# GENERATION & NETWORK
## Generator Protection

# NPG800

NPG800 protects generators connected to three phase network and driven by any type of prime mover: steam, hydraulic or gas turbine and also diesel or gas engine.
The various functions and connection possibilities are suitable for hundreds kVA to tens MVA generators.

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.


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

## Protection functions

- Minimum of impedance with 2 thresholds **[21]**
- Overfluxing with 2 thresholds **[24]**
- Undervoltage with 2 thresholds **[27]**
- Maximum **[32P*]** reverse **[32RP]** and minimum **[37P]** of active power
- Maximum with 2 thresholds **[32Q*]** and minimum **[37Q]** of reactive power
- Field failure with 2 thresholds **[40]**
- Negative phase sequence overcurrent with 2 thresholds **[46]**
- Thermal overload with 2 thresholds **[49]**
- Overcurrent with 3 thresholds **[51-1] [51-2] [50]**
  With voltage control unit **[51-1V] [51-2V] [50V]**
- Max of zero sequence voltage with 2 thresholds **[59N]**
- Overvoltage with 2 thresholds **[59]**
- Max of zero sequence current with 2 thresholds **[64]**
- Overfrequency with 2 thresholds **[81O]**
- Underfrequency with 2 thresholds **[81U]**

* operating mode of power, import or export, configurable

## Additional functions

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

# CHARACTERISTICS NPG800

## 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 current inputs | 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 0.01 to 18 In<br>display of primary current from 0 to 65 kA |
| • Recommended CTs | 5VA 5P10 |
| • Earth current inputs | $In_0$ 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 input from Ring CT 100/1 | adjustment from 0.1 to 48 A primary |
| • Phase voltage inputs | Un : 33 to 120 V<br>input impedance > 80 kΩ<br>continuous rating 240 V, short duration withstand 275V - 1 min<br>measurement from 1 to 240 V<br>VT setting: primary value from 220 V to 250 kV |
| • Frequency (50Hz or 60Hz) | measurement: 45-55 Hz or 55-65 Hz |

## Digital inputs (8)

| | |
|---|---|
| • 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 |

## Outputs Relays (7 + 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 et 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<br>maximum of 16 characters | by the setting software<br>capital letters or digits |

## Minimum of impedance function [21]

| | |
|---|---|
| • Trip authorization threshold IZ> | 10 to 40 % In |
| • Operating range Z< - Z<< | 10 to 200 % Zn |
| • Thresholds accuracy | ± 5% or 3% of Zn |
| • Reset percentage on the operating level | 105% |
| • Instantaneous operating time | 60 ms including trip relay |
| • Definite time delays | 40 ms to 300 s |
| • Accuracy of the time delays | ± 2% or 20 ms |
| • Accuracy of displayed measures | 3% of Zn |

## Overfluxing function [24]

| | |
|---|---|
| • Operating range (U/F)> - (U/F)>> | 80 to 200 % Un/Fn |
| • Measurement range | 45-55 Hz or 55-65 Hz |
| • Thresholds accuracy | ± 1.5% of Un/Fn |
| • Reset percentage on the operating level | 95% |
| • Definite time delay | 200 ms to 10 s |
| • Accuracy of the time delays | ± 2% or 20 ms |
| • Operating curves | IEC 60255-3, ANSI IEEE and factory configurable (consult us) |
| • Curves accuracy | class 5 - Time Multiplier Setting : 0.03 to 3 s |
| • Instantaneous operating time | 60 ms including trip relay |
| • Accuracy of displayed measures | 3% of Un/Fn |

# CHARACTERISTICS NPG800

## Undervoltage function [27]

| | |
|---|---|
| • Operating mode | function « Or » or « And » programmable |
| • Measurement method | phase-neutral voltages or phase-phase voltages, according to wiring |
| • Undervoltage operating range U< - U<< | 20 to 120 % Un |
| • Thresholds accuracy | 2% Un |
| • Reset percentage on the operating level | 103% |
| • Blocking of the thresholds | 10% of Un, programmable: in or out of service |
| • Definite time delay | 40 ms to 300 s |
| • Accuracy of the time delays | ± 2% to 20 ms |
| • Operating curves | IEC 60255-3, ANSI IEEE and factory configurable (consult us) |
| • Curves accuracy | class 5 - Time Multiplier Setting: 0.03 to 3 s |
| • Instantaneous operating time | 60 ms including trip relay |
| • Accuracy of displayed measures | 3% from 3 to 240 V |

## Power functions [32P] [32RP] [37P] [32Q] [37Q]

| | |
|---|---|
| • Measurement method | 3I-2U or 3I-3V, according to wiring and programming |
| • Operation of the [32P] threshold and the two [32Q] thresholds | 3 programmable modes for the power-flow : export / import / export and import |
| • Operating range RP>, P> and P< | 1 to 120 % of Sn |
| • Operating range Q>, Q>> and Q< | 1 to 120 % of Sn |
| • P-Q thresholds accuracy | 0.5% of Sn, Blocking of the thresholds [37P] and [37Q] 0.5% of Sn |
| • Reset percentage on the operating level | 95% for RP>, P> and Q>, 105% for P< and Q< |
| • Instantaneous operating time | 60 ms including trip relay |
| • Definite time delay | 40 ms to 300 s |
| • Accuracy of the time delays | ± 2% or 20 ms |
| • Operating curves | IEC 60255-3, RI, ANSI IEEE and factory configurable (consult us) |
| • Curves accuracy | class 5 - Time Multiplier Setting: 0.03 to 3 s – RI: 0.01 to 20 s |
| • Accuracy of displayed measures | 1% of Sn |

## Field failure function [40]

| | |
|---|---|
| • Setting of the circle offset X2 | 8 to 40 % Zn |
| • Setting of the circle diameter X1 | 50 to 500 % Zn |
| • Thresholds accuracy | ± 5% or 3% of Zn |
| • Reset percentage on the operating level | 95% |
| • Blocking threshold | U<16% of Un or I< 8% of In |
| • Instantaneous operating time | 60 ms including trip relay |
| • Definite time delay | 40 ms to 300 s |
| • Accuracy of the time delays | ± 2% or 20 ms |
| • Accuracy of displayed measures | 3% of Zn |

## Negative phase sequence overcurrent function [46]

| | |
|---|---|
| • Negative sequence threshold I2> - I2>> | 3 to 50% In |
| • Thresholds accuracy | ± 5% |
| • Reset percentage on the operating level | 95% |
| • Inverse time curve | 4 to 80 s (for Ineg = 100% Ineg/In) |
| • Min trip time | 0.1 to 10 s |
| • Curves accuracy | class 5, type: see application guide |
| • Definite time delay | 40 ms to 300 s |
| • Accuracy of the time delays | ± 2% or 20 ms |
| • Instantaneous operating time | 60 ms including trip relay |
| • Accuracy of displayed measures | 3% |

## Thermal overload function [49]

| | |
|---|---|
| • Tripping curves | IEC 60255-8 |
| • Heating-time constant $C_{TE}$ | 4 to 400 min |
| • Cooling time constant | 1 to 6.0 $C_{TE}$, in step of 0.1 |
| • Negative sequence factor | 0 to 9 |
| • Thermal trip threshold $I_b$ | 40 to 130 % In |
| • Thermal alarm threshold | 80 to 100 % $\theta$ thermal |
| • Thresholds accuracy | class 5 |

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

| | |
|---|---|
| • Operating range I> - I>> - I>>> | 0.3 to 10 In |
| • Thresholds accuracy | 1% between 0.5 and 4 In - 3% from 0.3 to 0.5 In and from 4 to 10 In |
| • 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: [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 3s (type: see last page) |
| • Operating principle [51V] – [50V] | assignment to [50] [51] thresholds of a criterion of voltage user configurable: in or out of order |

# CHARACTERISTICS NPG800

## Overvoltage function [59]

| | |
|---|---|
| • Operating mode | function « Or » or « And » programmable |
| • Measurement method | phase-neutral or phase-phase voltages, according to wiring |
| • Overvoltage operating range U> - U>> | 40 to 150 % Un |
| • Thresholds accuracy | 2% Un |
| • Reset percentage on the operating level | 97% |
| • Definite time delay | 40 ms to 300 s |
| • Accuracy of the time delays | ± 2% or 20 ms |
| • Operating curves | IEC 60255-3, ANSI IEEE and factory programmable (consult us) |
| • Curves accuracy | class 5 - Time Multiplier Setting : 0.03 to 3 s |
| • Instantaneous operating time | 60 ms including trip relay |
| • Accuracy of displayed measures | 3% from 3 to 240 V |

## Maximum of zero sequence voltage [59N]

| | |
|---|---|
| • Measurement of Vr (accord. Wiring) | calculated or measured (VT in neutral point or broken delta VTs) |
| • Operating range Vo> - Vo>> | 2 to 80 % Un |
| • Thresholds accuracy | 2% of Un |
| • Reset percentage on the operating level | 97% |
| • Instantaneous operating time | 60 ms including trip relay |
| • Definite time delay | 40 ms to 300 s |
| • Accuracy of the time delays | ± 2% or 20 ms |
| • Accuracy of displayed measures | 3% from 3 to 240 V |

## Maximum of zero sequence current [64]

| | |
|---|---|
| • Operating range Io> - Io>> | 0.03 to 2.4 $In_0$ / CT – 0.6 to 48 A / ring |
| • 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 |
| • Reset percentage on the operating level | 97% |
| • Instantaneous operating time | 60 ms including trip relay for I ≥ 2 Is |
| • Definite time delay | 40 ms to 300 s |
| • Curves | IEC 60255-3, ANSI IEEE and factory programmable (consult us) |
| • Curves accuracy | class 5 - Time Multiplier Setting: 0.03 to 3 s |

## Frequency functions [810] [81U]

| | |
|---|---|
| • Operating range F> - F>> | 50.05 – 54.00 Hz / 60.05 – 64.00 Hz |
| • Operating range F< - F<< | 46.00 – 49.95 Hz / 56.00 – 59.95 Hz |
| • Thresholds accuracy | ± 0.1 Hz |
| • Reset value on the operating level | 0.2 Hz |
| • Voltage inhibition threshold | <10% of Un |
| • Instantaneous operating time | 80 ms typical including trip relay, 150 ms maximum |
| • Adjustment of time delays | 80 ms to 10 s: [81O] F> - F>> - [81U] F< - F<< |
| • Accuracy of the time delays | ± 2% or 20 ms |
| • Accuracy of displayed measures | 0.1 Hz |

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

| | |
|---|---|
| • Trip circuit supervision [74TC] | requires one or two digital inputs (see application guide) |
| • Operating time (in faulty condition) | 500 ms fixed for [74TC] function |
| • Fixed operating range [BF] | >0.5 % of In / >0.5% of In or >1% of Un |
| • Breaker failure time delay | 60 to 1000 ms |

## Latching of the output contacts [86]

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

## Digital inputs assignment

| | |
|---|---|
| • By setting software | |
| • Setting table selection | set 1 – set 2 |
| • Disturbance recording order | |
| • Interlock o/o | dedicated to remote control, switching device position |
| • Interlock c/o | dedicated to remote control, switching device position |
| • Control mode | dedicated to remote control, local / remote |
| • 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 |
| • Blocking of the protection functions | (except thermal function) |
| • Blocking of the time delays | (when time delay cancelled, function acts instantaneously, except [49] function) |
| • Input-Output Programmable functions | |

# CHARACTERISTICS NPG800

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

| | |
|---|---|
| • Status of the function | in or out of service, by local MMI or by setting software |
| • Tripping mode or report | report: for time stamping and event recorder |
| • Operating and release time delays | tripping mode: 10 ms to 300 s |
| • Assignment of name to the function, maximum of 14 characters | by setting software |
| • Assignment of one or more output relays (alarm or trip) | by local MMI or by setting software<br>A, B, C, D, E, F, G |

## 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 |
| • Output relays assignment | by local MMI or by setting software<br>A, B, C, D, E, F, G |

## Digital outputs assignment

- By local MMI or by setting software

## Signalling LEDs assignment

- By setting software

## Counters

| | |
|---|---|
| • Energy | E. Active +, E. Active -, E. Reactive +, E. Reactive – |
| • Cumulative breaking current | maximum $64.10^6$ kA² (phase 1,2 and 3) |
| • Operation number circuit breaker | 0 to 10 000 |

## Man Machine Interface

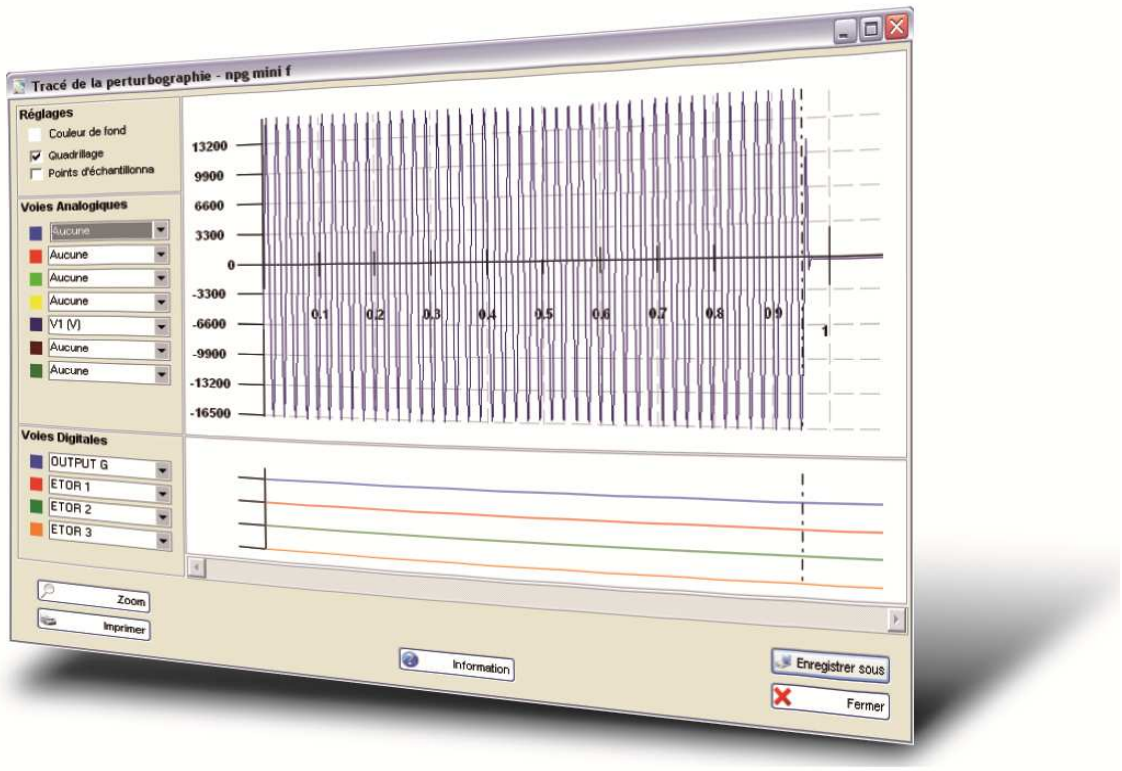
| | |
|---|---|
| • Relay display | 2 lines of 16 characters |
| Language | French, English, Spanish, Italian |
| • Configuration and operating software | Windows® 2000, XP, Vista and 7 compatible |
| Language | French, English, Spanish, Italian |

## 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 |



# CHARACTERISTICS NPG800

## 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 to +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>(open contact) |
| • 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 enclosure (IP code) | IEC / EN 60529 : IP51, with front face |

## Immunity – Conducted disturbances

| | |
|---|---|
| • Immunity to RF conducted disturbances | IEC / EN 61000-4-6: class III, 10 V |
| • Fast transient | 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<br>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 /<br>IEC / EN 61000-4-3 : class III, 10 V/m |
| • Electrostatic discharges | IEC / EN 60255-22-2 /<br>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

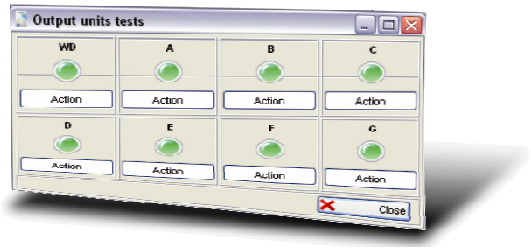
| | |
|---|---|
| • H, W, D without short-circuiting device | 173 x 106.3 x 250 mm (see drawing D37739) |
| • H, W, D with short-circuiting devices | 173 x 106.3 x 305 mm (see drawing D37739) |
| • Weight | 3.6 kg |

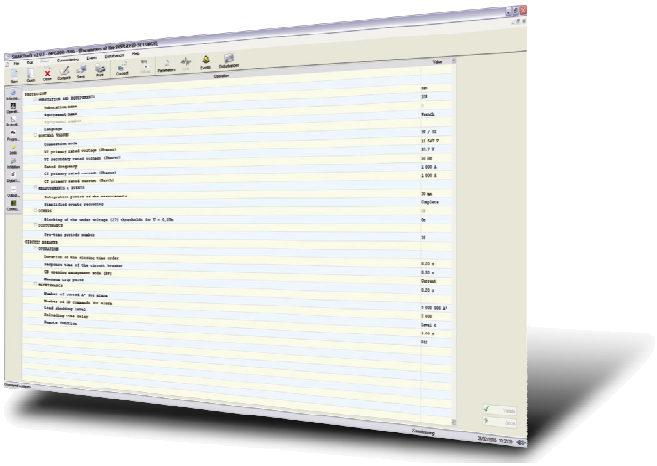
## Connection - codification

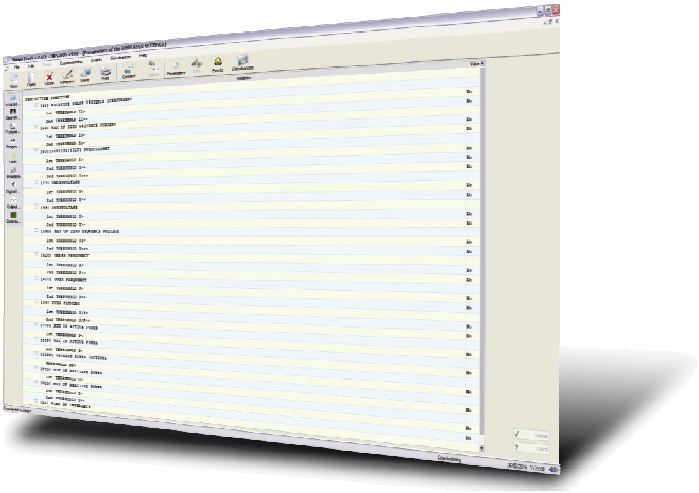
| | |
|---|---|
| • See diagram S39494 | |
| • Ring CT | See diagram 142941 |

# 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

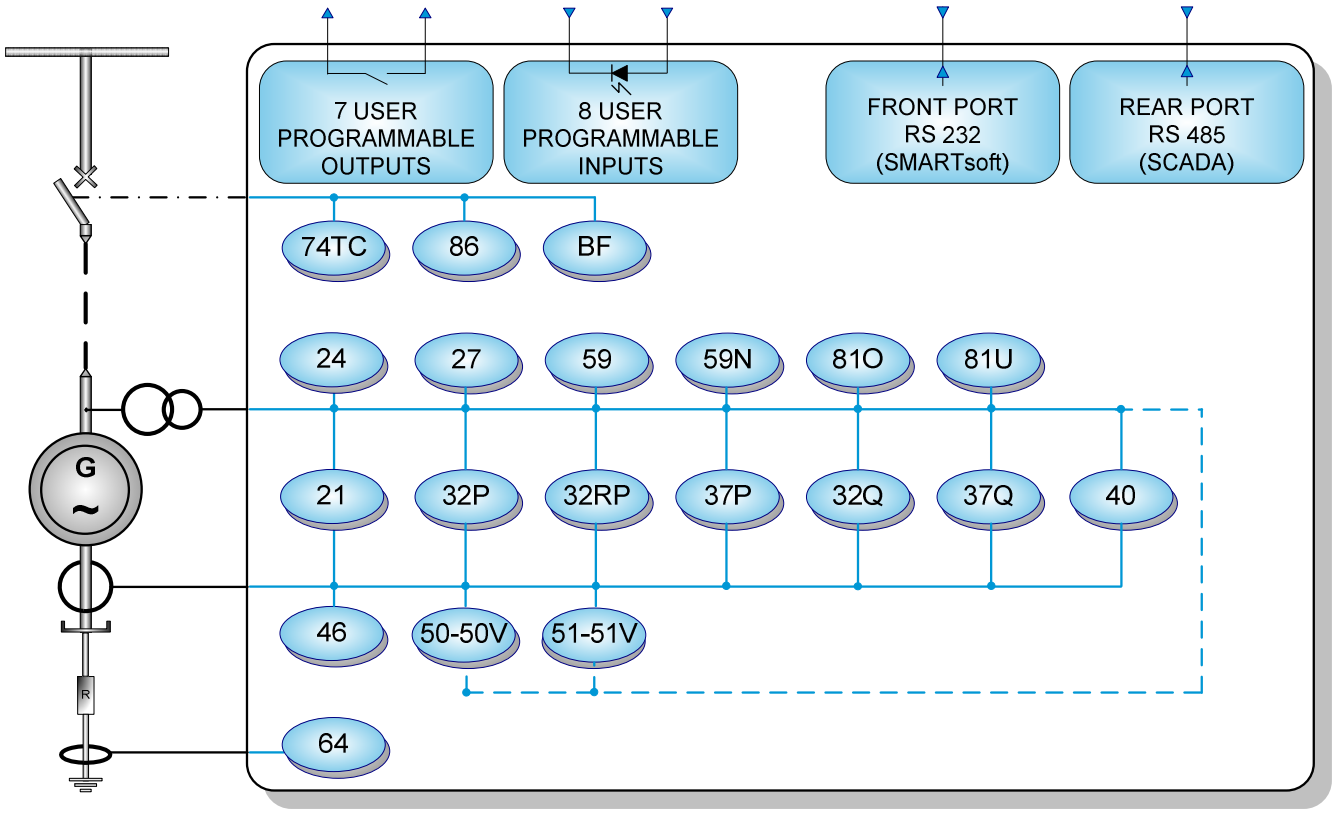
## Functionalities

- 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 and integrated values of phase currents and S, P, Q powers
  - Values, according to the wiring: phase to phase or phase to neutral voltages - residual voltage – zero sequence current
  - Thermal image value
  - Impedance
  - Frequency
  - Power factor, Cos φ
- Instantaneous alarm threshold
- Definite time tripping
- Dependent time tripping according to inverse/very inverse/extremely inverse IEC 60255-3 curves
- Tripping according to moderately inverse/very inverse/extremely inverse ANSI /IEEE curves
- 2 setting groups, locally or remotely selectable by a digital input or by the communication channel
- Energy metering : storage of values / hour
- CB Monitoring : interlocks discrepancy, local or remote control of closing / tripping
- 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 10 ms resolution
- Time stamping of digital inputs with 10 ms resolution
- Event recording: 250 locally recorded events, 200 saved in case of loss of auxiliary supply
- Local / remote event acknowledgment
- Disturbance recording according to Comtrade® format: storage of 4 recordings of 52 periods
- Disturbance recording initiated by digital input, setting software or communication network
- Remote setting, remote reading of measurements, counters, alarms and parameters 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® RS 485
- Communication by Modbus® RS 485 with redundancy
- 2 dependent time, configurable and downloadable curves, consult us

## Functional diagram






Protection & Control ICE

11, rue Marcel Sembat - F94146 Alfortville cedex
www.icelec.com - contact@icelec.com
Tel : +33 (0)1 41 79 76 00 - Fax : +33 (0)1 41 79 76 01