Distributed Digital Servo-Control
The distributed high-performance, real-time digital servo-control system for test and motion simulation, Pulsar provides a powerful yet flexible platform for creating controller configurations tailored to your needs.

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- PULSAR – Distributed Digital Servo-Control
- PULSAR in Action
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At the core of every Servotest system, Pulsar provides a powerful and flexible digital servo-control platform

- Pulsar hardware is distributed and configured to suit individual test requirements
- Pulsar software provides a framework combining Servotest & industry-standard software to deliver easy-to-use, customer-specific operator interfaces

From a single actuator through to complex multi-axis systems, Pulsar enables you to design, execute & monitor tests your way.

**PULSAR – Distributed Digital Servo-Control**

- **Central hub DSP**
- **Local node DSPs**
- **In-node 3rd-stage valve loop-closure**
- **’DSP socket’ option**

- **Tailored DIO & hydraulic control**
- **Pilz E-stop system**
- **Positively-guided relay outputs**
- **CE & EN13849**

- **Application-specific setup**
- **Real-time modal control**
- **Physical & calculated channels for DAQ & control**

- **Node box option for analogue I/O**
- **Dual-hub configurations**
- **SCRAMNet® option**

- **Rugged IP-rated actuator node boxes**
- **Digital fibre-optic node connection to hub**

- **Valve drive & feed-back signal conditioning**
- **Single or multiple independent tests**

- **Tough IP-rated actuator-mounted node boxes**
- **Signals digitised at actuator**
- **Short analogue cable runs minimise analogue signal noise pick-up**

- **Up to sixteen node box connections per hub**
- **Powerful central DSP for primary control tasks**
- **Loop-closure, modal coordinate transforms & real-time control**
- **Standard USB connection to operator PC workstation**

- **DIO and hydraulic safety interface box**
- **Pilz E-stop safety interface**
- **24V PSU**
- **Relay outputs for switching of hydraulic power supply, manifolds and other ancillaries**

- **Single Optostar fibre-optic cable per node box simplifies & tidies installation**
- **Noise-immune digital data communication between nodes & hub**
- **DC power to hub & safety loop-back**

- **Affordable and effective per-actuator dual-speed manual set-point adjuster option**
- **Add adjusters to key actuator control nodes as required**

- **Optional analogue nodes for analogue input & output signals**
- **Up to 12-channels per node**
- **Accelerometer conditioning & DC power for transducers**
- **Thermocouple conditioning modules also available**
Pulsar combines a powerful distributed hardware platform with a flexible software framework

- Solutions tailored to each customer’s requirements

Pulsar accepts a broad array of Servotest and industry-standard connections to system components via its distributed actuator, analogue and hydraulic safety nodes. Node data is communicated digitally via fibre-optic cables to a central Digital Signal Processor (DSP) hub.

The Pulsar hub digital signal processor executes all real-time calculations, coordinating servo-drive and feedback signals as required for multi-channel test rig control. The hub is connected via a standard USB interface to an operator PC workstation for operator interface, data display and storage.

System functionality is defined by a Pulsar ‘database’. Tailored to each customer’s specific requirements, this defines test signal processing, control loop operation and geometric transformations between actuator and test rig coordinates. Setup is downloaded to the hub DSP prior to test execution, enabling Pulsar to be reconfigured as required.

Operator interface is via test-specific Schematic displays, presenting test controls and data in an intuitive layout. Full or partial automation of test sequences can be set up using EZFlow and optional single-click Action-Runners embedded into Schematic displays.

Pulsar is a powerful yet versatile platform that is not only easy-to-use but also tailored and optimised for each unique test system configuration.
Pulsar applications for load and motion simulation are configured using selected modules from the core Automation, Simulation & Analysis groupings. Application-specific tailoring is achieved by adding additional software modules and applications as required. A customer-specific operator-interface is developed using a combination of Pulsar tools and off-the-shelf applications.

Pulsar combines Servotest programs with industry-standard applications for data analysis & reporting

- Capabilities are selected, combined and presented in a tailored Schematic operator interface specific to each unique customer application.
- This modular approach ensures long-term supportability as both PCs and operating systems evolve.

Bespoke Application Example - Elastomeric component static & dynamic test

PRE-TEST

Static & dynamic test parameters specified in Microsoft Excel via Advanced EZFlow
Simple on-screen controls for test execution

RUNNING TEST

Dynamic properties calculated in real-time by DSP socket

TEST RESULTS

Test sequence controlled in background by EZFlow
Data analysis post-processing and display of test results using Matlab

EZFlow add-ons
Utility & control
- Vibration test
- PSD Random
- MIMO random
- Desired File Generator
- Auto-PID
- Trend Monitor
- EZ ICS

EZFlow
- Data logger
- Replay
- ICS

Matlab®
- sDAP
- Excel®

Virtual ICS
- TMTS
- Danger Test

Applications

PULSAR Solution Framework

AUTOMATE

- Action-Runners - single-click execution of pre-programmed test sequences
- EZFlow for Servotest & customer test-sequence development
- C# programming option using Advanced EZFlow

SIMULATE

- Single or multiple loggers to record data
- Multi-channel play-back of recorded signals and drive-files
- Iteration to ensure multi-channel response signal fidelity during playback

ANALYSE

- Servotest Data Analysis Package for analysis and display of test results
- Seamless integration with MATLAB® and Microsoft Excel® for further analysis & reporting

CORE FUNCTIONS
- Action-Runner
- EZFlow
- Advanced EZFlow

ADDITIONAL MODULES
- Vibration test
- PSD Random
- MIMO random
- Desired File Generator
- Auto-PID
- Trend Monitor
- EZ ICS

Virtual ICS
- TMTS
- Danger Test

Applications
Wheel-pan assembly

Spacer tube

Restraint

Anti-rotate

Multiple 2-stage servovalves
(3-Stage and combination configurations supported)

Conical base (option)

P stabilisation transducer

On-actuator pressure & return accumulation

Local filtration

Servovalve manifold

Pancake load cell

Wheel-pan accelerometer

LVDT actuator displacement transducer (internal)

Wheel-Pan Actuator

• Multiple 2-stage servovalves (3-stage valve and combination configurations available)
• Load cell for 7-post rig, optional in 4-post configuration

High-Force Preload Actuator

• Preload stage for static load support
• Dual high-flow 3-stage servovalves & Backlash-free Cardan universal joints

Servo-drive

• 2-stage servovalve
• 3-stage servovalve

Feedback

• AC or DC load cells
• LVDT or Temposonic position
• Pressure & differential pressure
• ICP®/IEPE®/MEMS accelerometers
• DC-powered transducers – DWTs, RVTs etc.
• Thermocouples

Measurement & Monitoring

• Analogue signals
• ICP®/IEPE®/MEMS accelerometers
• DC-powered transducers – DWTs, RVTs etc.
• Thermocouples

• E-stop(s)
• Safety interlocks

Actuator configuration examples

Local signal connection with digital communication

• On-rig servo-drive command generation & feed-back signal conditioning using task-specific actuator & analogue node modules
• Hydraulic supply control, rig safety & digital I/O connections via a robust project-specific hydraulic control & safety node

Actuator node #1

• Specimen accelerometer
• Preload pressure transducer

Actuator node #2

• Specimen accelerometer
• Preload pressure transducer

Wheel-Pan Actuator

• Multiple 2-stage servovalves (3-stage valve and combination configurations available)
• Load cell for 7-post rig, optional in 4-post configuration
A single fibre-optic cable per node box

- Tidy installations, even for complex multi-channel systems
- Robust noise-immune digital data communication between test rig and Pulsar hub

**6-DoF Seismic MAST**

- Specimen data acquisition using analogue nodes
- Single digital connection per node

- Single actuator node on each horizontal actuator

- Dual actuator nodes on vertical pre-load actuators

- Single digital connection to hydraulic control node

**Motorsport 7-post**

- Specimen data acquisition using analogue nodes
- Single digital connection per node

- 3x aeroloader actuators with compliant links
- Dual electronic feedback valves per aeroloader
- Single node per aeroloader

- 4x wheel-pan actuators with both 2-stage & 3-stage servovalves
- Single node per wheelpan actuator

- Complementary Damper Test Machine fed from common HPS

- Single digital connection to hydraulic control node

6m x 6m, 100 ton, 6 degree-of-freedom MAST table for civil structural and seismic qualification testing

Long-stroke high-performance motorsport 7-post test rig with aerodynamic down-force simulation
Consult Servotest for recommended configurations

**Headline specifications**

### Hub Configurations

<table>
<thead>
<tr>
<th></th>
<th># hubs</th>
<th># hydraulic nodes</th>
<th># actuator/analogue nodes¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>1</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Extended*</td>
<td>2</td>
<td>1</td>
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</tbody>
</table>

### Actuator Node Box
- Rugged box, sealed to IP65, mounted on or close to actuator
- 150MHz node DSP for local tasks
- 6x node module slots for servovalve drive & feed-back signals
- Integral AC carrier signal for transducer excitation
- Short analogue cable lengths, tidies installation & minimises noise pick-up
- Single Optostar fibre-optic connection to Pulsar hub³
- DC-powered via Optostar connection

### Analogue Node Box
- Light-weight instrument chassis typically for data acquisition signals
- 150MHz node DSP for local tasks
- 6x node module slots, modules available include:
  - Dual-channel analogue input
  - Dual-channel thermocouple input
  - Dual-channel analogue output
- DC transducer power supply configured as required for:
  - DCDTs, DWTs or similar DC-powered devices
  - ICP® or IEPE® type accelerometers
  - MEMS - or servo-type accelerometers
- BNC connectors as standard, multi-pin connectors (e.g. 12-pin D) or other options available at customer request
- Single Optostar fibre-optic connection to Pulsar hub³
- DC-powered via Optostar connection

### Hydraulic Control and Safety Node
- Rugged enclosure
- Digital IO interface to hub, connection via single Optostar cable
- Positively-guided relay outputs
- Pila E-stop safety circuit
- 24V power supply

### PULSAR Specifications

#### Node Box Modules
- 2-stage servovalve: Drives up to 4x 2-stage servovalves (common drive) with auxiliary pressure-switch input
- 3-stage servovalve (2 slots) consists of:
  - 2-stage servovalve drive for pilot
  - Spool LVDT conditioner
- LVD7 actuator position transducer: 10kHz (nominal) carrier signal, variable gain, transducer ID available
- Temposonic actuator position transducer: Start/Stop digital interface, dedicated 24V DC transducer supply, max iteration rate 1.2-5.2 kHz (transducer stroke dependent), TEDS* required
- AC load cell (paired with external 2305 calibration module):
  - AC-coupled for maximum noise-rejection, 10kHz (nominal) carrier signal, full-bridge (2305), TEDS* chip required
- DC load/torque cell:
  - DC-coupled, full-bridge, ±2.5 or ±5V excitation, variable gain (x1, x100, steps to x1,000), TEDS* chip optional, external calibration resistor
- 2-channel analogue output (with built-in transducer power supply):
  - Differential input with 16-bit ADC, 500kHz 4-pole (G40B/Oct) Butterworth low-pass anti alias filter (optional defeat) per channel
  - Input ranges ±0.5, ±1, ±1.25 & ±2.5V selectable on a per-card basis
  - Constant-current supply (4.7mA) from isolated 24V DC bias voltage with AC coupling, for ICP®/IEPE® accelerometers
  - ±5V DC transducer power supply (max 33mA) for DC-powered transducers including MEMS & force-balance/valve DC-torques
- 2-channel analogue output:
  - ±10 volt into a 600Ω load
- 2-channel thermocouple signal conditioner:
  - J- & K-type as standard (1,000 or 1,250°C max temp ranges selectable), N-type as special
- Digital encoder input:
  - Programmable to accept ‘incremental’ (AB signal) or ‘absolute’ (14/-16-bits or SSI) encoders

#### System Performance

**Rates**
- Main hub processor: Texas Instruments TMS320C6718B DSP, 300MHz clock
- Local node processor: Texas Instruments TMS320VC5402A DSP, 150MHz clock
- Primary control loop update rate: 5kHz nominal max
- 2kHz multi-channel typical
- Local node control loop update rate: 10kHz nominal max
- Multiple DAQ processes available
- Optional high-speed DAQ logger: 20kHz

**Data acquisition (DAQ)**
- Main DAQ rate selectable as an integer divisor of the selected loop update rate
- Multiple DAQ processes available
- Optional high-speed DAQ logger: 20kHz

**Resolution**
- Primary transducer channels:
  - 19-bit maximum, 16- to 18-bit typical
  - 16-bit max for Temposonic
  - 5th-order polynomial calibration
- Analogue input:
  - 16-bit typical
  - Selectable input voltage range

### Notes
1. Actuator or analogue nodes, actuator count may vary with detailed configuration
2. 3x actuators per node box possible for 2-stage valve, load & stroke
3. 3x node boxes may be required for actuators with multiple 3-stage valves or pre-load
4. Includes loop-closure for 3rd stage of 3-stage valves
5. 4x with AC carrier
6. Includes DC power for node, safety connection & digital communication
7. Optional 24V DC bias voltage with AC coupling for ICP®/IEPE® accelerometers
8. +15V DC transducer power supply (max 33mA) for DC-powered transducers including MEMS & force-balance/valve transducers

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¹ Actuator or analogue nodes, actuator count may vary with detailed configuration
² Includes loop-closure for 3rd stage of 3-stage valves
³ 4x with AC carrier
⁴ Includes DC power for node, safety connection & digital communication
⁵ Digital outputs can be reconfigured as digital inputs
⁶ TEDS = Transducer Electronic Data Sheet...Servotest-specific configuration
⁷ Includes 2x hubs & 24 node box connections available using SCARMNet® selected memory
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Avery AL01 - 76x37mm