

Charge Amplifier

Type 5011B...

Single-channel multi-range laboratory charge amplifier

The mains-operated, microprocessor controlled single-channel charge amplifier Type 5011B... converts the electrical charge produced by piezoelectric sensors into a proportional voltage signal.

- Large measuring range
- Wide frequency range
- Automatic zero correction
- Adjustable low-pass filter and time constant
- Various options and versions provide optimum adaptation to the measuring problem
- Conforming to CE

Description

The main features of the instrument are its continuous measuring range adjustment range from $\pm 10 \dots \pm 999\,000$ pC and convenient adjustment of the parameters with a two-line LC display. The values entered are retained in the event of an interruption in the power supply.

A built-in IEEE-488 parallel interface or a serial RS-232C interface is available as an option. This enables all set values to be entered or queried. Transmission of data measured is not possible.

The version ...Y50 additionally has a drift compensation and is used in engine measuring technology with uncooled sensors

Application

This amplifier serves mainly to measure mechanical quantities, e.g. pressure, force or acceleration.

The instrument dimensions are DIN standardized and it can be supplied in a desktop or rack mount case.



The principle measurement without calculation:

- Set sensor sensitivity
- Select display scale
- Sensor sensitivity and scale are displayed
- Set the signal output of the data acquisition unit (recorder, oscilloscope...), for example to 1 V/unit (1 V/cm)
- The display appears directly in mechanical units according to the display scale selected

Technical Data

Basic unit

Measuring range for 10 V FS	pC	±10 ... ±999 000
Sensor sensitivity [T] (M.U. = Mechanical units)	pC/M.U.	±0,01 ... ±9 990
Scale [S]	M.U./V	0,001 ... 9'990'000
Output voltage	V	±10
Output current (short-circuit protected)	mA	±5
Output impedance	Ω	10
Frequency range (-3dB, Filter "OFF")	kHz	≈0 ... 200
Low-pass filter upper cutoff frequency -3dB Butterworth, 2 pin 8 stages (1, 3, 10 ...)	kHz (%)	0,01 ... 30 (±10)
Time constant [TC] (high pass filter)		
Long	s	>1 000 ... 100 000
Medium (T = R _g ·C _g)	s	1 ... 10 000
Short (T = R _g ·C _g)	s	0,01 ... 100
Error		
<±100 pC FS (max./typ.)	%	<±3/<±2
≥±100 pC FS (max./typ.)	%	<±1/<±0,5
Linearity	% FS	<±0,05
Noise	mV _{rms}	<0,5 (<1,5)
9,99 pC/V (1 pC/V)	mV _{pp}	<4 (<8)
Loss due to cable capacitance	pC _{rms} /pF	<2·10 ⁻⁵
Drift at 25 °C	pC/s	<±0,07

General Data

Operating temperature range	°C	0 ... 50
Connections		
Measuring input/signal output	–	BNC negative
Remote control (Operate, Overload, ...)	–	Connector 6 pin DIN 45322
Power plug	–	IEC 320 C 14
Conformity to EC Directive		
Safety	–	EN 61010-1
EMC Interference Emission	–	EN 50081-1/EN 50081-2
EMC Interference Immunity	–	EN 50082-1/EN 50082-2
Power, switchable (Protection class I)	VAC (%) Hz (VA)	230/115 (-22/+15) 48 ... 62 (20)
Voltage between protection and measuring ground	V _{rms}	<50
Dimensions		
with desktop case Type 5747A1	mm	94x141x195
for rack mounting	mm	71,12x128,7x169
Front panel according to DIN 41494 (Part 5)	HE (mm) TE (mm)	3 (128,7) 14 (71,12)
Weight (incl. IEEE-488 or RS-232C)	kg	≈2

Version ...Y50, Drift compensation; at [TC] setting "Drco"

Time constant [TC] (High-pass filter)		
Long	s	>1 000 ... 100 000
Drco	–	Driftcompensation
Short (T = R _g ·C _g)	s	0,01 ... 100
Driftcompensation; at [TC] setting "Drco"		
Range for ±10 V FS	pC	±100 ... ±999 000
Zero point error	mV	<±20
Max. Error in signal repetition frequency range	%	<1
Signal repetition frequency range	Hz	5 ... in dependence of the selected low-pass filter

Option: Parallel Interface IEEE-488 Type 5605A

Standardized interface with IEC 625-1 electrically compatible for remote control and checking of all parameters. Measured data are not transmitted.

Standard used	Type	IEEE-488-1978
Max. distance between 2 instruments	m	2
Max. bus length	m	20
Max. number of instruments on the bus	–	15
Address range	–	30
Functions	–	Listener, Talker

Option: Serial Interface RS-232C Type 5611A

Standardized interface for remote control and checking of all parameters. Measured data not transmitted.

Standard used	Type	RS-232C resp. V24
Max. cable length	m (pF)	20 (2 500)
Baud rates	Baud	50, 110, 250, 300, 600, 1 200, 2 400, 4 800
Number of data bit	Bit	7 or 8
Number of stop bit	Bit	1 or 2
Parity	–	without, even or odd
Software protocol	XON/XOFF	not allowed

Functional description

The charge signal to be measured (Charge Input) is fed to the inverting amplifier (OP1), which features high internal gain and extremely high input impedance (Fig. 2). C_g provides negative feedback and thus acts as an integrator for the charge to be measured. The C_g capacitance determines the charge measuring range according to the approximation formula $Q = C_g \cdot U_1$.

A voltage U_1 then appears at the output of OP1 proportional to the charge and thus to the mechanical measurand.

When a purely dynamic measurement is involved, one of the two time constant resistors R_g can be connected in parallel with the range capacitor C_g . This avoids problems of drift such as can occur in quasi-static measurements.

A shorting switch in the negative feedback branch of OP1 is used to discharge the range capacitor C_g thereby preparing the instrument for a new measurement (Reset function, $U_1 \rightarrow 0$).

Any remaining zero deviation is compensated by a special circuit (zero compensation) in the Reset condition. The voltage signal U is brought to the value calculated by the instrument with a digital voltage divider (12 bit DAC).

The adjustable 8-stage low-pass filter (LP filter) reduces in the upper frequency limit as required.

An 8 bit microprocessor circuit (μP) controls and monitors the entire instrument. The software is stored in an EPROM; the set values in a battery-backed NOVRAM.

The following functions are available through the remote control connections (Remote Control) without optional interface:

- Reset/Operate switching
- Reset overload signal
- Display: Overload
- Display: Zero out of Limit

Version ...Y50

The charge amplifier version ...Y50 additionally has a drift compensation and is used in engine measuring technology with uncooled sensors. The drift compensation detects drift as a slowly changing signal. This slow change in a positive and negative direction is compensated by means of a closed-loop control in the circuitry. This compensation keeps the reference line on zero (Fig. 1).

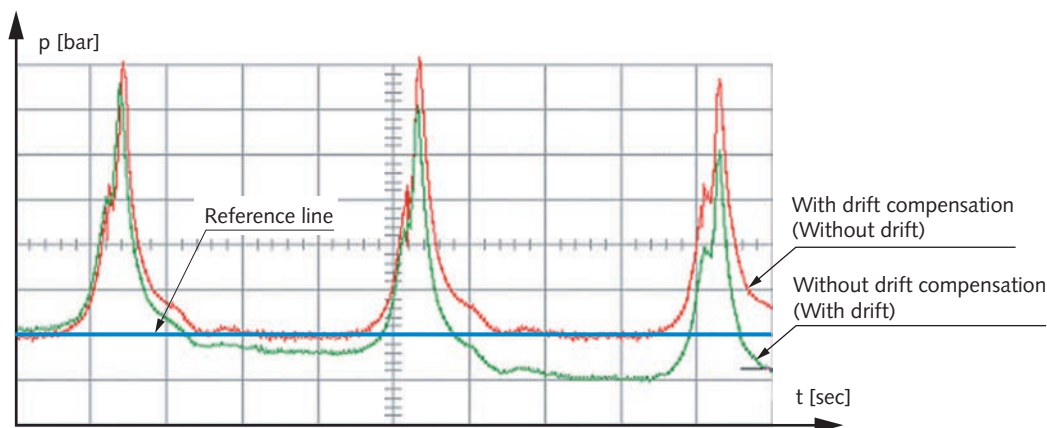


Fig. 1: Pressure measurement of the charge amplifier with and without drift compensation ...Y50

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Block diagram

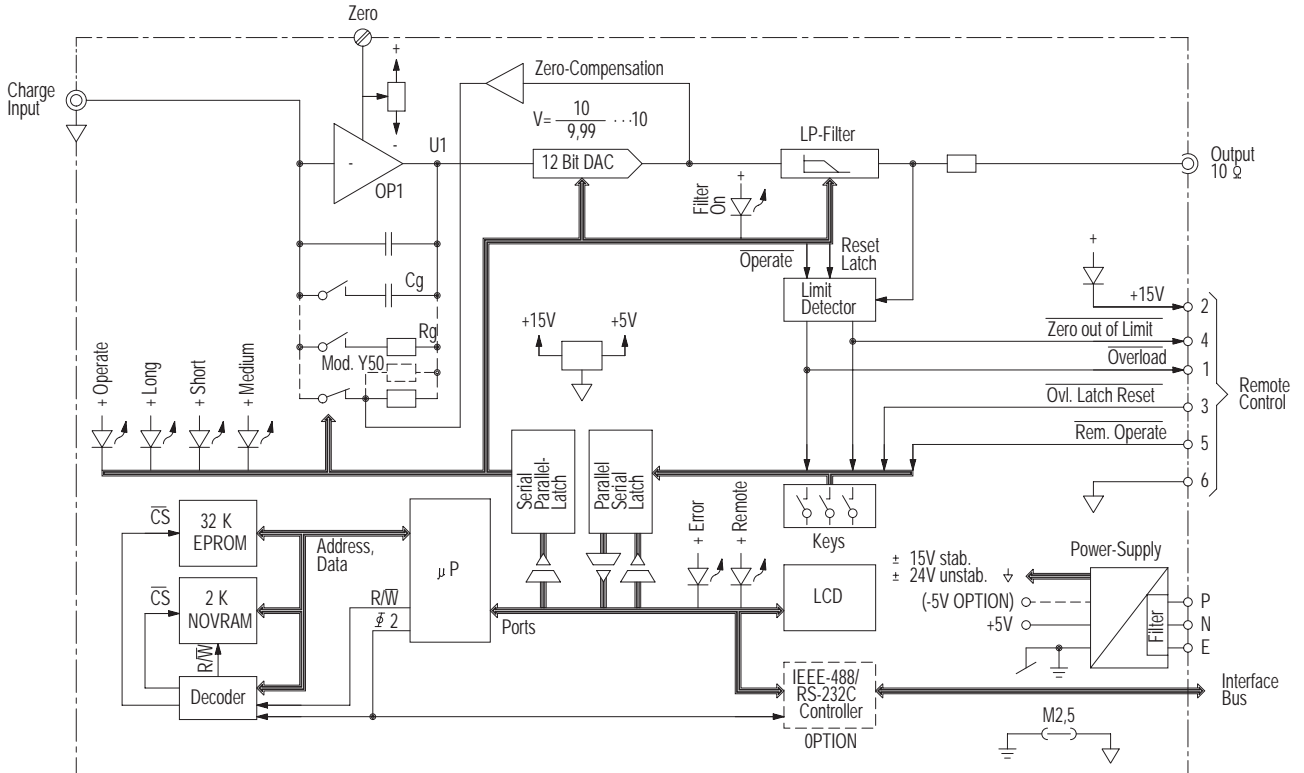


Fig. 2: Block diagram of charge amplifier Type 5011B...

Cable wiring for the RS-232 C interface

Without control signals for transmission up to 1200 baud
(S = Socket, P = Plug)

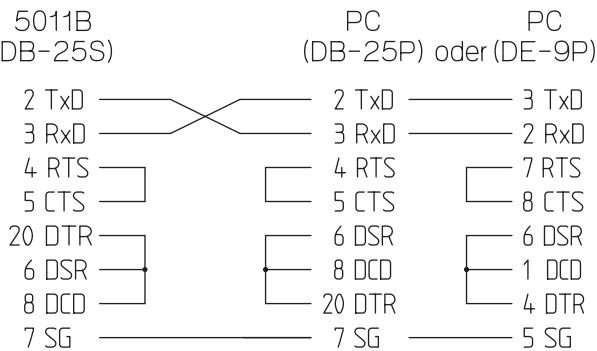


Fig. 3: Pin configuration for RS-232 C interface without control signals

With control signals for transmission up to 2 400 ... 4 800 baud
(S = Socket, P = Plug)

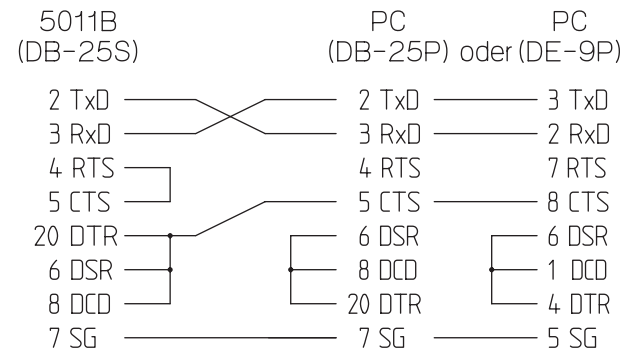


Fig. 4: Pin configuration for RS-232 C interface with control signals

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Dimensions

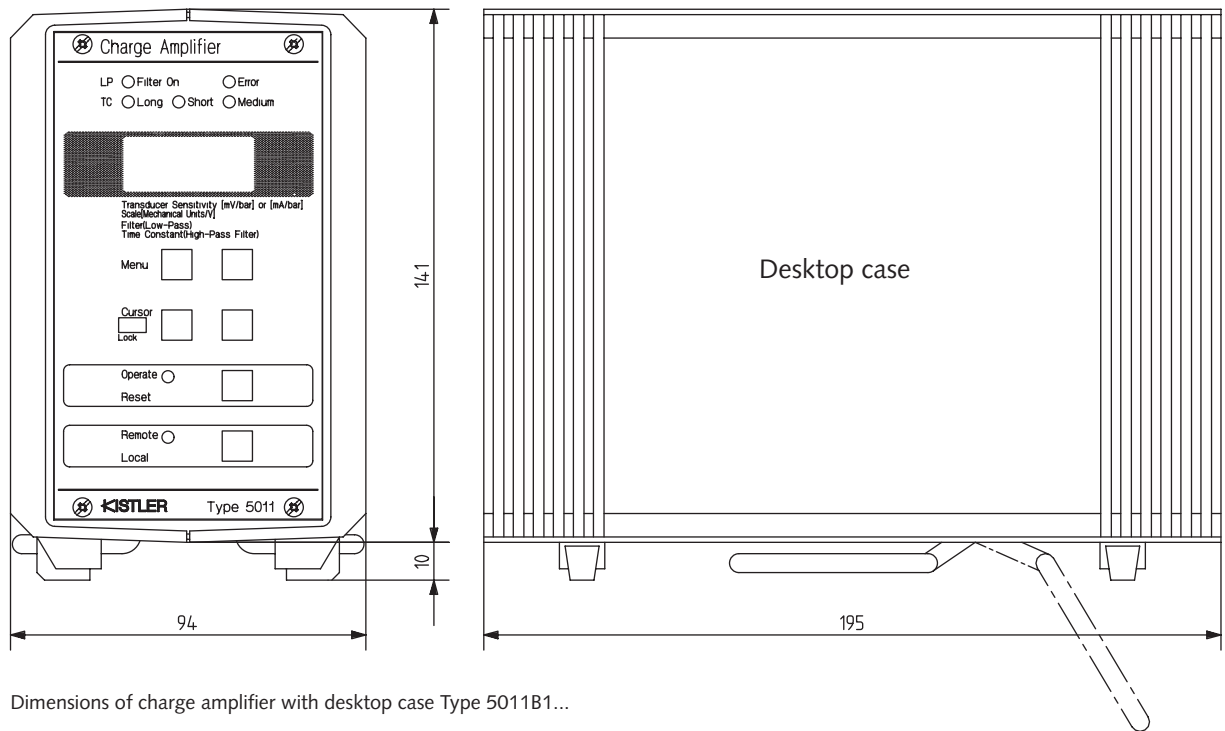


Fig. 5: Dimensions of charge amplifier with desktop case Type 5011B1...

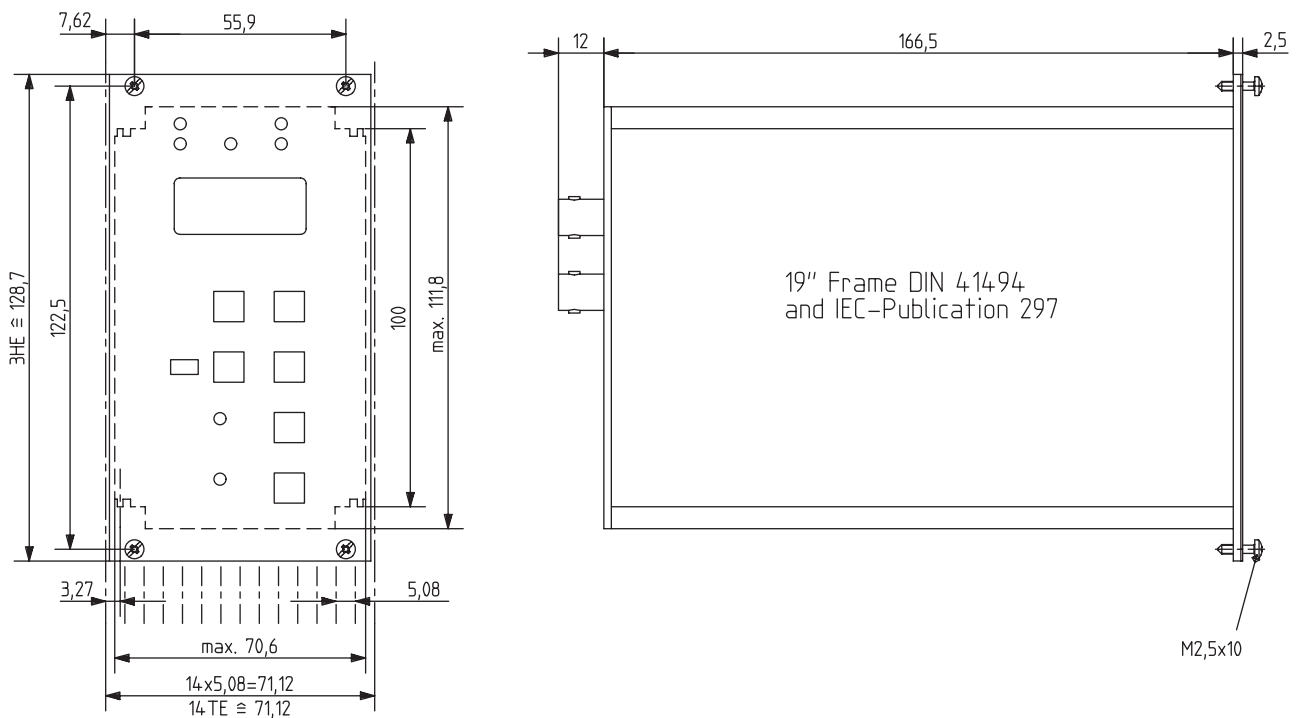


Fig. 6: Dimensions of charge amplifier for rack mounting Type 5011B0...

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Accessories Included

- BNC/BNC cable
- Power cable

Optional Accessories

- Connecting cable for remote control length 5 m (Data sheet 000-349)
- Remote control box (Data sheet 000-339)
- Connector for remote control connection 6 pin per DIN 45322 (Data sheet 000-349)
- RS-232C cable, length 3 m, with Hardwired-Handshake DB-25 P/DB-9 S
- RS-232C adapter DB-9 P/DB-25 S

Type/Art. No.
1601B

Type/Art. No.
1455A5

5663

1564

1475A3

1469

Ordering Key

Case

For rack mounting	0
With desktop case	1

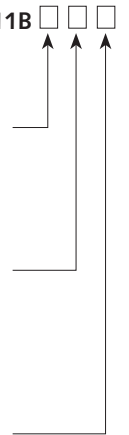
Interface

Without Interface	0
With parallel interface IEEE-488 (Type 5605A)	1
With serial interface RS-232C (Type 5611A)	2

Version

Charge amplifier set to 115 VAC power supply*	Y26
Charge amplifier with drift compensation	Y50

Type 5011B



*Supply voltage setting can be changed at any time

Ordering Example: Type 5011B10Y26Y50

This is a charge amplifier of the basic Type 5011B... with desktop case, without integral interface, set to 115 VAC supply with drift compensation.