

Instruction Manual



ESD 30N

Generator for simulation of electrostatic discharges

Firmware Version ≥ 1.10

For testing electronic components for industrial and automotive applications.

The ESD 30N Base unit includes the control and power parts for the Discharge module P30N. Replaceable discharge modules with different R/C networks as per IEC 61000-4-2, ISO 10605, MIL and other standards are available.

- IEC 61000-4-2
- EN 61000-4-2
- EN 50082
- EN 61000-6
- ISO 7637 / DIN 40839
- ISO 10605
- Manufacturer as per
GM, Ford, Chrysler,
Mercedes BMW, VW,
PSA, Renault, Fiat



EM TEST Switzerland GmbH
Sternenhofstrasse 15
4153 Reinach BL1
Switzerland

Phone : +41 61 717 91 91
Fax : +41 61 717 91 99

URL : <http://www.emtest.com>

Copyright © 2017 EM TEST Switzerland GmbH

All right reserved.
Specifications subject to change

Contents

1.	Safety.....	5
1.1.	General.....	5
1.2.	Before Use	6
1.3.	Maintenance, Adjustments, Exchange of Parts	6
1.4.	Failures and Over stressing	7
1.5.	Danger during testing.....	7
1.5.1.	Power Mains Supply and Ground Reference.....	7
1.5.2.	Discharge Modules and Grounding of <i>P30N</i>	8
1.5.3.	Danger from the Device Under Test (DUT)	8
2.	ESD test setup as per IEC 61000-4-2.....	9
2.1.	Test setup.....	9
2.2.	Parts and Connections of <i>ESD 30N</i> / <i>P 30N</i>	10
2.3.	Parts and functions.....	10
3.	Operation and functions.....	12
3.1.	ESD 30N – Base unit	12
3.2.	P30N – Discharge unit	13
3.2.1	Operating elements	13
3.2.2	The Start Display.....	13
3.3.	Menu structure	14
3.3.1.	The Trigger Button	15
3.3.2.	The Scroll wheel.....	15
3.3.3.	The Function keys	15
3.3.4.	General information for all menus	16
3.4.	The Bleeding Function	18
4.	Menu description.....	19
4.1.	Quick Start.....	19
4.2.	Evaluation.....	20
4.2.1.	Edit Parameters.....	20
4.2.2.	Start Evaluation	21
4.3.	Standard Test Routines	22
4.3.1.	Parameter change in standard routine.....	23
4.3.2.	Running standard routine	23
4.4.	Test Routines	24
4.4.1.	Edit Parameters.....	25
4.4.2.	Sequence of the iterations	25
4.4.3.	ESD test with Test Routines	26
4.4.4.	End of the test	26
4.4.5.	Report- and Event memory in <i>P30N</i>	27
4.5.	Setup menus	28
4.5.1.	Standard (Page 1/7)	28
4.5.2.	Setup Firmware (Page 2/7)	29
4.5.3.	Setup System (Page 3/7)	30
4.5.4.	Options (Page 4/7)	30
4.5.5.	System Info (Page 5 / 7)	30
4.5.6.	Device info Device (Page 6 / 7).....	31
4.5.7.	Device Info discharge unit (Page 6 / 7).....	31
4.6.	Error messages	31
5.	Setting into operation	32
5.1.	General.....	32
6.	Technical data	33
6.1.	<i>P30N</i>	33
6.2.	<i>ESD 30N</i>	33
6.3.	Discharge modules.....	34
6.3.1.	As per IEC/EN 61000-4-2	34
6.3.2.	As per ISO 10605.....	34
6.4.	Test Routines	35

7.	Maintenance and practical advice	36
7.1.	General.....	36
7.2.	Calibration and Verification	36
7.2.1.	Factory calibration	36
7.2.2.	Guideline to determine the calibration period of EM Test instrumentation	36
7.2.3.	Calibration of Accessories made by passive components only	36
7.2.4.	Periodically In-house verification.....	36
7.3.	Verification.....	37
7.3.1.	Test setup.....	37
7.3.2.	ESD waveform verification	37
7.3.3.	Verification of the discharge parameters	38
8.	Delivery	39
8.1.	Basic.....	39
8.2.	Options	39
9.	Appendix	40
9.1.	Declaration CE- Conformity	40
9.2.	Blockdiagram P30N	41
9.2.1.	Signal level ext. Trigger.....	41
9.3.	Application.....	42
9.3.1.	Test setup.....	42
9.3.2.	Air discharge with double discharge effect	43
9.3.3.	Test setup DaimlerChrysler DC-11224 REV.A (2007-06)	44
9.4.	Definitions.....	45

1. Safety

1.1. General

Read the following operations manual carefully. Pay special attention to both safety and operation details!!! Observe all of these precautions to ensure your personal safety and to prevent damage to the test equipment of our product range.

The test generator is designed according to IEC 61010 respectively EN 61010.

Symbols



WARNING Risk of electrical shock. Please read the related paragraph in the operating manual.



GROUND At this point the 2m ground cable must be connected.

Power mains supply

The equipment is intended to be operated from a power mains supply that will not apply more than 250Vrms between the supply conductors or between either supply conductor and ground. A proper ground connection, through the grounding conductor in the power cord, is essential for a safe system operation. Never apply a generator's voltage to a connector which is not specified for that voltage range.

Grounding the generators

The generators are grounded through the power cord. To avoid electric shock, plug the power cord into a properly wired receptacle where earth ground has been verified by a qualified service person. Do this before making connections to the input or output terminals of the test equipment.

Also the 2m long grounding cable required by the IEC 61000-4-2 must be connected to the related grounding port (see under Symbols) while the test is running. Without the protective ground connection, all parts of generators are potential shock hazards. This includes knobs and controls that may appear to be insulators.

Use the Proper Power Cord

Use only the power cord and connector specified for your product. Use only a power cord that is in good condition.

Use the Proper Fuse

To avoid fire hazard, use only the fuse specified in the parts list for your product, matched by type, voltage rating and current rating.

Do Not Remove Covers or Panels

To avoid personal injury, do not operate the generators without the panels or covers.

Do Not Operate in Explosive Atmospheres

The generators provide no explosion protection from static discharges or arcing components. Do not operate them in an atmosphere of explosive gases.



Please read the attached operating manual carefully !!!

You will find some additional and product specific safety recommendations.

1.2. Before Use

Prior to power-on the equipment

- Before putting the instrument into operation, please check the equipment you have received for damage due to transportation. Check the single boxes as well as the generator itself for mechanical damage. In case of damages, please contact the manufacturer before switching on the unit.

Damage due to transportation

- Prior to applying power, check if the selected supply voltage complies with the mains:

115V/230V ??

- Equipment of security class I which is supplied by an auto-transformer may be considered as follows:

If the equipment is powered by an auto-transformer, with a primary voltage higher than the secondary voltage, be sure that the low-voltage end of the secondary part of the auto-transformer is connected with the neutral of the primary side.

Equipment of security class I with removable neutral or with mains plug:

It is only permitted to insert the mains plug in a mains socket with protective earth connector. It is not allowed to interrupt or disconnect the protective earth connection.

Performance of measurements

- Each interruption or disconnection of the protective earth connection inside or outside the equipment may lead to a dangerous situation. Intentional interruption is prohibited.
- Interconnections between such equipment or to others, e.g. for remote control by personal computer, may be done with cables recommended or delivered by the manufacturer.

1.3. Maintenance, Adjustments, Exchange of Parts

The generator does not include any parts or components needing special maintenance.

Electrical maintenance should only be performed by experienced, specially instructed technicians.

Generally, standard maintenance requires periodic cleaning of the instrument and verification and calibrations of the specified pulse parameters only.



ATTENTION

Only trained technicians are allowed to perform service or maintenance work on these instruments.

- When removing the housing cover or other parts of the equipment, high voltage parts may become exposed. High voltage and high current are potentially lethal.
- The generator includes high voltage capacitors, which may retain their charge. **High voltage – High energy**
- For service, repair, adjustment, or replacement, the generator covers have to be removed and the generator must be disconnected from all power mains supplies.
- The user is not allowed to independently change or modify any EM TEST generator. For service and repair, only original EM TEST parts and components must be used. EM TEST is not responsible for any accident or injury incurred through the use of other parts or components.
- If maintenance or service work is necessary, it must be performed only by experts who are familiar with the existing danger.
- It has to be assured that only fuses of recommended type and nominal current are used for replacement. It is not permissible to use repaired fuses.

1.4. Failures and Over stressing

- If it is assumed that a safe operating mode of the equipment is no longer possible, the mains connection must be removed and the equipment secured from unintentional use.
- An unsafe operating mode is characterized as follows:
 - the equipment shows recognizable damages;
 - the equipment is not working;
 - the equipment has experienced severe transportation stress;
 - the equipment has been stored in an unsuitable environment for some time.

Please exercise prudence in determining whether a device is unsafe or not.

1.5. Danger during testing.

ESD tests are immunity tests on electronic equipment or devices. These tests are potentially dangerous for the operator. Therefore it is the responsibility of the user to avoid critical failures and risks to the environment and operator.

Long and distributed lines to the EUT are able to radiate a certain energy to their vicinity. Therefore it is also the responsibility of the user to decide whether it is allowed to conduct immunity tests in a given installation.

Test voltages above 500V may generate spark discharges. Therefore it is forbidden to test in an explosive environment.

National and international recommendations regarding human safety must be followed.

People with certain health conditions, e.g. with a heart pacemaker or similar device, should be excluded from testing.

- When setting up the test, national and international regulations regarding human safety have to be guaranteed.



Handicapped people, e.g. persons using pacemakers, are not allowed to use this test instrumentation. Hazardous radiation may influence these products.

1.5.1. Power Mains Supply and Ground Reference.

- EMC and High Voltage test setups must have a good decoupled and stable power mains supply.
- Decoupling may be achieved by:
 - Filtering
 - The use of isolation transformers
- By the use of isolation transformers, ground current detectors will not work as intended anymore.
- EMC and High voltage test areas must include a clear ground reference strategy. All generators, CDN's and LISN's must be connected directly and as short as possible to the ground reference.
- The ground reference system must be connected to the Protective Earth (PE) connection of the laboratory.

1.5.2. Discharge Modules and Grounding of P30N

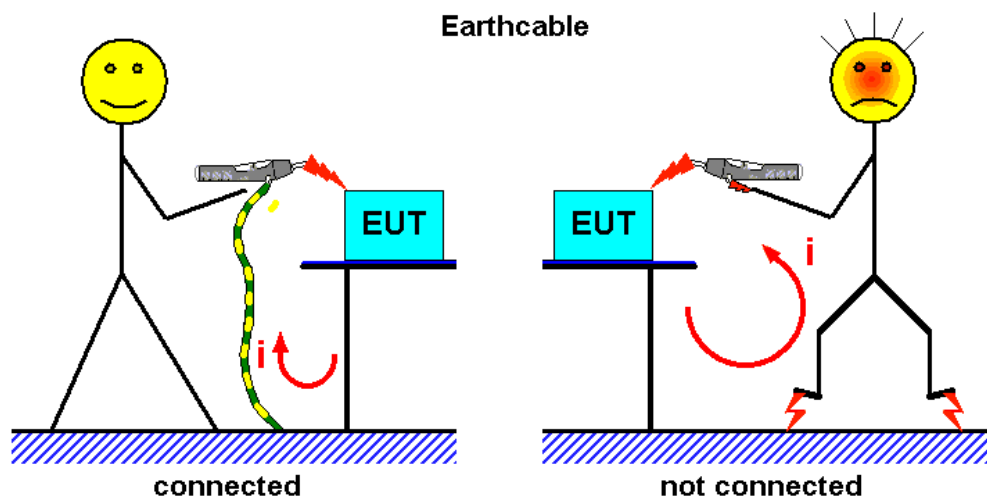
- A discharge module includes capacitors as required in the related standard. The user must take into account that a capacitor is still charged. The charged energy is so low that there is no danger to life. The energy is lower as required in standard IEC 61010.
- During the test, the discharge tip is at high voltage potential. Touching the discharge tip during a running test may cause uncomfortable discharges to the operator. Due to the low energy there is no danger to life.



WARNING

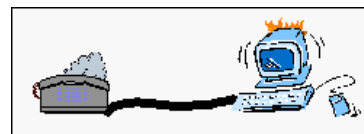
**Risk of electrical shock. Do not touch
any metallic part at the discharge module.
The 2m grounding cable must always be connected
to the P30N during any operation.**

- The 2m grounding cable, which is required by the standards, must always be connected between **P30N** and the ground reference system. In case that the grounding cable is not connected, the discharge current of the simulator will flow through the body of the operator and may cause uncomfortable discharges.



1.5.3. Danger from the Device Under Test (DUT)

The DUT may become dangerous due to the applied high voltage or to the energy content of the test pulses.



Therefore, please pay attention to the following points during testing:

- As soon as the DUT ceases to operate as intended, the test must be stopped immediately.
- In the case of internal damage, high voltages might be exposed at any point of the DUT.
- Cables and connectors can be overloaded by high voltages or energies.
- Due to internal damage of components, explosion and fire may occur.
- Unintended use of the DUT may cause hazardous situations in the vicinity of the test setup.

**Never touch the DUT or anything connected to the DUT
while a test is running**

2. ESD test setup as per IEC 61000-4-2

2.1. Test setup

A correct test set-up is very important for a reproducible test procedure, especially for ESD testing. The correct test set-up as specified in the standard is mandatory. Some of the most important points are the following:

1. Test table

The test must be performed on a wooden test table. On the table, a metallic plane of at least 1.6x0.8m must be used, the so-called horizontal coupling plane. The EUT has to be isolated by 0.5mm from this metallic plane.

2. Ground reference plane

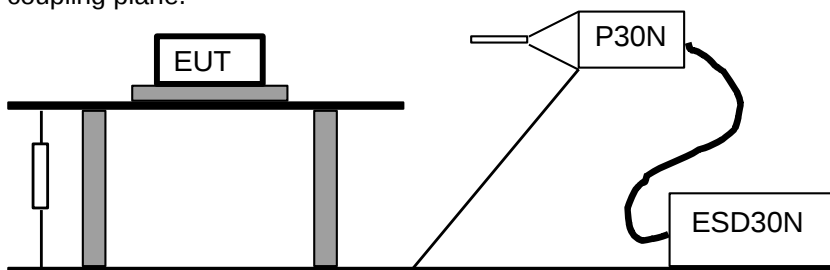
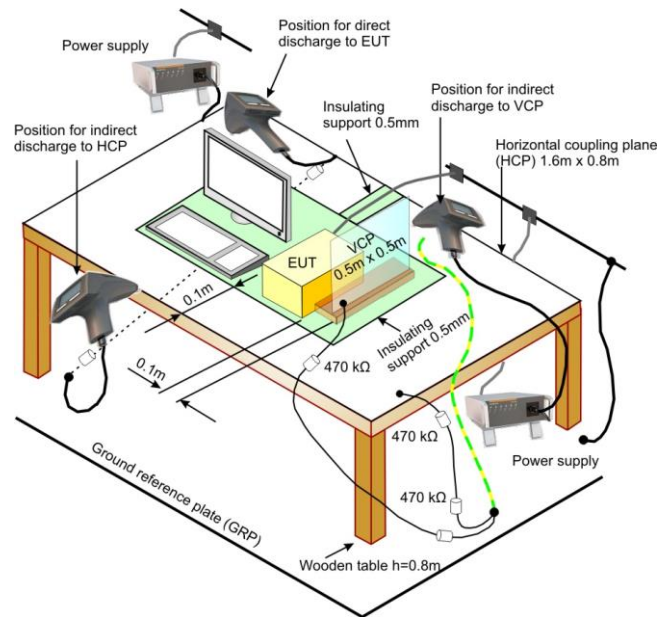
The ground reference plane is located under the test table. It must exceed the projection of the horizontal coupling plane by at least 0.5m on all sides and must be connected to the protective grounding system. The horizontal coupling plane on the test table has to be connected to the ground reference plane by 2x470 kΩ resistors (EAS30).

3. Test generator

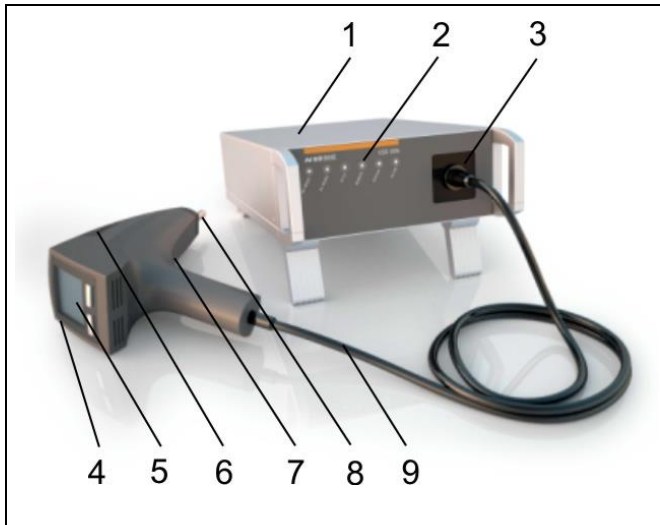
The test generator must be properly connected to the ground reference plane.

Important: The ESD simulator must not be connected to the horizontal coupling plane.

The discharge unit 2m ground cable must be connected to the ground reference plane and not to the horizontal coupling plane.



2.2. Parts and Connections of ESD 30N / P 30N



Parts

- 1** ESD30N base unit
- 2** Operation mode indicators
- 3** HV cable plug-in
- 4** P30N discharge unit
- 5** Display & operation panel
- 6** Discharge Module
- 7** Ground connection
- 8** Discharge Tip
- 9** HV & control cable

2.3. Parts and functions



P30N

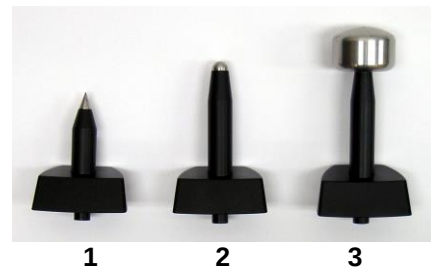
Simulator for discharges of Static Electricity.
Discharge unit

High voltage & control cable

Discharge tips

- **1** Contact discharge -(Direct Pin Contact)
- **2** Air discharge 8mm electrode up to 15kV
- **3** Air discharge 30mm electrode >15kV ⚡

Remark: For electrical fields above 15kV/cm on the electrode surface, the electrode starts to partial-discharge into the air.



Discharge module with RC parameters

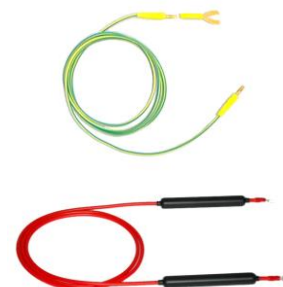
- RCN1** C= 150pF, R=330Ω IEC61000-4-2 ISO10605
- RCN 2** C= 330pF, R=2000Ω ISO10605
- RCN 3** C= 150pF, R=2000Ω ISO 10605
- RCN 4** C= 100pF, R=1500Ω
- RCN 5** C= 330pF, R=330Ω ISO 10605 VW TL

2m Grounding cable

- Connect the grounding cable to the reference ground connector of the **P30N** discharge unit.
- Grounding is also possible at the screw terminal for tripod mounting.

EAS 30

External bleeder resistor for discharging HCP and VCP



**ESD 30N base unit**

- Front panel status display
- Front panel High Voltage plug-in

esd.control

Software for up/down load procedures, remote control of **ESD30N**, test reports

**Interface cable:**

- USB interface cable
- Adapter Type IFA opto link USB (optional)

Carrying case

3. Operation and functions

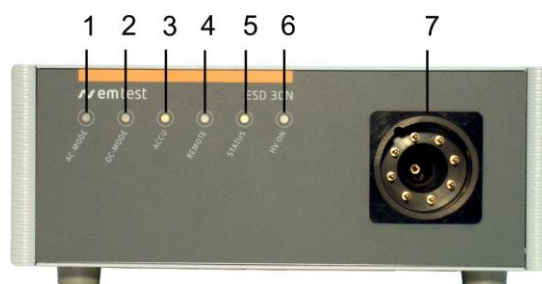
3.1. ESD 30N – Base unit

The ESD 30N base unit includes all main control functions of the ESD simulator system. This is

- the general power supply unit for ac and dc mains supply
- a chargeable battery (automatically charged when ac or dc supply is connected)
- the hv power supply to feed the P30N up to 30kV
- the main processing board to support all interfaces and control functions

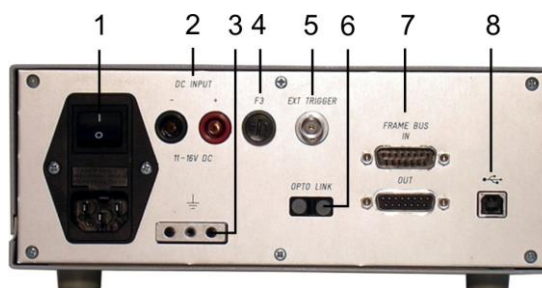
Front panel

- 1 AC MODE** : Base unit is powered by ac mains supply
- 2 DC MODE** : Base unit is powered by dc supply
- 3 ACCU** : Powered by internal battery,
blinking LED = battery charging
- 4 REMOTE** : Base unit is controlled via interface
- 5 STATUS** : See Chapter 4.6 error messages
- 6 HV ON** : High voltage is generated
- 7 Plug** : High voltage connector to PN30



Rearside

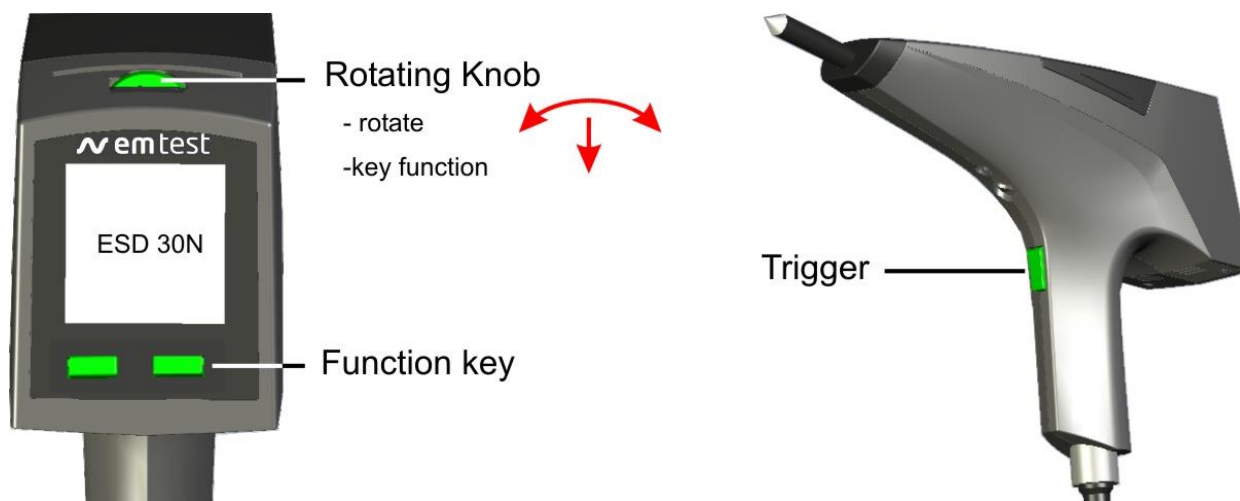
- 1** Power supply input AC, power ON switch and fuse
- 2** Power supply input DC
- 3** Earth bolt
- 4** Fuse F3
- 5** Ext trigger input
- 6** Optical interface
- 7** FRAME BUS IN / OUT (not in use)
- 8** USB interface



The ESD generator is completely operated via the LCD and control panel which is located in the P30N discharge unit.

3.2. P30N – Discharge unit

3.2.1 Operating elements



P30N is operated with the help of an easy to use menu structure. The operating is based on **2 function keys**, a digital **turn wheel** with **key function** and the **Trigger** button.

3.2.2 The Start Display

Standby Mode

After power on the base equipment the Display shows the letter ESD 30N without backlighting.

After pressing any key:

Activate P30N

- Press 2s the Triggerbutton.

The startdisplay appears with the active backlight.



Active Mode

150pF/330R Actually used discharge module

05:11:08 Date (DD : MM : JJ)
12:26:51 Actual time (hh : mm : ss)



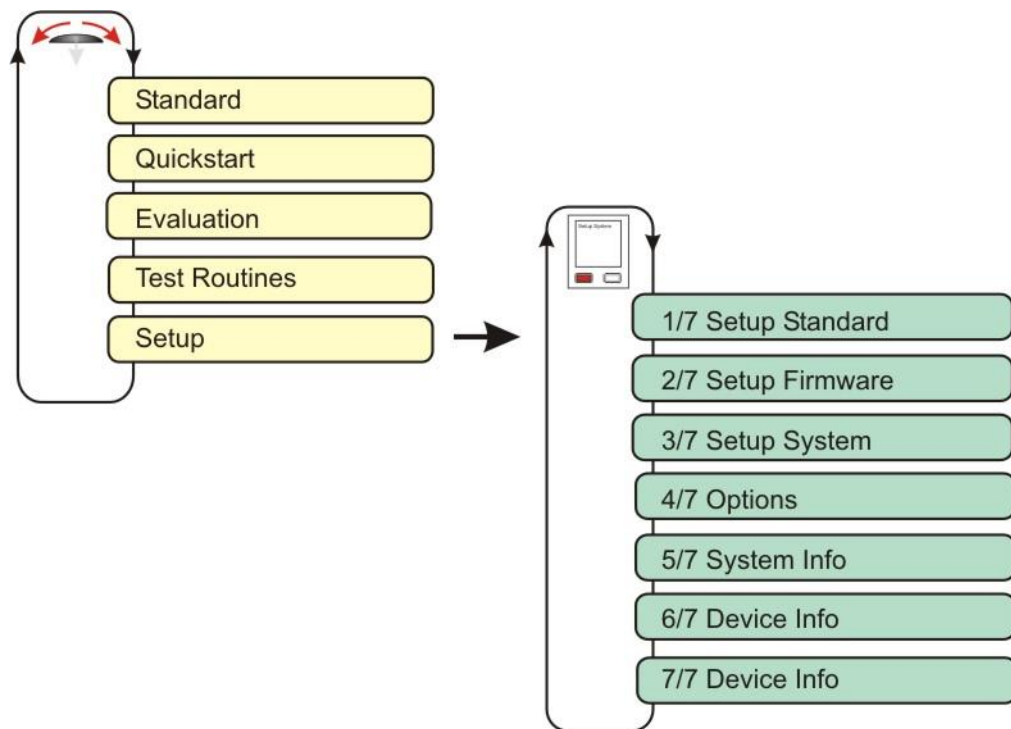
By operating any available button or wheel at the P30N the operator can move forward to the menu level on which different operating menus are available. At first the **Quick Start** menu will be displayed.

Is no discharge module detected the display shows **noModule**.

After mounting a module the **P30N** detect the module.



3.3. Menu structure



The following menus can be selected

- **Standard Test Routines**
The user can call up the standard routines with fixed test levels and start immediately. The test levels can be modified.
- **Quick Start**
Easy and fast operation of the generator without special functions. Voltage and polarity can be adjusted during the running test.
- **Evaluation**
This test routine helps to search for most sensitive test points at the DUT. The discharges are released with a higher repetition rate. This routine is normally not used for final testing at the preselected test points.
- **Test Routines**
The user can download his own specific test routines which he himself can program within the esd.control software. The P30N offers space for 8 customer-specific test routines.
- **Setup**
Hardware and software settings are made in this menu such as:
 - The standard test levels for AD and CD can be set.
 - Firmware settings
 - System settings
 - Menu control settings
 - System information
 - Device information
- **Tripod test**
only with remote operation.

3.3.1. The Trigger Button

The following functions are activated with the **Trigger** button:

To switch ON	Press the Trigger button once for about 2s
To switch OFF	Press the Trigger button for another 2s
To release discharges	Single: Press Trigger button once Cont : Discharging as long as the Trigger button is pressed. Auto: Press Trigger button once, the test runs automatically. Pressing Trigger button again stops the test procedure.
Change display parameter	Change in the menu the focus of the selectable parameter in a cyclic rotation.

3.3.2. The Scroll wheel

The following functions can be operated with the **Scroll** wheel.

To select a menu (rotate)	By turning the wheel the user can scroll through all available menus
To change parameter (rotate)	By turning the wheel the actually high-lighted parameter can be changed
To select digits (rotate, press down)	By pushing the wheel down individual digits can be selected. The related digit is under-lined e.g. : 12.5kV ; the second digit can be changed by turning the Scroll wheel

3.3.3. The Function keys

The following functions can be operated with the **Function** keys.

Start	By pushing the Start button the programmed test procedure is ready to be started. The test is started by pushing the Trigger button as explained before.
Edit	By pushing the Edit button the user enters the menu for modify each parameter
Save	The correct parameter setting is confirmed by pushing the Save button.
Cancel	The changed parameter setting isn't confirmed and will not be saved by menu exit.
1/7 7/7	In a menu including several different pages the user can toggle between the pages by pushing this key
Stop	To end the test procedure
+/-	To change the polarity

3.3.4. General information for all menus

Acoustic signals

- Single-beep** - Warning in Evaluation mode if the output voltage is < 50% of the setting voltage.
- Double-beep** A double beep always indicates warnings or failures.
- **MODULE MISSING**
 - **CHARGE BATTERY** voltage too low to generate high voltage
 - **NO DISCHARGE** with CD in future version implemented
 - **Pre-discharge** (air discharge occurred before the selected test voltage was reached)
 - **EARTH FAULT** Earthcable not connected
 - **RESIDUAL VOLTAGE**
 - **EVENT MEMORY FULL**
 - **FW VERSION CONFLICT** ESD30N and P30N have not the same firmware; Update mandatory.
 - **TIP MISSING , WRONG TIP** in future version implemented.
 - **Test voltage** .The preselected voltage can not be reached or is not correct
- Triple-beep**
- Test is finished
 - **P30N** has shut down (switched OFF)

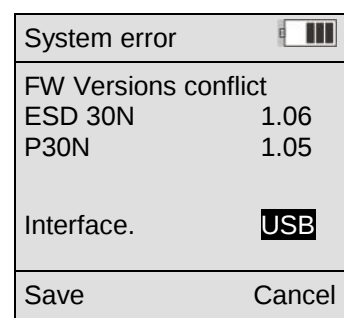
Display after a firmware conflict

inverse flashing ==>



System error

This status allowed to change the interface mode only. Inverse blinking shows the actual interface mode.



Operating modes

Mode	AD : Air Discharge CD : Contact discharge
Change Mode by changing the discharge tip; round tip for AD and sharp tip for CD	
Trigger	Single : Single discharge after pressing the Trigger button. Cont : Continuous discharges as long as the Trigger button is pressed Auto : Automatic released discharges, Start/Stop by Trigger button Change Trigger mode by Edit – Trigger button – Sing/Cont/Auto - Scroll wheel
Count	The counter has two basic functions indicated by the direction of the arrow: Count = 0...999'990 ↑ : P30N counts the total number of discharges starting at zero Count = 1...999'999 ↓ : P30N tests a preselected number of discharges Change counter mode by Edit – Trigger button – xx↓↑ - Scroll wheel
Rep/Freq	Repetition rate General : 0.5...20s in 0.5s steps Evaluation : 1...20 Hz in 1Hz steps Change Repetition rate by Edit – Trigger button – xx s - Scroll wheel
Voltage	Input of the test voltage ULevel 500V ..30.0kV UStep 100V / 1'000V / 10'000V Change Voltage Edit – Trigger button – xxxkV – push Scroll wheel (digit selection) - -turn wheel
High voltage	STOP in inverse letters indicate the running test. The high voltage is applied to the discharge module.
Polarity	Change by pressing turning the Scroll wheel when entering the menu Change by pressing the +/- button during a running test Changing the polarity during a test, will take 1...5 seconds depending on the test voltage.
Test point	Number of test points at different discharge modes; AD and CD
Bleed	Discharge of the static electricity from the EUT through the P30N
Battery	Symbols for battery charging status Charging is shown by moving Battery symbols.



3.4. The Bleeding Function

Ungrounded equipment, or ungrounded parts of equipment, cannot discharge itself. If the charge is not removed before the next ESD pulse is applied, it is possible that the EUT is stressed up to twice the intended test voltage.

With a bleed off function an isolated metal part can be discharged to a reasonable voltage level where the next ESD pulse goes to a uncharged target.

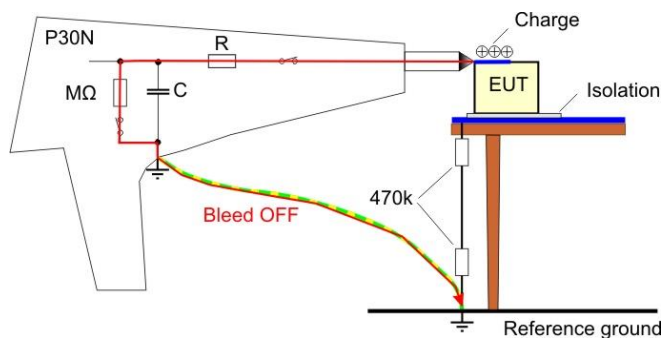
The P30N internal relays will close and short the circuit. The charge on the EUT will discharge via the ESD30N simulator.

The bleed function works only if the charged part on the EUT is tangible with the discharge tip.

Mode with Bleed off

Air discharge : Single

Contact discharge: Single, Auto, Cont



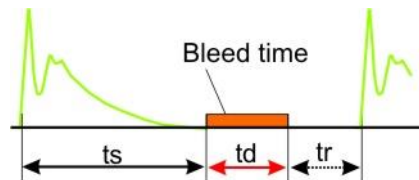
Bleed off timing

ts : Time during the ESD pulse application

td : Bleed off time

tr : Repetition time

Time between 2 pulses = $t_s + t_d + t_r$



4. Menu description

4.1. Quick Start

To select the Quick Start menu	Turn the Scroll wheel on top of the P30N
To start the test procedure	Push the Start button
To enter the menu	Push the Edit button

Functions	The first parameter which can be changed is the polarity by turning the Scroll wheel. By pressing the Trigger button the operator can move forward. The selected parameter is blinking. The displayed values are always related to the actual selected parameters.
Change	Functions, which are selected (blinking) can be modified by turning the Scroll wheel, e.g. Trigger mode: Single-Cont-Auto
Parameters	Numerical parameters are changed using the digital turn wheel. By pushing down the scroll wheel the digit to be changed can be selected. The related digit is under-lined and can be changed by turning the wheel.
Save	The correct parameter setting is confirmed by pushing the Save button.
Cancel	The changed parameter setting is not confirmed and will not be saved by exiting the menu

Quick Start 150pF / 330R	CD	Contact Discharge (sharp tip)
+ 10.0kV	Single 0.5s 10↓ Bleed OFF	Single trigger mode 0.5s Repetition rate Continuously adjustable test voltage 10↓ Counting downwards Bleed Discharge EUT
Start	Edit	

Before the test is started, the operator has to select

- the discharge mode, by selecting the specified discharge tip (round for AD and sharp tip for CD)
- the trigger mode, **Single – Continuous – Automatic**, preferred modes are Single & Auto
- the **repetition** rate of the discharges
- the number of discharges, *count upwards* ↑ or *downwards* ↓

After pressing **Start**, the menu shows up as follows: Start / Stop of the test with the trigger button
P30N is ready for testing ← Trigger button → P30N is charged

Quick Start 150pF / 330R	CD	
+ 10.0kV	Singl 0.5 s 10 ↓ Bleed OFF	
Stop	+/-	

Quick Start 150pF / 330R	CD	
+ 10.0kV	Sing 0.5 s 10 ↓ Bleed OFF	
10250 V		
Stop	+/-	

During the test, you can change polarity by pressing buttons **+/-**. The actual generated discharge voltage is displayed. In case of AD, it may happen that the discharge occurs before the final voltage level is reached. The message **Pre-discharge** is shown in the display.

With the **Scroll** wheel, the operator can change the test level.

Pressing the **Stop** button will stop the test routine.

4.2. Evaluation

This menu can be used to check the DUT for most sensitive test points. The preferred method to find these test points is air discharge.

Air discharges are continuously generated with a maximum repetition rate of up to 20Hz.

Contact mode is selected for long duration tests to apply a large number of repeatable discharges to a specified test point. The preferred Trigger mode is Auto or Continuous.

All parameters can be selected individually. During the evaluation procedure, the operator can change the polarity and the test voltage.

At "Evaluation Mode" it is not sure, that the set voltage will be reached at every frequency!

- Modules with 800pF need 500ms for charging up to 30kV
- Modules with a capacity > 800pF need 1s for charging up to 30kV

The **Bleed** function (discharge of the EUT between individual events) is not available within the **Evaluation** menu.

Evaluation 150pF / 330R		AD
+ 8.0kV		Auto 20Hz 0↑
Start	Edit	

Air Discharge

Auto Tigger mode
20Hz Repetition frequency [Hz] Selectable test voltage
0↑ Counting upwards

4.2.1. Edit Parameters

The parameter trigger, repetition as well as the counter can be changed. All other parameters are fix within the related test routine.

Evaluation 150pF / 330R		AD
+ 8.0kV		Auto 20Hz 0↑
Save	Cancel	

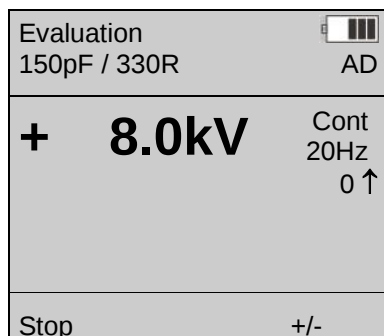
Press **Save** or **Cancel** for exit the Edit mode

Changeable parameters:

Parameter	Unit	Range
Polarity	-	positive , negative
Voltage	V	0.2kV ... 30kV step = 100V
Discharge tip	-	AD , CD
Trigger mode	-	Singel, Auto, Cont
Frequency	Hz	1 ...20Hz step = 1Hz
Number of shots	-	0 (counter) 1...99999 step = 1

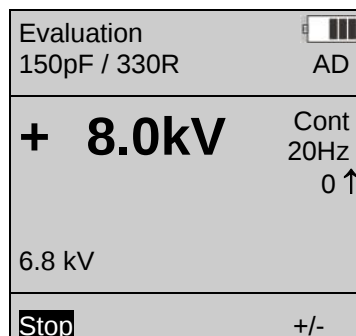
4.2.2. Start Evaluation

After pressing **Start**, the menu shows up as follows: **Start / Stop** of the test with the trigger button



P30N is ready for testing

← Trigger button →



P30N is charged

Display of the charging voltage during a test

During **Evaluation** testing with AD Module the charging voltage depends from the distance of the arc between the test finger and EUT.

During moving P30N over a EUT by hand, the distance is not stable and therefore the charging voltage change. **P30N** makes the following three voltage ranges with difference indicates in the display.



OK

Charged voltage is between 50% and 100% of the selected voltage



Wrong handling

The discharge happens before the charging voltage is reached 50% of the selected voltage.

4.3. Standard Test Routines

The Standard test routines offers an operating mode where the user can change the output voltage only in the given standard levels. For modify this levels the user must change it in the setup menu.

To select the Standard menu	Turn the Scroll wheel on top of the P30N
To start the test procedure	Push the Start button
To enter the menu	Push the Edit button

Functions	The first parameter which can be changed is the polarity by turning the Scroll wheel. By pressing the Trigger button the operator can move forward. The selected parameter is blinking. The displayed values are always related to the actual selected parameters.
Change	Functions, which are selected (blinking) can be modified by turning the Scroll wheel, e.g. Trigger mode: Single-Cont-Auto
Parameters	Numerical parameters are changed using the digital turn wheel. By pushing down the scroll wheel the digit to be changed can be selected. The related digit is under-lined and can be changed by turning the wheel. Note: The test voltage can only be changed on fixed levels. The levels are programmed in the setup menu.
Save	The correct parameter setting is confirmed by pushing the Save button.
Cancel	The changed parameter setting is not confirmed and will not be saved by exiting the menu

4.3.1. Parameter change in standard routine

Standard Routines 150pF / 330R		AD
+ 8.0kV	Cont	
	0.5s	
	10↓	
Level 3	Bleed OFF	
Start	Edit	

Air Discharge

Cont trigger mode

0.5s Repetition rate Test voltage only standard levels selectable

10↓ Counting downwards

Bleed OFF no EUT discharge after pulse

Before the test is started, the operator has to select in the menu

- the discharge mode, by selecting the specified discharge tip (round for **AD** and sharp tip for **CD**)
- the trigger mode, **Single – Automatic – Continuous**, preferred modes are Single & Auto
- the **repetition** rate of the discharges is seconds
- the number of discharges, *count upwards* ↑ or downwards ↓

4.3.2. Running standard routine

After pressing **Start**, the menu shows up as follows: Start / Stop of the test with the trigger button

Standard Routines 150pF / 330R		AD
+ 8.0kV	Cont	
	0.5 s	
	10 ↓	
Level 3	Bleed OFF	
Stop	+/-	

Standard Routines 150pF / 330R		AD
+ 8.0kV	Cont	
	0.5 s	
	10 ↓	
Level 3	Bleed OFF	
8050 V		
Stop	+/-	

P30N is ready for testing ← Trigger button → **P30N is charged**

- During the test, you can change polarity by pressing buttons **+/-**. The actual generated discharge voltage is displayed.
- In case of AD, it may happen that the discharge occurs before the final voltage level is reached. The message **Pre-discharge** is shown in the display. This message is only available if the function is enabled in the Setup menu (2/7).
- With the **Scroll** wheel, the operator can change the test level.
- Pressing the **Stop** button will stop the test routine.

4.4. Test Routines

To select the Test menu
To select a test procedure
To enter the menu

Turn the **Scroll wheel** on top of the P30N
Push the **Trigger** button
Push the **Select** button

User Test Routines		
150pF / 330R		CD
1	EN 61000-6-1	
2	EN 61000-6-1	
3	empty	
4	empty	
5	empty	
6	empty	
Select		

- Selected pre-programmed test routine
- 8 test routines can be stored
- Toggle between routines by pushing the **Trigger** button
- Push **Select**

Display after a test routine selection

User Test routines can be programmed in the esd.control software and downloaded into the memory of the P30N discharge unit. An example is shown below.

EN 61000-6-1		
150pF / 330R		CD
± PV	Bleed OFF	Pol +
L1	2.0 kV	Auto
L2	4.0 kV	1.0s
L3	8.0 kV	10 ↓
L4	--- kV	5 TP
Start		Edit

- Start** Change to the first testpoint
Edit Opens a menu for modify some parameters

Parameters in this menu:

- L1...L4** Levels of the selected test routines. Undefined test levels are marked with no voltage display.
Pol + - Both polarities are tested
±PV Automatic test sequence of iteration, see next paragraph
TP Number of EUT test points. **P30N** will test every test point with every test level.
Bleed Status Bleed function

Display after test start

EN 61000-6-1		
150pF / 330R		CD
+ 2.0kV		Auto
		1.0s
		10 ↓
1 TP	Bleed OFF	
Start		Edit

Air Discharge

- Cont** trigger mode
1.0s Repetition rate step size 0.5s
10 ↓ Counting downwards
Bleed OFF no EUT discharge after pulse

4.4.1. Edit Parameters

The parameter trigger, repetition, counter as well as the number of test point can be changed. All other parameters are fix within the related test routine.

EN 61000-6-1		
150pF / 330R		CD
$\pm$ PV	Bleed OFF	Pol +
L1	2.0 kV	Auto
L2	4.0 kV	1.0s
L3	8.0 kV	10 ↓
L4	--- kV	5 TP
Save		Cancel

Cyclic rotation for parameter change

Press **Save** or **Cancel** for exit the Edit mode

4.4.2. Sequence of the iterations

The sequence, in which the parameter polarity, test level and test point are handled, can be defined in 3 different modes.

- $\pm$ PV Select the 1rst test point and the starting test level. First the polarity ($\pm$) is changed, then go to the next test point (P) and finally repeat with the increased test level (V) .
- $\pm$ VP Select the 1rst test point and the starting test level. First the polarity ($\pm$) is changed, then the test level (V) is increased and finally go to the next test point (P).
- V $\pm$ P Select the 1rst test point and the starting test level. First the test level (V) is increased, then the polarity ($\pm$) is changed and finally go to the next test point (P)

4.4.3. ESD test with Test Routines

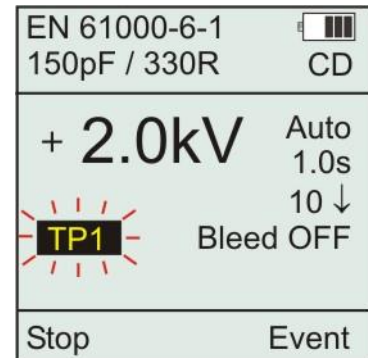
1. Press the **Start** button for run the test procedure.

P30N shows the position of the actual test point for testing by a blinking TP

1. This means, the tester must start with testing the test point 1.
After 10 discharges **P30N** shows in the display a blinking TP2 to continue testing the next test point.

P30N will guide the user through the test.

2. Begin with discharging at **Test point 1**. The discharge starts with pressing the **trigger** button.
3. Events as **Fail 1**, **Fail 2**, **Next**, **Repeat**, must be documented by writing a comment in the test notes (created with the **esd.control** software.



Stop The running test is stopped .

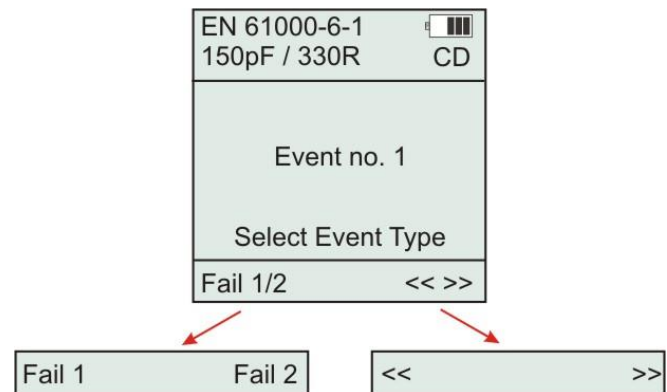
Event Procedure for enter an event in the note. Later after the test the user can write the note in the computer test report. The Event is registered and will append at the correct place in the test report.

<< (Retry) Repeat the test at the actual test point. Fail1 or Fail 2 information will be deleted and the test level is set back to the starting level.

>> (Next) Change to the next test point or test level. **P30N** shows on his display as example : Report Break : Nr

Fail 1 Fail 1 (The criteria for this fail must be defined by the user)

Fail 2 Fail 2 (The criteria for this fail must be defined by the user)



The P30N counts every event in a test and show it in the display. If you want to print the test notes please make indicate information's about the abnormal reaction of the EUT.

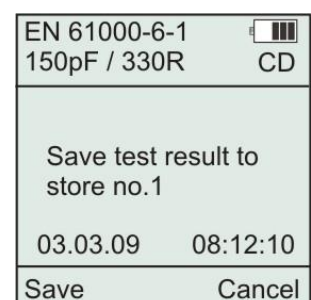
P30N can save max. 20 Events in each test before indicate EVENT MEMORY FULL in the display

4.4.4. End of the test

4. Terminate the test with the **Stop** button or **P30N** stops automatic after the last discharge on the last test point.
5. Note the displayed **Date** and **Time** in your test notes.

P30N saves all tests with a number 1...20 as reference.

Using **P30NControl** you find the test referenced by the test name and this number.



4.4.5. Report- and Event memory in P30N

P30N has the internal capability to save 20 files with results of test routines. A full memory is displayed at the begin of a test as shown below.

EN 61000-6-1 150pF / 330R	 CD		EN 61000-6-1 150pF / 330R	 CD
Report memory full. Clear memory or start without Reporting			Report memory full. Do you want to clear the report memory?	
Start	Clear	If Clear selected →	Yes	No

The following procedures are possible for continue:

Start without report. During the test no data are saved. Please use a test notes for having a document.

Clear all reports in **P30N**. The removed files can not be transferred later to the computer.

Make a transfer the data with the software **P30NControl** to the computer. Erase with **P30NControl** the test report you don't need in the future.

4.5. Setup menus

4.5.1. Standard (Page 1/7)

The standard voltage levels can be modified within this menu. The parameters are entered separately for air discharge and contact discharge.

Setup Standard 	
Mode	AD or CD
Level 1	2.0 kV
Level 2	4.0 kV
Level 3	6.0 kV
Level 4	15.0 kV
1/7 Edit	

To change the Standard Level:

Edit	By pushing the Trigger button the different functions can be selected. By turning the Scroll wheel the parameters can be modified.
Save	Push the Save button. The modified parameters will be stored and exit to the Setup Menu
Menu	By turning the Scroll wheel the operator can change into another menu

Test level requirements as per IEC 61000-4-2

Contact Discharge		Air Discharge	
Test Level	Test voltage [kV]	Test Level	Test voltage [kV]
1	2	1	2
2	4	2	4
3	6	3	8
4	8	4	15
x	special	x	special

Test sequence :

- Minimum 10 discharges positive and negative
- Starting at the lowest test level
- repetition rate max. 1 discharge/sec

4.5.2. Setup Firmware (Page 2/7)

The firmware setting configure additional features for ESD testing. Advanced users can enable these features for testing on a higher level. The figure below shows the default **factory firmware setting**.

Setup Firmware	
PreDsc	OFF
Vr/V	OFF
Vr/V	80%
Vstep	0.5kV
Bleed ts	0.1s
Bleed td	0.1s
2/7	Edit

Pre discharge detection during charging ON/OFF
 Level discharge detection / OFF Air discharge only
 Level discharge detection voltage [%] Air discharge only
 Voltage step for online charging change
 Bleed OFF delay
 Bleed OFF time

Pre Discharge ON / OFF

A discharge by AD testing below 90% of set voltage, caused by a too short air- distance during the charging procedure will indicate a double beep with the display Pre-Discharge. The counter will not count this discharge.

Warning Vr/V level ON / OFF (residual voltage) Air discharge only

In case that **P30N** is not discharged completely, an acoustic warning signal will appear. This may occur during testing of insulated objects. Maybe the DUT was charged up due to the previous testing so that no more discharges can be made to the DUT. Maybe only small partial discharges occur which may not be detected as a spark over by the operator. The function **Vr/Vlevel** can be used as spark over sensitivity detection.

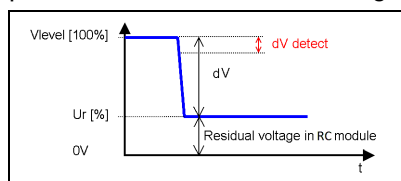
After each discharge the residual voltage within **P30N** is measured. Caused by the difference **P30N** knows if a discharge occurred or not. Based on this parameter the operator can decide whether a discharge is accepted as a complete discharge.

In case of **NO discharge** a double beep will be generated. It is up to the user to decide on this discharge. The counter will decrease in each case

REMARK: For a discharge detection, a voltage drop of approx. 200V is necessary. Slow voltage changes as RC discharges of the module and recharge for voltage stabilization, will not trip the discharge detection. Isolated EUT with small surface or already charged parts generates a small voltage drop who will not detect as discharge. This effect happens more at lower test levels.

Level for Vr 20...80 , (10% step), minimum voltage is 2000V

This function can only be used for CD mode and AD mode when the rep rate is larger than 0.5s. In the case when the discharge frequency is higher than 2Hz, it cannot be guaranteed that the test voltage ever reaches the preselected value. The discharge voltage mostly is determined by the distance of the spark gap.



V level = Test voltage

Vr = Residual voltage remaining in the **P30N** after a discharge occurs

V detect = min. voltage drop for discharge detection

Calculated value for $dV = V \text{ level} - V_r$

V Step

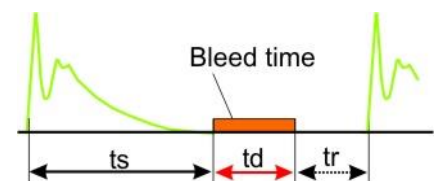
Selection of the voltage/step (ΔV) parameter which is used in the menus **Quick Start** and **Evaluation**. Range 100V...9900V. Default setting 1000V.

Bleed ts

The EUT discharge mode (Bleed Off) is started with a delay of t_s after the discharge was released. This works automatically in CD mode.

Bleed tr

The EUT discharge mode (Bleed Off) is activated for a time period t_r after t_s , if "Bleed Off" is enabled.



4.5.3. Setup System (Page 3/7)

Setup System 	
Contrast	50%
Date	dd.mm.yy
Time	hh:mm:ss
Language	English
Interface	USB
Baudrate	19200
3/7	Edit

Display contrast

Actual date

Actual time

USB, Optolink or Framebus (EM Test internal)

4800, 9600, 19200 Baud Default 9600

Contrast

The contrast of the display can be select with Edit and adjusted with the **Scroll** wheel

4.5.4. Options (Page 4/7)

Options 	
Quickstart	ON
Standard	ON
User Tests	ON
Evaluation	ON
Earth Fault	OFF
4/7	Edit

Earth fault detection (Earth cable ESD30N to reference GND)

The user can disable not used menus with the EDIT mode. This increases the simple handling and the operating efficiency.

4.5.5. System Info (Page 5 / 7)

The user can not change the system information.

System info 	
Module	150pF / 330R
RH	33%
T	23°
Device-No	ESDmyynnn
5/7	Edit

Actually used discharge module

Relative Humidity

Temperature

Device number: ESD (Month – Year – individual number

The values for relative Humidity and temperature are recorded just when the generator is switched on. The sensors are located in the discharge unit P30N. During testing the P30N will be warmed up and the Humidity will be influenced as well by the operator.

These measurements are recorded before starting the test and can be implemented into the test report manually.

For exact recording of both parameters throughout the complete test procedure an external sensor can be connected to the base unit ESD30N in future.

4.5.6. Device info Device (Page 6 / 7)

Device Info 1 	
Name	ESD 30N
HWV	102226-1
FWV	1.00
BLV	2.01a01
FBA	030000
U : 00 : 00 : 00 : 00 : 00 : D9	
6/7	Edit

Hardware version number module
Firmware version number
Boot loader version
Frame Bus Address
ID number

4.5.7. Device Info discharge unit (Page 6 / 7)

Device Info 2 	
Name	P30N
HWV	101227-0
FWV	1.00
BLV	2.01a01
FBA	030100
U : 00 : 00 : 00 : 00 : 00 : D6	
7/7	Edit

Hardware version number module
Firmware version number
Boot loader version
Frame Bus Address
ID number

4.6. Error messages

A double beep always indicates warnings or failures.

- **MODULE MISSING** No discharge module is connected to the **P30N**.
- **CHARGE BATTERY** voltage too low to generate high voltage
- **NO DISCHARGE** with CD in future version implemented
- **PRE DISCHARGE** The discharge occurs before **P30N** reached the charging voltage. Therefore the applied voltage is out of the tolerance. The discharge dip is too near to the EUT.
Help: Increase the distance from the discharge dip to the EUT.
- **EARTH FAULT** Earth cable not connected
- **RESIDUAL VOLTAGE**
- **EVENT MEMORY FULL**
- **FIRMWARE UPDATE** ESD30N and P30N have not the same firmware This happens if the user has more than one ESD30N and exchange the discharge units. An firmware update is mandatory to continue the work. The operator can only operate in the setup menu.
- **TIP MISSING, WRONG TIP** in future version implemented.

5. Setting into operation

5.1. General

- The ESD test is an EMC test. This means that artificial interference, which may lead to malfunction of electronic equipment, is generated. Consequently, the operator has the responsibility to avoid any risk for persons and material during laboratory tests. Long connection cables of the DUT can radiate certain energy and interfere with adjacent devices that do not belong to the test setup. Therefore, it is also the responsibility of the operator to decide whether EMC-tests are permissible in a certain environment and, if so, on what premises.
- National and international safety standards must be taken into account during each test procedure.
- Operators must be well educated in the use of high voltage test instruments.
- The discharge module must be connected to the ground reference plane during operation.
- The user is not allowed to change or modify any part of the instrument by himself. For service and repair, only original EM TEST parts or components must be used. EM TEST is not responsible for damage or personnel hazard due to the use of different parts or components.
- If maintenance or service work is necessary, it shall be performed only by experts who are familiar with the existing danger.

6. Technical data

6.1. P30N

Test voltage	Contact discharge (CD) 200V to 30kV Air discharge (AD) 200V to 30kV
Resolution	100V steps
Tolerance	±5% at the discharge tip
Polarity	Positive, negative, alternating (only software)
Trigger mode	
Single	Single discharge by pressing the trigger
Continuous	Continuous discharges as long as the trigger is pressed
Auto	Automatic discharges (for tripod only Auto)
External	Ext BNC Via optical link and esd.control
Counter	
Count down	1 ... 999'999
Count up	0 ... 999'999
Operating mode	
Controls	By 2 function keys and one Scroll wheel
Display	Graphic LCD included
Discharge tip	Sharp or round detected by P30N
Temperature	Internal sensor -20 to 70°C ± 2°C
Humidity	Internal sensor 10 to 90% ± 5%
Manual control	Via function keys of P30N
Remote control	Via optical interface and USB interface
Housing	Not flammable as per ABS-UL94V0
Total weight	app. 1250g

6.2. ESD 30N

Supply	
AC power mains	88V – 264V with 50/60Hz
DC power supply	11V - 16V dc
Internal battery buffer	For app. 1 hour of battery operation
Battery recharge	Automatically when connected to ac power mains supply
Interface	USB or Optolink for control the ESD generator To download preprogrammed test routines
General data	
Housing	9" / 2HE
Temperature range	15 – 35°C (59 to 95°F)
Relative Humidity allowed	20 – 80% non condensing
Total weight	app. 4500g
Fuse mains	230V : 2 x 500mA slow blow 115V : 2 x 1A slow blow
Fuse F3	3.15A slow blow



5mm x 20mm

6.3. Discharge modules

General

Dimension	ca. 80x70x80mm
Weight	Approx. 200g
Decode	Internal code resistance approx. 23 Module

6.3.1. As per IEC/EN 61000-4-2

Test voltage	AD : 0.5 – 30.0kV and CD: 0.5 – 30.0kV
Discharge capacitor	150pF $\pm 10\%$
Discharge resistor	330 Ω $\pm 10\%$
Holding time for AD	$\geq 5s$

Test voltage	2kV	4kV	6kV	8kV
tr rise time	0.7-1.0 ns	0.7-1.0 ns	0.7-1.0 ns	0.7-1.0 ns
I _{peak}	7.5A $\pm 10\%$	15.0A $\pm 10\%$	22.5A $\pm 10\%$	30.0A $\pm 10\%$
$\hat{I}$ at 30 ns	4.0A $\pm 30\%$	8.0A $\pm 30\%$	12.0A $\pm 30\%$	16.0A $\pm 30\%$
$\hat{I}$ at 60 ns	2.0A $\pm 30\%$	4.0A $\pm 30\%$	6.0A $\pm 30\%$	8.0A $\pm 30\%$

6.3.2. As per ISO 10605

Test voltage	AD : 0.5 – 30.0kV and CD: 0.5 – 30.0kV			
Discharge capacitor $\pm 10\%$	150pF	330pF	150pF	330pF
Discharge resistor $\pm 10\%$	2000 Ω	2000 Ω	330 Ω	330 Ω
Holding time	$\geq 5s$			
Discharge mode	AD or CD			

Test voltage	4kV	8kV	15kV	30kV
tr rise time	0.7-1.0 ns	0.7-1.0 ns	0.7-1.0 ns	0.7-1.0 ns
I _{peak} $\pm 10\%$	15.0A	30.0A	56.25A	112.5A
$\hat{I}$ at 30 ns	4.0A $\pm 30\%$	8.0A $\pm 30\%$	12.0A $\pm 30\%$	16.0A $\pm 30\%$
$\hat{I}$ at 60 ns	2.0A $\pm 30\%$	4.0A $\pm 30\%$	6.0A $\pm 30\%$	8.0A $\pm 30\%$

Other R/C discharge networks are available on request.

The discharge modules are equipped with two different discharge tips:



Sharp tip $\angle 30^\circ$ for contact discharge (CD)

8mm round tip for air discharge (AD) up to 15 kV

30mm round tip for air discharge (AD); high voltage range >15kV

6.4. Test Routines

Quick Start	Very fast and easy to handle test routine. While the test is running, the test voltage and the polarity can be selected. All other parameters can be preselected before the test is started.
Standard Test	Level 1 to 4 as per IEC/EN 61000-4-2 and per Generic Standard EN 50082-1 and –2. Test points can be preselected. User guided test procedure. All data can be used for test reporting in esd.control software.
Evaluation	Fast test routine to determine the most sensitive test points at the DUT. Prior before a standard test routine is used.
User Test Routines	User specific test routines can be programmed and downloaded via esd.control software

< Specifications subject to change without notice >

7. Maintenance and practical advice

7.1. General

P30N is free of maintenance.

7.2. Calibration and Verification

7.2.1. Factory calibration

Every EM TEST generator is entirely checked and calibrated as per International Standard regulations before delivery. A calibration certificate is issued and delivered along with a list of the equipment used for the calibration proving the traceability of the measuring equipment. All auxiliary equipment and accessories are checked to our internal manufacturer guidelines.

The calibration certificate and the certificate of compliance (if available) show the date of calibration.

The EM Test equipment are calibrated in the factory and marked with a calibration mark. The used measuring instruments are traceable to the Swiss Federal Office of Metrology.

The calibration date is marked. The validity of the calibration is to the responsibility of the user's quality system. Neither the certificate of calibration nor the corresponding label mark any due date for re-calibration.



Example: Calibration mark

7.2.2. Guideline to determine the calibration period of EM Test instrumentation

Our International Service Departments and our QA Manager are frequently asked about the calibration interval of EM TEST equipment.

EM TEST doesn't know each customer's Quality Assurance Policy nor do we know how often the equipment is used and what kind of tests are performed during the life cycle of a test equipment. Only the customer knows all the details and therefore the customer needs to specify the calibration interval for his test equipment.

In reply to all these questions we like to approach this issue as follows :

EM TEST make use of a solid state semiconductor switch technique to generate high voltage transients. A precious advantage of this technique is the absolute lack of periodical maintenance effort. In consequence thereof a useful calibration period has to be defined based on two criteria :

- The first one is the customer's Quality Assurance Policy. Any existent internal regulation has to be applied at highest priority. In the absence of such internal regulation the utilization rate of the test equipment has to be taken into consideration.
- Based on the experience and observation collected over the years **EM TEST recommend a calibration interval of 1 year** for frequently used equipment. A 2-years calibration interval is considered sufficient for rarely used test generators in order to assure proper performance and compliance to the standard specifications.

7.2.3. Calibration of Accessories made by passive components only

Passive components do not change their technical specification during storage. Consequently the measured values and the plots stay valid throughout the storage time. The date of shipment shall be considered as the date of calibration.

7.2.4. Periodically In-house verification

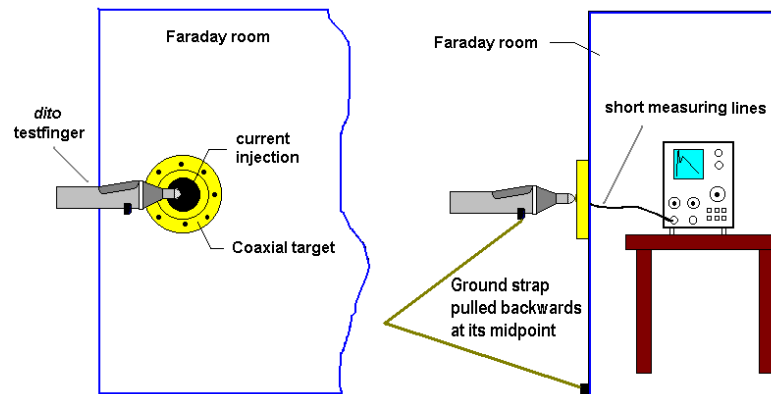
Please refer to the corresponding standard before carrying out a calibration or verification. The standard describes the procedure, the tolerances and the necessary auxiliary means. Suitable calibration adapters are needed. To compare the verification results, EM Test suggests to refer to the waveshape and values of the original calibration certificate.

7.3. Verification

- At normal operation with approx. 5 to 10 working hours per week a yearly function check and a calibration is sufficient.
- For the calibration procedure, an adequate measuring set-up must be used. The directions given in the chapter "Verification of the characteristics of the ESD generator" of the IEC 61000-4-2 standard have to be strictly followed. Only expert laboratories with adequate knowledge or EM Test or its authorized distributors are permitted to perform calibration of P30N.

7.3.1. Test setup

Verification set-up according IEC-61000-4-2



It is very important to keep the loop of the ground cable as large as possible as shown in the upper figure.

7.3.2. ESD waveform verification

EM TEST recommends the following test equipment:

- Digital oscilloscope with at least 2GHz single shot bandwidth
- Faraday cage
- EM TEST CTR-2 Coaxial Target including 20dB attenuator and high quality coaxial cable

Capturing the waveform on the scope can only be achieved with the proper setup on the Digital Oscilloscope (DSO). The setup must be chosen to measure waveforms at $\pm 2\text{KV}$, $\pm 4\text{KV}$, $\pm 6\text{KV}$ and $\pm 8\text{KV}$. There are five measurements required for each voltage. (or can also be measured at any other test level required)

- Initial peak current
- Rise time at 10% to 90% of initial peak current
- Current level at 30ns
- Current level at 60ns

The time domain for the initial peak and rise time measurement is 1ns/Div and 10ns/Div for the measurement of the current at 30ns and 60ns.



typical waveforms at 4KV:

7.3.3. Verification of the discharge parameters

The verification is specified for contact discharge mode only.

Verification procedure:

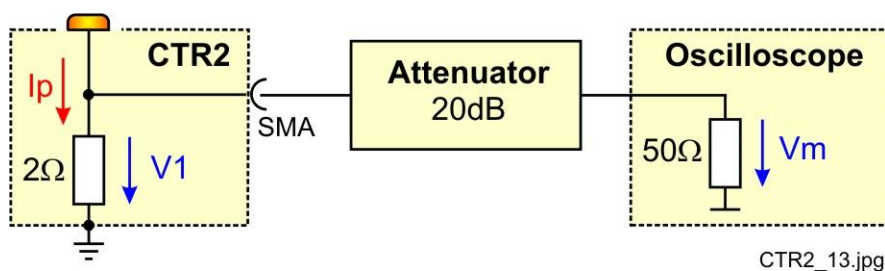
- Preselect **Quick Start**, Mode = **CD**, Trigger = **Single**
- Select the test level and press the **Start** key
- Contact the discharge tip to the surface of the calibration shunt.
- Press the Trigger button and one single discharge will be released.

Specification as per IEC 61000-4-2; 150pF/330Ω

Test level	I _{peak}	I at 30ns	I at 60ns	Rise time
	±10%	±30%	±30%	
2000V	7.5 A	4.0A	2.0A	
4000V	15.0A	8.0A	4.0A	0.7-1.0 ns
6000V	22.5A	12.0A	6.0A	
8000V	30.0A	16.0A	8.0A	
12000V	45.0A	24.0A	12.0A	
15000V	56.25A	30.0A	15.0A	0.7-1.0 ns
20000V	75.0A	40.0A	20.0A	
25000V	93.75A	50.0A	25.0A	
30000V	112.5A	60.0A	30.0A	

Specification as per ISO 10605:

Typical values Cap/Res	Peak current/ Charging voltage A/kV	Tolerance %	Current at I1/ Charging voltage A/kV	Tolerance %	Current at I2/ Charging voltage A/kV	Tolerance %
150pF/330Ω	3.75	10	2 at t1=30ns	±30	1 at t1=60ns	±30
330pF/330Ω	3.75	10	2 at t1=65ns	±30	1 at t1=130ns	±30
150pF/2000Ω	3.75	+30/-0	0.275 at t1=180ns	±30	0.15 at t1=360ns	±30
330pF/2000Ω	3.75	+30/-0	0.275 at t1=400ns	±30	0.15 at t1=800ns	±30



$$V1 = 20\text{dB} \times Vm$$

$$V1 = 2\Omega \times I1$$

$$\rightarrow I_p = 20\text{dB} \times Vm / 2\Omega$$

$$Vm = \text{displayed measuring voltage [V]}$$

$$V1 = \text{measured voltage across the } 2\Omega \text{ target}$$

$$I_p = \text{discharge current}$$

$$I_p = 5 \times Vm$$



A discharge current of 7.5A therefore will result in a displayed $Vm = 1.5\text{V}$

8. Delivery

8.1. Basic

- **ESD 30N** and **P30N** ESD generator
- Discharge tip for air discharge (8mm round)
- Discharge tip for contact discharge (sharp $\angle 30^\circ$)
- Grounding cable (2 m)
- Carrying case 580 x 470 x 200mm 4.05kg
- Manual on USB memory-stick
- Certificate of compliance



Identical accessory parts are delivered only once if several devices are orders. The delivered packing list is in each case valid for the delivery.

8.2. Options

Discharge modules

- RCN 1** C= 150pF, R=330 Ω according IEC 61000-4-2; ISO 10605
- RCN 2** C= 150pF, R=2000 Ω according ISO 10605
- RCN 3** C= 330pF, R=2000 Ω according ISO 10605
- RCN 4** C= 100pF, R=1500 Ω according MIL
- RCN 5** C= 330pF, R=330 Ω according ISO 10605; VW TL
- RCN X** customized modules on request
C = 50pF to 500pF and R = 100 Ω to 10k Ω

- esd.control** Operating software with optical interface **P30N** – computer
- EAS 30** Earthing resistor 2x470k Ω to test table, 1.40m
- VCP** Vertical coupling plane Set for indirect testing.
- CSL 200** Field coupling plane and field coupling strip as per FDIS ISO 10605, Annex F and DC-11224 for ESD powered-up test of electronic modules, requires EAS 30
- Optolink** Fiber optic link and interface for dito and ESD 30N with USB A connector, length 3m
- CTR 2** Target 2 Ohm for verification



CTR 2 Target

- **User Software " esd.control "**
Operating software with optical interface **P30N** – computer
 - Test, analysis and documentation with windows
 - License version for testing according the most industrial standards
 - Report generator with export function to word-processing software



9. Appendix

9.1. Declaration CE- Conformity

DECLARATION OF CONFORMITY

Manufacturer : **EM TEST Switzerland GmbH**

Address: Sternenhofstr. 15
CH 4153 Reinach
Switzerland

declares, that under its sole responsibility, the product's listed below, including all their options, are in conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product name: ESD30N/P30N
Model Function Simulator for Electrostatic Discharge

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1 : 2011 Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

EN 61326-1 : 2013 Electrical equipment for measurement, control and laboratory use Class A
EN 61000-3-2 : 2014 Limits for harmonic current emissions
EN 61000-3-3 : 2013 Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

European representative
AMETEK CTS Germany GmbH
Lünenerstr. 211
D 59174 Kamen
Tel: +49 (0) 2307 / 26070-0
Fax: +49 (0) 2307 / 17050



By A. Gerstner
General manager
Place Kamen, Germany
Date 20. December 2016

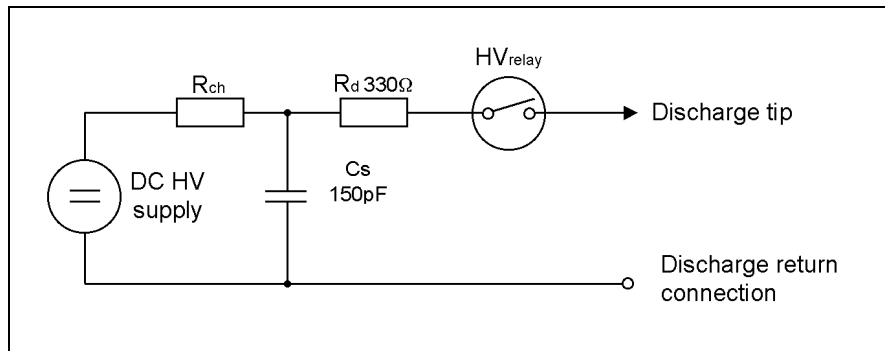
Manufacturer
EM TEST (Switzerland) GmbH
Sternenhofstr. 15
CH 4153 Reinach
Tel: +41 61-7179191
Fax: +41 61-7179199



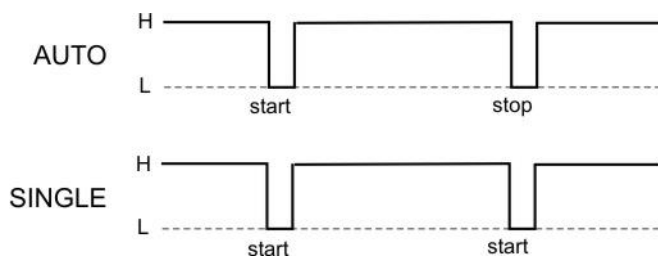
A. Burger
Business Manager Conducted EMC
Reinach BL, Switzerland
25. February 2016

9.2. Blockdiagram P30N

Blockdiagram

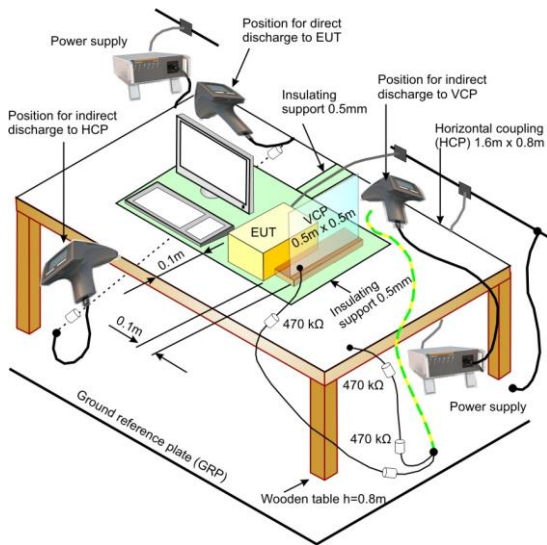


9.2.1. Signal level ext. Trigger



9.3. Application

9.3.1. Test setup



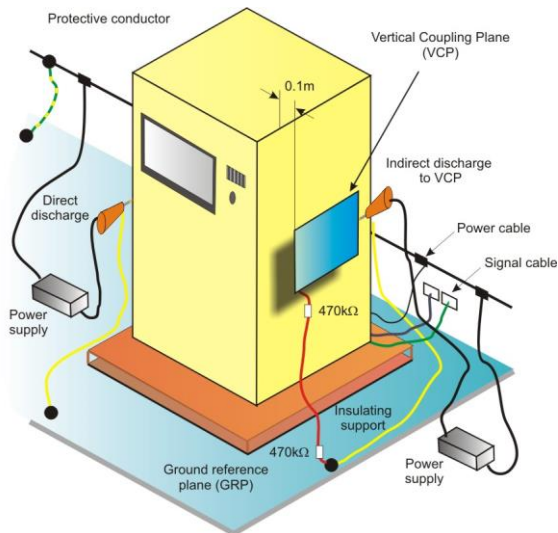
Example of test set-up for table-top equipment, laboratory tests.

Direct discharge test points per IEC 61000-4-2

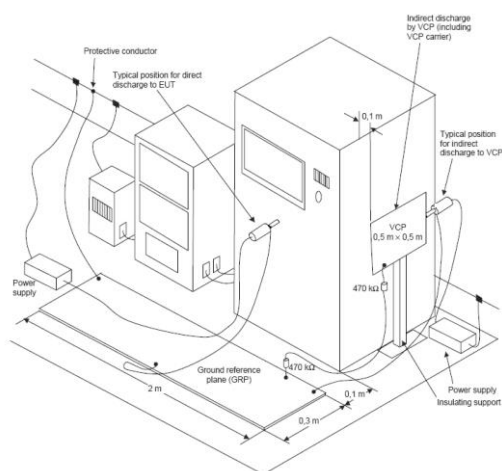
- All accessible points of the surface of the DUT: Cables, housings, displays, keyboards, etc.
- The points which are accessible only for customer maintenance.

Indirect discharge test points per IEC 61000-4-2

- VCP at each side of the DUT
- HCP 10 cm distance to the DUT



Example of test set-up for floor standing equipment, laboratory tests.



Example of test set-up for floor standing equipment, post installation tests.

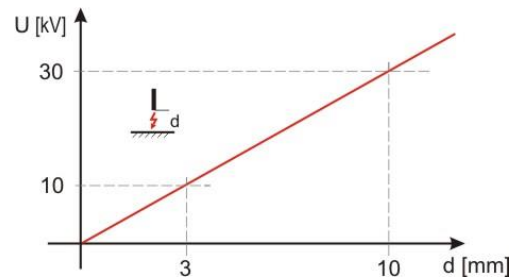
For additional information concerning the test setup and the test procedure please read the IEC 61000-4-2 carefully.

9.3.2. Air discharge with double discharge effect

After an air discharge, the ESD simulator will recharge the module after a short break with a linear voltage ramp. During the charging the voltage is present at the round discharge tip.

Is the distance between the tip and GND too near, a pre-discharge happens during the charging time.

The diagram shows the approximate breakdown characteristic of a top plate assembly



Example

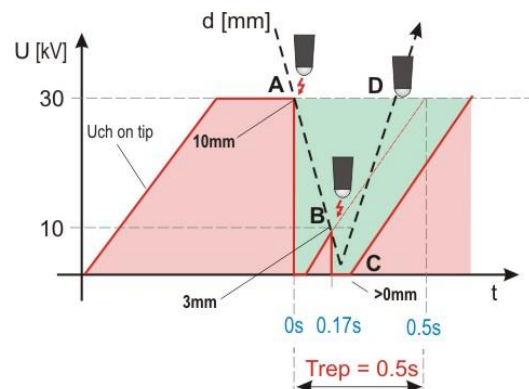
Air discharge with 30kV and 0.5s repetition

Movement to the EUT to slow

A slowly move of the discharge tip in direction to the EUT may result a double discharge. This happens particularly at short repetition times like 0.5s.

A : On the approach at **point A**, the **first discharge** appears at approx. 10mm distance to EUT.

The user moves the discharge module in the direction EUT. After some 10ms the ESD simulator starts charging again, because the voltage must be charged complete after 0.5s.



B : The user moves the discharge tip in direction EUT while the voltage on the discharge tip increases. At **point B**, approx. 3 mm distance to the EUT, a **second discharge** appears. After 170ms the voltage is approx. at 10kV. The second discharge is perceived by the user as a double discharge.

C : Reversal point: The user reverses the moving direction away from EUT. The tip speed is fast enough that no discharge takes place again.

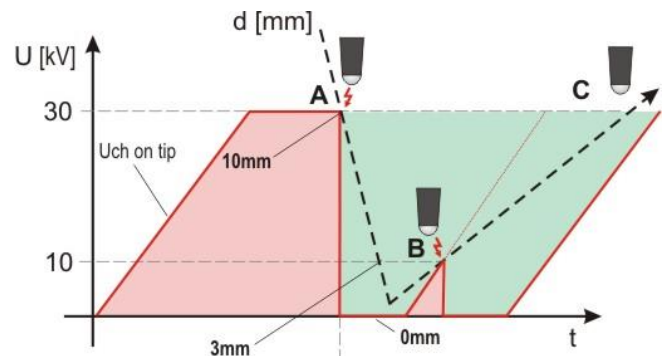
D : The user moves the discharge module **rapidly away** from the EUT. At point D the distance is far away, that no discharge can happen. As long as the discharge module is shown in green area, there is no arcing.

Slowly remove of the discharge tip from the EUT

A : On the approach, at **point A** the **first discharge** happens at about 10mm distance.

After the reverse the moving direction, the user moves the module with a slow speed away from the EUT.

B : The charging voltage on the discharge tip is increasing so quickly that at **point B**, a **second discharge** occurs. The second discharge is perceived by the user as a double discharge.



Conclusion



A double discharge during ESD air discharge testing appears, when the repetition time T_{REP} , charging voltage and moving speed are not in balance.

At charging voltages $> 16\text{kV}$ the repetition time T_{REP} must be at least **1s**.
Double discharges are avoided therefore in a simple manner.

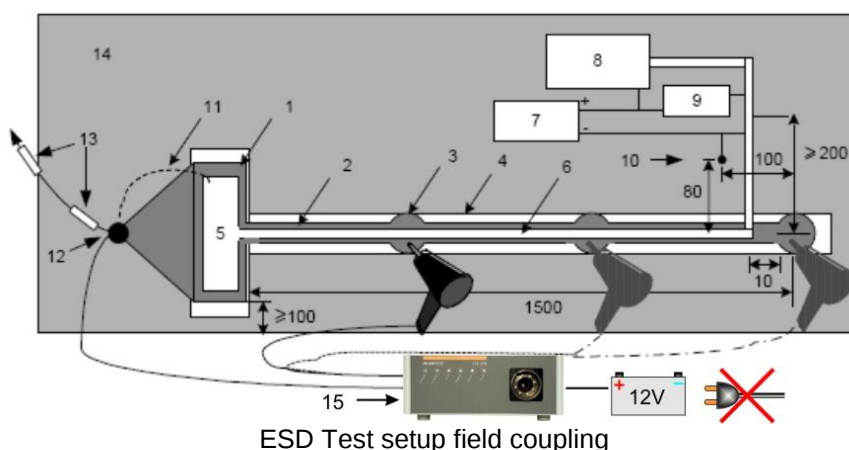
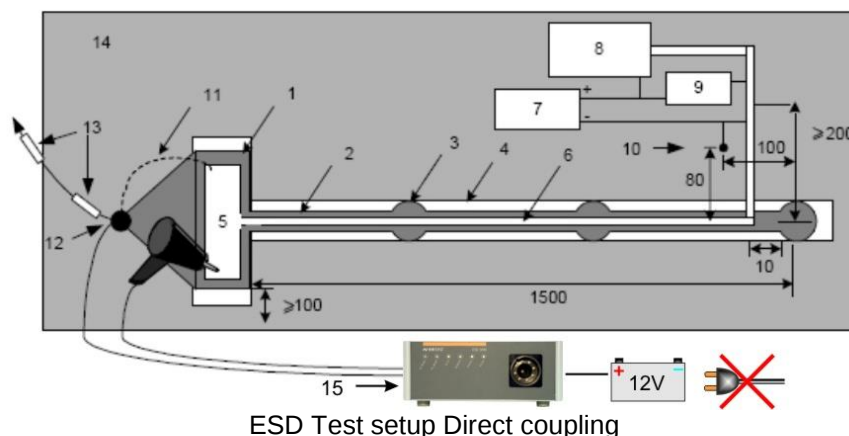
9.3.3. Test setup DaimlerChrysler DC-11224 REV.A (2007-06)

Test Bench setup

Using this Daimler Chrysler standard, the COMMON of the ESD generator is grounded at the Reference earth point (12). The horizontal coupling plane is connected via a 1 M Ω to PE (13). The ESD 30N is floating operated.

Legend:

1. Field Coupling Plane
2. Field Coupling Strip
3. Discharge islands
4. DUT and wiring harness isolation block
5. DUT
6. DUT wiring harness
7. Battery
8. Peripheral or support equipment
9. AN (if used)
10. Ground reference point for battery and support equipment
11. DUT local ground, (if required)
12. Ground reference point for ESD Coupling Plane, ESD generator and safety ground connection
13. 2 x 470kΩ resistor to safety ground
14. HCP
15. ESD Generator main unit



Settings ESD 30N and Test setup

- For testing this standard, the earth fault detection must be switched OFF (factory setting = OFF)
For change enter the menu **Setup / Options**.
- For this test the user must operate in battery mode. A full charged battery allows a test duration of approx. 1.5 hours (30kV / 2Hz discharge). For longer test duration an external battery has to be connected at the dc input at the base unit.
- In remote mode the optical interface must be used.
- The exact test procedure is written in the standard DC-11224.

9.4. Definitions

- **Actual ESD events:** Non-simulated electrostatic discharges that occur in the environment of the electronic equipment.
- **Air discharge method:** A method of ESD testing in which the charged electrode of the ESD simulator approaches the EUT regardless of the conductivity of the surface being subjected to the ESD event. A spark in air to the EUT actuates the discharge.
- **Bleeder wire:** Conductive wire with high impedance, high voltage series resistors to dissipate applied electric charge from HCP, VCP and EUT slowly.
- **Charging current:** The maximum continuous current at any charge voltage that may flow at the ESD simulator probe tip as measured on the return path of the simulator through a 1500-Ω resistor connected to the probe tip.
- **Contact discharge method:** A method of ESD testing in which the electrode of the ESD simulator is in firm electrical contact with a conductive surface of the EUT or coupling plane prior to discharge. A switching device (i.e., a relay) within the simulator actuates the discharge.
- **Controlled ESD environment: One in which an attempt is made to** maintain charge and/or voltage levels on humans and objects below a certain level. Typical control measures include Humidity controls, equipment earth grounding, use of anti-static materials, ionized air, and high-resistance discharge paths for humans.
- **Coupling plane:** A metal plate to which discharges are applied to simulate electrostatic discharge to objects adjacent (vertically or horizontally) to the EUT. See also: HCP, VCP.
- **Direct ESD test:** A test in which ESD is applied directly to the surface or structure of the EUT.
- **Electrostatic discharge (ESD):** The sudden transfer of charge between bodies of differing electrostatic potentials.
- **ESD event:** The occurrence of a single ESD.
- **ESD simulator:** A testing device used to simulate a human ESD event.
- **ESD target adapter:** Adapter used to connect reference pulse or sinusoidal generators to the ESD target.
- **ESD test voltage:** The amplitude (usually expressed in kV) of the electrostatic voltage that exists prior to discharge.
- **EUT:** Equipment Under Test.
- **Exerciser:** A device used to operate the EUT.
- **Failure:** The inability of a product to meet its operating specification.
- **Fault:** In testing a digital circuit, any difference between the expected and the actual output sequences produced in response to an input sequence. A fault may or may not lead to a failure.
- **Ground reference plane (GRP):** A flat conductive surface whose potential is used as a common reference. Where applicable, the operating voltage of the EUT and the operator ground should also be referenced to the ground plane.
- **Hand/metal ESD:** An ESD from an intruding human hand that occurs from an intervening metal object such as a ring, tool, key, etc. *Also called:* hand/metal discharge.
- **HCP:** Horizontal coupling plane.-