DIGITAL INDUSTRIES SOFTWARE

# Simcenter SCADAS Mobile and Lab Four-channel V/ICP, Bridge and Dynamic Strain module with monitoring output

## Simcenter VBDS4/2406/20240625

## Product Information Sheet


Summary

VBDS4-RT input module

In a single Simcenter SCADAS Mobile slot, the.

The VBDS4-RT supports four-channel signal conditioning and signal processing for measuring signals from Wheatstone bridges or strain resistors. Its exceptionally high dynamic range and the support for dynamic strain measurements make the VBDS4-RT an ideal module in aero-engine testing.

Supported transducers

Typical applications

# FEATURES

- High speed, high throughput data acquisition for jet engine,- turbine,- and wind tunnel testing
- Compatible with full bridge, half bridge and quarter bridge configuration and dynamic strain measurements
- Bridge balancing through current injection.
- AC and DC coupled monitoring output with Raw, RMS and Peak data output
- Bridge completion for 120 Ω and 350 Ω bridges
- Built-in shunt calibration
- Piezoelectric ICP sensor support
- TEDS CLASS 1 and 2 support

**VBDS4-RT input module**
In a single Simcenter SCADAS Mobile slot, the.
The VBDS4-RT supports four-channel signal conditioning and signal processing for measuring signals from Wheatstone bridges or strain resistors. Its exceptionally high dynamic range and the support for dynamic strain measurements make the VBDS4-RT an ideal module in aero-engine testing.

**Wheatstone bridge measurements**
In Wheatstone bridge mode the VBDS4-RT supports full bridge, half bridge and quarter bridge configurations under full software control. Bridge completion for 120 Ω and 350 Ω bridges is included. Automatic bridge balancing using the proven current injection technique compensates for bridge unbalance without changing the bridge sensitivity while reducing bridge non-linearity to a minimum. Highly accurate 100 kΩ resistor, connected via shunt and sense lines to the bridge, supports shunt calibration.

**Dynamic strain measurements**
To measure signals from strain resistors the VBDS4-RT supports balanced constant current supply that provides improved common mode rejection. Combined with AC-coupled input, for single strain gage measurements using only two or four wire configurations, it allows measurement of dynamic strain with optimum signal to noise ratio. Fail-safe operation even when one side of a strain gage is accidentally short-circuited to ground (e.g. due to cable damage). Bridge supply current can be set individually for each channel.

**Piezoelectric ICP sensor support**
The VBDS4-RT supports wide range of current-fed piezoelectric ICP sensors such as accelerometers or microphones.

**Transducer Electronic Data Sheet (TEDS)**
The VBDS4-RT supports IEEE1451.4 TEDS standard for ICP sensors (Class 1) and for bridge sensors (Class 2).

**EtherCAT support**
EtherCAT is a real-time network used in test benches or automation applications which require short data update times (low latency) with ultra-low communication jitter for synchronization purposes.

**Monitoring output**
Corresponding to each input channel a monitoring output is available through grounded CAMAC connectors. The monitoring output provide selectable RAW, RMS and peak modes.

**Product Information Sheet**

| General information | VBDS4-RT specifications |
|---|---|
| Product name | SCM-VBDS4-RT, SCL-VBDS4-RT |
| Description | Simcenter SCADAS 4 channel V/ICP/Bridge and Dynamic strain module with monitoring output and with EtherCAT support. |
| Inputs | Four (4) time-sychronous bridge or V/ICP inputs |
| Input ranges differential input | ±10 V, ±3.16 V, ±1 V, ±0.316 V, ±0.1 V, ±31.6 mV, ±10 mV, ±3.16 mV |
| Input ranges single ended V/ICP input | ±10 V, ±3.16 V, ±1 V, ±0.316 V |
| Digital interface | EtherCAT write, (requires ESO64 module) |
| Outputs | AC or DC coupled monitoring output on each channel, with raw data or peak and RMS output. |
| Transducer connector | Four (4) 8 pin LEMO 1B connector for sensor input<br>Four (4) CAMAC connector for monitoring output |
| **Supported transducers** | |
| | Full, half and quarter bridge configurations, including bridge completion for 120 Ω and 350 Ω.<br>Support of dynamic strain measurements<br>Wheatstone bridge-based transducers (force, pressure, torque, acceleration)<br>AC or DC coupled sensors<br>Voltage and ICP sensors<br>Sensors that require 14V power supply |
| **A/D Converter** | |
| Max. sampling rate | 204.8 kHz, can be downsampled in steps of 2 and 2.5 |
| Max. bandwidth | 88 kHz |
| ADC Architecture | 24 bit Sigma Delta ADC |
| Coupling | DC, AC in both single-ended and differential modes |
| **Filter** | |
| High Pass Filter | Software selectable high pass filter with 0.5 Hz (single ended mode) and 1Hz (differential input mode) cut off frequency |
| AC Coupling | Single ended mode: 0.048 Hz ±6% ( Boost function for fast settling time)<br>Differential input mode: 1Hz ±2% |
| Decimation filter | Reduces bandwidth prior to signal processing; bandwidth can be down-sampled in steps of 2 and 2.5. |
| Analog anti-alias filter | 4-pole Equal Time Delay filter with 164 kHz cut-off frequency and 0.01 dB flatness guaranteed. Alias suppression of better than 105 dB provides an alias free bandwidth of 92 kHz |
| **Transducer identification** | |
| TEDS | TEDS class 1 (ICP sensors) and TEDS class 2 (Bridge sensors) supported according to IEEE 1451.4<br>Maximum sensor cable length is 80 m |
| **Power** | |

| | |
|---|---|
| Power consumption | 7 W available for the module and the sensors (during normal operation, no overload and ICP supply switched on). |
| Power feedback | LED on the module front panel, providing information on connection, power status and any sensor supply overload/underload. During system booting and startup, the LED on channel 1 will be used to indicate module status (active) using a different LED color and/or blinking pattern.<br>**LED Modes**<br>V/ICP: Green<br>Bridge: Blue<br>Dynamic strain: Blue<br>Bridge mode balancing: Cyan<br>Bridge mode shunt active: Magenta<br>TEDS reading: Yellow flash<br>**Alarm**<br>Overload: Red<br>Supply current overload: Yellow/Red flashing<br>Open loop in dynamic strain: Yellow/Red flashing |
| Bridge supply | Symmetrical bridge supply can be selected from 1 V (±0.5 V) to 10 V (±5 V).<br>The negative bridge supply voltage sense line and the tracked voltage compensation for the positive bridge supply voltage guarantee nominal bridge supply voltage independent from cable length. |
| Bridge current supply | The module have a balanced current supply that can be set from 2.5 mA up to 25 mA with an accuracy of ±0.1 % for two wire or four wire connection; supported strain gauges have a resistance of 120 Ω or 350 Ω (metal foil) or from 40 Ω to 400 Ω (semiconductor)<br>**Strain gauge resistance** — **Maximum current**<br>120 Ω or semiconductor 40 Ω - 200 Ω — 25 mA<br>350 Ω or semiconductor above 200 Ω — 20 mA |
| ICP sensor supply | Between 9 mA and 5 mA over the Simcenter SCADAS Mobile operating temperature range. |
| Active sensor supply | 14 V DC; maximum current is upto two triaxial accelerometers 30mA or 4 active sensors up to 20mA each.<br>Because the power budget in a frame is limited to 160mA/module (90mA/channel) for the 9 slots frame (SCM2E09) and 200 mA/module (130mA/channel) for the five slots frame (SCM2E05). |

| Activated channels | **SCM2E09** Current limit | **SCM2E05** Current limit |
|---|---|---|
| 1 | 90 | 130 |
| 2 | 45 | 65 |
| 3 | 30 | 40 |
| 4 | 30 | 30 |

| **Input impedance** | |
|---|---|
| Single ended mode | 1MΩ \|\| 220pF |
| ICP mode (AC) | 523 KΩ \|\| 220pF |
| Bridge mode (DC) | 3 MΩ \| 500pF |
| **Slew rate** | |
| V/ICP (single ended) | 20V/µs |
| Differential input | 20V/µs |

| **Noise and distortion - better than** | | |
|---|---|---|
| Peak-to-peak noise (1/f) | Better than 0.4 µV max. between 0.1Hz and 10Hz in ±100 mV input range | |
| **Signal to noise ratio (SNR)** | **Differential input (typical)** | **Single ended input (typical)** |
| ±10 V | 110 dB | 110 dB |
| ±3.16 V<br>±1 V | 105 dB | |
| ±0.316 V | 100 dB | 105 dB |
| ±0.1 V | 90 dB | - |
| ±31.6 mV | 80 dB | |
| ±10 mV | 70 dB | |
| ±3.16 mV | 60 dB | |
| | Measured between 20Hz to 20KHz, with 32k block size, 16 averages | |
| **Common mode rejection (CMMR)** | **Differential input (typical)** | **Single ended input (typical)** |
| ±10 V<br>±3.16 V | 90 dB | - |
| ±1 V<br>±0.316 V | 110 dB | |
| ±0.1 V<br>±31.6 mV | 115 dB | |
| **Spurious Free Dynamic Range (SFDR)** | **Differential input (typical)** | **Single ended input (typical)** |
| ±10 V | 150 dB | 150 dB |
| ±3.16 V<br>±1 V | 145 dB | |
| ±0.316 V | 140 dB | 145 dB |
| ±0.1 V | 130 dB | - |
| ±31.6 mV | 120 dB | |
| ±10 mV | 110 dB | |
| ±3.16 mV | 100 dB | |
| | Between 20Hz and 20kHz, measured with block size of 51200 and 1Hz bins, Auto Power Spectrum after 16 averages | |
| **Crosstalk** | **Differential input (typical)** | **Single ended input (typical)** |
| ±10 V, ±3.16 V, ±1 V, ±0.316 V, ±0.1 V, ±31.6 mV, ±10 mV, ±3.16 mV | 130 dB | 120 dB |

| | | |
|---|---|---|
| | Tested at 1.5kHz frequency, between any two channels | |
| **Total Harmonic Distortion (THD)** | **Differential input (typical)** | **Single ended input (typical)** |
| ±10 V, ±3.16 V | 80 dB | 80 dB |
| ±1 V | 100 dB | 100 dB |
| ±0.316 V | 105 dB | 105 dB |
| ±0.1 V | 95 dB | - |
| ±31.6 mV | 100 dB | - |
| | At 1 kHz frequency, 25.6 kHz bandwidth, measured with a block size of 8192 Hz | |
| **Amplitude Accuracy** | **Differential input** | **Single ended input** |
| | At 1 kHz better than +/- 0.1% at 23 °C | |
| **Residual Offset** | **Differential input** | **Single ended input** |
| | Better than 0.1% at 22°C ± 2°C | |
| **Gain drift at SCADAS operating temperature range** | **Differential input (typical)** | **Single ended input (typical)** |
| ±10 V<br>±3.16 V | 19 ppm/°C | 18 ppm/°C |
| ±1 V<br>±0.316 V | 13 ppm/°C | |
| ±0.1 V<br>±31.6 mV | 19 ppm/°C | - |
| ±10 mV | 18 ppm/°C | |
| ±3.16 mV | 19 ppm/°C | |
| **Bridge supply drift** | **Differential input (typical)** | **Single ended input (typical)** |
| 1 V (±0.5 V), 2.5 V (±1.25 V), 5 V (±2.5 V), 10 V (±5 V) | 5 ppm/°C | - |
| Bridge supply accuracy | 0.1% | |
| **Offset drift** | **Differential input (typical)** | **Single ended input (typical)** |
| ±10 V | 6 µV/°C | 6 µV/°C |
| ±3.16 V | 2 µV/°C | 2 µV/°C |
| ±1 V | 3 µV/°C | 0.6 µV/°C |
| ±0.316 V | 0.3 µV/°C | 0.3 µV/°C |
| ±0.1 V<br>±31.6 mV | 0.2 µV/°C | - |

| | | |
|---|---|---|
| ±10 mV<br>±3.16 mV | | |
| **Phase match between any two channels (at 10 kHz)** | **Differential input (better than)** | **Single ended input (better than)** |
| ±10 V, ±3.16 V, ±1 V, ±0.316 V | 0.45° | 0.25° |
| ±0.1 V , ±31.6 mV, ±10 mV, 3.16 mV | 3° | 0.45° |
| **Strain gauge and Wheatstone bridge conditioning** | | |
| Conditioning | **Full bridge**<br>- 4 wires<br>- 5 wires with sense lines<br>**Half bridge**<br>- 3 wires<br>- 4 wires with sense lines<br>**Quarter bridge**<br>- 2 and 3 wires | |
| Internal completion resistors | 120 Ω±0.02 % and 350 Ω±0.02 % (with 1 ppm/k) for quarter bridges | |
| Shunt calibration | Shunt calibration by 100 kΩ (±0.12 %) shunt resistor between the negative bridge supply voltage sense line and the shunt sense line provides a simulated strain of 599 µstrain (120 Ω bridge) or 1744 µstrain (350 Ω bridge) | |

| **DC bridge mode** | **Full (1/1) bridge** | **Half (1/2) bridge** | **Quarter (1/4) bridge** |
|---|---|---|---|
| Selectable supply with 120 Ω | 0 V<br>1.25 V<br>2.5 V<br>- | 0 V<br>1.25 V<br>2.5<br>5V | 0 V<br>1.25 V<br>2.5<br>5V |
| Selectable supply with 350 Ω | 0 V<br>1.25 V<br>2.5 V<br>5 V<br>- | 0 V<br>1.25 V<br>2.5 V<br>5 V<br>10 V | 0 V<br>1.25 V<br>2.5 V<br>5 V<br>10 V |

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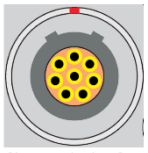
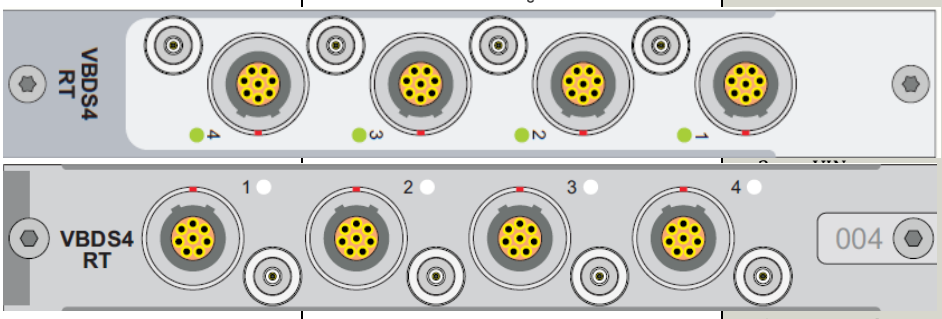
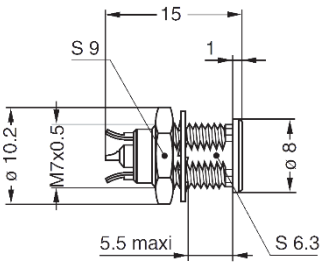
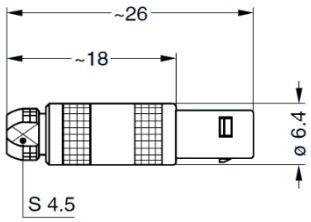
| | |
| | 100 kΩ (±0.12 %) resistor across all bridge arms<br>Via application software |
| **Monitoring output** | |
| Description | Each input channel can be configured to operate through D/A converter as a monitoring output channel, providing RAW, RMS and peak data. |

| | |
|---|---|
| None | Monitoring output is not sending out data |
| Raw | Data output provides 10 V scaled signal output. |
| Broadband RMS | Output provides moving averaged output with 100 msec time constant. |
| Peak | Instantaneous output with a 10 msec attack and 100 msec decay time |
| Coupling | AC or DC |
| Output voltage | ±10V |
| Output latency | **Bandwidth** **Latency**<br>25.6 kHz 1.26 ms<br>51.2 kHz 626 µs<br>102.4 kHz 320 µs |
| **Protection** | |
| Input protection | All input pins are protected against ±40 V overvoltage (without damage). Other pins (supply, sense) are not protected against overvoltage. |
| Sensor check | ICP and Bridge sensor check for open loop and short circuit detection.<br>Detection threshold depends on bridge supply voltage, quantization errors and tolerances on electronic components. The detection threshold is lower than 0.4mA. Overload (prior to decimation). Power overload: channel power exceeded (per channel), module power exceeded (all channels exceeding module power) |
| ESD protection | According to EN61000-4-2, level 2 and ISO10605 |
| EMC protection | Comply with CE-EMC directive, when installed in a SCADAS Mobile frame |
| Overload detection and indication | Analog overload detection at the input is combined with digital overload detection after the ADC;<br>Overloads are indicated on the front panel LED and transmitted to the host. |
| Error detection methods | **Error** / **LED Indication, effect on the module**<br>Signal overload / RED, N/A<br>ICP broken cable / RED/YELLOW, N/A<br>ICP short circuit / RED/YELLOW, N/A<br>Bridge or active sensor broken cable / RED/YELLOW, N/A<br>Bridge/Active Sensor power overload / RED/YELLOW, Bridge supply or active sensor supply is switched off<br>Module power overload / WHITE (*) Bridge supply or active sensor supply is switched off<br>*Note: in case of power overload, the first channel causing the overload and all subsequent channels will have the same LED indication |
| Shock protection | MIL-STD-810F |
| Vibration protection | MIL-STD-810F (2-2000Hz random, 7.7grms) 60 gpk applying an 11 ms saw tooth shock pulse, three shock per direction; |
| Ambient operating temperature range | -20 ºC to +55 ºC |

| | | |
|---|---|---|
| Storage temperature range | -20 °C to +70 °C | |
| **Housing** | | |
| Dimensions | 1 Simcenter SCADAS slot (129.1x20.10x2.75mm) | |
| **Connector and pinning layout** | | |
| |  <br>  | **Connector type:**<br>LEMO EGB.1B.308.CLVY<br>**Mating connector:**<br>LEMO FGB.1B.308.CLAD62 solder connector<br>LEMO FGB.1B.308.CLCD62 crimp contact connector can be ordered as an option<br>5. +Vsupply<br>6. -Vsupply<br>7. -Vsense<br>8. Ground |
| Monitoring output connector layout |  <br>  | **Connector type:**<br>CAMAC Chassis: ERN.00.250.CTL<br>Mating connector: FFA.00.250.CTAC29 |

**SCL-VBDS4-RT**

**SCM-VBDS4-RT**

**Ordering Information:**

Support of Simcenter SCADAS Frames and Modules may be restricted in specific Simcenter Testlab application workbooks.

Please check with your local representative for full details.

SCM-VBDS4-RT:

Simcenter SCADAS Mobile EtherCAT compatible 4-channel V/ICP, Bridge and dynamic strain conditioner

SCL-VBDS4-RT: Simcenter SCADAS Lab EtherCAT compatible 4-channel V/ICP, Bridge and dynamic strain conditioner

Package includes 4 input channel mating connectors and 4 monitoring output CAMAC to BNC cables of 0.5m