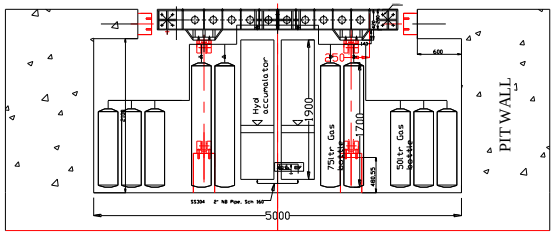
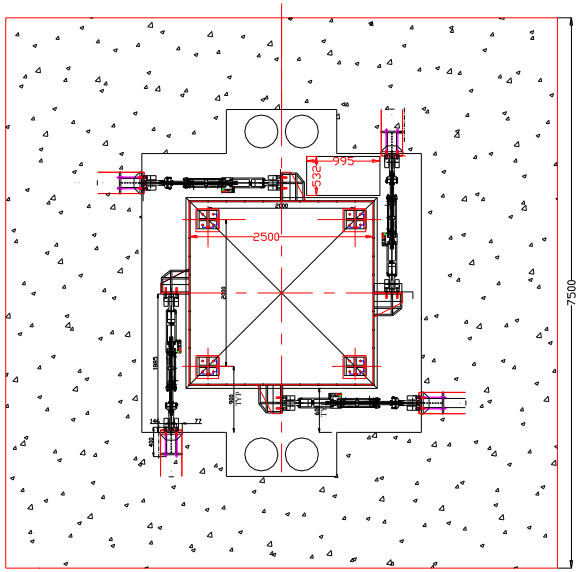
Indigenously 6DOF 5TE Servo Hydraulic Shake Table , HALL-11

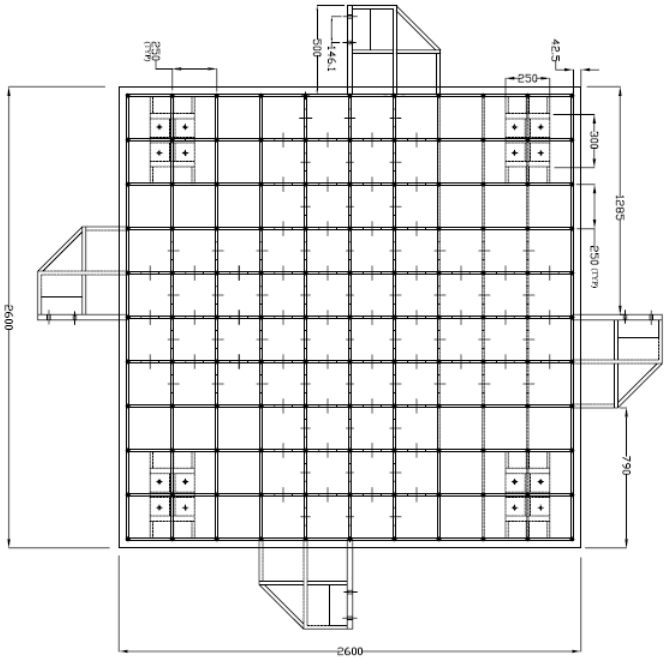
Degrees of freedom	*: Six*
Size of table	*: 2.5m X 2.5m*
Max payload	*: 5000Kg*
Max X, Y offset of payload C.G.	*: 0.25m*
Max Z offset of payload C.G.	:1*m*
Frequency of operation	*: 1Hz(up to 0.5g)-50Hz(up to 1g).*
Peak horizontal acceleration(X&Y)	*: 1g @ full load,*
Peak vertical acceleration(Z)	*: 1g @ full load,*
Max. Horizontal displacement(X&Y)	*: ±0.15m*
Max. Vertical displacement(Z)	*: ±0.1m*
Simultaneous Wave form in all 3 axis	*: sine, sine sweep, random, spectrum compatible time history*
Max Operating pressure	*:200Kg/cm2*
Control hardware and software	*:Digital servo controller*
Man machine interface, MMI	*:Operator friendly panel*
Table top mounting	*:121nos M20x2, 250mm pitch*





Shake Table Pit (5m x5m x 2.5 m deep)

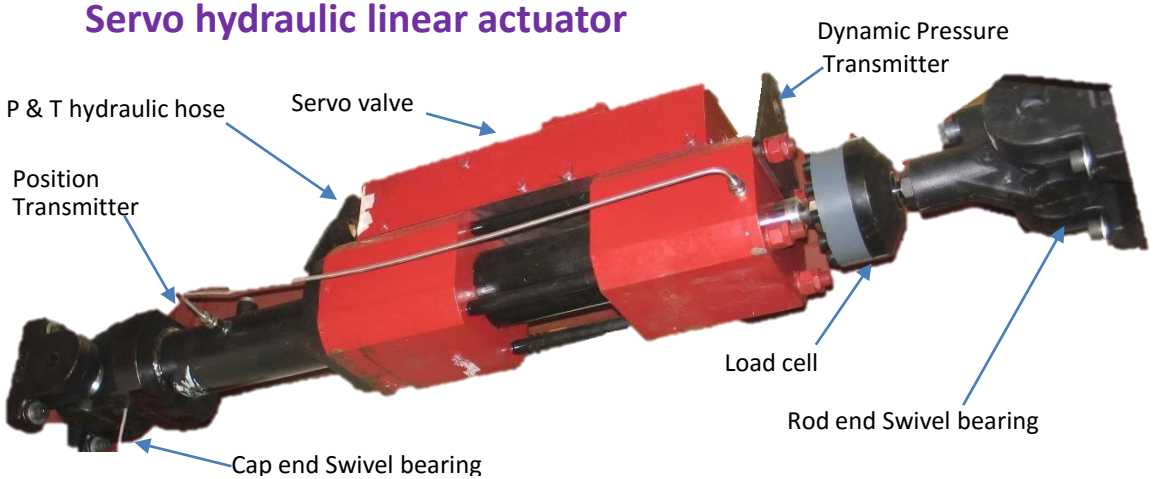
Table Top

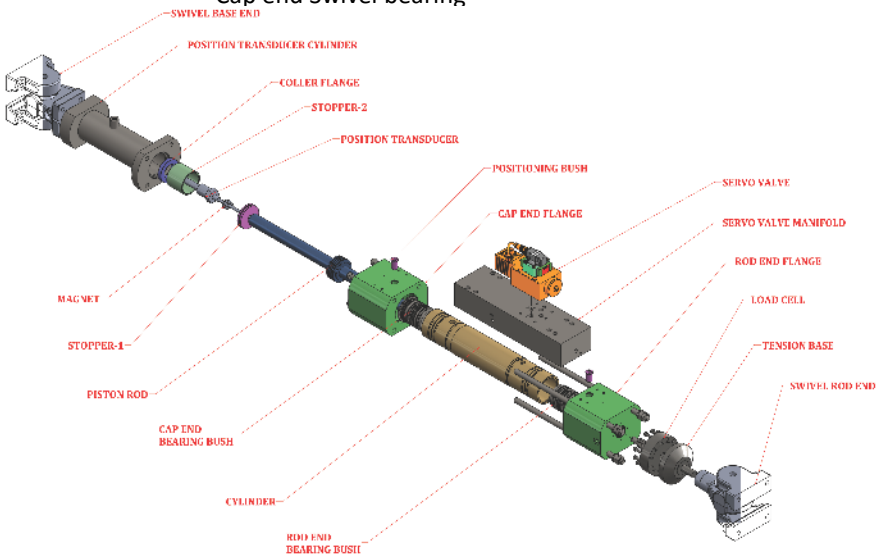


KEY CONTRIBUTIONS - 6 DOF 5Te Servo Hydraulic Shake Table

- High performance hydraulic servo linear actuators - Inhouse designed & developed
- In-house multi axis digital servo controller - Inhouse designed & developed
- Improved hydraulic system

Servo hydraulic linear actuator





- Hydrostatic bearings –reduced friction to obtain high bandwidth.
- Only dynamic elastomeric seal → wiper seal.
- Servo valve directly mounted → improve its dynamic response and stiffness.
- Inbuilt position transducer → accurate displacement of the piston.
- Multiple feedbacks for advanced control algorithms, Model based controllers
- Improved hydraulic system by use of degassing equipment to increase effective bulk modulus of oil.
- High perform - Precise motion control (20micron), High bandwidth (50Hz,whereas conventional act ~5Hz), Good repeatability.

Salient features of servo controller

- lot of flexibility in design and implementation of custom control algorithms to meet the application requirements.

Simultaneous Control of Eight Actuators

- 150 Mhz DSP processor boards.
- Inner control loop- displacement controlled with velocity and differential pressure feedback
- Force Balance compensation as shake table with eight actuators is over-constrained
- 80 user selectable in the controller can be acquired for offline data analysis at 1KHz rate.

Sensor Interface for Each Actuator.

- Position feedback from Digital transducer-CANBUS
- Differential Pressure feedback for superior actuator performance
- MEMS technology based high resolution accelerometer interface (1.9 mg @60Hz) for acceleration
- Load Cell interface (Full bridge-Current Excitation)

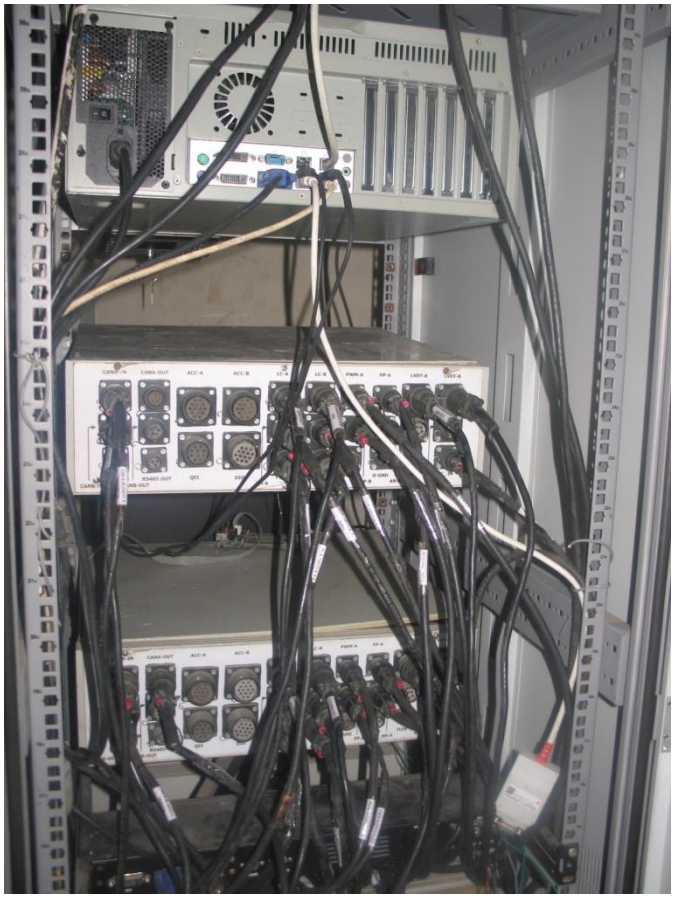
Computer Software

- Dedicated CAN bus connectivity for Computer software communication
- VB.Net GUI for controlling individual actuators with different test inputs
- Sine, Square, Step, Sine sweep and Random inputs are possible.
- On line plot of any parameters of interest
- On line controller tuning
- On line Calibration of individual channels.

Controller –FRONT view

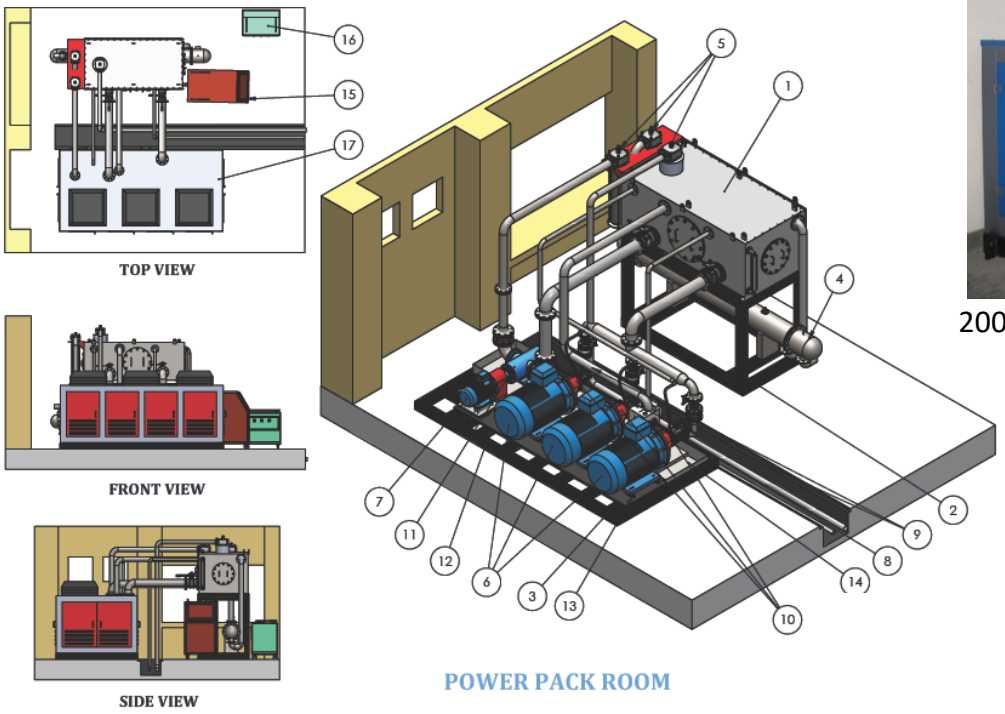
Salient features of Data Acquisition System Specifications

- In-house developed 128 Channel Fast DAQ system (FDAQ-128) for acquisition, configuration, display and storage of voltage signal available at its input channels.
- Based on user requirements any number of signal analysis functions can be incorporated in data analysis software.
- 16 Bit Resolution and 4KSPS sampling with all 128 channels selected.
- All 128 Channels channels with digital Input Trigger can be configured for any types inputs as follows
  - Quarter Bridge Signal Conditioning- 120, 350 and 700 Ohms
  - Half Bridge Signal Conditioning- 120, 350 and 700 Ohms
  - Full Bridge Signal Conditioning- 120, 350 and 700 Ohms
  - 4-20mA
  - 0-10V, -10-+10V, 5 to -5, 0-5V range



Controller -BACK view

Hydraulic Power Supply System- 200bar, 660lpm



200bar, 660lpm power pack with sound proof enclosure

2000ltr SS Oil Reservoir

Pumping system

- Three axial piston hydraulic pumps of 220 LPM each driven by 110 KW electric motor.
- Main pressure is set by relief valve at 210 bar pressure.

Cooling and Filtration System

- Separate cooling and filtration system is provided to remove the heat and contamination
- 700 lpm, 5bar screw pump circulates the oil through heat-exchanger (300KW) and two filters (10 µm and 3 µm).
- Contamination Sensor and Aqua sensor
- Cooling tower was selected for heat removal capacity = 110Ton