HSE Universal Multi Sensor Amplifier

USER'S MANUAL

73-5071: HSE UNIVERSAL MULTI SENSOR AMPLIFIER CUSTOM VERSION

73-5078: HSE UNIVERSAL MULTI SENSOR AMPLIFIER FOR HSE SENSORS

HUGO SACHS ELEKTRONIK
a division of Harvard Bioscience, Inc.

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Warranty

Research Use Only

Manufacturer:
Hugo Sachs Elektronik-Harvard Apparatus GmbH
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Hugo Sachs Elektronik (HSE) warranties the HSE Universal Multi Sensor Amplifier for a period of one year from the date of purchase. At its option, HSE will repair or replace the unit if it is found to be defective as to workmanship or materials. This warranty does not extend to any instrumentation which has been (a) subjected to misuse, neglect, accident or abuse, (b) repaired or altered by anyone other than HSE without HSE express and prior approval, (c) used in violation of instructions furnished by HSE. This warranty extends only to the original customer purchaser. IN NO EVENT SHALL HSE ELEKTRONIK BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. Some states and regions do not allow exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR USE,
OR OF ANY OTHER NATURE. Some states or regions do not allow this limitation on an implied warranty, so the above limitation may not apply to you. Without limiting the generality of the foregoing, HSE shall not be liable for any claims of any kind whatsoever, as to the equipment delivered or for non-delivery of equipment, and whether or not based on negligence. Warranty is void if the device is changed in any way from its original factory design or if repairs are attempted without written authorization by HSE. Warranty is void if parts or connections not manufactured by HSE are used with the equipment. If a defect arises within the warranty period, promptly contact Hugo Sachs Elektronik, Gruenstrasse 1, D-79232 March-Hugstetten Germany by phone at +49(0)7665/9200-0 or email sales@hugo-sachs.de. In the USA, call 800-272-2775 or 508-893-8999 or email: support@hbiosci.com).
Goods will not be accepted for return unless an RMA (Returned Materials Authorization) number has been issued by our customer service department. The customer is responsible for shipping charges. Please allow a reasonable period of time for completion of repairs, replacement and return. If the unit is replaced, the replacement unit is covered only for the remainder of the original warranty period dating from the purchase of the original device. This warranty gives you specific rights, and you may also have other rights, which vary from state to state.

Out of Warranty Service

Proceed exactly as for Warranty Service on previous page. If our service department can assist you by phone or other correspondence, we will be glad to help at no charge. Repair service will be billed on the basis of labour and materials. A complete statement of item spent and materials used will be supplied. Shipment should be prepaid. Your bill will include return shipment freight charges. Disassembly by the user is prohibited. Service should only be carried out by experienced HSE technicians.

Repair Facilities and Parts

HSE stocks replacement and repair parts. When ordering, please describe parts as completely as possible, preferably using our part numbers. If practical, enclose a sample photo or drawing.

Safety Information

Please read the following safety precautions to ensure proper use of your amplifier. If the equipment is used in a manner not specified, the protection provided by the equipment may be impaired.

Use Proper Input Plug

Use only the specified input plug for this product and make sure input plug is certified for country of use

Make Proper Connections

Make sure to use the appropriate connection for your country. Attach the connector of the amplifier power supply always correctly to the input socket at the rear side of the amplifier and the power socket. Never increase the connection cable length longer than 3 meters.

Observe All Terminal Ratings

Review the operating manual to learn the ratings on all connections.

Avoid Exposed Circuitry

Do not touch any electronic circuitry inside of the product.

Do Not Operate with Suspected Failures

If damage is suspected on or to the product do not operate the product. Contact qualified service personnel to perform inspection.

Orient the Equipment Properly

Do not orient the equipment so that it is difficult to manage the connection and disconnection of devices.

Place Product in Proper Environment

Review the operating manual for guidelines for proper operating environments.

Observe all Warning Labels on Product

CAUTION Refer to manual. Read all labels on product to ensure proper usage.

Caution Notice

CAUTION: FOR RESEARCH USE ONLY. NOT FOR CLINICAL USE ON PATIENTS.

The unit itself does not generate waste but may be used with samples that are hazardous. Please use appropriate PPE and ensure disposal in accordance with local regulations and practices. This product should not be used in the presence of a flammable atmosphere such as an anaesthetic mixture with air, oxygen, or nitrous oxide.

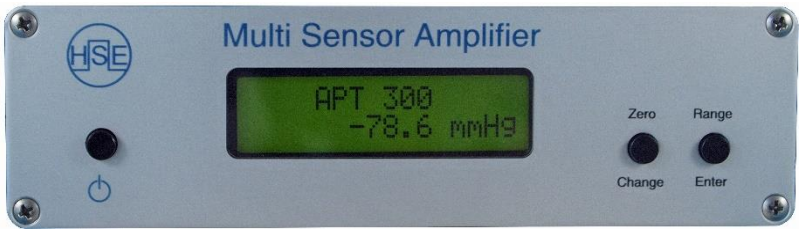
Compliance

These systems have been designed to meet the standards for electromagnetic compatibility (EMC) intended for laboratory equipment applications as well as the applicable safety requirements for electrical equipment for measurement, control, and laboratory use.

Introduction

This User's Manual explains the installation, function and use of the HSE Universal Multi Sensor Amplifier. Carefully read the operating instructions as well as other materials in this manual.

This manual is not a warranty of product performance. If you need help or have questions, please contact us and we will assist you. We want you to be completely satisfied with this product.



Product Overview

The HSE Universal Multi Sensor Amplifier is designed for measurement applications in animal experimental research or other technical uses in general laboratory, light industrial or office environments. The amplifier system is based on a resistance full bridge circuit and available ready set and calibrated to one of the HSE sensors or those of other vendors. If using other sensors, there may be different connection cables available.

The amplifier is factory calibrated to the sensor if such is ordered together with the amplifier.

Key Features (All Versions)

- Amplification of sensor signals measuring for example pressure, force or displacement
- Three measurement range settings, these can be used for low, mid and high measurement ranges for one specific sensors. Or you can use three different sensors without the need to change gain settings as long as there are no jumper changes needed.
- Internally pre-set gain for each range, abandoning the possibility of unintended gain change leading to issues comparing repeating measurement.
- Zero adjustment over full measurement range
- Bright display of measurement values, adjustable contrast
- Analog output ±5V for range maximum
- Output voltage adjustment for analog output signals

- Serial output of measurement values via USB port

- Supply voltage: 12VDC, 1.0A via universal power supply 115/230V, exchangeable connectors for EU, USA, CHINA, UK

Unpacking & Inspection

CAUTION: The amplifier contains electrostatic sensitive components. Please observe precautions for handling the amplifier device to prevent damage.

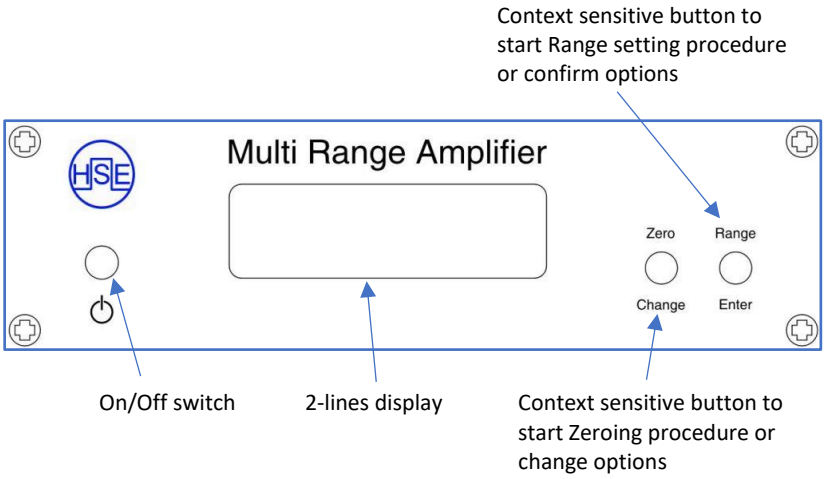
Please first check the contents of the shipment for completeness and note whether any damage has occurred during transport. If the contents are incomplete, or if there is damage on the amplifier or it´s accessories, notify the supplier from whom you have ordered the device or Hugo Sachs Elektronik directly.

Check to ensure that all items ordered and listed are included in the shipment. The shipment includes the following items:

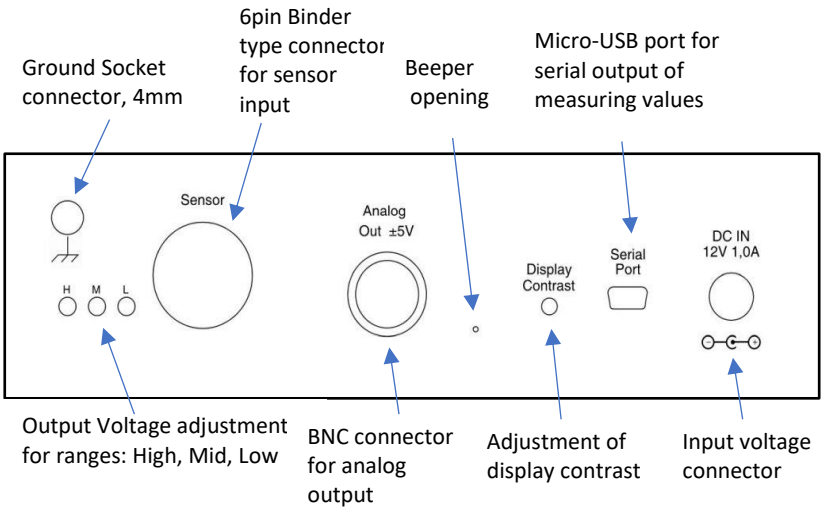
- HSE Universal Multi Sensor Amplifier
- Multirange power supply incl. cable
- BNC cable 2m length
- Screwdriver to adjust display brightness
- User´s manual (operating instructions)

Detailed Description

Main Design Features: Front



Main Design Features: Rear



Setting up the system

1. Position your amplifier on a solid, flat surface
2. Connect your sensor to the input at the rear of the amplifier, close the union nut
3. Plug in the power cord to the input voltage connector at the rear of your amplifier
4. Connect the power cable to a wall outlet socket
5. If you want to connect the amplifier to a data acquisition, connect the BNC analog output at the rear to the BNC input of your data acquisition system using a BNC cable.

Changing sensor type

The HSE Universal Multi Sensor Amplifier is prepared to work with all HSE sensors that need to connect to a bridge-amplifier. To adjust the amplifier to the selected sensor you always must enter a specific menu via the buttons and display of the amplifier. For some of the sensors you must in addition open up the amplifier and change jumper settings, as these sensors are very different from others by means of amplification factor and other features.

Please notice that when ordering a sensor together with the amplifier, the amplifier is factory set according to the sensor. There an no adjustments needed in that case.

The sensors that ONLY need to be selected via the software menu:

- APT 300 pressure sensor
- FT 20 force sensor, using low or mid measurement ranges
- FT 50 force sensor
- K 30, 100, 300 1000 force sensors
- Millar Single Pressure Sensor

Please note that when changing back to these sensors from one of the below listed you need to make an adjustment of the jumpers as well.

The sensors that IN ADDITION need adjustment of the internal jumper setting:

- P 75 pressure sensor
- DLP 2.5 pressure sensor
- MPX pressure sensor
- FT 20 force sensor, using all three measurement ranges
- FT 300 force sensor
- B 40 balance arm sensor

Selecting the sensor type via the menu of the amplifier:

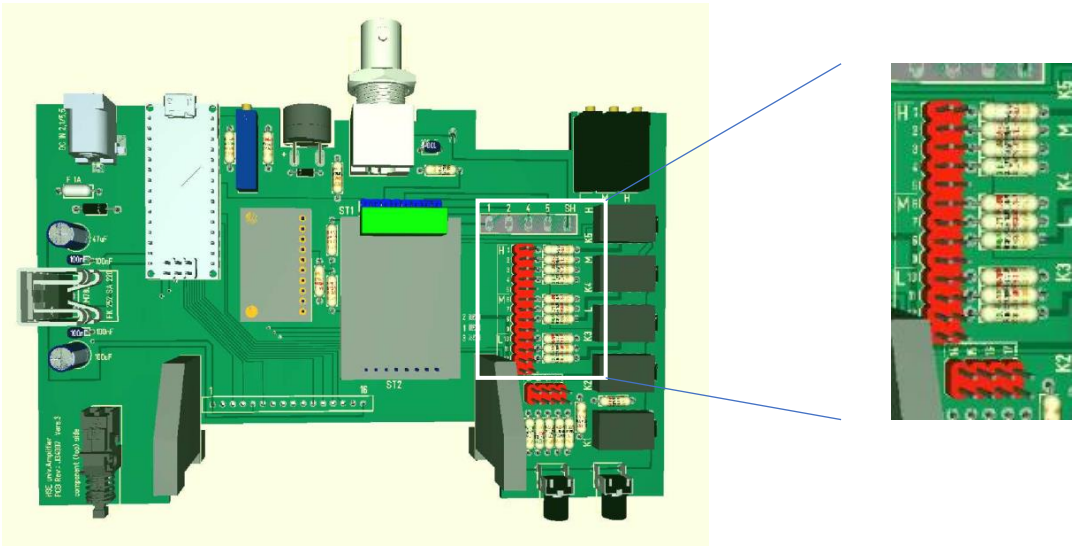
1. To enter the selection menu make sure the amplifier is switched off
2. Press and hold both the “Zero” and “Range” buttons and then switch on the amplifier. Keep holding the two buttons for a few seconds until the word “Sensor select” appears on the display. This takes about 5 seconds.
3. Step through the list of included sensors by pressing “Change”, if you want to exit the sensor select menu without changing the sensor type, switch off the amplifier.
4. Confirm the selected sensor, press “Enter” and the sensor selection will be stored, an according message confirms the change on the display. The actual selected sensor is always displayed during the measurement.

Adjusting the internal jumper settings:

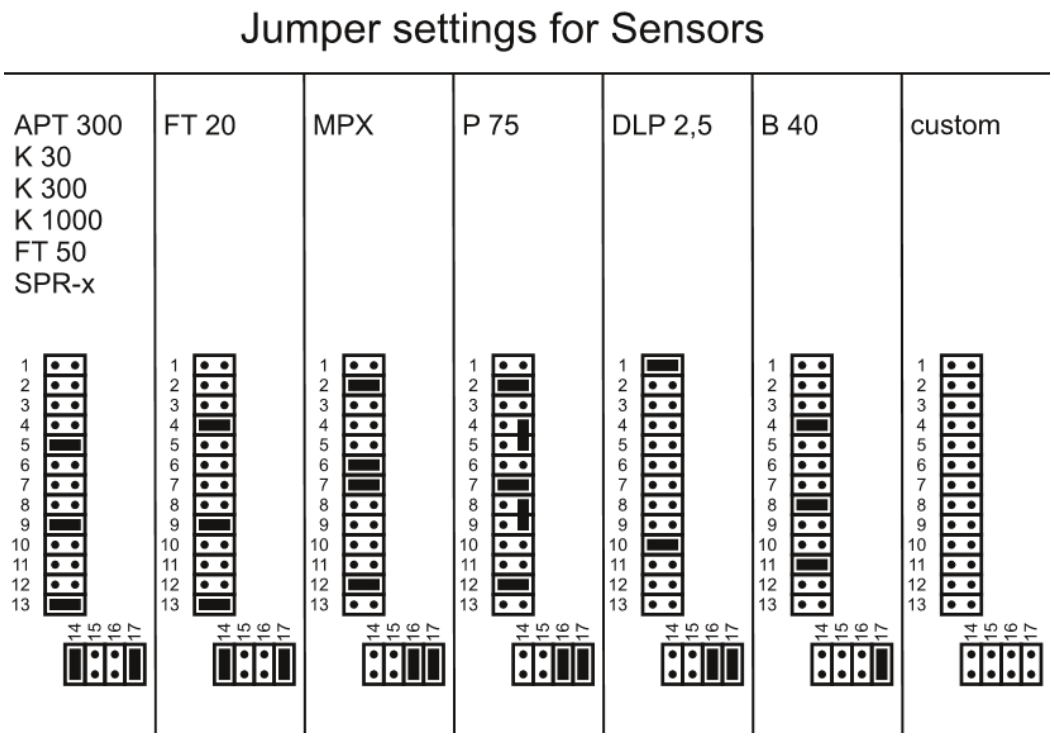
To change the jumper setting you must open up the amplifier case:

1. Disconnect the amplifier from power
2. Open the upper part of the amplifier case by removing the upper 4 screws, upper two on the front, upper two on the rear. Lift the upper part of the case and put aside.

3. You find the jumper bank here:



4. Change jumper setting according to the following diagram:



5. Put back upper case and reposition and hand tighten the screws, reconnect power to the amplifier.

6. Switch on the amplifier

7. Make sure the correct sensor is selected in the menu as well as described above.

8. Select the desired measurement range as described in section X.

9. If you use the analog output of the signals adjust the voltage as described in section X.

Switching on the amplifier

1. Switch on the amplifier pressing the On/Off button on the front
2. The start sequence on the display shows the amplifier and firmware version and the predefined sensor.
3. You can either start your measurement immediately, checking the zero and calibration values, which is always recommended at the start of your daily experiments or in case this is needed make a change to the measurement range or sensor selected.

Display

The display at the front shows information about the factory set sensor and current measurement range as well the actual measurement values and according units. To give the best reading comfort, the displayed values are mean values of the actual sensor readings. A mean value over 1000 samplings is calculated and the display is updated after 100ms.For fast measurement signals this may lead to deviations of the values displayed and the values transmitted via the analog or serial outputs. (The analog values are always the accurate ones) This may not be relevant for slow measurement signals, like blood pressure, where the means are calculated and analog signals correspond well.

The display guides you through the Zero, Calibration and settings processes as well.

Display contrast

The display contrast can be adjusted to different light conditions using a screwdriver turning the trimer that is accessible at the rear of the instrument. Please note that always using the maximum contrast leads to earlier aging of the display and might affect the ability to read the values from the display

Measurement range

The HSE Universal Multi Sensor Amplifier is equipped with three measurement ranges for optimized performance. Each of these represent a separate gain setting, that can be changed internally by positioning jumpers, according to the sensor selected. Setting these gains internally, makes sure that no unintended change of gain settings, for example on front panel turning knobs, can influence repetitive accuracy of the measurement values.

For example, for the pressure sensor APT-300 these are set to provide best precision and dynamics in the ranges 0-50 mmHg (Low), 0-200 mmHg (Mid) and 0-400 mmHg (High).

Please find the pre-set measurement ranges for different sensors in table 1:

Table 1: Measurement ranges

Sensor	Low	Mid	High	Units
Pressure				
APT-300	0-50	0-200	0-400	mmHg
P75	0-20	0-50	0-75	mmHg
DLP 2.5	-	-	2,5	cmH_2O
MPX	0-30	0-60	0-100	cmH_2O
Millar SPR-x	0-50	0-200	0-400	mmHg
Force				
FT20	0-5	0-10	0-20	cN
FT50	0-10	0-25	0-50	cN
FT300	0-100	0-200	0-300	cN
K30	0-5	0-15	0-30	cN
K100	0-20	0-50	0-100	cN
K300	0-100	0-200	0-300	cN
K1000	0-200	0-500	0-1000	cN

Changing the measurement range

To change the measurement range, press the RANGE button on the front for minimum 2 seconds. A beep is heard to confirm that input is valid and then press CHANGE to toggle the ranges and select by pressing ENTER. If you press the RANGE button too short a message will appear on the display.
The menu then proceeds with a two-point calibration. Depending on the sensor and amplifier version installed, a message calls to apply the zero value to the sensor. For a pressure sensor this can be for example 0 mmHg by opening the sensor to atmospheric pressure by turning a stopcock, or 0 mg, or no weight on a force sensor. You can apply every other pressure or force if you want this to become the zero value, but you must be aware, that every measured value below this zero value is shown as a negative value then. When the zero value is applied and stabilized press the ENTER button to confirm, the display proceeds to the second calibration point. Depending on the sensor used and range selected, the display calls you to apply a certain pressure, force or unit according to the sensor.

When working with pressure sensors we recommend using either a Manual Pressure Calibrator (HSE part number 73-4479 for the range 0 – 300mmHg) or when high accuracy is desired a KAL 84 Pressure Calibrator as listed:

73-0012: Electronic Pressure Calibrators, Model KAL 84 H, Mercury, Range 1: 0 to 199.9 mmHg, Range 2: 0 to 26.66 kPa, 115 VAC, 60 Hz, For Use with Blood Pressure Sensors

73-0013: Electronic Pressure Calibrators, Model KAL 84 H, Mercury, Range 1: 0 to 199.9 mmHg, Range 2: 0 to 26.66 kPa, 230 VAC, 50 Hz, For Use with Blood Pressure Sensors

73-0014: Electronic Pressure Calibrators, Model KAL 84 SH, Mercury, Range 1: 0 to 300.0 mmHg, Range 2: 0 to 39.99 kPa, 115 VAC, 60 Hz, For Use with Blood Pressure Sensors

73-0015: Electronic Pressure Calibrators, Model KAL 84 SH, Mercury, Range 1: 0 to 300.0 mmHg, Range 2: 0 to 39.99 kPa, 230 VAC, 50 Hz, For Use with Blood Pressure Sensors

For force measurement we recommend having the appropriate weight at hand. We recommend purchasing the weight at the time you purchase the amplifier/sensor system. Recommended pressure and weight calibration values in table 2

Table 2: Calibration values

Sensor	Low	Mid	High	Units
Pressure				
APT-300	50	100	200	mmHg
P75	20	50	75	mmHg
DLP 2.5	-	-	2.5	cmH_2O
MPX	30	60	100	cmH_2O
Millar SPR-x	50	100	200	mmHg
Force				
FT20	1	1	10	cN
FT50	10	20	50	cN
FT300	100	200	300	cN
K30	5	10	30	cN
K100	20	50	100	cN
K300	100	200	300	cN
K1000	200	500	1000	cN

When the appropriate pressure or weight is applied and has stabilized press ENTER. The amplifier stores the value and returns to the main display showing the current applied value. The amplifier and sensor are now ready to start the experiment.

Set zero measuring values

At least at the start of a daily experimental session the zero value of the amplifier should be checked and if needed reset. To reset the zero value, press the ZERO button on the front panel for minimum 2 seconds. If you press the ZERO button too short, a message will appear on the display. If accepted a sound confirm the selection and the display calls you to apply the zero value to the sensor. For a pressure sensor this can be for example 0 mmHg by opening the sensor to atmospheric pressure by turning a stopcock, or 0 mg, no weight on a force sensor. You can apply every other pressure or force if you want this to become the zero value, but you must be aware, that every measured value below this is shown as a negative value then. When the zero value is applied and stabilized press the ENTER button to confirm. The amplifier stores the value and returns to the main display showing the current applied value. The amplifier and sensor are now ready to start the experiment.

Analog output

The HSE Universal Multi Sensor Amplifier is equipped with an analog output of measuring signals through the BNC connector at the rear of the amplifier. Using a BNC cable to connect to the hardware of a data acquisition package you can further process the data. Please contact your Hugo Sachs Elektronik Harvard Apparatus sales person or distributor for recommendations regarding data acquisition packages. Output voltage range is ±5Volt.
The output voltage for the ranges listed in table 1 are factory set to achieve the best results over the entire selected measurement range. Due to potential aging of sensors or external effects (chemicals, heat, moisture etc.) or when changing to a new sensor, the resulting output voltage might differ slightly from the factory setting.

The output voltage for a selected measurement range can be adjusted thought the trimmers that are accessible at the rear of the amplifiers:

H = High range
M = Mid range
L = Low range

To adjust the output voltage connect a voltmeter to the BNC voltage output, read the voltage when applying the calibration value as listed in table 2 and carefully turning the trimmer screw in small steps with a small screwdriver, read the changes from the voltmeter until the voltmeter shows the desired voltage as listed in table 3. Disconnect the voltmeter, the amplifier and sensor are ready to proceed with the experiment.

When you do not use the analog output you do not need to adjust the output voltage.

Table 3: Analog output values

Sensor	Low	Mid	High	Units
Pressure				
APT-300	5	2.5	2.5	V
P75	5	5	5	V
DLP 2.5	-	-	5	V
MPX	5	5	5	V
Millar SPR-x	5	2.5	2.5	V
Force				
FT20	1	0.5	2.5	V
FT50	5	4	5	V
FT300	5	5	5	V
K30	5	5	5	V
K100	5	5	5	V
K300	5	5	5	V
K1000	5	5	5	V

Serial output of measurement values

The Micro-USB port at the rear of the instrument is a serial port that enables reading measurement values with a connected PC, tablet or similar using an appropriate software like HyperTerminal. Please refer to the manual of the device and software you use how to make a connection. The output serial signal of the amplifier is factory set to: 9600 baud rate, no handshake, 8 bits, no RX/TX.

Information that is provided: Not implemented yet

Specifications

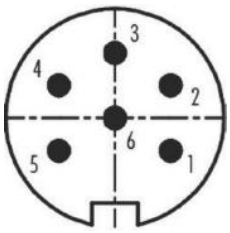
Sensor input	6-pin socket with screw lock (Binder, Amphenol, Tuchel)
Measurement range	3 selectable ranges depending on used sensor and desired measurement range
Analog signal Output	BNC socket ±5V
Hight	5cm
Width	16.5cm
Depth	12cm
Weight	0.8kg
Power	Wide range power supply 110 -230 V, exchangeable plug adapters for EU, USA, CHINA, UK
Operating Temperature	4°C to 40°C (40°F to 104°F)
Storage Temperature	10°C to 70°C (14°F to 158°F)
Operating and Humidity	20% to 80% RH, non-condensing
Mode of Operation	Continuous
Classification	Class II
Pollution	IP2X
Installation	Category

Sensor connection

The HSE sensors are connected to the HSE Universal Multi Sensor Amplifier with a 6-pin socket with screw lock. Sensors that do not have this socket might be connected using adapters or special cables. Please ask application service for further information.

6-pin Binder socket

Pin assignment
front view:



1. Supply Voltage
2. Signal
3. Unused
4. Signal
5. Supply Voltage
6. Unused

Servicing and maintenance

The HSE Universal Multi Sensor Amplifier does not require any regular service or maintenance. For the attached sensors please refer to the respective manuals.
Any splashes of salt solution should be removed immediately with a cloth to prevent corrosion damage to the metal parts, the connectors and the electronics.
For cleaning the front panel, connectors and cables never use scouring powder or cleaning agents which attack plastics or aluminium.
Any dust should be removed with a lint-free cloth or with a fine dust brush.
Heavier dirt can be removed with soapy water or a domestic cleaning agent, using a soft cloth. Then wipe up with clean water. Never allow any liquid to find its way inside the instrument or into switches or sockets.
Any spots on the aluminium front panel can be removed with an ordinary plastic rubber.
The interior of the module does not require any servicing or cleaning.

Return Shipment

To send back the amplifier it is essential to have very good packaging. It is best to use the supplied storage box together with an additional packaging around the amplifier.

Order information

Part Number	Description
73-5071	HSE Universal Multi Sensor Amplifier, custome version
73-5078	HSE Universal Multi Sensor Amplifier for HSE Sensors
73-4479	Manual Pressure Calibrator

Declaration of Conformity

Manufacturer: Hugo Sachs Elektronik-Harvard Apparatus GmbH[1]
Address: Grünstraße 1, D-79232 March-Hugstetten Germany

We herewith declare that the following products:
Product Name(s): Amplifier
Models: Multi Sensor Amplifier (73-5078 & 73-5071)

Are in conformity of the following applicable European regulations and directives:

2014/35/EU	Low Voltage directive (LVD)
2014/30/EU	Electromagnetic Compatibility directive (EMC)
2011/65/EU	Restriction on the use of certain hazardous substances directive (RoHS)[2]
2012/19/EU	Waste electrical and electronic equipment directive (WEEE)[2]

Standards used to demonstrate conformity include:

EN 61010-1:2010	Safety requirements for electrical equipment for measurement, control and laboratory use, General Requirements
EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use –EMC requirements[3]
EN 50581:2012	Assessment of products with respect to RoHS

[1]Harvard Apparatus holds an ISO 9001:2015 certificate BSI FM 629138 for its Quality Management System
[2]Classified as belonging to equipment categories 8 or 9
[3]Classified as class B equipment in accordance with CISPR 11 definition in a basic electromagnetic environment. This equipment will comply with the limits for a class A digital device, pursuant to CFR Title 47 part 15 of the FCC rules.

I, the undersigned, hereby declare that the equipment specified is in conformity with the relevant harmonised Union legislation. Signed for and on behalf of HSE at Holliston, USA

HUGO SACHS ELEKTRONIK
a division of Harvard Bioscience, Inc.

Signed:

Date:
April 22, 2020

Mark Davis
Harvard Bioscience, Director of Engineering and Quality