

AE-Amp

Acoustic Emission Amplifier MK II



User Manual

AE-AMP Boxed
AE-Amp Rack

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Safety Information

This instrument is intended for indoor use and should be operated in a clean, dry environment. Do not block any ventilation openings.

Make sure this product's operating environment is kept within the parameters as specified in the chapter Operating Condition!

The design of the instrument has been verified to conform to the EN 61010-1 safety standard per the following limits:

- Installation (Over voltage)
- Category II (Main Supply Connector) and Category I (Measuring Terminals)
- Pollution Degree 2
- Protection Class I

Warning (Rack Unit only)

Lethal voltages exist inside the instrument. Only qualified technicians of supplier staff are authorized to open the case of the Base Unit. Otherwise warranty will be lost!

Always ensure that power cord is removed before opening the case.

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1. Overview

The AE-Amp is design for amplifying signals generated from various types of different Acoustic Emission (AE) sensors. The amplifier inputs are AC coupled with a high pass frequency of 5 kHz. The Bandwidth depends on the selected gain from 1 to 3 MHz. The amplifier can be used with passive or active sensors due the integrated sensor power supply. The amplifier path can be passed-through for applying high voltage pulses when using the sensors also as ultra-sonic actuator.



This manual refers to product version MK2.

1.1 Key Capabilities

- Two independent channels per module
- Gain 0 dB, 20 dB, 40 dB, 60 dB
- Bandwidth up to 3 MHz (Gain 0 dB)
- High Voltage Pulse Through up to 500 V
- USB or RS485 interface for configuring all settings

1.2 Versions

There are two versions available:

Boxed Version

- 2-Channel Modules AE-Amp-Box
- USB interface (emulated COM port)
- External power supply

Rack Version

- 2-Channel Rack-Modules AE-Amp-P
- Two different Base Unit chassis available:
 - Amp-BU-24-AE
(for up to 12 modules / 24 channels)
 - Amp-BU-48-AE
(for up to 24 modules / 48 channels)
- USB interface (emulated COM port) for accessing all installed amplifiers (Internally over RS485)

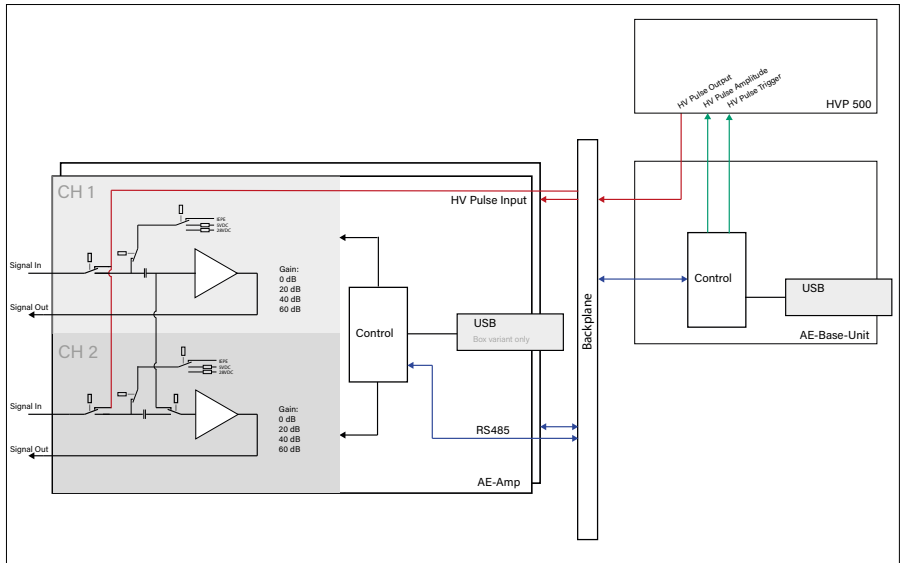
2. Architecture

A complete AE amplifier system consists of several AE-Amp rack modules which are installed in a base unit and an external high-voltage pulser (e.g. HVP 500)

The base unit is the control unit for configuring the AE modules and controls the multiplexer for the high-voltage pulses.

In the box version, the amplifier is controlled directly via USB. It is therefore not possible to control a high-voltage pulser or this must be solved by 3rd part hardware.

The amplifier settings are made via the AE-Amp Tool. The last setting made is saved and reloaded when the device is started. The device can therefore also be used without a PC connection. Only the high-voltage sequences can only be triggered via software.



Hardware Architecture of a full AE-Amp, Base Unit, HV Pulser System

3. Mode of Operation

3.1 Amplifier with Passive Sensor

Any type of passive AE sensor can be used with the AE-Amp. The gain levels can be set from 0 to 60 dB for each individual channel.

i The maximum output voltage is $\pm 9V$, at 60 dB amplification the maximum input voltage without overshooting is therefor limited to $\pm 9mV$!

3.2 Amplifier with Active Sensors

Active sensors have an integrated signal amplifier and therefore require a power supply. This is supplied by the amplifier via the signal cable. The AE-Amp can provide the following sensor supplies:

- Constant current (ICP/IEPE) 1 to 50 mA
- Constant voltage (DC) 5 V
- Constant voltage (DC) 28 V

The power supply can be configured and switched on for each channel.

3.3 Split Mode

Split mode allows the signal from one sensor to be sent in parallel to two different amplifier stages. In this case, the sensor is connected to channel 1 of the module and when split mode is activated, the input signal is also routed to the amplifier stage of channel 2.

3.4 High Voltage Pulse Through

If the sensors should also work as actuator, for example for tomography application, the amplifier stage can be passed through and the sensor input is acting as output. The front LED is red when the pass-through mode is activated. Activation is done over software. The applied voltage to the sensor is also passed to the amplifier output attenuated by 100.

i Do not use the High Voltage Pulse Through Mode with active sensor as this will damage the internal electronic of the sensor!

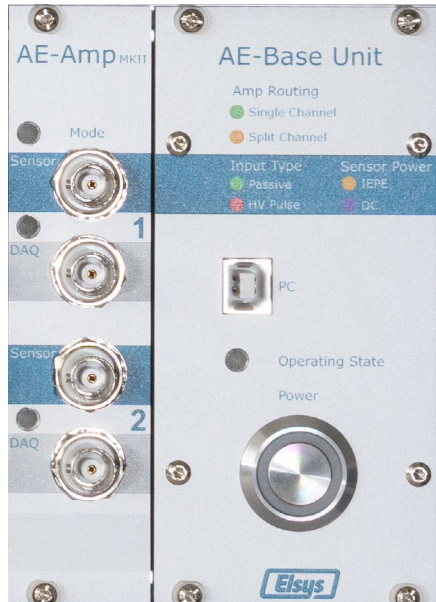
3.5 LED Indication

The LEDs on the front panel indicate the respective operating mode of the channel.

- Green: passive sensors
- Red: HV pulse
- Yellow: ICP/IEPE power on
- Violet: DC power on

Operating State

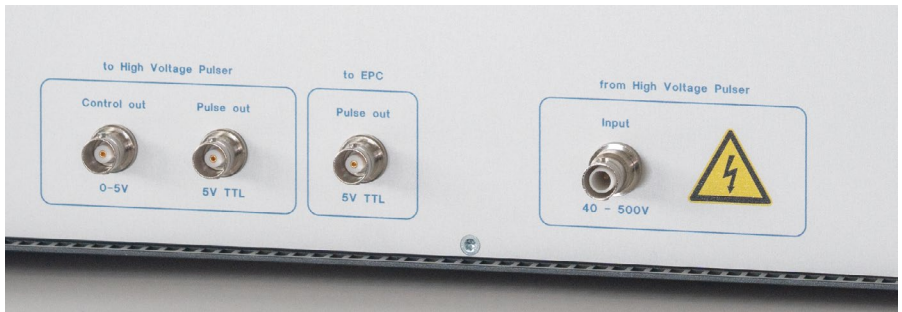
- Green: normal mode
- Green blinking: no USB connection
- Red: HV Sequence running



4. HV Pulse Generator

(Only available in the Rack Version together with an Amp-BU-24-AE or Amp-BU-48-AE)

The Amp-BU-24-AE or Amp-BU-48-AE base units provides a TTL Pulse Output for triggering any external high voltage pulse generators. The high voltage signal coming from the external pulse generator can be feed back to the base unit and is then multiplexed to one of the installed amplifier channels. If the Amplifier is set to the High Voltage Pulse Through Mode, the pulse is applied to the attached sensor.



Rear Side View of the AE Rack

4.1 Signals

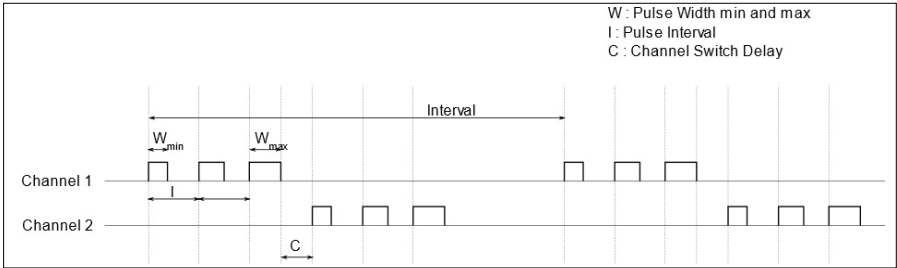
- **Control out:** 0-5 V signal for controlling the amplitude of the high voltage generator.
- **Pulse out:** 5V TTL pulse output for triggering the high voltage generator.

The second signal is normally fed to a digital input of the DAQ to distinguish HV pulses from passive AE events.

- **Input:** high voltage input which is multiplexed to a sensor/actuator.

4.2 Pulse Pattern Generator

The Pulse Pattern Generator allows pulse sequences with defined pulse lengths, time intervals and switching times between the channels to be programmed and executed autonomously.



The following parameters can be set by software:

Parameter	Description
Interval [s]	Repetition period between a pulsing session. This interval is controlled by the user application.
Voltage [V]	Amplitude of high voltage pulse.
No. Pulses	Number of consecutive pulses generated on the same channel
Pulse width min/max [us]	Pulse width of each pulse. If min/max are not equal, the generator starts with the smallest value and gets longer on each consecutive pulse on each channel. (see Sequence Diagram)
Pulse Interval [ms]	Time period between each pulse on the same channel
Chn. Delay	Delay between the last pulse on one channel until a new pulse on a second channel is applied

5. Software

To operate the AE-Amp, the AE-Amp software version 2.x must be installed.



Attention: The AE-AMP MK2 requires software version 2 and is not compatible with version 1.

Alternatively, a tool for operation can be programmed yourself via the serial interface using the programming instructions.

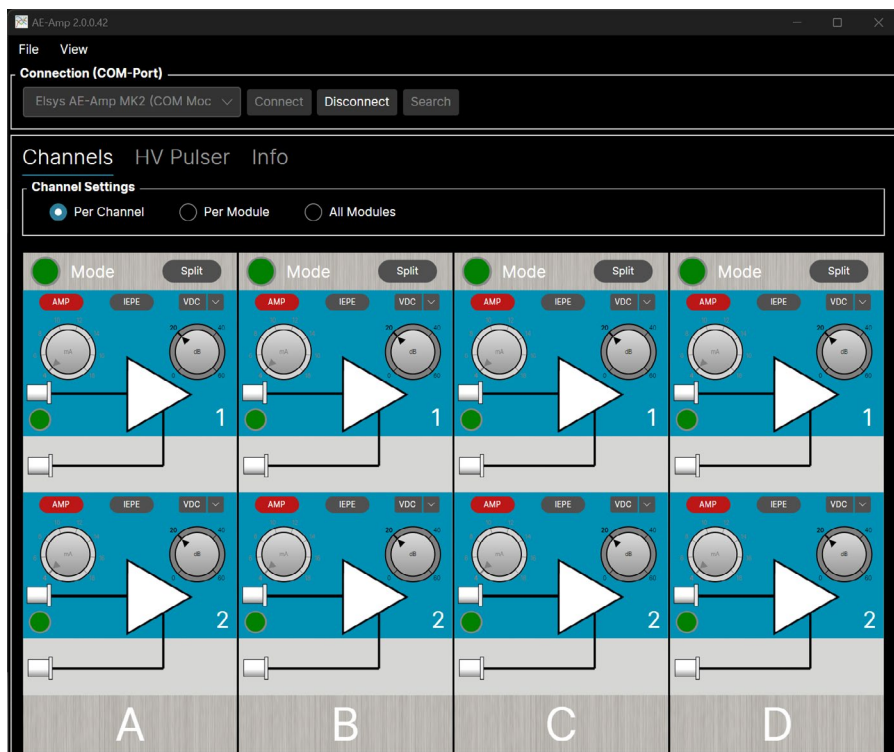
5.1 Driver Download

Download the drivers for the USB to RS485 converter chip directly from the FTDI web-site:
<http://www.ftdichip.com/Drivers/VCP.htm>

5.2 Amplifier Settings

As soon as the connection to the AE-Amp is established, the program determines the number of amplifier modules and displays them accordingly.

All parameters can be set graphically.



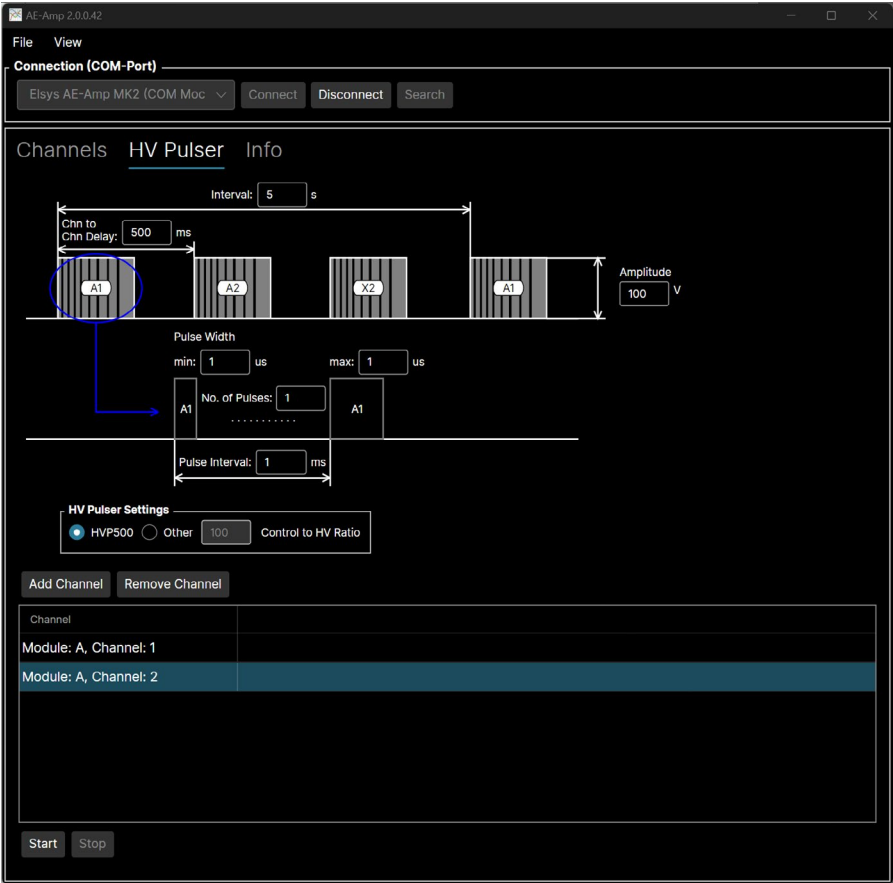
5.3 HV Pulser

The parameters of the HV Multiplexer and HV Pulser can be set in the HV Pulser tab.

In the channel list at the bottom of the tool, the active channels to which HV pulses are to be sent can be added.

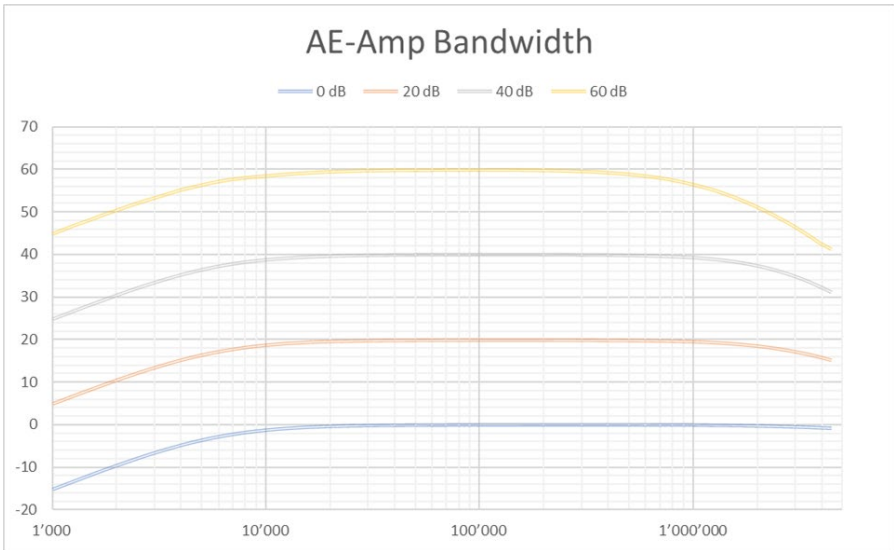
Pulse generation can be started or stopped using the Start/Stop button.

The program must remain open for the sequence to run.



6. Specification

Parameter	AE-Amp Box	AE-Amp Rack
Number of Channels	2	2 - 48
Gain	0 dB / 20 dB / 40 dB 7 60 dB	
Input Stage	AC coupled voltage input, single endet	
Compatible Sensor Types	passiv, JFET, ICP/IEPE, voltage powered	
Sensor Power	ICP/IEPE: 4 - 50 mA Voltage: 27 V, 5 V	
Output Impedance	50 Ω \pm 0.5%	
Max. Output Voltage Swing	\pm 9 V (no Load) \pm 4.5 V (Load = 50 Ω)	
Bandwidth -3 dB (low Cut)	5 kHz	
Bandwidth -3 dB (high cut)	00 dB : 5.0 MHz 20 dB : 3.0 MHz 40 dB : 2.0 MHz 60 dB : 700 kHz	
Gain Error @ 100 kHz	max. \pm 1%	
High Voltage Pulse Through	max. 500 V	
Power Supply	12 V DC, max 8 W	110 - 240 V AC, max 75 W
Interface	USB (emulated COM Port)	
Dimensions	108 x 45 x 170 mm	Amp-BU-24-AE: 19" x 3U x 32.5cm Amp-BU-48-AE: 19" x 6U x 32.5 cm



File Revision:

Date	Description
27.05.2024	Manual Update MK2