

**2 X 350 MW PIPAVAV CCPP**

**VOLUME : IIB**


**LV SWITCHGEAR**

**TECHNICAL SPECIFICATION  
FOR  
NETWORKING HARDWARE FOR NUMERICAL RELAYS**

**SPECIFICATION NO.: PE-TS-292-506-E002, Rev. 00**



**BHARAT HEAVY ELECTRICALS LIMITED  
POWER SECTOR, PROJECT ENGINEERING MANAGEMENT  
NOIDA 201301**

	<b>2 X 350 MW PIPAVAV CCPP LV SWITCHGEAR</b>	<b>Doc. No. PE-TS-292-506-E002</b>	
		<b>Volume IIB</b>	<b>Section</b>
	<b>TECHNICAL SPECIFICATION FOR NETWORKING HARDWARE FOR NUMERICAL RELAYS</b>	<b>Rev. : 0</b>	<b>Date : 10.08.11</b>
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## PREAMBLE

- 1 The Tender documents contain three (3) volumes. The bidder shall meet the requirements of all three volumes.

### 1.1 VOLUME - I : CONDITIONS OF CONTRACT

This consists of four parts as below:

**Volume – IA:** This part contains Instructions to bidders for making bids to BHEL.

**Volume – IB:** This part contains General Commercial Conditions of the Tender & includes provision that vender shall be responsible for the quality of item supplied by their sub-vendors.

**Volume – IC:** This part contains Special Conditions of Contract.

**Volume – ID:** This part contains Commercial Conditions for Erection & Commissioning site work, as applicable.

### 1.2 VOLUME – II TECHNICAL SPECIFICATIONS

Technical requirements are stipulated in Volume – II, which comprises of:-

**Volume – IIA** General Technical Conditions.

**Volume – IIB** Technical Specification including Drawings, if any.

### 1.3 VOLUME – IIB

This volume is sub-divided in to following sections:-

**Section – A:** This section outlines the Intent of Specification.

**Section – B** : This section provides “Project Information”.


**Section – C:** This section indicates Technical Requirements specific to Contract, not covered in Sec-D.

~~**Section – D:** This section comprises of Tech. Spec. of equipment complete with Data Sheets A and C.~~

**Data Sheet-A:** Specific data and other requirements pertaining to the equipment.

**Data sheet–B:** Indicates data / documents to be furnished along with bid/offer.

**Data sheet–C:** Indicates data / documents to be furnished after the award of Contract as per agreed schedule by the vendor (as applicable)

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## SECTION – A


### SCOPE OF ENQUIRY

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## **SECTION- A**


### **SCOPE OF ENQUIRY**

- 1.0 This specification covers design, engineering, manufacturing, assembly, inspection & testing, proper packing, supply, transportation of equipment and successful installation at site of LV numerical relay interface system as mentioned in different sections of this specification, complete with all accessories for efficient and trouble-free operation of 2 X 350 MW combined cycle power plant proposed at Pipavav in Gujarat.
- 2.0 It is not the intent to specify completely herein all details of the design and manufacture. However, the equipment shall conform in all respects to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation up to bidder's guarantee.
- 3.0 The general terms and conditions, instruction to bidders and other attachment referred to elsewhere are hereby made part of the Technical Specification.
- 4.0 The Bidder shall be responsible for and governed by all requirements stipulated hereinafter.
- 5.0 For every shipment made, a shipping list containing item reference [item number and description as per specification Bill of material or package drawing] and quantity of the same [in nos./ weight] shall be provided by vendor at the time of dispatch of material.
- 6.0 Deviation if any should be brought out very clearly on deviation sheet enclosed with the specification only. Otherwise it will be presumed that the bidder's offer is in line with what has been stated/ asked for in this specification.
- 7.0 The documents shall be in English language and MKS system of units.

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## SECTION – B

### PROJECT INFORMATION

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## SECTION – C

### SPECIFIC TECHNICAL REQUIREMENTS

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## 1.0 SCOPE

1.1 The scope shall include design, engineering, manufacturing, assembly, testing, inspection and testing, packing, supply, transportation of equipment and successful installation of **“Networking Hardware for Numerical Relays”** and associated equipment and services:

- Ethernet Switch
- Serial servers
- Fibre Optical Cables and
- Twisted Paired copper cable (Cat-5E)
- Light interface units
- Patch cards
- Multi drop connectors
- Lugs and glands
- Connecting terminals
- Software Drivers
- Special tools and tackles
- Any other item not listed above, however required for the completeness of the system.


## 2.0 GENERAL CONFIGURATION:

1.1 **Networking Hardware for Numerical Relays** are required for communication between DCS and LT switchgear relay for communication of analog signals (i.e. metering data of LT Switchgear PMCCs / PCCs Incomers & bus couplers). Metering data required to be communicated with DCS includes analog signals viz. voltage, current, power, frequency, energy etc.

1.2 Networking Hardware for Numerical Relays shall comprise 01 no. Ethernet switch, 07 nos. Serial servers, Fibre optical cables, Twisted Paired copper cable (Cat-5E). The basic configuration diagram of the same shall be as per annexure-B.

1.3 Total 07 nos. serial Servers shall be provided for communication between DCS and LT switchgear for entire Plant. One number Serial server shall be installed in each switchgear rooms i.e. Module-I switchgear room, Module-II Switchgear Room, CW PH PMCC room, RO/DM CLW PH PMCC room, Electrochlorination plant MCC room, New water system & common service PMCC room and Fire water MCC room. Serial Servers shall be suitable for conversion of MODBUS – TCP/IP protocol to MODBUS RTU protocol.



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- 1.4 Each Serial Server shall be connected to no. of numerical relays of LT Swgr. Each Serial Server switch shall have minimum two RS485 ports suitable for Twisted Paired copper cable (Cat-5E) from LV Switchgear Numerical Relays to DCS. Each Serial Server switch shall also have minimum two numbers of RJ45 ports suitable for Twisted Paired copper cable (Cat-5E) / Fibre Optical cables between Serial Servers to Ethernet Switch. Further each Ethernet switch shall have minimum two nos. spare terminals (1 no. with RS485 port, 1 no. RJ45 port suitable for Twisted Paired copper cable (Cat-5E) & n no. suitable for FO cable connection).
- 1.5 Connection from relay RS485 port to Serial Server shall be through twisted pair Cu cable (CAT-5E) for a distance less than 100M.
- 1.6 Each Serial Server shall be connected to Ethernet Switch (located in Module-I switchgear room / CER) via Twisted Paired copper cable (Cat-5E) where distance is less than 100 meters and by means of Armoured fibre optic cable for a distance greater than 100M.
- 1.7 Each node of connecting Serial Server / Ethernet switch to DCS with fibre optical cables shall be provided with Light Interface Unit (LIO) and patch card as applicable.
- 1.8 Armored Fibre Optical cable routing from Serial Servers located in offsite building switchgear rooms to Ethernet switch of Module-I switchgear room / CER shall be routed through cable tray designated for signal cables.
- 1.9 Each twisted pair cable connecting relay to Serial Server shall be routed through cable tray designated for signal cables or through conduits as applicable.
- 1.10 Serial Servers / Ethernet switches shall be of suitable wall mounted type/ placed at LT switchgear auxiliary equipment panel / mounted on rack.

### 3.0 OPERATING MECHANISM

- 3.1 Communication from LV Switchgear Numerical relay to Serial Servers, from Serial Servers to Ethernet switch and from Ethernet Switch to DCS shall be through Modbus-TCP/IP protocol.
- 3.2 Configuration shown in Annexure-B, RS485 port of numerical relays will be connected in a multidrop configuration. Ethernet switch shall be connected with DCS gateway computer by means of copper cable.
- 3.3 The communication between numerical relays and DCS is based on MODBUS serial protocol for acquiring analog parameters only.
- 3.4 Each Serial Server shall have unique IP address. IP address of each numerical relay and of Serial Servers shall be configured at DCS. The communication port of each Serial server shall be connected to a group of numerical relay.
- 3.5 Data from each relay shall be auto fetched by DCS. Data acquisition from any specific relay shall be through IP address of serial server followed by cop port no. & specific address configured of different relays in DCS.

<div><div>बी एच ई एल</div><div><div>बी एच ई एल</div><div>BHEL</div></div></div>	2 X 350 MW PIPAVAV CCPP	Doc. No. PE-TS-292-506-E002	
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### 3.0 **CODES AND STANDARDS:**

- 3.1 The equipment covered by this specification shall be designed, constructed and tested in accordance with the latest revisions of applicable IEC / IEEE/IS standards.

### 4.0 **Tests**

- 5.1 Bidder to indicate the list of equipment tests & site tests required at manufacturer works and at site.
- 5.2 Successful vendor shall demonstrate functioning of LV Numerical Relay communication interface system.


### 6.0 **DOCUMENTS REQUIRED ALONG WITH TECHNICAL OFFER & DOCUMENTS REQUIRED AFTER THE AWARD OF LOI**

- a] Filled in Data Sheet –B/C.
- b] Technical leaflet/ catalogue.
- c] General Arrangement drawing of various items indicated in Networking Hardware for Numerical Relays showing various dimensions etc.
- d] Architectural drawings for LV Numerical Relay communication interface system.
- e] Tests certificates indicating key test results, clause & standard reference, date and place of testing.
- f] Write up on operating mechanism of LV switchgear numerical relay interface.
- g] Schedule of special tools and tackles. (Unprice)
- h] Field quality plan.
- i] Reference list.

The vendor after LOI shall submit drawings/ documents in requisite no. of copies as indicated in attachment-IV (“Documents/Drawings distribution schedule”).

### 7.0 **SPECIAL TOOLS AND TACKLES**

- a) Bidder shall offer one set of unused special tools and tackles which are required for erection, assembly, adjustment and maintenance of “Networking Hardware for Numerical Relays”.
- b) These tools and tackles shall be separately packed and sent to site prior to assembling of cranking switch.

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c) List of tools and tackles, along with quantity shall be furnished as a part of technical offer.

## 8.0 O & M MANUAL


The vendor shall submit after award of LOI, O & M manual for approval. Final O & M manuals shall be properly bound.

The instruction manual shall contain full details and drawings of all equipment furnished, the storage procedures, testing procedures, operation and maintenance procedure of the equipment.


The operating and maintenance instructions of the equipment shall be in sufficient details to enable the owner to maintain, dismantle, reassemble and adjust all parts of the equipment. They shall give step by step procedures for all operations likely to be carried out during the life of the plant/ equipment including testing, operation, maintenance, dismantling, repair and assembly. Each manual shall include a complete set of approved drawings together with performance/ rating curves of the equipment and test certificate wherever applicable.

The instruction manual shall also include the spare part catalogue for all equipment. A separate section of the manual shall be for each size/ type of equipment and shall contain a detailed description of construction and operation, together with all relevant pamphlets, drawings and list of parts with procedure for ordering spares. Maintenance instructions shall include charts showing lubrication, checking, testing and replacement procedures to be carried out daily, weekly, monthly and at longer interval also to ensure trouble free operation. Where applicable fault location charts shall be included to facilitate finding the cause of mal-operation. A collection of Manufacturer's standard leaflet shall not be accepted as a compliance of this clause. The manual shall be specifically compiled for the concerned project.

9.0 Makes of various items such as serial Servers, Ethernet Switch fibre Optical Cables, twisted paired cables etc. shall be subjected to BHEL approval.

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**ANNEXURE-A TO SECTION – C**  
**(BILL OF QUANTITIES)**

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### **BILL OF QUANTITIES**


#### **ANNEXURE-A**

<b>S. NO.</b>	<b>DESCRIPTION</b>	<b>TOTAL QUANTITY</b>
1	ETHERNET SWITCH OF 16 CHANNEL (WITH TCP/IP PROTOCOL) FOR COMMUNICATION WITH SERIAL SERVERS & DCS GATEWAY COMPUTER AS PER SYSTEM REQUIREMENT	1 NO.
2	SERIAL SERVER SUITABLE FOR COMMUNICATION BETWEEN SEL NUMERICAL RELAY & ETHERNET SWITCH (WITH TCP-RTU PROTOCOL AND TCP-IP PROTOCOL) AS PER SYSTEM REQUIREMENT	7 NOS.
3	FIBRE OPTICAL CABLES FOR COMMUNICATION AS SHOWN IN ANNEXURE – B TYPICALLY (INCLUSIVE OF SUPPLY, LAYING AND TERMINATION ALONGWITH ANY HARDWARE REQUIRED AT EQUIPMENT SUPPLIED UNDER THIS PACKAGE)	2500 METERS
4	TWISTED PAIRED COPPER CABLES (TYPE – 5E)	2000 METERS
5	COMMISSIONING CHARGE FOR CABLE LAYING BETWEEN NUMERICAL RELAYS, SERIAL SERVER, ETHERNET SWITCH AND DCS.	LOT
6	SPECIAL TOOLS & TACKLES	LOT
7	E & C SPARES	BIDDER TO FURNISH QUANTITY & LIST
8	ENGINEERING CHARGES FOR COMPELETE NETWORKING HARDWARE FOR NUMERICAL RELAYS	LOT
8	ANY OTHER ITEM REQUIRED FOR COMPLETENESS OF SYSTEM	BIDDER TO FURNISH QUANTITY & LIST


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**DATA SHEET –A**

SL. NO.	PARAMETER	VALUE
<b>1.00</b>	<b>NUMERICAL RELAY PARAMETERS</b>	
	MAKE	SEL
	MODEL	751A
	PORT1	RJ45
	PORT3	RS485
<b>2.00</b>	<b>ETHERNET SWITCH</b>	
2.01	NOS. OF CHANNEL	16
2.02	CONNECTION TO SERIAL SERVER	Twisted Paired copper cable (Cat-5E) / FIBRE CABLE
2.03	CONNECTION TO DCS	Twisted Paired copper cable (Cat-5E)
2.04	PROTOCOL BETWEEN EATHERNET SWITCH & SERIAL SERVER	MODBUS TCP/IP
2.05	PROTOCOL BETWEEN EATHERNET SWITCH & DCS	MODBUS TCP/IP
<b>3.00</b>	<b>SERIAL SERVER</b>	
3.01	TYPE	Compatible for receiving multiple signals from numerical relays & can communicate with DCS via Ethernet switch
3.02	CONNECTION TO LV NUMERICAL RELAYS	Twisted Paired copper cable (Cat-5E)
3.03	CONNECTION TO EATHERNET SWITCH	Twisted Paired copper cable (Cat-5E) / FIBRE OPTICAL CABLES
3.04	PROTOCOL BETWEEN LV NUMERICAL RELAYS & SERIAL SERVER	MODBUS TCP/IP. SERIAL SERVERS to be suitable for conversion of MODBUS TCP-IP Protocol to MODBUS - RTU
3.05	PROTOCOL BETWEEN EATHERNET SWITCH & DCS	MODBUS TCP/IP
<b>4.00</b>	<b>FIBRE OPTICAL CABLES</b>	
	MAKE	REPUTED
	ACCOCIATED EQUIPMENTS	LIGHT INTENSITY UNIT , PATCH CARDS, ETC.
<b>5.00</b>	<b>TWISTED PAIRED COPPER CABLE (CAT-5E)</b>	
	MAKE	REPUTED

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	NOS. OF PAIRS	AS REQUIRED
<b>6.00</b>	<b>MULTI DROP CONNECTORS</b>	
6.01	MAKE	REPUTED
6.02	TYPE	suitable for connecting min. 09 nos. of RS485 ports

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**DATA SHEET –B/C**

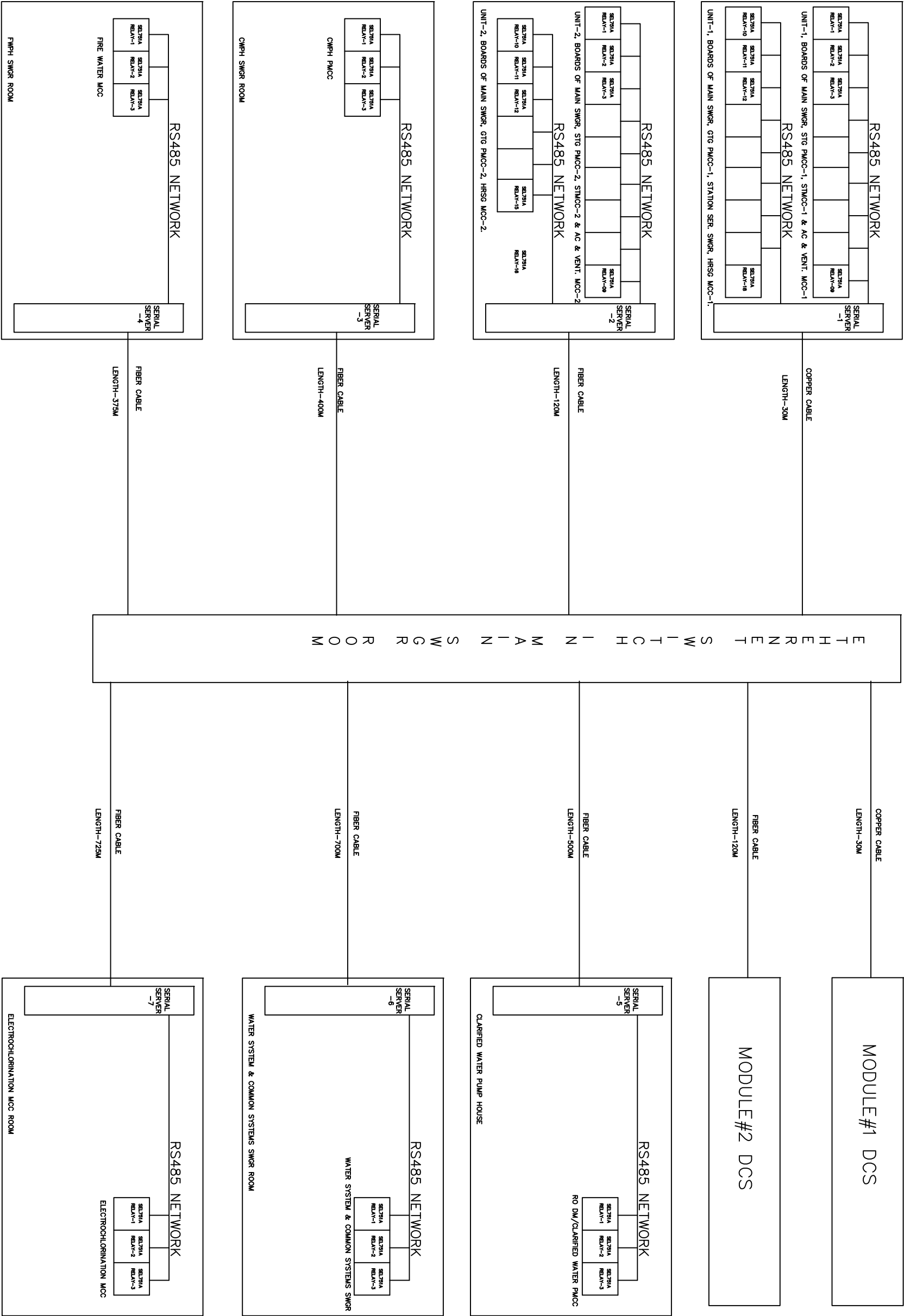
SL. NO.	PARAMETER	VALUE
<b>1.00</b>	<b>ETHERNET SWITCH</b>	
1.01	MAKE & MODEL	
1.02	TYPE	
1.03	NO. OF CHANNELS	
1.04	POWER REQUIREMENT	
1.05	CONNECTION TO SERIAL SERVER	
1.06	CONNECTION TO DCS	
1.07	PROTOCOL BETWEEN EATHERNET SWITCH & MOXA SERIAL SERVER	
1.08	PROTOCOL BETWEEN EATHERNET SWITCH & DCS	
1.09	DRIVERS (IF REQUIRED)	
1.10	MATERIAL	
1.11	DIMENSION	
1.12	WEIGHT	
1.13	INSTALLATION REQUIREMENT	
1.14	ANY OTHER SPECIFIC INFORMATION	
<b>2.00</b>	<b>SERIAL SERVER</b>	
2.01	MAKE & MODEL	
2.02	TYPE	
2.03	NO. OF CHANNELS	
2.04	POWER REQUIREMENT	
3.02	CONNECTION TO LV NUMERICAL RELAYS	
3.03	CONNECTION TO EATHERNET SWITCH	
3.04	PROTOCOL BETWEEN LV NUMERICAL RELAYS & MOXA SERIAL SERVER	
3.05	PROTOCOL BETWEEN EATHERNET SWITCH & DCS	
1.09	DRIVERS (IF REQUIRED)	
1.10	MATERIAL	
1.11	DIMENSION	
1.12	WEIGHT	
1.13	INSTALLATION REQUIREMENT	
1.14	ANY OTHER SPECIFIC INFORMATION	



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<b>3.00</b>	<b>FIBRE OPTICAL CABLES</b>	
3.01	MAKE	
3.02	MATERIAL	
3.03	OUTER DIA	
3.04	INSTALLATION REQUIREMENT	
3.05	ANY OTHER SPECIFIC INFORMATION	
3.06	ACCOCIATED EQUIPMENTS DETAILS (SUCH AS LIGHT INTENSITY UNIT , PATCH CARDS, ETC.)	
<b>4.00</b>	<b>TWISTED PAIRED COPPER CABLE (CAT-5E)</b>	
4.01	MAKE	
4.02	NOS. OF PAIRS	
4.03	TYPE OF CONSTRUCTION	
4.04	ANY OTHER SPECIFIC INFORMATION	
<b>7.00</b>	<b>Any other item not listed above,</b>  <b>Though required for the completeness of</b>  <b>the system</b>	

ANNEXURE-B



CONFIGURATION DIAGRAM OF LV NUMERICAL RELAY INTERFACE SYSTEM