



भारत सरकार/Government of India
अंतरिक्ष विभाग/Department of Space
द्रव नोदन प्रणाली केंद्र
LIQUID PROPULSION SYSTEMS CENTRE
एच ए एल II स्टेज, 80 फीट रोड
HAL II STAGE, 80 FEET ROAD,
बेंगलूरु/BANGALORE-560 008.
फोन सं./Phone No.080 25037171/140
ई-मेल/Email: purchase@lpscb.gov.in



दिनांक/Date: 01.10.2026

लोक निविदा सूचना सं. एल बी2026000263-01 दिनांक 01.10.2026
PUBLIC TENDER NOTICE NO. LB2026000263-01 DATED 01.10.2026

प्रतिरूपक द्रव स्थानांतरण यूनिट के लिए स्वचालित मापन एवं नियंत्रण प्रणाली (ए एम सी एस) की अभिकल्प एवं प्राप्ति हेतु निविदा।

Tender for Design & realization of Automated Measurement & Control System (AMCS) for Simulant Fluid Transfer Unit

निविदा वर्गीकरण: लोक निविदा
Tender Classification: PUBLIC TENDER

निविदा की निर्धारित तिथियाँ/TENDER SCHEDULE

बोली प्रस्तुति की आरंभिक तिथि/Bid Submission Start Date	: 01.10.2026 17:00
बोली स्पष्टीकरण की नियत तिथि/Bid Clarification Due Date	: 15.10.2026 14:00
बोली प्रस्तुतीकरण की नियत तिथि/Bid Submission Due Date	: 29.10.2026 14:00
बोली खुलने की तिथि/Bid Opening Date	: 29.10.2026 14:30
मूल्य बोली खुलने की तिथि / Price Bid Opening Date	: 12.11.2026 14:00

निविदा दस्तावेज़ <https://www.isro.gov.in/> OR <https://eproc.vssc.gov.in> या इसरो ई-प्रापण पोर्टल से डाउनलोड किए जा सकते हैं।/Tender documents can be downloaded from <https://www.isro.gov.in/> OR <https://eproc.vssc.gov.in> or ISRO E-Procurement Portal.

हस्ताक्षरित/Signed
क्रय व भंडार अधिकारी/Purchase & Stores Officer

**GOVERNMENT OF INDIA
DEPARTMENT OF SPACE
LIQUID PROPULSION SYSTEMS CENTRE (LPSC-B)
BANGALORE**

**Tender for Design & realization of Automated Measurement & Control
System (AMCS) for Simulant Fluid Transfer Unit**

Bids to be submitted online

**Tender No.: LPSC-B/Liquid Propulsion Systems Centre,
Bengaluru/LB202600026301 dated 01-10-2026**

A. Tender Details

Tender No :	LPSC-B/Liquid Propulsion Systems Centre, Bengaluru/LB202600026301
Tender Date :	01-10-2026
Tender Classification:	GOODS
Purchase Entity :	Liquid Propulsion Systems Centre, Bengaluru
Centre :	LIQUID PROPULSION SYSTEMS CENTRE (LPSC-B)

Design & realization of Automated Measurement & Control System (AMCS) for Simulant Fluid Transfer Unit

Design & realization of Automated Measurement & Control System (AMCS) for Simulant Fluid Transfer Unit

A.1 Tender Schedule

Bid Submission Start Date :	01-10-2026 17:00
Bid Clarification Due Date :	15-10-2026 14:00
Bid Submission Due Date :	29-10-2026 14:00
Bid Opening Date :	29-10-2026 14:30
Price Bid Opening Date :	12-11-2026 14:00

B. Tender Attachments

NA

Instructions To Vendors

1. Instructions to Vendors

1. LPSC(B) invites offers through eprocurement portal (<https://eproc.isro.gov.in>) for the supply / service of items as listed in the Tender document.

2. Prospective vendors interested in participating in the tendering process need to get registered in the e-procurement portal by using Digital Signature Certificate. Offers submitted through our online portal only shall be considered and offers received through fax or email or in person shall not be considered.

3. The Tenderers are requested to update their address and contact details, if necessary and submit the Bids online at least two days prior to closing date to avoid last minute system / network related problems. In case of any technical issues, tenderers may contact helpdesk team (Tel: 0471 2565454, email: eprocure@vssc.gov.in, egps@lpscb.gov.in) for resolution. Request for the extension of the due date for such instances shall not be considered.

4. GST @ 5% is applicable for following goods mentioned under Sl. No. 243B as per Department of Revenue Notification No. 25/2018 - Integrated Tax (Rate) dated 31/12/2018 (Amendment to Notification Nos. 07/2018 dated 25/01/2018 and 01/2017 dated 28/06/2017) and Department of Revenue Notification No. 24/2018 - Central Tax (Rate) dated 31/12/2018 (Amendment to Notification Nos. 06/2018 dated 25/01/2018 and 01/2017 dated 28/06/2017) and Government of Karnataka Notification No. 24/2018 dated 31/12/2018 (Amendment to Notification Nos. 06/2018 dated 25/01/2018 and 01/2017 dated 29/06/2017).

"Scientific and technical instruments, apparatus, equipment, accessories, parts, components, spares, tools, mock ups and modules, raw material and consumables required for Launch Vehicles and Satellites and Payloads"

5. LPSC(B), ISRO is eligible for Customs Duty Concession vide Notification No. 50/2017-Customs dated 30/06/2017 (Sl. No. 539), Notification No. 5/2018-Customs dated 25/01/2018 (Sl. No. 539A) and Notification No. 05/2025-Customs dated 01/02/2025 (Sl. No. 539A). Necessary Customs Duty Concession Certificate shall be provided if applicable.

6. Offer Validity: The offer shall be valid for a period of 90 days (for Single Part Tender) and 120 days (for Two Part Tender) from the date of opening of the tender or any other period as specified in the Tender document. Offers with lesser validity period than that specified are liable for exclusion from the

procurement process.

7. In case of Two Part Tender, Tenderers shall not mention any kind of price element in Techno-Commercial Bid. If any Price element is mentioned in the Techno-Commercial bid, their offer shall be liable for rejection.

8. LPSC(B) reserves the right to accept or reject any quotation in part or in full or part without assigning any reason thereof. LPSC(B) shall be under no obligation to accept the lowest tender and reserves the right to accept whole or any part of the tender or part of the quantity offered and the Tenderers shall supply the same at the rates quoted.

9. Bank Details: Tenderer shall provide their bank details such as IFSC code, IBAN No. , SWIFT etc. along with their offer which shall be not be changed till completion of supply/service.

10. Applicable Law: The Contract shall be governed by Indian Law for the time being in force and jurisdiction shall lie in the Courts of India.

11. Only Class-I and Class-II Local suppliers as per Public Procurement Policy (Preference to Make in India) Order, 2017 are eligible to participate in the bid unless otherwise specified in the Tender document.

12. As far as implementation of Public Procurement Policy (Preference to Make in India) Order, 2017 is concerned, the Office Orders vide No. P-45021/2/2017-B.E-II dated 15/06/2017, which is partially modified by Order No. P-45021/2/2017-PP(BE-II) dated 28/05/2018, Order No. P-45021/2/2017-PP(BE-II) dated 29/05/2019, Order No. P-45021/2/2017-PP (BE-II) dated 04/06/2020 and Order No. P-45021/2/2017-PP (BE-II) dated 16/09/2020 and subsequent Amendments issued by the Department for Promotion of Industries and Internal Trade (DPIIT), Ministry of Commerce and Industry regarding Class-I / Class-II local suppliers, Purchase preference, verification of local contents etc. shall be applicable to this tender unless otherwise specified in the Tender document.

Therefore, bidders may ensure compliance of the same while submitting tenders.

13. Price Preference shall be extended to the MSEs under the Public Procurement Policy for MSEs formulated under the Micro, Small and Medium Enterprises Development Act, 2006 unless otherwise specified in the Tender document. Such MSEs shall produce documentary proof of registration as per provisions of the Policy i.e. registration with District Industries Centre (DIC) or Khadi and Village Industries Commission (KVIC) or Khadi and Industries Board (KVIB) or Coir Board or National Small Industries Commission (NSIC) or Directorate of Handicrafts and Handlooms or Udyog Aadhar Memorandum or any other body specified by Ministry of MSME.

14. As per the Rule 144 (xi) of General Financial Rules,2017, any bidder from a country which shares a land border with India will be eligible to bid in this tender, only if the bidder is registered with the

Competent Authority. Competent Authority for the purpose of registration shall be the Registration Committee constituted by the Department for Promotion of Industry and Internal Trade (DPIIT).

15. Resolution of Disputes: Any dispute, disagreement or question arising out of or relating to or in consequence of the contract or to its fulfillment, or the validity of enforcement thereof which cannot be settled mutually, or the settlement of which is not herein specifically provided for, shall within 30 (thirty) days from the date either party informs the other in writing that such dispute or disagreement exists be referred to arbitration by the sole arbitrator. The Arbitrator shall be appointed as per the Indian Arbitration and Conciliation Act 1996 and proceedings will be conducted in Bangalore. The Arbitration proceedings shall be conducted in accordance with and subject to the Arbitration and Conciliation Act 1996 (Act 26 of 1996) as amended from time to time and the decision of the Arbitrator shall be final and binding on the parties thereto. Each party shall bear its own cost of preparing and presenting its case. The cost of Arbitration including the fees and expenses of the Arbitrator shall be shared equally by the parties unless the award provides otherwise. Subject to provisions of this clause, the courts at Bangalore shall have exclusive jurisdiction. Performance under this Contract shall, however continue during Arbitration proceeding and no payment due or payable by the parties hereto shall be withheld unless any such payment is/or forms a part of the subject matter of the Arbitration proceedings.

16. Force Majeure: Neither party shall bear responsibility for the complete or partial non-performance of any of his obligations if the non-performance results from such force majeure circumstances such as, but not restricted to, flood, fire, earthquake, civil commotion, sabotage, explosion, epidemic, quarantine restriction, strike, lock-out, freight embargo, acts of the Government, acts of public enemy and other acts of God as well as war or revolution, military operation, blockade, acts or actions of State authorities or any other circumstance beyond the control of the parties provided the other party is notified in writing within 21 days from the date of commencement of the unforeseeable event.

2. Local Content Declaration

1. DECLARATION OF LOCAL CONTENT

(To be given on company letter head with self certification - For tender value below Rs. 10 Crores

(To be given by Statutory Auditor or Cost Auditor or Cost Accountant or CA - For tender value above Rs. 10 Crores)

Date:

To,

Sub: Declaration of Local content

Tender Ref No:

Name of Tender:

1. Country of Origin of Goods being offered:

2. We hereby declare that items offered has -----% local content:

3. Details of Local Value additions:

4. Address At which Local value addition is being made:

"Local Content" means the amount of value added in India which shall, be the total value of the item being offered minus the value of the imported content in the item (including all customs duties) as a proportion of the total value, in percent.

It is certified that the above mentioned Local content is excluding the following (a) (b) & (c):

- a. Imported items sourced locally from resellers/distributors are excluded from calculation of the above local content.
- b. The license fees/royalties paid/ technical charges paid out of India shall be excluded from local content calculation.
- c. Procurement/Supply of repackaged/refurbished/rebranded imported products as understood commonly shall be treated as reselling of imported products and shall be excluded from calculation of local content. The definition of repackaged /refurbished/rebranded imported products is as follows; Refurbishing means repair or reconditioning of an imported product does not amount to manufacture because no new goods come into existence. Repackaging means repacking of imported goods from bulk pack to smaller packs would not ordinarily amount to manufacture of a new item. Rebranding means relabeling or renaming or change in symbol or logo/makes or corporate image of a company/organization/ firm for an imported product would amount to rebranding.

It is certified that as per DPIITs OM Ref P-45021/102/2019-BE-II-Paart(1)(E-50310) Dtd. 04/03/2021 the local content mentioned above, by which we are Class-I local suppliers / Class-II local suppliers, does not contain services such as transportation, insurance, installation, commissioning, training and after sales service support like AMC / value addition.

"False declaration will be in breach of Code of Integrity under Rule175(1)(i)(h)of the General Financial Rules for which a bidder or its successors can be debarred for up to two years as per Rule 151 (iii) of the General Financial Rules along with such other actions as may be permissible under law."

Yours faithfully,

(Signature of the Bidder/OEM with Official seal)

C. Bid Templates

C.1 Technical Bid - Design & realization of Automated Measurement & Control System (AMCS) for Simulant Fluid Transfer Unit

1. Design and realization of Automated Measurement and Control System (AMCS) for Simulant Fluid Transfer Unit

1.1 Design and realization of Automated Measurement and Control System (AMCS) for Simulant Fluid Transfer Unit - Annual Maintenance Contract

Item specifications for Design and realization of Automated Measurement and Control System (AMCS) for Simulant Fluid Transfer Unit

SI No	Specification	Value	Compliance	Offered Specification	Remark
1	Design & realization of Automated Measurement & Control System (AMCS) for Simulant Fluid Transfer Unit	As per attached RFP	Yes / No / Explain		

Document : Specifications

Document : Compliance sheet

Common Specifications (Applicable for all items)

SI No	Specification	Value	Compliance	Offered Specification	Remark
1	Refer RFP for detailed specification		-		

Supporting Documents required from Vendor

1. Hardware design document

2. Operating/User manual

3. Data sheets, Make & Model Nos for all the quoted items including control and data acquisition system

4. Hardware architecture for the Automated Measurement & Control System

5. software design document for control system & data acquisition system

5 additional documents can be uploaded by the vendor

C.2 Commercial Terms / Bid

Sl. No.	Description	Compliance	Vendor Terms
1	Heritage Clause: The party should have a previous experience of having successfully completed the similar system for reputed aerospace industries in India	Yes / No / Explain	
2	Warranty: The total system shall be warranted for total performance and failure-free operation for a period of 12 months from date of final acceptance of system by LPSC(B)/ISRO.	Yes / No / Explain	
3	Delivery period: Items shall be supplied and installed and site acceptance tested within 6 months from the date of receipt of Purchase Order.	Yes / No / Explain	
4	All the items should be from the preferred vendors list	Yes / No / Explain	
5	The party has to design, procure and integrate the system and final product along with software shall be supplied to LPSC(B)	Yes / No / Explain	
6	THIS IS A TWO PART TENDER : DO NOT MENTION THE PRICE ELEMENT IN TECHNO COMMERCIAL BID. IF ANY PRICE ELEMENT MENTIONED IN THE TECHNICAL BID, YOUR OFFER WILL NOT BE CONSIDERED.	Yes / No / Explain	

7	Goods and Services Tax (GST): GST @ 5% is applicable for following goods mentioned under Sl. No. 243B as per Department of Revenue Notification No. 25/2018 - Integrated Tax (Rate) dated 31/12/2018 (Amendment to Notification Nos. 07/2018 dated 25/01/2018 and 01/2017 dated 28/06/2017) and Department of Revenue Notification No. 24/2018 - Central Tax (Rate) dated 31/12/2018 (Amendment to Notification Nos. 06/2018 dated 25/01/2018 and 01/2017 dated 28/06/2017) and Government of Karnataka Notification No. 24/2018 dated 31/12/2018 (Amendment to Notification Nos. 06/2018 dated 25/01/2018 and 01/2017 dated 29/06/2017). "Scientific and technical instruments, apparatus, equipment, accessories, parts, components, spares, tools, mock ups and modules, raw material and consumables required for Launch Vehicles and Satellites and Payloads"	-	
8	Delivery Terms: FOR LPSC, Bangalore.	Yes / No / Explain	
9	Payment Terms: 100% payment shall be made after receipt of all items and installation, commissioning & satisfactory acceptance at the LPSC (B) site. Refer Clause No.12 of Annexure-IV	Yes / No / Explain	
10	Liquidated Damages (LD): If the ordered items are not supplied within the delivery schedule, LD shall be levied from your bill @ 0.5% of the order value per week or 0.5% of the value of the stores for which the delivery is delayed for each week of delay subject to a maximum of 5% of the order value. However, in case of inordinate delay in completion period, LD @ 10% shall be recovered. Please ignore Clause No.5 of Annexure-IV. The above will prevail.	Yes / No / Explain	

11	Warranty: The items shall be warranted for a minimum period of 12 months from the date of supply or acceptance of items at our site which ever is later. Necessary warranty certificate shall be furnished along with the supply. Refer Clause No.3 of Annexure-IV	Yes / No / Explain	
12	Performance Bank Guarantee (PBG): You have to submit PBG towards fulfilment of warranty obligations and performance of the system for 3% of the Order Value from a Nationalized / Scheduled Bank on non-judicial stamp paper of appropriate value valid till the completion of warranty period plus 60 days as per the format provided by Department.	Yes / No / Explain	
13	Security Deposit (SD): You have to furnish a Bank Guarantee from a Nationalized / Scheduled Bank on non-judicial stamp paper of appropriate value for 3% of the order value within 10 days of receipt of order towards the faithful execution of the order valid till the completion of the scope of work as per order plus sixty days (as claim period). Refer Clause No.2 of Annexure-IV	Yes / No / Explain	
14	SD cum PBG: In case, if parties are unable to provide two separate BGs, i.e. one for SD and one for PBG, they can submit a combined BG for SD & PBG within 10 days of receipt of order for 3% of order value valid till the completion of total contractual obligation (i.e. supply period plus warranty period plus 60 days) as per the format provided by the Department.	Yes / No / Explain	
15	Country of Origin for Non-local content:	Yes / No / Explain	
16	GeM Seller ID:	Yes / No / Explain	

17	Force Majeure:a. if the non-performance results from such force majeure circumstances such as, but not restricted to, flood, fire, earthquake, civil commotion, sabotage, explosion, epidemic, quarantine restriction, strike, lock out, freight embargo, acts of the Government either in its sovereign or its contractual capacity, hostility, acts of public enemy and other acts of God as well as war or revolution, military operation, blockade, acts or actions of state authorities or any other circumstances beyond the control of the Parties that have arisen after the conclusion of Purchase Order/Contract. In such circumstances, the time stipulated for the performance of an obligation under the Purchase Order/Contract may be proportionately extended. b. The party for whom it has become impossible to meet the obligation under this contract due to force majeure condition shall notify the other party in writing not later than 7 days from the date of the occurrence and cessation of the force majeure condition/s. In the event of delay lasting over one month, arising from force majeure causes, the LPSC, ISRO reserves the right to cancel the contract without any obligation to compensate the Tenderer in any manner. Unless agreed by both the parties, in writing, the Supplier shall continue to perform his obligations under the Purchase Order/Contract as far as is practical and shall seek all reasonable alternative means for performance not prevented by the force majeure event c. Any Certificate issued by the Chamber of Commerce or any other competent authority or organization of the respective country shall be sufficient proof of commencement and cessation of the above circumstances. In case of failure to carryout complete or partial performance of an obligation for more than 60 days, either party shall	Yes / No / Explain	
----	---	--------------------	--

reserve the right to terminate the Contract totally or partially. A prior written notice of 30 days to the other party will be given informing of the intention to terminate without any liability.

d. The Force Majeure condition is applicable only to the prime Supplier and Purchaser.

Refer Clause No.8 of Annexure-IV

18	Dispute Resolution:i. In the event of any conflict or dispute arising out of or in connection with the Contract placed through EGPS, the Parties shall endeavour to settle such disputes amicably. If a dispute is not resolved within 30 (thirty) days after a written notice of any dispute by one Party to the other, the same shall then be resolved through the mechanism of a Dispute Resolution Committee. This Dispute Resolution Committee shall comprise of representatives of both the Buyer and the Seller / Service Provider and shall be chaired by the Procuring entity or any other person as authorized by the Procuring entity. ii. If the Dispute Resolution Committee is not able to resolve the matter within 30 (thirty) days of its formation, the dispute shall be dealt with in accordance to ?Guidelines for Arbitration and Mediation in Contracts of Domestic Public Procurement? issued by Department of Expenditure via OM No. F.1/2/2024-PPD dated 03.06.2024, as amended from time to time. iii. The Contract shall be interpreted and governed in all respects in accordance with the laws of India. All disputes in connection with or arising out of the Contract, shall be subject to the exclusive jurisdiction of the Court within the local limits of whose jurisdiction principal place of business of the Buyer department/ organisation is located. Please ignore Clause No.6 of Annexure-IV. The above will prevail.	Yes / No / Explain	
19	Insurance: Being a Government of India Department, Insurance is not required at our cost. Please ensure the safe delivery of the ordered item with proper AIR / SEA / ROAD worthy packing.	Yes / No / Explain	

20	Free Issue Material (FIM), if applicable: You have to submit Bank Guarantee for a value equivalent to FIM (if applicable) from a Nationalized / Scheduled Bank on non-judicial stamp paper of appropriate value towards issue of FIM. The BG shall be valid till receipt and acceptance of supply and satisfactory accounting of FIM.	Yes / No / Explain	
21	Address, contact details like Telephone Number, e-mail, etc. on which order to be placed.	Yes / No / Explain	
22	Details of Principal: Address, contact details like Telephone Number, e-mail, etc. (if applicable)	Yes / No / Explain	
23	Bank Details: Bank name, Branch address, Account No., IFSC Code, IBAN Number, SWIFT, etc.	Yes / No / Explain	
24	Local Content (%): Please mention the percentage of Local Content and the location where local value addition takes place (Kindly enclose self-certification document in the prescribed format)	Yes / No / Explain	
25	MSE Status: Kindly mention the classification under MSE and submit supporting documentation (if applicable)	Yes / No / Explain	
26	Validity of offer: 06 months from the date of opening of tender. Refer Clause No.13 of Annexure-IV	Yes / No / Explain	
27	Non-Comprehensive AMC: We reserve the right to enter into a separate AMC after completion of warranty period. Kindly include your cost of Non-Comprehensive AMC for a period of two years after expiry of warranty period.	Yes / No / Explain	
28	Preventive Maintenance: One preventive maintenance visit in 06 months i.e. total of 04 visits during the contract period.	Yes / No / Explain	
29	Breakdown Maintenance: The breakdown calls shall be attended within 48 hours of intimation. (Although unlimited free breakdown calls are stipulated, Party may indicate the number of free breakdown visits considered in their offer and for additional breakdown visits, party may quote the charges separately on per day / per visit basis)	Yes / No / Explain	

30	Payment Terms for AMC: Maintenance charges shall be paid within 30 days after completion of each satisfactory Maintenance against submission of Invoice and Service report duly certified by the End User and approved by Division Head.	Yes / No / Explain	
31	Security Deposit (SD) for AMC: You have to furnish a Bank Guarantee from a Nationalized / Scheduled Bank on non-judicial stamp paper of appropriate value for 3% of the AMC value within 10 days of receipt of order towards the faithful execution of the order valid till the completion of the scope of work as per order plus sixty days (as claim period).	Yes / No / Explain	
32	Down-time Compensation: If the service provider fails to attend the breakdown within stipulated time i.e. within 48 hours of intimation, down-time compensation shall be levied at the rate of 0.5% of the Annual Maintenance Charges for every day of delay subject to a maximum of 5% of the Contract Value.	Yes / No / Explain	
33	Maintenance shall be carried out at our premises only. In case any item has to be taken to your premises for repairs, necessary Bank Guarantee for the value of the item shall be furnished, and valid till returning of the item.	Yes / No / Explain	
34	During AMC, in the event of damages to our property or injury to our personnel due to the negligence of your employees, the responsibility shall solely rest with you.	Yes / No / Explain	
35	Income Tax, as applicable shall be deducted from your bill, at source.	Yes / No / Explain	
36	Any other terms	Yes / No / Explain	

C.3 Price Bid

Sl. No.	Item	Quantity	Unit Price	Currency	Total Price	Remark
---------	------	----------	------------	----------	-------------	--------

1	Design and realization of Automated Measurement and Control System (AMCS) for Simulant Fluid Transfer Unit	1.00 Nos.		-		
1.1	Design and realization of Automated Measurement and Control System (AMCS) for Simulant Fluid Transfer Unit - Annual Maintainance Contract	1.00 Lot		-		

Common charges (Applicable for all items)

Additional Costs, if any (Value)	
Installation & Configuration	
Other Costs, if any (Value)	

**Design & realization of Automated
Measurement & Control System (AMCS)
for Simulant Fluid Transfer Unit**

CONTENTS

Sl. No.	Section	Page No.
1.0	Introduction	1
2.0	Scope of work	1
3.0	Responsibilities of vendor	1
4.0	SFTU instrumentation system requirements	2
5.0	Consolidated requirements	2
6.0	Integrated data acquisition system requirements	3
7.0	Control system requirements	4
8.0	General requirements	5
9.0	Measurement/ command chain details	6
10.0	Instrumentation rack-equipment assembly & wiring	10
11.0	Control system software requirements	12
12.0	Safety interlocks	19
13.0	Hardware Emergency stop	19
14.0	Propellant loading software requirements	19
15.0	Factory Acceptance testing	24
16.0	Site Acceptance testing	25
17.0	Training of LPSC personnel	27
Annexure-I	Specification of sensors/ vendor	28
Annexure-II	Specification of instruments/ equipments	31
Annexure-III	Price format, suggested vendors list & AMC details	47
Annexure-IV	Commercial terms and conditions	52

ABBREVIATIONS

AMCS	Automated Measurement & Control System
SFTU	Simulant Fluid Transfer Unit
BOM	Bill of Material
EGSE	Electrical ground Support Equipment
IDAS	Integrated data Acquisition system
PLC	Programmable Logic controller
RTD	Resistance Temperature Detector
IDPT	Integral Diaphragm Pressure Transducer
SCADA	Supervisory Control and data Acquisition System
TMR	Triple Modular redundancy Logic
FAT	Factory Acceptance testing
SAT	Site Acceptance Testing

1. Introduction

Automated Measurement & Control System (AMCS) for Simulant Fluid Transfer Unit is designed to facilitate loading of simulant fluid to the spacecraft for environmental testing and to draining upon test completion. The AMCS integrates Control, measurement and data acquisition system, Flow transmitters and weighing balance.

The AMCS is indented to perform the following operations

- a. Pressurization of the storage tank and transfer of simulant to the spacecraft
- b. Flow rate control during simulant loading operations
- c. Venting of the spacecraft tank if pressure exceeds the set limit
- d. Control of filling quantity using TMR (Triple Modular Redundancy) logic

At present, all the above operations are carried out in a semi-automatic mode. Hence, it is proposed to automate these operations through a PLC-based control system.

Additionally, the **AMCS** includes EGSE for measurement and acquisition of spacecraft propulsion system parameters such as pressure and temperature, as well as for commanding latch valves during simulant draining operation.

2. Scope of work

Procurement, Integration, supply, installation of complete Instrumentation system (Measurement & control system), application software development and demonstration. Necessary schematic drawings of command & measurement chains required for the execution of work is provided in this RFP.

3. Responsibilities of Vendor

The vendor shall be responsible for executing the complete work, including implementation of the system based on the schematic drawings of command and measurement chains provided as part of the specification.

- a. Submission of detailed engineering drawing
- b. Supply of materials as per BOM
- c. Installation & commissioning in stipulated time period
- d. Application software development
- e. Factory Acceptance Test
- f. Installation and Commissioning at site
- g. Training at Department site
- h. Providing warranty for the equipment supplied by the vendor
- i. Annual Maintenance Contract

4. AMCS-Instrumentation system requirements

4.1 Measurement system (EGSE)

Sl. No.	Description	IDAS Signal type	Range	No. of channels
1	Pressure	Voltage	-10 to 10V	36
2	Temperature-RTD	Resistance	100/1000Ω	12
3	Temperature-Thermistor	Resistance	10kΩ	20
4	Valve current	Voltage	0-10V	41
5	Command Voltage	Voltage	0-60V	41
6	Flow meter	RS485	-	6
7	Weighing balance	RS232 and Ethernet	-	4 & 2

Table No: 1

4.2 Control system

Sl. No.	Description	PLC Signal type	No. of channels
1	Solenoid valves	Digital output	25
2	Latch Valves	Digital output	16
		Digital Input (status)	8
3	Pressure Transmitter	Analog input	8
4	Flow meter	RS 485	6
5	Weighing balance	RS232 and Ethernet	4

Table No: 2

5. Consolidated system requirements

Sl. No	Description (Measurement/ Commands)	No. of channels	Signal Type	Sampling rate (Hz)	System
Measurement					
1	Pressure	36	Analog (volts) -10V to +10V	2000	IDAS
2	Temperature (Thermistor)	20	Resistance 10KΩ	100	
3	Temperature (RTD)	12	Resistance 100Ω/1000Ω	100	
4	Flow meter	6	RS 485	10	IDAS & PLC
5	Weighing balance	4	RS 232 & Ethernet	10	IDAS & PLC
Solenoid Valve					

6	SV command	25	Digital (volts)	100	PLC
7	SV voltage	25	Analog (Volts) 28 to 42V	1000	IDAS
8	SV current	25	Analog (Volts)	5000	IDAS
Latch Valve					
9	LV open command	8	Digital output	100	PLC
10	LV close command	8	Digital output	100	PLC
11	LV position	8	Digital Input	100	PLC
12	LV current	16	Analog (Volts)	5000	IDAS
13	LV voltage	16	Analog (Volts)	1000	IDAS
SFTU					
14	Pressure transmitter	8	Analog (Volts)	100	PLC

Table No: 3

6. Integrated Data acquisition system (IDAS) requirements

- The Integrated Data Acquisition System (IDAS) shall be a single, standalone configuration designed for acquisition, monitoring, recording, and storage of pressure and temperature parameters, along with measurement of voltage and current associated with valve operations.
- The IDAS configuration shall include signal conditioning modules comprising amplifier, filter, Analog-to-Digital Converter (ADC), and software filtering for all channels.
- Each channel in the IDAS shall have an independent ADC and the ADC shall be an integral part of the signal conditioning module.
- The sampling rate shall be user-selectable with provisions for at least the following rates: 10 Hz, 100 Hz, 1 kHz, 5 kHz, and 10 kHz.
- All hardware components shall be modular, expandable, and easily stackable for future scalability.
- The controller shall be rugged, modular, and portable in construction.
- The system shall include a high-precision reference clock for synchronization. Time stamps of acquired data shall precisely match between the IDAS and the control system.
- Health status indications such as network connectivity status, failure indication, power ON status, and controller health monitoring shall be provided.
- Suitable LEMO or D-Sub connectors with secure locking mechanisms (push-pull type or locking bolt type) shall be provided for IDAS input card interfaces. Mating connectors shall also be included in the scope of supply.

- j. The digitized data shall be stored in the IDAS controller and shall be available for display at the display node.
- k. The controller shall have sufficient memory capacity to ensure that, in the event of any system failure, the stored data can be retrieved without loss.
- l. The system shall be provided with user-friendly, reliable driver software and application software compatible with Linux and/or Windows platforms, with LabVIEW API support or equivalent software interface with license.
- m. The system configuration shall support acquisition and storage of all configured channels at the maximum sampling rate (5000 Hz) continuously for a minimum duration of 12 hours, with provision for automatic file segmentation to enable quick processing and retrieval.
- n. The data acquisition software shall provide facilities for real-time processing and monitoring of parameters in raw voltage and engineering units, online trend display, offline data processing, graphical plotting, mathematical analysis tools, and archival capabilities
- o. The system shall support online monitoring of pressure, temperature, voltage and current parameters through numerical display and real-time trend graphs
- p. The system shall support offline processing of acquired data for detailed analysis
- q. A graph plotting module shall be provided for plotting selected channel data from the stored datasets.

7. Control system requirements

- a. PLC based control system is designed to control solenoid valves (SV) and Latch valve (LV) and also measure, monitor, acquire and store the process parameters (Pressure, Flow etc.,) during process operation in manual and auto modes. Dedicated , Independent PLC shall be used for Latch valve commanding and status monitoring
- b. For auto operation (**auto sequence**) of process elements during stimulant filling/ draining the required sequence to be programmed based on the predetermined timings and/or limits of process parameters for parameter based operations. The system shall execute the interlocks for safeguarding the process.
- c. The Control system shall include controller, Analog & Digital I/O modules, power supply, SCADA system/ Mimic for control & monitoring of the process.
- d. The configuration and the storage capacity of the controller should be enough to acquire and store the required channels at the maximum sampling rate (100Hz) for a continuous duration of at least 12 hours.

- e. Software package for data acquisition, storage, processing, on line display, off line processing and analysis.
- f. System cycle time shall be fixed $10 \pm 0.1\text{ms}$.
- g. Controller shall have sufficient memory to store the system program and application program.
- h. Online monitoring of events data and Trend graph displays of process parameters are required.
- i. The raw counts shall be converted into engineering units as per the sensor constants. The conversion factor/constants shall be accessed from separate database file and can be modified whenever required.
- j. SCADA Mimic page for online error diagnosis of various subsystems like PLC processor, inputs and outputs, network and communication interfaces.
- k. Provision to process and print out / plot the analog and digital data through network using SCADA node.
- l. Programming: Ladder Diagram (LD), Functional Block Diagram (FBD), Structured Text (ST), Instruction List (IL), Sequential Functional Chart (SFC) - IEC 61131-3 Compatible. High level language with object oriented programming shall be available.
- m. The system should provide real time trend display and with color change for alarm condition of few critical parameters.
- n. Features such as fault LEDs, processor health LEDs, power supply status LEDs, and communication fault LED shall be available. Individual digital I/O shall have LED indication for ON/OFF status. Output cards shall be short circuit protected.
- o. System should be supportable for unlimited Tags & flags along with labeling provision (or) should meet tender requirement with additional 60% spare capacity.
- p. Minor changes and modifications in the SCADA program shall be done by the vendor during the commissioning if required for refinement according to the operator's requirement without any extra cost.
- q. Support shall be provided for modifying application software for a period of 1 year after the commissioning of the system without any extra cost
- r. Source code of all application programs shall be handed over to LPSC for future modifications.

8. General requirements

- a. All hardware & software shall be the most recent, field proven models/versions and revision levels marketed by their manufacturers at the time of proposal submission
- b. System shall be capable of expanding to accommodate the additional I/Os nearly 20% for future augmentation
- c. Detailed Configuration Schematic, Rack Assembly & Wiring Schematic and Interface

diagram for all measurements/command to be supplied.

- d. Detailed configuration for Integrated Data Acquisition System and Control system
- e. The quantity and model no. of complete bill of materials to be provided.
- f. In case of failure of any module, replacement of the module shall be possible and it shall not lead to change in software or requirement of additional software
- g. Software shall be menu driven and easy to use. The PLC and SCADA programming shall be in Integrated Development Environment (IDE) and changes updated in one place shall be reflected throughout. It shall incorporate on-line tutorials and help functions to assist the user. Software shall be self-documenting and shall provide cross-reference tables, I/O configuration tables and associated functions.
- h. Software Design document for implementation of application software.
- i. Implementing the modifications as suggested at free of cost
- j. Realization of the system and functional testing as per test plan and delivery
- k. Addition of any other systems in addition to the ones explicitly mentioned here, to make the functionality of the system complete.
- l. Application software and driver software to meet the requirement

9. Measurement/command chain details

9.1 Pressure Measurement

IDPT type pressure sensor is used for pressure measurement in spacecraft. IDPT pressure sensor is of 5 wire configuration (excitation & output). Sensor needs $\pm 15V$ DC excitation and full-scale output of the sensor is $\pm 5VDC$. Sensor to be excited with dual power supply and the output of the sensors shall be taken to analog input card of IDAS. Refer Annexure III for specification and pin details of pressure sensor.

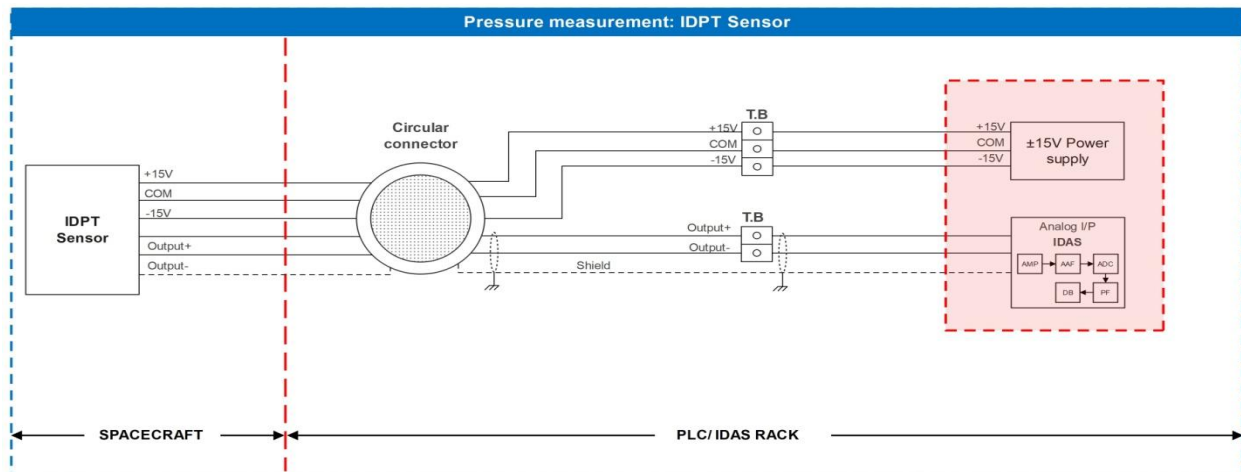


Figure-1: Pressure measurement chain

9.2 Thermistor temperature measurement

Thermistor temperature shall be measured using a current source or Wheatstone bridge or voltage divider method. The Thermistor temperature measurement using current source configuration is shown below.

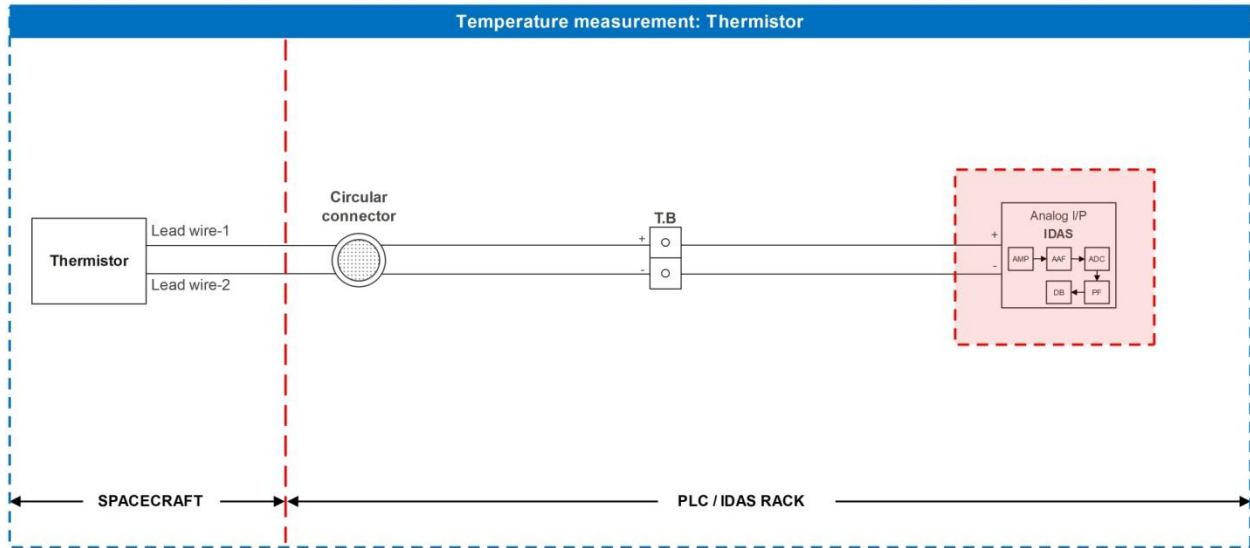


Figure-2: Thermistor measurement chain

9.3 RTD temperature measurement

The RTD temperature sensor shall be excited using a constant current source of ≤ 1 mA. The resulting RTD resistance shall be measured and acquired in IDAS. Schematic representation of RTD temperature measurement is given below

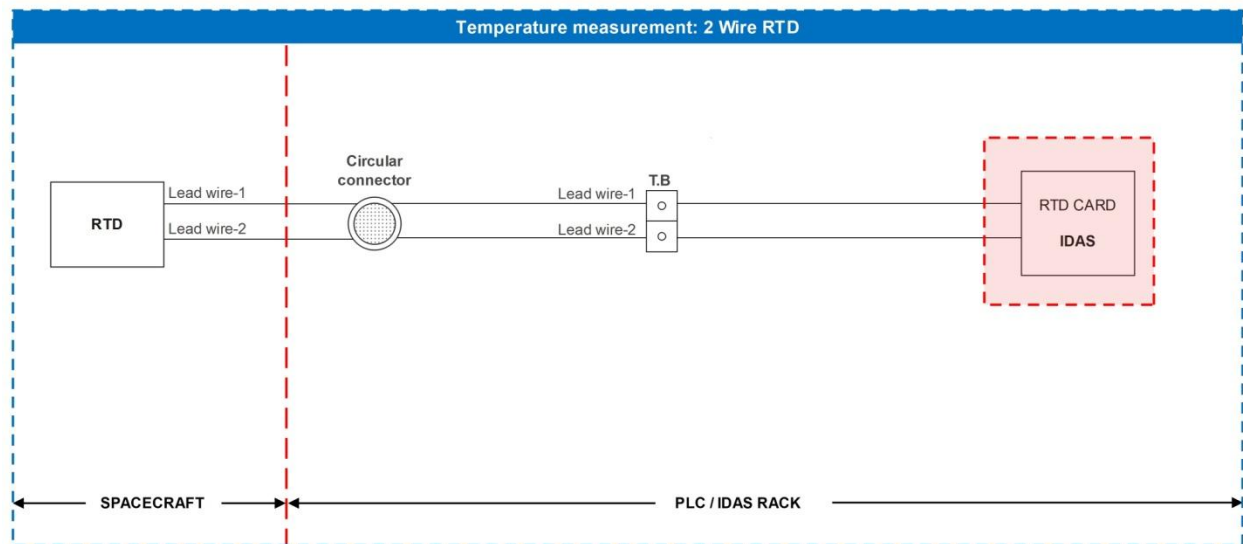


Figure-3: RTD measurement chain

9.4 Flow measurement

A Coriolis mass flow meter is used for flow measurement. The flow transmitter output shall be simultaneously acquired by IDAS and PLC through RS-485 (MODBUS RTU) communication interface. RS-485 splitter shall be incorporated to enable signal distribution between IDAS and PLC.

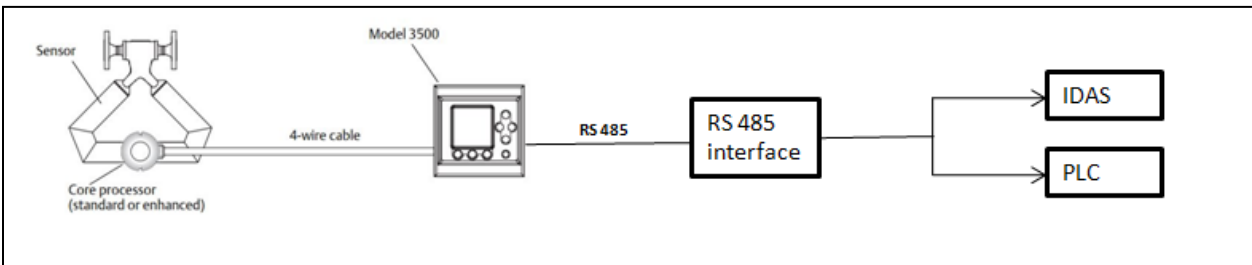


Figure-4: Flow measurement chain

9.5 Weighing balance data

A weighing balance is used to measure the simulant quantity to be filled into the spacecraft. The weighing balance display/controller output shall be acquired in the IDAS and PLC through RS-232 & Ethernet communication interfaces.

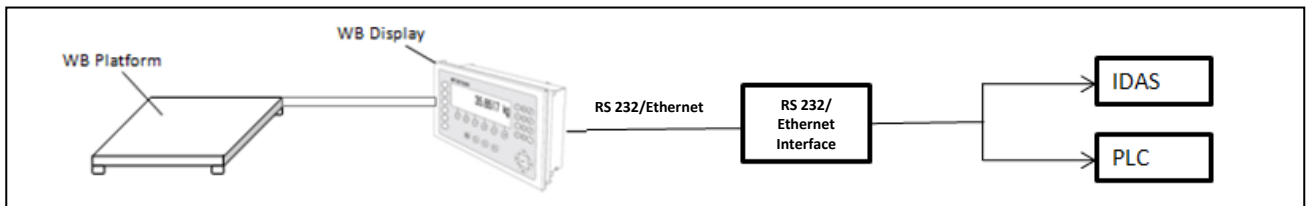


Figure-5: WB measurement chain

9.6 Solenoid valve

The solenoid valve shall be an electrically operated valve controlled through the PLC. The PLC shall generate the command signal to actuate a relay, which in turn shall energize the solenoid valve coil. The solenoid valve shall operate on nominal 24 VDC supply for opening and the valve shall return to the closed position upon withdrawal of the supply voltage. The supply voltage to the solenoid valve shall be measured and acquired through the Integrated Data Acquisition System (IDAS). The current drawn by the solenoid valve shall be measured using a Hall Effect current sensor and the sensor output shall be interfaced and acquired by the IDAS. The detailed electrical specifications of the solenoid valve are provided in section I.

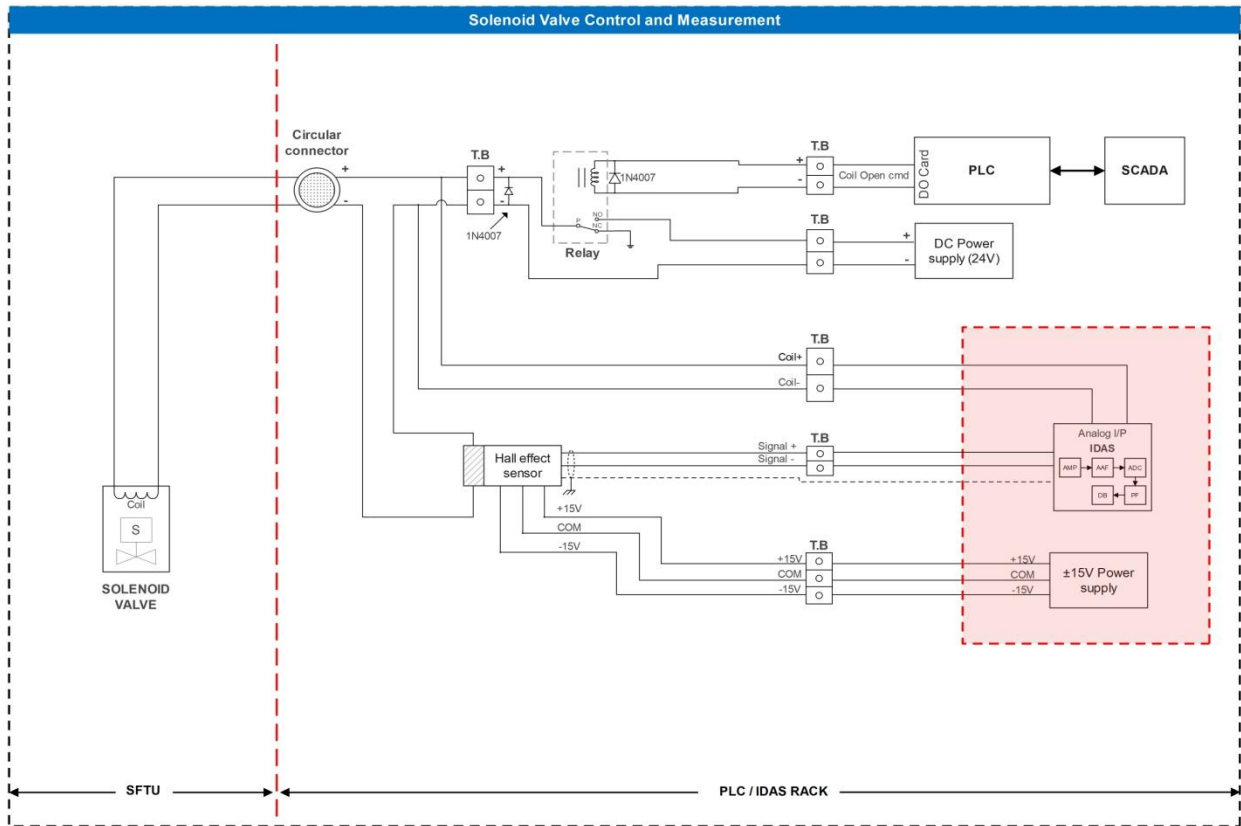


Figure-6: Solenoid Valve command chain

9.7 Latch Valve (LV)

The latch valve shall be provided with two independent coils, an open coil and close coil. A pulse command of user defined (ms) duration shall be applied to the respective coil to actuate the valve for opening or closing operations. The latch valve shall be equipped with a micro switch for position feedback. The valve status indication from the micro switch shall be displayed on the SCADA. Dedicated PLC, Power supply, Connector & dedicated software module shall be used for Latch Valve commanding & status monitoring.

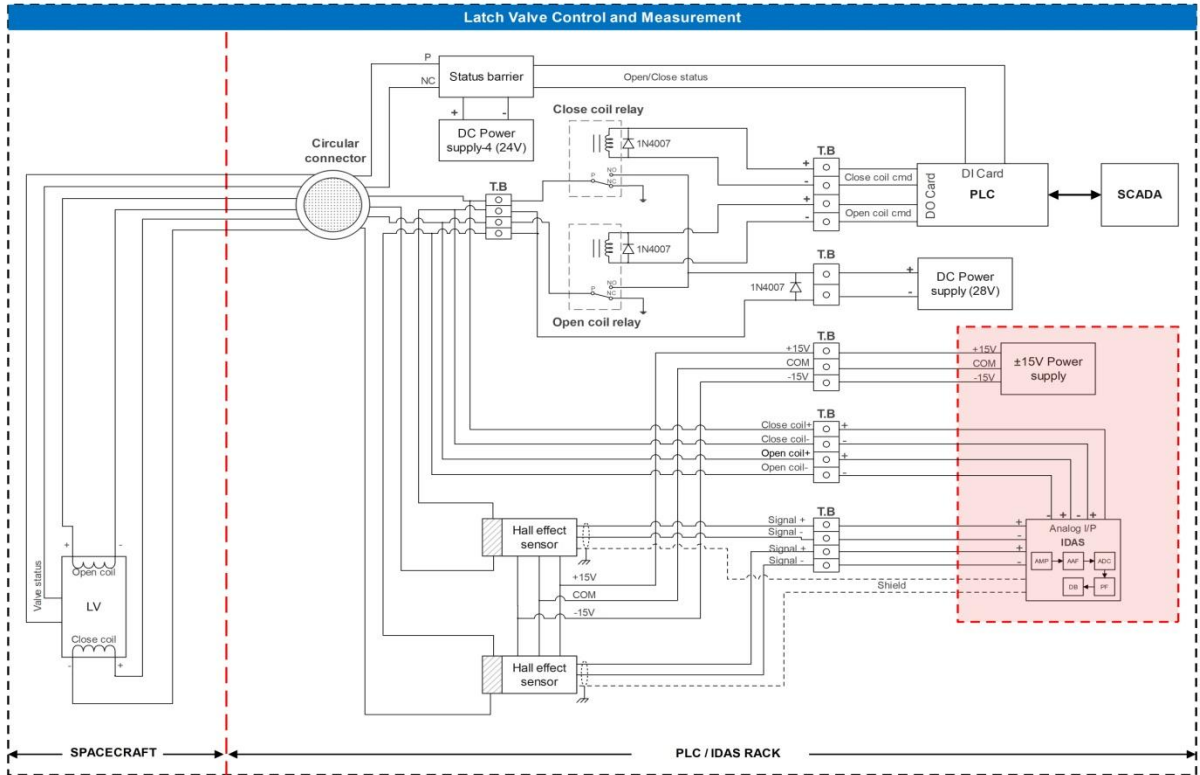


Figure-7: Latch Valve measurement chain

10. Instrumentation Rack-Equipment Assembly & Wiring

- Two Nos. of instrumentation racks are to be wired for full capacity
- The instrumentation rack shall be of 19-inch width and a maximum height of 25U to facilitate ease of transportation. The rack design shall ensure adequate access for operation and maintenance.
- All interconnecting wires and cables shall be properly concealed within the rack.
- The instrumentation rack shall accommodate the control system, IDAS, relays, power supplies, and associated components.
- Flow meter displays and weighing scale displays shall also be mounted within the instrumentation rack. Flow meter displays and weighing scale display will be provided by LPSC(B).
- Pressure, temperature, command voltage and current signals shall be terminated separately at the rear end of the rack using circular connectors. The mating ends shall be pre-wired with 15 m cables. Pin details for the mating connectors shall be provided by LPSC (B) at the time of installation.
- Solenoid valve command & status signals shall be terminated at the rear end of the rack and Latch valve commands and status shall be terminated in a separate connector. The mating ends shall be pre-wired with 15 m cables. Pin details for the mating connectors shall be provided by LPSC (B). Inside the rack, Wires shall be

housed in PVC cable ducts of suitable dimensions to accommodate system cables, I/O signal cables etc.

8. PVC cable ducts shall be organized to run electric wires according to the voltage level and function. Power supply wires and low voltage signal wires shall not be grouped together in the same cable duct.
9. 24 AWG, 22AWG PTFE cables shall be used for measurement and command signals respectively.
10. Wiring for different voltage signals shall be terminated separately on dedicated terminal strips.
11. DIN-rail mountable relays and terminal blocks shall be provided, and only solid-state relays shall be used.
12. Switched Mode Power Supplies are used for commands,. Linear power supplies shall be used for measurement and excitation.
13. The command power supply shall be provided in an ORed configuration using and ORing module to ensure seamless power availability.
14. All the instruments mounted in the rack shall be labeled properly.
15. All the termination of cable shall be labeled at both the ends and proper termination lugs shall be used and crimped with proper tools.
16. Instrumentation rack shall have power board & LAN switches mounted at the rear side.

10.1 Shielding and grounding of instrumentation racks

1. The instrumentation rack shall be provided with a dedicated protective earth (PE) bus bar made of copper, firmly mounted inside the rack.
2. The rack body, doors, side panels and all metallic parts shall be properly bonded to the earth bus bar using suitable earthing straps.
3. All equipment installed inside the rack (power supplies, controllers, IDAS, PLC, etc.) shall have their earth terminals connected to the rack earth bus bar.
4. Signal grounding and protective earthing shall be maintained separately to avoid ground loops and electrical noise.
5. Shielded cables shall have their shields grounded at one end only (preferably at the rack end) unless otherwise specified.
6. The earthing resistance of the rack shall comply with applicable standards and shall typically be less than 1 ohm.
7. Proper labeling shall be provided for all earthing points and grounding conductors.

11. Control system software requirements

11.1 Requirement for application software-PLC

The party shall develop and demonstrate PLC software as per the details given below. The software design document, source code and verification procedures shall be provided by the party.

11.1.1 Simulant filling

a. Commanding of EPVs

The PLC application software shall be able to command the solenoid valves which involve 2 types of operation such as Manual override and Auto sequence during simulant filling & draining. Manual override operation will be carried out during preparation for filling and auto sequence operation will be carried out during filling. There are total 10 Nos. of solenoid valves, in which 7 Nos. are to be commanded to open/close manually during Manual override and commanded to open based on the logic provided during Auto sequence. The other 2 Nos. of solenoids (SV3 & SV4) to be commanded to open by issuing always manual command from PLC during Manual override and Auto sequence. Remaining 1 No. of solenoid valve (SV5) will be commanded manually during Manual override and always under cutoff during auto sequence operation (it can be disabled in auto mode).

b. Storage tank pressure control

Storage tank pressure to be controlled between 9 to 8.5 bar during simulant filling. Pressure Transmitter PT1, in the feedback loop to monitor the storage tank pressure.

PLC shall monitor the pressure of PT1 and if it is ≤ 8.5 bar, actuate the solenoid SV1 to open and once it reaches to 9 bar it should cutoff the valve. The loop shall be continued till the completion of simulant filling.

c. Spacecraft tank pressure control

Spacecraft tank pressure to be controlled between 3 to 5 bar during simulant filling. Pressure Transmitter PT2 in the feedback loop to monitor the spacecraft tank pressure.

During simulant filling, PLC shall monitor the PT2 pressure and once it reaches ≥ 5 bar, cutoff the supply to solenoid SV8, SV9 & SV10, then wait for 10 seconds and actuate SV2. Once spacecraft pressure reaches to ≤ 3 bar it should cutoff SV2 and actuate SV8, SV9 & SV10 valves. The loop shall be continued till the completion of simulant filling.

d. Flow rate control

Flow rate control is a close loop operation to maintain the flow rate within the limits. There are two flow meters (MF1 & MF2) in the feed line. There are two range of filling low flow and High flow.

During the course of filling, flow sequence to be followed as per the table and flow rate shall be controlled. Sample filling sequence is given in below table which will be entered prior to filling by user.

Sl. No	Fill Qty (L)	Flow sequence	Pause time (min.)
1	0-7	5cc	User defined
2	7-140	80cc	User defined
3	140-200	5cc	User defined
4	200-800	80cc	User defined
5	Last 5L	5cc	

Table No: 4

Note: 5cc to 30cc is considered as low flow and above 30cc considered as high flow.

Initially 0-7 L phase, PLC shall issue a command to actuate SV6, SV8, SV9 and SV10 and PLC shall monitor the flow rate of MF1/MF2 (user selectable) in the feedback loop. If the flow rate reaches to $\geq 5\text{cc}$ (Flow cut off value should be user editable for low flow and high flow during initialization) cutoff SV8 and SV9. If the flow rate reduces to $\leq 4.8\text{cc}$ during filling, actuate SV8 & SV9 to increase the flow rate. When it reaches $\geq 5\text{cc}$, again cutoff SV8 & SV9. This flow rate control will be in close loop. Once total flow reaches 7L (Selected MF1/MF2 Volume Total), PLC shall cutoff the supply to SV6, SV8, SV9 and SV10. Subsequently hold the activities for 10 minutes (user editable) however data logging shall continue even during pause time.

After pause time Sl. No.2 of Table-4 shall be resumed. PLC shall issue a command to actuate SV7, SV8, SV9 and SV10. Then PLC shall monitor the flow rate of MF1/MF2 in the feedback loop, when the flow rate reaches to $\geq 80\text{cc}$ cut off SV8 & SV9. During flow, at any case flow rate reduces to $\leq 78\text{cc}$, actuate SV8 & SV9 to increase the flow rate. When it reaches to $\geq 80\text{cc}$, cutoff SV8 and SV9. Once flow reaches 140L (Selected MF1/MF2 Volume Total) PLC shall cutoff the supply to SV7, SV8, SV9 and SV10. Subsequently hold the activities till pause time however data logging shall happen during pause time.

The sequence shall be repeated as per the Table No. 4, till the end of the sequence.

After completing all the sequences, PLC shall cutoff the supply to all the valves.

e. Total Flow cutoff

At the end of flow sequence PLC shall monitor the mass total of MF1, MF2 and WB data once it matches with the simulant quantity to be filled, issue the command to stop the flow. For flow cutoff following cases shall be referred.

Case1: If the mass differences between of all three parameters are within specified limit (1/1.5Kg selectable by user), average of MF1, MF2 and WB shall be referred with respect to filling quantity (Kg) for total flow cutoff.

Case2: If MF1 mass deviates and MF2 and WB matches within specified limit, the total flow cutoff will be based on the average of MF2 and WB with respect to filling quantity (Kg).

Case3: If MF2 mass deviates and MF1 and WB matches within specified limit, the total flow cutoff will be based on the average of MF1 and WB with respect to filling quantity (Kg).

Case4: If mass of MF1 and MF2 both deviates more than specified limit with respect to WB, the total flow cutoff will be based on the WB data only with respect to filling quantity (Kg).

f. Real time computation of online parameters

During simulant filling the following parameters shall be computed online and to be referred for total flow cutoff in both PLC and IDAS.

- ✓ Gas mass
- ✓ Vapor loss
- ✓ $WB\ Mass\ Total = WB\ data + Gas\ mass + Vapor\ loss$
- ✓ MF1-MF2
- ✓ WB-MF1
- ✓ WB-MF2
- ✓ $Avg.\ Mass\ Total = Avg.\ of\ MF1,\ MF2\ \&\ WB\ Mass\ Total$

Computation algorithm will be provided during the time of PDR.

g. Mimic display

SCADA system shall be planned for mimic display and acquisition of all parameters like pressure, flow meters and weighing balance. Mimic should display the qty of simulant fluid is getting filled in the spacecraft tank and simulant fluid is getting drained from storage tank with reference to WB data.

h. Event data logging

SCADA system shall log the event data of all Solenoid vales current, supply voltage and valve status with date and time stamp. Valve status shall be taken feedback from current drawn by the respective valve.

11.1.2 Simulant Draining Requirement

a. Commanding of EPVs

Manual override operation will be carried out during preparation for stimulant draining and auto sequence operation will be carried out during draining. There are total 10 Nos. of solenoid valves, in which 7 Nos. are to be commanded to open/close manually during Manual override and commanded to open based on the logic provided during Auto sequence. The other 2 Nos. of solenoids (SV3 & SV5) to be commanded to open by issuing always manual command from PLC during Manual override and Auto sequence. Remaining 1 No. of solenoid valve (SV4) will be commanded manually during Manual override and always under cutoff during auto sequence operation (it can be disabled in auto mode).

b. Spacecraft tank pressure control

Spacecraft tank pressure to be controlled between 8 to 8.5 bar during simulant draining. Pressure Transmitter PT1 in the feedback loop to monitor the spacecraft tank pressure

PLC shall monitor the pressure of PT1 and if it is ≤ 8 bar, actuate the solenoid SV1 to open and once it reaches to ≥ 8.5 bar it should cutoff the valve. The loop shall be continued till the completion of simulant draining

c. Storage tank pressure control

Storage tank pressure to be controlled between 5 to 3 bar during simulant draining. Pressure Transmitter PT2 in the feedback loop to monitor the spacecraft tank pressure.

During simulant draining, PLC shall monitor the PT2 pressure and once it is reaches ≥ 5 bar, cutoff the supply to solenoid SV8, SV9 & SV10, then wait for 10 seconds and actuate SV2. Once spacecraft pressure reaches to ≤ 3 bar it should cutoff SV2 and actuate SV8, SV9 & SV10 valves. The loop shall be continued till the completion of simulant draining.

d. Flow rate control

Flow rate control is a close loop operation to maintain the flow rate within the set limits. There are two range of filling low flow and High flow.

During the course of draining, flow sequence to be followed and sample draining sequence is given below

Sl.No	Drain Qty (L)	Flow sequence	Pause time (min.)
1	0 to 5	20cc	User defined
2	5 to 795	80cc	User defined
3	795 to 800	Manual mode	

Table No. 5

Initially 0 to 5L phase, PLC shall issue a command to actuate SV6, SV8, SV9 and SV10. Then PLC shall monitor the flow rate of MF1 in the feedback loop, when the flow rate reaches 20cc (Flow cut off value should be user editable for low flow and high flow during initialization) cutoff SV8 & SV9. During flow, at any case flow rate reduces to ≤ 19.5 cc, actuate SV8 & SV9 to increase the flow rate. When it reaches 20cc, cutoff the supply to SV8 & SV9. Once the volume total of MF1/MF2 (user selectable) reaches 5L, PLC shall cutoff the supply to SV6, SV8, SV9 and SV10. Subsequently hold the activities during pause time (in min.) however data logging shall continue even during pause time.

After pause time, next flow sequence Sl. No.2 of Table No. 5 shall be resumed. PLC shall issue a command to actuate SV7, SV8, SV9 and SV10. Then PLC shall monitor the flow rate of MF1 in the feedback loop, when the flow rate reaches to 80cc cut off SV8 & SV9. During flow, at any case flow rate reduces to ≤ 78 cc, actuate SV8 & SV9 to increase the flow rate. When it reaches 80cc, cutoff SV8 & SV9. Once flow reaches 795L (MF1/MF2 Volume Total)

PLC shall cutoff the supply to SV7, SV8, SV9 and SV10. Subsequently hold the activities till pause time however data logging shall continue even during pause time.

The sequence shall be repeated as per the Table No. 5, till the end of the sequence.

e. Total Flow cutoff

At the end of draining sequence, total flow cut off shall be done manually.

f. Emergency stop

There should be an Emergency stop which should cut off supply to all the valves if called for.

g. Real time computation of online parameters

During simulant filling the following parameters shall be computed online and to be referred for total flow cutoff in both PLC and IDAS.

- ✓ Gas mass
- ✓ Vapor loss
- ✓ $WB\ Mass\ Total = WB\ data + Gas\ mass$
- ✓ $MF1 - MF2$
- ✓ $WB - MF1$
- ✓ $WB - MF2$
- ✓ $Avg.\ Mass\ Total = Avg.\ of\ MF1,\ MF2\ \&\ WB\ Mass\ Total$

Computation algorithm will be provided during the time of PDR.

Sample auto sequence is given in section 11.2.

11.1.3 Mimic display

SCADA system shall be planned for mimic display of solenoid valve status and acquisition of all parameters like pressure, flow meters and weighing balance. Mimic should display the quantity of simulant fluid is getting drained from the spacecraft tank and simulant fluid is getting filled in storage tank with reference to WB data.

11.1.4 Event data logging

SCADA system shall log the event data of all solenoid valves current, supply voltage and valve status with date and time stamp. Valve status shall be taken feedback from current drawn by the respective valve.

11.1.5 Preparation/Post operations

During preparation phase of simulant filling/draining all solenoids (SV1 to SV10) shall be operated by manual override. (Interlocks shall be disabled during preparation and post operation phase)

11.1.6 Solenoid valve open/ close status

During simulant loading/draining operations, solenoid valve open/close status is monitored through current drawn by solenoid valves and the current drawn is measured using Hall Effect sensors and to be acquired in Analog input of IDAS

11.1.7 Latch valve open/ close status

Latch valve to be commanded to open/close if called for. A dedicated software module shall be used for Latch valve commanding & status monitoring. Software module for LV commanding shall be standalone module & separate from SV commanding. It shall be invoked only when Latch Valves to be commanded."Issue of Latch valve commanding to be ensured by double confirmation. And micro switch position is connected to digital input via status barrier for latch valve status monitoring/acquisition. The current drawn is measured using Hall Effect sensors and to be acquired in Analog input of IDAS.

11.1.8 Pause timer

During simulant loading/draining operation, after the completion of each stage of volume total, a pause time shall be observed & pause time shall be user selectable. Elapsed time during this pause shall be displayed through a time elapsed indicator. Upon completion of pause time, the next operation as per sequence shall commence automatically.

11.1.9 Synchronization between PLC and IDAS

PLC based control system and measurement & data acquisition system shall be synchronized with hardware sync. A master clock shall provide time reference for PLCs, IDAS system and master clock may be based on GPS, NTP, PTP or IRIG-B. Data should be saved with common time stamp reference to ensure accurate correlation between events and measured parameters. PLC and IDAS shall receive SYNC signal through direct hardwired signal or via high precision network protocol. Synchronization accuracy between IDAS and PLC shall be $\leq 1\text{ms}$.

11.2 Sample Auto sequence

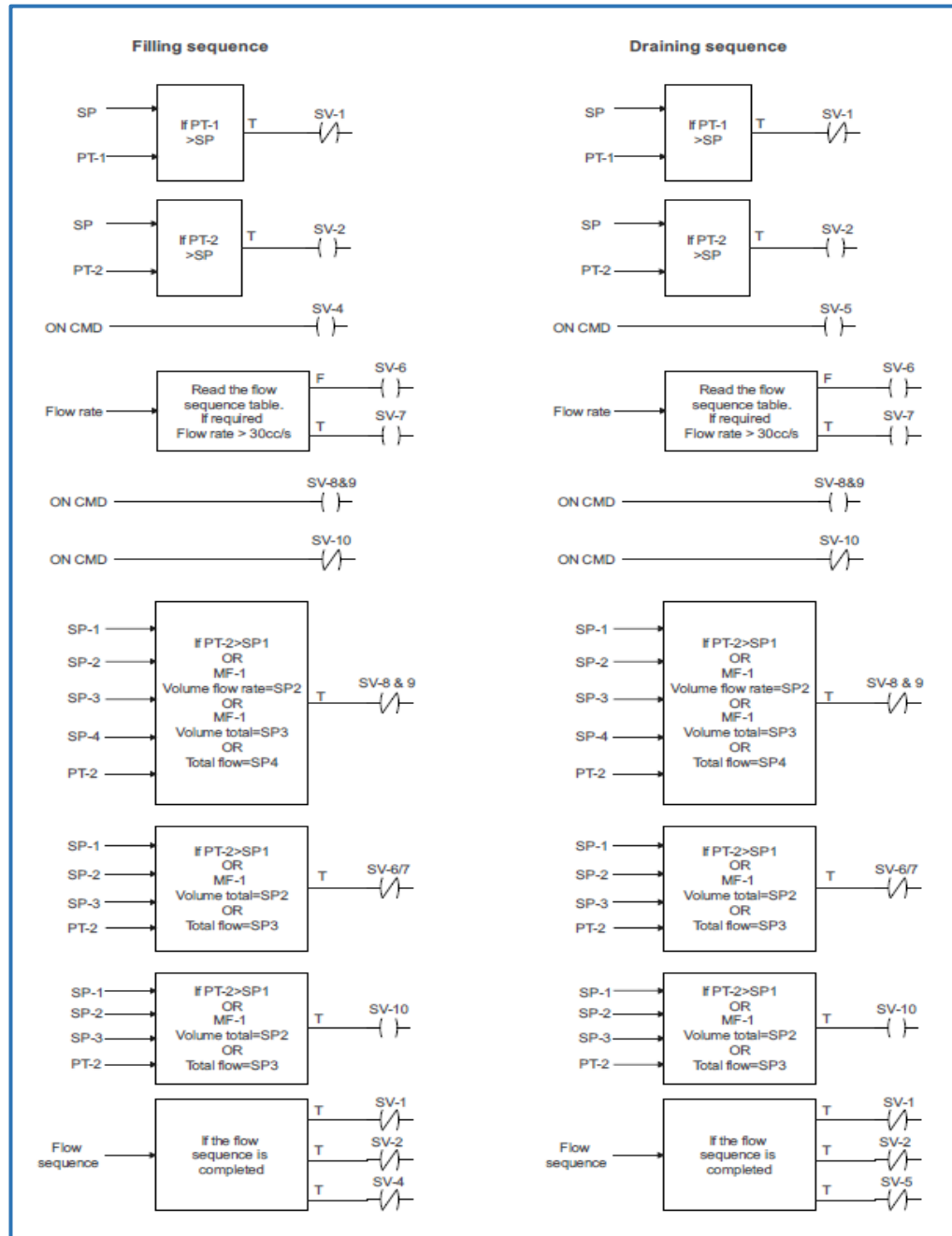


Figure-8: Sample Auto sequence

12. Safety Interlocks:

Interlocks shall be developed using PLC software, wherein various parameters shall be compared as per the defined logic and set limits. The program shall provide flexibility to modify variables such as time, analog and digital parameters. Logging of interlock enable/disable status, alarm limits and interlock execution status shall be provided for offline analysis.

1. During simulant filling, SV4 shall remain closed at all times in auto mode.
2. During simulant draining, SV5 shall remain closed at all times in auto mode.
3. During filling and draining operations, when SV6 is open (during low flow conditions), SV7 shall remain closed
4. During filling and draining operations, when spacecraft pressure reaches 5 bar, SV2 shall open and all other solenoid valves shall close

13. Hardware Emergency stop

There shall be a hardwired Emergency stop which directly cut the power supply to all the valves if called for.

14. Propellant loading software requirements

14.1 Introduction

It is application software used for simulant loading/draining. The software was configured to suit precise loading of simulant/propellant to the spacecraft through measured and derived parameters insitu. The software to Mass Link-EGSE configure for following features.

- Measurement & Acquisition of pressure and temperature
- Measurement & Acquisition of mass flow meter data through RS 485
- Measurement & Acquisition of weighing balance data through RS 232 & Ethernet
- Implementation of TMR logic for precise loading of propellant to the spacecraft
 - ✓ Computation of critical derived parameters
 - ✓ Gas mass correction
 - ✓ Vapor loss computation
 - ✓ Rate of pressurization
 - ✓ Prediction for venting during stimulant loading/draining

14.2 Software modules (EGSE-MASS link)

- ✓ LOGIN/LOGOUT Window
- ✓ General Configuration setting module
- ✓ EGSE parameters configuration module
- ✓ Mass parameters configuration module
- ✓ Algorithms for Gas mass correction, venting prediction, vapor loss computation and TMR logic for precise loading of propellant to the spacecraft

- ✓ Real time trend graph display
- ✓ Data logging and saving module
- ✓ Offline analysis module

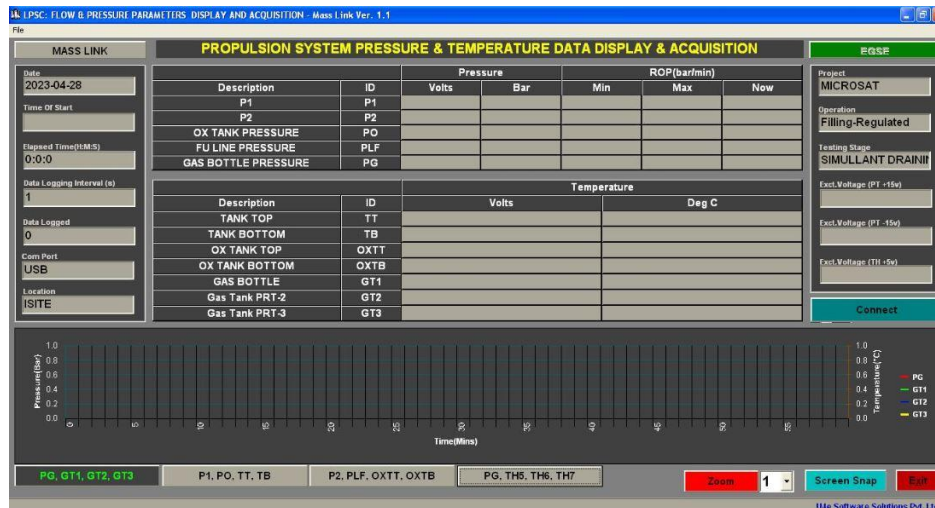


Figure-9: Sample EGSE data display screen

14.2.1 General configuration

This configuration is common for EGSE and Mass link

Description	Requirements
Project	This should be an editable box to enter project name (Alpha numerical)
Test stage	This shall be of DROPDOWN BOX with following selection (configurable) Simulant filling Simulant draining Propellant loading System level testing Post integration Other
File path	This should be an editable box to enter file name (Alpha numerical) to select drive/folder the file saving
Data logging interval	This shall be of DROPDOWN BOX with following selection (configurable) 1s, 2s, 5s, 10s, 30s, 60s etc This shall be used to log the data at different time interval
Operators	This should be an editable box to enter operators (Alpha numerical)
Location	This should be an editable box to enter location(Alpha numerical)

Table-6: Sample general settings

14.2.2 Configuration Module-EGSE

EGSE configuration window shall be configured to measure & display the selected pressure and temperature parameters. Also it has following configuration

Description	Requirements
EGSE ID	This should be an editable box to enter EGSE-ID (Alpha numerical)
Channel selection	Software shall have the provision for selecting the required channel to display, graph and ROP computation. Screen to be adjusted accordingly.
Polynomial constants	EGSE configuration should have provision to enter the calibration constants of Pressure and temperature sensor.
Engg unit conversion	Using the above mentioned polynomial constants, the raw voltage shall be converted to Engg unit and display
Sampling rate	This shall be of DROPDOWN BOX for selection of sampling rate for various measurement channels.
Decimal places	This shall be of DROPDOWN BOX for selection of decimal places to display and data logging.
Limits /Alarm	EGSE configuration screen shall have the provision to set the alarm limits and enable alarm in case the value exceeds the limits.
Start and stop acquisition	EGSE-MASS link software shall have the provision for start and stop acquisition by clicking the button
Graph selection	There shall be provision to select the required channels for trend graph display. 1. ROP 2. Real time pressure and temperature 3. Venting prediction All the above said graphs should appear in different screens

Table-7: Sample configuration module of EGSE

MASS

EGSE

LATCH VALVES

GRAPH

Mass-Link EGSE

Disconnect



General Settings

EGSE Settings

Prediction Settings

User Management

Ch.No: 1 to 19 Pressure Channels

Ch.No: 11 to 18 Temperature Channels

Ch.No: 19 to 26 Thermistor Channels

Ch.No: 27 to 29 Other Channels

NOTE: Please Click on the start button to start EGSE Data Acquisition

Start/Save EGSE

EGSE Settings

Description	ID	A0	A1	A2	A3	A4	Raw Volt	EU	Ch.No	EGSE	Mass	Graph	Prediction
PLO	PLO	14.732692	3.010006	0	0	0	0.001	14.736	1	☒	☐	☒	☐
PLF	PLF	14.940893	3.001198	0	0	0	0.001	14.944	2	☒	☐	☒	☐
PF	PF	15.130017	2.986328	0	0	0	0.001	15.133	3	☒	☒	☒	☒
PO	PO	14.909017	3.000697	0	0	0	0.001	14.912	4	☒	☒	☒	☒
PGR	PGR	14.757274	2.988256	0	0	0	0.001	14.760	5	☒	☒	☐	☐
PG (637)	PG	148.125165	29.853125	0	0	0	0.001	148.155	6	☒	☐	☐	☐
PLO (649)	PLO	0	1	0	0	0	0.001	0.001	7	☒	☐	☐	☐
PLF (650)	PLF	0	1	0	0	0	0.001	0.001	8	☒	☐	☐	☐
PF (642)	PF	0	1	0	0	0	0.001	0.001	9	☒	☐	☐	☐
PO (634)	PO	0	1	0	0	0	0.001	0.001	10	☒	☐	☐	☐
TH1	TH1	105.89	-56.149	14.635	-2.2844	0.0964	1.237	54.729	11	☒	☐	☐	☐
TH2	TH2	105.9	-56.098	14.6	-2.2749	0.0954	1.238	54.735	12	☒	☐	☐	☐
TH3	TH3	105.9	-56.098	14.6	-2.2749	0.0954	1.240	54.676	13	☒	☐	☐	☐
TH4	TH4	105.87	-56.259	14.71	-2.3049	0.0984	1.234	54.743	14	☐	☐	☐	☐
TH5	TH5	105.89	-56.181	14.656	-2.2903	0.097	1.236	54.742	15	☒	☐	☐	☐
TH6	TH6	105.89	-56.181	14.656	-2.2903	0.097	1.248	54.386	16	☒	☐	☐	☐
TH7	TH7	105.92	-56.023	14.549	-2.2609	0.0941	1.238	54.793	17	☒	☐	☐	☐
TH8	TH8	105.9	-56.102	14.603	-2.2756	0.0955	1.239	54.704	18	☐	☐	☐	☐
PRT1	PRT1	-481.13	1029.3	-1030.3	593.13	-126.79	1.314	60.142	19	☒	☐	☐	☐
PRT2	PRT2	-481.13	1028.9	-1029.6	592.47	-126.6	1.066	-0.102	20	☒	☐	☐	☐
PRT3	PRT3	-481.13	1026.5	-1024.8	588.32	-125.42	1.070	0.249	21	☒	☐	☐	☐
PRT4	PRT4	-481.13	1028.8	-1029.4	592.3	-126.55	1.068	0.357	22	☒	☐	☐	☐
PRT5	PRT5	-481.13	1031.1	-1034	596.32	-127.69	1.064	0.018	23	☒	☐	☐	☐
PRT6	PRT6	-481.13	1024.1	-1020	584.21	-124.25	1.070	-0.325	24	☒	☐	☐	☐

IC Pro

© 2024 IC Pro Solutions Pvt Ltd. All rights reserved.

Version 1.0.0

Figure-10: Sample EGSE configuration screen

14.2.3 Configuration Module-Mass link

Description	Requirements
Equipment ID	This shall be of DROPDOWN BOX with following selection (configurable) RC Equipment ID FTU ID Storage tank ID PDE ID Each configured option should have provision to enter the ID and save
Loading pressure	This should be an editable box to enter the pressure details (numerical)
Loading mass	This should be an editable box to enter the loading mass (numerical)
Fluid type	This shall be of DROPDOWN BOX with following selection (configurable) IPA HFE MON-3 MMH N2H4 Other

Description	Requirements
Gas type	This shall be of DROPDOWN BOX with following selection (configurable) GN2 GHe
Tank volume	This should be an editable box to enter the tank volume details (numerical)
MF1 port	Connection status and port no. to be displayed for MF1
MF2 port	Connection status and port no. to be displayed for MF2
WB port	Connection status and port no. to be displayed for WB
Graph	This shall be of DROPDOWN BOX with following selection (configurable) Time Vs Mass flow rate Time Vs Volume flow rate Time Vs Mass total, WB total & To be filled Time Vs Density & Temp. Time Vs EGSE Pressure & Temp.

Table-8: Sample configuration module of Mass Link

The screenshot displays the 'Mass-Link EGSE' configuration window. At the top, there are tabs for 'MASS', 'EGSE', 'LATCH VALVES', and 'GRAPH'. The 'EGSE' tab is currently selected. Below the tabs, there are sub-tabs for 'General Settings', 'EGSE Settings', 'Prediction Settings', and 'User Management'. The 'General Settings' sub-tab is active, showing a grid of configuration fields:

- System Settings:**
 - Remote Console *: SFTU/PA
 - Propellant Tank *: 1300
 - Fluid Transfer Unit/PDE *: SFTU
 - EGSE *: EGSE/05
 - Loading Mass (kg) *: 780
 - Loading Pressure (bar) *: 9.5
 - Fluid Type *: IPA
 - Gas Type *: (GN2/08)
 - Tank Volume (litr) *: 1300
 - Mass Difference Limit *: 1
- Project Settings:**
 - Configure Excel / Screenshot Path *: D:\07012026\TEST_13012026_6.xlsx
 - Operator *: (Empty)
 - Operator List: SAURABH X, SREEDHAR X
 - Project *: EGSE-05 VALIDATION
 - Operation *: Filling-Regulated
 - Location *: LPSCB
 - Testing Stage *: VALIDATION
 - EGSE Decimal Point *: 3
 - Sampling Rate *: 1000
- Communication Settings:**
 - MF-1 Port (RS485) *: COM12
 - MF-2 Port (RS485) *: COM13
 - WB Port (RS232) *: COM8
 - Data Logging Interval (sec) *: 1

At the bottom, there is a 'Save' button and a checkbox for 'Turn Off Settings' which is currently checked. The footer shows '© 2024 IC Pro Solutions Pvt Ltd. All rights reserved.' and 'Version 1.0.0'.

Figure-11: Sample Configuration screen of Mass link

14.2.4 Algorithms

Algorithms for Gas mass computation, Vapor loss, Difference calculation for MF1-MF2, WB-MF1, WB-MF2, Avg. Mass Total, Total cut off will be provided during PDR.

14.2.5 Real time graph display

Software shall have the tab for real time trend graph display. While clicking that, trend graph shall be displayed during the start of acquisition to end for the selected parameters. It also shall have provision to display the numerical value when user points the cursor at any point. Trend graph shall have the provision to zoom for the selected duration in real time. Real time graph updation shall be 1sec.

14.2.6 Graph plotting module

In graph plotting module, graph shall be plotted from the acquired data for selected parameters & scales. The module shall support plotting of both single and multiple parameters with same & different scales in a single graph and additionally the module shall provide features for editing and printing the plotted graph.

15. Factory acceptance test (FAT)

1. The Factory Acceptance Test shall be carried out before the dispatch of items to LPSC(B).
2. All items shall be procured as per approved BOM.
3. Tests and acceptance of the items shall be carried out as per mutually agreed procedures.
4. Vendor has to carry out necessary functional verification such as continuity, integrity check of the end to end wiring, simulation of voltage/ current, etc.,
5. The vendor shall test and demonstrate the functional integrity of IDAS & control system hardware and software. The test shall be carried out when the system is in fully assembled condition and no modules-wise test shall be accepted. Vendor shall provide all the required facilities to comply with the above requirement.
6. It shall be the vendor's responsibility to replace any hardware and modify the software if the specified functions are not completely achieved satisfactory during testing and factory acceptance.
7. No material or equipment shall be shipped until all required tests are successfully completed and certified "Ready for shipment" by the LPSC(B).

15.1 The following tests shall be carried out for IDAS as part of FAT

1. Linearity check: The IDAS will be tested for linearity by simulating the necessary inputs.
2. Cross Talk checking: Two adjacent channels will be tested for cross talk.
3. Input saturation test: Checking the saturation point of the analog input modules by giving a saturated input. The value shall be within the specified limits.
4. Input impedance check
5. CMRR, Isolation and CMV check

6. Over voltage check
7. IDAS software basic functionality verification
8. Online trend graph display verification
9. Error diagnostics of the network failure, system failure, input, output card failure
10. Data storage test (continuous storage for 12 hours with selectable sampling rate)

15.2 The following tests shall be carried out for control system as part of FAT

1. Cycle time verification
2. Functional verification of Digital I/O's
3. Accuracy, linearity and check of Analog Input cards.
4. Error diagnostics of the network failure, system failure & I/O failure.
5. Sample mimic with animation which demonstrate command generation, status and parameter display.
6. Data retrieval and processing
7. Any other mutually agreed test

16. SITE ACCEPTANCE TEST

16.1 SITE ACCEPTANCE TEST (SAT) OF IDAS

All specification of IDAS shall be verified with full load and vendor shall demonstrate the following major performance matrix

1. Hardware verification as per final BOM
2. Functional check of input/output module, linearity check, timing accuracy check, cross talk check
3. CMRR checks and Isolation Checks
4. Over voltage check
5. Noise and filter performance check
6. Acquisition of data with full channel capacity for selected sampling rates capacity for 12 hours, Data storage test & retrieval and processing of data
7. Validation of IDAS configuration software
8. Burn-in test for 48 hours (Data logging at 1 sec interval)
9. Verification of configuration of measurement channels
10. Verification of On-line trend graph display
11. Verification of offline data processing & graph plotting module
12. Verification of application software for its functionality including logics and calculation.
13. Any other mutually agreed test.

16.2 SITE ACCEPTANCE TEST (SAT) OF CONTROL SYSTEM

All the performance specification of the control system with load shall be verified and vendor should demonstrate the following major performance matrix

1. Hardware verification as per final BOM
2. Cycle time verification with application program with full load
3. Functional verification of digital I/O's
4. Linearity & accuracy check of Analog input cards
5. Online real time display & data reporting software for continuous acquisition of 12 hours
6. Commands shall be issued from SCADA to all solenoid valves and latch valves and Open/close status indications shall be verified in the control system.
7. Verification of event data logging and analog data recording and retrieval
8. Verification of all computation algorithms and derived parameter calculations shall be carried out.
9. Verification of auto-sequence logic and event logging.
10. Power failure recovery and system restart behavior shall be tested.
11. Error diagnostics of the network failure, system failure, I/O failure
12. Any other mutually agreed test

Note: Any malfunctioning in the system shall be rectified /replaced if required. Failure of any component shall be replaced with new one. No repaired parts/modules shall be accepted.

16.3 Test & Evaluation (End to end verification of complete system Demonstration)

a) Measurement system

A known input signal shall be fed from calibrated source for all the measurement channels and the output shall be recorded in IDAS and linearity shall be verified against the tender specification & all the results are to be logged in T&E format. The sample format will be provided by LPSC (B)

b) Command System

1. End-to-end demonstration of simulant filling and draining operations shall be conducted.
2. Real-time data monitoring, trending, and logging functionality shall be demonstrated.
3. Alarm annunciation and event recording during operation shall be verified
4. Operator interface usability and manual override features shall be demonstrated.

5. Simulation of power failure and restoration of sequence and data storage

17 TRAINING OF LPSC (B) PERSONNEL

- a. The supplier shall provide adequate training to department Engineers (2 persons), for a minimum period of 10 working days.
- b. The supplier shall intimate the date of commencement of the FAT in advance so that department's engineers shall plan to participate in the FAT.
- c. The training shall be organized for control system and data acquisition system to provide complete understanding of the functions of the system, overall system concepts and routine operation for maintenance of the system and minor modification in application software development if required in SCADA & IDAS by department engineers. It is essential that all the system and other required document shall be available before commencement of training.
- d. Integrated Data acquisition system (IDAS) training includes**
 - i. Hardware Installation and maintenance, Installation of IDAS software
 - ii. Configuration of measurement parameters , Sensor polynomial constants etc.,
 - iii. Error diagnostics & troubleshooting
 - iv. Any other area on mutually agreed basis
- e. Control system the details of training shall include**
 - i. Hardware Installation and maintenance, system configuration
 - ii. Installation of SCADA package
 - iii. Data acquisition, offline data storage & retrieval
 - iv. Application program modifications to cater addition and deletion of valves in control system
 - v. Error diagnostics & trouble shooting
 - vi. Any other area on mutually agreed basis

I. Specification of sensors/valves

1 Specification of sensors/valves

1.1 Specification of Pressure Sensor

1. Excitation voltage	:	$\pm 15V \pm 0.1 V$ DC
2. Zero (Absolute)	:	$-5 V \pm 0.25 V$ DC,
3. Full scale output	:	$+5V \pm 0.25V$
4. Non –Linearity + Hysteresis	:	$\leq \pm 0.7\%$ FSO
5. Bridge configuration	:	Wheatstone Bridge
6. Insulation Resistance	:	$>100M\Omega$ @ 100 V DC
7. Input Impedance	:	$>1000 \Omega$
8. Output Impedance	:	$<500 \Omega$
9. Current drawn	:	From -ve supply : -3mA nominal From +ve supply : +12 mA nominal
10. Compensated Temp. Range	:	-50 to $+65^{\circ} C$
11. Power Consumption	:	$<150mW$

1.2 Specification of latch valves

1. Operating Voltage	:	28 to 42 VDC
2. Coil Resistance	:	$90 \pm 5 \Omega$
3. Minimum actuation voltage (Open/ Close)	:	$\geq 3 V \leq 18 VDC$
4. Insulation resistance	:	$50 M\Omega @ 100 VDC$

1.3 Specification of solenoid valves

1. Operating pressure	:	0-20 bar
2. Operating voltage	:	28VDC
3. Coil resistance	:	$3.8K\Omega$
4. Current drawn	:	25 to 20mA

1.4 Flow meter

1. Flow sensor : Coriolis type,
2. Make: Micromotion, Model No: CMF 025,
3. Transmitter: 3500, Make: Micromotion
4. Protocol: Modbus RTU (RS485)

1.5 Weighing balance

1. Platform :Analog platform, Make : Mettler Toledo
2. Display : IND 570X
3. Protocol: RS232 & Ethernet

II. Specification of Instruments/Equipments

Sl. No.	Description	Page No.
1	Specification of control system	33
2	Specification of Integrated Data acquisition system (IDAS)	35
3	Instrumentation Rack & Accessories	38
4	RS485 & RS232 module	40
5	Specification of power supplies	41
6	Ethernet switch & cables	42
7	Solid state Relay	43
8	Specification of valve status barrier	43
9	Circular connectors & accessories	43
10	Hall effect sensor with PCB	44
11	PTFE cables	44
12	Printer	46

1. Specification of Control system

1.1 Controller

Sl. No.	Specification	Description
1	Controller/processor	Standalone PLC
2	Cycle time	10 ms
3	Event data acquisition	100 ms or better
4	Analog data acquisition	100 ms or better
5	Operating temperature	15-50°C
6	Humidity	0-95%, non-condensing or better
7	Memory for data storage	10MB or better
		Non volatile memory:1GB or better
8	Power voltage	18...32V DC
9	No. of I/O's	As required
10	Communication interface	USB 3.0, Ethernet 1000 Mbps or better
Software		
11	PLC programming language	As per IEC 61131-3
12	SCADA	Unlimited tags & flags along with labelling provision or should meet the tender requirements with additional 50%capacity.,Runtime Configuration/ Development package
13	Data updation in SCADA	≤ 500 ms
14	Diagnostic feature	Required
15	Real time display, Data acquisition, logging and reporting software	Required
16	Data base for analog and digital data	.csv, Microsoft excel or xml
17	Module power	18...32V DC

Table No: 9

1.2 Analog input module

Sl. No.	Specification	Description
1	No. of channels	8 (differential)
2	Input signal	±10VDC /4-20mA
3	Resolution	≥ 16 bit
4	Filter	Low pass (hardware/software)
5	Overall Accuracy	≤ ± 0.1 % or better for voltage ≤ ± 0.2 % or better for current
6	Conversion time for all channels in a module	≤ 10 ms
7	Input Impedance	Voltage mode: ≥1MΩ Current mode:<500Ω
8	Electrical Isolation	250 V rms input to PLC

Table No: 10

1.3 Digital Input module

Sl. No.	Specification	Description
1	No. of channels	8
2	Input Voltage	24 V DC
3	Input Resistance	> 2K ohm
4	Switching Delay	≤ 1 ms
5	Electrical Isolation	> 250 V rms input to PLC
6	LED Indication	For individual Channel

Table No: 11

1.4 Digital Output module

Sl. No.	Specification	Description
1	No. of channels	41
2	Output Voltage	24VDC
3	ON/OFF switching delay	≤ 1 ms
4	Overload protection	Required
5	Current per output	> 0.1 A
6	Electrical Isolation	> 250 V rms Output to PLC
7	LED Indication	For individual Channel

Table No: 12

1.5 SCADA system (Qty: 2 Nos.)

Sl No.	Specification	Description
1	Type	Mini PC (Box type)
2	Screen	27-inch or above, LED-backlit
3	Processor	Intel Core i9 or latest
4	Memory	64 GB DDR4 2666MHz or better
5	Hard Disk	2TB
6	Graphics	Integrated Intel HD Graphics
7	Network	100 Mbps inbuilt Ethernet Controller or better
8	USB Ports	USB 3 Nos
9	Optical drive	8X DVD +/- RW
10	Key board and Mouse	Wireless Keyboard and Mouse
11	OS	Windows 11 Pro, 64 bit
12	Display port	Dual display ports (one VGA & one HDMI)
13	Antivirus	To be provided

Table No: 13

2.0 Specification of Integrated Data acquisition system (IDAS)

2.1 Chassis

Sl. No.	Description	Specification
1	Type	19" rack mountable system
2	Input Power	230 VAC, 50Hz
3	Cooling	Suitable cooling for panel/chassis to be provided
4	LED indication/alarms	Temperature alarm, system failure, power on
5	Connectors on back and front panel	Suitable mating connectors to be provided. LEMO/suitable locking connector
6	Operating temperature	10 to 50°C (Nominal)
7	Humidity (Nominal)	10 to 90% RH non-condensing
8	Shock &vibration	EN60068-2-6, EN60721-3-2, EN60068-2-27 or equivalent
9	EMI/EMC	EN61000-3-2 , EN61000-3-3 or equivalent
		Note: Chassis shall have 2 Nos of dummy slots for future expansion
10	Chassis compatibility	Chassis compatible with controller

Table No: 14

2.1.1 Digital bus

Sl. No.	Description	Specification
1	Digital bus	PXI Express/ EtherCAT/Proprietary bus
2	Bus throughput rate (min)	$\geq 100\text{MBytes /second}$
3	Synchronization clock (min)	$\geq 10\text{MHz}$ between all input cards/Chassis
4	Synchronization	All Input modules shall be part of main system. If separate modules are used, then it should be hardware synchronized with main chassis through standard protocol like IRIG/PTP/NTP/EtherCAT

Table No: 15

2.2 Controller

Sl. No.	Description	Specification
1	Controller	Embedded controller/PXI/PXIe/Proprietary Controller with real time storage and analysis
2	Processor	Intel Core i7 / Atom / Xeon 4 core or better processor
3	Processor Type	64 bit
4	RAM	32 GB RAM or better with RTOS
5	Secondary memory	Flash /SSD 2 TB
6	Processor speed	2.8 GHz or better

Sl. No.	Description	Specification
7	Communication interface	5 X10GB Ethernet ports
8	Data Interface	Ethernet 10GB LAN/EtherCAT, USB 3.0 (4 Nos.)
9	Operating system	Windows (64 bit)/Linux
10	LED Indication, Alarm	System failure, Power on Alarm, Network Connectivity Indication etc.,

Table No: 16

2.3 Voltage signal conditioner module ($\pm 10V$)

Sl. No.	Description	Specification
1	Voltage input	$\pm 10V$
2	Number of channels	93
3	Input configuration	Differential
4	CMRR	≥ 80 dB @ 50 Hz
5	Input Impedance	$\geq 10M\Omega$
6	Overall Accuracy	$\leq \pm 0.1\%$ of FSO (Including gain accuracy, gain linearity, gain temperature coefficient, Stability, Offset drift etc.)
7	Isolation	
7.1	Type	Channel to Channel and Channel to ground
7.2	Isolation voltage	$\geq 250VDC$
8	ADC Configuration	
8.1	Quantity	Individual ADC for each channel
8.2	Type	Delta sigma/SAR
8.3	Sampling rate	10, 100, 1000, 5000Hz selectable.
8.4	Resolution	≥ 16 bit
Note:	Party has to provide Signal to noise ratio & Cross talk specification Anti-aliasing Filter: System shall be configured with Low pass filter for anti aliasing for each channel Programmable Filter: 4 pole Bessel or better programmable digital filter 10Hz-10 KHz	

Table No: 17

2.4 Voltage signal conditioner module (0- 60V)

Sl. No.	Description	Specification
1	Voltage input	0-60V
2	Number of channels	41
3	Input configuration	Differential
4	CMRR	≥ 80 dB @ 50 Hz
5	Input Impedance	$\geq 1M\Omega$
6	Overall Accuracy	$\leq \pm 0.1\%$ of FSO(Including gain accuracy, gain linearity, gain temperature coefficient, Stability,

		Offset drift etc.)
7	Isolation	
7.1	Type	Channel to Channel and Channel to ground
7.2	Isolation voltage	$\geq 250\text{VDC}$
8	ADC Configuration	
8.1	Quantity	Individual ADC per channel
8.2	Type	Delta sigma/SAR
8.3	Sampling rate	10, 100, 1000, 5000Hz selectable.
8.4	Resolution	≥ 16 bit
Note:	Party has to provide Signal to noise ratio & Cross talk specification Anti-aliasing Filter: System shall be configured with Low pass filter for anti aliasing for each channel Programmable Filter: 4 pole Bessel or better programmable digital filter 10Hz-5KHz	

Table No: 18

2.5 RTD signal conditioning Module

Sl. No.	Description	Specification
1	Type of input and configuration	➤ PT1000, PT100 (Resistance inputs) comply to IEC 60751. ➤ 2 wire, 3wire and 4 wire software selectable. ➤ The type and its range should be software selectable per channel
2	Number of channels	12 Nos.
3	Sensor excitation	$\leq 1\text{mA}$ DC excitation/pulsed dc excitation
4	Input impedance	$\geq 1\text{M}\Omega$
5	Accuracy	$\leq 1^\circ\text{C}$
6	Range	0 to 100 $^\circ\text{C}$
7	Filter	
7.1	Anti-aliasing Filter	Low pass filter for anti-aliasing
7.2	Programmable Filter	4 pole or better programmable Digital filter (1-100 Hz)
8	Isolation	
8.1	Type	Channel to Channel and Channel to Ground
8.2	Isolation voltage	$\geq 250\text{VDC}$
9	ADC Configuration	
9.1	Type	Delta sigma/SAR
9.2	Resolution	≥ 16 bit
9.3	Sampling rate	1 to 100Hz selectable

Table No: 19

Note: The above Nos. and Qty are indicative. In order to demonstrate the complete functionality of the system, the party has to supply all the necessary items.

2.6 Data processing node

Sl No.	Specification	Description
1	Type	Mini (box type)
2	Screen	27-inch or above, LED-backlit
3	Processor	Intel Core i9 or latest
4	Memory	64GB DDR4 2666MHz min
5	Hard Disk	2 TB
6	Graphics	Integrated Intel HD Graphics
7	Network	100/1000 Ethernet Controller in-built.
8	USB Ports	USB 3 Nos
9	Optical drive	8 X DVD +/- RW
10	Key board and Mouse	Wireless Keyboard and Mouse
11	OS	Windows 11 Pro, 64 bit
12	Display port	Dual display ports (one VGA & one HDMI)

Table No: 20

3.0 Instrumentation rack & accessories

Sl.No.	Description	Specification
1	Welded Frame Size	Single Rack Height: 25U Width: 600mm Depth: 800mm
2	Standard	Confirms to DIN 41914 & EIA 310
3	Material	Steel
4	Preferred Color	Black/Grey
5	Bottom Panel with cut-out for cable entry from false floor/trench	1No.
6	Bottom panel gland plate	3Nos.
7	Top panel with fan cut-out	1No.
8	Tube light with door limit switch	1No.
9	19" mounting angles with punched sections	2 pairs (front & rear)
10	Front & rear door	Front door: lockable made of toughened tinted glass
11	Side panels with slam latches left & right (lockable)	2 Nos. made of steel
12	Enclosure frame	Powder coated finish
13	Earth continuity kit	2 Nos.
14	Lifting eye bolts	4 Nos.
15	Wheels	Castor wheels
16	Power extension board	

Sl.No.	Description	Specification
17	Accessories per rack: L angles, Filler plates 1U,2U,4U and 6U and captive mounting hardware	

Table No: 21

General specification

1. Aluminum extruded frame along with side, top and bottom panels in steel.
2. Bottom panel with cable gland plate for cable entry.
3. Lockable front door made of toughened tinted glass of 5 mm Thick. Steel frame of 18 Gauge CRCA sheet.
4. Side panels with slam latches vented top cover made of 18 Gauge CRCA sheet.
5. 19" Mount for equipment mounting channels made of 14 Gauge CRCA sheet and to comply the specifications in IS 513 – CRCA.
6. Cross support to be made up of 14 Gauge CRCA sheet comply the specifications in IS-513- CRCA.
7. Base frame to be made up of 13 Gauge CRCA sheet and to comply the specifications in IS-513-CRCA.
8. Maximum Load rating of 300 kg.
9. Panels and doors to be powder coated with Light grey EPOXY/Anti flame property specified in RAL 7037 grey.
10. Frame to be made of Aluminum extrusions powder coated specified in RAL 7037 Grey.
11. Equipment support angles to be made of 14 Gauge CRCA sheet as specified in IS-513-CRCA.
12. Cross ventilation to be done with 4 fan trays made of 14 Gauge CRCA sheet at bottom with 10-micron filters.
13. Cooling fans and fan trays (in a group of 4 fans, two sets per rack) to be provided as per the specifications in NCB LL60X300RFEF16.
14. Earthing continuity kit to be provided.
15. AC mains channel (Horizontal mounting to be provided).
16. Rear steel door to be provided with a lock facility made of 18 Gauge CRCA sheet and to comply the specifications of IS-513-CRCA.
17. Captive mounting hardware 200 numbers to be provided.
18. Front and rear holed profiles for mounting equipment supports to be provided.
19. 100 mm Height Base Frame 600*800mm.
20. Vertical cable tray to be made up of polyamide with black color cover to be provided.
21. Internal lightings to be provided with on/off switch.
22. Hooks to be provided on the top plate for lifting and rollers to be provided at the bottom for moving the racks. The rollers should be lockable type for positioning the racks.
23. Colour: Frames-Black, Doors, side panels, top & Bottom panels – Black.

24. Accessories

- a. Support angles (14 Gauge CRCA sheet)
- b. Anodized aluminum filler plates - 1U, 2U, 3U, 4U, 5U & 6U size
- c. Keyboard tray
- d. Fasteners
- e. Castor wheels

4.0 RS 485 & RS 232 ports

Sl. No.	Description	Specification
1	Type of Input	RS232 and RS485
2	No. of Ports	4 Nos. RS232 6 Nos. RS485

Table No: 22

4.1 RS 485 splitter

Sl.No.	Description	Specification
1	No. of channels	4 channels
2	Input	1-RS485 Channel; Data+, data-
3	Output	4-RS485 Channel; Data+, data-
4	Transmission distance	Max. 1200m at 9.6 kbps; Max. 400m at 115.2 kbps
5	Speed	1200 ~ 115200 bps via fixed baud rate
6	Power supply	5V dc/ 24Vdc
7	Isolation	Required
8	Operating temperature	-25°C to +75°C
9	Humidity	10-90% RH, non-condensing

Table No: 23

4.2 RS 232 splitter

Sl.No.	Description	Specification
1	No. of channels	4 channels
2	Input	1-R232 master
3	Output	4-RS232 slave
4	Data rate	300bps to 115.2Kbps
5	Power supply	5V/24Vdc
6	Isolation	Required
7	Operating temperature	-25°C to +75°C
8	Humidity	10-90% RH, non-condensing

Table No: 24

5.0 Specification of power supplies

5.1 Fixed DC Power Supply 24V, 5A

Sl.No	Description	Specification
1	Type	DIN rail mountable fixed power supply
2	Input Voltage	230 $\pm$ 10%VAC, 50Hz as per Indian power supply standard
3	Rated output voltage	24VDC
4	Rated output current	5A or better
5	Output power	120W
6	Ripple and noise	$\leq$ 50 mVrms or better
7	Accuracy	$\pm$ 1 %
8	Efficiency	$>$ 85 % or better
9	Type of protection	Reverse voltage, short circuit
10	Operating temperature	10-50°C
11	Humidity	10 to 95%

Table No: 25

5.2 Variable DC Power Supply 60V, 12.5A

Sl.No	Description	Specification
1	Type	Rack mountable (full rack).1U (H)
2	Input Voltage	230 $\pm$ 10%VAC, 50Hz as per Indian power supply standard
3	Rated output voltage	0 – 60 V
4	Rated output current	0 -12.5A
6	Rated output power	750W
7	Efficiency	88% or better
8	Max. Line regulation	0.01% of rated output+2mV
9	Max. Load regulation	0.01% of rated output+2mV
10	Ripple and noise	$<$ 10 mVrms
11	Read back accuracy	$<$ 120 mV
12	Protection	Overvoltage, and shortcircuit
13	Programming	Analog programming option for voltage/current
14	Indications	Voltage and current, 4 digit Accuracy:0.5%
15	Interface	RS232/RS485
16	Input voltage	230V,50Hz
17	Temperature coefficient	50ppm/°C
18	cooling	Forced air
19	Operating temperature	10-50°C
20	Humidity	10 to 95%

Table No: 26

5.3 Dual power supply $\pm 15V$, 3A

Sl.No	Description	Specification
1	Type	Dual programmable power supply
2	Input Voltage	230 $\pm$ 10%VAC, 50Hz as per Indian power supply standard
3	Rated output voltage	$\pm 15V$
4	Rated output current	0-3A
5	Output voltage stability	0.3%
6	Max. Line regulation	0.01% of rated output+3mV or better
7	Max. Load regulation	0.01% of rated output+3mV or better
8	Ripple and noise	≤ 1 mVrms
9	Protection	Overvoltage, over current, short circuit and over temperature
10	Temperature coefficient	≤ 300 ppm/ $^{\circ}C$ or better
11	Cooling	Forced air
	Environmental conditions	
12	Operating temperature	10-50 $^{\circ}C$
13	Humidity	10 to 95%

Table No: 27

6.0 Ethernet switch & cables

Sl No.	Description	Specification
ETHERNET SWITCH		
1	Type	Layer 2 Manageable switch
2	Qty	As required
3	No of Ports	8 ports 10/100 Mbps
4	Switching capacity	8.8 Gbps
5	Transmission method	Store and forward
6	VLANS	255 static VLANS
7	Stacking capacity	32 units per stack
8	Stacking bandwidth	13.6 Gbps Integrated Modular stacking system
9	Power supply	24V DC /230 V + 10%AC, 50+ 1Hz
ETHERNET CABLES		
10	Category	CAT6A
11	Type	Twisted pair and shielded (100MHz)
12	Wire Gauge	24 AWG
13	Wiring standard	T568B
14	Cable impedance	100 Ω
15	Operating temperature	-10 $^{\circ}C$ to 60 $^{\circ}C$
16	Connector	RJ45C

Table No: 28

7.0 Solid state relay

Sl.No.	Description	Specification
1	Qty	50 Nos.
2	Type	MOSFET/IGBT switching
3	Coil rating	24Vdc, $\leq 20\text{mA}$
4	Contact rating	30V, 2A
6	Turn ON time	$< 2\text{ms}$
7	Turn OFF time	$< 2\text{ms}$
8	Isolation	Opto isolation
9	Insulation resistance	$> 1000\text{M}\Omega$

Table No: 29

8.0 Specification of valve status barrier

Sl.No.	Description	Specification
	General specification	
1	*Quantity	10 Nos.
2	Signal Type	Digital input
3	Supply	20 to 30VDC
4	Rated current	$\leq 50\text{mA}$
	Input	Proximity/Relay
5	Connection	Terminals 1+,2+,3- & 4+,5+,6-
6	Open circuit voltage/short circuit current	8V/8mA
7	Switching point	1.2 to 2.1mA
	Output	
8	Connection	Output terminals-1: 7,8,9 Output terminal-2: 10,11,12
9	Output I & II	Signal, relay
10	Energized/De-energised delay	20ms
11	Minimum switch current	2mA/24Vdc
12	Switching frequency	$\leq 10\text{Hz}$

Table No: 30

9.0 Circular connectors (As required)

Sl.No.	Description	Specification
1	Type	Crimp type
2	No. of pins	As required
3	Coupling system	Bayonet/threaded
4	Materials	
4.1	Insulator	Polychloroprene
4.2	Fixed plate & Guide pins	Stainless steel
5	Contacts	Copper alloy-gold over nickel

Sl.No.	Description	Specification
5.1	Contact size	22/24 AWG
6	Electrical characteristics	
6.1	Current rating	5A
6.2	Working voltage	600V
6.3	Insulation resistance	Greater than 5000 MΩ
6.4	Contact resistance	Less than 10mΩ
7	Protection	IP67
8	Base housing	
8.1	Material	Aluminum alloy
8.2	Locking mechanism	Double Latch
9	Environmental characteristics	
9.1	Contact retention	Greater than 50 N
9.2	Life	≥500 mating cycles
10	Accessories	Cable glands, plugs as required
11	Standards	MIL -DTL-5015/MIL-DTL-26482
12	Mating cycle	≥500 cycles

Table No: 31

10.0 Hall Effect sensor with PCB

Sl.No	Description	Specification
1	Range	0 to 2A
2	Output voltage	0 to 4V
3	Output impedance	<50Ω
4	Load resistance	≥10kΩ
5	Supply voltage	±15V
6	Accuracy	≤0.5%
7	Response time	3 μs or better
8	operating temperature	10 to +85°C
9	Isolation	Galvanic isolation between and primary & secondary circuit

Table No: 32

11.0 PTFE cables (22 & 24 AWG)

11.1 Hookup wire

Sl.No	Description	Specification
1	Inner conductor	Multi stranded silver plated copper wire of size AWG 22/19/0.16mm. Multi stranded silver plated copper wire of size AWG 24/19/0.13mm.
2	Standard	MIL-W-16878 (or) JSS 51034

Table No: 33

11.2 2 core PTFE cable (22 AWG)

Sl.No	Description	Specification
1	Type	PTFE insulated silver plated copper wire Size: AWG 22/19/0.16 mm, 2 core (1pair),Pair twisted laid in circular construction and overall Silver plated copper braided and overall PTFE jacketed.
2	Standard	MIL-W-16878 (or) JSS 51034
3	Inner conductor	Stranded silver plated copper wire of size AWG 22/19/0.16 mm
4	Core Insulation	PTFE tape wrapped and fused
5	Insulation thickness	0.25 ± 0.05 mm
6	Core diameter	1.37 ± 0.1 mm
7	No. of cores	Two core twisted into pair with a twisted lay of 25 mm .
8	No of twists per meter	40
9	Colour coding	Red – Black.
10	Max resistance of the conductor at 20 °C	49.54 Ω /Km
11	Max capacitance	≤ 75 pF/m
12	Overall Shield	Silver/Tinned copper braid over the pair.
13	Shield Gauge dia	0.12 mm
14	Coverage	> 90%
15	Overall Sheath	PTFE tape wrapped and fused
16	Sheath thickness	0.35 ± 0.05 mm
17	Colour	Smoke grey
18	Overall dia. of the cable	3.0 ± 0.5 mm.
19	Working voltage	600Vrms

Table No: 34

11.3 2 core PTFE cable (24 AWG)

Sl.No	Description	Specification
1	Type	PTFE insulated silver plated copper wire Size: AWG 24/19/0.13 mm, 2 core (1pair),Pair twisted laid in circular construction and overall Silver/Tinned copper braided and overall PTFE jacketed.
2	Standard	MIL-W-16878 (or) JSS 51034
3	Inner conductor	Stranded silver plated copper wire of size AWG 24/19/0.13 mm
4	Core Insulation	PTFE tape wrapped and fused
5	Insulation thickness	0.25 ± 0.05 mm
6	Core diameter	1.21 ± 0.1 mm
7	No. of cores	Two core twisted into pair with a twisted lay of 25 mm .

Sl.No	Description	Specification
8	No of twists per meter	40
9	Colour coding	Red – Black.
10	Max resistance of the conductor at 20 °C	79 Ω /Km
11	Max capacitance	≤ 75 pF/m
12	Overall Shield	Silver/Tinned copper braid over the pair.
13	Shield Gauge dia	0.12 mm
14	Coverage	> 90%
15	Overall Sheath	PTFE tape wrapped and fused
16	Sheath thickness	0.35 $\pm$ 0.05 mm
17	Colour	Smoke grey
18	Overall dia. of the cable	2.5 $\pm$ 0.5 mm.
19	Working voltage	600Vrms

Table No: 35

12.0 Color ECO Tank Network Printer

Sl.No	Description	Specification
1	Type	Color printer
2	Printing support	A4 size print
3	Tray capacity	250 sheets min.
4	Printing speed	17 pages/ min or better for monochrome
5	Printing resolution	4800 X 1200 DPI
6	Printing type	Automatic Duplex
7	scanner	Required
8	OS compatibility	Windows 7 or higher
9	Communication	Ethernet, USB 2.0

Table No: 36

III. PRICE FORMAT, SUGGESTED VENDORS LIST & AMC DETAILS

1. Price format*

Sl.No	Description	Qty (Nos.)	Unit price (INR)	Total price (INR)	Remarks
	PLC –Control system				
1	Chassis	1			
2	PLC processor/controller	1			
3	Digital Inputs	8			
4	Digital Outputs	41			
5	Analog Input	8			
6	Accessories	1 set			
7	Software development	1 lot			
8	SCADA system	2			
	Total				
	IDAS				
9	Chassis	1			
10	Controller	1			
11	Voltage Input card (-10 to 10V) (77 Nos.)	20			4 Ch/card is considered.
12	Voltage Input card (0 to 60V))(Qty:41 Nos.)	6			8 Ch/card is considered
13	RTD card (12 Nos.)	3			4 Ch/card is considered.
14	Thermister card (16 Nos.)	4			4 Ch/card is considered.
15	Ethernet switch and cables	1			
16	Software development	1lot			
17	Data processing node	1			
	Total				
18	RS485 module (6 Nos.)	2			4 Ch/card is considered.
19	RS 232 module	1			4 Ch/card is considered.
20	RS485 splitter	6			1 input and 2 output splitter is considered
21	RS232 splitter	4			1 input and 2 output splitter is considered
22	Power supply 24V,5A DC	1			
23	Power supply 60V,12.5 A DC	3			
24	Power supply ± 15 VDC,3A	2			
25	SSR Relays	41			

Sl.No	Description	Qty (Nos.)	Unit price (INR)	Total price (INR)	Remarks
26	Rack (19 inch) 25 U	2			
27	Circular connectors	As required+2 sets spare			
28	Hall effect sensors with PCB	6			
29	Status barriers	10			
30	PTFE Cables				
	HOOK UP WIRES (22 &24 AWG)	As required			
	2 CORE (22 AWG) & 24 AWG	As required			
31	Printer				
32	Installation & commissioning				
33	AMC charges				

Table No: 37

Note: Qty mentioned is based on the 8 channel card. No. of cards may vary depends on the make of the DAQ and Control system.

*The quantity indicated is tentative and may vary depending on the manufacturer. Hence, the party shall quote the required number of modules to meet the specified system requirements.

2. Suggested vendors list:

Sl.No.	Description	Preferred Make
1	PLC based Control system	1. M/s. Siemens 2. M/s. GE 3. M/s. Allen Bradley 4. M/s. Honeywell
2	IDAS	1. M/s. Dewesoft 2. M/s. Dewetron 3. M/s. Gantner instruments 4. M/s. National Instruments 5. M/s. Bustech
3	Instrumentation racks	1.M/s. Rittal 2.M/s. HCL
4	Programmable & fixed Power supplies	1.M/s. Ametek, 2.M/s. Lambda 3.M/s. Aplab 4.M/s. Weidmuller 5.M/s. Phoenix
5	Linear power supplies	1.M/s. GW instek 2.M/s. Aplab
6	SSR Relays	1.M/s. Phoenix 2.M/s. Weidmuller

Sl.No.	Description	Preferred Make
		3.M/s. Omron
7	SCADA/data processing node	1.M/s. IBM 2.M/s. HP 3.M/s. DELL 4.M/s. Lenovo
8	Ethernet switch and cables	1.M/s. Dlink 2.M/s. Amp 3.M/s. Belden
9	Circular Connectors	1.M/s. Weidmuller, 2.M/s. Amphenol, 3.M/s. TE connectivity
10	Hall effect sensors with PCB	1.M/s. LEM Make
11	PTFE cables	1.M/s. FLuTef Industries 2.M/s. Meerut PTFE cables 3.M/s. Tempsens 4. M/s.Satellite cables
12	Terminal Blocks	1.M/s. Wago 2.M/s. Phoenix 3.M/s. Weidmuller
13	Terminal lugs	1.M/s. Phoenix 2.M/s. Weidmuller

Table No: 38

3. AMC details

The Annual Maintenance Contract (AMC) is a **Non-Comprehensive** type, which includes preventive and break down maintenances. AMC comes into effect after the completion of one year of **warranty** period. Separate quote to be provided by the vendor for the AMC. Cost of AMC will be considered in the cost of the system. The details of AMC are provided in below table.

Sl. No.	Specification
1	Duration of AMC: 2 years
2	Frequency of visits: Once in 6 months. Total visits: 4 visits in two years
2.1	Work details (preventive maintenance): IDAS • Continuity verification of cables • Load testing of power supplies • Calibration of IDAS • Linearity and accuracy verification • Functional verification of flow meter and weighing balance • Software updates

Sl. No.	Specification
	• Test and evaluation of measurement channel and report generation • Accuracy estimation and preparation of T&E reports Control system • Functional verification digital I/O • Functional verification of solenoid valves and latchves and its status verification • Linearity/accuracy verification of Analog I/O modules • Software updation for SCADA systems, display, data processing nodes • Any other additional general checks/ tests required for smooth functioning of system to be included.
2.2	Work details (breakdown maintenance): • Checking the complete Instrumentation system against the break down defects. • Identifying the nature of problems. • Rectifying the identified problems and set right of the system. • Verification of system. • List of spares, components, consumables required for repair/service/running of the system to be provided by the party. • The required items for the break down maintenance will provided by LPSC(B). • Any other additional general checks/ tests required for smooth functioning of system to be included. • The spares inventory shall be checked by the party periodically and requirement of spares shall be indicated to LPSC (B) accordingly. • The Vendor/agent shall attend to the break down maintenance within 48 hours of intimation from LPSC (B).

Table No: 39

IV. Commercial terms & conditions

General commercial terms and conditions

1. Price

The prices are FIRM and FIXED. On receipt of Purchase Order, Vendor has to prepare detailed work break-up and delivery schedule chart as per tender document.

2. Security Deposit

The party shall submit the security deposit for the performance of the contract, equivalent to 3% of the total order value in the form of bank guarantee or either form of negotiable instrument, issued by a nationalized or scheduled bank in a Rs. 500 non-judicial stamp paper. This Security Deposit will be returned (interest free) after the successful completion of the ordered contract. The security deposit shall have a further claim period of 6 months.

3. Warranty

The total system shall be warranted for total performance and failure-free operation for a period of 12 months from date of final acceptance of system by LPSC(B)/ISRO.

4. Performance Bank Guarantee (PBG)

To cover the warranty period of 12 months, the party shall submit the performance bank guarantee for the performance of the systems, equivalent to 3% of the total order value in the form of bank guarantee or either form of negotiable instrument issued by a nationalized or scheduled bank in a Rs. 500 non-judicial stamp paper. This PBG (interest free) will be returned after the successful completion of the warranty period. The PBG shall have a further claim period of 6 months.

5. Liquidated Damages

As per the Delivery Schedule mentioned is the essence of the order, in case if you fail to deliver the item within the time specified or any extension thereof. Liquidated Damages at 0.5% (Zero Point Five Percent) of the order value or part thereof of the undelivered item for each calendar week of delay shall be recovered from your bill. However, total LD shall not exceed 10% (Ten Percent of the Order Value).

6. Arbitration

Dispute if any shall be settled mutually, failing which it will be referred to a One Man arbitrator appointed by Director, LPSC in accordance with the Indian Arbitration and Conciliation Act 1996, whose decision shall be final and binding on both the parties.

7. Jurisdiction

The Courts in the City of Bangalore alone shall have jurisdiction to deal with and decide any matter or dispute whatsoever arising out of this agreement including those arising under the Arbitration Act.

8. Force Majeure

If at any time during the continuance of the order the performance in whole or in part by either Contractor of any obligation under this order shall be prevented or delayed by reasons of any war, hostility, acts of public enemy, civil commotion, sabotage, fire, floods, epidemic, quarantine restrictions, strikes, go-slow, lockout or acts of God, notice of which is given either Contractor to the other within 21 days from the date of occurrence thereof, neither Contractor shall be reasons of such eventuality be entitled to terminate this order nor shall either Contractor have any claim for damages against the other in respect of such non-performance or delay in performance.

9. Secrecy

The drawings and documents sent along with this tender form part of vital documents and same should be kept on top secret. Under any situations, contractor should not part with or transfer the technology/contents of drawings and documents whatsoever to any 3rd party/agency without our prior consent. If at any time, it is brought to our notice that the secrecy has been transferred by you intentionally or otherwise to any third party /agency, contractor shall be liable to indemnify the loss/ damage to Government of India.

10. Indemnity

Contractor shall warrant and be deemed to have warranted that all the items supplied against this tender are free and clean of any infringement of any patent, copy right or trademark and shall at all times indemnify LPSC(B) against all claims which may be made in respect of the items for infringement of any right protected by patent registration of design or trade mark and shall take all risk of accidents or damage which may cause a failure of the supply from whatsoever cause arising and the entire responsibility for the sufficiency of all the means used for executing the Purchase Order.

11. Delivery

Items shall be supplied and installed and site acceptance tested within 6 months from the date of receipt of Purchase Order.

12. Payment Terms

100% payment shall be made after receipt of all items and installation, commissioning & satisfactory acceptance at the LPSC(B) site.

13. Validity

The quoted price should be valid for a period of 6 months from the date opening of the technical and commercial quotation.

14. Heritage Clause

The party should have a previous experience of having successfully completed the similar system for reputed aerospace industries in India, the address and details of the company (year of supply, commissioning date, and customer feedback) where they have supplied shall be mentioned in the offer.

15. General Conditions to the Vendors

1. The execution of the complete project is on turnkey basis as per the specifications and requirements deliberated in previous sections. The response to the tender is in the form of two separate offers, one as 'Part-A: Technical-Commercial Offer' and other as 'Part-B: Price Bid'. Both the offers are to be submitted simultaneously in separate sealed covers.
2. Authorized service team in India for extending service support and for undertaking annual maintenance contract for the system
3. Non comprehensive annual maintenance contract
4. The supplier shall compulsorily undertake AMC for the system after completion of warranty period.
5. The various manufacturers/brand specified in the technical specification shall be adhered. The terms like equivalent brands shall not be accepted.
6. The vendor shall select brand, model number of all instruments/ equipments and during offer period itself. All the specific models, datasheets, shall be provided along with the offer.
7. Any modifications in the system till installation shall meet the technical specification of the tender document and prior approval to be obtained from LPSC(B). Further the modifications made shall be technically equal or superior w.r.t. to the original offer and should not have any additional cost implication.
8. The total system shall be guaranteed for total performance and failure-free operation for a period of 12 months from date of final acceptance of system by LPSC(B)/ISRO.
9. During the evaluation of technical bids alternatives/options/suggestions shall be confirmed in technical offer to meet the system specifications. As the contract is for fixed price, no provision for addition/reduction in charges will be entrained after opening the price bid
10. Any information kept vague or not furnished shall be treated as non-compliance with the requirements of the vendor and hence tender are liable for rejection.