



BENEFITS

- long lifetime due to solid-state speaker relay
- dB-Lab integrated health monitoring
- wide application range from microspeaker to woofer
- updateable for future Klippel algorithms

FEATURES

- enables Klippel LSI and CTR applications
- dual speaker channels
- selectable current sensitivity on both channels
 - hall-sensor
 - shunt-resistor
- 500 V_{pp}/200 A_{pp} measurement range

DESCRIPTION

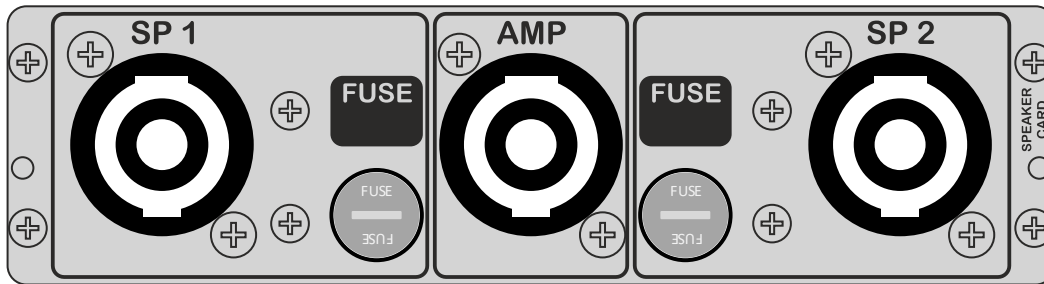
The *Speaker-Card* extension for the *KLIPPEL Analyzer 3* allows for two channel voltage and current sensing. Hence it is a key hardware product for most of the *KLIPPEL* software modules. It features a *Low- and High-Sensitivity* current measurement path in both speaker channels to cope with many different applications. The required hardware for real-time processing is also hosted by the *Speaker-Card* to allow for nonlinear analysis and control.

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1 Introduction



Speaker-Card

| | |
|-----------------|--|
| SP 1/2 | <p>The SPEAKON output connects to the terminals of the loudspeaker under test, driving it via pin 1+ and 1- of the Klippel speaker cable. The remaining pins 2- and 2+ of the Klippel speaker cable are used to sense the voltage close to the loudspeaker terminals.</p> <p>For details on cable connection, see chapter <i>Cables</i> in the <i>Hardware Manual</i>.</p> |
| Fuse 1/2 | <p>Each speaker channel is fused with 6.3 x 32 mm, 8 A slow-blow fuse by default. It can be replaced with 15 A type according to the Limitations.</p> <hr/> <p>Note: If the <i>High-Sensitivity</i> current measurement is used frequently, it is recommended to replace the fuse with 1 A type for optimal protection. See the <i>Hardware Manual</i> for details on recommended fuse-types.</p> <hr/> |
| AMP | <p>The SPEAKON input connector AMPLIFIER should be connected to the output signal of the power amplifier. The signals supplied to pins 1- and 1+ will be provided at the Speaker 1 connector. The pins 2- and 2+ at the Amplifier connector correspond with the Speaker 2 connector.</p> |

Attention: High Voltages and / or currents may occur at the Amplifier / SPEAKON connectors. Risk of electrical shock! Use isolated wires, connectors and clamps only. Do not touch metal conductors.

Warning: Pay extra attention to the [Limitations](#) when replacing the standard fuse. See *Hardware Manual* for details.

2 Specification

2.1 Maximum Ratings

| Parameter | Conditions | Max | Unit |
|------------------------------|------------------------|------------------|-------------------|
| Speaker Voltage ¹ | | 240 ⁴ | V _{peak} |
| Speaker Current | t < 10 ms, Low Sense | 100 | A _{peak} |
| | t < 100 ms, High Sense | 8 | A _{peak} |

2.3 Electrical Specification

| Voltage Measurement | | | | | |
|---------------------|--|-----|-------|------|-------------------|
| Parameter | Conditions | Min | Typ | Max | Unit |
| Accuracy | 10 V _{rms} , all Sample rates | | ±0.02 | ±0.2 | % |
| Noise Level | BW = 20 kHz | | 1.4 | | mV _{rms} |
| | BW = 40 kHz | | 2 | | |
| | BW = 80 kHz | | 35 | | |
| SNR ³ | 175 V _{rms} Sinusoidal signal, BW = 20 kHz | | 102 | | dB |
| Frequency Response | 0.1 Hz...20 kHz, Fs = 48 kHz | | -0.06 | | dB |
| | 0.1 Hz...38 kHz, Fs = 96 kHz | | -0.35 | | |
| | 0.1 Hz...50 kHz, Fs = 192 kHz | | -0.8 | | |
| | 0.1 Hz...66 kHz, Fs = 192 kHz | | -3 | | |

| Current Measurement | | | | | |
|--|--|-----|--------------|------|-------------------|
| Parameter | Conditions | Min | Typ | Max | Unit |
| Low Sense Path | | | | | |
| Continuous Current ² See Section Limitations | @ room temperature, one channel driven | | | 12 | A _{rms} |
| Path Impedance | Including SpeakON connectors | | 75 | | mOhm |
| Accuracy | 1 kHz, 1 A _{rms} , all Sample rates | | ±0.02 | ±0.2 | % |
| Noise Level | BW = 20 kHz | | 1.4 | | mA _{rms} |
| | BW = 40 kHz | | 2 | | |
| | BW = 80 kHz | | 11 | | |
| SNR ³ | 1 A _{rms} Sinusoidal signal, BW = 20 kHz | | 57 | | dB |
| THD | 1 A _{rms} (1 kHz, noise limited) | | -60 | | dB |
| | 5 A _{rms} (1 kHz, noise limited) | | -72 | | |
| | 10 A _{rms} (1 kHz) | | -72 | | |
| | 20 A _{rms} (1 k Hz) | | -68 | | |
| | 20 A _{rms} 20 Hz-20 kHz | | -64 | | |
| Frequency Response | 0.1 Hz...20 kHz, Fs = 48 kHz | | +0.4 | | dB |
| | 0.1 Hz...40 kHz, Fs = 96 kHz | | +0.5 | | |
| | 0.1 Hz...58 kHz, Fs = 192 kHz | | -1.0 +0.5 | | |
| | 0.1 Hz...67 kHz, Fs = 192 kHz | | -3.0 +0.5 | | |
| High Sense Path⁵ | | | | | |
| Continuous Current ² See Section Limitations | @ room temperature, one channel driven | | | 1.4 | A _{rms} |
| Path Impedance | Including SpeakON connectors | | 1.1 | | Ohm |
| Accuracy | 1 kHz, 1 A _{rms} , all Sample rates | | ±0.02 | ±0.2 | % |
| Noise Level | BW = 20 kHz | | 110 | | μA _{rms} |
| | BW = 40 kHz | | 170 | | |

| | | | | | |
|--------------------|---|--|--------------|--|--------------------------|
| | BW = 80 kHz | | 1.1 | | mA_{rms} |
| THD | 0.1 A_{rms} (1 kHz, noise limited) | | -60 | | dB |
| | 1 A_{rms} , 20 Hz-20 kHz, noise limited | | -60 | | |
| Frequency Response | 0.1 Hz...20 kHz, $F_s = 48$ kHz | | +0.1 | | dB |
| | 0.1 Hz...40 kHz, $F_s = 96$ kHz | | -0.1 +0.1 | | |
| | 0.1 Hz...52 kHz, $F_s = 192$ kHz | | -1.0 +0.1 | | |
| | 0.1 Hz...64 kHz, $F_s = 192$ kHz | | -3 +0.1 | | |
| SNR ³ | 0.1 A_{rms} Sinusoidal signal, BW = 20 kHz | | 59 | | dB |

¹ each speaker terminal is limited to a maximum of 200 V_{peak} against earth potential

² thermally limited

³ SNR refers to signal levels instead of power levels

⁴ Speaker channel 1 on High Power Speaker Card variant is rated at 400 V_{peak}

⁵ Speaker channel 1 on High Power Speaker Card variant does not offer High-Sense current measurement

3 Limitations

Maximum Speaker current is thermally limited, hence influenced by ambient operating temperature.

Speaker current derating is as follows:

| Parameter | Max @ room temperature 12 min ON / 48 min OFF | Max @ room temperature | Max @ 60° ambient temperature | Unit |
|---|--|------------------------|-------------------------------|------------------|
| Speaker current Low Sense Path ⁶ | 15 | 12 | 5 | A_{rms} |
| Speaker current High Sense Path | - | 1.4 | 0.4 | A_{rms} |

⁶ Speaker channel 1 on High Power Speaker Card variant offers 25 A_{rms} at room temperature (infinite time)

Note: The given current limitations are only valid for a Klippel Analyzer 3 in standard configuration, namely equipped with Laser-, Speaker- and XLR-Card, running one of the available Speaker-Channels.

Find explanations for symbols at:

<http://www.klippel.de/know-how/literature.html>

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