multimeter, Earth Meggering meter, Screw drivers, spanners, etc. And Optical power meter, OTDR meter for OFC, if applicable)			
9	Check The EI clock and synchronize with data logger clock.			

EARTHING (Measurements to be done yearly)

1	Verify that all earth pits are visible and measure the ring earth resistance as per the maintenance schedule (Earth measurements once a year). Earth Resistance shall be less than 1 ohm.			
2	Check whether MLK front and back doors are earthed or not			
3	Check whether shields of all communication cables are properly connected to earth ground at one end only, if not then connect properly.			
4	Check whether proper earth connection is provided for Data logger, if not then connect properly.			
5	Check whether surge suppressors (110V, 12V, 24V & 230V) used are connected to the respective REB & protective fitting, if not then connect properly.			
6	Check whether 230V OBO surge arrester is connected to the respective REB & protective fitting, if not then connect properly.			
7	Check whether painted surface are scraped to the clean metal surface where grounding connections are to be made, if not then connect properly.			
8	Check whether the earth connection between REB and the racks earth point are as short and there is no bend or any loose in the earth wire (Green) , if not then connect properly.			
9	Check that Armoured Cables used for Control Panel are Connected to REB, if not then connect properly.			
10	Check whether all joints are being mechanically and electrically effective (Example. clamped, screwed, bolted, riveted or welded) , if not then connect properly.			
11	Check that there are no loose connections in any of the earthing terminations; if not then tighten all connections properly.			
12	Check that there is no damage to earth wire			
13	Earth pits are wetted on regular basis (This is applicable only to non maintenance free earth pit sites)			

Trouble Shooting Guide for MLK-II Electronic Interlocking

FAILURE TYPE/MESSAGE	CAUSE/ANALYSIS	REMEDY/ACTION
SYSTEM RESET		
OUTPUT BOARD OUT16 Hardware error, Board J " x", Monitor "y" (or) OUT16 Output error, Board J "x", Output "y"	NOTE :- "x" indicates board number & "y" indicates bit number	
Output Read Failure	False feed before the diode terminal in bit "y" of the output board "x"	Isolated false feed at the identified bit
Output Monitor OFF Failure Output Monitor ON Failure Output Read Failure	Noise in the Microlok II I/O 24V DC Supply which may be due to sudden trip of 24V DC	1. Check/Replace the 24V DC fuse of the identified board 2. Check/Replace 24V DC-DC converter module 3. Check/Replace the 48 pin connector cable 4. Replace the faulty board
Output Flip Failure	Noise in the Microlok II Cardfile 12V DC Supply which may be due to variation in the 12V DC	1. Check/Replace 12V DC-DC Converter module.
	Noise in the Microlok II I/O 24V DC Supply	1. Check/Replace 24V DC-DC Converter module. 2. Check/Replace the 24V DC fuse of the identified board. 3. Isolate Output from the Relay 4. Check/Replace the diode terminal of the identified bit. 5. Check/Replace the transzorb across the Left & Right coils in the twin relay of the identified bit 6. Check/Replace the 48 pin connector cable 7. Replace the faulty board

Output Monitor OFF Failure Output Flip Failure	24V circuit is shorted in the output board	1. Disable the identified board 2. Switch ON the system 3. If the error shifts to the next board, disable all the output boards in the cardfile and remove them from the slot 4. If VCOR picks up, then 5. Switch OFF the system 6. Label the removed output boards 7. Insert the first labeled output board in the first slot 8. Enable the first output board slot and switch ON the system If the VCOR is NOT picking up, separate that output board with proper tags If the VCOR picks up, insert the next labeled output board in the first slot and repeat this cycle till isolating the faulty output board/s 9. Enable all the output board slots after replacing the faulty output board/s 10. If the problem persist Contact ASTS staff
OUTPUT BOARD OUT 16 Type error, Board J "x" (or) OUT 16 Echo error, Board J "x"	Identify the FAULTY ……. BOARD J "x" in the event/error log information using Maintenance Tool Disable the identified board	1. Ensure correct Jumper settings in the Address select PCB 2. Ensure locking of all crimps in the Address select PCB 3. Check/Replace the Address select PCB
INPUT BOARD IN 16 Type error, Board J "x" (or) IN 16 Echo error, Board J "x"		
NON-VITAL I/O BOARD NVIN32OUT32 Type error, Board J "x" (or) NVIN32OUT32 Echo error, Board J "x"		
Reset Bit set by application logic		
Vital serial link failed (i.e. VSL COM OK bit clear)	Dis connection in CPU 48 pin connector assembly	Ensure all the crimps are locked
	Disconnection in Microlok II rack serial communication terminals	Tighten the terminals
	Serial port failure	Replace the CPU board

FCOR bit set by application logic	False feed at output relay coil	Isolated false feed at the identified bit
System reset without any event/error log information	System power 12V DC is low	Increase Microlok II Cardfile source voltage as specified
	No power at Power supply board	1. Check/Replace the fuse of the MLK II 12 V DC 2. Ensure locking of all crimps in the power supply board 48 pin connector assembly and the terminals between power source and power supply board 3. Replace Power Supply board 4. Replace 12V DC module
VCOR failed	System Reset or failed	1. Ensure proper connection at VCOR relay coil 2. Ensure locking of all crimps in the 48 pin connector at CPU board and power supply board including power supply board 250Hz wire connection 3. Ensure Output board 24V DC fuse & wiring are OK 4. Ensure that the diagnostic switch is in OFF position, if used
CPS down mode (or) NO VCOR LED indication in the Power Supply board	Microlok II in sleep mode, attempted a minimum of five times to pick up VCOR and failed	Refer "CPS CLEAR FUNCTION" details
System Reset-Watchdog Hit without Critical Error	Glitch or Internal board error	1. If it happens once in an isolated situation, there is NO cause of concern 2. If it happens in regular interval, replace the CPU board
RAM error	CPU Data Corrupted	Replaced CPU board
Logic queue overflow error	Trigger list overflow (Either the MAKE or BREAK trigger is full and another equation cannot be queued) as this error will occur when too many statements are triggered for execution at once	1. Increase the logic timeout (maximum upto 5 seconds) using system configuration mode in the maintenance tool 2. Correction required in the application logic program, Contact ASTS staff
System Timer Watchdog Timeout- Idle Loop	Continuous processing of one particular statement due to incorrect application logic program	Correction required in the application logic program, Contact ASTS staff

System Timer Watchdog Timeout-Logic Processing	Program settings are NOT sufficient to complete the logic processing	Increase the logic timeout (maximum upto 5 seconds) using system configuration mode in the Maintenance tool. Contact ASTS staff
SYSTEM KILL		
Kill Bit set by application logic	Uploading of New application program in the CPU	Refer "CLEAR KILL CONDITION" details

GENERAL		
System configuration mode failed	System settings could not be changed through Maintenance Tool	1. Ensure locking of all crimps in EEPROM PCB 2. Replace EEPROM PCB 3. Maintenance Tool is to be reinstalled.
LINK 1920 (0)	System Reset or failed	Establish communication between Microlok II and Maintenance Tool application in Maintenance PC for Event/Error log information
Diagnostic mode failed	BAD LINK seen between Microlok II and Maintenance Tool application in Maintenance PC	1. Ensure Maintenance VDU is closed before open Maintenance Tool application 2. Check Port address and Baud rate settings in the Maintenance Tool 3. Remove and reconnect 9 pin connector at both Microlok II & Maintenance PC ends 4. Close & Restart Maintenance Tool program afresh
Non-vital serial link failed (i.e. NVLOP/NVLMP COM OK bit is clear)	Disconnection in CPU 48 pin connector assembly	Ensure all the crimps are locked
	Disconnection in Microlok II rack serial communication terminals	Tighten the terminals
	Disconnection in isolator/convertor terminals between Microlok II and Operator VDU PC/Microlok II and Maintenance VDU PC	1. Tighten the connections 2. Check isolator 12V DC 3. Check/Replace isolator and converter
	Structure error due to noise in the communication	Check 12V DC converter supply at the operator VDU PC end

	Microlok II CPU board serial port failure	Replace the Microlok II CPU board
	Operator/Maintenance PC communication port failure	Replace the Operator/Maintenance PC CPU
Bit FAIL in Vital Output board Vital Input board Non-vital I/O board		1. Ensure that the board is fully finger tightened 2. Check the terminals in the entire path 3. Ensure locking of all crimps in the 48/96 pin connector 4. Replace the faulty board

DOS AND DON'TS OF MICROLOK-II

DO:

1. Tighten the boards after insertion.
2. Ensure all terminations are fully tightened.
3. Place the removed boards with a tag into a conductive shielding bag.
4. Download user data log / Event log / Error log data periodically.
5. Maintain minimum 12V DC at the card file back plane.
6. Maintain minimum 24V DC and maximum 30V DC at the Microlok-II I/O power module.
7. Ensure diagnostic switch in "NORMAL" position before starting the system.
8. Keep the Microlok-II room free from dust.

Don't:

1. Reset the system when working.
2. Remove or insert boards, VCOR relays, Fuses / Links and 48/96 pin connectors when the system is on.
3. Force boards into the slots during insertion.
4. Change jumper settings in CPU board.
5. Touch the board components.
6. Repair boards on your own.
7. Alter Microlok-II system, Maintenance PC setting without authorization.
8. Delete / Modify application program Logics without authorization.
9. Apply blower for cleaning dust.

WESTRACE EI (Invensys) Brief System Description, Maintenance Check List and DOs and DONTs

CCIP	Control Cum Indication Panel
CENELEC	European Committee for electro technical standards
CIU	Central Interlocking Unit
COM	Communication Module
COMP	Communication Processor
CRO	cathode-Ray oscilloscope
DC	Direct Current
DIP	Digital input card
DOP	Digital output card
DL	Data Logger
DMM	Digital Multimeter
DPRAM	Dual Port RAM
DVM	Digital Volt meter
EI	Electronic Interlocking
EPROM	Erasable Programmable Read Only Memory
FP	Front Panel
HW	Hardware
IO	Input &Output
IOCOM	Input &Output Communication Module
IRS	Indian Railway Standards
MT	Maintenance Terminal
OC	Object Controller
OFC	Optical Fibre Communication
PFM	Protection Filter Module
PI	Panel Interlocking
PP	Panel Processor Unit
RRI	Route Relay Interlocking
RTC	Real Time Clock
SOT	Select on Test
SIL	Safety Integrity Level
SM	Station Master
SRS	System Requirement Specification
SVP	Supervisory Processor
SW	Software
VDU	Visual Display Unit
VHM	Voltage Health Monitor
VIC	Vital Interlocking Computer
VLE	Vital Logic Emulator
VP	Vital Processor
VPIMAB	Vital Parallel Input Module Analog Board
VPIODB	Vital Parallel Input/Output Digital Board
VROMAB	Vital Relay Output Module Analog Board
WDT	Watchdog Timer
WFM	Wayside Function Module
WFP	Wayside Function Processor

WESTRACE EI – Brief System Description

1. INTRODUCTION

The WESTRACE Vital Signalling System is a modular, safety critical, programmable electronic signalling control system for Railway Signalling developed by M/s Invensys Rail. WESTRACE is the acronym for **WES**tinghouse **T**rain **R**adio **A**dvanced **C**ontrol **E**quipment.

2. SYSTEM OPERATION

In a WESTRACE Electronic Interlocking System, Signalling and remote control inputs are processed in vital modules according to the application data to generate Signalling outputs and remote control outputs. The system operation is explained with the help of block diagram. (Fig. 1).

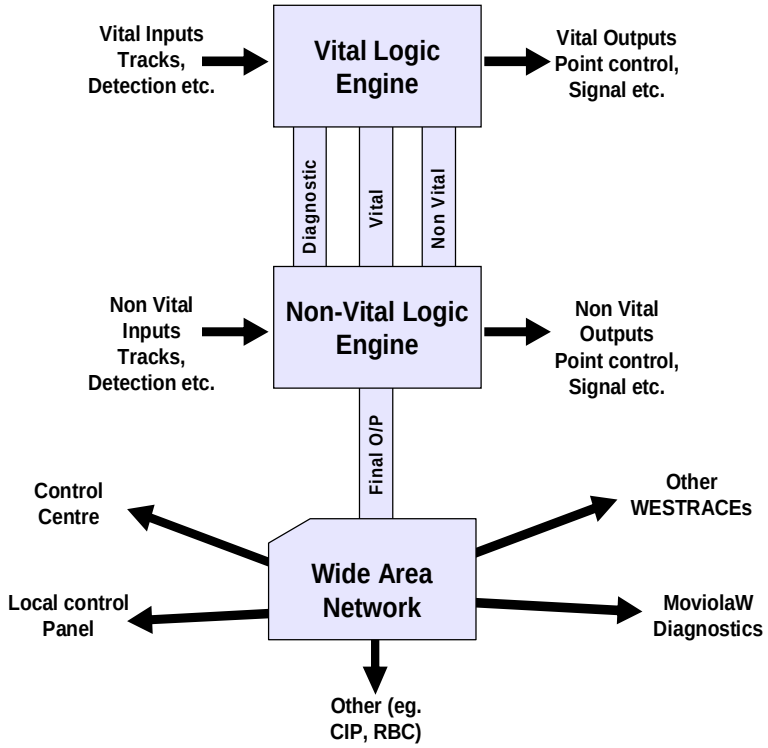


Fig.1: Block diagram for WESTRACE system operation

WESTRACE is a modular vital interlocking system and the indoor installation consists of modules, housings and racks. Various modules are installed in one or more WESTRACE housings. The system may use between one and four housings as necessary for the number of modules required. The housings are installed inside a rack and are numbered from 1 to 4 from top to bottom. Multiple housings are interconnected by special cable to extend data bus. Each housing has provision for a single power supply. The top housing contains modules for vital logic processing (Vital Logic Module or VLM), and Non-vital logic processing and diagnostics module NCDM.

3. SYSTEM POWER REQUIREMENTS

Every WESTRACE system requires a 24V DC uninterrupted power supply. This is usually taken from a float charge battery but may be taken from a AC/DC converter from a reliable source.

WESTRACE system also requires 50V DC signalling supply for powering up VPOM modules and input to VPIM modules.

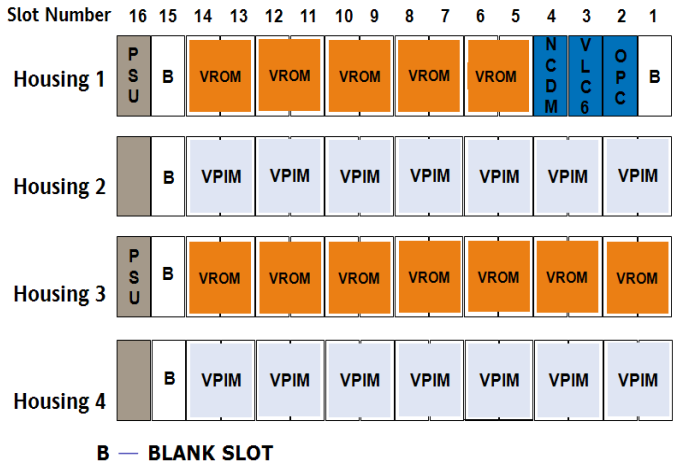


Fig. 2: Diagram for Westrace system rack from the front

Figure 2 shows the general arrangement of modules in a WESTRACE interlocking.
The position of VROM and VPIM will change depending on the yard layout, distribution of input and output and the number of modules required for a station.
The picture above shows only the slots available for VROM and VPIM.
The slots are fixed for VLC6, OPC, NCDM and PSU.
The number of housings (Housing 1 to Housing 4) may also differ from installation to installation.

4. OUTPUT POWER CONTROL RELAY (OPCR)

Every WESTRACE system that uses parallel input/output (VROM and VPIM) must have a vital Output Power Control Relay (and optional repeat relays) that will only provide power to the outputs when the system is proved healthy.

5. HOT STANDBY

WESTRACE system may be standalone or Hot standby. Hot standby allows for automatic, nearly uninterrupted, change over to standby system under manual command or triggered by online system failure.

Hot standby is always at a housing level. It requires two identical housings that are interconnected for fast data transfer and updates. It is quite acceptable for some housings in a system to be hot standby and the others to be standalone.

6. VITAL COMMUNICATION

WESTRACE can use vital communication between housings. This will be through Ethernet connection. Ethernet connection is always via NCDM module in the top housing.

Ethernet serial communication is enabled by Vital Serial Enable Voltage (VSEV) that is generated by the OPC, when the system is deemed healthy. All serial data is sent redundantly and checked for corruption. Suspect messages are discarded. User viewable mnemonics show the status of communication links.

7. NON-VITAL COMMUNICATION

WESTRACE can communicate to local or remote control centres and to diagnostic systems via serial links are Ethernet.

8. MODULES OF WESTRACE SYSTEM

The WESTRACE system hardware comprises following functional modules:

Vital Logic Module (VLM 6)

All WESTRACE systems have a Vital Logic Module as its processing core. VLM 6 consists of two cards. They are:

1. Vital Logic Card (VLC 6) - This is the vital processor card that does the vital interlocking processing and controls communication between system modules.
2. Output Power Card (OPC 50) – This is a vital card that generates the power supply required to drive the OPC relays upon getting a signal from VLC 6 that the system diagnostics has passed all tests.

The individual cards are interconnected by means of vital back plane and also by a Universal Hot-standby Vital Backplane Card (UHVBC). A WESTRACE Hot standby system comprises a pair of fully duplicated installation in a symmetrical arrangement. A VLM6 occupies slots 2 & 3 in housing 1.

Vital Parallel Input Module (VPIM 50)

The Vital Parallel Input Module (VPIM) is used to accept signalling inputs into the WESTRACE system. The module vitally detects the presence of externally supplied 50 V DC switched by signalling relays or other signalling equipment at each input. Each module has 12 inputs.

Vital Relay Output Module (VROM 50)

The Vital Relay Output Module (VROM) is used to directly drive 50 V DC signalling relay and similar loads. Each VROM has 8 individual outputs that provide voltage to the relays.

Network Communication Diagnostic Module (NCDM)

The NCDM is used to interface to the VLM6, adjacent WESTRACE systems, remote control centres (e.g. CTC), local control or indication PCs, MoviolaW diagnostic tool, local PC running under diagnostic programs and execute non-vital logic.

Blanker Card (BLANKER)

The blanker card is a small PCB and attached to a connector that provides continuity for the backplane signals. It must be fitted in all unused module slots in the system motherboard.

Power Supply Unit (PSU 24)

The Power Supply Unit converts the external nominal 24 V DC Power Supply to the internal voltages namely +5V DC, +12V DC, -12V DC and +12V Power required by the modules, and generates the system reset signal required by the other modules.

The PSU will normally be fed from a 24 V battery to ensure the system is not held up during any power fluctuations. Only one PSU can be installed per system housing, however additional PSUs may (optionally) be installed in other housings in multiple

housing installations. The PSU contains five red LEDs, which indicate the presence of the input and output voltages. All LEDs should be illuminated when power is applied to the system.

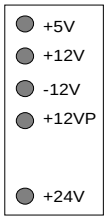


Fig. 3: Power indicator LEDs - PSU

Protection and Filter Modules (PFM)

These modules are required to protect Input and Output Modules and the Power Supply Unit from the effects of excessive external electrical disturbances generated by traction supplies, radios, relays, neon lamps etc.

Lithium batteries

The WESTRACE Network Communications Module (NCDM) has Lithium batteries installed to provide power backup for the RAMs to store events.

9. System Powering Up and Down

B24 supply

A housing may be powered down by the removal of the B24 fuse or negative terminal link.

Powering Down

Switch the top housing OFF *first*.

The other housings can be switched off in any order. Wait at least 40 seconds before powering up.

Powering Up

Switch the top housing ON *last*.

The other housings can be switched on in any order.

☞ **Caution**

Incorrectly powering up or down may:

- Cause the display of system with fault codes.
- Prevent system restart.

WESTRACE Monthly Maintenance Schedule

WESTRACE MONTHLY MAINTENANCE SCHEDULE

Division:	Station:	No. of Westrace:	Date commissioned:

1. Measuring Voltages

Sl. No.	Date	24V DC WESTRACE Supply (22V to 25.8 V)		50V DC OPCR & VROM & VPIM Supply (48V to 52V)		Remarks	Signature
		At PSU PFM	At HOPC PFM	At OPCR Relay	At VROM & VPIM Bus bar		
1							
2							

Procedure:

24V DC power supply is used for WESTRACE system operation and 50V DC power supply is used for the inputs and outputs of the WESTRACE interlocking system. The power supply shall be measured using a multi meter and recorded.

The 24 V busbar voltage shall be within the range 22V to 25.8V. The 50V power busbar voltage shall be within the range 48V to 52V.

The PSU PFM and HOPC PFM pin numbers for power supply measurement shall be verified from the interface circuits available in the station.

2. Fuse Check

Procedure:

All the fuses are provided with LED indications. If any fuse blows then the LED in the fuse terminals will glow. If there is any fuse blown indication is seen on any of the fuse terminals, replace the fuses with the correct rating of the fuse.

While verifying the fuses, the fuses shall be ensured that they are fully pressed into the respective terminals. All the fuse terminals shall be pressed once.

Sl. No	Date	Fuse Checking					Remarks	Signature
		24V Busbar fuses	50V Busbar fuses	VROM /VPIM Fuses	Panel Supply Fuses/ Scanner card fuses	Network switch /Modem fuses		
		WESTRACE Rack	WESTRACE Rack	WESTRACE Rack	S2- Rack	WESTRACE Rack		
1								
2								

3. Hot-Standby System Changeover

Procedure:

Hot standby test is performed to ensure that the standby system takes over "as is where" condition from the online system. The system that was online before conducting this test is indicated as primary system and the other as secondary system.

Set a route on the primary system. After the signal is cleared, switch off the primary system by disconnecting the 24V fuse for the primary system. The secondary system takes over and becomes primary. The signal cleared condition is not affected. Put the 24V fuses back that were removed. The system will power up and stabilizes after approximately 2 minutes.

Sl. No.	Date & Time	Hot Standby - System Changeover		Remarks	Signature
		Primary to Secondary	Secondary to Primary		
1					
2					

Cancel the signal and give a route release command. When the route release timer is 50% progressed, switch off the primary system by removing the 24V fuse. The secondary system shall take over and release the route after the required time delay. Put the 24V fuse back and the system will power up and stabilizes after approximately 2 minutes.

Record the test results.

4. Database Backup

Procedure:

For each day, there is a database file created in the MoviolaW with the event logs. The event log files shall be copied into a back-up system (thumb drive or any other equivalent equipment). Also note down the location in the PC drive where the database is stored.

Moviolaw Database Backup should be taken every 45 days

Sl. No	Backup Date	MoviolaW Data base backup	Storage in PC drive	Remarks	Signature
1					
2					

5. WESTRACE System Failure Registry

Procedure:

Verify any red colour LEDs are glowing in any of the VPIM or VROM modules. There shall not be any red LED glowing on any of the VPIM or VROM modules. If any of the modules show red LED, then verify the error code and take corrective action as given in the WESTRACE First Line Maintenance Manual.

Verify the red colour LEDs on the VLC 6 module as well as the alpha numeric display on the NCDM module. The alphanumeric display shall be blank and there shall not be any red colour LEDs lit on VLC 6 module. If any red colour LED lit on VLC 6 module or alphanumeric display lit on NCDM module, verify the error code on WESTRACE First Line Maintenance Manual and take corrective action.

The error code if any shall be registered in the system failure register, the faulty module if any shall be replaced with spare module.

Sl. No	Failure in System			Interlocking Down Time	Details of the Failure	Equipment or Component Failed	Corrective Action			
	Error code	Date	Time				Description	Date	Time	By
1										
2										

6. Connection with External Data Logger and Synchronisation of EI Clock

S. No.	Description of Item	Results OK/Not OK
1	Check Connectivity with External Data Logger and Working of MoviolaW.	
2	Check Correctness of Data being Received on External Data Logger	
3	Synchronise the Clock of EI with Data Logger Clock and Check Correctness of EI Time.	

7. EARTHING (Measurements to be done Yearly)

Sl No.	ACTIONS/OBSERVATIONS	OK/YES	NOT OK/NO	REMARKS
1	Verify that all earth pits are visible and measure the ring earth resistance as per the maintenance schedule (Earth measurements once a year). Earth resistance shall be less than 1 Ohm.			
2	Check whether front and back doors are earthed or not			
3	Check whether shields of all communication cables are properly connected to earth ground at one end only, if not then connect properly.			
4	Check whether proper earth connection is provided for Data logger, if not then connect properly.			
5	Check whether surge suppressors (110V, 12V, 24V & 230V), if provided used are connected to the respective REB & protective fitting, if not then connect properly.			
6	Check whether 230V OBO surge arrester is connected to the respective REB & protective fitting, if not then connect properly.			
7	Check whether painted surface are scraped to the clean metal surface where grounding connections			

	are to be made, if not then connect properly.				
8	Check whether the earth connection between REB and the racks earth point are as short and there is no bend or any loose in the earth wire (Green) , if not then connect properly.				
9	Check whether all joints are being mechanically and electrically effective (Example. clamped, screwed, bolted, riveted or welded) , if not then connect properly.				
10	Check that there are no loose connections in any of the earthing terminations; if not then tighten all connections properly.				
11	Check that there is no damage to earth wire				
12	Earth pits are wetted on regular basis (This is applicable only to non-maintenance free earth pit sites)				

WESTRACE EI TROUBLE SHOOTING GUIDE

Fault conditions and errors

WESTRACE generates and logs a fault for every test and check that fails.
Faults within WESTRACE system generate fault codes. Most fault error codes are displayed on the Diagnostic LEDs or alphanumeric display on the modules, but only one fault can be displayed by each module
To read all the logged faults, MoviolaW the maintenance VDU may be used.

Reading Fault Codes

A fault code indicated by the fault Diagnostic LEDs or alphanumeric display on the front of a module is applicable to that particular module.

The alphanumeric display shows the error code whereas the pattern of lit Fault Diagnostic LEDs has to be interpreted to determine the error code. All Fault Diagnostic LEDs are read in the same manner.

Each module has two groups of four LEDs to indicate a fault code comprising two bytes. The upper byte is the first (left) character of a Hexadecimal fault code and the lower byte is the second character. An LED represents 1 when illuminated and 0 when not illuminated. The example in figure 4 is displaying 1101 1000 (reading bottom to top) which represents D8H (where H means hexadecimal).

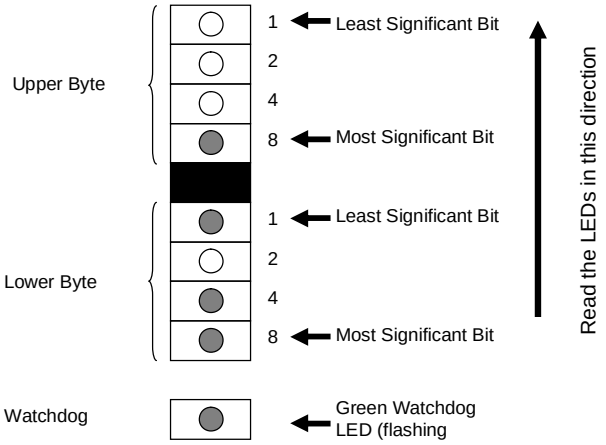


Fig.4: Fault Diagnostic LEDs

Fig. 5 shows the patterns of a group of four vertical LEDs. Each pattern represents a particular character and these are shown below the pattern.

Use the information in fig.5 to read the fault code displayed by Fault Diagnostic LEDs on the front of a module. Remember, the lower four LEDs represent the first (left) character and the upper four the second character in the Hexadecimal error code.

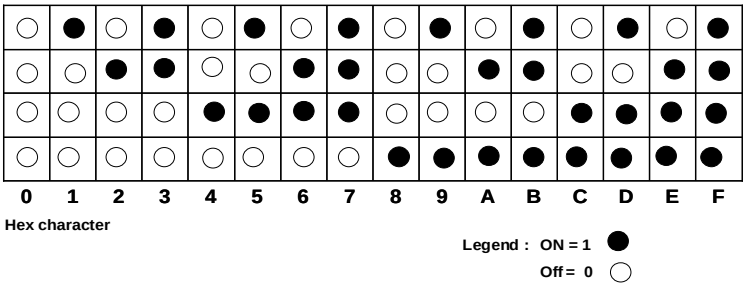


Fig.5: Reading Fault Diagnostic LEDs

Fault codes and their applicable meaning for individual WESTRACE modules can be referred from Appendix A of WESTRACE maintenance manual. Usually the faulty module displays its error code before the rest of the module display their codes. The timing is very quick and may be difficult to observe in a large WESTRACE system.

Fault Finding in WESTRACE System

WESTRACE is part of an overall signalling system. Do not assume that the fault is in WESTRACE system and not in some other part of the system. Try and validate all reports of faults that you may receive. Use the flow chart given in Fig-6 of this document as a reference for identifying system faults. In most cases, the flow chart will help you arrive at satisfactory solution to a first line maintenance problem.

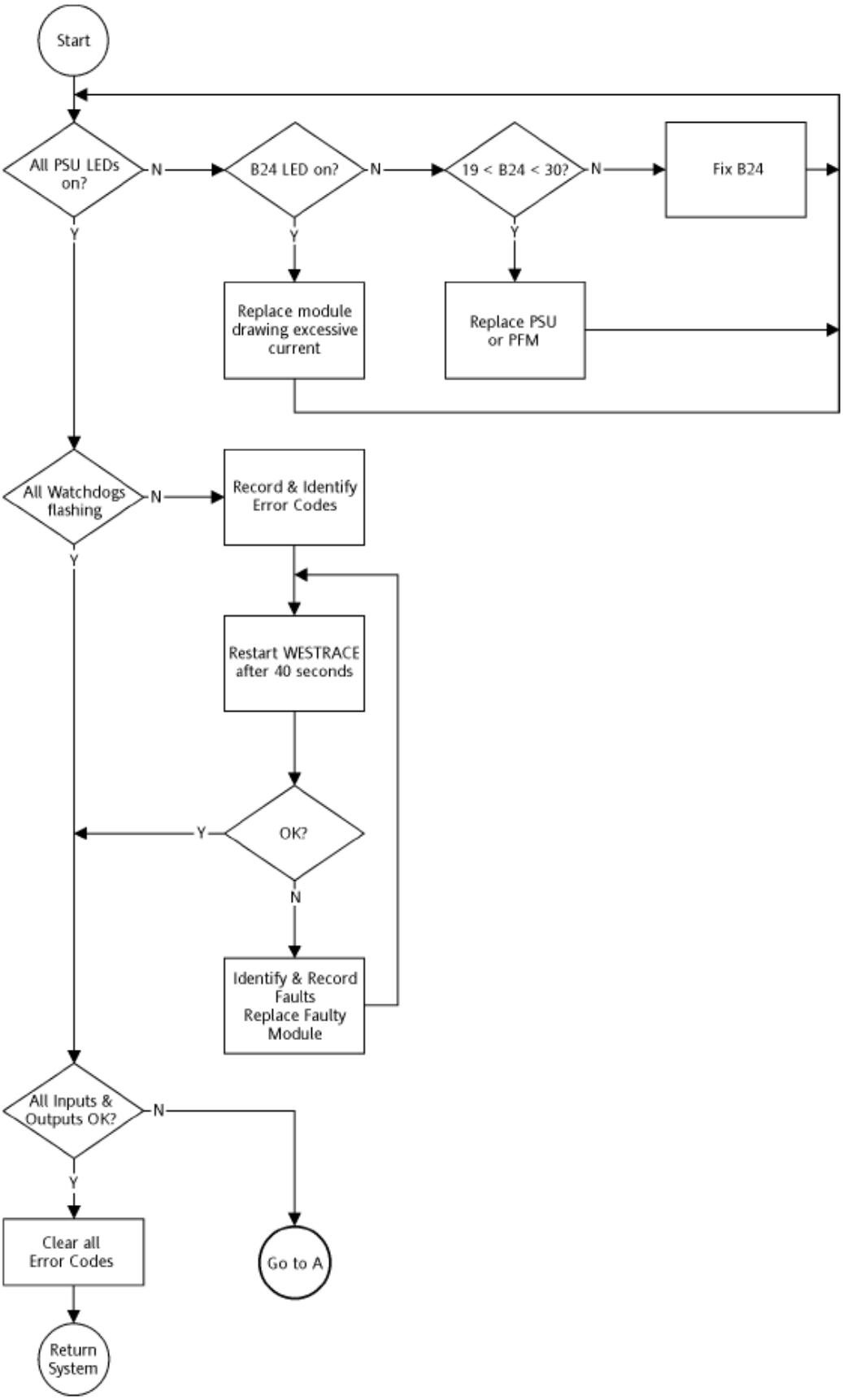


Fig 6(a) : Fault Finding Flowchart (WESTRACE)

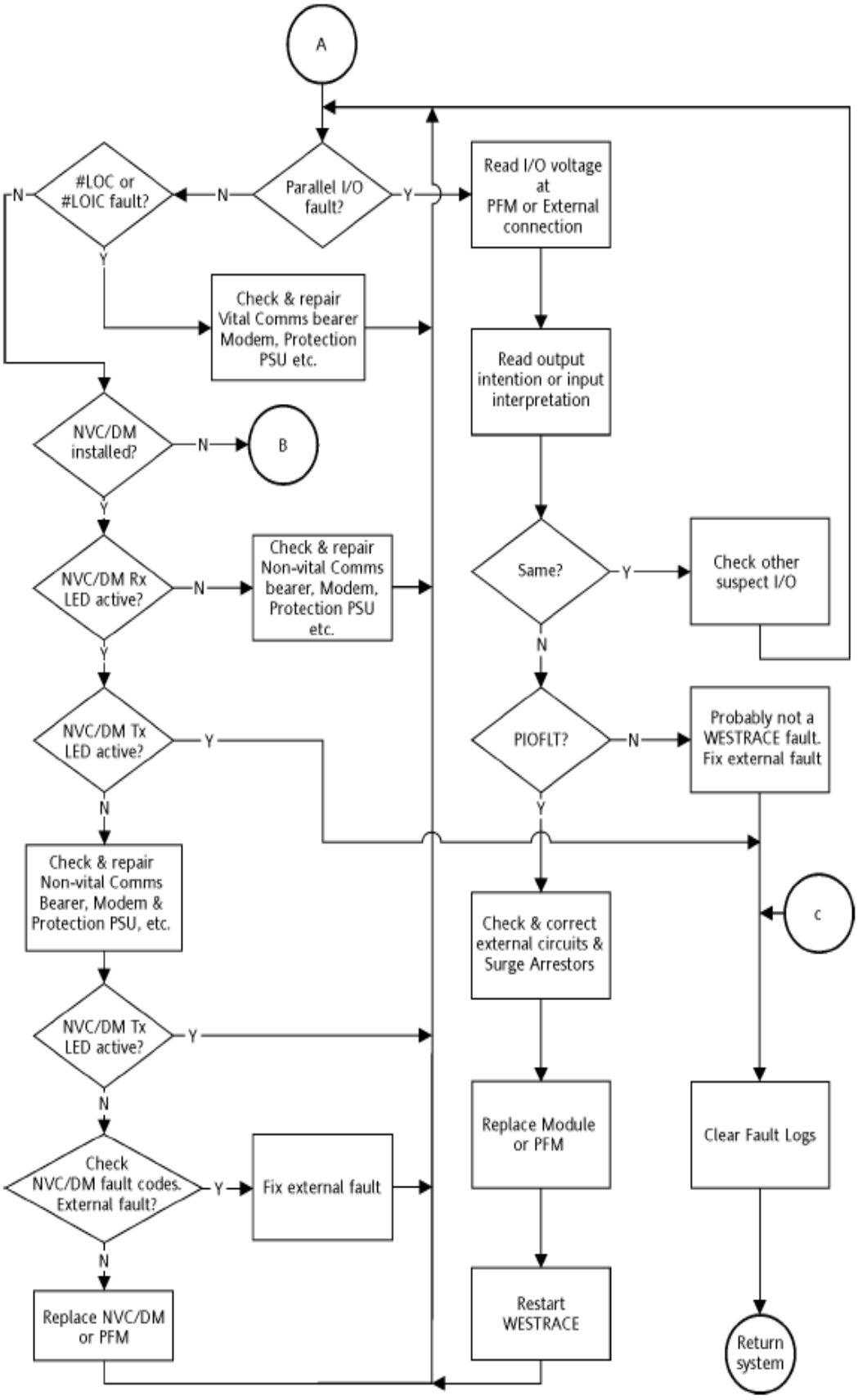


Fig 6(b) : Fault Finding Flowchart (WESTRACE)

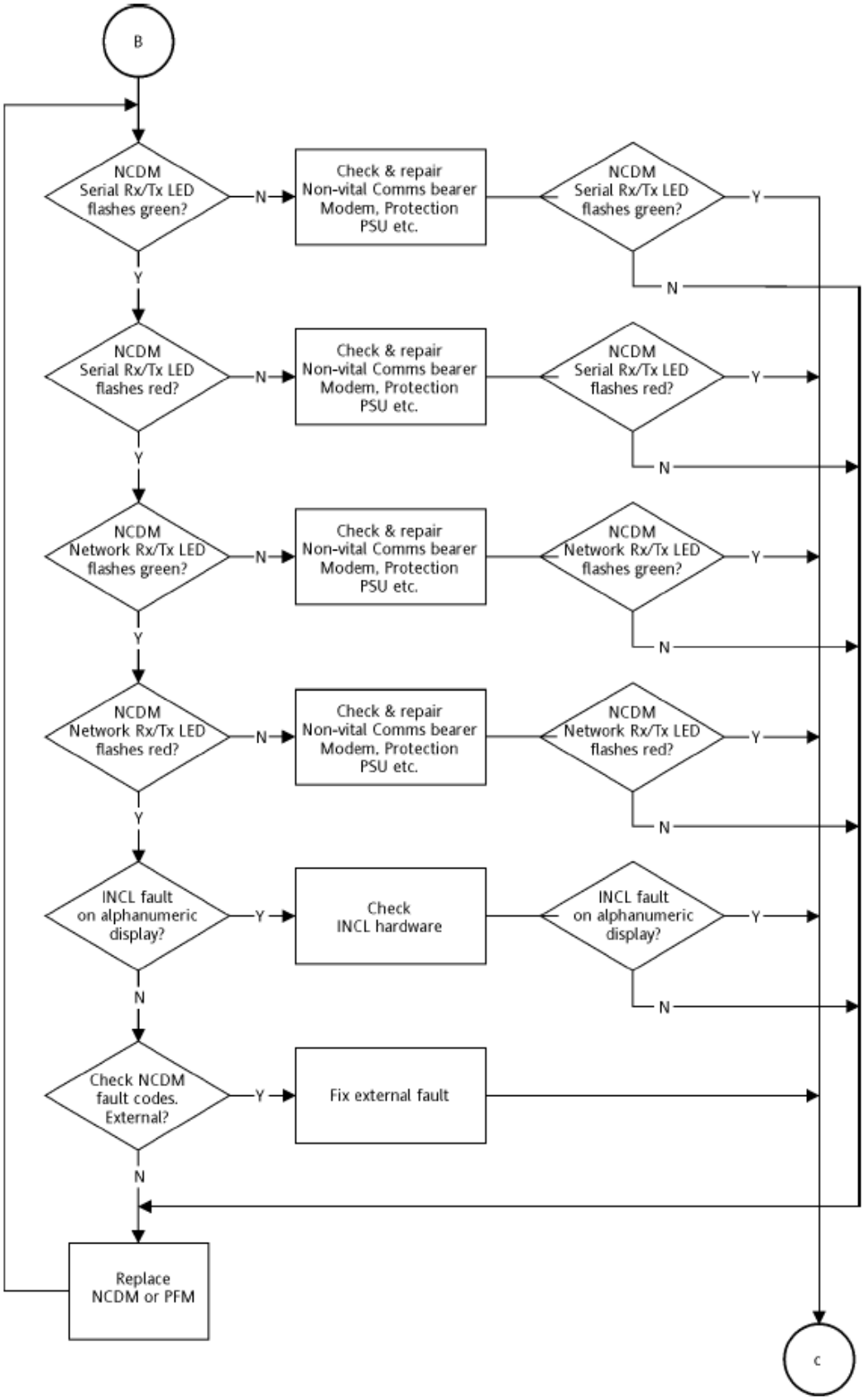


Fig 6(c) : Fault Finding Flowchart (WESTRACE)

Fault Finding of Signalling Failures in the installation

The Flowcharts shown below (Fig-7 and Fig-8) will help a Signal maintainer in quickly identifying the faults in the installation.

Fig-7 : Flowchart for Fault finding in installation (Vital)

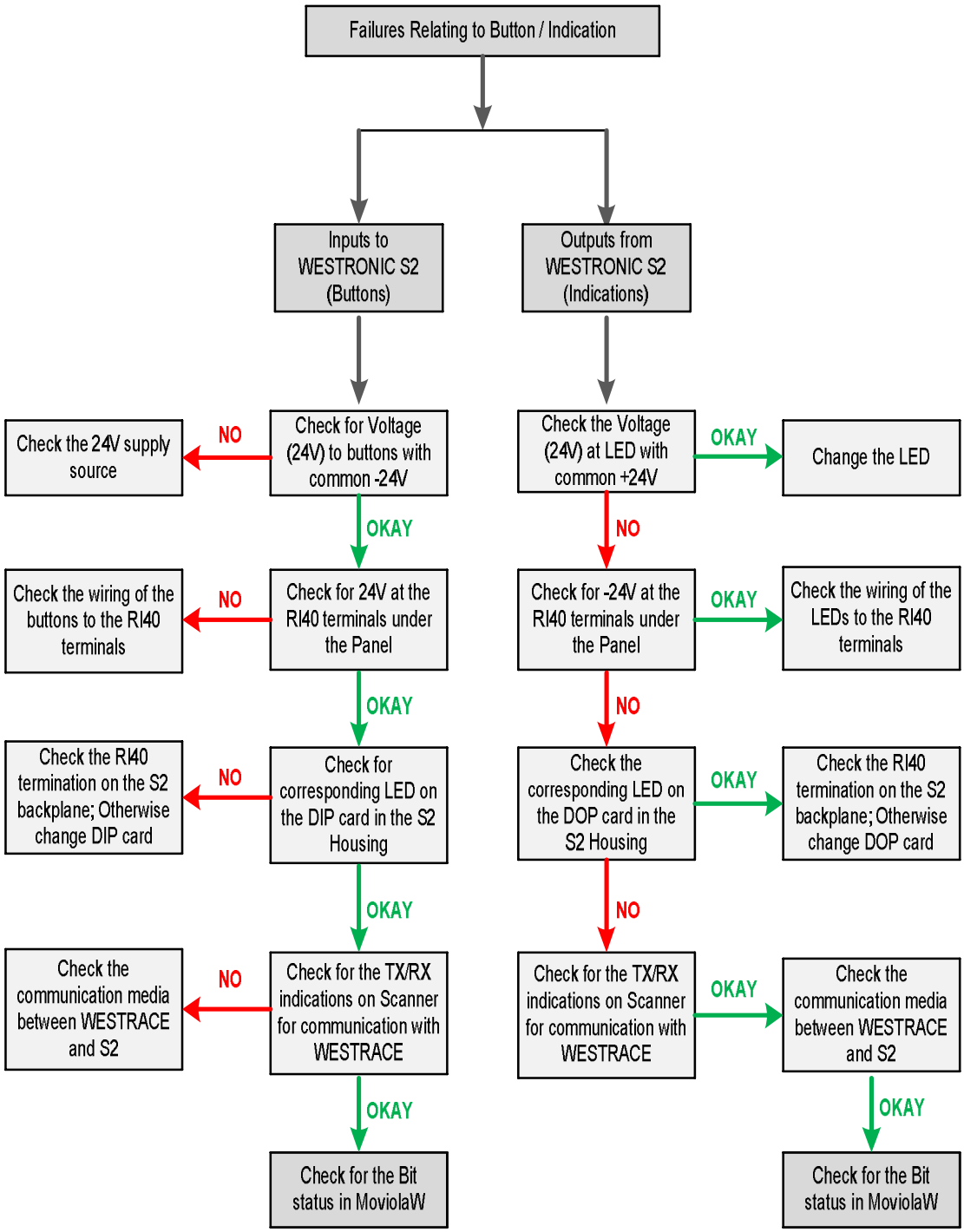


Fig-8 : Flowchart for Fault finding in installation (Non-Vital)

WESTRACE EI Dos and DONTs

DOs

- ✓ Keep the E.I room free from dust & Moisture
- ✓ Ensure all terminations are fully tight
- ✓ Place the faulty Modules removed from the system with an Identity tag into a conductive shielding bag
- ✓ Maintain Minimum 24 Volts DC between the power fuse and negative terminals on the WESTRACE rack [24 Volts]
- ✓ Maintain Minimum 50V DC between the WESTRACE Input/output Modules [50 Volts] fuse and negative terminals on the WESTRACE rack
- ✓ Check the WESTRACE system fuses at Regular interval
- ✓ Take back up of MoviolaW- Maintenance terminal user data Log files once in every 45 days
- ✓ Use Card Extractor for Removing of WESTRACE modules
- ✓ Use Vacuum cleaner for the EXTERNALLY accumulated dust and dirt
- ✓ Read carefully WESTRACE Fault codes and Fault Description on WESTRACE First Line Maintenance Manual during troubleshooting
- ✓ WESTRACE Powering down: Switch OFF the top housing first
- ✓ WESTRACE Powering Up: Switch ON the top housing Last after switching ON all other housings
- ✓ Give a delay of 40 seconds between powering down and powering up again

DON'Ts

- × Attempt WESTRACE trouble shooting if you do not have proper WESTRACE training
- × Remove modules, OPCR relays, Fuses, Links, PFM's & I/O module connectors, When the System is ON
- × Force modules into the slots during insertion
- × Change version Switch settings of VLC 6 & NCDM Modules
- × Change Jumper settings in UHVBC & S2- Scanner card
- × Touch the module components.
- × Repair module on your own
- × Switch OFF MoviolaW
- × Alter WESTRACE settings ,MoviolaW & WESTCAD PC settings without Authorization
- × Delete /modify Application logic programs without Authorization
- × Use blower for cleaning the dust
- × Use any kind of solvents, detergents or abrasive cleaners on the Housing or Internal components
- × Use vacuum cleaner INSIDE the Housing
- × Remove Optic Fiber cable connector when optical modem is ON.
- × Installation of Unauthorized software's in WESTCAD / MoviolaW PC's
- × View optical Laser light on Exposed Eyes.

VHLC (GE) EI DESCRIPTION, MAINTENANCE CHECK LIST, TROUBLE SHOOTING AND DOS AND DONTS

VHLC:

ACP	Auxiliary Communications Processor
CLA	Current Loop Adapter
CLCP	Custom Local Control Panel
CPU	Central Processing Unit
I/O	Input / Output
NVIO	Non-Vital Input / Output
PS	Power Supply
SIM	Serial Interface Module
SSM	Site Specific Module
VGPIO	Vital General Purpose Input/Output
VGPI	Vital General Purpose Input
VHLC	Vital Harmon Logic Controller
VLP	Vital Logic Processor

1. Introduction

The VHLC is a mature product that has an extensive service history and is in service on both passenger and freight railway networks throughout the United States and in U.K, Australia, India etc.

2. VHLC Functional Description

The VHLC consists of a chassis assembly and several plug-in and plug-on modules. The front of the chassis assembly provides card slots for up to 12 plug-in modules (Slots 1 through 12).

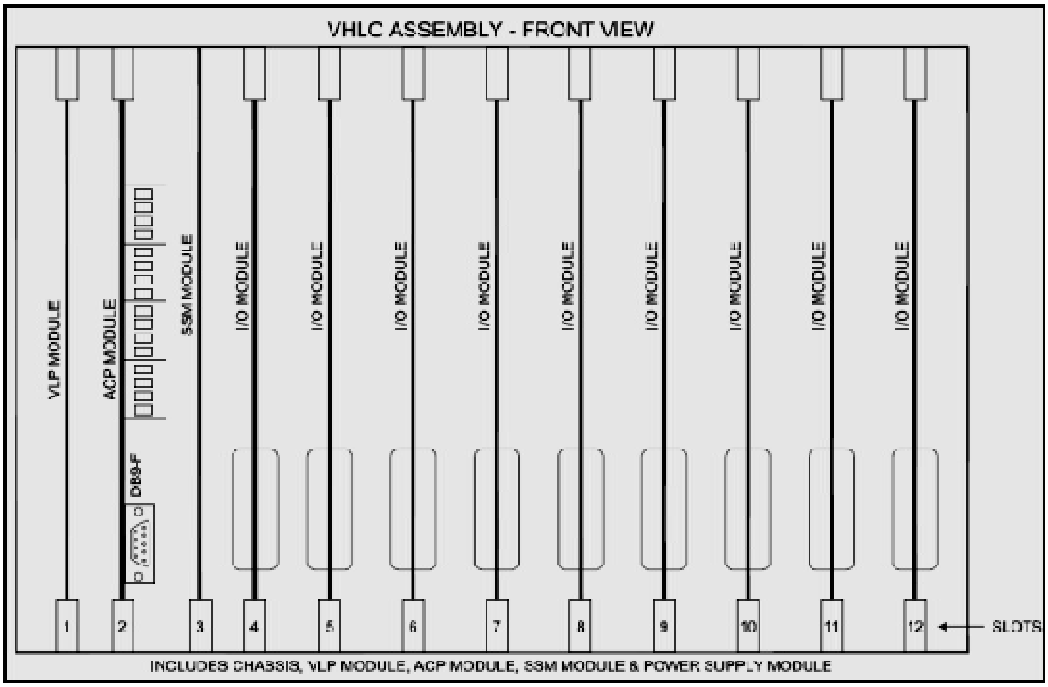


Figure 1: VHLC assembly front view.

The first three slots are dedicated to:

- **Vital Logic Processor Module (VLP):** Performs all of the vital logic functions, such as processing equations, generating speed control codes, and generating message packets for exchange with other units.
- **Auxiliary Communications Processor Module (ACP):** Processes the non-vital logic equations and provides serial data communications with up to five external devices. The ACP also maintains a log of events occurring within the system and provides access to this log for diagnostic purposes. Location of EPROMs containing the non-vital logic equations.
- **Site Specific Modules (SSM):** Location of EPROMs containing the vital logic equations, parameters, and configuration data unique to a given installation. It also contains information regarding chassis identification strapping which is unique to each chassis, so that the Site Specific Module will only function when plugged into the correct chassis.

The VLP, ACP and SSM are required for all VHLC systems. (Figure 2).

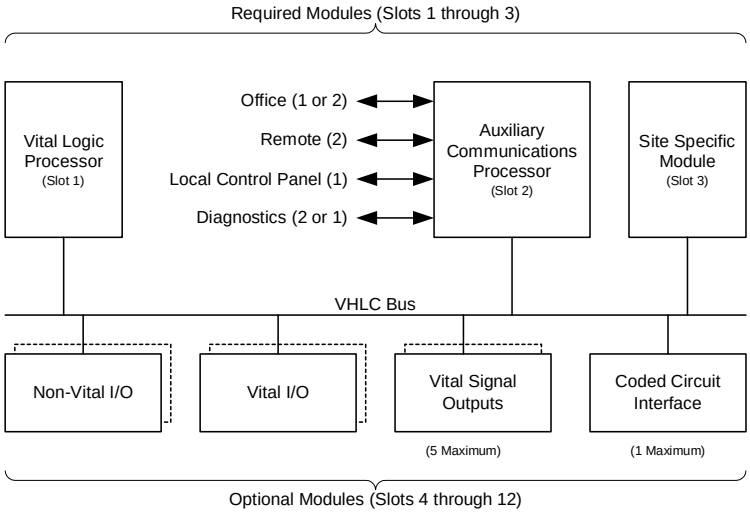


Figure 2: VHLC module block diagram.

The remaining nine slots are for any combination of Vital General Purpose I/O Modules (VGPIO), Vital General Purpose Input Modules (8VGPI, 16VGPI) and Non-Vital I/O Modules (16NVIO. The back of the chassis has positions for a plug-on +5 VDC power supply module and up to five serial port plug-on modules (Locations A through E).

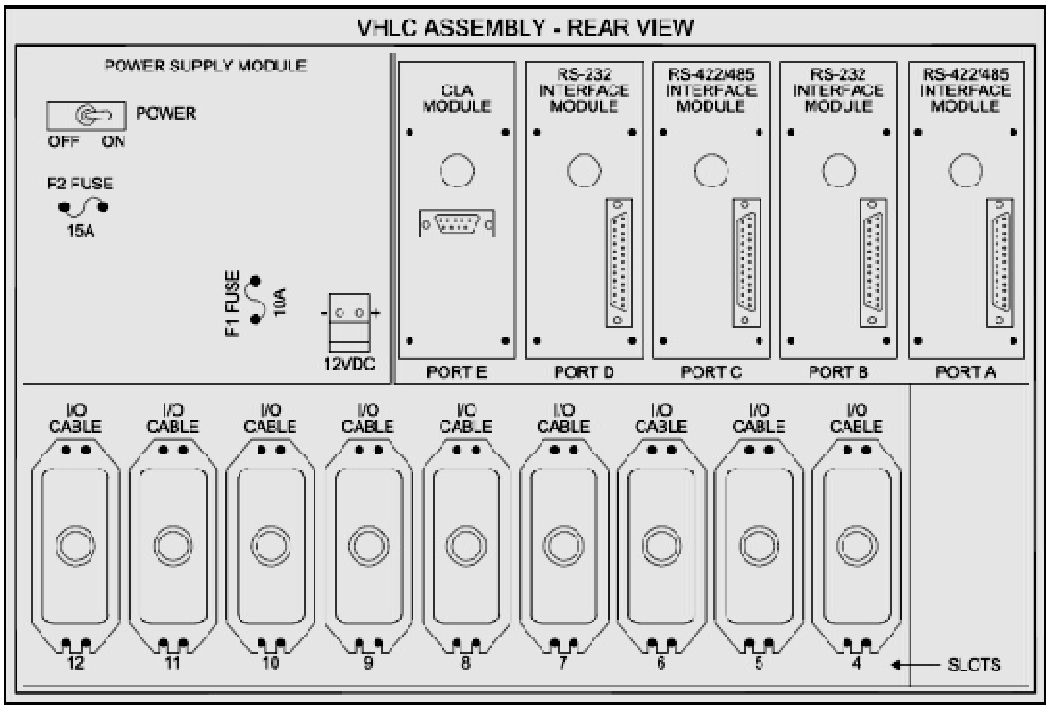


Figure 3: VHLC assembly rear view.

In a typical configuration of the VHLC, the serial ports are used to communicate with:

- The Central Traffic Control (CTC) office (non-vital);
- A Local Control Panel (non-vital);
- Two (2) adjacent VHLCs (vital); and
- Local and remote diagnostics (non-vital).

Available serial port modules are:

- RS-422/485;
- RS-232;
- Current Loop Adapter.

I/O module types include:

- Vital General Purpose I/O - 8 Inputs/8 Outputs (VGPIO);
- Vital General Purpose Input - 8 (8VGPI) or 16 Inputs (16VGPI);
- Non-Vital I/O - 16 Inputs and 16 Outputs (NVIO);

The field connection to an I/O module is made using a keyed I/O cable that prevents a different type of module from being installed in the slot.

2.1 Component Descriptions

2.1.1 +5 VDC Power Supply Module

The VHLC +5 volt power supply module provides up to 40 W of regulated +5 VDC output from a 10 to 16 VDC input. The output voltage, which is the operating power source for all +5 VDC circuits in the VHLC, is adjustable from 4.5 to 5.5 VDC and is isolated from the power inputs by 3000 VAC_{RMS}. An output logic signal drops and initiates a Vital Logic Processor reset and holds it in reset when the output voltage drops 250 mV below the set point.

2.1.2 I/O Modules

2.1.2.1 Vital General-Purpose I/O Modules

The Vital General Purpose I/O (VGPIO) module has the following sections:

The VGPIO module provides eight relay level vital outputs and eight voltage sensing vital inputs. The module designed so that failures will not cause outputs to become energized when they should be de-energized. Each input and output is two wires and is isolated from all other VHLC I/O and from signal battery. The green LED indicates the status of VGPIO module health. And there is a red LED for each input and output on the module. When the input or output is energized, the red LED will illuminate.

2.1.2.2 Vital General Purpose Input Module (VGPI)

The VGPI module has 16 vital inputs. They are identical to the inputs used on the VGPIO. The vital inputs cannot be falsely energized by 20 – 220 Hz induced AC noise. The inputs are two wires and are isolated from all other VHLC I/O and signal battery. The green LED indicates the status of VGPI module health. And there is a red LED for each input on the module. When the input is energized, the red LED will illuminate.

2.1.2.3 Non-Vital Input Output Module (NVIO)

The NVIO contains 16 bipolar outputs and 16 voltage sensing inputs. The green LED indicates the status of NVIO module health. And there is a red LED for each input and output on the module. When the input or output is energized, the red LED will illuminate. Positive output LED indicates the NVIO is receiving the current from battery positive and Negative output LED indicates the NVIO sending the current to battery negative. All the outputs are electrically isolated from the VHLC logic circuits to prevent grounding the site battery.

2.1.3 Serial Interface Modules

2.1.3.1 RS-232 Interface Module

The RS-232 interface provides 3000 VAC_{RMS} isolation for all output lines. It complies with the EIA RS-232C specifications for communications over primary interchange circuits and supports both asynchronous and synchronous communications.

2.1.3.2 RS-422/485 Interface Module

The RS-422/485 interface module provides a communications link to RS-422/485 compatible devices operating at data rates up to 9600 baud. The RS-422/485 interface module provides 2000 VAC_{RMS} isolation. The transmit data, transmit timing, receive data and receive timing lines have integral secondary lighting protection. When the DTR signal is inactive, the transit data and transmit clock outputs are tri-stated to allow for multi-drop RS-422/485 applications.

2.1.3.3 Current Loop Adapter Module

The Current Loop Adapter (CLA) module translates currents from the Harmon Logic Controller/ Control-cum-Indication Panel (HLC/CCIP) into serial data levels required by the Auxiliary Communications Processor (ACP).

The CLA provides 3000 VAC_{RMS} isolation and contains secondary protection circuitry against noise, and voltage surges. The CLA does not supply current to transmit or receive, it only switches the current supplied by the HLC/CCIP.

VHLC (GE) EI Periodic Maintenance Checklist and Trouble Shooting guide

VHLC EI (GE) Maintenance Format and Schedule

Division:	Station:	No. of Microloks:	Date commissioned:

Ensure adequate traffic block time for maintenance. Do not attempt to take readings with trains moving in to interlocking area.

MEASUREMENT

Rack / System / Module	Measuring Point	Specified / Recommended Value	Recorded Value	Maintenance Periodicity	
				Quarterly	Half-yearly
IPS/DC-DC Converter 24V DC O/P for Panel I/O	B24, N24 (20.4 to 31.2V of nominal 24V DC).	24 to 26V DC		✓	✓
IPS/DC-DC Converter 12V DC O/P for VHLC System PS I/P	B12, N12 (10.0 to 16.0V of nominal 12V DC).	12 to 14V DC		✓	✓
IPS/DC-DC Converter 12V DC O/P for VHLC I/O	B12, N12 (10.0 to 16.0V of nominal 12V DC).	12 to 14V DC		✓	✓
12V DC O/P for CLCP PS I/P	B12, N12 (10.0 to 16.0V of nominal 12V DC).	12 to 14V DC		✓	✓
VHLC Battery Surge Arrestor	+ & - Terminals of equipment side.	10 to 16V DC		✓	✓
CLCP Battery Surge Arrestor	+ & - Terminals of equipment side.	10 to 16V DC		✓	✓
VHLC 12V/5V DC PS Module on rear of chassis	+ & - Terminals of TB1.	10 to 16V DC		✓	✓
	TP1 & TP2 (Test Points).	4.50 to 5.50V DC [See Note 6]		✓	✓
CLCP 12V/5V DC PS Module in CLCP chassis	+ & - Terminals of TB1.	10 to 16V DC		✓	✓
	TP1 & TP2 (Test Points).	4.50 to 5.50V DC [See Note 6]		✓	✓
Voltage with respect to PEP & IPS Bus bar	Between respective bus bar (B24, N24, B12, N12) and PEP.	Zero voltage		**X**	✓

VISUAL

Rack / System / Module	Check Points	Observation (Ok / Not Ok)	Maintenance Periodicity	
			Monthly	Half-yearly
VHLC ACP Module	Verify the availability of diagnostic cable on ACP diagnostic port.		✓	✓
VHLC Normal / Standby (A/B) System Transfer Switch	Verify switch is in "AUTO" position unless intentionally left in other position (forced to A or B position) for maintenance purposes.		✓	✓
VHLC Debug Switch	Verify switch is in "DEBUG OFF" position unless intentionally left in other position (forced to DEBUG ON position) for maintenance purposes.		✓	✓
VHLC ACP	Verify “HARMON GEN VHLC” is displayed on ACP CDU display.		✓	✓
DLIM	Verify Data Logger Interface Module (DLIM) is powered ON.		✓	✓
	Verify serial cable from each VHLC ACP diagnostic port to DLIM is available.		✓	✓
DL	Verify Data Logger is powered ON.		✓	✓
VHLC Rack	Verify earth wire between VHLC Chassis and VHLC Rack earth point is intact.		**X**	✓
	Verify earth wire between VHLC racks and Prime Earth Plate (PEP) is intact.		**X**	✓
	Record the system transfer counter reading.		✓	✓
BSA	Verify earth wire between BSA earth bolt and its rack earth point is intact.		**X**	✓
Relay Rack	Verify earth wire between Relay rack and PEP is intact.		**X**	✓
C.T.Rack	Verify earth wire between C.T.Rack and PEP is intact.		**X**	✓
IPS	Verify earth wire between IPS Racks and PEP is intact.		**X**	✓
CLCP Chassis	Verify earth wire between CLCP Chassis and Panel is intact.		**X**	✓
Panel	Verify earth wire between Panel and PEP is intact.		**X**	✓
Maintenance PC	Switch on the Maintenance PC; log-on to the diagnostic tool through password and verify the diagnostic tool and maintenance menu are accessible (Maintenance PC will display top level menu as shown on page 3-11 in VHLC Software Manual).		✓	✓

	Before closing the diagnostic application log-off the diagnostic tool. *Failure to log-off may allow unauthorized persons to change the setup data or perform local controls.*		✓	✓
External Data Logger	Check the connectivity of External Data Logger with EI. Check Correctness of Data being Received by External Data Logger.		✓	✓
Synchronisation of EI Clock	Synchronise the EI clock with Data Logger Time. Check the automatic synchronisation of EI clock by Data Logger Clock.		✓	✓
Change Over From Standby System to ON Line System	Ensuring no trains in interlocked area, after obtaining permission from ASM, change and check working of Stand By System.		✓	✓

EARTHING (Measurements to be done yearly)

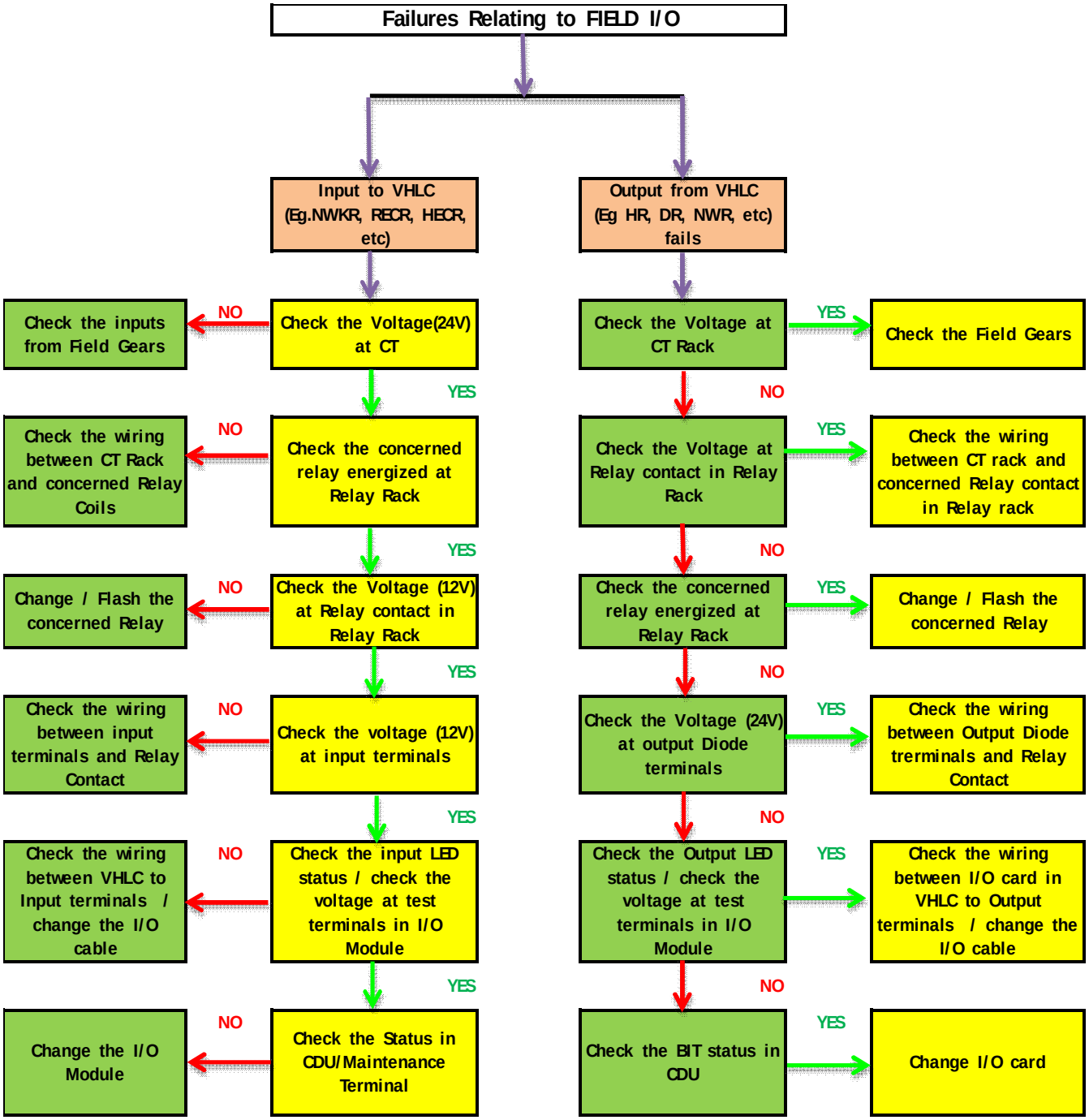
Sl No.	ACTIONS/OBSERVATIONS	OK/YES	NOT OK/NO	REMARKS
1	Verify that all earth pits are visible and measure the ring earth resistance as per the maintenance schedule (Earth measurements once a year). Earth resistance shall be less than 1 ohm.			
2	Check whether front and back doors are earthed or not			
3	Check whether shields of all communication cables are properly connected to earth ground at one end only, if not then connect properly.			
4	Check whether proper earth connection is provided for Data logger, if not then connect properly.			
5	Check whether surge suppressors (110V, 12V, 24V & 230V), if provided used are connected to the respective REB & protective fitting, if not then connect properly.			
6	Check whether 230V OBO surge arrester is connected to the respective REB & protective fitting, if not then connect properly.			
7	Check whether painted surface are scraped to the clean metal surface where grounding connections are to be made, if not then connect properly.			
8	Check whether the earth connection between REB and the racks earth point are as short and there is no bend or any loose in the earth wire (Green), if not then connect properly.			
9	Check whether all joints are being mechanically and			

	electrically effective (Example. clamped, screwed, bolted, riveted or welded) , if not then connect properly.				
10	Check that there are no loose connections in any of the earthing terminations; if not then tighten all connections properly.				
11	Check that there is no damage to earth wire				
12	Earth pits are wetted on regular basis (This is applicable only to non-maintenance free earth pit sites)				

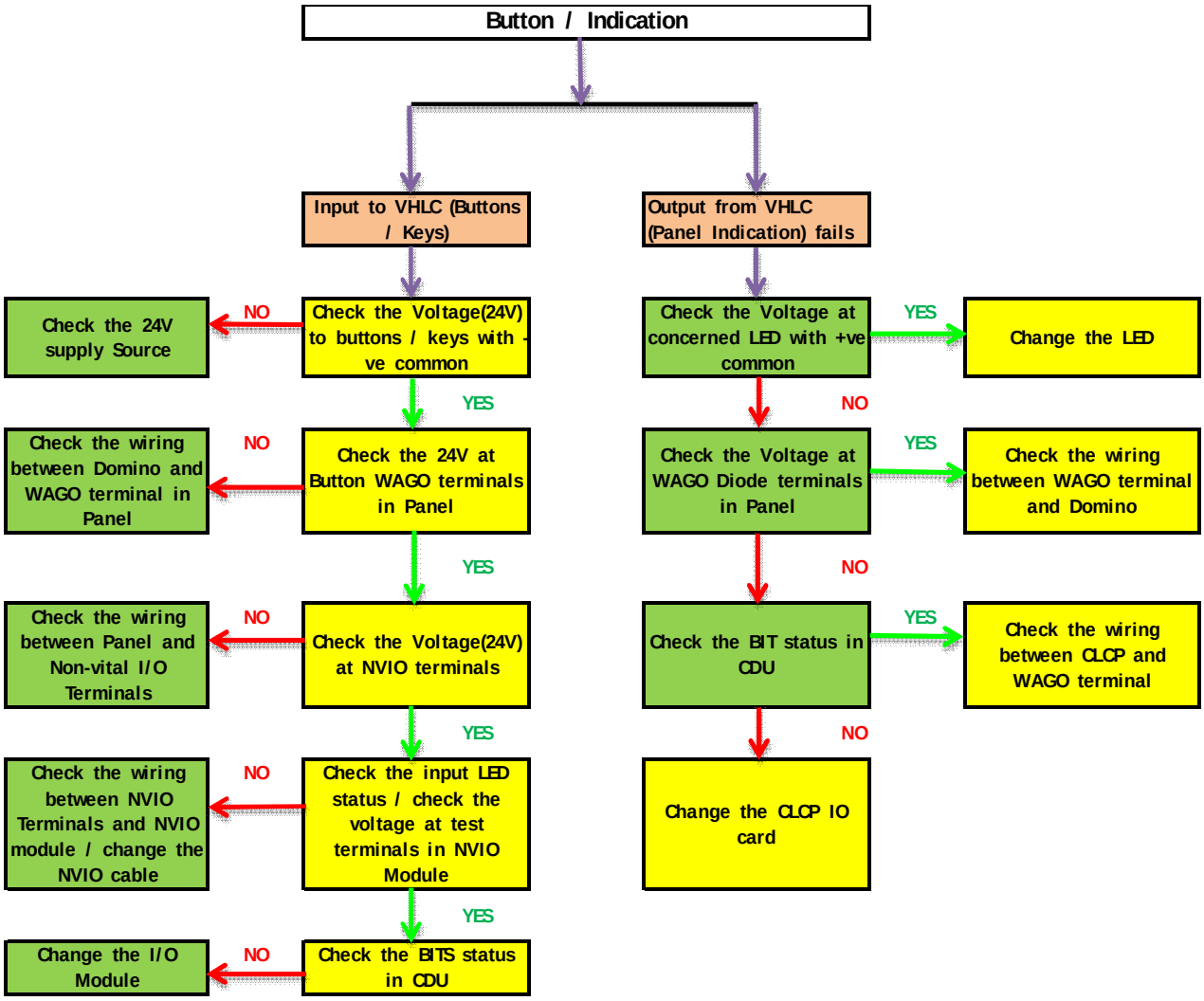
Recommended Tools & Instruments:

- Digital Multimeter $3^{1/2}$digit
- Assorted screw driver & spanner sets
- Wire cutter / stripper, cutting pliers, nose pliers
- Wire continuity tester
- Earth resistance measurement meter

Trouble shooting - Vital



Trouble shooting – Non Vital



VHLC EI (GE) DOs and DON'Ts

VHLC System Do's & Don'ts

Do's

1. Check the airflow vents on VHLC racks are free of obstruction for good airflow and fan is in working condition.
2. Ensure VHLC rack's front and rear doors are kept closed.
3. Check ACP CDU displays "HARMON GEN VHLC".
4. Check event log files downloaded from Data Logger are properly organized and stored in Maintenance PC.
5. Perform periodic maintenance as per VHLC Maintenance Check List (copy enclosed).
6. Check VHLC main/standby transfer switch is in AUTO position unless otherwise intentionally forced to A or B positions for maintenance purposes.
7. Check VHLC debug switch is in OFF position.

Don'ts

1. Do not open VHLC rack door without authorization.
2. Do not pull out any modules when power is applied to VHLC and system is working.
3. Do not remove vital relays when system is working.
4. Do not reset VHLC system (VLP, ACP reset pushbutton), use Transfer switch for transferring the system from A to B or vice versa, in case of problem.
5. Operate transfer switch from AUTO to A or B position and turn DEBUG switch to ON position for maintenance purposes.
6. Do not remove any communication cable when system is working.
7. Do not change the system configuration settings through CDU or Maintenance Terminal when system is working.
8. Do not attempt to repair any failed modules at site. Return failed modules to GE Transportation Systems, Bangalore for repair.
9. Do not interchange ACP module from one VHLC chassis to other VHLC chassis without verifying and changing the application EPROMs on the module.
10. Do not interchange SSM from one VHLC chassis to other VHLC chassis without verifying and changing the application EPROMs on the module.

MEI633 (MEDHA) SYSTEM OVERVIEW, Maintenance Check List, DOs and DONTs, and Trouble Shooting

Acronyms

Acronym / Abbreviation	Explanation
ATP	Automatic Train Protection/Acceptance Test Procedure
CB	Counter Box
CCIP	Control Cum Indication Panel
CENELEC	European Committee for electro technical standards
CIF	Communication Interface
CIU	Central Interlocking Unit
COM	Communication Module
COMP	Communication Processor
CRC	Cyclic Redundancy Check
CTC	Centralised Traffic Control
DL	Data Logger
EIS	Electronic Interlocking System
FPD	Front Panel Display
GUI	Graphical User Interface
HW	Hardware
IO	Input & Output
IOCOM	Input & Output Communication Module
IRS	Indian Railway Standards
IV&V	Independent Verification and Validation
MEI	Medha Electronic Interlocking System
MT	Maintenance Terminal
MTBF	Mean Time Between Failures
MTBWSF	Mean Time Between Wrong Side Failures
OC	Object Controller
OFC	Optical Fiber Communication
PCB	Printed Circuit Board
PI	Panel Interlocking
PP	Panel Processor
RDSO	Research Designs and Standards Organization
SIL	Safety Integrity Level
SMD	Surface Mount Device
SPN	Specification
SVP	Supervisory Processor
SW	Software
THR	Tolerable Hazard Rate
VDU CT	Video Display Unit Control Terminal
VIC	Vital Interlocking Computer
VP	Vital Processor

Acronym / Abbreviation	Explanation
WFM	Wayside Function Module
WFP	Wayside Function Processor

1. Introduction to MEI633

Interlocking is an arrangement of functions in a yard, interconnected in a manner that ensures safe passage of the train through the controlled area. An Electronic Interlocking System is used in the Railway stations and yards for ensuring the safe passage of trains. The train movement is allowed in accordance with the rules and regulations governing the movement of trains. The request to set a route or operate a signal or a point comes from the operator, who is a signalman, but the decision to allow the move is made by the interlocking system on the basis of the existing field conditions and the inbuilt safety logic. The final goal is to ensure safe passage of train through the controlled area. The System continuously monitors the field conditions, and if any condition is detected which violates the inbuilt safety logic, it drives the corresponding output to safe state.

The Electronic Interlocking System (EIS) offers a lot of advantages over the conventional relay based interlocking. An EIS occupies less space, cost-effective, consumes less power and is easy to install & maintain. The interlocking logic in the EIS is based on software and hence any modification is easy without the need for any wiring changes. This eliminates the need to block traffic for long intervals whenever there is need for system up-gradation or modification. EIS is a processor based system which have extensive diagnostic tests built into them. This improves the reliability of the system and leads to minimal system down time even in case of failures. The faulty module can be located easily and replaced with a spare one.

The EI System operation involves the operation of functions, which directly affect the safety, and hence it is designed to be fail-safe i.e. any failure within the system does not cause the outputs to assume unsafe state. Fail- safe in railway parlance means the system shall put the signals to danger and will not move any switch in case of any failure.

MEI633 is a microprocessor based system with interface to the Points, Signals, Track Circuits, Axle Counters, Level Crossing Gates, Ground Frames, Block Instruments for Block working with adjacent stations, and crank handles for manual operation of Points. It has the provision to interface with an External Data Logger, CTC or ATP through Serial Link. It is a self-contained independent system, which can be used standalone to control the train movement in the Yard. In case of big yards, where the System capacity is not sufficient to address the needs of interlocking, two systems can be cascaded using a serial link to achieve the required functionality.

MEI633 System implements Two-out-of-Two Hardware architecture with identical Hardware and identical Software for Vital modules.

MEI633 System is implemented as multi-processor distributed system, with the System functionality being apportioned to various sub-systems. The division of the total System functionality into different subsystems provides modularity, expandability and cost-effectiveness.

MEI633 can be installed as a centralized system or a distributed system. When the Centralized installation is used, the Relays in the Relay room have to be repeated in the field for operating the respective functions. This requires extensive use of expensive Signaling cables. When used in distributed configuration, the field modules can be located in the Wayside Huts, in proximity to the functions being operated by them. For a group of Inputs and Outputs, a redundant pair of Optical fiber communication cable is

used for carrying the commands from the Central Interlocking Unit to the field modules. Since the Signaling cables can be replaced with Optical fiber communication cable, substantial cost savings can be achieved.

MEI633 is modular system, which is scalable and configurable to suit the needs of a specific installation. The number of Object Controllers, the number of Input and Output WFMs in each OC, and the Input and Output modules required for the Panel Processor can be selected as per the Yard I/O requirement. The modular design of the MEI633 enables each customer to custom-configure a system that will meet the specific control and interface requirements for the intended application.

2. Overview

MEI633 is a microprocessor based system with interface to the Points, Signals, Track Circuits, Axle Counters, Level Crossing Gates, Ground Frames, Block Instruments for Block working with adjacent stations, and crank handles for manual operation of Points. It has the provision to interface with an External Data Logger through Serial Link to log events.

MEI633 is a self-contained independent system, which can be used standalone to control the train movement in the Yard.

Context Diagram

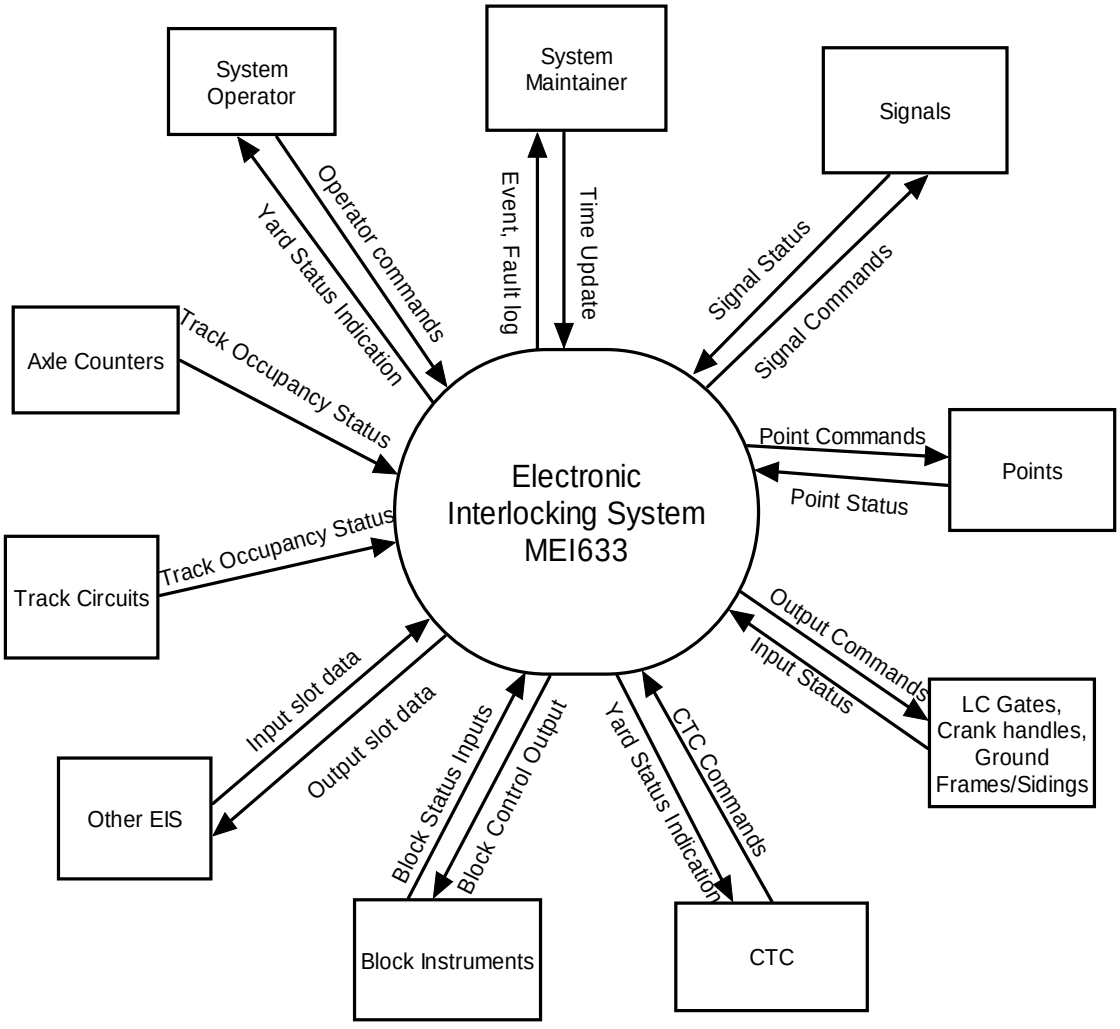


Figure 1 MEI633 Context Diagram

- MEI633 System is implemented as multi-processor distributed system, with the System functionality being apportioned to various sub-systems. Centralized Interlocking computation with distributed I/Os is the over-the-top feature of MEI633. Thus it can be installed as a centralized system or a distributed system

- MEI633 is cost-effective when used in distributed configuration, saving the signaling cable cost

- When the Centralized installation is used, the Relays in the Relay room have to be repeated in the field for operating the respective functions. This requires extensive use of expensive Signaling cables.

- When used in the distributed configuration, the field modules can be located in the Wayside Huts, in proximity to the functions being operated by them. For a group of Inputs and Outputs, a redundant pair of Optical fiber communication cable is used for carrying the commands from the Central Interlocking Unit to the field modules. Since the Signaling cables can be replaced with Optical fiber communication cable, substantial cost savings can be achieved.

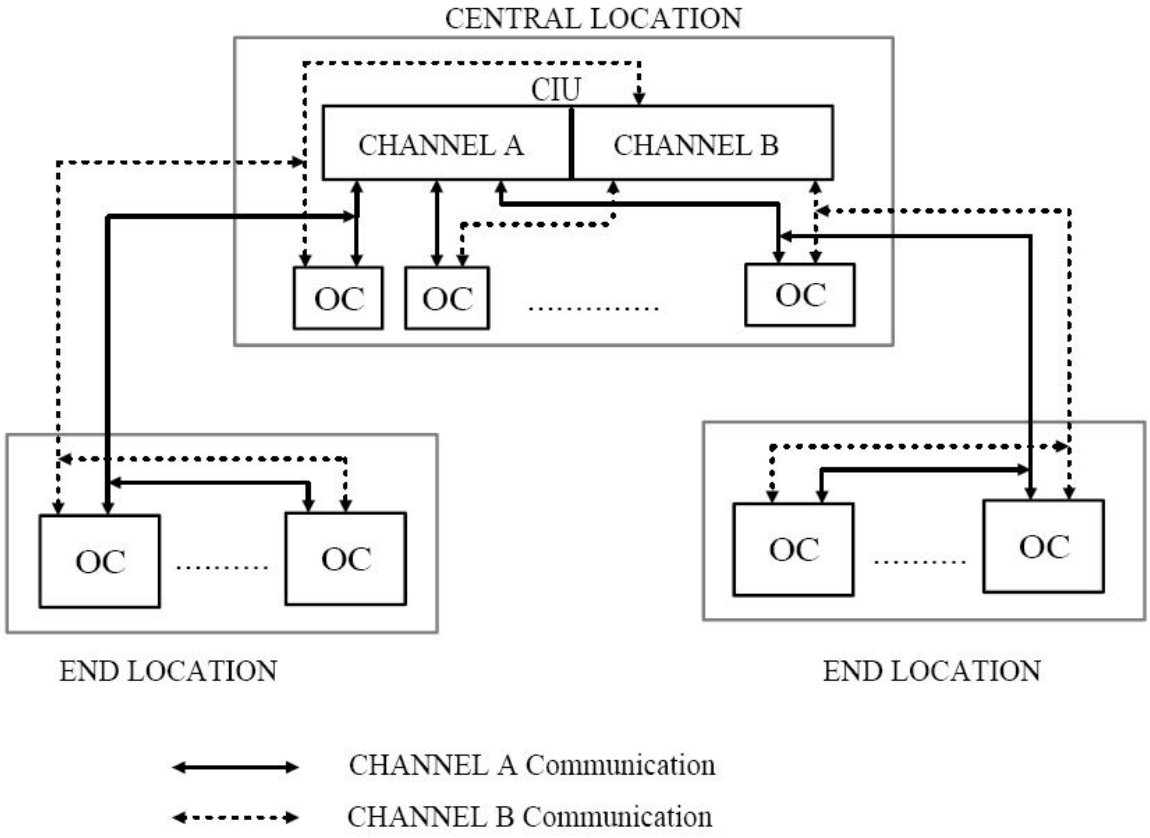


Figure 2 Generic Installation of MEI633 in Distributed configuration

- MEI633 system implements Two-out-of-Two Hardware architecture with identical Hardware and identical Software for Vital modules.

- MEI633 provides Hot Stand-by with automatic changeover for all modules, except the field modules.

- The division of the total System functionality into different subsystems provides modularity, expandability and cost-effectiveness.

- The number of Object Controllers, the number of Input and Output WFMs in each OC, and the Input and Output modules required for the Panel Processor can be selected as per the Yard I/O requirement.

- MEI633 system operates on a cycle time basis, where the Interlocking equations are executed every cycle. Accidental usage of stale data is avoided.

- MEI633 system is capable of handling the Yards up to 350 routes.

- The MEI633 comprises of the following sub-systems:

a) Central Interlocking Unit (CIU)

b) Object Controllers (OC)
c) Panel Processor Unit (PP)
d) Power Supply Module
e) Control Cum Indication Panel (CCIP)
f) Counter Box Module
g) Data Logger (DL)
h) Video Display Unit Control Terminal (VDU CT)
i) Maintenance Terminal (MT)
j) Front Panel Display Unit (FPD)

The major building blocks of MEI633 are Central Interlocking Unit (CIU), Object Controller Modules (OCM) and Panel Processor (PP). CIU collects the Yard information from OCMs and operator commands from PP/VDU CT. CIU validates and executes interlocking equations based on the available information. The outcome of the equation execution is the OCM output data and PP/VDU CT indication data. OCM output data is used to drive the output relays. Driving an output relay generally clears a signal or operates a point.

CIU

Central Interlocking Unit (CIU) consists of VIC, COMP, CIF and VHM cards, which are enclosed in a single box. Input data from PP/VDU CT Modules, OCMs is received by CIU. The received input data is processed for interlocking by CIU and output data is generated based on the input data. The respective output data is sent to PP/VDU CT Modules, Counter Box, MT and OCMs.

OCM

Object Controller Module consists of two IOCOMs namely IOCOM-A, IOCOM-B and a maximum of 8 WFMs. There can be at most 32 OCMs in a system. WFMs are connected to IOCOM-A and IOCOM-B through RS485 interface. IOCOM-A and IOCOM-B are connected to COMP-A and COMP-B respectively, through OFC interface.

Input WFM gets the status of the wayside functions in the yard.

Output WFM receives the wayside function output data from CIU through IOCOMs and drives the wayside functions connected to it.

Each Input WFM can read at most eight wayside function inputs and each Output WFM can drive at most 8 wayside function outputs.

CCIP

CCIP consists of Push Buttons/Knobs, Keys, LEDs and Buzzers. Push Buttons/Knobs are used to issue commands to System. Keys on CCIP can be in, Key In/Key Out position to enable/disable processing of the commands issued by operator to System. LEDs on CCIP indicate the yard status e.g. color light signal on/off status, point position and track occupation status. Buzzers are used to indicate the Button stuck condition or signal blank condition. CCIP is connected to PP Modules through Input and Output Cards. PP module's link status with CIU and its Health status are indicated on CCIP.

PP

Panel Processor module consists of two Panel Processors and each is connected to a common set of Input and Output cards through parallel interface. On the other hand, each Panel Processor is connected to COMP through Optical Fiber Interface. Each Panel Processor scans the state of the inputs on CCIP through Input cards, and sends the same to VICs via the respective COMP. Each of them receives Indication Information from Active VIC and drives the same to CCIP through output cards, providing visual indication to operator. Indication Information represents the current Yard status.

Counter Box

Counter Box consists of CPU card and Output card. Output card is used to drive the counters and buzzers. CPU card is connected to Output card and on the other end it is connected to COMP-A and COMP-B, through Optical Fiber Interface. CPU card receives messages from both COMPs. Ultimately it takes data to drive counters and buzzers from the Active COMP channel. Counter Box module also indicates VIC-A and VIC-B status (Active, Standby and Not Available), wrong side failure information from OC and CIU by the corresponding LEDs.

VDU CT

Video Display Unit Control Terminal (VDU CT) is a PC based application Software. VDU CT is connected to CIU through OFC interface. Operator can issue commands using the simulated buttons on the VDU CT screen. It sends the command and receives the yard status from COMP and displays the same on the VDU CT screen. With a redundant VDU CT arrangement, CCIP and PP can be eliminated and thus achieving substantial cost-effectiveness.

Front Panel Display

LED Display is connected to CIU through RS232 interface. The system consists of two units, namely Display-A and Display-B. They are used to display the system faults/recovery messages.

MT

MT (Maintenance Terminal) is a PC based application Software. MT is connected to CIU through RS232-OFC Interface. MT screen shows the status of the system, logs the events/faults received from CIU and generates alarm signal if any critical fault is received from the CIU. Proprietary serial communication protocol is used for communication between CIU and MT.

Data Logger

Data Logger (DL) is a device connected to CIU through RS232-OFC interface. DL is used to log the yard and system status in every cycle. Proprietary serial communication protocol is used for communication between CIU and Data Logger.

The MEI633 Block diagram is as follows:

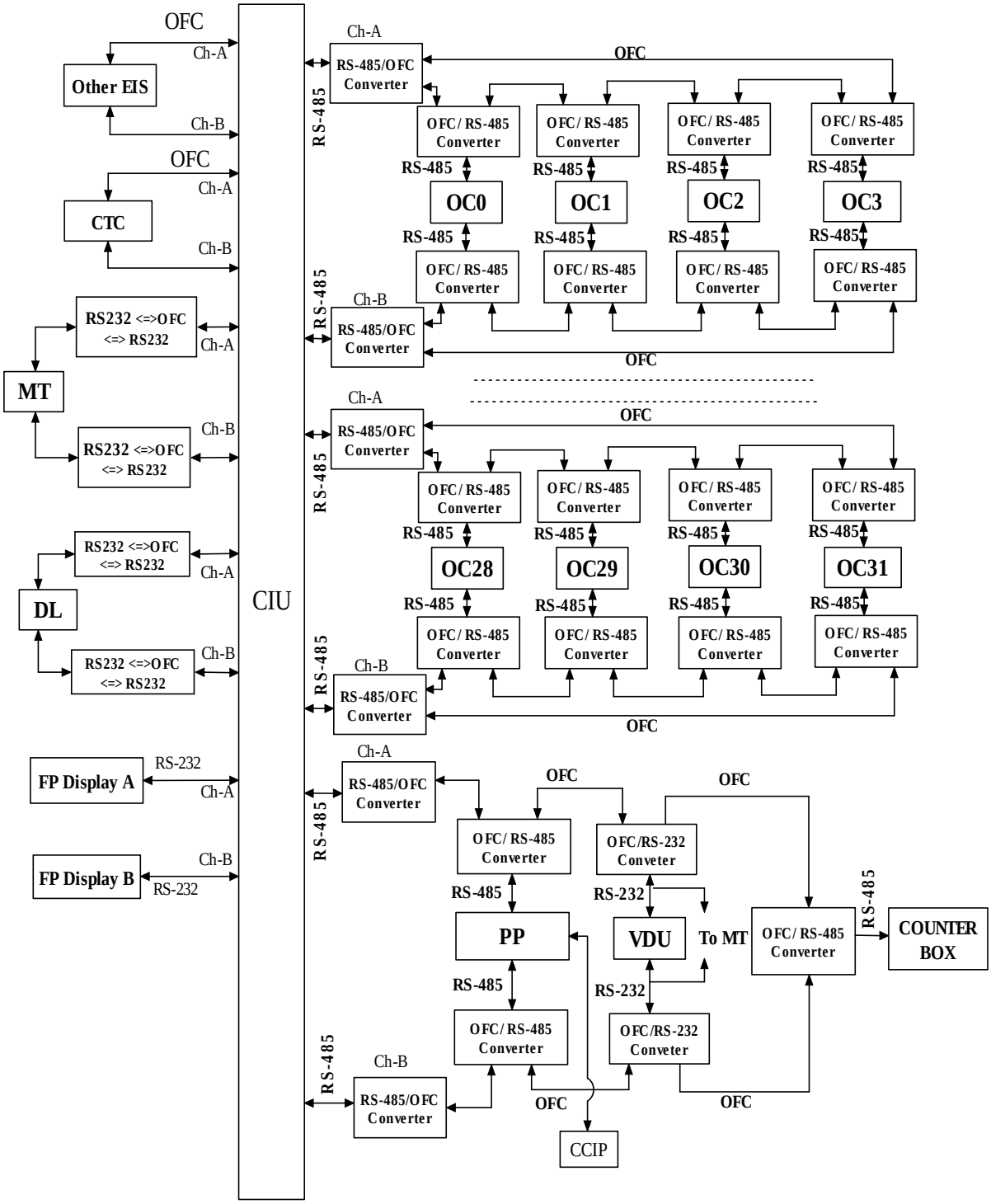


Figure 3 MEI633 Block Diagram

Maintenance Schedule and Items for Medha EI MEI 633

Monthly Maintenance Schedule			
Sl. No	**Description**	**Observation**	**Action taken / Note the Voltage Levels**
1	Clean the EI Room, OC Cabins, IPS room.	To be free from Dust	
2	Clean the Dust filters regularly	To be free from Dust	
3	Check the communication status of the EI Modules	Relevant Communication LED's & 7 Segment LED should be glow	
4	Check all Health Status of LED's, i.e System health Indication, Output Voltage Indication of system	Status LED should glow	
5	Check all VCOR power LED indication status.	VCOR Power Indication should glow	
6	Check the Voltage levels at Source End i.e IPS FRBC modules I/P Voltage.	Should be 24.5 Volts	
7	Check the SSI-A Power voltages at Equipment End	24.5V to 26V to be observed.	
8	Check the SSI-B Power voltages at Equipment End	24.5V to 26V to be observed.	
9	Check the SSI-Internal Power voltages at Equipment End	24.5V to 26V to be observed.	
10	Check the SSI-External Power voltages at Equipment End	24.5V to 26V to be observed.	
11	Check the PP Indication Power voltages at Equipment End	21V to 23V to be observed.	
12	Clean the exhaust fan filters as well as fans.	Exhaust Fans & Fan filters should be free from dust.	
13	Backup the MT data logs		
14	Ensure the MT PC ON and data Downloading in PC		

15	Regularly backup the MT data logs		
16	Ensure the operations of VDU / MT PC		
17	Ensure DL is always On and Data is backed up. Check the correctness of data being received by Data Logger.		

Quarterly Maintenance Schedule			
Sl. No	**Description**	**Observation**	**Action taken/Note the Voltage Levels**
1	Check all Health Status of LED's, i.e. System health Indication, Output Voltage Indication of system	Status LED should glow	
2	Check all Visual & Health Indications of System & Panel Processor	Visual & Audio Alarm should function if system / communication faulty	
3	Check all VCOR power LED indication status. Check VCOR Coil Voltage.	VCOR Power Indication should glow. VCOR Coil Voltage should be above 24V.	
4	Perform Change Over Test as per the prescribed method and ensure Both A& B Channels are working	System A & System B should work independently.	
5	Check all Vital Relay O/P voltage in all OC.	Shall be above 24V	
6	OFC Ring Modem – Verify the status LEDs and all ST Connectors are properly inserted.	Status as per Normal working and all the ST Connectors are inserted properly.	
7	Update the Antivirus SW and Scan the system (VDU & MT) to keep them free from Virus.	No Virus should be present in the system.	
8	Check all the Relays, Wirings for loose connections, Wago terminations,	Ensure all the relays are properly inserted and all the terminations are proper.	
9	Check the Panel Processor and CCIP wiring and terminations.	Ensure all the terminations are proper.	
10	Synchronize the clock of EI with Data Logger Clock.		
11	Check automatic updating of EI Clock by Data Logger Clock.		

EARTHING (Measurements to be done yearly)

Sl No.	ACTIONS/OBSERVATIONS	OK/YES	NOT OK/NO	REMARKS
1	Verify that all earth pits are visible and measure the ring earth resistance as per the maintenance schedule (Earth measurements once a year), Earth Resistance should be less than 1 ohm.			
2	Check whether front and back doors are earthed or not			
3	Check whether shields of all communication cables are properly connected to earth ground at one end only, if not then connect properly.			
4	Check whether proper earth connection is provided for Data logger, if not then connect properly.			
5	Check whether surge suppressors (110V, 12V, 24V & 230V), if provided used are connected to the respective REB & protective fitting, if not then connect properly.			
6	Check whether 230V OBO surge arrester is connected to the respective REB & protective fitting, if not then connect properly.			
7	Check whether painted surface are scraped to the clean metal surface where grounding connections are to be made, if not then connect properly.			
8	Check whether the earth connection between REB and the racks earth point are as short and there is no bend or any loose in the earth wire (Green), if not then connect properly.			
9	Check whether all joints are being mechanically and electrically effective (Example. clamped, screwed, and bolted, riveted or welded), if not then connect properly.			
10	Check that there are no loose connections in any of the earthing terminations; if not then tighten all connections properly.			
11	Check that there is no damage to earth wire			
12	Earth pits are wetted on regular basis (This is applicable only to non-maintenance free earth pit sites)			

MEI633 Medha EI Troubleshooting

This section lists the Fault codes associated with different modules of MEI633.

The Fault Codes for MEI633 are categorized into Critical and Non Critical Faults.

The Critical Faults are the Faults, which may cause Restart or Shutdown of the Faulty module, or they indicate a serious error, which needs immediate attention.

The Maintainer is alerted about the Critical Fault by a Fault Buzzer in the Front Panel Display and also in the Maintenance Terminal.

Non Critical Faults are the faults, which do not cause the System to restart, or shutdown, but the System may continue to operate through the other redundant channel or in a degraded mode of operation.

The following Tables indicate the Fault Codes for the Individual Modules in MEI633 System when the corresponding Fault Codes are observed on System Front Panel Display or on the Maintenance Terminal and the troubleshooting action to be taken for each module.

Supervisory Processor Troubleshooting Information

Fault Code.	Fault Message	Troubleshooting Action
0X01	CPU Test Fail	• Switch ON the power input to the corresponding CVC card, through the pushbutton switch on the CVHM card, and check. • If the problem persists, replace the CVC Card (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X02	INT. Flash Test Fail	
0X03	TIMERS Test Fail	
0X04	INT. RAM Test Fail	
0X05	INT. BUS Test Fail	
0X06	EXT. BUS Test Fail	
0X07	App. Data Flash Test Fail	
0X08	VP1 DPRAM Test Fail	
0X09	VP2 DPRAM Test Fail	
0X0A	EXT. WDT Test Fail	
0X0B	DIP Switch Setting Mismatch	
0X0C	POST Timer Test Fail	
0X13	PSC Timeout	
0X15	POST Time Out	
0X16	System Installation Id Mismatch	
0X17	Yard Data Ver Id Mismatch	
0X24	SVP status conflict	
0X4B	WFM Output Data Compare Fail	

0X4C	IND. Data Compare Fail	
0X4D	INT. Relay Data Compare Fail	
0X4E	Timer Relay Data Compare Fail	
0X4F	Panel Relay Data Compare Fail	
0X50	WFM Output Message Verification Fail	
0X51	IND. Message1 Verification Fail	
0X52	IND. Message2 Verification Fail	
0X53	IND. Message3 Verification Fail	
0X54	PP Request Message Verification Fail	
0X55	VDU Request Message Verification Fail	
0X5F	Random Error	
0X0D	Program Flow Check Fail	• After restart, if the system continues to function normally, ignore the fault. • If CVC shuts down due to the repeated occurrence of the same fault, Switch ON the power input to the corresponding CVC card, through the pushbutton switch on the CVHM card, and check. • If the problem persists, replace the CVC Card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X0E	RTC RAM Test Fail	
0X0F	I2C BUS Test Fail	
0X18	Cyc Timer Overflow	
0X1B	CY. Interrupt In Fail	
0X1C	SVP Seq. Number. Mismatch	
0X22	VP1 Health Fail	
0X23	VP2 Health Fail	
0X25	Unresolved status	
0X26	COMP active cyclic interrupt NA	
0X27	Power On Synch Fail	
0X29	Both COMPS Not Available	
0X2A	Synchronization Fail	
0X56	Exception Fault	

0X57	Data Read From RTC Fail	
0X58	I2C Bus Access Fail	
0X59	Data Log Flash read pointer Mismatch	
0X5A	Data Log Flash Write pointer Mismatch	
0X5B	Data Log Flash Operation Timeout	
0X5C	Data Log Flash Block Erase Fail	
0X5D	Sync Data Not Written	
0X5E	DPRAM CRC Fail	
0X1D	Invalid Pulse Received	• Indicates that Pulse Width of the Cyclic Interrupt Input is not ok. Check the other CVC Card.
0X1E	COMPA Mode Invalid	• If the same Fault code is observed in both CVC cards, check corresponding Communication Processor. • If the Fault is observed only in this CVC, Switch ON the power input to the corresponding CVC card, through the pushbutton switch on the CVHM card, and check. • If the problem persists, replace the CVC Card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer
0X1F	COMPB Mode Invalid	
0X20	COMPA Health Fail	
0X21	COMPB Health Fail	
0X31	MT. Link Fail	• Check the Cable connections between SVP and MT or DL or FP. • Switch OFF and switch ON the power input to the corresponding CVC and check. • If the problem persists, replace the CVC Card. (Refer MEI-633 Installation and Commissioning Manual)
0X33	MT. Channel Noisy	
0X34	DL. Link Fail	
0X36	DL. Channel Noisy	
0X37	FP. Link Fail	
0X39	FP. Channel Noisy	
0X10	INT UART0 Lpback Tst Fail	

0X11	EXT UART1 Lpback Tst Fail	• If the problem still persists, call Service Engineer
0X12	EXT UART2 Lpback Tst Fail	
0X44	VP1 DPRAM Semaphore Lock Fail	• If any data comparison result or message verification checks are caused due to this fault, switch OFF and switch ON the power input to the corresponding CVC and check. • If the problem persists, replace the CVC Card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X45	VP1 DPRAM Semaphore Release Fail	
0X46	VP2 DPRAM Semaphore Lock Fail	
0X47	VP2 DPRAM Semaphore Release Fail	
0X48	WFM Input Data Compare Fail	
0X49	PP Input Data Compare Fail	• This fault may be due to non-availability of data from the corresponding module. If the corresponding module is available, switch OFF and switch ON the power input to the CVC and check. • If the problem persists, replace the CVC Card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer
0X4A	VDU Input Data Compare Fail	

Vital Processor Troubleshooting Information

Fault Code No.	Fault Message	Troubleshooting Action
0X01	POST Check Timer Test Fail	• Switch ON the power input to the corresponding CVC card, through the pushbutton on the CVHM card, and check. • If the problem persists, replace the CVC Card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X02	CPU Test Fail	
0X03	RAM Test Fail	
0X04	INT Flash Test Fail	
0X05	Timers Test Fail	
0X06	SVP DPRAM Test Fail	
0X07	Application Data Flash Test Fail	
0X09	POST Perform Fault	
0X0A	POST Timeout	
0X0D	COMP A and B DPRAM Tests Fail	
0X1A	Invalid VP Channel No.	
0X1B	Invalid VIC No.	
0X1E	Cyclic Interrupt Timeout	
0X23	SVP Cyclic Intr. Sts Conflict	
0X0B	Program Flow Check Fail	• After restart, if the system continues to function normally, ignore the fault. • If CVC shuts down due to the repeated occurrence of the same fault, Switch ON the power input to the corresponding CVC card, through the pushbutton on the CVHM card, and check. • If the problem persists, replace the CVC Card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X0C	PSC Timeout	
0X1F	Power On Sync Fail	
0X20	Invalid SVP Sequence No.	
0X21	Cyclic Synchronization Fail	
0X22	Invalid Pulse Width	
0X24	SVP DHS Fail	
0X25	Cyclic Activity Timeout	
0X26	Sync. Mode Change Fail	
0X2E	Invalid Relay No.	
0X2F	Invalid Relay State	
0X30	Invalid Logical Operator	
0X31	Illegal Equation Offset	
0X32	END EQN Not Found	

0X35	IND Data CMP Fail	
0X36	IND Msg1 Verf Rslts Fail	
0X37	IND Msg2 Verf Rslts Fail	
0X38	IND Msg3 Verf Rslts Fail	
0X3E	Activity Variable Corrupted	
0X3F	Exception Occurred	
0X40	Variable Corruption	
0X41	Invalid Dipswitch Set	
0X67	WFM OP Data CMP Rslts Fail - WFM	
0X68	WFM OP Msg VERF Rslts Fail - WFM	
0X7C	PP Req Msg VERF Rslts Fail - PP	
0X90	VDU Req Msg VERF Rslts Fail - VDU	
0X0F	COMP A DPRAM Test Fail	
0X10	COMP B DPRAM Test Fail	
0X11	SVP DPR Data CRC Check Fail	• If the Fault is observed only in this CVC, Switch ON the power input to the corresponding CVC card, through the pushbutton on the CVHM card, and check. • If the problem persists, replace the CVC Card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X12	COMP A DPR Data CRC Check Fail	• If the fault is immediately recovered, as indicated by the recovery code, it may be a transient fault. • If the fault code is observed frequently, replace the CVC Card. (Refer MEI-633 Installation and Commissioning
0X13	COMP B DPR Data CRC Check Fail	
0X42	SVP DPR SEM ACQ Fail - SEM	
0X43	COMP A DPR SEM ACQ Fail- SEM	
0X44	COMP B DPR SEM ACQ Fail - SEM	
0X45	SVP DPR SEM RLSE Fail - SEM	
0X46	COMP A DPR SEM RLSE Fail - SEM	

0X47	COMP B DPR SEM RLSE Fail - SEM	Manual) • If the problem still persists, call Service Engineer.
0X27	COMP A DHS Fail	
0X28	COMP B DHS Fail	
0X4E	OC CHNL A IP WFM Msg NA - OC	• Indicates that the Messages from the corresponding Module may not be available. • Check the corresponding Module communication link. If it is OK, Switch OFF and switch ON the CVC card and check. • If the problem persists, replace the CVC Card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X4F	OC CHNL B IP WFM Msg NA - OC	
0X50	OC CHNL A OP WFM Msg NA - OC	
0X51	OC CHNL B OP WFM Msg NA - OC	
0X5A	WFM CHNL A OP RB Msg NA - WFM	
0X5B	WFM CHNL B OP RB Msg NA - WFM	
0X58	WFM CHNL A IP/RB Msg NA - WFM	
0X59	WFM CHNL B IP/RB Msg NA- WFM	
0X71	PP CHNL A IP Msg NA- PP	
0X72	PP CHNL B IP Msg NA- PP	
0X85	VDU CHNL A IP Msg NA - VDU	
0X86	VDU CHNL B IP Msg NA - VDU	
0X56	WFM CHNL A IP/RB Msg DHS Fail - WFM	• Indicates that the corresponding module may not be OK. • If the corresponding WFM/ PP/ VDU is healthy, Switch OFF and switch ON the CVC and check. • If the problem persists, replace the CVC Card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X57	WFM CHNL B IP/RB Msg DHS Fail - WFM	
0X5C	WFM CHNL A IP/RB Msg Intg Fail - WFM	
0X5D	WFM CHNL B IP/RB Msg Intg Fail - WFM	
0X66	WFM IP/RB Data CMP Rslts Fail - WFM	
0X6F	PP CHNL A IP Msg DHS Fail - PP	
0X70	PP CHNL B IP Msg DHS Fail - PP	
0X73	PP CHNL A IP Msg Intg Fail - PP	
0X74	PP CHNL B IP Msg Intg Fail - PP	
0X7B	PP Input Data CMP Rslts Fail - PP	
0X83	VDU CHNL A IP Msg DHS Fail - VDU	

0X84	VDU CHNL B IP Msg DHS Fail - VDU	
0X87	VDU CHNL A IP Msg Intg Fail - VDU	
0X88	VDU CHNL B IP Msg Intg Fail - VDU	
0X8F	VDU Input Data CMP Rslts Fail - VDU	
0X91	Invalid Panel Setting	• Set any one of PP /VDU to Indication Mode which is not used for Route setting
0X92	No Command Panel	• Switch ON the PP/VDU
0X93	Both PP and VDU are Indication Panels	• Switch-on the PP/VDU Module or both Modules • After restart, if the system continues to function normally, ignore the fault. • If the problem persists, replace the CVC Card. • If the problem still persists, call Service Engineer.
0X9C	Invalid Lamp Aspect - SIG	• Check corresponding Signal or the Input WFM.
0X9D	Signal Blank - SIG	
0X9E	HR Relay Drive Fail - SIG	• Check the Output WFM to which corresponding Signal is connected.
0X9F	DR Relay Drive Fail - SIG	
0XA0	HHR Relay Drive Fail - SIG	
0XAB	Point Detection Failed - PT	
0XA7	Invalid Point Detection - PT	• Check corresponding Input WFM or the Point. • If the problem persists, replace the CVC card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X98	HR Wrong Side Fail - SIG	
0X99	DR Wrong Side Fail - SIG	
0X9A	HHR Wrong Side Fail - SIG	

Communication Processor Troubleshooting Information

Fault Code No.	Fault Message	Troubleshooting Action
0X01	CPU Test Fail	• Switch ON the power input to the corresponding CCC card, through the pushbutton switch on the CVHM card, and check. • If the problem persists, replace the CCC card. . (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X02	TIMERS Test Fail	
0X03	INT. Flash Test Fail	
0X04	INT. RAM Test Fail	
0X05	POST Timer Test Fail	
0X06	EXT. WDT Test Fail	
0X07	VP1A DPRAM Test Fail	
0X08	VP2A DPRAM Test Fail	
0X09	VP1B DPRAM Test Fail	
0X0A	VP2B DPRAM Test Fail	
0X0B	INT. BUS Test Fail	
0X0C	EXT. BUS Test Fail	
0X0D	EXT. Flash Test Fail	
0X0E	DIP Switch Setting Mismatch	
0X0F	POST Timeout	
0X1E	System Installation Id Mismatch	
0X1F	Yard Data Version Id Mismatch	
0X28	CY. Interrupt A Received In Wrong Time	
0X29	CY. Interrupt B Received In Wrong Time	
0X31	VIC Act Stby status Conflict	
0X6E	Random Error	
0X10	Program Flow Check Fail	• After restart, if the system continues to function normally, ignore the fault. • If CCC shuts down due to the repeated occurrence of the same fault, Switch ON the power input to
0X24	Cyc Interrupt Timeout	
0X25	Active VIC CY. Interrupt Not Available	
0X26	Active VIC Not Available	

0X27	Both VICs Not Available	the corresponding CCC card, through the pushbutton switch on the CVHM card, and check. • If the problem persists, replace the CCC card. . (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X2A	VICs Seq. Number. Mismatch	
0X36	Both VICs Health Fail	
0X37	CY. Timer Overflow	
0X38	CY. Interrupt A Not Available	
0X39	CY. Interrupt B Not Available	
0X3A	First CY. Interrupt Received in Wrong Time	
0X3B	Both CY. Interrupts Not Available	
0X49	PSC Timeout	
0X55	Exception Fault	
0X6F	Excessive Fault Codes	
0X2B	VICA Health Fail	• If the same Fault code is observed in both CCC cards, check corresponding CVC Card. • If the Fault is observed only in this COMP, Switch OFF and Switch ON the power input to the corresponding CCC card, through the pushbutton switch on the CVHM card, and check. • If the problem persists, replace the CCC Card. . (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X2C	VICB Health Fail	
0X2D	VICA Mode Invalid	
0X2E	VICB Mode Invalid	
0X2F	Invalid Pulse received from Channel0	
0X30	Invalid Pulse received from Channel1	
0X32	VP1A SYNC. Data Not Written	
0X33	VP1B SYNC. Data Not Written	
0X34	VP2A SYNC. Data Not Written	
0X35	VP2B SYNC. Data Not Written	
0X11	EXT. UART0 Loopback Test Fail	• Check whether all the connectors between CIU and OCM/PP-VDU are firmly fixed. • Switch OFF and switch ON the system and check. • If the problem persists, replace the CCC card. . (Refer MEI-633 Installation and Commissioning
0X12	EXT. UART1 Loopback Test Fail	
0X13	EXT. UART2 Loopback Test Fail	
0X14	EXT. UART3 Loopback Test Fail	
0X15	EXT. UART4 Loopback Test Fail	
0X16	EXT. UART5 Loopback Test Fail	
0X17	EXT. UART6 Loopback Test Fail	

0X18	EXT. UART7 Loopback Test Fail	Manual) • If the problem still persists, call Service Engineer.
0X19	EXT. UART8 Loopback Test Fail	
0X1A	EXT. UART9 Loopback Test Fail	
0X1B	EXT. UART10 Loopback Test Fail	
0X1C	EXT. UART11 Loopback Test Fail	
0X3E	IOCOM Port0 Fail	
0X3F	IOCOM Port1 Fail	
0X40	IOCOM Port2 Fail	
0X41	IOCOM Port3 Fail	
0X42	IOCOM Port4 Fail	
0X43	IOCOM Port5 Fail	
0X44	IOCOM Port6 Fail	
0X45	IOCOM Port7 Fail	
0X46	PP/VDU Port Fail	
0X70	Link Fail – IOCOM	
0X71	Channel Noisy - IOCOM	
0X7A	Link Fail – PP	
0X7B	Channel Noisy - PP	
0X84	Link Fail – VDU	
0X85	Channel Noisy – VDU	
0X56	VP1A DPRAM Semaphore Lock Fail	• If no other fault code is observed in corresponding VP, it may be transient fault. • If the fault code is observed frequently, replace the corresponding CVC Card. . (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X57	VP1B DPRAM Semaphore Lock Fail	
0X58	VP2A DPRAM Semaphore Lock Fail	
0X59	VP2B DPRAM Semaphore Lock Fail	
0X5A	VP1A DPRAM Semaphore Release Fail	
0X5B	VP1B DPRAM Semaphore Release Fail	
0X5C	VP2A DPRAM Semaphore Release Fail	

0X5D	VP2B DPRAM Semaphore Release Fail	
0X5E	VP1A DPRAM CRC Comparison Fail	
0X5F	VP1B DPRAM CRC Comparison Fail	
0X60	VP2A DPRAM CRC Comparison Fail	
0X61	VP2B DPRAM CRC Comparison Fail	
0X62	VP1A Output Message Not Available	• Check the corresponding CVC Card. If the CVC is healthy, Switch OFF and switch ON the power input to the corresponding CCC card, through the pushbutton switch on the CVHM card, and check. • If the problem persists, replace the CCC card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X63	VP2A Output Message Not Available	
0X64	VP1B Output Message Not Available	
0X65	VP2B Output Message Not Available	
0X66	VP1A IND. Message1 Not Available	
0X67	VP1A IND. Message2 Not Available	
0X68	VP1A IND. Message3 Not Available	
0X69	VP1B IND. Message1 Not Available	
0X6A	VP1B IND. Message2 Not Available	
0X6B	VP1B IND. Message3 Not Available	
0X6C	VP1A PP/VDU Req. Message Not Available	
0X6D	VP1B PP/VDU Req. Message Not Available	
0X72	PSC Fail - IOCOM	• Check the corresponding IOCOM Module. • If the problem still persists, call Service Engineer.

0X75	WFM Config. Mismatch – IOCOM	• Check the DIP Switch Settings in the corresponding IOCOM. • If the problem still persists, call Service Engineer.
0X7C	PSC Fail - PP	• Check the corresponding PP Module. • If the problem still persists, call Service Engineer.
0X86	PSC Fail - VDU	• Check the corresponding VDU. • If the problem still persists, call Service Engineer.

Panel Processor Troubleshooting Information

Fault Code No.	Fault Message	Troubleshooting Action
0X01	CPU Test Fail	• Switch OFF and switch ON the power input to the PCC card and check. • If the problem persists, replace the PCC card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X02	Program memory Test Fail	
0X03	Internal Data memory Test Fail	
0X04	Application Data memory Test Fail	
0X05	External Buses Test Fail	
0X06	Timers Test Fail	
0X07	External UART Test Fail	
0X0A	External WDT Test Fail	
0X0B	POST Time Out	
0X0C	Configuration Test Fail	
0X0D	PSC Time Out	
0X0E	Program Flow Sequence Fail	
0X0F	Variable Corruption Error	
0X08	IO Cards Presence Test Fail	• Check the power input to the IO Backplane. Atleast one of the Power supplies (PSA) should be ON. • Check whether all the Input (PIP) and Output (POP) cards are ON and the Extender Receiver card (PPRC) is ON (the power LED on the facia of the cards should be ON). If the power to any card is NOT OK, switch OFF the system and replace the faulty card with a new one. • Check whether the connecting cables between the PP IO backplane and the CPU backplane are OK. • Check whether the power input to the Extender driver card (PPDR) is OK (the power LED on the facia of the card should be ON).

		• Switch OFF and switch ON the system. • If the problem still persists, call Service Engineer.
0X1C	COMP Link Fail	• Check whether all the OFC connectors are firmly fixed. • Switch OFF and switch ON the system and check. • If the problem persists, replace the PCC card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer
0X1D	COMP Receive Fail	
0X1E	COMP Channel Noisy	
0X1F	Indication Message Integrity Fail	
0X20	Request Message Integrity Fail	
0X21	COMP Message Receive Time	
0X22	Command Acknowledge Fail	
0X23	Message Transmission Time Out	
0X24	Message Receive Time Out	
0X25	Invalid Message ID	
0X1A	Power On Synchronization Fail	
0X1B	Cycle Synchronization Fail	
0X35	No Output Enable Active	
0X44	Button Stuck	• Check whether the D-type connectors on the facia of the Input cards are firmly fixed. • Continuously operate the corresponding button on the CCIP. • If the problem persists, switch OFF and switch ON the system and check. • If the problem still persists, call Service Engineer.
0X45	Button Stuck	

0X46	Button Stuck	
0X09	Version and ID Mismatch	• Switch OFF and switch ON the system and check. • If the problem persists, call Service Engineer.
0X10	Both Output Enables Active	
0X51 . 0X5B	Input Card1 Detection Fail . Input Card11 Detection Fail	• Switch OFF and switch ON the system and check. • If the problem persists, call Service Engineer.
0X61 . 0X86	Output Card1 Detection Fail . Output Card38 Detection Fail	• Switch OFF and switch ON the system and check. • If the problem persists, call Service Engineer

IOCOM Processor Troubleshooting Information

Fault Code No.	Fault Message	Troubleshooting Action
0X01	POST Check Timer Test Fail	• Switch OFF and switch ON the power input to the OICC card and check. • If the problem persists, replace the OICC card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer
0X02	CPU Test Fail	
0X03	RAM Test Fail	
0X04	INT. Flash Test Fail	
0X06	EXT. WDT Test Fail	
0X07	Timers Test Fail	
0X08	COMP UART Test Fail	
0X09	WFP UART Test Fail	
0X0A	WFP Configuration Test Fail	
0X0C	POST Timeout	
0X0D	PSC Timeout	
0X0E	Program Flow Check Word Fail	
0X0F	IOCOM Activity Corrupted	
0X10	IOCOM Mode Corrupted	
0X11	IOCOM POST Fail	
0XBA	IOCOM Random Error	
0XBB	IOCOM Processor Exception	
0xBC	Invalid WFP Connections	
0XBE	Power On Synch Activity Time out	
0XBF	Initialization Mode Time out	
0X1D	WFP Channel Link Not Ok	• Check the RS485 cable connection between the Top and Bottom OCM backplanes.
0X1E	WFP Channel Noisy	

0X1F	WFP Message Transmission Fail	• Switch OFF and switch ON the power input to the corresponding OCM and check. • If the problem persists, replace the OICC card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X20	WFP Message Receive Timeout	
0X99	WFPs Channel A Noisy	
0X9C	WFP CHNL. A MSGS. TX Timeout	
0XA6	WFPs Channel B Noisy	
0XA9	WFP CHNL. B MSGS. TX Timeout	
0X13	IOCOM Sync Fail	• Check whether all the OFC connectors between Ring Modems, RS-485 connectors at both COMP and IOCOM end are firmly fixed. • Switch OFF and switch ON the system and check. • If the problem persists, replace the OICC card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X15	COMP Message Receive Time Invalid	
0X16	COMP Message Receive Timeout	
0X18	No Output Telegram Received	
0X19	No Input Telegram Request Received	
0X1A	No Output RDBK. REQ. Message Received	
0XB8	COMP Channel Noisy	
0XC0	COMP Repeated Query messages	
0X22	WFP1 Connectivity Status Not OK	• Switch OFF and switch ON the power input to the corresponding OCM and check. • Check the RS485 cable connection between the Top and Bottom OCM backplanes. • If the problem persists, replace the OICC card. If the problem is not solved, replace the corresponding WFP CPU card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X23	WFP2 Connectivity Status Not OK	
0X24	WFP3 Connectivity Status Not OK	
0X25	WFP4 Connectivity Status Not OK	
0X26	WFP5 Connectivity Status Not OK	
0X27	WFP6 Connectivity Status Not OK	
0X28	WFP7 Connectivity Status Not OK	

0X29	WFP8 Connectivity Status Not OK	
0X2A	WFP9 Connectivity Status Not OK	
0X2B	WFP10 Connectivity Status Not OK	
0X2C	WFP11 Connectivity Status Not OK	
0X2D	WFP12 Connectivity Status Not OK	
0X2E	WFP13 Connectivity Status Not OK	
0X2F	WFP14 Connectivity Status Not OK	
0X30	WFP15 Connectivity Status Not OK	
0X31	WFP16 Connectivity Status Not OK	
0X32	WFP1 Link Fail	
0X33	WFP2 Link Fail	
0X34	WFP3 Link Fail	
0X35	WFP4 Link Fail	
0X36	WFP5 Link Fail	
0X37	WFP6 Link Fail	
0X38	WFP7 Link Fail	
0X39	WFP8 Link Fail	
0X3A	WFP9 Link Fail	
0X3B	WFP10 Link Fail	
0X3C	WFP11 Link Fail	
0X3D	WFP12 Link Fail	
0X3E	WFP13 Link Fail	
0X3F	WFP14 Link Fail	
0X40	WFP15 Link Fail	
0X41	WFP16 Link Fail	
0X42	WFP1 Communication Not OK	

0X43	WFP2 Communication Not OK	
0X44	WFP3 Communication Not OK	
0X45	WFP4 Communication Not OK	
0X46	WFP5 Communication Not OK	
0X47	WFP6 Communication Not OK	
0X48	WFP7 Communication Not OK	
0X49	WFP8 Communication Not OK	
0X4A	WFP9 Communication Not OK	
0X4B	WFP10 Communication Not OK	
0X4C	WFP11 Communication Not OK	
0X4D	WFP12 Communication Not OK	
0X4E	WFP13 Communication Not OK	
0X4F	WFP14 Communication Not OK	
0X50	WFP15 Communication Not OK	
0X51	WFP16 Communication Not OK	
0X62	WFP1 HS Fail	
0X63	WFP2 HS Fail	
0X64	WFP3 HS Fail	
0X65	WFP4 HS Fail	
0X66	WFP5 HS Fail	
0X67	WFP6 HS Fail	
0X68	WFP7 HS Fail	
0X69	WFP8 HS Fail	

0X6A	WFP9 HS Fail	
0X6B	WFP10 HS Fail	
0X6C	WFP11 HS Fail	
0X6D	WFP12 HS Fail	
0X6E	WFP13 HS Fail	
0X6F	WFP14 HS Fail	
0X70	WFP15 HS Fail	
0X71	WFP16 HS Fail	
0X92	WFPs Synchronization Fail	
0X93	WFPs Inter WFP Communication Mismatch	
0X94	WFPs Inter WFP Communication fail	
0X95	WFPs UART2 Channel Noisy	
0X9A	WFPs CHNL. A Cycle Start INTG. Fail	
0X9B	WFP CHNL. A MSGS. Wrong Time Receive	
0X9D	WFP CHNL. A OP. MSGS. INTG. Fail	
0XA7	WFPs CHNL. B Cycle Start INTG. Fail	
0XA8	WFP CHNL. B MSGS. Wrong Time Receive	
0XAA	WFP CHNL. B OP. MSGS. INTG. Fail	
0XBC	Invalid WFP Connections	• Problem may be due to DIP Switch settings in OICC. • Switch OFF and Switch ON the OC and check
0XBD	I2C Bus Fail	
0X14	WFM Configuration Mismatch	

Input and Output WFP Troubleshooting Information

Fault Code No.	Fault Message	Troubleshooting Action
0X01	Timer2 Fail	• Switch OFF and switch ON the power input to the corresponding OCM and check. • If the problem persists, replace the corresponding WFP CPU card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X02	Timer1 Fail	
0X03	Timer0 Fail	
0X04	Cpu Test Fail	
0X05	Internal RAM Faulty	
0X06	Internal Flash Faulty	
0X07	DipSwitch Config Fail	
0X08	Uart0 Loopback Fail	
0X09	Uart1 Loopback Fail	
0X0A	External Bus Fail	
0X0B	Watchdog Timer Fail	
0X0C	Excess Time for Self Test	
0X10	Ch 0 RdbK HW Test Fail	
0X11	Ch 1 RdbK HW Test Fail	
0X12	Ch 2 RdbK HW Test Fail	
0X13	Ch 3 RdbK HW Test Fail	
0X14	Ch 4 RdbK HW Test Fail	
0X15	Ch 5 RdbK HW Test Fail	
0X16	Ch 6 RdbK HW Test Fail	
0X17	Ch 7 RdbK HW Test Fail	
0X19	Unwanted Fault Mode Entry	
0X1A	Program flow sequence fail	
0X1B	Activity time out	
0X1F	Variable corruption	
0X20	Invalid Relay Drive	
0X21	Scan Timer Faulty	

0X22	WFP activity variable corruption	
0X23	Power On Sync flag corruption	
0X5B	Cycle Sync Fail	
0X5C	Inter WFP Exchg Mismatch	
0X5D	Inter WFP Communication fail	
0X5E	UART2 channel noisy	
0X0D	RLD Card Not Available	• Switch OFF and switch ON the power input to the corresponding OCM and check. • If the problem persists, switch OFF the power to the OCM, remove the ORLD card from the backplane, re-insert the card and check. • If the problem persists, replace the corresponding ORLD card with a new one. (Refer MEI-633 Installation and Commissioning Manual) • If the problem persists, replace the Output CPU card (OCCO) with a new one. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X0E	Intermediate Read Back Not ok	
0X2C	Relay 0 Intermediate Readback WSF	
0X2D	Relay 1 Intermediate Readback WSF	
0X2E	Relay 2 Intermediate Readback WSF	
0X2F	Relay 3 Intermediate Readback WSF	
0X30	Relay 4 Intermediate Readback WSF	
0X31	Relay 5 Intermediate Readback WSF	
0X32	Relay 6 Intermediate Readback WSF	
0X33	Relay 7 Intermediate Readback WSF	
0X46	Relay 0 Intermediate Readback SSF	
0X47	Relay 1 Intermediate Readback SSF	
0X48	Relay 2 Intermediate Readback SSF	
0X49	Relay 3 Intermediate Readback SSF	

0X4A	Relay 4 Intermediate Readback SSF	
0X4B	Relay 5 Intermediate Readback SSF	
0X4C	Relay 6 Intermediate Readback SSF	
0X4D	Relay 7 Intermediate Readback SSF	
0X0F	Relay State Read Back Not Ok	• Check the Relay wiring and rectify the fault, if any. • Check the Relay and visually ensure the correct state. • Check the Relay connections in the OCM and rectify any loose/open contacts or shorts. • If the problem persists, replace the corresponding Output CPU card (OCCO) with a new one. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X1C	VCOR WS Drive Op Detected	• Switch OFF and switch ON the power input to the corresponding OCM and check. • If the problem persists, replace the Vital cut-off card (OVCO) with a new one. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X3C	VCOR Drive Op Fail	
0X1D	VCOR Wrongside Failure	• Check wiring to the VCOR for any shorts and rectify the fault, if any. • Check the VCOR and visually ensure the

0X1E	VCOR Readback status mismatch	correct state. • Switch OFF and switch ON the power input to the corresponding OCM and check. • If the problem persists, replace the OVCO with a new one. (Refer MEI-633 Installation and Commissioning Manual) • If the problem persists, replace the corresponding Output CPU card (OCCO) with a new one. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X3D	VCOR Safeside Failure	
0X24	Relay 0 Wrong side failure	• Check the Relay wiring and rectify the fault, if any. • Check the Relay and visually ensure the correct state. • Check the Relay connections in the OCM and rectify any loose/open contacts or shorts. • Check the Relay drive indication LED on the facia of the ORLD card. If wrong indication is shown, replace the corresponding ORLD card . (Refer MEI-633 Installation and Commissioning Manual) • If the problem persists, replace the corresponding Output CPU card (OCCO). (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X25	Relay 1 Wrong side failure	
0X26	Relay 2 Wrong side failure	
0X27	Relay 3 Wrong side failure	
0X28	Relay 4 Wrong side failure	
0X29	Relay 5 Wrong side failure	
0X2A	Relay 6 Wrong side failure	
0X2B	Relay 7 Wrong side failure	
0X3E	Relay 0 Safe side failure	
0X3F	Relay 1 Safe side failure	
0X40	Relay 2 Safe side failure	
0X41	Relay 3 Safe side failure	
0X42	Relay 4 Safe side failure	
0X43	Relay 5 Safe side failure	
0X44	Relay 6 Safe side failure	
0X45	Relay 7 Safe side failure	

0X34	Output Relay 0 Readback Status mismatch	• Check the Relay wiring and rectify the fault, if any. • Check the Relay and visually ensure the correct state. • Check the Relay connections in the OCM and rectify any loose/open contacts or shorts. • If the problem persists, Switch OFF and switch ON the OCM and check. If the problem persists, replace the corresponding OCCO card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X35	Output Relay 1 Readback Status mismatch	
0X36	Output Relay 2 Readback Status mismatch	
0X37	Output Relay 3 Readback Status mismatch	
0X38	Output Relay 4 Readback Status mismatch	
0X39	Output Relay 5 Readback Status mismatch	
0X3A	Output Relay 6 Readback Status mismatch	
0X3B	Output Relay 7 Readback Status mismatch	
0X62	Channel-A Noisy	• Check the RS485 cable connection between the Top and Bottom OCM backplanes. • Switch OFF and switch ON the power input to the corresponding OCM and check. • If the problem persists, replace the corresponding WFP CPU card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X63	Chnl-A Cycle Start Integrity Fail	
0X64	Chnl-A Msg Wrong time Receive	
0X65	Chnl-A Msg Tx Timeout	
0X66	Chnl-A OpMsg Integrity Fail	
0X6F	Channel-B Noisy	
0X70	Chnl-B Cycle Start Integrity Fail	
0X71	Chnl-B Msg Wrong time Receive	
0X72	Chnl-B Msg Tx Timeout	
0X73	Chnl-B OpMsg Integrity Fail	
0X4E	Input Relay 0 Readback mismatch	• Check the Relay wiring and rectify the fault, if any. • Check the Relay and visually ensure the correct state.
0X4F	Input Relay 1 Readback mismatch	
0X50	Input Relay 2 Readback mismatch	

0X51	Input Relay 3 Readback mismatch	• Check the Relay connections in the OCM and rectify any loose/open contacts or shorts. • If the problem persists, Switch OFF and switch ON the OCM and check. If the problem persists, replace the Input CPU card. (Refer MEI-633 Installation and Commissioning Manual) • If the problem still persists, call Service Engineer.
0X52	Input Relay 4 Readback mismatch	
0X53	Input Relay 5 Readback mismatch	
0X54	Input Relay 6 Readback mismatch	
0X55	Input Relay 7 Readback mismatch	

Do’s and Dont’s for Medha EI

MEI 633

MEI 633 System Do's & Don'ts

Do's

1. Keep the EI Room free from dust.
2. Maintain minimum 27V-29V DC at the distribution box in EI IPS Room.
3. Check the EI system fuses at the regular intervals for proper contact.
4. Check the fuses provided in the EI IPS room power distribution box at regular intervals.
5. Check the SPD health indication i.e. whether indication glowing or not in EI Relay room & EI IPS room periodically.
6. Ensure Maintenance Terminal PC is always ON and verify the event data log updates.
7. Periodically changeover to standby system by shutting down the active channel in every quarter as per the prescribed changeover procedure.
8. Periodically check and tighten the Earth connections.
9. Clean externally accumulated dust in EI equipment with soft cloth/brush.
10. Close all the openings present in Relay Room/End Goomty's with proper packing, so that to avoid RAT entry.
11. Provide RAT poison cakes in Relay Room/End Goomtys.
12. Periodically check the battery for the electrolyte level and make up if necessary.

Don'ts

1. Try to Troubleshoot without MEI 633 training
2. Use Walkie-talkie, Mobile phone or any Radio equipment near EI equipment.
3. Switch Off any of the EI-IPS modules when EI is in operation.
4. Remove modules, fuses or connectors when EI is in operation.
5. Remove any EI Relays.
6. Forcibly pickup any Relays in EI Room/Field.
7. Touch the board components/Repair on your own.
8. Change jumper setting/Application data without prior approval.
9. Disturb OFC cable or connector.
10. Switch Off MT-PC/loading any software/Files.
11. Keep open Distribution box door/Wire cable tray closures.
12. Use Removable Media/USB/CD/DVD in MT-PC.