

Charge amplifier

Type 5018A...

Single-channel laboratory charge amplifier

This universal laboratory charge amplifier can be used for signal conditioning of all piezoelectric pressure sensors. The amplifier converts the charge signal from the sensor into a proportional output voltage.

- Single-channel charge amplifier
- Drift compensation for engine combustion applications
- Piezotron input (option)
- Wide measuring range
- Direct signal evaluation
- Automatic sensor identification PiezoSmart
- Automatic recording of sensor operating hours and pressure cycles when using PiezoSmart sensors
- USB- and RS-232C interface for remote control
- Liquid crystal display and menu-driven handling

Description

The Type 5018A... is the successor to the charge amplifier Type 5011B... . The operating modes are Short, Medium, Long and DrCo (drift compensation). Drift compensation will be applied when measuring the cylinder pressure to compensate any occurring drift.

The Charge Amplifier is available in different versions with:

- automated sensor identification PiezoSmart
- Voltage input for sensors with integrated Piezotron circuit

When using PiezoSmart, the individual sensor parameters of the measuring chain are set automatically. The main element of PiezoSmart is an electronic data sheet called TEDS (TEDS = Transducer Electronic Data Sheet) which is fixed attached to the sensor. This TEDS chip contains all the essential data of an individual pressure sensor.

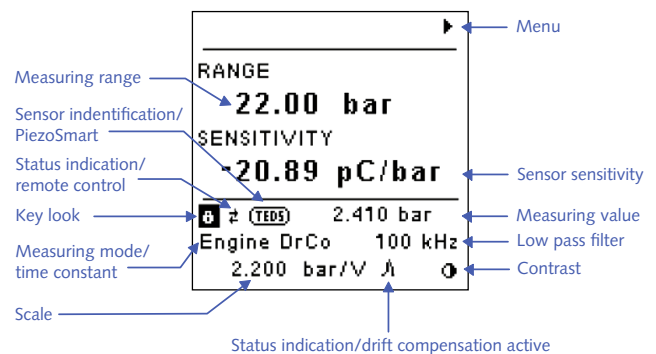
Another feature is the ability to determine when a cylinder pressure sensor is exposed to operating conditions. When utilized in conjunction with a PiezoSmart sensor, important information such as pressure cycles and run time can be calculated and automatically saved to the TEDS chip. This information can be used as part of a resource management program to determine calibration frequency and inventory control.

Application

This Charge Amplifier was developed specifically for use with piezoelectric pressure sensors in modern internal combustion engines. In addition, it is well suited for general applications in research, development and the laboratory.



Operation



Technical data

Charge input

Connector Type	BNC neg. or TRIAX pos.	
Measuring range FS	pC	±2 ... 2 200 000
Measurement uncertainty 20 ... 28°C		
Ranges FS < 10 pC	%	<±1
Ranges FS < 100 pC	%	<±0.5
Ranges FS ≥ 100 pC	%	<±0.1
Measurement uncertainty 0 ... 50°C		
Ranges FS < 10 pC	%	<±2
Ranges FS < 100 pC	%	<±0.6
Ranges FS ≥ 100 pC	%	<±0.3
Drift, measuring mode DC (Long)		
at 25°C, max. relative Humidity RH of 60% (non-condensing)	pC/s	<±0.03
at 50°C, max. relative Humidity RH of 50% (non-condensing)	pC/s	<±0.3
Max. common mode voltage between input and output ground	V	<±25
Overload	%FS	≈ ±110

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Optional voltage input (Piezotron)

Connector Type	BNC neg.	
Measuring range FS	mV	±20 ... 30 000
Measurement uncertainty 20 ... 28°C		
Range FS < 100 mV	%	<±1.5
Range FS < 1 V	%	<±0.8
Range FS ≥ 1 V	%	<±0.1
Measurement uncertainty 0 ... 50°C		
Range FS < 100 mV	%	<±3
Range FS < 1 V	%	<±1
Range FS ≥ 1 V	%	<±0.5
Max. common mode voltage between input and output ground	V	<±25
Overload	%FS	≈ ±110
Piezotron mode		
Supply current (adjustable)	mA/%	1/±20
	mA/%	2 ... 15/±10
Input voltage swing	V	0 ... 30

Voltage output

Connector	Type	BNC neg.	
Output range FS	V	±10 / −8 ... 10	
Output current	mA	0 ... ±2	
Output impedance	Ω	≈ 10	
Measure-jump			
Measure-jump (Long)	compensated		
Correction time, inclusive reed-relay delay time	ms	<15	
Offset error (Reset)	mV	<±2	
Output interference (0.1 Hz ... 1 MHz), Charge Mode			
Range FS, LP-filter off (200 kHz)			
2.000 ... 9.999 pC	mVpp	typ./max.	25/40
10.00 ... 99.99 pC	mVpp	typ./max.	8/12
100.0 ... 2 200 000 pC	mVpp	typ./max.	4/8
Dual Mode output interference (0.1 Hz ... 1 MHz), Piezotron Mode			
Range FS, LP-filter off (200 kHz)			
Gain 1 (Range FS 10V)	mVpp	typ./max.	4/8
Gain 2 (Range FS 5V)	mVpp	typ./max.	6/12
Gain 10 (Range FS 1V)	mVpp	typ./max.	10/20

Frequency response

DC (Long), TP-filter off			
Frequency range (-3 dB)	kHz	≈ 0 ... 200	
Group delay	μs	≈ 2	

Time constants

Time constants for Short/Medium			
Range FS Charge, (Voltage)			
≥ 2 pC ... < 217 pC	s	≈ 0.033/3.3	
(≥ 20 mV ... < 2 170 mV)			
Short/Medium			

≥ 217 pC ... < 4 717 pC (≥ 2 170 mV ... < 47 170 mV)	s	≈ 0.42/42
Short/Medium		
≥ 4 717 pC ... < 102 400 pC	s	≈ 10/1 000
Short/Medium		
≥ 102 400 pC ... ≤ 2 200 000 pC	s	≈ 220/22 000
Short/Medium		
Time constants for Long		
Range FS Charge, (Voltage)		
< 217 pC (< 2 170 mV)	s	≈ 10 000
≥ 217 pC ... ≤ 2 200 000 pC (≥ 2 170 mV ... ≤ 30 000 mV)	s	≈ 100 000

Drift compensation (DrCo)

Working range	1/min	≈ 100 ... 20 000	
Compensation range	pC/s	≈ ±8 ... ±280	
Operating range	pC	±50 ... ±2 200 000	

Low-pass filter

Selectable low-pass filter			
Filter Type	Butterworth		
Order	2.		
Cutoff frequency (-3 dB)	Hz	10, 20, 30, 100, 300, 600	
	kHz	1, 2, 3, 6, 10, 22, 30, 60, 100, (LP off)	
Tolerance	%	< ±10*	

*(@ 6 kHz < ±15%)

Refresh rate LCD

Instant value	s	0.3	
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Remote control

Connector	Type	MiniDin round socked
Pin allocation		
Inputs with internal pull-up resistor		
Pin 5 (input)		/Remote measure
Pin 6		DGND
Input voltage		
logic inactiv		
input open or	V	3.5 ... 30
logic activ	V(mA)	0 ... 1 (0 ... 4)
Delay time		
Measure (remote)	ms	< 15

Sensor identification

TEDS according to IEEE 1451.4	-	-	
Max. length for TRIAX extension cable	m	10	
Temperature range for PiezoSmart-coupling	°C	-20 ... 85	

RS-232C interface (electrically separated)

EIA/TIA-standard		RS-232C
Connector Type		DB-9S (D-Sub)
Pin allocation		
Pin 2		RxD
Pin 3		TxD
Pin 5		GND RS
Max. cable length at		
1 200 bps	m	<15
9 600 bps	m	<15
19 200 bps	m	<15
38 400 bps	m	<12
57 600 bps	m	<10
115 200 bps	m	<5
Max. input voltage, continues	V	<±20
Baud rates	bps	1 200/9 600/ 19 200/38 400/ 57 600/115 200
Data-bit		8
Stop-bit		1
Parity		none
SW handshake		none

USB 2.0-full speed-interface

Connector Type	USB	Type B
max. cable length	m	5

Power supply connection

Power plug (2P+E, protection class I)		IEC 320C14
Supply voltage setable	VAC	115/230
Supply voltage tolerance	%	–22, +15
Supply frequency	Hz	48 ... 62
Consumption	VA	≈ 20
Voltage between Signal ground and protective ground	V _{RMS}	max. 20

General data

Degree of protection (IEC 60529)	IP	40
Temperature range	°C	0 ... 50
min./max. temperature	°C	–10/60
Vibration resistance (20 Hz ... 2 kHz, duration 16 min, cycle 2 min.)	g	<10
Shock resistance (1ms)	g	<200
Housing dimensions		
with frame (BxHxT)	mm	105.3x142x253.15
without frame (BxHxT)	mm	71.12x128.7x230
Front panel (according DIN 41494, part 5)	HT/TE	3/14
Weight	kg	≈ 2.3

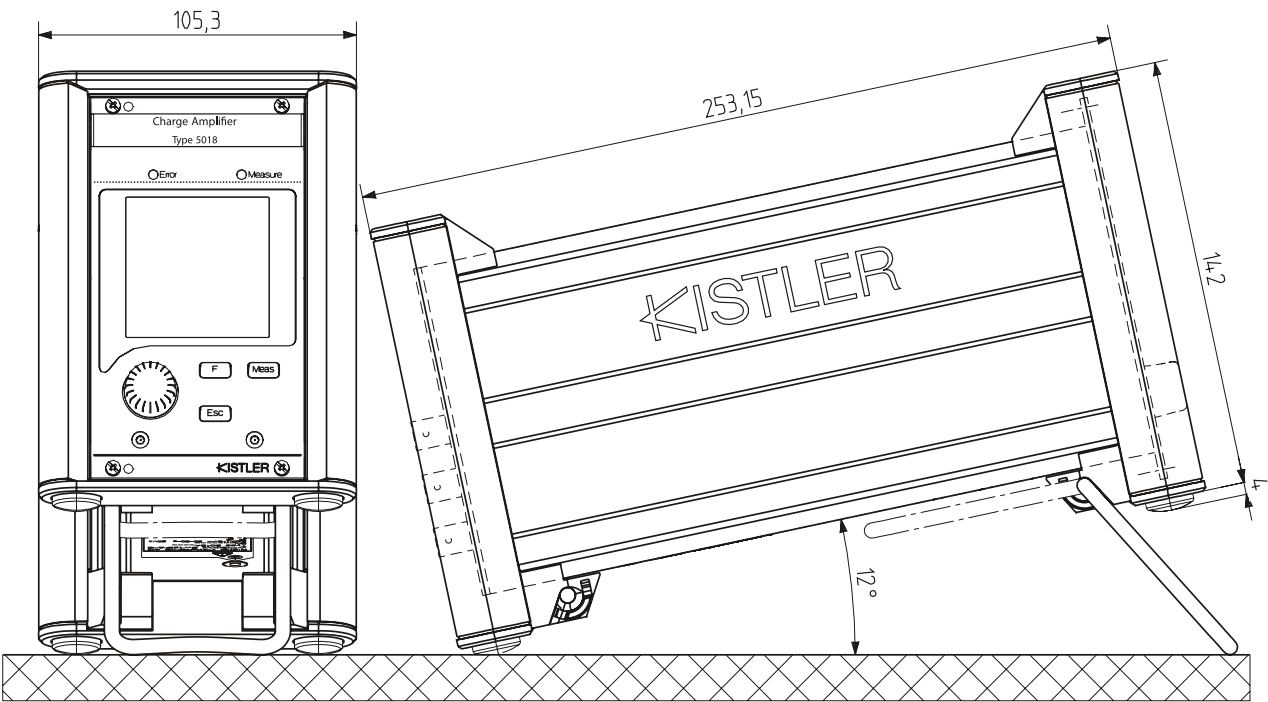


Fig. 1: Desktop Type 5018A1... (stackable)

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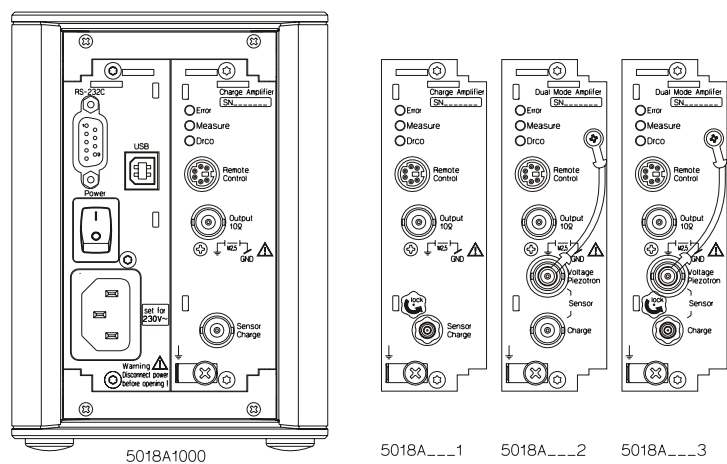


Fig. 2: 5018A... variation of types

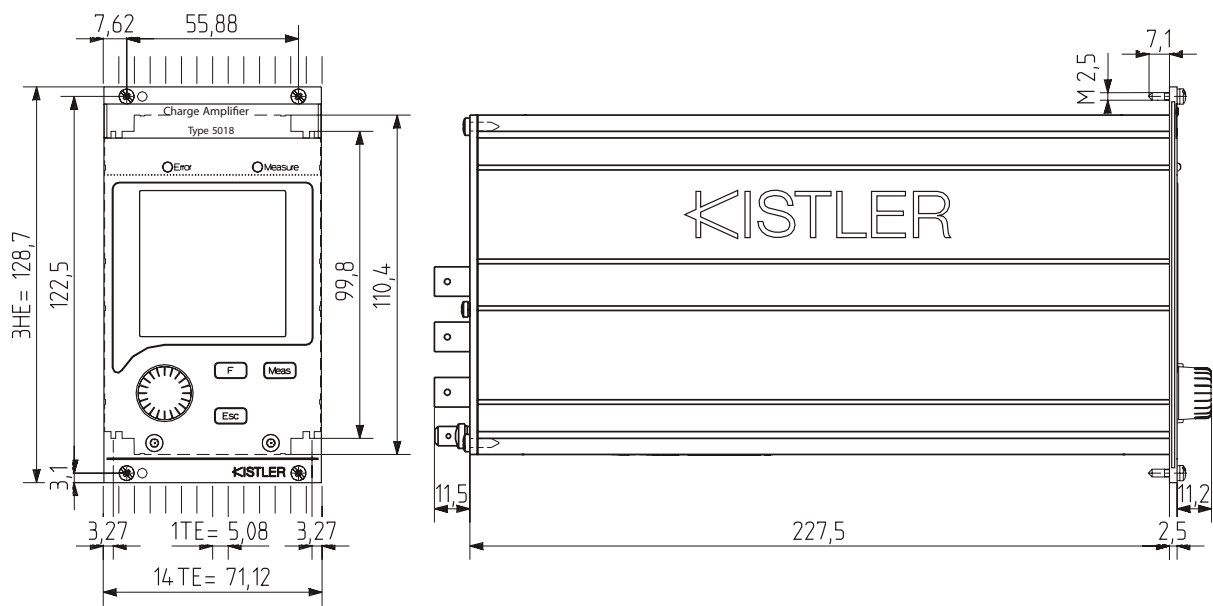


Fig. 3: 19"-Rack plug-in Type 5018A0...

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Included accessories

- Charge Amplifier Type 5018A... with
- Country-specific power cord
 - USB connecting cable Type A to B; length 1.8 m Type 5.590.303
 - Plug for 'Remote Control' Type 5.510.305
 - Calibration sheet
 - Adapter BNC neg. → TRIAX neg. Type 1704A1 (only for Type 5018A...1 and 5018A...3)

Instrument configurations

The complete type designation of the Charge Amplifier is made up of the basic type designation Type 5018A... and four additional digits.

The basic type contains a single-channel Charge Amplifier (with charge input for piezoelectric sensors) with display unit and USB 2.0 as well as RS-232C interface in the following versions:

Optional accessories	Type/Art. No.
• RS-232C cable, l = 5 m, null-modem, DB-9P/DB-9S	1200A27
• Connecting cable BNC pos. – BNC pos. (L = ... m)	1601B...
• Extension cable TRIAX neg. – TRIAX pos. (L = ... m)	1987B...

Ordering key

		Typ 5018A			
		□	□	□	□
		↑	↑	↑	↑
19" rack module version according to DIN 41494; width 14 TE and height 3 HE	0				
Desktop version with support bracket	1				
USB and RS-232C interface	0				
Charge Amplifier set to 230 VAC power supply*	0				
Charge Amplifier set to 115 VAC power supply*	1				
Charge Amplifier with BNC input	0				
Charge Amplifier with TRIAX input (PiezoSmart)	1				
Charge Amplifier with BNC input and voltage input for sensors with integrated Piezotron circuitry	2				
Charge Amplifier with TRIAX input (PiezoSmart and voltage input for sensors with integrated Piezotron circuitry)	3				

* Supply voltage setting can be changed at any time.