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Instruction Manual
IEPE Conditioning Module M33

Purpose

The IEPE Conditioning Module M33 is a signal conditioner for transducers with IEPE compatible output. It supplies the constant supply current for the sensor electronics. The unit features four gain ranges. Its wide frequency range allows both low frequency or quasi-static measurements and high frequency shock measurements. The M33 has plug-in high and low pass filters which can be replaced by a single or double integrator. The unit serves as a front end for PC based data acquisition systems or for instruments not having IEPE inputs. It can be combined with the IEPE Supply Module M29. The M33 is suited for both bench top applications and DIN rail attachment in switch cabinets. The wide supply voltage range allows power supply from external batteries, from USB voltage, from the optionally available mains plug adapter or from an industrial 24 VDC supply.

What is IEPE?

IEPE is a well-established standard for the output of piezoelectric transducers and microphones. It stands for "Integrated Electronics Piezo Electric". Other brand names for the same principle are ICP®, Isotron®, Deltatron®, Piezotron® etc. The integrated circuit of the sensor transforms the charge signal of the piezo-ceramic sensing element, with its very high impedance and high EMI sensitivity, into a voltage signal with low impedance which can be transmitted much easier.

A special feature of the IEPE electronics is that power supply and measuring signal are transmitted via the same cable. So, an IEPE transducer requires, like a transducer with charge output, only one single-ended shielded cable.

The integrated sensor electronics is supplied with constant current. This should not be confused with a 4-20 mA current loop. The constant current is fed into the signal cable of the sensor. A de-coupling capacitor keeps DC components away from the signal conditioning circuit. The constant current supply and de-coupling capacitor are part of the M33.

By supplying the sensor with constant current a positive DC offset voltage arises at the sensor output. This DC voltage depends on the manufacturer and the specimen and reaches 5 V to 14 V. Round this bias voltage the measuring signal of the transducer may oscillate. The output voltage of the transducer never changes to negative values. Its minimum value is the saturation voltage of the integrated electronics (about 1 V). The maximum value of the output voltage is limited by the supply voltage of the constant current source (24 VDC with the M33).

Device Description

Power Supply

The IEPE conditioning module M33 (Figure 1) includes the electronics to power one sensor. If more channels are needed up to 10 modules can be plugged into each other using the supplied screw-in banana plugs. The plugs interconnect the power supply of the modules.

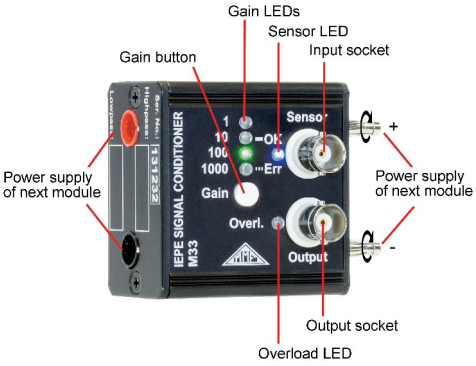

Figure 1: Functions of the M33

The M33 needs for operation a DC supply voltage between 5 and 28 V which can be, for example:

- 24 VDC industrial networks
- The optionally available mains plug adapter PS1600 for up to 5 M33
- USB voltage (5 V)
- Batteries from 5 VDC up

Power supply is connected via a DIN 45323 coaxial socket with the positive terminal at the inner contact. Alternatively the two banana sockets can be used to supply the M33 (polarity shown in Figure 1). The M33 is protected against false polarization and power transients up to 60 V. Isolation is provided between supply voltage and signal ground.

Sensor Indication

The M33 has a triple IEPE status indication by the blue LED "IEPE":

- LED permanently on: Sensor voltage in the valid range from 1 to 20 V
- LED flashes at 1 Hz: No sensor connected, sensor or cable broken
- LED flashes at 4 Hz: Sensor voltage below 1 V, sensor broken or cable shorted

Gain

The amplification factor can be selected by a push button between 1, 10, 100 and 1000. It is indicated by LEDs. The last gain setting is restored after switching power off and on.

You can lock the push button if you keep the button pressed while connecting power supply. The key lock can be released by connecting power again with the push button pressed.

An overload condition at the output or within the signal path is indicated by the LED "Overl.".

Filter and Integrator Modules

Sockets for high pass modules of FB3 type and low pass modules of FB2 type are provided. Alternatively single (FBV) or double integrators (FBD) can be inserted to measure velocity or displacement with an accelerometer.

To replace filter modules remove the four screws of the side walls and remove the cover. Figure 2 shows the filter sockets inside. Pin 1 is marked on the filters and on the printed circuit by an arrow. A low pass module is needed for operation. If no high pass module is used the jumper "HP off" has to be placed. In this case the lower frequency limit will be 0.2 Hz.

You can also insert integrator modules instead of the high and low pass filters. The jumper has to be removed when integrators are used.

The M33 case has two fields to attach filter labels on the outside.

Figure 3: Filter and integrator modules

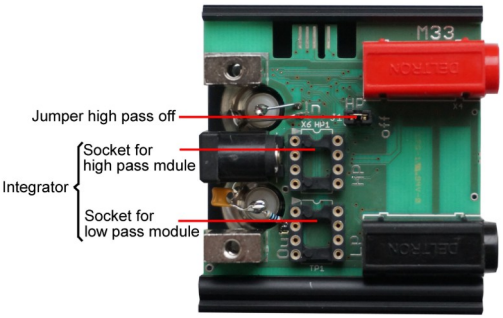

Figure 2: Filter/integrator sockets

Figures 4 to 6 show the amplitude response of the available filters and integrators. The integrators FBV and FBD have a gain of 10 at the radian frequency of 100 s^{-1} (15,915 Hz). With the single integrator FBV the gain is inversely proportional to the frequency, with the double integrator FBD it is inversely proportional to the square of the frequency. The integrators include high pass filters of 3 Hz (FBV) and 5 Hz (FBD). Low pass filters are not included.

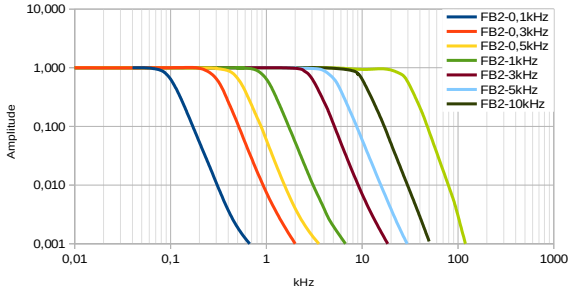

Figure 4: Amplitude response of low pass filters

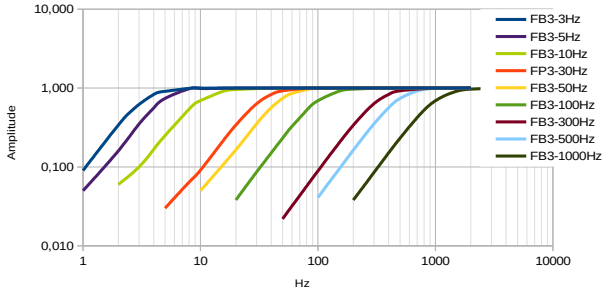

Figure 5: Amplitude response of high pass filters

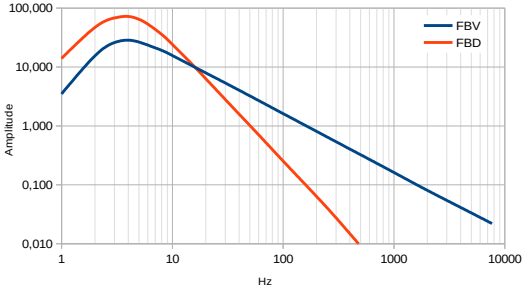

Figure 6: Amplitude response of integrators

Installation

The DIN rail adapter “M29+33DIN” is offered as optional accessory. It is attached to the unit by two M3 screws as shown in Figure 7.

Figure 7:
DIN rail adapter M29+33DIN

Technical Data

Input:	BNC; IEPE constant current source 3.5 .. 4.5 mA, bias voltage > 24 V
Output:	BNC; DC coupled, impedance 300 Ω
Gain:	1 / 10 / 100 / 1000 ± 1 %
Noise at output: (0.3 Hz to 40 kHz)	Gain 1: -100 dBV Gain 10: -80 dBV Gain 100: - 70 dBV Gain 1000: -50 dBV
Frequency range (-3 dB):	0.2 Hz to 30 kHz (with FB2-30 kHz)
High pass filter modules:	FB3-3/5/10/30/50/100/300/500/1000 Hz; Butterworth 2 poles
Low pass filter modules:	FB2-0.1/0.3/0.5/1/3/5/10/30 kHz; Butterworth 4 poles
Integrator modules:	Single integrator FBV: 3 to 10000 Hz; double integrator FBD: 5 to 1000 Hz
Output swing voltage:	± 10 V
Overload indication:	LED; at >10V peak at output and filter input
Power supply:	5 to 28 VDC; 170 to 25 mA; isolated from signal path; via coaxial power jack DIN 45323 (positive at inner contact) or 4 mm banana plug
Case:	Aluminum
Supplied accessories:	2 screw-in banana plugs for power supply connection to next module
Optional accessories:	PS1600: mains plug adapter for 100 to 240 VAC; 12 VDC/1600 mA for up to 5 units M33 M29+33DIN: 35 mm DIN rail adapter
Operating temperature:	-40 to 55 °C; 95 % rel. humidity; co condensation
Weight:	130 g
Dimensions (W x H x D):	54 mm x 55 mm x 45 mm

Warranty

Metra warrants for a period of

24 months

That its products will free from defects in material and workmanship and shall conform to the specifications current at the time of shipment. The warranty period starts with the date of invoice.
The invoice must be presented as proof of purchase.

The warranty period ends after 24 months.

Repairs do not extend the warranty period.
The limited warranty only covers defects which arise as a result of normal use according to the instruction manual.
Metra's obligations under this warranty do not apply in cases of improper or inadequate maintenance or modification and operation outside the product's specifications
Shipment to Metra will be paid by the customer.
The repaired or replaced product will be sent back to the customer at Metra's expense.

Declaration of Conformity

According to EMC Directive 2014/30/EC

Product: IEPE Conditioning Module

Type: M33

It is hereby certified that the above mentioned product complies with the demands pursuant to the following standards:

DIN EN 61326-1: 2013
DIN EN 61010-1: 2011
DIN 45669-1: 2010

The producer is responsible for this declaration

Metra Meß- und Frequenztechnik Radebeul GmbH & Co. KG
Meißner Str. 58a, D-01445 Radebeul

declared by

Michael Weber
Radebeul, January 3, 2018