

Welding & Fastening Monitor

Type 5825A2

Indicator and Analysis Tool for Spot Welding and Joining Processes

The Welding & Fastening Monitor (WFM) together with the welding force calibration transmitter Type 9831C... constitutes a high-performance portable measuring system for the analysis and optimization of welding and joining processes, such as spot welding or clinching.

- Portable indicator for the actuation of welding force calibration transmitter Type 9831C...
- Three selectable operating modes: "Welding", "Fastening" and "Voltmeter".
- Numeric display of all important characteristics of the force curve (e.g. in the "Welding" mode the 15 relevant process values per welding cycle).
- Storage of the characteristic values of up to 100 measuring cycles (welding cycles)
- Automatic measuring range detection with welding force calibration transmitter connected for types with a measuring range of 5, 10 and 45 kN.
- Rugged industrial version with impact protection, carrying strap and membrane keyboard.
- Analog measurand output (monitor output) of the force signal.
- External or internal triggering.
- Simple update of the monitor firmware with "Flash Loader" program and data export via RS-232C interface.

Description

The Welding & Fastening Monitor allows post-cycle evaluation of force curves. The force curve is recorded by means of a welding force calibration transmitter Type 9831C..., which is connected directly to the indicator.

In addition to the main operating mode "Welding", which allows the welding process to be optimized by measuring and analyzing the electrode force over time in conjunction with the welding current switching signal, the monitor offers an additional two operating modes. In the "Fastening" mode, it is possible to use a welding force calibration transmitter Type 9831C... equipped with suitable inserts (e.g. Type 9426B20) also for force measurement and analysis in joining processes such as "clinching". In the "Voltmeter" operating mode, the monitor acts as a digital voltmeter with an input measuring range of ± 5 V, for example with welding force calibration transmitter Type 9831C... connected, the monitor directly indicates the transmitter output voltage.



The monitor offers a large number of adjustment facilities which are accessible via the monitor menu. In addition, the Welding & Fastening Monitor has a series of external connection facilities. For example, the analog output signal from the sensor, an external trigger signal or an RS-232C interface can be connected to an appropriate system or a data acquisition unit.

With its rugged construction including impact protection and carrying strap as well as its membrane keyboard, this handy, battery-operated indicator is ideal for portable use in a harsh industrial environment.

Applications

The Welding & Fastening Monitor in conjunction with the welding force calibration transmitter Type 9831C... can be used for the following applications:

- Check measurements on welding robots or joining machines (such as clinching) in production lines.
- Adjustment of welding systems or joining machines to new workpieces.
- Calibration of joining machines or spot welding tongs for welding sheet metal parts.
- Optimization of process times and welding cycles.

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Technical Data

Sensor Input

Input voltage measuring range (FSO)	V	0 ... ±5
Max. input voltage	V	<±15
Resolution	mV	2,5
Error		
Voltage	mV	<±15
Time	ms	<±1
Sampling rate	kHz	<1
Input resistance	kΩ	>480
Low pass filter (2 nd order, Butterworth) –3 dB	Hz	240
Reset pulse duration (Actuation with "Measure")	ms	100
Sensor connection	8-pole Binder round connector (DIN 45326F)	

Sensor Supply Ueext

Voltage	V	18
Output noise (0,1 Hz ... 10 MHz, I _{ext} = 18 mA)	mV _{pp}	<40
Output current	mA	<20

Control and Monitoring Signals

Monitor Out (sensor signal unfiltered)	V	±5
Series resistance in the signal path	Ω	10
Digital output "Weld Out"		
Output low (Welding off)	V	0 ... 0,9
Output high (Welding on)	V	2,4 ... 6
Series resistance in the signal path	Ω	10
Digital input "Ext. Trigger", electrically isolated		
Input low (trigger off)	V	0 ... 0,9
Input high (trigger on)	V	5 ... 30
Input current	mA	0,4 ... 2,9
Input max.	V	<30
Pulse duration	ms	>2
Trigger rate	s	≥t _{mess}
Connection	D-Sub f. 9-pin	

Serial Interface

Interface	RS-232C	
Baud rate (selectable)	Bd	9 600/19 200
Data format		
Data bits, stop bit, parity	8, 1, none	
Character transmission	ASCII	

Monitor Power Supply

Battery (IEC 6LF22/9) (see Accessories)	V	9
External plug-in power pack (see Accessories)	V	12
Current consumption		
without transmitter	mA	≈23
with transmitter (max.)	mA	100
Battery life (9 V lithium battery)		
with transmitter Type 9831C...	h	≈12

Display

LCD graphic display, reflective	Pixel	128x64
Number of significant places for measurand display	digits	4
Refresh rate of the display (measurands)	Hz	2 ... 3

General Data

Memory location for number of data records	max. 100	
Operating temperature range	°C	0 ... 50
Min./Max. temperature	°C	0/70
Humidity	RH %	≤50
Degree of protection EN60529	IP	50
Case dimensions		
without impact protection (HxWxD)	mm	150x75x35
with impact protection (HxWxD)	mm	182x92x45
Weight	g	≈500

The monitor complies with EMC regulations EN61000-6-3 (interference emission) and EN61000-6-2 (interference immunity). The power line adapter complies with the safety requirements according to EN60950.

Case Dimensions

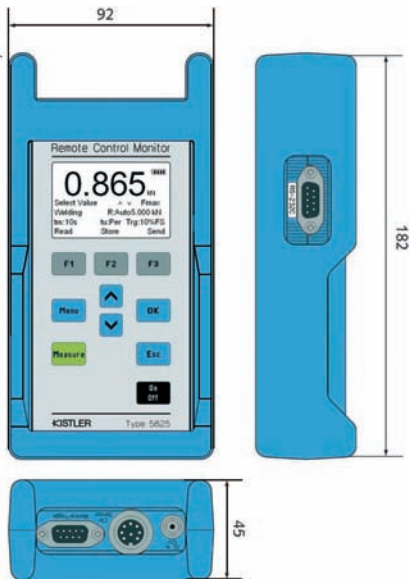
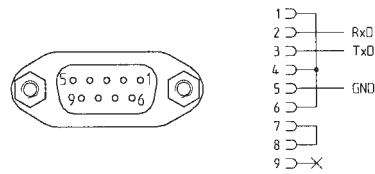


Fig. 1: Case dimensions of Welding & Fastening Monitor Type 5825A2 with impact protection

Connectors

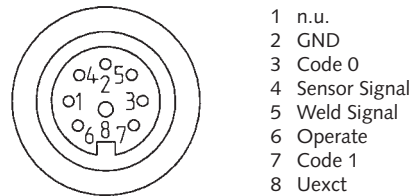
Connector for RS-232C Interface



Connector for Transmitter Type 9831C...

8-pin connector, DIN45326F

Pin allocation

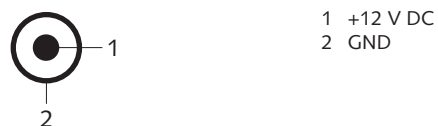


Connector for Analog Signal Output, ext. Trigger Input



Connector for Power Pack

12 V DC In: 2-conductor jack according to EIAJ standard



Block Schematic Diagram

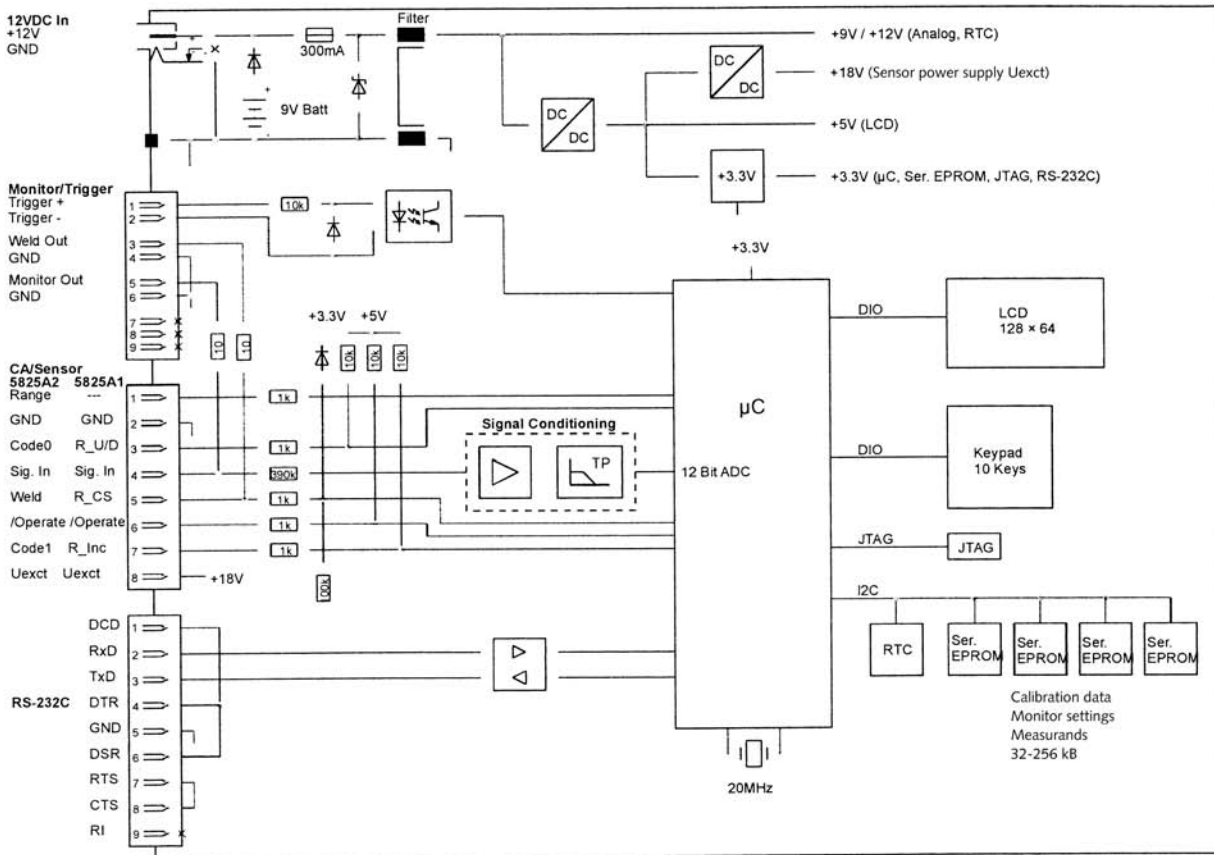


Fig. 2: Block schematic diagram Welding & Fastening Monitor Type 5825A2

Actuation – Measuring Principle

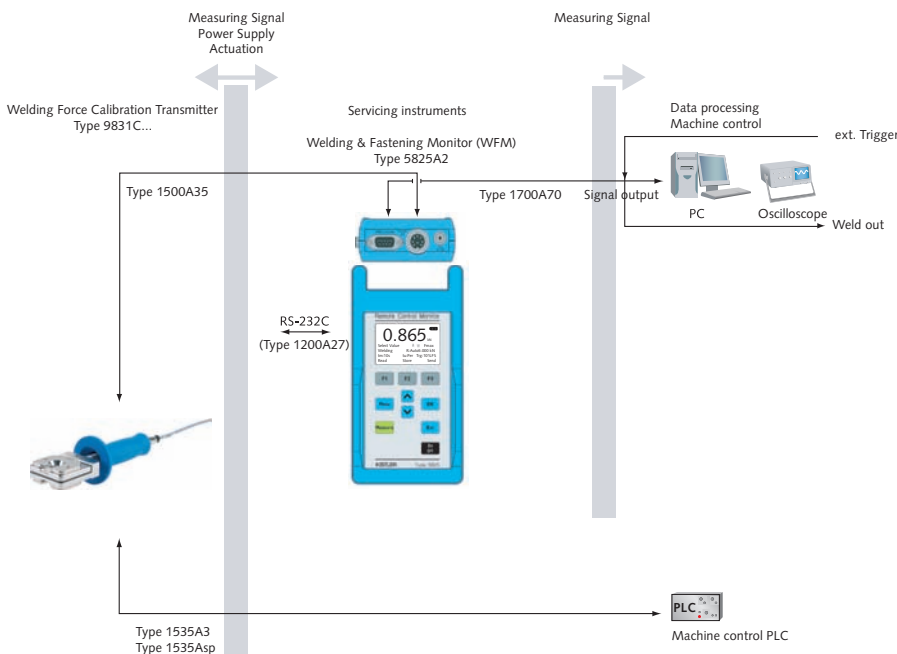
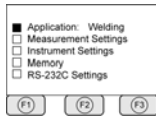


Fig. 3: Actuation – measuring principle Welding & Fastening Monitor Type 5825A2

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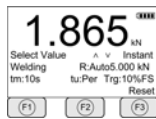
Description of the Main Functions

Selection between Three Operating Modes



- Welding
- Voltmeter
- Fastening

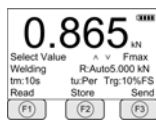
"Instant" Measuring Mode (Continuous Measurement)



This measuring mode is available in all three operating modes (Welding, Fastening and Voltmeter) and can be selected with the arrow keys \leftarrow \rightarrow .

The force signal is continuously indicated. The function key F3 (Reset) produces a reset pulse for the charge amplifier connected.

1. Operating Mode "Welding"



After the measurement has been started with the "Measure" key and the selected trigger threshold reached (or as a result of an external trigger pulse), the force curve is recorded until the end of the set measuring time t_{meas} . The measuring curve is sampled at a sampling rate of 1 ms (1 kHz). The first 1 000 measurands are stored and used to determine the value dt , i.e. from a set measuring time $t_{meas} > 1$ s, the entire force curve is no longer stored, but only the first second of the measuring time. If the set value $xx\% F_{wav}$ is reached only after more than one second measuring time, or if the welding signal is absent (welding voltage), then the related value dt is not measured and an error message appears.

At the end of the measuring time t_{meas} , the characteristic values of the force curve relevant for welding quality are measured and shown in the display.

All characteristic values of a measuring cycle can be automatically or manually stored in a nonvolatile ring memory (EEPROM) with 100 memory locations.

This means that the characteristic values determined from a maximum of 100 measuring cycles can be stored. The contents of the ring memory can be output as ASCII code via the integrated RS-232C interface.

The arrow keys \leftarrow \rightarrow can be used to switch between the instantaneous value (Instant) and the last measured or calculated characteristic values of a cycle.

Example 1: Continuous Welding Processes

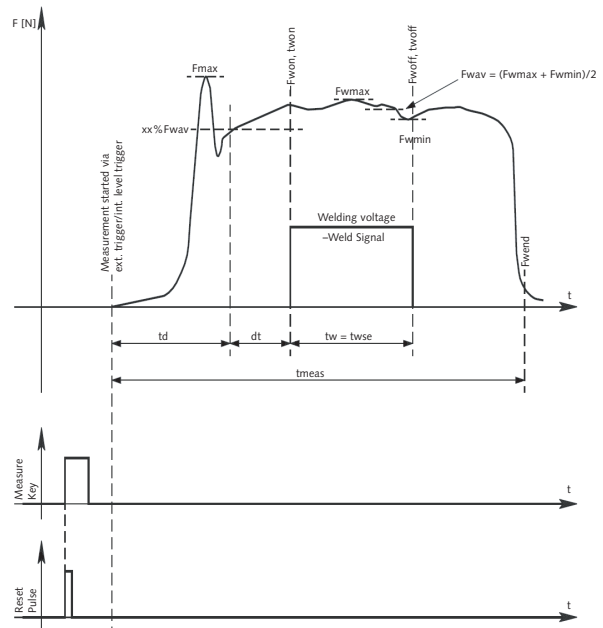


Fig. 4: Start of welding time late (dt is negative)

Explanation of the Measurands

- F_{inst}** Instantaneous value of the welding force F (not stored).
- F_{max}** Maximum electrode force over the entire measuring time t_{meas} (F_{max} selectable with peak value or instantaneous value display).
- F_{won}** Electrode force at welding voltage turn on.
- F_{woff}** Electrode force at welding voltage turn off.
- F_{wav}** Mean value of the electrode force during the welding process (application of welding voltage).
- $xx\%F_{wav}$** $xx\%$ of F_{wav} (calculated value); recommended set point for the start of the welding process (default value: $xx\%F_{wav} = 90\%$; xx adjustable from 50 ... 95 %).
- F_{wmin}** Minimum electrode force during the welding process.
- F_{wmax}** Maximum electrode force during the welding process.
- F_{wend}** Force at the end of total measuring time.
- td** Time from the start of the measurement (reaching the set trigger level or external trigger pulse) until $xx\%F_{wav}$ (calculated value) is reached.
- dt** Time difference between reaching $xx\%F_{wav}$ until the start of the welding process (calculated value); this time should be as short as possible.
 - dt : Welding voltage reached late (delayed by time dt), i.e. after reaching the $xx\%F_{wav}$ threshold.
Action: Shorten the squeeze time in the welding control unit by time dt .
 - + dt : Welding voltage reached prematurely by time dt , i.e. before reaching the $xx\%F_{wav}$ threshold.
Action: Extend the squeeze time in the welding control unit by time dt .
- t_w** Duration of the welding process (weld signal); with impulse welding, this is the total time of the individual pulses without pauses (see Fig. 5).
- t_{won}** Time elapsed to welding voltage turn on (from reaching the trigger level or external trigger).
- t_{woff}** Time elapsed to welding voltage turn off (from reaching the trigger level or external trigger).
- t_{wse}** Total time of the welding process in pulse welding (total time of the individual pulses with pauses; see Fig. 5).
- t_{meas}** Set total measuring time from reaching the trigger level or external trigger pulse.

Example 2: Pulse Welding

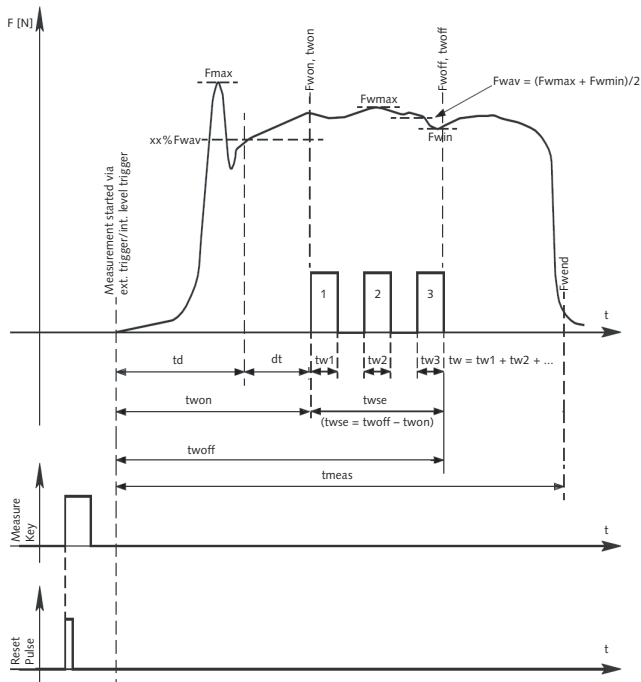


Fig. 5: Evaluation of welding curve in pulse welding

2. Operating Mode "Voltmeter"

The monitor acts as a digital voltmeter with an input measuring range of ± 5 V, for example with welding force calibration transmitter Type 9831C... connected, the monitor indicates the transmitter output voltage directly.

The arrow keys \leftarrow \rightarrow can be used to switch between the instantaneous value (Instant) U_{max} and U_{min} .

3. Operating Mode "Fastening"

After the measurement has been started with the "Measure" key and the trigger threshold has been reached (or with an external trigger pulse), the force curve is recorded until the end of the set measuring time t_{meas} . The measuring curve is sampled with a sampling rate of 1 ms (1 kHz). The measuring curve recorded is evaluated within the defined measuring window.

Exactly as in the "Welding" operating mode, all characteristic values measured in a measuring cycle are stored automatically or manually in a nonvolatile ring memory (EEPROM) with 100 memory locations, and can be output as ASCII code via the integrated RS-232C interface.

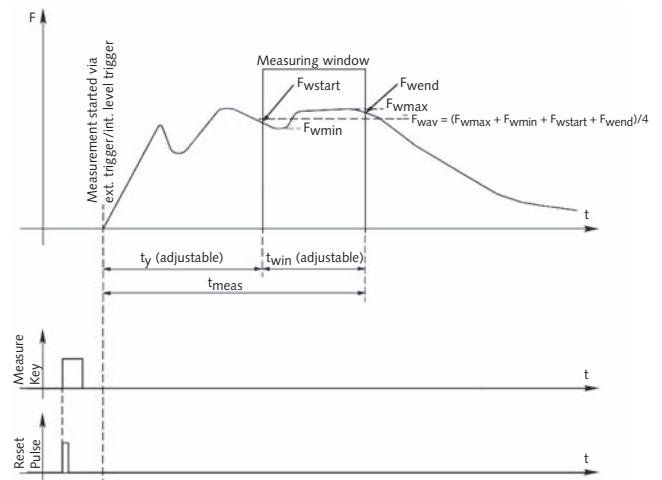


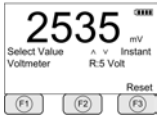
Fig. 6: Evaluation of a joining force curve

Explanation of Measurands (w = window)

- F_{wmax} Maximum force within the measuring window t_{win}
- F_{wmin} Minimum force within the measuring window t_{win}
- F_{wav} Mean value of the force within the measuring window t_{win}
- F_{wstart} Force at the start of the measuring window
- F_{wend} Force at the end of the measuring window
- t_y Delay, window shift (0 ... 100 s)
- t_{win} Measuring window of duration t_{win}
- t_{meas} Measuring time

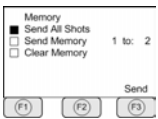
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Log Output and Storage of a Measuring Cycle



All characteristic values of a measuring cycle can be stored in a nonvolatile ring memory (EEPROM) with 100 memory locations either automatically ("Auto Shots" menu item must be activated) or manually ("F2" key). This means that the characteristic values measured from a maximum of 100 measuring cycles can be stored.

By pressing the "F1" key, the characteristic values of each previously stored measuring cycle can be read out manually again and shown on the display. The two arrow keys are used to select the memory location for storage and display.



A log of each memory cycle stored can be sent to the RS-232C interface via the "Memory" menu item.

a) Data Transfer: CONTINUOUS

The monitor continually digitizes the force curve (monitor in "Instant" measuring mode) and automatically feeds the force value (Instant = instantaneous value) to the RS-232C interface in ASCII format every 6 or 12 ms (at 9 600 baud or 19 200 baud respectively) in the exponential format to three decimal places without the unit (example: "4.113E+01").

b) Data Transfer : ON REQUEST

The monitor digitizes the force curve continuously (monitor in the "Instant" measuring mode) and feeds the force value (Instant = instantaneous value) to the RS-232C interface in ASCII format after actuation of the "Send" key or as a result of a command from a higher level control unit.

Transfer of Stored Measurands (Example "Fastening")

Memory 1				
Fastening				
Fwmax	Fwmin	Fwstart	Fwend	Fwav
4.567	0.000	0.000	3.449	2.004 kN
ty	tw			
0.4 s	1.0 s			
Time:(h m s)15 26 00		Date:(d m y) 16 05 03		

Transfer of Stored Measurands (Example "Welding")

Memory 1			
Welding		Correct Shoot	
Fmax	Fwmax	Fwmin	90%Fwav
4.570	4.404	2.739	3.213
Fwon	Fwoff	Fwav	Fwend
3.002	2.728	3.572	0.000 kN
dt	tw	td	twon
19ms	253ms	276ms	257ms
twoff	twse	tmeas	
578ms	321ms	1sec	
Time(h m s)15 20 00		Date(d m y) 16 05 06	

Accessories Included

- | | |
|---|-----------------------------------|
| • Battery, 9 V, Ultralife Lithium Power Cell #U9VL-FP | Type/Art. No.
5.310.023 |
| • Switched mode power supply unit 90 ... 264 VAC-12 V DC/1,25 A | 5.510.293 |
| • Impact protection | 3.750.101 |
| • Carrying strap for impact protection incl. 2 snap hooks | 5.211.533 |

Ordering Code

- Welding & Fastening Monitor (WFM)

Type

5825A2

Optional Accessories

- | | |
|--|---------------------------------|
| • RS-232C connecting cable, L = 5 m, PC to Remote Control Monitor | Type/Art. No.
1200A27 |
| • Connecting cable, L = 1 m D-Sub 9-pin male to 2 x BNC positive, 1 x terminal (incl. 1 x 5.530.032, 1 x 5.530.033, 2 x 5.530.034) | 1700A70 |
| • Connecting cable Type 9831C..., L = 1,5 m | 1500A35 |
| • Mini-Combicon terminal 2-conductor grid 3,81 0,25-1,5 mm ² (socket) | 5.530.032 |
| • Mini-Combicon terminal 2-conductor grid 3,81 0,25-1,5 mm ² (pin) | 5.530.033 |
| • Mini-Combicon cable housing 2-conductor grid 3,81 | 5.530.034 |
| • Desktop power pack (linear) 230 VAC/50 Hz-12 VDC/300 mA | 5.510.220 |
| • Welding force calibration transmitter | 9831C... |
| • Connecting cable to welding force calibration transmitter Type 9831C..., L = 2 m | 1700A66 |

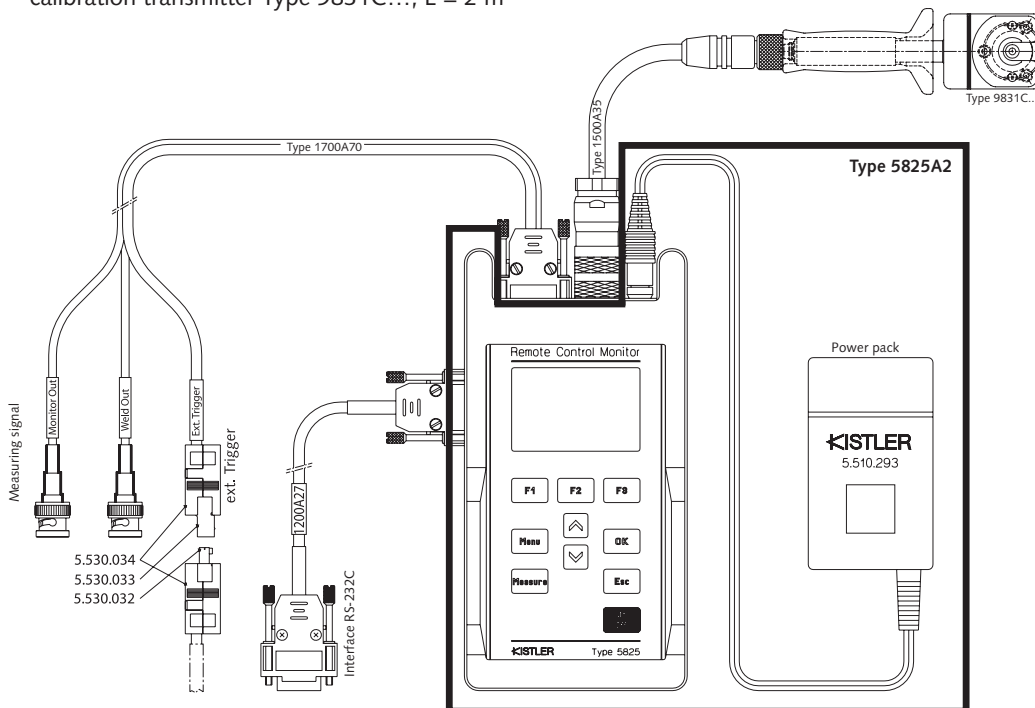


Fig. 7: Overview of accessories

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