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Handheld charge amplifier and insulation tester

Type 5811A00...

Portable, battery-powered handheld device with integrated data acquisition

This universal handheld device can be used wherever mechanical quantities are measured with piezoelectric sensors. Piezoelectric sensors produce an electric charge which varies in direct proportion with the load acting on the sensor. The amplifier converts this charge directly into digital values or a proportional output voltage. The battery-powered device is designed for environments and applications where the use of a line-powered charge amplifier in combination with a host computer for visualization and data acquisition of the measurement signal is not suitable. Additionally the handheld device acts also as a service tool for testing the insulation of piezoelectric measuring chains (sensor and cable) as part of regular maintenance work to verify sensor and cable quality.

- 1-channel handheld charge amplifier for piezoelectric sensors
- Insulation tester for piezoelectric measuring chains (sensors and cables)
- 4.3″ touchscreen display for simple configuration and control
- Tactile buttons for main controls allow operation with gloves
- Integrated data acquisition with up to 50 kSps
- Fully flexible low-pass and high-pass filter adjustment
- Trigger input/analog output for interaction with external systems
- Robust housing with IP54 protection for harsh environments
- Impact protection to prevent damage to housing and connectors
- Mounting lugs for convenient carrying using a shoulder strap
- Integrated rechargeable and replaceable battery
- USB-C port for battery charging and data exchange
- LED for indication of battery charging and device status

Description

The handheld device Type 5811A00... is not only a portable, battery-powered charge amplifier for quasi-static and dynamic signals, but also a powerful data acquisition system that stores the digitized measurement values directly on the device allowing to export the data to a host computer via its USB interface. The integrated insulation tester functionality makes it possible to test the insulation of piezoelectric measuring chains (sensors and cables) and to store the results on the device for documentation purposes.

The device is configured and operated via an intuitive user interface on a touchscreen display which is supplemented by side buttons to allow operation with gloves of the main controls. The graphical user interface not only provides a simple and intuitive way to configure the device but also displays various measurement values (e.g. live value, peak value, root mean square value) as well as the measurement curve in a y/t graph. An evaluation view allows to check if the measured process signal is within user defined limits. The insulation tester not only indicates the measured insulation value but also visualizes the result in a gauge graph with user defined limits for easy determination of good and bad results.

Furthermore, the handheld device can store presets of user generated measurement configurations. This not only allows to quickly change between repeatedly executed tasks, but it also ensures that these tasks are executed with identical settings, resulting in consistent data.

Application

With its ability to measure quasi-static and dynamic signals, the handheld device Type 5811A00... is not only suitable for force measurements but also acceleration & vibration and pulsating pressure measurements below 20 kHz in various applications in the industrial sector, laboratory as well as in research and development.

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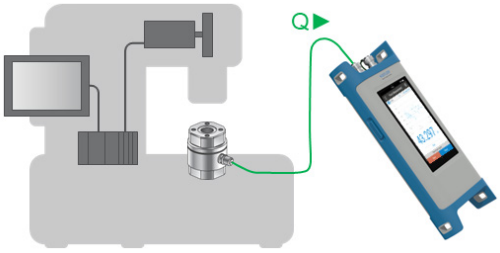
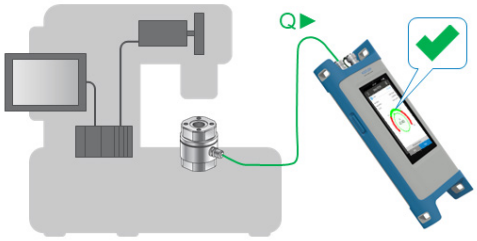
Following some typical use cases the handheld device Type 5811A00... is suitable for:

Portable test and measurement device



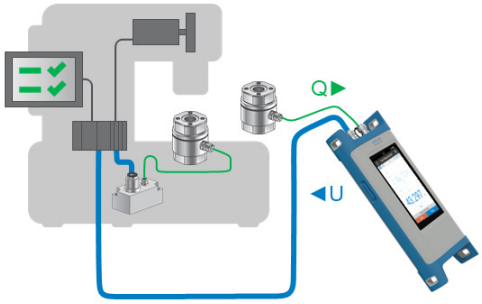
The handheld allows easy on-site measurement and signal recording without the need for a power source. The wide measurement range and powerful signal conditioning make it a great tool for test measurements and data acquisition for subsequent investigations to determine on-site measuring chain requirements.

Reference tool for process verification test



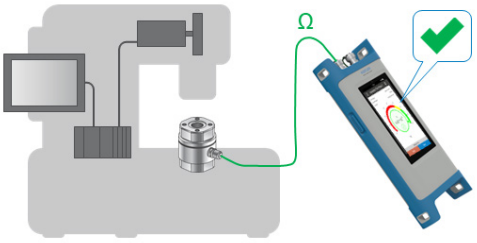
The evaluation mode allows periodic testing of a process according to user defined limits and visualization of the measurement in a customizable gauge graph with colors and texts. The results can be stored on the handheld device for documentation purposes, with the possibility of export them to a PC.

Closed-loop reference measurement



In combination with the accredited calibration service for handheld and sensor, the handheld can be used as a reference measuring device for checking correct machine operation. The integrated voltage output can be used to feed back the measured reference signal to the process control system.

Sensor and cable insulation test



The insulation tester allows to check the condition of the sensor and cable on site, thus ensuring a functioning measuring chain. The results can be stored on the handheld device for documentation purposes, with the possibility of export them to a PC.

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Technical data

Connections

Number of channels		1
Charge input / insulation tester input connector type		BNC neg.
Voltage output / ext. trigger input connector type		BNC neg.
USB interface connector type		USB-C socket

Charge input (shared connector with insulation tester input)

Measuring ranges	pC	±100 … 1 000 000
Frequency range (–3dB)		
≤10 000 pC	Hz	≈0 … >20 000
>10 000 pC	Hz	≈0 … >10 000
Input noise (typ.), battery powered		
1 Hz ... 20 kHz		
1 000 pC	pC_{rms}	0.15
10 000 pC	pC_{rms}	0.33
100 000 pC	pC_{rms}	6.0
1 000 000 pC	pC_{rms}	20
1 Hz ... 10 kHz		
1 000 pC	pC_{rms}	0.13
10 000 pC	pC_{rms}	0.27
100 000 pC	pC_{rms}	5.0
1 000 000 pC	pC_{rms}	16
Drift, measuring mode DC (Long)		
at 25°C, max. relative humidity RH of 60% (non-condensing)	pC/s	<±0.03
at 25°C, max. relative humidity RH of 70% (non-condensing)	pC/s	<±0.05
at 50°C, max. relative humidity RH of 50% (non-condensing)	pC/s	<±0.2
Measure-jump		Compensated
Measure-jump	pC	<±0.5
Correction time	ms	<20
Deviation		
Measuring range <1 000 pC	%	<0.1 (typ.)
	%	<1 (max.)
Measuring range ≥1 000 pC	%	<0.1 (typ.)
	%	<0.5 (max.)
Temperature coefficient of sensitivity, typ.	ppm/°C	<50
Linearity error, typ.	%FSO	<0.02
Sensor impedance	Ω	$>10^{12}$

Insulation tester input (shared connector with charge input)

Measuring range	Ω	$1{\cdot}10^{7}$ … $1{\cdot}10^{15}$
Calibrated range	Ω	$1{\cdot}10^{7}$ … $1{\cdot}10^{14}$
Max. deviation		
$>1{\cdot}10^{13}$ Ω	%	<20
$\leq 1{\cdot}10^{13}$ Ω	%	<10
Test voltage		
$>1{\cdot}10^{8}$ Ω	V	10
$\leq 1{\cdot}10^{8}$ Ω	V	2
Sensor and cable capacitance, max.	nF	30

Voltage output / Ext. trigger input (shared connector)

Voltage output		
Nominal output range	V	±10
Output current, max.	mA	±5
Output impedance	Ω	10
Max. voltage between input and output ground	V	500
Output noise (all ranges)		
1 Hz … 10 kHz, typ.	mV_{rms}	0.25
Frequency range (–3 dB)	Hz	0 … 20 000
Group delay (input to output, filters off)	µs	≤30
Zero error	mV	<±5
DAC resolution (analog out)	Bit	16
Trigger input		
5 V logic input levels (internal 100 kΩ pullup to +5 V)		
High (Reset, stop trigger)	V	>3.5 or input open
Low (Measure, start trigger)	V	<1.5
24 V logic input levels		
High (Measure, start trigger)	V	>11
Low (Reset, stop trigger)	V	<5 or input open
Max. input voltage	V	±30

Data acquisition

ADC resolution	Bit	16
Internal ADC sampling rate	kSps	500
Acquisition data rate per channel (adjustable), max.	kSps	50
File formats		csv / mdf (binary)

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Technical data (continuation)

Recording capacity	GB	6
Recording duration, max.		
1 channel at 10 kSps, csv	h	≈9
1 channel at 50 kSps, csv	h	≈1.75
1 channel at 10 kSps, mdf	h	≈22
1 channel at 50 kSps, mdf	h	≈4.5

Note: For the data acquisition with <25 kSps an anti-aliasing filter is automatically set with a cut-off frequency of 7kHz. From 25 kSps on the filter is set to 0.39 ... 0.43 x selected output update rate.

High-pass filter

Order		1.
Analog high-pass filter		
Time constant DC (long)		
≤900 pC	s	>10 000
>900 pC	s	>100 000
Time constant Short		
≤900 pC	s	10 ±30%
>900 pC ….≤30 000 pC	s	10 ±10%
>30 000 pC	s	110 ±10%
Digital high-pass filter		
Cutoff-frequency (–3 dB)	Hz	0.1 … 10 000
Tolerance (typ.)	%	<1

Digital low-pass filter

Filter type		Bessel or Butterworth
Order		2. / 4.
Cutoff-frequency (–3 dB)	Hz	10 … 20 000
Tolerance (typ.)	%	<1

USB interface

Version		2.0
Data rate	Mbit/s	480
Connector type		USB-C socket

WLAN interface*

Supported countries/areas		EU/EFTA/UK USA/Canada
WLAN standards		IEEE 802.11 b/g/n
Frequency band	MHz	2 400 … 2 480
Power	mW	<100
Channel bandwidth	MHz	20
Supported WLAN channels		1 to 11
Modes		Micro-AP (max. 8 clients)

*Available in future firmware releases

Bluetooth interface*

Supported countries/areas		EU/EFTA/UK USA/Canada
Supported radio modes		BR / EDR / BLE
Supported BR/EDR data rates	Mbps	1 / 2 / 3
Supported BLE data rates	Mbps	1 / 2
Version		5.2
Frequency band	MHz	2 400 ... 2 480
Power	mW	<10
Channel bandwidth	MHz	1

*Available in future firmware releases

Display with touchscreen

Display size (diagonal)	“	4.3
Display resolution	pixel	800 x 480
Touchscreen type		Capacitive

Buttons

Right side button		Device on/off Measure/reset Start/stop test
Left side button		Save result Start/stop record.

LED status indicator

Device on		
Device booting		Yellow
Device ready		LED off
Device in stand-by		Blue pulsating
Device off, charger connected		
Device charging		Red
Charging completed		LED off
Charger error		Red flashing

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Technical data (continuation)

Power supply

Battery (rechargeable and exchangeable by end-user)		
Type		RRC2057 Lithium-Ion
Nominal voltage	VDC	7.2
Capacity	Ah	6.9
Energy	Wh	49.7
Operating time, typ.		
Active, backlight level 100%	h	≈8
80% active, 20% standby, backlight level 50%	h	≈11
20% active, 80% standby, backlight level 50%	h	≈22
Standby	h	≈33
Charging time[1], typ. (device off)		
external power supply	h	≤4.5
external charging station	h	≤2.5
USB 3.x port type A (5 V / 0.9 A)	h	≤12
USB 2.0 port type A (5 V / 0.5 A), USB port type C	h	≤20[2]
External power supply		
Input voltage range	VAC	90 … 264
Output voltage	VDC	5
Output current	A	3
Output power	W	15

General data

Temperature range		
Operating from battery	°C °F	–20 … +50 –4 … +122
Operating & charging	°C °F	0 … +35 +32 …+95
Charging (device off)	°C °F	0 … +40 +32 … +104
Storage (device off)	°C °F	–20 … +40 –4 … +104
Rel. humidity, not condensing	%	≤90
Degree of protection (EN 60529)		IP54
Vibration resistance		MIL-STD-810H Method 514.8C-3 / Cat. 4 5 … 500 Hz / 1.17grms
Shock resistance		IEC 60068-2-27 25 g / 6 ms / half-sine
Free fall resistance		DIN EN 60068-2-31 0.8 m / Method 1
Outer dimensions incl. connector impact protection (WxHxD)	mm in	250 x 100 x 44 9.84 x 3.94 x 1.73
Weight (incl. battery)	g oz	840 30

[1] Supplies providing less than 0.5A may be damaged by the device.

[2] The battery safety circuit prevents charging durations longer than 18h. The battery may not be fully charged at 0.5A. When using the USB 2.0 interface for charging while the device is running, the battery will discharge.

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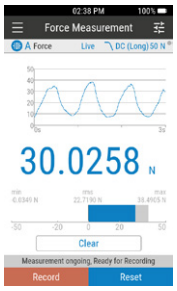
Basic functionalities and feature package

Depending on the required functionality two basic functionalities "Charge amplifier" and "Insulation tester" plus one feature package "Graphs & Recording" are available:

Modes & Features		Basic functionalities[1]		Feature package
		Charge amplifier	Insulation tester	Graphs & Recording[2]
	"Measurement" mode: • Display of live, min, max and RMS values • Numeric display and bar graph • Adjustable digital filters: low-pass and high-pass • Switchable time constant: "DC (long)" and "Short" • Flexible analog output scaling (±10 V) • Measure/reset control via external trigger input • Single measurement value storage • Saving/loading of user generated measurement configurations (presets)	X		
	Y/t graph and recording: • Y/t graph for the display of the measurement signal curve • Recording of measurement data on device with up to 50 kSps • Start/stop recording via external trigger input			X
	"Evaluation" mode: • Numeric display • Gauge graph with user defined evaluation limits (3 ranges with user defined color and text) • Adjustable digital filters: low-pass and high-pass • Switchable time constant: "DC (long)" and "Short" • Flexible analog output scaling (±10 V) • Start/stop of evaluation via external trigger input • Storage of evaluation result and value • Saving/loading of user generated evaluation configurations (presets)	X		
	"Insulation test" mode: • Numeric display • Gauge graph with 3 user defined insulation ranges (user defined color and text for each range) • Storage of insulation test result and value • Saving/loading of user generated insulation test configurations (presets)		X	

[1] At least one of the two basic functionalities needs to be selected
[2] Available in combination with basic functionality "Charge amplifier" only

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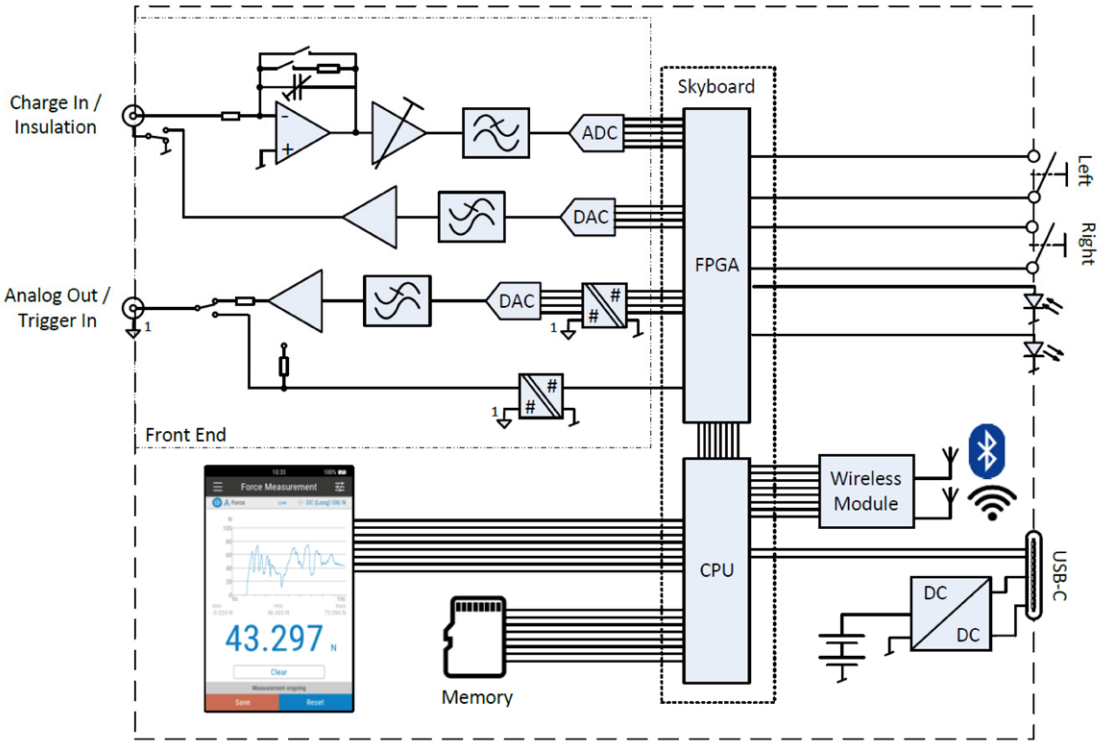
Block diagram



Pinouts

Port A: Charge input/Insulation tester input (BNC neg.)

Pinout	Pin	Charge input	Insulation tester input
A  Charge Insulation Test	Pin	Charge input	Leakage current input
	Shield	GND	Test voltage

Port B: Voltage output/Ext. trigger input (BNC neg.)

Pinout	Pin	Voltage output	Ext. Trigger input
B  Output ±10 V Trigger Test	Pin	Voltage output	Trigger voltage input
	Shield	GND	GND

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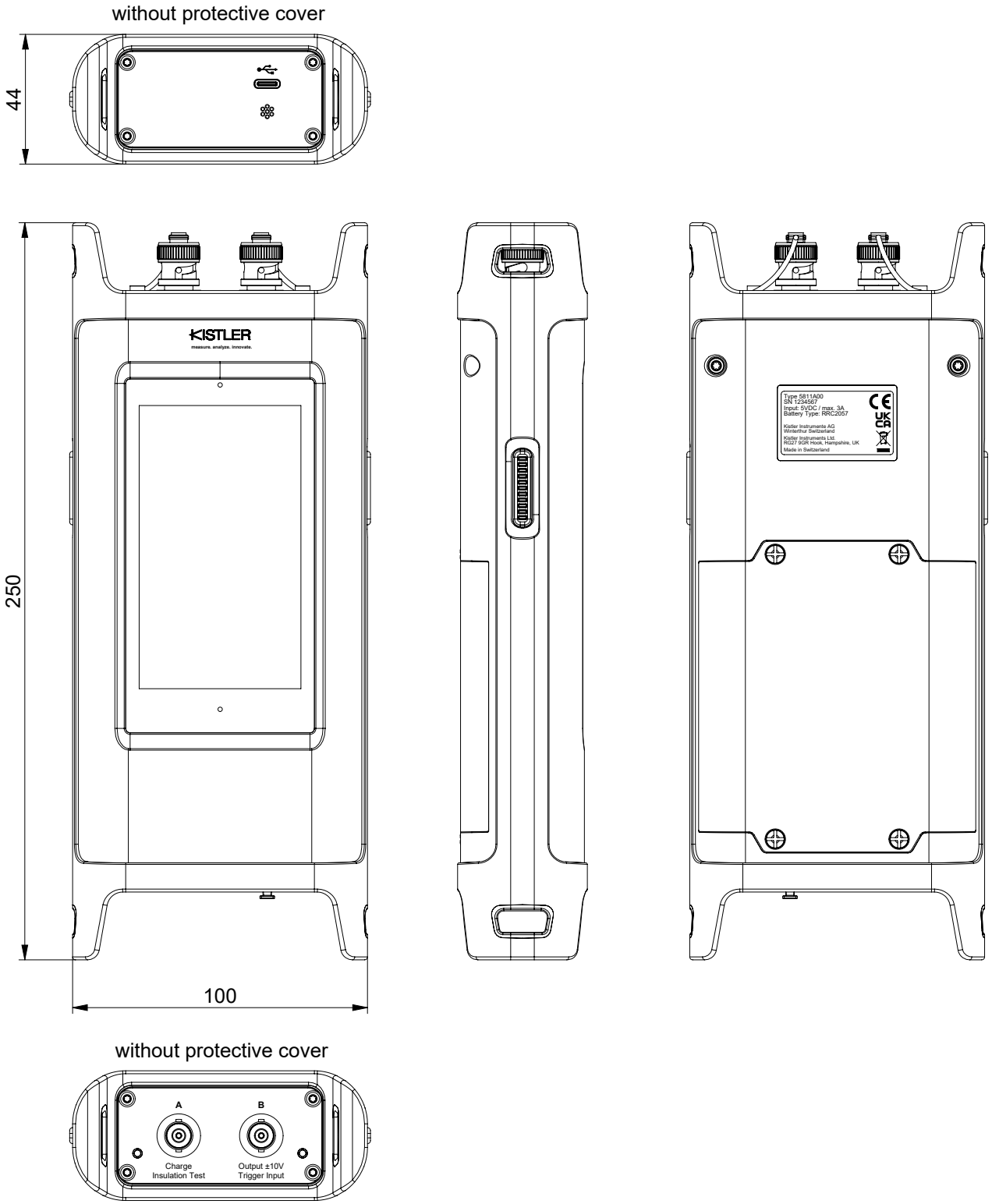
Dimensions



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Included accessories	Type/Mat. No.
• Calibration certificate	–
• Quick start guide	–

Optional accessories	Type/Mat. No.
• Plug-in power supply 5V / 3A with USB type C plug incl. country-specific plug, cable length 1 m	5791A1*
• USB cable type A to type C, 1 m	1200A259A1*
• USB cable type C to type C, 1 m	1200A261A1
• Carrying strap with shoulder pad	5811AZ111*
• Carrying case incl. foam insert	5811AZ121*
• Li-Ion battery (spare battery)	RRC2057**
• Battery charging station incl. country-specific power cable (only required in case of external charging of spare battery(s))	5811AZ221
• Battery compartment key	5811AZ141*

* Available as combined kit together with the handheld in a carrying case.
** To be obtained from local distributor. Please contact your Kistler sales representative for ordering information.

Spare parts	Type/Mat. No.
• Protective cover for BNC neg. connector incl. cord & mounting screw	5811A00Z111

Ordering key

Type 5811A00 ☐ ☐ ☐ ☐ **00** ☐

Kit with handheld (incl. battery) in a carrying case incl. 5 V plug-in power supply, USB cable type A to type C, carrying strap, battery compartment key	**K1**
Handheld (incl. battery) only *or SW order for existing device*	**--**

Hardware & Software (new device with SW features)	**H**
SW order for existing device	**S**

No charge amplifier	**0**
Charge amplifier*	**1**
SW order for existing device: no change on existing configuration	**–**

No insulation tester	**0**
Insulation tester*	**1**
SW order for existing device: no change on existing configuration	**–**

No Graphs & Recording	**0**
Graphs & Recording (in combination with basic functionality "Charge amplifier" only)	**1**
SW order for existing device: no change on existing configuration	**–**

*At least one basic functionality needs to be selected

Configuration examples:

5811A00K1H11001: Handheld 5811A00 device incl. carrying case with accessories (plug-in power supply, USB cable type A to type C, carrying strap and battery compartment key), incl. charge amplifier and insulation tester functionality, incl. y/t graph visualization & recording

5811A00--S-100-: Insulation tester functionality for an existing 5811A00 device

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