CDN 3153-S63
CDN 3153-S63.1

AUTOMATED 3-PH COUPLING/DECOUPLING NETWORKS

USER MANUAL 601-341D

AMETEK®
COMPLIANCE TEST SOLUTIONS

TESEQ
Advanced Test Solutions for EMC

WARNING - Lethal danger from high voltages and the risk of radiating illegal electromagnetic interference.

This system must be used only for EMC test purposes as specified in these operating instructions.

The NSG 3150 and CDN 3153-S63.1 must be installed and used only by authorized and trained EMC specialists.

Personnel fitted with a heart pacemaker may not operate the instrument and must not be near the test setup while it is in operation.

When the system is used in conjunction with options, accessories or other equipment the safety instructions concerning those devices must also be observed.

Content

1 EXPLANATION OF SYMBOLS

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

The following symbol draws your attention to a circumstance where non- observation of the warning could lead to inconvenience or impairment in the performance.

Example:

This connection must not be confused with the Equipment under Test (EUT) power input.

The following symbol draws your attention to a circumstance where non- observation of the warning could lead to component damage or danger to the operating personnel.

Example:

Never connect or disconnect the EUT while the test system is performing a test.

Never connect or disconnect the coupling path while the test system is performing a test.

Lethal danger from high voltages and the risk of radiating illegal electromagnetic interference.

The CDN 3153-S63.1 with its CDN may only be installed and used by authorized and trained EMC specialists (electrical engineers).

The CDN 3153-S63.1 must only be used for EMC tests as set down in these operating instructions. The safety is not guarantee when using the device in other application than specified.

Personnel fitted with a heart pacemaker must not operate the instrument and must not be near the test rig while it is in operation.

Lethal danger from high voltages and the risk of high levels of electromagnetic radiation being generated.

The system must only be used for EMC test purposes as set down in these operating instructions.

When the system is used in conjunction with options, accessories or other equipment the safety instructions concerning those devices must also be observed.

2 INTRODUCTION

2.1 General description

The NSG 3150 with the CDN 3153-S63.1 test systems are designed primarily for cable-borne transient interference tests as specified in the European generic standard IEC/EN 61000-6-1 covering equipment for household, office and light industrial use, and IEC/EN 61000-6-2 for applications in industrial environments, in accordance with the requirements of the basic standard. IEC/EN 61000-4-5.

The EU directive no. 2014/30/EU (for the assignment of the CE symbol) refers to this standard for this type of equipment.

The CDN 3153-S63.1 is modular and automated coupling/decoupling network for inject surge pulses to 3-phase AC supply lines up to 3 x 690 V /63 A. With the option INA 3151-63 it is possible to test with DC supply up to 1000 V / 63 A

The CDN 3153-S63.1, connected to the NSG 3150 can handle the IEC 61000-4-5 recommendations. This standard requires that the EUT power voltage level has to be taken into account.

2.1.1 Reference ground connector

CDN 3153-S63.1 is part of the 3000-series family 3-phase coupling networks, rated to test equipment of 63 A per phase. It can couple combination wave up to 15 kV.

No PQT test can be selected since the three phase PQT test recommends other test units like the Teseq Profline 2100 system.

3 SAFETY INSTRUCTIONS

WARNING - Improper or careless operation can be fatal! The instrument must only be accessible to trained persons.

The coupling networks CDN 3153-S63.1 are intended for use with surge generators. These generators produce high voltage test pulses with high energy.

These operating instructions form 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.

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3.1 General

Use of the coupling device in combination with the generator is restricted to authorized and trained specialists.

The user is directly responsible for ensuring that the test rig does not cause excessive radiated interference which could affect other instrumentation. The test system itself does not produce any excessive EM radiation. However, the injection of interference pulses into a EUT can result in it and/or its associated cables radiating electromagnetic energy.

To avoid unwanted radiation, the standards organizations recommend that the test setup be operated inside a Faraday cage.

WARNING - Because of its construction, the instrument is not suitable for use in an explosive atmosphere.

WARNING - Persons fitted with a heart pacemaker must neither operate the instrument nor approach the test setup while a test is being executed.

Only approved accessories, connectors, adapters, etc. are to be used to ensure safe operation.

Upon switching on the generator, it will perform a self test. Therefore, the EUT output is to be considered as carrying EUT power all the times!

WARNING – For lift the device suitable lifting device is required.

The test rig must provide adequate insulation protection for up to 15 kV surge and the additional rated EUT mains voltage (peak). Particular care should be given to the connections between the CDN and the equipment under test (EUT).

The rated data for the cable insulation must be such that the insulation of the cables in the high-voltage circuit is 20 kV, and the power cable to the device is min. 2.5 kV.

The EUT may only be tested when placed inside a suitable protective enclosure which should provide protection against flying fragments, fire and electric shock.

Under normal operating conditions no toxic gases are released.

The pulse voltage must not be able to find its way to unearthed metal objects in the event of the EUT failing.

Only use the instrument in a dry room.

Never leave the instrument unattended when the EUT is switched on.

Do not open the instrument. Repairs and adjustments must only be carried out by qualified maintenance personnel.

Do not continue to use the CDN in case of mechanical damage. The CDN housing and the cables have both insulating and a screening function, which can only be assured while the housing is intact. Return the damaged CDN to a Teseq service center immediately for repair.

Warning symbols on the test system:

CAUTION! Warning of a danger spot (refer to the documentation).

CAUTION! Warning of electrical hazards!

4 INSTALLATION

Test system conforms to protection class 1. Local installation regulations must be respected to ensure the safe flow of leakage currents.

WARNING - Operation without an earth connection is forbidden!

WARNING - Switch off EUT power before accessing EUT power IN or OUT terminals.

The terminals of the three phases CDN 3153-S63.1 are accessible with the included insulated Allen key.

An external fuse is required with max. 63 A current rating. There are no built in fuses in the CDN 3153-S63.1.

Two independent ground connections are necessary - one for the test system and one for the EUT. These must be connected back to the local permanent installation or to a fixed, permanent ground conductor.

Operate the equipment only in dry surroundings. Any condensation that occurs must be allowed to evaporate before putting the equipment into operation. Do not exceed the permissible ambient temperature or humidity levels. Use only officially approved connectors and accessory items. Take care to have access to all connectors for disconnect them in no time in case of emergency.

Ensure that a reliable return path for the interference current is provided between the EUT and the generator. The ground reference plane and the ground connections to the instruments, as described in the relevant test standards, serve this purpose well.

Since the instrument works, on principle, with two independent power supplies (one for the coupling network and one for the EUT), the CDN 3163-S62 must be disconnected from both sources before any modifications to the test rig are undertaken. Besides the mains connections themselves, certain components also operate at high voltages, which are not provided with any form of extra protection against being accidentally touched.

4.1 Installation of a power emergency off switch

The CDN itself has an internal power switch to control EUT power ON/OFF, accessible via the user interface or the software, but nerveless, it is recommended to connect the EUT power through a properly rated circuit breaker and an emergency off button as per IEC/EN 61010-1. In order to ensure an easy and quick access, the button should be located close to the test setup and should be clearly and visibly labelled as a device for “Emergency power ON/OFF” switching.

WARNING - The test setup should only be accessible to trained persons.

Dimensioning of the mains supply and rating of fuse protection of the AC power supply must conform with local electrical codes and EUT requirements.

Inappropriate arrangement, mounting, cabling or handling of the device under test or the protective elements can make the protective features that are incorporated in the design of the instrument worthless.

5 APPLICABLE THE SAFETY STANDARDS

The construction of the instrument conforms to the safety requirements and offers everything necessary for safe and efficient operation.

Development and manufacture is in compliance with ISO 9001. The system complies with the safety requirements of IEC/EN 61010-1 (safety requirements for electrical equipment for measurement, control and laboratory use).

All mains power driven types of units are designed for high voltage working safety.

The interference immunity has been tested in accordance with EN 61326-1. It is the user's responsibility to ensure that the test rig does not emit excessive electromagnetic interference (EMI) which might affect other items of 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 starting to radiate EMI. To avoid radiating of unwanted interference the test rig might be operated in a Faraday cage.

Since the purpose of the test system is to produce interference signals for interference immunity testing, the requirements in IEC/EN 61000-6-x series concerning limiting the radiated EMI can only be complied with by operating the test system inside a Faraday cage.

5.1 Test execution

WARNING - The test area must be organized so that unauthorized persons do not have access during the execution of a test. If a safety contact (Interlock) is used as a means of access control to the test zone (e.g. a Faraday cage), then an additional contact connected in series is necessary to provide protection for parts of the EUT that are likely to be touched accidentally.

During a test, the EUT together with its accessories and cables are to be considered live at all times. The test system must be stopped and the EUT supply disconnected before any work can be carried out on the EUT. This can be achieved simply by opening the interlock circuit.

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 (see: User warnings - Generator).

The user must observe safety instruction for all the instruments and associated equipment involved in the test setup.

Test setup configuration 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.

6 PULSE COUPLING

6.1 Combination wave test

The surge test in compliance with IEC/EN 61000-4-5 simulates high voltage/high energy interference as experienced with a lightning strike. Generally speaking, the interference finds its way into equipment by way of the mains supply.

This kind of interference can affect equipment in either of two ways. Firstly, the interference can be coupled directly into the equipment via the mains supply. The interference is conveyed directly from the source (e.g. lightning strike to external power cables). Every item of equipment connected to this power source will be affected by the interference pulses.

Surge pulse interference can also occur on signal and data lines through coupling effects and electrical discharges. For this, the CDN 117/118 is recommended.

The test system enables tests to be carried out using both coupling methods. The EUT is connected to the mains power socket on the front panel of the test system for the direct mains injection test. Externally coupled tests require the interference to be superimposed on the EUT power feed cable via an external coupling unit that is connected to the Surge output on the front panel of the system.

6.1.1 Combination wave (CW) - Surge generator

The combination wave test involves the generation of high voltage surge pulses as specified in the international standard IEC/EN 61000-4-5.

The test pulses are injected directly into the EUT power supply lines. The EUT obtains its power from the EUT power outlet on the CDN of the test system where the voltage has the interference signal superimposed on it.

- Surge voltage of up to 15 kV which follows the 1.2/50 µs curve (open circuit)
- Surge current of up to 7.5 kA which follows the 8/20 µs curve (short circuit).

7 FIRST STEP

This chapter contains a short check-list with steps that should be taken before the instrument is connected to the generator, switched on and put into operation.

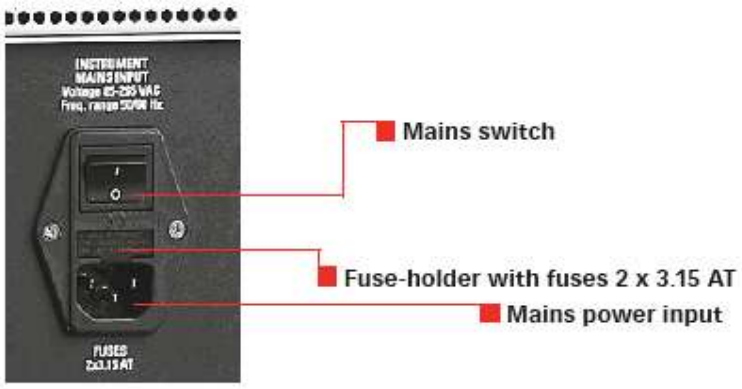
Check the packaging for signs of damage in transit. Any damage should be reported immediately to the transportation company. Check, using the following list, that all the items ordered as well as their accessories have been delivered:

1. CDN 3153-S63.1 coupling network unit
2. Operating instruction (*.pdf or WIN 3000 CD)
3. 1 Mains power cable for the CDN
4. 1 grounding ship (to ref. ground)
5. 2 HV cable with high voltage connector
7. 1 System cable
8. 1 Allen key for output connector
9. Ordered options

Check the instrument for signs of transport damage. Any damage should be reported to the transportation company immediately.

8 INSTALLATION OF THE CDN 3153-S63.1

The mains power voltage indicated on the instrument must accord with the local supply voltage (mains voltage: 85–265 VAC, universal power unit, mains frequency: 50–60 Hz).

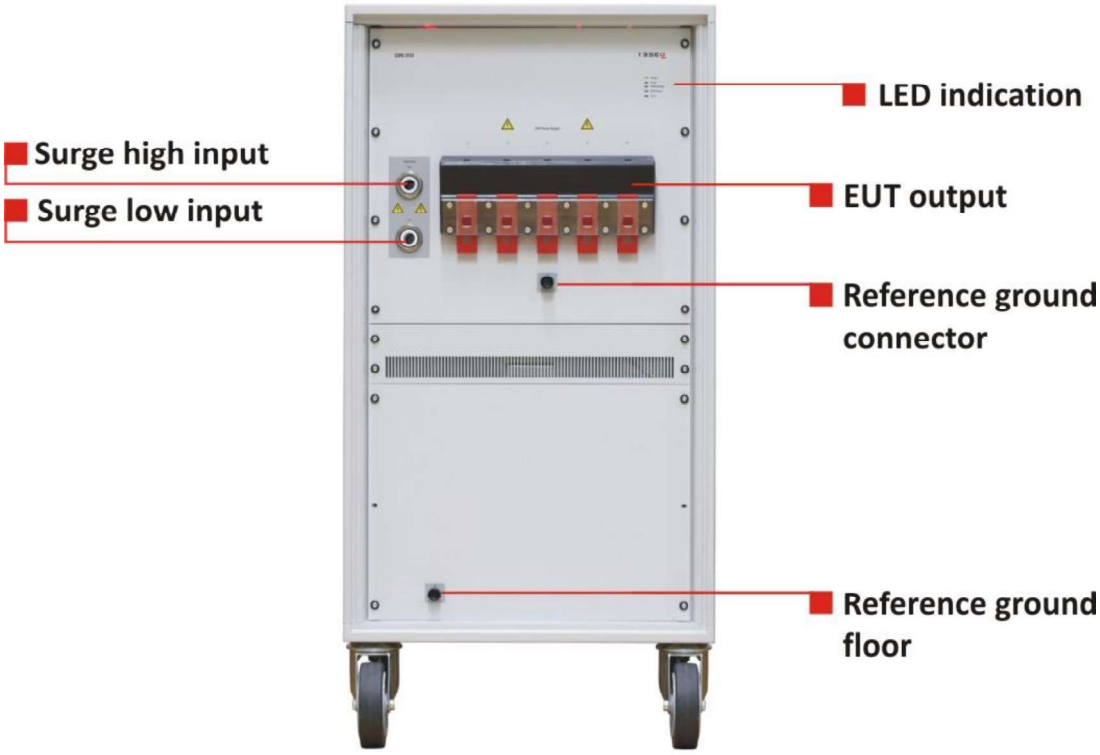


To insert a fuse, pull the fuse-holder out of the connector, insert 2 fuse cartridges 2 x 3.15 AT (slow blow) into the holder and put the holder back.

Plug the mains cable into a power outlet with a solid earth connection. Place the test system such that there is sufficient free space around the cooling air inlets on both sides and behind the fan outlet on the rear panel switch on and operate as stated in the accompanying instructions.

9 MAIN FRAME DESCRIPTION

9.1 Front panel CDN 3153-S63.1



9.1.1 EUT output connection

Never attempt to connect or disconnect an EUT while a test is being carried out.

The power output connection for three phases 5 cord EUTs. A suitable “Allen key” to screw /unscrew the power leads is included in the delivery package.

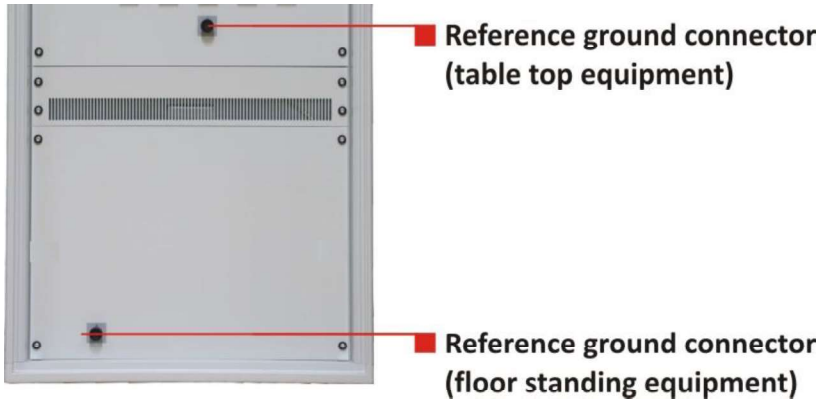
	CDN 3153-S63.1
EUT current range	0 - 63 A
Max. wire gauge	16 mm²
Torque	5 Nm

The used cable must fulfill the following specs:

- **Insulation: 15 kV + EUT mains peak voltage**
- **Current: At least the EUT current rating**

9.1.2 Ground reference terminal

A good earth connection between the CDN and the earth reference plate is essential. This terminal of the CDN provides a solid earth connection point to the test system. There is no need to connect the earth connector from the generator itself, since the surge connectors provide the reference ground from the generator to the CDN.



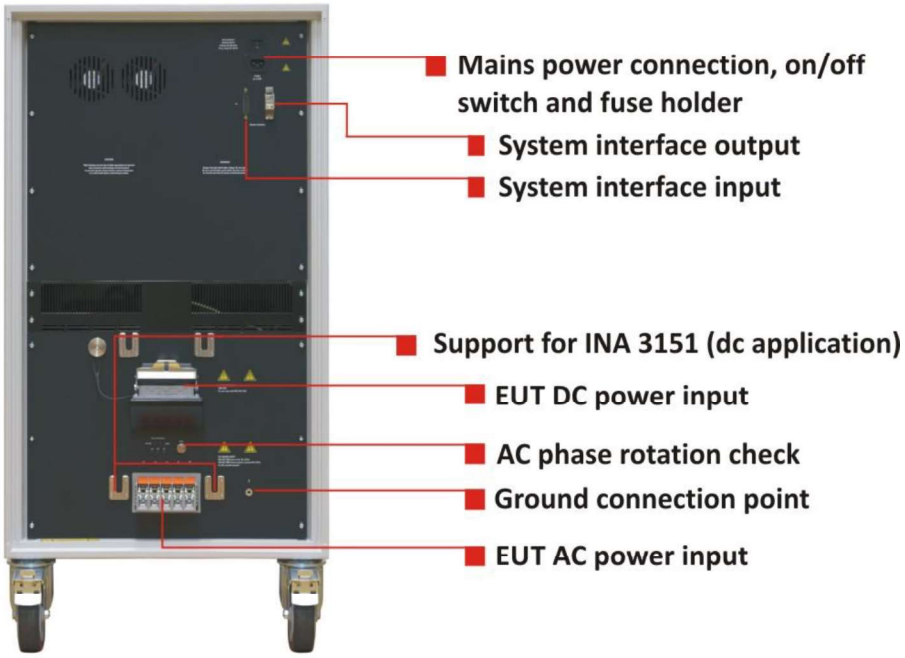
9.1.3 Surge input sockets

These sockets (High, Low) serve to connect the surge signal from the generator to the CDN. The surge output from the generator is potential free (floating). The inner conductor of each connector is the surge high and surge low connection respectively while the outer conductor (shielded) is connected to the instruments earth.

9.1.4 LED indicator

LED indicator function	Description
Power on	Instrument/system in operation
Pulse	Shows the occurrence of a pulses or a test event
Pulse blinking	The generator is set to a safe position and need some seconds to move the switch into the final position.
High voltage active	Shows that high voltage is present in the instrument (in line with “Pulse” LED)
EUT-Power on	Indicates when the power supply to the EUT is present at the EUT connector on the front panel
Error	Indicates that a system error has occurred

9.2 Rear panel CDN 3153-S63.1



9.2.1 Mains input and power switch

The main input is the power to the internal electronics of the CDN.

This connection must not be confused with the EUT power input.

The input contains the mains power input connector, the mains switch and the mains fuses.

Before putting the instrument into operation, please make sure that the voltage range shown on the mains input module corresponds with the voltage of the local supply to which the instrument will be connected, and whether the fuses are correctly rated (2 x 3.15 AT).

The used cable must be rated for a current of at least 3.5 A

9.2.2 EUT input supply

The power source connected to this connector provides the power for the EUT.

Surge interference signals are coupled into this supply line internally.

Special care must be taken to use the right phase line from the EUT input at the EUT output connector.

Depending on countries, different color codes are used. Please refer to the EUT input section in this manual to verify the coding.

Because of the capacitors in the internal coupler, earth leakage currents of up to several amperes can occur in the EUT power supply network.

The test system must therefore be correctly earthed and be powered from a supply that is not protected by a residual current detector (RCD).

EUT with DC supply must be powered by using the INA 3151-63 1000 VDC breaker. Take care to the correct connection for match the polarity with the EUT.

9.2.3 3-phase AC EUT mains input

The EUT main input is equipped with screw terminals type Phoenix TW 50/5 CL with following parameters:

Phoenix type	max. current	Wire gauge		Max. voltage	Torque
TW 50/5 CL	150 A	Solid	min. 10 mm² max. 50 mm²	690 V AC	Min. 4 Nm max. 4.5 Nm
		Stranded	min. 10 mm² max. 50 mm²		
		AWG/kcmil	min. 10 mm² max. 50 mm²		

Required conductor cross-section for multi wired cable Class 2

Max. current (Cu wire)	Wire size
4 mm^2	34 A
6 mm^2	44 A
10 mm^2	61 A
16 mm^2	82 A

The used cable must fulfill the following specs:

- **Insulation: 2.5 kV**

9.2.4 Color codes of a 3-phase system

Conductors of a three phase-system are usually identified by a color code, to allow for balanced loading and to assure the correct phase rotation. Colors used may adhere to International Standard IEC 60446, older standards, or to no standard at all, and may vary even within a single installation. For example, in the U.S. and Canada, different color codes are used for grounded (earthed) and ungrounded systems.

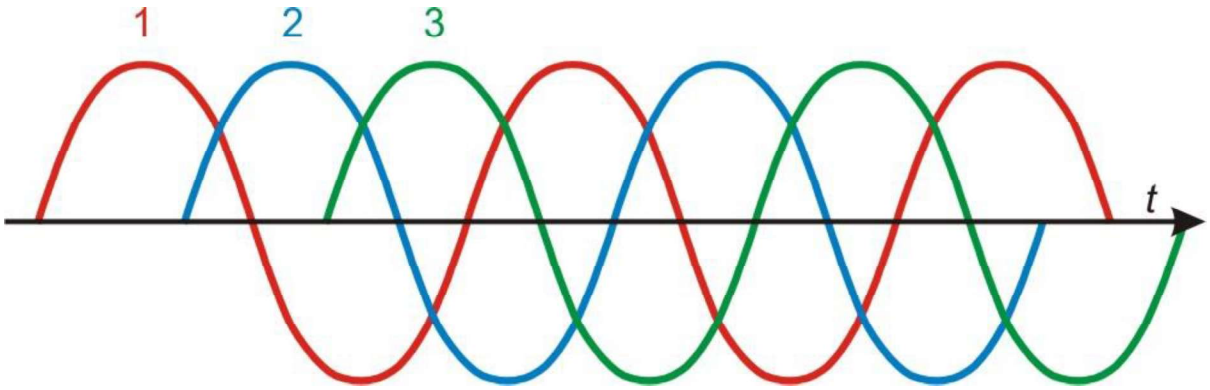
Countries / 5 wire power cord	**L1**	**L2**	**L3**	**Neutral**	**Ground / protective earth**
United States (common practice)	Black	Red	Blue	White or gray	Green, green/yellow tripped or a bare copper wire
United States (alternative practice)	Brown	Orange (Delta) or Violet (Wye)	Yellow	Gray or White	Green
Canada (mandatory)	Red	Black	Yellow	White	Green (or bare copper)
Canada (isolated 3-phase installations)	Orange	Brown	Yellow	White	Green
Europe and many other countries, including UK from April 2004 (IEC 60446), Hong Kong from July 2007	Brown	Black	Grey	Blue	Green/yellow striped
Older European (IEC 60446, varies by country)	Black or Brown	Black or Brown	Black or Brown	Blue	Green/yellow striped
UK until April 2006, Hong Kong until April 2009, South Africa, Malaysia	Red	Yellow	Blue	Black	Green/Yellow striped (green on installations approx. before 1970)
Pakistan	Red	Yellow	Blue	Black	Green
India	Red	Yellow	Blue	Black	Green
Australia and New Zealand (per AS/NZS 3000:2000 section 3.8.1)	Red	White (prev. yellow)	Blue	Black	Green/yellow striped (green on very old installations)
People's Republic of China (per GB 50303-2002 Section 15.2.2)	Yellow	Green	Red	Light Blue	Green/yellow striped

Peak impulse voltages of up to 2250 V can occur on these power lines. Such voltages can, under certain circumstances, destroy AC/DC power supplies. It is the user's responsibility to ensure adequate protection being provided at the inputs of the source.

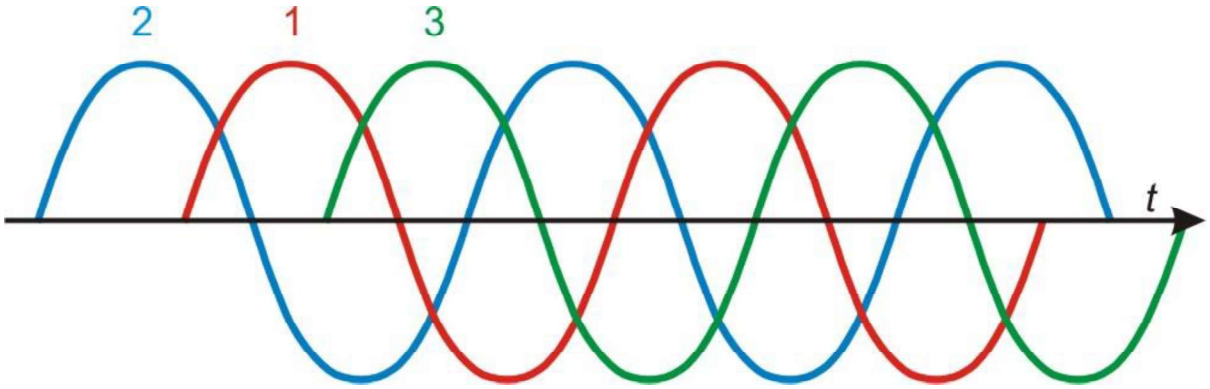
9.3 Phase rotation indication

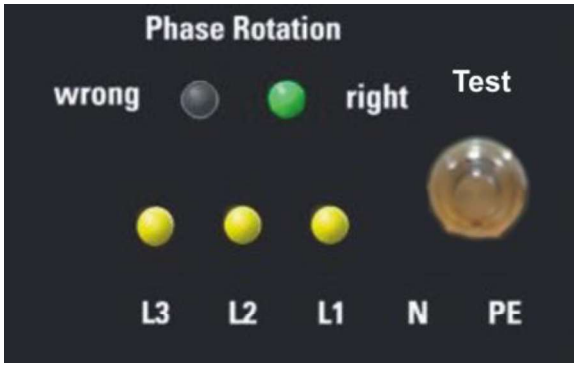
This important and easy to read feature guaranties a correct coupling especially in synchronous mode.

The phase rotation identifies cation at the back off the CDN units shows clearly, if all phases are connected and if the rotation of L1, L2 and L3 are correctly set, this is important especially in synchronous mode. The phase angle shift of 120° is a function of the actual rotational angle, following a definite order. For clockwise rotation the phase sequence order is 1-2-3.



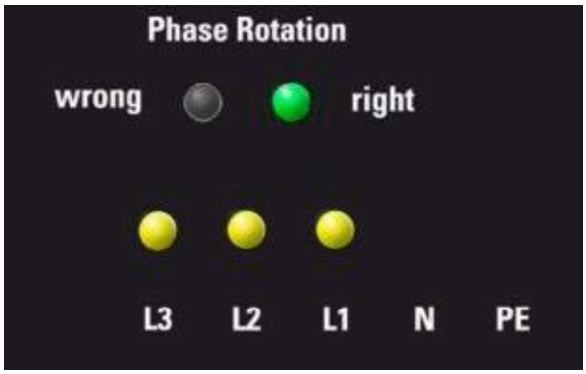
However, if we reverse the rotation winding 2's waveform will be leading 120° ahead of 1 instead of lagging, so the coupling point of a synchronous coupling will be wrong, since the zero crossing of L1 is measured and calculated for the other lines. The counter clockwise rotation phase sequence is 2-1-3, which is wrong.



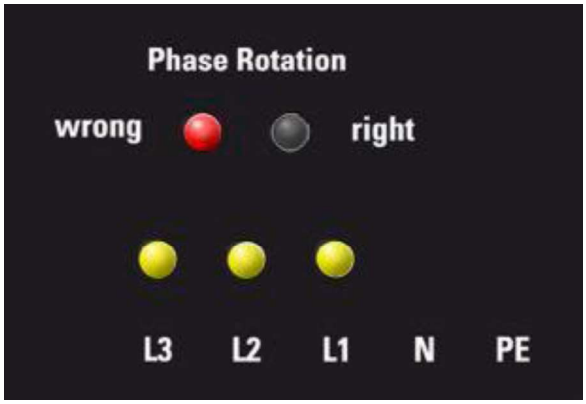


To test the proper phase rotation of the EUT Power Input, push the button "**Test**" beside the LED's - phase rotation will be shown by the LED's as long as the button is pushed.

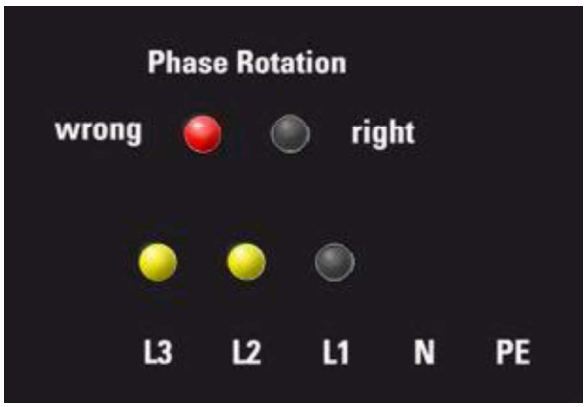
This is a correct EUT power setting, all phases are connected (all lines indication are on) and the rotation is right too.



The EUT power lines provide all power, but the phase rotation is wrong. In this case the exchange of line L1, L2, or L3 will solve the rotation problem.



Not all EUT power lines provide power and the phase rotation is wrong too. All phase of the EUT in power need to be checked and re-plugged.



9.3.1 2- or 1-phase AC EUT mains input

The CDN is able to handle also two and single phase power mains. In this case the color code is different.

It is the user's responsibility to ensure that in two or 1-phase system, the phases are correctly set at the input as well as at the EUT output connector, in this case the phase rotation detector does not work properly.

Following lines have to be used to guaranty the correct coupling mode selection:

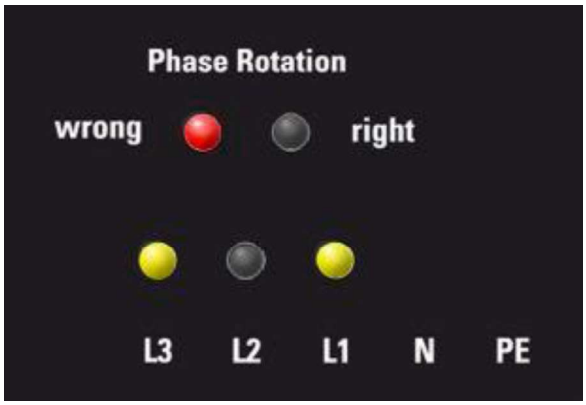
- 2-phase system: L1, L2, N, PE
- 1-phase system: L1, N, PE

9.3.2 Phase rotation indication using single- or two lines EUT power mains

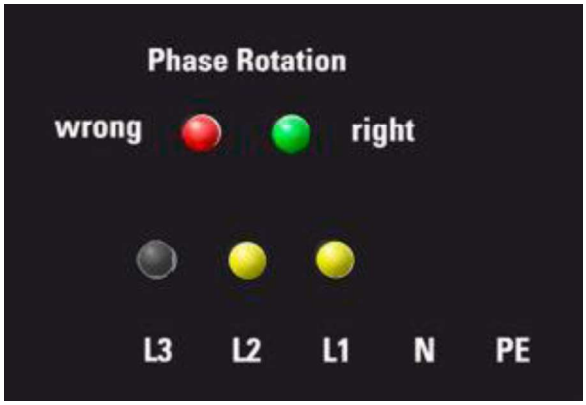
The phase rotation indication is made for 3-phase EUT power mains. In single or two phases application the indication will show different behavior.

As soon as the three phases input is used for single or two phase EUT application, the rotation indication will not work, resp. will not indicate properly and always showing error. However, the EUT power mains will anyway go through the CDN with any damage or harm.

Indication in single-phase mode
If L1 is connected, then L2 will be dark while L3 will light up softly as well and the red rotation led will be on.



Indication in two-phase mode
If L1 and L2 are connected, then L3 will light up softly as well and the red and green rotation led will be on dimly.



9.3.3 DC EUT input

For DC application up to 1000 V the user must connect the DC option INA 3151-63 to the rear panel. This option includes a DC switch, that can switch off 1000 VDC up to a current of 63 A.

In the case of DC applications, the positive and negative EUT output are on lines L1 and N respectively.

The polarity at this EUT power input connector must be the same as at the EUT output connector.

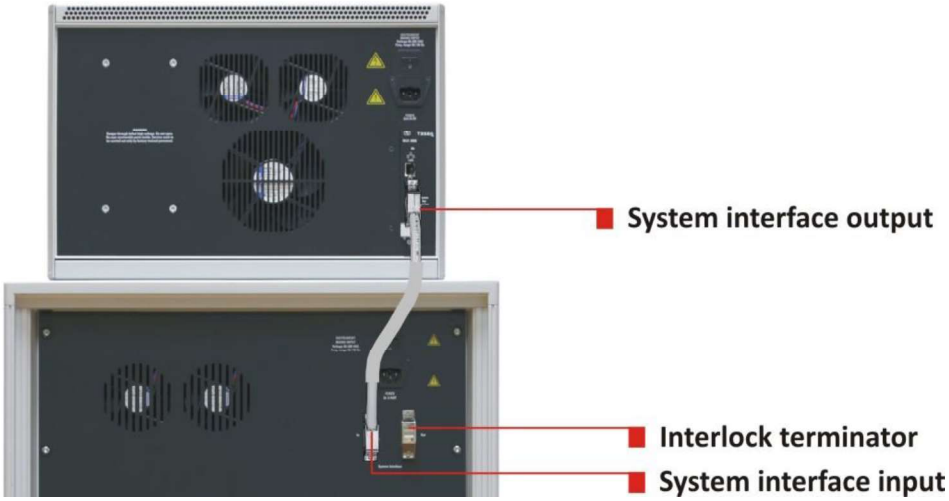
Cable wire size: 10 mm2

Cable:

red:	+ positive
black:	- negative
yellow-green:	PE protected earth
cable:	10 mm2

9.3.4 System Interface

The system interface is for control external devices. The system interface cable is between generator and the coupling network. The “System in” connector of the CDN 3153-S63.1 need a link to the “Master controller” NSG 3150 generator. The system cable is part of the delivery.



Otherwise the interlock terminator must be connected at the CDN 3153-S63.1 System interface out plug and the screws need to be tightened. The interface terminator plug is part of the generator.

9.3.5 Fan and cooling concept

The CDN 3153-S63.1 have been designed with a dynamic cooling concept. Internal elements suspected to warm up in any condition, especially the Surge pulse decoupling chokes, are equipped with thermal sensors. So at standby or for lower EUT currents, when there are nearly no dissipation losses in the CDN, and so no heat generation, there is no need of cooling and the fans will turn at a very low speed, generating no noise. There must be sufficient free space (< 20 cm) around the device for the cooling air.

As soon as the EUT current raises, heat will be generated in the housing, the internal control electronics will detect this and increase fan speed to improve cooling.

In case of internal or external overloading, there will be a point where even full speed cooling will no more be sufficient, at this moment the CDN 3153-S63.1 will switch OFF EUT power through the built in EUT power contractor, and so avoid destruction of the instrument (risk of fire). The CDN 3153-S63.1 control electrics will also send a message back to the NSG 3150 which will immediately stop the firing of pulses.

That way CDN 3153-S63.1 series give large overload capabilities, allowing up to 1,5 nominal current loading for 10 minutes, as well as high inrush currents or peak laods.

10 TEST SETUP SETTING

10.1 Applicable safety standard

Development and manufacture is in compliance to ISO 9001.

The instrument complies with the safety requirements of IEC/EN 61010-1 (Safety requirements for electrical equipment for measurement, control and laboratory use).

The interference immunity has been tested in accordance with EN 61326-1.

It is the user's responsibility to ensure that the test rig does not emit excessive electromagnetic interference (EMI) that might affect other items of 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 starting to radiate EMI. To avoid radiating unwanted interference the standards organizations recommend that the test rig be operated in a Faraday cage.

Since the purpose of the test system is to produce interference signals for interference immunity testing, the requirements in IEC/EN 61000-6-1, -2, -3, -4 concerning limiting the radiated EMI can only be complied with by operating the test system inside a Faraday cage

10.2 Test execution

During a test, the EUT together with its accessories and cables are to be considered as being live always. The test system must be stopped and the EUT supply disconnected before any work is carried out on the EUT.

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 EUT (see: Dangers concerning the EUT).

The safety instruction concerning all the instruments and associated equipment involved in the test rig must be observed.

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

For proper cooling the air flow through the ventilator must be ensured with a free space of at least 20 cm.

10.3 Dangers concerning the generator

- **Local burning, arcing, ignition of explosive gases.**
- **Danger from the resultant EUT supply current caused by a flashover or breakdown resulting from the superimposed high voltage effects.**

  Dangers from a disrupted EUT.
- **Disturbance of other, unrelated electronics, telecommunications, navigational aids and heart pacemakers through unnoticed radiation of high frequency energy.**
- **In the test system the interference voltage, corresponding to the level called for in the relevant test specification, is superimposed on the EUT's protective earth conductor. Earth contacts or pins (e.g. as in German and French mains plugs) as well as the EUT earth itself can be at an elevated voltage level that would make touching dangerous. In many power connectors, even the screws are linked to the protective earth.**

10.4 Dangers concerning the EUT

- **EUTs are often simply functional samples that have not previously been subjected to any safety tests. It can therefore happen in some cases that the EUT is quickly damaged by internal overloads caused by the control electronics being disrupted or it may even start to burn.**
- **As soon as the EUT begins to show signs of being disrupted the test should be stopped and the power to the EUT switched off.**
- **Internal disruption of the electronics can result in the interference voltage or the EUT supply voltage being present on the EUT's outer casing.**
- **Electrical breakdown or arcing from and in plugged connections that is overstressed voltage-wise during the test.**
- **Explosion of components with fire or fragmentation as a result of energy dissipated, e.g. from the resultant supply current or ignition of vaporized plastics materials.**
- **Faulty behavior by the EUT, e.g. a robot arm strikes out or a temperature controller fails, etc.**

10.5 Test setup

Regular setup is the CDN on the floor and the generator on top of the CDN. A standardized test setup can be referred at the IEC/EN 61000-4-5 standard, IEEE/ANSI A with 12 Ω impedance up to 15 kV and IEEE/ANSI B with 2 Ω impedance up to 8 kV.

1. Connect the ground strap of the CDN from the reference ground connector to the ground reference plate of the test setup. A proper earth strip to the CDN it is imperative. A proper grounding to the ground reference plane is essential to fulfil standard test requirements.

Operation without a protective earth connection is forbidden!

2. The earth connection between the CDN and the generator is realized via the shield of the HV connectors. No additional earth link from the generator CDN is needed.
3. Connect the HV cable between CDN and generator using the delivered cables.
4. Connect the 25 Pin system cable at the rear of the generator System out interface with the CDN System interface and tighten the screws of this connectors. (The pin setting is described in the NSG 3150 manual).
5. Connect the termination plug to the CDN system out interface to terminate the system.

   If accessories such as INA or MFO are used for the test, these may need to be connected as a “Daisy Chain” at the CDN System out interface to the System in connector from the accessories and be terminated via termination plug at System out.
6. Connect the mains to the CDN and to the generator.
7. Connect the EUT supply input, use the phase rotation detection to verify proper connection.
8. Use the delivered and insulated Allen key to connect the EUT cable on the EUT output of the CDN. Respect the phase L1 for single phase resp. L1, L2, L3 for the three phases connection. Do not forget to check the proper connection to the EUT earth. Make sure that the EUT is properly connected to the CDN EUT output.

To ensure a proper recognition of the automated accessories and CDN, the generator is the final unit to be switched on.

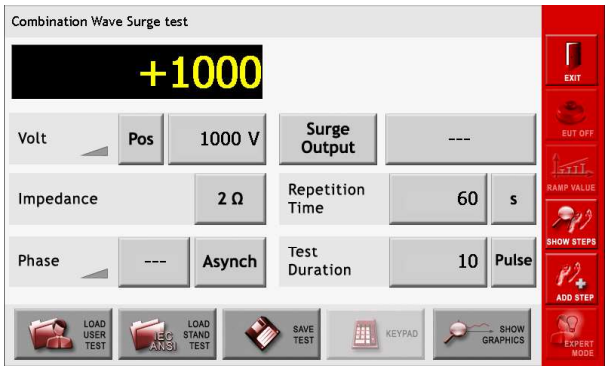
9. Switch on the mains on CDN first then the generator.
10. Start test procedure.

11 SETUP AND COUPLING MODE CONNECTION

11.1 General

As long as a CDN 3153-S63.1 3-phase coupler is connected to the generator, this CDN will always be taken as default unit and the 3-phase coupling modes is shown at the user interface.

12 COUPLING MODE SELECTION AT THE GENERATOR USER INTERFACE



The possible selections are:

- Surge output
- Manual CDN
- IEC coupling

12.1 Surge Output

If a CDN 3153-S63.1 3-phase coupler is connected to the generator, this CDN will always be taken as default unit and the 3-phase coupling modes is shown at the user interface.

The selection “Surge Output” is for using the HV pulse output plugs for any surge application without any CDN or other selectable device. The surge output selection will activate the HV pulse output. This can be a verification or an application to external equipment (no Teseq product).

No coupling to the EUT lines of the connected CDN will be realized.

12.2 Manual CDN

This selection must be used if an external manual coupler is connected; like CDN 3083 for surge pulse. With this selection, the loss of an external CDN will be compensated.

12.3 IEC coupling mode

12.3.1 IEC coupling

Touching the coupling line selection field, it will activate a new window with the selection possibilities.

Three phase setting windows for surge

The coupling path will be shown by open or closed relay signs.

By touching the “OK” button the selected coupling will be activated. With “cancel” it will close the window without saving the coupling selection. By touching the button “Show Graphics” it will show a graphical setting.

13 TECHNICAL DATA COUPLING NETWORK CDN 3153-S63.1

13.1 CDN 3153-S63.1

Mechanical

Dimensions CDN 3153-S63.1:		
W	554 mm	(21.8”)
H:	1105 mm	(43.5”; 25 HU)
D:	600 mm	(23.6”)
Weight CDN 3153-S63.1:	234 kg	(516 lb) approx.

Electrical

EUT Current rating Over temp protection	3 x 0 - 63 A continuous 3 x 110 A for ca. 10 min
Instrument supply:	85 to 265 VAC, 50 / 60 Hz (max. 3.15A)
Fuse instrument supply	3.15 A slow blow
Standard conform pulse:	Combination wave, max. 3.5 kA
EUT current range for surge	0 to 63 A as per IEC 61000-4-5 Ed.3
Connections:	HV-surge pulse input from generator (GES connector) Connector for EUT supply input (Knee lever connection Phoenix) Connector for EUT supply output (Screw terminals) System cable (25 pin connector) Earth connection Connector for control power
EUT supply:	Three phases (5 wire) Two phases (4 wire) Single phase (3 wire)
EUT VAC line to line:	Up to 690 VAC rms, 50 / 60 Hz (below 30 V sync not guaranteed, asynchronous mode only)
EUT VAC line to neutral / ground:	Up to 400 VAC rms, 50 / 60 Hz (< 30 V sync not guaranteed, asynchronous mode only)
EUT VDC max. DC current range:	1000 VDC (using INA3151-63) 63 ADC

EUT Fuse

External EUT fuse	63 A max. or depends the EUT rating
	REMARK: The CDN has no internal fuse

Environment

Temperature	10 °C to 40 °C
Humidity	30 % to 78 %, non-condensing
Atmospheric pressure	86 kPa (860 mbar) to 106 kPa (1,060 mbar)

13.2 Coupling possibilities IEC/EN 61000-4-5 / ANSI C62.45

Combination wave pulse IEC/EN 61000-4-5 / ANSI C62.45:		**EUT input connections**		
		1-phase L1, N, PE	**2-phase** L1, L2, N, PE	**3-phase** L1, L2, L3, N, PE
Line to ground (12 Ω)	up to 15 kV	L1 ⇨ PE	L1 ⇨ PE	L1 ⇨ PE
Line to ground (2 Ω)	up to 8 kV	N ⇨ PE	L2 ⇨ PE	L2 ⇨ PE
			N ⇨ PE	L3 ⇨ PE
				N ⇨ PE
Lines to ground (12 Ω)	up to 15 kV	L1, N ⇨ PE	L1, L2 ⇨ PE	L1, L2 ⇨ PE
Line to ground (2 Ω)	up to 8 kV		L1, N ⇨ PE	L1, L3 ⇨ PE
			L2, N ⇨ PE	L1, N ⇨ PE
			L1, L2, N ⇨ PE	L2, L3 ⇨ PE
				L2, N ⇨ PE
				L3, N ⇨ PE
				L1, L2, L3 ⇨ PE
				L1, L2, N ⇨ PE
				L1, L3, N ⇨ PE
				L2, L3, N ⇨ PE
Line to line (2 Ω & 12 Ω)	up to 15 kV	L1⇨ N	L1 ⇨ L2	L1 ⇨ L2
			L1⇨ N	L1 ⇨ L3
			L2, ⇨ N	L1 ⇨ N
				L2 ⇨ L1
				L2 ⇨ L3
				L2 ⇨ N
				L3 ⇨ L1
				L3 ⇨ L2
				L3 ⇨ N
Line to line (12 Ω)	up to 15 kV		L1, L2⇨ N	L1, L2 ⇨ N
Line to line (2 Ω)	up to 8 kV			L1, L3 ⇨ N
				L2, L3 ⇨ N
				L1, L2, L3 ⇨ N

All ANSI C62.45 couplings with 2 Ω up to 8 kV
All ANSI C62.45 couplings with 12 Ω up to 15 kV

13.2.1 Special ANSI C62.45 couplings

Selected coupling for single phase systems (one line and neutral with ground)

Test type	Connection of generator		
	Ground	**Neutral**	**Line**
Basic 1	Lo	HN	HH
Basic 2		Lo	
Supplemental 1	Lo	HN	
Supplemental 2	Lo		HH
Diagnostic 1		HN	Lo
Diagnostic 2		Lo	HH

Lo: Connection to Surge generator low
HG: Connection to surge generator high
HN: Connection to surge generator high by coupling to capacitor CN
HH: Connection to surge generator high by coupling to capacitor CH

Selected coupling for single phase systems (two lines and neutral with ground)

Test type	Connection of generator			
	Ground	**Neutral**	**Line 1**	**Line 2**
Basic 1	Lo	HN	H1	H2
Basic 2		Lo	H1	
Basic 3		Lo		H2
Supplemental 1	Lo	HN		
Supplemental 2	Lo		H1	
Supplemental 3	Lo			H2
Diagnostic 1		Lo	H1	H2
Diagnostic 2	Lo		H1	H2

Selected coupling for single phase systems (3-phase lines and neutral with ground)

Test type	Connection of generator				
	Ground	**Neutral**	**Line 1**	**Line 2**	**Line 3**
Basic 1	Lo	HN	H1	H2	H3
Basic 2			Lo	H2	
Basic 3				Lo	H3
Basic 4		H1	H1		Lo
Supplemental 1	Lo	HN			
Supplemental 2	Lo		H1		
Supplemental 3	Lo			H2	
Supplemental 4	Lo				H3
Diagnostic 1		Lo	H1	H2	H3
Diagnostic 2	Lo		H1	H2	H3

Lo: Connection to Surge generator low
HG: Connection to surge generator high
HN: Connection to surge generator high by coupling to capacitor CN
H1: Connection to surge generator high by coupling to capacitor C1
H2: Connection to surge generator high by coupling to capacitor C2
H3: Connection to surge generator high by coupling to capacitor C3

For more information see IEEE/ANSI Standard C62.45

13.3 CDN 3153-S63

Mechanical

Dimensions CDN 3153-S63:		
W	554 mm	(21.8”)
H:	1105 mm	(43.5”; 25 HU)
D:	600 mm	(23.6”)
Weight CDN 3153-S63.1:	234 kg	(516 lb) approx.

Electrical

EUT Current rating Over temp protection	3 x 32 A - 63 A continuous 3 x 110 A for ca. 10 min
Instrument supply:	85 to 265 VAC, 50 / 60 Hz (max. 3.15A)
Fuse instrument supply	3.15 A slow blow
Standard conform pulse:	Combination wave, max. 3.5 kA
EUT current range for surge	0 to 63 A as per IEC 61000-4-5 Ed.3
Connections:	HV-surge pulse input from generator (GES connector) Connector for EUT supply input (Knee lever connection Phoenix) Connector for EUT supply output (Screw terminals) System cable (25 pin connector) Earth connection Connector for control power
EUT supply:	Three phases (5 wire) Two phases (4 wire) Single phase (3 wire)
EUT VAC line to line:	Up to 690 VAC rms, 50 / 60 Hz (below 30 V sync not guaranteed, asynchronous mode only)
EUT VAC line to neutral / ground:	Up to 400 VAC rms, 50 / 60 Hz (< 30 V sync not guaranteed, asynchronous mode only)
EUT VDC max. DC current range:	1000 VDC (using INA3151-63) 63 ADC

EUT Fuse

External EUT fuse	63 A max. or depends the EUT rating
	REMARK: The CDN has no internal fuse

Environment

Temperature	10 °C to 40 °C
Humidity	30 % to 78 %, non-condensing
Atmospheric pressure	86 kPa (860 mbar) to 106 kPa (1,060 mbar)

13.4 Coupling possibilities

Combination wave pulse IEC/EN 61000-4-5:	**EUT input connections**		
	1-phase L1, N, PE	**2-phase** L1, L2, N, PE	**3-phase** L1, L2, L3, N, PE
Line to ground (12 Ω)	L1 ⇨ PE	L1 ⇨ PE	L1 ⇨ PE
	N ⇨ PE	L2 ⇨ PE	L2 ⇨ PE
		N ⇨ PE	L3 ⇨ PE
			N ⇨ PE
Lines to ground (12 Ω)	L1, N ⇨ PE	L1, L2 ⇨ PE	L1, L2 ⇨ PE
		L1, N ⇨ PE	L1, L3 ⇨ PE
		L2, N ⇨ PE	L1, N ⇨ PE
		L1, L2, N ⇨ PE	L2, L3 ⇨ PE
			L2, N ⇨ PE
			L3, N ⇨ PE
			L1, L2, L3 ⇨ PE
			L1, L2, N ⇨ PE
			L1, L3, N ⇨ PE
			L2, L3, N ⇨ PE
Line to line (2 Ω)	L1⇨ N	L1 ⇨ L2	L1 ⇨ L2
		L1⇨ N	L1 ⇨ L3
		L2, ⇨ N	L1 ⇨ N
		L1, L2⇨ N	L2 ⇨ L1
			L2 ⇨ L3
			L2 ⇨ N
			L3 ⇨ L1
			L3 ⇨ L2
			L3 ⇨ N
			L1, L2 ⇨ N
			L1, L3 ⇨ N
			L2, L3 ⇨ N
			L1, L2, L3 ⇨ N

13.5 General

There are no adjustable elements accessible to the user for either calibration or maintenance purposes.

The housing of the test system must not be opened. Should any maintenance or adjustment become necessary, the whole test system, together with an order or fault report, should be sent in to a Teseq service center.

Maintenance by the user is restricted to cleaning the outer housing, performing a function check and verification of the pulse parameters.

13.6 Cleaning

In general, a moist cloth is sufficient for cleaning the outer housing. In stubborn cases use a small amount of a mild, non-foaming household cleanser as well.

No chemicals should be used for cleaning purposes.

Before beginning to clean the test system, ensure that it is switched off and the mains power cable is unplugged from the supply.

13.7 Function check

The safety measures described previously must be strictly observed while carrying out a function check.

As soon as the test system is switched on the Power-LED should light up. If this is not the case, then please check the mains power connection to the test system as well as the fuses and any other cabling.

The instrument automatically carries out a diagnostic routine once it has been successfully switched on. The generator cannot perform any test while the Interlock circuit is open.

Pulse generation can be observed at the output connectors by using a differential voltage probe and an oscilloscope. This is a practical way to check that the system is functioning correctly but should never be used for reference or calibration purposes.

The safety measures described previously must be strictly observed while carrying out a function check.

13.8 Calibration

The combination of high voltages and high frequencies in a single pulse makes the calibration of EMC pulse generators particularly demanding and difficult. Teseq has one of the few accredited test laboratories in Europe, Asia and USA that is in the position to undertake calibrations in this specialized field.

14 WARRANTY

Teseq grants a warranty of 2 years on this test system, effective from the date of purchase.

During this period, any defective components part will be repaired or replaced free of charge or, if necessary, the test system will be replaced by another of equivalent value. The decision regarding the method of reinstating the functional capability is at the sole discression of Teseq.

Excluded from the warranty is damage or consequential damage caused through negligent operation or use as well as the replacement of parts subject to degradation.

The warranty is rendered invalid by any intervention on the part of the customer or a third party.

The faulty items are to be returned in their original packaging or other equivalent packaging suitable for the purpose of the foreseen means of transportation.

Teseq can accept no responsibility for damage in transit.

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Declaration of conformity

CE

Manufacturer:	AMETEK CTS GmbH
Address:	Sternenhofstrasse 15, 4153 Reinach, Switzerland
	declares that the following product
Product:	**CDN 3153-S63.1**
	conforms to the following Directives and Regulations
	EMC Directive 2014/30/EU LVD Directive 2014/35/EU
Generic standards:	EN 61326-1:2013 EN 61326-2-1:2013 EN 61010-1:2011

The purpose of this instrument is the generation of defined interference 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
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Tel: +41 61-7179191
Fax: +41 61-7179199

By	A. Burger Business Manager Conducted EMC
Place	Reinach BL, Switzerland
Date	09. December 2016

15 ACCESSORIES

The CDN 3153-S63.1 with the generator NSG 3150 is suitable for perform surge impulses up to 15 kV.

When using accessories rated for lower surge impulse voltages, the user is responsible not to test with higher voltages than the used equipment is rated.

15.1 CDN 3153-S63.1 accessories part of delivery

INA 3156	**15kV surge pulse cable** For connect the NSG 3150 to the CDN 3153-S63.1

INA 3015	**Isolated Allen Key** for CDN 3151 and CDN 3153-S63.1 EUT terminals

15.1.1 Calibration adapters (options)

INA 3154	**15 kV pulse verification box** **18 µF capacitor for NSG 3150** Dimension: 250mm x 160 mm x 155 mm Connection cable to generator: 0.5 m Weight: 3.9 kg
INA 3155	**Pulse verification voltage probe adapter** Surge calibration adapter set, to connect CDN 3153-S63.1 to the HV probe ex. DP20-20K or current probe Pearson Model 4997. Can also be used for EUT connection to CDN 3153-S63.1 via banana plugs, limited to 32 A.

15.2 Measuring accessories

15.2.1 CIC-Research DP20-20K differential high voltage probes

The CIC-Research DP20-20K high voltage differential probes are ideally suited to allow EMC engineers to verify their conducted EMC test generators periodically. Their performance permits to be used for many other purposes where higher voltages must be measured in a potential free manner.

Annual calibration and periodic verification
The annual calibration of test equipment recommended by most of the quality systems (ISO 9000, ISO 17025, etc.) must be considered as a validation of all measurements done since the last calibration.

Many EMC standards call for a verification of the test equipment before and after every test session. If the verification shows differing results, no valid test results can be assumed and the test equipment must be re-calibrated. It is therefore highly recommended that the EMC test engineer periodically verifies his test equipment to ensure good functionality and accuracy.

Periodic verification can be done before a test session or once a day or week or month; it is up to the user to decide. Only a few points need to be checked, which will take only a few minutes if the right test equipment is available.

Potential free (differential) measurements
Since it may be useful to measure pulses superimposed on the mains for periodic verification purposes, it is essential to work with differential measurements. Using classic non-differential probes and connecting with reversed polarity will result in the oscilloscope chassis being connected to the mains. In the best case a circuit breaker will trip, in the worst case, for example if the oscilloscope is battery powered or supplied via an isolation transformer, the oscilloscope chassis will be at a voltage equal to mains voltage plus the peak pulse voltage, which could be lethal for the user. CIC-Research DP20-20K high voltage differential probe DP20-20 is ideally suited to measure all kinds of EMI pulses in the microsecond range, industrial, telecom and automotive surges as well as power line dips, interrupts and distortions.

CIC-Research DP20-20K

Technical specifications DP20-20K

Attenuation ratio:	1:20,000
Bandwith:	DC to 120 MHz
Accuracy:	+ / 1.0 %
Max. input voltage different mode:	30 kV peak
Max. input voltage common mode:	15 kV peak
Input impedance:	20 MΩ / 2 pF each input ground
Common Mode Rejection CMRR (typical):	-145 dB at 100 Hz; -115 dB at 100 kHz, -100 dB at 10 MHz
Operating temperature:	-40 ºC to + 85 ºC (-40 ºF to 185 ºF)
Dimensions (L x W x D):	168 mm x 183 mm x 92 mm (6.625 x 7.22 x 3.625”)
Connector to scope:	50 Ω RG223 BNC-BNC and auxiliary earth lead
Input connectors:	4 mm safety plugs
Power	±5.20 V @ 100 mA
Weight:	2.5 kg approx. (5.5 lbs)

15.2.2 Pearson Model 4997 surge pulse current probe for 20 kA

The Model 4997 probe has been specially designed to verify surge current pulses as specified in IEC / EN 61000-4-5.

The main advantage of the Model 4997 current probe is, that the measuring system is physically isolated from the circuit under test. The probe can be used for current pulse verification on surge generators.

The Model 4997 current probe is ready to use as coming along with pre-mounted coaxial cable. The BNC-end plug needs to be connected to the high-impedance input or 50 Ω input of an ordinary memory oscilloscope. Then the conductor carrying the surge current to be measured is passed through the hole in the current probe. The resulting voltage wave shape on the oscilloscope will then be an authentically reproduction of the actual current wave shape within the given accuracy.

Technical specifications

Max. peak. Current:	20,000 Amp
Max. RMS current:	150 Amp
Sensitivity:	0.01 V / Amp (MΩ system), 0.005 V / Amp (50Ω system)
Hole diameter:	53.3 mm, 2.1 “
Probe connector:	BNC (UG-290A/U)
Scope coax cable:	BNC
Operating temperature:	0 to 65°C
Output impedance:	50 Ω
Accuracy:	<±1 %

15.2.3 Optional extension

INA 3151-63	**1000 VDC breaker for CDN 3153-63** Circuit breaker for Nominal voltage: 1000 V dc Nominal current: 63 A Dimension: 290 mm x 290 mm x 200 mm Weight: 7.3 kg.
INA 3050	**3 phase isolation transformer** 90KVA, Input 690V (p-p), Output 190/380/690V (p-p) Max 75A

16 SYSTEM DESCRIPTION

Parameter	Value	
Dimensions NSG 3150:		
W:	449 mm	(17.7”)
H:	310 mm	(12.9”; 7 HU)
D:	565 mm	(22.2”)
Weight NSG 3150:	41.2 kg	(90.8 lb) approx.
Dimensions CDN 3153-S63.1:		
W	554 mm	(21.8”)
H:	1105 mm	(43.5”; X HU)
D:	600 mm	(23.6”)
Weight CDN 3153-S63.1:	234 kg	(516 lb) approx.

Description:	Test system for EMC tests with mains-borne interference in accordance with the EN 61000-6-1 and 2 standards for surge tests. Operation via touch-screen or software-wise via a PC link Ethernet TCP / IP interface. Pulse output to external coupling networks. Housing for bench-top or rack use.
Housing:	Bench-top housing made of metal with molded plastic front panel. Supplementary rack-mounting kit.
Mains on / off:	On / off switch on rear panel of the instrument
Indicator LED’s on front panel:	Power on: LED, yellow, Pulse: LED, green, High voltage active: LED, red, EUT Power on: LED, green, Error: LED, red
Safety functions:	Main fuses, interlock, EUT fail input
Ambient conditions:	+5° to 40°C, 20 to 80 % relative humidity (non-condensing), 68–106 kPa atmospheric pressure
Self-test:	Routines for functional self-test
Relevant safety standards:	IEC 61010-1 safety requirements for electrical equipment used for measurement and control purposes as well as laboratory use
Relevant EMC electro-standards:	EN 61326-1 / EN 61326-2-1 Electrical equipment for measurement, control and laboratory use

Manufacturer

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