

AMP-8 OPERATOR'S MANUAL

Version 2.0

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Vatell Corporation
P.O. Box 66
Christiansburg, VA 24073

Phone: (540) 961-3576
Fax: (540) 953-3010

WARNING: Read instructions carefully and completely before operating the AMP-8. Improper usage may damage the unit. Save this manual for safety and operating instructions, as well as warranty information.

FORWARD

Thank you for purchasing the AMP-8 signal conditioning amplifier. The AMP-8 was designed to be used with Vatech Corporation's line of Heat Flux Microsensors. It has customer specified gains, is simple to operate, and can be powered from most wall sockets for continuous use.

To fully appreciate the capabilities of your AMP-8, please read this Operator's Manual thoroughly. If you have any questions or need any assistance please contact:

Vatech Corporation
Attn.: Amplifier Assistance
P.O. Box 66
Christiansburg, VA 24073

Phone: (540) 961-3576
Fax: (540) 951-3010

Please indicate model and serial number in all correspondence. The model and serial number is printed on the bottom of the amplifier.

CONVENTIONS

As you go through this manual, certain conventions are consistently used:

- All front and rear panel control label references are italicized capitals - for example, reference to the sensor input would be shown as *SENSOR INPUT*.
- All safety alerts will be preceded by **“WARNING:”**
- Necessary, but not safety related information will be preceded by **“NOTE:”**
- Referenced information will be in *italics*.

AMP-8 Operators Manual

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UNPACKING AND INSPECTION

Included with each AMP-8 are the following items:

- 1) Operator's manual
- 2) AC-to-DC adapter
- 3) Heat Flux Microsensor connection cable
- 4) Gain Calibration Sheet

If any of these items are missing or damaged, contact Vatell Corporation at the address listed in the Foreword section of this manual.

AMP-8 EQUIPMENT OVERVIEW

DESCRIPTION OF AMP-8 CONNECTIONS

Sensor Input: Lemo connector for the HFM cable.

Power 5 VDC: The connecting point between the AC-to-DC adapter and the amplifier.

WARNING: Do not attempt to power the AMP-8 with an adapter other than the one supplied by Vatell. An improper adapter could damage the unit.

HFS Output: Output of the Heat Flux amplifier channel. It is a BNC type connector. The approximate gain of the HFS channel is specified by the customer when the amplifier is ordered. The exact gain is listed here.

RTS Output: Output of the RTS amplifier channel. It is a BNC type connector. The approximate gain of the RTS channel is specified by the customer when the amplifier is ordered. The exact gain is listed here.

CABLING AND CONNECTIONS

The standard cable supplied with the AMP-8 is six feet in length. Cables of longer lengths can be supplied by Vatell Corporation as an option.

The standard connector supplied with each Vatell Corporation AMP-8 and HFM is a 4 pin Lemo connector. Some customers may need to make custom cables or need to replace

damaged connectors. To obtain Lemo parts, you can either order them from VateLL Corporation or Lemo, USA.

Lemo, USA
P.O. Box 11488
Santa Rosa, CA 95406

Phone: (800) 444-5366
Fax: (707) 578-1545

Lemo part numbers:

Male Lemo connector (used on cable)- FGG.0B.304.CLAD56

Female Lemo connector (used on sensor)- PHG.0B.304.CLLD21

Figure 1 illustrates the connections on each of the 4 pins of the sensors Lemo connector and their respective orientations.

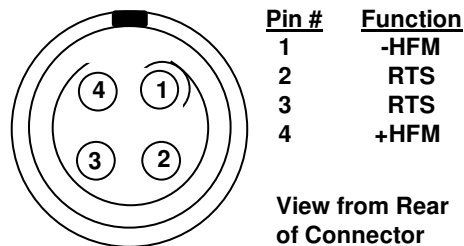


Figure 1 - Female Lemo Connector Pin Out

OPERATION

PRINCIPLES OF OPERATION

The AMP-8 is a 2 channel signal-conditioning instrumentation amplifier designed to be used with a VateLL Corporation Heat Flux Microsensor (HFM). The HFM is a state-of-the-art sensor which requires low-noise, precision amplification. The AMP-8 is designed specifically with these requirements in mind to give the user quality data.

The HFM consists of two sensors on the same surface. The Heat Flux Sensor (HFS) measures heat flux flowing through the sensor surface. The Resistance Temperature Sensor (RTS) measures the temperature at the face of the sensor. One channel of the AMP-8 amplifies signals from the HFS portion of the HFM. The other channel excites the RTS portion of the HFM with a 100 μ A current source and then amplifies the resulting voltage signal.

The AMP-8 is powered by a 5 V AC-to-DC adapter that plugs into the wall.

TAKING MEASUREMENTS

In order to collect data from the HFM, proceed with the following steps.

1. The amplifier should be placed in a position that avoids strong electromagnetic fields and large temperature excursions. *See Theory of Operations section for detailed discussion.*
2. Plug the amplifier into the wall. It will be powered on automatically.
3. Attach one end of the 6 foot cable to the HFM and the other end to the input connection (*SENSOR INPUT*) on the back panel of the amplifier. The cable and HFM connectors are keyed to assure proper pin alignment.
4. Connect output BNC connections *HFS OUTPUT* and *RTS OUTPUT* to a measuring device (chart recorder, oscilloscope, voltmeter, etc.).
5. Allow amplifier to warm-up (become temperature stable). This takes approximately eight minutes from the time the amplifier is turned on. *See step 2.*
6. System is now ready for measurement of heat flux and temperature.

THEORY OF OPERATION

The AMP-8 is a 2 channel amplifier based on 2 Analog Devices' AD624 instrumentation amplifier chips. These instrumentation amplifiers have dual supplies, differential inputs, and pre-selectable gains. The AMP-8 was designed to be used with a Vatec Corporation Heat Flux Microsensor (HFM). One channel is used to amplify the Heat Flux Sensor (HFS) portion of the HFM and the other channel is used to amplify the Resistance Temperature Sensor (RTS) portion. The HFS channel and RTS channel inputs are connected to a single 4 pin Lemo connector located on the back panel. The outputs (single ended) are connected to two male BNC coax connectors located on the side panel. The amplifier will rail at approximately ± 5 V.

The heat flux amp has both its inputs tied directly to the Lemo connector. There are two bias resistors (200 k Ω) placed from the inputs of the amplifier to ground. Figure 2 shows a simplified circuit diagram. The sensor will produce zero output when there is no source or sink of heat flux. The amplifier should be turned on at least 8 minutes prior to adjustment, and should be at the same temperature as its environment. *See specifications for operating limits.*

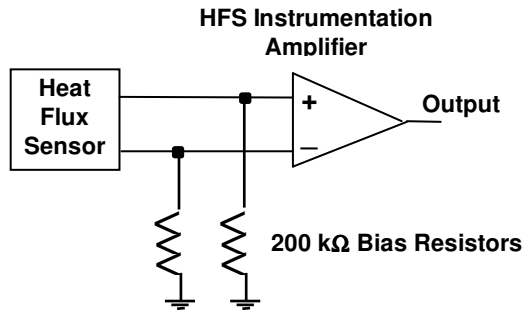


Figure 2 - Simplified Heat Flux Signal Circuit Diagram

The RTS amplifier has one input tied to a pin on the Lemo connector and the other connected to a factory-set potentiometer. The resistance temperature sensor (RTS) is driven by $100\ \mu\text{A}$ of current from a precision current source (Burr-Brown REF200) referenced to ground. The RTS lead not connected to ground is fed to the positive side of the RTS differential amplifier. The negative side of the amplifier is connected to a factory-set, precision potentiometer also driven by $100\ \mu\text{A}$. The other side of the potentiometer is connected to ground. The two current sources are mounted on the same chip to precisely equalize the currents. Figure 3 shows a simplified schematic of this circuit. The relationship between the HFS and RTS signals is described in "Use of Vateil Heat Flux Microsensor Calibration Equations" included with each heat flux microsensor.

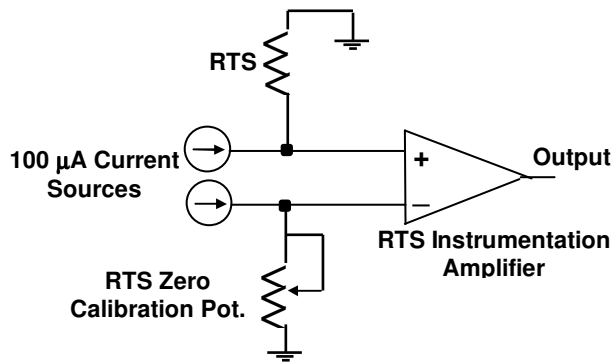


Figure 3 - Simplified RTS Signal Circuit Diagram

NOISE REDUCTION

All precision amplifiers working with small signals are susceptible to Electromagnetic Interference (EMI). Special care should be taken in the placement of the sensor and amplifier relative to any source of EMI noise. The following actions will tend to reduce EMI noise problems:

- Avoid creating ground loops.
- Do not subject the amplifier, sensor, or cables to large electrical fields.
- High frequency PWM (Pulse Width Modulated) motors tend to be very noisy. If possible, avoid data collection when motors are on.
- Use shielded, twisted pair for any connections beyond the cable supplied with the sensor and amplifier.
- Do not ground the cable supplied with the amplifier at the end nearest the sensor.

CARE AND MAINTENANCE

The AMP-8 is a durable instrument. If handled carefully, it should last for years. The AMP-8 can be cleaned with a soft dry cloth. Avoid the use of strong chemicals and solvents, especially when cleaning around connector surfaces.

In case of any difficulty with operation or maintenance of this amplifier, contact Vatek Corporation for further assistance.

WARRANTY

Vatell Corporation warrants that this product will be free from defects in materials and workmanship for a period of 90 days from the date of shipment. If the product proves defective during this warranty period, Vatell Corporation, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, the customer must notify Vatell Corporation in writing of the defect before the expiration of the warranty period and make arrangements for service. The customer shall be responsible for packaging and shipping of the defective product to Vatell Corporation with shipping charges prepaid. Vatell Corporation will pay for the return of the product to the customer, if the shipment is to a location within the United States of America. The customer is responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to locations outside of the USA.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care.

THIS WARRANTY IS GIVEN IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. VATELL CORPORATION DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. VATELL CORPORATION'S REPAIR OR REPLACEMENT OF A DEFECTIVE PRODUCT IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR WARRANTED DEFECTS. VATELL CORPORATION WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

AMP-8 SPECIFICATIONS

	Heat Flux Channel	Temperature Channel
Gain Settings	Customer specified	Customer specified
Gain Accuracy %	(At some selected gains)	(At some selected gains)
Gain = 1	±0.6	±0.6
Gain = 100	±1.5	±1.5
Gain = 200, 500	±1.5	±1.5
Gain = 1000	±2.1	
Gain = 5000	±3.6	
Bandwidth	(At some selected gains)	(At some selected gains)
Gain = 1	1 MHz	1 MHz
Gain = 100	150 kHz	150 kHz
Gain = 200		100 kHz
Gain = 500	50 kHz	50 kHz
Gain = 1000	25 kHz	
Gain = 5000	5 kHz	
Input Impedance	10 ⁹ Ω	10 ⁹ Ω
Input Noise	0.2 μV	0.2 μV
Maximum RTS Resistance	factory adjustable	factory adjustable
Full Scale Output	5 V	5 V

Dimensions: 3.2 cm x 3.8 cm x 10.2 cm (1¼" x 1½" x 4")

Weight: 0.15 kg (5.3 oz.)