LANGER
EMV-Technik

IC TEST SYSTEM

User Manual

P1202 / P1301 L-ESD set

ESD Langer Pulse H 0.2/2.5 E 0.2/5.5 ns Field Coupling

IC immunity test against ESD electric and magnetic field

- Translation of the original user manual -

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1 Declaration of Conformity

Hersteller / Manufacturer / Fabricant
Langer EMV-Technik GmbH
Nöthnitzer Hang 31
01728 Bannewitz, Germany

Die Langer EMV-Technik GmbH bescheinigt die Konformität für das Produkt
The Langer EMV-Technik GmbH herewith declares conformity of the product
Langer EMV-Technik GmbH déclare la conformite du produit

Bezeichnung / Product name / Designation:	P1202 / P1301 L-ESD set
mit / with / avec:	BPS 203 P1202 P1301 EPM 02 BPM 02

mit den folgenden Bestimmungen
with applicable regulations
avec les directives suivantes

EMV Richtlinien:	2014/30/EU
EMV Directives:	2014/30/EU
Directives CEM:	2014/30/UE
Niederspannungsrichtlinie:	2014/35/EU
Low-Voltage Equipment Directive:	2014/35/EU
Directive des equipments basse tension:	2014/35/UE

Angewendete harmonisierte Normen
Harmonized standards applied
Normes harmonisées utilisées

EMV / EMC / CEM:	EN 61000-6-1:2007-10 EN 61000-6-3:2011-09
Sicherheit / Safety / Sécurité:	EN 61010-1:2011-07

2020-10-02

Datum / Date / date

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2 General Information

2.1 Storage of the User Manual

This user manual enables the safe and efficient use of the P1202 / P1301 L-ESD set. It must be kept close at hand and accessible to the user.

2.2 Reading and Understanding the User Manual

Read the user manual carefully, observe the safety information (Section 5.3) and follow the instructions given in this manual before putting the device into service.

2.3 Local Safety and Accident Prevention Regulations

The local accident prevention and general safety regulations also apply to ensure that the P1202 / P1301 L-ESD set is used for its intended purpose.

2.4 Images

Figures have been included in this user manual to assist the reader's understanding but may differ from the device's actual version.

2.5 Limitation of Liability

In the following cases, Langer EMV-Technik GmbH can assume no liability for damage to property and personal injury if:

- The information given in this user manual has not been observed.
- P1202 / P1301 L-ESD set was operated by staff not qualified in the field of EMC.
- P1202 / P1301 L-ESD set was subjected to unauthorised modifications or technical changes.
- P1202 / P1301 L-ESD set was not used according to its intended purpose.
- Spare parts or accessories were used that had not been approved by Langer EMV-Technik GmbH.

The actual scope of delivery may deviate from the illustrations and texts in this user manual due to the customization of orders or due to technical changes and innovations.

2.6 Errors and Omissions

The information in this manual has been carefully checked and is believed to be accurate; however, the Langer EMV-Technik GmbH assumes no responsibility for any clerical, typographical, or proofreading errors, or omissions.

2.7 Copyright

The content of this user manual is protected by copyright law and may only be used in connection with the P1202 / P1301 L-ESD set. This user manual may not be used for any other purpose without the prior written approval of Langer EMV-Technik GmbH.

2.8 Description of Symbols

Warning signs	**Prohibition Signs**
 General warning sign	 No access for people with active implanted cardiac devices
 Warning, Electricity	

3 Scope of Delivery

Item	Designation	Type	Qty.
1	ESD Magnetic Field Source Langer Pulse 0.2/2.5 ns	P1202 L-ESD	1
2	ESD E-Field Source Langer Pulse 0.2/5.5 ns	P1301 L-ESD	1
3	Burst Power Station	BPS 203	1
4	Control Software	BPS 203-Client	1
5	dB/dt Field Meter	BPM 02	1
6	dE/dt Field Meter	EPM 02	1
7	Spacer Ring, 3 mm	D70 h03	1
8	Spacer Ring, 10 mm	D70 h10	1
9	Field Chamber Insert	FKE 30	1
10	Measuring Cable	SMA-SMB 1 m	2
11	High-Voltage Cable, Fischer-Fischer	HV FI-FI 1 m	1
12	Control Cable	FBK 12P 1 m	1
13	USB Cable Type A-B	USB-AB	1
14	Power Supply Unit	NT Ex EU	1
15	System Case	P1202 / P1301 case	1
16	User Manual	P1202 / P1301 m	1
17	Quick Guide		1

Important: The scope of delivery may deviate depending on the respective order!

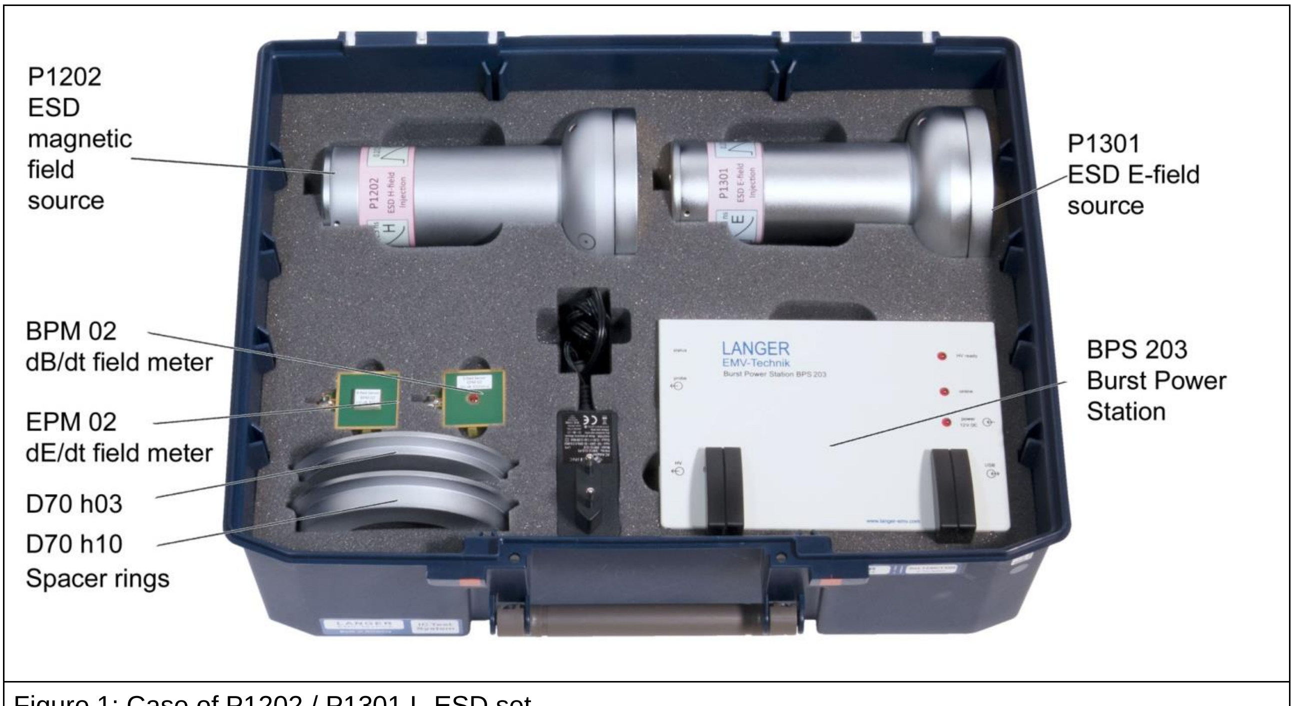

Figure 1: Case of P1202 / P1301 L-ESD set

4 Technical Parameters

4.1 P1202 L-ESD – General Parameters

Dimensions (h/w/d)	(180 x 96 x 96) mm
Weight	700 g
Pulse parameter	
Shape	0.2 / 2.5 ns
Frequency	0.1 Hz – 10 Hz
Max. current	± 144 A
Voltage	± (0.1 – 6) kV
Ammeter	
Measurement output	50 Ω, SMB
Shunt	0.1 Ω
Current correction factor R	-26 dB Ω
Connector – input	50 Ω Fischer (D103A023)

Table 1: P1202 general parameters

4.2 P1202 L-ESD – Magnetic Flux Density B

HV in kV	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
V_{iout} in V	0.6	1.2	1.8	2.4	3	3.6	4.2	4.8	5.4	6	6.6	7.2
i_P in A	12	24	36	48	60	72	84	96	108	120	132	144
D70 h03 spacer, height h = 3 mm												
B in µT	0.293	0.586	0.878	1.17	1.46	1.76	2.05	2.34	2.64	2.93	3.22	3.51
D70 h10 spacer, height h = 10 mm												
B in µT	0.149	0.298	0.446	0.595	0.744	0.893	1.04	1.19	1.34	1.49	1.63	1.79

Table 2: Magnetic flux density generated depending on the high voltage HV and probe current i_P

4.3 P1202 L-ESD - Shunt

Bandwidth	3 GHz
Measurement error	approx. 10 %
Attenuator settings	x 20 A / V → 26 dB
Deskew B to v_{out} at measurement output	1 ns

Table 3: P1202 shunt parameters

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www.langer-emv.com

4.4 P1301 L-ESD – General Parameters

Dimensions (height/width/depth)	(180 x 96 x 96) mm
Weight	700 g
Pulse parameter	
Shape	0.2 / 5.5 ns
Frequency	0.1 Hz – 10 Hz
Voltage	± (0.1 - 6) kV
Connector - input	50 Ω Fischer (D103A023)

Table 4: P1301 general parameters

4.5 P1301 L-ESD – Electric Field Strength

HV in kV	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
D70 h03 spacer, height h = 3 mm												
E in kV/cm	1.67	3.33	5	6.67	8.33	10	11.67	13.33	15	16.67	18.33	20
D70 h10 spacer, height h = 10 mm												
E in kV/cm	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6

Table 5: Electric field strength depending on the high voltage HV

4.6 BPM 02 dB/dt Field Meter

Frequency range	500 kHz - 3 GHz
Magnetic flux density B calculation based on the voltage $\mathrm{u_{out}}$ at the measurement output	$\dot{\mathrm{B}} = \mathrm{K} \cdot \mathrm{u_{out}}$ $\mathrm{K} = 122\ \mathrm{dB}\left(\frac{\mathrm{T}}{\mathrm{V} \cdot \mathrm{s}}\right)$ $\mathrm{B} = (1/\omega)\ \dot{\mathrm{B}}$ $\mathrm{B} = \dot{\mathrm{B}} - 20\ \log_{10}(\omega)$
Table 6: Conversion factor of BPM 02	

4.7 EPM 02 dE/dt Field Meter

Frequency range	500 kHz - 3 GHz
Electric field strength E calculation based on the voltage $\mathrm{u_{out}}$ at the measurement output	$\dot{\mathrm{E}} = \mathrm{K} \cdot \mathrm{u_{out}}$ $\mathrm{K} = 251\ \mathrm{dB}\left(\frac{1}{\mathrm{cm} \cdot \mathrm{s}}\right)$ $\mathrm{E} = (1/\omega)\ \dot{\mathrm{E}}$ $E = \dot{\mathrm{E}} - 20\ log_{10}(\omega)$
Table 7: Conversion factor of EPM 02	

4.8 BPS 203 Burst Power Station

Frequency range	0.1 Hz – 30 Hz
Output voltage	± (0.1 ... 9) kV
Supply voltage	12 V / 1 A DC
Interface	USB
Weight	350 g
Sizes (L x W x H)	(175 x 122 x 61) mm
Software	BPS 203-client
Table 8: BPS 203 technical parameters	

5 Intended Use

The P1202 ESD magnetic field source and P1301 ESD electric field source can be used to test the immunity of integrated circuits (ICs) against magnetic and electric ESD fields, respectively.

The P1202 generates a magnetic ESD field and the P1301 field source generates an electric ESD field. The respective field source is positioned above the test IC by using a spacer ring and the generated ESD field is then applied to the IC to determine its immunity against ESD disturbances.

The P1202 / P1301 L-ESD set is used for applications such as:

- test the immunity of integrated circuits (ICs) against magnetic and electric fields
- determine the orientation of critical loops within the tested IC

The user must comply with all information and instructions given in this user manual.

The P1202 / P1302 L-ESD set may only be used in an environment with a temperature of 10 to 30 degree Celsius and a humidity of 20 to 85 percent without condensation.

Keep the L-ESD set free from dirt and liquids to prevent adverse effects on tests and damage to the field sources and other parts of the set.

5.1 Staff Requirements

Only persons who are trained and qualified in the field of electromagnetic compatibility (EMC) may operate the P1202 / P1301 L-ESD set.

Persons whose responses are impaired by alcohol, medicines, drugs or similar substances must not be allowed to operate the P1202 / P1301 L-ESD set.

5.2 Risks if Not Used for Its Intended Purpose

Warning!

Danger due to misuse!

Incorrect use of the P1202 / P1301 L-ESD set can lead to dangerous situations!

Incorrect use of the P1202 / P1301 L-ESD set may put the user at risk, damage the L-ESD set and/or the technical equipment connected to the L-ESD set.

Examples of improper use that may put persons/equipment at risk:

- Safety devices are bypassed or rendered ineffective.
- The P1202 / P1301 L-ESD set is used in a defective state.
- The P1202 / P1301 L-ESD set is used outside the specified range of technical parameters.
- The field of application is changed by modifications to the design.

Claims due to the P1202 / P1301 L-ESD set’s abnormal use are excluded!

5.3 Safety Instructions

5.3.1 General Safety Information

Risks cannot be totally excluded even if the P1202 / P1301 L-ESD set is used for its intended purpose.

Observe the safety information and hazard warnings listed below to prevent damage to property and personal injury. Also observe the operating and safety instructions for all other devices used in the measurement set-up.

Carry out a visual check before performing a measurement with a product from Langer EMV-Technik GmbH. Replace anything that is damaged, like connecting cables, attachments, field meters and sources. Please contact Langer EMV-Technik GmbH if damaged parts need to be replaced or repaired.

Wear tight-fitting clothes when using the P1202 / P1301 L-ESD set.

Langer EMV-Technik GmbH assumes no liability for damage to property and/or personal injury or for consequential damage that arises from the incorrect unpacking, set-up or operation of the P1202 / P1301 L-ESD set.

5.3.2 Hazard Due to Electrical Voltage

Warning, Electricity

Danger from electricity!

Risk of injury due to electric shock!

Always check any attachments, measuring devices, cables, field meters and sources before using the P1202 / P1301 L-ESD set. Never use any damaged or defective devices.

Do not connect or disconnect any cables whilst the P1202 / P1301 L-ESD set is in operation.

Only staff from Langer EMV-Technik GmbH may open the field sources and work on the electrical components and electrical lines.

Switch devices off immediately, disconnect the mains plug and contact Langer EMV-Technik GmbH if you detect any damaged insulation on lines, cables or electric components!

5.3.3 Hazard due to Electromagnetic Fields (Near and Far Fields)

Prohibition, No access for people with active implanted cardiac devices

Danger from electromagnetic fields!

Risk of affecting a cardiac device!

Persons with a cardiac device, such as a pacemaker or implanted defibrillator, are not allowed to work on or approach the P1202 / P1301 set whilst it is in operation.

Caution!

Material damage due to electromagnetic fields!

Risk of affecting or damaging electronic devices!

Keep electronic devices, that are not necessary for the test set-up in a appropriate safety distance so they are not affectd by generated electromagnetic fields.

Use shielded rooms or enclosures (e.g. shielded tents) to protect electronic devices against electromagnetic near and far fields.

Make sure that the field chamber (Figure 7) is not opened under any circumstances while the P1202 / P1301 L-ESD set is in operation.

!

Caution!

Material damage due to high intensity electromagnetic fields!

Risk of damaging or destroying the test IC (latch-up)!

Protect the test IC by e.g.:

- connecting a protective resistor in the test IC's incoming power supply,
- increasing the intensity gradually and stopping when a functional fault occurs or
- interrupting the power supply to the test IC in the event of a latch-up.

Make internal functional faults of the test IC visible from outside by:

- monitoring representative signals in the test IC,
- using special test software,
- making the reaction of the test IC to inputs visible (reaction test).

6 Overview of P1202 / P1301 L-ESD Set

6.1 System Description

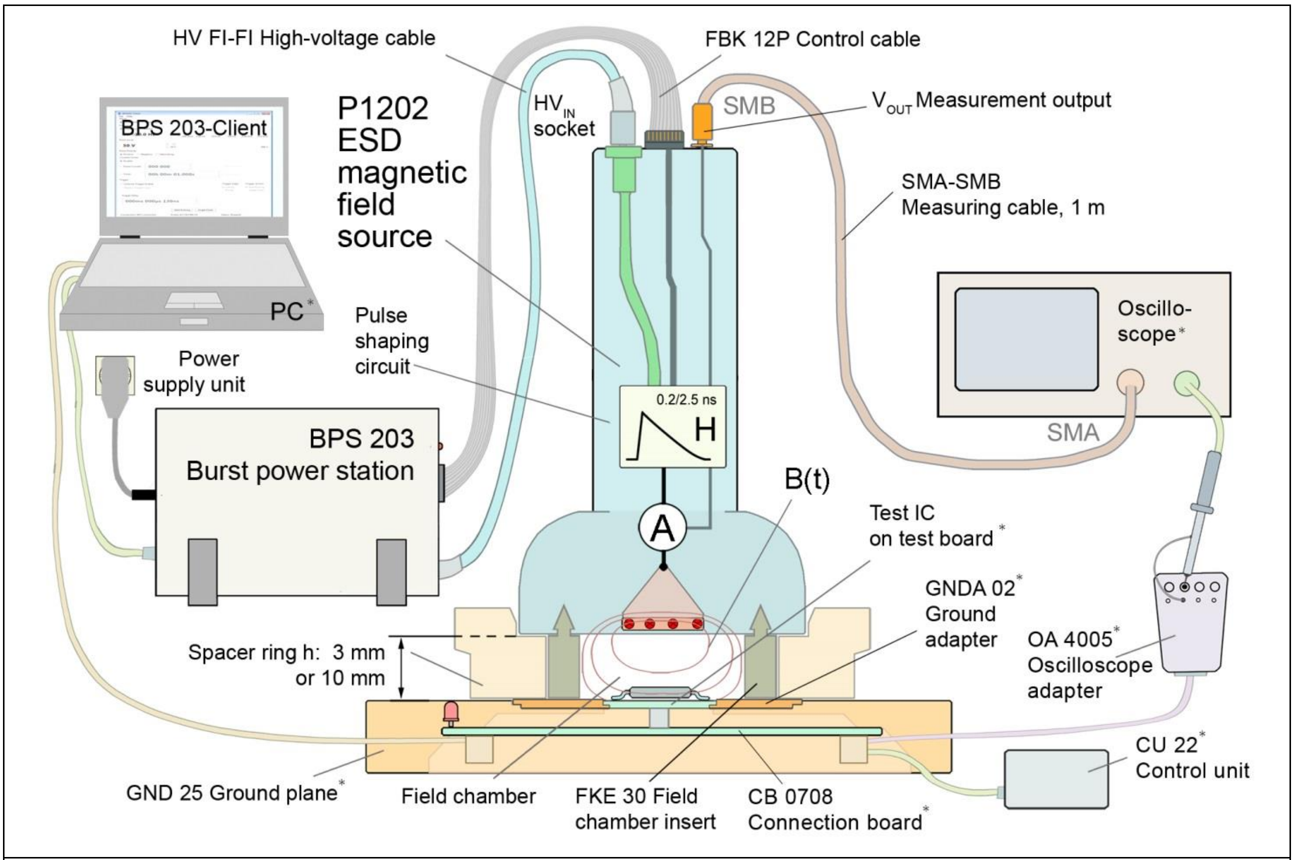

Figure 2: Set-up of P1202 probe. All devices which are not included in the scope of delivery are marked with an asterisk (*).

Name	Description
P1202	Generates the H-field injected into the DUT
P1301	Generates the E-field injected into the DUT
BPS 203	Supplies the high voltage and control signals
HV / signal cable	Connects L-ESD field sources with the **BPS 203**
Measurement cable	SSMB to SMA cable to connect measurement output with an oscilloscope
D70 h03	Spacer ring with height of 3 mm
D70 h10	Spacer ring with height of 10 mm
FKE 30	Field chamber insert
SMA-SMB 1m	Measuring cable
HV FI-FI 1m	High-voltage cable, Fischer-Fischer
FBK 12P 1m	Control cable
USB cable	Connects the **BPS 203** with a PC, type A-B
Power supply unit	12V / 1A power supply unit, used to power the **BPS 203**
BPS 203-Client[1]	PC software / DLL to control L-ESD field sources
BPM 02	dB/dt field meter
EPM 02	dE/dt field meter

[1] Minimum requirements: Win XP SP3 or above

6.2 BPS 203 Burst Power Station

The **BPS 203** is used as a high voltage supply and control unit for the L-ESD field sources. The **BPS 203** is connected to a computer with windows operating system. The provided installation medium includes the **BPS 203-Client** software and a DLL for implementing automated systems.

Figure 3: BPS 203 burst power station

Features are:

- adjustment of pulse frequency and pulse voltage
- single pulse or pulse sequence with selectable pulse rate

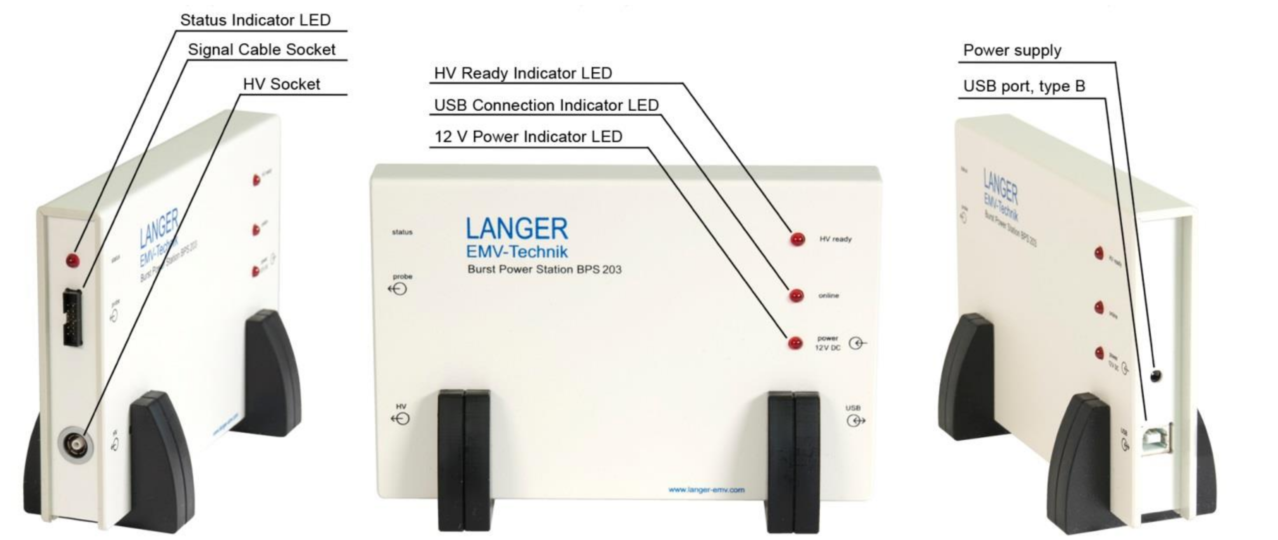

Figure 4: BPS 203 features

Socket	Description
Signal Cable socket	High-voltage power supply and
HV Socket	Probe communication
Power Supply	Power input for **BPS 203** and the attached probe
USB Port	USB-B port to connect **BPS 203** to a PC

Table 9: **BPS 203** features

LED	State		Description
Status		10Hz	Fault: Probe is not connected or is incorrectly connected
		2Hz	Probe is ready (both cables have to be connected)
		2Hz	Pulse operation
HV ready		-	BPS 203 is ready to initiate (start pulse)
USB		-	USB Connection to PC established
12V Power		-	**BPS 203** is powered

Table 10 **BPS 203** states (Indicator LEDs)

Figure 5 shows the block diagram of the **BPS 203**. The internal logic is controlled by the **BPS 203-Client** or the DLL.

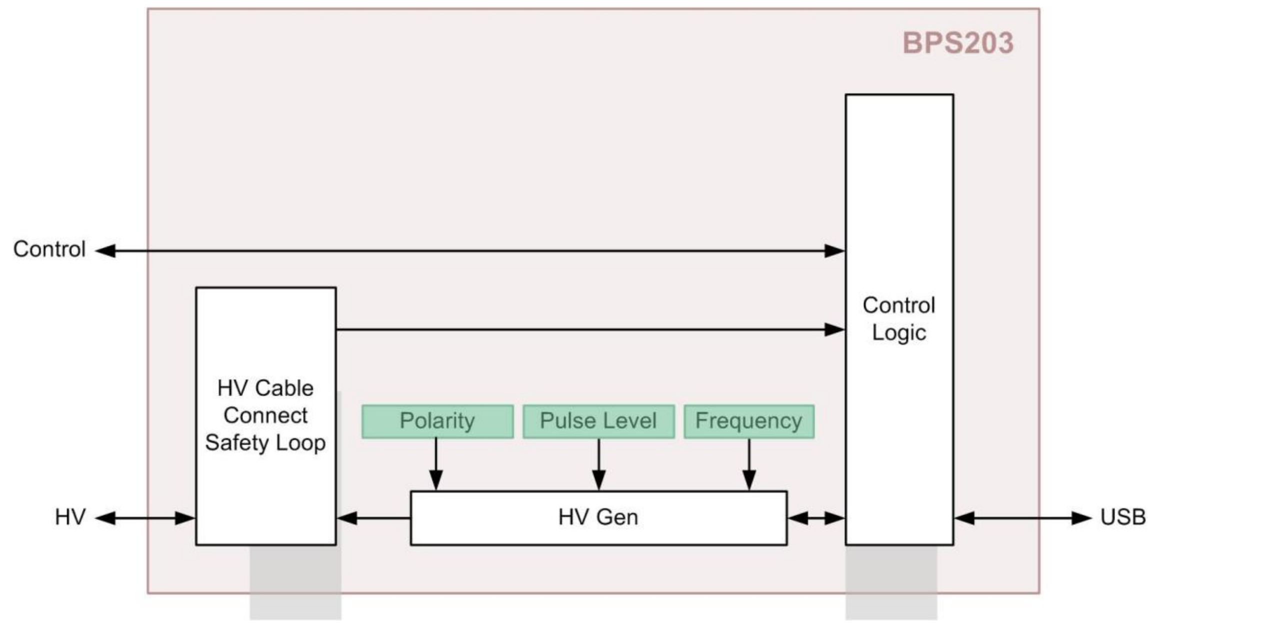

Figure 5: Block diagram of the **BPS 203**

6.3 P1202 Magnetic Field Source

Figure 6 shows the P1202 ESD magnetic field source.

The P1202 has three plug connectors, a high-voltage input (Fischer connector) to supply the field source, a digital control input (12 pin header) to control the field source and a measurement output (SMB connector) at the top.
The high-voltage input is marked $\mathrm{HV_{in}}$ and the measurement output is marked $\mathrm{i_{out}}$.

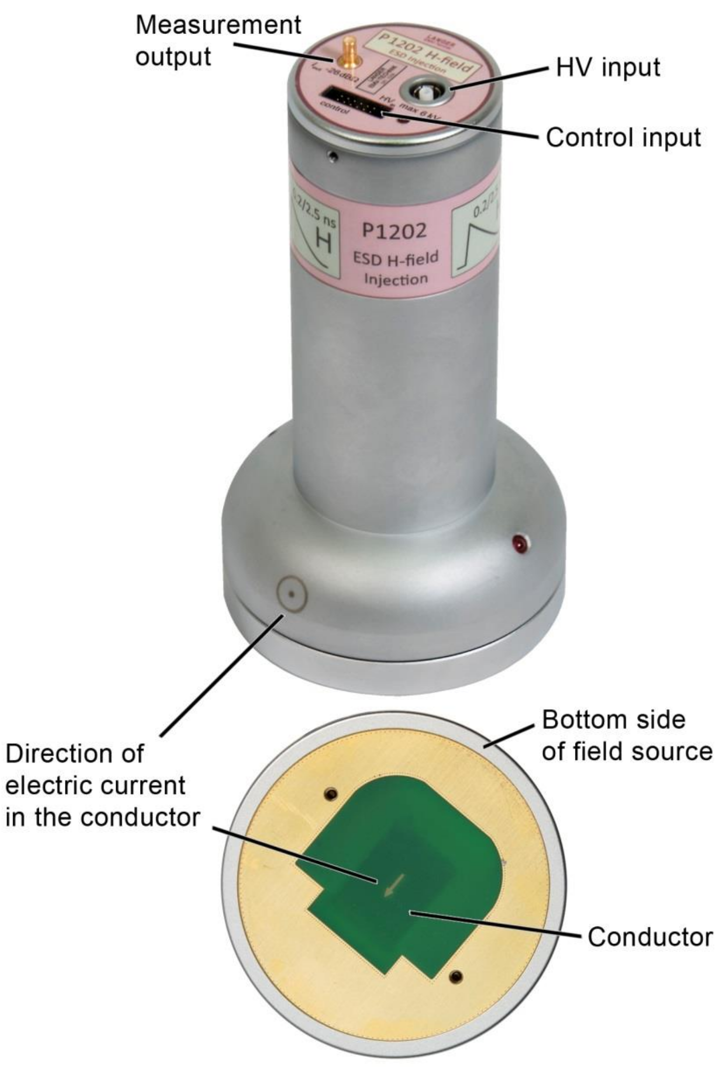

Figure 6: P1202 ESD field source with 3 cm long electric conductor

On the inside of the P1202 ESD field source (see **Figure 3)**, the HV power input is connected to the pulse shaping circuit. The output of the pulse shaping circuit is connected to the electric conductor located at the bottom of the field source. The end of the electric conductor is connected to ground of the field source and thus causes a short circuit in the current path.
The resulting current $\mathrm{i_P}$ generates a magnetic field that develops around the electric conductor.

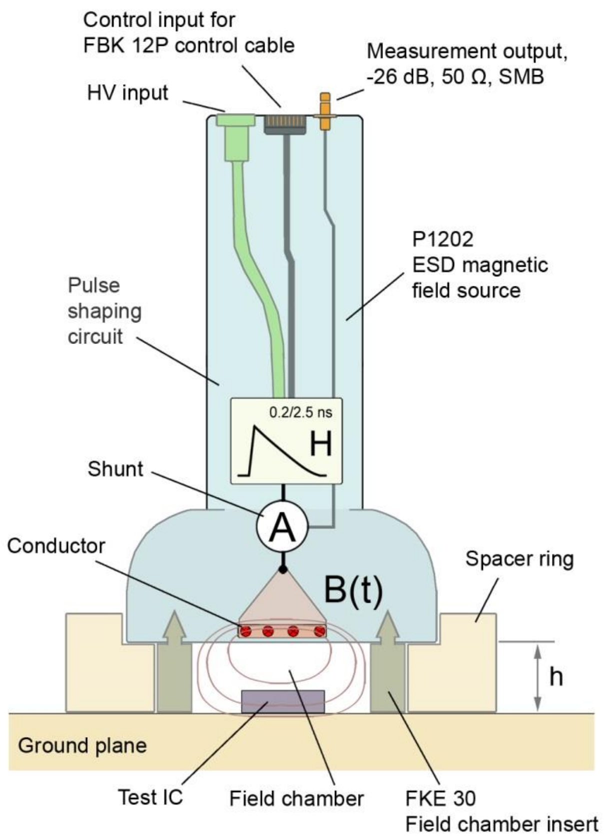

Figure 7: Principle of the immunity measurement using the P1202 field source (magnetic field)

Figure 7 shows the basic measurement principle. The field source, the spacer ring, the field chamber insert and the ground plane with the test IC form a field chamber. This field chamber limits and shields the generated magnetic field.

A shunt is located in the current path of the field source to measure the field-generating current i_P. This current can be calculated from the voltage at the field source's measurement output (refer to Section 8.4). The measurement output is terminated with 50 Ω inside the field source.

6.4 FKE 30 Field Chamber Insert

The FKE 30 field chamber insert is used together with the P1202 field source and the D70 h10 spacer ring. The field chamber insert has to be installed at the bottom of the P1202 field source as shown in Figure 8.

The field chamber insert ensures a higher suppression of the field’s electric component. All measured probe parameters are determined with the FKE 30 installed.

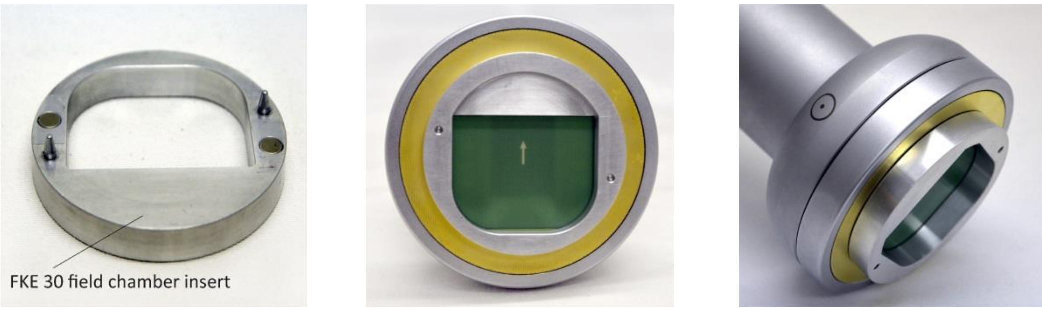

Figure 8: FKE 30 field chamber insert for use with P1202 field source

6.5 P1301 – Electric Field Source

Figure 9 shows the P1301 ESD E-field source.

The field source has two plug connectors, a high voltage input (Fischer connector) to supply the field source and a digital input (12 pin header) to control the field source.
The power input is marked $\mathrm{HV_{in}}$.

Figure 9: P1302 ESD field source

On the inside of the P1301 ESD field source (see Figure 10) the HV power input is connected to the pulse shaping circuit. The output of the pulse shaping circuit is connected to the electrode located at the bottom of the field source.
Due to the potential difference between the electrode and the ground surface, an electric field is generated which exits the electrode in the orthogonal direction. Figure 10 shows the basic test principle. The field source, the spacer ring and the ground surface with the test board form a field chamber. This field chamber limits and shields the generated electric field.

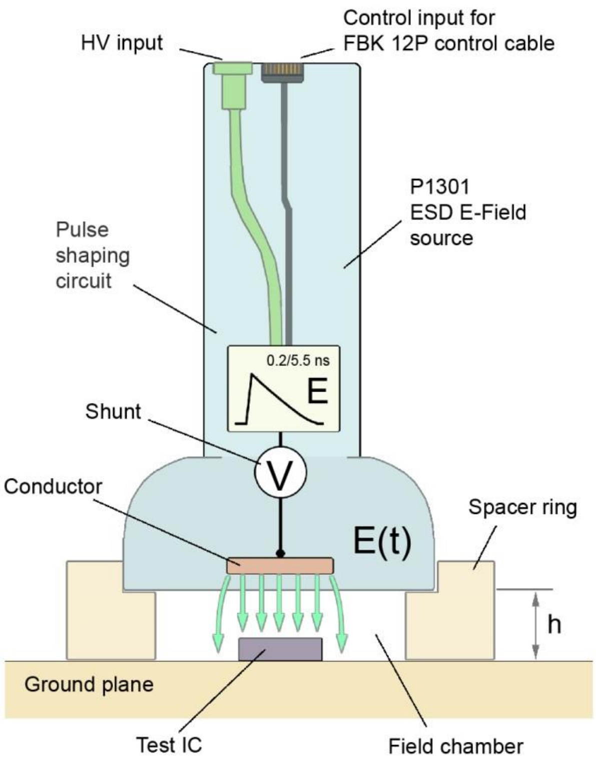

Figure 10: Principle of the immunity measurement using the P1301 field source (electric field)

6.6 EPM 02 and BPM 02 Field Meters

The magnetic or electric field strength generated by the field sources at the position of the test IC can be measured with the BPM 02 and EPM 02 field meters respectively. To do so, a field meter has to be inserted in the GND 25 ground plane[2] using the GNDA 02 ground adapter[3]. To calculate the magnetic flux density and the electric field strength based on the voltage u_{out} measured at the output of the respective field meter, the conversion factors defined in Table 6 and Table 7 are used.

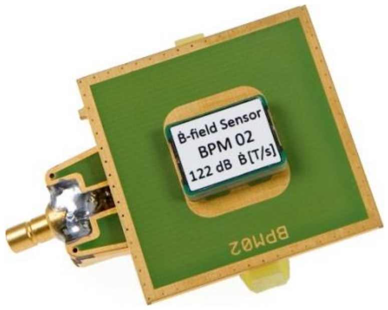

Figure 11: BPM 02 dB/dt field meter

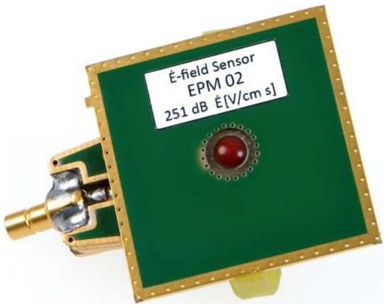

Figure 12: EPM 02 dE/dt field meter

[2] Not included. Is part of the ICE1 set.
[3] Not included. Is part of the ICE1 set.

6.7 D70 h10 and D70 h03 Spacer Rings

The D70 h10 and D70 h03 spacer rings are part of the P1202 / P1301 set. They are used to position the field sources above the test IC while providing a ground connection between the hull of the field source and ground system of the test IC. The height of the spacer ring determines the distance between the field source and the IC thus impacting the field strength that is present at the test IC. The ground surface, the field source and the spacer ring form a field chamber in which the test field develops.

Figure 13: D70 h03 and D70 h10 spacer rings

7 Set-up of the P1202 / P1301 L-ESD Set

Figure 14 shows the basic set-up for immunity measurements with the P1202 field source as an example. The P1202 / P1301 L-ESD set, the ICE1 set IC test environment[4] as well as different measuring and test devices[5] are required for the measurement set-up:

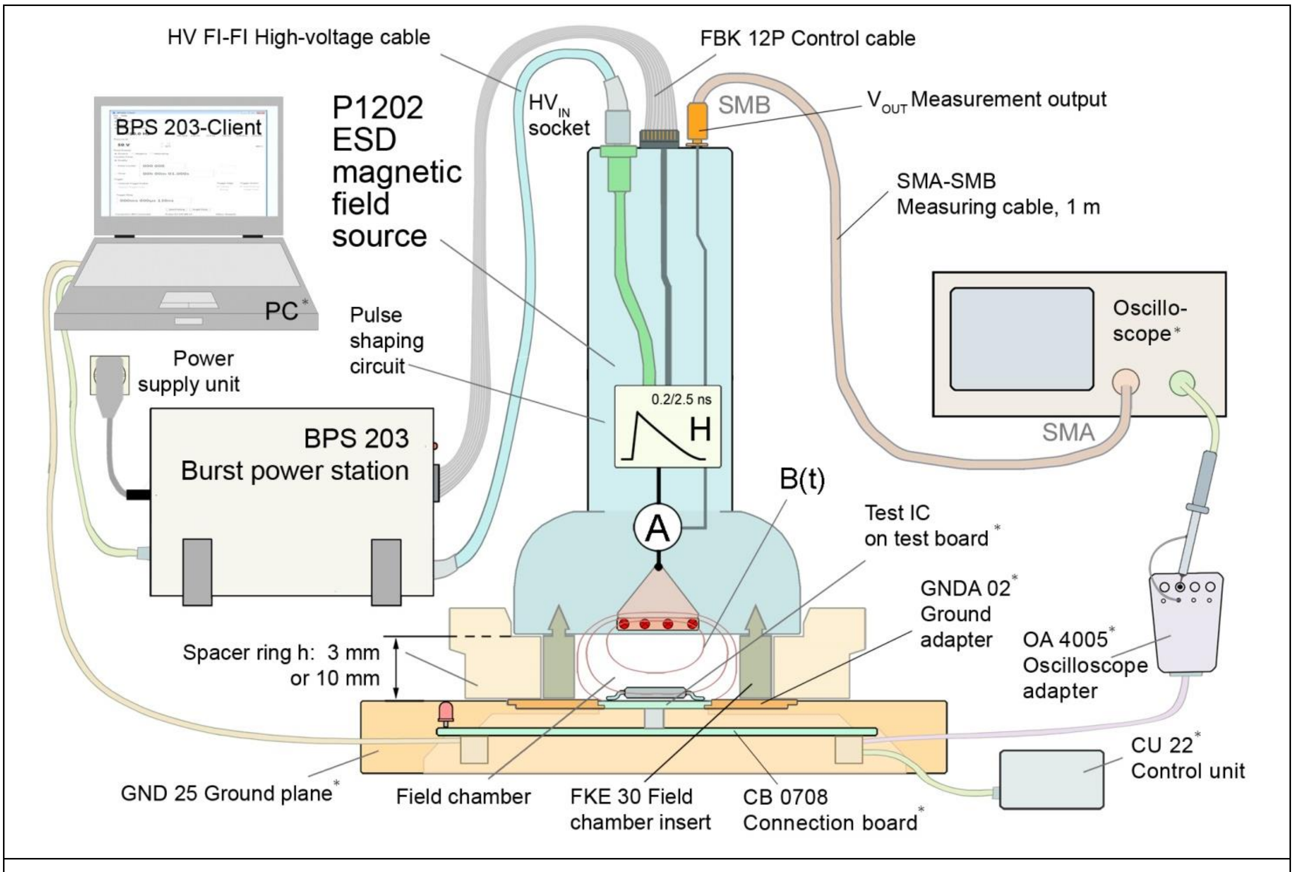

Figure 14: Set-up for immunity measurements using the ICE1 set and P1202 ESD magnetic field source. All devices which are not included in the scope of delivery are marked with an asterisk (*).

The following components, not included in the scope of delivery, are also needed:

- **ICE1 set,** IC test environment (Langer EMV-Technik GmbH)
- **Measuring and test devices** (e. g. Oscilloscope)
- **Test board** for the test IC

The test board together with the test IC is inserted into the GND 25 ground plane of the measurement set-up. The field source (here P1202) is located above the test IC by using a spacer ring. The BPS 203 is used to supply the high voltage and control the field source.

An oscilloscope and PC are needed to monitor the device under test and/or control the measurement set-up.

Only the P1202 features a measurement output, which allows controlling generated pulse current.

[4] not included in the scope of delivery
[5] not included in the scope of delivery

7.1 Orientation of the Field Sources

<u>Magnetic field (P1202):</u>
The magnetic field is oriented in a plane parallel to the ground surface in the area of the test IC (cf. Figure 16). Turning the field source on the spacer ring allows the user to vary the magnetic field's direction in this plane. The orientation of the electric conductor is marked at the bottom of the field source as an aid. In addition, there are two marks on the outer margin of the field source that show the orientation of the electric conductor. These are visible in Figure 6 and can be used to adjust the orientation of the field source on the spacer ring. The electric conductor and the magnetic field are perpendicular to each other in the area of the test IC.

<u>Electric field (P1301):</u>
The electric field is orthogonal to the ground surface (surface of the test IC) in the area of the test IC (cf. Figure 15). Turning the field source on the spacer ring has no significant impact on the direction and the intensity of the electric field. However, we recommend that the orientation is selected for the measurement that was also used to calibrate the measurement set-up. Please refer to Section 8.2 for further information on the calibration of the measurement set-up.

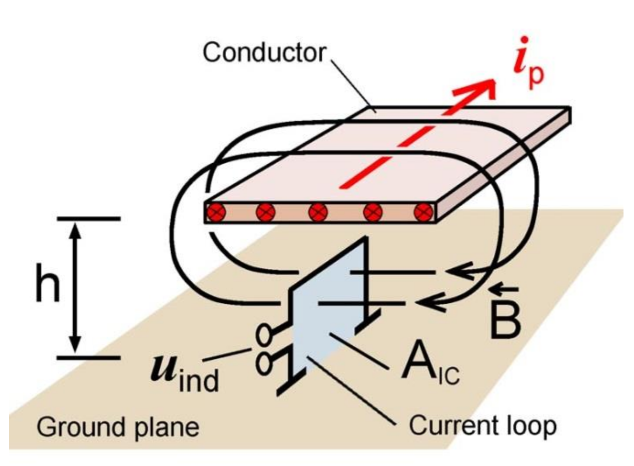

Figure 15: Field coupling principle, magnetic field

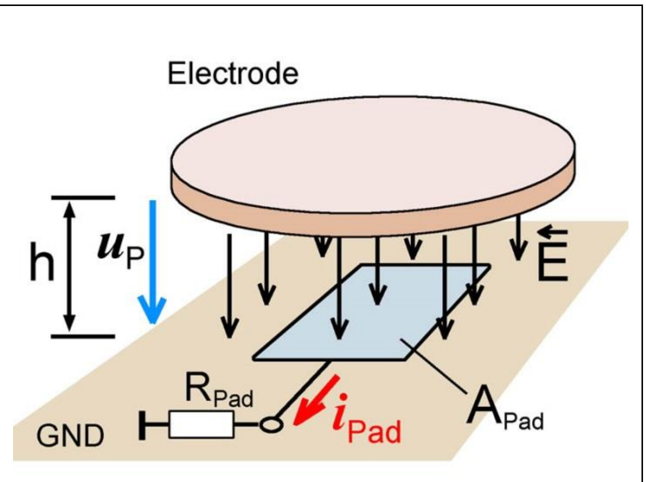

Figure 16: Field coupling principle, electric field

8 Start-up, Measurement and Calibration

The P1202 / P1301 L-ESD set can be used to measure the immunity of integrated circuits (ICs) against fast pulsed magnetic and electric fields. The tests are carried out while the IC is in operation.
The immunity to electric fields and magnetic fields is measured separately.

8.1 Measuring Devices

The ICE1 set and the P1202 / P1301 L-ESD set from Langer EMV-Technik GmbH are used to carry out immunity measurements. Depending on your measurement set-up, the following devices might be needed additionally:

- **Oscilloscope** to monitor the functions and/or signals of the device under test (DUT)
- **Computer** to control the field sources and / or automate the measurement
- **ICE1 set** IC test environment (Langer EMV-Technik GmbH)
- **Test board** see Section 8.2

8.2 Test Board

The test IC must be put into operation for the measurement. Thus a test board for the specific IC has to be manufactured for the following tasks:

- Provision of the signals and supply voltages required for test IC's operation
- Provision of connections for devices such as an oscilloscope to monitor the operation condition and/or detect faults

For further information on manufacturing the test board, please refer to IEC 62132-1 and the "Guideline IC EFT immunity"[6] from Langer EMV-Technik GmbH.

8.3 Quick Start

1. Visually check all components for damage. Continue if nothing is amiss.
2. Install **BPS 203-Client** onto your PC (skip if already done).
3. Connect the **P1202** or **P1301** field source with the **BPS 203** via the provided Fisher cable and the ribbon cable.
4. Connect the measurement output to an oscilloscope (only **P1202**).

⚠ Make sure you do not exceed the limits of your oscilloscope (Table 12). If required use an external attenuator[7].

5. Insert the test IC mounted on the test board into the GND 25 ground plane
   a. the IC is tested in operation, therefore connections for monitoring and operation have to be provided
6. Place a spacer ring onto the GND 25 and align for the test IC to be in its center.
7. Place the field source P1202 / P1301 into the spacer ring.
8. Power up the test IC.
9. Connect the power supply unit to the BPS 203.
   a. the status indicator LED of the BPS 203 light up
10. Connect the BPS 203 to the PC via the provided USB cable
11. Start the BPS 203-client software

[6] Available on request (mail@langer-emv.de)
[7] Not in scope of delivery

8.4 Pulse-Current Measurement (only P1202)

Use the measurement output of the P1202 field source to view the internally generated pulse current. The oscilloscope input has to be set to 50 Ω. Otherwise an external termination should be used.

> ⚠ Make sure not to exceed the limits of your oscilloscope (Table 12). If required use an external attenuator [8].

The appropriate attenuator settings for the oscilloscope (resulting from the shunt / external attenuator and 50 Ω termination) are found in Table 11. To get a proper pulse-current reading, the damping factor in the oscilloscope must be set according to the individual attenuator used. The transfer function is listed below.

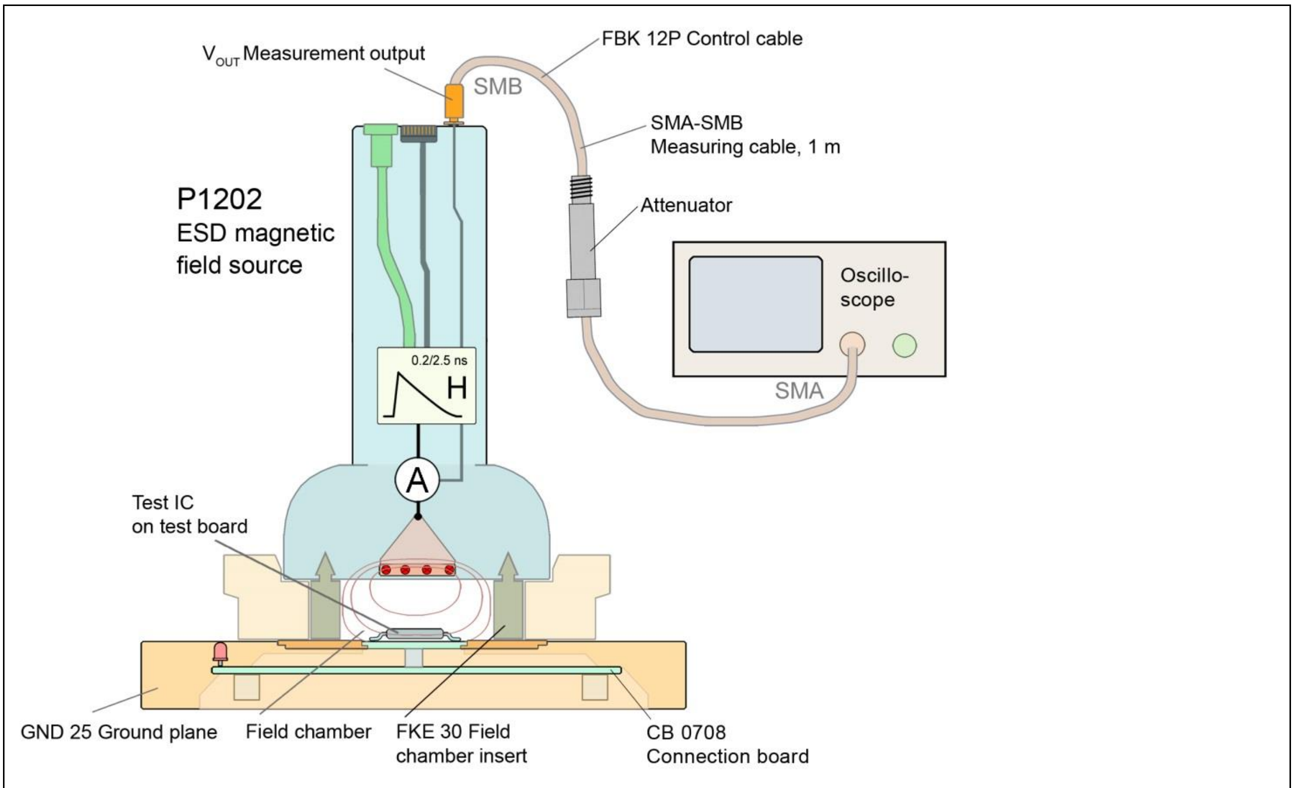

Figure 17: Set-up for pulse-current measurement with an oscilloscope.

V_{Out} (linear / log)	Attenuator (linear / log)	Termination oscilloscope (termination / att.)	Total attenuation (linear / log)
10 / -20 dB	-	50 Ω (-6 dB)	20 / -26 dB
10 / -20 dB	3.2 / -10 dB	50 Ω (-6 dB)	63 / -36 dB
10 / -20 dB	10 / -20 dB	50 Ω (-6 dB)	200 / -46 dB
10 / -20 dB	31.6 / -30 dB	50 Ω (-6 dB)	631 / -56 dB

Table 11: Measurement output – oscilloscope settings

[8] not in scope of delivery

Pulse level (HV)	**Pulse current (i_P)**	**Input voltage oscilloscope (50 Ω) using different attenuators**			
[kV]	**[A]**	**- [V]**	**10 dB [V]**	**20 dB [V]**	**30 dB [V]**
0.5	12	0.6	0.19	0.06	0.02
1	24	1.2	0.38	0.12	0.04
1.5	36	1.8	0.56	0.18	0.06
2	48	2.4	0.75	0.24	0.08
2.5	60	3	0.94	0.3	0.09
3	72	3.6	1.13	0.36	0.11
3.5	84	4.2	1.31	0.42	0.13
4	96	4.8	1.5	0.48	0.15
4.5	108	5.4	1.69	0.54	0.17
5	120	6	1.88	0.6	0.19
5.5	132	6.6	2.06	0.66	0.21
6	144	7.2	2.25	0.72	0.23

Table 12: Input voltage present at oscilloscope using different attenuators

The P1202 field source's measurement output can be used to calculate the magnetic flux density B generated by the field source at the position of the test IC.
The voltage equivalent of the pulse current i_p has to be measured at the field source's measurement output for this purpose. The respective field quantities can then be calculated using the conversion factor defined in Table 13.

$\mathrm{B} = \mathrm{K1} \cdot \mathrm{i_P}$
$\mathrm{i_P} = \mathrm{K4} \cdot \mathrm{u_{out}}$
Table 13: Conversion factor of the P1202 field source to calculate the field quantities

8.5 Calibration of the Measurement Set-up

The EPM 02 or BPM 02 are used to calibrate the measurement set-up. The BPM 02 is used in conjunction with the P1202 and the EPM 02 is used in conjuction with the P1301.
During calibration, the generated field strength is measured and adjusted via the BPS 203-client software to achieve the desired (test) field strength. It depends on the set high voltage HV_{in} (see Table 2 and Table 5).
The values of the generated field strength have to be stored in the BPS 203-client for each high-voltage step. After the calibration, the field meters are removed and the test board with the test IC is installed in the measurement set-up. The stored field strength values are used to measure the test IC's immunity.

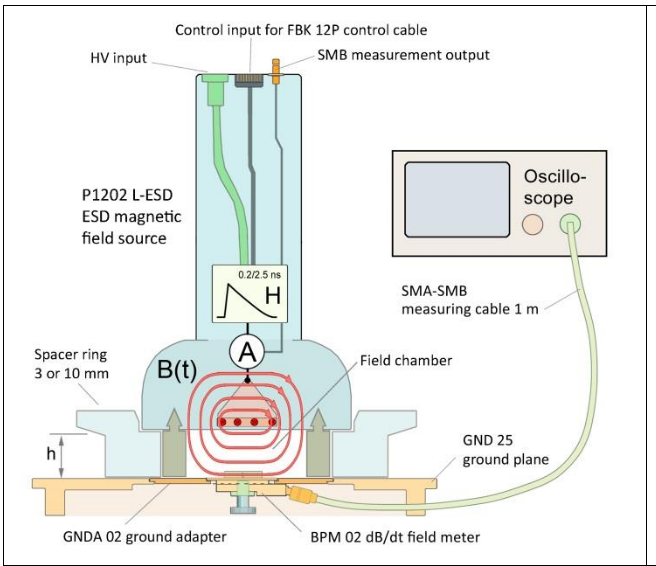

Figure 18: Calibration of P1202

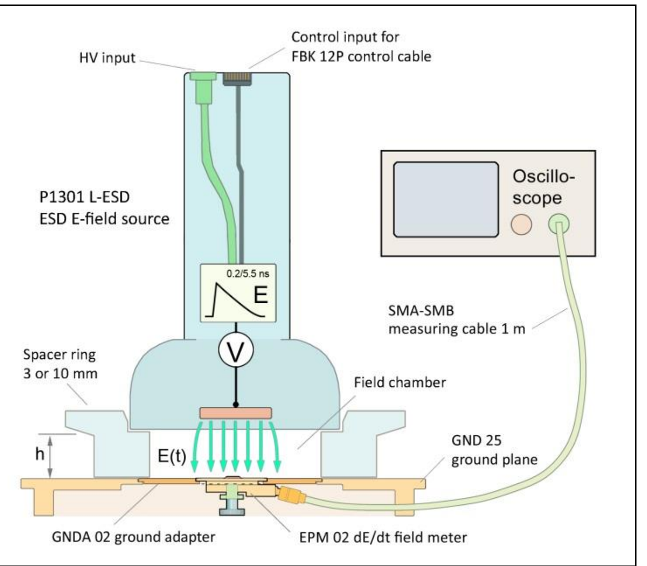

Figure 19: Calibration of P1301

The basic measurement set-up corresponds to Figure 14. The respective field meter is inserted into the GNDA 02 ground adapter instead of the test IC. The field strength that is generated by the field source can be determined on the basis of the relations described in Section 8.4.

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www.langer-emv.com

8.6 Measurement Sequence

The basic measurement can be carried out in accordance with IEC 62132-2:2010, for example:

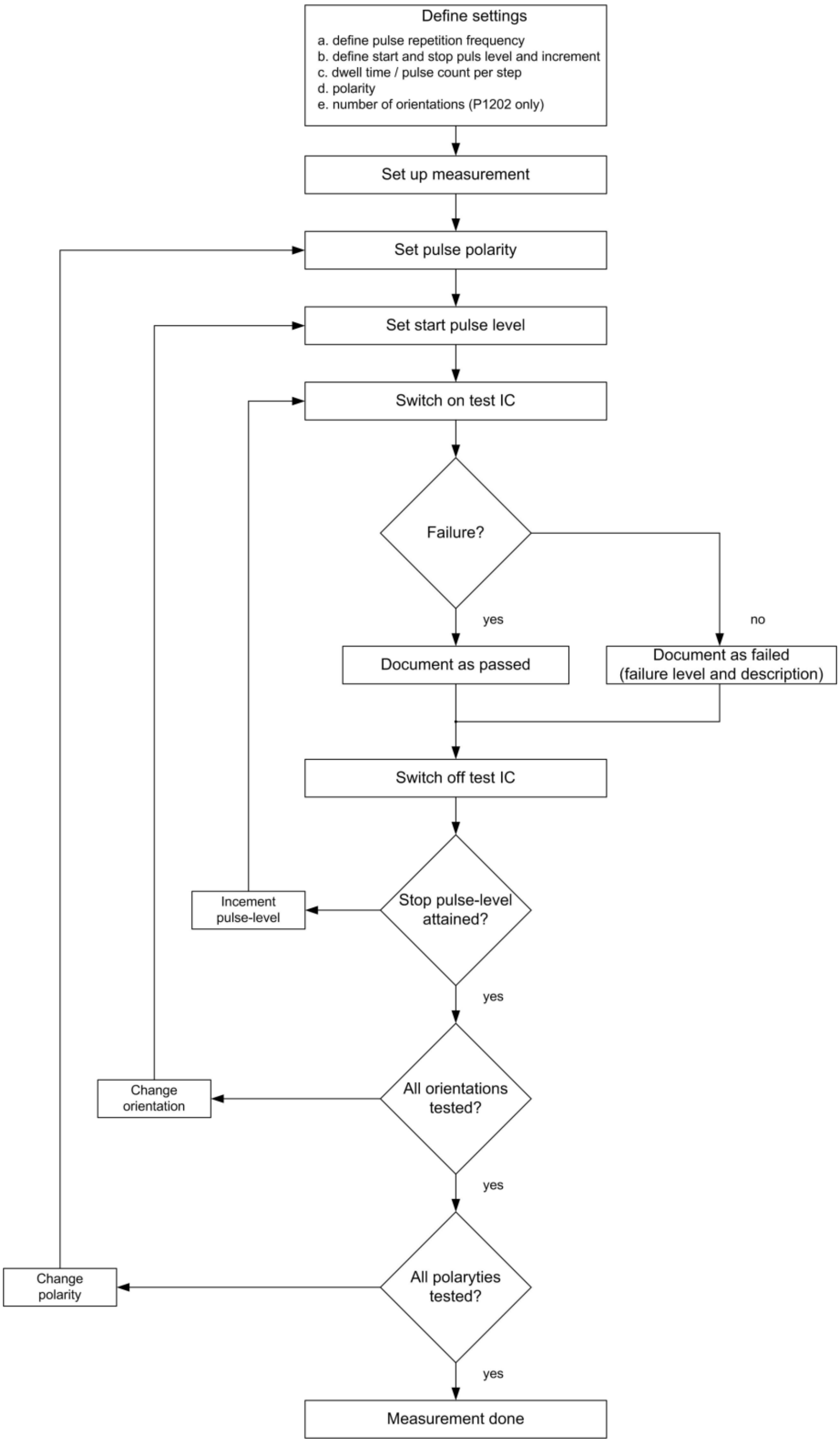

Figure 20: Flow chart showing the basic measurement procedure

9 BPS 203-Client Software

9.1 Installation

The enclosed installation media contains
- **BPS 203-Client** software and DLL
- operational manual
- device driver

Important: You need administrator rights to install the device driver on the PC.

- Double click the installer file BPS 203-Client-*.exe on the installation media.
- Follow the instructions during the installation.
- Proceed with the device driver installation which follows automatically.

9.2 Software Client – General Notes

The **BPS 203-Client** software contains the control elements needed to operate the **BPS 203** and its probes in its operating modes.

The Graphical User Interface (GUI) consists of:
- Burst configuration
- Probe parameter read out
- Polarity control
- Impulse counter
- Start / Stop / Single Pulse control
- Status bar

Settings are only possible if a valid **BPS 203** and a valid probe is detected by the software. This is displayed in the status bar (see Chapter 9.7).

After launching the software, the main dialog of the application always displays the ***Pulse Mode***, see Figure 14.

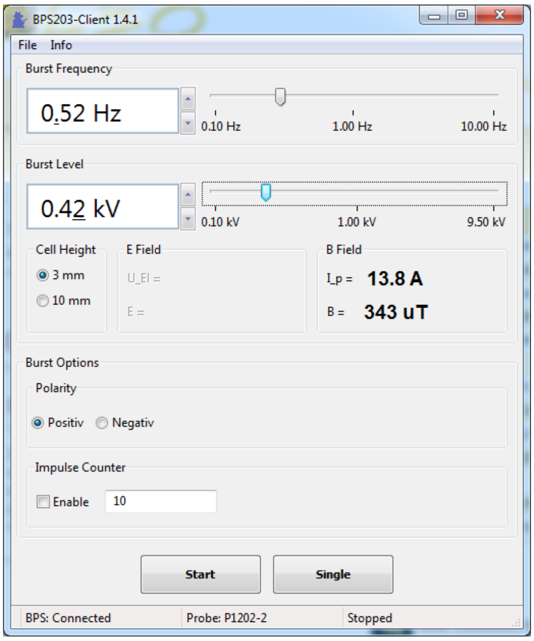

Figure 21: Main Dialog Pulse Mode

9.3 Pulse Configuration

The pulse repetition frequency and the pulse voltage level that is fed into the attached field source can be adjusted with the sliders depicted in Figure 22

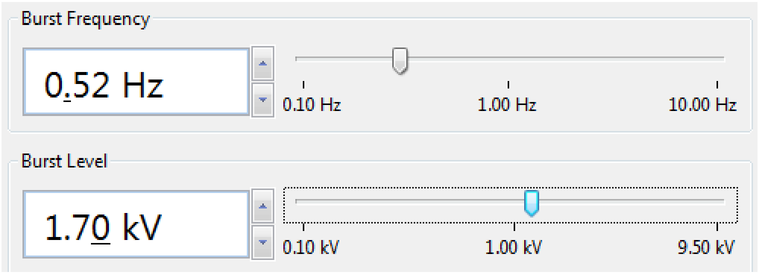

Figure 22: Setting of the pulse repetition frequency and pulse voltage level

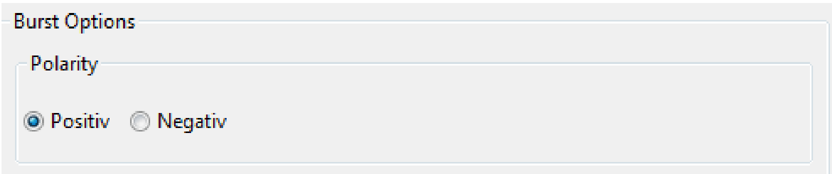

Figure 23: Pulse polarity

The polarity of the created pulses can be set in the GUI section **Polarity**. Available options are:

- Positive (+)
- Negative (-)

9.4 Setting of a Defined Pulse Counter

When enabled, the BPS 203 issues only the predefined number of pulses. After all pulses are issued, the BPS 203 returns to the wait state.

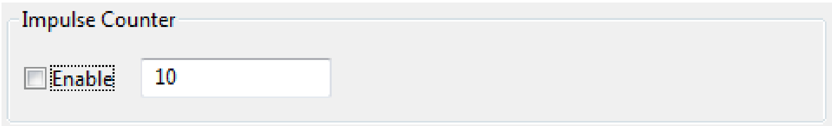

Figure 24: Impulse counter

9.5 Probe Parameter Read Out

Depending on the attached field source, this field will show the resulting voltage / current / electric field strength / magnetic flux density for a given pulse voltage level. These values are hardcoded into the field source's memory during factory calibration.
When using field-coupled probes e.g. P1202 or P1301 the spacer ring used in the measurement set-up has to be selected, since the electric field strength / magnetic flux density applied to the test IC is highly dependant on the distance between field source and IC.

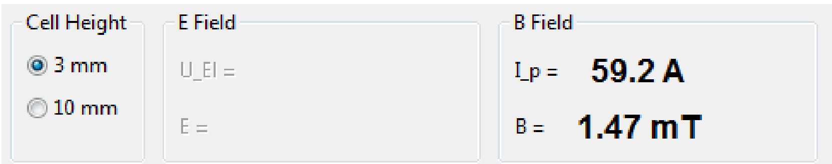

Figure 25: Probe parameter read out

9.6 Operating Modes

<u>Single Pulse</u>
By pressing the ***Single (Pulse)*** button (Figure 26) the **BPS 203** will generate a single pulse with the defined **Pulse Level** and **Polarity**. The **Status LED** of the **BPS 203** and the **LED** of the connected field source will blink one time.

Figure 26: Active buttons: Start Pulsing and Single Pulse

<u>Continuous Pulses</u>
When the ***Start (Pulsing)*** button (Figure 26) is pressed, the **BPS 203** will generate continuous pulses with the defined pulse parameters. Additionally the LED on the field source and the **Status LED** on the BPS 203 will blink continuously. The software's status will display ***Status: running*** and the **Start (Pulsing)** button is renamed **Stop (Pulsing)**. The pulse frequency and voltage can be changed at any time.
Depending on the **Counter** settings, the pulses remaining are displayed in the **Impulse Counter** box and are updated continuously.

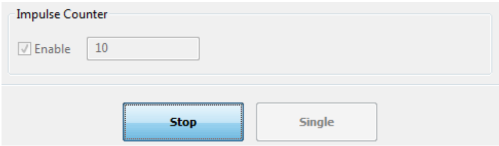

Figure 27: Pulse counter at start up 10 pulses remaining

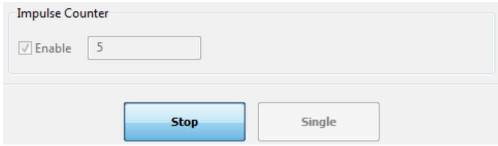

Figure 28: Pulse option counter after 5 pulses

9.7 Status Bar Messages

The status bar of the **BPS 203-Client** consists of:

1. The status of the **BPS 203** USB connection
   - ***Connection: BPS disconnected***
   - ***Connection: BPS connected***

2. Status of the automatic probe recognition
   - ***No Probe detected***
   - ***P#### detected***

3. Operating mode of the **BPS 203**
   - ***Status: stopped* –** no generation of pulses or bursts
   - ***Status: running* –** generating pulses or bursts
   - ***Status: Waiting for Trigger* – BPS 203** waits for an external trigger event

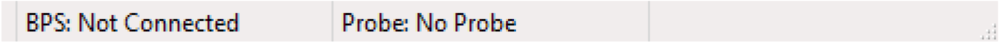

Figure 29: No USB connection to BPS 203

Figure 30: BPS 203 connected but no valid probe detected

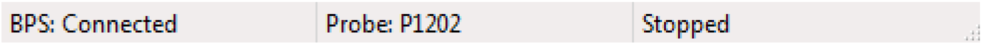

Figure 31: BPS 203 connected and the P1202 field source is detected

9.8 Menus

File:

- EXIT:Shuts down the **BPS 203-Client**

Figure 32: File menu

Info:

- Hardware Info:Display hardware information about the **BPS 203** and its connected probe.
- About: Software information / link: www.langer-emv.de

Figure 33: Info menu

Warranty

Langer EMV-Technik GmbH will remedy any fault caused by defective materials or defective manufacture during the statutory warranty period, either by repair or replacement.

This warranty is only granted on condition that:

- the information and instructions in the user manual have been observed.

The warranty will be forfeited if:

- an unauthorized repair is performed on the product,
- the product is modified,
- the product is not used for its intended purpose,
- the product has been opened.

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