

**Indian Institute of Technology Delhi
Electrical Engineering Department**

26-12-2013.

Sub: NIQ for DC Modular Servo System with Power Function Generator.

On behalf of duly constituted purchase committee, sealed quotations are invited from the OEMs & Authorized dealers for **DC Modular Servo System with Function Generator** as per specifications given below.

1. DC Modular Servo System with Power Function Generator:

The DC Modular Servo System with Function Generator setup should consist of following components.

a. DC Modular Servo System:

The DC modular servo unit must comprise of modules which would be used for individual study and construction of speed and position control using DC error signals. The modules must be mountable on a base to form an electrical or mechanical system.

1. Operational Amplifier Unit:

- a. This unit must be capable of accepting multiple inputs and should provide for feedback arrangements.
- b. The unit should be operable as a summing amplifier and as a block to add extra time constant into the system.
- c. The adjustable Offset range should be +/-1.5V referred to any input terminal.

2. Attenuator Unit:

- a. This unit should cater for gain and tacho feedback.
- b. It should consist of two calibrated potentiometers mounted in a single case.

3. Pre-amplifier Unit:

- a. This unit should cater for two input channels and a push – pull output for direct drive of the servo amplifier.
- b. The expected gain is around 25.
- c. It should also include a switched defined time constant network.
- d. The Offset adjustable range should be between +/-270mv to +/-330mv referred to the normal inputs.

4. Servo Amplifier: This unit would drive the motor.

- a. There should be provision of a protective circuit to limit the motor current under overload condition.
- b. Maximum Load current should not be less than 2A.

5. DC Motor Unit:

- a. This should be a Permanent magnet motor fitted with an inertia disk and hexagonal spacer with hubs.
- b. The shaft length should be between 3 cm to 4 cm.
- c. The nominal maximum speed should not be less than 3000r/min,
- d. Maximum load should not be less than 0.1 Nm.
- e. The rotor inertia should be between 3×10^{-5} Kg m² to 4×10^{-5} Kg m².



6. **Reduction gear tacho unit:**
 - a. This unit must provide speed reduction of at least 30/1.
 - b. It should have a display for speed and external DC voltage.
 - c. Appropriate couplings and 'O' rings should also be provided.
7. **Input & output potentiometers:**
 - a. These should be servo-type potentiometers, mounted and fitted with calibrated position dials.
 - b. The Output unit should carry an extension shaft that can be directly coupled to the reduction gear tacho unit.
 - c. **Input potentiometers** should be fitted with a switch, which can be used to introduce a min of +1V step disturbance onto the buffer output voltage or alternatively to invert the buffer output voltage about 0V and provide a variable magnitude step disturbance.
8. **Loading Unit:**
 - a. This unit should comprise of a brake disc to provide adjustable viscous load for the motor.
 - b. Moment of inertia of the disc should be between 0.001 Kg m² to 0.002 Kg m²
9. **Power Supply:** The power supply unit is used to power the servo amplifier.
 - a. It should be operable at 230V, 50Hz power supply.
 - b. It should be able to deliver 24V, 2A DC at its output when unregulated.
 - c. Stabilized DC at +/- 15V, 150mA should also be available in order to operate units of lower power requirement.
 - d. An 18V rms at 50 Hz should be available to generate reference signals.

Additional Specifications

- All the above units must be compatible with one another.
- They should be connected with standard connectors.
- The connectors should also be provided along with the units.
- Couplings for the base plate along with appropriate tools set should also be provided.
- The unit should not exceed 55cm in depth, 75 cm in width and 25 cm in height.
- The weight of the entire set-up should not exceed 15 Kg.

The unit should have compatibility of upgrading with servo upgrade system to work with MATLAB.

- b. **Power Function Generator:** The Function Generator should confirm the following specifications:
 - Frequency range 0.0001Hz to 1Khz
 - Sine, Square, triangle and trapezoid waveforms
 - Variable d.c. offset up to $\pm 50V$
 - Adjustable output 0V to 100V pk to pk
 - Current output up to 200mA (Limited)
 - Switched attenuation X1, X0.1, X0.01, X0.001
 - Square & Triangular auxiliary outputs
 - Hold and set facilities
 - Modulation facilities
 - External input facilities for power amplifier
 - Single common isolated from ground
 - Should have option to be used as transfer function Analyzer

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Waveforms: Sine, Square, triangle and trapezoid, push button selected
Source impedance: about 2 Ω (with stepped attenuation at X1) i.e. essential a voltage source.
Amplitude: 0-100V Pk-Pk continuously adjustable with output control.
Stepped Attenuator: Four pushbuttons selectable X1, X0.1,X0.001, X0.001
Offset: An adjustable and calibrated offset voltage of from-50V through 0V to +50V is available added to the selected waveforms from the main output only. This offset is attenuated by the stepped attenuator and by the main amplitude control.
Auxiliary Outputs; Square & Triangular, Amplitude: 10V Pk-Pk, Impedance; 1K-Ohm
Dimensions & Weight; should be less than 350x120x250mm & 3 Kg.

Terms and Conditions:-

1. Please submit the TECHNICAL and FINANCIAL bids in separate sealed envelopes. Mark the two envelopes clearly as “**Technical Bid**” and “**Financial Bid**”. Both the sealed envelopes should be sent in a single sealed envelope, with clearly marked as Quotation for as “**DC Modular Servo System with Function Generator**”. The quote should reach the following address on or before **16/01/2014 up to 5.00PM**.

Name : Prof. I.N.Kar

Address : Control Lab,
Room No. II-214,
Department of Electrical Engineering,
IIT Delhi, New-Delhi – 110016 (India)

2. All quotations should be delivered at the above address, within the specified time. Quotations not confirming to this practice would be rendered invalid.
3. Please quote the price at FOB / CIF New- Delhi, inclusive of installation charges.
4. Quote should be in Indian Rupees as well as US Dollars or GBP and to be valid for at least three months.
5. Attached all technical literature and list of similar installation done in India.
6. Warranty as per OEM.
7. Mention if you can provide any technical support like training of IIT Delhi personnel at IIT Delhi or in your factory and providing a technical person for operation of the equipment for the initial period of 2 years. Kindly mention about this in technical bid.
8. If the quote is being submitted by the representative of the principals/manufactures themselves, a valid Agency ship/ Dealership certificate authorizing the agent to quote to IIT Delhi on behalf of the Principals should be enclosed.
9. The institute reserves the rights to accept/reject any/all quotations without assigning any reasons thereof.
10. Complete set of manuals for the operation of the equipment should be given. All circuit diagrams, other mechanical and electrical schematics must be provided to main unit, sub systems and accessories.
11. Delivery within 20 weeks on receipt of PO.

J.N.Kar

12. Clearly specify the installation requirements – Such as space, power, frequency, environment (Temperature and Humidity) .
13. If the item quoted are proprietary in nature, please enclose proprietary certificate from the principals stating “certificate that ----- is proprietary item of M/s ----- and no other manufacture make these items”.
14. If the bidder is Indian agent, the agency certificate should be enclosed.
15. Please produce compliance certificate for the specification.
16. Please ensure that the Indian agent has been enlisted with the Department of Expenditure, evidence may please be attached.
17. All bank charges payable in India are to buyer’s account and the bank charges in seller’s country to seller’s account.



(Prof. I.N.Kar)

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