

AFT400B

Differential Preamplifier



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1 WARRANTY

Anfatec warrants that this product will be free from defects in materials and workmanship for a period of two years from the date of shipment. If any such product proves defective during this warranty period, Anfatec, will either repair the defective product without charge for parts and labour or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, the end user must notify Anfatec of the defect in writing before the expiration of the warranty period. The customer is responsible for packaging and shipping the defective product to Anfatec's head quarter with shipping charges prepaid. Anfatec pays the return shipping costs for customers inside EU. For customers outside EU, the customer is responsible for paying all duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Anfatec is not obligated to furnish service under this warranty to repair damage resulting from improper use or connection to incompatible equipment or to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

2 SPECIFICATION OF THE AFT400B

2.1 GENERAL PARAMETERS

Gain	x1, x10, x100 or x1000
Filter Bandwidth (-3 dB)	100 Hz, 1 kHz, 10 kHz, 100 kHz or 1 MHz
Switched Manual Output Offset	10-turn Potentiometer -10 V .. +10 V referred to output
Input Modes	+In, -In and (+In – -In)
Input Coupling	DC or AC with $f_{-3dB} = 1.2$ Hz
Input referred Noise (Gain x1000)	$< 1 \text{ nV}_{\text{rms}}/\sqrt{\text{Hz}}$ for $f > 100$ Hz
Positive and negative Overload LEDs	
Remote Control Interface (optional)	Optical Fibre
Resistor coded Gain Output (optional)	
Power Supply Requirement	DC 12 V, > 400 mA
Power Supply Input	C14 connector, 100 V ... 240 V / 47..63 Hz
Weight	450 g
Housing Size	20 cm (L) x 10.5 cm (W) x 5 cm (H)

2.2 SIGNAL INPUT

Connector	Isolated BNC
Input GND to Output GND	100 Ohm
Common Mode Input Range (DC coupled)	-10 V ... +10 V
Input Resistance (DC coupled)	1 M Ω
Input Capacitance Gain x1 & x10 for $f < 100$ kHz	39 pF -30/+0%
Damage Threshold	
DC coupled, Gain x1, x10 & x100	± 12 V
DC coupled, Gain x1000	± 10 V
AC coupled, all Gains	10 V_{peak} for sine signal: 7 V_{rms}
Voltage Rating of Input Capacitor	250 V
For safety reasons never operate above	40 V
Internal thermal Fuse for Gains x1, x10 and x100	63 mA
No Fuse ! for Gain x1000	x1000
Swift AC Coupling Feature	DC to AC switching results in fast signal equalizing to zero

2.3 FILTER AND GAIN

Filter 100 Hz, 1 kHz, 10 kHz, 100 kHz	2 nd Order
f_{-3db} (for 100 mV at output)	$\pm 10\%$
Full Bandwidth in Gains x1 & x10	1 MHz
Full Bandwidth in Gains x100 & x1000	Limited by Circuit Design to 600 kHz
Amplitude Accuracy	
@10 Hz all Gains, all Filter	$< 1 \%$
Harmonic Distortion @ 0.2 V_{RMS} , 1 kHz	$< 10 \mu\text{V}$ (3 th harmonic)

Gain1 Full BW, 3 V _{RMS} , 1 kHz	
Output Offset (Manual Offset off, Full BW)	Referred to input
Gain x1	< 2 mV
Gain x10	< 0.2 mV
Gain x100	< 0.1 mV
Gain x1000	< 50 μV

2.4 NOISE & CMRR SPECIFICATION

Input Referred Noise (0 Ω @ input)	@ 1 kHz
Gain x1	< 150 nV/√(Hz)
Gain x10	< 20 nV/√(Hz)
Gain x100	< 10 nV/√(Hz)
Gain x1000	< 1 nV/√(Hz)

CMRR 1 kHz / 1 V _{rms} on Input	typ.
Gain x1	> 75 dB
Gain x10	> 90 dB
Gain x100	> 100 dB
Gain x1000	> 125 dB

CMRR 100 kHz / 1 V _{rms} on Input	typ.
Gain x1	> 70 dB
Gain x10	> 80 dB
Gain x100	> 85 dB
Gain x1000	> 90 dB

2.5 STANDARD PART LIST

AFT400B	1
Power Supply	1
Manual	1
Low-Noise BNC cable, 2 m long	1

3 SAFETY REQUIREMENTS

Please read the following safety precautions before starting up the preamplifier to avoid injury or damage to devices. In order to avoid any risks, please use the preamplifier merely as stated in this manual.

Use proper supply voltages

In order to avoid fire hazards and electric shocks as well as damage to the device, only supply voltages as specified in this manual.

Ground properly

The device is supposed to be grounded through inputs and output. Always ensure proper grounding before switching on the device to avoid electric shock.

Use input connections properly

The inputs of the device is shielded and the shield is connected to ground via 100 Ohm. Never apply a voltage to the shield; it may cause damage to the device.

Use proper input voltages

In order to avoid damage to the pre-amplifier do not apply voltages higher than specified. Applying voltages higher than specified will damage the device and void the warranty.



Never supply the two inputs "+IN" and -IN" with voltages larger than specified!

IMPORTANT NOTE:

The inputs do NOT survive voltages higher than specified. The AFT400B is operated without fuse in gain x1000.

Observe all device ratings

Be aware of any ratings the pre-amplifier shows. Read the instructions in this manual before making any connections. Damage to the device as well as electric shocks can be caused.

Use with supplied housing

Never operate the pre-amplifier without the supplied housing. Do not touch any wires or components of the circuit.

Use overload protection

In order to avoid electric shock and damage to the device, ensure proper overload protection e.g. by a lightning stroke.

Do not operate a possibly broken pre-amplifier

In case the pre-amplifier could be damaged, do not operate it any more. Please contact service personnel for maintenance.

Do not operate in an explosive atmosphere

In order to avoid injury or damages to the pre-amplifier, do not operate the device in an explosive atmosphere.

Do not use in humid environment

Do not use the pre-amplifier in humid environment or in liquids in order to avoid electric shock and damage to the device.

Maintain the device clean and dry

In order to avoid the influence of dust and humidity of the atmosphere, keep the device clean and dry.

Electrostatic prevention

In order to avoid electrostatic damage, ensure grounding of both the exterior and interior conductors before connecting to the pre-amplifier.

Ensure proper ventilation

In order to avoid damage to the pre-amplifier ensure proper ventilation.

Handle safely

Please handle safely during transportation to avoid damage.

4 INSTALLATION

4.1 GET STARTED

- ☑ Connect OUT to the oscilloscope or measurement tool
- ☑ Always start with a low gain (e.g. x1), never gain x1000
- ☑ Switch +IN and or -IN to AC, GND or DC (depends on application)
- ☑ Connect the 12 V power supply to "Power"

- ☑ Connect IN to your source
- ☑ Use Gain x1000 only, if there is no need for a fuse

4.2 CONNECTIONS TO THE AFT400B

Power	Requires 12 V dc, >400 mA Inner pin is positive.
+IN	non-inverted input
-IN	inverted input
OUT	output of the amplifier

4.3 SWITCHES & KNOBS

AC/GND/DC ... switches the input coupling type for the two signals +IN and -IN independently. For single input configuration, set this switch behind "-IN" to "GND"

Gain ... switches the total amplification between x1, x10, x100 and x1000.

IMPORTANT NOTE: the range "x1000" requires special care.

Bandwidth ... adds low pass filters behind the amplification stage.

Offset ... for large amplifications (x100 or x1000), it might be required to DC shift the OUT signal.



Figure 1: Top View onto the AFT400B

5 SCHEMATIC & FUNCTIONAL DESCRIPTION

The idea of this pre-amplifier is to enable oscilloscopes with low resolution to measure smaller voltages by amplification of the original signal. Within the output range of the pre-amplifier the original signal can be amplified in steps of 10 up to x1000 times. Additionally, a low-pass is implemented, where several corner frequencies can be selected. If two similar signals need to be compared, the pre-amplifier allows subtraction of the two signals at equal pre-amplification factors.

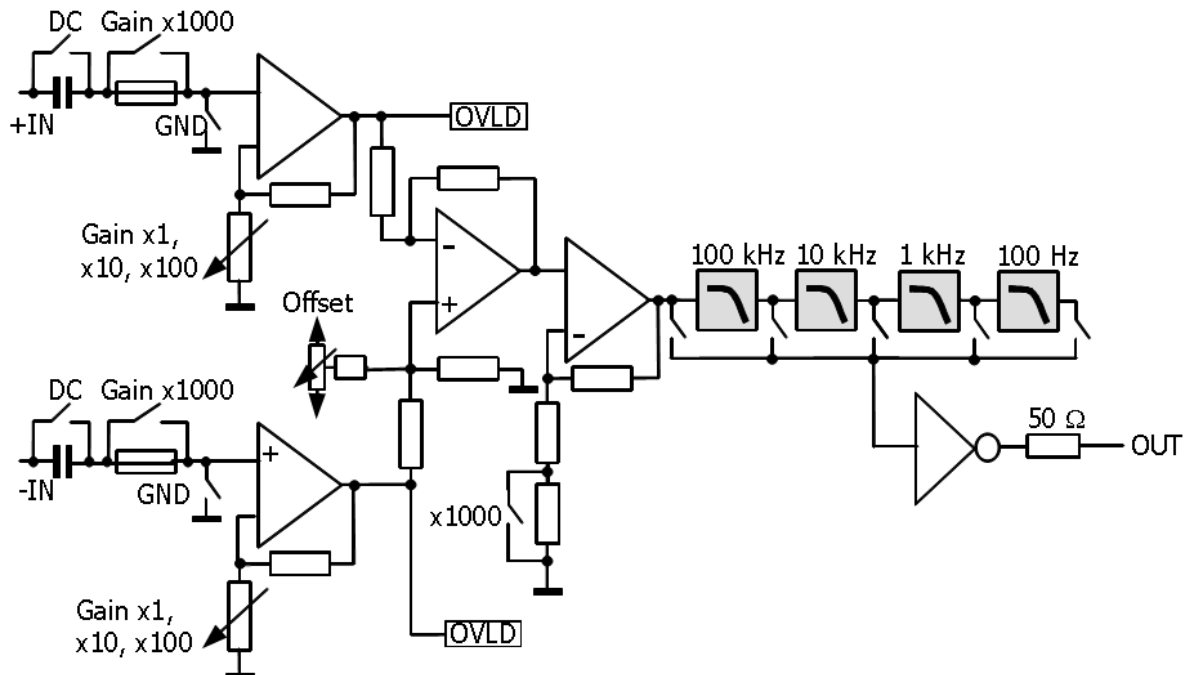


Figure 2: Schematic diagram of the AFT400B low noise differential amplifier.

As shown in Fig. 2, the coupling of each input +IN and -IN can be selected between AC, GND and DC coupling. A fuse protects the input of the 1st operational amplifier against too high currents. In case of a x1000 amplification, this fuse is bridged.

For single ended signals, the not used input needs to be switched to GND. An overload after the first amplifier stage is detected for each input separately and displayed by a red LED. In order to adjust for too large signal differences between +IN and -IN in the higher amplifications (x100 and x1000), an offset can be added manually with a 10-turn potentiometer onto the pre-amplified -IN signal prior to the differential amplifier. The selectable bandwidth filters are located directly at the output.

6 REVISION HISTORY

2020, the specifications on page 4ff. have been loosened in order to achieve a more robust long term compliance of the same.

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