

**LANGER**  
EMV-Technik

# IC TEST SYSTEM

User Manual

**P250 set**

EFT/burst injection up to 6 kV



- Translation of the original user manual -

<b>Table of contents</b>	<b>Page</b>
<b>1 Declaration of Conformity .....</b>	<b>3</b>
<b>2 General Information .....</b>	<b>3</b>
2.1 Storing the user manual.....	4
2.2 Reading and understanding the user manual .....	4
2.3 Local safety and accident prevention regulations.....	4
2.4 Figures and diagrams .....	4
2.5 Limitations of liability.....	4
2.6 Errors and omissions .....	4
2.7 Copyright .....	4
<b>3 Scope of Delivery .....</b>	<b>5</b>
<b>4 Technical Parameters .....</b>	<b>6</b>
<b>5 Safety .....</b>	<b>7</b>
5.1 Labels and Signs .....	7
5.2 Intended Use .....	7
5.3 Reasonably foreseeable Misuse .....	7
5.4 Staff Requisition .....	8
5.5 Safety Instructions .....	8
<b>6 Design and Operating Principle .....</b>	<b>9</b>
6.1 Overview .....	9
6.2 Additional Equipment.....	9
6.3 Description .....	10
6.4 Design and Function of the P250 Probe .....	10
6.5 Changeable Probe Tips .....	11
6.6 Characteristics.....	12
<b>7 Operational Notes .....</b>	<b>13</b>
<b>8 System Set-Up .....</b>	<b>14</b>
<b>9 Verifying the Waveform .....</b>	<b>16</b>
<b>10 Warranty .....</b>	<b>17</b>

# 1 Declaration of Conformity

Manufacturer:

Langer EMV-Technik GmbH

Nöthnitzer Hang 31  
01728 Bannewitz  
Germany

Langer EMV-Technik GmbH herewith declares that the

**P250 set**, EFT/burst injection up to 6 kV including P250 with TS 250-2.2p, TS 250-10p, TS 250-100p, TS 250-1n, TS 250-100n

conforms with the following relevant regulations:

- Restriction of certain Hazardous Substances 2011/65/EU

The following applicable standards were used to implement the requirements specified by the a forementioned directives:

- IEC 60502-2 – Power cables with extruded insulation for rated voltages 1 kV up to 30 kV
- DIN EN IEC 63000:2019-05 (Restriction of hazardous substances)

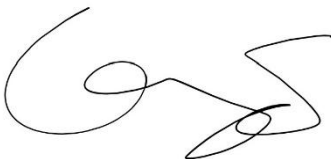
Note: This product is not covered by the Low Voltage Directive (2014/35/EU), as the operating voltage exceeds 1000 V AC.

Name of the person authorized to compile the technical

Katja Langer

Bannewitz, 2025-09-08

Signature:



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K. Langer, Managing Director

## **2 General Information**

### **2.1 Storing the user manual**

This user manual provides the basis for the safe and efficient use of the P250 set. It must be kept close at hand and easily accessible to the user.

### **2.2 Reading and understanding the user manual**

The user must have read and understood the user manual before using the product. Please contact Langer EMV-Technik GmbH if you have any queries and remarks.

### **2.3 Local safety and accident prevention regulations**

The local safety and accident prevention regulations must be observed.

### **2.4 Figures and diagrams**

The figures and diagrams in this user manual help the user understand the system, but they may also differ slightly from the actual design.

### **2.5 Limitations of liability**

Langer EMV-Technik GmbH can assume no liability for damage to property and personal injury if

- The instructions given in this user manual have been ignored.
- The product was used by persons who are not qualified in the field of EMC and are not fit to work under the influence of disturbance voltages and electromagnetic ESD fields.
- The product was not used for its intended purpose.
- The product was subjected to unauthorized modifications or technical changes.
- Spare parts or accessories were used that had not been approved by Langer EMV-Technik GmbH.

### **2.6 Errors and omissions**

The information in this user manual has been checked very carefully and found to be correct to the best of our knowledge; however, Langer EMV-Technik GmbH can assume no responsibility for spelling, typographical or proofreading errors.

### **2.7 Copyright**

The content of this user manual is protected by copyright and may only be used in connection with the P250 set. This user manual may not be used for other purposes without the prior consent of Langer EMV-Technik GmbH.

### 3 Scope of Delivery

Item	Designation	Type	Parameter	Qty.
01	EFT Coupling Network	P250	6 kV	1
02	Probe Tip 2.2 pF	TS 250-2.2p	6 kV	1
03	Probe Tip 10 pF	TS 250-10p	6 kV	1
04	Probe Tip 100 pF	TS 250-100p	6 kV	1
05	Probe Tip 1 nF	TS 250-1n	6 kV	1
06	Probe Tip 100 nF	TS 250-100n	0.5 kV	1
07	High-voltage Cable Fischer-Fischer	HV FI-FI	1 m	1
08	Shunt	SM 02-01	0.1 $\Omega$	1
09	System Case	P250 case		1
10	User manual			1
11	Quick guide			1

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



## 4 Technical Parameters

<b>Max. pulse voltage acc. to IEC 61000-4-4</b>	6 kV
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Table 1: Limit values / load factor of the P250 EFT coupling network

Parameter	TS 250-100 n	TS 250-1 n	TS 250-100 p	TS 250 – 10 p	TS 250 – 2.2 p
Coupling capacitance	100 nF	1 nF	100 pF	10 pF	2.2 pF
Max. pulse voltage	0.5 kV	6 kV	6 kV	6 kV	6 kV

Table 2: Limit values / load factor of the probe tips

## 5 Safety

### 5.1 Labels and Signs

 <p>General warning sign</p>	 <p>Warning; Electricity</p>	 <p>Prohibition sign; No access for people with active implanted cardiac devices.</p>
<p>Table 3: Safety signs</p>		

Safety instructions in this user manual are marked by symbols (Table 3). Observe the safety precautions and act cautiously to avoid accidents as well as personal and material damages.

### 5.2 Intended Use

The P250 set is used to inject electrical fast transients into integrated circuits so as to determine their pulse immunity according to IEC 62215-3 and IEC 61000-4-4. The probe contains a coupling network which is supplied with pulses from an EFT/burst generator (according to IEC 61000-4-4).

The P250 probe and all included probe tips are built according to their specified use therefore they should be used only for the following purposes:

- Injection of pulses into IC pins or balls with the P250 including one of the TS 250-x coupling networks powered by a standard EFT generator (according to IEC 61000-4-4).
- The P250 set must be used in conjunction with the ICE1 set from Langer EMV-Technik GmbH.

Any use beyond these specifications is considered contrary to the intended use.

### 5.3 Reasonably foreseeable Misuse



**Danger resulting from misuse!**

**Misuse of the P250 set can lead to dangerous situations!**

- Use of the product outside of the given specifications
- Modification or changing of the product without consent of Langer EMV-Technik GmbH
- Operating the product with a technical fault.

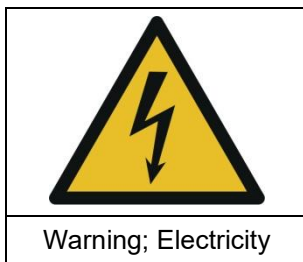
## 5.4 Staff Requisition

Only qualified staff with training, knowledge, and experience in the field of EMC is allowed to operate the P250 set.

Persons whose ability to perform is influenced or impaired by alcohol, drugs, or pharmaceuticals, are not allowed to operate the P250 set.

Certain functions may only be carried out by qualified personnel of Langer EMV-Technik GmbH.

## 5.5 Safety Instructions



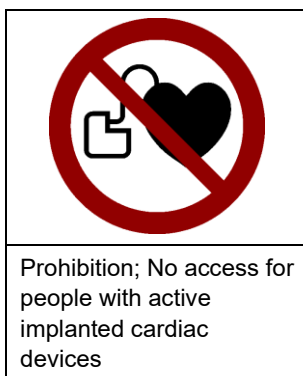
**Danger resulting from Electricity!**

**Risk of injury by electrocution!**

Only connect the high-voltage cable to the P250 probe before operation.

Don't touch the connected probe tip while the P250 probe is in operation.

- If insulation is damaged, the power supply has to be disconnected immediately.
- Replace damaged parts with undamaged parts before operation. Contact Langer EMV-Technik GmbH for proper replacements.
- Protect live parts from moisture to avoid short circuits.



**Danger resulting from electromagnetic fields!**

**Risk of affecting a cardiac device!**

Persons with a cardiac device, such as a pacemaker, are not allowed to work on or approach the P250 set while it is in operation.

## 6 Design and Operating Principle

### 6.1 Overview

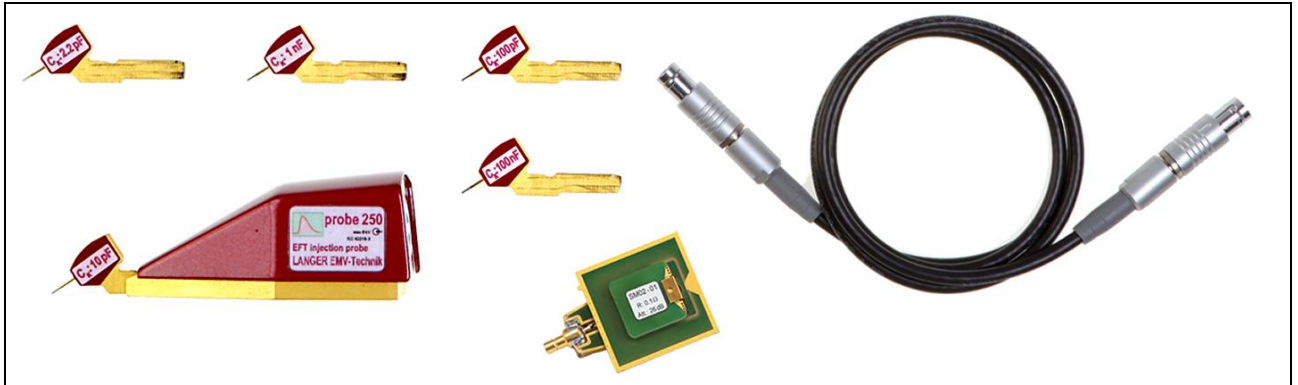


Figure 1: P250 with probe tips, shunt, and HV cable

Name	Description
P250	EFT coupling network
TS 250-2.2p	Changeable probe tip with coupling capacity of 2.2 pF.
TS 250-10p	Changeable probe tip with coupling capacity of 10 pF.
TS 250-1n	Changeable probe tip with coupling capacity of 1 nF.
TS 250-100p	Changeable probe tip with coupling capacity of 100 pF.
TS 250-100n	Changeable probe tip with coupling capacity of 100 nF.
SM 02-01	Shunt to verify the waveform of the current pulse.
HV FI-FI	Connects the P250 probe with an EFT/burst generator

Table 4: Description of P250 set

### 6.2 Additional Equipment

This additional equipment is needed to operate the P250 set.

- Windows PC
- ICE1 set<sup>1</sup>

<sup>1</sup> Product of Langer EMV-Technik GmbH

### 6.3 Description

The P250 probe is used to inject electrical fast transients into integrated circuits so as to determine their pulse immunity according to IEC 62215-3 and IEC 61000-4-4. The probe contains a coupling network which is supplied with pulses from an EFT/burst generator (according to IEC 61000-4-4).

Apart from its layout and housing design, the characteristics of the ICs which are used in a device are decisive for its EMC characteristics. The ICs' susceptibility to fast pulsed disturbances increases significantly if their structural dimensions, operating voltages and operating points are reduced. ICs with identical functions can thus show a very different EMC behavior depending on the respective manufacturer, the package used or the corresponding series, among other things.

### 6.4 Design and Function of the P250 Probe

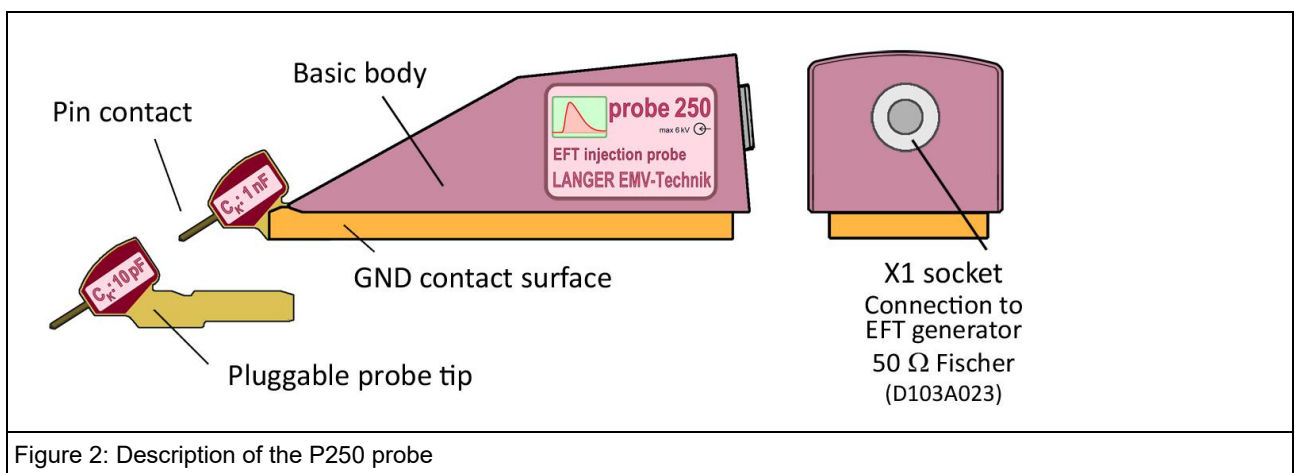




Figure 2: Description of the P250 probe


The basic body (**Figure 2**) holds the different probe tips which include the coupling network. The GND contact surface on the bottom of the probe is the return conductor. The socket X1 is connected to the EFT/burst generator via the enclosed high-voltage cable HV FI-FI 1 m.


## 6.5 Changeable Probe Tips


Each of the five probe tips (Figure 3...Figure 7) includes a different coupling network that is used to inject disturbances into the different pins of the device under test.

	$C_K = 2.2 \text{ pF}$ $R = 0 \Omega$ max. 6 kV	Application: Quartz crystal or oscillator input
Figure 3: TS 250-2.2p probe tip		

	$C_K = 10 \text{ pF}$ $R = 0 \Omega$ max. 6 kV	Application: Inputs/outputs: reset, IRQ, analog inputs, amplifier inputs
Figure 4: TS 250-10p probe tip		

	$C_K = 100 \text{ pF}$ $R = 0 \Omega$ max. 6 kV	Application: Automotive test, inputs/outputs
Figure 5: TS 250-100p probe tip		

	$C_K = 1 \text{ nF}$ $R = 0 \Omega$ max. 6 kV	Application: Inputs/outputs: power supply
Figure 6: TS 250-1n probe tip		

	$C_K = 100 \text{ nF}$ $R = 0 \Omega$ max. 0.5 kV	Application: Automotive test, power supply
Figure 7: TS 250-100n probe tip		

## 6.6 Characteristics

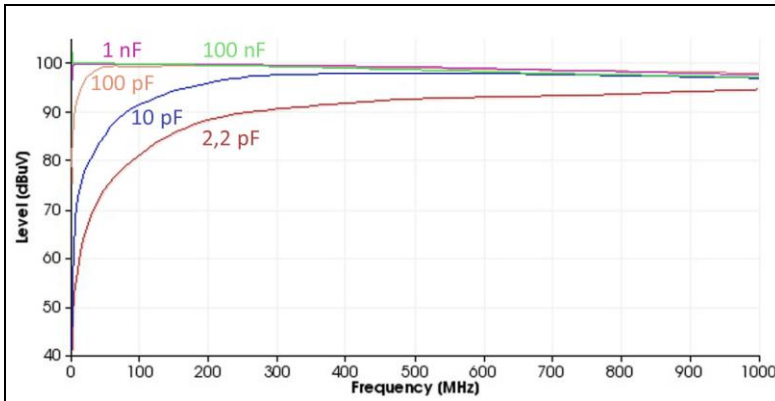


Figure 8: Frequency responses of the P250 probe with different probe tips

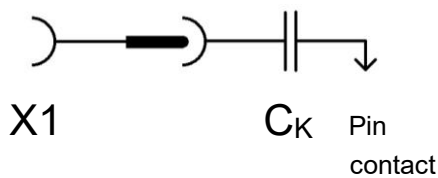


Figure 9: P250 equivalent circuit diagram

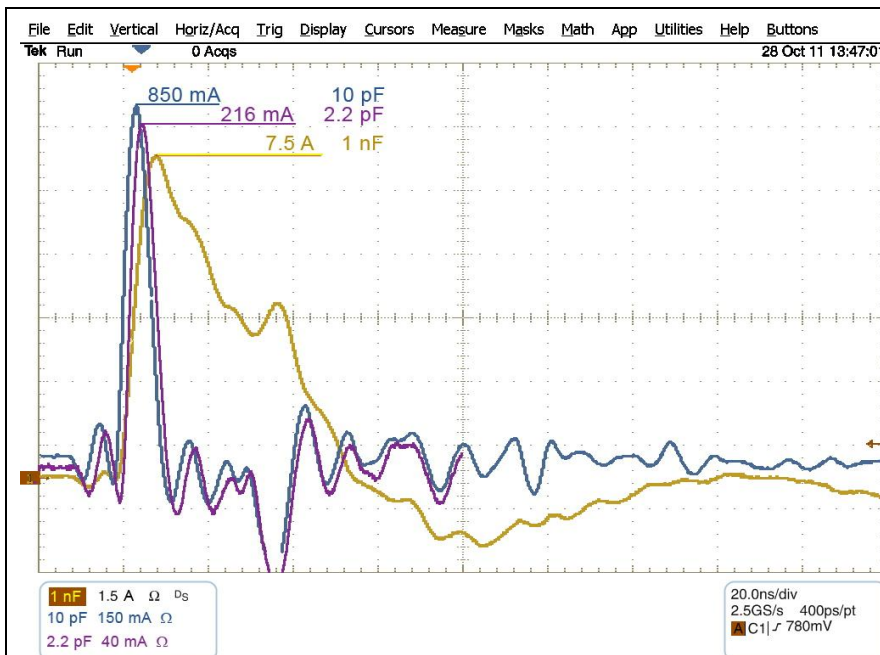


Figure 10:

- EFT/burst disturbance pulses from the probe tips depending on the coupling capacitance  $C_K$
- Supply voltage of the P250 probe: 500 V, 5/50 ns
- The probe tip injects a voltage into a 200 m Ohm shunt
- Measurement signal: current flow from the probe tip into the 200 mOhm shunt

The coupling capacitance of the probe tip converts the disturbance pulse of the EFT/burst-generator. The smaller the coupling capacitance  $C_K$  of the probe tip, the smaller the amplitude and pulse width of the emitted disturbance (**Figure 10**).

## 7 Operational Notes

- The test set-up should always be operated via a filtered power supply.
- **Attention! Functional near fields and interference emissions may occur when operating EMC test set-ups. The user is responsible for taking measures to prevent any interference to the correct function of products outside the EMC environment of the test set-up (in particular through radiated interference).**  
This can be achieved by:
  - observing an appropriate safety distance,
  - use of shielded or shielding rooms.
- The disturbances that are injected into the ICs can destroy (latch-up) the device under test if their intensity is too high. Protect the device under test by:
  - increasing the disturbance gradually and stopping when a functional fault occurs,
  - interrupting the power supply to the device under test in the event of a latch-up.
- **Attention! Make sure that internal functional faults are visible from outside. The device under test may be destroyed due to an increase in the injection intensity if the faults are not visible outside. Take the following measures as necessary:**
  - monitoring of representative signals in the device under test,
  - special test software,
  - visible reaction of the device under test to inputs (reaction test of the device under test).

We cannot assume any liability for the destruction of devices under test!

## 8 System set-Up

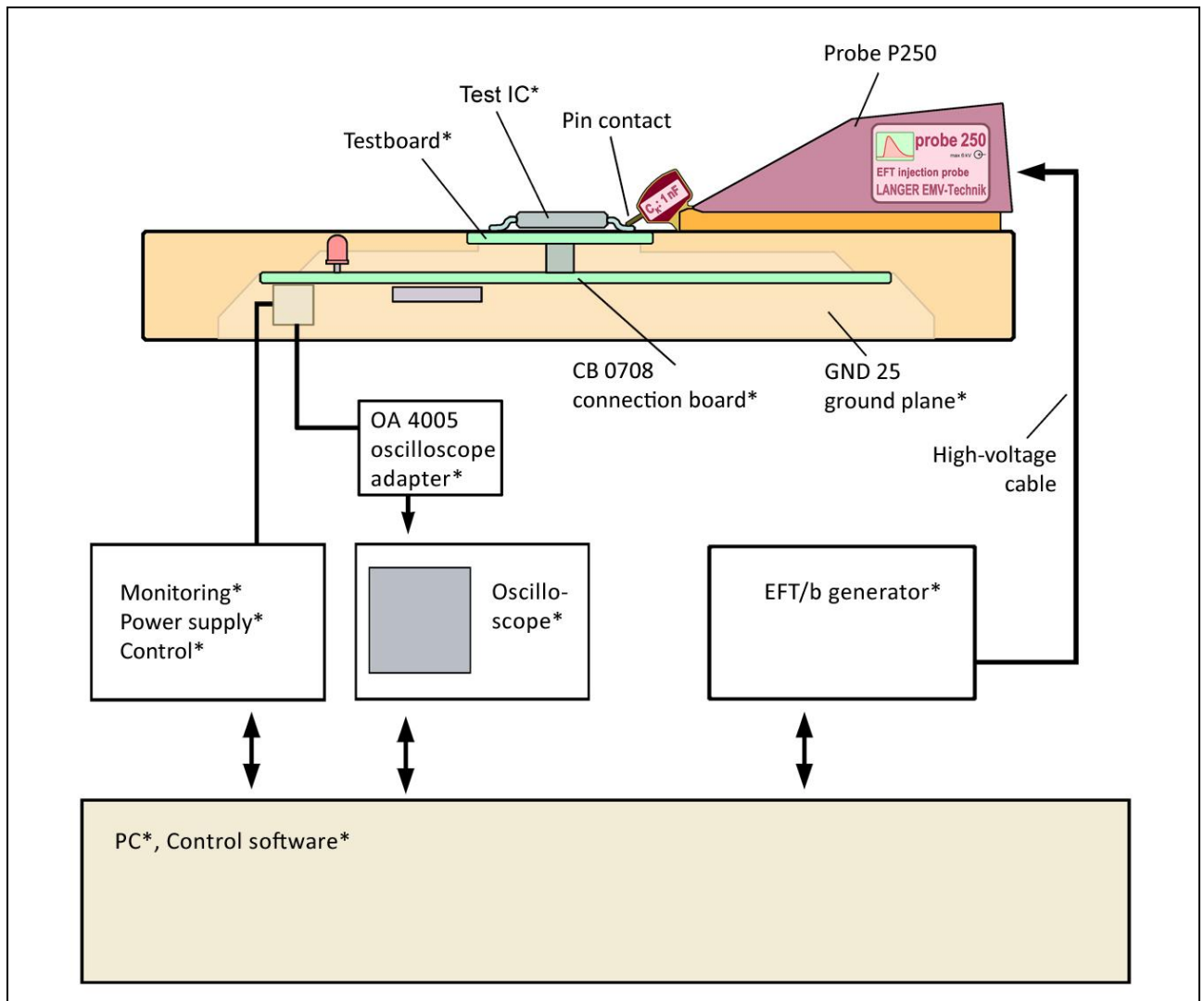


Figure 11: P250 probe in the test environment

The components marked with an asterisk (\*) are not included in the scope of delivery.

**Figure 11** shows the set-up of the IC test system with the ICE1 IC test environment set (**Table 5**) and the P250 probe set.

The probe is used to contact the individual IC pins directly. Different coupling networks are available for the injection depending on the type of pin (I/O, Vdd), (see **Figure 3...Figure 7**). The HV output of the EFT/burst generator is connected directly to the probe via the enclosed HV FI-FI 1 m high-voltage cable.

The P250 probe is used to inject the disturbance pulse of the EFT/burst generator into the pin of the test IC through the coupling capacitance  $C_K$ .

The test IC is mounted on a test board<sup>2</sup>. The test board is inserted via a GNDA xx ground adapter into the GND 25 ground plane and connected to the CB 0708 connection board via a plug connector.

<sup>2</sup> For manufacturing of the test board: "Guideline IC EFT immunity", Langer EMV-Technik GmbH

The ground plane and connection board are components of the ICE1 set. External devices such as an oscilloscope or special test hardware may be required to evaluate signals from the test IC (**Figure 12**).

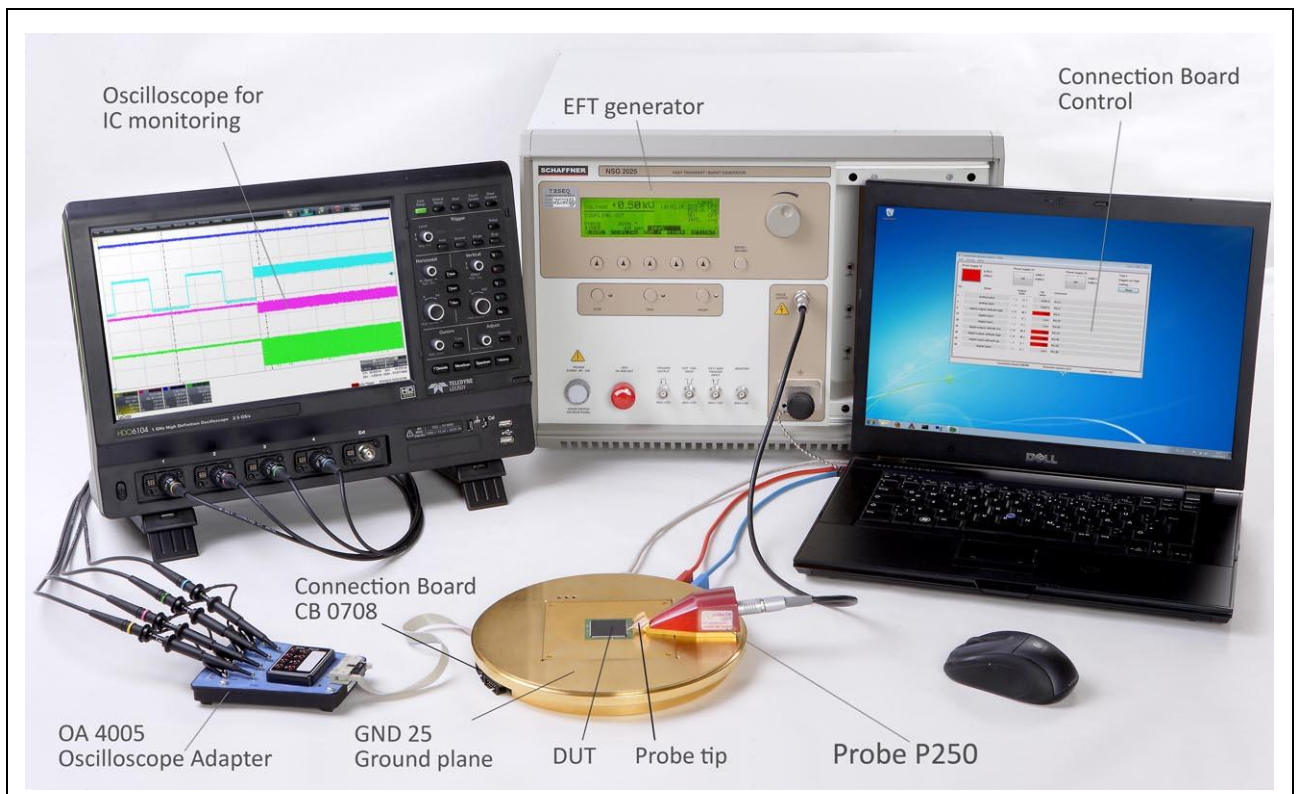


Figure 12: Test set-up with the P250 probe set and ICE1 set

The devices and tasks listed in **Table 5** are described in their respective manuals:

Tasks and Devices	Manuals
<ul style="list-style-type: none"> <li>• Instructions for the development of the test board</li> <li>• Test process</li> </ul>	<b>Guideline IC EFT immunity</b> (Langer EMV-Technik GmbH)
<ul style="list-style-type: none"> <li>• <b>GND 25</b> ground plane</li> <li>• <b>CB 0708</b> connection board</li> <li>• <b>OA 4005</b> oscilloscope adapter</li> <li>• <b>TH 22</b> probe head holder</li> <li>• Monitoring and controlling the test IC</li> </ul>	<b>ICE1 set</b> user manual

Table 5

## 9 Verifying the Waveform

The SM 02-01 shunt can be used to verify the waveform of the current pulse. The shunt has a bandwidth of 3 GHz and can be loaded with a maximum pulse current of 180 A in the single-pulse mode of the EFT generator.

The shunt is inserted in the GNDA 02 ground adapter (**Figure 13**). The SMB output is connected to the 50 Ohm input of an oscilloscope. If the oscilloscope's attenuator is set to 26 dB (x20), the voltage value that is measured with the oscilloscope corresponds to the current flowing through the shunt. An oscilloscope with a bandwidth of 500 MHz or more should be used for the measurement. **Table 6** shows the probe parameters depending on the respective probe tip. The measurement was performed with an EFT/burst generator according to IEC 61000-4-4. The voltage was set to 1 kV on the EFT/burst generator, except for the 100 nF probe tip (500 V).

The waveform has to be verified prior to every major measuring job. Provided the waveform does not deviate from the given parameters, the P250 probe only has to be calibrated every two years by Langer EMV-Technik GmbH.

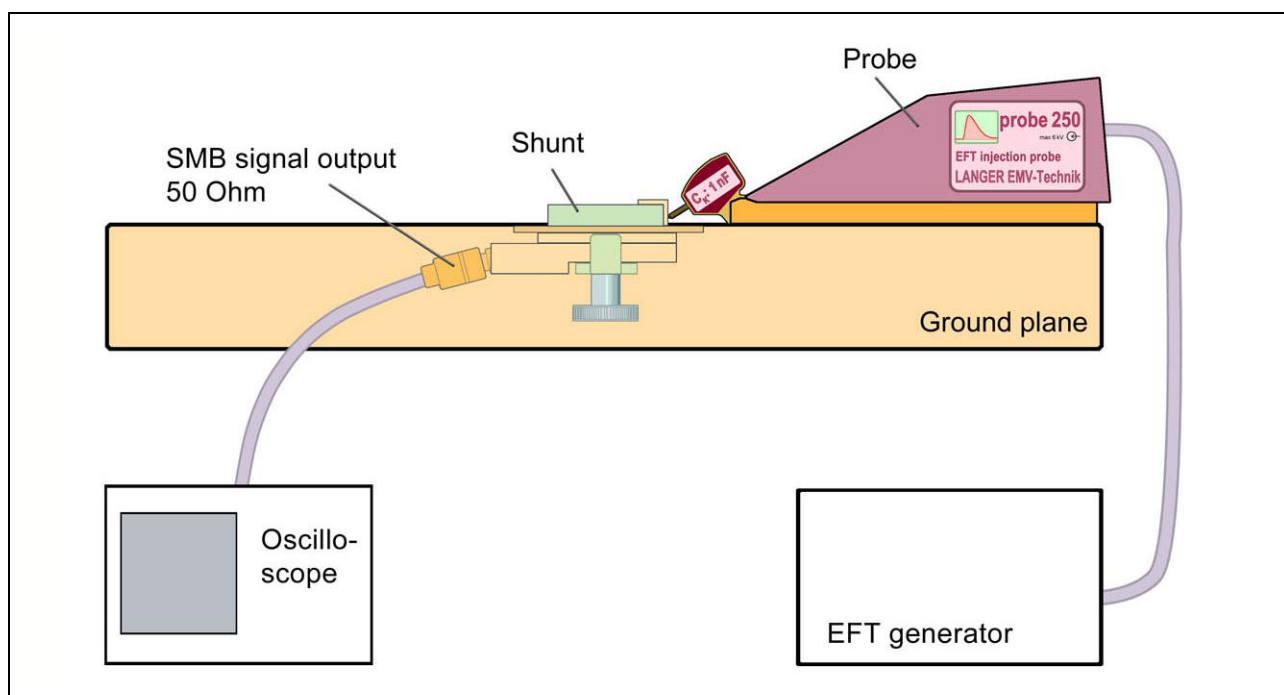


Figure 13: Measurement set-up to verify the waveform

Parameter	TS 250-2.2 p	TS 250-10 p	TS 250-100 p	TS 250-1 n	TS 250-100 n
$I_{max}[A]$	0.29...0.35	1.0...1.3	8.0...10.0	15.7...19.0	9.0...11.0
Rise [ns]	3.0...4.0	3.2...4.0	3.8...4.6	5.0...6.0	4.5...5.5
Width [ns]	5.0...6.0	5.0...6.0	6.0...7.4	21.0...27.0	42.0...52.0

Table 6: Waveform parameters

## 10 Information on Recycling and Disposal



**DE 80567526**

In accordance with the WEEE Directive 2012/19/EU (Waste of Electrical and Electronic Equipment), the following must be observed:

At the end of its service life, this product should be taken to a suitable disposal facility for recycling and disposal. Do not dispose of with household waste.

# 11 Customer service

Please contact us if you have any questions, comments or suggestions.

## You can contact us:

Monday – Friday  
8:00 Uhr bis 15 Uhr (CET)

## Contact us at:

Address: Langer EMV-Technik GmbH  
Nöthnitzer Hang 31  
01728 Bannewitz  
Germany

Internet: <https://www.langer-emv.com/>

E-mail: [sales@langer-emv.de](mailto:sales@langer-emv.de)

Phone: +49 (0) 351-430093-0

Fax: +49 (0) 351-430093-22

## **Calibration**

We recommend having the product calibrated every two years by the manufacturer Langer EMV-Technik GmbH or by a certified distributor.

## 12 Warranty

Langer EMV-Technik GmbH will remedy any fault due to defective material or defective manufacture, either by repair or by delivery of replacement, during the statutory warranty period.

**This warranty is only granted on condition that:**

- the information and instructions in this 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 according to its intended purpose.

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