





Plant CAUSTIC SODA	Client Punjab Alkali	Contract Code PACL	Document ID 0215-INS-11-EC-0002	Contract No. 66- 0215-700
	TECHNICAL SPECIFICATIONS FOR INDIVIDUAL CELL VOLTAGE MONITORING SYSTEM			
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<p>tkIS India / Vendor</p> <p>Category Codes (Submission Purpose)</p> <table style="width: 100%;"> <tr><td><input type="checkbox"/></td><td>1</td><td>For Approval</td></tr> <tr><td><input type="checkbox"/></td><td>2</td><td>For Review / Comments</td></tr> <tr><td><input type="checkbox"/></td><td>3</td><td>For Information</td></tr> <tr><td><input type="checkbox"/></td><td>4</td><td>For Engineering</td></tr> <tr><td><input type="checkbox"/></td><td>5</td><td>For Enquiry</td></tr> <tr><td><input type="checkbox"/></td><td>6</td><td>For Order Placement</td></tr> <tr><td><input type="checkbox"/></td><td>7</td><td>Final & Approved</td></tr> <tr><td><input type="checkbox"/></td><td>8</td><td>Released for Construction</td></tr> </table> <hr/> <p>Acceptance Codes (Approval Codes)</p> <table style="width: 100%;"> <tr><td><input type="checkbox"/></td><td>1</td><td>Approved</td></tr> <tr><td><input type="checkbox"/></td><td>2</td><td>Approved for Manufacturing / Fabrication with Comments as marked</td></tr> <tr><td><input type="checkbox"/></td><td>3</td><td>Not Approved / Resubmit</td></tr> <tr><td><input type="checkbox"/></td><td>4</td><td>Retained for Information / Records</td></tr> <tr><td><input type="checkbox"/></td><td>5</td><td>Reviewed</td></tr> <tr><td><input type="checkbox"/></td><td>6</td><td>Reviewed as Noted / Resubmit</td></tr> </table> <p>Remarks for AC2 : This marked-up drawings is hereby approved for fabrication / manufacturing and shall be re-submitted after revision. This drawing should be revised only to the extent of tkIS India / Owner / Client comments. Any other changes made by you will not be considered unless clearly highlighted in covering letter asking for approval.</p> <p>This approval / review does not absolve the supplier from the full responsibility for design and fabrication.</p> <p>Date : ___/___/____ Name : _____</p>	<input type="checkbox"/>	1	For Approval	<input type="checkbox"/>	2	For Review / Comments	<input type="checkbox"/>	3	For Information	<input type="checkbox"/>	4	For Engineering	<input type="checkbox"/>	5	For Enquiry	<input type="checkbox"/>	6	For Order Placement	<input type="checkbox"/>	7	Final & Approved	<input type="checkbox"/>	8	Released for Construction	<input type="checkbox"/>	1	Approved	<input type="checkbox"/>	2	Approved for Manufacturing / Fabrication with Comments as marked	<input type="checkbox"/>	3	Not Approved / Resubmit	<input type="checkbox"/>	4	Retained for Information / Records	<input type="checkbox"/>	5	Reviewed	<input type="checkbox"/>	6	Reviewed as Noted / Resubmit	<p>tkIS India / Owner / Client</p> <p>Category Codes (Submission Purpose)</p> <table style="width: 100%;"> <tr><td><input type="checkbox"/></td><td>1</td><td>For Approval</td></tr> <tr><td><input type="checkbox"/></td><td>2</td><td>For Review / Comments</td></tr> <tr><td><input type="checkbox"/></td><td>3</td><td>For Information</td></tr> <tr><td><input type="checkbox"/></td><td>4</td><td>For Engineering</td></tr> <tr><td><input checked="" type="checkbox"/></td><td>5</td><td>For Enquiry</td></tr> <tr><td><input type="checkbox"/></td><td>6</td><td>For Order Placement</td></tr> <tr><td><input type="checkbox"/></td><td>7</td><td>Final & Approved</td></tr> <tr><td><input type="checkbox"/></td><td>8</td><td>Released for Construction</td></tr> </table> <hr/> <p>Acceptance Codes (Approval Codes)</p> <table style="width: 100%;"> <tr><td><input type="checkbox"/></td><td>1</td><td>Approved</td></tr> <tr><td><input type="checkbox"/></td><td>2</td><td>Approved for Manufacturing / Fabrication with Comments as marked</td></tr> <tr><td><input type="checkbox"/></td><td>3</td><td>Not Approved / Resubmit</td></tr> <tr><td><input type="checkbox"/></td><td>4</td><td>Retained for Information / Records</td></tr> <tr><td><input type="checkbox"/></td><td>5</td><td>Reviewed</td></tr> <tr><td><input type="checkbox"/></td><td>6</td><td>Reviewed as Noted / Resubmit</td></tr> </table> <p>Date : ___/___/____ Name : _____</p>	<input type="checkbox"/>	1	For Approval	<input type="checkbox"/>	2	For Review / Comments	<input type="checkbox"/>	3	For Information	<input type="checkbox"/>	4	For Engineering	<input checked="" type="checkbox"/>	5	For Enquiry	<input type="checkbox"/>	6	For Order Placement	<input type="checkbox"/>	7	Final & Approved	<input type="checkbox"/>	8	Released for Construction	<input type="checkbox"/>	1	Approved	<input type="checkbox"/>	2	Approved for Manufacturing / Fabrication with Comments as marked	<input type="checkbox"/>	3	Not Approved / Resubmit	<input type="checkbox"/>	4	Retained for Information / Records	<input type="checkbox"/>	5	Reviewed	<input type="checkbox"/>	6	Reviewed as Noted / Resubmit
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PART-I

1. GENERAL

1.1 The single element voltage monitoring system shall measure and record all single element voltages of electrolyzer for caustic soda plants. This is done by means of distributed hardware for high precision voltage readings installed in the cell room.

1.2 **Part-I** covers the general requirements of Data Acquisition System, like scope of work of selected vendor, general hardware & software requirements, documentation, training requirements etc.

Part-II covers specific project requirements of the system.

Part-III covers the Input/output requirements.

Part-IV covers the Schematic diagram.

In case of conflict between **Part-I** & **Part-II** of the specifications, the specific requirements of **Part-II** shall govern.

1.3 This CVMS system shall be used to gather data from the individual cell voltages and display the same on a Computer for monitoring.

1.4 Scope of supply of Open Metallic Console for Computer used for monitoring is excluded from the vendors scope.

1.5 For Typical Wiring diagram refer individual cell voltage monitoring schematic diagram.

1.6 Total Electrolyzer qty = 6 Nos.



1.7 Data Acquisition Hardware (Analog Input cards, DAQ Controller System etc) will be located in Cell house outdoor in locally mounted panel. However, the PC based data acquisition system shall be located in the Existing control room approx.. 100 metres away. The connectivity shall be through Ethernet.

1.8 Longest Distance from field mounted CVMS panel to control room is approx. 100 mtrs.

1.9 PC shall have facility of signal trending.

1.10 At least 20% spare ports shall be available on Ethernet Switches. Vendor to provide wall mounted panel to install Ethernet switch(Field side). Ethernet switch shall be Industrial grade (Hirschmann/Cisco make). Power supply arrangement shall be made by vendor.

1.11 Single point UPS Supply of 110VAC will be provided up to the PDB panel which is in CVMS vendor scope of supply, further distribution of the power supply to Field mounted CVMS panels is in CVMS vendor scope.

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- 1.12 Vendor to configure dynamic excel reports for each electrolyzer where following parameters can be configured (Average Voltage, Average current, Max Current, Min current etc.)

2 VENDOR'S RESPONSIBILITIES

- 2.1 Vendor's responsibilities shall include, but are not limited to, the following:
- 2.1.1 System engineering
 - 2.1.2 Supply of system hardware and software for configuration, programming and monitoring purpose.
 - 2.1.3 System programming and configuration.
 - 2.1.4 Generation of logging history database, trends and reports, generation of logging reports and other management information reports.
 - 2.1.5 Factory acceptance test (FAT) and Site acceptance test (SAT).
 - 2.1.6 Packing and forwarding.
 - 2.1.7 Transport to site.
 - 2.1.8 Loop checking and commissioning.
 - 2.1.9 Commissioning of the unit with assistance from Client.
 - 2.1.10 Providing documentation in required number of sets during engineering and also As-built documents after commissioning.
 - 2.1.11 Providing training for client's maintenance personnel at project site.
 - 2.1.12 Ensuring hardware support (supply of spare parts) and software support for a minimum period of 10 years after commissioning.
 - 2.1.13 Preparation of specifications, procurement, inspection, erection, integration and commissioning of all bought out items, if any, included in vendor's scope of supply.

3 SYSTEM OVERVIEW

- 3.1 The data acquisition system shall have the following main components shown in the schematic diagram. Detailed specifications of each are as per Part-II of this specification. Overview is briefed below:
- 3.1.1 PC based HMI for configuration, programming and monitoring purpose.
 - 3.1.2 Data acquisition controllers (Controllers shall be installed in Locally mounted panels)
 - 3.1.3 Communication interfaces with PC based HMI.
 - 3.1.4 Analog input cards as per specification.
 - 3.1.5 System hardware cabinet shall be with purging arrangement. Hardware cabinets will be installed in Cell house outdoor.
 - 3.1.6 Interconnection cables, required by the system offered.
 - 3.1.7 Any other device needed to implement the requirements of this specification but not covered above (i.e. Ethernet switches, repeaters etc).

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4 FUNCTIONAL SPECIFICATIONS

4.1 Engineering cum Monitoring station

4.1.1 This shall be a PC based engineering and monitoring station with 22" TFT/LED monitor (Single screen), working on WINDOWS 7 / Latest operating system platform. PC should be work station grade PC installed on an open metallic console. The capacity of hard disk should be at least 500 GB.

4.1.2 The PC shall be loaded with configuration/ engineering/monitoring software.

4.1.3 Application software shall be capable of updating real time data.

4.1.4 The system shall have the following minimum fault diagnostics facility.

- CPU Fault
- Communication Fault
- I/O module faults
- Power Supply Faults

4.1.5 A3/A4 Combined Black & White LaserJet Printer 1No.

4.1.6 Speaker Set for Audible alarm (With standard alarm tones) 1 set.

4.2 Micro Controller

4.2.1 The DAS system shall be a microprocessor based programmable device. The same functionality may be implemented by micro controller as per the vendor's standard.

4.2.2 For all inputs alarms dead band shall be configurable.

4.2.3 A/D converter shall have a minimum resolution of 12 bits.



4.2.4 The system shall be modular in nature and shall support future expandability.

4.3 Scan Time and System cooling

4.3.1 All the input analog channels shall be scanned in parallel to get an overall scan time of 1 sec for all the channels per electrolyzer block (i.e. **120 channels per Electrolyzer**).

~~4.3.2 In case a forced cooling device like a cooling fan is provided, failure of the same shall be detected either directly or indirectly (through temperature sensor, common relay) and connected to DCS.~~

4.3.3 If volatile memory is present in the system, it shall be protected by battery backup with re-chargeable battery. In any case no system configuration shall be lost due to power failure.

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5 Specifications for Cabinet



5.1 Hardware Cabinet

- 5.1.1 These shall be used to terminate all field signal cables (minimum 122 wires per Electrolyser), communication and incoming power supply cables. Two pole MCB shall be provided to isolate the power supply. Power 'ON' indication shall be provided on the front door.
- 5.1.2 This shall be used to mount all hardware required by the system.
- 5.1.3 Dimensions & color of the cabinet shall be of good aesthetics. Dimensions shall be suitable to mount required hardware along with terminals and color of cabinets shall be RAL 7035.
- 5.1.4 Cabinet shall be provided with door locks, shield bus bar, earthing bus bar. The earthing bus bar shall be extended outside the cabinet for earthing.
- 5.1.5 Removable gland plates for all cables shall be provided at the bottom.
- 5.1.6 For prefabricated system cables between cabinets (Ethernet switch and repeaters), a separate gland plate with split holes & rubber grommets shall be provided. Bunching of cables and routing them through a single big cutout is not permitted.
- 5.1.7 Internal layout of the cabinet shall ensure that there is no overcrowding of components and maintenance access properly obtained. All components shall be mounted on front of the mounting plate. No component shall be mounted on the sides /gland plates.
- 5.1.8 Terminal strips shall be used for all external connections. Terminals for different voltages, feeder terminals, etc. shall be separated by means of adequate plates. Terminal strips shall be easily accessible and ferrules readable. Fused, quick disconnect terminals shall be used for all signal wires.
- 5.1.9 Following components shall be mounted on the panel in field and wired according to attached typical circuit diagram:
- Programmable logic controller (PLC) module
 - Analog input and output modules
 - Power supply unit
 - Terminal blocks, incoming fuses

The wiring shall be laid in plastic cables ducts and 20% spare space shall be provided.

5.2 Interconnection Cables

The hardware panels shall be mounted in field. The interconnection cables will run between Field & console room.

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6 INSPECTION

6.1 The system and all its associated components shall be inspected and tested at the vendor's works by Clients/tkIS (I) on 100% basis, with actual simulation of signals and the total system hooked up as per the specifications. All hardware required for inspection shall be arranged by the vendor.

6.2 Cost of inspecting/testing shall be borne by the vendor.



6.3 The inspection shall briefly envisage the following:

6.3.1 Hardware Inspection

- a. Checks on general workmanship like fabrication quality, paint quality, paint shade of the cabinet etc.
- b. Dimensional inspection for width, height, depth, mounting supports and gland plates etc.
- c. Power supply, wiring checks for fans, tube lights etc.
- d. Supply/signal wiring checks including color code checking, checking of ferrules, correctness of wiring, size of wires, proper segregation of wires etc.
- e. Provision of terminals of correct size and type.
- f. DC Isolation voltage check in the analog input cards for channel to channel and channel to ground (common mode voltage) as per specification.
- g. Provision of earthing bus bars for safety earth.
- h. Power supply, and provision of correct ratings of MCBs.
- i. CPU
- j. Memory
- k. Communication interfaces
- l. Individual modules wherever possible shall be checked for their performance.
- m. All volatile memory shall be checked for battery backup by tripping power for the duration given in the vendor's specifications.

6.3.2 Software Checks - These shall include, but not limited to, the following:

- a. 100% check on the generated data base. This includes checks on:
 - i. Correctness of tag number and description, measuring range
 - ii. Input type, input conditioning.
 - iii. Other details if required.
- b. Logging operation shall be checked.

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7 INSTALLATION

7.1 The scope of installation of the system shall be as follows:

- a. Vendor's representative is responsible for powering-up the system, loading the system configuration, conduct all system hardware/software checks and loop simulation. This shall be carried out from each field electrolyzer element to the field mounted cabinet and further verified up to HMI PC.
- b. Co-ordination with Client / tkIS (India) during complete loop checking
- c. Consolidate all loops checking report with Client/ tkIS (India).
- d. During commissioning, the vendor shall provide required qualified and experienced manpower to carry out the above activities. Vendor shall bear all the cost that may be incurred.
- e. During this period of commissioning, if any time is lost due to fault in the system or any other reason attributed to the vendor, the commissioning period shall be extended by that period at no additional cost to the client.



7.2 Activities in purchaser's Scope

Laying and termination of all signal and power supply cables from plant to inlet terminals of Field mounted cabinet.

8 FINAL ACCEPTANCE & WARRANTY



Purchaser shall take over the system from vendor after final acceptance test and site acceptance test. The integrated system shall run uninterruptedly for **four** weeks from the date of commissioning of the whole plant. Any loss of time due to reasons like power failures, forced shutdowns etc. which are due to no fault of the vendor shall also be counted as run time. However, if any major software/hardware failure of the system occurs due to which the system or a part thereof has to be shutdown the test shall be conducted afresh on the whole system.

During warranty period vendor shall make good all failed components of any part of the system and depute his service engineer to site if required free of cost.

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9 SPECIAL REQUIREMENT :

9.1	All electronic components / cards of DAS system shall have conformal (silicon) coating so as to have a very high corrosion resistance
9.2	Transient, Static and EMI/RFI protection
	The system shall be internally protected against system errors and hardware damage resulting from:
a.	Electrical transients on power/signal wiring.
b.	Connecting and disconnecting devices or removing or inserting printed circuit boards.
9.3	The DAS system shall be capable of withstanding noise errors due to electromagnetic interference (EMI) or radio frequency interference (RFI) including nearby radio stations, hand-held 2-way walkie-talkie sets, mobile phones, electrical storms, solenoids, relays or contactors carrying heavy currents. RFI/EMI noise immunity shall be as per SAMA standard PMC 33.1. The surge withstanding capability for input modules shall be as per IEEE 472.
9.4	Vendor to provide a warning board with description "Danger 425 VDC". Warning board (Yellow Board with Red letters, Height of the Board 150mm & Height of letters 100mm) shall be provided inside as well as outside the panel. The material of warning board can be plastic / Acrylic.
9.5	Fused terminals shall be considered inside field cabinet with Hinge towards I/O cards. (The make of terminals should be Phoenix / Weidmuller Only)
	Wiring insulation & terminals shall be considered rated for 600 VDC.
	Terminal Strip shall be provided cell rack wise, with adequate spare terminals in case of spare addition & extra wires for first & last element.
9.6	Scope includes supplies of i) circular lugs qty = 750 nos, ii) SS316 M5 bolts and nuts qty = 750 nos., iii) SS316 cable glands M40 size (with PVC hoods) with check nuts, qty = 80 nos., iv) 12 nos. FRP 80 terminal Junction Box, v) 1 core x 1.5 Sq.mm. PTFE wire 5100 metres, vi) 24 core x 2.5 sq.mm. multicore cable 1500 metres

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			CLIENTS	tkIS			CLIENTS	tkIS			
15.	Software reference manual.								3	4	
16.	Installation instructions.								3	4	
17.	Algorithm library.								3	4	
18.	Standard symbol library.								3	4	



1. Abbreviations:

S : Soft copies (.pdf files) (1 copy to Client + 2 copies to tkIS (India))

P : Prints

2. Notes:

- a) Final documents shall not be submitted to tkIS (India) for further compilation at following address. These shall be dispatched to site directly.
- b) Drawings submitted for information shall not be approved by tkIS (India). Vendor to note that documents prepared for the purpose of manufacturing shall not be sent to tkIS (India) for approval. tkIS (India) shall not be responsible for any mistakes/omissions in these documents as well as any delays due to the same. Specifications of instruments ordered shall be strictly as per tkIS (India) data sheets which shall also form the basis for inspection.



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PART-II

1 SPECIFIC PROJECT REQUIREMENTS

- 1.1 This section deals with requirements of Data Acquisition System (DAS) specific to the project under consideration.
- 1.2 In case requirements of this section are at variance with general system requirements given in Part-I, the requirements of Part-II shall govern.
- 1.3 The offered hardware and software shall meet requirements of inputs given in I/O list, as well as spare I/O requirements given in the I/O list summary in Part-III of this specification. All electronic cards shall have conformal coating suitable for corrosion resistance.
- 1.4 The system shall be supplied only for 6 nos. electrolyzers.

2	Control Room Conditions		
a.	Area classification	:	Non-Hazardous
b.	Atmospheric conditions with air conditioning system operative inside control room.		
	Temperature	:	16 ~ 40°C
	Humidity	:	85 RH
3	POWER SUPPLY SPECIFICATIONS		
3.1	Power Supply Levels		
a.	<u>DAS System Hardware</u>		
	Type of supply	:	UPS <input checked="" type="checkbox"/> Non-UPS <input type="checkbox"/>
		:	Floating <input type="checkbox"/> Grounded <input checked="" type="checkbox"/>
	Voltage/frequency	:	110V AC, 50 Hz <input checked="" type="checkbox"/> 230V AC, 50 Hz <input type="checkbox"/>
		:	24V DC <input type="checkbox"/> <input type="checkbox"/>
b.	<u>Controller System Auxiliaries Like Cabinet Fans, Tube-lights, Utility Sockets etc.</u>		
	Type of supply	:	UPS <input type="checkbox"/> Non-UPS <input checked="" type="checkbox"/>
		:	Floating <input type="checkbox"/> Grounded <input checked="" type="checkbox"/>
	Nominal Voltage/frequency	:	110V AC, 50 Hz <input type="checkbox"/> 230V AC, 50 Hz <input checked="" type="checkbox"/>
3.2	Power Supply Details		
a.	<u>UPS Power</u>		110 VAC 50 Hz <input checked="" type="checkbox"/> 230V AC, 50Hz <input type="checkbox"/>
	Voltage regulation	:	± 1 %
	Frequency regulation	:	± 5 %
	Harmonic distortion	:	

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b.	<u>Non-UPS Power/UPS Bypassed</u>		
	Voltage regulation	:	+/- 10%
	Frequency regulation	:	+ /- 3%

4 DATA ACQUISITION CONTROLLER



4.1 <u>Scan Rates</u>			
a.	Isolated Analog Inputs	:	250ms <input type="checkbox"/> 500 ms <input type="checkbox"/> 1s <input checked="" type="checkbox"/>
4.2 <u>Signal Isolation Requirements of Input card</u>			
a.	Between Channel to Channel of inputs	:	Required
	Type	:	Galvanic/ Optical – 120 V DC (minimum)
b.	Between any input Channel to Ground (Common Mode Voltage)	:	Required
	Type	:	Galvanic/ Optical – 600 V DC (minimum)
c.	Between any input Channel to system bus/ communication bus	:	Required
	Type	:	Galvanic/ Optical – 120 V DC (minimum)
4.3 <u>Analog Input Type</u>			
	Inputs		
a.	Floating, unbalanced, differential voltage from electrolysis cell elements	:	0 to 5 V DC
b.	Max. number of inputs/module	:	10
c.	Input Resistance	:	10 MOhm for 1 V or less & 1 Mohm for 2V and more.
d.	Leakage Current (shall be minimum)	:	Vendor to specify
e.	Accuracy	:	+/- 0.1% of Span.

4.4 Following mathematical functions shall be available in the system as a minimum

- ✓ Comparator (i.e., High and Low Alarms, etc.)
- ✓ Addition
- ✓ Subtraction
- ✓ Multiplication
- ✓ Division
- ✓ Sq. rooting/square

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5 Common Specifications for Cabinet	
a.	Type : Wall Mounted/ FRP (IP 65)
b.	Dimensions : * W x * D x * H
c.	Make : Rittal
d.	Colour : RAL 7035
e.	Cable entry : Bottom
f.	Lifting eyebolts : Required
g.	Various bus bars : Copper Ni/ Chromium Plated
h.	Hinged door : Required
i.	Material of labels: <u>All labels to be fixed in the cabinet with screws and not pasted.</u> : Rear engraved acrylic, white letters on black background
j.	Cabinet illumination : Not required
k.	Ventilation fans : Not required. Purging connection with 8mm OD Bulk head union (Push fit type, weatherproof IP65) is to be provided.
l.	<u>Terminals</u>
	Material : PVC <input type="checkbox"/> Polyamide <input checked="" type="checkbox"/> Bakelite <input type="checkbox"/>
	Make : Elmex <input type="checkbox"/> Phoenix <input checked="" type="checkbox"/> Weidmuller <input checked="" type="checkbox"/>
	Type : Fused terminals; size 2.5 mm ² Suitable for 600 VDC.
m.	<u>Power Supply</u> (Utility power) : Not required
	: Common incoming fuse for all above.
5.1 CABINET WIRING	
a.	Wiring : 0.75 mm ² multistrand, tinned copper, PVC insulated wire for analog inputs. Wiring Insulation shall be suitable for 600VDC.
b.	<u>Colour Coding Of Wires</u>
	Power supply (110/230 VAC) : (L)Red, (N)Black
	Power supply (24 VDC) : (+)Red, (-)Blue
	Earthing : Green
	Analog signals : (+)White,(-)Blue
c.	Power Supply : Incoming 2 pole MCB for each type of supply. Outlet of MCB shall be terminated on a bus bar. Individual circuits shall be tapped from the busbar and 2 pole MCB's shall be provided in each for protection.

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Specific Requirements –

- All incoming field cables shall be terminated on a terminal strip only and not directly on any other hardware.

6 INTERCONNECTION CABLES

These shall be used for interconnection between expandable units (if any) only when cabinets are located apart. The required cable qty shall be supplied by vendor.

7 BOUGHT OUT ITEMS INCLUDED IN VENDOR'S SCOPE OF SUPPLY

These items are to be supplied along with the system by vendor, for the system offered:

Panel Mounted Instruments Along with Mounting Accessories

Sr. No.	DESCRIPTION	MAKE	MODEL	QUANTITY	REMARKS
a.	Indicating Lamps (Incomer-ON, System-ON)	Standard		2 nos.	
b.	MCBs (DOUBLE POLE)	MDS / Siemens		As required	UPS, Non-UPS
c.	Glass cartridge fuses	Essen		For all field inputs	



8 TRAINING REQUIREMENTS

Following requirements shall govern:

Sr. No.	DESCRIPTION	NO. OF PERSONS	DURATION OF TRAINING	LOCATION OF TRAINING
a.	Operation/ Maintenance staff	4	2 Days	Punjab Alkalies Chemicals limited , Naya Nangal, Punjab

8.1 COMMISSIONING ASSISTANCE

Man-Months for Commissioning Assistance	15 working days
Maximum number of trips during Commissioning Assistance	4

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8.2 LICENSED SOFTWARE

- ✓ Operating System – Windows XP/ Windows 7 or latest as recommended by vendor - 1 no.
- ✓ Runtime package (HMI software) 1 no.
- ✓ DAS programming software (Engg. Station full edition) 1 no.
- ✓ Anti-virus software Norton/Mcafee latest version 1 no.
- ✓ MS-Office 1 no.

8.3 COMMISSIONING SPARES

These spare parts are required for commissioning and are purchased with the main equipment. Commissioning spares should be as mentioned in purchase order.

8.4 MAINTENANCE SPARES



These spare parts are required for the subsequent continuous operation on the basis of the details listed below: (Should be as mentioned in Purchase Order)

- Wear and corrosion during normal operation
- Damage or deficiencies during operation, maintenance or inspection of equipment

The required components and quantities shall be suggested by the supplier for a two-year operation period and quoted in the offer for the equipment.

8.5 EARTHING REQUIREMENTS

Vendor should submit detailed earthing requirements along with the offer. (With necessary earthing sketch details)



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PART-III

9 SUMMARY OF I/O

(A) INPUTS



S.No.	Description		Data Acquisition System	Remarks
1.	Voltage	0 to 5 V DC (FLOATING, UNBALANCED, DIFFERENTIAL INPUTS)	120 * 6 = 720	Each system with 120 inputs. 6 systems for Six new electrolysers

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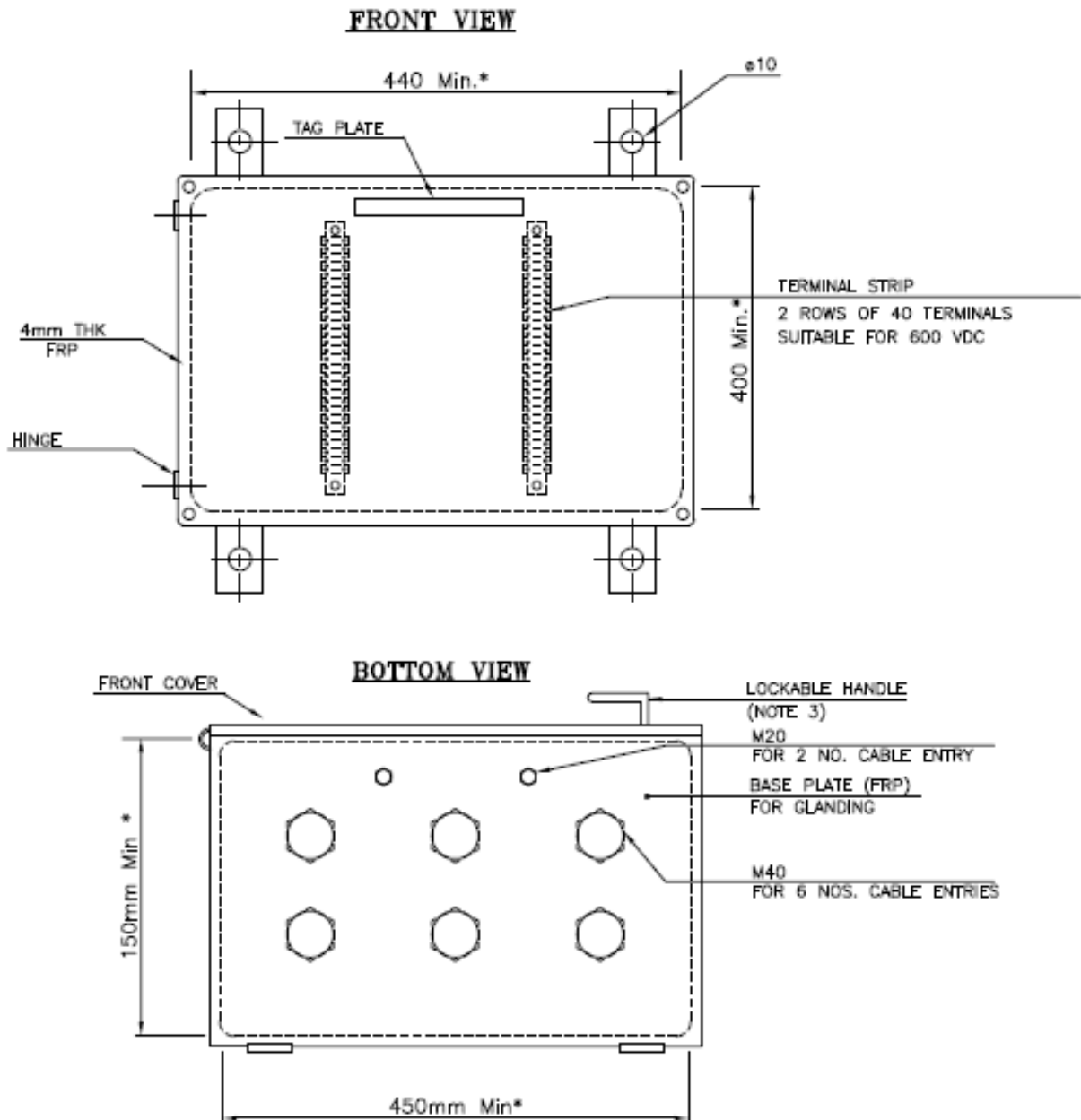
10 SPECIFICATION FOR PTFE WIRES

<i>Manufacturer</i>	:	*
<i>Type of Conductor</i>	:	Silver plated copper
<i>Area of conductor (Nominal)</i>	:	1.5 Sq.mm.
<i>No. of Strands</i>	:	19
<i>Diameter of each strand</i>	:	0.32mm
<i>Type of Insulation</i>	:	PTFE
<i>Insulation thickness (Nominal)</i>	:	0.8 ± 0.10 mm
<i>Diameter of core incl. Insulation</i>	:	3.2 ± 0.2 mm
<i>Operating temperature</i>	:	-40° to +200° C
<i>Withstanding Voltage</i>	:	1000 VAC
<i>Core Colour</i>	:	Grey

TOTAL QUANTITY = 5100 metres



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11 SPECIFICATION FOR EI FRP JUNCTION BOXES (QTY = 12 Nos.)





NOTES:

- * DIMENSIONS TO BE FURNISHED BY VENDOR, THESE JB DIMENSIONS ARE NOMINAL REQUIREMENTS, VENDOR SHALL PROVIDE STANDARD DRAWING WITH $-10\%/+20\%$ OF TOLERANCE. THIS IS TO TAKE CARE STANDARD DIMENSIONS OF VENDOR'S JB.
- 1) ALL DIMENSIONS ARE IN mm.
- 2) JUNCTION BOX ENCLOSURE SHALL BE IP65 AS PER IEC 529.
- 3) SINCE JUNCTION BOX IS FREQUENTLY USED, FASTENERS ON COVER SHALL NOT BE PROVIDED. HINGED DOORS SHALL BE PROVIDED.



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12 SPECIFICATION FOR CONTROL CABLES

- 1.1 **Applicable Standard** : IEC 60502 Part 1;
- 1.2 **Conductor**
- a. Material : Annealed bare copper
: Annealed tinned copper
- b. Number of strands : Single stranded
: Multi stranded [7 Strands]
- c. Area of cross section : 1.5 mm² 2.5 mm²
(For Branch cables) (For Main cables)
: For details refer Part-IV Schedule of quantities
- 1.3 **Primary Insulation**
- a. Material : Extruded PVC Type A
: Extruded XLPE
- b. Voltage rating : 500 V 1000 V
- c. Minimum insulation thickness : ~~As per Table 5 of IEC 60502-1 for PVC~~
As per Table 6 of IEC 60502-1 for XLPE
- 1.4 **Core Identification** : Coding for identification shall be
By numbered polyester film
By printing numbers
Colour coded
- 1.5 **Binder Tape** : Non-hygroscopic polyester tape minimum 0.025 mm thick helically wound with minimum 50% overlap shall be applied over final layer of cores.
- 1.6 **Inner sheath**
- a. Type : Extruded
- b. Material : PVC Grade ST1(80Deg C) as per
IEC60502-1 Table 4
: PVC Grade ST2(90Deg C) as per
IEC60502-1 Table 4

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- : PE ST3 (80Deg C)as per IEC60502-1 Table 4
 - : PE ST7 (90Deg C)as per IEC60502-1 Table 4
 - : Halogen free flame retardant compound ST8 (90Deg C)as per IEC60502-1 Table 4
 - c. Thickness : As Table 8 of IEC 60502-1
 - d. Colour : Black
- 1.7 **Armour** : Required Not required
- a. Type : Galvanised steel wire of minimum diameter as per Table 9 of IEC60502-1
 - : Flat galvanised steel wires with dimensions as per Table 9 of IEC60502-1 where under armour diameter is more than 15 mm
- 1.8 **Outer Sheath** : Required only if armour is specified in 12.7 above
 - a. Type : Extruded
 - b. Material : PVC Grade ST1(80Deg C) as per IEC60502-1 Table 4
 - : PVC Grade ST2(90Deg C) as per IEC60502-1 Table 4
 - : PE ST3 (80Deg C)as per IEC60502-1 Table 4
 - : PE ST7 (90Deg C)as per IEC60502-1 Table 4
 - : Halogen free flame retardant compound ST8 (90Deg C)as per IEC60502-1 Table 4
 - c. Thickness : Minimum thickness of 1.8 mm
 - d. Colour : Black
 - e. Meter markings : Required Not required

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PART-IV

BILL OF MATERIAL

Manufacturer: ***

Model no. ***

Sr. No.	Item Description	Model	UOM	QTY
A	Items:-			
1	Data aquisition system hardware	**	No's	**
2	Power Supply	**	No's	**
3	Base plate	**	No's	**
4	I/O modules	**	No's	**
5	Cover for baseplate	**	No's	**
6	Data Acquisition Software(with diagnostics features, trend, report etc. Scan time 1 Sec.	**	No's	**
B	Bought-Out items:			
1	Instrument Panel to mount the above hardware with provision for cable entry, fused TB's, MCB's with Internal Wiring. *(H)x*(W)x*(D)	RITTAL colour RAL 7035	No's	**
2	Engineering Cum Monitoring Station with OS win 10	HP/DELL Equiv/ 22"Monitor/Windows 10/500GB HDD, 64Bit OS 8 GB/4GBRAM & MS Office), Antivirus (Norton/Mcafe)	No's	**
3	A3/A4 Combined printer	**	No's	1
4	Speaker Set with Audible Alarm	**	Set	1
5	Ethernet Switch / Cable	**	Lot	1
6	1 Core x 1.5 mm ² , PTFE insulated wire, Outer colour grey , Voltage 1000 V		m	5100
7	Circular lugs m6 suitable for 1.5 mm ² wire		No's	750
8	Nuts-Bolts with washers m5x10 ss316		No's	750
9	Junction boxes machine moulded FRP, 80 terminals		No's	12
10	Cable glands – SS316, M40 single compression with check nut.		No's	80
11	Multicore cables 24 C x 2.5 mm ² unarmoured		m	1500

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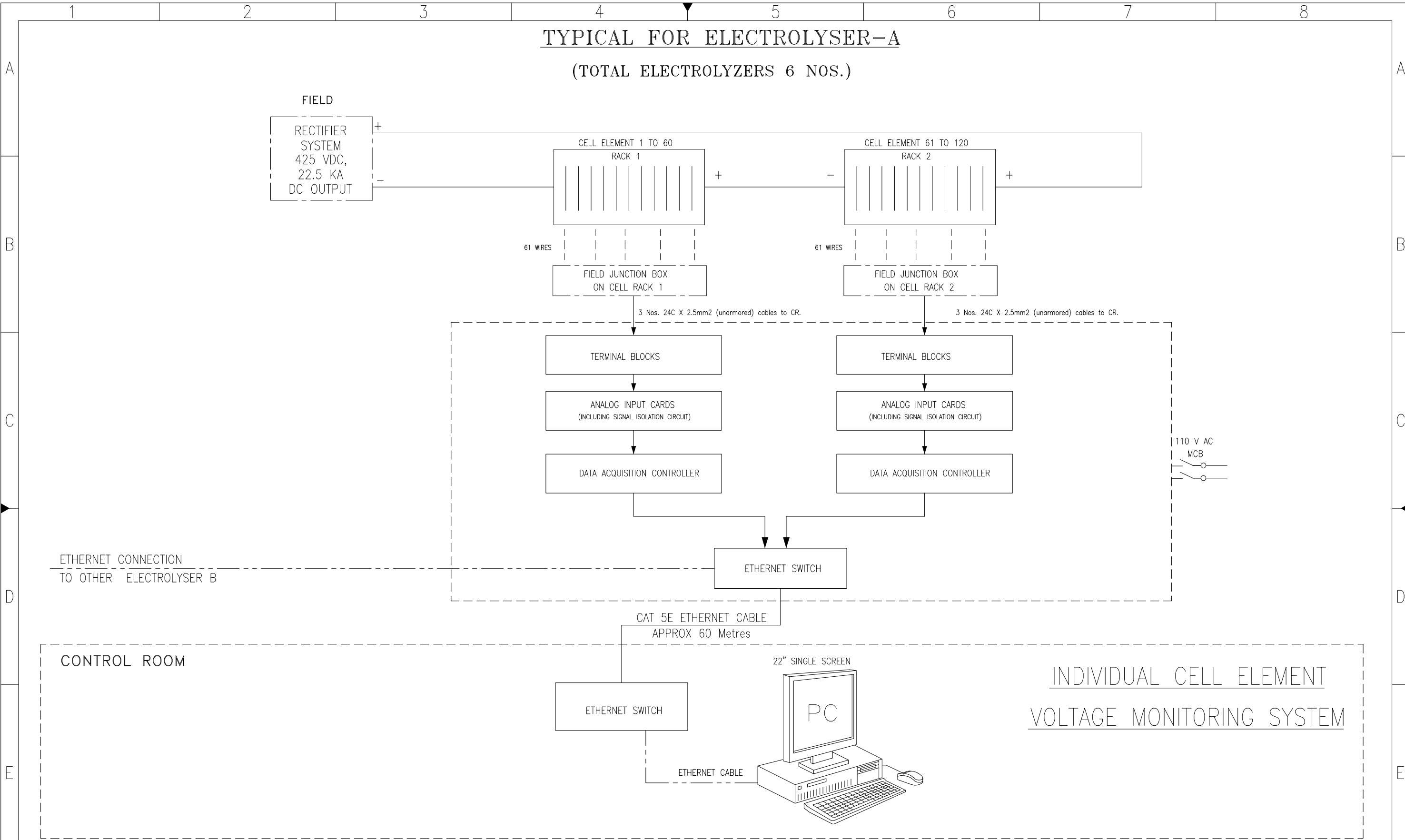
C	Commissioning spares fuses	Spare fuses	Nos.	**
D	2 years Spares	Main Module / Input module	No.	**
E	Engg. & Documentation			
F	Supervision for E&C -			
1	For Engineer with Max. 4 visits 15 Days Max.			
2	Training for 4 persons for max 2 days at site			

Note:

- I. Field side terminals shall be fused.
- II. Power for internal distribution shall be redundant.

TYPICAL FOR ELECTROLYSER-A

(TOTAL ELECTROLYZERS 6 NOS.)



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