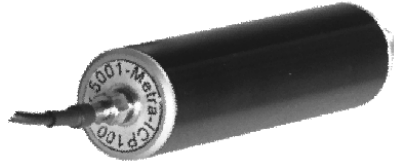




Operator's Manual

Charge Preamplifiers

ICP100 / 110 / 120



Application

The Charge Preamplifiers ICP1x0 are used for connection of piezoelectric transducers with charge output. These types of transducers are frequently given preference over ICP[®] compatible transducers because they are smaller in dimension, they have a higher dynamic range, or in case high temperature at the measuring point doesn't allow electronic circuits near to this place.

The Charge Preamplifiers ICP1x0 have an ICP[®] compatible voltage output with low impedance, the signal of which may be transmitted over long distances and processed there without any problem.

They are supplied by constant current via the output cable. Therefore, a special cable for power supply is not required.

Function

The abbreviation ICP[®] means "Integrated Circuit Piezoelectric". It has been established between many other brand names as industrial standard for piezoelectric transducers. The integrated circuit of the Charge Preamplifier transforms the charge signal of the piezo ceramics, with its very high impedance and sensitivity against interference, into a voltage signal with low impedance. This signal may be transmitted and processed much easier than the high impedance charge signal.

The distinguishing feature of the integrated circuits for impedance transformation is, that power supply and measuring signal are transmitted via the same line. Figure 1 shows the circuit diagram. For easy separation of the low impedance output signal from the power supply, the amplifier circuit is supplied with constant current. This constant current has to be fed into the measuring line.

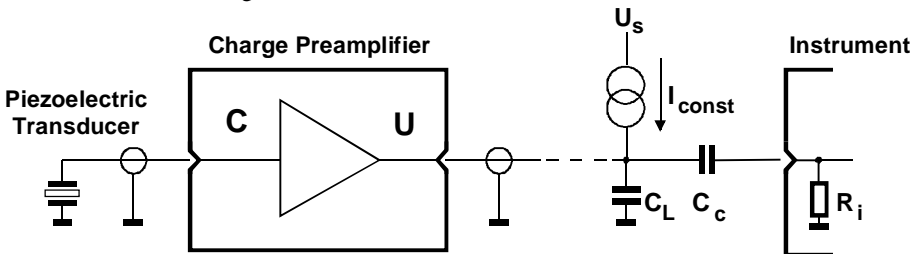


Figure 1: Principle of ICP

U_s is the supply or compliance voltage of the constant current source. C_L is the capacity of the cable. The capacitor C_c decouples the direct current share of the output voltage of the Charge Preamplifier from the following measuring instrument.

When feeding the Charge Preamplifier with constant current, a positive DC voltage arises at the output. This voltage varies in dependence of the constant current and amounts to values from 9 V to 13.5 V. Round this bias voltage the measuring signal may oscillate with an amplitude of ± 3 V. The maximum voltage at the output of the Charge Preamplifier, consequently, is the sum of the maximum bias voltage and the maximum modulation: $U_{\text{amax}} = 13.5 \text{ V} + 3 \text{ V} = 16.5 \text{ V}$. Therefore, the voltage of the power supply has to be higher than this voltage, that means, the voltage of the constant current source has to be higher than 16.5 V. Many measuring instruments are already equipped with ICP[®] compatible inputs with constant current source and coupling capacitor. The Sensor Supply Units Type M27 and M31 and the Measuring Amplifiers of Metra's M67 Series, for instance, are well suited for constant current supply and decoupling the measuring signal.

The output voltage of a measuring chain consisting of piezoelectric accelerometer and Charge Preamplifier is the product of the acceleration at the measuring point (a), the charge sensitivity of the transducer (B_{qa}), and the gain of the Charge Preamplifier (B_{uq}):

$$U_a = a \times B_{\text{qa}} \times B_{\text{uq}} .$$

Connection

The piezoelectric transducer is connected to the Charge Preamplifier via an UNF 10-32 socket. Because of the high sensitivity of the charge input against interference it is recommended to use special low noise cable only, for example Metra's Type 009 or 010. With other cable the shielding effect is often insufficient. At mechanical strain, for example bending strain, an interfering signal, as the result of the so-called triboelectrical effect, may falsify the measuring value. At special low-noise cable material this effect has been minimized by coating the dielectric with a conducting plastic layer.

The length of the cable between accelerometer and Charge Preamplifier has to be chosen in any case as short as possible. A length of more than 10 m is not recommended.

The input of the Charge Preamplifier is protected against overvoltage pulses up to 1000 V. Such pulses may occur at shock load of accelerometers with charge output.

The cable between the Charge Preamplifier and the measuring instrument, however, may have a length of more than some 100 m. It is connected to the Charge Preamplifier through a BNC socket. Normal coaxial cable is sufficient for this purpose. You have to pay attention only to a low inner capacity of the cable. The mentioned data refer to an inner cable capacity of $C_1 < 10$ nF. This corresponds for example to a length of about 100 m of standard cable material with a diameter of 5 mm, offered by Metra. A higher cable capacity is possible, but it reduces the dynamic range at higher frequencies.

Mounting

For fixing the Charge Preamplifier, a pipe or cable clip (22 mm) is recommended. Doing this, pay attention to the fact, that the case of the Charge Preamplifier is grounded.

Technical Data

Gain (B_{uq})	
ICP100:	0.1 mV/pC \pm 2 %
ICP110:	1 mV/pC \pm 2 %
ICP120:	10 mV/pC \pm 2 %
Frequency range ($C_I < 10$ nF):	0.25 .. 25 000 Hz (-3dB) 0.4 .. 12 000 Hz (-10%)
Input:	Charge input, UNF 10-32 socket
Overvoltage input protection:	up to 1000 V pulse
Output:	ICP [®] compatible, BNC socket
Dynamic range at the output: ($C_I < 10$ nF)	$> 6 V_{p-p} / 2.3 V_{rms}$; at higher load capacity the dynamic range decreases at higher frequencies
Output impedance:	$< 50 \Omega$
Output bias voltage:	9 .. 13.5 V
Distortion factor ($C_I < 10$ nF):	< 0.5 %
Noise floor at the output at 25°C:	$< 200 \mu V$
Power supply:	Constant current 4 .. 20 mA Compliance voltage > 16.5 V
Gain stability in dependence of supply current:	< 0.05 % / mA
Operating temperature range:	-20 .. 80 °C
Case:	Aluminum, lateral surface anodized, grounded
Dimensions without sockets:	72 mm x 22 mm (1 x \emptyset)
Weight:	35 g

Limited Warranty

Metra warrants during a period of
24 months

that its products will be free from defects in material or workmanship and shall conform to the specifications current at the time of shipment.

The warranty period starts with the date of invoice.

Customer has to provide the dated bill of sale as evidence.

The warranty period ends after 24 months. Repairs do not extend the warranty period.

This limited warranty covers only defects which arise as a result from normal use according to the instruction manual. Metra's responsibility under this warranty does not apply to any improper or inadequate maintenance or modification and operation outside the product's specifications.

Shipment to Metra has to be paid by the customer.

The repaired or replaced product will be sent back at Metra's expense.



Declaration of Conformity

Product: Charge Preamplifier

Models: ICP100 / 110 / 120

Hereby is certified that
the above mentioned products
comply with the demands
of the following standards:

- EN 50081-1
- EN 50082-1

Responsible for this declaration is the producer

Metra Mess- und Frequenztechnik

Meißner Str. 58

D-01445 Radebeul

Declared by
Manfred Weber
Radebeul, 3rd of August, 1997