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**Detailed Technical Specifications for Digital Data Acquisition System:**

**1. 4 Channel Data Acquisition system:**

A 4 Channel Data Acquisition system (DAS) is required to monitor signals from Strain, force, pressure, and Displacement sensors. All the signal conditioning must be digital, and the modules should be synchronised with each other. Software compatible with the hardware for setup, simplified data Logging & simplified Data Viewing must be supplied.

**Specifications for 4 Channel Digital Universal Signal Conditioner**

1) No of modules	:	One Input module containing 4 electrically isolated & individually configurable channels. Facility to upgrade to 32+ channels via cascading.
2) Signal conditioning	:	All Channels should support half and full bridge Strain gauges, Load cells, Force transducers, Half & full inductive bridges, LVDT, PT100, PT1000, Thermocouples, Potentiometer, voltage, current, resistance, frequency, incremental rotary encoder, speed sensor (rpm), pulse counter, SSI protocol. All individually adjustable for each channel inputs
3) A/D Converter	:	Each channel should have separate 24-bit A/D Converter for synchronous & parallel measurements. No Multiplexing / sample & hold.
4) Sampling rate per channel	:	≥ 40 kHz/channel. Individually adjustable / channel
5) Excitation for Active Sensors	:	5 ... 24VDC adjustable for each channel
6) Bridge Excitation Voltage	:	1 or 2.5Vrms with selectable AC & DC excitation
7) Carrier frequency (sine)	:	4800Hz
8) Accuracy class	:	0.05
9) Linearity error	:	< 0.02%
10) Strain gauge-based Sensors	:	± 10 mV (must support 6 wire Kreuzer circuitry)
11) LVDT's	:	± 3000 mV
12) Inductive sensors	:	± 1000 mV
13) Piezo resistive sensor	:	± 2500 mV
14) Potentiometer	:	± 1000 mV
15) DC voltage & Currents	:	± 60 V, ± 10 V, ± 100 mV & 4...20mA
16) Resistance	:	5000 ohms
17) Thermocouples	:	Type K, J, S, T, R, N, B, E. Optional cold junction compensation
18) Thermistors	:	PT100, PT1000 with linearization range of -200 ... +48°C
19) Pulses & Frequency	:	0 ... 1,000,000 pulses/sec; 0 ... 1,000,000 Hz
20) SSI mode (differentially)	:	Shift clock(100,200,500,1000 KHZ); Word length (12-31 bit); Code (Dual or Grey); Input Level- Low Level (Differential inputs: RS422: Signal(+)< Signal(-) -200mV), High Level (Differential inputs: RS422: Signal(+)> Signal(-) +200mV)
21) Transducer impedance	:	300 ... 1000Ω

## I. General Specifications

1) <b>Bessel &amp; Butterworth Filters</b>	:	0.01 HZ to 3.2 kHz individually adjustable per channel
2) <b>Channel Isolation</b>	:	All inputs to be electrically isolated
3) <b>Transducer cable length</b>	:	Should support $\geq 80$ meters
4) <b>Common Mode Rejection</b>	:	$>100$ dB
5) <b>Common Mode Voltage</b>	:	60V
6) Zero drift	:	$<0.002\%$ of Full Scale
7) Full Scale drift	:	$<0.005\%$ of the measured value
8) TEDS support	:	TEDS (IEEE 1451.4) supported on every channel. Capability to read & TEDS. Support full bridge TEDS in $\leq 6$ wire circuit.
9) Transducer connector	:	D Connector / Screw Terminals/ Push Pull Connector
10) Interface	:	Firewire, Ethernet
11) Synchronization	:	Via Firewire, NTP, PTP
12) EMC requirements	:	EN 61326
13) Vibration (30 min)	:	50m/s <sup>2</sup>
14) Shock (6 ms)	:	350m/s <sup>2</sup>
15) Operating temperature	:	-20 ... +65°C
16) Power Supply	:	10 ... 30V DC for field applications with 230 VAC adapters for Lab.
17) Size & Weight	:	Must be compact and portable. Weight $<2$ Kg and size $<2$ liter
18) Distributed & Scalable Modules	:	The modules must be upgradeable to $> 100$ channels. Every 4/8 channel unit must be able to be used separately with a computer.

## II. Software Requirement:

1) Software	:	The software should include Hardware setup, simplified data Logging, simplified Data Viewing. Automatic sensor recognition through TEDS. No programming knowledge should be required to work on the software or make online digital displays, graphs & calculations.
2) Channel configuration	:	Automatically via TEDS (integrated editor). Manually via integrated sensor database which must be open & expandable.
3) Online calculations	:	Arithmetic, exponent, root, root mean square value, logic, trigonometry, integral/differential, exponential, logarithm, limit values (connect digital output, play audio file via external speaker, entry in log file), software filters (moving averages, Bessel, Butterworth), Experimental stress analysis using SG
4) Software Display Elements	:	Numeric display, line recorder (y-t, x-y, y-f / FFT), spreadsheet, indicator, bar graph, LED, polar diagram, Rain flow.
5) Data Storage Format	:	ASCII, Microsoft Excel, RPC III, MATLAB, nCode, MDF 4.0, NI DIAdem. The complete meta data (sensors, measurement, configuration, test parameters), statistics log should be stored for data traceability.

### III. General:

1. Vendors should provide Compliance statement (with proof marked/ highlighted in the datasheet) along with technical bid. If compliance statement is not provided or not properly filled, it will be considered that the vendor does not meet specifications.
2. Warranty: 2 Year.
3. Manuals: A set of system operating manuals should be supplied

### LIST OF DELIVERABLES

S.NO	DESCRIPTION	QTY
1	4 Channel Digital Universal Signal Conditioner With all essential accessories: Software, Power supply, Synchronization cable, connectivity cable, casing clips and connectors to connect transducers to DAS.	2 Set

#### **2. 8 Channel Data Acquisition system:**

An 8 Channel Data Acquisition system (DAS) is required to monitor signals from Strain, force, pressure, and Displacement sensors. All the signal conditioning must be digital, and the modules should be synchronised with each other. Software compatible with the hardware for setup, simplified data Logging & simplified Data Viewing must be supplied.

#### **Specifications for 8 Channel Digital Universal Signal Conditioner**

1) No of modules	:	One Input module containing 4/8 electrically isolated & individually configurable channels. Facility to upgrade to 32+ channels via cascading.
2) Signal conditioning	:	All Channels should support half and full bridge Strain gauges, Load cells, Force transducers, Half & full inductive bridges, LVDT, PT100, PT1000, Thermocouples, Potentiometer, voltage, current & resistance. All individually adjustable for each channel inputs
3) A/D Converter	:	Each channel should have separate 24-bit A/D Converter for synchronous & parallel measurements. No Multiplexing / sample & hold.
4) Sampling rate per channel	:	$\geq 40$ kHz/channel. Individually adjustable / channel
5) Excitation for Active Sensors	:	5 ... 24VDC adjustable for each channel
6) Bridge Excitation Voltage	:	1 or 2.5Vrms with selectable AC & DC excitation
7) Carrier frequency (sine)	:	4800Hz
8) Accuracy class	:	0.05
9) Linearity error	:	$< 0.02\%$
10) Strain gauge-based Sensors	:	$\pm 10$ mV (must support 6 wire Krezuer circuitry)
11) LVDT's	:	$\pm 3000$ mV
12) Inductive sensors	:	$\pm 1000$ mV
13) Piezoresistive sensor	:	$\pm 2500$ mV
14) Potentiometer	:	$\pm 1000$ mV
15) DC voltage & Currents	:	$\pm 60$ V, $\pm 10$ V, $\pm 100$ mV & 4...20mA
16) Resistance	:	5000 ohms
17) Thermocouples	:	Type K,J,S,T,R,N,B,E. Optional cold junction compensation
18) Thermistors	:	PT100, PT1000 with linearization range of $-200$ ... $+848^{\circ}\text{C}$

19) Pulses & Frequency	:	0 ... 1,000,000 pulses/sec; 0 ... 1,000,000 Hz
20) Transducer impedance	:	300 ... 1000Ω

## **I. General Specifications**

1) <b>Bessel &amp; Butterworth Filters</b>	:	0.01 HZ to 3.2 kHz individually adjustable per channel
2) <b>Channel Isolation</b>	:	All inputs to be electrically isolated
3) <b>Transducer cable length</b>	:	Should support ≥80 meters
4) <b>Common Mode Rejection</b>	:	>100dB
5) <b>Common Mode Voltage</b>	:	60V
6) Zero drift	:	<0.002% of Full Scale
7) Full Scale drift	:	<0.005% of the measured value
8) TEDS support	:	TEDS (IEEE 1451.4) supported on every channel. Capability to read & TEDS. Support full bridge TEDS in ≤ 6 wire circuit.
9) Transducer connector	:	D Connector / Screw Terminals/ Push Pull Connector
10) Interface	:	Firewire, Ethernet
11) Synchronization	:	Via Firewire, NTP, PTP
12) EMC requirements	:	EN 61326
13) Vibration (30 min)	:	50m/s <sup>2</sup>
14) Shock (6 ms)	:	350m/s <sup>2</sup>
15) Operating temperature	:	-20 ... +65°C
16) Power Supply	:	10 ... 30V DC for field applications with 230 VAC adapters for Lab.
17) Size & Weight	:	Must be compact and portable. Weight <2Kg and size <2 liter
18) Distributed & Scalable Modules	:	The modules must be upgradeable to > 100 channels. Every 4 / 8 channel unit must be able to be used separately with a computer.

## **II. Software Requirement:**

1) Software	:	The software should include Hardware setup, simplified data Logging, simplified Data Viewing. Automatic sensor recognition through TEDS. No programming knowledge should be required to work on the software or make online digital displays, graphs & calculations.
2) Channel configuration	:	Automatically via TEDS (integrated editor). Manually via integrated sensor database which must be open & expandable.
3) Online calculations	:	Arithmetic, exponent, root, root mean square value, logic, trigonometry, integral/differential, exponential, logarithm, limit values (connect digital output, play audio file via external speaker, entry in log file), software filters (moving averages, Bessel, Butterworth), Experimental stress analysis using SG
4) Software Display Elements	:	Numeric display, line recorder (y-t, x-y, y-f / FFT), spreadsheet, indicator, bar graph, LED, polar diagram, Rainflow.
5) Data Storage Format	:	ASCII, Microsoft Excel, RPC III, MATLAB, nCode, MDF 4.0, NI DIAdem. The complete meta data (sensors, measurement, configuration, test parameters), statistics log should be stored for data traceability.

### III. General

1. Vendors should provide Compliance statement (with proof marked/ highlighted in the datasheet) along with technical bid. If compliance statement is not provided or not properly filled, it will be considered that the vendor does not meet specifications.
2. Warranty: 2 Year.
3. Manuals: A set of system operating manuals should be supplied

#### **LIST OF DELIVERABLES**

S.NO	DESCRIPTION	QTY
1	8 Channel Digital Universal Signal Conditioner With all essential accessories: Software, Power supply, Synchronization cable, connectivity cable, casing clips and connectors to connect transducers to DAS.	1 Set

#### **3. 16 Channel Data Acquisition system:**

A 16 Channel High Speed Universal Data Acquisition system (DAS) is required to monitor signals from Strain, force, and Acceleration. All the signal conditioning must be inbuilt, and the channels should be synchronised with each other. Software compatible with the hardware for setup, simplified data Logging & simplified Data Viewing must be supplied.

#### **Specifications for 16 Channel Universal Signal Conditioner**

1) No of modules	:	One Input module containing 8/16 electrically isolated & individually configurable channels. Facility to upgrade to 64+ channels via cascading.
2) Signal conditioning	:	All 16 Channels should support quarter, half and full bridge Strain gauges, Load cells, Force, Pressure, potentiometric displacement transducers; MEMS, IEPE & piezoelectric accelerometers; RTD, 4...20 mA sensors & Thermocouples. All individually adjustable for each channel inputs
3) A/D Converter	:	Each channel should have separate 24-bit A/D Converter for synchronous & parallel measurements. No Multiplexing.
4) Sampling rate per channel	:	$\geq 500\text{kHz/channel}$ . Individually adjustable / channel
5) Strain gauge quarter bridge	:	2ppm inbuilt completion resistor of 120 & 350 ohm
6) Strain gauge-based Sensors	:	Up to 5000 ohms
7) ICP/IEPE	:	$\pm 1\text{ mV}$ , $\pm 10\text{ mV}$ , $\pm 100\text{ mV}$ , $\pm 1\text{ V}$ , $\pm 10\text{ V}$ with 2, 4, 6, 8 mA, software selectable constant current excitation
8) Charge	:	$\pm 1\text{ nC}$ , $\pm 10\text{ nC}$ , $\pm 100\text{ nC}$ , $\pm 1\text{ }\mu\text{C}$ , $\pm 10\text{ }\mu\text{C}$
9) DC voltage & Currents	:	$\pm 1\text{ mV}$ , $\pm 10\text{ mV}$ , $\pm 0.1\text{ V}$ , $\pm 1.0\text{ V}$ , $\pm 10.0\text{ V}$ & 4...20mA
10) Thermocouples	:	K, J, T, B, E, N, R, S, C with optional cold junction compensation
11) Thermistors	:	PT10, Pt100, Pt500, Pt1000, Pt2000 with linearization range $-200 \dots +848^\circ\text{C}$
12)	:	
13) Impedance	:	10 M $\Omega$
	:	

## **I. General Specifications**

1) <b>Onboard Memory</b>	:	2GB on acquisition card for transient recording & 500GB inbuilt SSD
2) <b>Filters</b>	:	Digital 12 pole Bessel, Butterworth & Elliptic with Sample rate tracking
3) <b>Auto Zero &amp; Bridge Balance</b>	:	Bridge in-balance measured, and software compensated by means of auto zero in parallel in a channel
4) <b>Shunt Calibration</b>	:	Two software selectable inbuilt 5ppm/°C shunt for every channel
5) <b>Channel Isolation</b>	:	>50V Channel to channel and channel to chassis
6) <b>Common Mode Rejection</b>	:	>100dB
7) TEDS support	:	Class 1 / 2
8) Acquisition Modes	:	Continuous, Transient, Multiple Transient & Mixed Mode
9) Digital I/O	:	At least 1 Digital Input and one Digital Output
10) Trigger	:	0-100% Pre-Trigger & post Trigger (>10 mins)
11) Transducer connector	:	Lemo/ D Connector/ Push Pull Connector with 10m cable
12) Interface	:	1 Gigabit Ethernet
13) Transfer Speed	:	≥100 MB/s uncompressed, ≥ 150 MB/s with compression to PC ≥200 MB/s uncompressed, to internal SSD
14) Synchronization	:	NTP, PTP, IEEE1588 with < 200 ns accuracy
15) EMC requirements	:	EN 61326, EN 61010-1, EN 61000-4
16) Vibration (1 hour)	:	10m/s <sup>2</sup> , random 5 to 500Hz
17) Shock (6 ms)	:	250m/s <sup>2</sup>
18) Operating temperature	:	-10 ... +55°C
19) Power Supply	:	12/24VDC with 230 VAC adapters for Lab.
20) Size & Weight	:	Compact and portable. Weight < 5Kg and size < 100x400x400mm
21) Distributed & Scalable Modules	:	The modules must be upgradeable to >64 channels. Every 8 / 16 channel unit must be able to be used separately with a computer.

## **II. Software Requirement:**

1) Software	:	The software should include Hardware setup, simplified data Logging, simplified Data Viewing. Automatic sensor recognition through TEDS. No programming knowledge should be required to work on the software or make online digital displays, graphs & calculations.
2) Channel configuration	:	Automatically via TEDS (integrated editor). Manually via integrated sensor database which must be open & expandable.
3) Online calculations	:	Arithmetic, exponent, root, root mean square value, logic, trigonometry, integral/differential, exponential, logarithm, limit values, software filters (Bessel, Butterworth).
4) Software Display Elements	:	Numeric display, line recorder (y-t, x-y, y-f / FFT), spreadsheet, indicator, bar graph, LED, synchronised Video playback
5) Data Storage Format	:	ASCII, Microsoft Excel, MATLAB, nCode, UFF58, Diadem, FlexPro

6) Reports	:	Quick Reports in Excel & Word
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**General**

1. Vendors should provide Compliance statement (with proof marked/ highlighted in the datasheet) along with technical bid. If compliance statement is not provided or not properly filled, it will be considered that the vendor does not meet specifications.
2. Warranty: 2 Year.
3. Manuals: A set of system operating manuals should be supplied

**LIST OF DELIVERABLES**

S.NO	DESCRIPTION	QTY
1	<p><b>High Speed Data Acquisition system &amp; accessories</b>            Consisting of:            1 x DAQ mainframe GEN2tB, with 2 slots for input cards, RJ45 1 GBit Ethernet, Dig I/O and Remote I/O connector.            Streaming rate to PC 100 MB/s, to internal SSD 150 MB/s.            500 GB internal SSD.</p> <p>1 x Perception Enterprise 64bit software for multi-instrument setup, sensor database, acquisition, analysis, and reporting (to be installed on control PC)</p> <p>Incl. optional accessory            16X KAB430-0.3 Adapter for IEPE/voltage (ODU 14p to BNC).</p> <p>Host Controller.</p>	01 Set