LANGER
EMV-Technik

User manual

Demonstration Boards Mini Burst Field Generators
EMC-Basic 1 set

Table of contents: **Page**

1 Declaration of Conformity

Manufacturer:
Langer EMV-Technik GmbH

Nöthnitzer Hang 31
01728 Bannewitz
Germany

CE

Langer EMV-Technik GmbH herewith declares that the

EMC-Basic 1 set, Emission Development System

conforms with the following relevant regulations:

- EMC Directive 2014/30/EU
- Low-Voltage Directive 2014/35/EU
- Restriction of certain Hazardous Substances 2011/65/EU

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

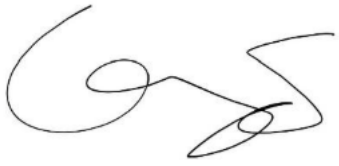
- DIN EN IEC 61000-6-1:2019-11 (EMC immunity)
- DIN EN IEC 61000-6-3:2022-06 (EMC emission)
- DIN EN 61010-1:2020-03 (Safety)
- DIN EN IEC 63000:2019-05 (Restriction of hazardous substances)

Name of the person authorized to compile the technical documentation:

Katja Langer

Bannewitz, 2026-01-14

Signature:



_____
K. Langer, Managing Director

2 General Information

2.1 Storage of the User Manual

This user manual enables the safe and efficient use of the EMC-Basic 1 set. It must be kept close at hand and accessible to the use.

2.2 Reading and Understanding the User Manual

Read the user manual carefully, observe the safety information (Chapter 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 EMC-Basic 1 set is used for its intended purpose.

2.4 Images

Figures and images 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.
- EMC-Basic 1 set was operated by staff not qualified in the field of EMC.
- EMC-Basic 1 set was subjected to unauthorized modifications or technical changes.
- EMC-Basic 1 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

3 Safety

3.1 Labels and Signs

		
General warning sign	Warning; Electricity	Prohibition sign; No access for people with active implanted cardiac devices.
Table 1: Safety signs		

Safety instructions in this user manual are marked by symbols (**Table** 1). Observe the safety precautions and act cautiously to avoid accidents as well as personal and material damages.

3.2 Intended Use

The EMC-Basic 1 set with the SF 11 and SF 21 demonstration boards is an assembly for demonstrating immunity phenomena.
The boards are developed for demonstrations with ESD and burst generators of all manufacturers. With these demonstration boards, magnetic (SF 11) and electric (SF 21) coupling mechanisms of immunity can be clearly illustrated on one board each with the corresponding mini burst field generators (B-field: P11 pulser and E-field: P21 pulser).

3.3 Reasonably foreseeable Misuse

	**Danger resulting from misuse!** **Misuse of the EMC-Basic 1 set can lead to dangerous situations!**
Warning!	

Incorrect applications of the sets include:

- Use of the product outside of the given specifications.
- Modification or changes to the product without the consent of Langer EMV Technik GmbH.
- Operation of the product with a technical defect.

3.4 Staff Requisition

Only qualified staff with training, knowledge, and experience in the field of EMC is allowed to operate the EMC-Basic 1 set.

Persons whose ability to perform is influenced or impaired by alcohol, drugs, or pharmaceuticals, are not allowed to operate the EMC-Basic 1 set.

3.5 Safety Instructions

 Warning; Electricity!	**Danger resulting from electricity!** **Risk of injury by electrocution!**

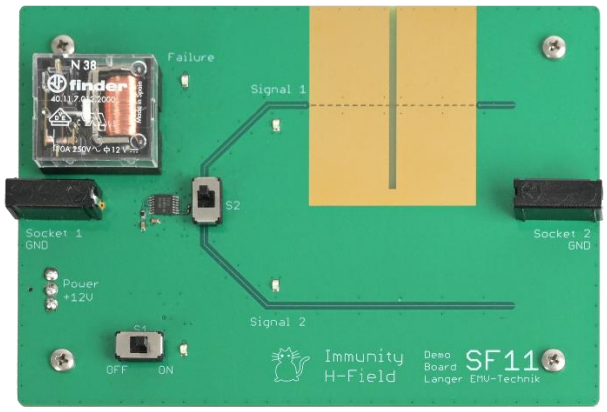
4 Scope of delivery

SF 11 – Demo Board Immunity B-Field

Short Description
The SF 11 demo board is a board on which interference effects such as burst and ESD due to magnetic field are demonstrated.
The interference can be generated e.g. with burst generators, ESD generators, the E1 Immunity development system and field sources from Langer EMV-Technik GmbH and thus illustrate their operating principle.

Technical Parameters

Supply voltage	12 V
Current input	ca. 20 mA
Sizes (L x W x H)	(140 x 100 x 23) mm

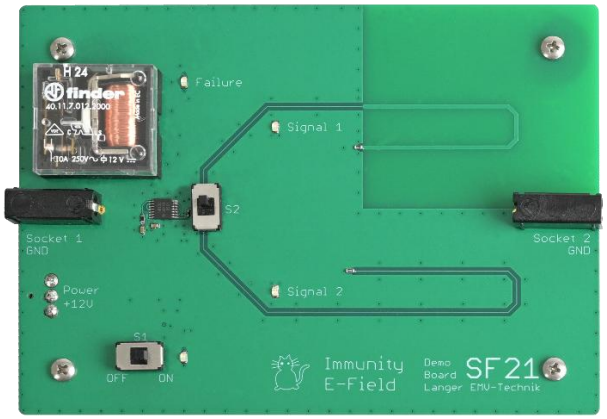


SF 21 – Demo Board Immunity E-Field

Short Description
The SF 21 demo board is a board on which interference effects such as burst and ESD due to E-field are demonstrated.
The interference can be generated e.g. with burst generators, ESD generators, the E1 Immunity development system and field sources from Langer EMV-Technik GmbH and thus illustrate their operating principle.

Technical Parameters

Supply voltage	12 V
Current input	ca. 20 mA
Sizes (L x W x H)	(140 x 100 x 23) mm



NT FRI EU – Power Supply Unit

Technical Parameters

Output voltage	12 V

P11 – Mini Burst Field Generator (B)

Short Description
The P11 mini burst field generator creates a magnetic disturbance field with a diameter of approx. 3 mm at its tip. Localized pulses can be transmitted via this field onto the surface of printed circuit boards and components allowing for weak points such as the sensitive parts of conducting paths, components and component connectors to be detected.

Technical Parameters

Generated magnetic flux density	approx. 1 mT
Pulse parameter	
Pulse width	2 ns ... 8 ns
Frequency	single / 5 kHz
Polarity	switchable
Supply voltage	1.5 V / AAA
Weight	30 g
Sizes (L x W x H)	(118 x 24 x 13) mm

P21 – Mini Burst Field Generator (E)

Short Description
The P21 mini burst field generator creates an electric field at its tip, which is suitable for coupling into conducting paths, wires, pins, and components, especially SMD components like resistors and capacitors. Single conductors of flat cables or plug contacts can be also tested.

Technical Parameters

Generated E-field strength	ca. 100 kV/m
Pulse parameter	
Rise time	1.8 ns ... 10 ns
Frequency	single / 5 kHz
Polarity	switchable
Supply voltage	1.5 V / AAA
Weight	30 g
Sizes (L x W x H)	(118 x 24 x 13) mm

5 Pulser

5.1 Disturbance Mechanisms

- Electronic modules have differing disturbance immunities, related to their Layout and IC-sensitivity.
- Weak spots, which can be exactly pinpointed, are the cause of burst and ESD- sensitivity. The formation of the weak spots is largely dependent upon the GND/Vcc-geometry and type/manufacturer of the installed ICs.
- Magnetic or electrical pulse fields are the essential physical quantities, which have an effect upon the flat modules.
- As a rule, a weak spot is either only magnetically or only electrically sensitive.
- From a practical point of view, both types of weak spots are relevant. For example, electrical fields can occur, during disturbance events, which influence electrically sensitive weak spots. The currents, which are driven by the electrical field produce magnetic fields, which, in turn, influence magnetically sensitive weak spots.
- The disturbance effects of both mechanisms overlay one another and are difficult to separate.
- Both types of weak spots require different EMC measures, due to their differing physical mechanisms.
- The localization of the weak spots and separation according to type takes place with the E- or B-field sources of the Mini Burst Field Generators.

Mini Burst Field Generators - Color mapped types

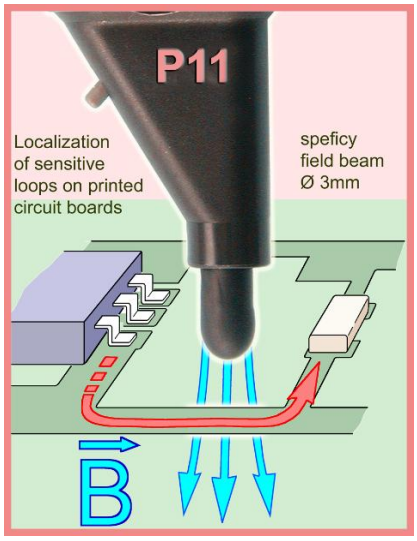
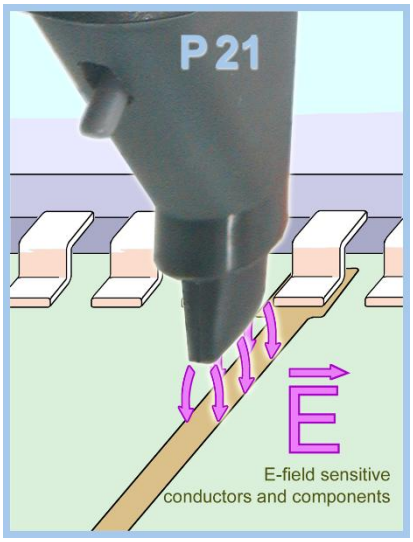
B pulser P11 (red)	E pulser P21 (blue)
	

Table 1: Field generation of the generators

5.2 Design and Mode of Operation

5.2.1 Design

The MINI burst field generator consists of a battery-operated disturbance quantity generator, which feeds an E- or B-field source. Upon activation of the generator, either a single pulse or a continual pulse sequence is given off, depending on the setting.

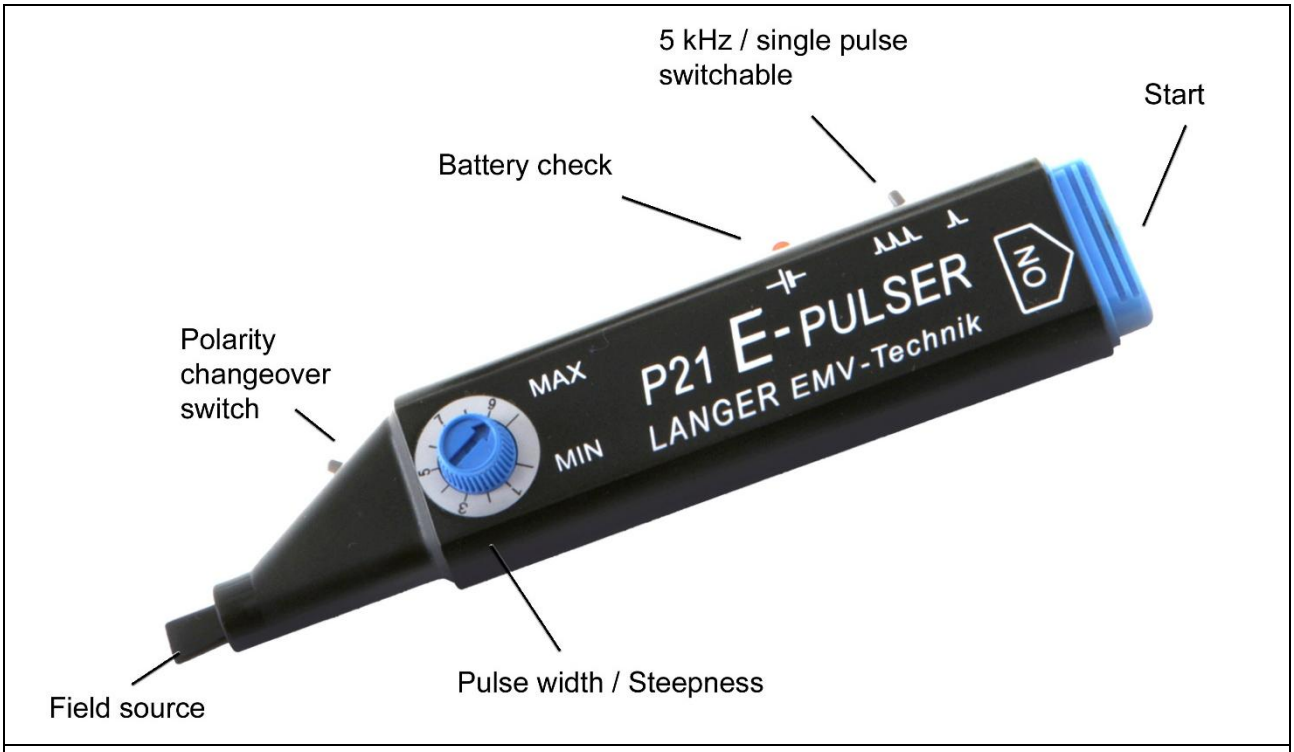


Figure 1: Design Mini Burst Field Generator

Note: The tips of the mini burst field generators are sensitive to mechanical stress.

5.2.2 Operation

„ON“-Pushbotton:	The device is only active with the button pressed (no closed-circuit current).
Single pulse:	A pulse is triggered each time the ON pushbutton is pressed.
Pulse sequence:	Pulses are produced at a repetition frequency of approx. 5 kHz as long as the ON pushbutton is pressed.
Intensity: B field	Max: wide pulse / Min narrow pulse
Intensity: E field	Max: steep edge - high steepness Min: steep edge - reduced steepness
Polarity:	The polarity of the disturbance can be switched over.
LED:	„Voltage monitoring“ The battery has to be changed if the LED comes on permanently

5.2.3 Battery Change

by pulling off the rear sealing cap in the direction of the arrow:

- Plus pole (+) of battery on the cap side
- Replace the cap in the reverse order

Battery:
AAA 1.5 Volt

Figure 2: Changing the battery of the Mini Burst Field Generator

5.3 Setting the Pulse Parameters

5.3.1 Adjustability of the Pulse Parameters: B pulser P11 (red)

POLARITY:
The direction of the magnetic pulse field can be adjusted with the „Polarity“ button.

INTENSITY: The pulse width can be adjusted with the „Intensity“ controller.

Adjustment of the Intensity:

Setting	**Impulse width**
MAX	approx. 8 ns
MIN	approx. 2 ns

The scale is divided into ten parts, for orientation.

Narrow pulses (setting MIN, approx. 2 ns) influence sensitive ICs.

Insensitive ICs are not influenced by these pulses.

Wide pulses (setting MAX, approx. 8 ns) influence sensitive and insensitive ICs.

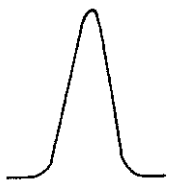
Pulse parameter		**Setting**	**Quantity**	**Value**	**Unit**
	Pulse width	MIN MAX	T T	approx. 2 approx. 8	ns ns
	Amplitude (voltage induction in a loop)		û	max 20	V
	Repeating frequency	Pulse sequence	f	5	kHz

Table 2: Pulse parameter B pulser

5.3.2 Adjustability of the Pulse Parameters: E pulser P11 (blue)

POLARITY: The direction of the steep edge can be adjusted with the „Polarity“ button.

INTENSITY: The pulse width / height can be adjusted with the „Intensity“ controller.

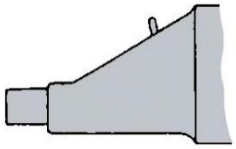
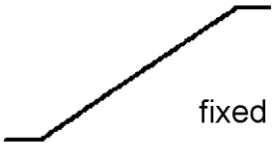
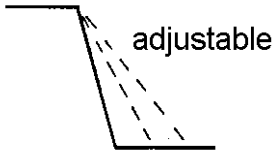
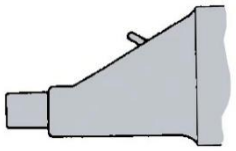
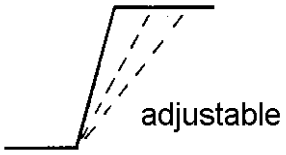
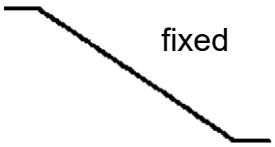
Pulse parameters	**Change of the electric field strength**	
Polarity	Rising edge	Falling edge
Switch position 	FLAT: Constant approx. 1kV/mm µs 	STEEP: MAX setting: approx. 1kV/mm ns 
Switch position 	STEEP: MAX setting: approx. 1kV/mm ns 	FLAT: Constant approx. 1kV/mm µs 
Repetition frequency	5 kHz	

Table 3: Pulse parameter E pulser

STEEP	- only fast IC (digital technology)
1kV/mm ns	- high-resistance and low-resistance structures
FLAT	- slow and fast IC
1kV/mm µs	- high-resistance structures

The STEEP edge can be adjusted with the „Intensity“ controller. The maximum value of the field strength change E=1 kV/mm ns corresponds to the MAX setting and can be reduced with the controller. This allows the evaluation of the susceptibility of weak spots and / or the sensitivity of the IC concerned. The scale is divided into ten parts for better orientation.

5.4 Use

The Mini burst field generators facilitate the development-accompanying analysis of the disturbance immunity of flat modules.
The field source of the generator produces ESD/burst-similar pulse-shaped fields, which are limited to a few square millimeters. The mini burst field generators are guided by hand, with their field-producing points (field source) close to the surface of the unit under test (flat module). This makes it possible to precisely influence GND/Vcc- structures, individual tracks, and ICs on the flat module, in order to determine the presence of weak spots by means of function failures.
By means of the adjustable intensity of the disturbance quantity, one can compare the weak spots with one another and evaluate the effectiveness of the EMC-measures.
The separation of magnetic disturbance (B-pulser P11, red) and electrical disturbance (E-pulser P21, blue) makes it possible to differentiate between magnetic and electrical weak spots.

B-pulser type P11 Weak spot tester RED	- produces a limited, radial magnetic field at its tip, for the localization of B-field-sensitive circuit areas.	
E-pulser type P21 Weak spot tester BLUE	- produces a limited, radial electrical field at its tip, for the localization of E-field-sensitive circuit areas.	

Regulation testing cannot be carried out with the mini burst field generators. Measurements at regulation testing sites are necessary for the determination of regulation disturbance immunity values. Experience, however, makes it possible to make estimates
In order to achieve the level of disturbance immunity, as defined in regulations, during developmental examinations, it is advisable to make comparative measurements with regulation disturbance quantities on a random basis.

5.5 Execution of Tests

5.5.1 Starting up the Mini Burst Field Generators

Single pulses / pulse sequences are triggered by pressing the ON pushbutton.
(Please refer to Point 5.2.2 for operation and Point 5.3 for setting the pulse parameters)

Functional check using the „Voltage monitoring“ LED
- Flashes briefly if the „ON“ pushbutton is pressed - system is operational

- Steady light: batteries are empty.

Figure 3: Functional check at the Mini Burst Field Generator

Single Pulses

- These pulses are used to determine edge-sensitive signal lines and components. One pulse is normally enough to trigger a functional fault.
- Example: RESET lines and components

6 Demo Board

6.1 Structure and Function

6.1.1 General Structure

With two different demo boards, immunity mechanisms can be displayed. The demo boards are printed circuit boards with the same basic structure (Figure 4):

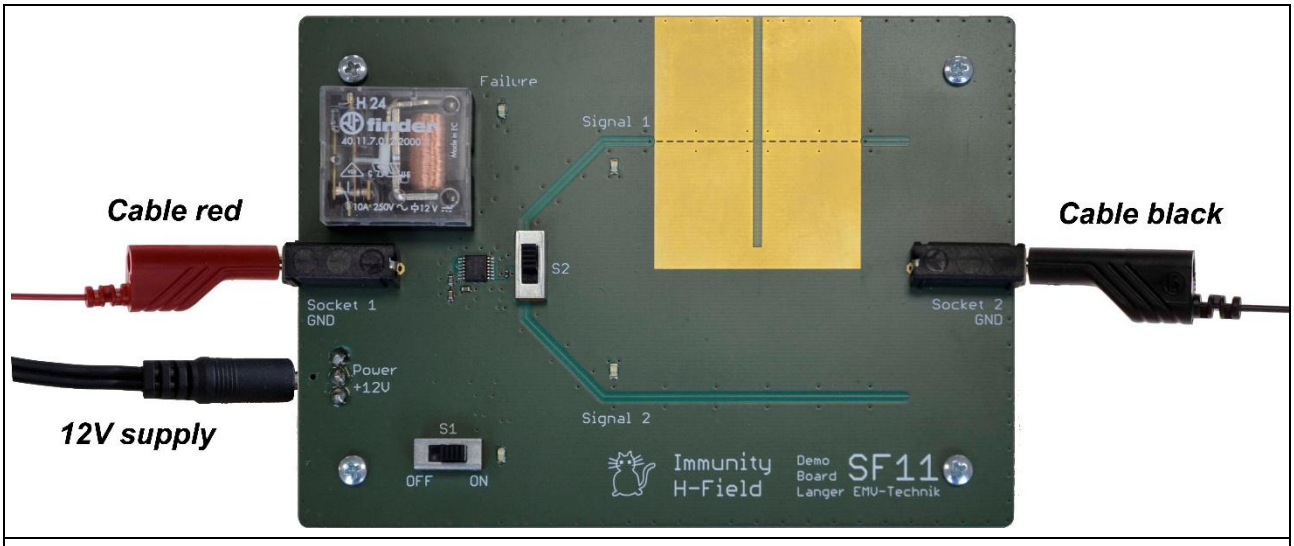


Figure 4: Demo board with connected cables

- Power is supplied by the included power supply unit and the socket labeled "Power +12 V" on the left side of the demo boards.
- The demo boards are switched on with the switch labeled “S1”. For control purposes a red LED lights up directly to the right of the switch.
- All demo boards have two signal lines labeled “Signal 1” and “Signal 2” on the upper side, which can be switched by the switch labeled “S2”. The currently active signal line is indicated by a red LED directly at the lettering "Signal 1" or "Signal 2". On all demo boards, the signal line Signal 1 is installed without EMC protection. In contrast, the signal line Signal 2 is embedded in GND. All demo boards have four layers.
- On the left and right side of the demo boards there is a 4 mm socket labeled "Socket 1 GND" and "Socket 2 GND" respectively. Depending on the test set-up, the supplied laboratory cables or possibly existing laboratory cables of other lengths can be connected there.
- Four rubber feet allow the Demo Boards to stand safely on both insulation and conductive surfaces.

6.1.2 Demo Boards for Demonstration of Interference Immunity

The SF demo boards are suitable for demonstrating the influence of electronic circuits in the presence of interference pulses from the environment such as burst and ESD. They can be used in conjunction with burst generators according to IEC 61000-4-4, ESD generators according to IEC 61000-4-2, E1 set development system immunity and field sources from Langer EMV-Technik GmbH.
Interference is either caused by magnetic fields (SF 11 demo board) or by electric fields (SF 21 demo board).

Figure 5: Demo boards for immunity SF 11 (magnetic fields) and SF 21 (electric fields)

Function:
The switch S2 connects either the signal line Signal 1 or the signal line Signal 2 to an IC input. If the signal in question is affected by a disturbance pulse, the IC outputs a signal lasting approx. 100 ms to the LED labelled "Failure" and to the relay. The influence is thus clearly visible and can be clearly heard through the relay clacking.
As in the uninfluenced condition the signals are always connected to GND - i.e. are detected by the IC as "low" or "0", an influence only occurs with positive interference pulses. The measurement results are therefore always dependent on the polarity set on the interference generators.

Interference of SF 11 Demo Board:
Signal 1 of the SF 11 is sensitive to a pulsed magnetic field or to current pulses flowing through the SF 11:
A current flowing through the SF 11 generates a magnetic field that orbits the GND plane. Part of the field lines runs through the gap in the GND plane and thus induces an interference voltage in the loop of Signal 1 and GND (highlighted in red in Figure 6). The LED labeled “Failure” lights up, the relay switches.

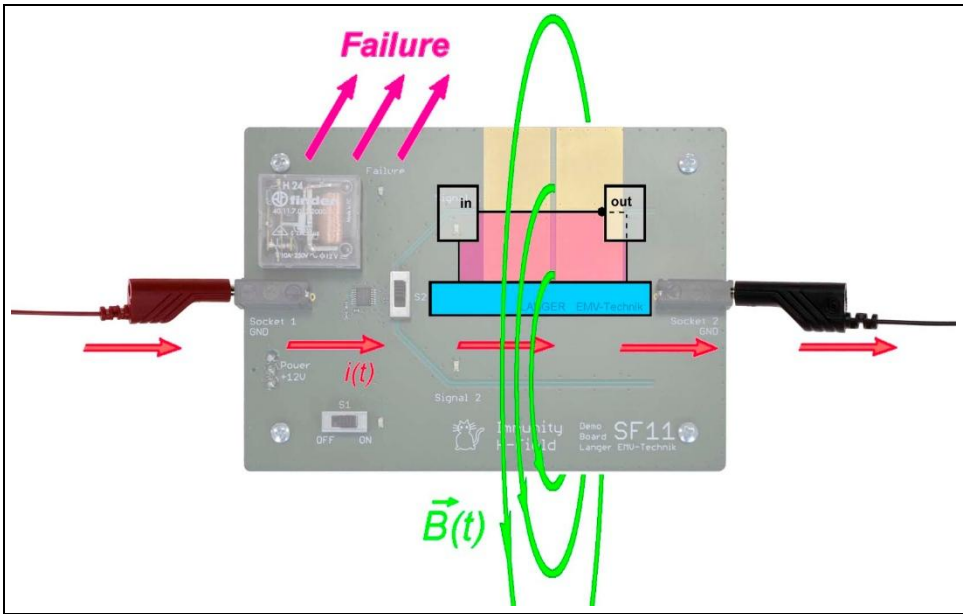


Figure 6: Interference of the SF 11 by pulse current

The Signal 2 is routed close to the GND plane throughout its entire course (Figure 7). There is almost no magnetic field between signal and GND plane. The SF 11 is largely immune to interference.

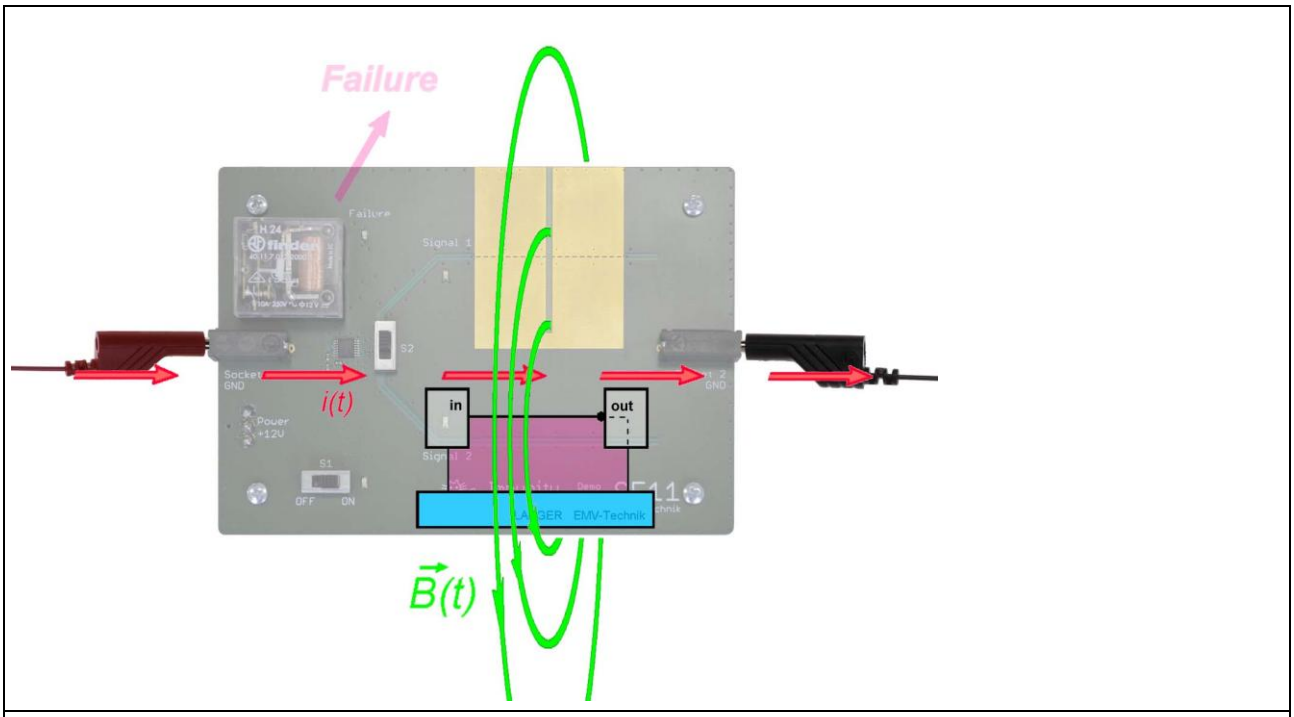


Figure 7: Signal 2 of the SF 11 is not affected

Interference of SF 21 Demo Board:
Signal 1 of the SF 21 is sensitive to a pulsed electric field.
An interference current flowing into the SF 21 through Socket 1 must be capacitively decoupled if no cable is connected to Socket 2 (Figure 8). This capacitive current (displacement current) mainly flows from GND to the environment. However, a smaller partial current flows from GND through resistor R into the exposed line Signal 1 and from there to the surroundings. A voltage drop occurs at R, which leads to interference.
Common practical examples of this are RESET lines, chip select lines or programming inputs.

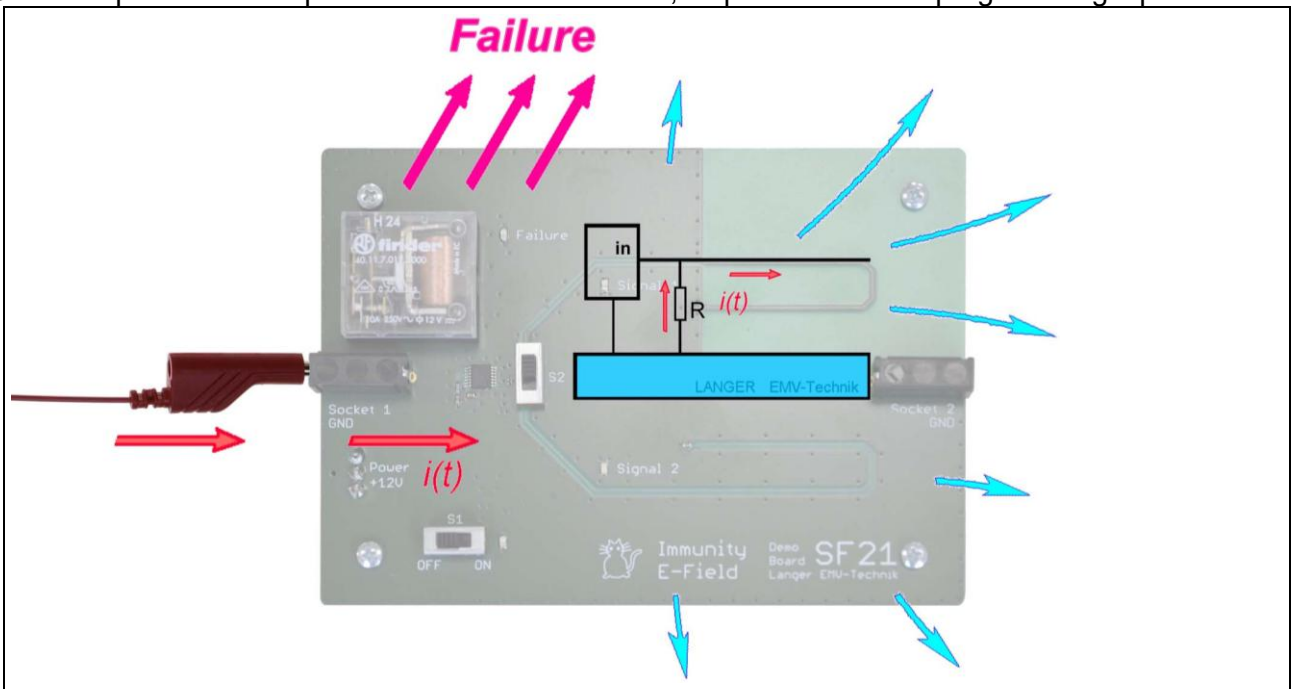


Figure 8: Interference of the SF 21 by E-field

The influence of Signal 2 is considerably less, because the signal line runs very close to the GND plane throughout the whole path. The current capacitively decoupling from the signal line is therefore very small.

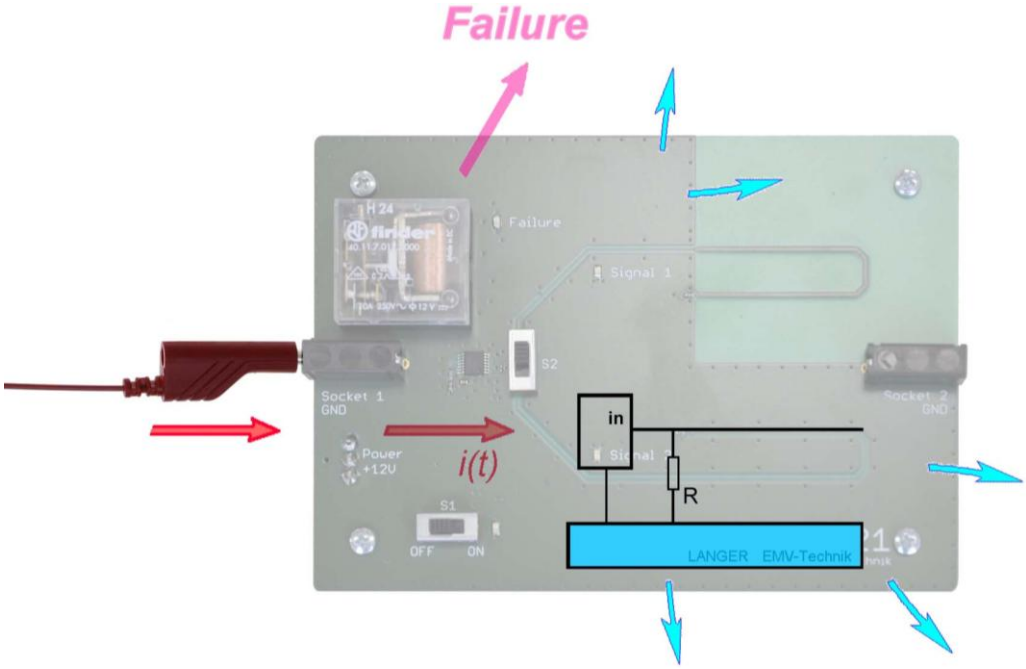


Figure 9: Signal 2 of the SF 21 is not affected

6.2 Demonstration Tests

6.2.1 General Information

Immunity measurements are usually performed at a fixed distance above a metallic surface. This reduces environmental influences and makes measurements carried out at different locations comparable.
To simplify the measurement set-up during practical demonstrations, all measurements described below are carried out above a wooden table without metal base. However, the small and light measurement set-up is opposed by a larger measurement uncertainty. We recommend always making pre-measurements before presentations to determine the actual properties of the measurement set-up in the actual environment.

6.2.2 Tests with Burst Generator according to IEC 61 000-4-4

6.2.2.1SF 21: Tests for Electric Coupling

Example: SF 21 demo board with one cable

- SF 21 is connected via power supply unit to the socket adapter network of the burst generator
- Burst current flows from the generator to the device under test
- Capacitive decoupling from the device under test (generation of E-field)
- Backflow through the air to the burst generator (parasitic capacity)

Interference from:	Signal 1:	Signal 2:
	+0.7 kV	> +4.4 kV
	- 0.6 kV	> - 4.4 kV

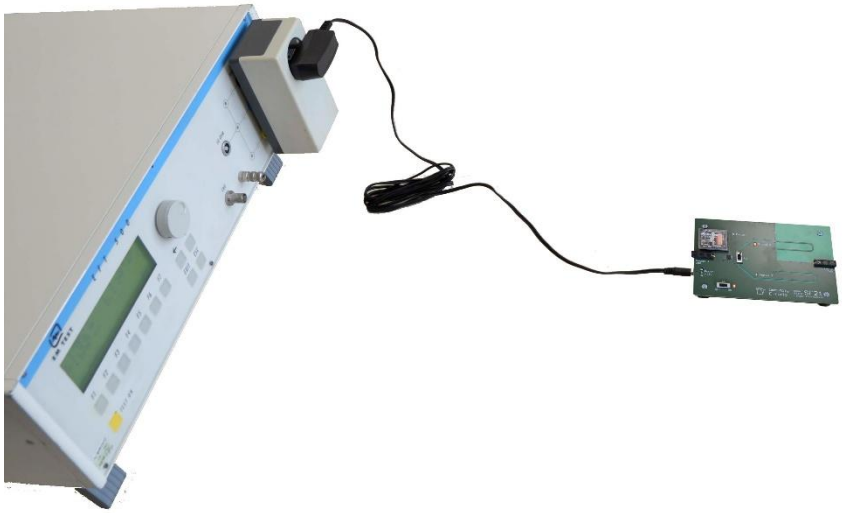


Figure 10: SF 21 connected to the burst generator with one cable

Example: SF 21 demo board with two connected cables:

- the interference immunity is increased because the second cable reduces the electric field strength in the area of the demo board

Interference from:	Signal 1:	Signal 2:
	+1.1 kV	> +4.4 kV
	- 1.0 kV	> - 4.4 kV

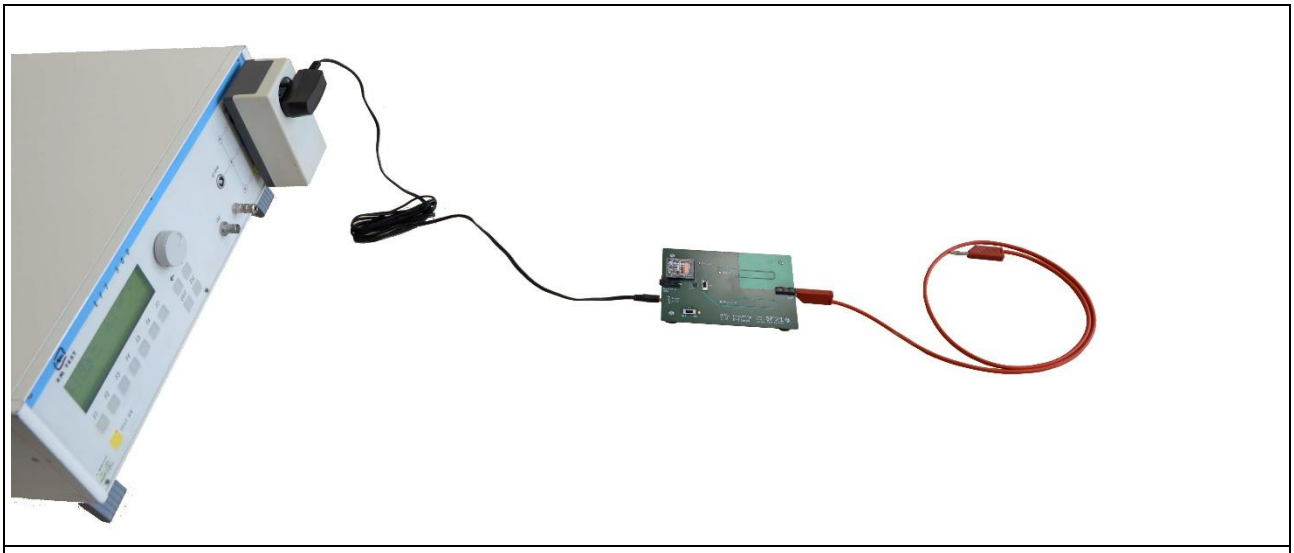


Figure 11: SF 21 operated on burst generator with two cables

Example: SF 21 demo board with two cables connected, the second cable is connected to GND of the burst generator

- the immunity is further increased because the voltage generated by the burst generator is short-circuited to GND - the electric field strength is low

Interference from:	Signal 1:	Signal 2:
	+2.1 kV	> +4.4 kV
	- 1.8 kV	> - 4.4 kV

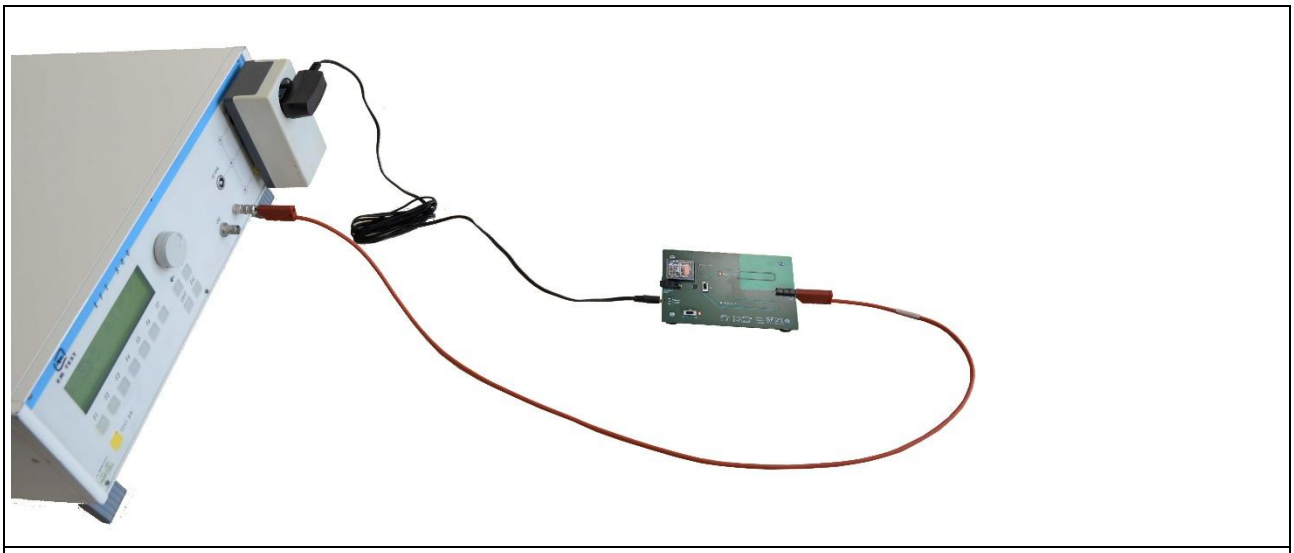


Figure 12: SF 21 operated on burst generator with two cables and low-impedance interference current path

6.2.2.2 SF 11: Tests for Magnetic Coupling

Example: SF 11 demo board with one cable

- SF 11 is connected via power supply unit to the socket adapter network of the burst generator
- low burst current from the generator to the device under test, since the current can only flow back to the generator through the (small) parasitic capacity
- thus only low current flow through the SF 11 and low magnetic coupling into the signal conductor loop

Interference from:	Signal 1:	Signal 2:
	> +4.4 kV	> +4.4 kV
	> - 4.4 kV	> - 4.4 kV

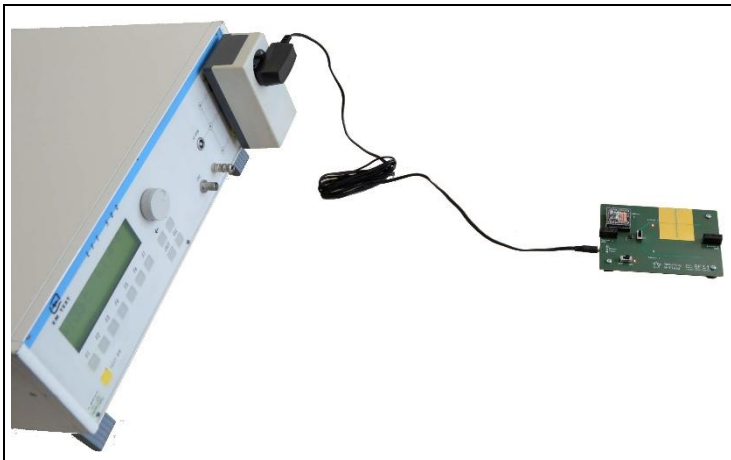


Figure 13: SF 11 connected to the burst generator with one cable

Example: SF 11 demo board with two connected cables

- the immunity is reduced, because the second cable increases the current and thus the magnetic field in the area of the demo board

Interference from:	Signal 1:	Signal 2:
	+2.1 kV	> +4.4 kV
	- 1.9 kV	> -4.4 kV

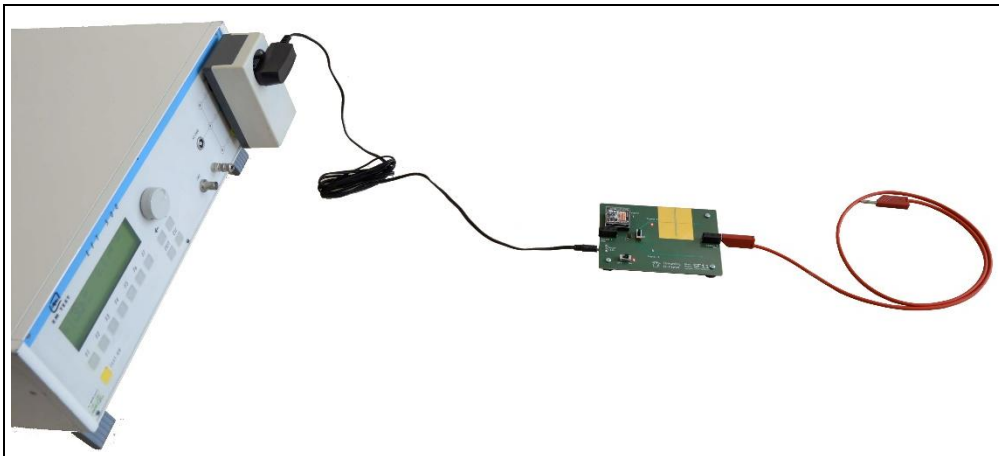


Figure 14: SF 11 operated on burst generator with two cables

Example: SF 11 demo board with two cables connected, the second cable is connected to GND of

the burst generator

- the immunity to interference is further reduced, since the voltage generated by the burst generator is shorted to GND, thereby maximizing the current and the magnetic field

Interference from:	Signal 1:	Signal 2:
	+1.1 kV	> +4.4 kV
	- 1.3 kV	> - 4.4 kV

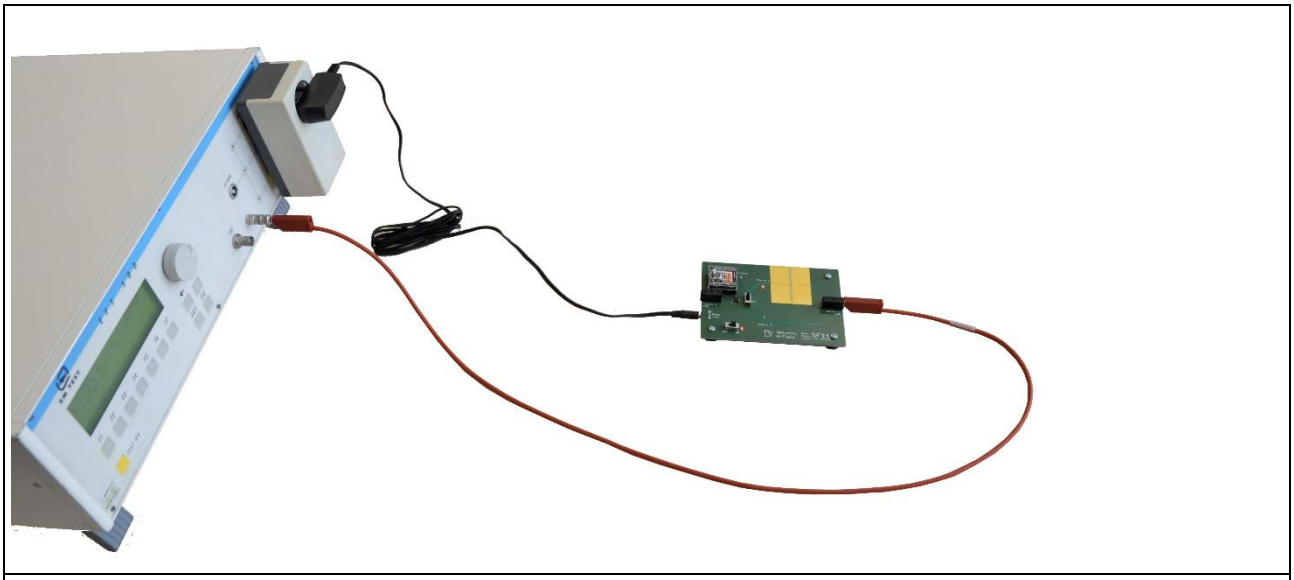


Figure 15: SF 11 operated on burst generator with two cables and low-impedance interference current path

6.2.3 Tests with PT4 Burst Transformer

For specific tests of DUTs with burst current or burst voltage the PT4 burst transformer can be used. It is connected to the output of a burst generator instead of a coupling clamp and converts the generator pulses referred to GND into potential-free pulses. This makes it possible to connect and disconnect burst current at almost any point on a DUT.
The single-pole connection to the DUT in Figure 16 on the left creates a large E-field at low current. In Figure 16 on the right, the E-field is very low at maximum current (magnetic field).

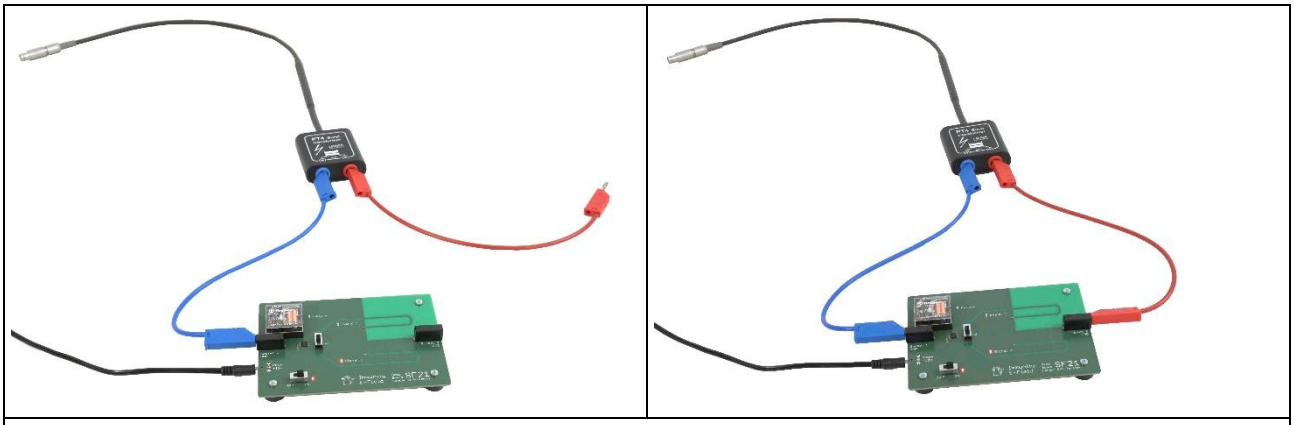


Figure 16: Single-pole and two-pole coupling with the PT4 burst transformer

6.2.4 Tests with SGZ 21 Burst Generator

6.2.4.1Tests for Electric Coupling

Example: SF 21 demo board with one cable

- SF 21 is supplied via power supply unit. One output of the SGZ 21 is connected via Socket 1. At the second output of the SGZ 21 there is a cable which is not connected to the SF 21 (Figure 17).
- As there is no low-impedance connection between the two generator outputs, there is a large voltage difference and thus an electric field which couples into the line Signal 1 and causes an error.
- The line Signal 2 is protected within the GND area and is much less sensitive.

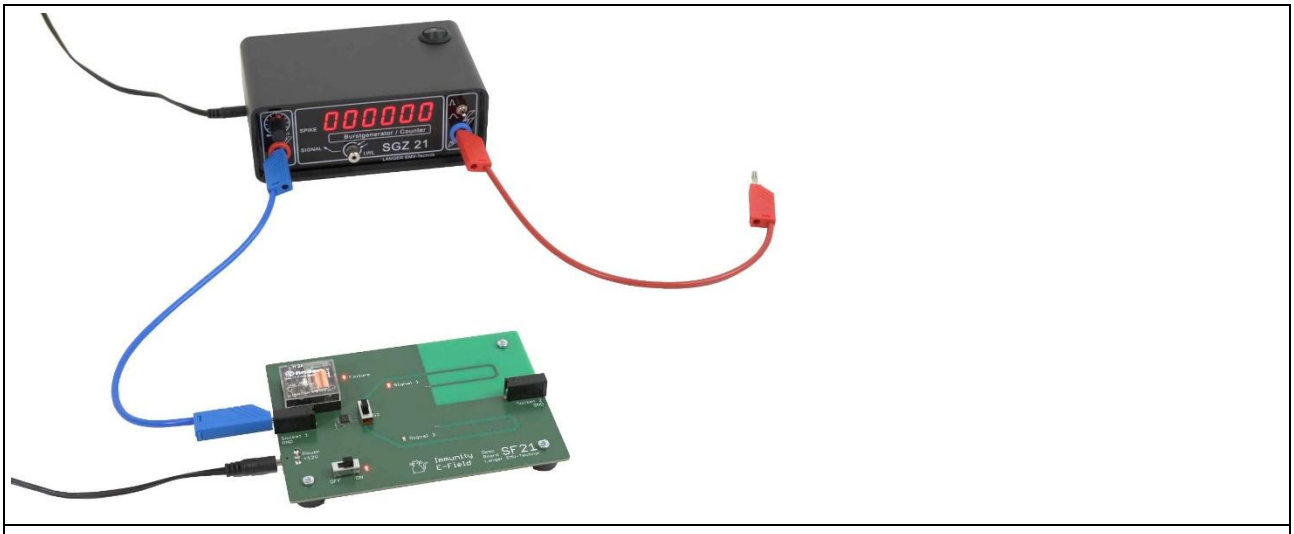


Figure 17: SF 21 is single-pole connected to the SGZ 21

If the SGZ 21 is connected to the SF 21 with two cables (Figure 18), a low-impedance current path is created. The interference current and thus the magnetic field increase, while the electric field decreases at the same time.
Since the SF 21 demo board reacts manly to electric field, the immunity increases significantly when the second cable is connected.

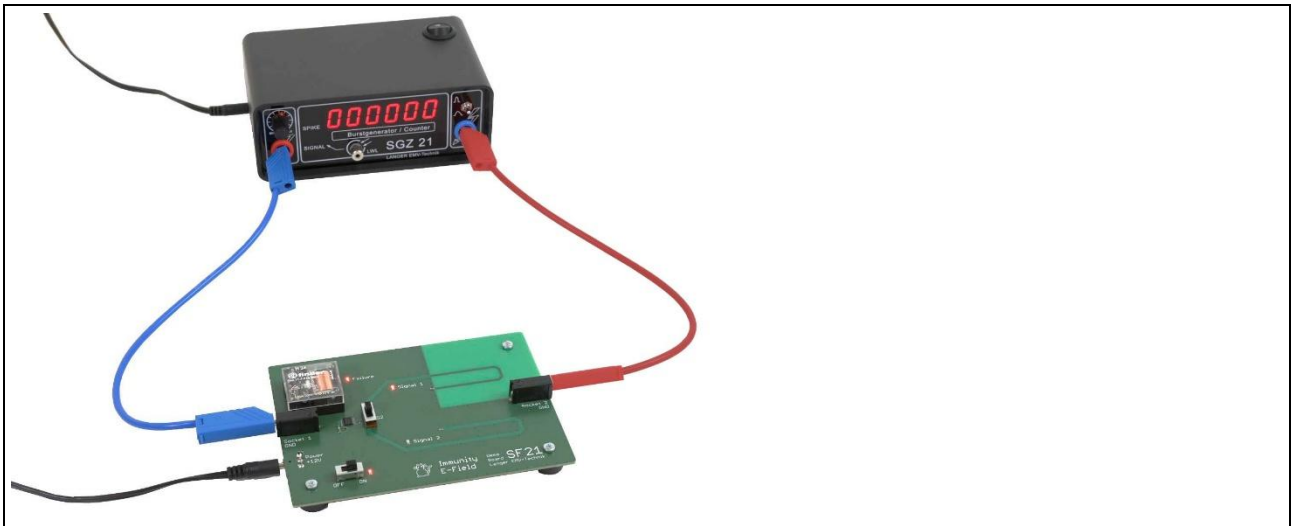


Figure 18: SF 21 is two-pole connected to the SGZ 21

6.2.4.2Tests for Magnetic Coupling

The experiments presented in Section 6.2.4.1 for electrical coupling with the SF 21 demo board can also be carried out with the SF 11 demo board. Since the SF 11 reacts to magnetic fields, the test results are exactly the opposite:

- two-pole coupling generates a large interference current – immunity to interference is low,
- single-pole coupling generates a smaller interference current – immunity is higher.

6.2.5 Tests with Field Sources (H3 Set, Mini Burst Field Generators)

6.2.5.1General Information

With field sources for coupling magnetic or electric fields, printed circuit boards can be tested for their immunity to interference during development. It is important for the developer to recognize the relationship between the type of functional fault (LED flashing, RESET, defect) and the location and type of the coupled field (electric or magnetic field) in order to improve the DUT by effective modifications.
A statement about the absolute value of the immunity to interference with standardized measuring methods cannot be derived from measurements with probes.

6.2.5.2Tests for Electric Coupling

For the local coupling of electric fields, the P21 mini burst field generator (E), the ES 05 E-field probe from the E1 immunity development system and the ES 05 (h) from the H3 set for burst generators according to IEC 61 000-4-4 are suitable, for example.
With these or similar field sources, the DUT can be scanned by hand at a distance of a few millimeters. A high-impedance signal (SF 21 demo board, see Section **Fehler! Verweisquelle konnte nicht gefunden werden.**) reacts much more sensitively than a low-impedance signal (SF 11 demo board).

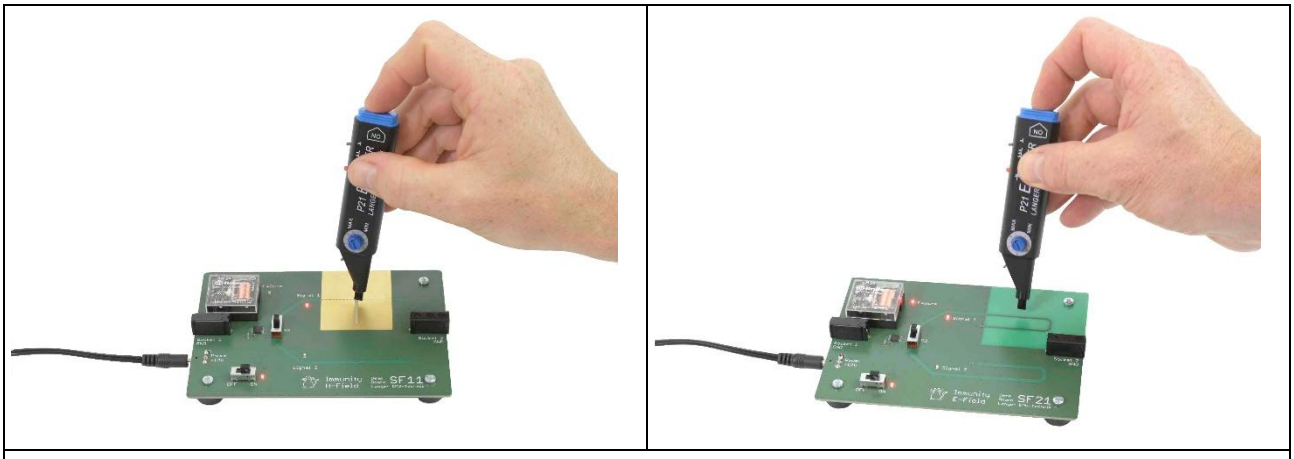


Figure 19: The SF 21 demo board is much more sensitive than the SF 11 in case of E-field coupling

6.2.5.3Test for Magnetic Coupling

Analogous to the E-field coupling, a local magnetic field can be coupled in (with P11 mini burst field generator, BS 04 or BS 04 (h) magnetic field source). The SF 11 demo board is particularly sensitive to magnetic fields in the area of the GND slot (Signal 1) (Figure 20).
It should be noted that the magnetic field must pass between GND and the signal line so that an interference voltage is induced in the loop between GND and signal line. The magnetic field strength directly on the signal line is of no importance.

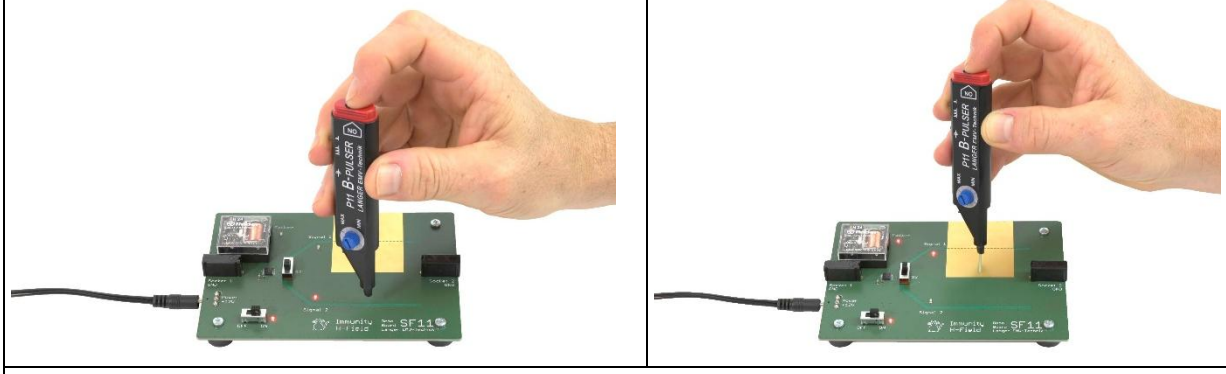
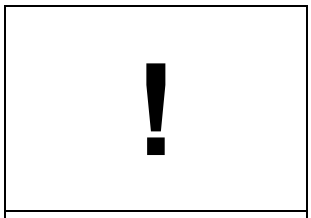


Figure 20: The SF 11 demo board reacts to magnetic fields in the area of the GND gap

6.2.6 Tests with ESD Generator

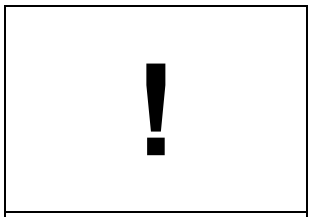


Caution!

Tests with ESD generators according to IEC 61 000-4-2 require special caution!

The demo boards can be destroyed if the test set-up is not carried out properly!

For tests with ESD generators a metallic base plate (not included in the scope of delivery) is absolutely necessary. Both the ground connection of the ESD generator and the GND of the demo board must be connected to this base plate. The length and position of these connections influences the test result. In Figure 21 these connections are realized by a blue laboratory cable with connected terminal (demo board) and by a screw connection (ESD generator).



Caution!

The ESD generator must be operated in such a way that no direct discharge of the ESD generator into electronic components and their connecting cables can occur.

Optimal is a contact discharge into the 4 mm Socket 2 as shown in Figure 21. This design ensures reproducible measurement results and protects the demo board (no flashovers into sensitive components and cables possible).

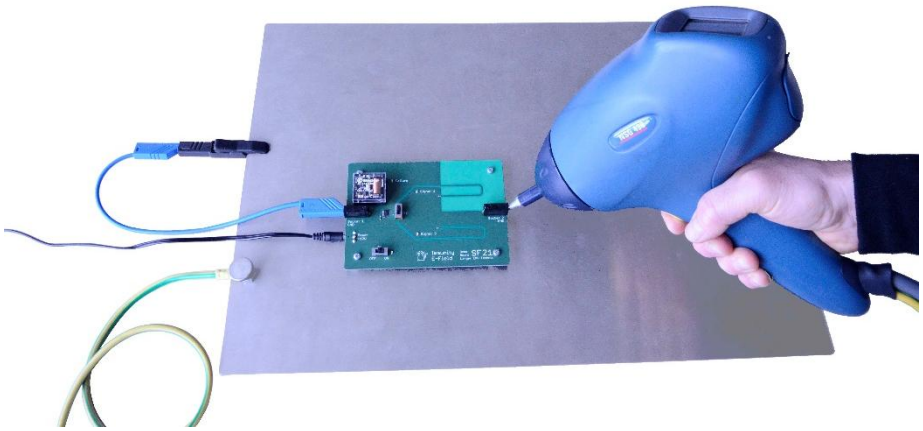


Figure 21: Experiments with ESD generator over a metal surface

While tests with active Signal 1 both demo boards (SF 11 and SF 21) are affected even at low ESD voltages, their immunity to interference is greater than 9 kV with active Signal 2.
Due to the very short rise time of the ESD pulse in the area of the demo boards, both electrical and magnetic fields are present.
Typical measurement results are:

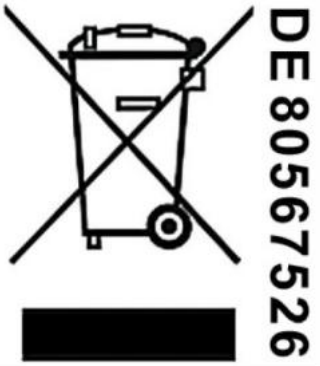
SF 11:	Interference from:	Signal 1: +0.9 kV - 4.0 kV	Signal 2: > +9.0 kV > - 9.0 kV
SF 21:	Interference from:	Signal 1: +0.8 kV - 0.8 kV	Signal 2: > +9.0 kV > - 9.0 kV

It is not recommended to increase the generator voltage above 9 kV.

7 Information on Recycling and Disposal

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.



8 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
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.

9 Warranty

Langer EMV-Technik GmbH shall remedy all defects attributable to material or manufacturing faults within the statutory warranty period by repairing the product or supplying replacement parts.

This guarantee is only granted on condition that:

- the information and instructions in the operating instructions are observed.

The guarantee expires if:

- an unauthorized repair is carried out on the product
- the product is modified
- the product is not used as intended

LANGER
EMV-Technik GmbH
Noethnitzer Hang 31
DE-01728 Bannewitz
www.langer-emv.de
Tel.: +49 351/430093-0
Fax: +49 351/430093-22
sales@langer-emv.de