Kistler LabAmp

Charge Amplifier and Data Acquisition Unit for Dynamic Measurements

This universal laboratory charge amplifier can be used wherever dynamic signals of mechanical quantities are measured with piezoelectric sensors, Piezotron sensors (IEPE) or sensors with voltage output. Piezoelectric sensors produce an electric charge which varies in direct proportion with the load acting on the sensor. The amplifier converts this charge directly into digital values or a proportional output voltage.

- 1 or 4 channel amplifier for piezoelectric sensors (charge), Piezotron sensors (IEPE) and voltage
- Integrated 24-bit data acquisition with up to 200 kSps per channel
- Continuous digital signal processing at minimal latency
- Fully flexible low-pass, high-pass and notch filter adjustment
- Low-noise design
- TEDS (IEEE 1541.4) for Piezotron sensors
- 1 or 4 analog outputs with fully flexible 2-point scaling and internal routing
- Status indication per channel via LED
- Virtual channels for real-time calculations using one or more sensor channels
- Configuration and control in a standard web-browser
- Virtual instrument driver for LabVIEW
- Two Ethernet interfaces with included switch functionality
- PTP synchronization option for data acquisition with multiple devices

Description

The Kistler LabAmp Type 5165A... is not only an outstanding low-noise charge amplifier for dynamic signals but also a powerful data acquisition device delivering the digitized measurement values directly to a host computer for further analysis. It is configured and operated in a web-interface, conveniently accessible by a standard web-browser.

Thanks to advanced signal processing technology, the Kistler LabAmp Type 5165A... offers impressive flexibility. The frequencies of the highpass, low-pass and notch filters can be directly entered as numeric values in Hertz. The input signals can be flexibly routed to the analog outputs.

The graphical user interface not only offers a simple and intuitive way to configure the device but also displays different measurement values (e.g. live value, peak value, root mean square). The virtual channel functionality allows real-time summation of different input signals. Furthermore, the browser-based data download allows the acquired data to be processed in an analysis software. For more advanced tasks or direct analysis, the amplifier can be integrated directly into LabVIEW thanks to the provided Virtual Instruments Driver.

For higher channel counts, the optional synchronization feature (PTP) allows acquiring data from multiple Type 5165A... devices. Kistler LabAmp Type 5167A... amplifiers can be synchronized with the Type 5165A... as well which allows for example the combined acquisition of dynamic IEPE signals and quasi-static signals from piezoelectric sensors. No additional cables are required.

1) dynamic PE/IEPE signals from 0,1 Hz (time constant ≈1,6 s) / voltage signals from 0 Hz; not suitable for quasi-static charge measurements
2) This functionality is included as a free trial for the moment but will cost extra in the future.
## Technical data

### Connections

<table>
<thead>
<tr>
<th>Number of channels</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 5165A1</td>
<td>1</td>
</tr>
<tr>
<td>Type 5165A4</td>
<td>4</td>
</tr>
<tr>
<td>Input connector type</td>
<td>BNC neg.</td>
</tr>
<tr>
<td>Analog output connector type</td>
<td>BNC neg.</td>
</tr>
<tr>
<td>Ethernet interface</td>
<td>2x RJ45</td>
</tr>
</tbody>
</table>

### Charge input

**Measuring ranges**

<table>
<thead>
<tr>
<th>pC</th>
<th>±100 ( \ldots ) 1 000 000</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 pC</td>
<td>( p_C )</td>
</tr>
<tr>
<td>1 000 pC</td>
<td>( p_C )</td>
</tr>
<tr>
<td>10 000 pC</td>
<td>( p_C )</td>
</tr>
<tr>
<td>100 000 pC</td>
<td>( p_C )</td>
</tr>
<tr>
<td>1 000 000 pC</td>
<td>( p_C )</td>
</tr>
</tbody>
</table>

**Frequency range (–3dB)**

<table>
<thead>
<tr>
<th>Hz</th>
<th>0,1 ( \ldots ) 100 000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hz ( \ldots ) 10 kHz</td>
<td>( p_C )</td>
</tr>
<tr>
<td>1 kHz ( \ldots ) 10 kHz</td>
<td>( p_C )</td>
</tr>
<tr>
<td>1 kHz ( \ldots ) 10 kHz</td>
<td>( p_C )</td>
</tr>
<tr>
<td>10 kHz ( \ldots ) 100 kHz</td>
<td>( p_C )</td>
</tr>
<tr>
<td>100 kHz ( \ldots ) 1 MHz</td>
<td>( p_C )</td>
</tr>
</tbody>
</table>

**Input noise (typ.)**

<table>
<thead>
<tr>
<th>Hz ( \ldots ) 1 kHz</th>
<th>( p_C )</th>
<th>( p_{\text{rms}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hz ( \ldots ) 10 kHz</td>
<td>100 pC</td>
<td>0,006</td>
</tr>
<tr>
<td>1 Hz ( \ldots ) 10 kHz</td>
<td>1 000 pC</td>
<td>0,008</td>
</tr>
<tr>
<td>1 Hz ( \ldots ) 10 kHz</td>
<td>10 000 pC</td>
<td>0,048</td>
</tr>
<tr>
<td>1 Hz ( \ldots ) 10 kHz</td>
<td>100 000 pC</td>
<td>0,67</td>
</tr>
<tr>
<td>1 Hz ( \ldots ) 10 kHz</td>
<td>1 000 000 pC</td>
<td>4,6</td>
</tr>
</tbody>
</table>

**Maximum input voltage**

| V | ±30 |

**Measurement uncertainty**

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;100 pC</td>
<td>&lt;1</td>
</tr>
<tr>
<td>≥100 pC</td>
<td>&lt;0,5</td>
</tr>
</tbody>
</table>

**Crosstalk between channels**

| dB | ≤–80 |

**Sensor impedance**

| MΩ | >10 |

### Piezotron input

**Gain**

<table>
<thead>
<tr>
<th>1/10</th>
</tr>
</thead>
</table>

**Sensor supply voltage**

| V | 22 |

**Power supply**

| mA | 4/10 |

**Frequency range (–3dB)**

<table>
<thead>
<tr>
<th>Hz</th>
<th>0,1 ( \ldots ) 100 000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hz ( \ldots ) 10 kHz</td>
<td>( p_C )</td>
</tr>
<tr>
<td>1 Hz ( \ldots ) 10 kHz</td>
<td>( p_C )</td>
</tr>
<tr>
<td>1 Hz ( \ldots ) 10 kHz</td>
<td>( p_C )</td>
</tr>
<tr>
<td>1 Hz ( \ldots ) 10 kHz</td>
<td>( p_C )</td>
</tr>
<tr>
<td>1 Hz ( \ldots ) 10 kHz</td>
<td>( p_C )</td>
</tr>
</tbody>
</table>

**Input noise (typ., 0 \( \Omega \) shunt at input)**

<table>
<thead>
<tr>
<th>Hz ( \ldots ) 1 kHz</th>
<th>( \mu V_{\text{rms}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hz ( \ldots ) 10 kHz</td>
<td>Gain 10</td>
</tr>
<tr>
<td>1 Hz ( \ldots ) 10 kHz</td>
<td>Gain 1</td>
</tr>
</tbody>
</table>

### Voltage input

**Input type**

| single-ended |

**Measuring range**

| V | ±1 \( \ldots \) 10 |

**Input impedance**

| MΩ | 10 |

**Frequency range (–3dB)**

| Hz | 0 \( \ldots \) 100 000 |

**Input noise (typ.)**

<table>
<thead>
<tr>
<th>Hz ( \ldots ) 1 kHz</th>
<th>( \mu V_{\text{rms}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hz ( \ldots ) 10 kHz</td>
<td>Measuring range 1 V</td>
</tr>
<tr>
<td>1 Hz ( \ldots ) 10 kHz</td>
<td>Measuring range 10 V</td>
</tr>
</tbody>
</table>

**Max. input voltage**

| V | ±30 |

**Measurement uncertainty**

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 V</td>
<td>&lt;1</td>
</tr>
<tr>
<td>≥1 V</td>
<td>&lt;0,5</td>
</tr>
</tbody>
</table>

**Crosstalk between channels**

| dB | ≤–80 |

**Voltage output**

**Nominal output range**

| V | ±10 |

**Output impedance**

| Ω | 10 |

**Max. common mode voltage**

| V | ±14 |

**Output noise (all ranges)**

<table>
<thead>
<tr>
<th>Hz ( \ldots ) 100 kHz, typ.</th>
<th>( mV_{\text{rms}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hz ( \ldots ) 10 kHz, typ.</td>
<td>0,046</td>
</tr>
<tr>
<td>1 Hz ( \ldots ) 10 kHz, typ.</td>
<td>0,041</td>
</tr>
</tbody>
</table>

**Group delay**

| μs | ≤12 |

**Zero error**

| mV | <±2 |

**DAC resolution (analog out)**

| Bit | 16 |
## Technical data (continuation)

### Data acquisition

<table>
<thead>
<tr>
<th>ADC resolution</th>
<th>Bit</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal ADC sampling rate</td>
<td>kSPs</td>
<td>625</td>
</tr>
<tr>
<td>Acquisition data rate per channel (adjustable)</td>
<td>kSPs</td>
<td>≤200</td>
</tr>
</tbody>
</table>

Note: For the data acquisition with ≥25 kSPs an anti-aliasing filter is automatically set with a cut-off frequency of 0,3 ... 0,45 x selected output update rate.

### Digital high-pass filter

<table>
<thead>
<tr>
<th>Order</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutoff-frequency (–3dB) selection in 0,1 Hz steps</td>
<td>Hz</td>
</tr>
<tr>
<td>Tolerance (typ.)</td>
<td>%</td>
</tr>
</tbody>
</table>

### Digital low-pass filter

<table>
<thead>
<tr>
<th>Filter type</th>
<th>Bessel or Butterworth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order</td>
<td>2./4.</td>
</tr>
<tr>
<td>Cutoff-frequency (–3dB) selection in 1 Hz steps</td>
<td>Hz</td>
</tr>
<tr>
<td>Tolerance (typ.)</td>
<td>%</td>
</tr>
</tbody>
</table>

### Digital notch filter

| Center frequency selection in 1 Hz steps | Hz | ≥10 |
| Tolerance (typ.)                       | %  | <1  |
| Q factor                               |    | 0,9 ... 1 000 |

### Virtual channels

<table>
<thead>
<tr>
<th>Number of channels</th>
<th>Type 5165A1</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type 5165A4</td>
<td>2</td>
</tr>
</tbody>
</table>

### Ethernet interface

<table>
<thead>
<tr>
<th>Data rate</th>
<th>MBit</th>
<th>100</th>
</tr>
</thead>
</table>

### Power supply requirements

<table>
<thead>
<tr>
<th>Supply voltage range VDC</th>
<th>18 ... 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption W</td>
<td>≤15</td>
</tr>
<tr>
<td>Socket for barrel jack plug (IEC 60130-10 Type A) mm</td>
<td>5,5x2,5x9,5</td>
</tr>
<tr>
<td>Power supply requirements – galvanic isolation – PE and GND not connected</td>
<td></td>
</tr>
</tbody>
</table>

### General data

| Operating temperature range °C | 0 ... 60 |
| Storage temperature range °C   | -10 ... 70 |
| Rel. humidity, not condensing % | ≤90 |
| Degree of protection (EN 60529) | IP20 |
| Outer dimensions incl. feet and connectors (WxHxD) mm | ≈218x50x223 |
| Weight kg | 1.2 |

### Application

The instrument has been designed for use in research, development and the laboratory. The Kistler LabAmp Type 5165A... is the perfect choice wherever dynamic signals need to be measured precisely and with high resolution. Acceleration and vibration measurements, pulsating pressure applications or force measurements of fast machining procedures are just a few examples where the Kistler LabAmp Type 5165A... can demonstrate his strengths.

### Operation

All settings are configured in a standard web-browser through the graphical user interface. Simply connect to the Kistler LabAmp Type 5165A... by its network name and start working. A simple data acquisition is also implemented, offering a data download controlled by a start/stop button. In addition, an API is available to perform automated measuring tasks PC-based.

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3) This functionality is included as a free trial for the moment but will cost extra in the future.
Block Diagram

Fig. 1: Block diagram of the Kistler LabAmp Type 5165A...
Dimensions

![Dimensions of Kistler LabAmp Type 5165A](image)

Fig. 2: Dimensions of Kistler LabAmp Type 5165A

### Included Accessories
- Calibration sheet
- Quick-start guide

### Optional Accessories
- Power supply* 24 V incl. country-specific plug
- Ethernet cable, l = 2 m*
- 19" rack mounting tablet
- Dummy panel for empty 19" position
- PTP synchronization per device incl. MDC software
- DynoWare software
- Full license with HASP license key

* Available as combined kit together with the amplifier

### Ordering Key

<table>
<thead>
<tr>
<th>Type/Mat. No.</th>
<th>LabAmp</th>
</tr>
</thead>
<tbody>
<tr>
<td>5165A</td>
<td></td>
</tr>
<tr>
<td>SN 1234567</td>
<td></td>
</tr>
<tr>
<td>18...30V</td>
<td></td>
</tr>
<tr>
<td>__W</td>
<td></td>
</tr>
<tr>
<td>Kistler Instrumente AG Winterthur Switzerland Made in Switzerland</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type/Mat. No.</th>
<th>Ordering Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>5779A2</td>
<td>Single-channel 1</td>
</tr>
<tr>
<td>5748A1</td>
<td>4 channels 4</td>
</tr>
<tr>
<td>5748A2</td>
<td>Amplifier only –</td>
</tr>
<tr>
<td>5165ASW001</td>
<td>Kit with amplifier, 24 V power supply, 2 m Ethernet cable K</td>
</tr>
<tr>
<td>2825A-03-2</td>
<td></td>
</tr>
</tbody>
</table>

*Available as combined kit together with the amplifier

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