COUPLING DECOUPLING NETWORK FOR UNSHIELDED SYMMETRICAL HIGH SPEED COMMUNICATION LINES
CDN HSS-2

USER MANUAL

AMETEK®
COMPLIANCE TEST SOLUTIONS

TESEQ
Advanced Test Solutions for EMC

COUPLING DECOUPLING NETWORK FOR UNSHIELDED SYMMETRICAL HIGH SPEED COMMUNICATION LINES
CDN HSS-2

USER MANUAL

CONTENT

1. SAFETY ADVICE

The coupling and decoupling networks (CDN) can work at dangerous voltages.

WARNING: Improper or careless handling can be fatal!
Use of the CDN is restricted to authorized and trained specialists

These operating instructions form an integral part of the equipment and must be available to the operating personnel at all times. All the safety instructions and advice notes are to be observed. Neither Teseq GmbH nor any of the subsidiary sales organizations or the manufacturer can accept any responsibility for personal, material or consequential injury, loss or damage that results from improper use of the equipment and accessories.

1.1. General

- Use of the CDN is restricted to authorized and trained specialists.
- In the fault case dangerously high voltage may be on the housing.
- The coupling network housing must be properly grounded (earthed).
- Operate the equipment only in dry surroundings.
- This instrument is not designed for use in an explosive atmosphere.
- Only approved accessory items, connectors, adapters, etc. are to be used to ensure safe operation.
- The setup must offer insulation protection against voltage which is at least equal to the pulse voltage.
- The pulse voltage must not be able to find its way to ungrounded metallic objects even if the EUT is faulty or fails.
- Depending on the type of EUT and especially on its cabling, a considerable amount of interference can be radiated which could affect nearby systems and radio communication. These environmental interference effects to be controlled by the user through the use of suitable measures such as a Faraday cage, shielded cable runs, etc.

1.2. Applicable safety standards

Development and manufacture of the instrument complies with ISO 9001. The product conforms with the requirements of the Low Voltage Directive (LVD) 2006/95/EC based on DIN EN 61010-1:2001.

1.3. Safety symbols used on the product

Attention: Refer to manual

Protective earth (earth terminal)

1.4. Installation

Connect the CDN with the ground plane before using. The operation without proper earth connection is prohibited. Operate the equipment only in dry surroundings. Allow any condensation that occurs to evaporate before putting the instrument into operation. Do not exceed the permissible ambient temperature, humidity or altitude.
Connections are not protected by fuses inside the CDN. Avoid any over load with adequate arrangements.

1.5. Test execution

The test area must be organized so that no unauthorized persons have access during execution of a test. If a safety contact (interlock) is used as a means of access control to the test area (e.g. Faraday cage), then an additional contact in series with any hazardous voltages or currents is necessary to provide protection for parts of the EUT that are in danger of being touched.

EUTs, together with their accessories and cables, are to be considered live during a test. The test generator must be stopped and the EUT supply interrupted before any work can be performed on the EUT. This can often be achieved by opening the interlock circuit, depending on the type of generator in use.

The EUT is to be tested only in a protective cage or under a hood which provides protection against electric shock and all manner of other dangers pertaining to the particular EUT.

The safety instructions for all instruments and associated equipment in the test setup are to be observed.

The configuration of the test setup is to be strictly in compliance with the methods described in the relevant standard to ensure that the test is executed in a compliant manner.

2. UNPACKING, STORAGE AND TRANSPORT

2.1. General

Save all packing materials! They will be needed in order to safely package the equipment for calibration service or repair.

Packaging materials

- Carton: Cardboard
- Padding: CFC-free polystyrene foam
- Plastic bags: Polyethylene

- Avoid the risk of condensation!

If a large temperature difference has occurred, allow time for the temperature to stabilize. This may take several hours.

2.2. Storage and transport

- Do not stack, either packaged or unpacked.
- Do not stand on end; arrows on the packaging must always point upwards.
- Protect from dampness, heat, cold and rain.
- Do not throw.
- Do not sit or stand on the instrument and packaging.

2.3. Unpacking

- Is the packaging damaged? If YES ☎ transportation company
- Are all the packages present and correct? If NO ☎ transportation company
- Open the packaging, remove the accessories.
- Grip the instrument at the sides and lift it from the packaging.
- Are the instrument or accessories damaged? If YES ☎ transportation company
- Are the contents of the package complete? If NO ☎ Teseq sales office
- Keep the instruction manual with the instrument.
- Keep the packaging.

2.4. Scope of delivery

- CDN HSS-2
- 8 Jumper (4 mm safety banana)
- Operating manual

3. DESCRIPTION OF THE PRODUCT

3.1. General

he Coupling Decoupling Network CDN HSS-2 is designed for convenient surge testing with 1.2/50 µs pulses, as defined in IEC/EN 61000-4-5, on unshielded symmetrical high speed telecommunication lines e.g. Ethernet. Coupling modes to 1, 2 or 4 pairs are given and coupled with 40 Ω in series with a capacitive coupling element. The CDN HSS-2 allows testing on ISDN and Ethernet with 10/100BaseT and 1000BaseT as well. Power over Ethernet (PoE) is applicable.

With a surge test voltage of 2 kV is the maximal residual voltage at the AE port only 65 V due to the excellent decoupling network. Additional decoupling elements are not required to protect the auxiliary equipment (AE). The high decoupling provides an AE independent pulse shape for the EUT testing. A high measurement reproducibility is given by using the CDN HSS-2. The decoupling network is in accordance with IEC 61000-4-5 Edition 3.

It can be used with Teseq's NSG series or any industry standard surge generator with the appropriate connector adapter.

3.2. Functional schematic

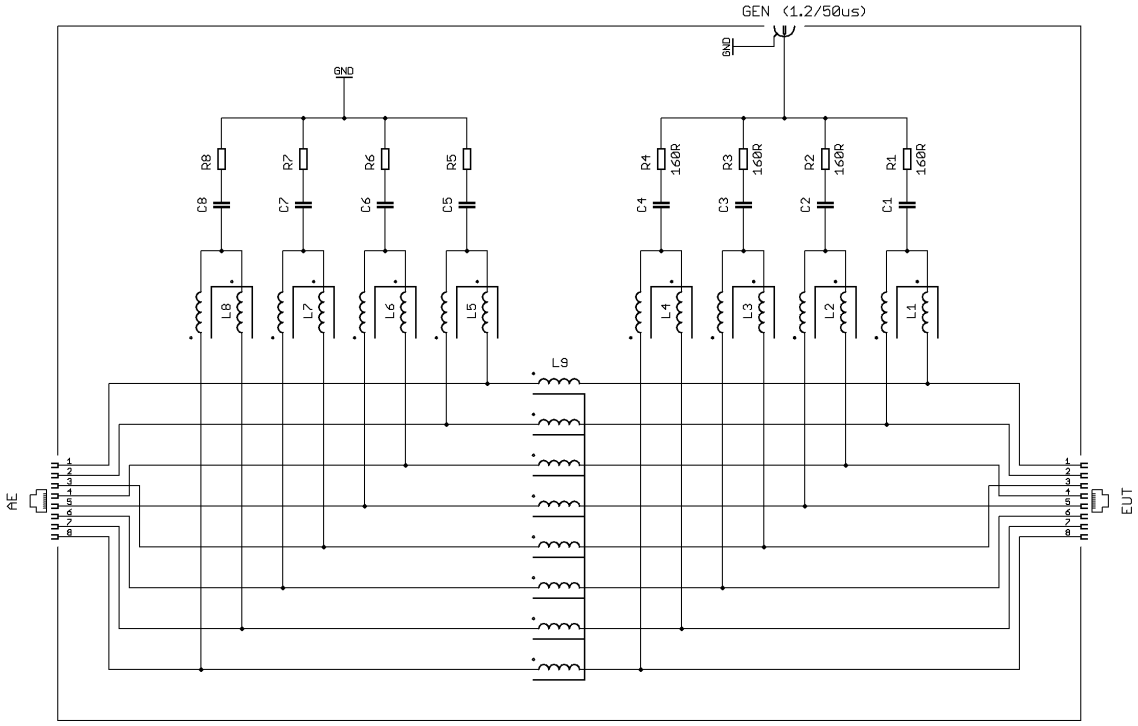

Figure 1: Functional schematic of the CDN HSS-2

3.3. Construction of the product

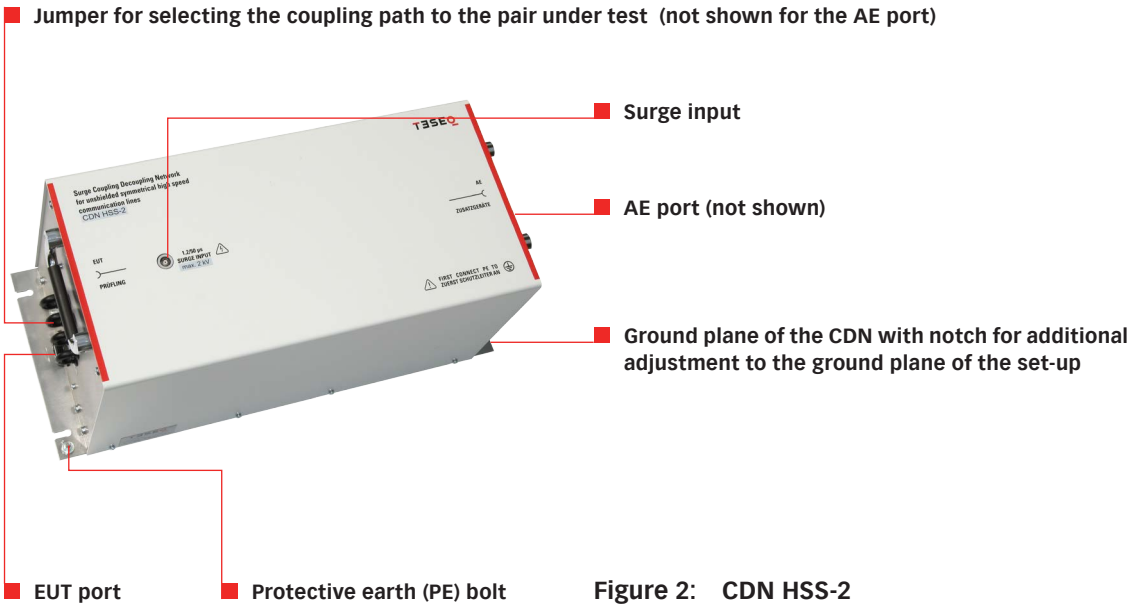

Figure 2: CDN HSS-2

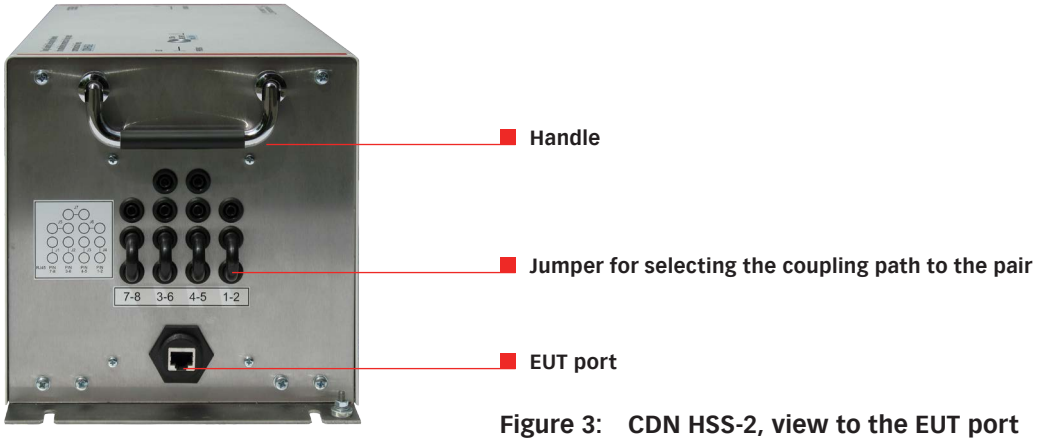

Figure 3: CDN HSS-2, view to the EUT port

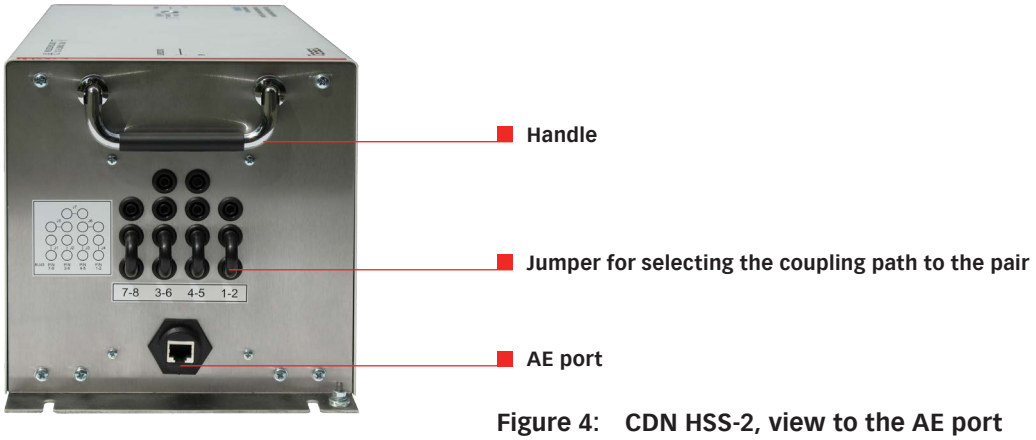

Figure 4: CDN HSS-2, view to the AE port

4. APPLICATION

4.1. Setup

Each test setup should be carefully planned. All the equipment should be securely positioned, and all cables should be securely connected.

Caution: **The safety advice given in Section 1 and in the generator manual must be observed. The EUT and the wiring should be handled only when the generator is not active.**

The following figure provides an examples of a setup.

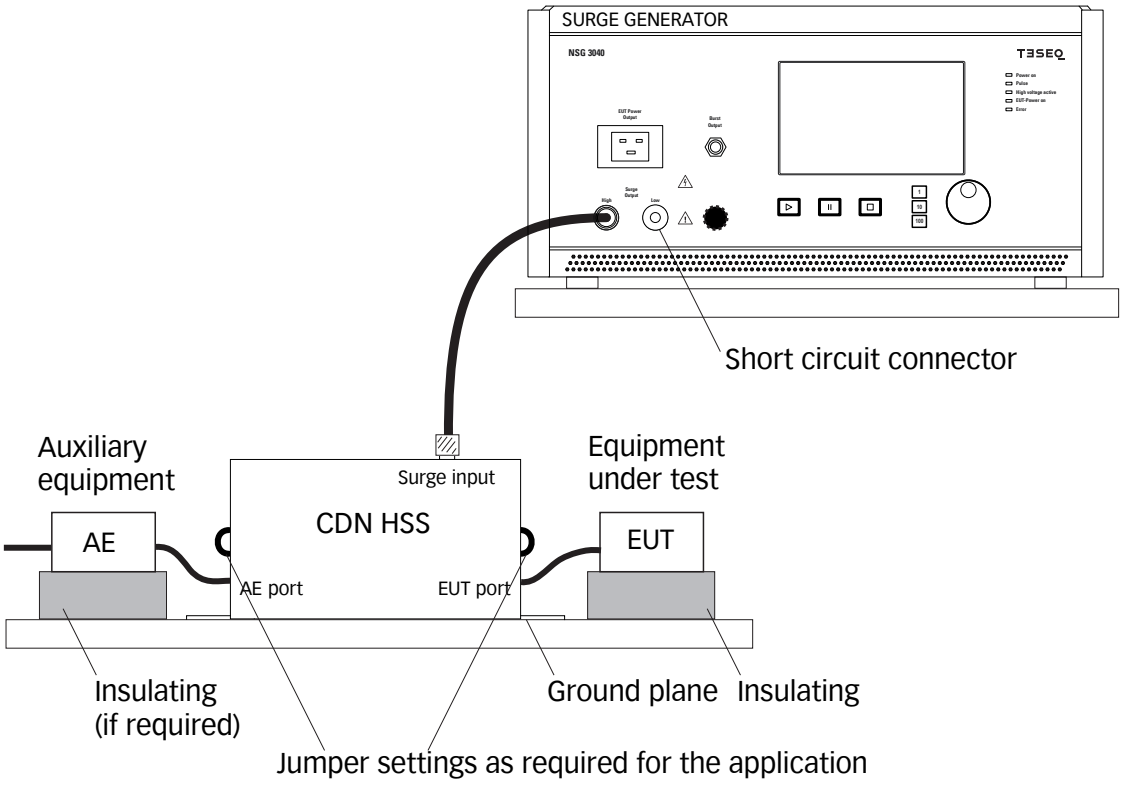

Figure 5: Setup example with CDN HSS-2

The EUT needs to be connected with a suitable UTP (unshielded twisted pair) cable to the RJ45 on the EUT-side of the CDN HSS-2. An auxiliary equipment is required to be connected to the AE-side of the CDN HSS-2. The pulse connections from the surge generator is plugged into the HV socket of the CDN HSS-2.

The length and layout of the cables, distances, height above ground plane and other descriptions are given in the basis and product standards.

The jumper setting for selecting the coupling path to 1, 2 or 4 pairs is given in chapter 4.3. Power over Ethernet (PoE) is described in chapter 4.4.

4.2. Coupling path to the pair under test (Jumper settings)

The coupling path to the pair under test will be set by use of jumpers. It provides the correct 40 Ω in series with a capacitive coupling element to the selected lines under test. The following tables and figures provide examples with more precise details.

PIN/RJ45	7-8	3-6	4-5	1-2
Jumper	J1	J2	J3	J4
EIA/TIA 568B	P4	P3	P1	P2
EIA/TIA 568A	P4	P2	P1	P3

Table 1: Relation between RJ45 pin arrangement, jumper settings and EIA/TIA specifications

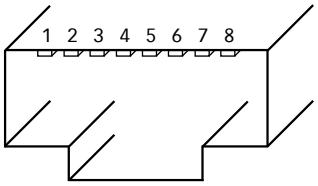

Figure 6: RJ45 pin arrangement

Jumper	J1	J2	J3	J4	J5	J6	J7	Number of lines under test	Example given in figure
PIN/RJ45	7-8	3-6	4-5	1-2				/	
1-2				X	X	X	X	2	
3-6		X			X	X	X	2	
4-5			X		X	X	X	2	7
7-8	X				X	X	X	2	
ISDN basic rate access, S0		X	X		X	X		4	8
ISDN primary rate access			X	X	)*	)*	X	4	9
10BaseT, 100BaseT		X		X	X	X		4	10
ATM, FDDI	X			X	X	X		4	
1000BaseT, 100BaseT4	X	X	X	X				8	11

)* short 4 mm test lead (safety banana connectors) between outer pins of J5 and J6

Table 2: Jumper settings in relation to EIA/TIA 568B

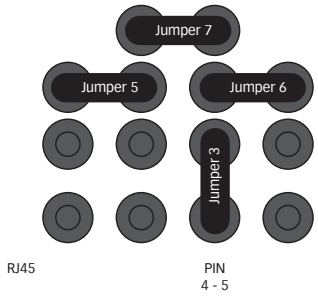

Figure 7: Jumper settings for testing on pin 4 and 5

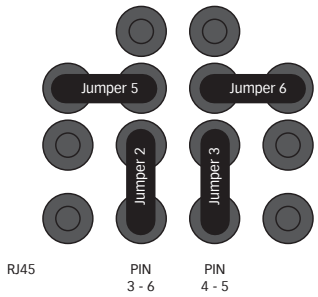

Figure 8: Jumper settings for ISDN basic rate access, S0

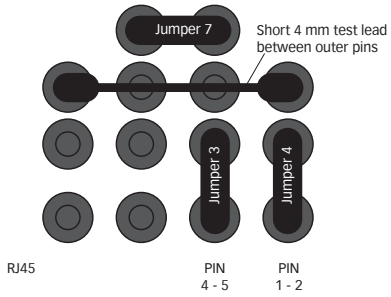

Figure 9: Jumper settings for ISDN primary rate access

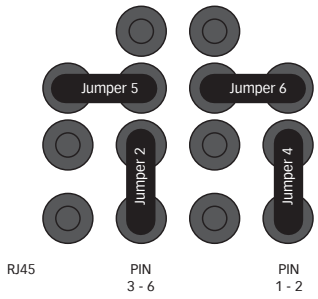

Figure 10: Jumper settings for 10BaseT, 100BaseT

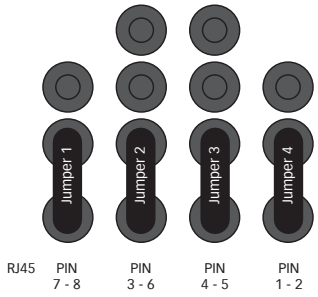

Figure 11: Jumper settings for 1000BaseT, 100BaseT4

4.3. Power over Ethernet (PoE)

The CDN HSS-2 allows the use of the Power over Ethernet (PoE) function. In case the handshake procedure fails, all jumpers needs to be removed from the CDN HSS-2. The jumpers need to be replaced after establishment of a successful PoE connection for proceeding the surge testing.

4.4. One pair (two lines) application with DC and LF

All applications with coupling to one pair (two lines) only allowed with absence of DC and low frequency signals below 10 KHz. The signals will be shorted by the internal Z-chokes of the CDN HSS-2. Teseq recommends the us of CDN 118 for this application, even 10/700 µs pulses with up to 6 kV can be applied.

5. VERIFICATION

5.1. Voltage

The pulse specification can be verified with the following setups. The AE- and EUT-side of the CDN HSS-2 need to be connected in the common mode for the requested application. An oscilloscope with a 1 MΩ input is connected via a 1/1000 divider with the EUT-side of the CDN HSS-2. The pulse connections from the surge generator is plugged into the HV socket of the CDN HSS-2.
The jumper setting for selecting the coupling path is required in relation to the application.

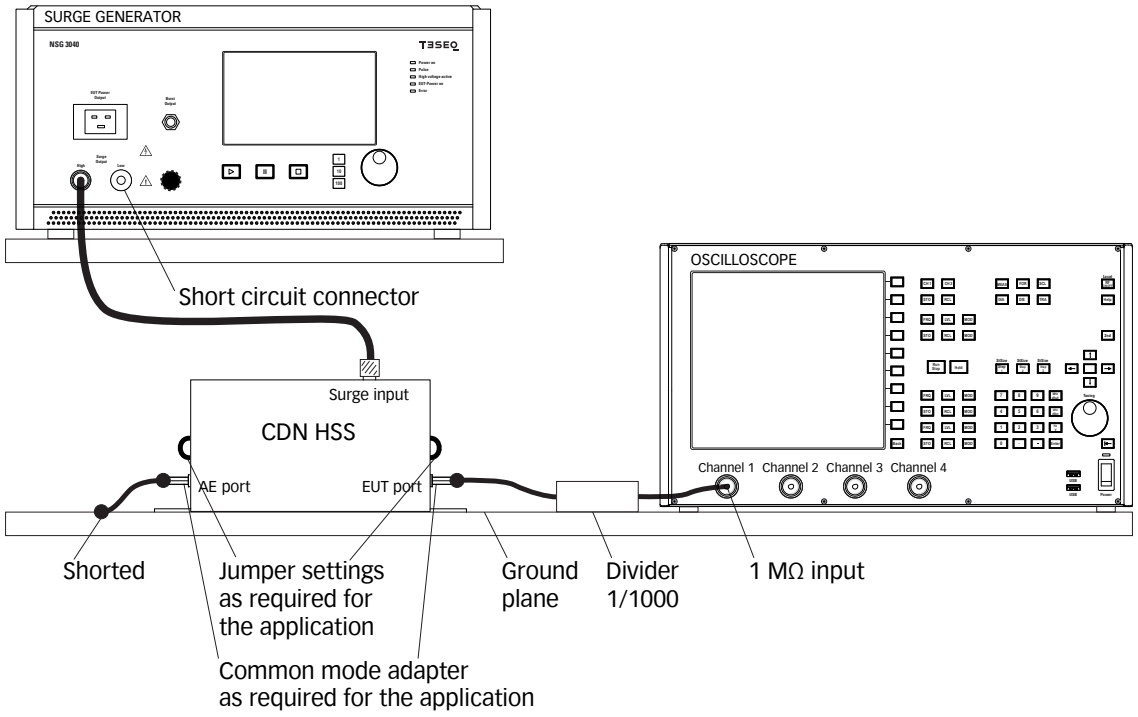

Figure 12: Example of a setup for verifying the pulse parameters with measuring the open-circuit voltage

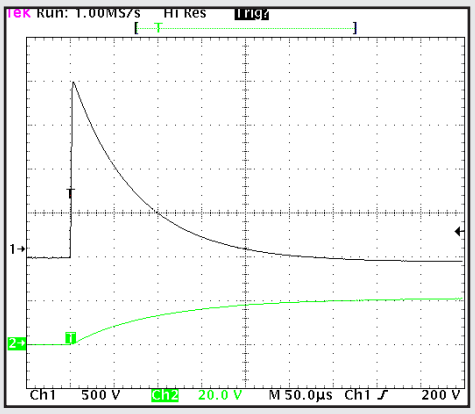

Figure 13: Typical voltage waveform

5.2. Current

The AE- and EUT-side of the CDN HSS-2 need to be connected in the common mode for the requested application. An oscilloscope with a 50 Ω input is connected with a suitable current probe. The AE- and EUT-side of the CDN HSS-2 is shorted. Between the common mode adapter inserted in the EUT-side of the CDN HSS-2 and ground is placed the current probe for measuring the short cut. The pulse connections from the surge generator is plugged into the HV socket of the CDN HSS-2.
The jumper setting for selecting the coupling path is required in relation to the application.

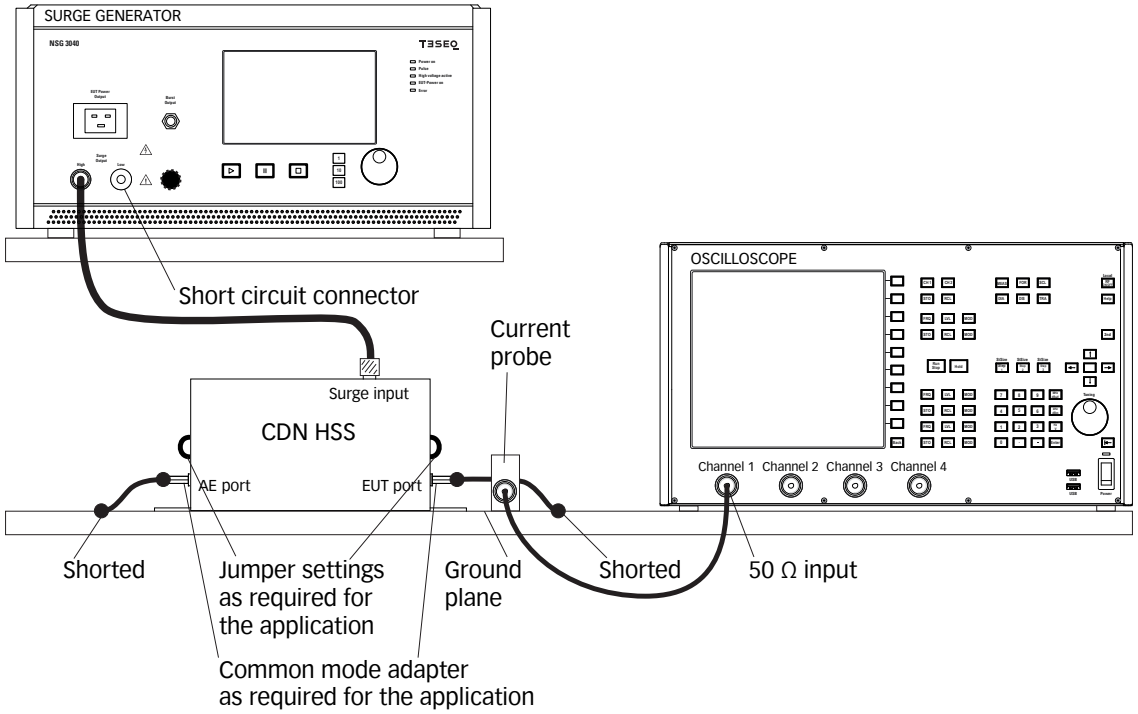

Figure 14: Example of a setup for verifying the pulse parameters with measuring the short-circuit current

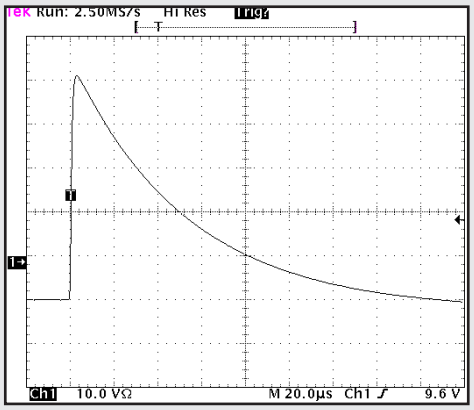

Figure 15: Typical current waveform

6. TECHNICAL SPECIFICATION

6.1. Technical specifications of CDN HSS-2

Circuit diagram:	according to Fig. 11 of IEC 61000-4-5 Edition 3
Max. surge test voltage:	2 kV* (1.2/50 µs pulse as per IEC/EN 61000-4-5)
Max. surge test current:	50 A (8/20 µs pulse as per IEC/EN 61000-4-5)
Coupling mode:	Common mode to 1, 2 or 4 pairs with respect to CDN chassis
Coupling elements:	40 Ω in series with capacitive coupling elements
Max. residual test voltage at AE port:	65 V (at 2 kV surge test voltage)
Surge input connector:	HV connector female (Fischer D103A023)
Applications:	ISDN, 10/100BaseT, 1000BaseT etc., switchable per jumper, PoE applicable
Cable type:	8 wire unshielded twisted pair (UTP)
Insertion loss, typical:	9 dB at 100 MHz
Other typical network limits:	TIA-568-A Category 5-TSB95 Link
Max. operating speed:	1000BaseT
Max. operating voltage:	100 VDC between pairs
Max. operating current:	1 A (rated for Power over Ethernet)
Connection (EUT port, AE port):	RJ45 female
*) +10 % tolerance allowed	

6.2. Mechanical specifications of CDN HSS-2

Size (W x H x D) in mm:	200 x 200 x 470
Weight:	approx. 15 kg

7. MAINTENANCE

7.1. General

The CDNs including the accessories need no special maintenance. The maintenance is limited to the cleaning of the contacts. The life time of the connectors is limited because of the contact durability. Teseq can replace the worn out connectors and offers a general adjustment of CDNs with adapters which might be necessary.

No modifications are to be carried out on CDNs and accessories by the user.
It is recommended to send the units to a Teseq Service Centre once a year for recalibration.

7.2. Cleaning

The cleaning shall be done with dry cloth. If a wed cleaning would become necessary, make sure that no humidity will enter inside of the unit and clean the instrument housing with a damp cloth using a little mild, non-abrasive household cleanser if necessary.

Chemicals must not be used for cleaning purposes

8. DISPOSAL

The unit is constructed that it can be dismantled right down to the component level.

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