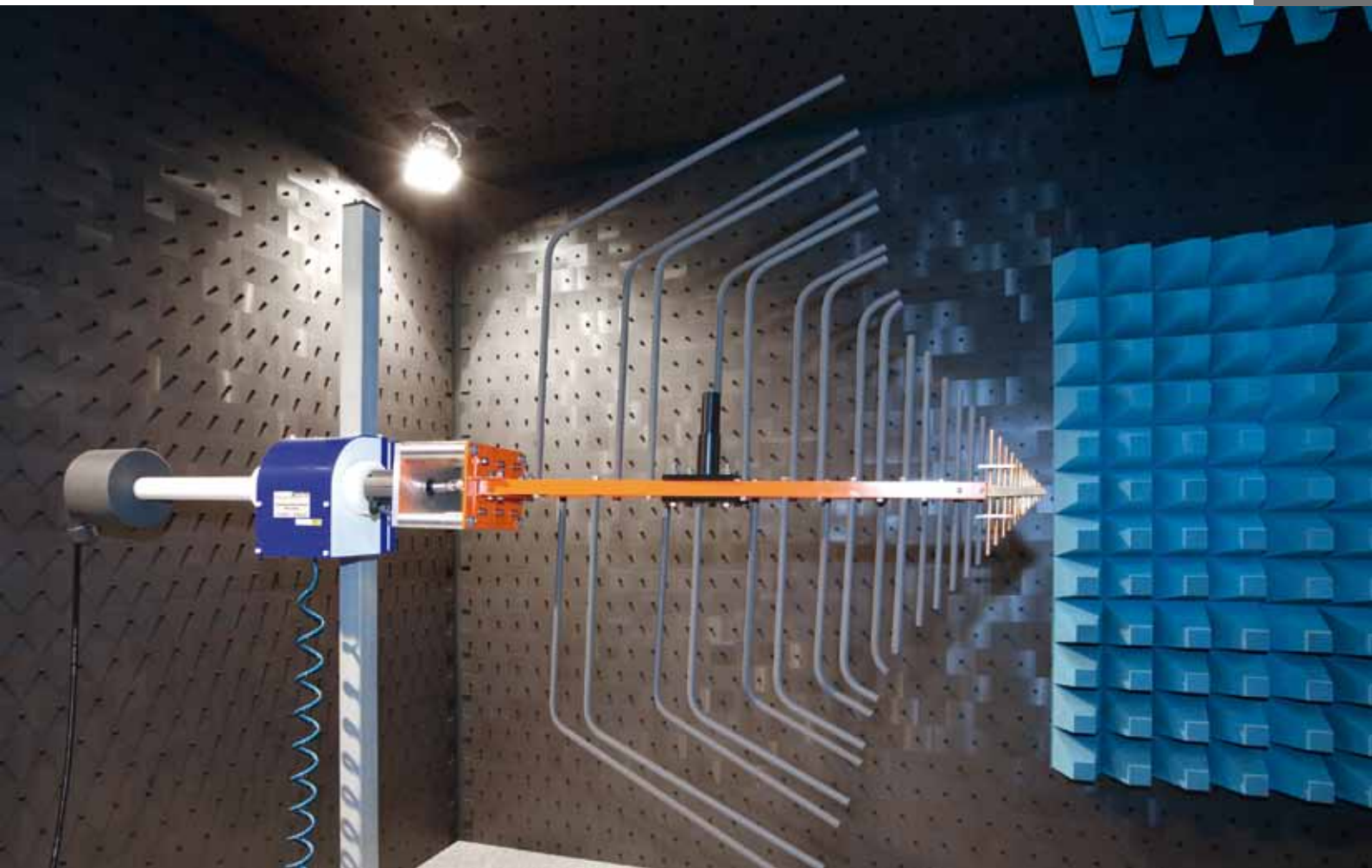


The Balluff Testing Laboratory



The Balluff Testing Laboratory



With over 50 years of sensor experience, Balluff is a leading global sensor specialist with its own line of connectivity products for every area of factory automation. Balluff is based in Germany and has a tight international network of 54 representatives and subsidiaries.

Our product range includes electronic sensors, transducers which use various operating principles, identification systems, bus-capable sensors as well as electromechanical and inductive single and multiple position switches. Balluff products are found wherever accuracy and reliability are in demand.

Wherever processes are automated, objects detected, rotary and linear motion reported to controllers – Balluff is always the right partner.

Innovative technology and application-specific customer solutions are the hallmarks of the entire product range. Highly-qualified development engineers and experienced designers work closely with the manufactures to ensure mature series products that are used successfully in every area of automation – even under extreme and aggressive operating conditions.

The Balluff GmbH testing laboratory conducts tests in the following areas on behalf of Balluff divisions, other Balluff companies and external customers:

- Electromagnetic compatibility
- Shock, sinusoidal and noise tests
- Product-specific tests, including:
 - Making and breaking capacity
 - Cable anchoring of sensors with integral connection cables
 - Short circuit protection test
 - X-ray analysis
 - HALT test

On 27.08.2010, the testing laboratory was accredited for testing electromagnetic compatibility (registration number D-PL-12017-01-01) by the German Accreditation Institute (Deutsche Akkreditierungsstelle GmbH). Tests in the testing laboratory are conducted according to DIN EN ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories". The defined regulations are documented in the quality management handbook of the testing laboratory.





Accreditation, certification	2
Test equipment in the test laboratory	4
Electromagnetic compatibility	
Conformity evaluation procedure	5
EMC standards	6
Immunity from the discharge of static electricity (ESD)	7
Immunity from electromagnetic fields (RFI)	8
Immunity from fast, transients (bursts, EFT)	9
Immunity from abrupt voltage surges	10
Immunity from conducted interference induced by high-frequency fields	11
Immunity from magnetic fields with power transmission frequencies	12
Immunity from voltage dips, short breaks in power supply and voltage fluctuations	13
Emission testing, RF emission	14
Emission testing, radio interference voltage	15
Emission testing, HF magnetic field	16
Product-specific tests	
Testing the making and breaking capacity of proximity switches	17
Testing the cable anchoring of proximity switches with integral connection cables	18
Testing the short circuit protection	19
X-ray analysis	
HALT test	
Vibration and shock tests	
Sinusoidal vibration test	22
Shock test	
Noise test	





The Balluff Testing Laboratory

Test equipment in the test laboratory

	Tests	Test equipment
1. Electromagnetic compatibility (EMC)	Immunity from discharge of static electricity (EN 61000-4-2)*	ESD generator ESD 30C, EM test ESD generator DITO, EM TEST
	Immunity from electromagnetic fields EN 61000-4-3* EN 61000-4-20	Absorber room 7.00 m x 4.00 m x 3.00 m (LxWxH), Albatross projects GTEM cell 1500, MEB Signal generator SML03, Rohde & Schwarz HF amplifier BLWA 0810-250/200, BONN HF amplifier model CBA9429, SCHAFFNER HF circuit network RFSN, SCHAFFNER Power meter NRVS, Rohde & Schwarz Power sensing head NRV-Z 51, Rohde & Schwarz Directional coupler RK 100, MEB Directional coupler C6187, VERLATONE Electric field probe HI-6005, Holaday Software MEB IMM, SCHAFFNER
	Immunity from fast transients (bursts) (EN 61000-4-4)*	Burst generator EFT 500, EM-Test Capacitive coupler HFK, EM test
	Immunity from voltage surges (EN 61000-4-5)*	Hybrid Generator CE-SURGE, Hilo-Test Coupling / decoupling network CDN 104 Coupling / decoupling network CDN 202
	Immunity from conducted, high-frequency disturbances (EN 61000-4-6)*	Signal generator SMH, Rohde & Schwarz HF amplifier model 150A100A, AR Coupling / decoupling network M2, MS3, S4, S9, AF2, A401, AF3, RJ45/5 EM injection clamp F-203I-23 mm, FCC Software MEB IMM, Schaffner MEB
	Immunity from magnetic fields with power transmission frequencies (EN 61000-4-8)*	Self-built test equipment, Balluff GmbH
	Immunity from voltage dips, short breaks in power supply and voltage fluctuations (EN 61000-4-11)*	Self-built test equipment, Balluff GmbH
	Radiated emissions EN 55011, EN 55016-2-3	GTEM cell 1500, MEB Test receiver SM41, MEB Software, MEB
	Conducted emissions (EN 55011; EN 55022; EN 55016-2-1)*	Test receiver ESHS 30, Rohde & Schwarz Interference test set ESH3-Z5, Rohde & Schwarz
	Emissions, HF magnetic field (DIN EN 300 330-1)	Frame antenna HLA6120, SCHAFFNER Test receiver ESHS 30, Rohde & Schwarz
2. Product-specific tests	Making capacity / breaking capacity (EN 60947-5-2)	Self-built test equipment, Balluff GmbH
	Testing the cable anchoring of proximity switches with integral connection cables (EN 60947-5-2)	Self-built test equipment, Balluff GmbH
	Short circuit testing (EN 60947-5-2)	Self-built test equipment, Balluff GmbH
3. Shock, sinusoidal and noise tests	Shock, sinusoidal and noise tests (EN 60068-2-6) (EN 60068-2-27; EN 60068-2-29) (EN 60068-2-64)	Shock and vibration equipment, model SA15-S092-PB and model H560B-24-LP, Unholtz-Dickie with software modules for: Sinusoidal vibrations Shocks noise tests Signal analysis
4. Other	X-ray analysis	X-ray inspection equipment RTX 113, HEEB-INOTEC
	Highly Accelerated Life Test, HALT	AST 35, THERMOTRON

* included in the accreditation

The Council of the European Union has passed a series of EU Directives to remove trade barriers and allow the free movement of goods within Europe as part of a push towards further European integration.

Balluff products fall within the scope of the following three EU Directives:

EMC directive
2004/108/EC

Low-Voltage Directive
2006/95/EC

Radio Equipment and Telecommunications Terminal Equipment (RTTE) 1995/5/EU

EU Directives are valid European laws integrated into national legislation by the states within the European Union.

All products that fall under the jurisdiction of these three EU Directives must bear the CE mark as a sign of their compliance with the corresponding Directive. Since 01.01.1996, the CE mark has been mandatory for all products governed by the EMC Directive and since 01.01.1997, for all products governed by the Low-Voltage Directive.

The manufacturer is responsible for assigning the CE mark if the stipulations in the relevant EU Directive are observed. The manufacturer conduct a so-called conformity evaluation procedure, shown in the following schematic illustration.



EU Directive
2004/108/EU (EMC Directive) or
2006/95/EC Low-Voltage Directive or
1995/5/EU (RTTE Directive)

Test according to the section in the harmonized product standard or generic standard, which outlines the protection objectives of the corresponding EU Directive

Documentation of test results

Declaration of conformity from the Balluff testing laboratory

CE mark



Electromagnetic Compatibility

EMC standards



	European standard	Contents of standard
1. Generic standards The generic standards define the requirements for products used in specific electromagnetic environments and are based on the Basic Standards. The Generic Standards must always be used when no product standards are available for the relevant products or when the EMC requirements are not specified in the product standard.	EN 61000-6-1*	Generic standard. Immunity for residential environments
	EN 61000-6-2*	Generic standard. Immunity for industrial environments
	EN 61000-6-3*	Generic standard. Emission standard for residential environments
	EN 61000-6-4*	Generic standard. Emission standard for industrial environments
2. Basic standards The basic standards describe the requirements and measuring procedures for individual EMC tests. The basic standards include limit values in the form of different severity levels that are defined for the requirements in the product or generic standard.	EN 61000-4-2*	Immunity from the discharge of static electricity (ESD)
	EN 61000-4-3*	Immunity from electromagnetic fields (RFI)
	EN 61000-4-4*	Immunity from fast transients (bursts)
	EN 61000-4-5*	Immunity from voltage surges
	EN 61000-4-6*	Immunity from conducted interference, induced by high-frequency fields
	EN 61000-4-8*	Immunity from magnetic fields with power transmission frequencies
	EN 61000-4-11*	Immunity from voltage dips, short breaks in power supply and voltage fluctuations
	EN 55011	Emissions; radio interference voltage* and RF emission EN 55022, EN 55016-1-2, EN 55016-2-3
3. Product standard The electromagnetic compatibility requirements for inductive, capacitive, photoelectric and ultrasonic sensors are defined in the product standard.	EN 60947-5-2*	Low-voltage switchgear and controlgear Part 5: Control circuit devices and switching elements Section 2: Proximity switches
	EN 60947-5-6	Low-voltage switchgear and controlgear Part 6: DC interface for proximity sensors and switching amplifiers (NAMUR)
	EN 60947-5-7	Low-voltage switchgear and controlgear Part 7: Control circuit devices and switching elements Requirements for proximity devices with analogue output
	EN 61131-2*	Programmable controllers
	EN 61326-1*	Electrical equipment for measurement, control and laboratory use
	EN 61326-2-3*	Electrical equipment for measurement, control and laboratory use, transducers
4. Harmonized standards for the RTTE Directive The electromagnetic compatibility requirements for BIS read heads are defined in the product family standard.	EN 300330-1	Short Range Devices (SRD) ... inductive loop systems in the frequency range 9 kHz to 30 MHz Part 1: Technical characteristics and test methods
	ETSI EN 301489-1	Standard for radio equipment and services Part 1: Common technical requirements
	ETSI EN 301489-3	Standard for radio equipment and services Part 3: Specific conditions for Short Range Devices (SRD) Operating on frequencies between 9 kHz and 40 GHz
Environmental test methods Standards for shock, sinusoidal and noise tests	MIL STD 202	International series of standards
	EN 60 068-2-6	Vibration, sinusoidal
	EN 60 068-2-27	Shock
	EN 60 068-2-29	Continuous shock
	EN 60 068-2-64	Vibration, broadband random
	GL	Germanischer Lloyd
	DIN EN 50155 IEC / EN 61373	Standard for rolling stock

* included in the accreditation

Electromagnetic Compatibility

Immunity from the discharge of static electricity (ESD)

ESD = Electrostatic Discharge

Origin

Discharge originates from people wearing well insulated shoes or walking on a carpeted floor who become electrostatically charged on days when air humidity is low and then discharge this electricity when coming into contact with conductive materials (e.g. metal).

Features

Voltages up to 30 kV and a current of several amperes are momentarily discharged once in a matter of nanoseconds.

The European standard

EN 61000-4-2

Test through direct discharge

Areas and components accessible to users during normal operation are tested (e.g. housing, operating panel, cables, connectors, etc.)

1. Contact discharge

(with relay attachment)

The discharge electrode touches the conductive housing or penetrates the paintwork (without any insulating properties).

2. Air discharge

(with IEC finger)

The discharge electrode is moved towards the test object until the electricity discharges over a spark gap.

Test through

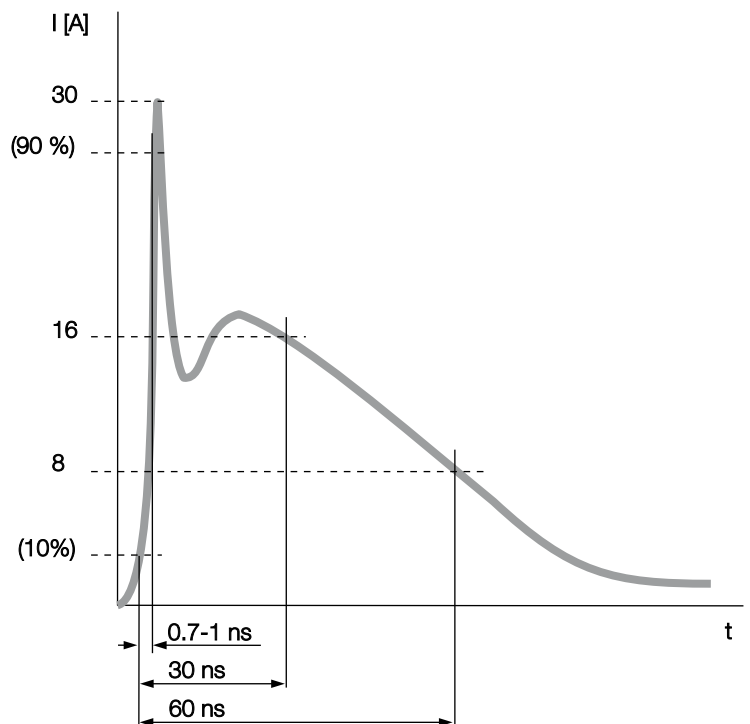
indirect discharge

Contact discharge on a horizontal or vertical coupling plate installed at a distance of 10 cm from the test object.

Testing frequency

10 single pulses at a distance of 1 s.

Testing severity	Contact discharge	Air discharge
1	2 kV	2 kV
2	4 kV	4 kV
3	6 kV	8 kV
4	8 kV	15 kV
X	special	special



Electromagnetic Compatibility

Immunity from electromagnetic fields (RFI)

RFI = Radio Frequency Interference

Origin

Electromagnetic radiation from radio transmitters, mobile tele-phones, "walkie talkies", WLAN, radar systems as well as devices operated in the direct vicinity.

Features

Narrow frequency band concentrated up to 3 GHz, often directed energy, permanent interference, often frequency or amplitude-modulated.

The European standard

EN 61000-4-3

Frequency range

up to 3000 MHz

Test field strength

(unmodulated)

up to 20 V/m

Modulation

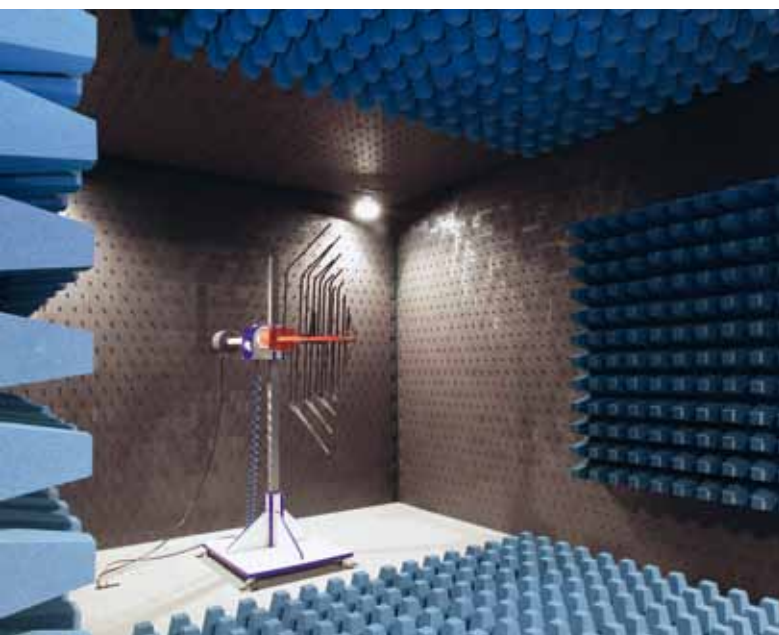
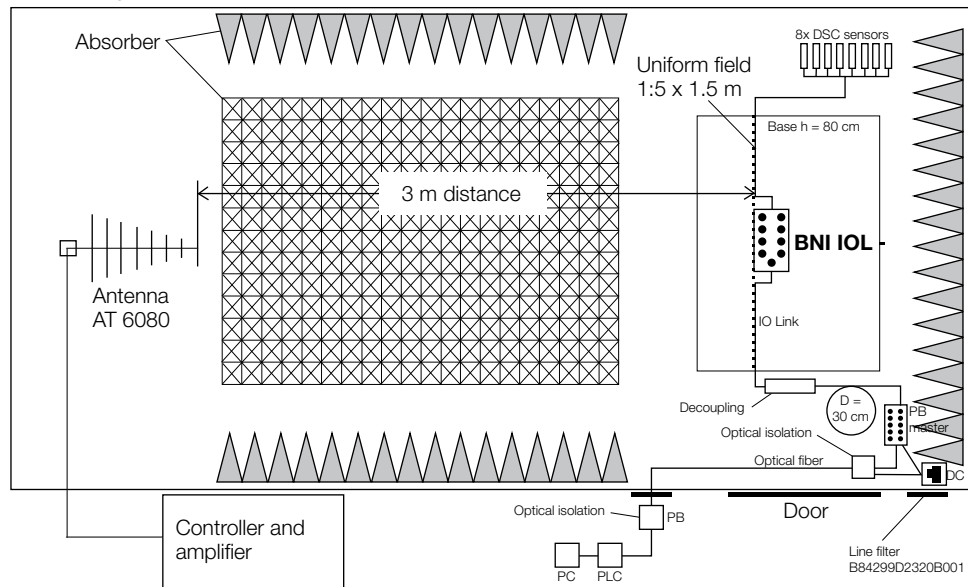
80 % amplitude-modulated

Modulation frequency

1 kHz, sinusoidal

Testing severity	Test field strength	
1	1 V/m	
2	3 V/m	
3	10 V/m	
X	special	

Circuit diagram



Electromagnetic Compatibility

Immunity from fast transients

(bursts, EFT)

EFT = Electrical Fast Transient

Origin

Switching inductive loads such as relays, motor coils, solenoid valves, transformers, high-voltage mains switches and frequency inverters on and off.

The European standard

EN 61000-4-4

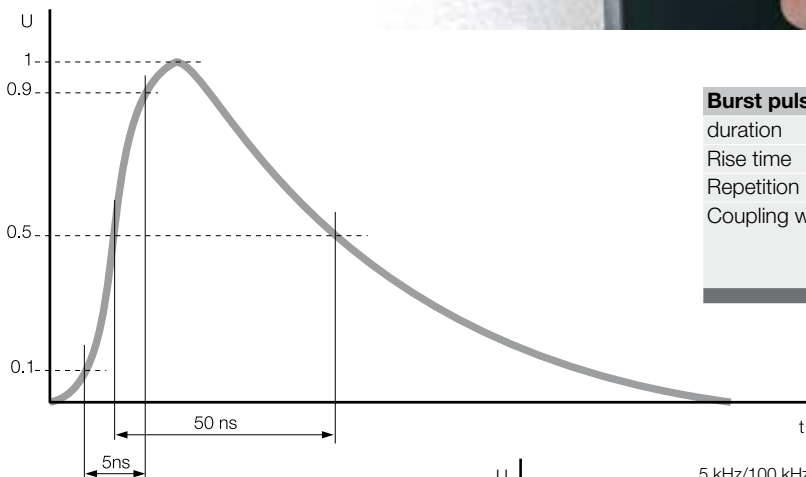
Testing severity

According to the adjacent table.

Testing severity	AC/DC or ground line	I/O data line
1	0.5 kV	0.25 kV
2	1.0 kV	0.5 kV
3	2.0 kV	1.0 kV
4	4.0 kV	2.0 kV
X	special	special

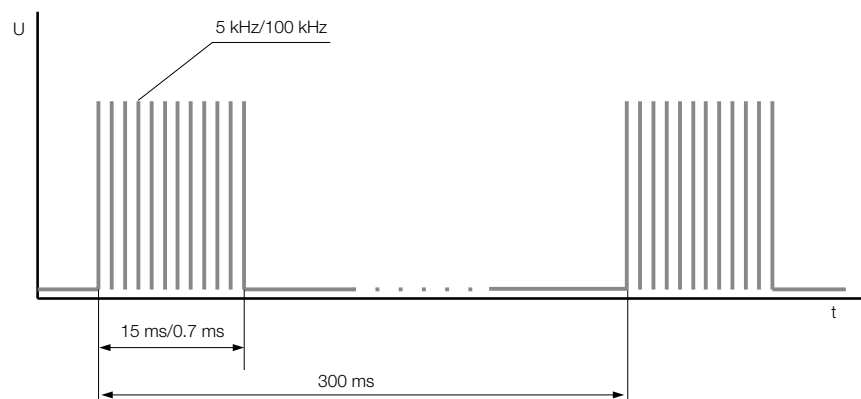
Features

Broadband spectrum up to 300 MHz, stress amplitudes up to several kV. Burst packets with duration of 20 μ s to several ms or permanent spectrum (motor collectors). Flank increase in ns range, low power.



Burst pulse

duration	50 ns \pm 30 %
Rise time	5 ns \pm 30 %
Repetition rate	5.0 kHz or 100 Hz
Coupling with	Coupling/decoupling network for AC/DC mains power supply lines, capacitive coupler for input/output, data and control lines



Electromagnetic Compatibility

Immunity from abrupt voltage surges



Origin

Lightning strike, short circuits and switching operations in high-energy networks.

Features

High energies, voltages of kilo volts, current of kilo amperes. Rise times in μs range, broadband spectrum up to several MHz.

The European standard

EN 61000-4-5

Testing severity

as per EN 61000-4-5
According to the adjacent table

Test with CDN 104 or CDN 202 coupling/decoupling network

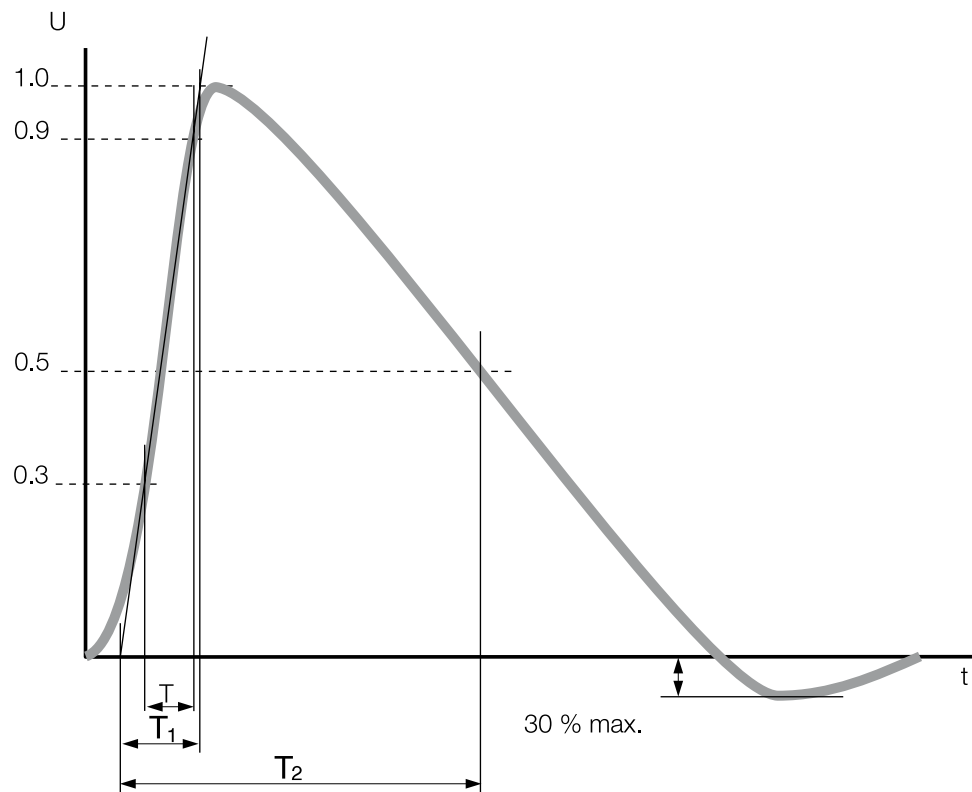
Pulse shape

1.2/50 μs

Testing severity	Open circuit voltage	
1	0.5 kV	
2	1.0 kV	
3	2.0 kV	
4	4.0 kV	
X	special	

Surge pulse

$T_1 = 1.2 \mu\text{s} = 1.67 \times T$
 $T_2 = 50 \mu\text{s}$



Electromagnetic Compatibility

Immunity from conducted interference induced by high-frequency fields

Origin

Conducted interference that originates from electromagnetic fields interspersed by cables.

Features

Narrow frequency band, frequency or amplitude-modulated, permanent interference.

The European standard

EN 61000-4-6

Frequency range

150 kHz...80 MHz

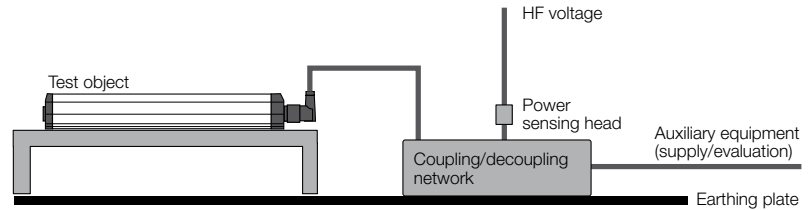
Modulation

80 % amplitude-modulated

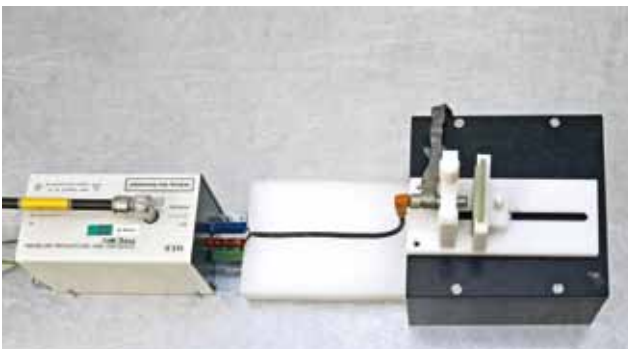
Modulation frequency

1 kHz, sinusoidal

Testing severity	U_0	U_0
1	120 dB μ V	1 V
2	130 dB μ V	3 V
3	140 dB μ V	10 V
X	special	special



The interference voltage is supplied either via a coupler (injection clamp) or coupling/decoupling networks (CDN). Search for interference threshold by automatically decreasing the interference field strength.



Electromagnetic Compatibility

Immunity from magnetic fields
with power transmission frequencies

Origin

From currents in power supplies, power rails, high-voltage cables, devices or earth connections for protective equipment and high-power electrical equipment in the direct vicinity.

Features

Constant magnetic fields up to 100 A/m in the vicinity of equipment under normal operating conditions.

Momentarily high magnetic fields up to 1000 A/m when protective equipment responds.
Power transmission frequencies e.g. 50 Hz, 60 Hz

The European standard
EN 61000-4-8

Testing severity

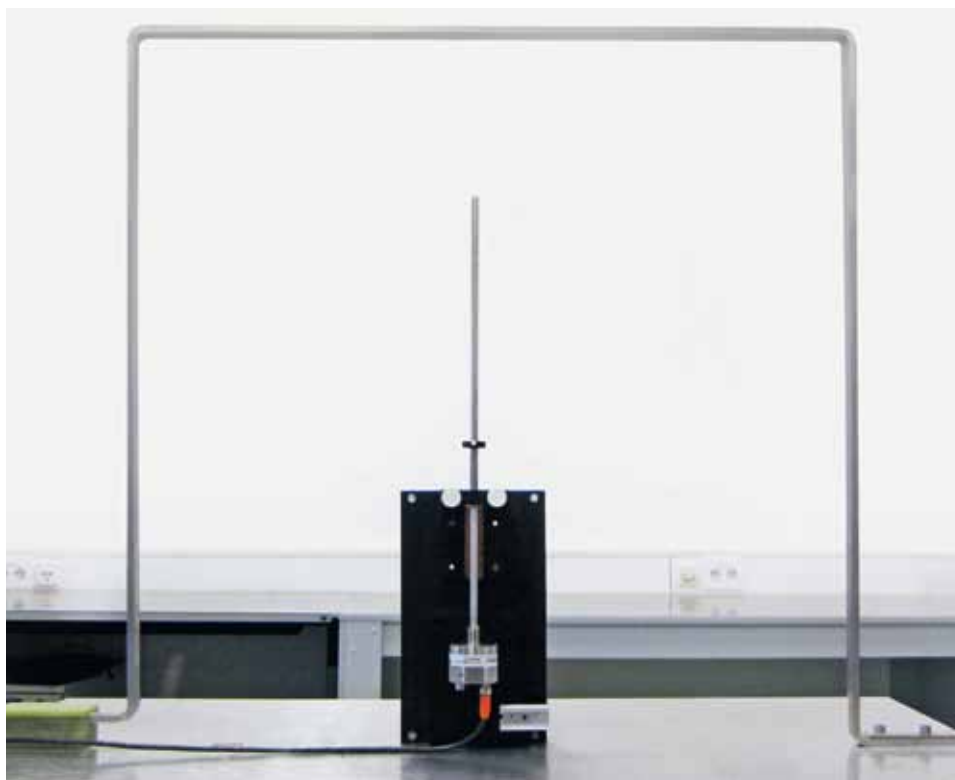
as per EN 61000-4-8
According to the adjacent table.

Testing severity	Permanent field [A/m]	Short duration 1...3 s [A/m]
1	1 A/m	–
2	3 A/m	–
3	10 A/m	–
4	30 A/m	300 A/m
5	100 A/m	1000 A/m
X	special	special

Test equipment

Test generator

Induction coil:
1 m × 1 m square



Electromagnetic Compatibility

Immunity from voltage dips, short breaks in power supply and voltage fluctuations

Origin

Voltage dips and fluctuations in the power supply caused by sudden load changes or the connection of other devices.

Features

Voltage dips occur sporadically. The size, frequency and duration of the dips can vary.

The European standard

EN 61000-4-11

EN 61000-4-29

Standard	Voltage reduction of U_N	Duration
EN 61000-4-11 For devices intended for connection to AC low-voltage power supply networks.	0 %	0.5, 1, 5, 10, 25 and 50 semi-vibrations at 50 Hz, correspond to: 5, 10, 50, 100, 250 and 500 ms
	40 %	
	100 %	
EN 61000-4-29 For devices intended for connection to DC low-voltage power supply networks.	0 %	at 0 %: 1, 3, 10, 30, 100, 300, 1000 ms
	40 %	at 40 and 70 %: 10, 30, 100, 300, 1000 ms
	70 %	



Electromagnetic Compatibility

Emission testing, RF emission

Measurement of radiated emissions

Frequency range

30...1000 MHz

Limit values as per EN 55011

Group 1, class A

(industrial environments)

30...230 MHz

40 dB μ V/m (quasi peak)

230...1000 MHz

47 dB μ V/m (quasi peak)

10 m measuring range

Group 1, class B

(residential environments)

30...230 MHz

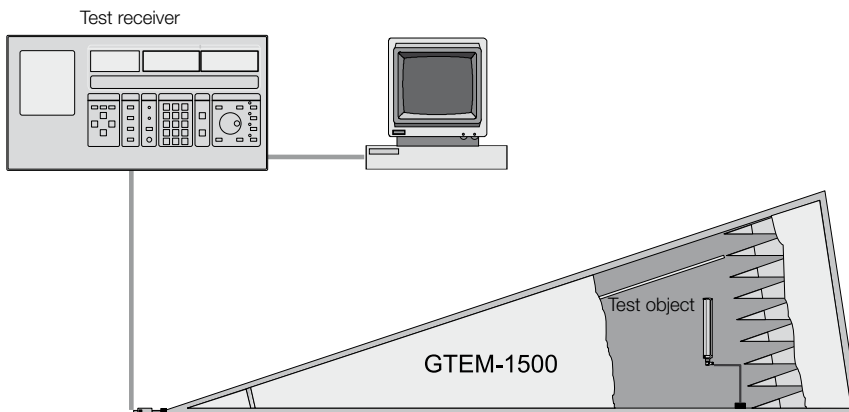
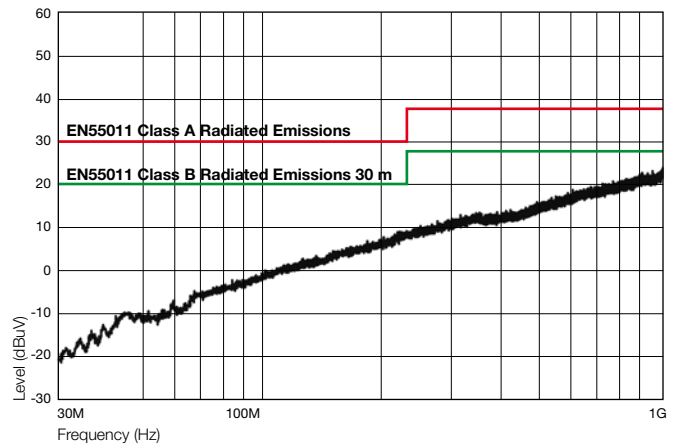
30 dB μ V/m (quasi peak)

230...1000 MHz

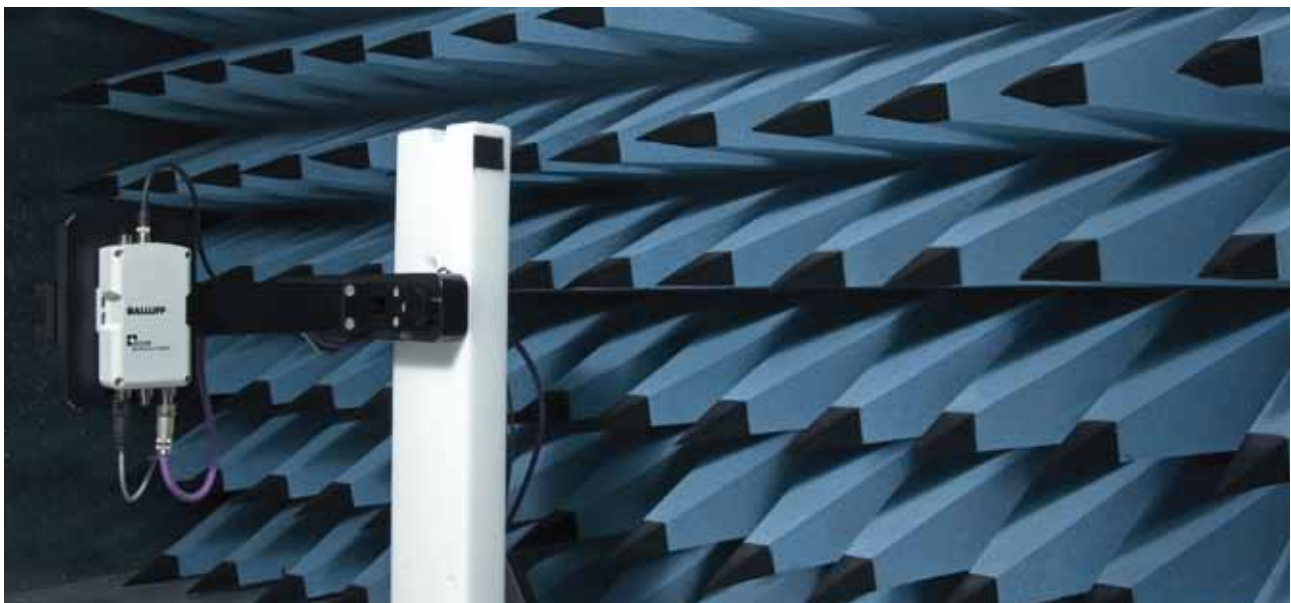
37 dB μ V/m (quasi peak)

10 m measuring range

EN55011 Class A and Class B Radiated Emissions



Measurement of RF emissions in the GTEM cell





Electromagnetic Compatibility

Emission testing, radio interference voltage

Measurement of conducted emissions on AC supply lines

Frequency range
150 kHz...30 MHz

Limit values as per EN 55011

for devices used in industrial environments:

0.15...0.5 MHz
79 dB μ V (quasi peak)
66 dB μ V (average value)

0.5...30 MHz
73 dB μ V (quasi peak)
60 dB μ V (average value)

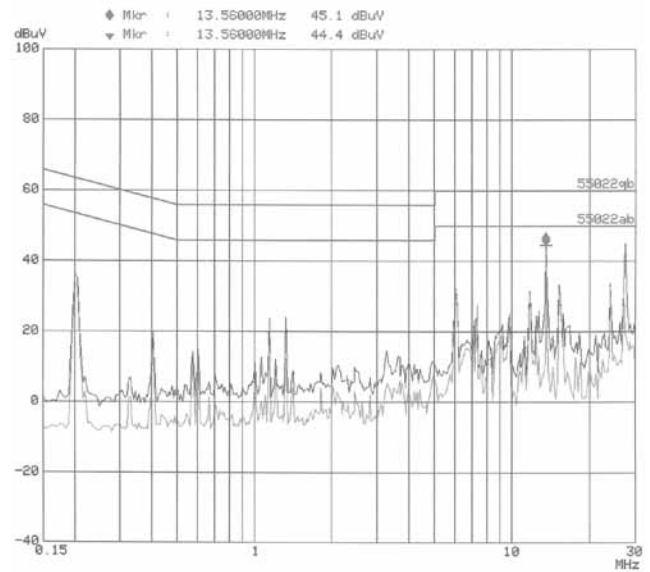
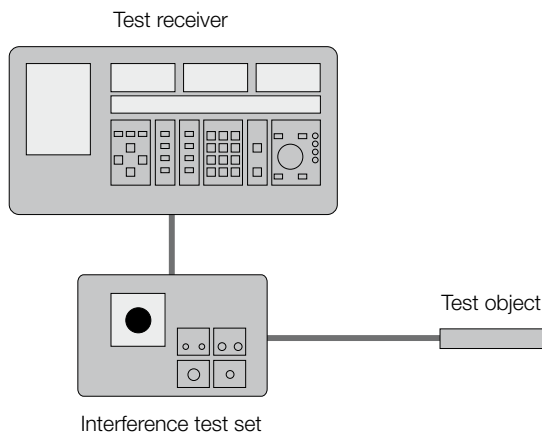
for devices used in residential environments:

0.15...0.5 MHz
66...56 dB μ V (quasi peak*)
56...46 dB μ V (average value*)

0.5...5 MHz
56 dB μ V (quasi peak)
46 dB μ V (average value)

5...30 MHz
60 dB μ V (quasi peak)
50 dB μ V (average value)

*linear with the logarithm for the falling frequency



Electromagnetic Compatibility

Emission testing, HF magnetic field

Measurement of the HF magnetic field from read heads and remote sensors with frame antenna

Frequency range

9 kHz...30 MHz

Limit value according to DIN EN 300330-1 for coils with $A < 0.05 \text{ m}^2$ at 10 m distance, quasi peak

9...30 kHz	62 dB μ A/m
30...70 kHz	62...58.5 dB μ A/m, falling 3dB/oct
70...119 kHz	32 dB μ A/m
119...135 kHz	56...55.6 dB μ A/m, falling 3 dB/oct
135 kHz...1 MHz	27.7...19 dB μ A/m, falling 3dB/oct
1...4.642 MHz	19...-1 dB μ A/m, falling 9 dB/oct
4.642...30 MHz	-1 dB μ A/m





Product-specific Tests

Testing the making and breaking capacity of proximity switches

Origin

By activating resistor and semiconductor loads, auxiliary contactors or electromagnets.

Features

The proximity switches must be able to make or break these loads without error.

The European standard

EN 60947-5-2

Sections 7.2.4 and 8.3.3.5

UL 508

Utilization categories for proximity switches, EN 60947-5-2

	Category	Typical applications
Alternating current	AC-12	Controlling resistor and semiconductor loads
	AC-140	Controlling small electromagnetic loads with a holding current ≤ 0.2 A (e.g. auxiliary contactors)
Direct current	DC-12	Controlling resistor loads and semiconductor loads
	DC-13	Controlling electromagnets

Table for verifying the making and breaking capacity of switch elements under normal conditions according to their utilization categories, EN 60947-5-2

Normal operating conditions

Utilization category	Make ¹⁾			Break			Number and switching frequency of make and break operations		
	I/I _e	U/U _e	cosφ or T _{0.95}	I/I _e	U/U _e	cosφ or T _{0.95}	Number of Switching operations	Switching frequency per min	Break duration MS
AC-12	1	1	0.9	1	1	0.9	6050	6	50
AC-140	6	1	0.3	1	1	0.3	6050	6	20
DC -12	1	1	1 ms	1	1	1 ms	6050	6	1
DC -13	1	1	6×P ms	1	1	6×P ms	6050	6	T _{0.95}

U_e Nominal operating voltage

T_{0.95} Time in milliseconds until the stationary current reaches 95 %

P U_e × I_e, stationary power

I Making and breaking current

U Voltage before make

Product-specific Tests

Testing the cable anchoring of proximity switches with integral connection cables

Origin

Tensile, pressure, torsional and bending loads may be exerted on the cable during assembly or when a proximity switch with integral connection cable is operated.

Features

The integral connection cable must withstand the loads and must not be pulled out of the proximity switch.

The European standard

EN 60947-5-2

Appendix B, appendix C

Each of the following four tests must be conducted three times with a break of one minute between each test.



1. Tensile test



2. Torsion test



3. Push test



4. Bend test

Product-specific Tests

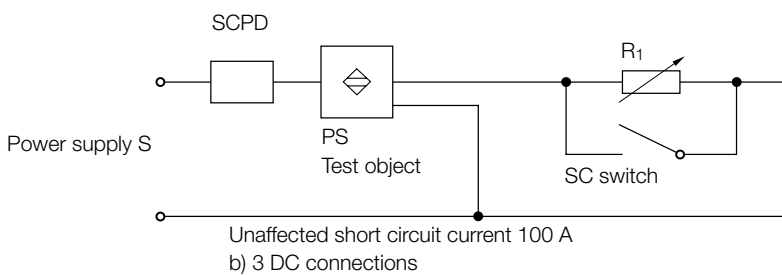
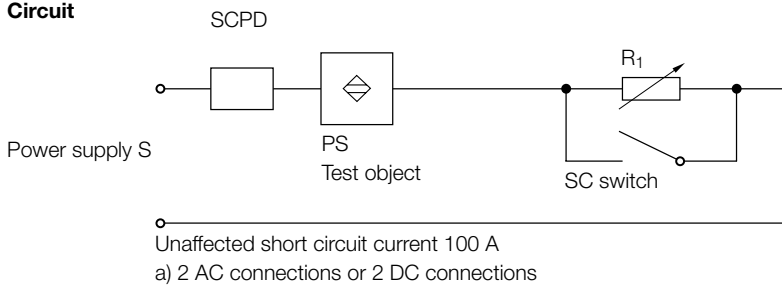
Short circuit protection test

Balluff products are fitted either with a thermal or a cyclic short circuit protection. The short circuit protection is tested using an instrument that can generate a short circuit current of 100 A.

The European standard
EN 60947-5-2, section 8.3.4



Circuit



The switch must be installed in the open air under normal operating conditions.

Sensor ON: NO contact damped
NC contact not damped

R1 is configured so that rated operating current I_e flows.

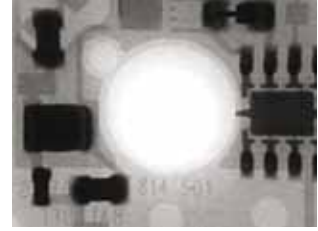
Open circuit voltage: $1.1 \times$ rated operating voltage or highest voltage within the voltage range

The power supply must be configured so that a current of 100 A flows in the event of a short circuit!

The test is conducted three times by actuating the SC switch.

The time between tests must be at least 3 min!

X-ray Analysis

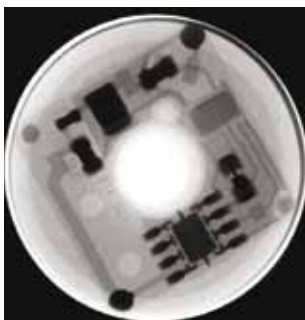


High-resolution realtime X-ray machine for inspecting soldering points for defects such as bridges, inclusions and missing or open soldering points as well as the option of measuring coils and pot core caps on molded switches using PC software (dhs image database).

Technical data	
Field of view	D = 25 mm
Max. test object height	30 mm
Max. test object size	500x600 mm
Max. enlargement	15-way
Anode voltage	35...65 kV
Anode current	20...50 μ A



X-ray and inspection machine
RTX 113 by HEEB INOTEC



Printed circuit board



Switch element



Distance measurement

HALT Tests

HALT = Highly Accelerated Life Test

The objective is to accelerate the aging process during the development of a product to identify potential design faults or other weaknesses and as a result, launch reliable products onto the market.

Process:

Phase 1: Temperature level test – cold and heat. The function and destruction limits are established during this phase.

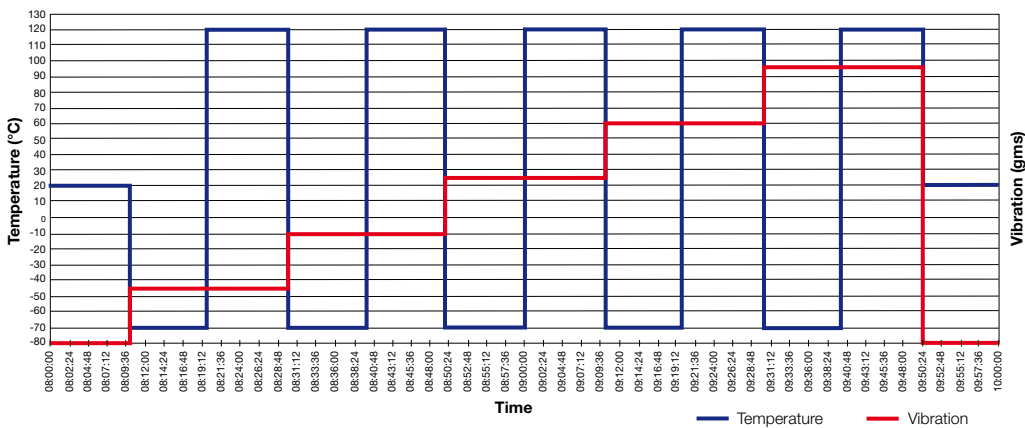
Phase 2: Rapid temperature change. First practical test
Extreme stress = rapid aging

Phase 3: Vibration test. Determining the vibration limit

Phase 4: Combined environment – rapid temperature change with vibration: combined cycles are run in line with the limits identified in phase 1 and 3. The combination of loads above the specification makes this phase a high stress factor for the product.



Combined environment stress test



Technical data



HALT system

Manufacturer: Thermotron Industries, USA
 Dimensions HxWxD: 230x164x227 cm
 Test bench: 106x106 cm
 Frequency range: 2...10,000 Hz
 Acceleration: up to 50 g rms
 Excitation: 9 pneumatic cylinders, Noise spectrum, triple-axis, 3 linear and 3 rotary degrees of freedom
 Temperature range: -100...+200 °C
 Temperature gradient: 70 K/min
 Power: 96 kW
 Process: electric heating, cooled by liquid nitrogen (17 liter/min.)



Vibration and Shock Tests

Sinusoidal vibration test, shock test and noise test

Sinusoidal vibration test

Objective: determine the resonance frequencies. Simulation of applications with speed-proportional vibrations e.g. in the vicinity of engine.

Standard:
EN 60068-2-6

Description: amplitude and acceleration profile between the start and end frequency, usually at logarithmic tuning speed so that resonances of the same quality are processed at the same speed.

Shock test

Objective: simulate e.g. the transport and handling of goods, switching impacts, earthquakes and equivalent machines, e.g. presses.

Standard:
EN 60068-2-27
EN 60068-2-29

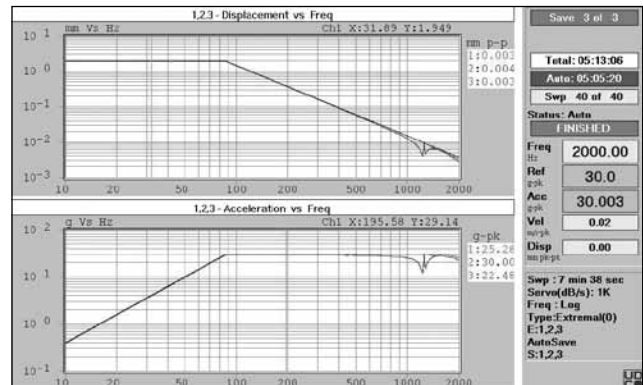
Description: as an acceleration time signal, usually semi-sinusoidal, but also trapezoidal or in saw tooth form.

Noise test

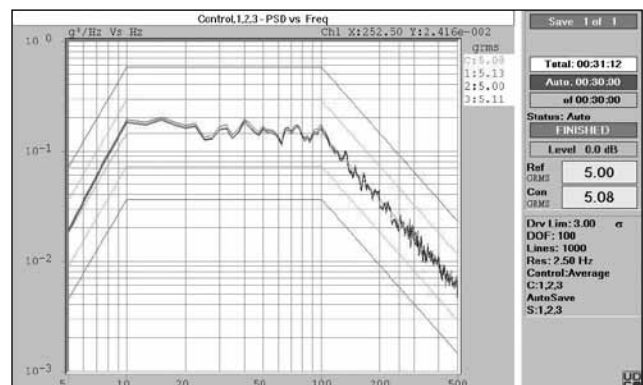
Objective: simulate applications with broad vibration range e.g. in processing machines, vehicles, etc.

Standard:
EN 60068-2-64

Description: with spectral power density between the lower and upper limit frequency.



Sinusoidal test diagram



Noise spectrum diagram

Vibration and Shock Tests

Sinusoidal vibration test, shock test and noise test

Objective: Simulate the mechanical loads of a product over its working life. Balluff products are often used in machines in which mechanical shock and vibration occur. To make sure they function reliably, they must be designed such that they are insensitive to shock and vibration. In the Balluff testing laboratory all products are therefore tested for mechanical stability before they are released for production.

The vibration testing equipment at Balluff has the following characteristics:

Manufacturer	Unholtz-Dickie Corporation	
Model	SA 15-S092-BP	SAI60-H560B-24-LP
Sinusoidal force vector	4.4 kN	35.6 kN
Random force vector	4.4 kN	35.6 kN
Shock force vector	8.8 kN	73 kN
Max. sinusoidal acceleration	100 g	89 g
Max. random acceleration	100 g	74 g
Max. shock acceleration	200 g	210 g
Max. sinusoidal speed	2.0 m/s	1.9 m/s
Max. shock speed	5.1 m/s	3.5 m/s
Max. displacement	51 mmp-p	51 mmp-p
Frequency range	up to 3.5 kHz	up to 2.7 kHz

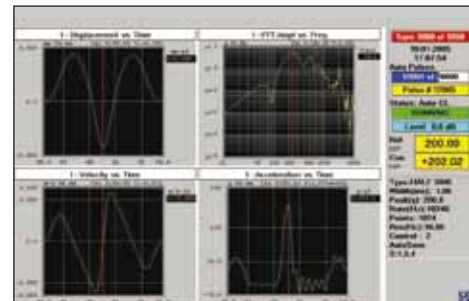
The following tests can be performed on this equipment:

- Sinusoidal test
- Noise test
- Shocks

The system is also equipped with an FFT analyzer.

Tests can be performed to the following standards:

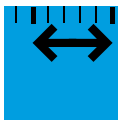
- MIL STD 202
- EN 60068-2-6
- EN 60068-2-27
- EN 60068-2-29
- EN 60068-2-64
- DIN EN 50155
- IEC / EN 61373
- GL





Object Detection

Inductive sensors BES, cylinder sensors BMF, magnetic field sensors BMF, capacitive sensors BCS for object detection, ultrasonic sensors BUS for object detection, photoelectric sensors BOS, fiber optic devices BFB, fiber optics BFO, angle sensors BWL, through-beam fork sensors BGL, optical window sensors BOW, light grids BLG, contrast sensors BKT, luminescence sensors BLT, color sensors BFS, mechanical and inductive single and multiple position switches BNS



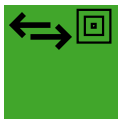
Linear Position Sensing

Micropulse® transducers BTL, magnetic linear encoder system BML, incremental encoders BDG, absolute encoders BRG, inductive displacement system BIW, inductive positioning system BIP, inductive distance sensors BAW, magnetoinductive distance sensors BIL, capacitive distance sensors BCW, photoelectric distance sensors BOD, ultrasonic sensors BUS for analog distance measurement



Fluid Sensors

Pressure sensors BSP, capacitive sensors BCS for level detection



Industrial Identification

Industrial RFID systems BIS, vision sensors BVS



Industrial Networking and Connectivity

Connectors and connection cables BCC, valve connectors BCC, passive splitter boxes BPI, active splitter boxes BNI, IO-Link, bus systems (Profibus, Profinet, CC-Link, DeviceNet, EtherNet), inductive couplers BIC, wireless systems BWT, power supplies BAE, electrical devices BAE



Accessories

Brackets and mountings, assembly system BMS

Balluff GmbH
Schurwaldstrasse 9
73765 Neuhausen a.d.F.
Germany
Phone +49 7158 173-0
Fax +49 7158 5010
balluff@balluff.com

