



**NATIONAL CENTER FOR COMBUSTION RESEARCH
AND DEVELOPMENT (NCCRD)
INDIAN INSTITUTE OF TECHNOLOGY MADRAS
CHENNAI – 600036, INDIA**

Ref. No. ICS/11-12/013/DSTX/TSUN

Date: 29 Dec. 2014

Due date: 19 Jan. 2015

Item name: DAQ for Drop Tower (2 nos.)

1. Quotations are invited in duplicate for the items shown overleaf (in Annexure I). The quotations duly sealed and superscribed on the envelope with reference no. and due date, should be addressed to the undersigned so as to reach on or before the due date mentioned above.
2. The quotations should be valid for sixty days from the due date and the period of delivery required should also be clearly indicated.
3. The total cost of the equipment in terms of CIP Chennai should be clearly mentioned.
4. Terms of warranty and guarantee should be explicitly mentioned.
5. Packing and delivery charges, customs and clearance duty should be clearly stated.
6. Goods shall not be supplied without an official supply order.
7. Local firms : Quotations should be for free delivery to this institute. If quotations for ex-godown delivery charges should be indicated separately.
8. Firms outside Chennai: Quotations should be for F.O.R. Chennai. If F.O.R. consignor station, freight charges by passenger train / lorry transport must be indicated. If ex-godown, packing, forwarding and freight charges must be indicated.
9. The rate of sales / general taxes and the percentage of such other taxes legally leviable and intended to be claimed should be distinctly shown along with the price quoted. Where this is not done, no claim for sales / general taxes will be admitted at any stage and on any ground whatsoever. The taxes leviable should take into consideration that we are entitled to have Concessional Sales Tax (CST) applicable to non-government educational institutions run with no profit motive for which a concession sales tax certificate will be issued at the time of final settlement of the bill.
10. Payment : Specify the mode of payment and if advanced payment has to be made. Every attempt will be made to make payment within 30 days from the date of receipt of bill / acceptance of goods, whichever is later.
11. IIT Madras is exempt from payment of excise duty and is eligible for concessional rate of customs duty. Necessary certificate will be issued on demand.
12. IIT Madras has the right to accept the whole or any part of the tender or portion of the quantity offered or reject it in full without assigning any reason.
13. In case of any queries/clarifications, please contact Mr. Arjun B.J., IIT Madras, Ph. 8903446831, E-mail: arjunbj007@gmail.com.
14. The sealed quotation may be sent to

Prof. S. R. Chakravarthy

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Annexure I

Ref. No. ICS/11-12/013/DSTX/TSUN

Date: 29 Dec. 2014

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Technical Specification of DAQ for Drop Tower

Quantity= 2 Nos.

Embedded System with Real Time Controller and FPGA

- a) Processor 667 MHz dual-core or more
- b) Voltage input range = 9 VDC to 30 VDC
- c) Maximum power input (with eight I/O modules) = 25 W
- d) Memory
Nonvolatile of at least 1
DRAM of at least 512 MB
- e) A minimum of 2 Gigabit Ethernet, 1 USB device, 1 USB Hi-Speed host, and 1 serial port for connectivity
- f) Internal Real-Time Clock of accuracy 5 ppm or better
- g) Reconfigurable FPGA for custom I/O timing, control and processing of the below specifications or better
Number of DMA channels– 16 or more
- h) Operating shock (IEC 60068-2-27)
30 g, 11 ms half sine
50 g, 3 ms half sine
18 shocks at 6 orientations
- i) Operating vibration, random
(IEC 60068-2-64) - 5 grms, 10 Hz to 500 Hz
- j) Operating vibration, sinusoidal
(IEC 60068-2-6) - 5 g, 10 Hz to 500 Hz
- k) Operating temperature
- l) (IEC 60068-2-1, IEC 60068-2-2) -20 °C to 55 °C
- m) Storage temperature
(IEC 60068-2-1, IEC 60068-2-2) -40 °C to 85 °C
- n) Ingress protection as per IP 40 or better.
- o) Operating humidity (IEC 60068-2-56) - 10% RH to 90% RH, noncondensing
- p) Storage humidity (IEC 60068-2-56) - 5% RH to 95% RH, noncondensing
- q) The embedded device must be programmable using LabVIEW. The reconfigurable FPGA should also be programmable using LabVIEW.
- r) All the necessary connectors and accessories should be included.



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Modules

1) Thermocouple Module

- a) Number of Channels – The module must have at least 4 thermocouple input channels, with at least 1 internal auto zero channel and at least 1 internal cold junction compensation channel.
- b) ADC Resolution – The resolution of the ADC must be at least 16bit for accurate temperature measurements.
- c) Temperature Measurement Range – The module must support J, K, T, E, N, B, R, S thermocouple types.
- d) Differential input impedance should be at least 20 M Ω to ensure accurate measurement of temperature.
- e) Cold-junction compensation sensor accuracy
 - 0 to 70 °C0.6 °C typ, 1.3 °C max
 - 40 to 70 °C1.7 °C max
- f) Measurement sensitivity
 - With autozero channel on
 - Types J, K, T, E, N<0.07 °C
 - Types B<0.25 °C
 - Types R, S<0.60 °C
 - With autozero channel off
 - Types J, K, T, E, N<0.05 °C
 - Type B.....<0.20 °C
 - Types R, S<0.45 °C
- g) Shock and Vibration
 - Operating vibration
 - Random (IEC 60068-2-64).....5 grms, 10 to 500 Hz
 - Sinusoidal (IEC 60068-2-6)5 g, 10 to 500 Hz
 - Operating shock
 - (IEC 60068-2-27).....30 g, 11 ms half sine,
 - 50 g, 3 ms half sine,
 - 18 shocks at 6 orientations
- h) Operating humidity
 - (IEC 60068-2-56).....10 to 90% RH, noncondensing
- i) Storage humidity
 - (IEC 60068-2-56).....5 to 95% RH, noncondensing
- j) The module must be programmable using LabVIEW and the module must be capable of working on an FPGA and RT based embedded system.
- k) All the necessary connectors and accessories should be included.



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2) Digital I/O Module

- a) 8 channels of Digital Input/Output of TTL Logic.
- b) I/O propagation delay should be lesser than 100 ns.
- c) Maximum input signal switching frequency by number of input channels, per channel
 - 8 input channels.....9 MHz
 - 4 input channels.....16 MHz
 - 2 input channels.....30 MHz
- d) Maximum output signal switching frequency by number of output channels with an output load of 1 mA, 50 pF, per channel
 - 8 output channels.....5 MHz
 - 4 output channels.....10 MHz
 - 2 output channels.....20 MHz
- e) Isolation
 - Channel-to-earth ground
 - Continuous60 VDC, Measurement Category I
- f) Shock and Vibration
 - Operating vibration
 - Random (IEC 60068-2-64).....5 grms, 10 to 500 Hz
 - Sinusoidal (IEC 60068-2-6)5 g, 10 to 500 Hz
 - Operating shock
 - (IEC 60068-2-27).....30 g, 11 ms half sine,
 - 50 g, 3 ms half sine,
 - 18 shocks at 6 orientations
- g) Operating humidity
 - (IEC 60068-2-56).....10 to 90% RH, noncondensing
- h) Storage humidity
 - (IEC 60068-2-56).....5 to 95% RH, noncondensing
- i) The module must be programmable using LabVIEW and the module must be capable of working on an FPGA and RT based embedded system.
- j) All the necessary connectors and accessories should be included.

3) SPST Relay Module

- a) Number of channels.....4 electromechanical relay channels
- b) Relay typeSingle pole single throw (SPST)
- c) Power-on output stateChannels off



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- d) Switching capacity (resistive load)
- e) Switching voltage.....60 VDC max, 250 Vrms max
- f) Switching current, per channel
 - One channel on2.5 A max at 30 VDC,
1 A max at 60 VDC,
2.5 A max at 250 Vrms
 - Two channels on2 A max at 30 VDC,
1 A max at 60 VDC,
2 A max at 250 Vrms
 - All channels on1.5 A max at 30 VDC,
1 A max at 60 VDC,
1.5 A max at 250 Vrms
- g) Resistance per channel, channel on.....0.2 Ω
- h) Switching rate1 operation per second
- i) Relay release time..... maximum 10 ms
- j) Relay operate timemaximum 15 ms
- k) Relay bounce time maximum 3 ms
- l) Off state leakagemaximum 10 μ A
- m) Life expectancy
 - Mechanical (no load).....20,000,000 operations or more
 - Electrical (connecting to load) ...100,000 operations or more
- n) Shock and Vibration
 - Operating vibration
 - Random (IEC 60068-2-64).....5 grms, 10 to 500 Hz
 - Sinusoidal (IEC 60068-2-6)5 g, 10 to 500 Hz
 - Operating shock
 - (IEC 60068-2-27).....30 g, 11 ms half sine,
50 g, 3 ms half sine,
18 shocks at 6 orientations
- o) Operating humidity
 - (IEC 60068-2-56).....10 to 90% RH, noncondensing
- p) Storage humidity
 - (IEC 60068-2-56).....5 to 95% RH, noncondensing
- q) The module must be programmable using LabVIEW and the module must be capable of working on an FPGA and RT based embedded system.
- r) All the necessary connectors and accessories should be included.

4) Analog Input Module



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- a) Number of channels - At least 16 analog input channels
- b) ADC resolution – At least 16 bits
- c) Measurement Voltage (AI+ to AI-) Maximum range of at least ± 10.6 V
- d) Sample rate – At Least 100 kS/s
- e) CMRR should be at least ($f_{in} = 60$ Hz) 70 dB
- f) Input impedance should be greater than 1 G Ω for higher accuracy of measurement.
- g) Shock and Vibration
 - Operating vibration
 - Random (IEC 60068-2-64).....5 grms, 10 to 500 Hz
 - Sinusoidal (IEC 60068-2-6)5 g, 10 to 500 Hz
 - Operating shock
 - (IEC 60068-2-27).....30 g, 11 ms half sine,
 - 50 g, 3 ms half sine,
 - 18 shocks at 6 orientations
- h) Operating humidity
 - (IEC 60068-2-56).....10 to 90% RH, noncondensing
- i) Storage humidity
 - (IEC 60068-2-56).....5 to 95% RH, noncondensing
- j) The module must be programmable using LabVIEW and the module must be capable of working on an FPGA and RT based embedded system.
- k) All the necessary connectors and accessories should be included.

5) Accelerometer Measurement Module

- a) Number of channels per module - At least 4 analog input channels
- b) The module must have a delta sigma ADC of resolution 24 bits (with analog prefiltering) or more.
- c) Simultaneous Sampling at minimum 51.2kS/s in each channel.
- d) Dynamic Range of 102dB or more.
- e) Software-selectable IEPE signal conditioning (0 or 2 mA)
- f) Software-selectable AC/DC coupling; AC-coupled (0.5 Hz)
- g) Type of TEDS supportedIEEE 1451.4 TEDS Class I
- h) Shock and Vibration
 - Operating vibration
 - Random (IEC 60068-2-64).....5 grms, 10 to 500 Hz
 - Sinusoidal (IEC 60068-2-6)5 g, 10 to 500 Hz
 - Operating shock
 - (IEC 60068-2-27).....30 g, 11 ms half sine,



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- 50 g, 3 ms half sine,
18 shocks at 6 orientations
- i) Operating humidity
(IEC 60068-2-56).....10 to 90% RH, noncondensing
 - j) Storage humidity
(IEC 60068-2-56).....5 to 95% RH, noncondensing
 - k) The module must be programmable using LabVIEW and the module must be capable of working on an FPGA and RT based embedded system.
 - l) All the necessary connectors and accessories should be included.

6) Motion Control Module

- a) Number of axes - 1
- b) Motor Type- Brushed Servo
- c) Output voltage range- 8V-30V
- d) Inductance range- At least 500uH to 1000mH
- e) Quadrature/ Incremental Interface- Direct Interface
- f) Maximum quadrature frequency- 5 MHz
- g) Shock and Vibration
Operating vibration
Random (IEC 60068-2-64).....5 grms, 10 to 500 Hz
Sinusoidal (IEC 60068-2-6)5 g, 10 to 500 Hz
Operating shock
(IEC 60068-2-27).....30 g, 11 ms half sine,
50 g, 3 ms half sine,
18 shocks at 6 orientations
- h) Operating humidity
(IEC 60068-2-56).....10 to 90% RH, noncondensing
- i) Storage humidity
(IEC 60068-2-56).....5 to 95% RH, noncondensing
- j) The module must be programmable using LabVIEW and the module must be capable of working on an FPGA and RT based embedded system.
- k) All the necessary connectors and accessories should be included.

For any technical clarification please contact.

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