

TENDER

FOR

SUPPLY & INSTALLATION OF PMSM MOTOR CONTROL
MODULE at IIT MANDI



Tender No.: IITMANDI/S&P/PUR-69/2015-16/4516-17

Tender date: 21st August, 2015

Last Date of submission: 11th September, 2015

Indian Institute of Technology Mandi

Transit Campus: Mandav Hotel, 2nd Floor (Near Bus Stand), Mandi – 175001 (H.P)

Tel.: 01905-237921 & 01905-267039

Email: bsr@iitmandi.ac.in & arsp@iitmandi.ac.in

Indian Institute of Technology Mandi, Mandi invites tender for supply, erection, installation, commissioning, testing, demonstration and training of **PMSM Motor Control Module**, as per specifications given in the Annexure attached to the Tender form. All offers should be made in English and should be written in both figures and words. Tender forms can be downloaded from the website (<http://iitmandi.ac.in/administration/tenderseoi.html>) of the Institute. Tender document also published on e-tendering (<http://eprocure.gov.in/eprocure/app>). The bidder can also submit bids online.

The bidders are requested to read the tender document carefully and ensure compliance with all specifications/instructions herein. Non-compliance with specifications/instructions in this document may disqualify the bidders from the tender exercise. The Director, IIT Mandi, Kamand reserves the right to select the item (in single or multiple units) or to reject any quotation wholly or partly without assigning any reason. Incomplete tenders, amendments and additions to tender after opening or late tenders are liable to be ignored and rejected.

Terms and Conditions:

1. The technical and financial bids should be quoted separately and put in different sealed envelopes marked “**Technical bid**” or “**Financial bid**” as applicable. These separate bids envelopes are to be put in an outer envelope which should also be sealed.
2. The Vendors who have earlier supplied the equipment to any of the IITs, IISc, IISERs and other Scientific Institute of National Repute may only tender. The details of such institutions and the cost with name of equipment may also be supplied with the bids.
3. The technical and financial bids should be submitted in original. The financial bid should include the cost of main equipment/item and its accessories. If there is any separate cost for installation etc. that should be quoted separately.
4. Each individual sealed envelope as well as the outer envelope should be marked with the following reference on the top left hand corner: “**IITMANDI/S&P/PUR-69/2015-16/_____/Item Name.____ dated 21st August, 2015**”
5. The printed literature and catalogue/brochure giving full technical details should be included with the technical bid to verify the specifications quoted in the tender. The bidders should submit copies of suitable documents in support of their reputation, credentials and past performance.
6. The rates should be quoted in figures (typed or printed) and cutting should be avoided. The final amount should be in figures as well as in words. If there are cuttings, they should be duly initialed, failing which the bids are liable to be rejected.
7. Any bids received after **1:00 P.M. on 11th September, 2015** shall not be considered
8. The Technical Bids will be opened on **11th September, 2015 at 03:00 P.M.** The date & time for opening of Financial Bids will be informed later on to the technically qualified bidders.
9. While sending rates, the firm shall give an undertaking to the effect that “*the terms/conditions mentioned in the enquiry letter/Tender Notice against which the rates are being given are acceptable to the firm.*” In case the firms do not give this undertaking, their rates will not be considered.
10. If the supplier/firm is original equipment manufacturer (OEM)/authorized dealer/sole distributor of any item, the certificate to this effect should be attached.

11. The quantity shown against the item is approximate and may vary as per demand of the Institute at the time of placing order.
12. All tender documents should have to be sent through courier, speed post or registered post only. All tender documents received after the specified date and time shall not be considered.

The postal address for submitting the tenders is:

**“Assistant Registrar, Stores and Purchase”
Indian Institute of Technology Mandi (IIT Mandi),
Administrative Block (Mandav Hotel,
Near Bus Stand), Mandi – 175001 (H.P), India”**

13. In the event of any dispute or difference(s) between the vendee Institute (IIT Mandi) and the vendor(s) arising out of non-supply of material or supplies not found according to specifications or any other cause whatsoever relating to the supply or purchase order before or after the supply has been executed, shall be referred to “The Director, IIT Mandi”, Kamand who may decide the matter himself or may appoint arbitrator(s) under the arbitration and conciliation Act,1996. The decision of the arbitrator shall be final and binding on both the parties.
14. The place of arbitration and the language to be used in arbitral proceedings shall be decided by the arbitrator.
15. All disputes shall be subject to Mandi Jurisdiction only.
16. All tenders in which any of the prescribed conditions is not fulfilled or any condition is putforth by the tenderer shall be summarily rejected.
17. IIT Mandi reserves the right to cancel the tender at any point of time without assigning any reason.
18. The bidders or their authorized representatives may also be present during the opening of the Technical Bid, if they desire so, at their own expenses.

Note: Price bids of only those bidders will be opened whose technical bids are found suitable by the committee appointed for the purpose. Date and time of opening of price bids will be decided after technical bids have been evaluated by the committee. Information in this regard will be intimated to the technically qualified bidders. In exceptional situation, an authorized committee may negotiate price with the qualified bidder quoting the lowest price before awarding the contract.

19. **Clarifications:**

In case the bidders requires any clarification regarding the tender documents, they are requested to contact our office (e-mail: bsr@iitmandi.ac.in & arsp@iitmandi.ac.in on or **before 31/08/2015**).

20. **Tender Cost:**

A Demand draft of **Rs. 1,000/- (Rupees One Thousand only)** towards non-refundable **tender fee, drawn in favour of “The Registrar, IIT Mandi”** payable at Mandi should accompany the Technical bid documents. In the absence of tender cost, the tender will not be accepted.

21. **Earnest Money Deposit (EMD):**

A refundable amount of **Rs 20,000/-** as earnest money deposit (EMD) in the shape of DD from a scheduled bank in India (**valid for a minimum period of 3 months from the date of submission of tender**) should accompany the bid documents. The DD drawn in favour of “The Registrar, IIT Mandi” payable at Mandi should accompany the bid documents. The EMD should be kept in a separate sealed envelope, should be marked clearly and put in the outer envelope that contains the technical and financial bid envelopes. The bidders should enclose a pre-receipted bill for the EMD to enable us to return the EMD of unsuccessful bidders. Failure to deposit **Earnest Money** will lead to rejection of tender. The bidders should submit separate EMD. In the event of the awardee bidder backing out, EMD of that bidder will be forfeited.

22. **Pre – Qualification Criteria:**

- a. Bidders should be the manufacturer / authorized dealer. Letter of Authorization from original equipment manufacturer (OEM) on the same and specific to the tender should be enclosed.
- b. The Vendors who have earlier supplied the equipment to any of the IITs, IISc, IISERs and other Scientific Institute of National Repute may only tender. The details of such institutions and the cost with name of equipment may also be supplied with the bids.
- c. An undertaking from the OEM is required stating that they would facilitate the bidder on a regular basis with technology/product updates and extend support for the warranty as well.
- d. OEM should be internationally reputed Branded Company.
- e. Non-compliance of tender terms, non-submission of required documents, lack of clarity of the specifications, contradiction between bidder specification and supporting documents etc. may lead to rejection of the bid.
- f. **Furnishing of wrong/ambiguous information in the compliance statement may lead to rejection of bid and further black listing of the bidder, if prima-facie it appears that the information in the compliance statement was given with a malafide/fraudulent intent.**

23. **Prices:**

- a. The Prices quoted should be inclusive of all taxes or duties, packing, forwarding, freight, insurance, delivery and commissioning etc. at destination site (IIT Mandi, Mandi/Kamand). IIT Mandi is registered with DSIR, Govt. of India and is exempted from Custom / Excise Duty. Exemption Certificate to this effect will be issued by IIT Mandi. **Hence, Customs/Excise Duty exempted price should be quoted.** The rates shall be firm and final. Nothing extra shall be paid on any account. **In the price bid/financial bid, the vendor should clearly mention the final price breakup i.e. ex-work price/FCA price, FOB price, CIP/CIF price & FOR IIT Mandi, Kamand Campus price, as applicable in their bid.**
- b. In case of imported equipment(s)/item(s), the agency commission, if any, payable in Indian rupees should be mentioned separately. For imported equipment, the Letter of Credit will be opened for the amount excluding agency commission in Indian Rupees. The firm should clearly mention the address of foreign bank in the financial bid.

24. **Validity:**

The bid should be valid for acceptance up to a period of 180 Days. The Bidders should be ready to extend the validity, if required without any additional financial implications.

25. **Delivery:**

The Equipment should be delivered and installed within the period as specified in the purchase order and be ready for use within 24 weeks of the issue of purchase order unless otherwise prescribed. If the bidder fails to deliver and place any or all the Equipments or perform the service by the specified date, penalty at the rate of 1% per week of the total order value subject to the maximum of 10% of total order value will be deducted.

26. **Training:**

Bidders need to provide adequate training to the nominated persons of IIT Mandi at their cost. IIT Mandi will not bear any training expenditure.

27. **Warranty Declaration:**

Bidders must give the comprehensive on-site warranty as required from the date of successful installation of Equipment against any manufacturing defects and also give the warranty declaration that *“everything to be supplied by us hereunder shall be free from all defects and faults in material, workmanship and shall be of the highest quality and material of the type ordered, shall be in full conformity with the specification and shall be complete enough to carry out the experiments, as specified in the tender document.*

Any deviation in the material, and the specifications from the accepted terms may liable to be rejected and the bidders need to supply all the goods in the specified form to the satisfaction / specifications specified in the order / contract and demonstrate at their own cost.

28. **Performance Bank Guarantee:** A performance bank guarantee from a scheduled bank in India for an amount equal to 10% of the price for duration of two months beyond the expiry of warranty period will be taken from the supplier or Indian agent.

29. **Terms of Payment:** Payment will generally be made only after delivery and satisfactory installation, testing, commissioning etc. **This must be specified in the tender/quotation.**

- In case of imported supplies, payment (excluding Indian agency commission, if any) will be made through irrecoverable Letter of Credit in two installments. 80 % of the money will be released on submission of shipping of documents. Remaining 20 % will be released after successful installation of the instrument and submission of a performance bank guarantee for 10% of the order value from a nationalized bank, valid for 2 months beyond the expiry of the warranty.

30. **Tender expenses and documents:** All costs incurred by the bidder in the preparation of the tender shall be at the entire expense of the bidder.

31. **Tender Evaluation Criteria:** The technical bids will be opened and evaluated by a duly constituted committee. After evaluation of the technical bid, the financial bid for only those offers which have qualified in the evaluation of technical bid will be opened.

32. **Return of EMD:**

- The earnest money of unsuccessful bidders will be returned to them without any interest within 15 working days after awarding the contract.
- The earnest money of the successful bidder will be returned to them without any interest within 15 Days after supply of material.

33. **Manual and documentation:** All the manuals necessary for operating and servicing the equipment (including details of electronic circuits) will have to be provided along with the instrument.

34. The IIT Mandi reserves the right to cancel the tender at any stage (point of time) without assigning any reason.

35. Bidders should go through the tender terms, conditions and specifications carefully and fill in the attached compliance statement accurately and unambiguously. They should ensure that all the required documents are furnished along with the bid.

Sd/-
Assistant Registrar
Stores & Purchase

BID PARTICULARS

1. Name of the Supplier :

2. Address of the Supplier :

3. Availability of demonstration of equipment : Yes / No

4. Tender cost enclosed: : Yes/No if yes

D.D. No. _____ Bank _____ Amount _____

5. EMD enclosed : Yes / No if (Yes)

D.D. No. _____ Bank _____

6. Name and address of the Officer/contact person to whom all references shall be made regarding this tender enquiry.

Name :

Address :

Telephone No. :

Fax No. :

Mobile No :

e-Mail :

Web

Ref:-ENQUIRYNO:-IITMANDI/S&P/PUR-69/2015-16/PMSM Motor Control Module

PMSM Motor Control Module:-

Tender Sl. No.	Item	Make	Quantity
1	3-phase IGBT based Inverter Stack (rectifier + inverter)	SEMIKRON	1
2	FPGA and PWM Daughter Card	Altium NB3000 + PWM Daughter card	1
3	Software for FPGA	Altium Designer	1 user
4	1 HP PMSM Motor With 1 kW DC Motor Loading arrangement	ABB	1
5	Current & Voltage Sensor along with encoder for feedback & protection		V Sensors-2 I Sensors-2 Encoder-1
6	In line Torque Sensor		1
7	Software Development and Control from all sub System. Integration of hardware, Sensors, Instrumentation & software. All Operation and Service manual one Copy both in Soft and Hard bound.		

Detail specifications as follows

Three phase IGBT based Inverter details (Rectifier + Inverter + Brake Chopper)

General Specifications

I/P AC Voltage:- 415 Volt

DC Voltage:- 600 Volt

O/P AC Voltage:- 415 Volt

O/P AC Current 30 Amp

Switching Frequency upto 20 kHz

Fundamental Frequency 50 Hz

Type of Cooling:- Forced Air

Ambient Temp:- 40 Deg

Duty Class:- Class I

Cooling Method Forced Air Cooled.

IGBT Details

V-IGBT=6. Generation Trench V-IGBT

CAL4= Soft switching 4 Generation CAL-diode.

Isolated copper baseplate using DCB technology (Direct Copper Bonding).

Increased power cycling capability.

With integrated gate resistor.

Low switching losses at high di/dt.

Bridge Module

Three phase bridge rectifier

Blocking voltage of 1600 V

High surge current carrying capability

Large isolated base plate & Easy mounting

Gate Driver

It should interface and isolate the Control Unit/Primary Circuit from the secondary which is directly connected to the high power.

Gate Driver controls the IGBT's dynamic behavior and its short circuit protection.

Input signal level is 0/15V.

Interlocking time between the input signals is 3 μ s.

It monitors the errors: power supply under-voltage (below 13 V), short-circuit between

Collector and Emitter. The error reset time is typically $9\mu\text{s}$.

On detection of error/fault, the Gate Driver switches off the IGBT.

The IGBT switching speed may be adjusted by the resistors R_{GON} and R_{GOFF} .

The two parameters (R_{ce} , C_{ce}) define the values and time delays for the comparison of an internal reference with the monitored value of V_{ce} (sat).

Kit Details

3-phase teaching kit consists of 3-phase uncontrolled rectifier and 3-phase IGBT based controlled Inverter. It should also have a brake chopper.

3-phase 415 V input is applied to the uncontrolled rectifier (SKD100/16) using an autotransformer

The dc output of the Rectifier is given to the input of the IGBT based inverter.

DC capacitor bank is connected in between the rectifier and inverter as source to the inverter.

3 phase 415 V ac Output is achieved from the inverter and is provided for the Motor Interface.

Driver is the interface unit between the power module and controller.

Each Driver drives 2 switches in a Module.

+15V/0V supply is given to V_s and GND. Alternate ON/OFF pulses of +15V are given to V_{in1} and V_{in2} .

V_{in1} corresponds to TOP IGBT and V_{in2} corresponds to BOTTOM IGBT.

ERROR is triggered when V_s falls below 13.9 V and Short circuit of IGBT.

ERROR output is taken to the controller for turning off the system during occurrence of the error.

Capacitor & Snubber

Rectified DC input is given to electrolytic filtering capacitors.

Each capacitor is $4700\ \mu\text{F}$ / 450 V.

2 capacitors are connected in series to have equivalent capacitance of $2350\ \mu\text{F}$ / 900 V.

Resistors of value $27\ \text{k}$ / 20 W are connected across each capacitor for voltage balancing.

Snubber Capacitors of $0.22\ \mu\text{F}$ / 1500 Vdc (4 nos) are connected across the dc link for voltage overshoot protection.

The snubbers limit the over-voltages during commutations and as a consequence reduce the losses.

They are kept very close to the device to reduce the inductance between the switches and the capacitors.

Cooling

Teaching kit stack assembly is provided with forced air cooling.

IGBT modules are mounted on 250 mm heat sink (extruded type).

Forced air-cooling is provided by Hi cool Fan. 230VAC 1ph. should be applied to the Fan input terminals provided on the unit.

Flow of air is 3 m/s.

Input to the fan is 1- Φ 230 V Supply

Thermal Protection

Normally Closed Thermal contact switch is used for protection against thermal runaway.

The position of the thermal switch normally closed when its temperature is below the threshold temperature (80 deg C) & it changes to normally open above 80 deg C.

After cooling down, it again retains it normally closed position.

Thermal switch is placed at the warmest point on the heat sink.

FPGA Board details

FPGA Device : Spartan 3AN FPGA device

Integrated color TFT LCD panel (240x320) with touch screen. Stereo audio capabilities including Line in/out/headphones, audio CODEC with I2S-compatible interface, analog mixer, audio power amplifier and high-quality speakers.

USB hub, providing connection of up to three USB 2.0 devices, with interfacing handled by an ISP1760 Hi-Speed USB Host Controller. SVGA interface (24-bit, 80MHz).

Variety of standard communications interfaces: RS-232, RS-485, PS/2, 10/100 Fast Ethernet,

USB 2.0, MIDI ,Dual SD card readers – for use by user FPGA and Host Controller respectively.

IR receiver – supports data transmitted using a 38kHz carrier frequency, Programmable clock (6 to 200MHz) and fixed clock (20MHz) – both available to user FPGA.

4-channel 8-bit ADC, SPI-compatible – providing maximum sample rate of 200ksps.

4-channel 8-bit DAC, SPI-compatible – operating at clock rates of up to 40MHz 4x isolated Relay channels. 4x PWM power drivers, 8-way general purpose DIP-Switch, 8 RGB LEDs, 5 PDA-style pushbutton switches.

User prototyping area. I/O expansion headers, with power supply selection links.

On-board memories accessible by user FPGA - 256KB x 32-bit common-bus SRAM (1MB), 16M x 32-bit common-bus SDRAM (64MB), 8M x 16-bit common-bus 3.0V Page Mode

Flash memory (16MB), dual 256KB x 16-bit independent SRAM (512KB each)
Four 8Mbit SPI flash memory devices – one containing Primary boot image for Host Controller, one containing golden boot image for Host Controller, two for use by user FPGA (for boot/embedded purposes)
SPI Real-Time Clock with 3V battery backup. 5V DC power connector with power switch, plus test points for all major supplies on the board (and GND).
High-speed PC interconnection through USB 2.0 allows for fast downloading and debugging.
Software for FPGA Board.

Daughter Card Details

The Daughter card board capable of generating 12 nos. of 15V PWMs.
It should also have 16 channel, 14 bit, 1 MSps, 10V bipolar ADC's.
Option to use the card with Altium NB3000 as well as with other controllers with 3.3V/5V logic levels
This card should support Xilinx system generator software with all peripherals directly available as blocksets. Matlab Simulink blocksets should be provided for ADC's, Sinewave, Carrier wave, comparator etc and these should be compatible with system generator.

PMSM and DC Motor Details

PMSM 1 Hp, 4000 rpm, with DC shunt 1 kW DC Motor coupled together as loading arrangement. Along with required power supplies for Sensors and shielded cables for motor terminals

Voltage & Current Sensor Details

Voltage and current sensors for feedback
Voltage 0-1000V AC/DC measurement and output is true value & signal conditioned 0-3.3V DC
Current Sensor 0-25 AC/DC measurement and output is true value & signal conditioned 0-3.3V DC
1024 ppr Encoder for Speed Feedback

Torque Sensor Details

Torque 0-5 NM, 12000 RPM Measurement and output is true value
5VDC as corresponding output.

COMPLIANCE STATEMENT FOR THE TENDER SPECIFICATIONS

INDIAN INSTITUTE OF TECHNOLOGY MANDI
HIMACHAL PRADESH-175001

Ref:-ENQUIRYNO:- IITMANDI/S&P/PUR-69/2015-16/Annexure 1

S. NO	Check list of documents/ Undertakings ?	YES/NO	Remarks (Give explanation if answer is No)
1	Is Tender fees attached?		
2	Is EMD attached? (if applicable)		
3	Is the bidder original equipment manufacturer (OEM)/authorised dealer?		
4	If authorised dealer, recent dated Certificate to this effect from OEM, attached or not?		
5	Undertaking from OEM regarding technical support & extended warranty period		
6	Validity of 180 days or not?		
7	Undertaking from bidder regarding acceptance of tender terms & conditions		
8	Whether list of reputed users (along with telephone numbers of contact persons) for the past three years specific to the instrument attached.		
9	Whether special educational discount for Indian Institute of Technology (IIT) Mandi (H.P) given.		
10	Whether two weeks training of operator and research students without any charges offered.		
11	Does the instrument complies with all the required specifications as per annexure 1. Attach a separate sheet showing compliance with the specifications and explanations thereto if the equipments varies from the requested specifications.		
12	Whether free Installation, Commissioning and Application Training offered.		
13	Whether three year comprehensive onsite extended warranty offered.		
14	Whether Annual maintenance after expiry of comprehensive onsite warranty quoted separately as optional.		