# GENERATION & NETWORK
## Phase and Earth Overcurrent Relay

# NPI800
# NPIR800

Protection & Control ice

NPI800 provides the three-phase and earth fault overcurrent protection for medium and high voltage electrical networks. This multi-function relay supervises phase to phase and phase to earth faults, negative sequence currents, thermal state of the protected device and the good operating of the circuit breaker and its trip circuit.

As well as the usual protection functions, NP800 relays provide monitoring, measurement and recording of the electrical quantities of the network.
The relays can be set locally, using either the keypad and display or the RS232 port, or remotely using the RS485 port.

Setting, reading, measurement and recording are all available locally or remotely.


- Multifonction
- Measurement
- Recording / event log
- Disturbance recording
- Local MMI

### Protection functions

- Overcurrent with 3 thresholds **[51-1] [51-2] [50]**
- Earth fault with 2 thresholds **[51N] [50N]**
- Thermal overload for cable and transformer **[49]**
- Negative phase sequence overcurrent **[46]**
- Broken conductor with 2 thresholds **[46BC]**
- Load reclosing function
- Logical selectivity

### Additional functions

- Latching of the output contacts **[86]**
- Trip circuit supervision of the breaker **[74TC]**
- Breaker failure **[50BF][50N_BF]**
- Load shedding – Load Restoration, remote control (communication option)

### Additional function NPIR800 only

- Recloser 1 fast cycle and 3 slow cycles **[79]**

# CHARACTERISTICS NPI800 – NPIR800

## Auxiliary Supply

| | |
|---|---|
| • Auxiliary supply ranges | 19 to 70 – 85 to 255 / Vdc or Vac 50 or 60 Hz |
| • Typical burden | 6 W (DC), 6 VA (AC) |
| • Memory backup | 72 hours |

## Analogue inputs

| | |
|---|---|
| • Phase CT | In 1 or 5 A<br>burden at In < 0.2 VA<br>Continuous rating 3 In, short duration withstand 100 In / 1s<br>CT setting: primary value from 1 A to 10 kA<br>measurement from 0.05 to 24 In<br>display of primary current from 0 to 65 kA |
| • Recommended CTs | 5VA 5P20 |
| • Earth current CT | $In_0$ 1 or 5 A<br>burden at $In_0$ < 0.5 VA<br>Continuous rating 1 $In_0$, short duration withstand 40 $In_0$ / 1s<br>measurement from 0.005 to 2.4 $In_0$<br>display of primary current from 0 to 6.5 kA |
| • Earth current from Ring CT 100/1 or Ring CT 1500/1 and BA800 | measurement from 0.1 to 48 A primary |
| • Frequency (50Hz or 60Hz) | measurement: 45 to 55 Hz or 55 to 65 Hz |

## Digital inputs 4 or 8 according option

| | |
|---|---|
| • Polarizing voltage | 20 to 70 Vdc for 19 to 70 V auxiliary supply range<br>37 to 140 Vdc for 85 to 255 V auxiliary supply range |
| • Level 0 | < 10Vdc range 19 to 70 V – < 33Vdc range 85 to 255 V |
| • Level 1 | > 20Vdc range 19 to 70 V – > 37Vdc range 85 to 255 V |
| • Operating of the input by level 1 or 0 | programmable |
| • Burden | < 15 mA |

## Output Relays 3* or 7 according option + 1 WD

| | |
|---|---|
| • Relays A*, B*, E, F:<br>(signalling, Shunt Opening Release) | double contact NO, permanent current 8 A<br>closing capacity 12 A / 4 s<br>short circuit current withstand 100 A / 30 ms<br>breaking capacity DC with L/R = 40 ms: 50W<br>breaking capacity AC with cos φ = 0.4: 1250 VA |
| • Relays C*, D, G & WD:<br>(control, WD: Watchdog)<br>(C, D, G: programmable for CB Shunt Opening Release or Under Voltage Release) | changeover contact, permanent current 16 A<br>closing capacity 25 A / 4 s<br>short circuit current withstand 250 A / 30 ms<br>breaking capacity DC with L/R = 40 ms: 50W<br>breaking capacity AC with cos φ = 0.4: 1250 VA |
| • Relays pulse, except WD | adjustable from 100 to 500 ms |
| • Assignment of name to the output maximum of 16 characters | by the setting software<br>capital letters or digits |

## Overcurrent function [51-1] [51-2] [50]

| | |
|---|---|
| • Operating range I> - I>> - I>>> | 0.3 to 24 In |
| • Thresholds accuracy | 1% typical, 2% max from 0.5 to 4 In<br>3% typical, 5% max from 0.3 to 0.5 In and from 4 to 24 In |
| • Reset percentage on the operating level | 95% |
| • Instantaneous operating time | 60 ms including trip relay for I ≥ 2 Is |
| • Definite time delay | 40 ms to 300 s: [51-1] I> - [51-2] I>> - [50] I>>> |
| • Accuracy of the time delays | ± 2% or 20 ms |
| • Curves [51-1] I> - [51-2] I>> | IEC 60255-3, ANSI IEEE and factory programmable (consult us) |
| • Curves accuracy and type | class 5 - Time Multiplier Setting: 0.03 to 3 s, type: see functionalities |

## Earth fault function [51N] [50N]

| | |
|---|---|
| • Operating range Io> - Io>> | 0.03 to 2.4 $In_0$ / CT - 0.6 to 48 A / ring CT |
| • Thresholds accuracy | 1% typical, 2% max from 0.05 to 0.4 $In_0$ / CT<br>3% typ., 5% max from 0.03 to 0.05 $In_0$ and 0.4 to 2.4 $In_0$ / CT<br>5% from 0.6 to 48 A / ring CT |
| • Reset percentage on the operating level | 95% |
| • Instantaneous operating time | 60 ms including trip for I ≥ 2 Is |
| • Definite time delay | 40 ms to 300 s: [51N] Io> [50N] Io>> |
| • Accuracy of the time delays | ± 2% or 20 ms |
| • Curves [51N] Io> | IEC 60255-3, ANSI IEEE and factory programmable (consult us) |
| • Curves accuracy and type | class 5 - Time Multiplier Setting: 0.03 to 3 s, type: see functionalities |

## Transformer thermal overload function [49]

| | |
|---|---|
| • Tripping curves | IEC 60255-8 |
| • Heating-time constant $C_{TE}$ | 4 to 180 min, class 5 |
| • Cooling time constant | 1 to 6.0 $C_{TE}$, in step of 0.1 |

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## Transformer thermal overload function [49] (Continue)

| | |
|---|---|
| • Negative sequence factor | 0 to 9 |
| • Closing factor $F_D$ | 50 to 100% $C_{TE}$ |
| • Thermal trip threshold $I_b$ | 40 to 130 % In, class 5 |
| • Thermal alarm threshold | 80 to 100 % θ thermal, class 5 |
| • Reclosing thermal threshold inhibition | 40 to 100 % θ thermal, class 5 |

## Cable thermal overload function [49]

| | |
|---|---|
| • Tripping curves | IEC 60255-8 |
| • Heating-time constant $C_{TE}$ | 4 to 180 min, class 5 |
| • Thermal alarm threshold | 80 to 100 % θ thermal, class 5 |
| • Thermal trip threshold $I_b$ | 40 to 130 % In, class 5 |

## Negative phase sequence overcurrent function [46]

| | |
|---|---|
| • Threshold Ineg: I2> | 0.1 to 2.4 In, accuracy 5% for Iph > 0.3 In |
| • Instantaneous operating time | 60 ms including trip relay for I ≥ 2 Is |
| • Definite time delay | 40 ms to 300 s |
| • Accuracy of the time delay | ± 2% or 20 ms |
| • Curves | IEC 60255-3, ANSI IEEE and factory programmable (consult us) |
| • Curves accuracy and type | class 5 - Time Multiplier Setting: 0.03 to 3 s, type: see functionalities |

## Broken conductor function [46BC]

| | |
|---|---|
| • Threshold Ineg/Ipos: I2/I1> - I2/I1>> | 10 to 250% |
| • Accuracy | ± 5 % |
| • Definite time delay | 40 ms to 300s |
| • Accuracy of the time delays | ± 2% or 20 ms |

## Recloser [79] (NPIR800 only)

| | |
|---|---|
| • Dead time delay (1st cycle) | 0.1 to 360 s |
| • Reclaim time delay (1st cycle) | 9 to 360 s |
| • Dead time delay (2nd, 3rd and 4th cycle) | 15 to 360 s |
| • Reclaim time delay (2nd, 3rd and 4th cycle) | 1 to 360 s |
| • Width of reclosing pulse | 100 to 500 ms |
| • Reclaim time for manual reclosing | 1 to 360 s |
| • Accuracy of time delays | ± 2% or 20 ms |
| • N cycles alarm / T min | N: 4 to 30 and T: 1 to 30 min |

## Trip circuit supervision and breaker failure [74TC] [50BF] [50N_BF]

| | |
|---|---|
| • Trip circuit supervision [74TC] | requires four digital inputs (see application guide) |
| • Operating time (in faulty condition) | 500 ms fixed for [74TC] function |
| • Failure threshold [50BF] | 5% to 30 % In, step of 1 In |
| • Failure threshold [50N_BF] | 0.5% to 3% $In_0$, step of 0.1 $In_0$ |
| • Breaker failure time delay | 60 to 1000 ms, step of 10 ms |

## Latching of the output contacts [86]

| | |
|---|---|
| • Manual reset for output relays | A, B, C and with option: D, E, F, G (programmable assignment) |
| • Reset | digital input, digital communication or local MMI |

## Load reclosing function

| | |
|---|---|
| • Application | threshold adjustment [50] [51] [50N] [51N] [46] [46BC] |
| • Operating principle | function activation by digital input |
| • Ratio « K » of reclosing time | 50 à 200% |
| • Accuracy | ± 5 % |
| • Reclosing time | 40 ms to 300s, ± 2% or 20 ms |

## Logical selectivity

| | |
|---|---|
| • Application on radial network | number of relays too important to allow the use of time co-ordination |
| • Operating principle | additional time added to the functions [50] [51] [50N] [51N] |
| • Additional time delay [51] [51N] | 60 ms to 120s, ± 2% or 20 ms |
| • Additional time delay [50] [50N] | 60 ms to 3s, ± 2% or 20 ms |
| • Operating mode of digital input | negative or positive true-data mode |

## Digital inputs assignment

| | |
|---|---|
| • By setting software | |
| • Setting table selection | set 1 – set 2 |
| • Disturbance recording order | |
| • Logical selectivity | |
| • Interlock o/o | |
| • Interlock c/o | |
| • Control mode | dedicated to remote control, local / remote |
| • Reclosing mode | |
| • Reset [86] function | acknowledgment of the selected output(s) |
| • Trip circuit supervision | [74TC] function |
| • CB trip external order | function [74TC] blocked if external trip order |

# CHARACTERISTICS NPI800 – NPIR800

## Digital inputs assignment (Continue)

| | |
|---|---|
| • Circuit breaker ready | NPIR800 only |
| • Inhibition 1 | NPIR800 only |
| • Inhibition 2 | NPIR800 only |
| • RSE A | NPIR800 only |
| • RSE B | NPIR800 only |
| • Input – output programmable functions | |

## User programmable functions (digital inputs – digital outputs)

| | |
|---|---|
| • Status of the function | in or out of service, by local MMI or by the setting software |
| • Tripping mode or report | report: for time stamping and event recorder |
| • Operating and release time delays | tripping mode: 40 ms to 300 s |
| • Assignment of name to the function, maximum of 14 characters | by the setting software |
| • Assignment of one or more output relays (alarm or trip) | by local MMI or by the setting software<br>A, B, C and with option: D, E, F, G |

## Counters

| | |
|---|---|
| • Cumulative breaking current | maximum $64.10^6$ kA² (phase 1,2 and 3) |
| • Operation number of circuit breaker | 0 to 10 000 |

## Load shedding – Load Restoration, remote control (communication option)

| | |
|---|---|
| • Load shedding level | 1 to 6 |
| • Time delay before reclosing | 1 to 120 s, ± 2% |
| • Reclosing pulse | 100 to 500 ms (remote control) |
| • Output relays assigned | programmable by local MMI or by setting software<br>A, B, C and with option: D, E, F, G |

## Digital outputs assignment

- By local MMI or by setting software

## Signalling LEDs assignment

- By setting software

## Man Machine Interface

| | |
|---|---|
| • Relay display | 2 lines of 16 characters |
| Language | French, English, Spanish, Italian |
| • Configuration and operating software | Windows® 2000, XP, Vista and 7 compatible |
| Language | French, English, Spanish, Italian |

## MODBUS® Communication (option)

| | |
|---|---|
| • Transmission | asynchronous series, 2 wires |
| • Interface | RS 485 |
| • Transmission speed | 300 to 115 200 bauds |

## Disturbance recording

| | |
|---|---|
| • Number of recordings | 4 |
| • Total duration | 52 periods per recording |
| • Pre fault time | adjustable from 0 to 52 cycles |

## Climatic withstand in operation

| | |
|---|---|
| • Cold exposure | IEC / EN 60068-2-1: class Ad, -10 °C |
| • Dry heat exposure | IEC / EN 60068-2-2: class Bd, +55 °C |
| • Damp heat exposure | IEC / EN 60068-2-3: class Ca, 93 % HR, 40 °C, 56 days |
| • Temperature variation with specified speed | IEC / EN 60068-2-14: class Nb, -10 °C à +55 °C, 3 °C/min |

## Storage

| | |
|---|---|
| • Cold exposure | IEC / EN 60068-2-1: class Ad, -25 °C |
| • Dry heat exposure | IEC / EN 60068-2-2: class Bd, +70 °C |

## Electrical safety

| | |
|---|---|
| • Ground bond test current | IEC / EN 61010-1: 30 A |
| • Impulse voltage withstand | IEC / EN 60255-5: 5 kV MC, 5 kV MD (waveform: 1.2/50µs)<br>except Digital Output, 1 kV differential mode<br>except RS485, 3 kV common mode |
| • Dielectric withstand (50Hz or 60Hz) | IEC / EN 60255-5: common mode 2 $kV_{rms}$ – 1 min<br>differential mode for Digital Output 1 $kV_{rms}$ – 1 min<br>(contact open) |
| • Insulation resistance | IEC / EN 60255-5: 500 Vdc - 1 s: > 100 MΩ |
| • Clearance and creepage distances | IEC / EN 60255-5: rated insulation voltage: 250 V<br>pollution degree: 2<br>overvoltage category: III |

## Enclosure safety

| | |
|---|---|
| • Degree of protection provided by enclosures (IP code) | IEC / EN 60529: IP51, with front face |

# CHARACTERISTICS NPI800 – NPIR800

## Immunity – Conducted disturbances

| | |
|---|---|
| • Immunity to RF conducted disturbances | IEC / EN 61000-4-6: class III, 10 V |
| • Fast transients | IEC / EN 60255-22-4 / IEC / EN 61000-4-4: class IV |
| • Oscillatory waves disturbance | IEC / EN 60255-22-1: class III, 2.5 kV CM, 1 kV DM except RS485, class II, 1 kV CM |
| • Surge immunity | IEC / EN 61000-4-5: class III |
| • Supply interruptions | IEC / EN 60255-11: 100% 20 ms |

## Immunity – Radiated disturbances

| | |
|---|---|
| • Immunity to RF radiated fields | IEC / EN 60255-22-3 / IEC / EN 61000-4-3: class III, 10 V/m |
| • Electrostatic discharges | IEC / EN 60255-22-2 / IEC / EN 61000-4-2: class III, 8 kV air / 6 kV contact |
| • Power frequency magnetic field immunity test | IEC / EN 61000-4-8: class IV, 30 A/m continuous, 300 A/m 1 to 3 s |

## Mechanical robustness - energised

| | |
|---|---|
| • Vibrations | IEC / EN 60255-21-1: class 1 - 0.5g |
| • Shocks | IEC / EN 60255-21-2: class 1 - 5g / 11 ms |

## Mechanical robustness - not energised

| | |
|---|---|
| • Vibrations | IEC / EN 60255-21-1: class 1 - 1g |
| • Shocks | IEC / EN 60255-21-2: class 1 - 15g / 11 ms |
| • Bumps | IEC / EN 60255-21-2: class 1 - 10g / 16 ms |
| • Free fall | IEC / EN 60068-2-32: class 1 - 250 mm |

## Electromagnetic compatibility (EMC)

| | |
|---|---|
| • Radiated field emissivity | EN 55022: class A |
| • Conducted disturbance emissivity | EN 55022: class A |

## Presentation

| | |
|---|---|
| • Height | 4U |
| • Width | ¼ 19" |
| • Brackets 19” rack mounting | option (see drawing D37739) |

## Case

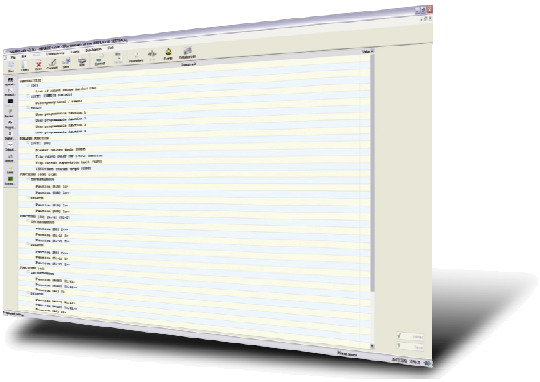
| | |
|---|---|
| • H, W, D without short-circuiting device | 173 x 106.3 x 250 mm (see drawing D37739) |
| • H, W, D with short-circuiting devices | 173 x 106.3 x 305 mm (see drawing D37739) |
| • Weight | 3.6 kg |

## Connection - codification

| | |
|---|---|
| • NPI800 | See diagram S38018 |
| • NPIR800 | See diagram S38023 |
| • Ring CT | See diagram 142941 |
| • BA800 | See diagram 38766 |

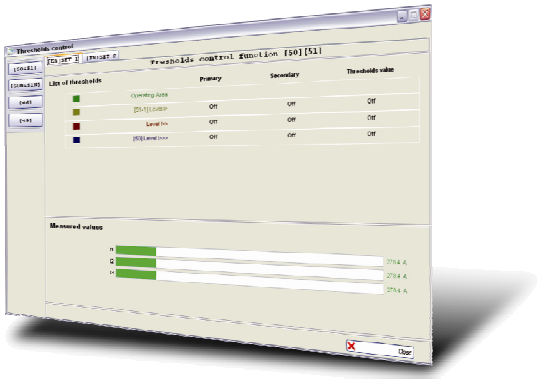
## SMARTsoft

SMARTsoft, integrated software for the Industry, Railway and Transmission ranges, helps the User get the best from NP800 series relays.



SMARTsoft

User friendly
Diagnosis
Fault analysis
Maintenance tools



## Functionalities

- 2 ranges of auxiliary supply
- Storage of the lack and the restoration of the auxiliary voltage (time stamped events)
- Configuration and parameter setting by local MMI or off-line / on-line PC
- Measurement of electrical quantities:
  Display expressed in primary values
  Instantaneous, integrated and maximum values of phase and earth currents
- Instantaneous alarm threshold
- Definite time tripping
- Dependent time tripping according to inverse/very inverse/extremely inverse IEC 60255-3 curves
- Tripping according to RI curve (electromechanical)
- Tripping according to moderately inverse/very inverse/extremely inverse ANSI /IEEE curves
- Logical selectivity on the three phase thresholds and the two earth thresholds
- Thermal image according to IEC 60255-8:
- Cable (by phase) and transformer (3 phase)
- 2 setting groups, locally or remotely selectable
- CB Monitoring: interlocks discrepancy, local or remote control of closing / tripping
- Circuit breaker maintenance:
- counters of operation number and cut-off ampers² per phase, alarm and threshold
- Monitoring of breaker failure by checking the disappearance of current after opening
- Remote control by communication channel: tripping or closing, load shedding with priority levels and load restoration
- Setting software compatible with Windows® 2000, XP, Vista and 7
- User interface with access to all protection functions
- Time stamping of internals events with 10ms resolution
- Time stamping of digital inputs with 10ms resolution
- Event recording: 250 locally recorded events, 200 saved in case of loss of auxiliary supply
- Recording of measurements and current setting group
- Local / remote events acknowledgment
- Disturbance recording according to Comtrade® format: storage of 4 recordings of 52 periods
- Disturbance recording initiated by digital input, setting software or communication channel
- Closing function: adjustment of phase, earth, negative sequence current thresholds by external input
- Remote setting and reading of measurements, counters, alarms and parameter settings
- Remote reading of disturbance recording and event log
- Self-diagnosis: Memories, output relays, A/D converters, auxiliary supply, cycles of execution of software, hardware failure
- Test of wiring, phase rotation and direction of the currents

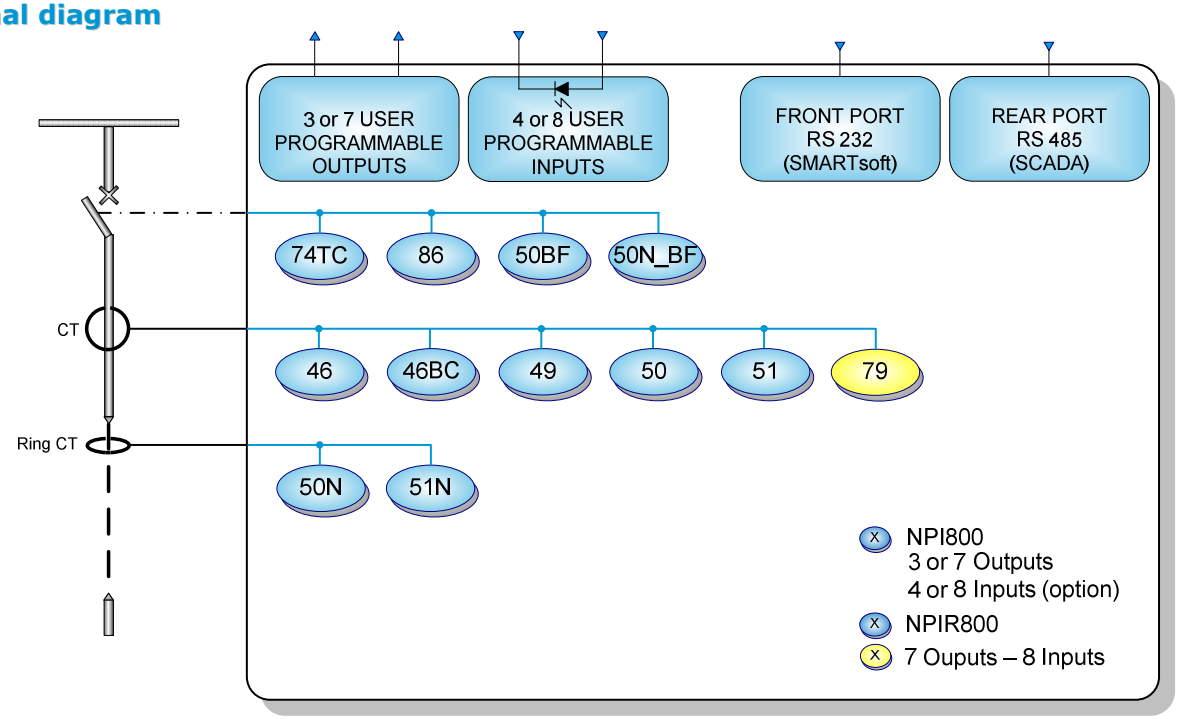
## Options

- Communication by Modbus® - (IEC 60870-5-103 protocol: consult us)
- Additional card with 4 assignable output relays and 4 assignable digital inputs (card include for NPIR800)
- 2 inverse time curves, programmable (in factory, consult us) and downloadable

## Related equipment

- BA800 for ring CT 1500/1

## Functional diagram



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