

VF-500

VOLTAGE FOLLOWER / LINEAR AMPLIFIER FOR PIEZOELECTRIC (CAPACITIVE) LOADS



USER MANUAL

DYNAMIC STRUCTURES AND MATERIALS, LLC
REV. 130201

VF-500 LINEAR PIEZOELECTRIC AMPLIFIER

Please review the following points for both personal and equipment safety while operating the linear piezoelectric amplifier.

HIGH ENERGY/VOLTAGE WARNINGS

Exercise caution when using amplifiers. High energy level can be stored at the output voltage terminals on all amplifiers in normal operations. In addition, potentially lethal voltages exist in the power circuit and the output screw terminals. Filter capacitors store potentially dangerous energy for some time after power is removed.



AC SOURCE GROUNDING WARNING

Ensure that the amplifier's power supply is connected to a grounded AC outlet with the recommended AC input connector configured for the available line voltage.

OPERATING AND SERVICES PRECAUTIONS


Operate the amplifier in an environment free of flammable gases or fumes. To ensure that its safety features are not degraded, do not use substitute parts or make any unauthorized modifications to the amplifier. Contact DSM for service and repair assistance.

VF-500 SPECIFICATIONS

- Output Voltage: -30/+150V or -30/+200V
- Input Voltage Signal (gain = 20): -1.50V to +7.50V (for -30/+150V unit)
-1.50V to +10.0V (for -30/+200V unit)
- Maximum Continuous Current: 500mA, > 5msec
- Maximum Peak Current: 1000mA, < 5msec
- Dimensions: 100mm x 240mm x 330mm (4" x 9.5" x 13")
- Operating Voltage: 85 ~ 264VAC, 47 ~ 63Hz
- Amplifier bandwidth: 5kHz
- Electrical Noise on Output: 4mVrms
- Short circuit, over-current, and over-temperature protection
- Output Connector: SMA
- Input Connector: BNC

NOTE: The output voltage is configured at the factory and is not re-configurable in the field.

WARNING!

 This device is marked with the international caution symbol. It is important to read the Recommended Operation section of this manual before using this device as it contains important information related to product safety.

General Precautions

- ◆ All insulation of leads connected to output terminals should have at least a 300V rating.
- ◆ Do not use clip leads in the connections used in arrangements employing the VF-500 linear amplifier. They are very dangerous for high-voltage work.
- ◆ Do not place objects on top of or close beside the amplifier during operation. Adequate airflow around the unit is needed to allow heat to dissipate.

Acceptable Load Types

- ◆ This amplifier is designed to drive capacitive loads only. Do not use this amplifier to drive resistive loads. The amplifier will only work properly when a capacitive load is connected to the output.
- ◆ Never connect an inductive or a resistive load to the unit. This would cause a short-lived high-current pulse at the output and would damage the amplifier unit.

Short Circuit Damage

- ◆ Although the VF-500 is protected against a short circuit on the output, it is recommended that a short circuit condition be avoided.
- ◆ Never connect an "earth ground" lead (e.g., an oscilloscope ground lead) to the center pin of the SMA output terminal. This causes a short-lived high-current pulse and subsequent damage to the unit.
- ◆ If the user desires to observe or audit the output signal of the amplifier using a voltage meter or an oscilloscope, the user must ensure that the meter or oscilloscope has an input impedance of at least 1 MOhm. Smaller input impedances could damage the amplifier.

RECOMMENDED OPERATION

Intended Use

DSM's VF-500 linear amplifier is intended to drive piezoelectric (capacitive) loads of the following types:

1. Low voltage piezoelectric materials rated for a maximum operating range of -30 to $+150V$ (piezo devices which have two lead wires: output voltage and ground)
2. Low voltage piezoelectric materials rated for a maximum operating range of -30 to $+200V$ (piezo devices which have two lead wires: output voltage and ground)

The VF-500 applies a gain of 20 to an analog input signals and generates an output voltage suitable for driving or actuating piezoelectric materials of the types described previously.



Figure 1. Front Panel View



Figure 2. Rear View

Instructions for Use

Start-Up / Shut-Down Procedure

The VF-500 amplifier can be powered-up and powered-down with or without being connected to an input signal. However, DSM recommends that the amplifier be connected to a load (capacitive, such as a piezoelectric device of the appropriate rating) during start-up and while the amplifier is running; operating without a load can be damaging to the amplifier's circuitry.

During start-up and shut-down, the output of the amplifier passes through some fast voltage transients that quickly settle to zero volts (assuming there is no voltage on the input). These fast voltage transients can cause the load (piezo actuator or stage) to move, and there can be an audible noise that results from this fast motion. This is not damaging to the piezo element.

Connecting the Load to the Amplifier's Output

The VF-500 will have been configured at the factory for an output voltage range corresponding to the specifications of the customer's load (one of the two types discussed in the "Intended Use" section).

Attach a standard load (i.e. a piezoelectric actuator with two lead wires for signal and ground) to the VF-500 via the OUTPUT SMA connector on the amplifier's front panel. Typically, the piezoelectric material manufacturer will designate the "live" or "hot" electrode with red lead wire and/or a visible mark on the piezo material to distinguish this electrode from the ground electrode.



CAUTION: When the VF-500 is powered, the OUTPUT SMA connector of the amplifier can carry voltages ranging up to 200V, depending upon the amplifier's configuration.

Power

Power for the VF-500 is provided through the standard receptacle located on the back panel of the product enclosure. The power switch is located above the receptacle.

Input

Input to the unit (i.e. from a function generator) is made by a single BNC connector on the front panel. This is a low-voltage only (-1.5V to +7.5V or -1.5 to +10V) input. Over-voltage input beyond $\pm 10V$ can damage the unit.

AC, DC, or superposed AC and DC signals (for example, from a computer D/A board) can be used as input signals.

Operation

Prior to completing the electrical connections outlined below, ensure that the work place is free of conductive objects that could pose electrical hazards to the user should the objects make contact with the high voltage output screw terminals of the VF-500 amplifier.

- Connect the load to the VF-500 via the OUTPUT SMA connector
- Connect line power to the VF-500 through the receptacle on the back panel
- Connect the input signal to the VF-500's INPUT BNC connector
- Adjust the input signal as needed to achieve the desired output from the piezoelectric load

Circuitry Protection

The VF-500 circuitry incorporates over-current, over-temperature and short-circuits protection.

When the protection circuitry is enabled as a result of excessive operating conditions or temperature, the amplifier will disconnect the output temporarily and will attempt to restart. During restart, the amplifier will recheck the operating conditions and will go into protection mode again if fault conditions exist. This protection thus protects both the amplifier and the load.

The VF-500 is equipped with temperature sensors that will protect the circuitry if the internal temperature of the unit exceeds the safe operating condition. The over-temperature condition triggers at approximately 70C. Although the signal from the input BNC will continue to be fed into the amplifier and the amplifier will remain connected to the load, the output signal will be restricted to a small voltage oscillation (20-30 mV) around earth ground until the sensor indicates that the unit has reached approximately 50C. There is no indication to communicate the over-temperature condition to the operator.

If the equipment is used in a manner not specified by DSM, the protection provided by the equipment may be impaired.

Recommended Environmental Conditions for Operation

The VF-500 is designed to operate in non-hazardous environments. Any deviation from the specified environment must be approved by DSM and may result in the voiding of any warranty. Any deviation not approved by DSM will be grounds for voiding of any warranty.

- Environmental Temperature: 0-50C
- Percent Relative Humidity: 0-80% non condensing
- Operating Supply Voltage: Refer to label at power receptacle

Cleaning

Prior to any cleaning, unplug the electrical power to the VF-500. Dust can be readily removed by wiping or by blowing with compressed dry air. Wiping the unit with a damp cloth is acceptable, but care must be taken not to leave any residual liquid at the electrical connections or let any liquid enter the electrical enclosure.



CAUTION: In order to avoid electrical shock, do not spill or immerse the VF-500 amplifier in liquids.

Warranty Information

The DSM Warranty Period is a period of sixty (60) days beginning on the date that DSM ships the new, customer-purchased equipment or software. DSM warrants that its new equipment will be free from defects in materials and workmanship during the DSM Warranty Period.

DSM warrants that its software shall be fit for the particular uses described in DSM product literature and user's manuals available at the time of initial equipment shipment, and shall operate properly during the DSM Warranty Period.

In the event that DSM receives written notice of a claim under this Warranty within the DSM Warranty Period, DSM will repair or replace equipment or software, at its option, at no charge. These services shall be performed at DSM's factory or its designated repair facility.

Freight charges to return equipment or software to DSM are the customer's responsibility. DSM will pay freight charges to return the equipment to the customer.

Warranty Shipments Outside of North America:

Warranty-repaired product is generally re-imported into the customer's country without duty; however the customer can most efficiently complete the administration of this duty exemption. Return freight to convey repaired or replaced parts or equipment from DSM to customer shall be "E.X.W." as such term is described by Incoterms 2000, with such expenses charged to customer's freight account for direct payment by customer to their freight service provider. All brokerage, freight, shipping, forwarding and handling charges, duties, customs and taxes applicable to warranty-repaired product shipments, if any, will be paid directly by the customer. DSM agrees to promptly reimburse customer for its actual freight cost incurred, *excluding* brokerage and handling charges, duties, customs and taxes, for warranty shipment from DSM to customer, using the same class of freight service selected to initially return the warranty claim equipment to DSM.

Reinstallation and recalibration of DSM equipment and software into a customer-specific application are not covered by this Warranty.

Equipment or software repaired or replaced under this Warranty is covered under the remaining DSM Warranty Period, if any, associated with the original new equipment or software.

Exclusions

This Warranty does not cover:

1. Damage related to modification of DSM equipment or software after initial shipment by DSM.
2. Consequential or incidental damages such as property damage and incidental expenses.
3. Conditions caused by external factors such as abuse, misuse, inadequate power supply, or acts of God.

Owing to the wide range of experimental uses attempted by our customers, DSM does not warrant that its products are fit for a particular use.

Opening of devices, machines, or electronics enclosures by anyone other than DSM voids this Warranty.