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FIRST HANDLING GUIDE
NPI800 - NPI800R
PHASE AND EARTH
OVERCURRENT RELAY

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FOREWORD

The aim of this handbook is to provide to the User information useful for the commissioning and the tests of NPI800 and NPI800R relays, multifunction digital protections with 3 Phases + Earth over-current.

We advise you to read it carefully, in order to take note of the available functionalities and to proceed to connection and power of the product in accordance with the provided recommendations.

The protection functions described in the following chapters are user configurable locally or from *Configuration* menu, *Protection*, *Thermal Overload* and *Closing Function* sub-menus of the setting software:

- ◆ thresholds of over-current phases
- ◆ thresholds of zero-sequence current
- ◆ threshold of negative sequence current
- ◆ threshold of broken conductor

The operation functions of the products are locally user configurable or using the *Configuration* menu, *Circuit Breaker Maintenance*, *Logical Selectivity* and *Remote Control* sub-menus of the setting software.

Locally, setting, commissioning and real time or event readings are accessible from keyboard and displayed on the protection display.

To be fully exploited, the available functions must be parameterized and consulted with the setting software PC – Protection, provided with the product.

Before any use, we also recommend you to read the safety instructions of this Guide.

Info: this guide is the substitute A0335E1E. (First handling guide NPI800)

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1. Safety instructions

For your safety, we advise you to read the following information carefully. They aim to specify the precautions essential to the good installation and the correct operation of the relays.

1.1 Documentation

Following documentations are available for the NP800 and NP800R:

- ◆ Application guide of the NP800 and NP800R series
- ◆ User's Guide of Setting Software
- ◆ User's Guide (for each kind of relay)
- ◆ First Handling Guide (for each kind of relay)
- ◆ Diagram of each relay
- ◆ Dimensions and mounting diagram
- ◆ Matrix choice and dimensions of ring core type C.T.
- ◆ User's Guide and diagram of the BA800

We advise you to read them before any handling.

1.2 Connection of NP800 and NP800R relays

The terminal blocks of the relays are studied to ensure the safety of the people during the operation of the relays.

During installation, commissioning or maintenance, they can however present high voltages and possibly a thermal heating. Consequently, the following precautions must be respected:

- ◆ Connection of the terminal blocks at installation must be carried out after having ensured of the absence of any voltage
- ◆ Their access during operation must be carried out through adequate means ensuring as well electric as thermal insulation
- ◆ The connection of the earth of the relays must imperatively be done with mean of a 2.5 mm² wire.

Before powering the relays, it will be necessary to check particularly:

- ◆ The value of the voltage rating of the auxiliary supply and its polarization
- ◆ The tightening of the:
 - fixing rods of the current terminal blocks (NPI800)
 - fixing rods of the relay (NPI800R)
- ◆ The good realization of connections
- ◆ The reliability of the connection to the earth.

1.3 On load withdrawal

With voltage or on load, it is formally misadvised to withdraw the:

- Connectors and the current terminal blocks*
- NPI800R relay

* For NPI800 relays fitted with short-circuiting devices

1.4 Removal and destruction

The User should in no case open the relays. During their removal, they must be completely isolated from any external polarity and condensers must be discharged by connecting their external terminals to the earth.

Destruction of the relays will have to be carried out in accordance with legislation.

2. Preliminary information

In the NP800 and NP800R ranges of relays, technology used is digital.

Due to their design, they comprise a significant number of self-controls, as well as powering as under operation. Any material or software failure is automatically detected and announced by an alarm.

During the first use, it is thus not necessary to test all the functions. It is on the other hand recommended to look after and check the good wiring of the relay, and the specifications of this handbook have the aim of allowing a fast setting in order of the relay.

The User will be able then to define the setting values necessary to his installation, and to adjust the relay using the Setting software, common to the whole of the range. The saving of the configuration and its loading will be carried out with a laptop.

The functions of recording of events and disturbance recording, available through the setting software, will also largely contribute to the setting in order of the installation.

3. Relay checking and commissioning

3.1 Recommendations

All the relays are delivered after a final inspection in factory.

It is important before any test to make sure that the relay did not suffer any mechanical damage.

3.2 Checking's prior to the commissioning

This checking's intended to verify that the hardware did not suffer damage during its transport or its storage and constitute a proof of right operation at the set values.

These simple tests require minimum equipment, as indicated:

- ◆ A current generator with automatic injection cut-off system, timer and auxiliary supply.

The results of the tests all are expressed with a general tolerance of $\pm 10\%$, in accordance with the conditions of tests.

If the equipment does not have an automatic cut-off system, it is advised to stop the current injection as soon as the awaited phenomenon has occurred.

In order to be free from the interaction of the multiple functions of the relay, the tests must be carried out function per function.

3.3 Diagram of connection

NPI800: The connection diagram is available under the S38018 reference.

NPI800R: The connection diagram is available under the S39962 reference.

4. Checking of the Thermal Unit [49]



4.1 Cable Thermal Image

Before any test, please read paragraph "Checking's prior to the commissioning".
 Enable the thermal overload function and select Cable as device to be protected.
 The test of the thermal unit will be carried at 2 times the rated value.

- ◆ C_t is the thermal heating time-constant.
- ◆ I_b is the thermal trip threshold.

Sequence of the operations to be carried out		Result to obtain
Apply the auxiliary supply.		Indication « CURRENT I1 0.0A » on the display
Connect the current generator to the terminals:		
NPI800: IA-S1 and IA-S2	NPI800R or RE: T1-2 and T1-3	
Preset the current at $2 \times I_b \times I_n$ then stop the injection		
Assign an output unit to the « TH. TRIP RELAY » function and use the contact to stop the current generator.		
Switch off the auxiliary supply then restore it.		
Inject the current. At the end of the tests cut the injection		Operation of the output unit of at the end of $t = C_t \times 17,3$ (time is expressed in seconds) Indication « TRIP THERMAL OVERLOAD » on the display

Wait until the thermal state decreases below the threshold.

Acknowledge the fault thanks to the  key then use  key.

Disable the thermal image function

4.2 Transformer Thermal Image

Before any test, please read paragraph "Checking's prior to the commissioning".



Enable the thermal overload function and select Transformer as device to be protected.

The test of the thermal unit will be carried at 2 times the rated value, with the adjustment of the Start Ratio = 100 % and the Negative sequence Factor = 0.

- ◆ C_t is the thermal heating time-constant.
- ◆ I_b is the thermal trip threshold.

Sequence of the operations to be carried out		Result to obtain
Apply the auxiliary supply.		Indication « CURRENT I1 0.0A » on the display
Connect the current generator to the terminals:		
NPI800: IA-S1 and IA-S2	NPI800R or RE: T1-2 and T1-3	
Preset the current at $2 \times 3 \times I_b \times I_n$ then stop the injection NB: 3 due to single phase test		
Assign an output unit to the « TH. TRIP RELAY » function and use the contact to stop the current generator.		
Switch off the auxiliary supply then restore it.		
Inject the current. At the end of the tests cut the injection		Operation of the output unit of at the end of $t = C_t \times 17,3$ set (time is expressed in seconds) Indication « TRIP THERMAL OVERLOAD » on the display

Wait until the thermal state decreases below the threshold.

Acknowledge the fault thanks to the  key then use  key.



Disable the thermal image function

5. Checking of the Low-set Phase Threshold [51-1]

Before any test, please read paragraph "Checking's prior to the commissioning".

Enable the low-set phase function.

Sequence of the operations to be carried out		Result to obtain
Apply the auxiliary supply.		Indication « CURRENT I1 0.0A » on the display
Connect the current generator to the terminals:		
NPI800: IA-S1 and IA-S2	NPI800R or RE: T1-2 and T1-3	
Set the type of time delay on Definite		
Assign an output unit to the « REL. TRIP tl » Trip Relay function and use the contact to stop the current generator.		
Increase the current slowly.		
When the injected current becomes higher than the Low Phase Threshold.		Indication « INSTANT. PHASE THRESHOLD > » on the display, following by the operation of the output unit at the end of the Time delay of the Low Phase Threshold Indication « TRIP PH > » on the display
Preset the current at 1.5 x the low phase threshold then stop the injection.		
Switch off the auxiliary supply then restore it.		
Inject the current. At the end of the tests cut the injection		Operation of the output unit at the end of the Time delay of the Low Phase Threshold Indication « TRIP PH > » on the display

Acknowledge the fault thanks to the  key then use  key.



Disable the low-set phase function.

6. Checking of the High-set Phase Threshold [51-2]

Before any test, please read paragraph "Checking's prior to the commissioning".

Enable the high-set phase function.

Sequence of the operations to be carried out		Result to obtain
Apply the auxiliary supply.		Indication « CURRENT I1 0.0A » on the display
Connect the current generator to the terminals:		
NPI800: IB-S1 and IB-S2	NPI800R or RE: T1-6 and T1-7	
Set the type of time delay on Definite		
Assign an output unit to the « REL. TRIP tI>> » Trip Relay function and use the contact to stop the current generator.		
Increase the current slowly.		
When the injected current becomes higher than the High Phase Threshold.		Indication « INSTANT. PHASE THRESHOLD>> » on the display, following by the operation of the output unit at the end of the Time delay of the High Phase Threshold Indication « TRIP PH >> » on the display
Preset the current at 1.5 x the high phase threshold then stop the injection.		
Switch off the auxiliary supply then restore it.		
Inject the current. At the end of the tests cut the injection		Operation of the output unit at the end of the Time delay of the High Phase Threshold Indication « TRIP PH >> » on the display

Acknowledge the fault thanks to the  key then use  key.



Disable the high-set phase function.

7. Checking of the very High-set Phase Threshold [50]

Before any test, please read paragraph "Checking's prior to the commissioning".

Enable the very high-set phase function.

Sequence of the operations to be carried out		Result to obtain
Apply the auxiliary supply.		Indication « CURRENT I1 0.0A » on the display
Connect the current generator to the terminals:		
NPI800: IB-S1 and IB-S2	NPI800R or RE: T1-6 and T1-7	
Assign an output unit to the « REL. TRIP tI>>> » Trip Relay function and use the contact to stop the current generator.		
Increase the current slowly.		
When the injected current becomes higher than the High Phase Threshold.		Indication « INSTANT. PHASE THRESHOLD>>> » on the display, following by the operation of the output unit at the end of the Time delay of the High Phase Threshold Indication « TRIP PH >>> » on the display
Preset the current at 1.5 x the high phase threshold then stop the injection.		
Switch off the auxiliary supply then restore it.		
Inject the current. At the end of the tests cut the injection		Operation of the output unit at the end of the Time delay of the High Phase Threshold Indication « TRIP PH >>> » on the display

Acknowledge the fault thanks to the  key then use  key.



Disable the very high-set phase function.

8. Checking of the phase Negative Sequence Current [46]

Before any test, please read paragraph "Checking's prior to the commissioning".

Enable the phase negative sequence current function.

Sequence of the operations to be carried out		Result to obtain
Switch off the auxiliary supply then restore it.		Indication « CURRENT I1 0.0A » on the display
Connect the current generator to the terminals.		
NPI800: IC-S1 and IC-S2	NPI800R or RE : T1-10 and T1-11	
Assign an output unit to the Unbalance Trip function « REL. TRIP I2> » and use the contact to stop the current generator.		
Set the I2> threshold at 0.5 In and the type of time delay on Definite.		
Increase the current slowly.		
When the injected current becomes higher than 3 x I2> x In.		Indication « INSTANT. THRESHOLD I2> » on the display, following by the operation of the output unit at the end of the Time delay of the Negative Sequence fault Threshold. " REL. TRIP I2> " Indication " REL. TRIP I2> " on the display.
Preset the current at 1.5 x the threshold then stop the injection.		
Switch off the auxiliary supply then restore it.		
Inject the current. At the end of the tests cut the injection		Operation of the output unit at the end of the Time delay of the Negative sequence current Indication « TRIP I2> » on the display

Acknowledge the fault thanks to the  key then use  key.

Disable the phase negative sequence current function.

9. Checking of the earth fault units [51N]

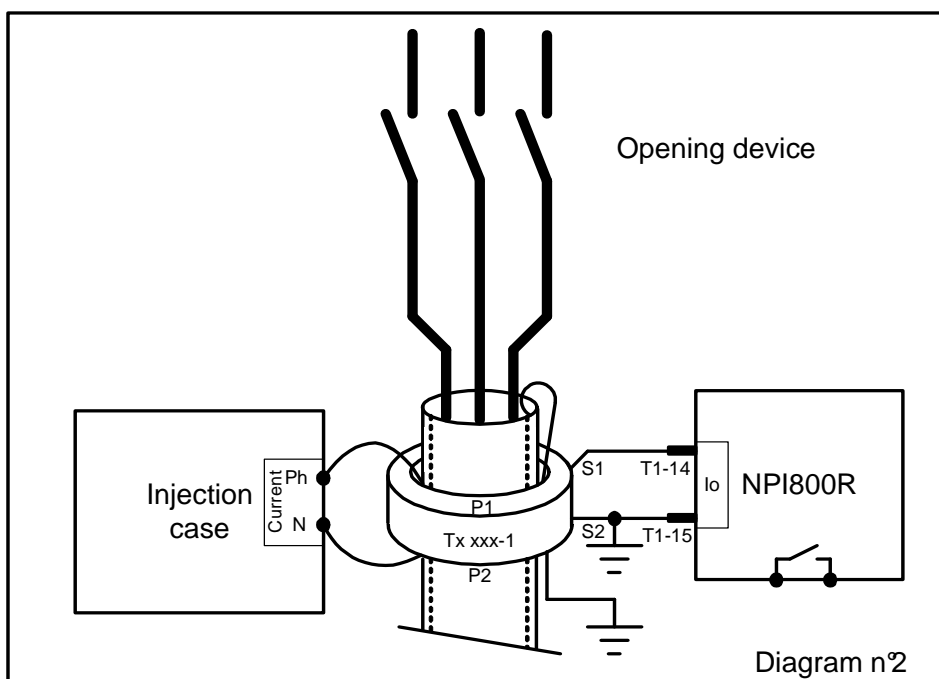
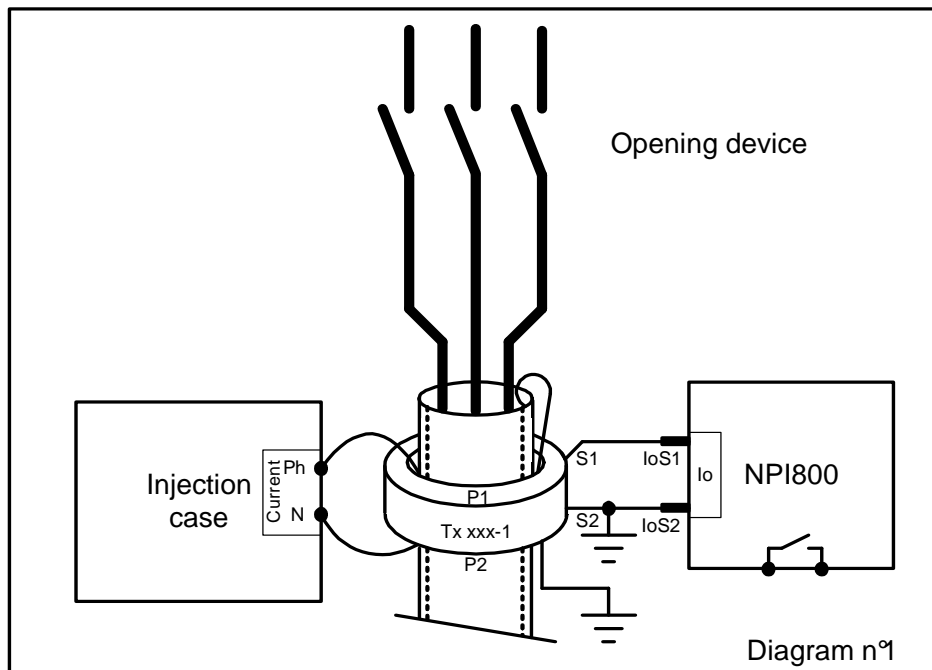
Before any test, please read paragraph "Checking's prior to the commissioning".

Enable the earth low-set function

9.1 Earth unit with ring C.T. (Test according relay characteristic)

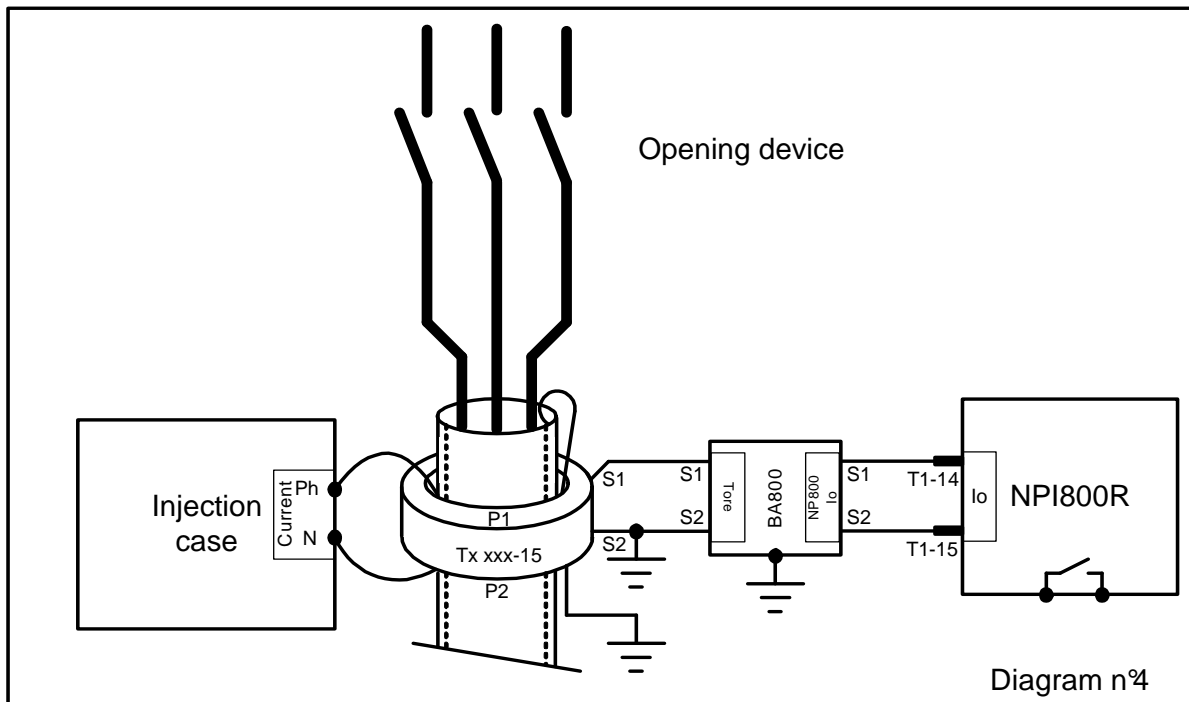
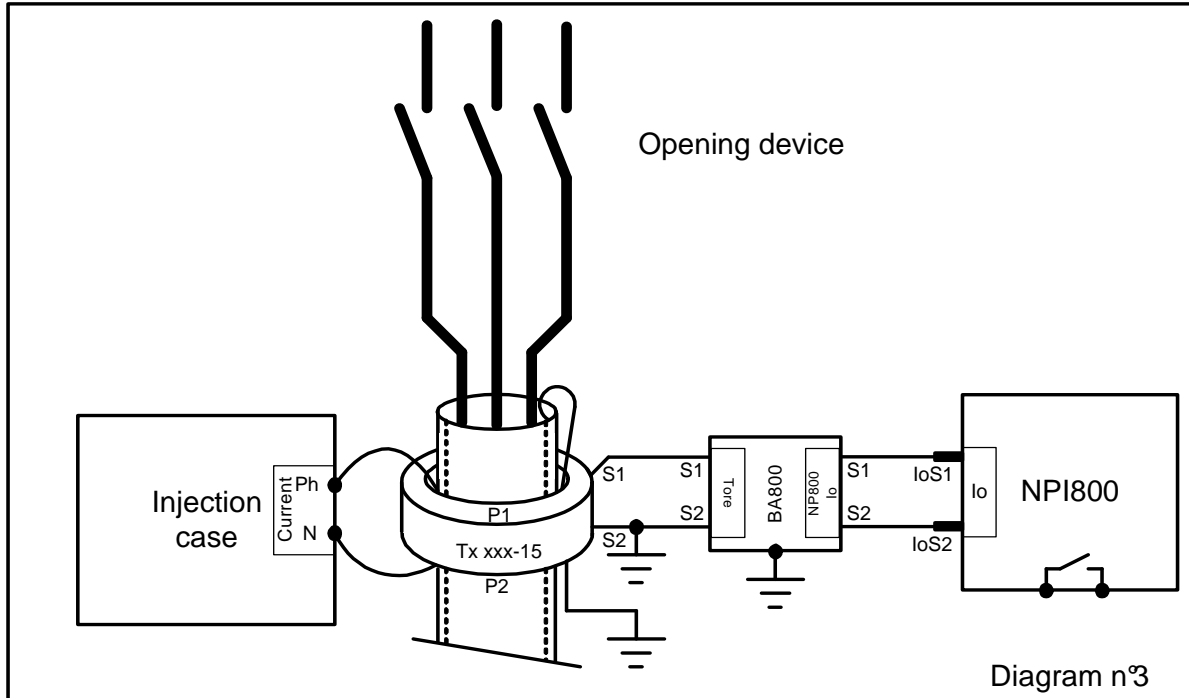
9.1.1 Ring C.T. - TX xxx-1 (ring CT supply with the relay, ratio 1/100)

Connect the current generator to the primary of the ring C.T. of which the secondary is linked to **IoS1** and **IoS2** for the **NPI800** relays (see diagram n°1) or to **T1-14** and **T1-15** for the **NPI800R** relays (see diagram n°2)





9.1.2 Ring C.t. - TX xxx-15 (ring CT, ratio 1/1500)

Connect the current generator to the primary of the ring C.T. of which the secondary is linked to Tore S1 and Tore S2 for BA800. The secondary of BA800 is linked to **IoS1** and **IoS2** for the **NPI800** relays (see diagram n°3) or to **T1-14** and **T1-15** for the **NPI800R** relays (see diagram n°4)





Sequence of the operations to be carried out.	Result to obtain.
Switch off the auxiliary supply then restore it.	Indication « CURRENT I1 0.0A » on the display
Set the type of time delay on Definite.	
Assign an output unit to the Earth fault function « REL. TRIP t IO> » and use the contact to stop the current generator.	
Increase the current slowly.	
When the injected current becomes higher than the Low Earth Threshold.	Indication « INSTANT. LOW EARTH THRESHOLD> » on the display, following by the operation of the output unit at the end of the Time delay of the Earth fault Threshold. Indication « TRIP Io > » on the display.
Preset the current at 2 x the low earth threshold then stop the injection.	
Switch off the auxiliary supply then restore it.	
Inject the current. At the end of the tests cut the injection	Operation of the output unit at the end of the Time delay of the Low Earth Threshold Indication « TRIP Io > » on the display

Acknowledge the fault thanks to the  key then use  key.

Disable the Earth fault function.

9.2 Earth unit with residual connection (test according relay characteristic)

Sequence of the operations to be carried out.		Result to obtain.
Switch off the auxiliary supply then restore it.		Indication « CURRENT I1 0.0A » on the display
Connect the current generator to the terminals :		
NPI800:Io-S1 and Io-S2	NPI800R or RE : T1-14 and T1-15	
Set the type of time delay on Definite.		
Assign an output unit to the Earth fault function « REL. TRIP t IO> » and use the contact to stop the current generator.		
Increase the current slowly.		
When the injected current becomes higher than the Low Earth Threshold.		Indication « INSTANT. EARTH THRESHOLD> on the display, following by the operation of the output unit at the end of the Time delay of the Earth fault Threshold. Indication « TRIP Io > » on the display.
Preset the current at 2 x the low earth threshold then stop the injection.		
Switch off the auxiliary supply then restore it.		
Inject the current. At the end of the tests cut the injection		Operation of the output unit at the end of the Time delay of the Low Earth Threshold Indication « TRIP Io > » on the display

Acknowledge the fault thanks to the  key then use  key.

Disable the Earth fault function.

10. Commissioning

Before the commissioning of the relay, it is necessary to check that the:

- ◆ The current transformer's have a secondary rated current in conformity with the rating mentioned on the relay label and have a minimum power of 5VA, class 5P20.
- ◆ Frequency of the relay label is the same as the frequency of the network
- ◆ Wiring is in conformity with the connection diagram
- ◆ The phase sequence and the CTs connection are not reversed
- ◆ Auxiliary supply match the auxiliary supply range of the relay label
- ◆ Tripping circuit is OK.
- ◆ Fixing rods of the NPI800 current terminal blocks* are correctly tightened
- ◆ Fixing rods of the NPI800R are correctly tightened

* For NPI800 relays fitted with short-circuiting devices

WARNING: check the phase sequence order

11. Checking of the connection of the current inputs

Example of various connection of the current inputs if $|I_1| = |I_2| = |I_3| = I$

Thanks to the menu « Measurement » checking of the relay connection:

Connection	Positive sequence	Negative sequence
Correct connection Correct phase rotation	1	0
2 phases crossed or correct connection with wrong phase rotation	0	1
One phase open-circuit	$\frac{2}{3}xI$	$\frac{1}{3}xI$
Two phases open-circuit	$\frac{1}{3}xI$	$\frac{1}{3}xI$
Reversed inputs on 1 or 2 CT	$\frac{1}{3}xI$	$\frac{2}{3}xI$
2 Phases in opposition	$\frac{\sqrt{3}}{3}xI$	$\frac{\sqrt{3}}{3}xI$
2 Phases in phase	$\frac{1}{3}xI$	$\frac{1}{3}xI$
3 Phases in phase	0	0