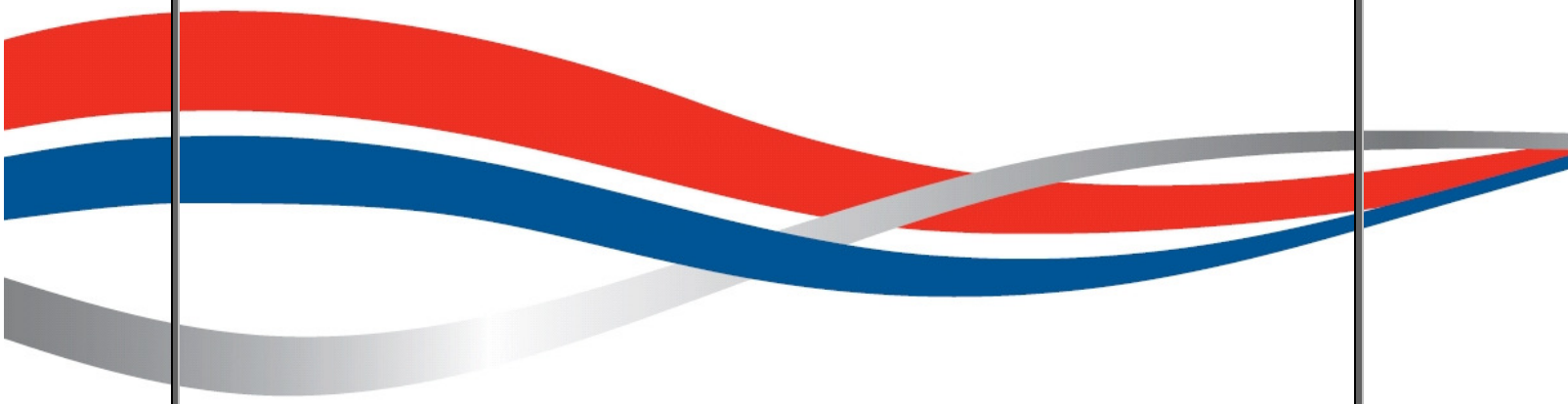
Microlok® II
INSTALLATION



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0.1	**Draft for review**
1.0	**Initial Issue for ECOR**
1.1	**Initial Issue for SER**
1.2	**Review comments by P.V.K Subramanian/Engineering Manager**
1.3	**Initial Issue to SECR**
1.4	**Improvements on Surge Protection, Bonding and grounding included**
1.5	**RDSO comments updated**
2.0	**New sections added on Split card file, Fiber cable, Fiber equipments, System Configuration and Earthing Arrangements**
2.1	**Updated to implementation of Hot standby details and Pre-commissioning Checklist**
3.0	**Issue to NCR**

Please refer this document in conjunction with earlier versions for the existing installations on or before July 2008.

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1. INTRODUCTION

This manual provides the basic information about Microlok II installation practices. This manual is to be referred in conjunction with the station specific Microlok II interface circuits and Microlok II service manual SM6800B.

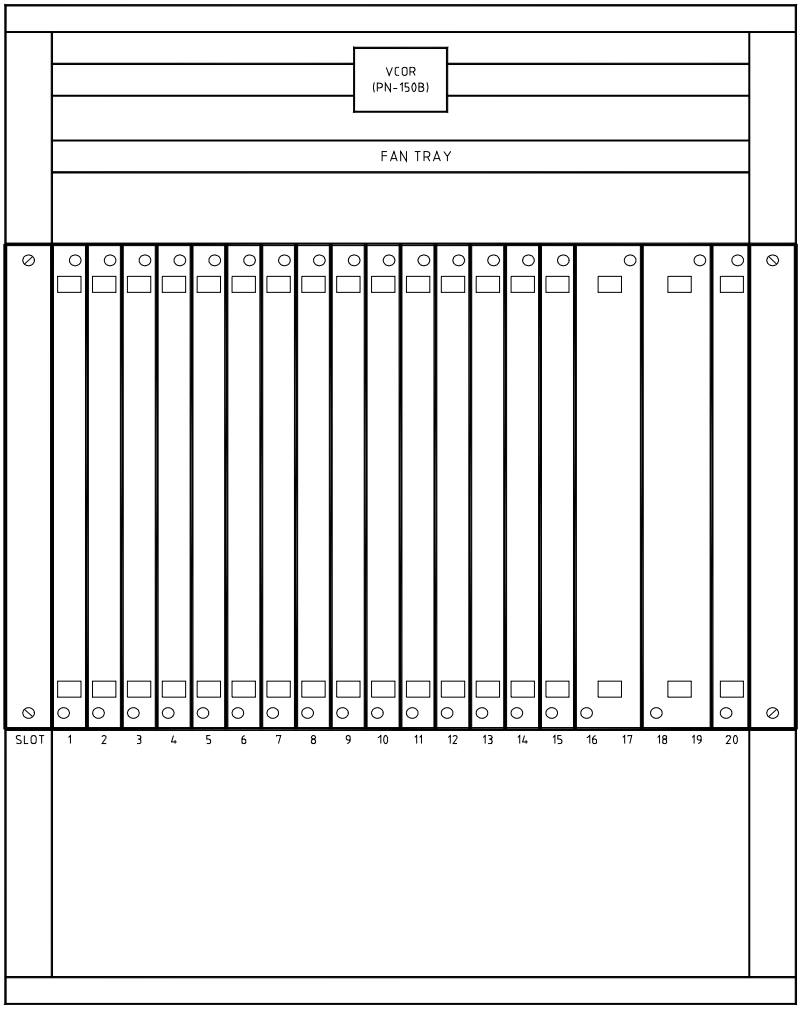
⚠ Restricted Area Warning
This system is intended for installation in restricted access areas. A restricted access area is where access can only be gained by service personnel through the use of a special tool, lock and key or other means of security and is controlled by the authority responsible for the location.

2. CARD FILE

- The Microlok II system Card file is mounted in 19-inch rack equipment.
- 24V DC fan is mounted on top of the card file, it is needed to dissipate the heat generated inside the rack. If two card files are installed on a rack, fan tray is fixed on top of the top card file and for the bottom card file, the fan tray is fixed below the card file. The fans are powered in such a manner that the air flows out of the card files.
- Card guides in the card file slot facilitates easy insertion of CPU, Power Supply and I/O boards.
- 48 and 96 pin connector assemblies are fixed at the backend of card file.
- The unused slots in the card file are fitted with blank facia panel on the front side.
- The Standard card file part no. is N16903101.

Typical Microlok II rack layout with card file arrangement is depicted below.

CARD FILE IN MICROLOK II RACK



Specification

ENVIRONMENTAL

System Card file Vibration	Operating Temperature Range (All Units)	Humidity Limit
1.0grms, 0.2" displacement, 5-1000 Hz	-40℃ to +70℃	95% non-condensing

SYSTEM CARDFILE HARDWARE CONFIGURATION

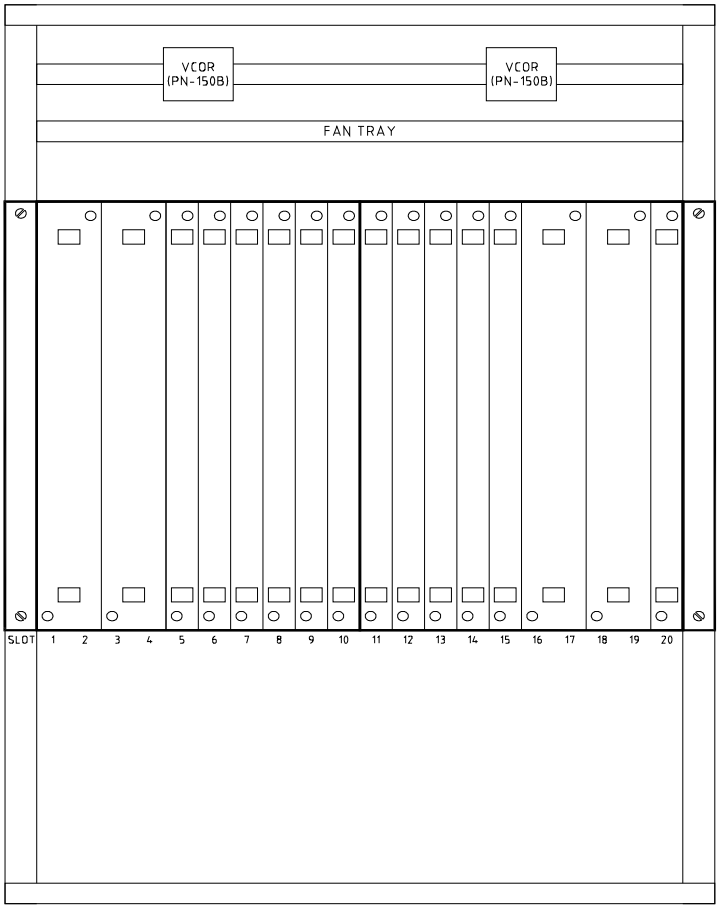
Card file Mounting	PCB Mounting	Total PCB Slots	Slot Bus Addressing	Upper PCB Interface Connectors	Remote Power Supply Connector
Std. 19" rack, Shelf or wall	Eurocard	20	Via jumpers in connector housings	96-pin male	8-way screw lock discrete wire conn.

2.1. SPLIT CARD FILE

The split backplane allows two independent CPU and associated circuit boards to be housed in a single card file, certain Microlok II applications require that redundant systems be provided. In order to accommodate this requirement a split backplane is needed. This split backplane has been made from a 19-slot mother board. An additional power connector is placed on the split side in the space formerly occupied by slot-2. This reduced the slot count to 18. The copper is separated at the center between slot-10 and slot-11 with all traces power and ground planes severed. The split card file part no. N16905301 with the split mother board. The rear panel is modified to have an additional cut out to allow connections to be made to the new power connector.

Typical Microlok II rack layout with Split card file arrangement is depicted below.

SPLIT CARD FILE IN MICROLOK II RACK

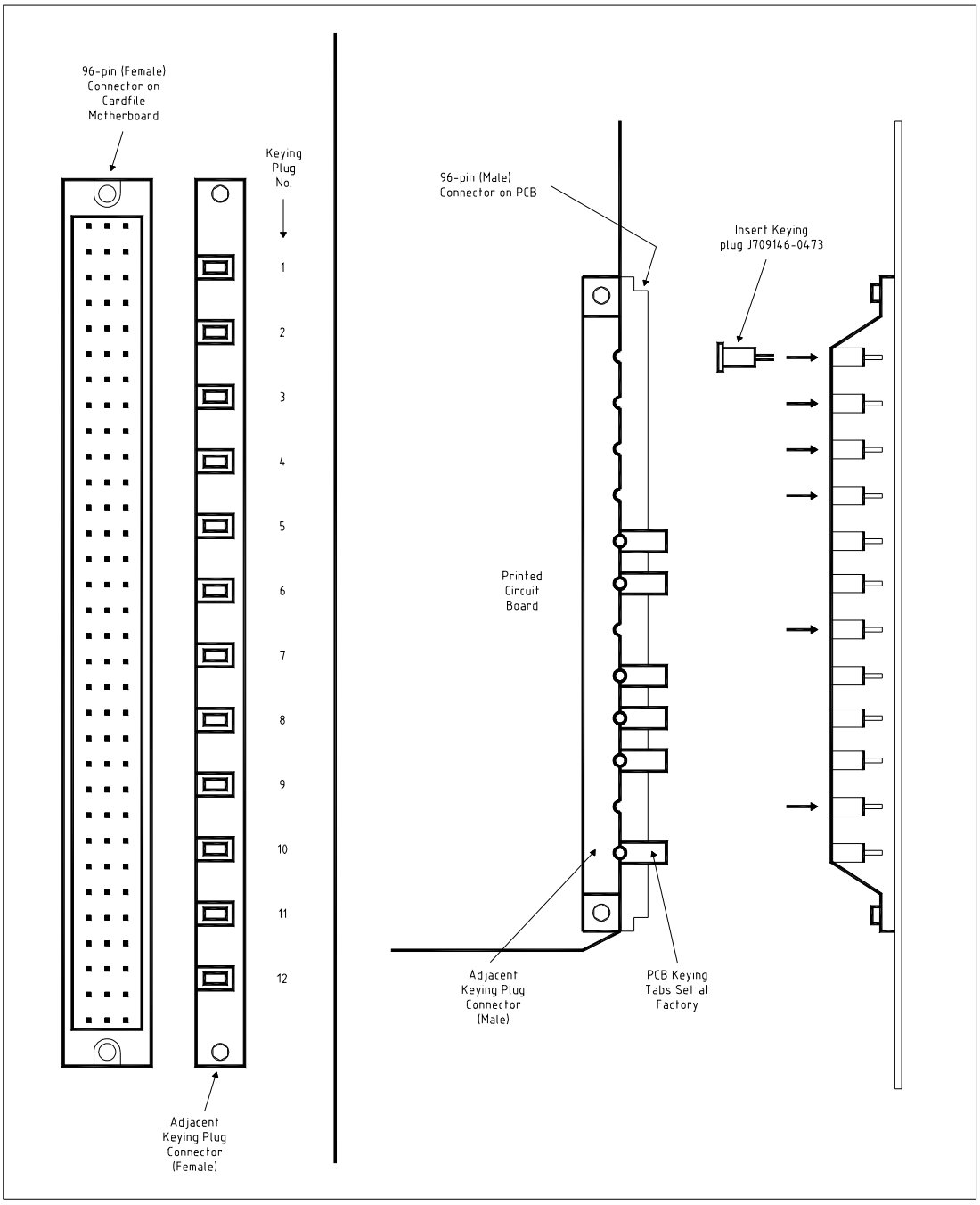


2.2. KEYING PLUG

- Each of the Microlok II card file slot includes a 12-way female keying plug connector fixed next to the 96-pin connector on the mother board.
- Each board is equipped with a corresponding 12-way male keying plug connector, individual keying tabs are removed at the factory in a specific pattern for the board part number.
- Prior to installing a board, insert keying plugs into the corresponding card file motherboard keying plug connector.
- The purpose of the keying plug is to avoid insertion of wrong type of board in any slot.
- Each slot requires 6 Nos. of Keying plugs, which is given below.

Sl.No	Printed circuit board	ASTS Part No	Keying Plug Location											
			1	2	3	4	5	6	7	8	9	10	11	12
1.	CPU Board	N17061301	√	√			√	√	√		√			
2.	Power Supply Board	N16660301	√	√	√					√	√			√
3.	Enhanced power supply Board	N16601203	√	√	√					√	√			√
4.	Vital Output Board	N17060502	√	√		√					√		√	√
5.	Vital Input Board	N17061002	√	√		√						√	√	√
6.	Mixed Vital I/O Board	N17061602	√	√			√	√	√	√				
7.	Non-Vital I/O Board	N17061501	√	√		√					√	√	√	
8.	SYNC I/O Board	N17066402	√		√			√	√	√		√		
9.	Comms Board	N17066403	√		√			√	√	√				√

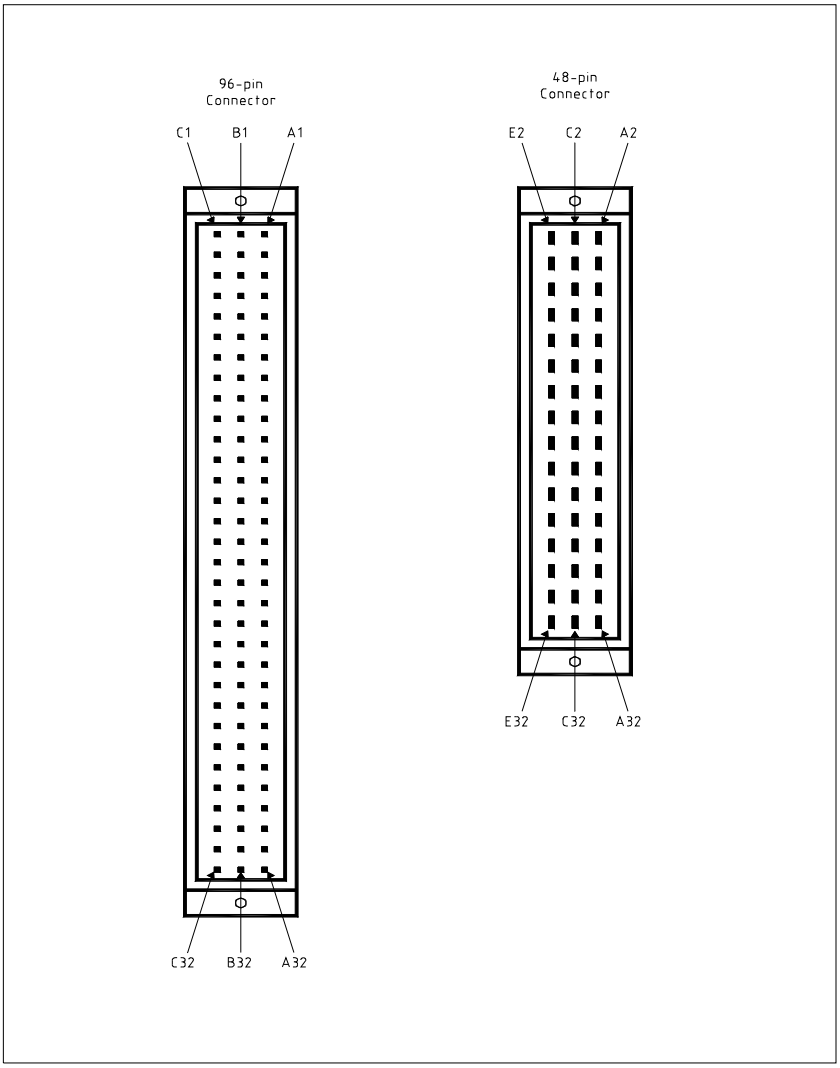
Typical keying plug location



2.3. PCB CONNECTOR ASSEMBLY

- Microlok II circuit boards are interfaced to external circuits using 48 and 96 pin connector assemblies.
- All boards are used with 48-pin connector assemblies except non-vital board. Non-vital boards are used with 96-pin connector assembly.
- The connector cable assemblies provide discrete wiring for all available I/O points on each board.
- Wire bundles are routed through a protective sleeve on wiring openings at bottom/top of the connector hood.
- Each connector assembly consists of connector receptacle, connector hood and guide pair to fix the connector on the card file.
- Crimp contacts are used to wire all the boards.
- Wires are to be connected shall match with the correct size of crimp contacts. The wires are to be crimped to the crimp contacts using the respective Harting crimp tool.
- Extraction tool is necessary if contacts are to be replaced.
- Address select PCBs are fixed onto the connector hood of each I/O board. Separate address select PCBs are available for 48-pin connector and 96-pin connector.
- EEPROM PCB is fixed onto the connector hood of CPU board.

Typical 48 and 96 pin connector assemblies.



Specification

Type	Receptacle Part No. Harting	Connector Hood Part No. ERN	Crimp Contact Part No. Harting	Guide Pair Part No. ERN	Removing Tool Part No. Harting	Crimp Tool Part No. Harting	Insertion Tool Part No. Harting	Size of Wire in sq mm
48 Pin Connector	09050483202	173051	09060008482/6482	043554	0999000010000	09990000076	099900008800	0.14-0.5
96 Pin Connector	09030963214	173001	09020008484	043553	0999000010100	09990000075	099900010000	0.09-0.32

3. CIRCUIT BOARD CONNECTION TO EXTERNAL CIRCUITS

3.1. CPU BOARD

CPU board forms the heart of the Microlok II system. It contains the Motorola 68332 microprocessor operating at 21MHz clock and its associated peripheral circuitry. The CPU board also contains necessary memory space to store the executive software, the station specific application software and the event logs. A real time clock is also present on the CPU board to time stamp the log events. The CPU reads from/writes to I/O boards respectively through the system bus extended by mother board.

- CPU board is installed at slot 18-19 in a Standard card file.
- CPU boards are installed at slot 1-2 and 18-19 in a Split card file.
- It provides five serial ports, those are used to communicate with other Microlok II and Operator PC/Maintenance PC.
- Four serial ports are terminated on the 48-pin connector.
- Fifth serial port is extended on the front facia panel of the CPU board.
- A 250Hz. signal is generated from the CPU board if all diagnostic checks are passed and this signal is externally connected to Power supply board to generate a Conditional Power Supply (CPS) to drive VCOR relay.
- EEPROM is installed behind 48-pin connector in each CPU board.

Typical CPU board wiring

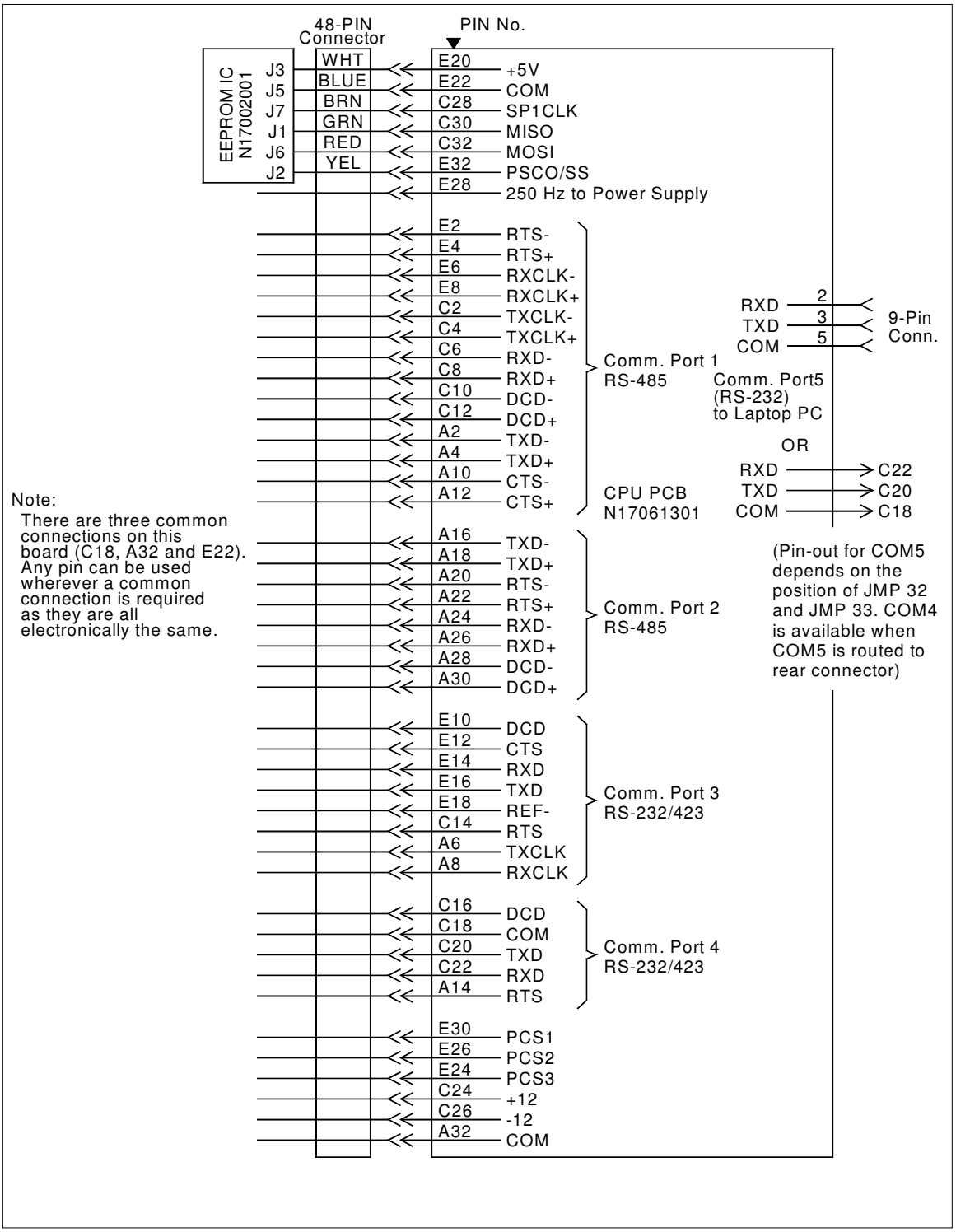


Fig-1

JUMBER ID	DESCRIPTION		POSITION
JMP1	BOTTOM PCMCIA 2 WAIT STATES		POSITION 2-3
JMP2			NOT INSTALLED
JMP3	ON-BOARD RAM 1 WAIT STATE		POSITION 2-3
JMP4	TOP PCMCIA 2 WAIT STATES		POSITION 2-3
JMP5			NOT INSTALLED
JMP6	FLASH 1 WAIT STATE		POSITION 2-3
JMP7	ENABLE COM4 RXD		POSITION 1-2
JMP8	ENABLE COM4 DCD		POSITION 1-2
JMP9	DISABLE BACKPLANE CPU RESET		POSITION 1-2
JMP10	COM1 TX.CLK IS AN OUTPUT		POSITION 2-3
JMP11	COM3 VOLTAGE DRIVE LEVELS	RS-232	POSITION 1-2
		RS-423	POSITION 2-3
JMP12	COM3 VOLTAGE DRIVE LEVELS	RS-232	POSITION 1-2
		RS-423	POSITION 2-3
JMP13	COM3 TX.CLK IS AN OUTPUT		POSITION 2-3
JMP14	COM3 TX.CLK IS AN OUTPUT		POSITION 1-2
JMP15	COM4 RX.CLK =9.83MHz		POSITION 1-2
JMP16	COM3 RX.CLK =9.83MHz		POSITION 1-2
JMP17	COM2 RX.CLK =9.83MHz		POSITION 1-2
JMP18	COM1 RX.CLK =9.83MHz		POSITION 1-2
JMP19	NOT AVAILABLE		NOT APPLICABLE
* JMP20	FLASH 3 PROGRAMMING LANGUAGE	LOCKED	POSITION 1-2
	(APPLICATION SPACE)	PROGRAM	POSITION 2-3
JMP21	FLASH 1 PROGRAMMING LANGUAGE	LOCKED	POSITION 1-2
	(EXECUTIVE SPACE)	PROGRAM	POSITION 2-3
JMP22	FLASH 2 PROGRAMMING LANGUAGE	LOCKED	POSITION 1-2
	(EXECUTIVE SPACE)	PROGRAM	POSITION 2-3
* JMP23	FLASH 4 PROGRAMMING LANGUAGE	LOCKED	POSITION 1-2
	(APPLICATION SPACE)	PROGRAM	POSITION 2-3
JMP24	FLASH 1 BOOT BLOCK	LOCKED	POSITION 1-2
	(BOOT SPACE)	PROGRAM	POSITION 2-3
JMP25	SPEAKER VOLUME	SOFT	POSITION 2-3
		LOUD	POSITION 1-2
		OFF	NOT INSTALLED
JMP26	IRQ7 OFF		POSITION 2-4
JMP27	68332 NORMAL		POSITION 1-2
JMP28	TOP PCMCIA PROGRAMMING VOLTAGE	LOCKED	POSITION 1-2
		PROGRAM	POSITION 2-3
JMP29	BOTTOM PCMCIA PROGRAMMING VOLTAGE	LOCKED	POSITION 1-2
		PROGRAM	POSITION 2-3

The CPU board holds a number of jumpers and these jumper settings are to be verified for correctness before CPU board installation at site as per the table (Fig-2) below:

MICROLOK II CPU PCB JUMBER SETTINGS

MICROLOK II CPU PCB JUMBER SETTINGS

JUMBER ID	DESCRIPTION		POSITION
JMP30	FLASH PROGRAMMING VOLTAGE	OFF	POSITION 1-2
		5V	POSITION 2-3
		12V	POSITION 3-4
JMP31	CPS DRIVE NORMAL		POSITION 1-2
JMP32	J1 COMM PORT 4 TX SELECT	COMM 4	POSITION 1-2
		COMM 5	POSITION 2-3
JMP33	J1 COMM PORT 4 RX SELECT	COMM 4	POSITION 1-2
		COMM 5	POSITION 2-3
JMP34	EXTERNAL "+5VBAT" ZENER DIODE SELECT (REGULATES TO 3.3V)	DISABLE	POSITION 1-2
		ENABLE	POSITION 2-3
* JMP35	RTC COIN BATTERY ENABLE	ENABLE	POSITION 1-2
		DISABLE	POSITION 2-3
JMP36	BACKPLANE SYS.CLK	ENABLE	POSITION 1-2
		DISABLE	POSITION 2-3

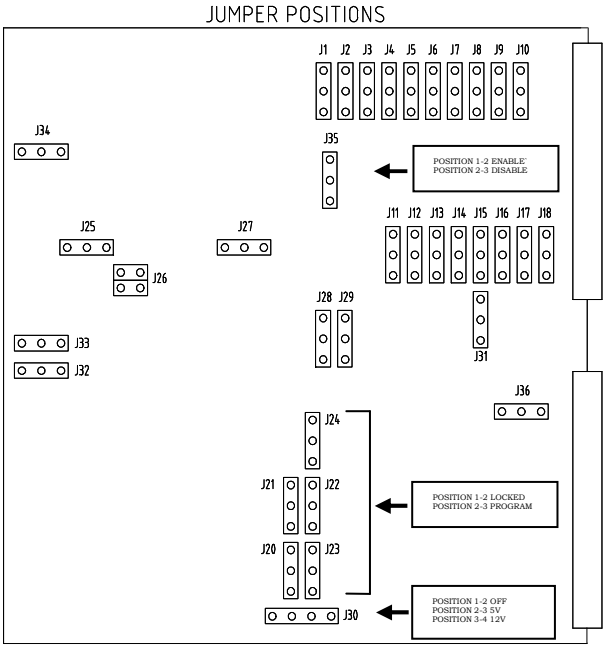


Fig-2

*** Note:**

- Jumpers J20 & J23 are to be placed in PROGRAM Position for loading the application program.
- Jumpers J20 & J23 are to be placed in LOCKED Position after uploading the application program.
- Jumper J35 is to be placed in 1-2 for ENABLE position and 2-3 for DISABLE position.

Specification

CPU Printed Circuit Board

Microprocessor

Type	Clock Speed	Internal Bit Operations	External Bus Operations
Motorola MC68332	21 MHz	32 bits wide	16 or 8 bits wide

Executive and Application EPROMs

Capacity and Type	Total Code Space	Clock Speed	Programming Voltage
Four Intel/Micron TE28F800CV-B90 Flash Type	Up to 8 megabytes (4M x 16)	21 MHz 1 wait state	+5V and +12V

RAM (Vital Data Processing and Event/Error Logs)

Vital Data: Type	Vital Data: Capacity	Vital Data: Batt. Back-Up	Event/Error Data: Type	Event/Error Data: Capacity	Event/Error Data Batt. Back-Up
Fast Static RAM	2 banks of 64K x 16 (128K bytes)	None	Low Power Static Ram	4 banks of 512K x 16 (256K bytes)	>4hrs. @25°C

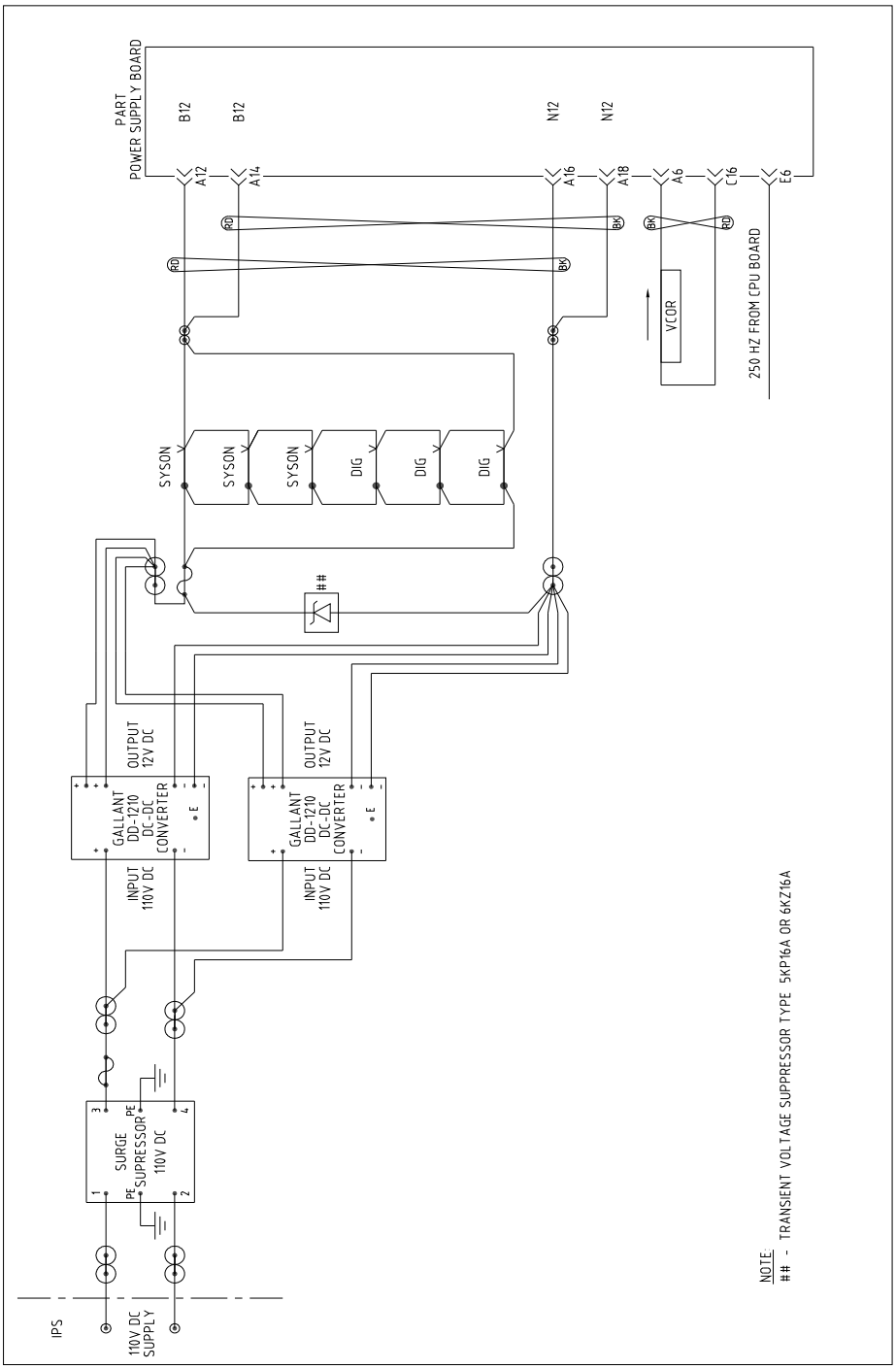
3.2. POWER SUPPLY BOARD

The power supply board is basically a DC–DC converter, which converts a 12V DC card file supply into three different voltages +5V, +12V and –12V. It also has a conditional power supply circuitry driven by a 250Hz. signal generated from CPU board. The conditional power supply drives VCOR relay.

- It occupies slot 16-17 in a Standard card file.
- Power supply boards are installed at slot 3-4 and 16-17 in a Split card file.
- It provides regulated +12V, -12V and +5V power, which are distributed to all system card file boards through the card file back plane bus.

12V supply from IPS/Battery chargers is wired to Power supply board through connector.

Typical Power supply board external wiring



Specification

SYSTEM OPERATING POWER

Power Input to System Cardfile				
Voltage Range	**Nominal Voltage**	**Min. Sys. Start-Up**	**Maximum Ripple**	**Current Draw**
10.8 to 16.5V DC	12V DC	11.5V DC	0.5V P-P	Determined by installation (number of signal lamps, cab carrier frequency, etc.)

Cardfile Power Supply Printed Circuit Board Outputs*		
For System Cardfile PCB 5V Internal Circuits	**For System Cardfile PCB 12V Internal Circuits**	**TO VCOR**
+5V @ 3A	+12V @ 1A, -12V @ 1A	+12V into 400 ohm coil
*Not used to power vital or non-vital external devices or circuits		

Enhanced power supply Board

SYSTEM OPERATING POWER

Power Input to System Cardfile				
Voltage Range	**Nominal Voltage**	**Min. Sys. Start-Up**	**Maximum Ripple**	**Current Draw**
9.8 to 32.0V DC	12V DC	11.5V DC	0.5V P-P	Determined by installation (number of signal lamps, cab carrier frequency, etc.)

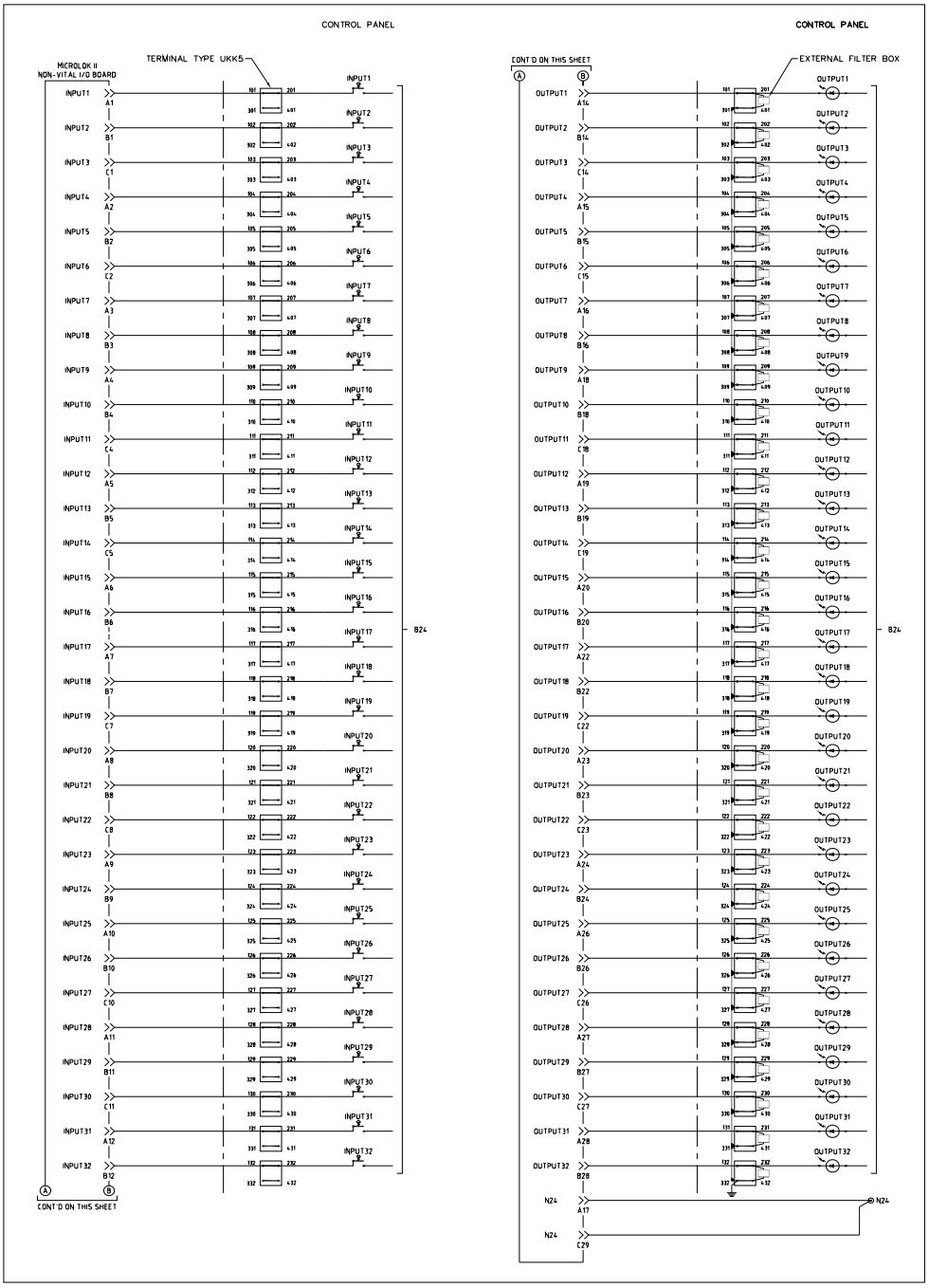
Cardfile Power Supply Printed Circuit Board Outputs*		
For System Cardfile PCB 5V Internal Circuits	**For System Cardfile PCB 12V Internal Circuits**	**TO VCOR**
+5V @ 3A to 5A	+12V @ 1A, -12V @ 1A to 2A	+12V into 400 ohm coil
*Not used to power vital or non-vital external devices or circuits		

3.3. NON-VITAL I/O BOARD

In Microlok II installations, Panel interface is done using NV.IN32.OUT32 (N17061501) boards. The non-vital I/O boards enable the Microlok II system to generate and monitor the status of non-vital discrete outputs and inputs respectively. This board connects each of its 32 inputs and outputs to a 96-pin connector mounted on the top rear of the card file slot. It employs polyswitches to protect the output circuitry. Inputs on boards are activated from a positive voltage relative to battery ground over a range of 6 to 30V DC. The non-vital I/O boards use latch ICs to buffer inputs and field effect transistors (FETs) to drive outputs. Outputs are sinking type i.e. if a non-vital output is delivered, the corresponding output bit becomes zero level and the LED connected to that output bit is lit. Note that the B24 for the LEDs are looped in the panel.

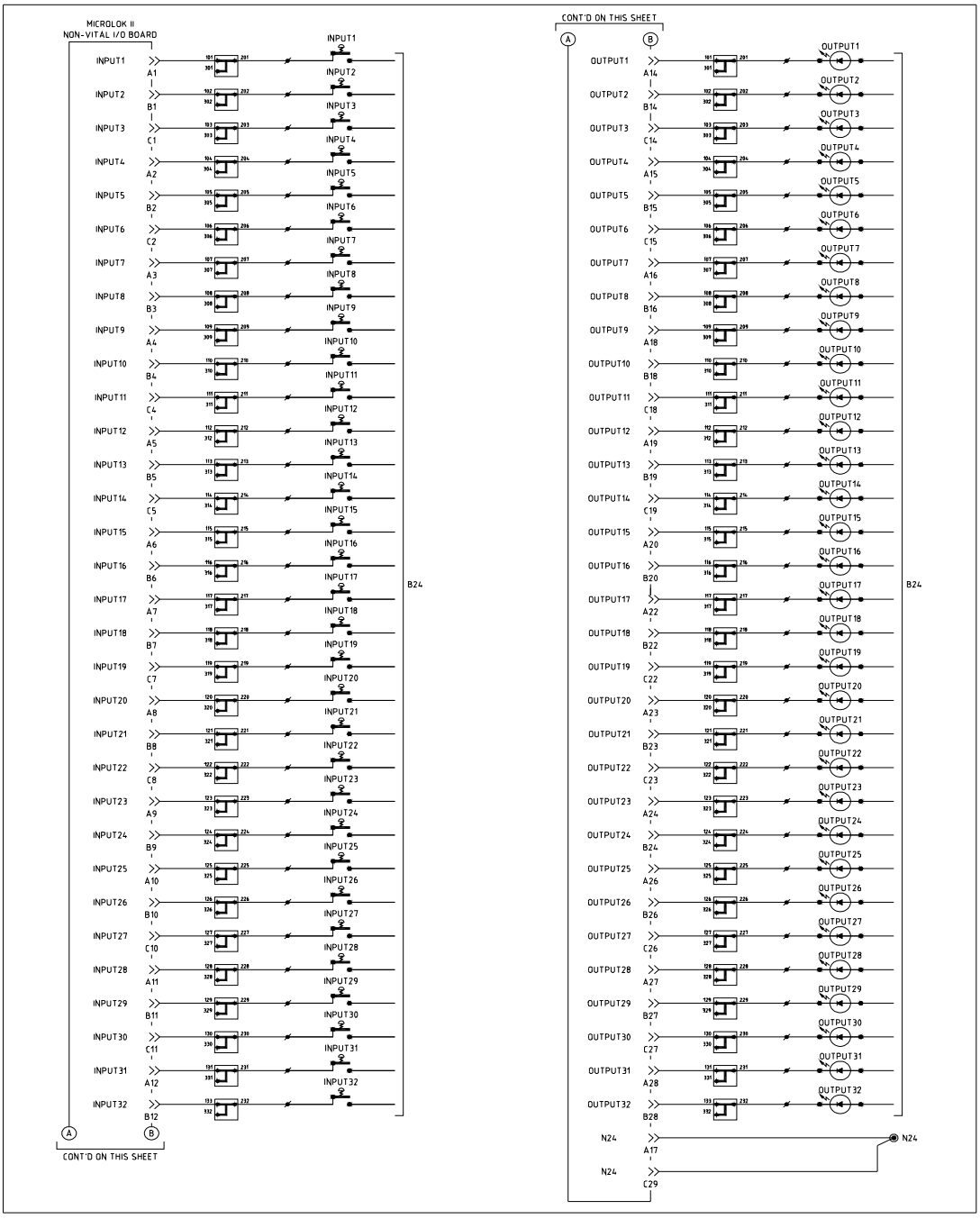
- External wiring is achieved using 96-pin connector. They are connected to UK5N Terminal (Single Deck Phoenix Non-Disconnect Terminal) in the Panel Processor Microlok II arrangement, having single set of Non-Vital boards. But, in case of duplicated Non-Vital boards, they are connected to UK5-Twin Terminal (Double Deck Phoenix Non-Disconnect Terminal).
- A +ve panel input is read into non-vital I/O board.
- A –ve output is delivered out of non-vital I/O board.
- N24 for input/output reference is separately wired to 96-pin connector.

TYPICAL NON-VITAL I/O BOARD INTERFACE WIRING



The above typical circuit shows the Non-Vital board interface wiring, where the Panel room is located in a different building (External Filter Box for the NON-VITAL Board OUTPUT lines Refer Section 7.15).

TYPICAL NON-VITAL I/O BOARD INTERFACE WIRING



The above typical circuit shows the Non-Vital board interface wiring is connected, where the Panel room is located in the same building of signal equipment room.

Specification

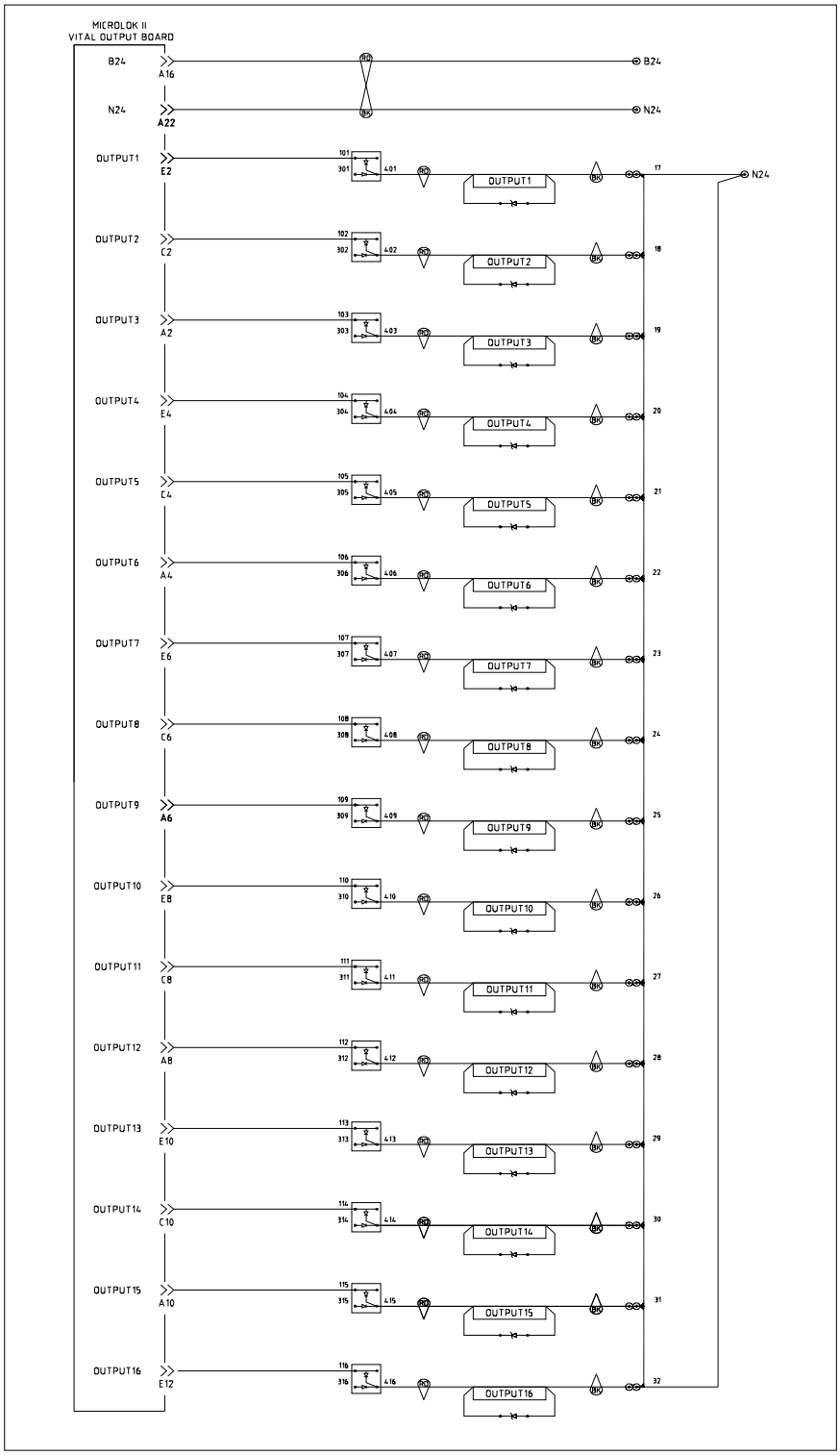
Non-Vital I/O Printed Circuit Boards				
ASTS Part No.	**Input and Output Voltage Range**	**Externally Available Inputs**	**Externally Available Outputs**	**Current Rating On Outputs**
N17061501	6.0 to 30.0V DC	32	32	Outputs 1-30: 0.25A (polyswitch-protected) Outputs 31, 32: 5.0A fuse*
*Suitable for lighting lamp upto 25W				

3.4. VITAL OUTPUT BOARD

Vital output boards enable the Microlok II system to control the field gears like signals, point machines, LX, CH etc. The OUT.16 (N17060502) output board connects each of its 16 discrete outputs to a 48-pin connector mounted on the top rear of the card file slot. Each output is controlled by "high side" software-controlled switch. Each output is protected with a polyswitch, which acts like a circuit breaker.

- External wiring is achieved using 48-pin connector & diode terminals.
- 16/0.2 mm wires are used for wiring between output boards (+ve end) and diode terminals.
- All –ve ends are looped using comb link.
- Twisted pair wires are used for wiring between diode terminals and relay coils.
- Tranzorb is provided across all relay coils that are driven by Microlok II to nullify the back emf generated by relay coils.
- Loads should be connected between Microlok II outputs and battery negative.
- Each output card should have VCOR controlled B24 and N24 connections to switch the controlled outputs.

TYPICAL VITAL OUTPUT BOARD INTERFACEWIRING



Specification

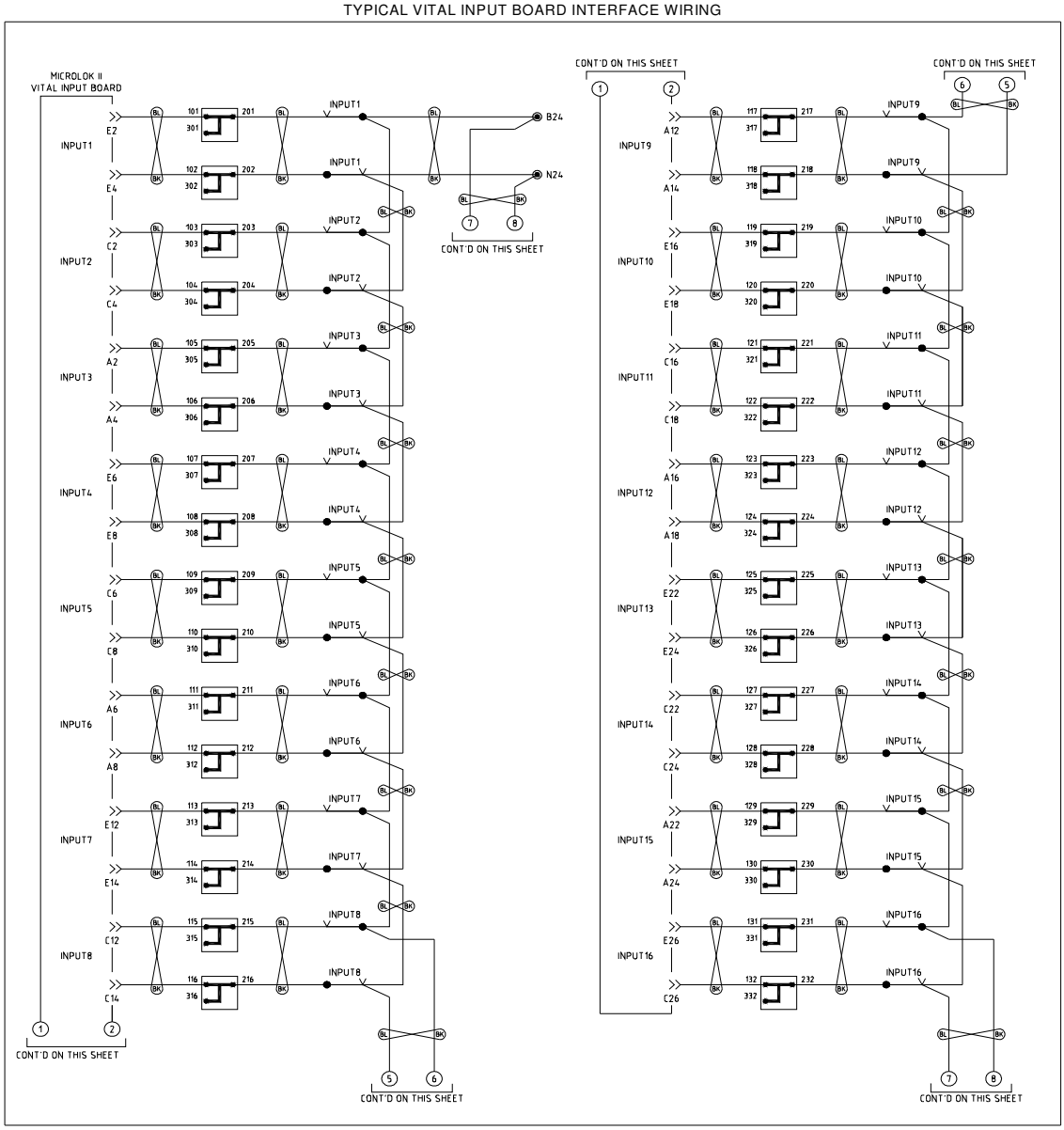
Vital Output Printed Circuit Boards				
ASTS Part No.	**Voltage V_{BATT} Range**	**Load Resistance Range**	**Max. OFF Voltage**	**Min. ON Voltage**
N17060502	24V	100Ω - ∞	1.5V	V_{BATT} - 1V

3.5. VITAL INPUT BOARD

Vital input boards enable the Microlok II system to monitor the field gear status like signal aspect, point detection, track status, LX status, CH status etc. The IN.16 (N17061002) input board connects each of its 16 isolated inputs to a 48-pin connector mounted on the top rear of the card file slot.

- External wiring is achieved using 48-pin connector and “one-in-two-out” terminals.
- All inputs require a “double cut” wiring using twisted pair cables.

TYPICAL VITAL INPUT BOARD INTERFACE WIRING



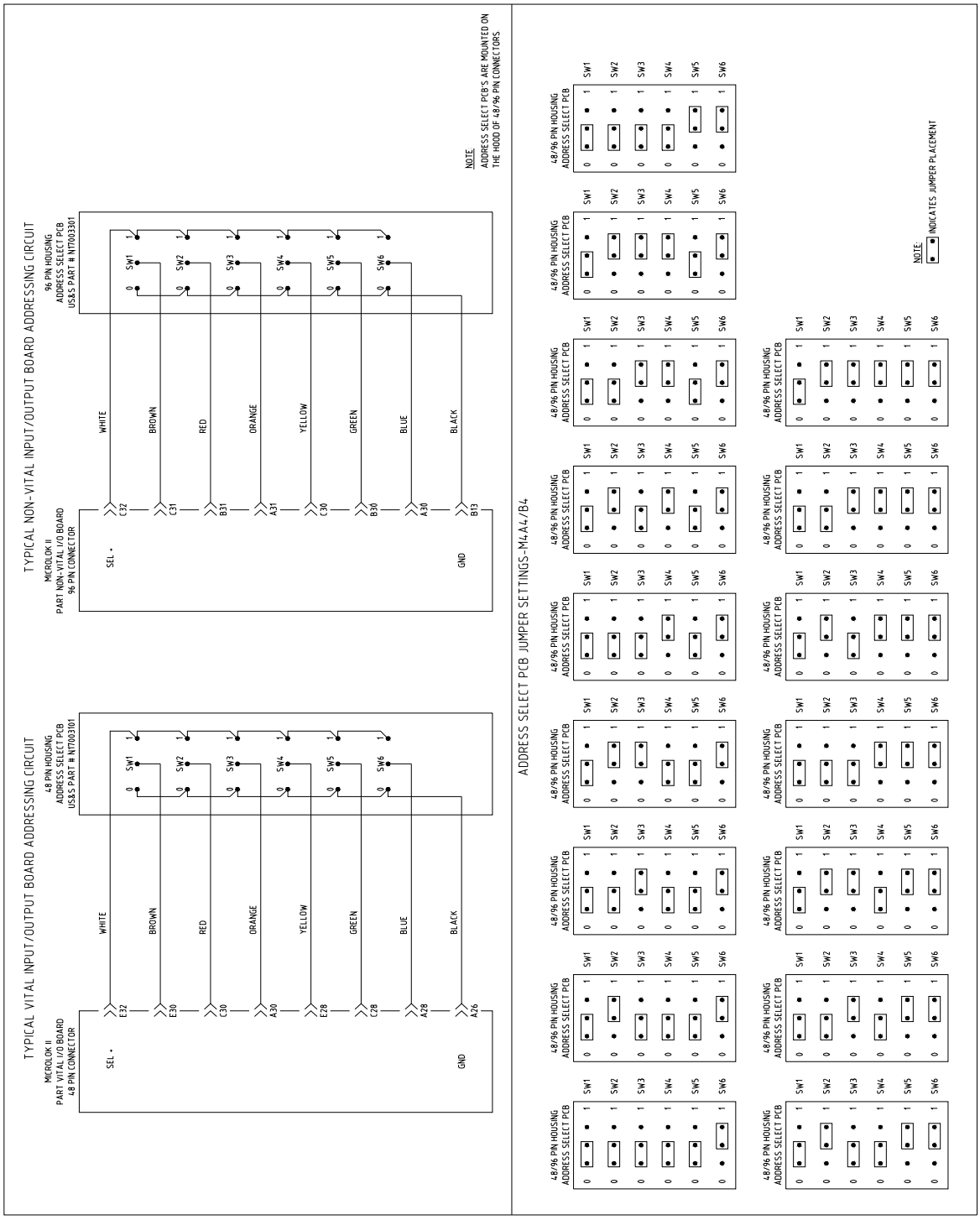
Specification

Vital Input Printed Circuit Boards				
ASTS Part No.	**Nom. Input Voltage**	**Min. Voltage to Ensure ON State**	**Voltage to Ensure OFF State**	**Max. Sustained Input Voltage**
N17061002	24V	16.0V	12.0V or less	62V

3.6. ADDRESS SELECT PCB

- It is wired in every vital and non-vital I/O boards for CPU addressing. The power supply PCB does not have an address select PCB connected to it.
- It is installed at rear end of connector assemblies.
- The jumper setting of boards can be found by looking at the configuration menu in the Microlok II Maintenance Tool. The jumper settings do not depend on the order of the boards that happen to appear in the card file.

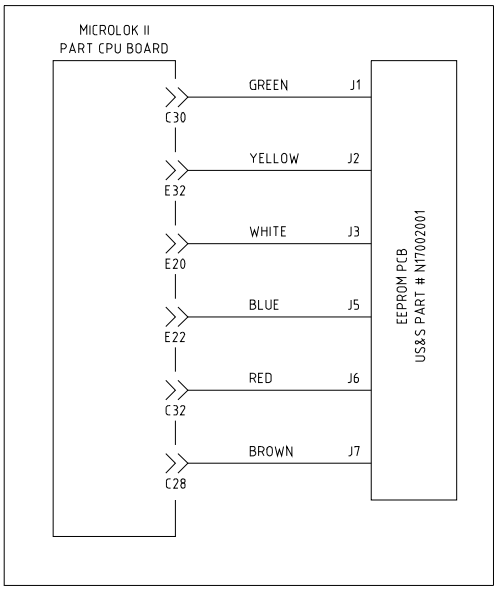
Typical board addressing circuit



3.7. EEPROM PCB

- The site-specific configuration data is stored in the EEPROM PCB.
- It is housed in the CPU board edge connector.
- The data can be loaded using a laptop PC connected to the CPU board front panel serial port.
- Even if the CPU board is replaced, the configuration data remains intact within the CPU connector's EEPROM PCB.

Typical CPU-EEPROM PCB Interface



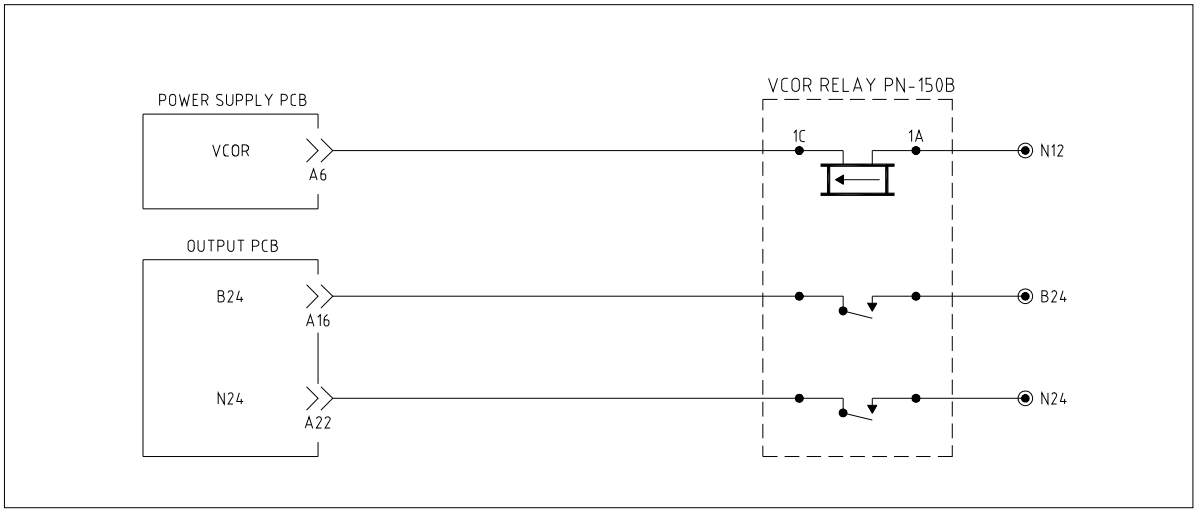
3.8. VITAL CUT-OFF RELAY

The vital cut-off relay (VCOR) is used by the Microlok II system to control the power of all vital outputs. This relay is energized by the conditional output from the power supply board in the system card file. This relay consists of silver-to-silver impregnated graphite front and silver-to-silver back contacts. It is mounted above the card file in the Microlok II rack.

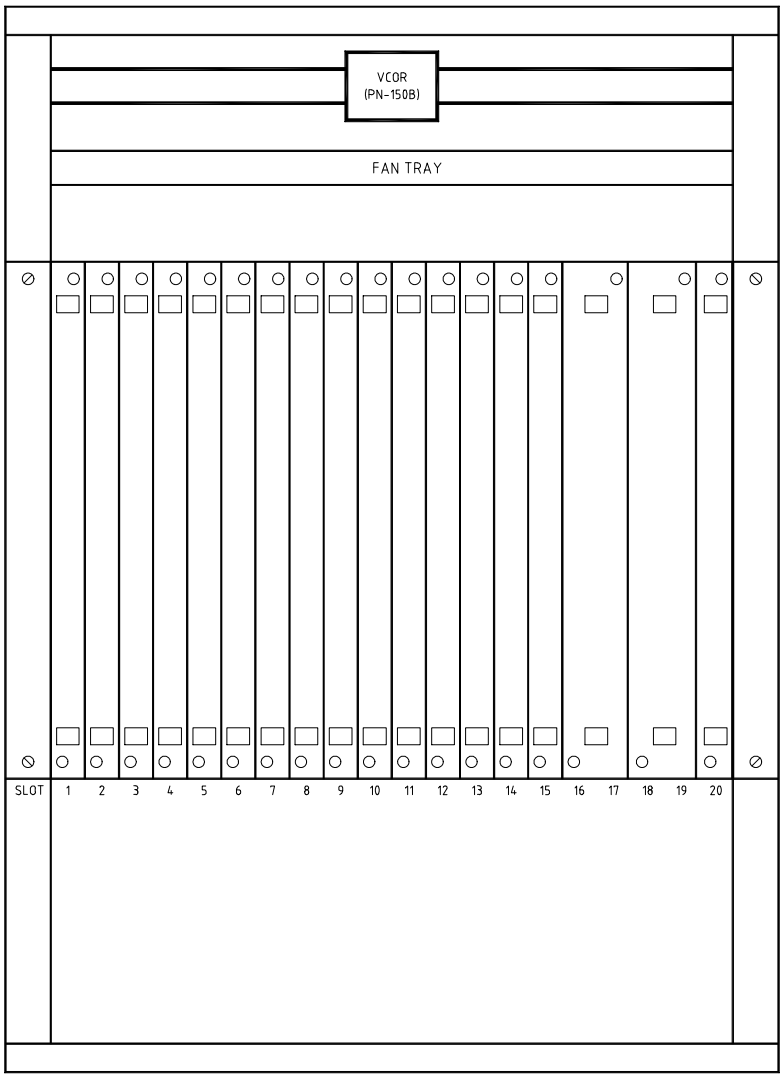
If the CPU board detects an error, it stops the 250Hz. signal, which removes the conditional power supply to the VCOR relay and thereby VCOR drops. Thus the power to all vital output boards is removed, when there is an error in the system and safety is ensured.

VCOR is provided for the card file, which caters to vital I/O boards and the same is not required if the card file caters to Non-vital I/O boards.

TYPICAL VCOR RELAY CIRCUIT



VCOR IN MICROLOK II RACK



Specification

VCOR

Type	Contacts	Coil Resist. (Ohms)	Pickup Amps	Pickup DC Volts	System Voltage
ASTS PN-150B N322500-701	6FB	400	0.0132	5.3	10

3.9. TERMINALS

Phoenix make terminals are used in Microlok II wiring.

- One in Two out type terminals are used for connection between Non-vital I/O board to panel and vital input board to relay rack and serial communication circuits.
- Diode type terminals are used for vital output board to relay coils.
- Two in Two out type terminals are used for connection between relay racks to Cable Termination rack.
- One in One out type terminals are used for relay coil to supply negative & power distribution.
- Link and fuse terminals are used for power circuits.

Specification

Type	Make	Nominal Current	Nominal Voltage	Conductor Size In Sq mm	Terminal width	Order No
UK5N	Phoenix	30A	600V	6	6.2	3004362
UK5-TWIN	Phoenix	35A	300V	4	6.2	1923021
UK10-TWIN	Phoenix	65A	300V	16	10.2	3005196
UKK5	Phoenix	20A	600V	4	6.2	2774017
UKK5-DIO/UL-UR	Phoenix	32A	500V	4	6.2	2591029
URTK/S	Phoenix	50A	300V	10	8.2	0311087
UK5-HESILED24	Phoenix	6.3A	15-30V	4	8.2	3004126
UK5-HESILA250	Phoenix	6.3A	110-250V	4	8.2	3004142

3.10. SURGE SUPPRESSOR

230V AC to Operator PC and Maintenance PC are connected through Surge suppressor to protect the equipment from lightning damages.

Specification

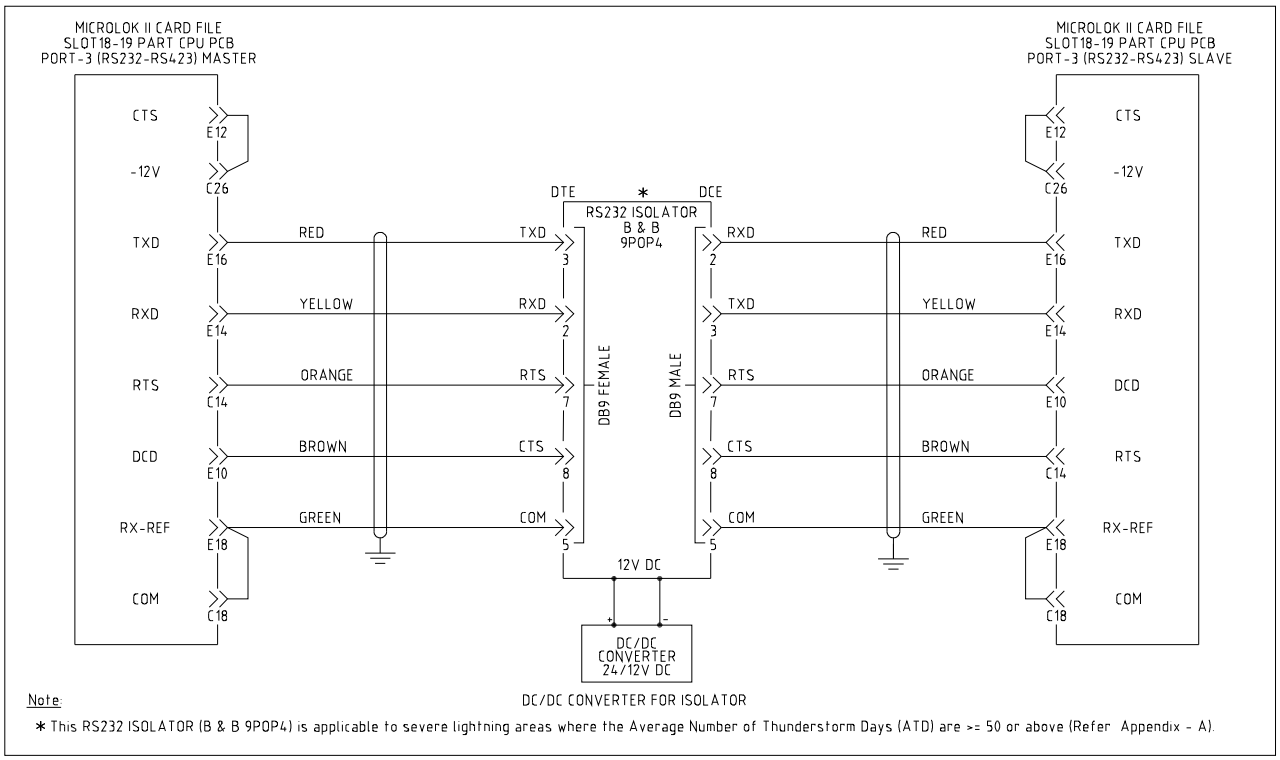
Type	Make	OBO Part No	Voltage Range	Current Rating
OBO-VF Surge suppressor	OBO-Bettermann	5097649	230V AC	Up to 16A

4. SERIAL COMMUNICATION CIRCUITS

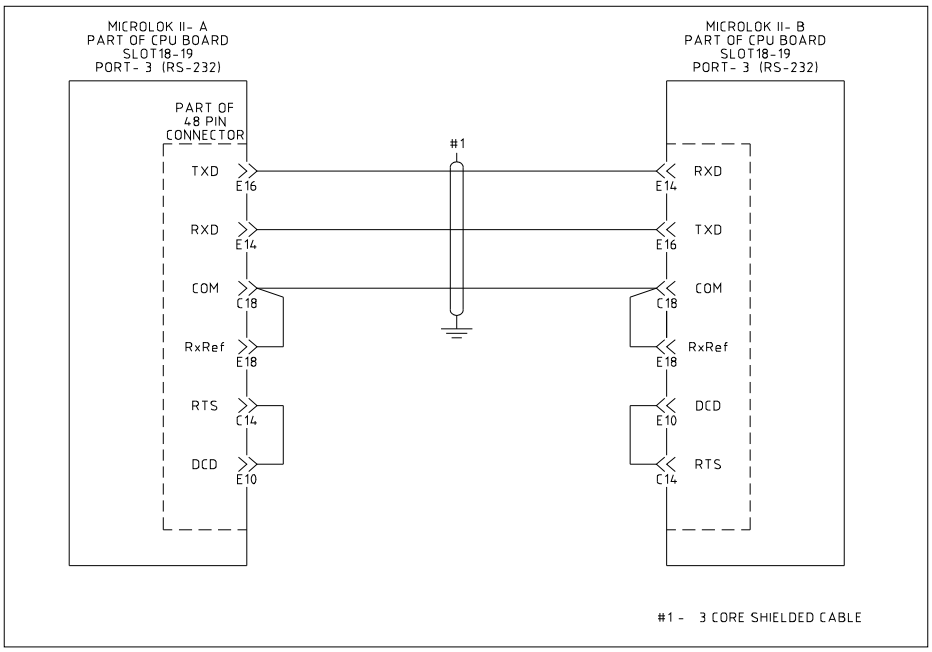
The MICROLOK II controller board has five serial ports.

- Ports 1 and 2 support an RS-485 standard hardware interface.
- Port 3 supports an RS-423 standard, which is compatible to RS 232 standard interface.
- Port 4 & 5 supports an RS-232 standard interface.

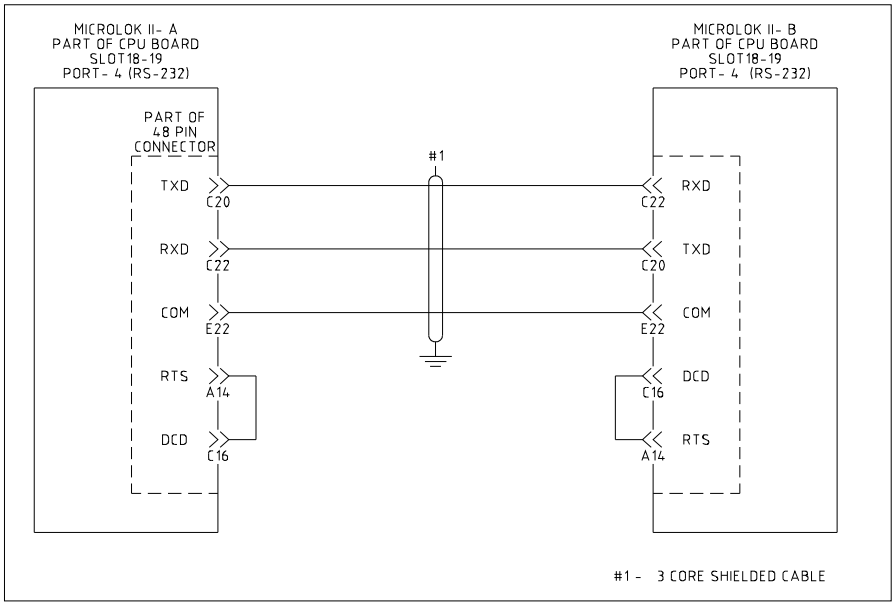
4.1. MICROLOK II PORT 3 MASTER TO PORT 3 SLAVE CIRCUIT (Microlok Protocol)



4.2. MICROLOK II PORT 3 TO PORT 3 DIRECT SERIAL CIRCUIT (Peer Protocol)



4.3. MICROLOK II PORT 4 TO PORT 4 DIRECT SERIAL CIRCUIT (Peer Protocol)



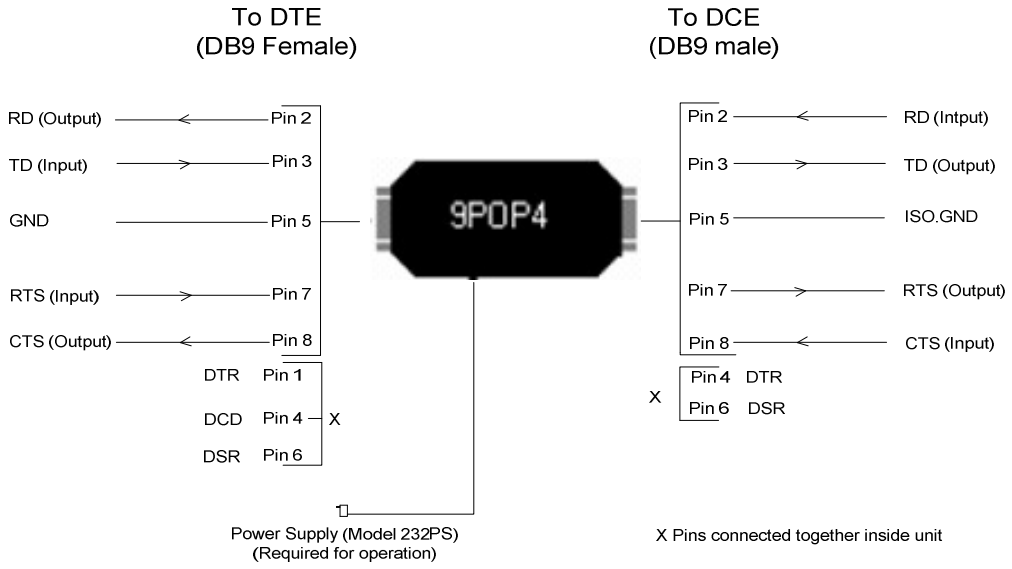
4.4. ISOLATOR AND CONVERTER

Whenever, Microlok II equipment is connected to a computer or external modem, which is powered from a different power supply through serial ports, the Microlok II serial ports have to be isolated from the computer/modem serial ports. In Microlok II equipment, the serial port common is connected with the N12 of the power supply card. In computers and modems, the serial port common is connected to their "Earth" terminal and this might induce noise/surges into the Microlok II power supply N12 through serial ports. By inserting a serial isolator, this noise/surge from the computer and modem serial ports are prevented from entering into Microlok II system.

4.5. RS232 OPTICAL ISOLATOR

❖ B&B 9POP4 (RS232 2KV Optical Isolator)

The Model 9POP4 isolates and protects RS-232 equipment from lightning surges, accidental high voltage shorts, and ground loops. RS-232 data signals TD, RD, RTS and CTS are supported at up to 115.2 kbps. The 9POP4 provides 2500 Volts RMS of isolation between sides. The two sides of the isolator are powered from a single +12V DC power supply and maintain isolation. This powering configuration allows the device to be run in any system with only a single supply, regardless of the power levels on the RS-232 ports. Connections to the DTE device are made through a DB9 female connector. Connections to the DCE device are made through a DB9 male connector. The 9POP4 isolators are used between computers and Microlok II equipment, where the distance between them is less than 15 meters.

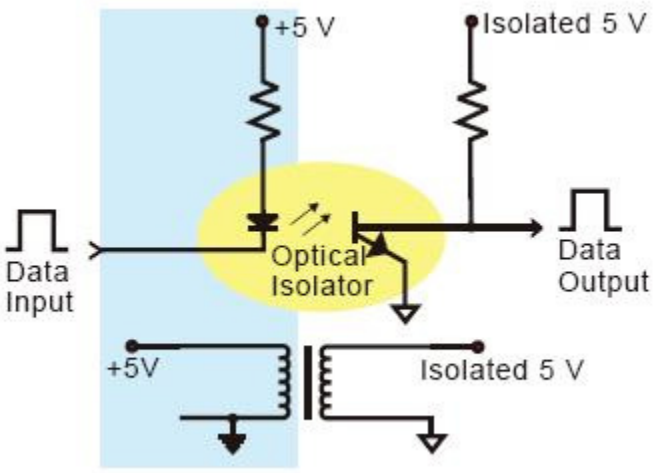


Specification

Type	Make	Nominal Voltage	Current rating	Interface	Data Rates
9POP4	B&B	12V DC	100 mA	RS-232	0-115.2 kbps

❖ MOXA TCC – 82 (RS232 4KV Optical Isolator) 

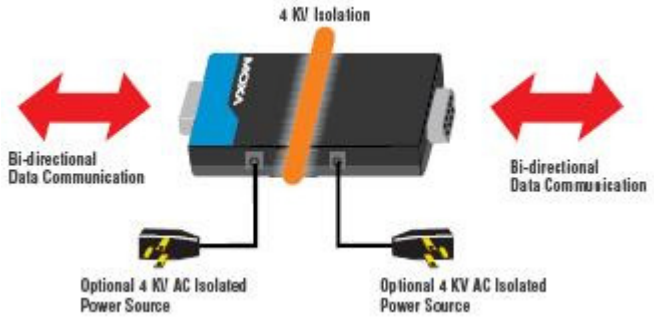
The TCC-82 provides full electrical isolation for bi-directional serial communication between two RS-232 devices in a compact, industrial grade package. Both sides of an RS-232 connection are isolated optically to provide perfect protection against lightning surges, accidental high voltage shorts, and ground loops. The built-in, wide range isolators are tested to ensure that they can withstand more than 4 KV rms input to output for 1 minute. This means that the TCC-82 not only meets the requirements of general serial data communications, but also the high standards required by industrial automation and medical applications. The TCC-82 protects the TxD and RxD data lines, and also protects the RTS and CTS handshake lines for a total of 4 isolated channels to provide complete protection of your RS-232 applications.



External Power Source Not Required

The TCC-82 supports port-powered operation, which means that it can obtain power directly from the attached serial devices. Power is obtained from the RS-232 TxD, RTS, or DTR lines, regardless of whether the signal is high or

low, eliminating the need for an external power supply. However, external power can be used if handshake lines are not available, if the serial cable is too long, or if the serial device is a low powered device. For external power, the TCC-82 can use a 5 to 12 VDC adaptor or a USB power cord. Note that both sides of the connection are powered independently, so if necessary, one side can rely on port power and the other on an external power source. When installing the TCC-82, we recommend that you connect all output signals. The TCC-82 obtains power from these signals even if they are not used by your system. Care should be taken when choosing the external power supply if your application requires the full 4 KV of isolation. Most commercial power supplies provide only 1500 VAC isolation between the primary and secondary windings. If you are using external power for both sides of the TCC-82, make sure that separate power sources are used, each with sufficient isolation protection.



4.5.1. RS422/RS485 OPTICAL ISOLATOR

- B&B OPDR (RS422/RS485 2KV Optical Isolator)

The 485OPDR provides 2-way optical isolation between one piece of RS-422/485 equipment and the remainder of the network. As a repeater, it extends the distance of an existing network and expands it beyond the 32-node limitation. All inputs connect to a terminal block. Data lines, power, and ground are isolated from one side of the repeater to the other. The device supports Transmit Data (A) and (B), Receive Data (A) and (B), Signal Ground, and Protective Ground. The 485OPDR operates in two-wire half-duplex, four-wire half-duplex, or four-wire full-duplex systems. Additionally, it will convert four-wire to two-wire. An external 10 to 30 VDC power supply is required

Specification

Description	Type	Make	Voltage Range	Current rating	Data Rates	Nominal Voltage	Switch settings for 9600 baud and RS422 standard selection
RS422/485 Isolator	485OPDR	B & B	10-30V DC	100 mA	1200-115.2kbps	12V DC	3 – ON 1,2,4,5,6,7,8-OFF

4.5.2. CONVERTER CUM ISOLATOR (RS-232 TO RS-422/485 CONVERTER)

- B&B 485LDRC (Converter cum Isolator)

The RS232<->485 converter is provided to support a long distance (upto 1000 meters.) between the operator VDU computer and the Microlok II equipment. It also provides isolation between PC & Microlok II and protects RS-232 equipment from lightning surges. This converter is used only in stations where the operator VDU is kept at a distance of more than 15 meters from the Microlok II. The 485DRC/485LDRC has screw down terminal blocks on the RS-232 side and the RS-422/RS-485 side. Transmit (TD), Receive (RD) and Ground are supported on the RS-232 side. The unit is powered by a supply voltage of 10 to 30V DC on the RS-232 side. Transmit Data A (-), Transmit Data B (+), Receive Data A (-), Receive Data B (+), and Ground are supported on the RS-422/RS-485 side. Communication features on the 485LDRC are dipswitch selectable on the unit. If installed, two such converters are connected (one at operator VDU computer room and another at Signal Equipment Room) between Microlok II and VDU computer as both the serial ports will be RS232 standard.

Specification

Description	Type	Make	Voltage Range	Current rating	Data Rates	Nominal Voltage	Switch settings for 9600 baud and RS422 standard selection
Converter Cum Isolator RS 232 – RS 485	485LDRC	B & B	10-30V DC	100 mA	1200-115.2kbps	12V DC	6 – ON 1,2,3,4,5,7,8-OFF

- B&B 422CFCR (RS232 to RS 422 Converter)

The RS-232 to RS-422 Converter converts unbalanced RS-232 signals to balanced RS-422 signals. The RS-422 Standard uses a balanced voltage digital interface to allow communications of 90k bits per second on cable lengths of 4000 feet. Ten receivers can be connected to any one driver for use in multi-drop systems

Laser Product Warning (Applicable for fiber equipments)
Invisible laser radiation when this component is opened and the preregulation is disabled. Don't look in to the ends of any optical fiber or bulkhead connector.

4.6. OPTIC FIBER MODEM (OSD 136L SYNC/ASYNC RS232 MODEM)

The OSD is a small, self contained modem which can provide full duplex synchronous or asynchronous RS232 communication over duplex fiber cable. Clock, data signals and handshake lines are all operating at a rate of up to 20kbps. Fiber Optic Modem for multimode fiber is OSD136L and it is also optionally available to operate over single mode fiber. This model is designated the OSD136L. RS232 ports will be connected to 25pin Male connector and fiber cable will utilize ST fiber connector to connect fiber cable. These units should be powered by Microlok-II 12V DC supply.

The OSD136 modem has a red LED indicator. The indicator is the link fail indicator and it is illuminated when there is a failure between the links of two OSD136 modems. The LED indicator is found on the OSD modem between optical connectors.

Specification

Type	Make	Nominal Voltage	Current rating	Data Supported	Data Rates
OSD136L	Optical Systems Design	13V DC	150 mA	RS-232	20kbps

Optical Transmit Power	Optical Link Budget	Optical Wavelength	Electrical Connector	Operating Temperature
>-23dBm into Single mode fiber	>17dB at 1310nm (>25km of Single mode fiber)	1310nm	25 pin male D-Subminiature	-20 to +75°C

4.7. OPTIC FIBER MODEM (OSD 1250L MODEM)

The OSD1250 is a small, self-contained optical modem designed to interconnect Bus Master/Slave Data Terminal Equipment either in bus or ring topologies using dedicated optical fibers. Data link networks of hundreds of kilometers can be achieved when using single mode fiber, with a maximum spacing between optical modems of 30km.

The OSD1250 has data interfaces for RS232, RS422, RS485 (2wire), and RS485 (4 wire). Anti-streaming logic, which is set to 300ms detection time, prevents a faulty data transmission from hogging the network. The anti-streaming logic can be turned off for RS232 and RS422 thus allowing very low data rate or DC level to be transmitted.

Specification

Optical Wavelength	Electrical Connector	Operating Temperature
1300nm (850nm and 1550nm are optional)	HDB26	-20°C to +75C

Type	Make	Nominal Voltage	Current rating	Data Supported	Data Rates
OSD1250	Optical Systems Design	9 to 30 V DC	6V A	RS-232, RS422,RS485 2 Wire, RS485 4 Wire	DC to 2Mbps

4.8. SERIAL TO ETHERNET CONVERTER

The Serial-to-Ethernet Converter (SEC) provides Ethernet network connectivity to Microlok II units. The SEC converts the Microlok II Peer messages from the Microlok II serial ports to Ethernet data which is then available to other devices across an Ethernet network. The SEC thus enables the routing of Microlok II Peer messages using the TCP and UDP network protocols. Conversely, the SEC converts Ethernet signals to serial data for use by a Microlok II unit. Microlok II serial data placed on the network is also available for central office applications enabling Microlok II units to communicate with central office applications that support the Peer protocol. The SEC can route Peer messages to any destination that implements the Peer protocol. The SEC supports the option of attaching the Hash-keyed Message Authentication Code (HMAC) to peer protocol messages.

The SEC functionally consists of the following:

- A serial protocol communication channel which translates between Microlok II RS-232 signals and Ethernet to allow Microlok II units to communicate with outside networks using Peer protocol.
- Power source circuitry which conditions a nominal 12-volt battery source to provide isolated power.
- An internal web server/interface that provides screens for configuring the SEC unit.

The SEC provides translation for one serial communications channel between RS-232 and Ethernet. The RS-232 port connection is a DB-9 female connector mounted on the front panel. This port supports both RX and TX signals. The SEC Ethernet Connection uses an RJ45 connector. These two communication ports (Serial Connection and Ethernet Connection) are isolated from each other, from the system chassis, and from the system battery. The SEC is connected to a Microlok II RS-232 Comm port using a customer-supplied standard DB-9 connector which is connected to the Serial Connection port on the front panel of the SEC.

SEC to Microlok II Connections

SEC (DB-9)		Microlok II Connection
Pin No.	Signal	For Port 3, Jumper Pin C14, RTS (Output), to Pin E10, DCD (Input), and Jumper Pin E18, RXREF, to C18, Signal Common. For Port 4, Jumper Pin A14, RTS (Output), to Pin C16, DCD (Input).
2	RXD (Input)	
3	TXD (Output)	
5	Signal Common	

Specification

Type	Make	Part No	System Power Source Voltage	Operating Temperature
SEC	ASTS	N16920401	+9.8 to +16.2VDC	-40° C to +70°C

4.9. RS SERIAL SERVERS/SWITCHES

❖ Rugged Server 400

The RS400 is an industrially hardened, serial device server with an integrated, fully managed, Ethernet switch, designed to operate reliably in electrically harsh and climatically demanding environments. Featuring an

integrated 4 port serial server, a 4 port managed Ethernet switch, and an optional v.90 modem, the RS400 is able to interconnect multiple types of intelligent electronic devices (IEDs) that have different methods of communications. The RS400 also features a wide operating temperature range of -40°C to + 85°C allowing it to be installed in virtually any location. The RS400 also includes an industrially rated integrated power supply that can support a wide range of power supply options suitable for multiple industries and for worldwide operability. Options include 24VDC, 48VDC, and 88VDC - 300VDC/85VAC - 264VAC, allowing for great installation flexibility.

Specification

Type	Make	Power Consumption	Data Supported	Operating Temperature
RS400	Rugged Com	8 Watts	EIA/TIA RS485, RS422, RS232 serial ports (software selectable) - DB9, RJ45, Phoenix style connectors	-40°C to + 85°C

- Rugged Server 416

The RS416 is an industrially hardened serial device server with an integrated, fully managed, Ethernet switch, designed to operate reliably in electrically harsh and climatically demanding environments. Featuring a modular design that can support up to 16 serial ports and up to 4 Ethernet ports, the RS416 is able to interconnect multiple types of intelligent electronic devices (IEDs) that have different methods of communications. The RS416 also features a wide operating temperature range of -40°C to + 85°C allowing it to be installed in virtually any location. The embedded Rugged Operating System (ROS™) within the RS416 provides advanced layer 2 and layer 3 networking functions, advanced cyber security features, and a full array of intelligent functionality for high network availability and manageability. Coupled with the ruggedized hardware design, the RS416 is ideal for creating mission-critical, real-time, control applications in any harsh environment. Options include 24VDC, 36VDC, (9-36VDC) 48VDC, and 88VDC - 300VDC/85VAC - 264VAC, allowing for great installation flexibility.

Specification

Type	Make	Power Consumption	Data Supported	Operating Temperature
RS416	Rugged Com	15 Watts	EIA RS422 / TIA RS485, RS422, RS232 serial ports (software selectable) - DB9 or RJ45 connectors	-40°C to + 85°C

- Rugged Server 900

The RS900 is a 9-port industrially hardened, fully managed, Ethernet switch specifically designed to operate reliably in electrically harsh and climatically demanding environments. The RS900 provides a high level of immunity to electromagnetic interference and heavy electrical surges typical of environments found on plant floors or in curb side traffic control cabinets. An operating temperature range of -40 to + 85°C coupled with hazardous location certification (Class 1 Division 2) allows the RS900 to be placed in almost any location. The RS900 is packaged in a compact, galvanized steel enclosure that allows either DIN or panel mounting for efficient use of cabinet space. The RS900 provides an integrated power supply with a wide range of voltages (88-300VDC or 85-264VAC) for worldwide operability or dual-redundant, reversible polarity, 24VDC and 48VDC power supply inputs for high availability applications requiring dual or backup power inputs. The RS900 provides up to three 100Mbps fiber optical Ethernet ports for creating a fiber optical backbone with high noise immunity and long haul connectivity.

Specification

Type	Make	Power Consumption	Operating Temperature
RS900	Rugged Com	10 Watts	-40 to + 85°C

- RuggedMC 30

The RMC30 is an industrially hardened, 2-port Serial-to-Ethernet server that has been specifically designed to operate in electrically harsh and climatically demanding environments. The RMC30 allows you to communicate with virtually any serial device via Ethernet providing simple and reliable network

connectivity. The RMC30 is packaged in a compact, galvanized steel enclosure that allows either DIN or panel mounting for efficient use of cabinet space. It has an integrated power supply with a wide range of voltages for worldwide operability. An operating temperature range of -40 to + 85°C without the use of internal cooling fans allows it to be placed in almost any location. The RMC30 is compliant with EMI and environmental standards for utility substations, industrial manufacturing, process and control and intelligent transportation systems applications. The RMC30 offers both an RS232 port and a RS485/422 port simultaneously via a solid screw down terminal block. The 10Base-T Ethernet port supports both auto-negotiation and auto-crossover detection and simplifies cabling. Options include 24VDC, (18-36VDC) 48VDC, (36-59VDC) and 88VDC - 300VDC/85VAC - 264VAC, allowing for great installation flexibility.

Specification

Type	Make	Power Consumption	Data Supported	Operating Temperature
RMC30	Rugged Com	2 Watts	EIA/TIA RS485 and RS232 ports	-40 to + 85°C

- RuggedMC 40

The RMC40 is a 4-port unmanaged Ethernet switch that provides both copper-to-fiber media conversion as well as 10Mbps to 100Mbps speed conversion. Specifically designed to operate reliably in electrically and climatically harsh environments it is well suited for use in mission critical Ethernet networking applications. The RMC40 is packaged in a compact, galvanized steel enclosure that allows either DIN or panel mounting for efficient use of cabinet space. It has an integrated power supply with a wide range of voltages for worldwide operability. An operating temperature range of -40 to + 85°C without the use of internal cooling fans allows it to be placed in almost any location. It is compliant with EMI and environmental standards for utility substations, industrial plants, and intelligent transportation systems. The versatility and wide selection of fiber optics allows the RMC40 to be used in a variety of applications. Options include 24VDC, (18-36VDC) 48VDC, (36-59VDC) and 88VDC - 300VDC/85VAC - 265VAC, allowing for great installation flexibility.

Specification

Type	Make	Power Consumption	Operating Temperature
RMC40	Rugged Com	5 Watts	-40 to + 85°C

Note:

The type of OSD/SEC/RS equipments or equivalent devices and its part number shall be chosen depending on the System Configuration of the station/section/yard.

4.10. MOXA TERMINAL SERVERS (Serial / Ethernet)

- MOXA IA5000AI Series (1, 2 and 4 port Terminal Servers)

Compared to other NPort IA device servers, the NPort IA5000A series device servers have a more rugged design with respect to housing, connectors, mounting methods, and surge protection. The NPort IA5000A series is not only hardware upgrade, but in addition, the device server's software tools are more versatile and user-friendly

The NPort IA5000A device servers deliver easy and reliable serial-to-Ethernet connectivity for the industrial automation market. The servers support several operation modes—TCP Server, TCP Client, UDP, Real COM, RFC2217, Reverse Telnet, Pair Connection, and Ethernet Modem—ensuring the compatibility of network software, and are an ideal choice for connecting RS-232/422/485 serial devices, such as operator displays. The NPort IA5000A device servers come with a compact casing and a DIN-Rail mounting kit

Cascading Ethernet Ports Make Wiring Easy
The NPort IA5000 series device servers each have two Ethernet ports that can be used as Ethernet switch ports. One port connects directly to the network or server, and the other port can be connected to another NPort IA device server or another Ethernet device. The dual Ethernet ports help reduce wiring costs by eliminating the need to connect each device to a separate Ethernet switch.

Relay Output Warning and E-mail Alerts
The built-in relay output can be used to alert administrators of problems with the Ethernet links or power inputs, or when there is a change in the DCD or

DSR serial signals. The web console indicates which Ethernet link or power input has failed, or which serial signal has changed. An e-mail warning can also be issued when an exception is detected. These functions are valuable tools that enable maintenance engineers to react promptly to emergency situations.

Type	Make	Power Consumption	Data Supported	Operating Temperature
NPort IA5000AI Series	MOXA	500mA	RS-232/422/485 and Ethernet data	-40 to + 75°C

❖ MOXA NPort 5600 Series (8/16 port RS-232/422/485 serial device servers)

NPort5600 Series device servers can conveniently and transparently connect 8 serial devices to an Ethernet, allowing you to network your existing serial devices with only basic configuration. You can both centralize management of your serial devices and distribute management hosts over the network. Since the NPort® 5600 Series device servers have a smaller form factor compared to our 19" models, they are a great choice for applications that need additional serial ports, but for which mounting rails are not available.

Type	Make	Power Consumption	Data Supported	Operating Temperature
NPort 5600 Series	MOXA	6 Watts	RS-232/422/485 and Ethernet data	-40 to + 75°C

❖ MOXA NPort S8000 Series (Ethernet/serial device server)

The NPort® S8000 series combines an industrial device server with a full-function managed Ethernet switch by integrating 2 fiber ports, 3 Ethernet ports, and 4 RS-232/422/485 serial ports, allowing you to easily install, manage, and maintain the product. Combining a device server and switch in one product allows you to save space in your cabinet, reduce overall power consumption, and reduce costs, since you will not need to purchase a switch and serial device server separately. The NPort® S8000 series has a built-in full-function managed Ethernet switch that supports QoS, IGMP-snooping/GMRP, VLAN, Port Trunking, SNMPv1/v2c/v3, and IEEE 802.1X, allowing you to handle virtually any kind of application. Ethernet

redundancy, which is used to increase the reliability and availability of your industrial Ethernet network. (Recovery time < 20 ms) or RSTP/STP (IEEE 802.1w/D).The NPort S8000 series integrates a full function NPort device server with an industrial switch to carry serial and Ethernet devices at the same time. In addition, the NPort S8000 can also achieve ring redundancy with standard STP/RSTP and Moxa's proprietary Turbo Ring or Turbo Ring 2 redundancy protocols. This all-in-one design can be used to optimize and simplify your device network, and enhance reliability.

Type	Make	Power Consumption	Data Supported	Operating Temperature
NPort 8000 Series	MOXA	12 Watts	RS-232/422/485 and Ethernet data	-40 to + 75°C

❖ MOXA CN2600 Series 

The CN2600 has two separate LAN ports that can be connected to separate LAN networks. Dual-LAN redundancy involves setting up two separate physical networks to connect the PC host with the CN2600. In this case, the PC host must also be installed with two LAN cards. If one of the networks fails, the PC host will still be able to communicate with your serial devices over the redundant LAN. Redundancy is an important issue for industry, and several different solutions have been developed to prevent damage caused by equipment or software failures. “Watchdog” hardware is required to utilize redundant hardware, and a “Token” switching mechanism is required for software. The CN2600 terminal server uses its built-in dual-LAN ports to implement a “redundant COM” mode that keep your applications running smoothly.

Type	Make	Power Consumption	Data Supported	Operating Temperature
CN2600 Series	MOXA	24 VA	RS-232/422/485 and Ethernet data	-40 to + 75°C

4.11. MOXA V2400 Series (Embedded Computer for LCP)

The V2406 Series embedded computers are based on the Intel Atom N270 x86 processor, and feature 4 RS-232/422/485 serial ports, dual LAN ports, and 3 USB 2.0 hosts. In addition, the V2406 computers provide VGA and DVI-I outputs , and are EN 50155 certified, making them particularly well-suited for railway and industrial applications.

The dual 10/100 Mbps Ethernet ports with M12 connectors offer a reliable solution for network redundancy, promising continuous operation for data communication and management. As an added convenience, the V2406 computers have 6 DIs and 2 DOs for connecting digital input/output devices, and the Compact Flash feature provides the reliability needed for industrial applications that require data buffering and storage expansion.

Pre-installed with Linux or Windows Embedded Standard 2009, the V2406 Series provides programmers with a friendly environment for developing sophisticated, bug-free application software at a low cost. Wide temperature models of the V2406 Series that operate reliably in a -40 to 70°C operating temperature range are also available, offering an optimal solution for applications subjected to harsh environments.

4.12. FIBER OPTICAL CABLE

An optical communication system consists of a transmitter, which encodes a message in to an optical signal, a channel, which carries the signal to its destination and a receiver, which reproduces the message from the received optical signal. Optical fiber are widely used in fiber optic communication, which permits transmission over longer distances and at higher data rates than other forms of wired and wireless communication. Fibers are used instead of metal wires because signals propagate along them with less loss, and they are immune to electromagnetic interference.

Installation Warning
Failure to obtain approved training and to act in accordance with the procedures and warning outlined in this manual, may result in serious personal injury and/or property damage.

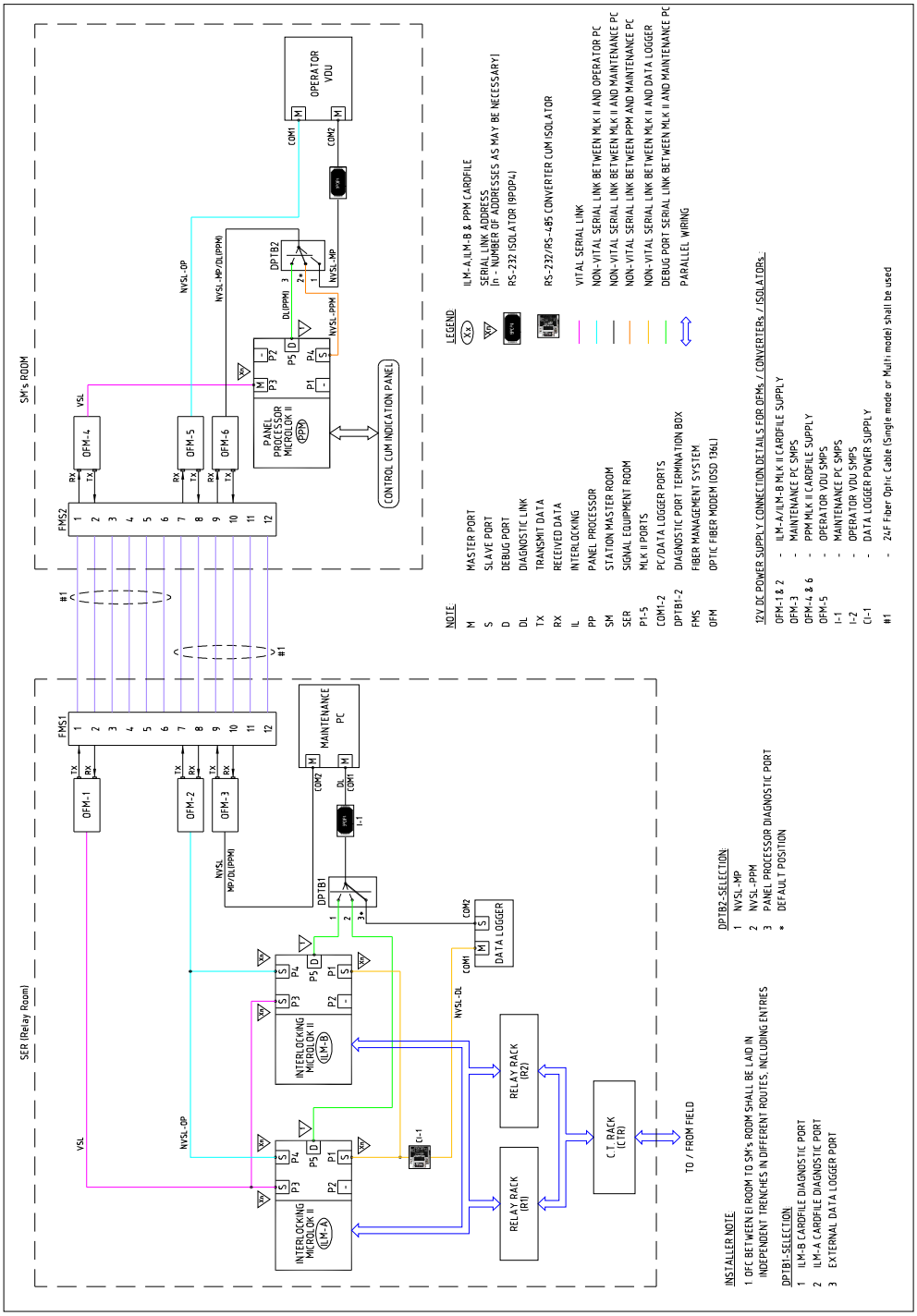
5. MICROLOK II SYSTEM

The Panel processor Microlok-II placed in the Panel room or Signal Equipment Room (Relay Room) shall consists of one Microlok-II unit with one set of Non-Vital boards, CPU & Power supply board. The Panel processor will handle the Panel inputs & outputs and will be connected to both "A" Interlocking Microlok-II and "B" Interlocking Microlok-II respectively. In order to increase the system availability, Panel Processor Microlok II unit will be duplicated where the operator PC is not provided as standby.

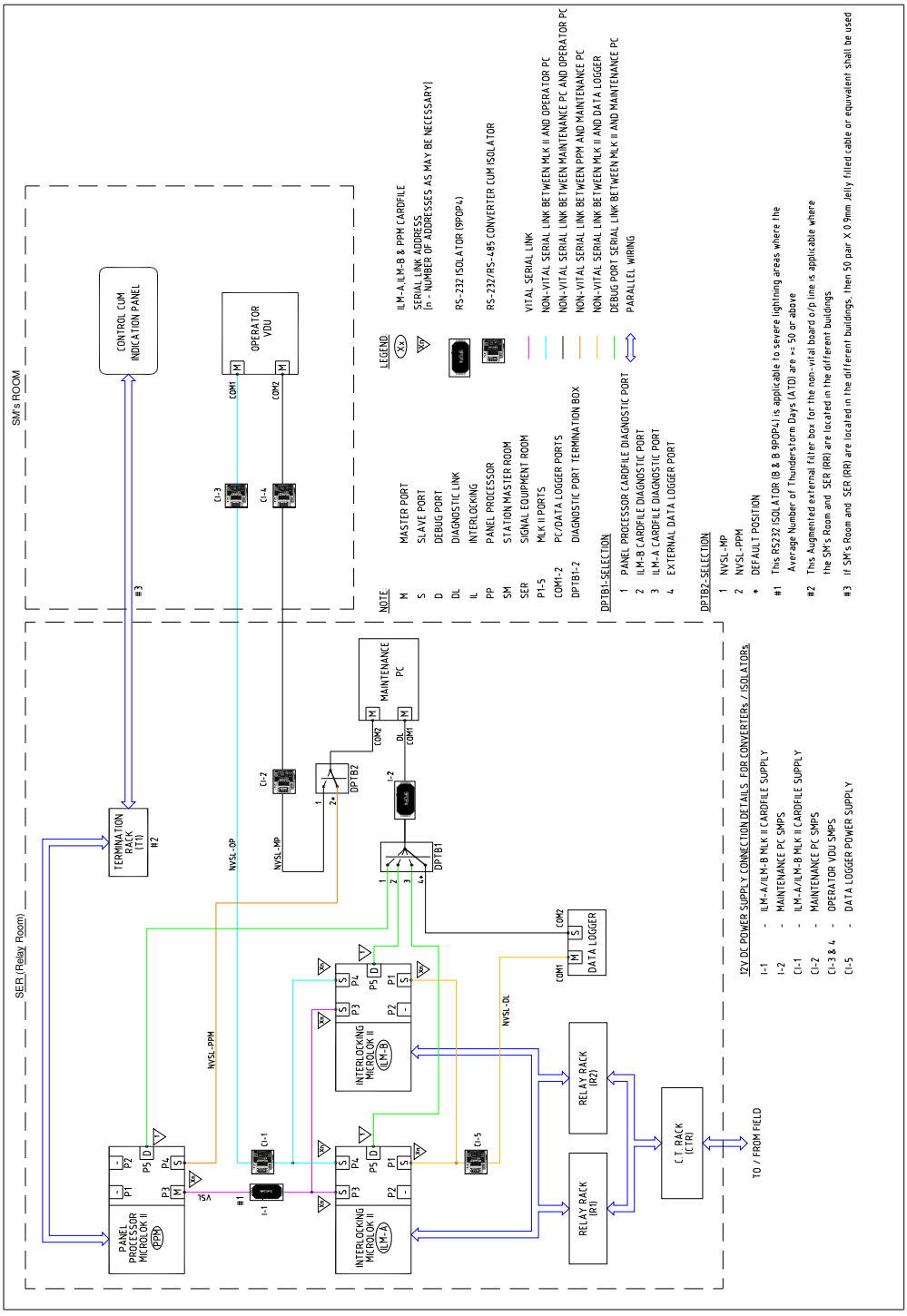
Also, the Vital Interlocking Microlok II units having vital I/O boards will be duplicated to increase the availability and mean time between failures. The Vital Interlocking Microlok II systems will deliver outputs to the interface relays via 24V DC vital output boards for control of field equipment and, receive field status inputs (direct from field and/or through interface relays) via 24V DC vital input boards.

The Microlok II systems can be configured depending on the station interlocking requirements. The various typical system configurations are depicted in the following pages.

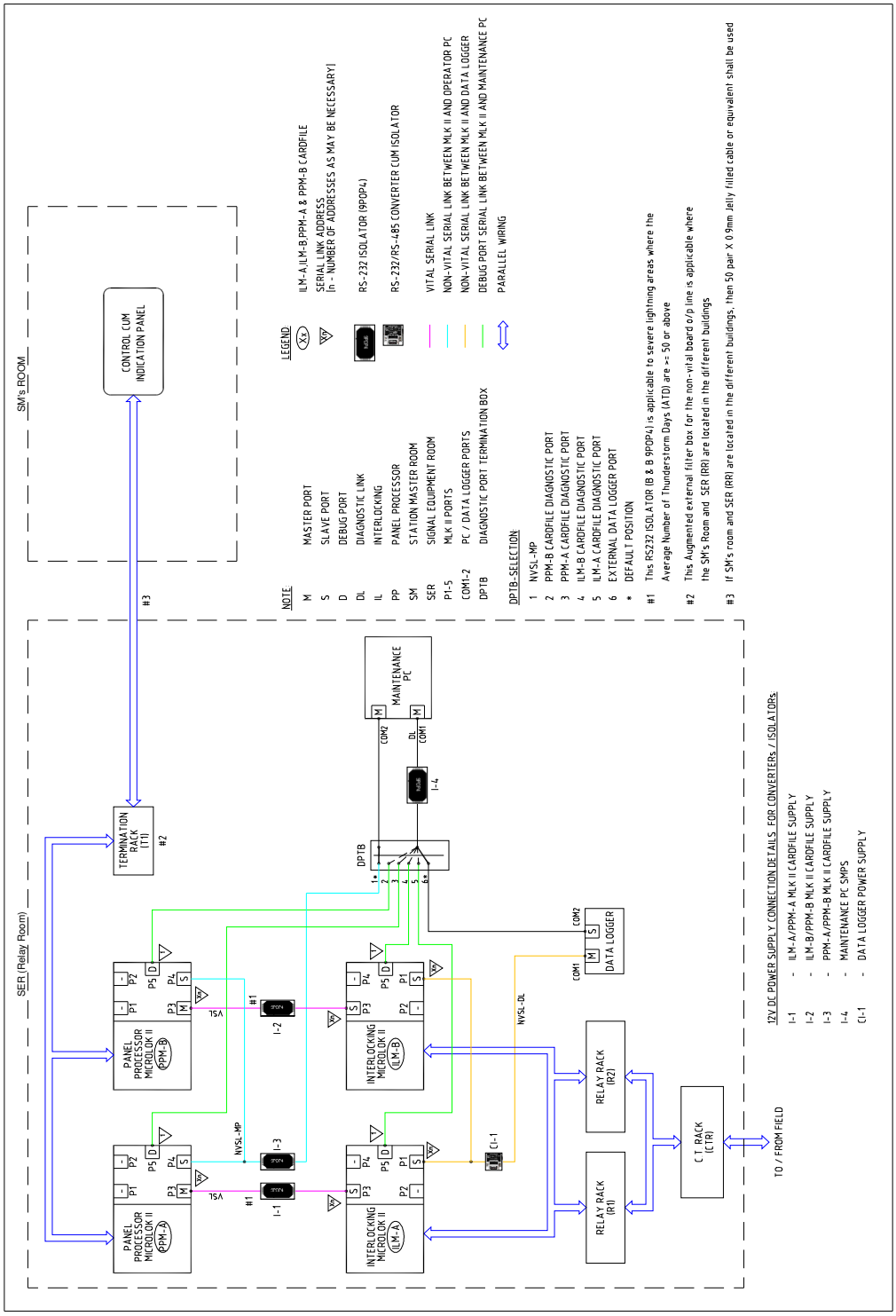
5.1. TYPICAL SYSTEM CONFIGURATION (Single Panel Processor Microlok II at SM's Room with Operator PC)



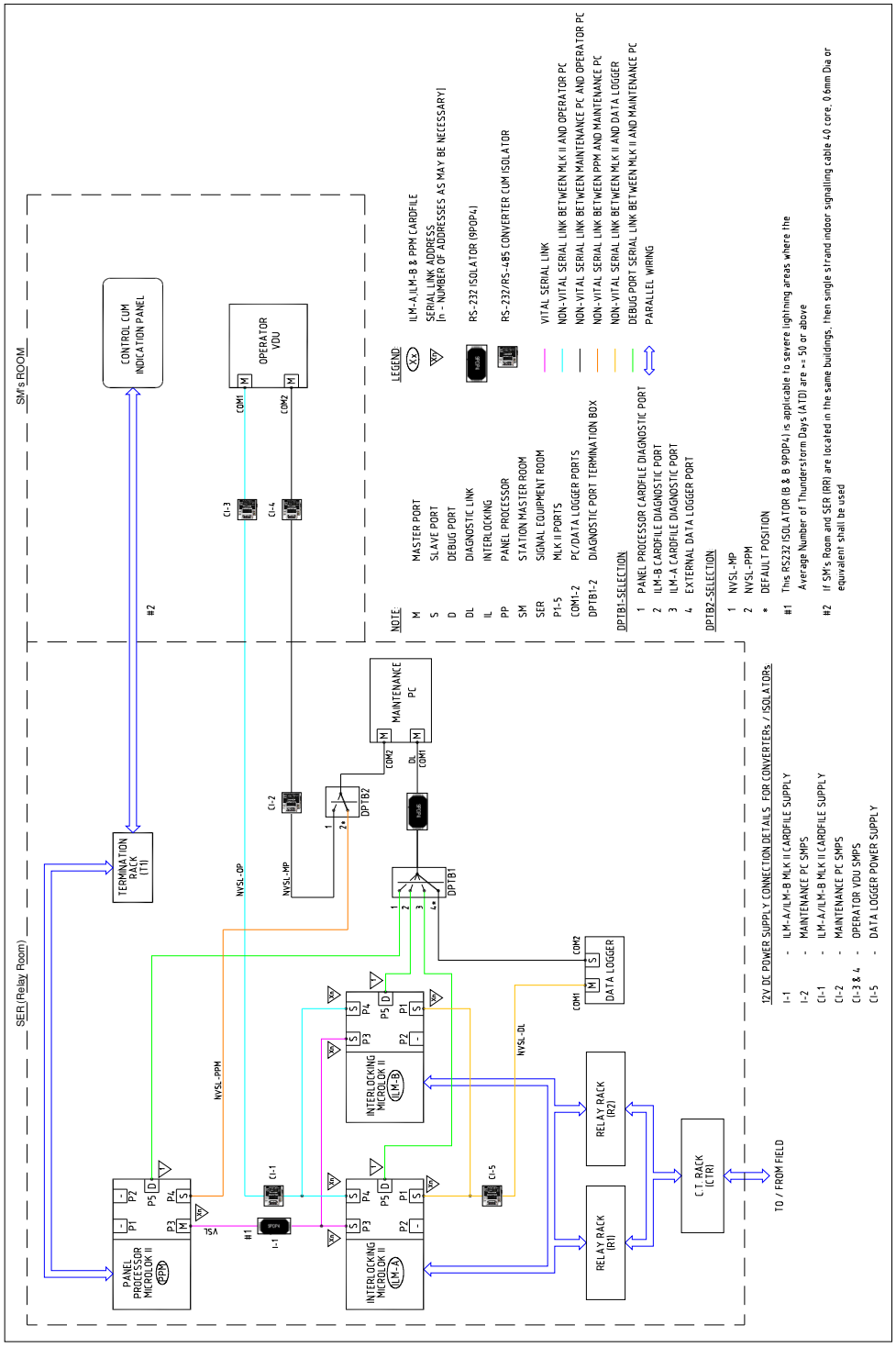
5.2. TYPICAL SYSTEM CONFIGURATION (Single Panel Processor Microlok II at SER with Operator PC in the different building)



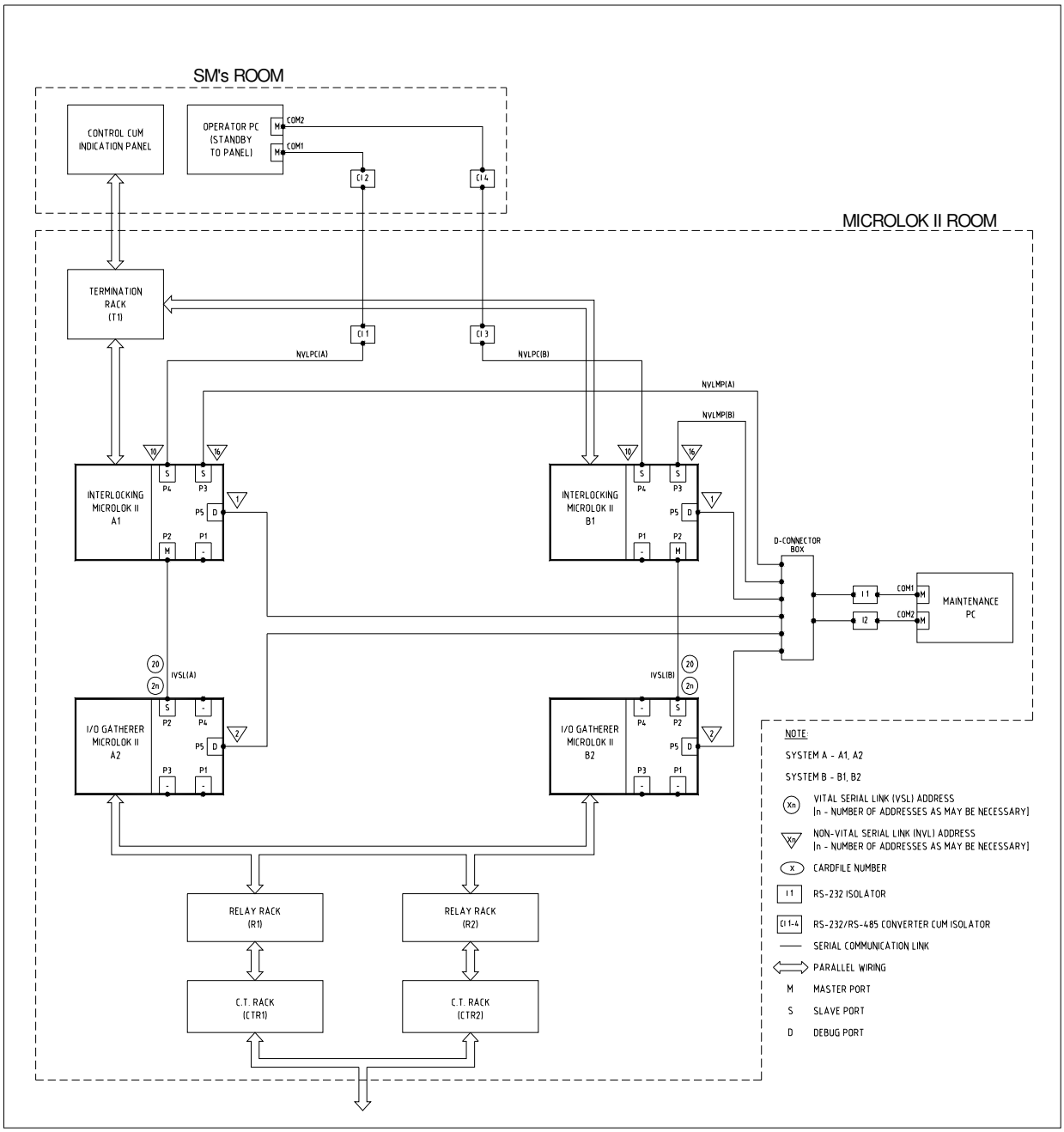
5.3. TYPICAL SYSTEM CONFIGURATION (Duplicated Panel Processor Microlok II at SER without Operator PC)



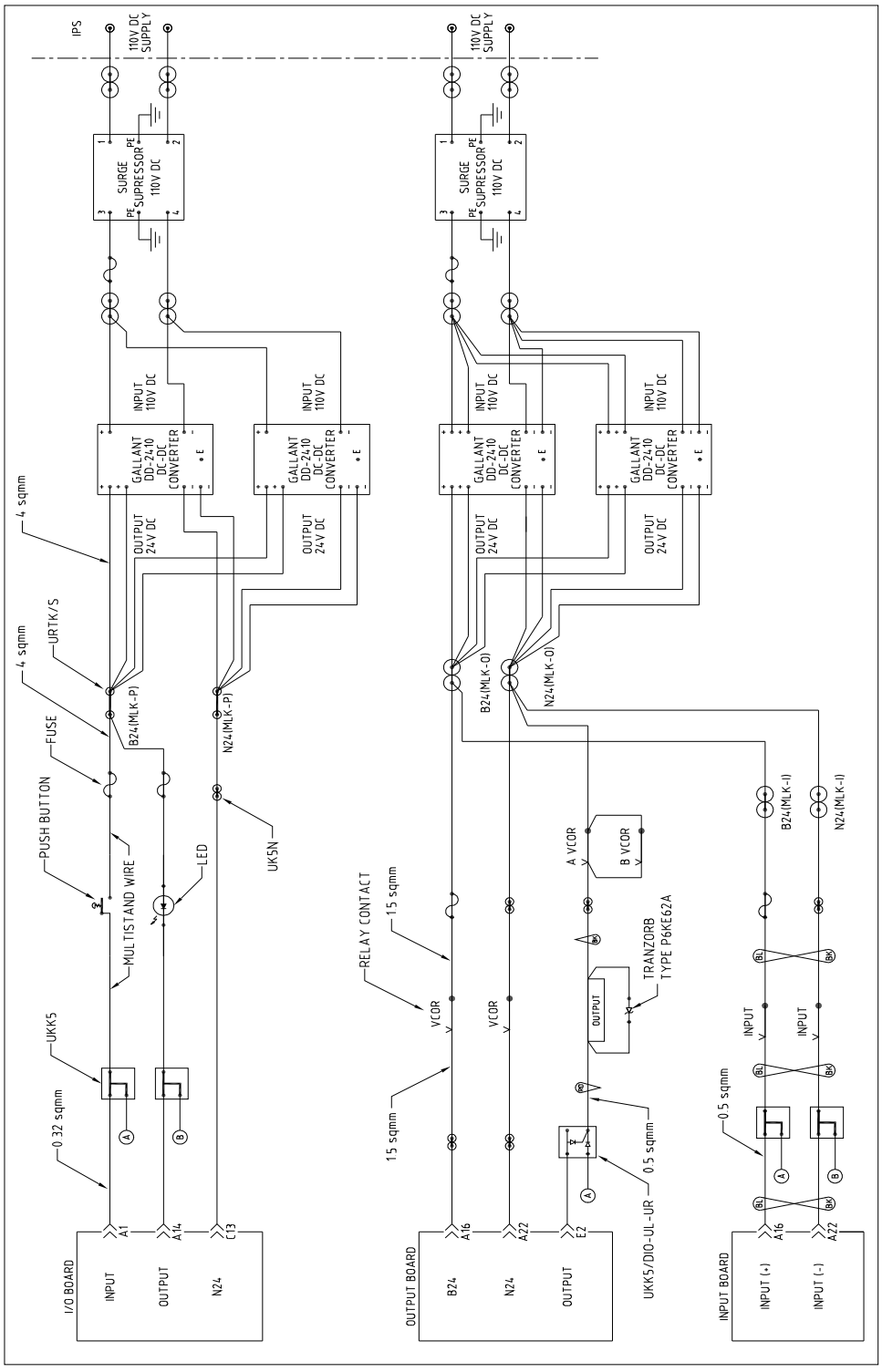
5.4. TYPICAL SYSTEM CONFIGURATION (Single Panel Processor Microlok II at SER with Operator PC in the same building)



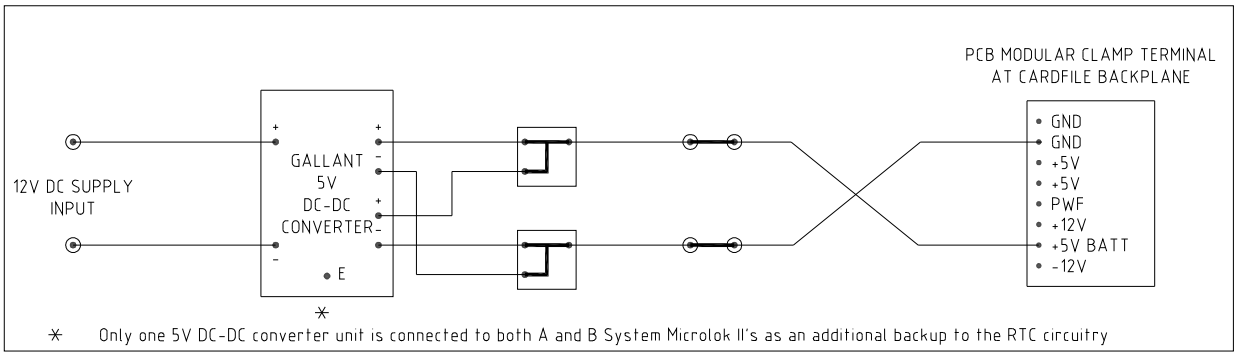
5.5. EXISTING SYSTEM CONFIGURATION (Stations Already Commissioned)



5.6. TYPICAL I/O INTERFACE CIRCUIT



5.7. MICROLOK II RTC INTERFACE CIRCUIT



6. MICROLOK II SYSTEM MAJOR COMPONENTS

Type	Part No
Card file	N16903101
Split Card file	N16905301
Non-Vital I/O Board	N17061501
Vital Input Board	N17061002
Vital Output Board	N17060502
Mixed Vital I/O Board	N17061602
Power Supply Board	N16660301
Enhanced power supply Board	N16601203
CPU Board	N17061301
VCOR Relay	N322500-701 (ASTS PN-150B)
VCOR Relay Base	N451376-0302
1" wide Blank front panel	N451850-2902
Address select PCB – 96-pin	N17003301
Address select PCB – 48-pin	N17003101
EEPROM PCB	N17002001
96-pin connector assembly & hood	09030963214
96-pin connector hood	173001
48-pin connector assembly & hood	09050483202
48-pin connector hood	173051
SYNC I/O Board	17066401/02
Comms Board	17066403

7. WIRING PRACTICES

7.1. RACKS

- Dust proof metallic racks with protective arrangements are provided for card file.
- All the racks used are insulated from the ground by means of PVC bushes for suitable mounting bases.
- Adequate moving space is to be maintained around all the racks in line with Railway Standards.

7.2. LADDERS

- Cable ladders installed horizontally shall have sufficient space to facilitate cable pulling and cleating/stapping.
- It is isolated from racks and wall via rubber bush & hylum sheet.
- All power cables and I/O cables & interconnection wires shall run different ladders. Where it is NOT possible, these cables are to be separated at least by 6 inches gap.
- Ladder width shall be 2/3rd of rack width and it is ensured that it carries fewer amounts of cables & wires to avoid bends/damages.
- Maximum distance between the supports is provided every 3 meters.
- All surfaces are cleaned prior to bolting together.

7.3. CABLE RUNS

- All the cable /wire run will have smooth surface.
- Sharp bending will be avoided when coming to racks.
- Cable entry holes in the Racks will have correct size rubber beedings.
- Ladders will be used for Interconnection of cable runs.
- PVC Troughs with cover will be used for Intra-connections.

7.4. CABLE SYSTEMS

- Cable shall be separated into Power cable, Serial Communication cable, I/O cable and Panel cable.
- Sufficient cable spare length shall be provided for equipment, which needs future adjustment.
- Cable splicing will be avoided.
- Cable insulation resistance must be 20 mega ohms.
- Cable should be arranged properly for maintenance.

7.5. CLEAN WIRING

Wires carrying extremely small currents that are prone to EMI and other disturbance coupling caused by transient conditions in adjacent wiring.

7.6. DIRTY WIRING

Wires regularly carrying large varying currents or currents that are subject to EMI or other disturbance caused transient conditions which can couple with adjacent wiring. Dirty wiring will be separated as much as possible from clean wiring.

7.7. INPUT & OUTPUT WIRING

- The input and output wiring to a particular unit should be separated from each other and from power wiring and ideally not run in parallel, i.e., all input wires are bunched together and are routed in a separate trough from output and power wiring. All output wires are bunched together and are routed in a separate trough from input and power wiring. All power wires are bunched together and are routed in a separate trough from input and output wiring.
- All output wiring from signalling power supply units to the Microlok II card file shall be considered as “clean” wiring and routed by the shortest practical path, even if it runs via intermediate distribution fuses or terminals.

7.8. POWER WIRING

- The power supply wiring and equipment should be located close to the Microlok II and other electronic equipment to minimize the length of low voltage power leads.

- The power supply feeding to external equipment will be separated from the supply that feeds internal equipment to ensure that external surges and transients are not directly connected to the internal bus bars.
- Earth wires associated with main power supply will be installed to the applicable standards specified but these shall be kept as short as possible and well away from the signalling power supply and signalling earths.
- It will be of reasonable cross-sectional area to minimize noise coupling and avoid the power sag.
- Cables & wires will be kept as short as possible from power supply to minimize induced noise.
- Case/house wiring will also be arranged to minimize noise.
- To avoid transient voltage, surge suppression device must be installed for Microlok II card file.

7.9. SERIAL LINK WIRING

- For maximum noise mitigation serial data cables must be shielded with an overall shield and contain no more conductors than required. (The conductors shall be twisted pairs). The purpose of this structure is to minimize capacitive, inductive and RF coupling.
- The cable shields must be earthed at one end only.
- All cable shields located within the CPU board 48-Pin connector must be bonded together and attached to the Microlok II chassis using a low impedance copper braid.
- RS-485 serial ports (Port 1 & Port 2) should be interconnected using ONLY twisted pair cable with an over-all shield.
- RS-232 & RS-423 serial ports (Port 3, Port 4 & port 5) should not contain any twisted pairs.
- The interconnecting cables should not contain extra wires/unused pairs. Any extra wires/unused pairs should be connected together at both ends of the cable and connected to signal common (COM) for best noise immunity.

7.10. COLOUR CODING OF WIRES/CABLES

- Blue/Grey sleeved shielded serial communication cable is used for serial communication wiring.

- 4/5 twisted pairs blue sleeved shielded serial communication cable is used for RS485 standard serial ports.
- 8 core grey sleeved shielded serial communication cable is used for RS232/423 standard serial ports.
- Red/Black and Blue/Yellow colour wire is provided for power supply wiring.
- (16/0.2) Blue/Black colour twisted pair wire is provided for Vital input circuits.
- (16/0.16) Grey/Blue/Red colour wire is provided for Non-vital I/O circuits.
- (16/0.2) Grey/Red/Black colour wire is provided for vital output circuits.

7.11. LABELLING

- All cable ends are provided with proper identification Tags made of non-deteriorating material.
- All the Terminals will have identification markers.
- All the wires connected to the terminals will have proper PVC ferrules.
- In the racks, Column/Row will be numbered and also, all the major equipments used in the system/sub system will have proper labels or painting for easy identification.

7.12. TERMINATION

- A perfect termination is gastight, therefore corrosion free and amounts to a cold weld of the parts being connected.
- Wires are to be terminated shall match with the correct size of the crimp contacts.
- If these basic requirements are met, highly reliable connections with low contact resistance and high resistance to corrosive attack are assured.
- Conductors of cables are to be correctly identified and are to be connected to the correct terminals.
- Conductors are to be securely held in terminals of fittings and are not subject to tension at the terminations.

7.13. SPARE CORE TERMINATION

Cables having spare conductors will be terminated in the spare terminals and will have proper tags for future use. In case of non-availability of Terminals, spare conductor ends will be insulated and neatly separated cable wise with proper identification tags.

7.14. INSULATION

The following shall be provided with proper Insulation from ground

- Mat and Rubber bushes between Racks/Panel and floor.
- Hylum sheet and PVC separators between ladders and Racks/Walls.
- PVC cable trays for all the wires/cables runs.
- PVC tape/sleeve wrapped over the flat connecting to the angles of the ladder for insulation between wires/cables and ladder.

7.15. EXTERNAL FILTER BOX FOR THE NON-VITAL BOARD OUTPUT LINES

An augmented surge protection arrangement (external filter box) introduces 3 stages surge suppression for the Non Vital Board output lines to safeguard the system against lightning surges and other switching surges.

The external filter box also provides protection to the 24V common line for every Non Vital board output lines. Every 24V common line is provided with 30V Tranzorb (1.5KE30A) and MOV (V36ZA80). The Tranzorb connected to the +24V DC signal line & MOV connected to the earth ground. The RS-5 Resistor is provided in each of the output lines which is capable of withstanding 5 joules energy

STAGE-1

Every Non Vital Board output line is provided with GDT (CG2 145L) and MOV (V36ZA80). GDT is grounded to the earth & MOV connected to the +24V DC signal line. The RS-5 Resistor is provided in each of the output lines which is capable of withstanding 5 joules energy.

STAGE-2

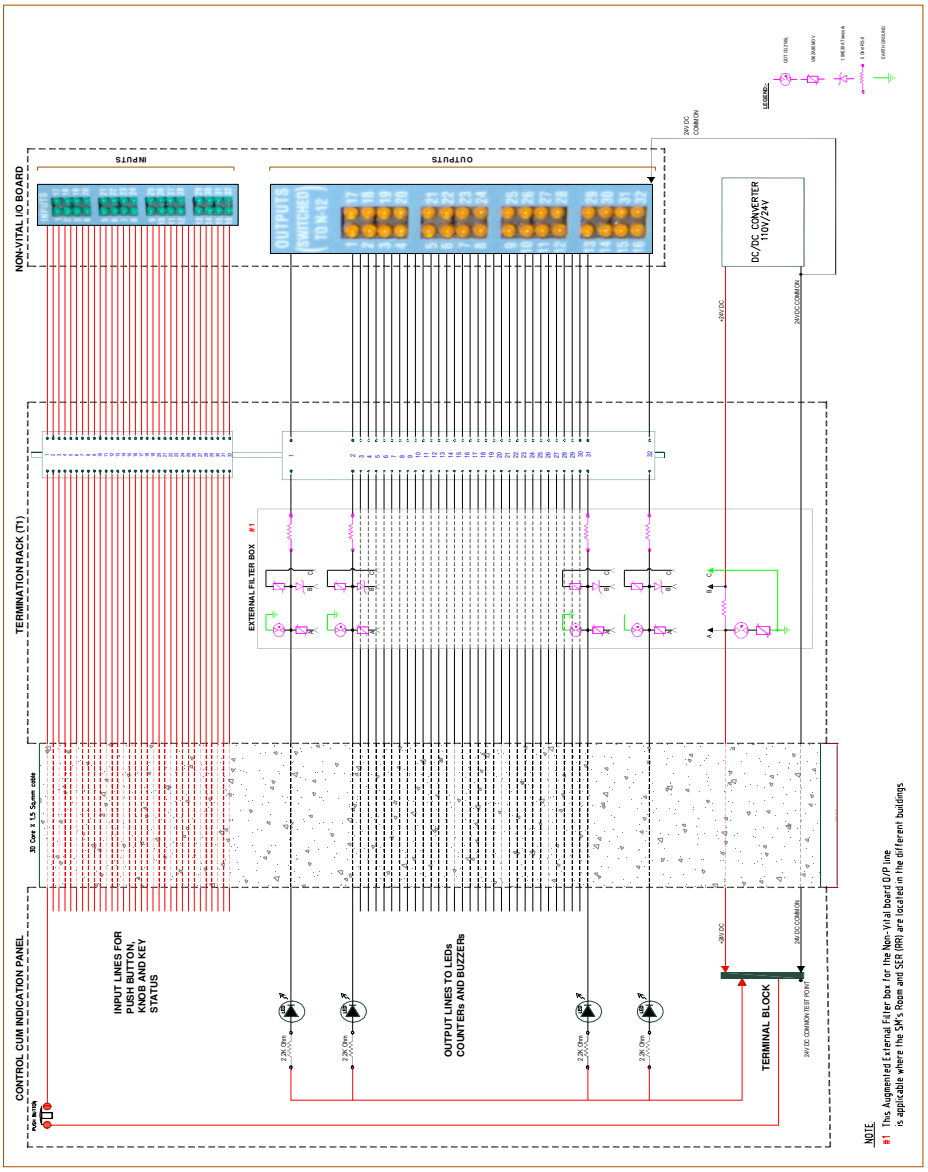
Every Non Vital Board output line is provided with 30V Tranzorb (1.5KE30A) and MOV (V36ZA80). The Tranzorb connected to the +24V DC signal line & MOV connected to the earth ground.

STAGE-3

The stage 3 protection is available in the form of MOV inside the Non Vital Board itself.

This arrangement replaces the existing terminal blocks mounted on the termination rack (T1) in the signal equipment room. The external filter box diagram is given below.

AUGMENTED SURGE PROTECTION BOX FOR THE NON-VITAL BOARD O/P LINES



8. SURGE PROTECTION PRACTICES

The IEEE specification contains updated and new parts, which provide detailed guidelines for effective surge protection of signalling equipment and systems. These guidelines are to be followed to a maximum extent on all Microlok II installations. Deviations are allowed when adequate cause or justification exists and documented.

8.1. POWER PROTECTION

Power protection is much important in a signalling facility. The power supply is distributed throughout the signal equipment rooms and is often toughed with other wiring. Much of the equipments that are driven from power supply has some built-in tertiary protection, but in no way can bear the brunt of a major surge. Such levels must be handled properly by staged protection. The staged protection refers to primary, secondary & tertiary levels and DC & Data line equipment.

Specification

Type	Make	OBO Part No	Voltage Range	Current Rating
OBO-VF Surge suppressor	OBO-Bettermann	5097495	110V DC	Up to 16A
OBO-VF Surge suppressor	OBO-Bettermann	5097460	24V DC	Up to 16A
OBO-VF Surge suppressor	OBO-Bettermann	5097452	12V DC	Up to 16A

Note:

This Surge Protection is not required where the Signal Equipment Room and Power Room are located in the same room.

⚠ Power cord Warning
Installations might have more than one AC power cord. To reduce the risk of electric shock, disconnect the two power supply cords before servicing the AC units.

8.2. AC POWER PROTECTION

- Primary AC line protection

In AC line feeds, primary protection begins at the service entrance. In severe lightning areas, primary protection begins at the service entrance inside the equipment rooms. The preference for primary side protection is the block type MOVs. These MOVs are 60mm diameter discs capable of handling enormous

amounts of energy, while maintaining reasonable clamping levels of for an AC system. It is better to use two or more in a fused, parallel fashion with indicator lamps across the fuse. In this way, it will be known if one MOV is shorted and because of the parallel redundant configuration, line protection continues. Generally the IPS is connected to the AC service entrance and provided OBO make surge arrestor as primary AC line protection device.

❖ Secondary/Tertiary AC line protection

Secondary protection levels in AC feeds are only effective if sufficient isolation impedance exists between the primary and secondary protectors. The needed amount of isolation number is not easy to arrive at. Therefore secondary protection level is often forgone.

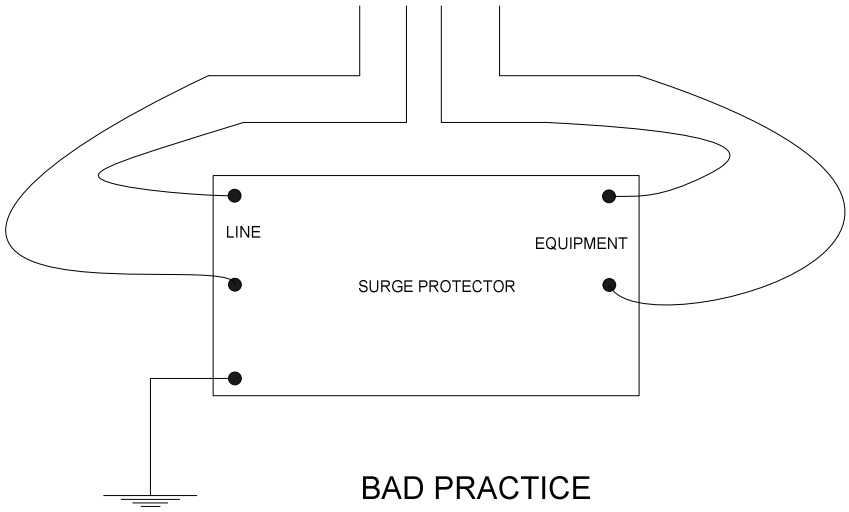
Tertiary protection is generally found within the equipment itself.

OBO-VF surge suppressor is provided for 230V AC circuit (Operator and Maintenance PC).

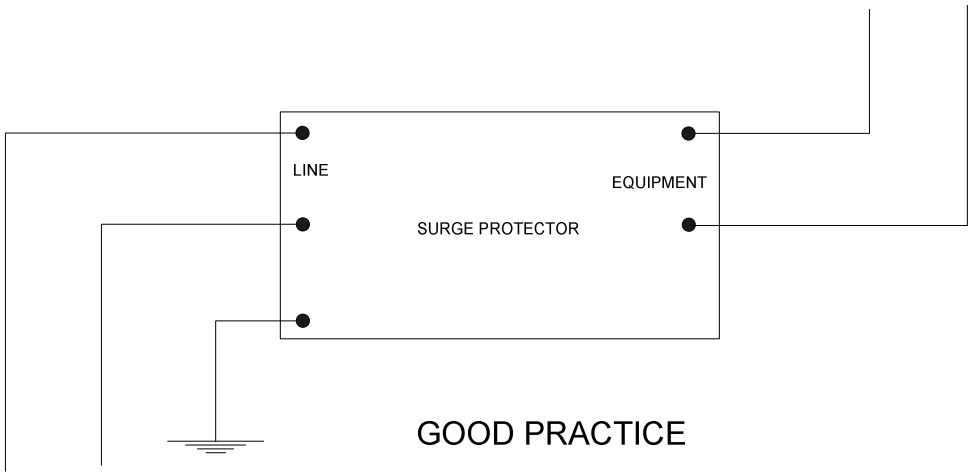
8.3. INSTALLATION OF SURGE PROTECTION EQUIPMENT

Installation of Surge protection equipment shall be as close to the entry point of the Surge as practical.

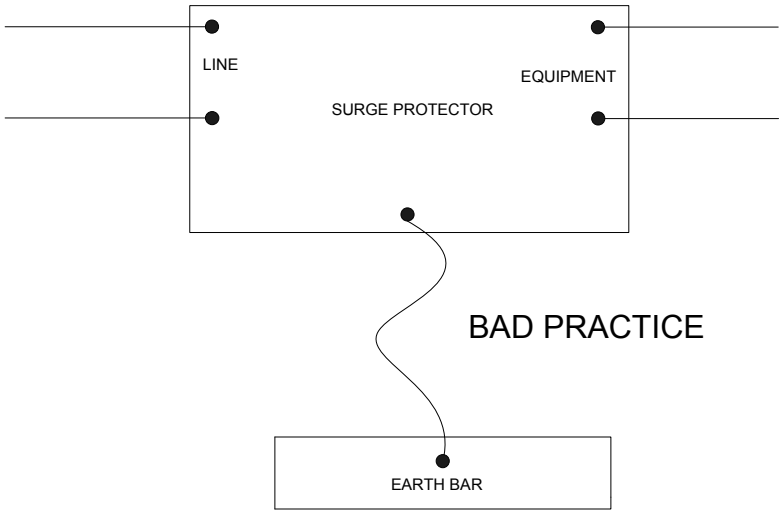
- Minimizing length of earth wires
- Separation of unprotected and protected wiring
- Power supply surge protection equipment should be mounted as close to REB as practical
- Preventing surges from entering equipment locations and cable routes.



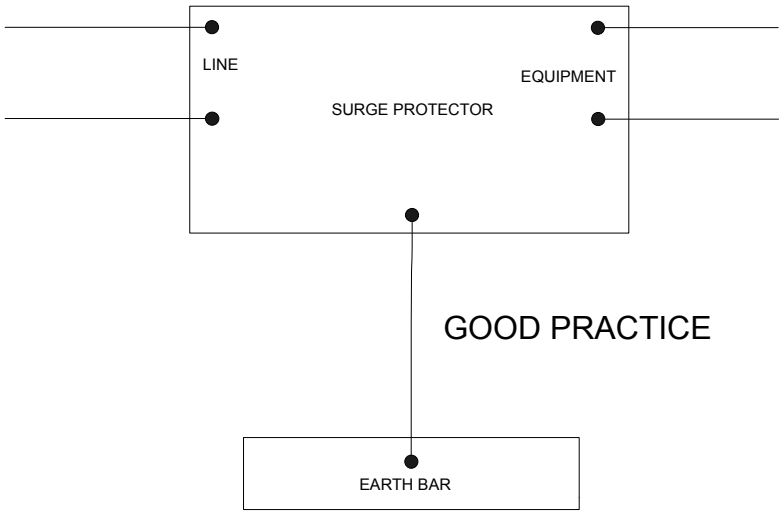
If the surge protector is installed as per the drawing given above, then the surge can couple between the wiring and bypass the surge protector. This is BAD PRACTICE and needs to be avoided.



If the surge protector is installed as per the drawing given above, due to the separation of the wiring on the line and equipment side then the surge is unable to bypass the surge protector. This is GOOD PRACTICE.



Coils and bends in the earth wire as per the drawing given above, increase its length and inductance and as a result reduce the effectiveness of the surge protector. This is BAD PRACTICE.



Minimum length on earth wire result in the best possible performance of the surge protector as per the drawing given above, this is GOOD PRACTICE. This shows good wiring practice, as the earth wire is as short and as direct as possible, with no bends, or coils, and separated from other wiring.

DC Power Supply Wiring Warning
Wire the DC power supply using the appropriate lugs at the wiring end. The proper wiring sequence is ground to ground, positive to positive and negative to negative.

8.4. DC–DC CONVERTER EQUIPMENT

The DC–DC Converter shall use Diodes/SCRs/Power Transistors, Power Mosfets, Linear & Digital Integrated circuits for achieving conversion from high DC voltage to low DC Voltage. The DC–DC Converter provides more than 1.5KV isolation and shall not be connected to the earth ground.

The DC–DC converters are designed to work with an input voltage of 110V DC. The output ratings are 12V/10A and 24V/10A. Two such DC–DC converters can be connected in parallel to achieve the N+1 configuration. The necessary diode 'OR'ing is done internal to the DC–DC converters. The above 110V input DC–DC converters are suitable for installations where IPS is installed.

The 5V DC–DC Converter is used for the Microlok II RTC (Real Time Clock) backup. The input of the 5V DC–DC is connected from 12V DC–DC Converter output.

Specification

Sl No	DC-DC Converter Input Voltage	DC–DC Converter Output Voltage	Current Rating	Make	Manufacturer Part No
1	12V DC	5V	500ma	Gallant	DD5
2	110V DC	12V	10Amps	Gallant	DD1210
3	110V DC	24V	10Amps	Gallant	DD2410

9. DATA LINE EQUIPMENT PROTECTION

Data line equipment has become extremely vulnerable to a phenomenon known as voltage surges and electrical transients. Source of electrical surges are numerous. The most common is a nearby lightning strike, which will affect nearby data line through induction. Electrostatic discharge is another form of an electrical surge that can affect data line equipment. In order to protect the equipment from incoming surge through data line, the following protections are to be implemented.

- Twisted pair wiring

It consists of two identical wires wrapped together in a double helix. Both wires in the pair have the same impedance to ground, making it a balanced medium. This characteristic helps to lower the cable's susceptibility to noise from neighboring cables or external source. Twisted pair wiring is adopted in all Vital I/O circuits and in RS485 standard serial communication circuits. A pair of twisted wires is loosely twisted at 10 twists per meter.

- Isolation

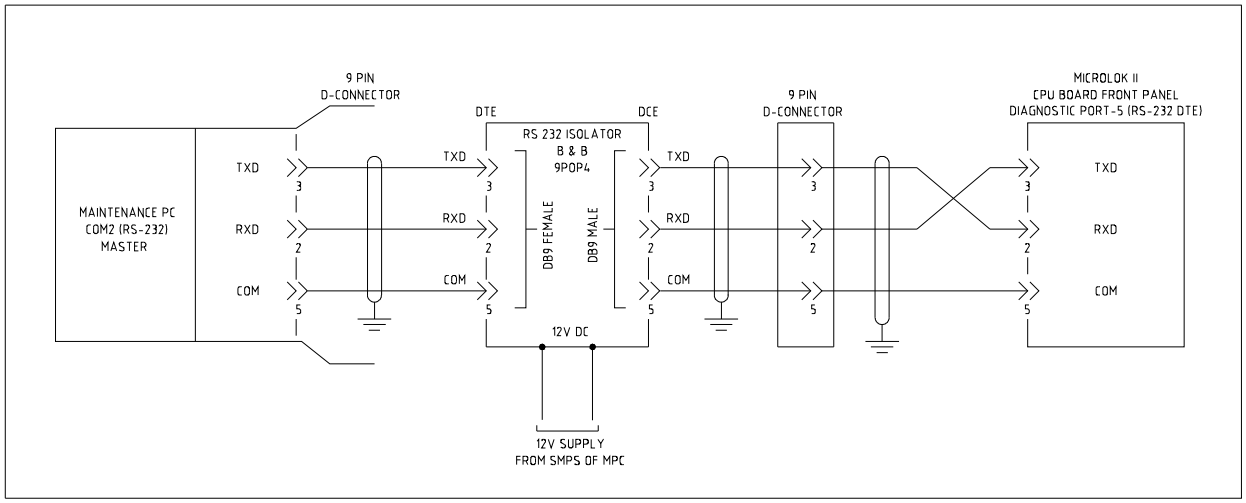
Isolators block unwanted currents originating on one side from reaching the other side. Isolators are designed to eliminate ground loops. A ground loop is a current across the cable created by a difference in potential between two grounded points. This happens if you have a long cable run of several hundred feet, or cables run between two buildings. When two devices are connected and their ground potentials are different, current flows from high to low by traveling through the data cable ground wire. If the voltage difference is large enough one of the RS-232 ports can be damaged. Even a small potential difference can cause trouble even though it does not cause

circuit failure. Small ground loop voltages cause transmission errors with data signals riding on top the ground loop current. Isolators block this damaging or interfering current.

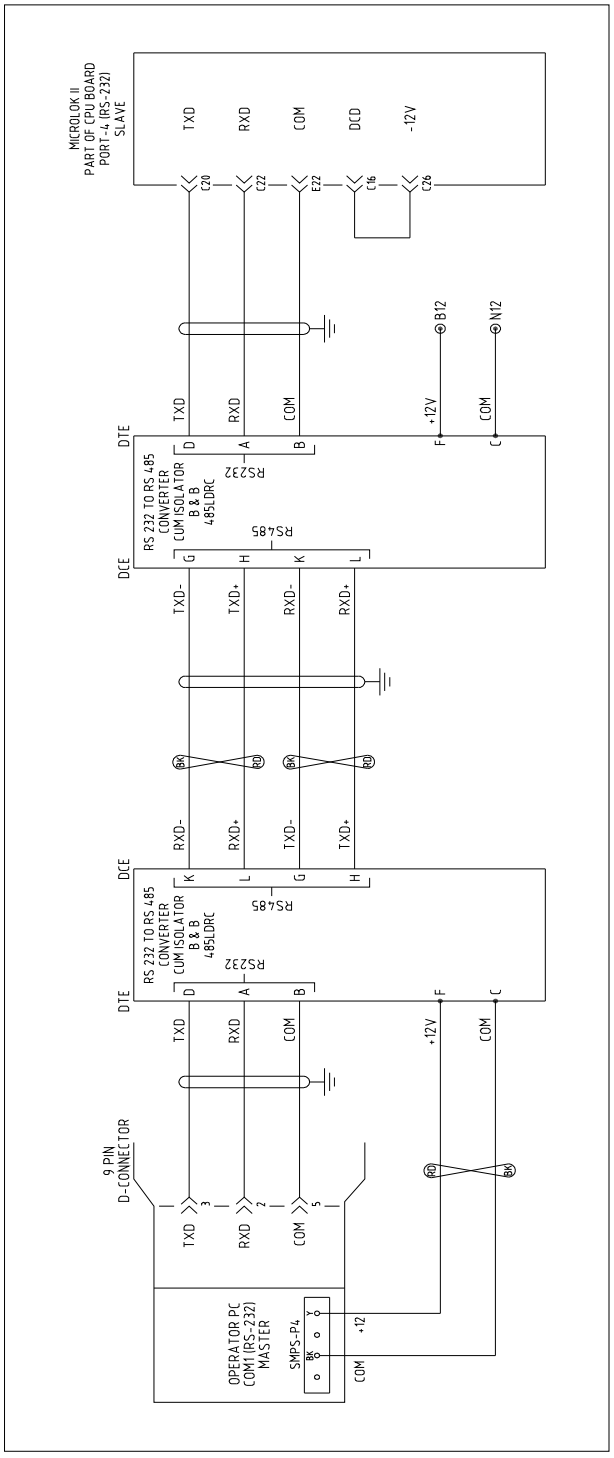
A common application of an isolator is that allows a computer to be connected to a data line without risk of damage from electrical transients and also "surges" or "spikes". If a transient occurs on the data line which is common, the equipment will be unaffected because the optical gap does not conduct electric current. For this reason, isolators provide superior protection.

Isolator and Converter cum isolator of “B&B” make are provided for serial communication circuits. The Isolator provides 2500V isolation between its DTE and DCE sides and protection against lightning damages. The Converter cum Isolator provides 2000V AC isolation between its input and output.

9.1. Isolator connection between Maintenance PC and Debug port of Microlok II



9.2. Isolator connection between Operator PC and port 4 of Microlok II



10. INTERFACE PROTECTION

10.1.

10.2. NON-VITAL I/O INTERFACE PROTECTION REQUIREMENTS

Normally indoor signalling cable is used to interface panel and Non-vital boards, where the panel room is adjacent to signal equipment room. If the panel room is at a distance from the signal equipment room. i.e. in a different building, then underground twisted pair jelly filled cables are used to interface panel and Non-vital boards. Also Augmented surge protection box for the Non-Vital board O/P line is provided, as mentioned in section 7.15.

10.3. VITAL I/O INTERFACE PROTECTION REQUIREMENTS

The vital inputs from the field to the Microlok II equipment are read through a relay contact. Since reading through relay contacts provides galvanic isolation to the vital inputs, there is no need of providing any surge protection devices for the vital inputs.

The vital outputs from the Microlok II equipment to the field are through vital relays. Since output vital relays provide galvanic isolation, there is no need of providing any surge protection devices for the vital outputs. However, relay coil snubs are introduced across the coils of the vital output relays. Relay coil snubs are intended to dissipate large electro magnetic surges that are dissipated from the inductance of relay coils and to prevent these surges from interfering with normal operation of Microlok II system. Tranzorb type GE /Motorola 6KE62A are recommended for relay coil snub.

Noise reduction in the cables is taken care of by using twisted cables for vital I/O from the termination racks. All the vital output cables from a Microlok II equipment should be gathered in a bundle, input wires should be gathered in a bundle, power wires should be gathered in a bundle. Each of the bundles should be physically separated from each other (preferably 6”) and all bundles should be physically separated from other house wiring. It is particularly important to maintain this physical separation from high current “dirty” wiring.

11. GROUNDING PROCEDURE

The first step in providing effective personnel and equipment protection is preparing a low impedance grounding electrode or grounding electrode system at each equipment housing room.

Once the low impedance earth ground is established for a signal housing, the apparatus in the house should be connected to the earth ground as described in the following sections.

11.1. EARTH PIPE

The Copper Clad earth electrode has been in use for grounding purpose. The details of Copper Clad earth electrode is given below.

11.2. COPPER CLAD EARTH ELECTRODE

Modern maintenance free and durable earthings employ steel conductors which are copper clad pipe (Maintenance Free Earthing) and utilize graphitic compounds and non corrosive salts as “ground enhancing material” (GEM) which does not lead to corrosion. Such earth pits would also not require the usual watering schedules to maintain the earth resistance within limits.

For installations where earth’s are not freely accessible for maintenance and measurements. Where clusters of earth pits are required to keep the earth resistance as low as less than 1 ohm, provision of maintenance free earth pits may be made during initial installations and whenever replacements takes place (Refer section 12.3).

11.2.1. Type, size and specification of earth electrode

- Shall have 3000mm (10feet) , 17mm (3/4”) copper bonded/copper clad stainless steel
- Shall be corrosive resistant
- Shall be molecularly bonded with copper to high strength steel cores
- Shall withstand minimum 20 KA discharge current for one year
- Shall have a minimum life of 20 years
- To achieve earth resistance 1 ohm, depending on the soil condition, two or more earth rods may be used in the form of mesh.
- The distance between two earth pipes is maintained within 20 feet.

11.2.2. Composition of earth enhancement material and its specification

- Shall have high conductivity, low water solubility and highly hygroscopic
- Shall be non corrosive
- Shall have resistivity of less than 4.7 ohm meter
- Shall be stable between -60 to +60^{o} C temperature
- Shall be suitable for any kind of electrode and grounds (soil) of different sensitivity
- Shall procedure compounds with conductive powder and decrease the earth resistance, mainly in those areas with salts deficiency.
- Shall not be explosive when comes in contact with another explosive gas or dust
- Shall not releases toxic and irritating gases in any abnormal explosive gas or dust
- Shall not cause burns when moist, irritation to eye, skin and mucous membrane
- Shall be anti-allergic

11.2.3. Composition of earth enhancement material and its specification

Low lying close to the building or location box or signal equipment room is good for locating earth electrodes. The location box can be close to any water bodies or water points. Earthing rods should not be fixed on high bank or made up soils.

11.3. Procedure for measuring earth resistance of termination system

This method is applicable to all types of ground impedance measurements. The impedance of a large grounding system may have an appreciable reactive component when the impedance is less than 0.5 ohm, i.e, the measured value is an impedance and should be so considered although the terminology often used is resistance.

The method involves passing a current into electrode to be measured and noting the influence of this current in terms of voltage between the ground under test and a test potential electrode. A test current electrode is used to permit passing a current into the electrode to be tested.

The fall of potential method consists of plotting the ratio of V/I = R as a function of probe spacing X. The potential electrode is moved away from the ground under test in steps. A value of impedance is obtained at each step. This impedance is plotted as a function of distance, and the value in ohms at

which this plotted curve appears to level out is taken as the impedance value of the ground under test (Refer section 12.4).

11.4. ROOM EARTH BAR (REB)

The signal equipment room earth bar shall be a copper bus bar with the required length with 50mm width and 6mm thickness. The REB shall be predrilled with number of holes required of M10 size suitable for termination of bolted cable lugs.

There shall be one REB for each of the following rooms:

- Signal Equipment Room and
- Power supply room.

To avoid circulating earth loops, the REBs shall be insulated from the building structure. Each REB shall be installed against the wall, with low voltage insulator spacers of height 60mm. The REBs shall be installed as per the site convenience, but the lead length should be very less. Hence the REB is maintained at a nominal height of 0.5m from the ground level. All terminations on the REB shall be by bolted lugs with spring washers. The earth leads shall however be bolted to the lugs.

All terminations on the REB shall be by bolted lugs with spring washers. The earth leads shall however be bolted to the lugs.

11.5. REB-REB BONDING CONDUCTORS

To minimize the effect of circulating earth loops, noise pick-up and to provide equipotential bonding, star point earthing is required. In this respect, Signal Equipment Room and Power supply room REBs mentioned above, should be directly connected to the REB within the Power supply room. To facilitate this, it is proposed that a REB be installed within the Power supply room at a height of 0.5m. The bonding is done by bare stranded copper wire run along the wall on insulators. If the bonding wire need to cross building wall, it must be isolated from building structure to avoid circulating current. The bonding conductors shall be bolted to their respective lugs.

11.6. EARTH CONDUCTORS

Earth conductors are typically those conductors that carry the surge to the main point of injection into the ground. These would typically are:

- Copper conductors for equipotential bonding or fault protection, that come out of a building and which are finally terminated in an earth pit.

- The copper conductors that come down the sides of a building (for lightning protection) and which are finally terminated in an earth pit.

It is recommended that the earth conductors are of stranded insulated copper cables.

The earth cable from signal equipment room REB to the first earth pit should be of 3/16" cadmium cable. This cable is used between REB and the first earth pit and it is connected by exothermic welding at both the ends.

Specification of 3/16" Cadmium cable:-

- One center strand of 19 wires surrounded by 6 bunches of 19 wires.
- Center strand made of galvanized steel.
- 18 outer strands composed to tinned copper cadmium.
- The cadmium contents should be less than 0.9%.
- Wire should have dia of 0.3mm.
- The conductor of 19 wires each should be coated with PVC coating of 1mm.
- The breaking strength of the 24" length of the cable should not be less than 540kg.

The earth conductor from first earth pit to the nearest building earth pits should be connected with 3X25mm copper strap. Where this earth conductor is buried in the ground it shall be mechanically protected.

11.7. EQUIPMENT GROUNDING REQUIREMENTS

The following sections define the requirements of equipment grounding inside the signal equipment rooms.

11.8. RACK GROUNDING

Each rack should be connected to the REB with 10 sq. mm. insulated copper wire. The racks should be isolated from the floor of the signal equipment room as well as from each other. The racks should also be isolated from the top ladders.

11.9. GROUNDING OF EQUIPMENT MOUNTED IN RACKS

Card files and chassis of equipment mounted in a rack must be grounded via the rack. This can be done by connecting the ground stud on each card file/chassis, to the rack using 4 sq. mm. Insulated copper wire. Terminate

this wire on the rack frame. When no ground studs are provided on the card files/chassis, ensure good contact between the metallic mounting ears of the card files/chassis and the rack via proper use of mounting screws and star washers.

The earth terminal of other surge protecting devices such Isolator/converters used for serial communications shall also be connected to Rack frame as done in case of card file/chassis using 4 sq. mm. Insulated copper wire.

11.10. CABLE SHIELDS

Shielded cables within a particular location are considered to be non-exposed. These cable shields should be grounded at one end only. This end should be at the lowest impedance point with respect to the REB and the end closest to the REB.

❖ **Recommended Earth resistance value**

The following values stated are the minimum earth resistance requirements prior to bonding the first earth pit (1st earth pit) to the building perimeter earth.

Earth measurement points	Resistance
First Earth pit	Less than 1 Ohm
Building perimeter Earth	Less than 1 Ohm

Note:

It is always difficult do Perimeter earthing (Fig. 4 of section 12.1) due to geographical constraints associated with Signal Equipment Room (Relay Room) situated in platforms. In those cases, the earth connections shall be achieved by doing a ring arrangement (Fig. 5 of section 12.1) in any one side of the Signal Equipment Room (Relay Room).

12. EARTHING ARRANGEMENT

12.1. TYPICAL EARTHING SCHEMES

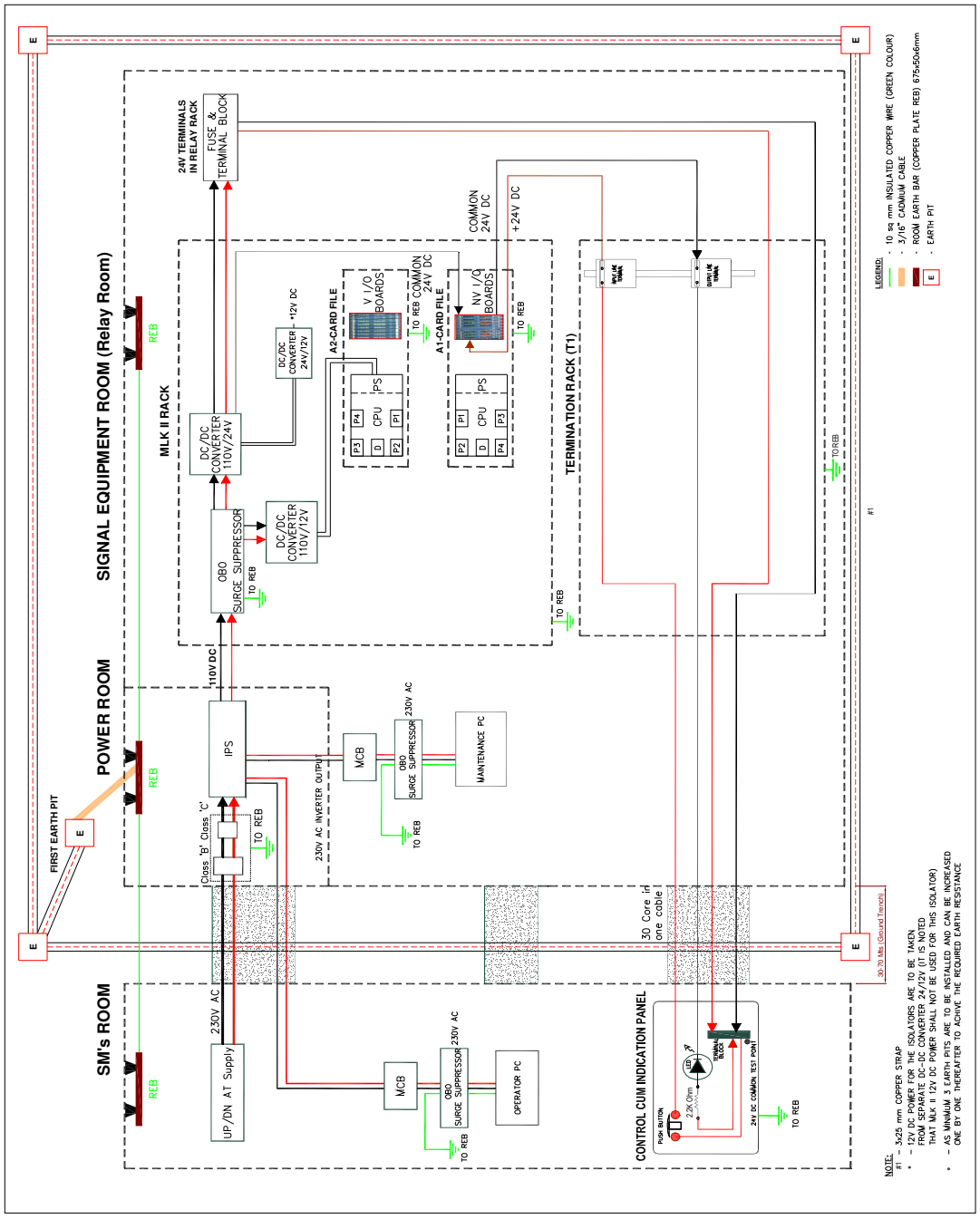


Fig-4 Perimeter Earthing around of the Signal Equipment Room (Relay Room)

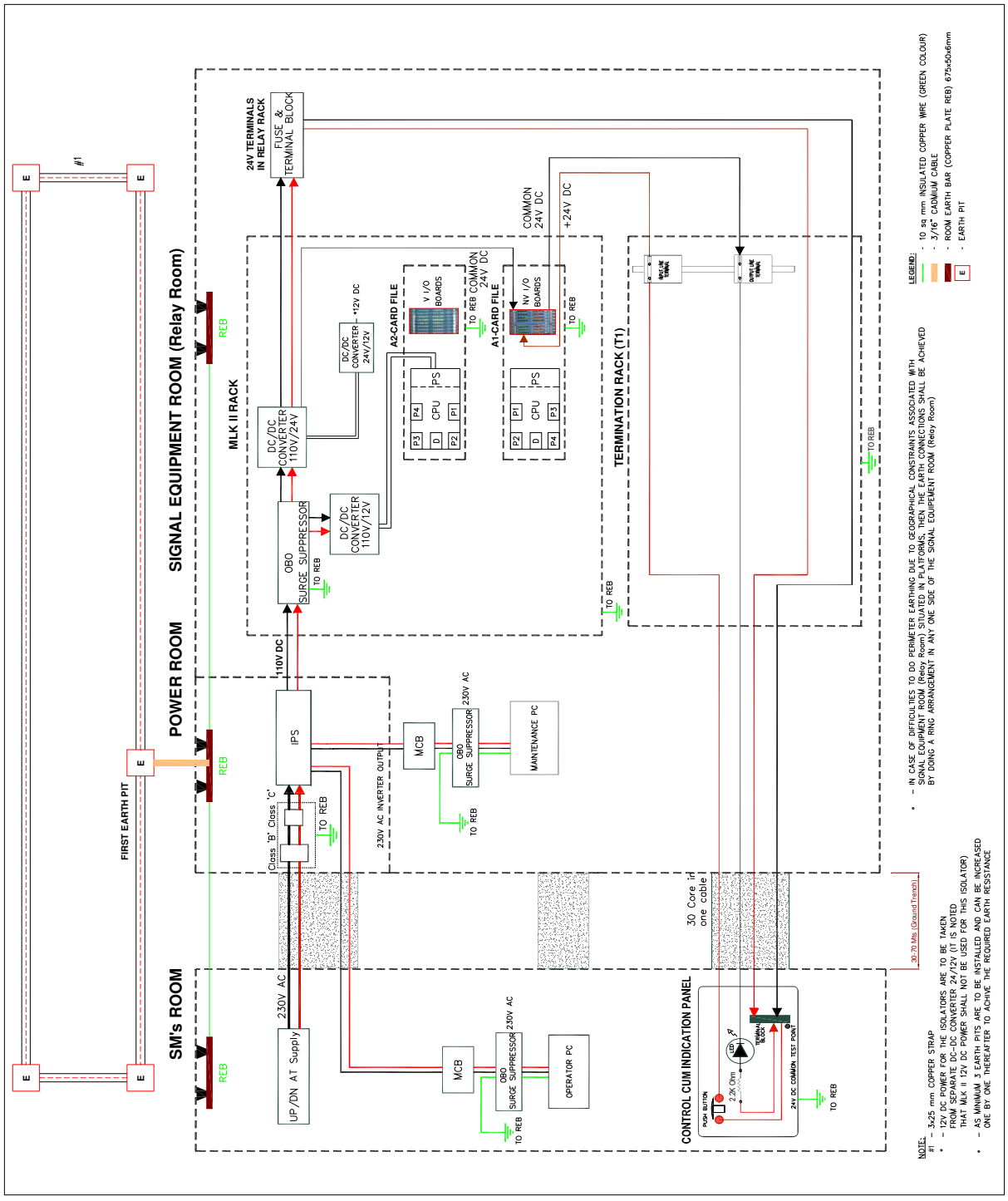
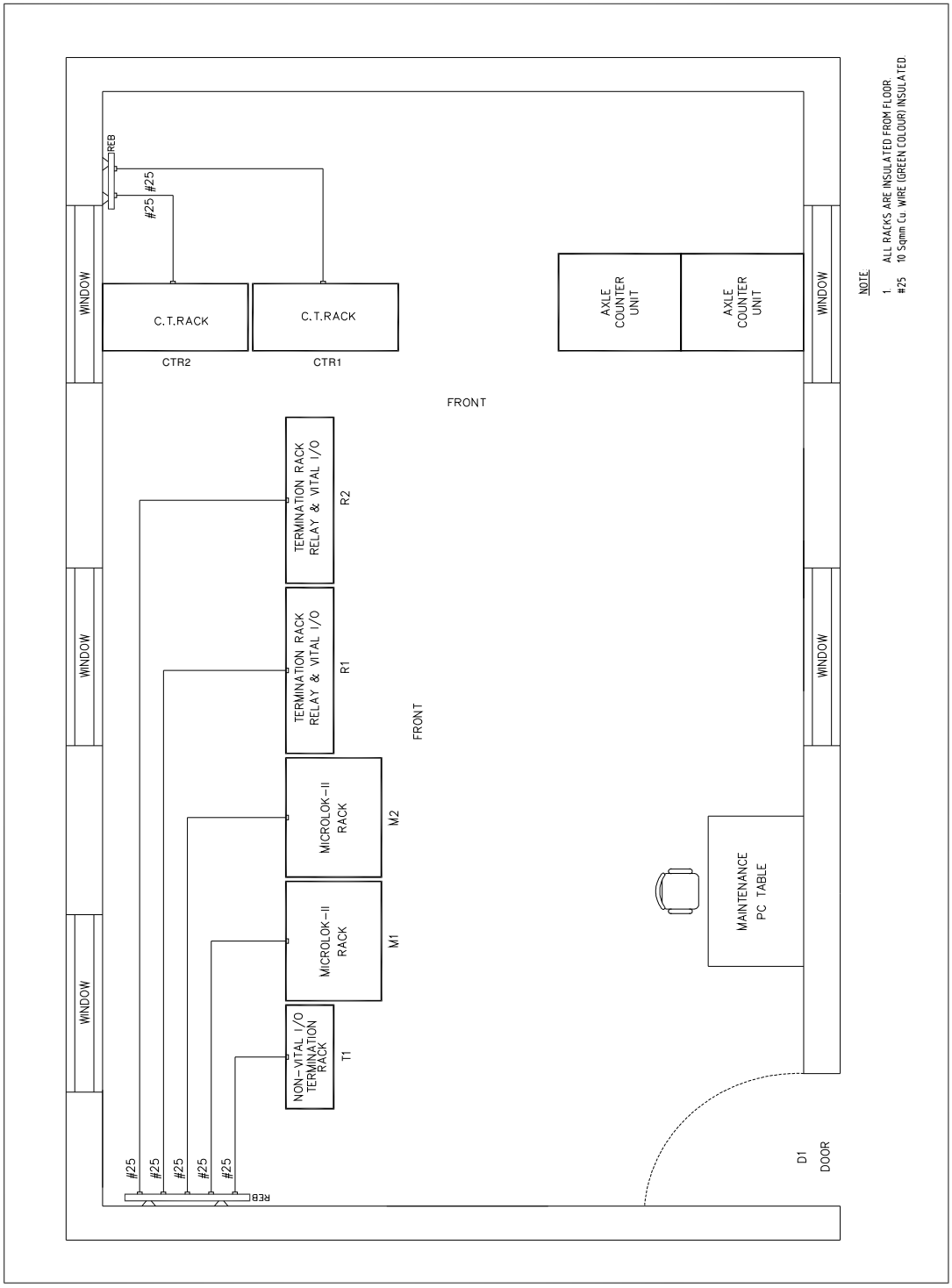
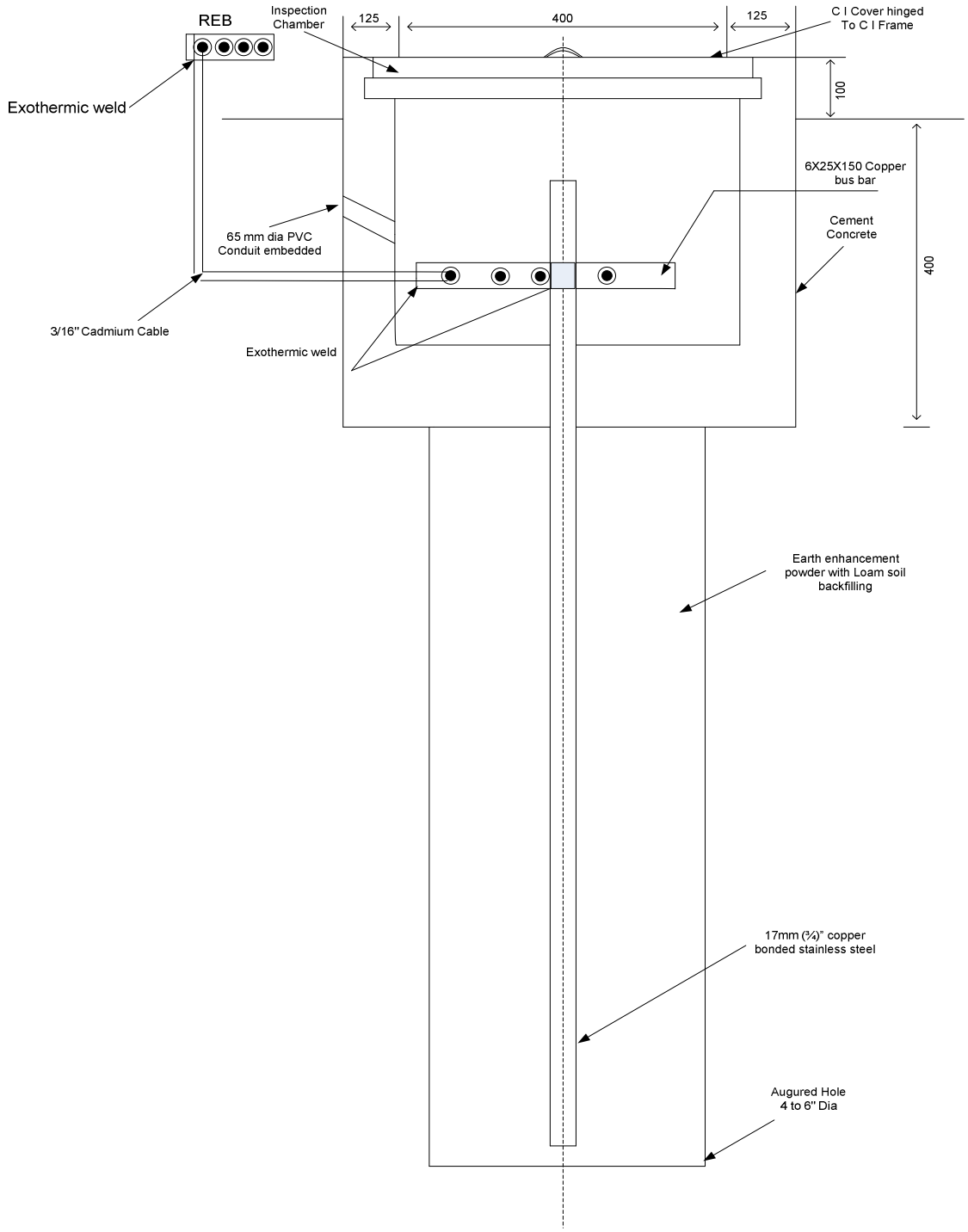


Fig-5 Ring Earthing in one side of the Signal Equipment Room (Relay Room)

12.2. RACK EARTHING



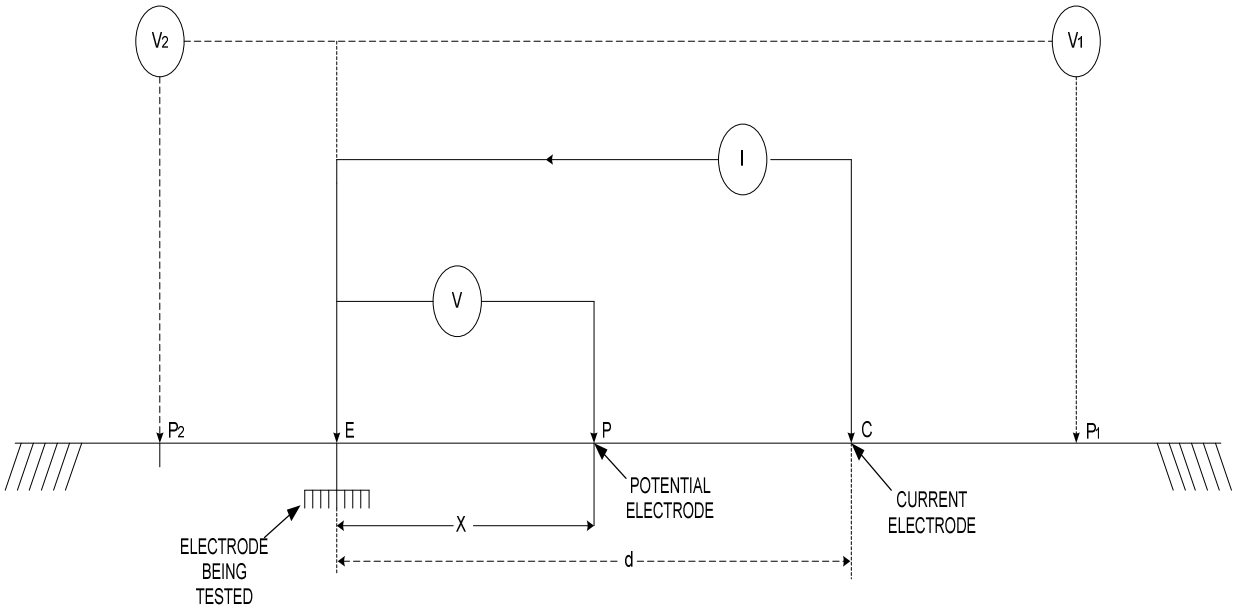
12.3. GROUND EARTH PIPE BURIAL (COPPER CLAD ELECTRODE)

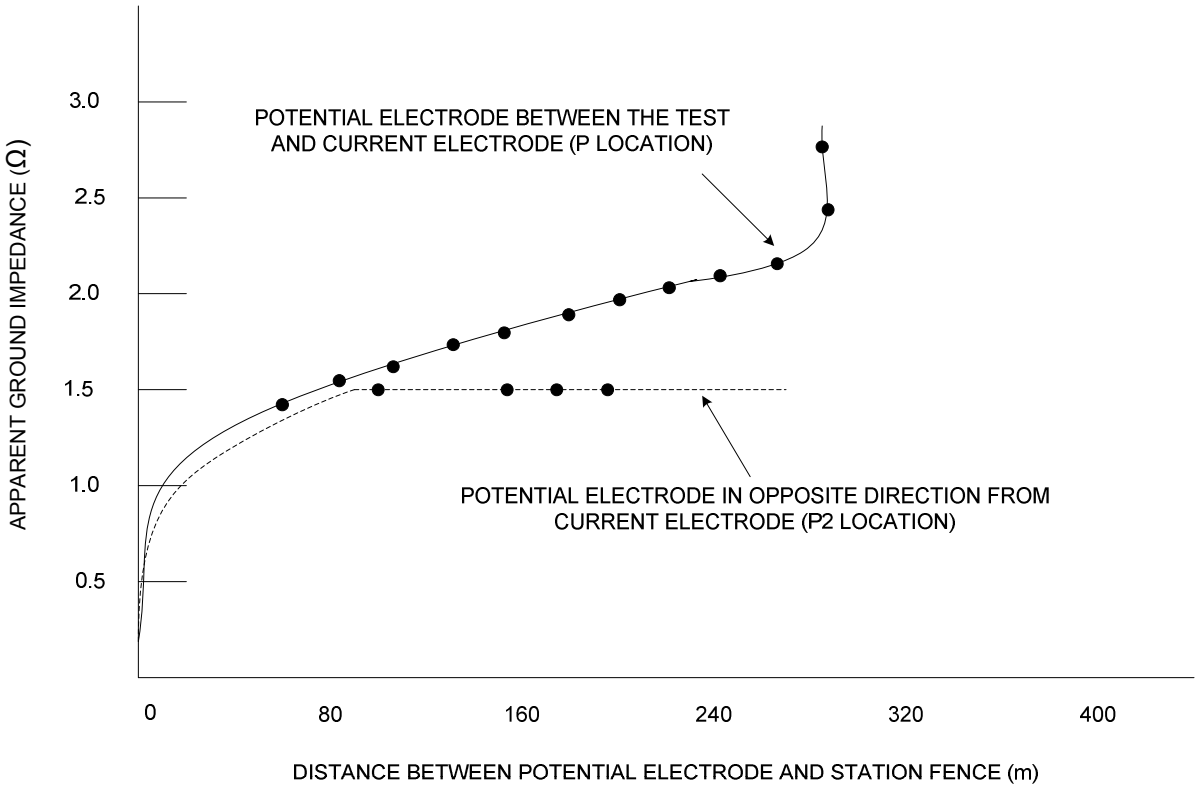


Special Note:-

This arrangement may be reviewed when a proper guideline is issued by RDSO on the earthing scheme.

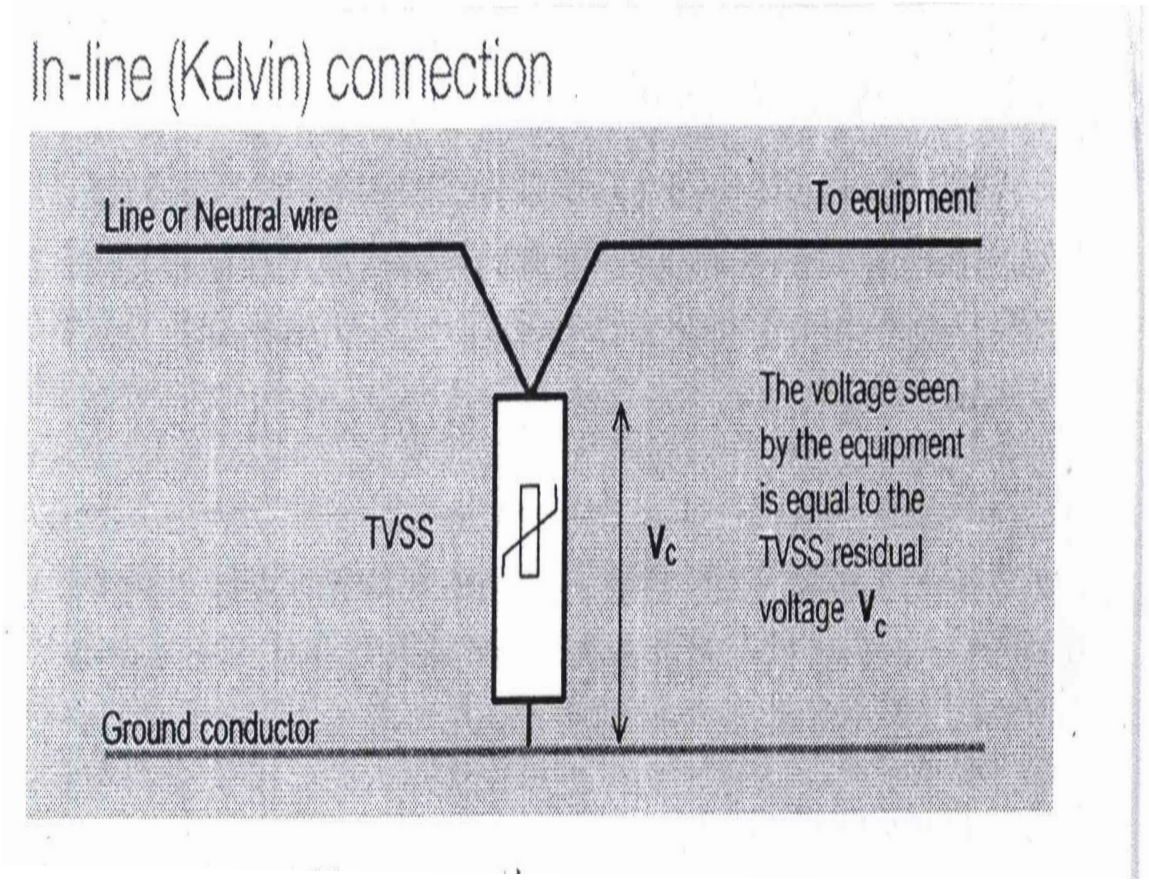
12.4. PROCEDURE FOR MEASURING EARTH RESISTANCE

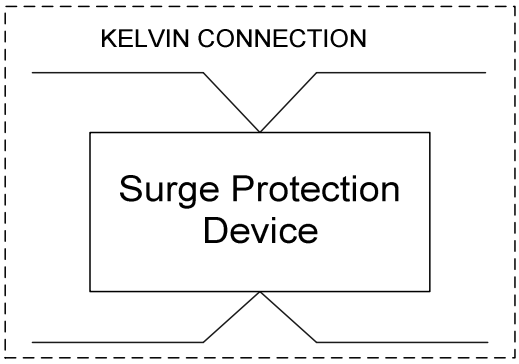



APPARENT GROUND IMPEDANCE (Ω)
3.0
2.5
2.0
1.5
1.0
0.5
POTENTIAL ELECTRODE BETWEEN THE TEST AND CURRENT ELECTRODE (P LOCATION)
POTENTIAL ELECTRODE IN OPPOSITE DIRECTION FROM CURRENT ELECTRODE (P2 LOCATION)
0
80
160
240
320
400
DISTANCE BETWEEN POTENTIAL ELECTRODE AND STATION FENCE (m)

13. KELVIN CONNECTION

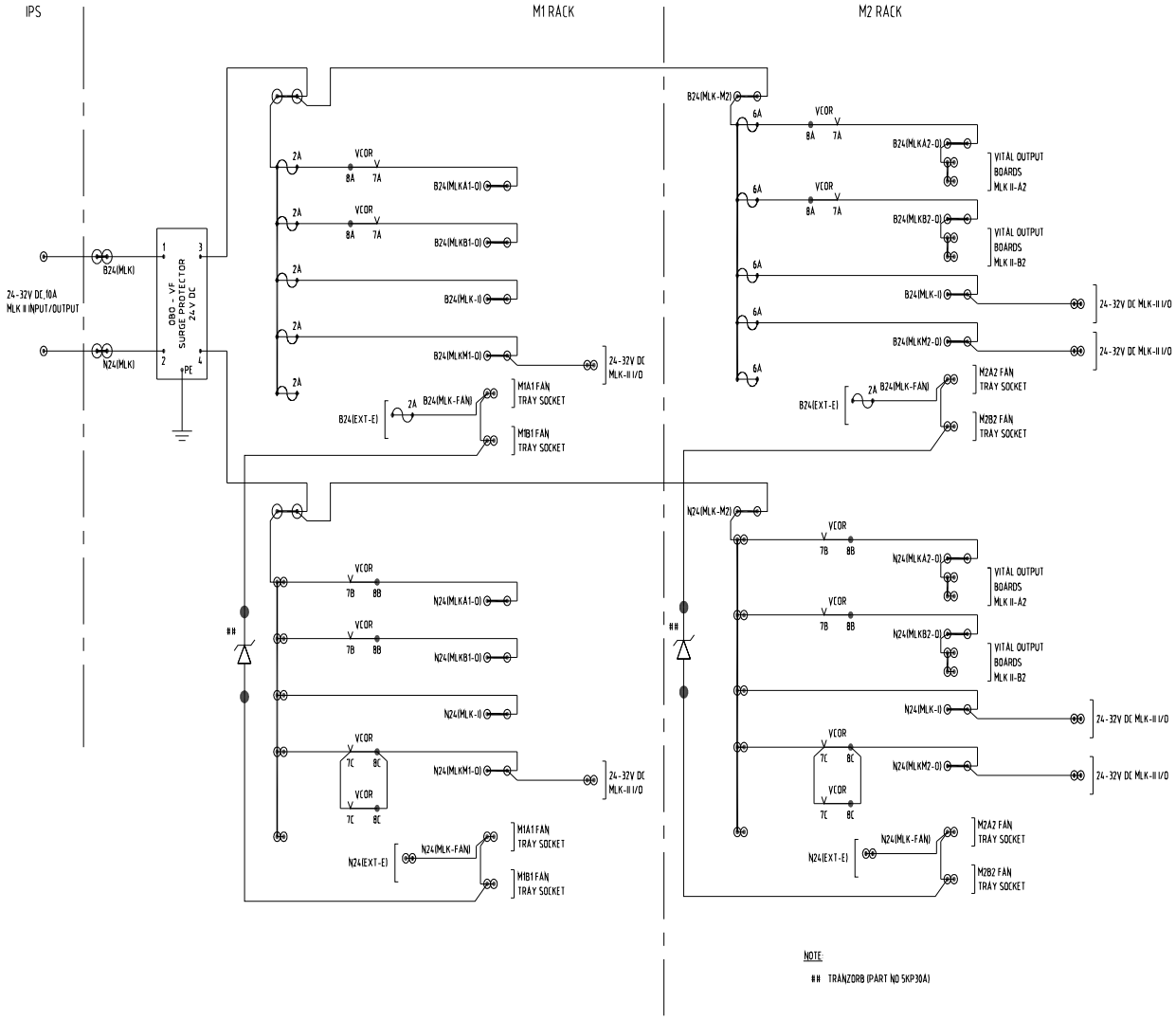
The lead lengths of surge protection connections shall be as short as possible. The total let through voltage is a combination of the surge protection clamping voltage plus the voltage drop in its connecting leads due to inductance. Thus for the rates of change of current associated with lightning strikes, if a surge protector has an earth cable longer than 1 meter, much greater voltage surges can be let through to the equipment being protected. Thus cable lengths associated with surge protection devices must be less than 0.5 meter. Where practical, the Kelvin method of connection surge protection devices should be used.



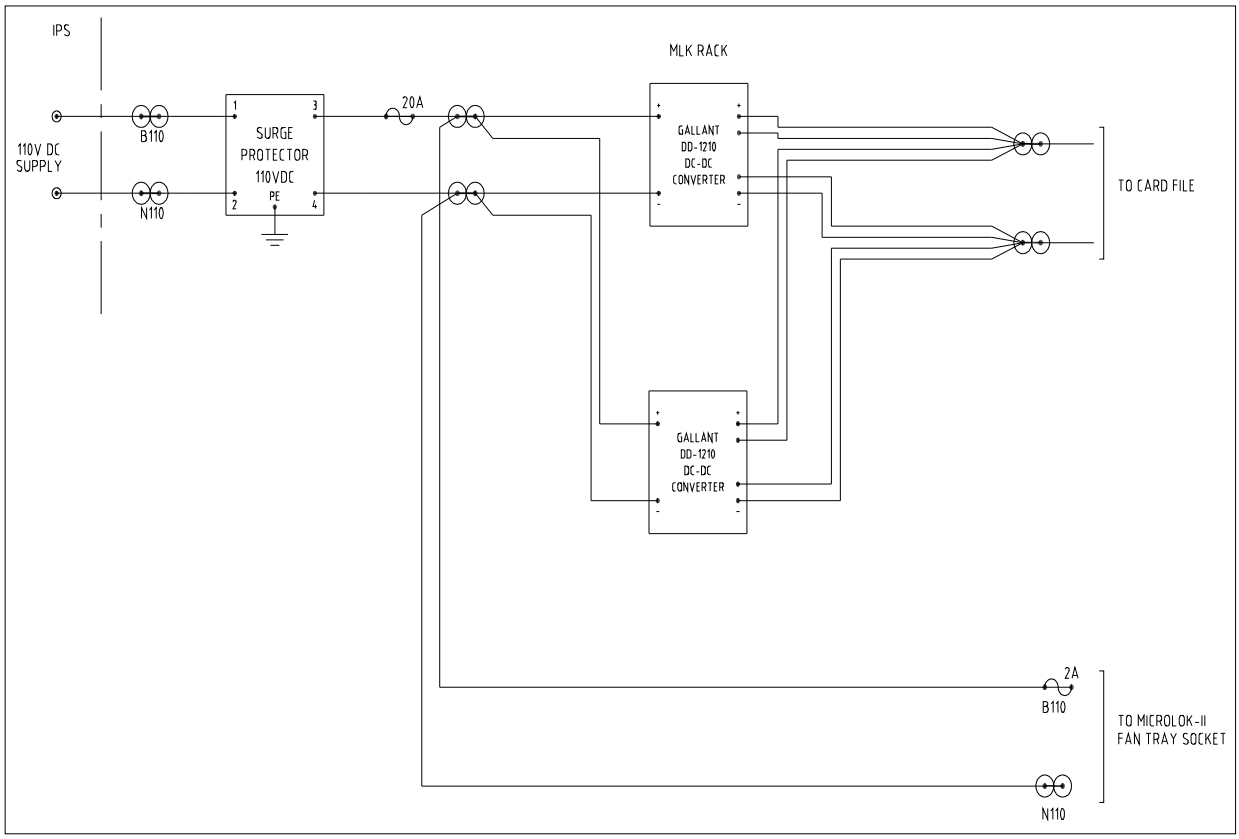


14. MICROLOK II RACK COOLING FAN POWER CONNECTION

The Microlok-II Rack is provided with a Fan Tray having 4 nos. of 24V DC fans for cooling. Fan tray is fixed on top of the top card file and for the bottom card file, the fan tray is fixed below the card file. The fan supply 24V DC is to be derived from an 24V external available in the IPS equipment and shall not be connected to any Microlok II 24V supply line to safe guard the Microlok II boards against any noise generated by an inductor circuit of the fan. To protect the fan supply against any transient voltages, special type Tranzorb (Part No 5KP30A) is to be connected between the supply lines. The power connection for the same is given below.



As an option, 110V DC fan can be used instead of 24V DC fan in the Microlok II Rack. The power connection for the same is given below.


IPS
110V DC
SUPPLY
B110
N110
SURGE
PROTECTOR
110VDC
PE
1
2
3
4
20A
MLK RACK
GALLANT
DD-1210
DC-DC
CONVERTER
GALLANT
DD-1210
DC-DC
CONVERTER
TO CARD FILE
2A
B110
N110
TO MICROLOK-II
FAN TRAY SOCKET

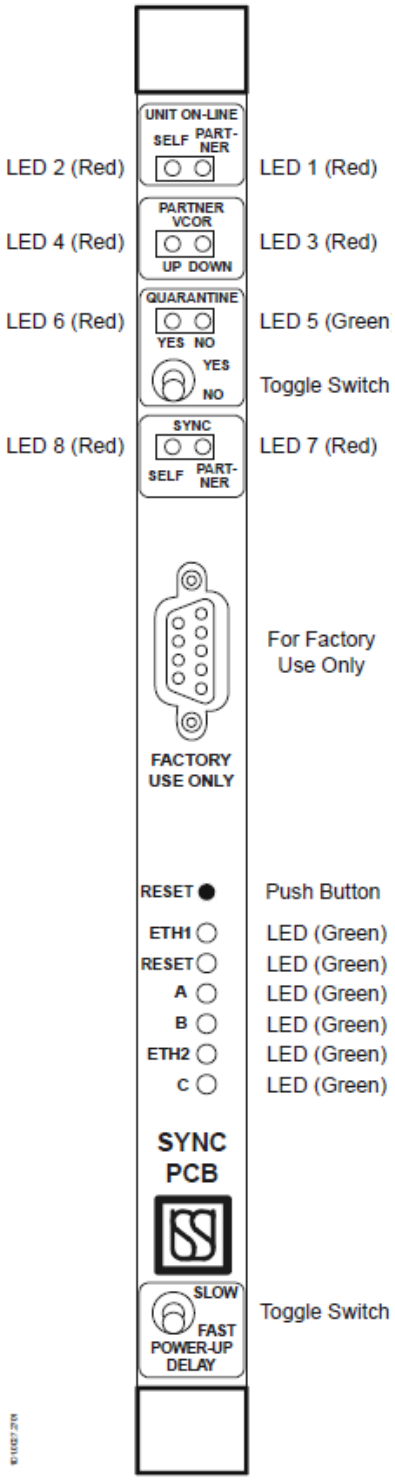
15. Microlok II Duplicated Seamless Changeover system (HOT STANBY system)

15.1. SYNC I/O Board

The Synchronization PCB allows two MICROLOK II units to connect to each other in order to form a synchronized pair for a seamless redundant application. Each MICROLOK II cardfile contains a Synchronization PCB. The MICROLOK II cardfiles are linked through an Ethernet interface, receive the same physical inputs, deliver the same physical outputs, and have the same hardware and software architecture and same physical I/O.

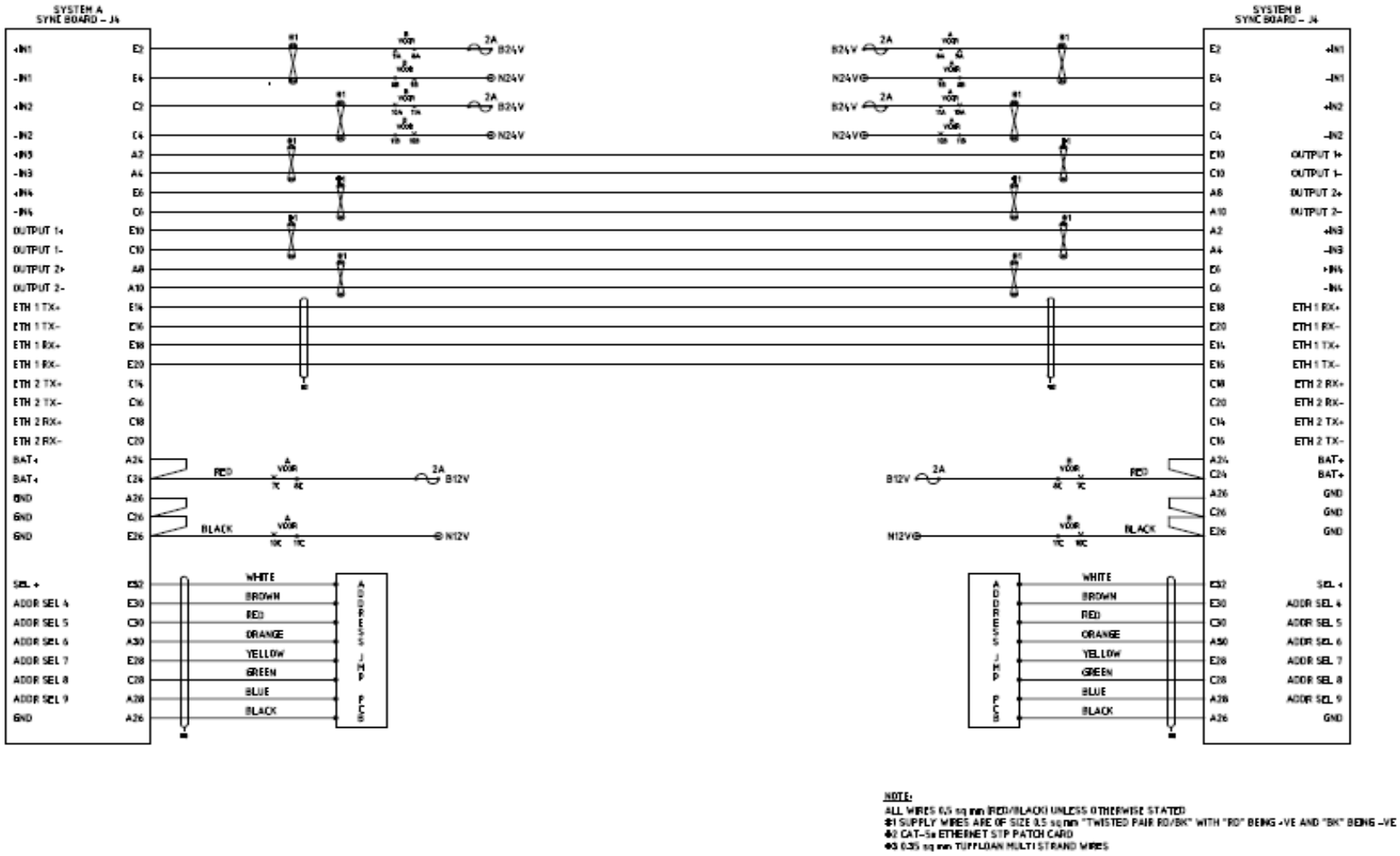
One unit of each synchronized pair is identified as the on-line unit and the other unit is identified as the off-line unit. Each MICROLOK II unit monitors the state of the other MICROLOK II unit via the synchronization Ethernet link and the physical I/O on the Synchronization PCB. Both units deliver synchronized physical outputs so that if one unit is disabled (due to a system reset, power down or other error condition), the internal and output states remain unchanged and control will transfer to and seamlessly continue with the second unit.

The Synchronization PCB contains its own microprocessor, has four vital isolated inputs, two vital isolated outputs, and other I/O circuitry in order to interface with two independent MICROLOK II units.



SYNC I/O PCB Front Panel

TYPICAL SYNC I/O PCB WIRING CIRCUIT

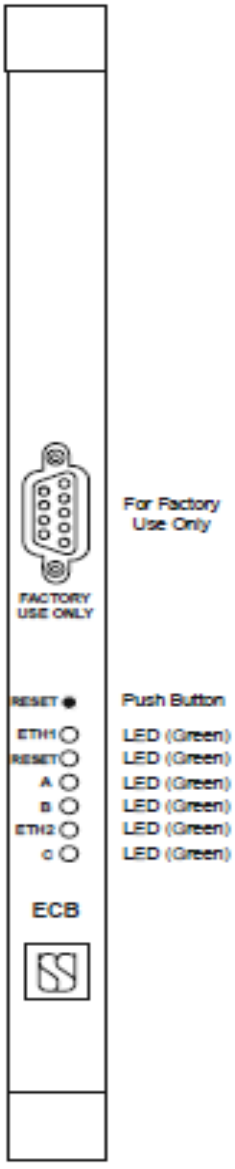


NOTE:
ALL WIRES 0.5 sq mm (RED/BLACK) UNLESS OTHERWISE STATED
#1 SUPPLY WIRES ARE OF SIZE 2.5 sq mm "TWISTED PAIR RD/BK" WITH "RD" BEING +VE AND "BK" BEING –VE
#2 CAT–5e ETHERNET STP PATCH CARD
#3 0.35 sq mm TUFFLOAN MULTI STRAND WIRES

15.2. COMMS PCB

The Communication PCB allows a MICROLOK II system to connect directly to an Ethernet network by means of two Ethernet ports. The Ethernet ports may be used individually for different communication links or may be paired on the same link for use as a redundant network.

The Communication PCB plugs into a MICROLOK II cardfile linking the MICROLOK II CPU Board to external equipment via two Ethernet ports. The Communication PCB contains its own microprocessor.



COMMS PCB Front Panel

15.3. Communication Equipments utilized for MLK II Hot standby system

15.3.1. MOXA IKS-6726 (Modular Rackmount Ethernet Switch)

The IKS-6726 series of industrial rack mount Ethernet switches are designed to meet the rigorous demands of mission critical applications for industry and business, such as traffic control systems (NEMA TS2) and maritime applications. The IKS-6726's Gigabit and fast Ethernet backbone, redundant ring, and 24/48 VDC. The modular design of the IKS-6726 also makes network planning easy, and allows greater flexibility by letting you install up to 24 fast Ethernet ports.

Type	Make	Power Consumption	Data Supported	Operating Temperature
IKS-6726	MOXA	26 Watts	Ethernet data (Fiber/Copper)	-40 to + 75°C

15.3.2. MOXA EDS 408A/405ASeries (Managed Ethernet Switches)

The EDS-405A/408A are entry-level 5 and 8-port managed Ethernet switches designed especially for industrial applications. The switches support a variety of useful management functions, such as Turbo Ring, Turbo Chain, ring coupling, port-based VLAN, QoS, RMON, bandwidth management, port mirroring, and warning by email or relay. The ready-to-use Turbo Ring can be set up easily using the web-based management interface, or with the DIP switches located on the top panel of the EDS-405A/408A switches.

Type	Make	Power Consumption	Data Supported	Operating Temperature
EDS-405A/408A	MOXA	8 Watts	Ethernet data (Fiber/Copper)	-40 to + 75°C

15.3.3. MOXA EDS-305/308 Series (Un Managed Ethernet Switches)

The EDS-305/308 switches are 5-port and 8-port Ethernet switches that provide an economical solution for your industrial Ethernet connections. The built-in relay warning function alerts network engineers when power failures or port breaks occur, and the switches are designed for harsh industrial environments, such as in hazardous locations (Class I, Div.

2/ATEX). The switches comply with FCC, TÜV, UL, and CE standards. The EDS-305/308 switches are available with a wide operating temperature range from -40 to 75°C. Both models undergo a 100% burn-in test to ensure that they fulfill the special needs of industrial automation control applications. The EDS-305/308 switches can be installed easily on a DIN-Rail or in a distribution box.

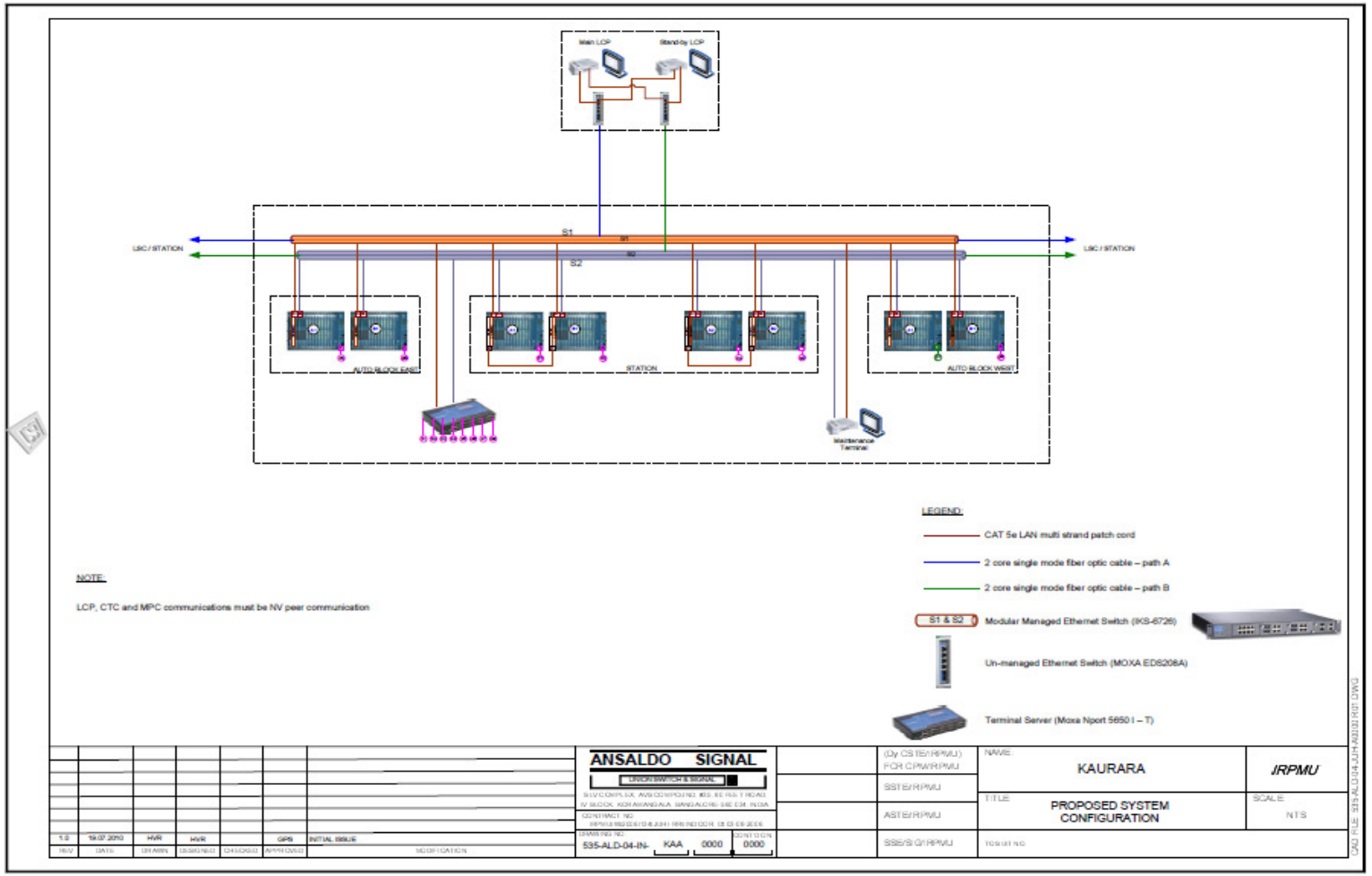
Type	Make	Power Consumption	Data Supported	Operating Temperature
EDS-305/308	MOXA	8 Watts	Ethernet data (Fiber/Copper)	-40 to + 75°C

15.3.4. MOXA EDS 208A/205ASeries (Un Managed Ethernet Switches)

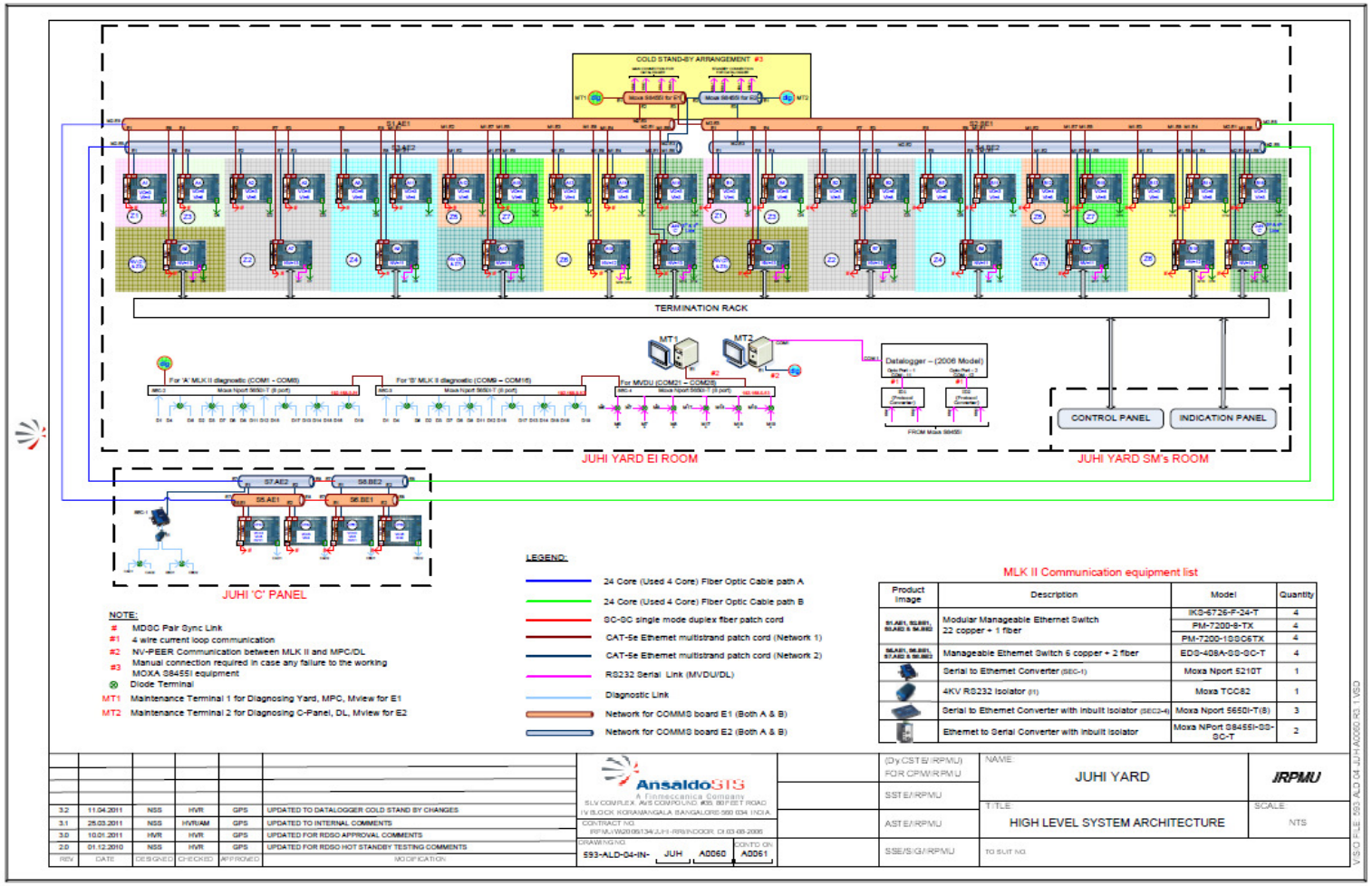
The EDS-205A/208A series are 5 and 8-port industrial Ethernet switches that support IEEE 802.3 and IEEE 802.3u/x with 10/100M full/half-duplex, MDI/MDI-X auto-sensing. The EDS-205A/208A switches provide 12/24/48 VDC (9.6 to 60 VDC), 18 to 30 VAC redundant power inputs that can be connected simultaneously to live AC/DC power sources. These switches have been designed for harsh industrial environments, such as in maritime (DNV/GL) or hazardous locations (Class I Div. 2, ATEX Zone 2) that comply with FCC, TUV, UL, and CE standards.
The EDS-205A/208A switches are available with a wide operating temperature range from -40 to 75°C. All models are subjected to a 100% burn-in test to ensure that they fulfill the special needs of industrial automation control applications. In addition, the EDS-205A/208A switches have DIP switches for enabling or disabling broadcast storm protection, providing another level of flexibility for industrial applications.

Type	Make	Power Consumption	Data Supported	Operating Temperature
EDS-205A/208A	MOXA	6 Watts	Ethernet data (Fiber/Copper)	-40 to + 75°C

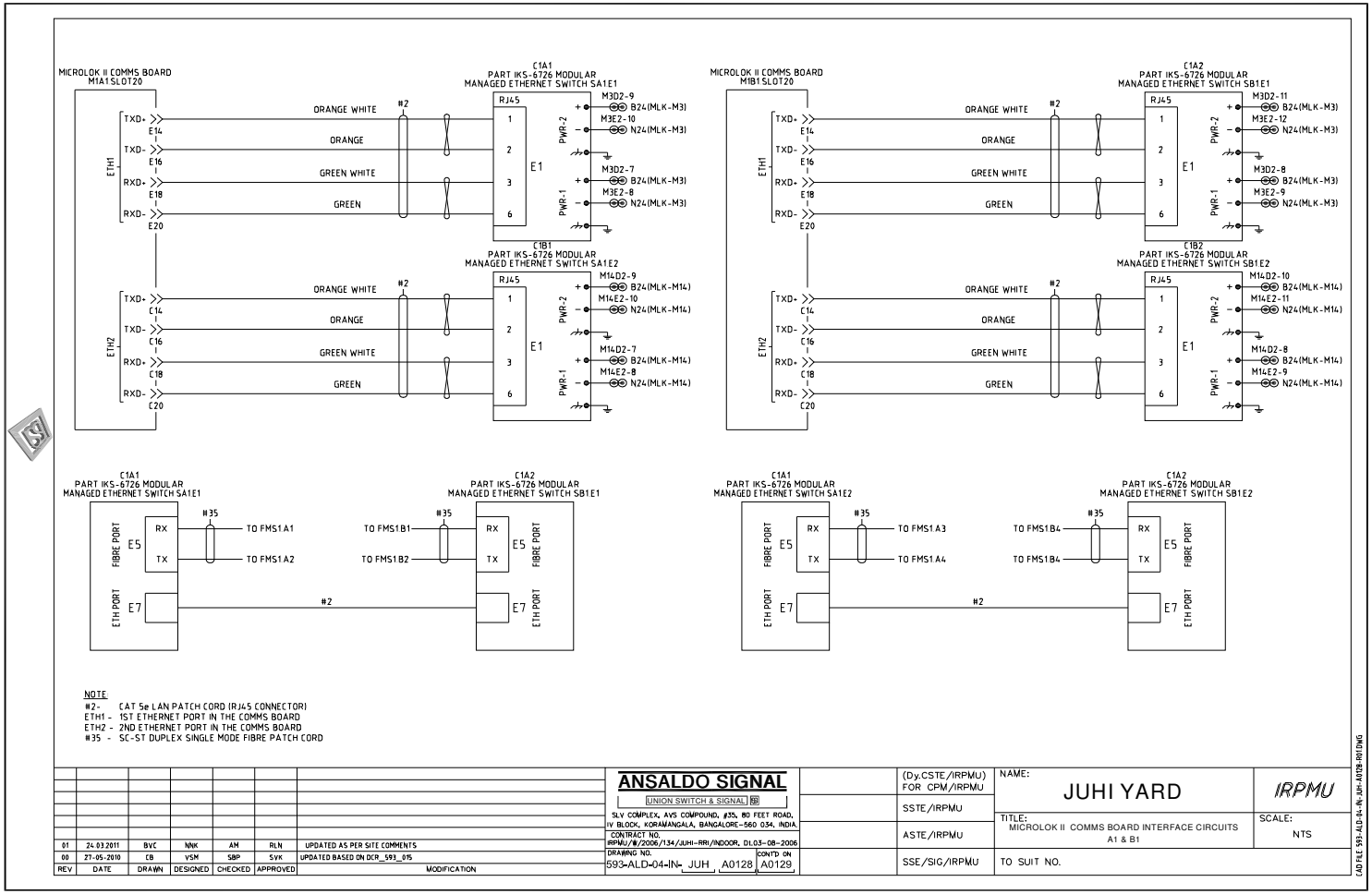
15.4. Typical SYSTEM Configuration using COMMS & SYNC Board 2+2 MLK II (HOT STANDBY SYSTEM)



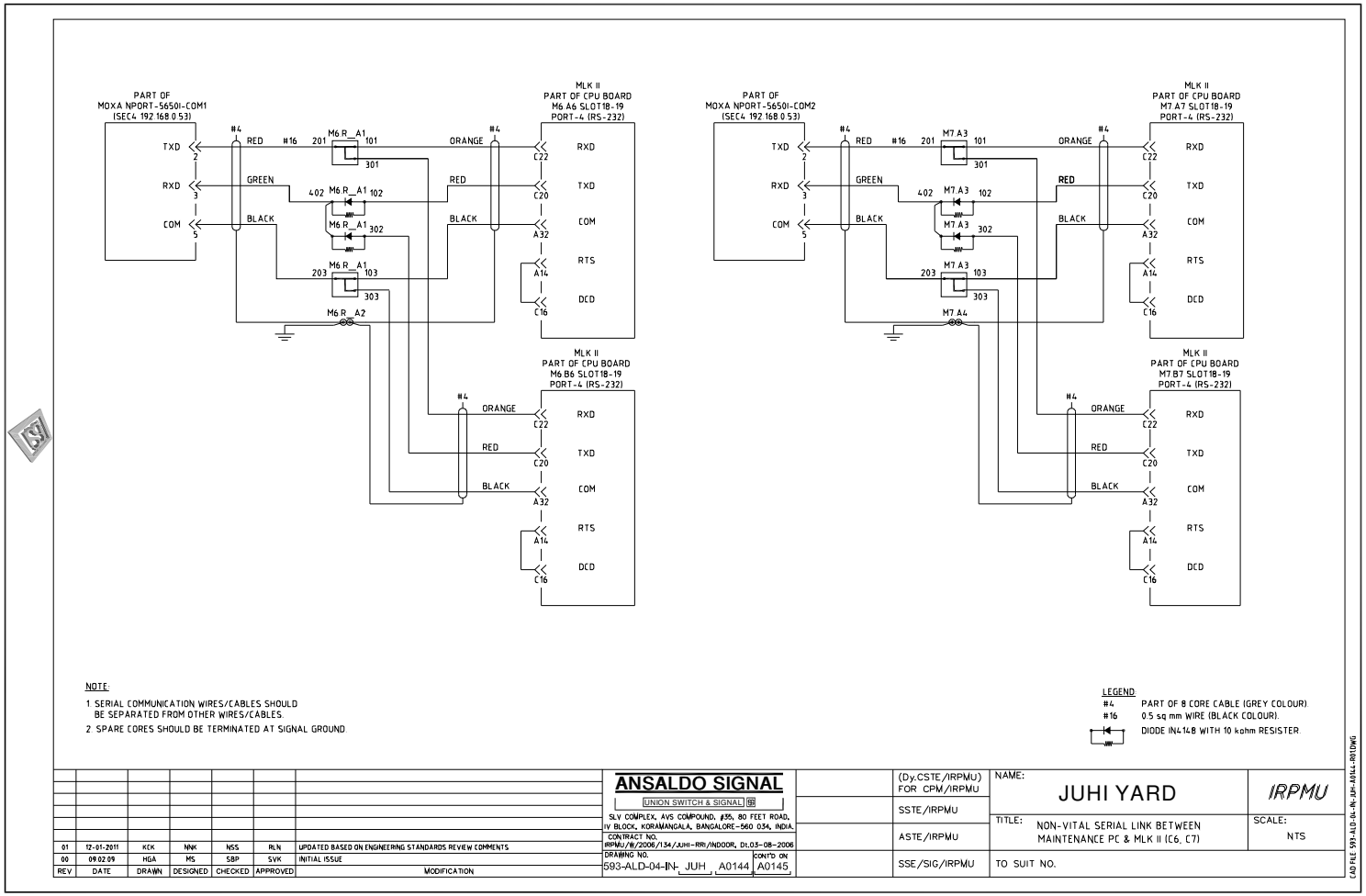
15.5. Typical SYSTEM Configuration using COMMS & SYNC Board JUHI YARD (HOT STANDBY SYSTEM)



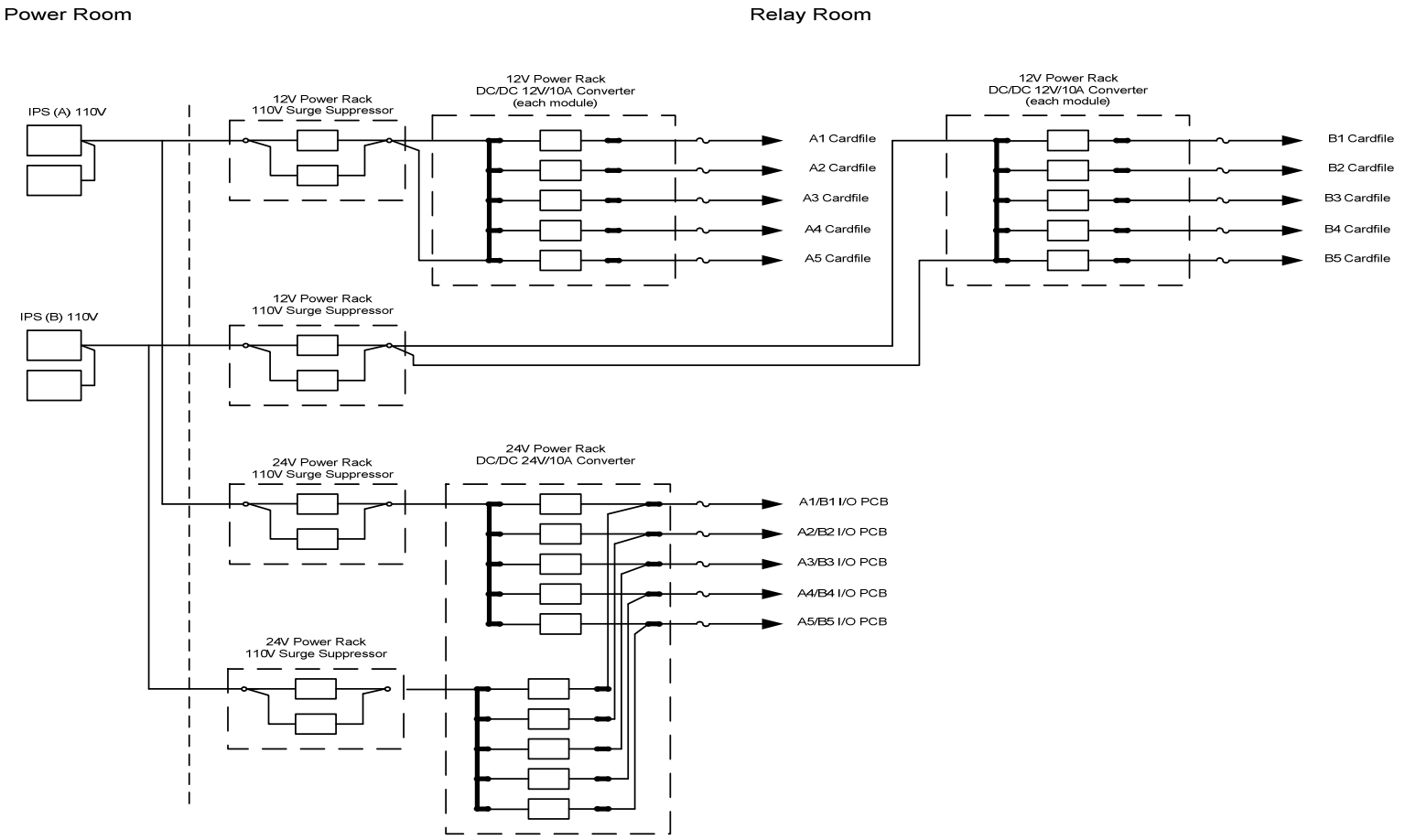
15.6. Typical wiring circuit between COMMS PCB using MOXA Ethernet switch



15.7. Typical wiring between M.VDU and MLK II using MOXA



15.8. Typical 12V & 24V Power distribution circuit for (MDSC)



16. PRE-COMMISSIONING CHECK LIST FOR ELECTRONIC INTERLOCKING MICROLOK-II

Name and Type of Equipment:	**Specification No:** Draft_Rev.4.0
Name and Address of manufacturer / supplier: Union Switch & Signal Pvt Ltd., #1, Ist Main Road, Suddaguntepalya DRC Post, Ward No 63, Bangalore – 560 029	**Serial number of the equipment:**
Station / Section / Yard Name:	**Division / Zonal Railway:**
Executive Software CRC checksum: Checksum: 705A Executive Software Version: CC 3.0 CRC : 564A	**Application Software checksum (MLK II Unit specific in that Station /Section/ Yard):**

Reference Documentation:

UM6800A Functional Description of Microlok II Revision 1.2 released in Oct 2004.
UM6800B Micorlok II Installation Revision 2.1 released in Jul 2011.
UM6800C Microlok II Startup and Maintenance Revision 1.2 released in Sep 2004.
UM6800E Microlok II trouble shooting and Recovery Revision 1.2 released in Aug 2004.
SM6800K Microlok II Network protocol and Networking Hardware released in Mar 2004.
1D1.0026 Communication PCB rev2 released in Oct 2009.
1D1.0027 Synchronization PCB rev3 released in Nov 2009.
1D1.0029 - Communication PCB Software Rev1 released in Mar 2010.
1D1.0030 - Synchronisation PCB Software Rev2 released in Apr 2010.
Interface Circuit documentation for specific Station / Section / Yard.

Note: The installation practices should be strictly adhered and be checked before commissioning covering all points in the following table:

Si.no.	Check Points	Requirement	Observed Result OK / Not OK / NA	Remarks	
				ASTS Rep.	Rly. Rep.
Type of Inspection: Visual / Measurement					
01	Earthing / Surge & lightning Protection for EI system	Follow the RDSO/SPN/197/2008 for "Code of practice for Earthing of signalling Equipments" issued by RDSO on 19.09.2008.			
02	Grounding	The EI racks Which are having Epoxy coating will be provided with copper foil. (All new rack come without Epoxy coating)			
		Shielded cable between termination rack and control panel is to be properly grounded at the termination side.(Applicable when the EI room and panel room are in different building)			
03	Foundations and insulation bases for racks and panels	Check whether the foundation for panel, Microlok II and other racks are firm, straight and permissible height.			
04	Visual inspection on Microlok II rack	Check whether the fan trays are connected/mounted properly (Exhaust direction).			
		Check whether free space is available in the rack for maintenance.			
		Check Proper modules are inserted as per the Interface circuits.			
05	Visual check of card file back plane	Check for proper mounting of EEPROM PCB on CPU card and Address Select PCBs on all I/O cards.			
		Check for 48/96pin connectors are fixed as per I/O circuits.			

		Check for neat wiring harness.			
		Check for correct jumper settings on the Address select PCBs as per the I/O Boards configuration of the Station.			
		Check whether input and output cables from the cards are routed separately.			
06	Visual check of all boards	Unpack all the boards from their covers and check whether the boards are inspected by RDSO. Check for RDSO inspection stamp on the board.			
		Visually check all the boards for their neat finish and plug them in the card file.			
		Check whether all the cards are mating with the top 48/96 pin connector properly for each card insertion.			
		Note down the serial number and part number of each board.			
07	Keying plug fixing	Check whether keying plugs are inserted in the correct location for the cards that are being inserted in each slot as per interface circuits.			
08	Card file/boards dust cover	Check whether card file motherboard cover is intact at the back plane.			
		Fix the 1 wide blank facia panels in the unused slots.			
09	48/96 Connector pin locking	Check whether the 48 and 96 pin connector hoods are properly fixed to the card files.			

10	EEPROM wiring	Check the EEPROM PCB wiring to the 48-pin connector in CPU board slot 18 and19.			
11	CPS – CPU 250 Hz wire	Check whether 250Hz wire from CPU board is connected to Power supply board.			
12	System power wiring	Check whether system power wiring is done as per the interface circuits in terms of wire thickness, Phoenix terminal type and rigid connection.			
13	Interconnect cables routing	Check whether interconnect cables are routed properly.			
14	Panel cable routing	Check whether panel cable routing is done properly (as short as possible).			
15	Diode terminals for Outputs	Check whether diode terminals are provided for +ve vital output from Microlok II where twin relays or MDSC system are provided.			
16	Tranzorbs across output (Mlk II) relay coils	Check whether tranzorbs of specified make are installed properly across all relay coils that are driven by Microlok II.			
		Check the polarity of the tranzorbs for correctness.			
17	I/O wire routing	Check whether input cables (Blue & Black) are twisted pair from Microlok connector to the respective relay rack termination.			
		Check whether output cables (Red & Black) from diode terminals are twisted pair to relay coils.			
		Check whether the input, output and power cables are routed in different troughs. This should be maintained in Microlok II rack, cable trays, ladder arrangements and relay rack.			

		Check whether Transient voltage suppressor diode are provided across the input of EI supply (Part No 5KP16A or 6KZ16A), as shown in UM-6800B manual section 3.2.			
18	Visual check of Non-Vital board Protection box	Check whether proper mounting of Non-Vital board output line filter box, as given in UM-6800B manual, section 7.15. in case the operating panel room(SM's Room) and the equipment room (EI room) are located in two different building.			
19	VCOR wiring/Receptacles locking	Check the VCOR coil wiring and contact wiring are done as per the interface circuits of the station.			
		Check whether VCOR receptacles are inserted properly and the receptacles are locked in the base.			
20	FCOR Circuit	Check the FCOR coil wiring and contact wiring are done as per the interface circuits of the station.			
		Check the functioning of FCOR circuit.			
21	Relay type	Check whether the type of the relays inserted in the relay racks are as per the relay disposition chart given in the interface circuits. (Only metal to carbon plug in type Relays shall be used with Microlok-II).			
22	Fuses Terminals/Fuse ratings/Fuse fixing	Check whether fuse terminals are fixed with proper fuse ratings as per the interface circuits.			
		Check the mechanical dimensions of the fuseand Check whether the fuses are fits in the fuse holder properly and there is no loose connection.			
23	Terminals/connectors Tightness	Check whether the wire ends are crimped with correct size lugs and there are no loose connections at the terminals.			

		Check whether all the wirings in the terminals are properly lugged and securely tightened.			
		Ensure that there are no loose connections in any of the terminations.			
24	230V surge suppressor for Operator PC/Maintenance PC	Check whether OBO 230V surge suppressor is provided in PC power supply and check the wiring is as per interface circuits.			
		Check whether earth terminal of the OBO arrestor is connected to the REB in respective rooms.			
25	Visual check installation of surge protection equipment	Check whether surge protection placement is as much as close to the REB/SEEB, as given in UM-6800B manual, section 8.3.			
26	DC-DC Converter for MLK II system power (12V)	Check whether 12V DC-DC converters are provided with N+1 configuration (Required no. of Converters + 1) for Microlok II card file supply.			
		Check the wiring as per interface circuit.			
		DC-DC converter should not be Earthed.			
27	DC-DC Converter for MLK II I/O Boards & Panel power (24V)	Check whether 24V DC-DC converters are provided with N+1 configuration (Required no. of Converters + 1) for Microlok II I/O Board & Panel supply.			
		Check the wiring as per interface circuit.			
		DC-DC converter should not be Earthed.			
		Power supplies and wiring connection for vital input board and output board should be isolated from the other power supplies of EI.			

28	DC-DC Converter for RTC & Event Log Backup (5V)	Check whether 5V DC-DC converters are provided with N+1 configuration (Required no. of Converters + 1) for Microlok II RTC & Event Log Backup.(Not Applicable for Hot standby)			
		Check the wiring as per interface circuit.			
		DC-DC converter should not be Earthed.			
29	Serial port wiring	Check the serial communication cable wiring is done as per the interface circuits.			
		Check whether serial link cables are routed separately from both power and I/O wirings.			
		Check in all serial ports whether unused pairs of wires/extra wires are connected together and connected to signal common at both ends for best noise immunity(Should not be earthed).			
		Check whether one end of every serial cable shield is connected to rack earth.			
		Check the following standard serial/ Ethernet communication cable length does not exceed as mentioned below: RS232 – 15 meters (MLK II Port 3, Port 4 & Dig port) RS485 – 1000 meters (MLK II Port 1 & 2) Ethernet – 70 meters (Comms Board & PC LAN communication) In case the distance is exceeds the limit, then External Communication devices should be provided as per the interface circuits.			
		Check whether all the diagnostic ports are wired from Microlok II rack to Maintenance PC location and terminated in a box.			

30	Serial equipment location	Check whether the serial communication devices are properly placed and wired as per the interface circuits, between Microlok to Microlok, Microlok to OP.PC, Microlok to M.PC and Microlok to Data Logger.			
31	OFC Equipment/ Fiber cable	Check the gain of OFC equipment optic power without Outdoor OFC (TX End) & with Outdoor OFC (RX End).			
		Check whether redundant path arrangement is working properly (i.e., seamless transfer of one fiber path to the other fiber path).			
		Check whether OFC between SER to SER/LSC/SM's Room is laid in independent trenches having different entries to those rooms.			
		Check whether OFC is laid using HDPE pipe.			
		Check whether the one end of the armored OFC cable earthed.			
		Check whether the Optical Time Domain Reflector (OTDR) Report is done for each and every fiber core after the splicing (Fusion Splicing) the fiber.			
32	230V AC Connection	Check whether 230V supply cable for Operator/Maintenance PC is routed properly and is kept away from I/O cables and serial communication cables.			
33	Isolator	Check whether Isolator is provided between Microloks , Microlok to OPC / MPC / DL as per the interface circuits.			
34	Converter Cum Isolator switch settings	Check the converter/Isolator switch settings are as per the interface circuits.			

35	MLK II power supply wire routing	Check whether MLK-II power supply wiring is routed properly and is kept away from I/O wiring.			
36	Wire size for 12V, 24V & 110V supply	Check the wire size of the 12V, 24V & 110V supply connections between Microlok II racks as per the interface circuits.			
		Check whether the wire size of the power switching circuits (in case of warm standby) is as per the interface circuits.			
37	IPS connections	Check the power connections from the IPS room to the Microlok II rack and all equipments in the Signal Equipment Room (Relay Room)			
38	Fittings are adequately supported	Ensure that all the fittings in the racks are adequately supported and will withstand the vibration due to train movement.			
39	Labels/Markers/Ferrule/Heat shrink	Ensure that all terminations have markers and ferrules for their right connection.			
		Check whether gaskets are provided on the cable entry cut outs in the racks and cable trays.			
		Check whether correct labels are provided for all equipments/ terminals in all the racks as per interface circuit			
40	Block cable routings	Check Block cable routings are separated from other cables/wires.			
41	Axle/VFT/Misc. functions cable routings	Check Axle/VFT/Misc. functions cable routings are separated from other cables/wires.			
42	Switching circuit & wiring	Check the switching circuit and wiring as per the interface circuits.			

43	Insulators for Racks & Ladders	Check whether Racks are insulated from the floor.			
		Check whether Ladders are insulated from the Racks/walls.			
44	Lithium Battery CR2032 Panasonic CPU backup	Check whether Lithium battery CR2032 is installed on "BATT1" location in the CPU board is loaded with right polarity.			
45	24V or110V DC External supply for Fan supply	Check whether Fan is fed with separate 24V or 110V DC is connected External supply, as shown in UM-6800B manual section 14.			
46	MLK-II Fan input supply	Check whether Tranzorb (Part No 5KP30A) connected across the MLK-II Fan input supply.			
47	CPU jumper settings	Check the jumper setting on the CPU board. Check whether the jumpers are inserted as per the given of UM-6800B manual section 3.1.			
48	RTC Coin Battery jumper setting	Check whether RTC Coin Battery jumper JMP35 on the CPU board is set to ENABLE position 1-2, as given in UM-6800B manual section 3.1 Fig-2.			
49	Voltages at IPS/MLK II	After switching on the Power, check the voltages at the IPS terminals & at the respective Microlok II power terminals and ensure that all the Microlok II card file power terminals have minimum 13.5 – 15.5V DC.			
		Ensure that the 24V I/O supplies at respective Microlok II terminals are between 25 - 27V DC after the VCOR has picked up.			
50	Voltages in respect to earth for every Bus	Ensure that there is no steady voltage recorded when connected to different bus polarity.			

51	Application Program Upload	Load the application data in all the CPU boards one by one as per the procedure given in UM-6800C manual section 5.9.			
		If all the Microloks are up, switch them off all. Remove the CPU card from each Microlok card file and set jumpers JMP20 - JMP23 to position 1-2 (after uploading the service version of Application program) in the Station/Section/Yard.			
52	Yard layout and its indications on Control cum indication panel, VDU and MT	Check the yard layout on CCIP/VDU/MT whether it is according to the approved signalling plan.			
53	VDU Active flashing indication	Check the RGY colour bar on the right hand top corner of the VDU screen is flashing in sequence. The flashing of this indication depicts that the VDU is active.			
54	Password protection for Emergency operation	Check from VDU that all emergency operations are protected with password.			
55	Check-sum & CRC	Check the Check-sum & CRC of the Executive Software. version : CC 3.0 Check-Sum : 705A CRC : 564A			
		Check the Check-sum & CRC of the Application Software			
56	Connectivity with External Datalogger (If provided)	Check the RDSO approved Datalogger should be connected to EI and events are logged in chronological order with time stamp.			
		Set the RTC and check the RTC of all microloks are synchronised by Datalogger RTC			

Below checklists are applicable only where Hot-standby(MDSC) is provided					
57	SYNC PCB & COMMS PCB	Check every cardfile is provided with both SYNC PCB & COMMS PCB as per Interface requirements.			
		Check whether SYNC I/O PCB and COMMS Board address select PCB jumper settings are set as per compiler listing file (.mll)			
		Check all the Ethernet ports in Sync & COMMS PCB are wired as per interface circuits			
58	Power-Up Delay	Ensure that, one system ("A" System) Power-Up Delay (PUD) is set to fast mode and its partner system ("B" System) is set to slow mode.			
59	SYNC I/O board wiring	Ensure that, SYNC I/O board wiring between MLK II is done as per the Interface circuits			
		Check whether CAT 5e Ethernet patch card (Twisted Pair) is used for between SYNC I/O boards Ethernet communication wiring.			
		Check whether the IP address specified on the Sync I/O board & COMMS I/O board for both systems are as per the Address mapping table.			
60	Duplicated Power supply	Check 12V modules for Cardfile supply is wired separately for Systems A and B. i.e One pair for System A and another pair for System B			

		Check bus bars from IPS room to relay room for MLK II power is duplicated i.e single failure (wire cut) should not affect system availability			
61	Quarantine switch setting	Ensure that, all Sync boards are not in quarantine mode (i.e Quarantine switch is set in “NO” Position).			
62	Maintenance Tool	Check MLK II Maintenance PC is installed with MLK 3.0 version of maintenance tool.			

Note: i) All external circuit (from relay room internal relay rack to field gears) should have double cutting provision.
ii) Consignee/Railway is advised to carryout recommended tests given in “section B” of Acceptance test format SIP-0712 of RDSO before the commissioning of the system.

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