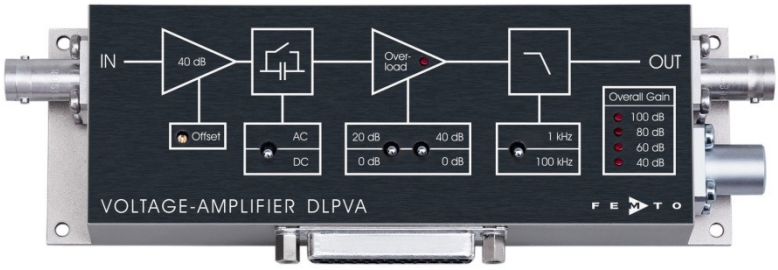
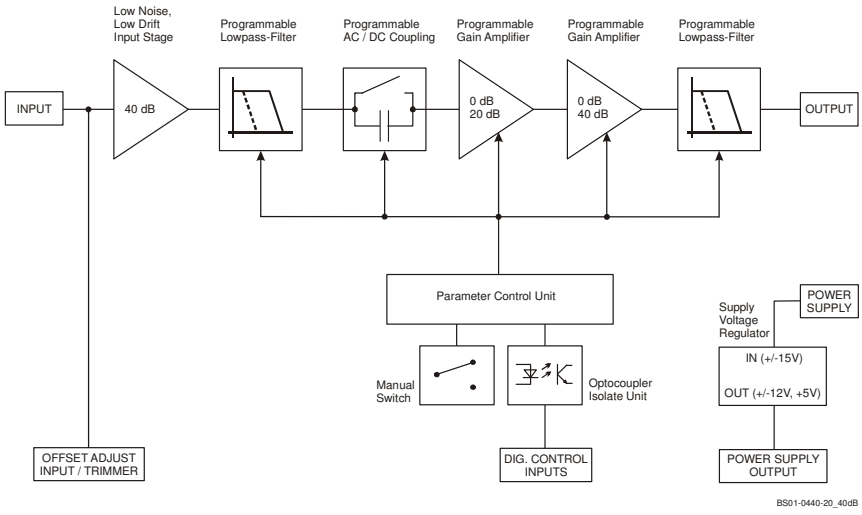
# Low-Noise Variable Gain Low-Frequency Voltage Amplifier




| | |
|---|---|
| Features | • **Variable gain 40 to 100 dB, switchable in 20 dB steps**<br>• **Bipolar input stage, recommended for low impedance sources smaller than 100 Ω**<br>• **Very low input voltage noise: 700 pV/√Hz**<br>• **DC-coupled, single ended**<br>• **DC-drift 0.5 µV/°C**<br>• **Bandwidth DC - 100 kHz, switchable to 1 kHz**<br>• **Switchable AC/DC-coupling**<br>• **Local and remote control** |
| Applications | • **Low-noise laboratory amplifier**<br>• **Pulsed thermal EMF analysis**<br>• **Industrial sensors**<br>• **Detector preamplifier**<br>• **Integrated measurement systems** |
| Block Diagram |  |

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## Specifications

Test conditions: $V_S$ = ±15 V, $T_A$ = 25 °C, load impedance = 1 MΩ

### Gain

| | |
|---|---|
| Gain values | 40, 60, 80, 100 dB<br>Indicated by four LEDs |
| Gain accuracy | ±0.1 % (between settings)<br>±1 % (overall) |
| Gain flatness | ±0.1 dB |

### Frequency Response

| | |
|---|---|
| Lower cut-off frequency | DC, switchable to 1.5 Hz |
| Upper cut-off frequency | 100 kHz, switchable to 1 kHz |
| Upper cut-off frequency rolloff | 12 dB/oct. |

### Time Response

| | |
|---|---|
| Rise/fall time (10 % - 90 %) | 3.5 µs (@ BW = 100 kHz)<br>350 µs (@ BW = 1 kHz) |

### Input

| | |
|---|---|
| Input impedance | 1 MΩ |
| Input capacitance | 13 pF |
| Input voltage drift | 0.5 µV/°C |

Equivalent input voltage noise (100 Hz … 100 kHz)

| Gain setting | noise |
|---|---|
| 100 dB | 700 pV/√Hz |
| 80 dB | 730 pV/√Hz |
| 60 dB | 860 pV/√Hz |
| 40 dB | 6 nV/√Hz |

| | |
|---|---|
| Equivalent input current noise | 3 pA/√Hz |
| 1/f-noise corner | 80 Hz |
| Input Bias current | 1 µA |
| Input bias current drift | 8 nA/°C |
| Input offset voltage | ±500 µV, adjustable by offset trimmer and external control voltage |

### Output

| | |
|---|---|
| Output impedance | <100 Ω (terminate with > 10 kΩ load for best performance) |
| Output voltage range | |
| For linear amplification | ±10 V (@ > 10 kΩ load) |
| Output current (max.) | ±20 mA |
| Output overload recovery time | 0.5 ms (after 20 x overload) |

### Overload LED

The amplifier features a LED to indicate an overload condition. The Overload LED will turn on if the signal level within the signal path exceeds the linear operating range. In order to ensure the correct operation of the amplifier without signal distortions reduce the gain setting until the Overload LED turns off.

The Overload LED may also turn on when the amplifier is operated with open input or with a high source resistance, e. g. external AC coupling. In this case the bias current may cause a considerable input voltage. For proper operation please use a source resistance of less than 1 kΩ or switch to a lower gain setting.

### Remote Offset Control

| | |
|---|---|
| Offset control voltage range | ±10 V, corresponds to ±500 µV input offset voltage |
| Offset control input impedance | 200 kΩ |

### Remote Digital Control

| | |
|---|---|
| Control input voltage range | Low: –0.8 ...+0.8 V<br>High: +1.8 ... +15 V, TTL / CMOS compatible |
| Control input current | 0 mA @ 0 V, 1.5 mA @ +5 V, 4.0 mA @ +12 V |
| Overload output | Non active: +5 V, max. 1 mA, active: 0.8 V, max. –10 mA; |

# Low-Noise Variable Gain Low-Frequency Voltage Amplifier

Specifications (continued)

| | | |
|---|---|---|
| Power Supply | Supply voltage | ±15 V (±14.5 V to ±16 V) |
| | Supply current | ±75 mA typ. (depends on operating conditions, recommended power supply capability min. ±150 mA) |
| Case | Weight | 0.32 kg (0.7 lbs) |
| | Material | AlMg4.5Mn, nickel-plated |
| Temperature Range | Storage temperature | –40 °C to +85 °C |
| | Operating temperature | 0 °C to +60 °C |

**Absolute Maximum Ratings**

| | |
|---|---|
| Power supply voltage | ±21 V |
| Control input voltage | +16 V / –5 V |
| Signal input voltage | ±0.7 V |
| Input current | ±25 mA |

Overvoltage at the signal input can severely degrade the noise performance or destroy the amplifier!

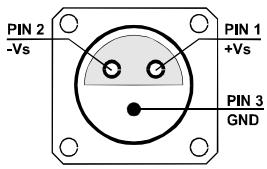
**Connectors**

Input: BNC jack (female)

Output: BNC jack (female)

Power supply: Lemo® series 1S, 3-pin fixed socket (mating plug type: FFA.1S.303.CLAC52)

Pin 1: +15V
Pin 2: –15V
Pin 3: GND




Control port: Sub-D 25-pin, female

Pin 1: +12 V (stabilized power supply output, max. 100 mA*)
Pin 2: –12 V (stabilized power supply output, max. 100 mA*)
Pin 3: AGND (analog ground)
Pin 4: +5 V (stabilized power supply output, max. 50 mA*)
Pin 5: digital output: overload
Pin 6: NC
Pin 7: NC
Pin 8: offset control voltage input
Pin 9: DGND (ground f. digital control Pin 10 - 25)
Pin 10: NC
Pin 11: digital control input: gain, LSB
Pin 12: digital control input: gain, MSB
Pin 13: digital control input: AC/DC
Pin 14: digital control input: 100 kHz / 1 kHz
Pin 15 - 25: NC

*check power supply for maximum deliverable current

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## Remote Control Operation

**General**

Remote control input bits are opto-isolated and connected by logical OR to local switch setting.
For remote control set the corresponding local switch to "0 dB", "AC" and "1 kHz" and select the wanted setting via a bit-code at the corresponding digital inputs.
Mixed operation, e.g. local gain setting and remote controlled bandwidth setting, is also possible.

**Gain setting**

| Gain | Pin 11 | Pin 12 |
|---|---|---|
| 40 dB | low | low |
| 60 dB | high | low |
| 80 dB | low | high |
| 100 dB | high | high |

**AC/DC setting**

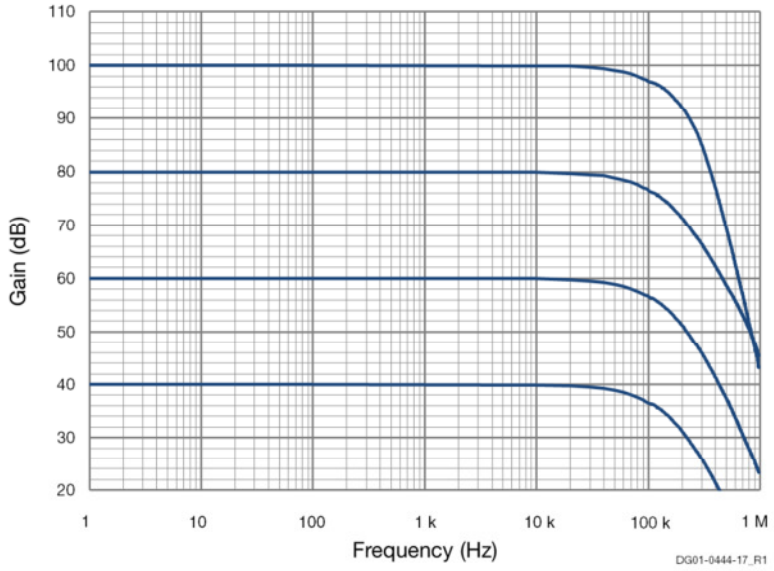
| Coupling | Pin 13 |
|---|---|
| AC | low |
| DC | high |

**Bandwidth setting**

| Bandwidth | Pin 14 |
|---|---|
| 1 kHz | low |
| 100 kHz | high |

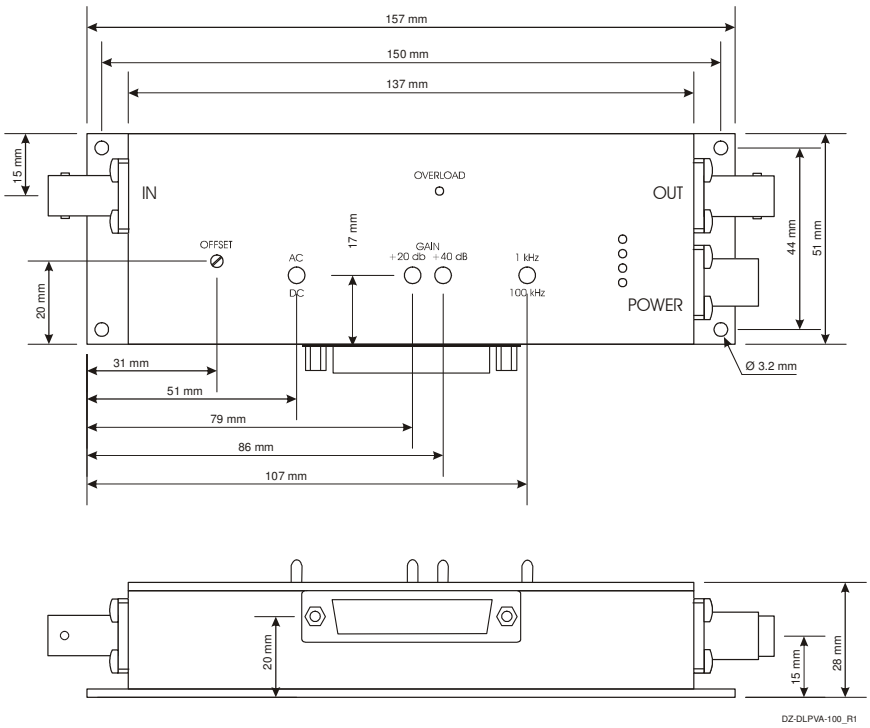
## Typical Performance Characteristics

Frequency response (logarithmic)



# Low-Noise Variable Gain Low-Frequency Voltage Amplifier

Dimensions

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