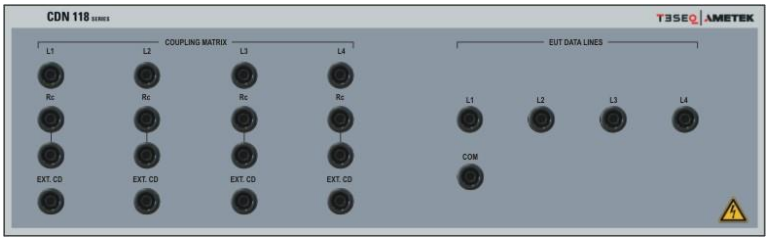
.

Operating-manual



CDN 118A Series

CDN 118A-C4-4-1

CDN 118A-C6-4-1

Coupling network for surge and telecom-surge to signal and datalines

The coupling network of the CDN 118A series are designed for coupling surge and telecom-surge pulses to symmetrical signal or datalines.

The coupling network expands the range of application of the impulse generator of the NSG 3040A and NSG 3060A series, for testing signal and datalines.

Main characteristics are the advantages for handling and the easy using with banana plugs.

- EC 61000-4-5 Ed3.0
- EN 61000-4-5
- ITU-T K.44

AMETEK CTS GmbH
Sternenhofstrasse 15
4153 Reinach BL1
Switzerland

Phone: +41 61 204 41 11
Fax: +41 61 204 41 00

URL: http://www.emtest.com

Content

1. General 4
1.1. Intended use 4
1.2. Safety label on the device 4

2. Safety 5
2.1. Safety aspects 5
2.2. Testing and danger 6
2.2.1. Coupling networks 6
2.2.2. Danger from EUT 6

3. Standards for testing with coupling networks of CDN 118A series 7
3.1. Device models 8
3.2. Impulse generators 8

4. Device functions and operating 9
4.1. Coupling network CDN 118A-C4-4-1 and CDN 118A-C6-4-1 9
4.2. Device components CDN 118A-C4-4-1 and CDN 118A-C6-4-1 9
4.3. Test Setup for I/O and datalines 10
4.4. Test setup for 1.2 µs / 50 µs impulses 11
4.5. Test setup for 10µs / 700µs impulses 12
4.6. Diagram CDN 118A series 13

5. Technical data 14
5.1. CDN 118A series 14
5.2. Weight and dimension 15

6. Maintenance 16
6.1. General 16
6.2. Calibration and Verification 16
6.2.1. Factory calibration 16
6.2.2. Guideline to determine the calibration period of AMETEK CTS instrumentation 16
6.2.3. Calibration of Accessories made by passive components only 16
6.2.4. Periodically In-house verification 16
6.3. Maintenance, Adjustments, Replacement of Parts 17

7. Calibration procedure as per IEC 61000-4-5 Ed3 18
7.1. Calibration Surge impulse (1.2/50 µs – 8/20 µs) 18
7.1.1. **General** 18
7.1.2. **Calibration procedure for CDNs for symmetrical interconnection lines** 18
7.1.3. **Surge waveform definition on CDN for symmetrical interconnection lines** 19
7.2. Calibration Telecom Surge impulse (10/700 µs – 5/320 µs) 20
7.2.1. **General** 20
7.2.2. **Calibration procedure for CDNs for symmetrical interconnection lines** 20
7.2.3. **Telecom Surge waveform definition** 21

8. Delivery Groups 22
8.1. Delivery groups CDN 118A-Cx-4-1 22
8.2. Accessories 22

9. Appendix 23
9.1. Declaration of conformity 23
9.2. Typical waves 25
9.2.1. **Voltage waveform** 25
9.2.2. **Current waveform** 25
9.2.3. **Residual voltage waveform** 26
9.3. Transferfunction 26

1. General

1.1. Intended use

Coupling decoupling networks of the CDN 118A series are used for simulating conducted electromagnetic interference effects for immunity testing to international, national, and manufacturers' standards.

The CDN's are designed for full compliance conducted electromagnetic compatibility (EMC) test requirements. The application range is for testing of industrial, light industrial, household or commercial equipment, including many product family and product standards as per following basic standards

Only *qualified personnel* who deal with attendant hazards in impulse generators, are allowed to perform installation and servicing. Before put in service the attached safety and user manual must be readed and applied. The Safety and user manual are an essential part of the equipment and must be available to the operator at all times. The user must obey all safety instructions and warnings.

It is the user's responsibility to ensure that the test rig does not emit excessive electromagnetic interference (EMI) that might affect other equipment. The test system itself does not produce any excessive radiation; however, the injection of interference pulses into the EUT can result in the device and/or its associated cables radiating EMI. To avoid radiating unwanted interference the standards organizations recommend that the test setup be located in a Faraday cage.

1.2. Safety label on the device

Please take note of the following explanations of the symbols used in order to achieve the optimum benefit from this manual and to ensure safety during operation of the equipment.

This symbol warns of a potential risk of shock hazard. The symbol on an instrument shows that it can source 1000 volt or more, including the combined effect of normal and common mode voltages. Use standard safety precautions to avoid personal contact with these voltages.

This symbol indicates where a caution is required. Refer to the operating instructions located in the manual to protect against personal injury or damage the equipment

CAUTION The CAUTION symbol indicates a potential hazard. It calls attention to a procedure, practice or condition which, if not followed, could possibly cause damage to equipment. Such damage may invalidate the warranty. If a CAUTION is indicated, do not proceed until its conditions are fully understood and met.

WARNING The WARNING symbol indicates a potential hazard. It calls attention to a procedure, practice or condition which, if not followed, could possibly cause bodily injured or death. If a WARNING is indicated, do not proceed until its conditions are fully understood and met.

2. Safety

2.1. Safety aspects

Read the following operation 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.
The generators correspond to Installation Category II (overvoltage category).

Symbols marked on equipment

	**WARNING**	Risk of electric shock. Dangerous voltages are present. Use extreme care. Refer to the manual.
	**GROUND**	Indicates protective earth terminal

Power Mains
The equipment is intended to operate with a power mains supply that will not apply more than 250Vrms between the supply conductors or between either supply conductor and ground. A proper protective ground connection, through the grounding conductor in the power cord, is essential for safe system operation.

Safety Ground and grounding the generators
The generators are grounded through the power cord. To avoid electrical 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.

Without the protective ground connection, all parts of generators are potential shock hazards. This includes knobs and controls that may appear to be insulators. The equipment MUST NOT BE USED if this protection is impaired.

Use the proper power cord
Use only the power cord and connector specified for your product. Only use 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, with matching type, voltage rating, and current rating.

Do not remove covers or panels
To avoid personal injury, do not operate the generators without the panels in place or covers.

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

Electric Overload
Never apply a generator's voltage to a connector which is not specified for that voltage range.

☞ **Read the Operation Manual of each instrument carefully!**

2.2. Testing and danger

All tests offered by the High Voltage or EMC generators 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 of the DUT can radiate certain energy to their vicinity. Therefore, it is also the responsibility of the user to decide whether it can 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 pace-maker or similar device, must be excluded from testing.

When setting up the test national and international regulations regarding human safety must be guaranteed.

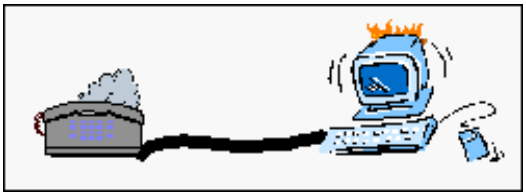
Generator and coupling/decoupling network must be grounded and connected to reference plane.

2.2.1. Coupling networks

- The coupling network has mostly no On- Off switch and no internal fuse for the EUT power supply. This is caused the different regulation in each country. The device under test must be protected by the user in an adequate safe solution. As an option special adapters and switches can be built-in, but the user must to specify these special solutions.
- Generators and coupling devices must be grounded and connected to the reference ground.
- For coupling pulses to the lines, the coupling path must be setted.
- If a line has not to be coupled, it is necessary to disconnect or switch off this coupling path.
- Special safety adapter cables are part of the delivery.

2.2.2. Danger from EUT

The device being tested may become defective and ignite due to the influence of the applied test signal.



Therefore, the operator shall take the following precautions:

- As soon as the EUT ceases to operate as intended, the test shall be stopped immediately.
- In case of internal damage, the operator may be exposed to high frequency signals of high power (up to 75 Watts and more) anywhere on the EUT.
- Cables and connectors can be overloaded by high voltages or energies.
- Due to internal damage of components fire and/or explosion may occur.
- Unintended use of the EUT may cause hazardous situations near the test area.

Never touch the EUT or anything connected to the EUT during a test.

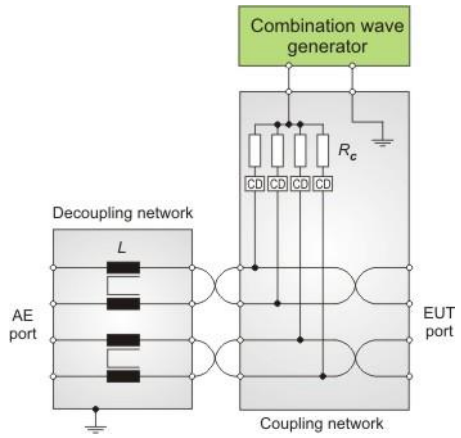
It is suggested to read the operating manual carefully and completely. It is necessary to observe and comply with all safety recommendations.

3. Standards for testing with coupling networks of CDN 118A series

The coupling network CDN118A series are suitable for tests according the following standards:

- **IEC 61000-4-5** - Surge 1.2/50µs as per figure 10 for unshielded symmetrical interconnection lines
- **EN 61000-4-5**
- **IEC 61000-4-5** - Telecom surge 10/700µs, Figure A4 for unshielded outdoor symmetrical communication lines
- **EN 61000-4-5**
- **ITU-T K.44**

Impulse 1.2 µs / 50 µs

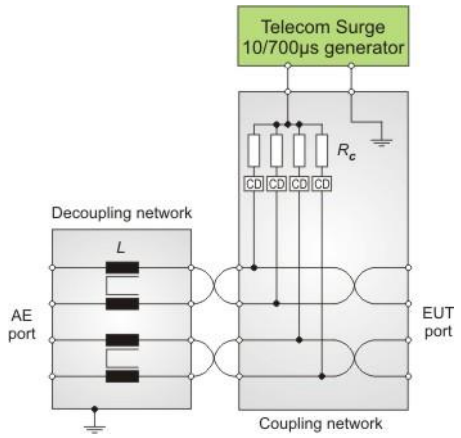


IEC 61000-4-5 Ed.3 Figure 10

Example for n= 4:

Rc = n x 40 Ω = 160 Ω

Impulse 10 µs / 700 µs



IEC 61000-4-5 Ed.3 Figure A4

Example for n= 2:

Rc = 25 Ω

3.1. Device models

Following coupling decoupling network for signal and data lines exist:

Standard devices:

Model	Signal lines	EUT max.	Test level max.	Coupling gas arrestor or other 1.2/50µs	10/700µs
CDN 118A-C4-4-1	4 wires	50 VDC 1A	4,8 kV 1.2/50us	4 x 160 Ω	4 x 25 Ω
CDN 118A-C6-4-1	4 wires	50 VDC 1A	6,6 kV 1.2/50us	4 x 160 Ω	4 x 25 Ω

3.2. Impulse generators

The CDN 118A series can be used for the following surge generators:

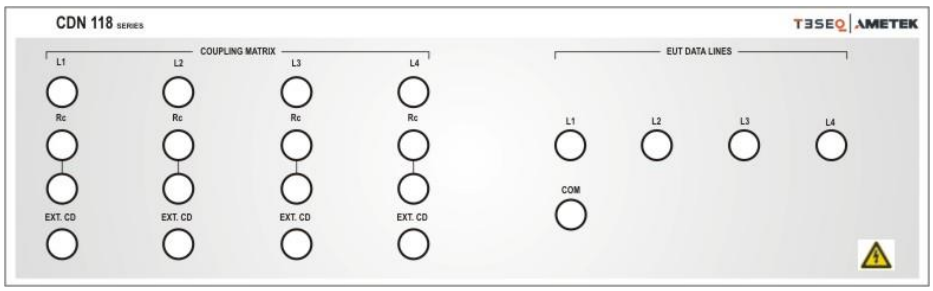
Device	previous name	Pulseform	Remark generator
NSG 3040A	All models	1.2/50µs - 8/20µs	up to 4800V as per IEC 61000-4-5
NSG 3060A	All models	1.2/50µs - 8/20µs	up to 6600V as per IEC 61000-4-5
NSG 3040	All models	1.2/50µs - 8/20µs	up to 4800V as per IEC 61000-4-5
NSG 3060	All models	1.2/50µs - 8/20µs	up to 6600V as per IEC 61000-4-5

4. Device functions and operating

The difference between the various models is:

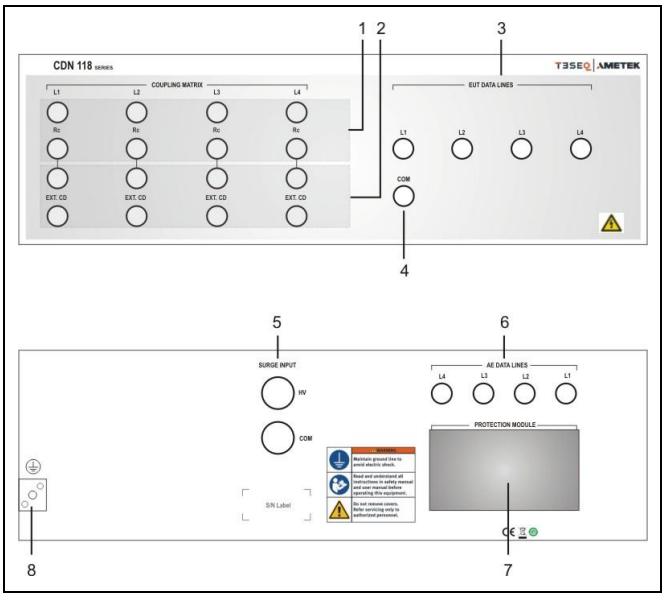
- Number of data lines (CDN 118A Cx-4-1 series with 4 lines)
- nominal voltage and current level of the signal- and data lines
- various test voltage level of 4.8 kV and 6.6 kV

4.1. Coupling network CDN 118A-C4-4-1 and CDN 118A-C6-4-1



CDN 118A-Cx-4-1 for 4 lines

4.2. Device components CDN 118A-Cx-4-1



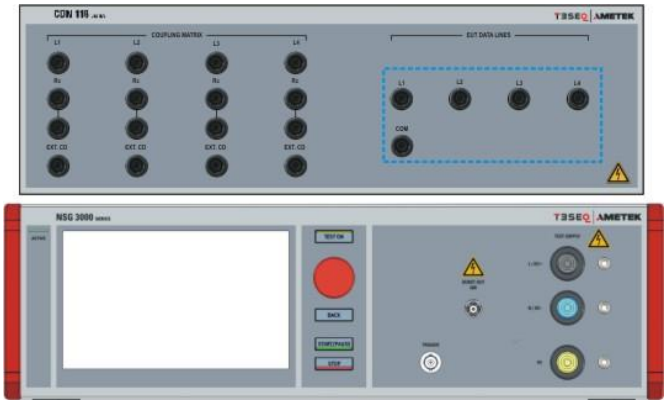
Front

1 Bypass for get 25 Ω impedance
2 Coupling GDT / ABD enable
3 Signal output to EUT
4 GND for Calibration measuring device
5 HV / COM input (Generator)
6 Signal input (AE port)
7 Protective devices
8 PE connector to ground

4.3. Test Setup for I/O and datalines

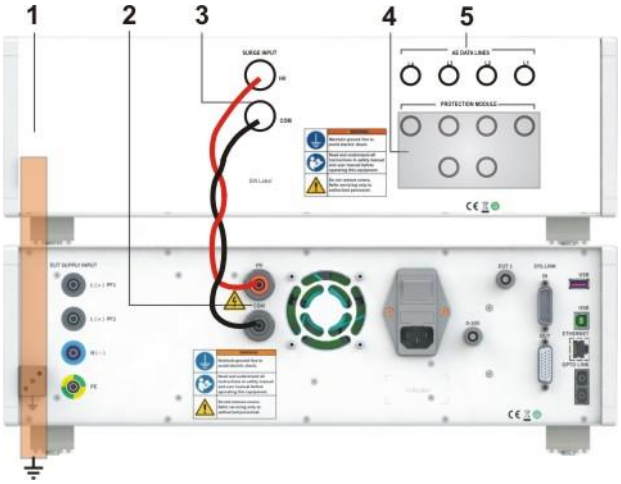
Arrangement:
The CDN 118A series is placed on the top or on the side of the surge generator.

Connections frontside
Couplings: All couplings for surge pulses are realized with short circuit connectors.
Data lines: L1...L4 Output to EUT



Front NSG 3040A with CDN 118A-Cx-4-1

Connections rear side:



Rear NSG 3040A with CDN 118A-Cx-4-1

1 Earth: Earth bolt generator - CDN 118A-Cx-4-1 and **additional layer to the system GND**
A low inductice copper band or the delivered cable from the earth set (green-yellow cable).

2 Twisted high voltage cable from generator to CDN
HV-cable red: **HV** generator - **HV** CDN 118A
HV-cable black: **COM** generator - **COM** CDN 118A

HV-COM plug on CDN 118A device

3 HV and COM generator output CDN 118A-Cx-4-1

4 AE Port protection

5 AE Port Input, Transducer - Sensor

Example of a test setup with an NSG 3040A or NSG 3060A generator and CDN 118A-Cx-4-1 coupling / decoupling network. It is important to connect GND wire from CDN 118A-Cx-4-1 to the impulse generator. The HV impulse cables between the generator and CDN 118A-Cx-4-1 must be **twisted** for mimimize the magnetic field influence.

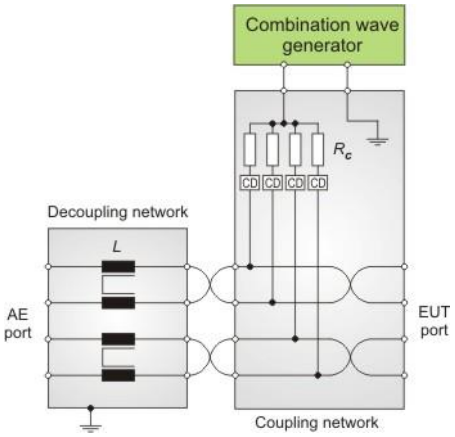
The device earth bolt must be connected to the ground reference plane if there is one. In other case user is responsible that the generator earth bolt is proper connected with the building earth.

Earth set
The earth set is part of the delivery and includes a length of 0.6m

4.4. Test setup for 1.2 µs / 50 µs impulses

The energy transfer from the surge generator to the EUT is considered to be a constant which independs from the number of lines in the cable, equivalent to a coupling impedance of about 40 Ω. This equivalent coupling impedance is split between the lines in the cable. For this reason, the coupling resistor value used on each line in a pair is a multiple of 40 Ω. This rule applies for cables with up to 8-line (4-pair). The CDN shall be selected to match the number of lines/pairs existing in the cable.

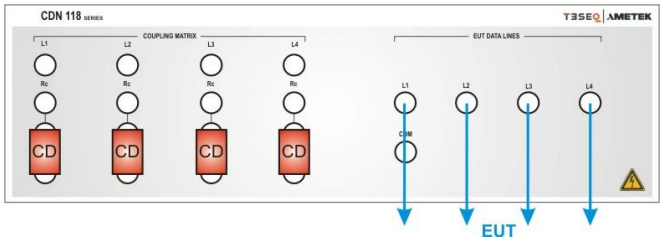
Rc for 4 lines: 4 x 40 Ω = 160 Ω (25 Ω +135 Ω)



4.4.1. Test setup with 4 lines Network CDN 118A-Cx-4-1

4 Data line setup:

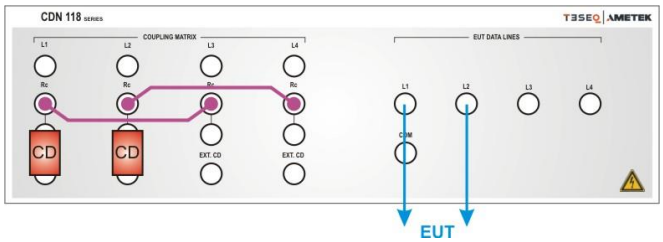
Each of the 4 lines has an impedance of= **160 Ω**
All four lines are connected by using a coupling device (CD, see chapter 8.2. Accessories)



2 Data line setup:

Two lines are switched in parallel. Each of the 2 lines has an impedance of= **80Ω** (160 Ω // 160 Ω)

L1 = (L1' // L3')
L2 = (L2' // L4')



- Line 1 and Line 2 coupled with a coupling device (CD) to the EUT output.
- Lines L1 is parallel with L3
- Lines L2 is parallel with L4

4.5. Test setup for 10µs / 700µs impulses

Due to the nature of the wiring used for unshielded outdoor symmetrical communication lines (twisted pairs), the coupling is always in common mode. The coupling decoupling schematic is shown in Figure A.4. (IEC 61000-4-5 Ed 3.0)

Coupling via arrestors (GDT) or Avalanche breaking diodes (ABD) is the preferred coupling method for unshielded outdoor symmetrical communication lines. The coupling network also has the task of splitting the surge current into multiple pairs in multi-conductor cables. The internal generator matching resistor Rm2 (25 Ω) is replaced by the Rc = 25 Ω in the CDN 118A coupling / decoupling network.

The suggested coupling and decoupling network design and component values may not be suitable for high speed networks as the wanted data transmission may be degraded.

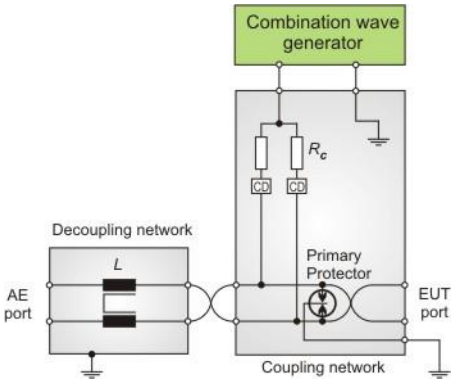


Figure A4 IEC 61000-4-5 Ed3.0

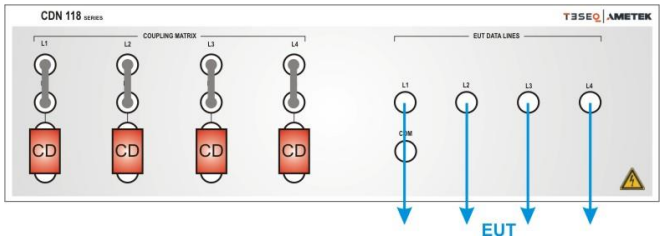
4.5.1. Test setup with 4 lines Network CDN 118A-Cx-4-1

4 Dataline setup: *Two symmetrical lines (2 pairs)*

Each of the 4 lines has an impedance of= 25 **Ω**

Bridge (grey): The 25 **Ω** impedance results by shorting the 135 **Ω** resistors.

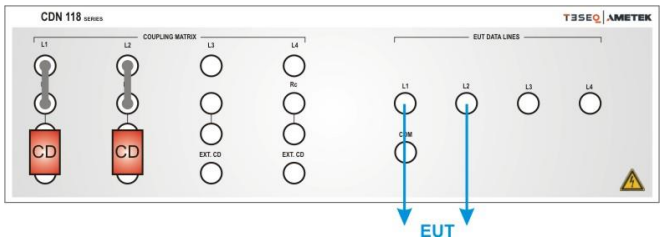
Bridge (CD): Connection for the built-in coupling device (GDT/ABD) for coupling to lines L1 to L4.



2 Data line setup: *One symmetrical lines (1 pair)*

Bridge (grey): The 25 **Ω** impedance results by shorting the 135 **Ω** resistors of lienes L1 and L2.

Bridge (CD): Connection for the built-in (GDT/ABD) for coupling to lines L1 and L2.



4.5.2. Diagram CDN 118A-series

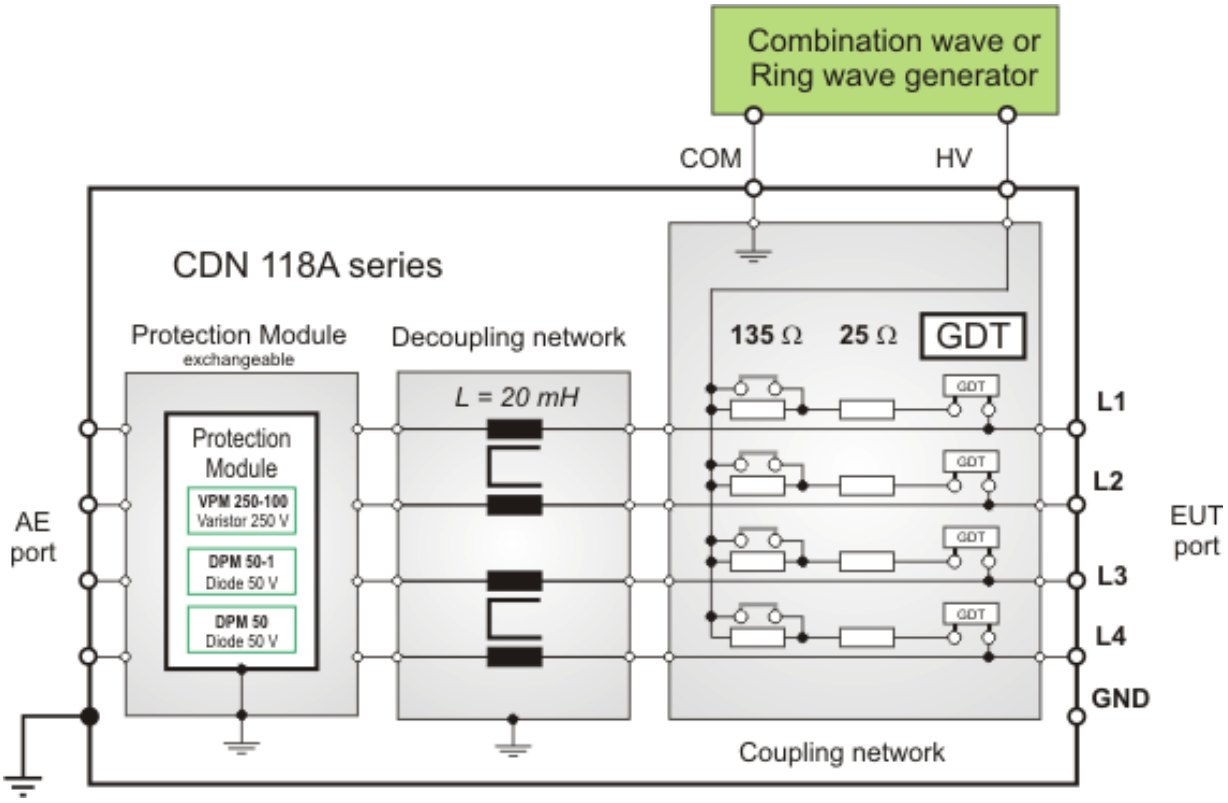
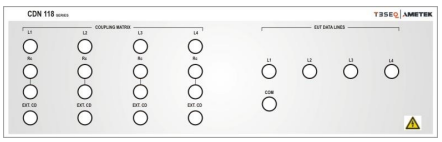


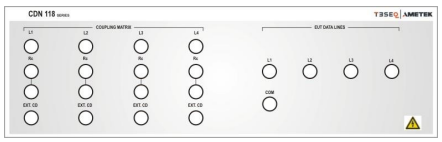
Diagram CDN 118A-Cx-4-1

5. Technical data

5.1. CDN 118A series



CDN 118A-C4-4-1

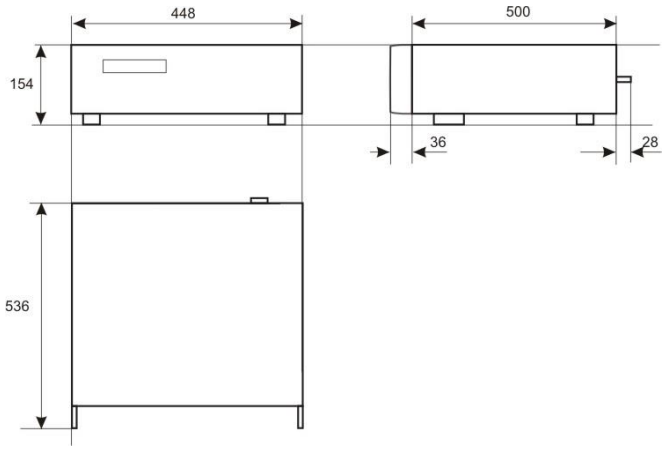


CDN 118A-C6-4-1

Testlevel		
Max. test voltage	4800V 1,2/50µs or 10/700µs	6600V 1,2/50µs or 10/700µs
Number of lines	4	4
Decoupling	L = 20mH	L = 20mH
Residual voltage (decoupled side)		
1.2 µs / 50 µs	85 V	
10 µs / 700 µs	80 V	
EUT signal		
EUT line voltage	50 V or 250 V depends on DPM model	
EUT current	1 A	
Signal Bandwith	Coil up to 100 kHz with 600 Ω load	
Coupling 1.2 µs / 50 µs	**yes**	
Serial resistor	4 x 160 Ω (25 Ω + 135 Ω)	4 x 160 Ω (25 Ω + 135 Ω)
Coupling elements	Gas arrestor or other coupling device with external box	
Coupling 10 µs / 700 µs	**yes**	
Serial resistor	4 x 25 Ω	
Coupling elements	Gas arrestor or other coupling device with external box	
Coupling ITU K20	**yes**	
Serial resistor	4 x 25 Ω	
Output		
Datalines 4 lines	Bananaplugs 4 Lines L1, L2, L3, L4	
General		
Temperature	5 - 40 °C operating	
Humidity	10%...90% no condensing	
Dimension (B x D x H)	448 mm x 400 mm x 154 mm	

5.2. Weight and dimension

Model	**Signal lines**	**Weight** [kg]	**Dimension** L x W x H [mm]	**Housing**
CDN 118A-C4-4-1	4 wires	11.2 kg	448 x 500 x 154	A
CDN 118A-C6-4-1	4 wires	11.2 kg	448 x 500 x 154	A



Housing A

=> Non relevant data for the standards can be changed by the manufacturer <=

6. Maintenance

6.1. General

The coupling network is built with passive components only. The coupling network of the CDN 118A series is absolutely maintenance free.

6.2. Calibration and Verification

6.2.1. Factory calibration

Every AMETEK CTS 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 AMETEK CTS equipment is 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.

Examples: Calibration mark

6.2.2. Guideline to determine the calibration period of AMETEK CTS instrumentation

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

AMETEK CTS doesn't know each customer's Quality Assurance Policy, nor do we know how often the equipment is used and what kind of tests is performed during the life cycle of 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:
AMETEK CTS 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 must be defined based on two criteria:

- The first one is the customer's Quality Assurance Policy. Any existent internal regulation must be applied at highest priority. In the absence of such internal regulation the utilization rate of the test equipment must be taken into consideration.

- Based on the experience and observation collected over the years **AMETEK CTS recommends 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.

6.2.3. 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.

6.2.4. 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, AMETEK CTS suggests for refer to the waveshape and values of the original calibration certificate.

All calibrations and verifications are always done without mains supply voltage connected to the coupling network input.

Danger

Before starting the calibration or verification

remove the EUT Mains Supply

from the generator and from the coupling network

6.3. Maintenance, Adjustments, Replacement of Parts

ATTENTION

Electrical maintenance must only be performed by qualified service technicians...

The generators do not contain any parts or components requiring special maintenance.

Electrical maintenance must only be performed by experienced and specially trained technicians. Generally, standard maintenance requires only the periodic cleaning of the instrument, verification and calibration of certain parameters.

- When removing the cover or other parts of the equipment, high voltage parts may become exposed. High voltages are potentially lethal.
- For service, repair, adjustment or replacement of parts, the generator must be disconnected from all power supply sources before covers are to be removed.
- The user is not permitted to change or modify any EM TEST generator. Only original EM TEST parts and components shall be used for repair and service. EM TEST is not responsible for accidents or injuries caused through the use of parts or components not sold by EM TEST...
- Maintenance and service must only be performed by qualified service technicians who are trained and familiar with the dangers of servicing the EM TEST generator.
- Only fuses of correct voltage and amperage as specified by the manufacturer are to be used for replacement. The repair of fuses is not permitted.

7. Calibration procedure as per IEC 61000-4-5 Ed3

7.1. Calibration Surge impulse (1.2/50 µs – 8/20 µs)

7.1.1. General

Calibration measurements shall be performed as indicated in Table 9 of IEC 61000-4-5 Ed3.0 at the CDN rated impulse voltage. The peak amplitude, the front time and duration shall be measured at the EUT output port.

7.1.2. Calibration procedure for CDNs for symmetrical interconnection lines

The inputs of the DN at the auxiliary equipment (AE) shall be short-circuited to PE for the voltage and current measurements at the EUT output port.

The residual voltage value depends on the protection requirements of the AE. Therefore, no limits are given in this standard.

It is recommended that the open-circuit voltage between wires of different pairs is also measured. A differential voltage between pairs can produce false failures in EUTs that are designed to operate in highly balanced networks. No limit has been proposed for this value as the tolerance is dependent upon the design of the EUT.

	Coupling	Measuring	AE side	EUT side
Surge voltage at EUT side	Common mode – all lines to PE 40 Ω path*	All lines shorted together Peak voltage, front time, duration	All lines shorted to PE	Open–circuit all lines connected together
Surge current at EUT side	Common mode – all lines to PE 40 Ω path*	Single line Peak current, front time, duration	All lines shorted to PE	All lines shorted to PE
Residual voltage on AE side (with protection elements)	Common mode – all lines to PE 40 Ω path*	Line to PE at a time peak voltage	Open–circuit	Open–circuit
* A 40 Ω path means that the transfer impedance is always 40 Ω. This means that for coupling to 1 pair 80 Ω per line or 40 Ω per pair are used, for coupling to 2 pairs 160 Ω per line or 80 Ω per pair are used, for coupling to 4 pairs 320 Ω per line or 160 Ω per pair are used.				

Table 9 IEC 61000-4-5 Ed3.0 Summary of calibration process for CDNs for symmetrical interconnection lines

The intention of this calibration process is to check the proper function of the components, the saturation of decoupling chokes, the decoupling effect of the decoupling part, the current capability and the coupling effect of the coupling network part. The coupling method has an influence on the voltage and current wave forms. The parameters for the calibration are defined in Table 10 of IEC 61000-4-5 Ed3.0

Coupling method	**CWG Output voltage** a,b,c	**Voc at CDN EUT output ± 10 %**	**Voltage front time Tf** Tf = 1,67 × Tr **± 30 %**	**Voltage duration Td** Td = Tw **± 30 %**	**Isc at CDN EUT output ± 20 %**	**Current front time Tf** Tf = 1,25 × Tr **± 30 %**	**Current duration Td** Td=1,18 ×Tw **± 30 %**
Common mode CD [d] 40 Ω path	2 kV	2 kV	1,2 µs	45 µs	48 A	1,5 µs	45 µs

a It is recommended to calibrate the CDN at the highest rated impulse voltage, as this will minimise the effects of the switching noise generated by CLDs and GDTs. The value shown in the table is for a generator setting of 2 kV. In case the CDN is rated for another maximum impulse voltage, the calibration shall be done at this maximum rated impulse voltage. The short-circuit peak current specification shall be adapted accordingly. For example, if the maximum voltage is 4 kV, the shortcircuit current value shall be multiplied by 2.

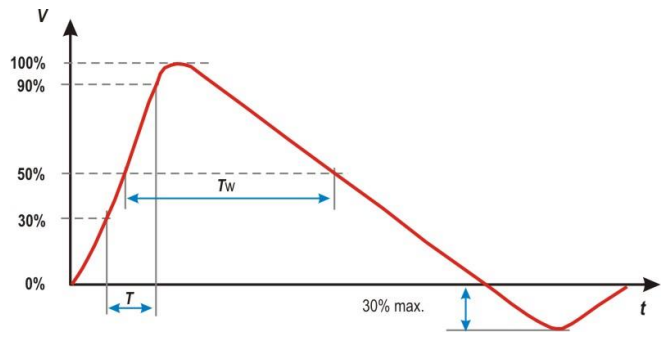
b Coupling via gas arrestors, clamping or avalanche devices will show some switching noise on the impulse wave. Working with the highest possible impulse voltage will minimise their impact on measurements, however, it is recommended to neglect the switching noise for the peak values measurements.

c The values shown in this table are for a CWG with ideal values. In case the CWG generates parameter values close to the tolerances, the additional tolerances of the CDN may generate values out of tolerances for the CWG-CDN combination.

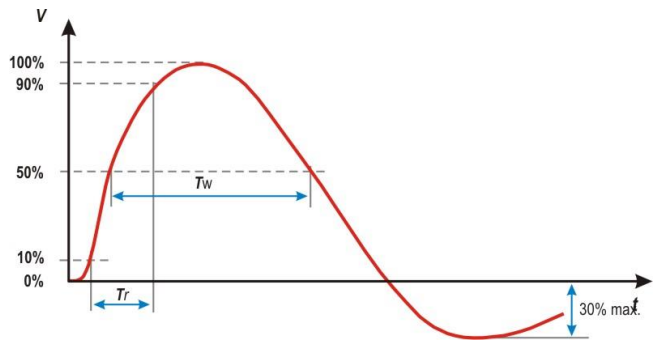
d The coupling device (CD) can be based upon capacitors, gas arrestors, clamping devices, avalanche devices or any method that allows the wanted data of the EUT to function correctly and at the same time meet the impulse waveform parameters of this table.

Table 10 – Surge waveform specifications at the EUT port of the CDN for symmetrical interconnection lines

7.1.3. Surge waveform definition on CDN for symmetrical interconnection lines



Waveform of open circuit voltage (1,2/50 µs)



Waveform of short circuit current (8/20µs)

	Front time Tf [µs]	**Duration Td** [µs]
Open-circuit voltage	Tf = 1,67 × T = 1,2 ± 30 %	Td = Tw = 45 ± 30 %
Short-circuit current	Tf = 1,25 × Tr = 1.5 ± 20 %	Td = 1,18 × Tw = 45 ± 30 %

7.2. Calibration Telecom Surge impulse (10/700 µs – 5/320 µs)

7.2.1. General

Due to the nature of the wiring used for unshielded outdoor symmetrical communication lines (twisted pairs), the coupling is always in common mode.

The coupling decoupling schematic is shown in IEC 61000-4-5 Ed.3.0 Figure A.4.

7.2.2. Calibration procedure for CDNs for symmetrical interconnection lines

Measurements shall be performed with the impulse applied to one coupling path at a time.

The peak amplitude, the front time and impulse duration shall be measured for the CDN at the impulse voltage under open-circuit conditions and the current under short-circuit conditions according to (Table A.4. of IEC 61000-4-5 Ed3.0).

The inputs of the decoupling network (DN) at the AE side shall be short-circuited to PE for the impulse voltage and impulse current measurement at the EUT output port.
The residual voltage value depends on the protection requirements of the AE. Therefore, no limits are given in this standard.

	Coupling	Measuring	AE side	EUT side
Surge voltage at EUT side	Common mode – one pair to PE	Both lines from one pair shorted together: peak voltage, front time, duration	All used lines shorted to PE	Open-circuit, both lines from one pair connected together
Surge current at EUT side	Common mode – one pair to PE	Both lines from one pair shorted together: peak current, front time, duration	All used lines shorted to PE	Both lines from one pair shorted to PE
Residual voltage on AE side (with protection elements)	Common mode – one pair to PE	Both lines from one pair shorted together: peak voltage	Open–circuit	Open–circuit

Table A.3 IEC 61000-4-5 Ed3.0– Summary of calibration process for CDNs for unshielded outdoor symmetrical communication lines

The intention of the calibration process is to check the proper function of the components, the saturation of de-coupling chokes, the decoupling effect of the DN part, the current capability and the coupling effect of the CN part. The coupling method described in the above paragraphs has an influence on the voltage and current wave forms. The parameters for the calibration are defined in Table A.4.

Coupling method	**CWG output voltage**	**V_{oc} at CDN EUT output ± 10 %**	**Voltage front time T_f ± 30 %**	**Voltage duration T_d ± 30 %**	**I_{sc} at CDN EUT ouput ± 20 %**	**Current front time T_f ± 30 %**	**Current duration T_d ± 30 %**
Common mode CD 1 pair 27,5 Ω	4 kV	4 kV	8 µs	250 µs	145 A	3,2 µs	250 µs

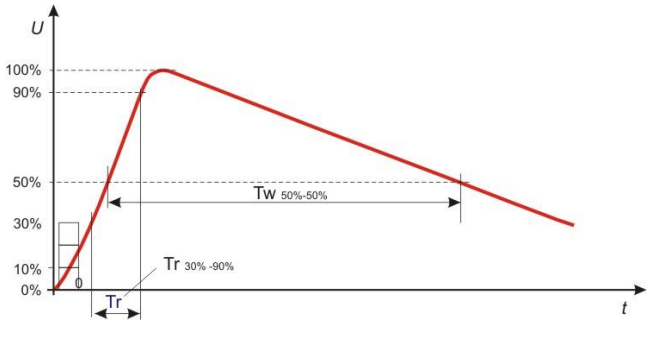
a For CDN with more than one pair, each pair has to be calibrated separately, as described in Table A.3.

b Coupling via gas arrestors, clamping or avalanche devices will show some switching noise on the impulse waveform. Working with the highest possible impulse voltage will minimize their impact on measurements; it is recommended to neglect the switching noise for the front times and duration values measurements.

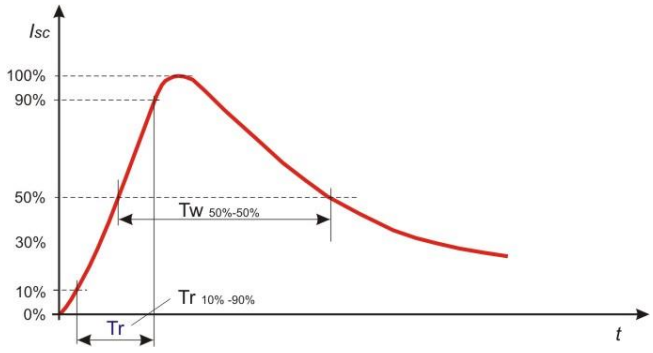
c The values shown in this table are for a CWG with ideal values. In case the CWG generates parameters values close to the tolerances, the additional tolerances of the CDN may generate values out of tolerances for the CWGCDN combination.

Table A.4 – Surge waveform specifications at the EUT port of the CDN for unshielded outdoor symmetrical communication lines

7.2.3. Telecom Surge waveform definition



Waveform of open circuit voltage (10/700 µs)



Waveform of short circuit current (5/320µs)

	Front time Tf [µs]	**Duration Td** [µs]
Open-circuit voltage	Tf = 1,67 × T = 10 ± 30 %	Td = Tw = 700 ± 20 %
Short-circuit current	Tf = 1,25 × Tr = 5 ± 20 %	Td = Tw = 320 ± 20 %

8. Delivery Groups

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

8.1. Delivery groups CDN 118A-Cx-4-1

- **Base equipment CDN 118A-C4-4-1 / CDN 118A-C6-4-1**
- **DPM 50-1** AE Protection module for 4 lines, 50V, 1 kΩ
- **GDT 90** 4 x Gas discharge tube 90 V
- **ABD plug 140** 4 x Avalanche breaking diode 140 V
- **HVS - Banana - Banana** 1 HV cable red (HV), 1.0 m
  1 HV cable black (COM), 1.0 m
- **Earth Cable** Art:109046
  1 x 0.6 Meter earth cable yellow-green with 2* ring tongue;
  2 x M4 screws, for connect to the earth bolt
  2 x M4 toothed washer
- **SCC** 8 x Short circuit connector, 4mm
- **Safety lab cables** 8 x 0.25 m Safety lab cables, Art:105886
- **Manual** German and English manual on USB memory stick

8.2. Accessories

ABD Plug 140 V Avalanche Breaking Diode (± 140 V)
Coupuling diode for
- Surge impulse 1.2 / 50 µs and
- Telecom surge impulse 10 /700 µs
- Max. impulse voltage 7 kV

GDT Plug 90 V Gas Discharge Tube for coupling
- Surge impulse 1.2 / 50 µs and
- Telecom surge impulse 10 /700 µs
- Max. impulse voltage 7 kV

9. Appendix

9.1. Declaration of conformity

Manufacturer:	**AMETEK CTS GmbH**
Address:	Sternenhofstr. 15 CH 4153 Reinach BL1 Switzerland

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

Product's name:	Coupling decoupling network for surge pulses
Model Number(s)	CDN 118A-C4-4-1 CDN 118A-C6-4-1

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: 2012	Electrical equipment for measurement, control and laboratory use Class A
EN 61000-3-2: 2007	Not applicable
EN 61000-3-3: 2013	Not applicable

The purpose of this instrument is the generation of defined interferences signals for EMI immunity testing. Depending on the arrangement of the test rig, the configuration, the cabling and the properties of the EUT itself, a significant amount of electromagnetic radiation may result that could also affect other equipment and systems. The user himself or herself is ultimately responsible for the correct and controlled operation of the rig. In case of doubt, the tests should be carried out in a Faraday cage.

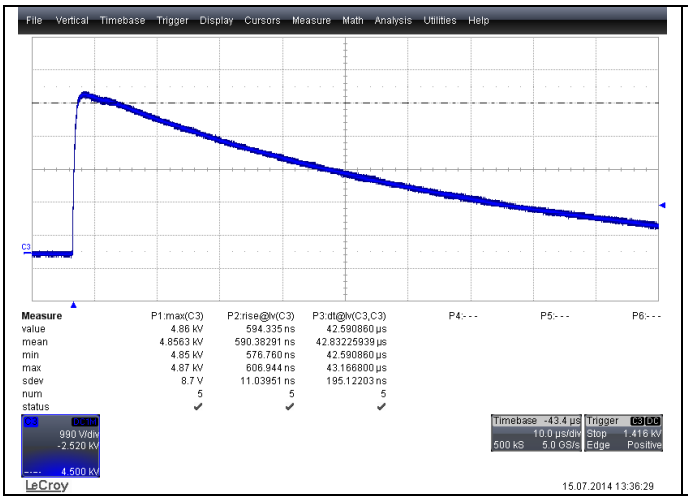
Manufacturer
AMETEK CTS GmbH
Sternenhofstr. 15
CH 4153 Reinach
Phone: +41 61 204 41 11
Fax: +41 61 204 41 00

By	A. Burger Director Engineering AMETEK CTS
Place	Reinach BL, Switzerland
Date	10. October 2018

9.2. Typical waves

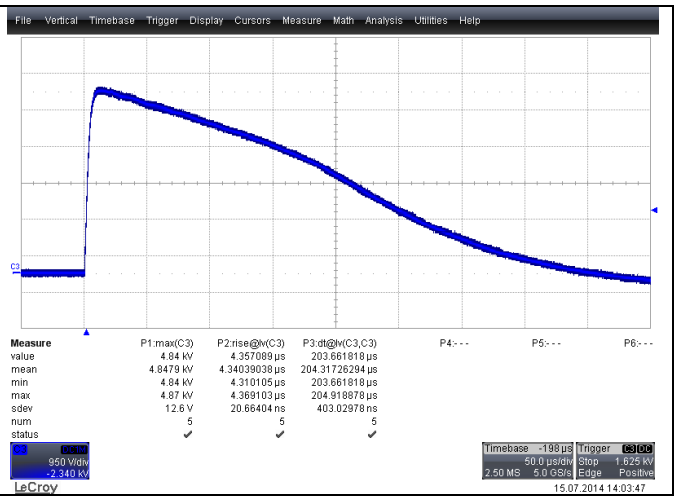
9.2.1. Voltage waveform

Surge 1.2/50 µs **5.0 kV**



	Nominal		Measured
U peak	5.0 kV	± 10%	4.86 kV
Tf	1.2 µs	± 30%	1.67 * 0.59 = 0.89 µs
Td	50 µs	± 20%	43.9 µs

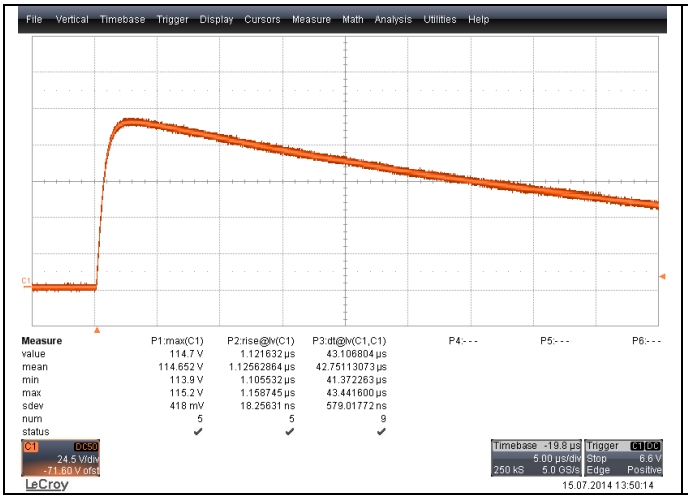
Telecom Surge 10/700 µs **5.0 kV**



	Nominal		Measured
U peak	5.0 kV	± 10%	4.84 kV
Tf	8 µs	± 30%	1.67 * 4.36 = 7.28 µs
Td	250 µs	± 20%	203 µs

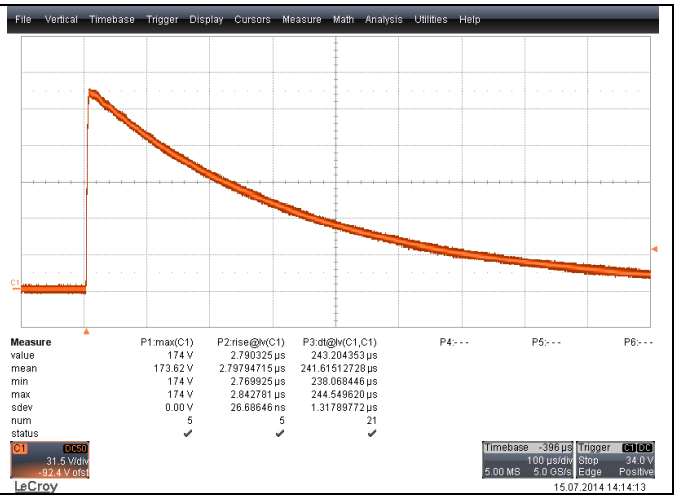
9.2.2. Current waveform

Surge 1.2/50 µs **5.0 kV**



	Nominal		Measured
I peak	5.0 A	± 10%	4.86 kV
Tf	8 µs	± 20%	1.25 *1.22 µs = 1.40
Td	20 µs	± 20%	43.1 µs

Telecom Surge 10/700 µs **5.0 kV**

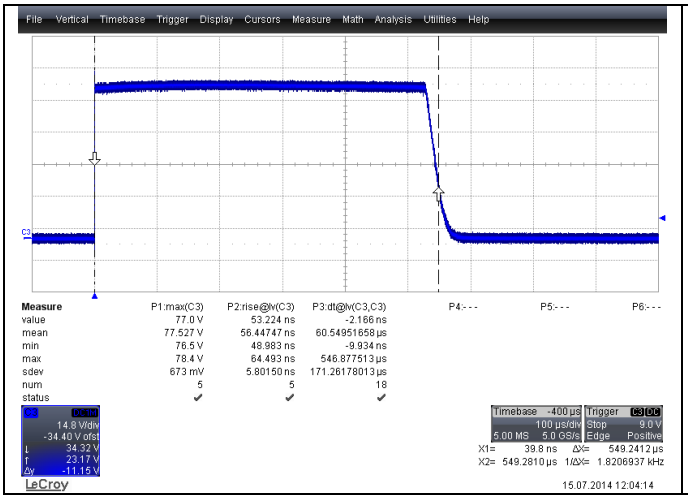


	Nominal		Measured
I peak	181 A	± 10%	4.86 kV
Tf	3.2 µs	± 30%	1.25 *2.79 µs = 3.49 µs
Td	250 µs	± 30%	243 µs

Reference: IEC 61000-4-5 Ed3.0
Surge: Table Table 8
Telecom Surge Table A.4

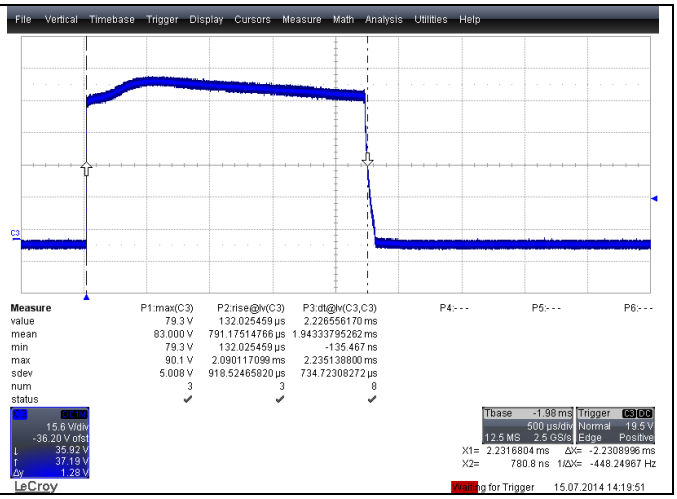
9.2.3. Residual voltage waveform

Surge 1.2/50 µs **5.0 kV**



Residual voltage: < 80 V

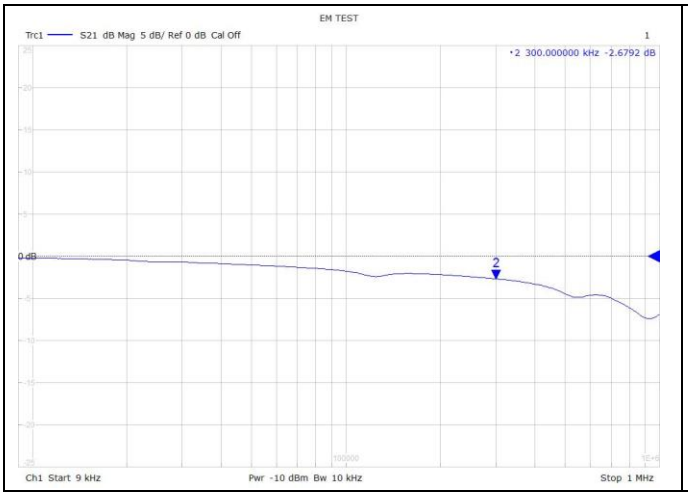
Telecom Surge 10/700 µs **5.0 kV**



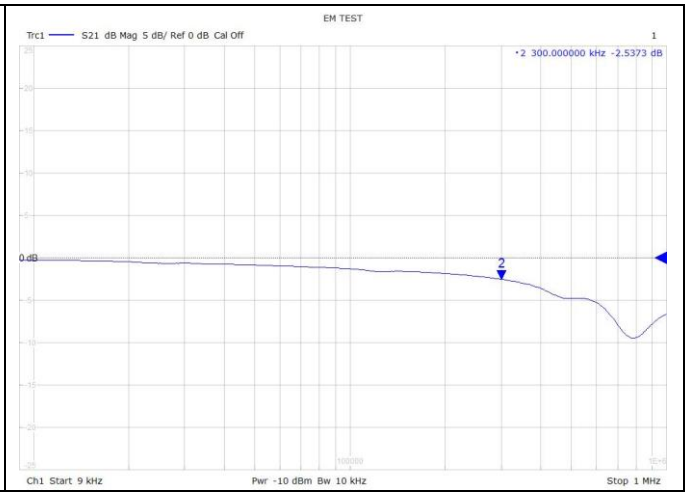
Residual voltage: < 83 V

9.3. Transferfunktion

The figure below illustrates the transferfunction of a typical symmetrical lines L1-L2 & L3-L4.



Typical transfer function L1 – L2



Typical transfer function L3 – L4