Electronics & Software

Charge Meter

Universally Applicable for Piezoelectric Measuring Technology

This instrument can be used wherever mechanical quantities are measured with piezoelectric sensors. Piezoelectric sensors produce an electric charge which varies in direct proportion to the load acting on the sensor.

- Single-channel charge amplifier
- Piezotron input (option)
- Measure-jump compensated
- Liquid crystal display (128x128 pixels)
- Menu-driven operation
- Direct signal evaluation
- Flexible adjustment of high-pass and low-pass filters
- Compatible with Charge Amplifier Type 5011B...
- PC-Software and Virtual Instrument Driver for LabVIEW

Type 5015A...

Description

The Type 5015A... is not only a charge amplifier but an universal Charge Meter with a graphical liquid crystal display. However, the 19”-rack module is also suitable for measurements in an industrial environment. It can display instantaneous, peak and average values as well as reference deviations. State-of-the-art technology allows the naturally occurring interference to be almost entirely eliminated. The instrument is distinguished firstly by its excellent technical data and secondly by its extremely simple operation.

Application

The instrument has been designed for use in research, development and the laboratory.

Operation

Technical Data

Charge Input

<table>
<thead>
<tr>
<th>Connector Type</th>
<th>BNC neg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range FS</td>
<td>pC ±2 ... 2 200 000</td>
</tr>
</tbody>
</table>

Measurement uncertainty

| Range FS <10 pC | % <±3 |
| Range FS <100 pC | % <±1 |
| Range FS ≥100 pC | % <±0,5 |

Drift, measuring mode DC (Long)

| at 25 °C, max. relative humidity RH of 60 % (non-condensing) | pC/s ≤±0,03 |
| at 25 °C, max. relative humidity RH of 70 % (non-condensing) | pC/s typ. ≤±0,05 |
| at 50 °C, max. relative humidity RH of 50 % (non-condensing) | pC/s ≤±0,3 |

Max. common mode voltage

| between input and output ground | V ≤±30 |

Overload

| % FS | ±105 |

Voltage Input (Piezotron)

<table>
<thead>
<tr>
<th>Connector Type</th>
<th>BNC neg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range FS</td>
<td>mV ±2 ... 20 000</td>
</tr>
</tbody>
</table>

Measurement uncertainty

| Range FS <10 mV | % <±3 |
| Range FS <100 mV | % <±1 |
| Range FS 100 mV | % ≤±0,5 |

This information corresponds to the current state of knowledge. Kistler reserves the right to make technical changes. Liability for consequential damage resulting from the use of Kistler products is excluded.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drift, meas. mode voltage DC (long)</td>
<td>mV/s $\leq 0.03$</td>
</tr>
<tr>
<td>(@ Range 10 V FS; Gain = 1)</td>
<td></td>
</tr>
<tr>
<td>at 25 °C, max. relative humidity RH of 60 % (non-condensing)</td>
<td></td>
</tr>
<tr>
<td>at 50 °C, max. relative humidity RH of 50 % (non-condensing)</td>
<td>mV/s $\leq 0.3$</td>
</tr>
<tr>
<td>Max. common mode voltage</td>
<td>V $\leq 30$</td>
</tr>
<tr>
<td>between input and output ground</td>
<td></td>
</tr>
<tr>
<td>Overload</td>
<td>% FS $\approx 105$</td>
</tr>
<tr>
<td>Piezotron mode</td>
<td></td>
</tr>
<tr>
<td>Supply current</td>
<td>mA $4 \pm 10%$</td>
</tr>
<tr>
<td>Input voltage swing</td>
<td>V $0 \ldots 20$</td>
</tr>
<tr>
<td>Current</td>
<td>mA $&lt; 10 %$</td>
</tr>
<tr>
<td>Output range FS Voltage</td>
<td>mVpp $10 \ldots 50%$</td>
</tr>
<tr>
<td>Output current</td>
<td>mA $&lt; 10$</td>
</tr>
<tr>
<td>Measure-jump</td>
<td>mV $&lt; 10$</td>
</tr>
<tr>
<td>Measure-jump (Long)</td>
<td>mV $&lt; 3$</td>
</tr>
<tr>
<td>Correction time, inclusive reed-relay delay time</td>
<td>ms $&lt; 10$</td>
</tr>
<tr>
<td>Zero errors</td>
<td>mV $&lt; 0.2$</td>
</tr>
<tr>
<td>Output interference (0.1 Hz ... 1 MHz), Type 5015Ax0</td>
<td></td>
</tr>
<tr>
<td>Range FS, LP filter off</td>
<td></td>
</tr>
<tr>
<td>2,000 ... 9,999 pC</td>
<td>mVpp $&lt; 140 \ldots 40$</td>
</tr>
<tr>
<td>10,000 ... 99,999 pC</td>
<td>mVpp $&lt; 30 \ldots 10$</td>
</tr>
<tr>
<td>100,000 ... 999,999 pC</td>
<td>mVpp $&lt; 15 \ldots 7$</td>
</tr>
<tr>
<td>0.220 ... 2,200 µC</td>
<td>mVpp $&lt; 15 \ldots 7$</td>
</tr>
<tr>
<td>Range FS, LP filter 30 kHz</td>
<td></td>
</tr>
<tr>
<td>2,000 ... 9,999 pC</td>
<td>mVpp $&lt; 60 \ldots 20$</td>
</tr>
<tr>
<td>10,000 ... 99,999 pC</td>
<td>mVpp $&lt; 20 \ldots 7$</td>
</tr>
<tr>
<td>0.220 ... 2,200 µC</td>
<td>mVpp $&lt; 5$</td>
</tr>
<tr>
<td>Output interference (0.1 Hz ... 1 MHz), Type 5015Ax1</td>
<td></td>
</tr>
<tr>
<td>Range FS, LP filter off</td>
<td></td>
</tr>
<tr>
<td>2,000 ... 9,999 pC, mV</td>
<td>mVpp $&lt; 220 \ldots 50$</td>
</tr>
<tr>
<td>10,000 ... 99,999 pC, mV</td>
<td>mVpp $&lt; 50 \ldots 12$</td>
</tr>
<tr>
<td>100,000 ... 999,999 pC, mV</td>
<td>mVpp $&lt; 20 \ldots 7$</td>
</tr>
<tr>
<td>0.220 ... 2,200 µC</td>
<td>mVpp $&lt; 5$</td>
</tr>
<tr>
<td>Range FS, LP filter 30 kHz</td>
<td></td>
</tr>
<tr>
<td>2,000 ... 9,999 pC, mV</td>
<td>mVpp $&lt; 180 \ldots 50$</td>
</tr>
<tr>
<td>10,000 ... 99,999 pC, mV</td>
<td>mVpp $&lt; 30 \ldots 10$</td>
</tr>
<tr>
<td>100,000 ... 999,999 pC, mV</td>
<td>mVpp $&lt; 10 \ldots 5$</td>
</tr>
<tr>
<td>0.220 ... 2,200 µC</td>
<td>mVpp $&lt; 10 \ldots 5$</td>
</tr>
</tbody>
</table>

1) Values valid from MCC version V2.xx

**Frequency Response**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC (Long), LP-filter off</td>
<td></td>
</tr>
<tr>
<td>Bandwidth (~3 dB)</td>
<td>kHz $= 0 \ldots 200$</td>
</tr>
<tr>
<td>Group delay</td>
<td>ms $&lt; 10$</td>
</tr>
</tbody>
</table>

**High-pass Filter (1st order)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog high-pass filter</td>
<td></td>
</tr>
<tr>
<td>DC (Long)</td>
<td></td>
</tr>
<tr>
<td>Range FS Charge, (Voltage)</td>
<td>s</td>
</tr>
<tr>
<td>2 pC, (mV)</td>
<td>10 000</td>
</tr>
<tr>
<td>1,000 pC, (mV)</td>
<td>100 000</td>
</tr>
<tr>
<td>Time constants</td>
<td>s</td>
</tr>
<tr>
<td>Medium</td>
<td>10/100/1 000/22 000</td>
</tr>
<tr>
<td>Short</td>
<td>0,1/1/10/220</td>
</tr>
<tr>
<td>Tolerance</td>
<td>% $&lt; 20$</td>
</tr>
</tbody>
</table>

**Low-pass Filter**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital low-pass filter computed by DSP</td>
<td></td>
</tr>
<tr>
<td>Filter Type</td>
<td>IIR, linear phase</td>
</tr>
<tr>
<td>Order</td>
<td>2. or 5.</td>
</tr>
<tr>
<td>Cutoff frequency (~3 dB)</td>
<td>kHz</td>
</tr>
<tr>
<td>5, 10, 20, 30, 50, 100, 200, 300, 500</td>
<td></td>
</tr>
<tr>
<td>Time constants</td>
<td>s</td>
</tr>
<tr>
<td>Range FS Charge, (Voltage)</td>
<td>1, 2, 3, 5, 10, 20, 22, 30, (LP off)</td>
</tr>
<tr>
<td>Tolerance</td>
<td>% $&lt; 10$</td>
</tr>
</tbody>
</table>
### Signal Evaluation

<table>
<thead>
<tr>
<th>Sample rates</th>
<th>kpsps</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>LP-filter on</td>
<td>kpsps</td>
<td>1 000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Minimum pulse width for peak-peak value detection</th>
<th>μs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LP-filter 5 Hz ... 30 Hz</td>
<td>&gt;2 500</td>
<td></td>
</tr>
<tr>
<td>LP-filter 50 Hz ... 300 Hz</td>
<td>&gt;250</td>
<td></td>
</tr>
<tr>
<td>LP-filter 500 Hz ... 3 kHz</td>
<td>&gt;2,5</td>
<td></td>
</tr>
<tr>
<td>LP-filter 5 kHz ... 30 kHz</td>
<td>&gt;1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Max. integration time for mean value</th>
<th>min</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;75</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Integration time for the updating rate of the liquid crystal display</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Instant value</td>
<td>ms</td>
</tr>
<tr>
<td>Characteristic values</td>
<td>ms</td>
</tr>
<tr>
<td>Bar graph</td>
<td>ms</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>17,5</td>
</tr>
</tbody>
</table>

### Remote Control

<table>
<thead>
<tr>
<th>Connector Type</th>
<th>MiniDin round socked</th>
</tr>
</thead>
</table>

#### Pin allocation

<table>
<thead>
<tr>
<th>Inputs with internal pull-up resistor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 4 (input) Window (remote)</td>
<td></td>
</tr>
<tr>
<td>Pin 5 (input) Measure (remote)</td>
<td></td>
</tr>
<tr>
<td>Pin 6 DGND</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input voltage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>logic inactive or input open V</td>
<td>3,5 ... 30</td>
</tr>
<tr>
<td>logic active V (mA)</td>
<td>0 ... 1 (0 ... 4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Delay time</th>
<th>ms</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Window (remote)</td>
<td>&lt;0,5</td>
<td></td>
</tr>
<tr>
<td>Measure (remote)</td>
<td>&lt;15</td>
<td></td>
</tr>
</tbody>
</table>

### Digital Measuring Data Transfer

The instrument provides a continuous measuring data transfer via the serial interface to a PC. For this, the PC software (Windows) of the VI driver (LabVIEW) is required. This feature is not available on the IEEE-488 interface.

<table>
<thead>
<tr>
<th>Sampling rates</th>
<th>kpsps</th>
</tr>
</thead>
<tbody>
<tr>
<td>0,1/0,25/0,5</td>
<td></td>
</tr>
</tbody>
</table>

### RS-232C Interface (Electrically Separated)

<table>
<thead>
<tr>
<th>Connector Type</th>
<th>DB-9S (D-Sub)</th>
</tr>
</thead>
</table>

#### Pin allocation

<table>
<thead>
<tr>
<th>Pin 2</th>
<th>RxD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 3</td>
<td>TxD</td>
</tr>
<tr>
<td>Pin 5</td>
<td>SG</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Max. cable length at bps</th>
<th>m</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>9 600</td>
<td>&lt;15</td>
<td></td>
</tr>
<tr>
<td>19 200</td>
<td>&lt;15</td>
<td></td>
</tr>
<tr>
<td>38 400</td>
<td>&lt;12</td>
<td></td>
</tr>
<tr>
<td>57 600</td>
<td>&lt;10</td>
<td></td>
</tr>
<tr>
<td>115 200</td>
<td>&lt;5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Max. input voltage, continues V</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Max. voltage between signal ground and protective ground VRMS</th>
<th>&lt;20</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Baud rates</th>
<th>bps</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 200/9 600/19 200/38 400/57 600/115 200</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data-bit</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop-bit</td>
<td>1</td>
</tr>
<tr>
<td>Parity</td>
<td>none</td>
</tr>
<tr>
<td>SW handshake</td>
<td>none</td>
</tr>
</tbody>
</table>

### IEEE-488 Interface (Option)

<table>
<thead>
<tr>
<th>Connector Type</th>
<th>Microribbon series 57 (24-pole)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Standard</th>
<th>IEEE-488.1-1987</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Max. distance between devices</th>
<th>m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Max. bus length</th>
<th>m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Max. number of devices</th>
<th>15</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Adress range</th>
<th>0 ... 30</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Functions</th>
<th>Listener and Talker</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Interface functions</th>
<th>SHT, AH1, L4, LE0, T6, TE0, SR1, RL2, PM0, DC1, DT1, CO, E1</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Multiline commands</th>
<th>DCL, SDC, GET, UNL, UNT, SPE, SPD</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Uniline commands</th>
<th>IFC, REN, EOI, SRQ, ATN</th>
</tr>
</thead>
</table>
**Power Supply Connection**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Power plug (2P+E, protect. class I)</td>
<td>IEC 320C14</td>
</tr>
<tr>
<td>Supply voltage setable</td>
<td>V~ 115/230</td>
</tr>
<tr>
<td>Supply voltage tolerance</td>
<td>% –22, +15</td>
</tr>
<tr>
<td>Supply frequency</td>
<td>Hz 48 ... 62</td>
</tr>
<tr>
<td>Consumption</td>
<td>VA ≈20</td>
</tr>
<tr>
<td>Voltage between</td>
<td></td>
</tr>
<tr>
<td>Signal ground and</td>
<td>V_RAMS &lt;50</td>
</tr>
<tr>
<td>protective ground</td>
<td></td>
</tr>
<tr>
<td>Fuses</td>
<td></td>
</tr>
<tr>
<td>F1 (slow)</td>
<td>mA 100</td>
</tr>
<tr>
<td>F2 (slow)</td>
<td>mA 100</td>
</tr>
</tbody>
</table>

**Remaining Data**

| IP-Degree of protection       | IP40, IEC 60529            |
| Operating temperature         | °C 0 ... 50                |
| Storage temperature           | °C –10 ... 70              |
| Rel. humidity, not condensing | % 10 ... 80                |
| Vibration steadiness          | (20 Hz ... 2 kHz, duration 16 min, cycle 2 min.) g <10 |
| Shock steadiness (1 ms)       | g <200                     |
| Housing dimensions            | with frame (wxhxd) mm 105,3x142x253,15 |
|                             | without frame (wxhxd) mm 71,12x128,7x230 |
| Front panel (according DIN 41494, part 5/IEC 60297) | HE/TE 3/14 |
| Weight                       | kg ≈2,3                   |

**Fig. 1: Block Diagram of charge meter Type 5015A...**
Fig. 2: Desktop Type 5015A1… (stackable)

Fig. 3: 19"-Rack plug-in Type 5015A0…
Included Accessories
Charge Meter Type 5015A... with
- Country-specific power cord
- Plug for ‘Remote Control’
- Self-adhesive label with supply voltage details
- Flash-Loader with current firmware
- Demo-Program for visualization of the display on a PC
- PC-Software and VI-Driver for LabVIEW for the equipment configuration and measured data acquisition
- Instruction manual
- Calibration sheet

Optional Accessories
- RS-232C cable, l = 5 m, null-modem, DB-9P/DB-9S
- or PC-link cable RS-232C, l = 3 m, DB-25P/DB-9S
- with suitable D-Sub adapter, DB-9P/DB-25S

Ordering Key

<table>
<thead>
<tr>
<th>Size/Measuring Range</th>
<th>Type 5015A</th>
</tr>
</thead>
<tbody>
<tr>
<td>19” rack module version according to DIN 41494; width 14 TE and height 3 HE</td>
<td>0</td>
</tr>
<tr>
<td>Desktop version with support bracket</td>
<td>1</td>
</tr>
<tr>
<td>Without interface option</td>
<td>0</td>
</tr>
<tr>
<td>With IEEE-488 interface (option)</td>
<td>1</td>
</tr>
<tr>
<td>Adjusted in the factory to 230 V~; switching to 115 V~ supply by the user possible at any time</td>
<td>0</td>
</tr>
<tr>
<td>Adjusted in the factory to 115 V~; switching to 115 V~ supply by the user possible at any time</td>
<td>1</td>
</tr>
<tr>
<td>Without voltage input</td>
<td>0</td>
</tr>
<tr>
<td>With voltage input for sensors with integrated Piezotron circuitry (option)</td>
<td>1</td>
</tr>
</tbody>
</table>

Instrument Configurations
The complete type designation of the Charge Meter is made up of the basic type designation Type 5015A... and four additional digits.
The basic type contains a single-channel Charge Meter (with charge input for piezoelectric sensors) with display unit and RS-232C interface in the following versions:

Windows is a registered trademark of Microsoft Corporation.
LabVIEW is a registered trademark of National Instruments Corporation.