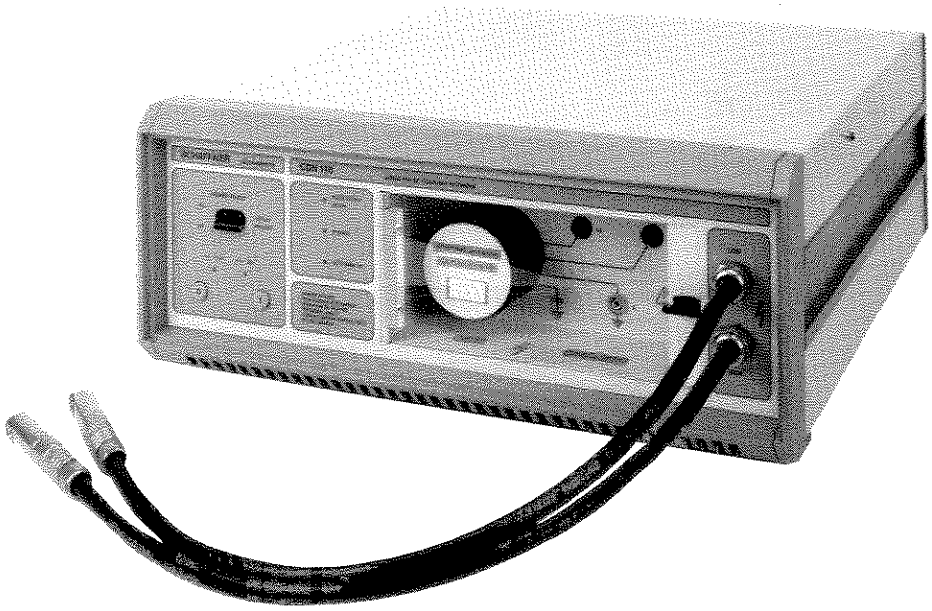
COUPLING NETWORK

CDN 110

OPERATING INSTRUCTIONS



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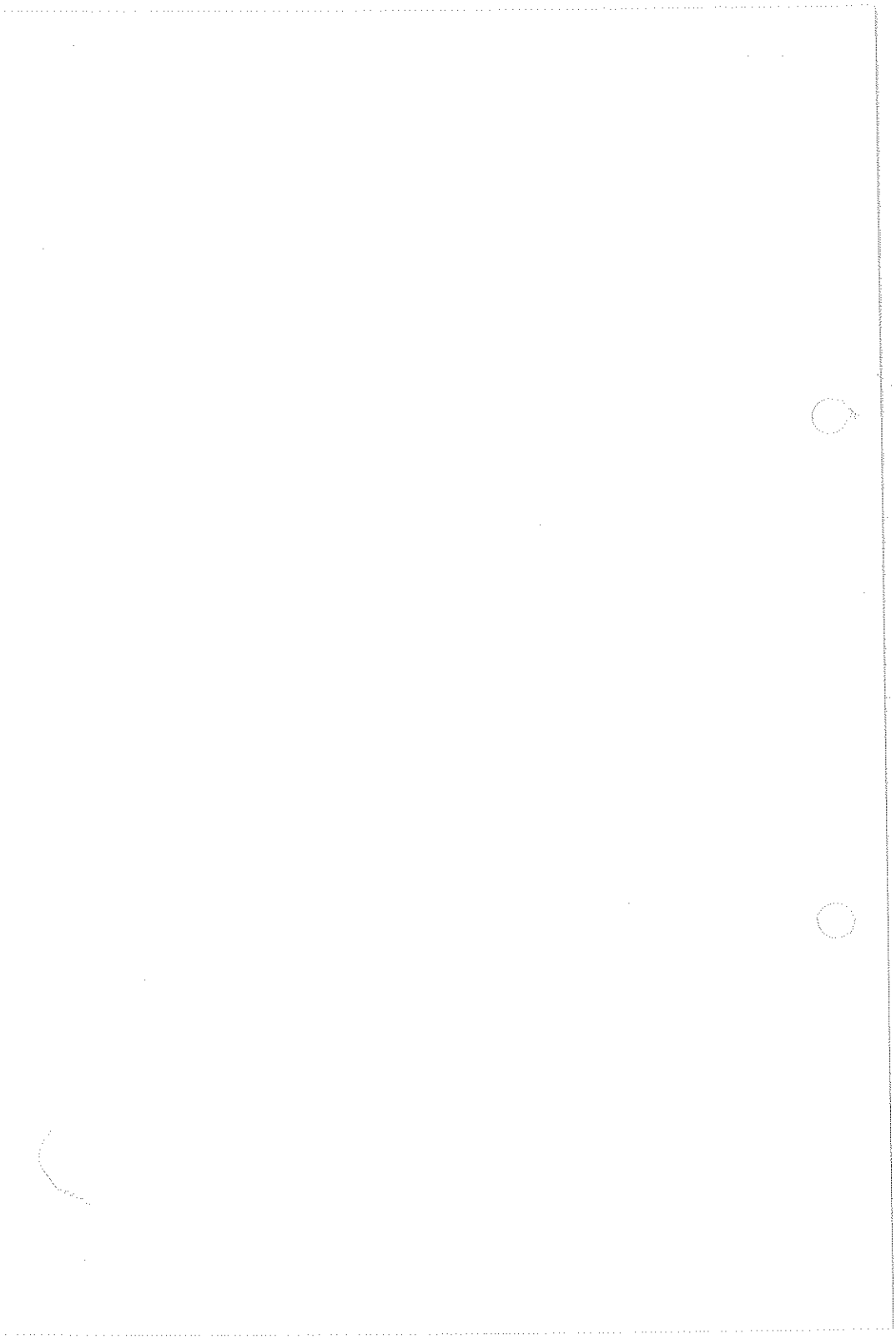

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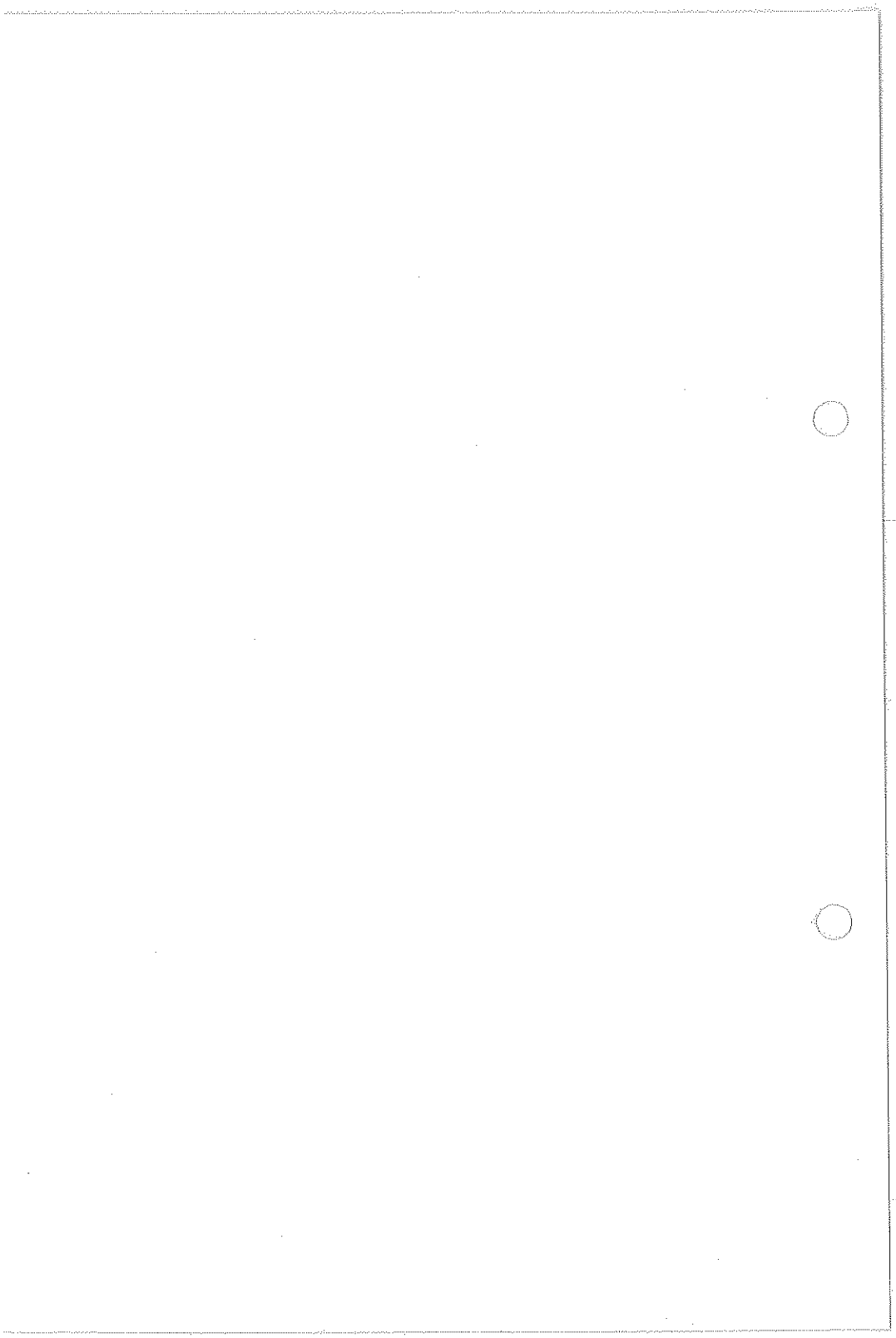


1 First things first: Safety

The Coupling Network CDN 110 is intended for use with the Surge Generators type NSG 650 and NSG 651. These generators produce high voltage test pulses that have high energy.

Incorrect or irresponsible operation can be lethal!

Keeping responsibly to the instructions and recommendations that follow is imperative.

The safety advice referring to the generators also applies and must be complied with when using the instruments together with the CDN 110.

Neither Schaffner Elektronik, Luterbach, Switzerland nor any of the associated sales organisations accept any responsibility for personal injury or for material or consequential damage that results through irresponsible or negligent operation of this equipment.

The coupling device itself is built in conformity with the VDE 100 Safety Standard and provides all the amenities for safe and reliable operation.

Safety measures

These operating instructions form an integral part of the instrument and must be studied carefully before putting the device into use as well as being available at all times to the operating personnel.

The instrument must only be used by trained personnel.

Persons fitted with a heart pacemaker must not operate the instrument and should not be in the vicinity of the test rig when pulses are triggered.

Arrange the working area in compliance with appropriate Safety Standards (e.g. VDE 104).

Connect an additional earth wire to the rear panel of the generator and to the coupling network.

The test rig must provide adequate insulation protection for up to 10 kV. Particular care should be given to the connections between the CDN 110 and the equipment under test (EUT).

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

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 it is switched on. The EUT supply should be switched off at the CDN 110.

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

2 Introduction

The Coupling Network CDN 110 serves to inject the following standardized surge pulses from the surge generator into the mains supply to the device under test:

Voltage surge of up to 6 kV which follows the 1.2/50 μs curve (open-circuit)

Current surge of up to 3 kA which follows the 8/20 μs curve (short circuit conditions).

The CDN 110 permits test pulses of up to 6 kV and is proofed for up to 10 kV.

The unit is used in conjunction with a surge generator in setting up a test rig. Surge pulse tests can be carried out on equipment, systems and installations that are in operation. Such tests are prescribed in IEEE 587, ANSI/IEEE C62.45, IEC 801-5, VDE 0109, etc.

The CDN 110 is designed to be used with an EUT supply of up to 420 Veff (phase to phase) or 230 Veff (phase to earth) at 16 A. Operation is simple and designed to be safe.

This coupling unit is built into a table-top housing which can be adapted for 19"-rack installation by the addition of the appropriate mounting brackets.

The construction takes into account the relevant specifications issued by the VDE and IEC concerning personal safety.

Interlock circuits prevent dangerous voltages from reaching the connections to the device under test in an unnoticed or unprotected manner. A prerequisite is the assembly of a correctly built test rig. In order to make the assembly of the test rig easier for the user, protective enclosures, external warning lamps, coupling modules, etc. are available as accessories.

3 Applications

The instrument is intended for surge voltage and surge current tests on mains-operated units, systems and installations with:

1.2/50 μs voltage pulse (open circuit)

Current surge with 8/20 μs current pulse (short circuit)

Combined voltage/current surge (hybrid pulse)

as called for in many international and national standard recommendations, such as:

ANSI/IEEE C62.45 - 1987

VDE 0109

IEEE 587

VDE 0845/T2

IEC 801-5

VDE 0846/T11

IEC 664

etc.

In conjunction with the generators type NSG 650 / NSG 651, the CDN 110 enables these types of test to be carried out with all types of symmetrical and asymmetrical coupling modes.

10	Coupling sockets	Red:	Pulse output (HIGH)
		Blue:	Pulse output (LOW)
		Black:	Line coupling
		Green:	HF-earth via capacitor
		Green/yellow:	System earth
11	EUT connections	Black:	Phase/neutral line
		Green/yellow:	System earth

WARNING When the EUT supply is switched on, the mains voltage is present at the mains sockets even if the protective door is open. This has been deliberately done so that if an adjustment is necessary to the EUT, it does not have the supply cut off from it.

A small modification to the internal wiring, that can be undertaken by any SCHAFFNER Service Center, ensures that the supply to the EUT is also switched off when the interlock contact is opened.

12 HV pulse connections — Pulse connection to the generator (HIGH/LOW)

WARNING Because of the large coupling capacitors used, the mains voltage is also present on the inner conductors when the EUT supply is switched on. It is therefore imperative to plug the high voltage connectors into the generator **first**.

13 Interlock connector — For external signal lamps and safety contacts.

WARNING The mains voltage is present at some of the connector pins when the generator is switched on.

14 Interlock cable — Interlock connection to the surge generator

15 Fuse-holder — Instrument protection

16 Blanking plates

17 Earth connection — For connecting a safety earth to the mains earth or for a surge earth connection from the test rig.

Make reliable earth connections!

18 EUT supply connector

5.3 Wiring of the connectors

5.3.1 EUT power feed

The power is fed in via a 3-core screened cable. The cores are brought out as loose leads:

Blue:	L1
Brown:	L2
Green/yellow:	Protective earth
Green/yellow:	Cable screen

The cable screen and the protective earth are normally wired in common to the protective earth.

LED's on the front panel indicate to which line the phase is connected.

5.3.2 Earth connection

The earth connection lug serves to ensure a positive connection to the mains earth. On the instrument side it is electrically connected to the mains earth and the instrument case. In the case of a test installation with a solid earth (e.g. a Faraday cage), this lug can be used to form a star-connection point for the earth wires.

5.3.3 Interlock connector

A solid 8-pin connector is provided for the connection of external safety elements.

The door or safety contact prevents the high voltage from being switched on while it is in the open state. The contact is fed with 220 Vac at up to 100 mA from the NSG 650/651.

The external signal lamps enable the operating status of the generator to be seen from a distance. The signal lamps are supplied with 220 V (60 W max.).

The interlock connector supplied with the generator is plugged into the CDN 110, then the interlock link cable from the CDN 110 is connected to the generator. Neither the generator nor the coupling network can be operated if the interlock connector is extracted. If no safety contact is used in the arrangement of the test rig, a wire link has to be inserted in its place in the interlock connector.

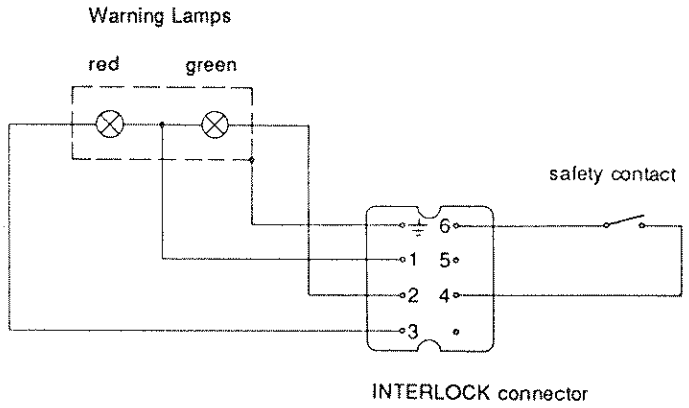


Fig. 3 - Wiring to the interlock connector

5.3.4 Interlock connection

The interlock connection to the generator loops the safety circuit from the CDN 110 through to the NSG 650/651. The interlock connection cable also carries the instrument power supply to the CDN 110. Without this connection the CDN 110 is therefore unable to operate.

5.3.5 High voltage connections

The coaxial high voltage cables from the CDN 110 have to be connected to the generator outputs (HIGH to HIGH / LOW to LOW). The cores of the cables carry the pulse voltage (earth-free, differential generator concept) while the shields are electrically connected to the instrument's chassis and the protective earth.

ATTENTION

Because of the large coupling capacitors, the mains voltage can be present at the HV connectors when the EUT power supply is switched on. The HV connectors must therefore always be hooked up to the generator before the mains and the EUT power supply are switched on.

5.4 Test rig

Every test rig must be planned carefully. All the instrumentation should be readily accessible and rigidly positioned. Cable connections are to be made positively.

WARNING

The foregoing safety measures are to be observed. The test object may only be handled when the instruments are switched off. The power supply to the EUT is not affected by the interlock circuit and hence has to be switched off separately.

ATTENTION

The whole test assembly should be supplied from the same mains connection in order to prevent an uncontrolled flow of pulse current in other parts of the system. Installation in a Faraday cage ensures that non-associated items and equipment are not disrupted by pulses radiated from the cabling or the device under test. Connections to the EUT must be of low impedance and be made with high contact pressure otherwise welding or arcing can occur at the contact points.

5.4.1 Schematic layout of a test facility

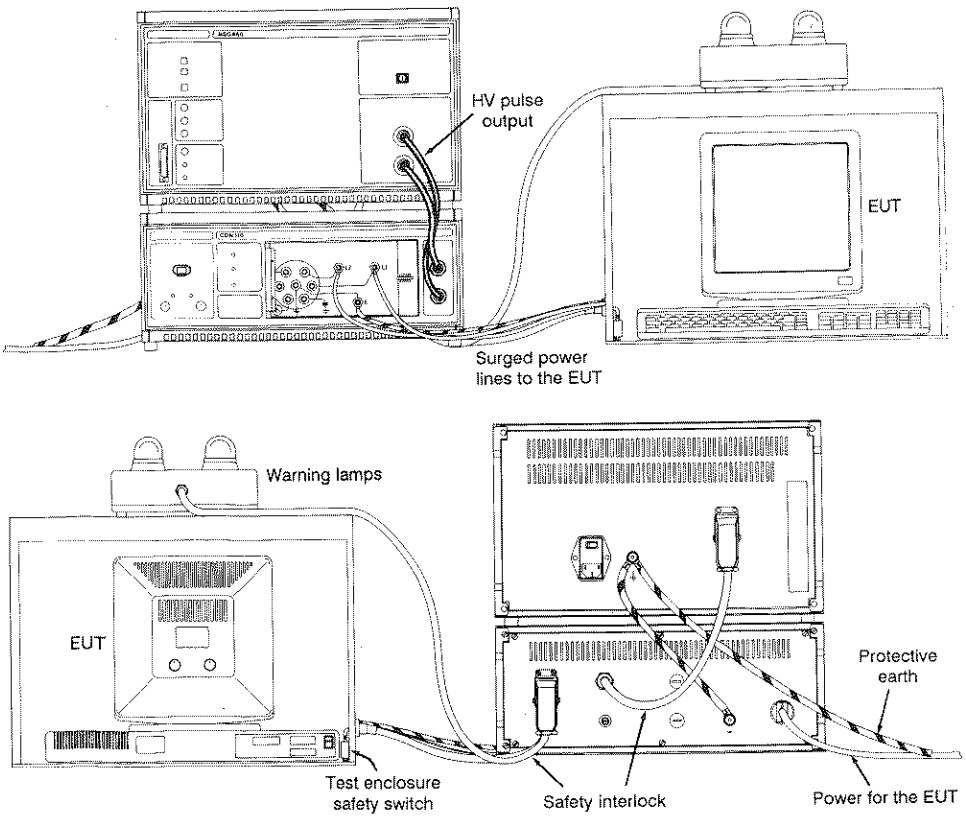
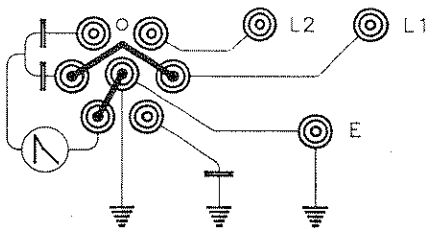


Fig. 4 - System configuration with the CDN 110 and NSG 650/651

5.4.2 Coupling modes with the CDN 110

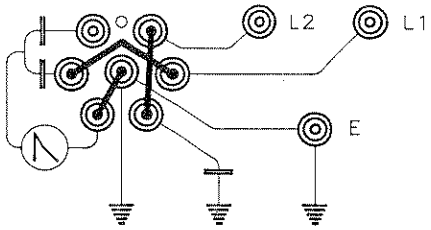
Non-symmetrical coupling into L1

a) Pulse HIGH → L1
Pulse LOW → E
L2 → ∞



This coupling mode can also be achieved by using the coupling module INA202.

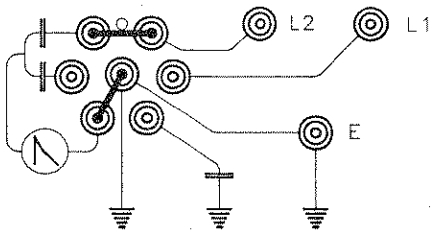
b) Pulse HIGH → L1
Pulse LOW → E
L2 → 0



This coupling mode can also be achieved by using the coupling module INA 203.

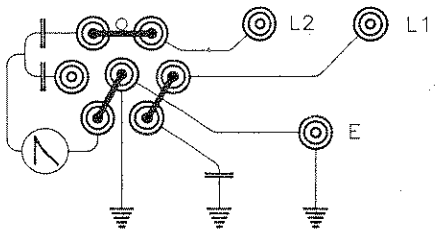
Non-symmetrical coupling into L2

c) Pulse HIGH → L2
Pulse LOW → E
L1 → ∞



This coupling mode can also be achieved by using the coupling module INA 204.

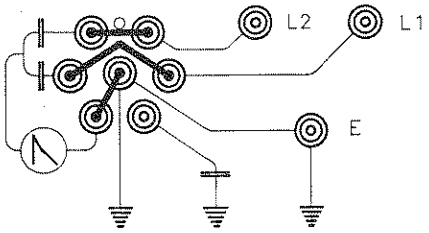
d) Pulse HIGH → L2
Pulse LOW → E
L1 → 0



This coupling mode can also be achieved by using the coupling module INA 205.

Asymmetrical coupling into L1 and L2

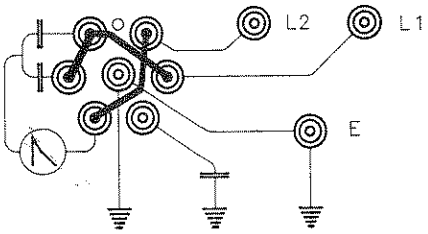
e) Pulse HIGH → L1 and L2
Ground → E



This coupling mode can also be achieved by using the coupling module INA 201.

Symmetrical coupling between L1 and L2

f) Pulse HIGH → L1
Pulse LOW → L2



This coupling mode can also be achieved by using the coupling module INA 206.

ATTENTION

Because of the coupling and decoupling capacitors, leakage and mains feedback currents of up to 4 A can flow. The earthing of the system should be carefully thought out and be reliably effected. Large resultant mains currents can occur in the event of the device under test breaking down (danger of fire). Such currents should be taken into account in the choice of fuses and overload protection devices.

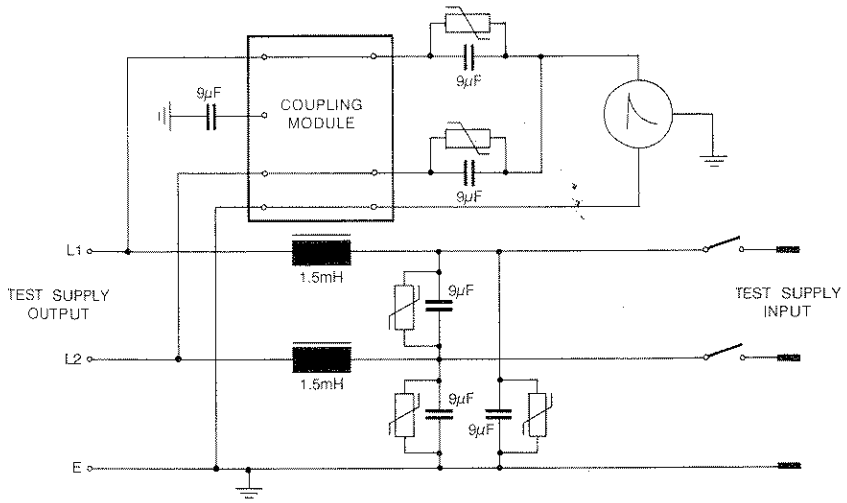


Fig. 5 - Schematic showing pulse coupling into L1 and L2

5.5 Effect on the device under test

The pulse contains considerable energy. When superimposed on the mains, a significant resultant current can occur if the EUT becomes defective. The effects can be very various, depending on the characteristics of the device being tested:

- No effect
- Brief faulty operation without permanent damage
- Reduction of the insulation resistance or similar
- Quality is affected (life expectancy)
- Change in the technical specification of the device under test
- Flash-over in cables, connectors and equipment
- Bursting of components
- Explosion of components
- Burning of parts caused principally by resultant mains current when mains superimposition mode is used
- Damage to equipment, systems or components that are electrically or inductively coupled to the pulse current path.

When testing with high energy surge pulses, a test on a device should never be considered as being damage-free until a subsequent thorough investigation proves that the EUT is still fully intact.

5.6 Installation

This section describes the checkover and installation of the CDN 110 coupling network after delivery as well as providing a check on the functions of the unit after being transported or following significant changes to the test rig.

a) Installation should only be carried out by experienced personnel

b) Check that the delivery is complete

c) Check the unit for any signs of damage in transit. Report any damage found to the carrier immediately.

d) Study the manual

e) Set up the surge generator in accordance with the instructions in its manual but do not, however, switch the instrument on.

f) For convenience, place the coupling network underneath the generator.

g) Connect the protective earth to the terminal **17**. The same protective earth should also be connected to the earth terminal of the generator.

h) Plug the high voltage connectors into the surge generator. **IMPORTANT!**

i) Switch off the circuit breaker in the coupling unit.

j) Connect the EUT supply. The screen is normally connected to the protective earth.

k) Extract the interlock connector from the generator and plug it into the coupling unit. (This might be just a bridged connector or it may be a connection to the signal lamps).

l) Establish the interlock connection between the coupling unit and the generator.

m) Switch on the mains at the generator.

n) Function check: the "PULSE OUTPUT ACTIVE / STANDBY" indicator shows "STANDBY" and only changes to "ACTIVE" when pulse triggering is implemented in the generator's "Test" menu.

o) Function check: Check the operation of EUT power "ON/OFF" **1**, **2** and the "EUT POWER ON" indicator **8** (check with a voltmeter at the EUT output, as necessary).

p) Choose the appropriate coupling mode, insert the corresponding module or use laboratory safety cables according to the wiring diagram.

q) Connect the device to be tested according to the relevant safety specifications and with due regard to the magnitude of the pulse voltage selected. Take the necessary measures to cope with any possible explosion or outbreak of fire.

r) Close the protective door/cover (interlock circuit).

s) Switch on the EUT power supply.

t) Operate the generator as instructed in its manual and carry out the required tests.

5.7 Operation of the instruments

It is assumed that the test rig has been set up in accordance with the foregoing notes and that the device to be tested has been connected taking the relevant safety measures into account.

a) Select the required coupling mode.

b) Switch on the power supply to the EUT (can be left switched on even when changing the coupling mode provided that the EUT is protected against being touched accidentally).

c) Operate the generator as instructed in its manual.

d) Test the device.

WARNING

Only handle the test rig or the device being tested when the EUT power supply **1** is switched off and the generator's test sequence has been halted or aborted (system is in the STANDBY state).

6 Maintenance

On the rear panel there is a fuse in the supply to the instrument through which the control logic and indicating elements are powered.

Replacement fuse: 5 x 20mm as per IEC 127/III and DIN 41662, 400mA slow-blow.

Only specialist or trained maintenance personnel may carry out internal work on the instrument. In the event of more involved service or repair work being necessary, the instrument should be returned to a SCHAFFNER Service Center accompanied by an appropriate description of the problem.

7 Technical specifications

7.1 Electrical specifications

Number of phases	1
AC - voltage, 50/60 Hz	24 ... 420 V rms (phase - phase) 24 ... 230 V rms (phase - protective earth)
DC - voltage	24 ... 80 V
Current	16 A max. continuous
Overload protection	Resettable thermal circuit breaker
Overload capability at 23°C	150% for 20 sec 200% for 8 sec 500% for 0.9 sec 1000% for 0.1 sec
Voltage drop at 16 A	5%
Decoupling attenuation:	
EUT to mains feed	Residual pulse on the mains: 10% or 2 x V_p max. of EUT supply (at 230 V rms)
Crosstalk attenuation:	Residual pulse on non-disturbed line: 15% or 300 V max.
The following Standard-conform test pulses can be injected	1.2/50 µs up to 6 kV 8/20 µs up to 3 kA 0.5/100 kHz up to 6 kV
Coupling:	
Coupling capacitors	18 µF or 9 µF (depending on coupling mode)
Decoupling capacitors	9 µF
Decoupling inductors	1.5 mH (without magnetic coupling)
Coupling modes: symmetric:	L1 --> L2
asymmetric:	L1+L2 --> E
non-symmetric:	L1 --> E or L2 --> E The non-disturbed line can be set for high or low impedance to earth.
Instrument power supply:	Supplied by the Generator NSG 650/651

7.2 Mechanical specifications

Dimensions	Width:	449 mm (17.7")
	Height:	183 mm (7.2")
	Depth:	461 mm (18.2")
Weight	17 kg (37.5 lbs) approx.	

7.3 Operating and display elements

EUT supply protective switch	Thermo-magnetic circuit breaker
EUT supply On/Off	Manually-operated switch
Phase indicator	LED (lights when L > 10V)
Operation indicators, HV-input	LED's, red and green
Status indicator, EUT supply on	LED, red
Connectors:	
Protective earth	Threaded connection
Coupling mode	Laboratory safety connectors or coupling modules
EUT connection	Laboratory safety connectors
EUT power supply	Cannon connector (rear panel)
HV inputs	Coaxial cable with Lemo HV connectors
Safety circuit (interlock)	Interlock plug with cable
Signal lamps and safety contact connection	Interlock connector from the generator is used

8 Ordering information

Order No.	Description
CDN 110	Surge Pulse Coupling Network The unit is supplied complete with a cable for the EUT supply, four cables for coupling mode selection, safety banana plugs for connecting the EUT and the operating instructions.

9 Optional accessories

Order No.	Description	
INA 201	Coupling module	L1+L2 → E
INA 202	" "	L1 → E (L2 open)
INA 203	" "	L1 → E (L2 capacitively to earth)
INA 204	" "	L2 → E (L1 open)
INA 205	" "	L2 → E (L1 capacitively to earth)
INA 206	" "	L1 → L2
INA 120	Test enclosure	with acrylic hood, high voltage cable and safety circuit
INA 140	Warning lamp unit	external warning device with red and green lamps as per VDE 0104
INA 160	Mounting brackets	for assembly of the unit in a 19" rack