Technical
Information
TI 241F/00/en

EMC Test Procedures

Electromagnetic Compatibility (Immunity, Emission)

Test Requirements for Instruments made by Endress+Hauser

Deutsche Akkreditierungsstelle Technik (DATech) e.V.

vertreten im

Deutschen AkkreditierungsRat

Akkreditierung

Die **Deutsche Akkreditierungsstelle Technik (DATech) e.V.** bestätigt hiermit, daß das Prüflaboratorium

Endress + Hauser GmbH + Co.
Hauptstraße 1
79689 Maulburg

die Kompetenz nach DIN EN 45001 besitzt, Prüfungen in den Bereichen

EMV-Messungen
im Bereich Störfestigkeit

auszuführen.

Die Akkreditierung ist gültig bis: **30.09.1998**

Die Anlage ist Bestandteil der Urkunde und besteht aus **1** Seite

DAR-Registriernummer: **DAT-P-036/93-00**

Frankfurt/M., **01.10.1993**

Geschäftsführer
Leiter der Akkreditierungsstelle

Akkreditierungsstelle in der TGA - Trägergemeinschaft für Akkreditierung GmbH

Siehe Hinweise auf der Rückseite

Endress+Hauser, Maulburg has received, as the first EMC test laboratory for process instrumentation, accreditation for electromagnetic immunity testing from the "Deutschen Akkreditierungsstelle Technik (Federal Approval Centre)"
This approval from an independent authority confirms that the immunity tests that we carry out on our own instruments conform to national and international standards.
We simulate EMC environmental conditions found in practice in the laboratory and produce reports on the appropriate tests.

Endress+Hauser with an Accredited Test Laboratory

The increasing pace of technological change demands that more emphasis is placed on "Electromagnetic Compatibility (EMC)". While the complexity of instruments increases, the power required to operate them is being continually reduced. Despite this, the number of possible sources of interference, such as frequency converters and portable telephones, is steadily increasing. Today, these conflicting trends require EMC guidelines to be closely followed at the earliest stages of instrument design.

Both technical considerations and future regulations on electromagnetic compatibility are also to be considered when designing instruments. The EU guideline 89/336/EWG must be applied from 1.1.1996 onwards for all electrical and electronic devices. Ignoring the guidelines will mean that the products cannot be sold within the European Union.

In addition to specifying the permissible limits for emission, which have been in use for some years now, the EMC guideline sets down for the first time (for civil purposes) basic values for electromagnetic immunity.

Endress+Hauser drew the consequences from this development and began testing at an early stage. The accreditation of the EMC laboratory demonstrates once again Endress+Hauser's competence in this field.

Endress+Hauser
The Power of Know How

EMC Test Procedures
A large number of EMC standards and proposals already exist: the names of the standard often change. This brochure describes the most important interference effects defined in the standards as well as providing information on how such EMC difficulties can be prevented in practice.

IEC 1000-4-2: Instrument Immunity to Electrostatic Discharge (ESD)
This type of interference is usually caused by plant personnel working in unfavourable electrostatic conditions. A high static electricity charge is built up which discharges when instruments are handled (see Fig.1 and 2). Electrostatic charging is closely related to the humidity of the air and the material of articles present (shoes, carpet, etc.).
Simple Prevention:
Grounded metal parts should be touched before handling an instrument.

Fig. 1
Test rig for "ESD", electrostatic discharge to conductive surfaces

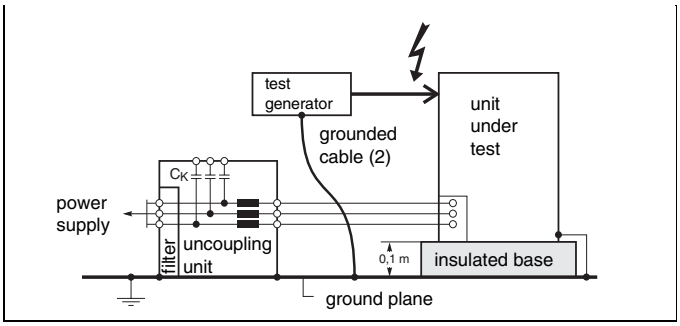
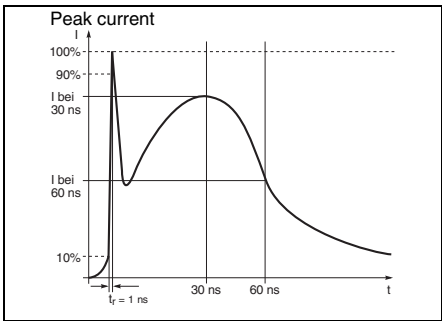


Fig. 2
Graph showing a discharge current from an ESD generator



sensor leave the "protected area". The signal cables are wired up in the control cabinet and thus are not directly exposed to the electromagnetic field.

The situation is completely different when the Racksyst card is mounted in a field housing as a single measuring point. In this case the signal cables are fully exposed to the field, with the result that completely different measurements can be obtained.

Basically, all Endress+Hauser instruments can be considered to have good EMC without the need for additional protection. If your application is subject to strong electromagnetic fields (e.g. walkie-talkies with a power of more than 2 W at less than 1 m from sensitive sensors), then screened cabling is sometimes recommended. Full details are given in the device documentation.

IEC 1000-4-4: Instrument Immunity to Rapid Transients (Bursts)
This test simulates interference generated when an inductive load is switched off (e.g. contacter or relay). This is the most common source of interference found in practice (Fig. 4 and 5). In this case too, correct wiring is critical to EMC behaviour.

The power supply and signal cables should be as far apart as possible (min. 20 cm). This greatly reduces the effect of rapid transients in the power supply on parallel signal cables.

If no separation is possible, then screened cabling is recommended. For power supplies which generate strong interference, central filters should be used for control instrumentation, connected, for example, at the input of a control switching cabinet.

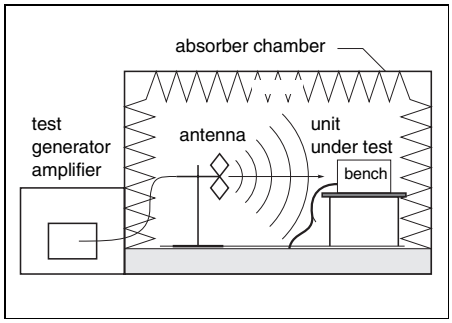


Fig. 3
Absorption chamber for determining electromagnetic immunity of the unit under test.

IEC 1000-4-3: Instrument Immunity to Electromagnetic Fields in the Frequency Range 27...1000 MHz
Effects due to telecommunication systems, e.g. local radio stations or walkie-talkies, are simulated. This test is very expensive as it involves not only the costs for the instrumentation used (absorption chamber, high- powered HF amplifier) but also those of a time-consuming scan across the frequency range 27...1000 MHz at various antenna polarities (Fig. 3). The results are strongly dependent on the type of test rig used.

Example: Racksyst plug-in cards are mounted in assembly racks which are then inserted in a control cabinet. Normally only the lines to an external

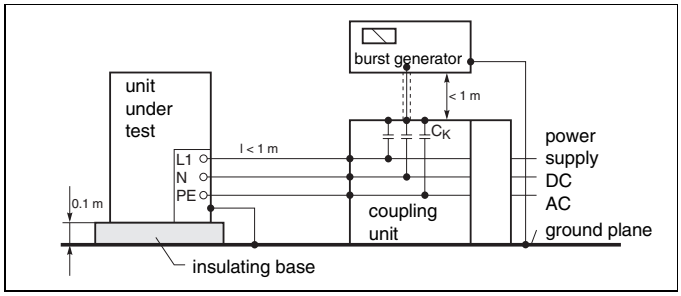


Fig. 4
Test rig for "burst"; immunity against rapid and transient interference variables

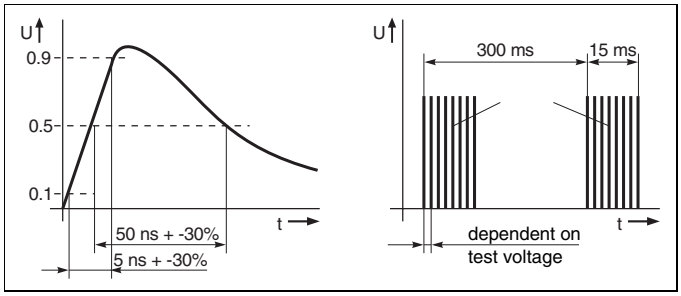


Fig. 5
Graph showing pulse bursts; single pulse and sequential pulses

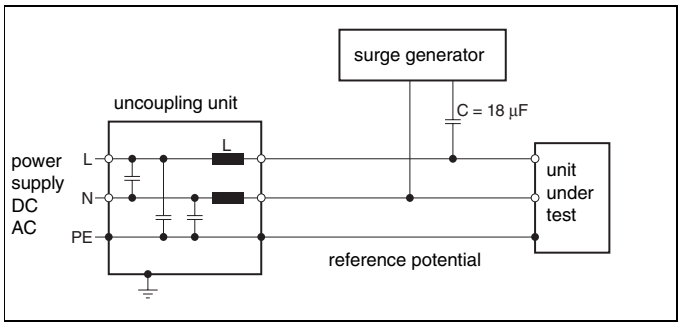


Fig. 6
Test rig for "immunity to voltage peaks" between phase and ground wire

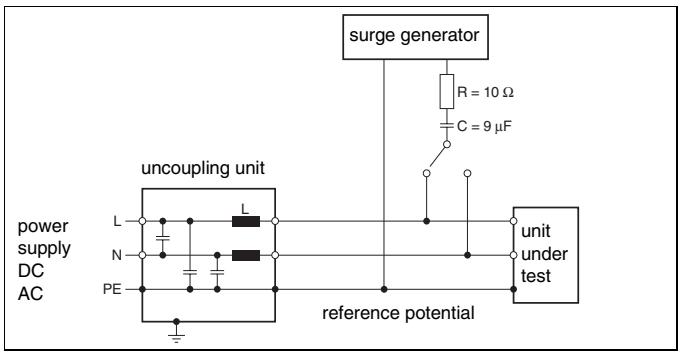
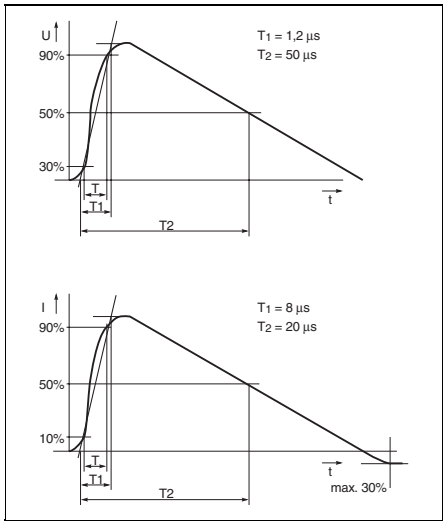


Fig. 7
Test rig for "immunity to interference voltages" between phase or zero potential and ground wire

Fig. 8
Graph showing surge ⇒ voltage peaks in no-load operation; 1.2/50 µs
Graph showing surge ⇒ short-circuit current; 8/20µs



IEC 1000-4-5: Instrument Immunity to Transient Voltages (Surge/Hybrid)
Hybrid or surge voltages are caused when large loads are switched off or lightning strikes near to the installation. All instruments from Endress+Hauser are protected from such overvoltages. Where thunderstorms are frequent and there is a high risk of lightning strikes, however, a separate overvoltage protection unit should be used (e.g. HAW 262).

The test rig for these measurements is shown in Fig. 6 + 7, the test signal in Fig. 8.

IEC 1000-4-6: Instrument Immunity to Narrow Band Cable Interference, Caused by Electromagnetic Fields
This test (Fig. 9 + 10) simulates the effects caused by telecommunication systems, already described in IEC 1000-4-3, but uses a different frequency band (150 kHz- 26 MHz).

In this test, coupling networks feed high frequency signals direct to the cabling of the unit under test. The procedure is ideal for small units and provides a wealth of information at higher frequencies. The connection cables absorb a large part of the interference energy and transmit it to the unit under test. Such direct high-frequency coupling is ideal, therefore, for evaluating how an instrument will respond in an electromagnetic field.

Please note: screened cables should always be used if interference is expected in the lower frequency range (e.g. from frequency converters).

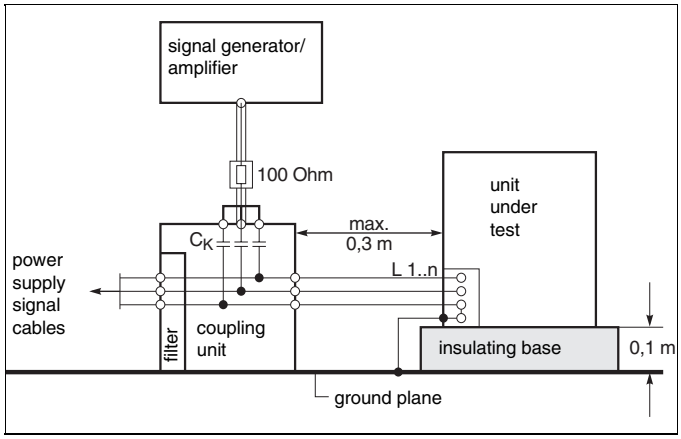
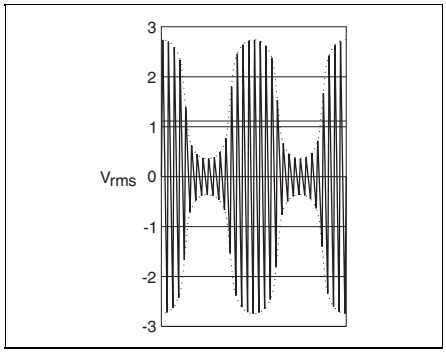


Fig. 9
Test rig for "resistance to narrow band interference in cables"

Fig. 10: Graph showing test signal; 80% AM; 1 kHz



EN 55011, EN 60555-2, EN 60555-3 Electromagnetic Emission of ISM Instruments*

Not only can an instrument be affected by external interference, it can also be a source of electromagnetic interference itself. The emissions can be made to both the surrounding cabling and the atmosphere.

In contrast to electromagnetic immunity, specifications on permissible limits for emission from instrumentation have been in operation in the civil sector for many years. The reason: protection of civilian telecommunications.

Emission from power supply cables is measured in the frequency range 10 or 150 kHz...30 MHz. The electromagnetic field emitted from the instrument itself is measured in the frequency range 30...1000 MHz. The permissible limits are closely related to the use of the instrument. A distinction is made between "industrial" (with separate transformer station) and "commercial/ light industrial" (on the local supply). Higher emissions are permissible for "industrial use".

Measurements of power feedback from instruments must now be carried out in the frequency range 100 Hz ...2 kHz also (EN 60555-2). This effect is due to non-sinusoidal current consumption, e.g. when primary cyclic switching components are in use. Problems arise primarily for power supplies above approx. 50 VA. Most Endress+Hauser instruments have a power consumption below 10 W, i.e. significantly lower than the permitted limits. The voltage variation an instrument causes when connected to a power supply is also tested (EN 60555-3). Again, thanks to the small power consumption, no difficulties should arise.

General Information for Using Screened Cabling

- All local regulations for explosion protection, especially those regarding gaps, are to be observed when laying cables in explosion-hazardous areas.
- The maximum screening effect is assured when the cable screening is grounded at both ends.
- If, for technical reasons, e.g. differing ground potentials, only one end of the screening can be directly grounded, then this should be the sensor/probe end. Nivosonic instruments are usually grounded at the sensor end only.
- A good ground connection is important for proper screening. Make sure that largest possible contact area is available for the screening, e.g., by using suitable cable glands.
- If the screening cannot be connected to the housing of the sensor or the evaluating unit (e.g. Monorack housings), it should be connected to the nearest grounding point, e.g. plant grounding system, metallic housing of a control cabinet, reinforcing wire of a concrete wall or water pipe.
- If screened multicore cable is used, care must be taken that no interference is emitted by the other cores.

*Instruments for industrial, scientific and medical use

EMC Measurements at Endress+Hauser

The EMC behaviour of instruments made by Endress+Hauser is dependent on their installation and use. Since all the applications found in practice cannot be modelled in the laboratory, in the test the instrument is operated under typical conditions. The following installations and settings are used:

- Racksyst plug-in cards are operated in Monorack housings using an AC power supply.
- If screened cabling is required for operating instruments, then this is stated in the device documentation.
- Capacitive and conductive sensors (probes) are mounted in steel vessels.
- Electronic inserts (transmitters in sensors) are mounted in aluminium housings during the test.
- A relay is connected in series as an external load (e.g. Siemens 3TH 8271-OA, 220 V~) when using compact instruments with a two-wire AC booster board.

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