MEI633

Electronic Interlocking

Installation and Commissioning Manual

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Version History

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Revision History:

S.No	Change Description
1	Panel Processor Rack – MPP (Top Bin) Changed to Panel Processor Rack – MPP (Bottom Bin)
2	Panel Processor Rack – MPP (Bottom Bin) Changed to Panel Processor Rack – MPP (Top Bin)
3	Mechanical Drawings of all the Bins and Racks are modified
4	CIU and PP card level configuration details have been included.
5	Power connection diagrams for CIU, OC & PP are included
6	Pre-commissioning check-list added
7	Details of Cancellation timer added
8	Wiring details updated
9	Earthing and Lightning protection included
10	PCB Configuration details updated
11	Typical EI configuration, Power supply distribution scheme and OFC Communication arrangement details included as Annexure C
12	Annexure D added with the testing and commissioning details

Table of Contents

List Of Tables

List Of Figures

1 Scope of the Manual

This manual is generic in nature and is intended to cover the installation of the MEI633 system and its external support equipment for all possible applications of the system. The extent and complexity of each installation depends on the application and the equipment ordered for the specified yard.

This manual provides the basic information necessary to install the MEI633 system and its peripheral equipment. Topics covered include equipment preparation, configuration and mounting, connection of operating power, installation of plug-in boards, and typical printed circuit board external circuit interfaces.

2 Pre-Commissioning Checklist

The following are the checklist to be considered before installation of MEI633 system:

Before installing MEI633 make sure of the installation details:

Serial number of the equipment:
Station / Yard Name:
Division / Zonal Railway:

2.1 Software Checklist

Table 2.1 Executive Software CRC checksum

S.No.	Module Name	CRC Checksum	Source code Version no.	Verified (OK/Not OK)
1	PP			
2	COMP			
3	VP			
4	SVP			
5	IOCOM			
6	INPUT WFM			
7	OUTPUT WFM			
8	COUNTER BOX			

Table 2.2 Application Data checksum (Station specific)

S.No.	Module Name	Application Data Checksum	Application Data version no.	Verified (OK/Not OK)
1	PP			
2	COMP			
3	VP			
4	SVP			

2.2 Hardware Check-list

Before making the interconnections between the sub-systems, ensure the following:

1. Check whether the cards are inserted in the respective slots.
2. Check whether locking arrangement is provided for front, glass and rear doors.
3. Check whether the RS485 cables between the Distribution box and CIF card are routed and harnessed properly.
4. Check whether the all the OFC cables are connected properly to the RS485-OFC converters.
5. Check whether all the EMI filters are fixed properly on DIN rail.
6. Check whether the Power connections are as per the details given in this manual.
7. Check whether the fuses of correct rating are provided in the WAGO connectors for power input.
8. Check whether the RS232-OFC converters are properly fixed on DIN rail.
9. Check whether cable glands are provided for all the incoming and outgoing wires.
10. Check whether the Power connections are as per the details given in this manual.
11. Check whether all the connections of the Relays are proper and no wire is loose or is hanging out.
12. Check whether the yard layout on the Panel is as per the approved signalling plan.
13. Check whether two redundant power inputs are provided for the panel.
14. Power supplies and wiring connection for input boards and output boards should be isolated from the other power supplies.
15. Check whether the Input and Output connections for the Panel are routed properly.
16. Check whether all the WAGO connectors used are RDSO approved parts.
17. Ensure that the Surge protection and Earthing of the System is conforming to RDSO/SPN/197/2008 (included as Annexure-A)

2.3 Miscellaneous Peripheral Checklist

1. Check the VCOR coil wiring and contact wiring are as per the interface circuits of the station.
2. Check whether VCOR receptacles are inserted properly and the receptacles are locked in the base.
3. Check whether the type of the relays inserted in the relay racks are as per the relay disposition chart given in the interface circuits.
4. Check whether all the wires are with proper lugs and are inserted properly in the terminal blocks.
5. Check whether all the terminations are provided with proper identification markers.
6. Check whether fuse terminals are fixed with proper fuse ratings as per the interface circuits.
7. Check the mechanical dimensions of the fuse so that the fuse fits in the fuse holder properly and there is no loose connection.

8. Check whether serial link cables are routed separately from both power and I/O wirings.
9. Check for proper power connections from the IPS to all equipments in the system and the operator VDU PCs.
10. Suitable surge arrestor devices should be provided at various power entry points.
11. Check for earth-termination system for all earthing tasks.
12. Check for Equi-potential bonding which helps in eliminating common damages caused by differential earth potentials.

3 System Components

The following Table lists the major components of the MEI633 system that are covered in this manual:

MEI633 System Major System Components

Name	Part No.	Basic Function(s)
Central Interlocking Unit	MCI	Performs the vital interlocking functions and communicates with the other sub-systems
Object Controllers	MOC	Acquiring the Vital Field Input Data and Driving the Vital Field Outputs
Panel Processor Unit	MPP	Acquiring the Operator Command inputs and displaying the Yard Status Indication to the Operator
Control Cum Indication Panel	CCIP	a) Enables the operator give inputs to the system for setting routes through buttons and keys b) Provides the yard status indication to the System Operator by driving the LEDs, buzzers and Counters
Data Logger	DL	Event Logging, Troubleshooting and Diagnostic aids
PC Based Operating Terminal	VDU	It has the same functionality as the Panel processor unit and CCIP
Maintenance Terminal	MT	Event and Fault Logging, Troubleshooting and Diagnostic aids
Front Panel Display Unit	FPD	Displays the fault codes and system health status

4 Sub System Components / Plug-in printed circuit boards

MEI633 consists of various sub-systems that can be housed in standard 19" racks (with an exemption to PP which is a 27" rack). Each sub-system / bin is designed to house individual PCBs pertaining to a logical sub-system of the MEI633. The following tables list the PCBs housed in the individual bins

a) Central Interlocking Unit Rack – MCI (Bottom Bin)

PCB Name	MEI633 Part No.	Qty	Basic Function(s)
CIU Bottom Backplane	M633CBBP-01	1	Mother board for the CPU, CIF and VHM cards
Communication Processor card (COMP CPU card)	M633CCC-01	2	Bridges the field modules and PP with the Vital Interlocking computer through serial interface
Communication Interface card (CIF card)	M633CIF-01	2	CIF Card provides Isolated, Full Duplex RS485 Interface to the Communication Processor Card in the CIU module
Vital Interlocking Computer card (VIC card)	M633CVC-01	2	Performs the vital interlocking and indication logic computation
CIU Voltage and Health Monitoring card (CVH card)	M633CVH-01	2	Monitors the voltage and health of COMP and VIC cards

b) Central Interlocking Unit Rack – MCI (Top Bin)

PCB Name	MEI633 Part No.	Qty	Basic Function(s)
CIU Top Backplane	M633CTBP-01	1	Mother board for the Power supply cards
Power Supply Type B	M633PSB-01	4	To provide power to COMP CPU cards (2 no.s) and VIC cards (2 no.s)

c) Central Interlocking Unit Rack – MCI (Front Panel Display) – 2 no.s

PCB Name	MEI633 Part No.	Qty	Basic Function(s)
Front Panel Display Card	M633FPD-01	1	To display Fault codes and System status messages received from SVP

d) Object Controller Rack – MOC (Bottom Bin)

PCB Name	MEI633 Part No.	Qty	Basic Function(s)
OC Bottom Backplane	M633OBBP-01	1	Mother board for the WFM cards
Input Wayside Function Module CPU Card (Input WFM CPU Card)	M6333OCI-01	5 (max)	Reads the status of input relays
Output Wayside Function Module CPU Card (Output WFM CPU Card)	M6333OCO-01	3 (max)	Drives the field output relays through the Relay Driver card
WFM Relay Driver Card (ORD Card)	M633ORLD-01	3 (max)	Drives the field output relays in a fail-safe manner
Vital Cut-off Card (OVC Card)	M633OVC-01	1	Monitors the health of output WFM CPU cards

e) Object Controller Rack – MOC (Top Bin)

PCB Name	MEI633 Part No.	Qty	Basic Function(s)
OC Top Backplane	M633OTBP-01	1	Mother board for the CPU, CIF and VHM cards
IO Communication Processor card (IOCOM CPU card)	M6333OIC-01	2	Transfers information between COMP and WFMs
Power Supply Type B	M633OPSB-01	2	To provide power to IOCOM CPU cards (2 no.s)
Power Supply Type C	M633OPSC-01	2	To provide power to WFM CPU cards (2 no.s)
OC Voltage and Health Monitoring card (OVH card)	M633OVH-01	2	Monitors the voltage and Health of IOCOM CPU card

f) Panel Processor Rack – MPP (Bottom Bin)

PCB Name	MEI633 Part No.	Qty	Basic Function(s)
PP CPU Backplane	M633PCBP-01	1	Mother board for the CPU, PVH, PSB and PExD cards
PP CPU card	M6333PCC-01	2	Scans the CCIP buttons and drives the indication
Power Supply Type B	M633PPSB-01	2	To provide power to the PP CPU cards (2 no.s)
PP Extender Driver Card	M633PExD-01	2 (max)	Interface between the CPU backplane and IO backplane
PP Voltage and Health Monitoring card (PVH card)	M633PVH-01	2	Monitors the voltage and Health of PP CPU card

g) Panel Processor Rack – MPP (Top Bin)

PCB Name	MEI633 Part No.	Qty	Basic Function(s)
PP IO Backplane	M633PBP-01	4	Mother board for PExR, PP Input and Output cards
PP Receiver Card	M6333PExR-01	4	Interface between the CPU backplane and IO backplane
PP Input Card	M633PIP-01	11	Interface card for scanning the CCIP buttons
PP Output Card	M633POP-01	38	Interface card for driving the CCIP indication outputs
Power Supply Card -A	M633PSA-01	8	To provide power to PExR, PP Input and Output cards

5 Organization of individual sub-systems

The figures of individual sub-systems with the respective modules in place are attached as Annexure-B

6 Printed Circuit Board Configuration details

6.1 CIU – Card Level Configuration details

CIU module contains Vital Interlocking CPU cards (CVC-A, CVC-B), Communication CPU cards (CCC-A, CCC-B), Voltage and Health Monitoring Cards (CVH-A, CVH-B), Communication Interface Cards (CIF-A, CIF-B) on the Bottom back plane (CBBP). The Top Back plane (CTBP) contains Power supplies Type B (PSB).

The following paragraphs, detail the configuration of each card in CIU.

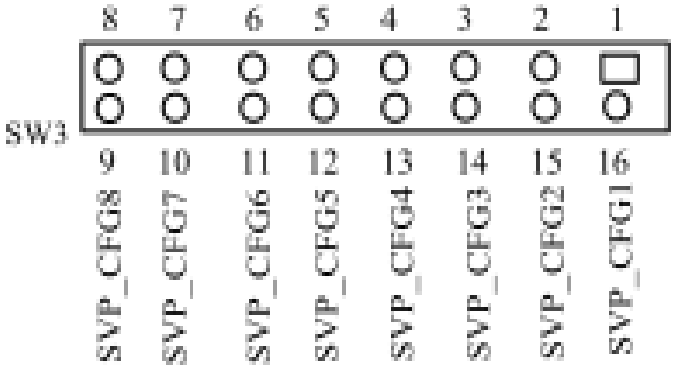
6.1.1 Configuring CVC Card

CVC card contains three CPUs on board namely SVP, VP1 and VP2. Each CPU has to be configured in respect of its CHANNEL and MODE. To Set CHANNEL and MODE CVC card contains three switches on board SW3, SW8 and SW7 for SVP, VP1 and VP2 respectively. Each switch contains 8 bits and each bit can take a value of either 0 or 1.

Note: While setting Channel in the CVC card, it should be ensured that all three CPUs (SVP, VP1 and VP2) shall be set to either Channel A or Channel B. In one card if SVP is set to Channel A and VP1 or VP2 is set Channel B system will not function.

6.1.1.1 SVP Channel and Mode Selection

SW3 is used to configure SVP's CHANNEL and MODE. Two bits of SW3 (SVP_CFG3 and SVP_CFG4) are used for configuring SVP CHANNEL and two bits (SVP_CFG1 and SVP_CFG2) are used for configuring SVP MODE.



Switch Position ON represents ZERO (0)

Switch Position OFF represents ONE (1)

Table 3.3 SVP Channel Selection Table

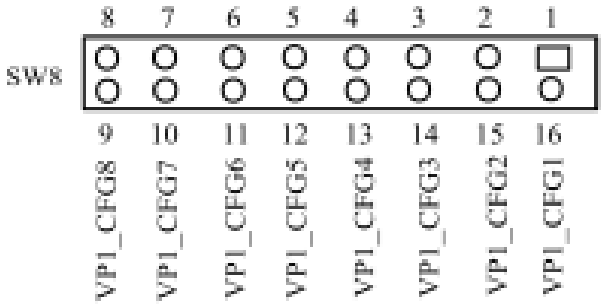
SVP_CFG3	SVP_CFG4	CHANNEL TYPE
OFF	OFF	Invalid
OFF	**ON**	**SVP-A**
ON	**OFF**	**SVP-B**
ON	ON	Invalid

Table 3.4 SVP Mode Selection Table

SVP_CFG1	SVP_CFG2	MODE
OFF	OFF	Invalid
OFF	**ON**	**ONLINE**
ON	**OFF**	**OFFLINE**
ON	ON	Invalid

6.1.1.2 VP1 Channel and Mode Selection

SW8 is used to configure VP1 CHANNEL and MODE. Two bits of SW8 (VP1_CFG5 and VP1_CFG8) are used for configuring VP1 CHANNEL and two bits (VP1_CFG6 and VP1_CFG7) are used for configuring VP1 MODE



Switch Position ON represents ZERO (0)

Switch Position OFF represents ONE (1)

Table 3.5 VP1 Channel Selection Table

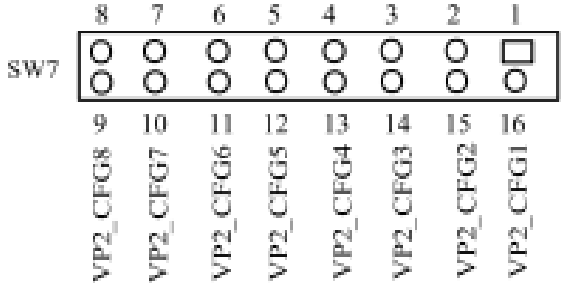
VP1_CFG5	VP1_CFG8	CHANNEL TYPE
OFF	**ON**	**VP1-A**
ON	**ON**	**VP1-B**

Table 3.6 VP1 Mode Selection Table

VP1_CFG6	VP1_CFG7	MODE
OFF	OFF	Invalid
OFF	**ON**	**OFFLINE**
ON	**OFF**	**ONLINE**
ON	ON	Invalid

6.1.1.3 VP2 Channel and Mode Selection

SW7 is used to configure VP2 CHANNEL and MODE. Two bits of SW7 (VP2_CFG5 and VP2_CFG8) are used for configuring VP2 CHANNEL and two bits (VP2_CFG6 and VP2_CFG7) are used for configuring VP2 MODE



Switch Position ON represents ZERO (0)

Switch Position OFF represents ONE (1)

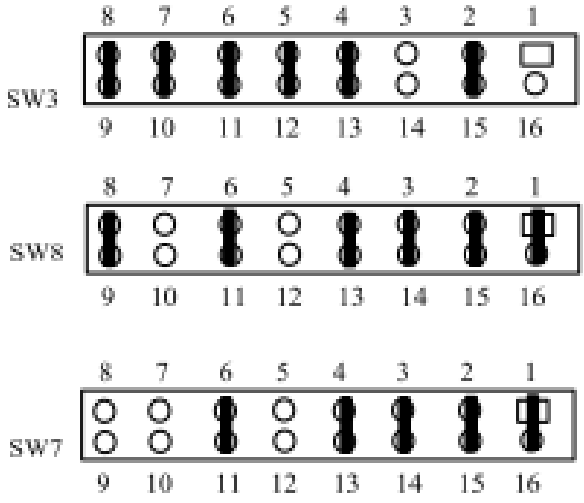
Table 3.7 VP2 Channel Selection Table

VP2_CFG5	VP2_CFG8	CHANNNEL TYPE
OFF	**OFF**	**VP2-A**
ON	**OFF**	**VP2-B**

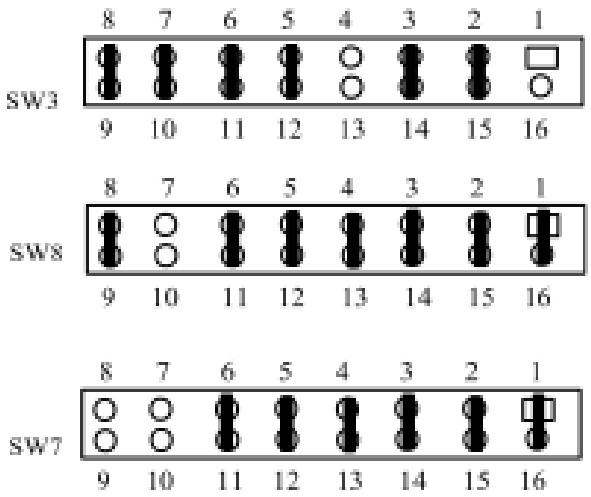
Table 3.8 VP2 Mode Selection Table

VP2_CFG6	VP2_CFG7	MODE
OFF	OFF	Invalid
OFF	**ON**	**OFFLINE**
ON	**OFF**	**ONLINE**
ON	ON	Invalid

CVC-A Card Online Mode Settings:



CVC-B Card Online Mode Settings:

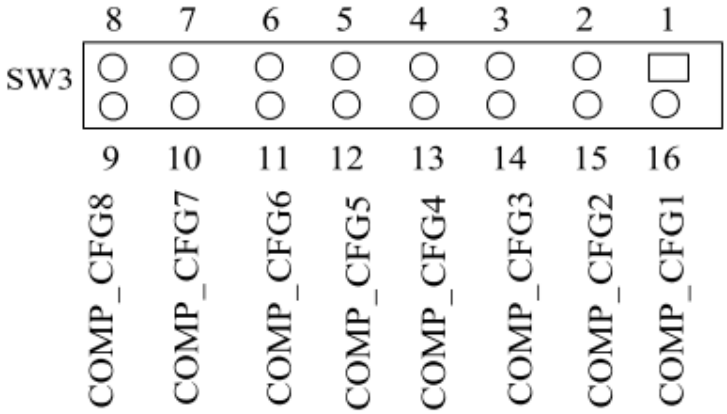


6.1.2 Configuring COMP CPU Card

COMP CPU Card has to be configured in respect of its CHANNEL and MODE. It contains Switch SW3 to configure its CHANNEL and MODE. Each switch contains 8 bits and each bit can take a value of 0 or 1.

6.1.2.1 COMP Channel and Mode Selection

SW3 is used to configure COMP CHANNEL and MODE. Two bits of SW3 (COMP_CFG3 to COMP_CFG4) are used for configuring the CHANNEL and two bits (COMP_CFG1 and COMP_CFG2) are used for configuring the MODE



A short on pins 1 and 16 represents a ZERO (OFF)

An open between pin 1

and 16 represents ONE (ON)

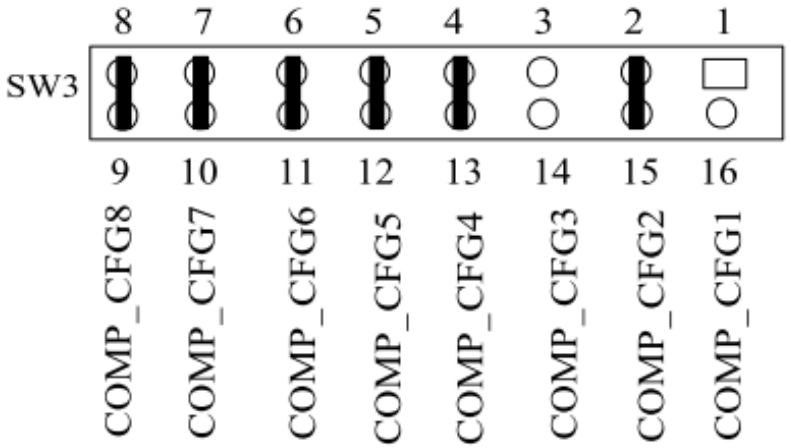
Table 3.9 COMP Channel Selection Table

COMP_CFG3	COMP_CFG4	CHANNNEL TYPE
OFF	OFF	Invalid
OFF	**ON**	**CCC-A**
ON	**OFF**	**CCC-B**
ON	ON	Invalid

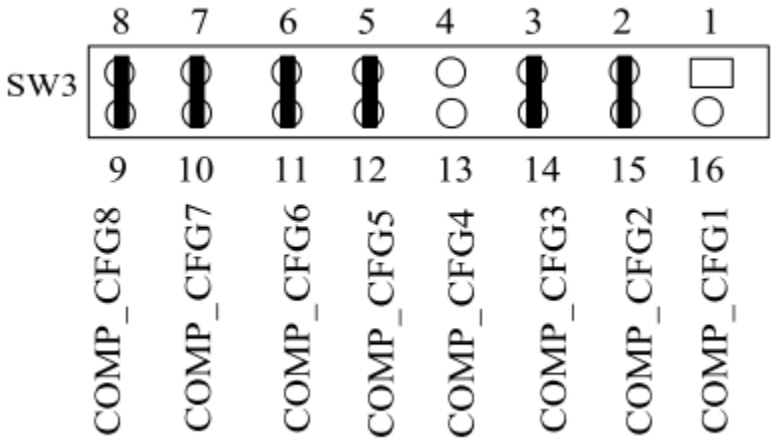
Table 3.10 COMP Mode Selection Table

COMP_CFG1	COMP_CFG2	MODE
OFF	OFF	Invalid
OFF	**ON**	**ONLINE**
ON	**OFF**	**OFFLINE**
ON	ON	Invalid

CCC-A Card Online Mode Settings:



CCC-B Card Online Mode Settings:



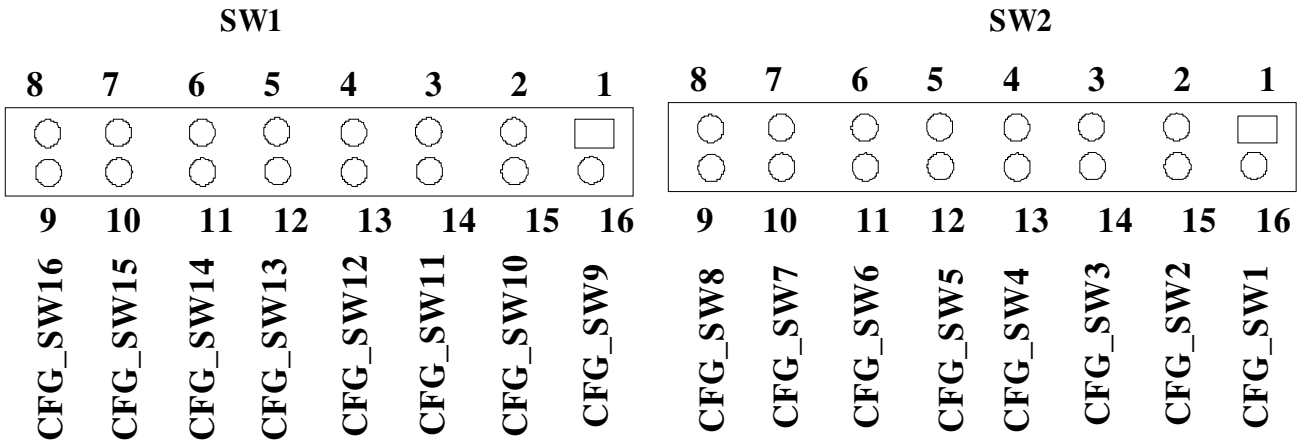
Before installing CVC and CCC cards into CIU the Yard configuration details must be studied.

6.1.3 System Installation ID Setting

CVC card contains Switches SW1 and SW2; CCC card contains Switches SW1 and SW2 to set the System Installation ID.

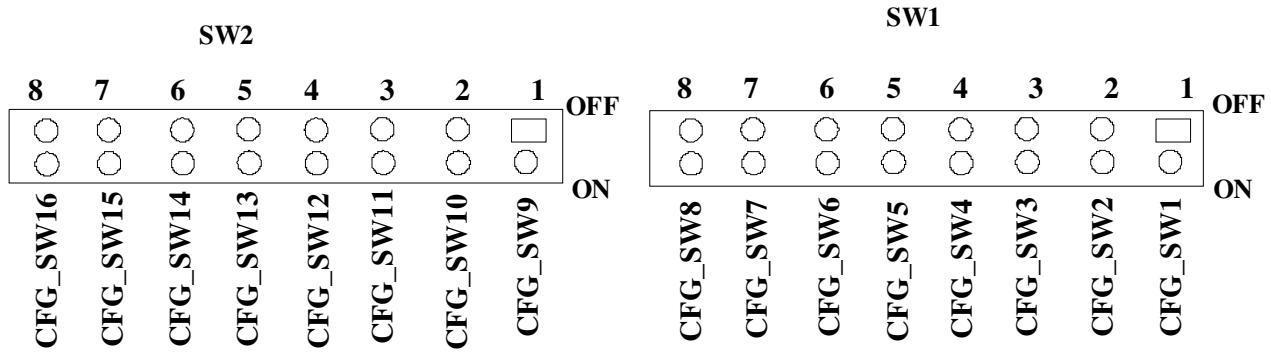
By using these 16 bits (SW1 + SW2), System Installation can be set from the Yard Configuration details. The value of 16-bits can be interpreted in binary format so that it can be configured up to 65535.

CCC card System Installation ID Setting:



A short on pins 1 and 16 represents a ZERO (OFF)
An open between pin 1 and 16 represents ONE (ON)

CVC card System Installation ID Setting:



Switch Position ON represents ZERO (0)

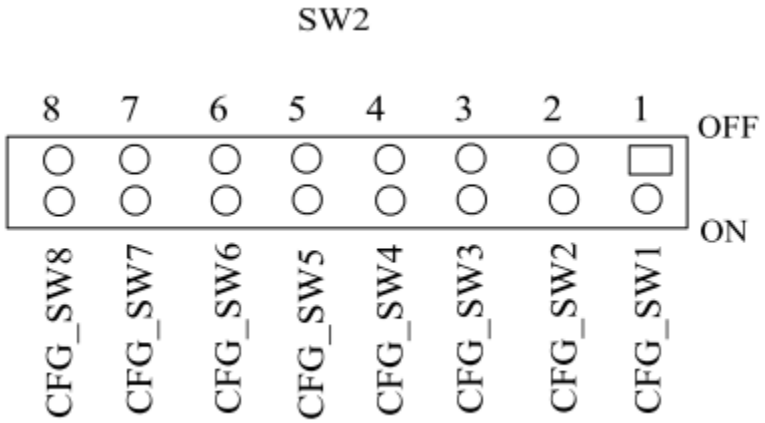
Switch Position OFF represents ONE (1)

6.1.4 Application Data Version Setting

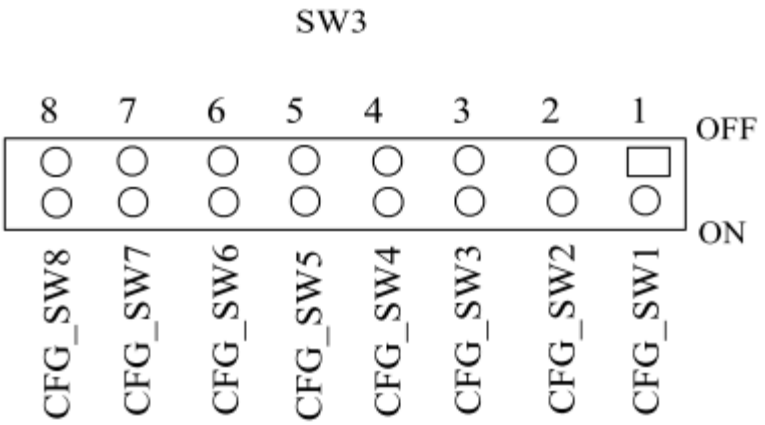
Application Data Version Number can be set on the CIU Bottom Back Plane (CBBP). This back plane contains the Switches SW2 and SW3. Each switch contains 8 bits and each bit can take a value of ZERO or ONE. SW2 shall be used to set the Application Data Version for Side-A (CVC-A and CCC-A) and SW3 shall be used to set the application data for Side-B (CVC-B and CCC-B).

The value of 8-bit can be interpreted in binary format so that it can be configured up to 255.

Application Data Version Setting for Side-A (CVC-A and CCC-A):



Application Data Version Setting for Side-B (CVC-B and CCC-B):



6.2 OC

M – Card level configuration details

OCM module contains IOCOM CPU cards (OIC), Voltage and Health Monitoring Cards (OVH), Power supply Type B (PSB) and Power supply Type C (PSC) on the Top back plane (OTBP). The bottom back plane (OBBP) contains Input WFM CPU cards (OCI), Output WFM CPU cards (OCO), Relay Driver Cards (ORD) and Vital Cutoff card (OVC).

Out of the above-mentioned cards, IOCOM CPU cards, Input WFM CPU cards, Output WFM CPU cards and Vital Cutoff card are to be configured based on the required Yard configuration details.

OCM contains two IOCOM CPU cards (OIC- channel A and Channel B) and one Vital Cutoff card (OVC). The number of Input and Output WFM CPU cards varies depending on Yard configuration details.

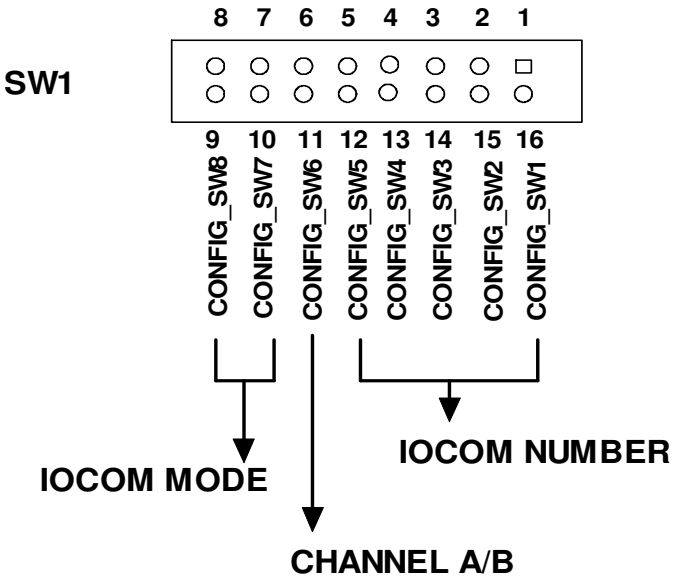
The following paragraphs, detail the configuration of each type of card in OCM.

6.2.1 Configuring IOCOM CPU Card

An IOCOM Card has to be configured with respect to IOCOM NUMBER, CHANNEL, MODE and WFM Connect Status. IOCOM CPU card contains three switches on board (SW1, SW2 and SW3). Each switch contains 8 bits and each bit can take a value of 0 or 1.

6.2.1.1 IOCOM NUMBER, CHANNEL and MODE

SW1 is used to configure IOCOM's NUMBER, CHANNEL and MODE. Five bits of SW1 (CONFIG_SW1 to CONFIG_SW5) are used for configuring IOCOM NUMBER. One bit (CONFIG_SW6) is used for configuring IOCOM channel and two bits (CONFIG_SW7 and CONFIG_SW8) are used for configuring IOCOM MODE.



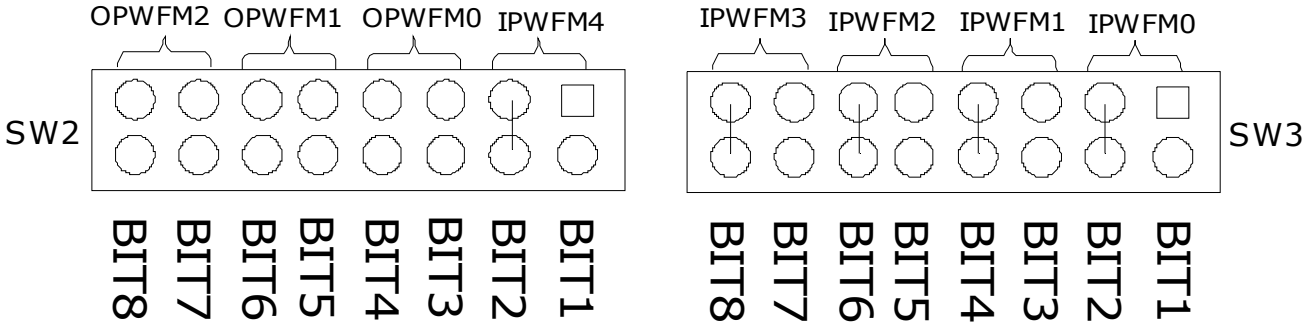
A short on pins 1 and 16 represents a ZERO (0)
An open between pin 1 and 16 represents ONE (1)

6.2.1.2 WFM CONNECT STATUS

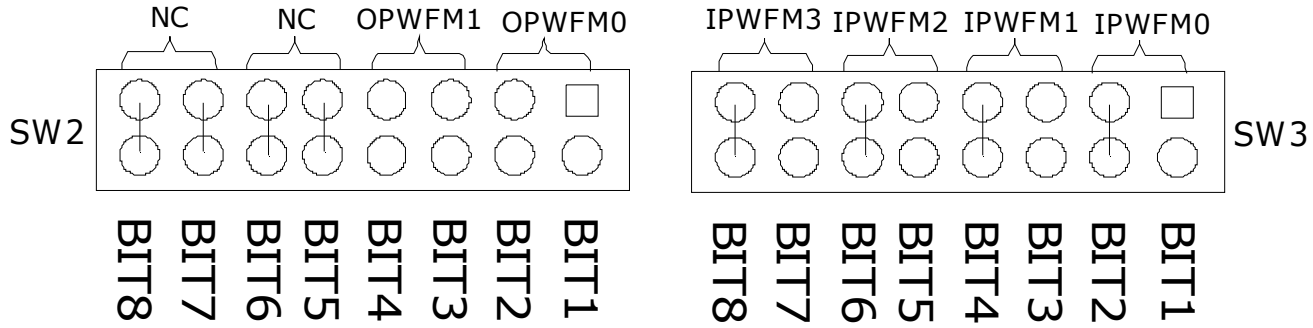
Each IOCOM can be connected to a maximum of 5 Input and 3 Output WFMs. The status of the connected WFMs is provided to IOCOM by the two 8-bit switches SW2 and SW3. The connect status of a WFM is indicated by two bits. Thus all the 8 WFM's connect status is represented by the 16 bits.
The configuration for WFM type is defined in the below table.

BIT 2	BIT 1	WFM CONNECT STATUS Configuration
0	0	NOT CONNECTED
0	1	INPUT WFM
1	0	INVALID SETTING
1	1	OUTPUT WFM

Ex: WFM Connect status showing 5 Input WFMs and 3 Output WFMs



Ex: WFM Connect status showing 4 Input WFMs and 2 Output WFMs



6.2.2 Configuring Input WFM CPU Card

An Input WFM Card has to be configured in respect of it's NUMBER, MODE and Input Relays Connect Status. Input WFM CPU card contains six switches on board (SW1, SW2 , SW3, SW4, SW5 and SW6). In turn each switch contains 8 bits and each bit can take a value of 0 or 1.

An Input WFM CPU card consists of two sections namely Master and Slave. The two sections are identical in respect of configuration, except the Master/Slave configuration which can be identified based on the factory settings of the indicated switches.

SW2, SW4 and SW6 are used in Master, where as SW1, SW3 and SW5 are used in Slave section.

6.2.2.1 Input WFM NUMBER Configuration

SW2 is used to represent WFM number for Master section (SW1 in case of Slave).

A short on pins 1 and 2 represents a ZERO (0)
An open between pin 1 and 2 represents ONE (1)

The value of the 8 bits must be interpreted in Hexadecimal format. SW2 can take values from 0x00 to 0xFF (0 to 255). Based on the Yard configuration details, WFM NUMBER must be configured. Refer table 3.11 for WFM numbers based on OCM.

6.2.2.2 Master/Slave Configuration

The Master/Slave configuration is preset as a factory setting.
The setting of bits 1 and 2 of SW4 shall be cross checked for the MASTER configuration and of SW3 for SLAVE configuration. The Master/Slave configuration is defined in the below table.

BIT 2	BIT 1	WFP Configuration(Master/Slave)
0	0	Invalid Setting
0	1	Master
1	0	Slave
1	1	Invalid Setting

6.2.2.3 WFP MODE Configuration

The third and fourth bits of SW4 are used to represent the WFP MODE for Master section (SW3 in case of Slave).

Under normal working conditions, WFM CPU card must be normally in ONLINE MODE.

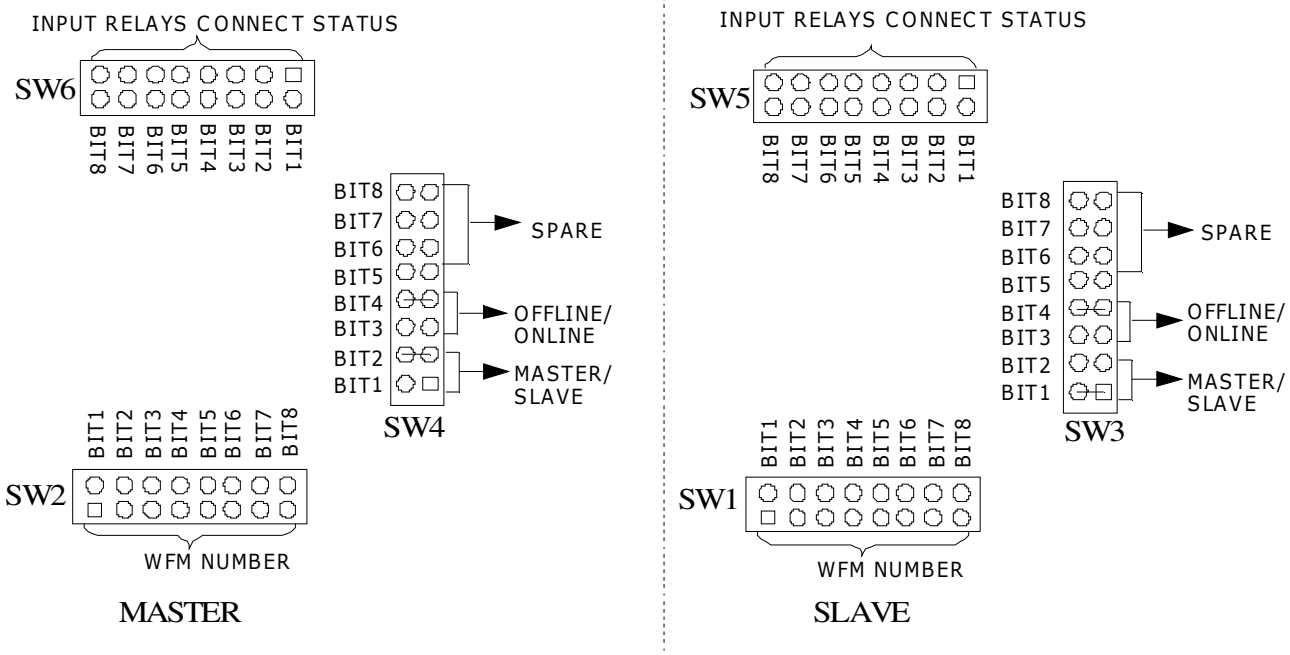
The configuration for ONLINE and OFFLINE mode is defined in the below table.

BIT 4	BIT 3	MODE Configuration (ONLINE/OFFLINE)
0	0	Invalid Setting
0	1	ONLINE
1	0	OFFLINE
1	1	Invalid Setting

6.2.2.4 Input Relays Connect Status

This information provides the number of Input Relays connected to the Input WFM card. SW6 is used in Master section (SW5 in case of Slave). Each Relay is allocated a bit. An open switch (1) indicates the presence of Input relay where as an short (0) indicates the absence of Input relay. The configuration is same for both Master and Slave sections.

Ex: Input WFM with NUMBER 0xFF(255), ONLINE MODE and all Input Relays connected (with Master/Slave configuration preset)



Input Relays Connect Status configuration for Input WFM-0

The 8th Input Relay of Input WFM-0 of OC-0 is reserved for MEI633 testing with Reduced Route Cancellation Timer Relay. It should be ensured that this input is configured as UNCONNECTED prior to commissioning of the System. The status of this input should not be changed under any circumstances.

6.2.3 Configuring Output WFM CPU Card

An Output WFM Card has to be configured in respect of its NUMBER, MODE and Output Relays Connect Status. Output WFM CPU card contains six switches on board (SW1, SW2, SW3, SW4, SW5 and SW6). In turn each switch contains 8 bits and each bit can take a value of 0 or 1.

An Output WFM CPU card consists of two sections namely Master and Slave. The two sections are identical in respect of configuration, except the Master/Slave configuration which can be identified based on the factory settings of the indicated switches.

SW2, SW4 and SW6 are used in Master, where as SW1, SW3 and SW5 are used in Slave section.

6.2.3.1 Output WFM NUMBER Configuration

SW2 is used to represent WFM number for Master section (SW1 in case of Slave).

A short on pins 1 and 2 represents a ZERO (0)
An open between pin 1 and 2 represents ONE (1)

The value of the 8 bits must be interpreted in Hexadecimal format. SW2 can take values from 0x00 to 0xFF (0 to 255). Based on the Yard configuration details, WFM NUMBER must be configured.

6.2.3.2 Master/Slave Configuration

The Master/Slave configuration is preset as a factory setting.
The setting of bits 1 and 2 of SW4 shall be cross checked for the MASTER configuration and of SW3 for SLAVE configuration. The Master/Slave configuration is defined in the below table.

BIT 2	BIT 1	WFP Configuration(Master/Slave)
0	0	Invalid Setting
0	1	Master
1	0	Slave
1	1	Invalid Setting

6.2.3.3 WFP MODE Configuration

The third and fourth bits of SW4 are used to represent the WFP MODE for Master section (SW3 in case of Slave).

Under normal working conditions, WFM CPU card must be normally in ONLINE MODE.

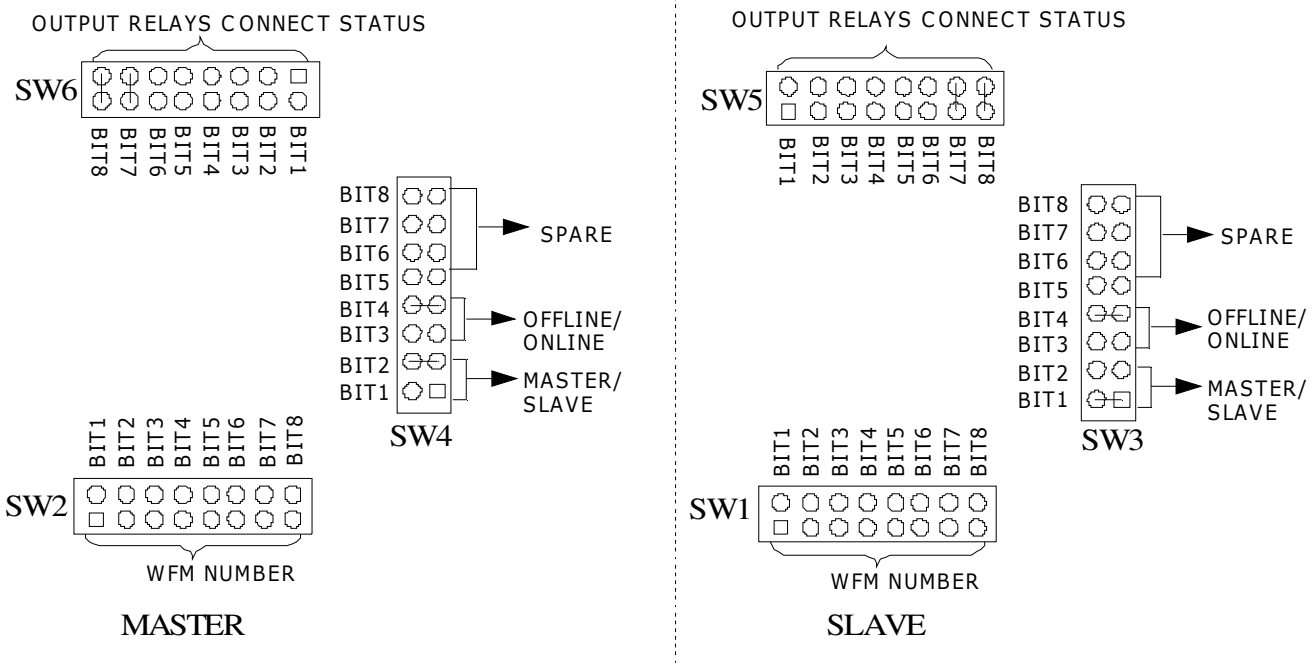
The configuration for ONLINE and OFFLINE mode is defined in the below table.

BIT 4	BIT 3	MODE Configuration (ONLINE/OFFLINE)
0	0	Invalid Setting
0	1	ONLINE
1	0	OFFLINE
1	1	Invalid Setting

6.2.3.4 Output Relays Connect Status

This information provides the number of Output Relays connected to the Output WFM card. SW6 is used in Master section (SW5 in case of Slave). Each Relay is allocated a bit. An open switch (1) indicates the presence of Output relay where as an short (0) indicates the absence of Output relay. The configuration is same for both Master and Slave sections.

Ex: Output WFM with NUMBER 0xFF(255), ONLINE MODE and Six Output Relays connected (with Master/Slave configuration preset)

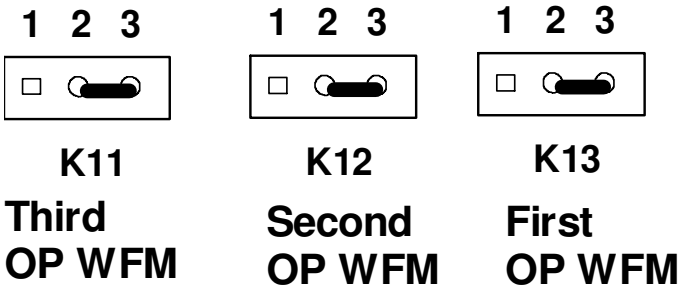


6.2.4 Configuring Vital Cutoff card

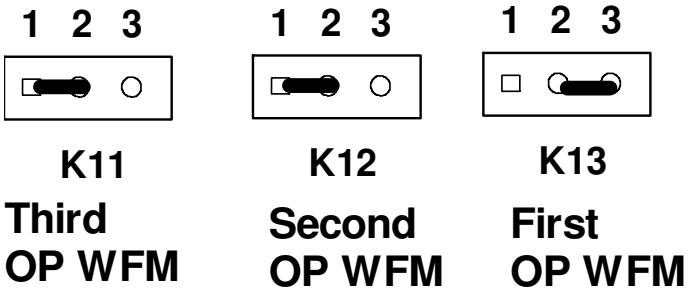
The configurable item in a Vital Cutoff card (OVC) is the number of Output WFM cards present in the OCM (based on Yard configuration details). OVC card has three jumpers namely K13, K12 and K11. Each of them is a three pin jumper. K13, when connected to GND (pin 2 and 3 short) represents the presence of first Output WFM card in the OCM. K12, when connected to GND (pin 2 and 3 short) represents the presence of second Output WFM card in the OCM. K11, when connected to GND (pin 2 and 3 short) represents the presence of third Output WFM card in the OCM. Absence of an Output WFM card is represented by shorting pin 1 and 2 of the respective jumpers.

Placement of Output WFM cards is specific. If an OCM contains only one Output WFM card, it must be configured as the first Output WFM card. Similarly if an OCM contains two Output WFM cards, they must be configured as the first and second Output WFM cards. Any other combination is invalid.

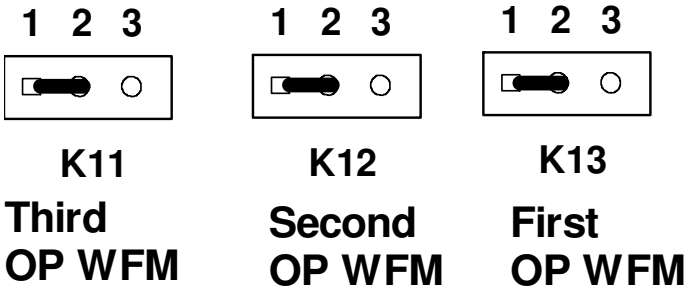
Ex: OVC configuration showing that all the three Output WFM cards are present.



Ex: OVC configuration showing only one Output WFM card is present.



Ex: OVC configuration showing no Output WFM card is present (in case only Input Cards are present)



6.2.5 Yard Configuration Setting in OC

Before installing an OCM, the details of that particular OCM from the Yard configuration details must be studied. All the cards are configured and only an authorized service engineer should change the setting if required.
Any OCM contains two IOCOM CPU cards and an OVC card. The number of Input WFM and Output WFM cards is based on the Yard configuration details. Each OCM has a unique number (0 to 31).

In an OCM the Top bin contains two slots for IOCOM A and IOCOM B named as OICC-A and OICC-B. Based on the Channel configuration, IOCOM A must be placed in OICC-A slot and IOCOM B in OICC-B slot respectively.

As a next step, the number of Input WFMs and Output WFMs must be known from the Yard configuration details. These cards are to be placed in the Bottom bin of the OCM. Bottom bin of an OCM can contain a maximum of five Input WFM CPU cards (OCCI-1 to OCCI-5) and a maximum of three Output WFM CPU cards (OCCO-1 to OCCO-3). Based on the WFM NUMBER, the card has to be placed in the appropriate slot. The Input WFM NUMBER, which is the lowest in that particular OCM, must be placed in OCCI-1 slot. Similarly, Output WFM NUMBER, which is the lowest in that particular OCM, must be placed in OCCO-1 slot. The other cards follow in the ascending order.

The following table provides the details of WFM CPU cards to be placed in an OCM based on their NUMBER.

Table 3.11 WFM CPU Cards Configuration

OCM No.	WFM No.s
0	0 to 7
1	8 to 15
2	16 to 23
3	24 to 31
4	32 to 39
5	40 to 47
6	48 to 55
7	56 to 63
8	64 to 71
9	72 to 79
10	80 to 87
11	88 to 95
12	96 to 103
13	104 to 111
14	112 to 119
15	120 to 127
16	128 to 135
17	136 to 143
18	144 to 151
19	152 to 159
20	160 to 167
21	168 to 175
22	176 to 183
23	184 to 191

24	192 to 199
25	200 to 207
26	208 to 215
27	216 to 223
28	224 to 231
29	232 to 239
30	240 to 247
31	248 to 255

6.3 PP - Card level configuration details

Panel Processor Module contains PP CPU cards (PCC), Extender Driver Cards (PExD), Voltage and Health Monitoring Cards (PVH) and Type B Power supplies (PSB) on the CPU back plane (PCBP). The IO Back plane (PBP) contains Extender Receiver card (PExR), Input cards (PIP), Output cards (POP), and Type A Power supplies (PSA).

Out of the above-mentioned cards, PP CPU cards, CPU Back plane, Input cards and Output cards have to be configured based on the Yard configuration details.

The number of Input and Output cards that are present in the IO Backplane varies depending upon Yard for which EI is being installed.

The following paragraphs describe the configuration of each type of card in PP module.

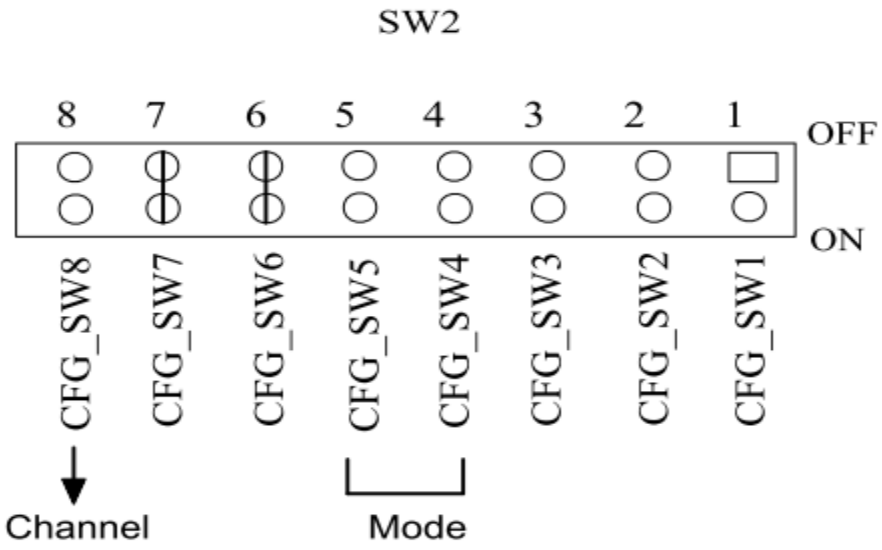
6.3.1 Configuring PP CPU Card

PP CPU Card contains two on-board switches namely Password switch (SW1) and Configuration switch (SW2). Each switch contains 8 bits and each bit can take a value of 0 or 1.

SW1 is provided for future use. (SW1-1 to SW1-8 shall be configured to ZERO.)

PP CPU Card has to be configured in respect of its CHANNEL and MODE. SW2 is used to configure PP's CHANNEL and MODE.

One bit of SW2 (CONFIG_SW8) is used for configuring PP CHANNEL. Two bits (CONFIG_SW5 and CONFIG_SW4) are used for configuring PP MODE. Two bits (CONFIG_SW7 and CONFIG_SW6) are kept permanently short. Remaining three bits are provided for future use.(CONFIG_SW3, CONFIG_SW2 and CONFIG_SW1).



A short on pins 1 and 16 represents a ZERO (0)

An open between pin 1 and 16 represents ONE (1)

CONFIG_SW8 can be interpreted as Channel. For Channel A it is '0' and for Channel B it is '1'

PP MODE configuration depends upon the state of usage of the CPU card. The setting of the switches CONFIG_SW5 and CONFIG_SW4 during the time of downloading Application data and during the normal operation of the EI shall be as per the following table:

Table 3.12 PP MODE Configuration

CPU card usage	CONFIG_SW5	CONFIG_SW4
Application Data download	0	1
Normal operation of EI	1	0

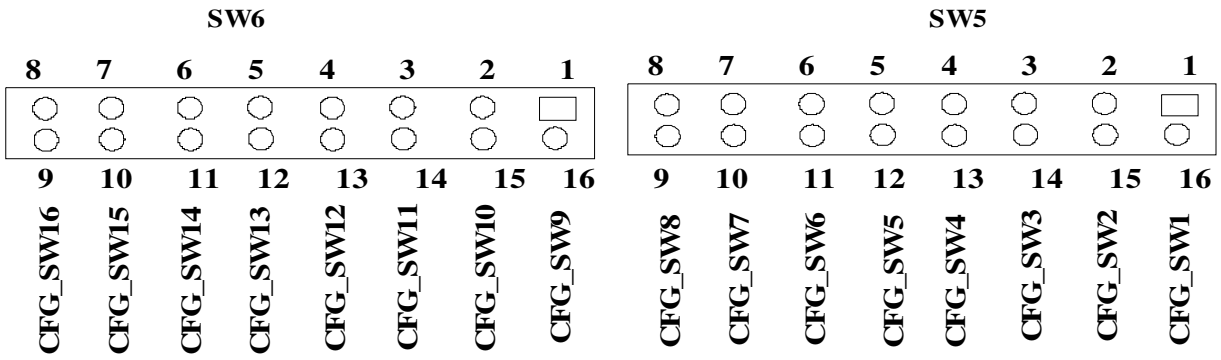
6.3.2 Configuring PP CPU Back Plane

PP CPU Back plane contains Six Switches (3 for Channel A and 3 for Channel B) namely Application Software version switch and System Installation ID Configuration switches (2 Switches). SW4 and (SW5+SW6) are used for Channel A, SW1 and (SW2+SW3) are used for Channel B. Each switch contains 8 bits and each bit can take a value of 0 or 1.

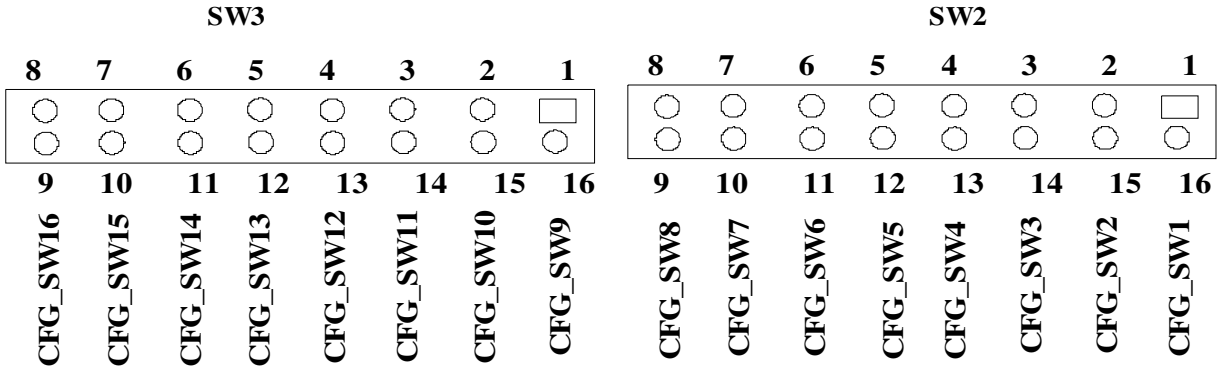
Channel A side and B side configuration of these switches should be same for a yard.

The value of the 8 bits must be interpreted in binary format. Each switch can take values from 0 to 255(0x00 to 0xFF). Based on the Yard configuration details, Application Software version switch and Installation ID Configuration switches must be configured.

System Installation ID Setting:(For Channel A)



System Installation ID Setting:(For Channel B)



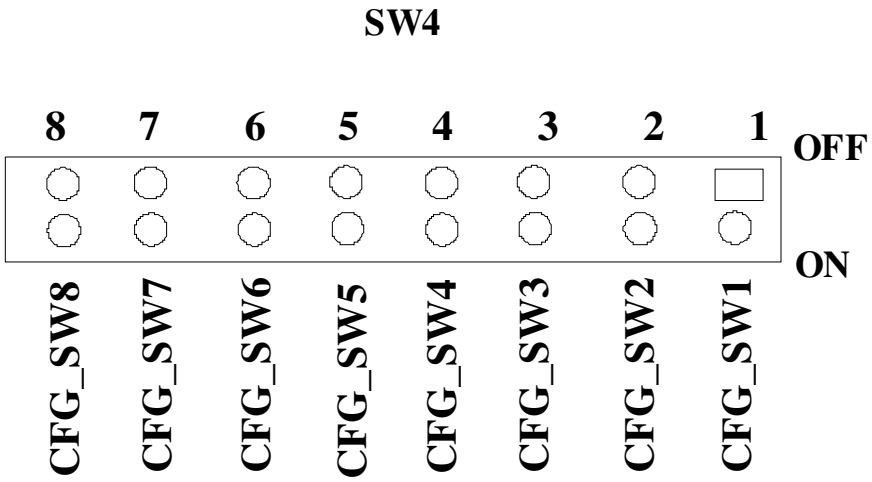
A short on pins 1 and 16 represents a ZERO (OFF)

An open between pin 1 and 16 represents ONE (ON)

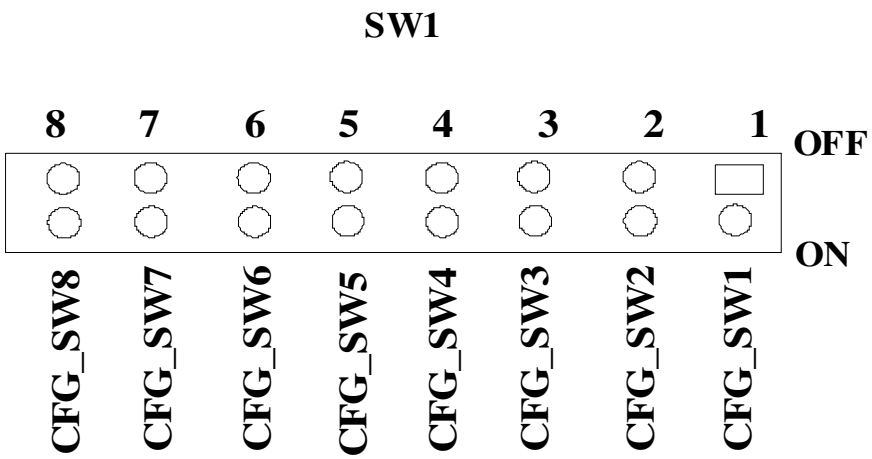
Switch Position ON represents ZERO (0)

Switch Position OFF represents ONE (1)

Application Data Version Setting (For Channel A)



Application Data Version Setting (For Channel B)



A short on pins 1 and 16 represents a ZERO (OFF)
An open between pin 1 and 16 represents ONE (ON)

Switch Position ON represents ZERO (0)

Switch Position OFF represents ONE (1)

6.3.3 Configuring PP Input Card

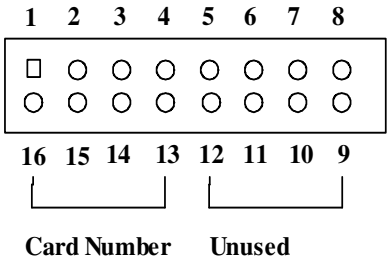
The number of input cards present in an EI installation depends upon the Yard configuration. Each input card is identified by a unique number/address.

An Input Card has to configured in respect of its NUMBER. Input card contains an on board switch (SW1) which in turn contains 8 bits and each bit can take a value of 0 or 1.

6.3.3.1 Input Card NUMBER Configuration

Out of 8 bits of SW1 only 4 switches are used. (CONFIG_SW1 to CONFIG_SW4) and remaining four bits are for provided for future use.

SW1:



A short on pins 1 and 16 represents a ZERO (0)
An open between pin 1 and 16 represents ONE (1)

The value of the 8 bits must be interpreted in Binary format. SW1 can take values from 1 to 11 (0x01 to 0x0B) (The maximum number of input cards present in any EI installation is 11)

Input Card Number shall be configured as per the below table. (SW1-5 to SW1-8 shall be configured to ZERO.)

Table 3.13 Input Card Number Configuration

Card Number	SW1-4	SW1-3	SW1-2	SW1-1
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1

6.3.4 Configuring PP Output Card

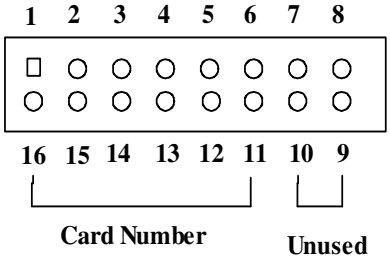
The number of Output cards present in an EI installation depends upon the Yard configuration. Each output card is identified by a unique number/address.

An Output Card has to configured in respect of it's NUMBER. Output card contains an on board switch (SW1) which in turn contains 8 bits and each bit can take a value of 0 or 1.

6.3.4.1 Output Card NUMBER Configuration

Out of 8 bits of SW1 only 6 switches are used.(CONFIG_SW1 to CONFIG_SW6) and remaining TWO bits are provided for future use.

SW1:



A short on pins 1 and 16 represents a ZERO (0)

An open between pin 1 and 16 represents ONE (1)

The value of the 8 bits must be interpreted in binary format. SW1 can take values from 1 to 38 (0x01 to 0x26) (The maximum number of Output cards present in any EI installation is 38)

Output Card Number shall be configured as per the below table. (SW1-7 and SW1-8 shall be configured to ZERO)

Table 3.14 Output Card Number Configuration

Card Number	SW1-6	SW1-5	SW1-4	SW1-3	SW1-2	SW1-1
1	0	0	0	0	0	1
2	0	0	0	0	1	0
3	0	0	0	0	1	1
4	0	0	0	1	0	0
5	0	0	0	1	0	1
6	0	0	0	1	1	0
7	0	0	0	1	1	1

Card Number	SW1-6	SW1-5	SW1-4	SW1-3	SW1-2	SW1-1
8	0	0	1	0	0	0
9	0	0	1	0	0	1
10	0	0	1	0	1	0
11	0	0	1	0	1	1
12	0	0	1	1	0	0
13	0	0	1	1	0	1
14	0	0	1	1	1	0
15	0	0	1	1	1	1
16	0	1	0	0	0	0
17	0	1	0	0	0	1
18	0	1	0	0	1	0
19	0	1	0	0	1	1
20	0	1	0	1	0	0
21	0	1	0	1	0	1
22	0	1	0	1	1	0
23	0	1	0	1	1	1
24	0	1	1	0	0	0
25	0	1	1	0	0	1
26	0	1	1	0	1	0
27	0	1	1	0	1	1
28	0	1	1	1	0	0
29	0	1	1	1	0	1
30	0	1	1	1	1	0
31	0	1	1	1	1	1
32	1	0	0	0	0	0
33	1	0	0	0	0	1
34	1	0	0	0	1	0
35	1	0	0	0	1	1
36	1	0	0	1	0	0
37	1	0	0	1	0	1

Card Number	SW1-6	SW1-5	SW1-4	SW1-3	SW1-2	SW1-1
38	1	0	0	1	1	0

6.3.5 Yard Configuration Setting in PP

Before installing the PP Module, the details of that particular PP from the Yard configuration details must be studied. All the cards are configured and only an authorized service engineer should change the setting if required.

Any PP contains two PP CPU cards, an Extender Driver card and Extender Receiver card. The number of Input and Output cards is based on the Yard configuration details.

In the PP module, the bottom bin contains two slots for PP A and PP B named as PCC-A and PCC-B. Based on the Channel configuration, PP A must be placed in PCC-A slot and PP B in PCC-B slot respectively.

As a next step, the number of Input Cards and Output Cards must be known from the Yard configuration details. These cards are to be placed in the Top bin of the PP Module. Top bin of PP can contain a maximum of three Input cards (PIP-1 to PIP-3) and a maximum of ten Output cards (POP-1 to POP-10). Based on the Card NUMBER, the card has to be placed in the appropriate slot. The Input Card NUMBER, which is the lowest in that particular PP, must be placed in PIP-1 slot. Similarly, Output Card NUMBER, which is the lowest in that particular PP, must be placed in POP-1 slot. The other cards follow in the ascending order.

Both CPU Back plane and IO Back plane are interconnected through two Shielded Flat cables having 78-pin D type connectors on either end. One is for Channel A and the other for Channel B.

In any EI installation, if the number of Input cards exceeds 3 or the number of Output cards exceeds 10, these cards should be mounted in the next IO backplane. The second IO backplane is connected to the CPU backplane with two 78-pin D type connectors. Likewise, there can be upto 4 IO backplanes that are connected to the CPU backplane. The following table provides information about connecting the IO backplanes with the CPU backplane.

Table 3.15 Yard Configuration setting

CPU backplane	IO backplane – 1	IO backplane – 2	IO backplane – 3	IO backplane – 4
K23	K18			
K24	K19			
K21		K18		
K22		K19		
K19			K18	

K20			K19	
K17				K18
K18				K19

6.4 Yard configuration details

6.4.1 Relay Disposition Chart and Contact Analysis

Relay Disposition Chart and Contact Analysis will be prepared according to the specific yard.

6.4.2 Relay Circuits

Relay circuits will be prepared according to the specific yard and submitted to the user Railways for verification and approval.

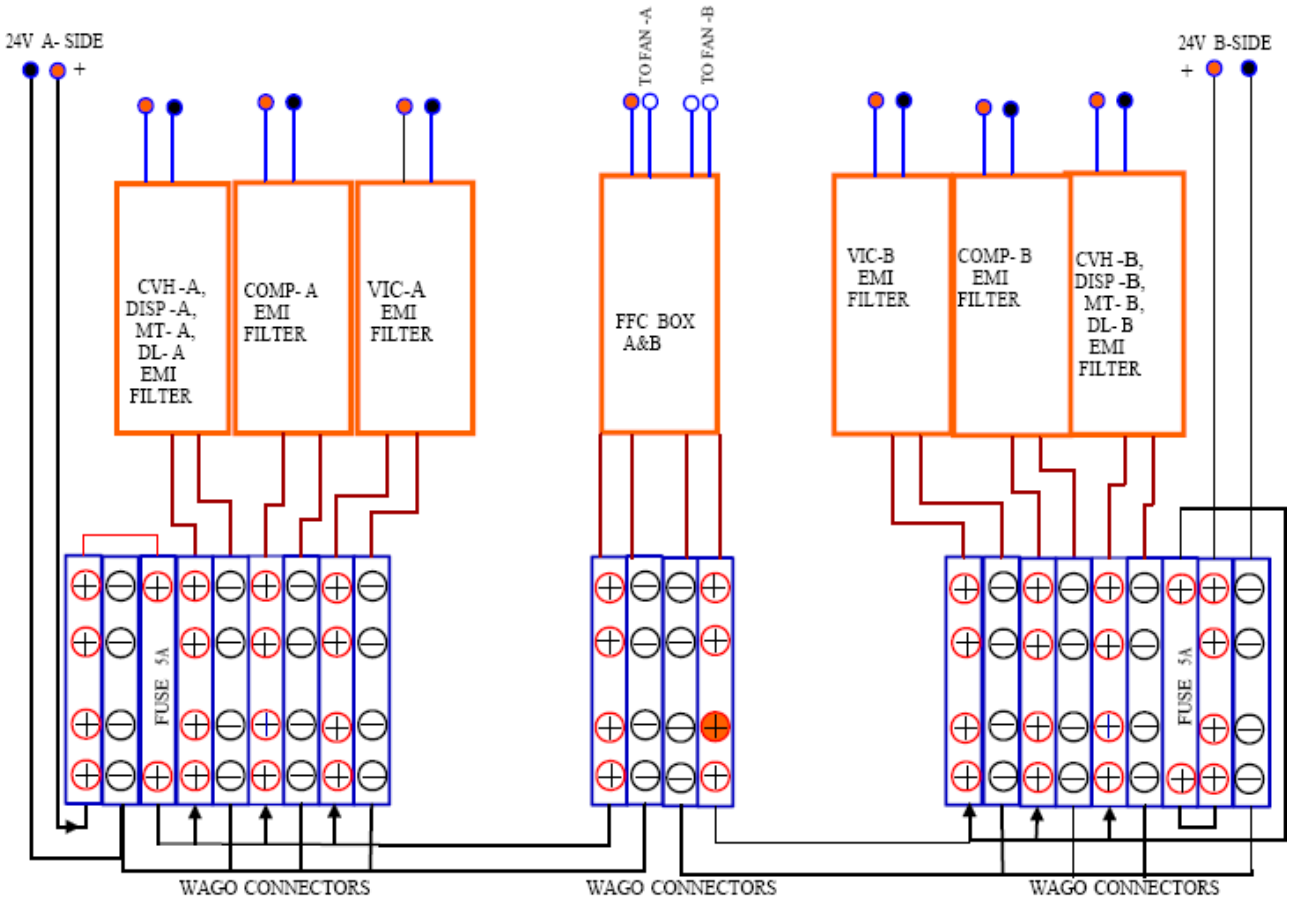
7 Power supply connection details

Each of the modules of MEI633 namely, Central Interlocking Unit, Object Controller and the Panel Processor, are provided with two independent sources of power. One of them is used to power the Section-A PCBs and the other is used to power the Section-B PCBs of the modules.
For the PCBs that are common to both Section-A and Section-B, the two powers are OR-ed with Diodes and fed to them.

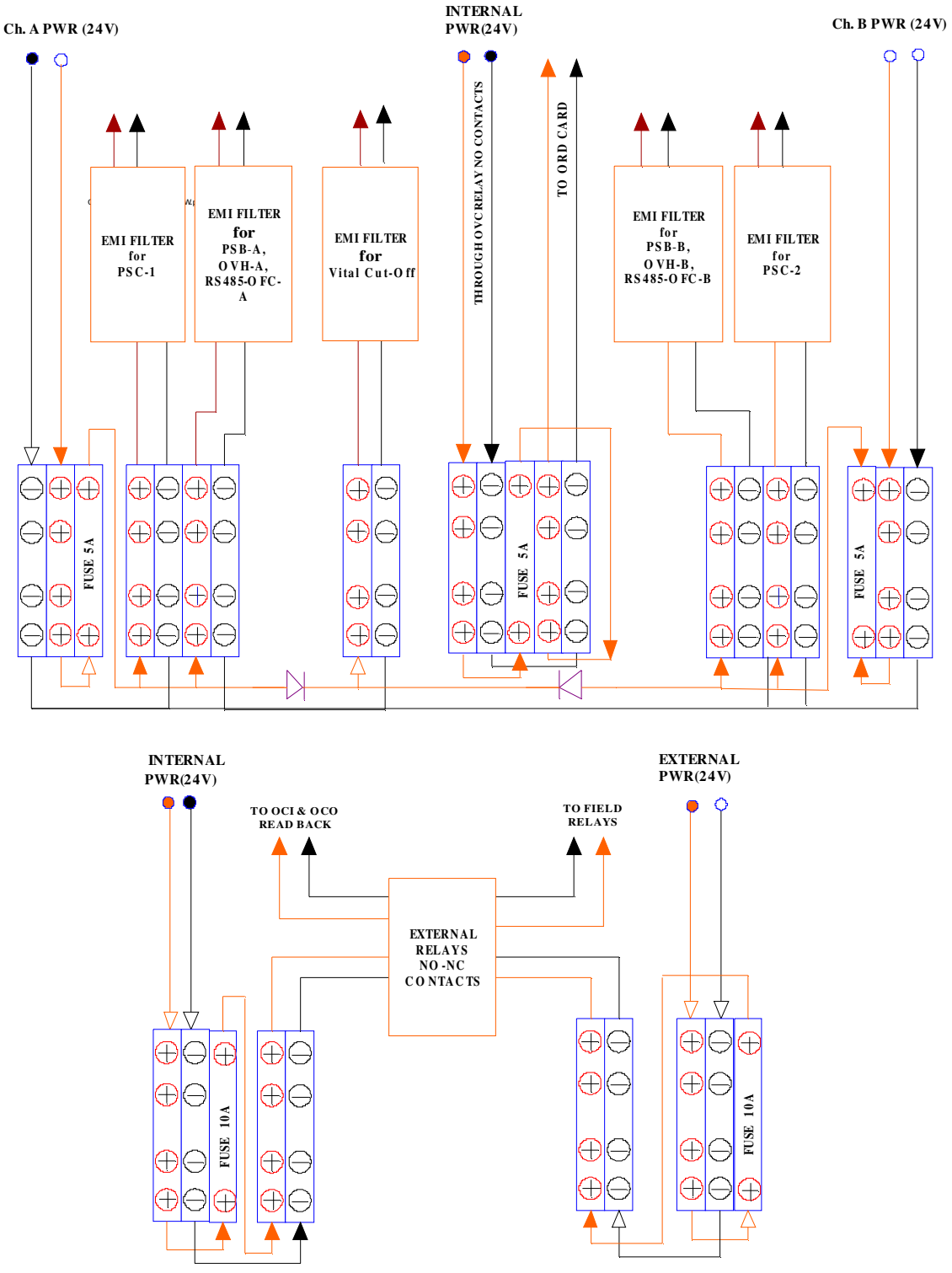
The external power cables are terminated on to WAGO connectors mounted on the rear side of the modules. Then they are distributed among different PCBs using WAGO connectors with inbuilt fuse. Before the power is fed to any PCB, it is filtered using an EMI filter to suppress the effects of EMI, noise and surges on the power input.

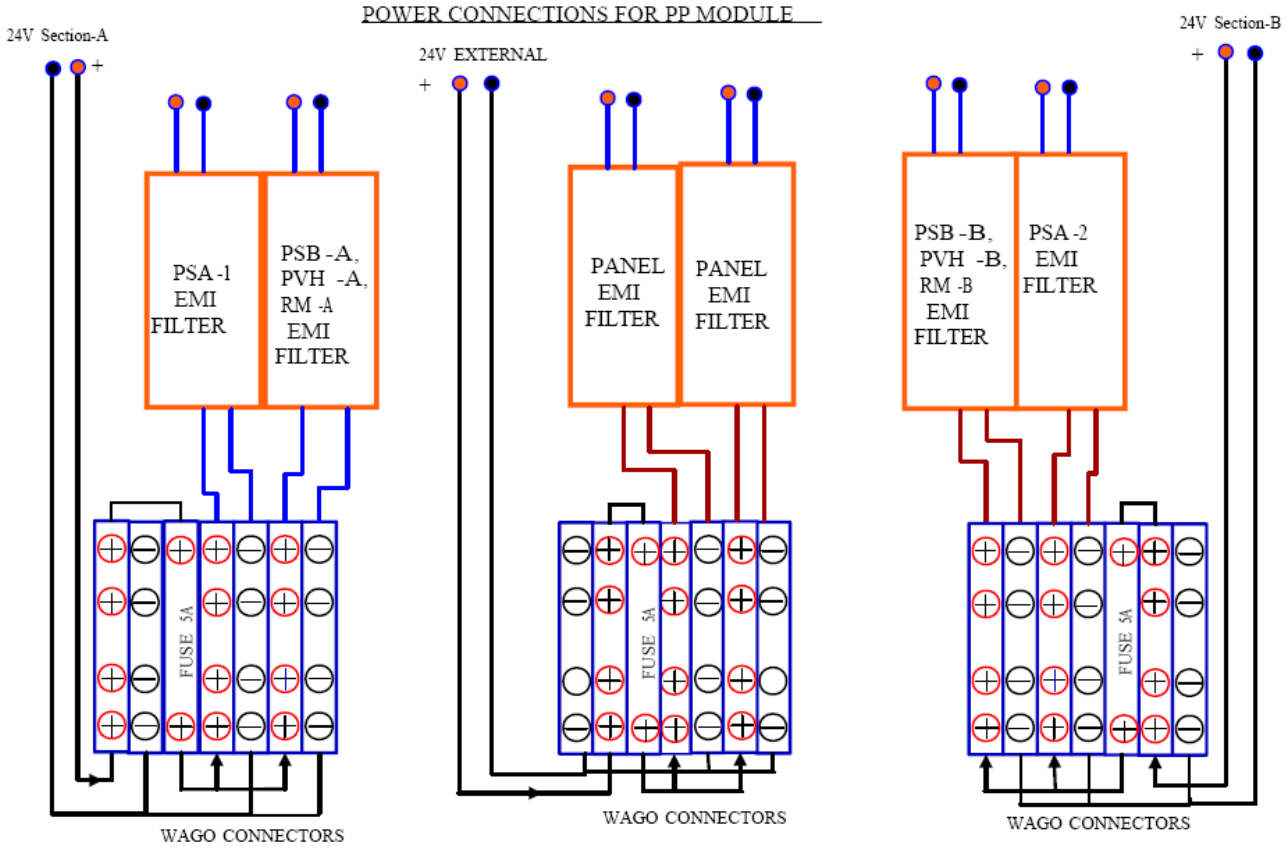
The following figures provide information about the connection details for each module:

POWER CONNECTIONS FOR CIU MODULE



POWER DISTRIBUTION SCHEME FOR OBJECT CONTROLLERS




POWER CONNECTIONS FOR PP MODULE
24V Section-A
+
PSA -1
EMI
FILTER
PSB -A,
PVH -A,
RM -A
EMI
FILTER
FUSE 5A
WAGO CONNECTORS
24V EXTERNAL
+
PANEL
EMI
FILTER
PANEL
EMI
FILTER
FUSE 5A
WAGO CONNECTORS
24V Section-B
+
PSB -B,
PVH -B,
RM -B
EMI
FILTER
PSA -2
EMI
FILTER
FUSE 5A
WAGO CONNECTORS

7.1 External relay connections to OC bottom back plane

a) Input Relay connections

Table 5.16 Input Relay connections

	Relay	Master NO		Slave NO	
		NO +	NO -	NO +	NO -
OCI-1	1	K42 / 1+	K42 / 1-	K45 / 1+	K45 / 1-
	2	K42 / 2+	K42 / 2-	K45 / 2+	K45 / 2-
	3	K42 / 3+	K42 / 3-	K45 / 3+	K45 / 3-
	4	K42 / 4+	K42 / 4-	K45 / 4+	K45 / 4-
	5	K43 / 5+	K43 / 5-	K44 / 5+	K44 / 5-
	6	K43 / 6+	K43 / 6-	K44 / 6+	K44 / 6-
	7	K43 / 7+	K43 / 7-	K44 / 7+	K44 / 7-
	8	K43 / 8+	K43 / 8-	K44 / 8+	K44 / 8-
OCI-2	1	K38 / 1+	K38 / 1-	K41 / 1+	K41 / 1-
	2	K38 / 2+	K38 / 2-	K41 / 2+	K41 / 2-
	3	K38 / 3+	K38 / 3-	K41 / 3+	K41 / 3-
	4	K38 / 4+	K38 / 4-	K41 / 4+	K41 / 4-
	5	K39 / 5+	K39 / 5-	K40 / 5+	K40 / 5-
	6	K39 / 6+	K39 / 6-	K40 / 6+	K40 / 6-
	7	K39 / 7+	K39 / 7-	K40 / 7+	K40 / 7-
	8	K39 / 8+	K39 / 8-	K40 / 8+	K40 / 8-
OCI-3	1	K34 / 1+	K34 / 1-	K37 / 1+	K37 / 1-
	2	K34 / 2+	K34 / 2-	K37 / 2+	K37 / 2-
	3	K34 / 3+	K34 / 3-	K37 / 3+	K37 / 3-

	4	K34 / 4+	K34 / 4-	K37 / 4+	K37 / 4-
	5	K35 / 5+	K35 / 5-	K36 / 5+	K36 / 5-
	6	K35 / 6+	K35 / 6-	K36 / 6+	K36 / 6-
	7	K35 / 7+	K35 / 7-	K36 / 7+	K36 / 6-
	8	K35 / 8+	K35 / 8-	K36 / 8+	K36 / 8-
OCI-4	1	K30 / 1+	K30 / 1-	K33 / 1+	K33 / 1-
	2	K30 / 2+	K30 / 2-	K33 / 2+	K33 / 2-
	3	K30 / 3+	K30 / 3-	K33 / 3+	K33 / 3-
	4	K30 / 4+	K30 / 4-	K33 / 4+	K33 / 4-
	5	K31 / 5+	K31 / 5-	K32 / 5+	K32 / 5-
	6	K31 / 6+	K31 / 6-	K32 / 6+	K32 / 6-
	7	K31 / 7+	K31 / 7-	K32 / 7+	K32 / 6-
	8	K31 / 8+	K31 / 8-	K32 / 8+	K32 / 8-
OCI-5	1	K26 / 1+	K26 / 1-	K29 / 1+	K29 / 1-
	2	K26 / 2+	K26 / 2-	K29 / 2+	K29 / 2-
	3	K26 / 3+	K26 / 3-	K29 / 3+	K29 / 3-
	4	K26 / 4+	K26 / 4-	K29 / 4+	K29 / 4-
	5	K27 / 5+	K27 / 5-	K28 / 5+	K28 / 5-
	6	K27 / 6+	K27 / 6-	K28 / 6+	K28 / 6-
	7	K27 / 7+	K27 / 7-	K28 / 7+	K28 / 6-
	8	K27 / 8+	K27 / 8-	K28 / 8+	K28 / 8-

b) Output Relay connections

Table 5.17 Output Relay connections

	Relay	Master NC		Slave NO		Drive	
		NC +	NC -	NO +	NO -	Coil +	Coil -
OCO-1	1	K64 / 1+	K64 / 1-	K66 / 1+	K66 / 1-	K61 / 1+	K61 / 1-
	2	K64 / 2+	K64 / 2-	K66 / 2+	K66 / 2-	K61 / 2+	K61 / 2-
	3	K64 / 3+	K64 / 3-	K66 / 3+	K66 / 3-	K61 / 3+	K61 / 3-
	4	K64 / 4+	K64 / 4-	K66 / 4+	K66 / 4-	K61 / 4+	K61 / 4-
	5	K63 / 5+	K63 / 5-	K65 / 5+	K65 / 5-	K62 / 5+	K62 / 5-
	6	K63 / 6+	K63 / 6-	K65 / 6+	K65 / 6-	K62 / 6+	K62 / 6-
	7	K63 / 7+	K63 / 7-	K65 / 7+	K65 / 7-	K62 / 7+	K62 / 7-
	8	K63 / 8+	K63 / 8-	K65 / 8+	K65 / 8-	K62 / 8+	K62 / 8-
	VCOR	K63 / A-VC+	K63 / A-VC-	K65 / B-VC+	K65 / B-VC-	K68 / 01	K68 / 02
OCO-2	1	K58 / 1+	K58 / 1-	K60 / 1+	K60 / 1-	K55 / 1+	K55 / 1-
	2	K58 / 2+	K58 / 2-	K60 / 2+	K60 / 2-	K55 / 2+	K55 / 2-
	3	K58 / 3+	K58 / 3-	K60 / 3+	K60 / 3-	K55 / 3+	K55 / 3-
	4	K58 / 4+	K58 / 4-	K60 / 4+	K60 / 4-	K55 / 4+	K55 / 4-
	5	K57 / 5+	K57 / 5-	K59 / 5+	K59 / 5-	K56 / 5+	K56 / 5-
	6	K57 / 6+	K57 / 6-	K59 / 6+	K59 / 6-	K56 / 6+	K56 / 6-
	7	K57 / 7+	K57 / 7-	K59 / 7+	K59 / 7-	K56 / 7+	K56 / 7-
	8	K57 / 8+	K57 / 8-	K59 / 8+	K59 / 8-	K56 / 8+	K56 / 8-
	VCOR	K57 / A-VC+	K57 / A-VC-	K59 / B-VC+	K59 / B-VC-		
OCO-3	1	K52 / 1+	K52 / 1-	K54 / 1+	K54 / 1-	K49 / 1+	K49 / 1-
	2	K52 / 2+	K52 / 2-	K54 / 2+	K54 / 2-	K49 / 2+	K49 / 2-
	3	K52 / 3+	K52 / 3-	K54 / 3+	K54 / 3-	K49 / 3+	K49 / 3-
	4	K52 / 4+	K52 / 4-	K54 / 4+	K54 / 4-	K49 / 4+	K49 / 4-
	5	K51 / 5+	K51 / 5-	K53 / 5+	K53 / 5-	K50 / 5+	K50 / 5-
	6	K51 / 6+	K51 / 6-	K53 / 6+	K53 / 6-	K50 / 6+	K50 / 6-
	7	K51 / 7+	K51 / 7-	K53 / 7+	K53 / 7-	K50 / 7+	K50 / 7-
	8	K51 / 8+	K51 / 8-	K53 / 8+	K53 / 8-	K50 / 8+	K50 / 8-
	VCOR	K51 / A-VC+	K51 / A-VC-	K53 / B-VC+	K53 / B-VC-		

7.2 VCOR Installation and wiring

The Vital Cut-Off Relay (VCOR) is a fail-safe QN Signalling Relay that is driven by the Vital Cut-Off card. The front contacts of VCOR are used to provide power for driving the external output relays. The output relays can be driven only when the VCOR is in picked-up state. Each Object controller module is provided with one VCOR. The vital cut-off card is responsible for picking up the VCOR. The vital cut-off card monitors the voltages of all the output WFP CPU cards. It also monitors the health status of all the output WFP CPUs. The vital cut-off card energizes the VCOR only when the voltage inputs and health of all the output WFP CPUs are OK. For any failure detected in the status of voltage or health of the output CPUs, the VCOR is commanded to drop. Also, for any critical fault or any kind of wrong side failure that is detected by the output WFP CPU, the VCOR is dropped by which all the output relays connected to that particular Object controller are de-energized thereby ensuring the safety of the system.

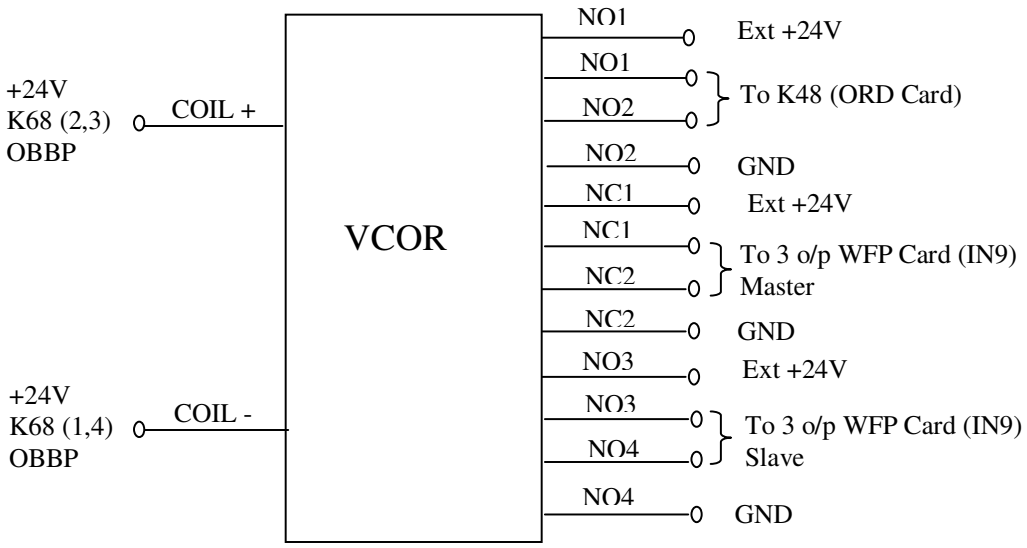


Figure 5.1 VCOR Wiring details

7.3 MEI633 Communication Interfaces

The following are the serial communications between CIU and other modules.

- CIU (CVC Card) is connected to Maintenance Terminal through RS232-OFC interface in which the changed events and fault codes of the modules are displayed. Customized communication protocol is used between MT and CIU. The changed events and fault codes are continuously logged in external flash.

- CIU (CVC Card) is connected to data logger through RS232-OFC card, which 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.

- CIU (CVC Card) is connected to FPD through RS232 isolated interface, which consists of two LED display units, namely Display-A and Display-B. LED Display is used to display the system faults/recovery messages.

- CIU (CIF Card) is connected to RS485-OFC bi-directional converter card to provide RS485 communication through distribution box.

- IOCOM is connected to CIU through serial OFC communication to receive the output telegram from COMP and transmit the extracted output message to the output WFPs.

- PP is connected to CIU through serial OFC communication to receive the indication data from COMP and drives the indication LEDs on the CCIP / Indication Panel.

- IOCOM and PP are connected to respective RS485-OFC bi-directional converter cards through RS485 Interface.

The communication arrangement between CIU and other sub-systems is included as Annexure-C

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ANNEXURE A

RDSO/SPN/197/2008

CODE OF PRACTICE FOR EARTHING AND BONDING SYSTEM

FOR

SIGNALLING EQUIPMENTS

DID: 2450115 Extn. 42651(O)
BSNL: 0522-2465749 (O)
Fax: 0522-2452332
Email- dsig1@rdso.railnet.gov.in

Government of India
Ministry of Railways
Research Designs & Standards Organisation
LUCKNOW - 226011

No.STS/E/SPD

Dated 19.09.2008

eq[; ladsr ,oa nwjlapkj vfHk;Urk]
eq[; ladsr ,oa nwjlapkj vfHk;Urk fuekZ.k
eq[; ladsr ,oa nwjlapkj vfHk;Urk ¼ifj;kstuk½

Chief Signal & Telecom Engineer
Chief Signal & Telecom Engineer (Construction)
Chief Signal & Telecom Engineer (Project)

e/; jsyos] eqEcbZ lh-,l-Vh-& - 400001	Central Rly, Mumbai CST-400 001
if'pe jsyos] ppZ xsV] eqEcbZ & 400020	Western Rly, Churchgate,Mumbai - 400 020
iwoZ jsyos] Qs;jyh lysl] dksydkrk & 700001	Eastern Rly, Fairlie Place, Kolkata - 700 001
nf{k.k iwoZ jsyos] xkMZu jhp] dksydkrk &43	South Eastern Rly., Garden Reach, Kolkata - 700 043
mRrj jsyos] cM+kSnk gkml] ubZ fnYyh & 01	Northern Rly., Baroda House, New Delhi- 110 001
iwoksZRrj jsyos] xksj[kiqj & 273012	Northeastern Rly., Gorakhpur -273 012
iwoksZRrj lhekUr jsyos] ekyhxkao] xqokgkVh &11	North Frontier Rly., Maligaon, Guwahati- 781 011
nf{k.k jsyos] ikdZ Vkmu] psUubZ & 600 003	Southern Rly., Park Town, Chennai -600 003
nf{k.k e/; jsyos] fldUnzkckn &500 371	South Central Rly, Rail Nilayam, Secunderabad-71
iwoZ e/; jsyos] gkthiqjA	East Central Railway, Hazipur
mRrj if'pe jsyos] t;iqj&300206	North Western Railway, Jaipur-300206
iwoZ rVh; jsyos] jsy fogkj ch-Mh-,-jsUVy dkyksuh] pUnz'ks[kjiqj] Hkqous'oj&751023	East Coast Railway, Rail Vihar, BDA, Rental Colony, Chandrashekherpur, Bhubneshwar -751023
mRrj e/; jsyos] gsfLVax jksM] bykgkcknA	North Central Railway, Hesting Road, Allahabad.
nf{k.k if'pe jsyos] eq[; dk;kZy;] gqcyh A	South Western Railway, Headquarter Office, Hubli.
if'pe e/; jsyos] tcyiqj	West Central Railway, II floor,DRM Office, Jabalpur.
nf{k.k iwoksZe/; jsyos] vkj0bZ0 vkWfWQl dkEiysDl] fcykliqj& 495004	South East Central Railway, R. E. Office Complex, Bilaspur-495004
eq- fl- ,oa nwjlapkj vfHk;Urk] eSVz~ks jsyos] 33@1]tokgjyky usg: jksM] dksydkrk &71	**Chief Signal & Telecom Engineer**, Metro Railway, 33/1, Jawaharlal Nehru Road, Kolkata - 700071
eq- fl- ,oa nwjlapkj vfHk;Urk] dksj] uokc ;qlqQ jksM] flfoy ykbUl bykgkckn&01	Chief Signal & Telecom Engineer, CORE, Nawab Yusuf Road, Civil Lines, Allahabad- 211 001

Sub: Code of practice for Earthing of signalling equipments.

Code of practice for earthing & bonding system for signalling equipments RDSO/SPN/197/2008 has been prepared and is enclosed for information, comments and implementation.

RDSO letter no. STS/E/SPD/SPN/144 dt. 09.06.05 on recommended list of supplier for only “Ground Enhancement material” is hereby withdrawn.

Recommended list of suppliers for supply, installation & commissioning of this earthing & bonding system shall be issued by RDSO in due course.

DA: As above (in 09 pages)

(Vipul Goel)
Director/Signal
For Director General/Signal

CODE OF PRACTICE

FOR

EARTHING AND BONDING SYSTEM

FOR SIGNALLING EQUIPMENTS

SPECIFICATION NO. RDSO/SPN/197/2008

SIGNAL DIRECTORATE

RESEARCH, DESIGNS & STANDARDS ORGANISATION

LUCKNOW - 226011

CODE OF PRACTICE FOR EARTHING AND BONDING SYSTEM FOR SIGNALLING EQUIPMENTS

1. Scope

This document covers earthing & bonding system to be adopted for signalling equipments with solid state components which are more susceptible to damage due to surges, transients and over voltages being encountered in the system due to lightning, sub-station switching etc. These signalling equipments include Electronic Interlocking, Integrated Power supply equipment, Digital Axle counter, Data logger etc.

2. References

IS 3043	Code of practice for earthing
ANSI/UL 467	Grounding & bonding equipment
IEEE 80	IEEE guide for Safety in AC sub-station grounding
IEEE 837	Standard for qualifying permanent connections used in sub-station grounding
IEC 62305	Protection against lightning

3. Importance of Earthing

The installation and maintenance of an effective low resistance earthing system is essential due to the following -

- Efficiently dissipate heavy fault currents and electrical surges, both in magnitude and duration, to protect equipment being damaged so as to minimize down time, service interruption and replacement cost.
- Provide a stable reference for electrical and RF circuits at the installation to minimize noise during normal operation.
- Protection of personnel who work within the area from dangerous electric shock caused due to “step potential” or “touch potential”.

4. Characteristics of good Earthing system

- Excellent electrical conductivity
  - Low resistance and electrical impedance.
  - Conductors of sufficient dimensions capable of withstanding high fault currents with no evidence of fusing or mechanical deterioration.
  - Lower earth resistance ensures that energy is dissipated into the ground in the safest possible manner.
  - Lower the earth circuit impedance, the more likely that high frequency lightning impulses will flow through the ground electrode path, in preference to any other path.

- High corrosion resistance

  The choice of the material for grounding conductors, electrodes and connections is vital as most of the grounding system will be buried in the earth mass for many years. Copper is by far the most common material used. In addition to its inherent high conductivity, copper is usually cathodic with respect to other metals in association with grounding sites, which means that it is less likely to corrode in most environments.

- Mechanically robust and reliable.

5. Location for Earth

- Low lying areas close to the building or equipment are good for locating Earth Electrodes.
- The location can be close to any existing water bodies or water points but not naturally well-drained.
- Dry sand, lime stone, granite and any stony ground should be avoided.
- Earthing electrode should not be installed on high bank or made-up soil.

6. Acceptable Earth Resistance value

The acceptable Earth Resistance at earth busbar shall not be more than 1 ohm.

7. Components of Earthing & Bonding system

The components of Earthing & Bonding system are-

Earth electrode, Earth enhancement material, Earth pit, Equi-potential earth busbar, connecting cable & tape/strip and all other associated accessories.

8. Design of Earthing & Bonding system

8.1 Earth Electrode

- The earth electrode shall be made of high tensile low carbon steel circular rods, molecularly bonded with copper on outer surface to meet the requirements of Underwriters Laboratories (UL) 467-2007 or latest. Such copper bonded steel cored rod is preferred due to its overall combination of strength, corrosion resistance, low resistance path to earth and cost effectiveness.
- The earth electrode shall be UL listed and of minimum 17.0mm diameter and minimum 3.0mtrs. long.
- The minimum copper bonding thickness shall be of 250 microns.
- Marking: UL marking, Manufacturer's name or trade name, length, diameter, catalogue number must be punched on every earth electrode.
- Earth electrode can be visually inspected, checked for dimensions and thickness of copper coating using micron gauge. The suppliler shall arrange for such inspection at the time of supply, if so desired.

8.2 Earth Enhancement material

Earth enhancement material is a superior conductive material that improves earthing effectiveness, especially in areas of poor conductivity (rocky ground, areas of moisture variation, sandy soils etc.). It improves conductivity of the earth electrode and ground contact area. It shall have following characteristics-

- shall mainly consist of Graphite and Portland cement. Bentonite content shall be negligible.
- shall have high conductivity, improves earth's absorbing power and humidity retention capability.
- shall be non-corrosive in nature having low water solubility but highly hygroscopic.
- shall have resistivity of less than 0.2 ohms-meter. Resistivity shall be tested by making a 20cm. cube of the material and checking resistance of the cube at the ends. The supplier shall arrange for such testing at the time of supply, if so desired. Necessary certificate from National/ International lab for the resistivity shall also be submitted.
- shall be suitable for installation in dry form or in a slurry form.
- shall not depend on the continuous presence of water to maintain its conductivity.
- shall be permanent & maintenance free and in its "set form", maintains constant earth resistance with time.
- shall be thermally stable between -10^0 C to $+60^0$ C ambient temperatures.
- shall not dissolve, decompose or leach out with time.
- shall not require periodic charging treatment nor replacement and maintenance.
- shall be suitable for any kind of electrode and all kinds of soils of different resistivity.
- shall not pollute the soil or local water table and meets environmental friendly requirements for landfill.
- shall not be explosive.
- shall not cause burns, irritation to eye, skin etc.
- Marking: The Earth enhancement material shall be supplied in sealed, moisture proof bags. These bags shall be marked with Manufacturer's name or trade name, quantity etc.

8.3 Backfill material

The excavated soil is suitable as a backfill but should be sieved to remove any large stones and placed around the electrode taking care to ensure that it is well compacted. Material like sand, salt, coke breeze, cinders and ash shall not be used because of its acidic and corrosive nature.

8.4 Earth Pit

8.4.1 Construction of unit earth pit: Refer typical installation drawing no. SDO/RDSO/E&B/001.

- A hole of 100mm to 125mm dia shall be augured /dug to a depth of about 2.8 meters.
- The earth electrode shall be placed into this hole.
- It will be penetrated into the soil by gently driving on the top of the rod. Here natural soil is assumed to be available at the bottom of the electrode so that min. 150 mm of the electrode shall be inserted in the natural soil.
- Earth enhancement material (minimum approx. 30-35 kg) shall be filled into the augured/dug hole in slurry form and allowed to set. After the material gets set, the diameter of the composite structure (earth electrode + earth enhancement material) shall be of minimum 100mm dia covering entire length of the hole.
- Remaining portion of the hole shall be covered by backfill soil, which is taken out during auguring /digging.
- A copper strip of 150mmX25mmX6mm shall be exothermically welded to main earth electrode for taking the connection to the main equi-potential earth busbar in the equipment room and to other earth pits, if any.
- Exothermic weld material shall be UL listed and tested as per provisions of IEEE 837 by NABL/ ILAC member labs.
- The main earth pit shall be located as near to the main equi-potential earth busbar in the equipment room as possible.

8.4.2 Construction of loop Earth by providing multiple earth pits

- At certain locations, it may not be possible to achieve earth resistance of ≤1ohm with one earth electrode /pit due to higher soil resistivity. In such cases, provision of loop earth consisting of more than one earth pit shall be done. The number of pits required shall be decided based on the resistance achieved for the earth pits already installed. The procedure mentioned above for one earth pit shall be repeated for other earth pits.

- The distance between two successive earth electrodes shall be min. 3mtrs. and max. upto twice the length of the earth electrode i.e. 6 mtrs. approx.

- These earth pits shall then be inter linked using 25X2 mm. copper tape to form a loop using exothermic welding technique.

- The interconnecting tape shall be buried at depth not less than 500mm below the ground level. This interconnecting tape shall also be covered with earth enhancing compound.

8.4.3 Measurement of Earth resistance

The earth resistance shall be measured at the Main Equi-potential Earth Busbar (MEEB) with all the earth pits interconnected using Fall of Potential method as per para 37 of IS: 3043.

8.4.4 Inspection Chamber

- A 300X300X300 mm (inside dimension) concrete box with smooth cement plaster finish shall be provided on the top of the pit. A concrete lid, painted black, approx. 50 mm. thick with pulling hooks, shall be provided to cover the earth pit.
- Care shall be taken regarding level of the floor surrounding the earth so that the connector is not too deep in the masonry or projecting out of it.
- On backside of the cover, date of the testing and average resistance value shall be written with yellow paint on black background.

8.5 Equipotential Earth Busbar and its connection to equipments & Surge protection devices in the Equipment room: Refer typical bonding connections drawing no.SDO/RDSO/E&B/002.

8.5.1 Equi-potential earth busbars

There shall be one equi-potential earth busbar for each of the equipment room i.e. IPS/Battery charger room and EI/Relay room. The equi-potential earth busbars located in individual rooms shall be termed as Sub equi-potential busbars (SEEB). The equi-potential earth busbar located in the IPS /Battery charger room and directly connected to Class 'B' SPDs and the main earth pit shall be termed as Main equi-potential earth busbar (MEEB).

The EEBs shall have pre-drilled holes of suitable size for termination of bonding conductors. The EEBs shall be insulated from the building walls. Each EEB shall be installed on the wall with low voltage insulator spacers of height 60mm. The insulators used shall have suitable insulating and fire resistant properties for this application. The EEBs shall be installed at the height of 0.5m from the room floor surface for ease of installation & maintenance. All terminations on the EEBs shall be by using copper lugs with spring washers.

8.5.2 Bonding Connections

To minimize the effect of circulating earth loops and to provide equi-potential bonding, "star type" bonding connection is required. As such, each of the SEEBs installed in the rooms shall be directly connected to MEEB using bonding conductors. Also, equipment/racks in the room shall be directly connected to its SEEB. The bonding conductors shall be bonded to their respective lugs by exothermic welding.

8.5.3 All connections i.e routing of bonding conductors from equipments to SEEB & from SEEBs to MEEB shall be as short and as direct as possible with min. bends and separated from other wiring. However, connection from SPD to MEEB shall be as short as possible and preferably without any bend.

8.5.4 Materials and dimensions of bonding components for connection of individual equipments with equipotential bus bar and earth electrode shall be as given below.

Component/Bonding	Material	Size
Main equipotential earth busbar (MEEB)	Copper	300X25X6 mm (min.)
Sub equipotential earth busbar (SEEB)	Copper	150X25X6 mm (min.)
Individual equipments to SEEB using copper lugs with stainless steel nut and bolts.	Multi-strand single core PVC insulated copper cable as per IS:694	10 sq.mm
SEEB to MEEB using copper lugs with stainless steel nut and bolts.	Multi-strand single core PVC insulated copper cable as per IS:694	16 sq.mm
Surge protection devices (SPD) to MEEB using copper lugs with stainless steel nut and bolts.	Multi-strand single core PVC insulated copper cable as per IS:694	16sq.mm
MEEB to main earth electrode	Multi-strand single core PVC insulated copper cable as per IS:694 (Duplicated)	35sq.mm
Main earth pit to other earth pit in case of loop earth	Copper tape	25X2 mm

9. Drawing of earthing & bonding system

The complete layout with dimensions of the earthing & bonding system shall be submitted by the supplier after commissioning.

10. Warranty

The supplier shall be responsible for complete supply, installation & commissioning of the earthing & bonding system. The warranty of such system shall be 60 months from date of commissioning. During this period, any failure of earthing system due to improper materials & bad workmanship shall be attended free of cost by the supplier.

11. Maintenance of earthing & bonding system

The maintenance schedule should cover verification of earthing system conductors and components, verification of electrical continuity, measurement of earth resistance, re-fastening of components and conductors etc.

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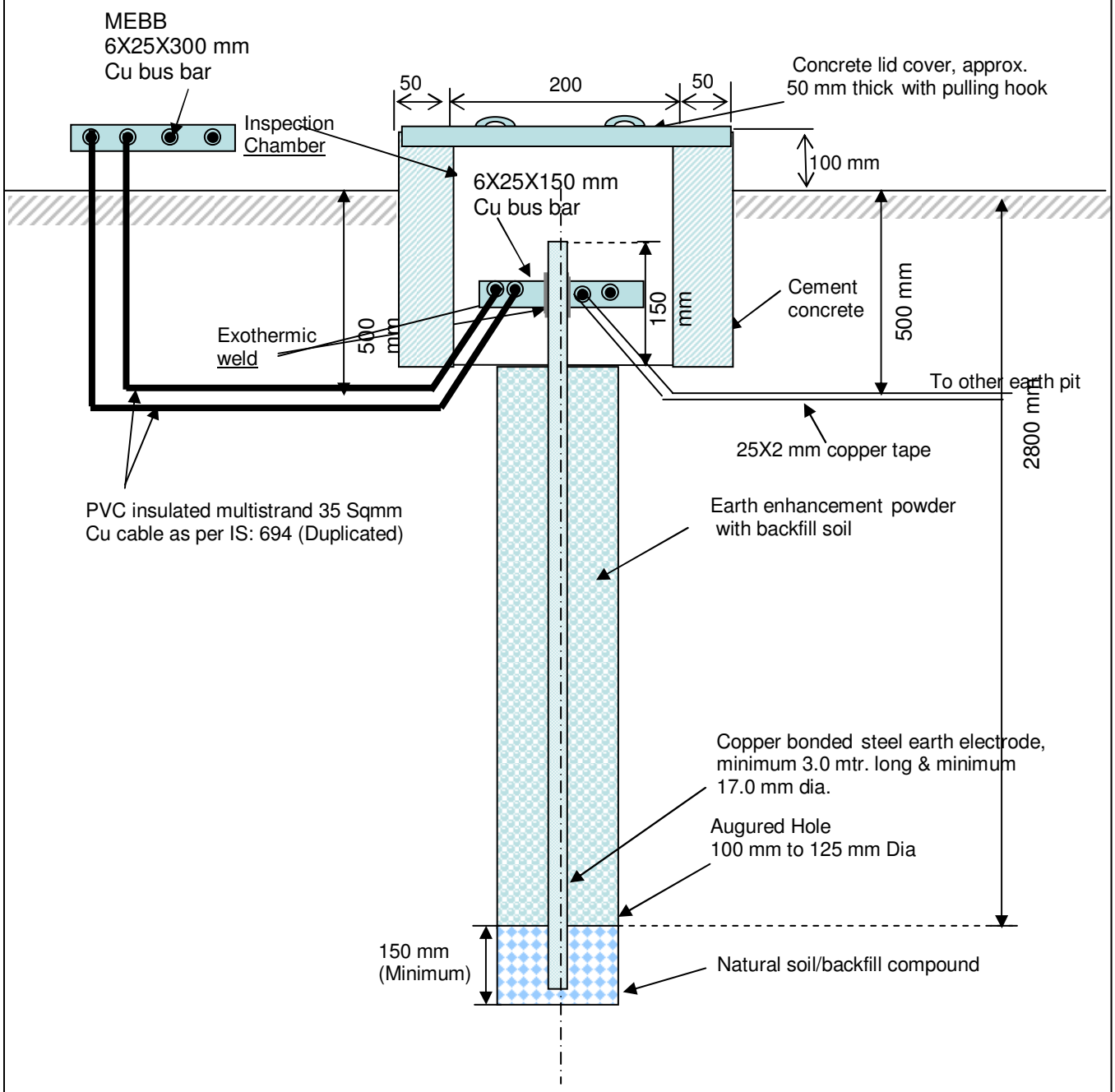
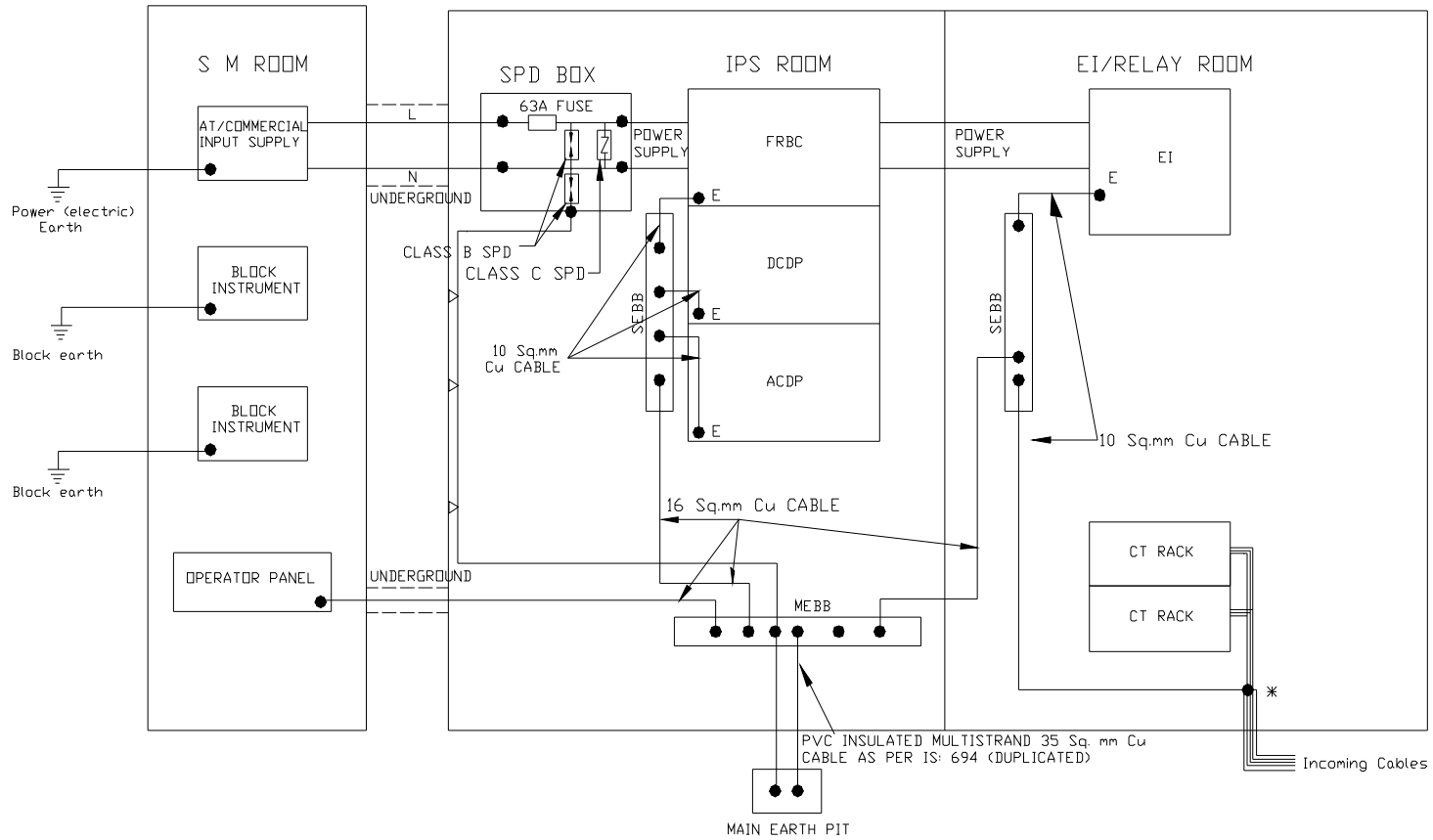


			RDSO	
			Typical installation of earth for S&T Installations	
JE/SE/ Sig	ADE/Sig	For DG/Sig	Drg. No. SDO / RDSO/ E&B/001 Date: 19.09.08	Sheet No. 1 of 1

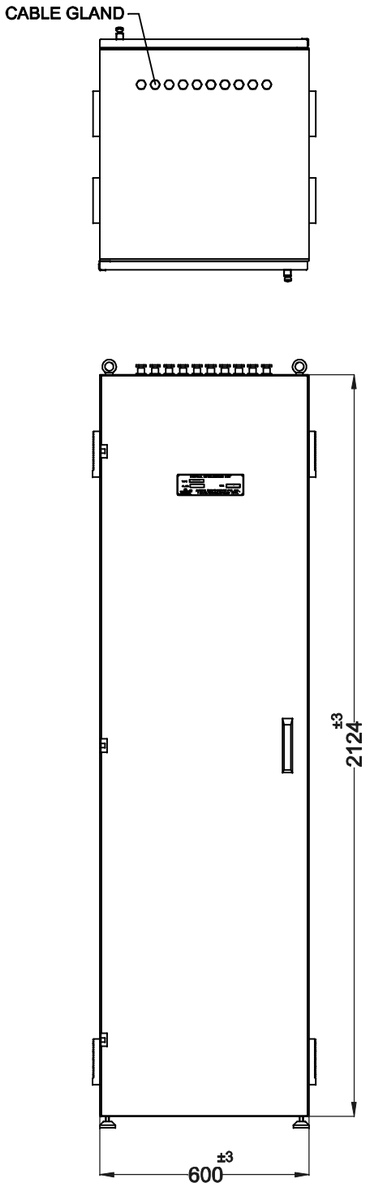


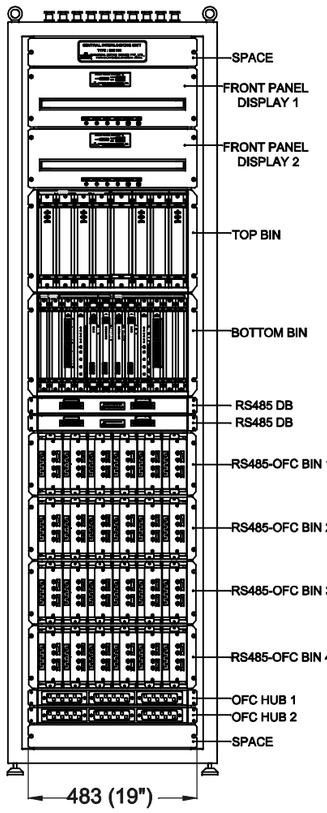
1. CLASS B & C SPDs SHALL BE PROVIDED AS PER RDSO GUIDELINES AND FROM RDSO RECOMMENDED SOURCES.
2. * ALL THE ARMOURING OF THE CABLES SHALL BE CONNECTED TO SEBB.
3. ALL DIMENSIONS ARE IN MILLIMETER.

			R.D.S.O.	
			Typical bonding and earthing connections for signalling equipments	
JE/SE/Sig.	ADE/Sig.	For DG/Sig.	Drg. No. SDO/RDSO/E&B/002 Date : 19.09.08	Sheet 1 of 1

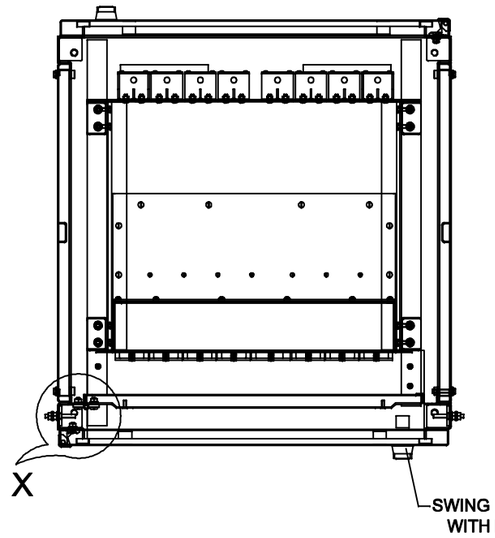
ANNEXURE B

ORGANIZATION OF INDIVIDUAL SUB-SYSTEMS

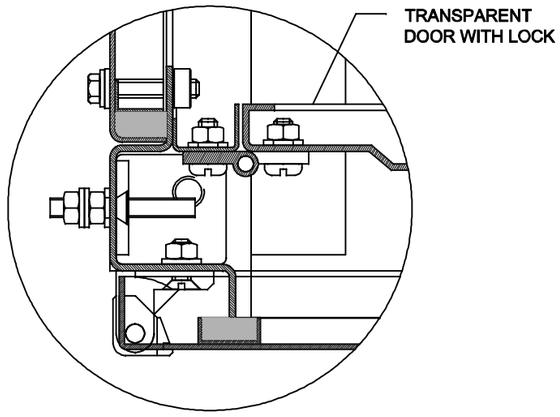




VIEW WITHOUT FRONT DOOR



SECTIONAL TOP VIEW

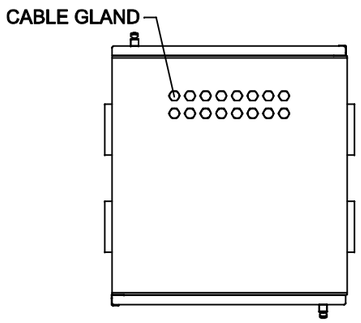


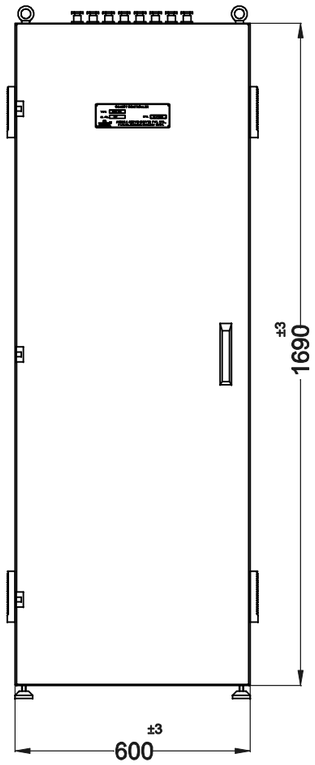
DETAIL - X

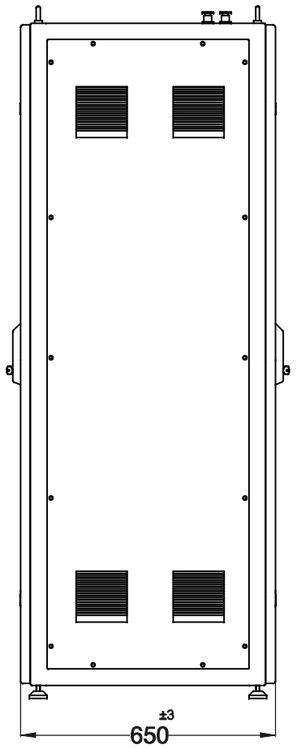
UNIT SIZE : 2124 (H) x 600 (W) x 650 (D)

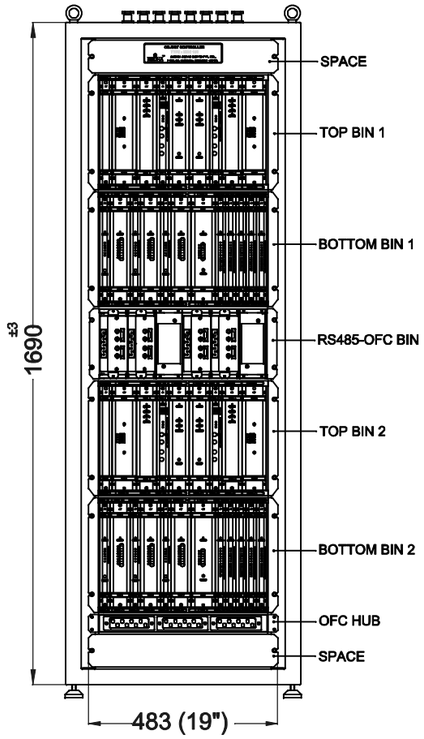
PROPOSED LAYOUT FOR CENTRAL INTERLOCKING UNIT
TYPE : MCI 150

MEDHA™ MEDHA SERVO DRIVES PVT. LTD.
P-4/5B, IDA, NACHARAM, HYDERABAD - 500 076.

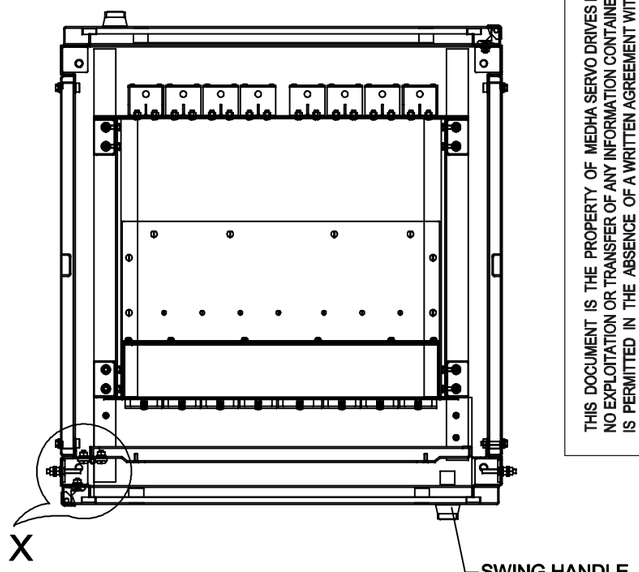








VIEW WITHOUT FRONT DOOR



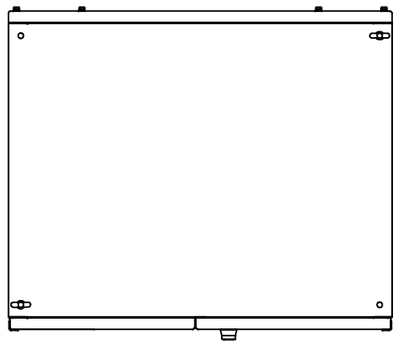
SECTIONAL TOP VIEW

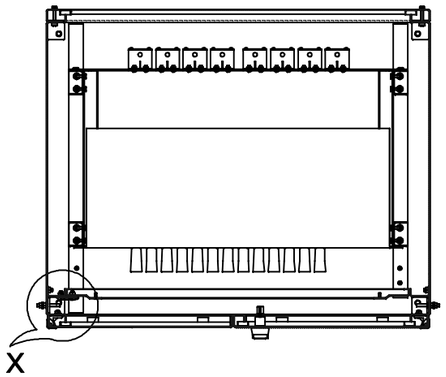
DETAIL - X

UNIT SIZE : 1690 (H) x 600 (W) x 650 (D)

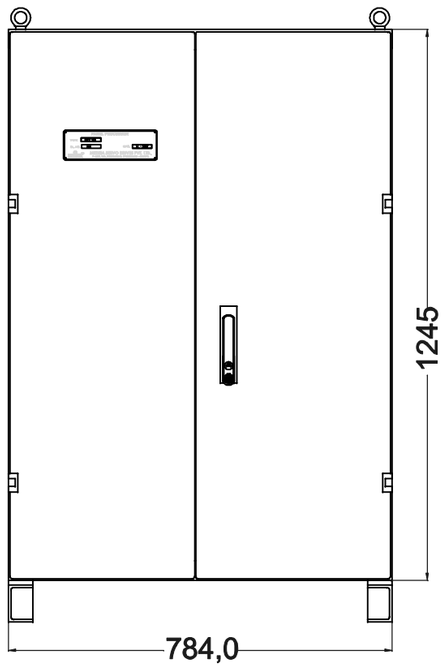
PROPOSED LAYOUT FOR TWIN OBJECT CONTROLLER
TYPE : MOC 151

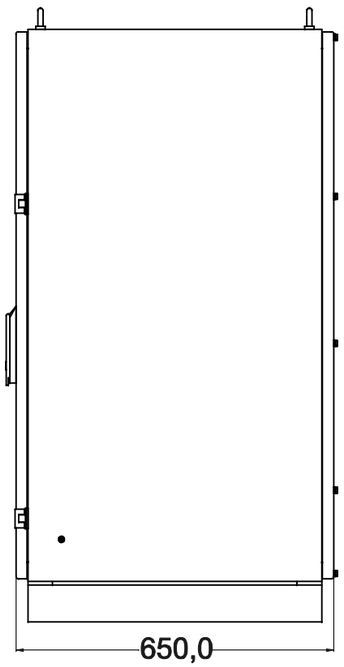
MEDHA SERVO DRIVES PVT. LTD.
P-4/5B, IDA, NACHARAM, HYDERABAD - 500 076.

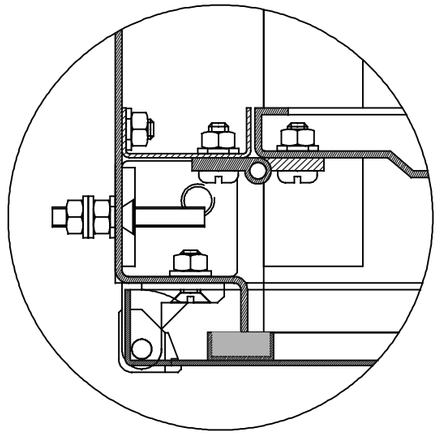




SECTIONAL TOP VIEW







DETAIL - X

UNIT SIZE : 1245 (H) x 784 (W) x 650 (D)

LAYOUT FOR PANEL PROCESSOR MODULE
TYPE : MPP 152

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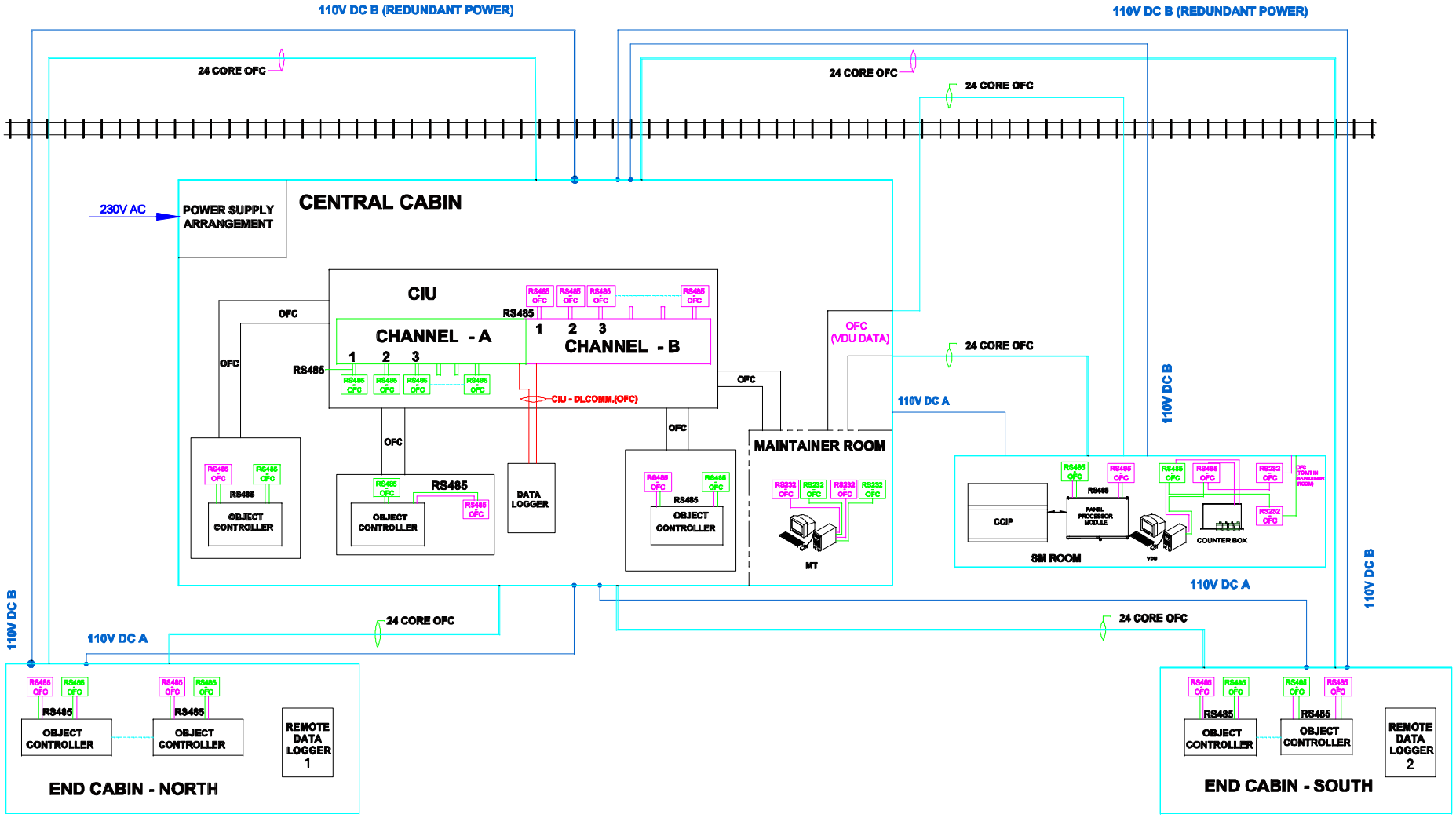
ANNEXURE C

EI CONFIGURATION

MEI633 TYPICAL CONFIGURATION DIAGRAM - 1



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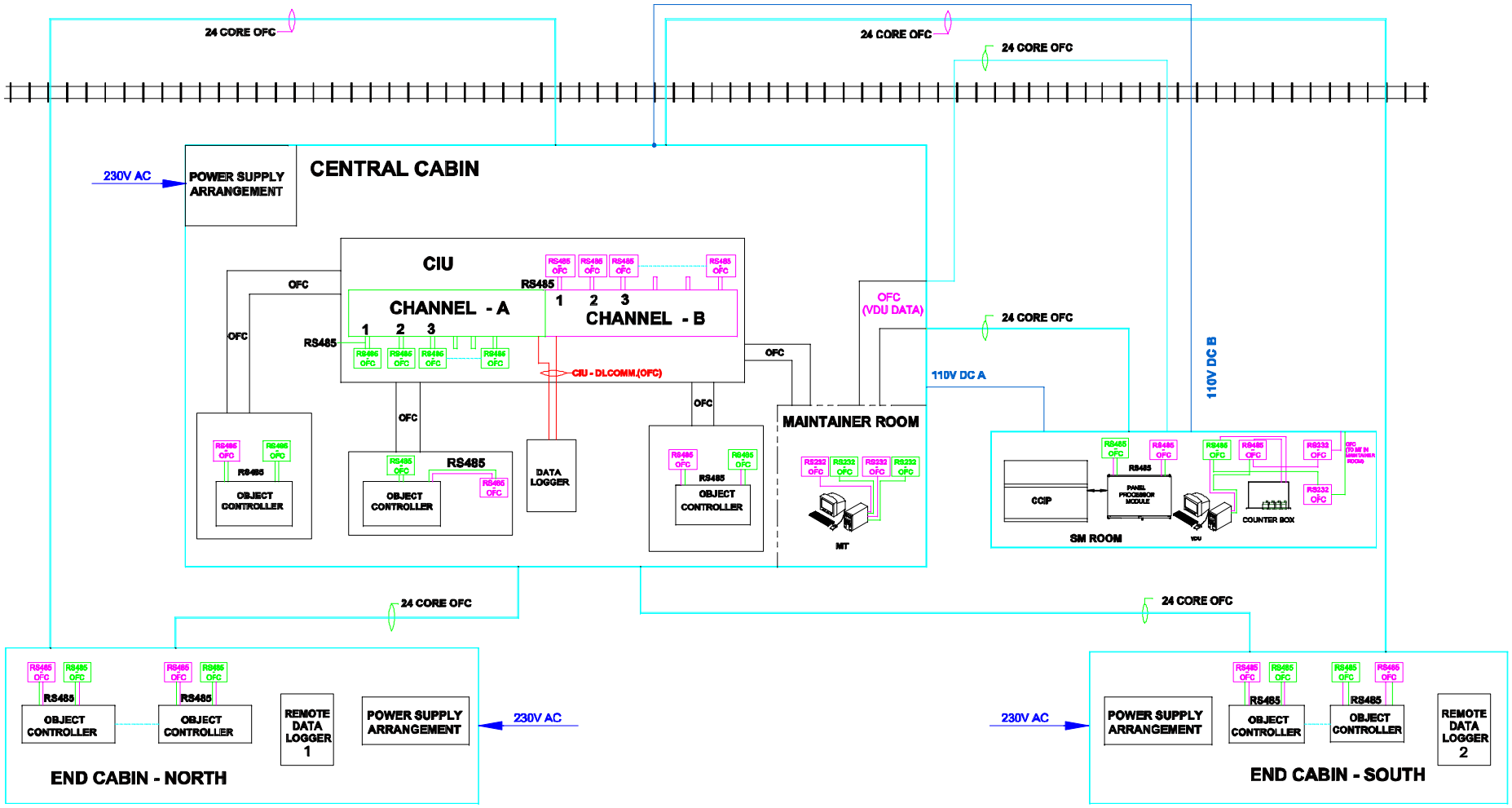
MEI633 TYPICAL CONFIGURATION DIAGRAM - 2



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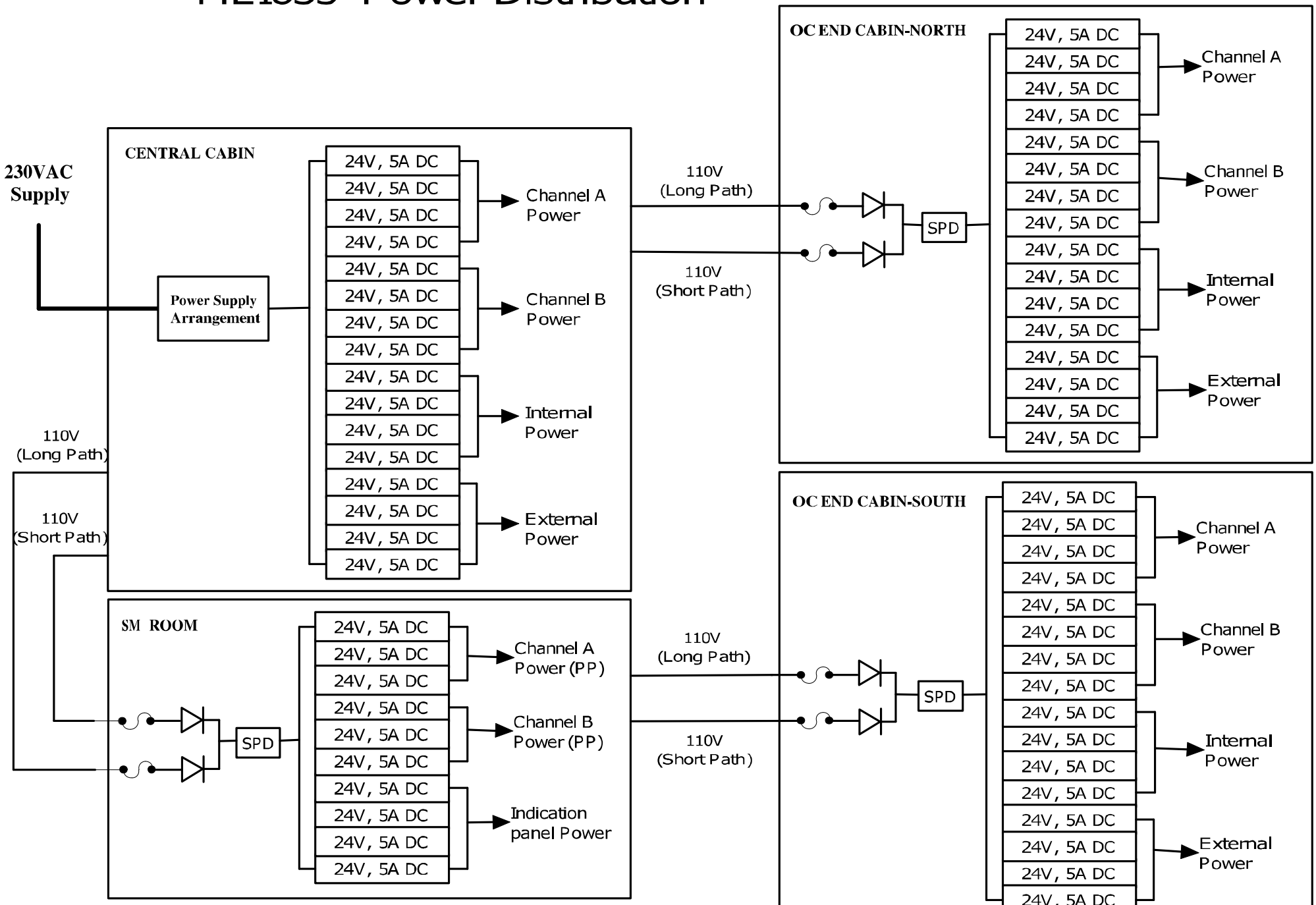
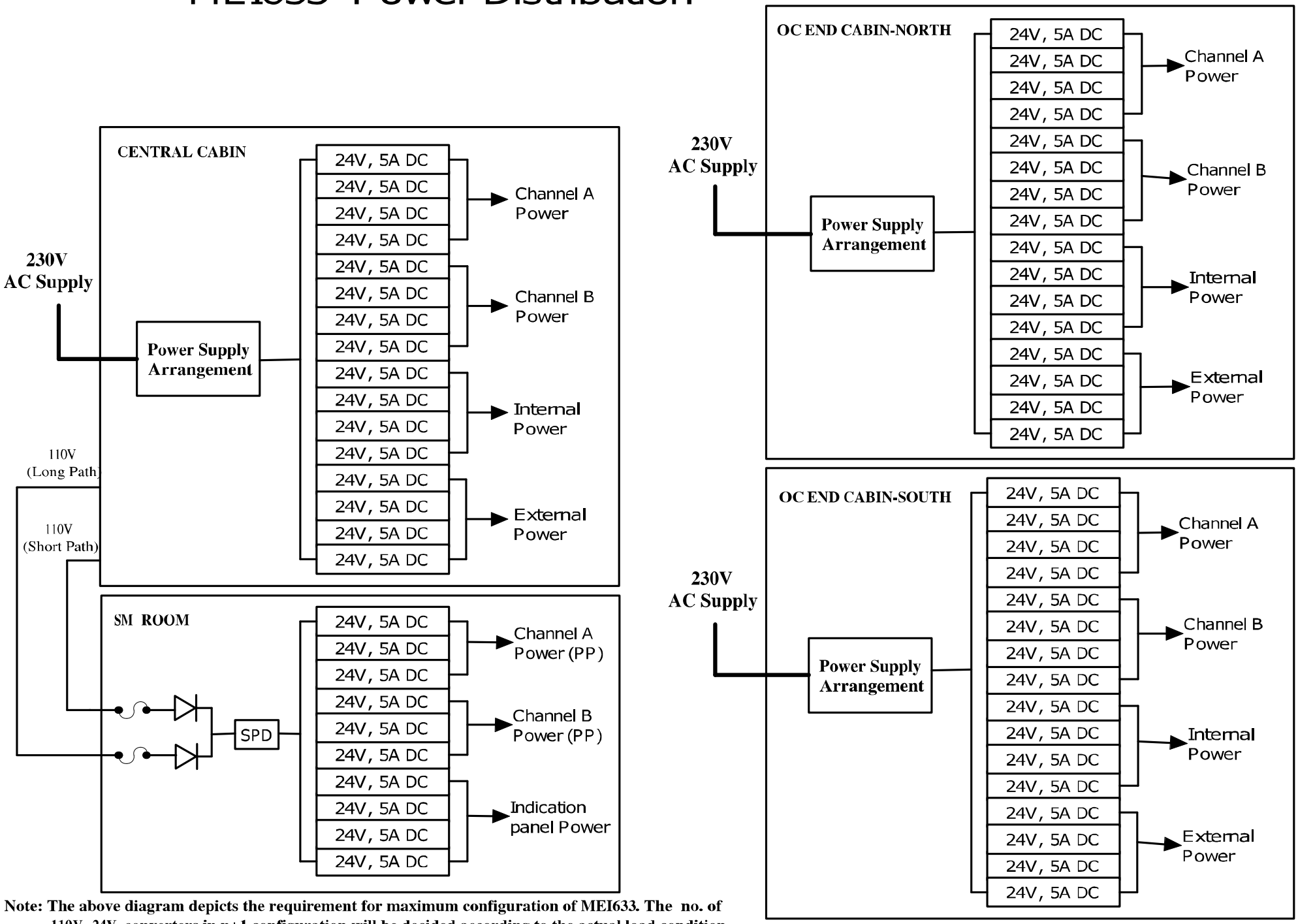
MEI633 Power Distribution



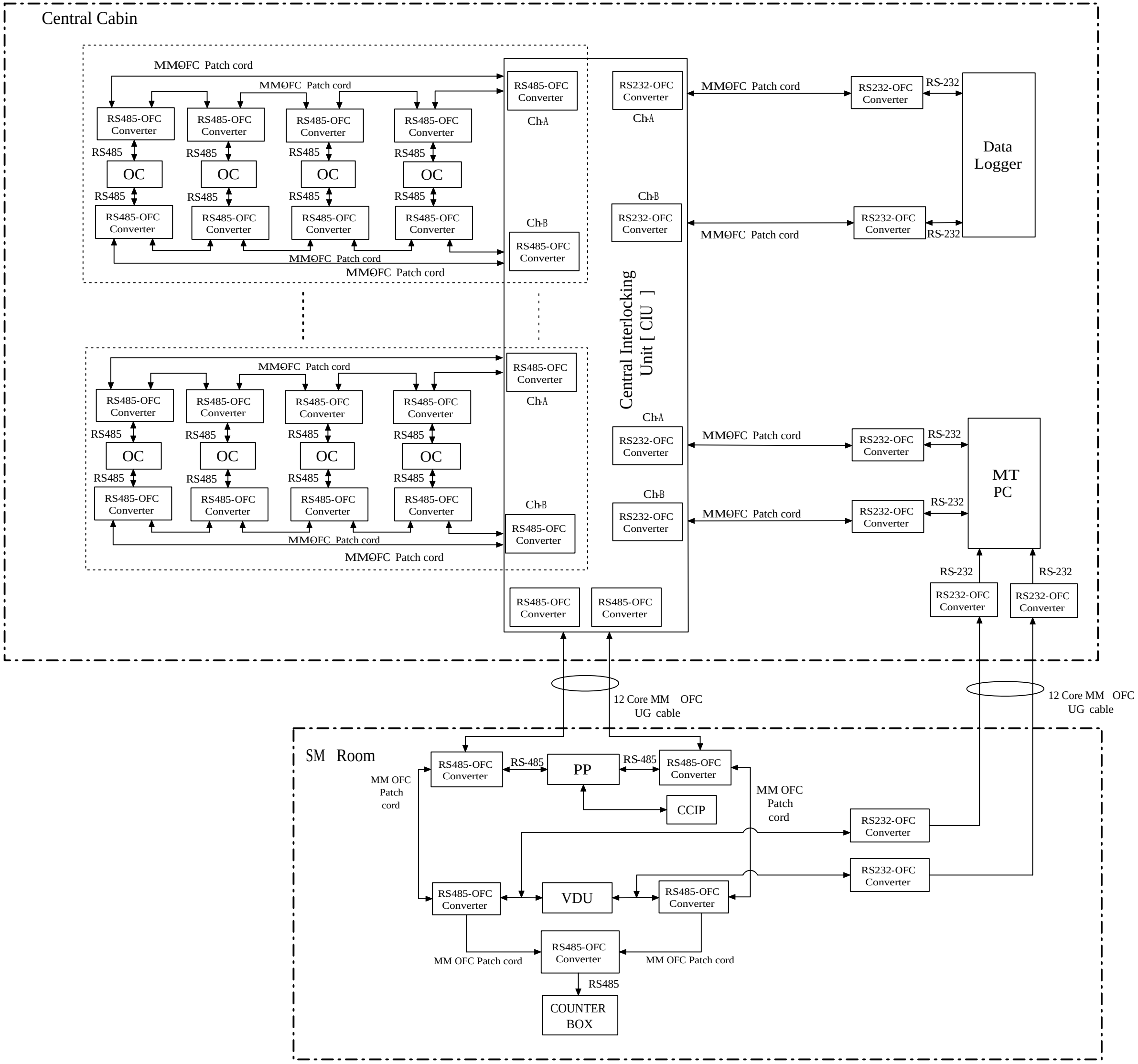
Note: The above diagram depicts the requirement for maximum configuration of MEI633. The no. of 110V -24V converters in n+1 configuration will be decided according to the actual load condition.

MEI633 Power Distribution

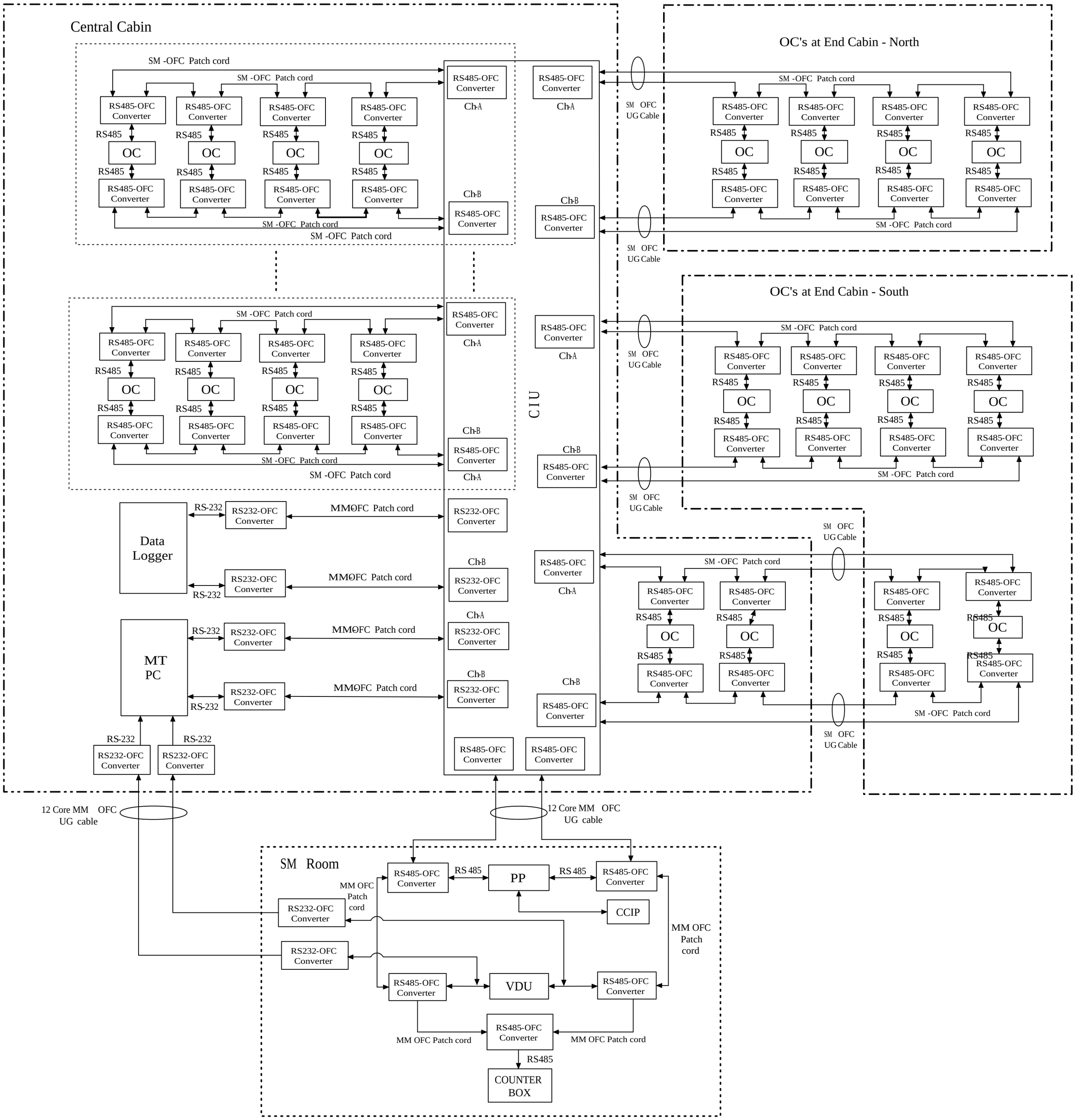


Note: The above diagram depicts the requirement for maximum configuration of MEI633. The no. of 110V -24V converters in n+1 configuration will be decided according to the actual load condition.

MEI633 Communication Arrangement for Centralized Installation



MEI633 Communication Arrangement for Distributed Installation



ANNEXURE D

PROCEDURE FOR

INSTALLATION, TESTING AND COMMISSIONING OF

MEI633

IN STATION YARDS

1. RELAY RACK AND INTERCONNECTION SETUP:

a. The provisions of SEM and Zonal Railway practices shall be broadly followed in relay erection and wiring.

b. The equipments are to be wired in Relay room, Station Master's office and End Cabins.

c. Contact numbering for the relays shall be made as per the approved circuit diagram issued by the railway and type of relay proposed to be used on the installation.

d. The following sequence shall be followed for Wiring and Testing :

i. Erection of Relay racks
ii. Fixing of Relay bases as per Disposition Chart prepared
iii. Fixing of Fuses and Terminals
iv. Drawing of wires from contact to contact
v. Testing including wire count w.r.t. Wiring Diagram by the designated Railway staff.
vi. Soldering after due corrections by trained personnel
vii. Testing of soldered wires including wire count wrt Wiring Diagram by the designated Railway staff.
viii. Testing of Wire to wire by the designated Railway staff.
ix. Plugging of Relays after due corrections taking care of the relay code pins for ensuring correct contact configuration. The Clips shall be locked properly and firmly.
x. Additional/extra holes for code pin if any shall be sealed with Epoxy/ M-Seal
xi. Clips shall be checked for proper insertion by inspecting from rear
xii. Energization of Relays and EI equipment.
xiii. Connection of Simulation panel and Panel, Block Instrument etc
xiv. Functional Testing by Supervisor
xv. Simulation Testing w.r.t. TOC of the specific installation by the designated Railway staff.
xvi. Functional Testing including correspondence with field gears

e. The wiring between the terminal board of the panel and the unwired tag block on the relay rack/Panel processor is to be carried out using multi-core cables (40 core or 60 core) 0.6mm/1.0 mm dia Annealed Tinned Copper wire to IS: 694 or any other suitable cable wire approved by the Engineer in-charge. The wiring on the interface relay rack is to be carried out by 16/0.2 mm dia single core multi-strand flexible A.T. copper wire to I.S. 694 or any other suitable cable wire approved by the Engineer in-charge.

f. Soldering at the tag block terminals shall be made using good quality Solder and Flux. Care must be taken to prevent dropping of excessive solder from terminal thereby causing failure/unwanted connection or short by fusing of PVC insulation in the row below it. It is advisable to raise the wires by mechanical means and temporarily

interposing a wooden or plastic sheet between the adjacent rows while soldering, to collect the excessive solder that may be dropping out.

g. After testing, the loose wires on the cable ladder shall be neatly bunched and laced with twine black. A suitable color code for wiring shall be adopted as required by Railways.

h. After the testing is completed by the Railways representative and before commissioning the installation, the relays shall be sealed with sealing bands and wires.

i. The nomenclature of each relay shall be painted both in front and rear side of each relay with contact configuration. The relay index sheet duly painted with details of relay and their position in the relay rack shall be manufactured out of Decolum / Novapan sheet and fixed in the relay room. All the relays to be plugged shall be checked visually and defect if any, noticed shall be replaced duly reporting the same to the Railways. As made relay rack wiring and contact chart of all relays shall be prepared in Linen / Polyester sheets, duly signed and handed over to Railways for preparation of handing over documents to maintenance organization.

j. All circuits shall be carefully protected by individual fuses in the relay room and locations grouped, preferably, to facilitate easy fault location. Fuses shall be so arranged that they can easily be placed without causing interference to other circuits. Charts showing the arrangements of fuses and the circuits in which they are used shall be prepared and kept in the relay room. Fuses for all Signaling circuits shall be of the non-deteriorating type as per RDSO specification.

k. Fixing of EKT/HKT with Micro Switches 2NO / 2NC at S.M's office on Teakwood board, providing telephone at SM's office, carrying out wiring of EKT/HKT, telephone using 16/0.2mm wire and testing as per approved circuit diagram and commissioning the same. Wiring has to be neatly clipped wherever necessary.

l. The wires for the Vital Inputs, Vital Outputs and the Power connections shall be grouped and routed separately. Vital I/O wire pairs shall be twisted together.

m. OFC cables and Patch cords shall be routed in a protected manner and tagged to indicate so that tampering is avoided.

2. STATION EQUIPMENT:

a. The control panel shall be erected in the place as shown by the Inspector-in-charge of the work on proper foundation bolts and cement concrete. Before erecting the panel, a suitable duct shall be made for bringing the jumper cables into the control panel if necessary.

b. The Control Panel shall be protected while doing the wiring.

c. The terminal particulars, power supply points, tag block particulars shall be neatly painted on the inner side of the panel. Before commencing wiring all knobs, buttons and indicators shall be tested for proper contact and defective ones shall be replaced in the initial stage itself.
d. The cable termination and internal wiring terminal particulars of control panel shall be made out signed by contractor and handed over to Railways. The control panel shall be earthed properly.
e. Any modification to the panel wiring shall be done by the contractor at site, as required by the Railways before final commissioning.
f. The inter-connections arrangements includes laying of multi core hook up wire cables by using sufficiently thick wires not less than 7/1.4mm PVC copper or 10 Sq.mm multi strand copper conductor to avoid the voltage drop.
g. The ladder arrangements provided shall be of suitable capacity fixed neatly and firmly with proper supports. Cable details, functions allotted to each core and terminal numbers shall be prepared and handed over to Railways.
h. All connections / terminations shall be fully tested by the contractor. Then, testing has to be done jointly with Railway's representatives. Any alterations shall be carried out by the contractor before commissioning of installation.
i. Any additions / alterations in the wiring of relay racks control panel and cable termination racks, power rack, battery room and in apparatus cases involving safety shall be carried out by the contractor during testing / commissioning.

3. CRANK HANDLE INTERLOCKING: Electric Key Transmitter with crank handle fixed to the key shall be installed on Acrylic sheet/Glass fronted T.W. box firmly on suitable angle supports, in SM's room/Cabin/Battery box/apparatus cases as indicated by Railways. The wiring shall not be exposed, EKT when fixed with crank handle, shall be ensured that proper supports, have been given to the crank handle to avoid undue strain to the mechanism of the EKT. A push button with 2NO / 2NC contacts of reputed make viz., L&T/Crompton, 3 Nos. of LEDs - Red, Yellow and Green shall be provided inside the box to give crank handle "OUT", crank handle "IN", crank handle "FREE" indications. Providing nickel coated welded chain handle and key, locking and sealing arrangements. 37mm brass locks good quality should be provided. Carrying out wiring as per approved circuit diagram as instructed at site by Site Engineer.
(This includes necessary mounting of the box to the wall using TW plugs and cement mortar, all materials to be arranged by contractor).

4. PAINTING:
All signaling equipments shall be painted in accordance with signal engineering manual chapter XI. The coloring scheme shall be as per Annexure '29 Para 19.106 of SEM Part-II.

5. INDOOR PAINTING:
a. Painting of complete relay rack/cable termination rack and ladder and its fixtures and other equipment installed in the relay room as per the instructions of CSI/SI and writing all cable termination numbering particulars in rack and also on board, relay numbering,

nomenclature and other details both on relays and racks, rack numbering, particulars of condensers, and fuses, resistances both at fixing boards as well as in the particulars board, axle counter equipment details, cable numbering as cables. And any other details requires in Relay Room for panel interlocking circuits by Site Engineer at site.

b. Painting equipment rack and wiring all equipment numbering details, painting of hard wood planks provided on the equipment rack and power board racks, details of equipment fixed on power board.
c. Painting of Battery Bank Titles and Particulars Summary. Boards with computer lettering on PVC plastic Sheets of about 3-5mm shall be used in lieu of Painting on Walls.
d. Painting numbering on secondary cells, writing circuit details in the battery room as instructed by Site Engineer at site.
e. Painting all termination particulars in the panel, block instruments, EKTs, Crank Handle box, in the SM's office/panel room.

6. TESTING AND COMMISSIONING:

A. The different stages and procedures for testing of indoor and outdoor equipments are given below as guidelines.
B. Testing and Commissioning consist of testing of the application software at factory, final testing of selection circuits, for proper functioning of track circuits and points, gears as per SEM, energizing and testing of power cables, stabilizers, secondary cells for all circuits, energizing and testing of colour light signals and final commissioning of the entire signaling arrangements for traffic use. .

The equipment shall be first tested by the contractor and then jointly with Railways. The contractor shall provide test panel for testing. The different stages and procedures for testing of indoor and outdoor equipments are given below as guidance.

STAGE-I
TESTING OF THE ELECTRONIC INTERLOCKING

STAGE-II
TESTING OF THE OUTDOOR GEARS, VIZ., POINTS, SIGNALS, TRACK CIRCUITS, LC GATES ETC.

STAGE-III
COMMISSIONING OF PANEL BY CONNECTING THE OUTDOOR GEARS TO THE PANEL.

C. **TESTING OF ELECTRONIC INTERLOCKING:**
i. Testing of Electrical Signaling Circuits shall be broadly as per Para 13.30 to 13.41 and other relevant pares of SEM Part-II .
ii. Energization of relays by connecting the simulation panel.

iii. Clearing of signals on the simulation panel and carrying out the following tests (As per table of control):-

a) Negative tests
b) Dead/Approach locking tests.
c) Route/Back locking tests.
d) Testing of conflicting signals.
e) All other circuits viz., SM's key, CHLR, LXPR, KLCPR are provide correctly in the respective signaling circuits.

D. **COMMISSIONING OF PANEL:** Commissioning of panel consists of:-

a) Testing all signals from panel and their correspondence of panel indications
b) Checking the correspondence between the points and their panel indications.
c) Checking the correspondence between the track circuits and its panel indications.
d) Testing of sidings, its electrical transmission of EKT, panel indications.
e) Testing of LC gates, its electrical transmission of EKT, panel indications.

E. **Connecting simulation panel:** Simulation panel consists of two Boards:-

(A) **BOARD No.1**

It depicts the yard (painted) with points, track circuits, LC gates and slots. Switches are fixed on the board to simulate the conditions of the points, track circuits, interlocked LC gates, slots etc.,

Track circuit switches are fixed on the track. Point control switches are fixed nearer to the points for small yards. For major yards the switches are grouped as point switches and track circuit switches.

Functions requiring ON and OFF switch (with make and break facility i.e., two wires only) with facility to pick up a relay in one position and drop the same in other position. Example:

Switch OFF - Track Down. - TPR dropped. Switch ON - Track pick up - TPR picked up.

For controlling the following function the above type switched shall be used:-

i) Track circuits
ii) Siding point
iii) Crank handle
iv) Slot
v) LC gate

Points require ON and OFF switches with facility to pickup conflicting relays (i.e., NWKR and RWKR) in two positions. (These switches require three wires).

(B) **BOARD No.2**

To simulate the signals the following bulbs are used as dummy loads for the ECRs to pick up and also to observe the aspect of the signals during testing.

ON aspect: 110V 40 W
OFF aspect: 110V 25 W
ROUTE aspect: 110V 75 W (Jn. Type route indicator)

(C) Wiring simulation panel to the relay room side wiring at MDF:

Disconnect all the links on cable termination rack. Wires from the switches are connected to the relay room side termination. Similarly the wires from simulation panel Board No.2 consisting of lamps are connected to the relay room side termination.
Multi core 0.6mm dia cable is used for wiring the simulation boards. To reduce the voltage drop, more conductors are used for supply taken to the test panel and also to the negative since common return is used.

7. COMMISSIONING OF PANEL:

a. Check up the incoming feed of TPRs in the C.T. rack. The above checking will confirm the pairing of cable conductors.
b. Remove the wiring connection of simulation board on cable termination rack and make through the links of all TPRs, WKRs and signal circuits.
c. First test the points from panel individually and conduct all tests discussed earlier including track locking test, correspondence between point position and NWKR/RWKR in relay room.
d. Check whether all TPRs have picked up and check up the panel indication individually by dropping each track circuit correspond correctly.
e. Check whether all other required relays viz., CHLR, LXPR, KLCR have picked up.
f. Test all the signals from panel.
g. Check the correspondence between relay from and signal aspects which is most important. For checking the aspects of home signals, distant signals, designated railway staff shall be deputed to site with walkie-talkie or Magneto telephone and check the correspondence.
h. Remove the signal bulb at site of every aspect and check whether indication disappears on the panel and ECR drops in the relay room.
i. Open all the registers and make entries of counter numbers before handing over to operating staff.

Note: The procedure for Installation, Testing and Commissioning of the Electronic Interlocking System described above is generic in nature and may vary depending upon the practices and guidelines laid out by the specific zonal railways.