

RAILWAY

Transformer Differential Protection

The digital differential protection relays NPDT620 and NPDT630 are designed to provide fast and selective protection of 2 and 3-winding three-phase transformers.

The NP600 relays can detect various types of fault in the zone to be protected, such as phase-phase faults, inter-winding faults and earth-fault.

Restricted earth-fault protection, on primary and secondary sides, is available as an optional function for 3-winding transformers.

In addition to the protection functions, NPDT relays also perform monitoring, measurement and recording of the electrical quantities of the network.

Parameters can be set locally, using either the integrated display/keypad or the RS232 port, or remotely using the RS485 port.

Electrical values calculation is achieved by Fast Fourier Transforms.

Setting, reading, measurement and recording functions are available in local mode as well as in remote mode.

NPDT620
NPDT630



Multifunction
Measures
Events log
Disturbance
Local HMI

Main functions

- NPDT 620: Differential protection [87T] for 2-winding transformer or generator / transformer unit
- NPDT 630: Differential protection [87T] for 3-winding transformer
- Circuit breaker failure protection [50BF]

Common options

- Buchholz alarm and trip functions
- Temperature alarm and trip functions

NPDT 630 option

- Restricted earth-fault protection [64]



CEE Relays Ltd

CHARACTERISTICS NPDT600

Auxiliary supply

- Supply voltage range
- Typical burden
- Power off withstand
- Memory backup

48 VDC or 110 to 125 VDC, +10% -20 %
20 W
20 ms
32 hours

Analogue inputs

- Phase current In 1 or 5 A

Measurement range: 0.2 to 20*In - Accuracy 2.5%
Burden at In: < 0.2 VA - Continuous withstand: 3*In, 80*In/1s
Display of primary current: from 0 to 5 000 A
Measurement range: 0.3 to 24*In
Burden at In: < 0.2 VA - Continuous withstand: 3*In, 80*In/1s
Primary current supply: from 0 to 5 000 A
47-53 or 57-63 Hz

- Earth current input In 1or 5 A (restricted earth-fault option)

- Frequency

Relay outputs

- matrix allocation
- DC breaking capacity with L/R = 40 ms
- AC breaking capacity at cosφ = 0.4
- A and B relays

50W
1250 VA
Double contact NO, permanent current: 8A
Closing capacity: 10A / 4s - short circuit current withstand: 100A/30ms
Change over contact, permanent current: 16A
Closing capacity: 25A / 4s - short circuit current withstand: 250A/30ms

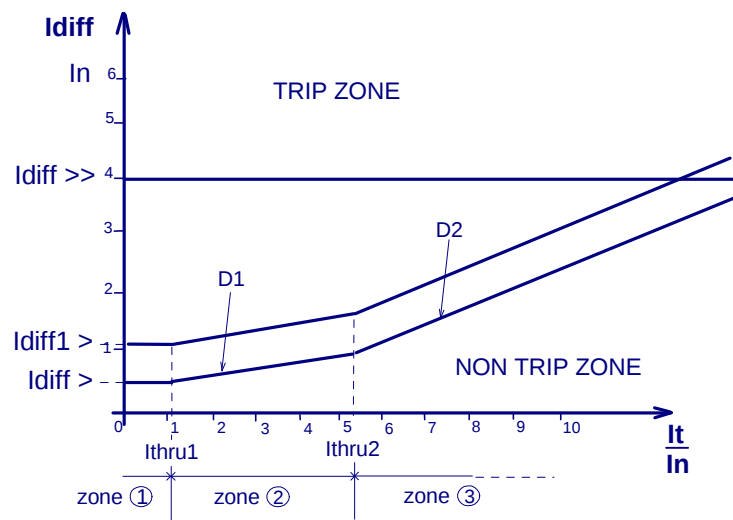
- WD, C, D, E, F, G and H Relays

Differential protection [87T]

- Differential current
- Through current
- Bias curve diagram:

0.05 to 20.00 In
0.05 to 20.00 In

accuracy ± 5%
accuracy ± 5%



- Instantaneous high threshold : Idiff>>
- H. Threshold operating time for Idiff=1.5 Is
- H. Threshold operating time for Idiff ≥ 5 Is
- Normal low threshold: Idiff>
- Over-fluxing low threshold: Idiff1>
- Desensitized low threshold: Idiff2
- Start of zone 2 Ithru1
- Slope of zone 2 D1
- Start of zone 3 Ithru2
- Slope of zone 3 D2
- L. Threshold operating time for Idiff ≥ 1.5 Is
- Trip time delay
- Frequency range

0.8 to 20.0 *In, step of 0.1
typical: 17 ms
typical: 13 ms
1 to 200 % *In, step of 1%
5 to 350 % *In, step of 1%
5 to 350 % *In, step of 1%
0.40 to 6.00 *It/In, step of 0.01
10 to 100 %, step of 1%
2.00 to 8.00 *It/In, step of 0.01
20 to 100 %, step of 1%
18 to 25 ms
0 to 2000 ms, step of 1 ms
0.9 ≤ f/fn ≤ 1.1

accuracy ± 5%
± 5 ms
± 5 ms
accuracy ± 5%
accuracy ± 5%
accuracy ± 5%
accuracy ± 5%
accuracy ± 5%
accuracy ± 5%
± 5 ms
± 1% or 10 ms

Stability during transformer energisation

- H2 harmonic measurement
- Maximum duration of Inrush restraint

10 to 50 % H1, step of 1 %
0 to 2000 ms, step of 1 ms

accuracy ± 5%
± 1% or 10 ms

CHARACTERISTICS NPDT600

Desensitisation to magnetizing currents

- ON/OFF function setting
 - H5 harmonic measurement
- 10 to 50 % H1, step of 1% accuracy $\pm 5\%$

Restricted earth-fault protection [64]

- Low and high thresholds
 - Threshold delay
- 0.05 to 10.00*In, step of 0.01 In accuracy $\pm 3\%$
20 to 12 000 ms, step of 1 ms $\pm 1\%$ or 20 ms

Time delay of auxiliary functions

- Buchholz Alarm input
 - Buchholz Trip input
 - Temperature Alarm input
 - Temperature Trip input
- 60 ms to 120 s $\pm 5\%$ or 20 ms
60 ms to 120 s $\pm 5\%$ or 20 ms
60 ms to 120 s $\pm 5\%$ or 20 ms
60 ms to 120 s $\pm 5\%$ or 20 ms

Compensation for 2-winding transformers

- Dd0, Dy0 et Yy0
 - Dy1
 - Dy5
 - Dy6
 - Dy7
 - Dy11
 - Yy6
 - Yd1
 - Yd5
 - Yd7
 - Yd11
- 0°
phase lag: 30°
phase lag: 150°
phase lag: 180°
phase lead: 150°
phase lead: 30°
phase lag: 180°
phase lag: 30°
phase lag: 150°
phase lead: 150°
phase lead: 30°

Compensation for 3-winding transformers

- Y d1 y0
 - Y d11 y0
 - Y d5 y0
 - Y d7 y0
 - D d0 d0
- phase lag: 30° 0°
phase lead: 30° 0°
phase lag: 150° 0°
phase lead: 150° 0°
0° 0°

Programming

- Display
 - Configuration software
- Language: English, French
Environment: Windows® 95, 98, 2000, XP
Language: English, French

MODBUS® Communication

- Transmission
 - Interface
 - Transmission speed
- Asynchronous series, 2 or 4 wires
RS 485
300 to 19 600 bauds

Disturbance recording

- Number of recordings
 - Total duration
 - Pre fault time
- 8
52 periods per recording
adjustable from 0 to 52 periods

Environment

- Transient impulses 5 ns
 - Shock
 - Dielectric withstand
 - Insulation resistance
 - EMC emissivity
 - EMC susceptibility
 - Operating temperature
 - Vibrations
 - Mechanical shocks
 - Low voltage directive
 - Water and dust protection
- IEC 801.4 class 4 (equivalent to IEC 255-22-4 class 4)
IEC 255-4 class 3 (5 kV - 1.2/50µs)
IEC 255-5 class 3 (2 kVrms - 1 min)
> 100 MΩ according to IEC 255-5
EN 55011 and EN 55022 class A
IEC 255-22 (1/2/3/4)
-5 to + 55 °C - IEC 870-2-1/B4
IEC 255.21.1 class 1
IEC 255.21.2 class 1
89/336/CEE dated 03.05.1989
IP50

Presentation and dimensions

- Rack height and width
 - Display
 - Indicators
 - Overall dimensions (H, W, D)
 - Weight
- NPDT 620 : 6U x $\frac{1}{2}$ 19"
NPDT 630 : 6U x $\frac{1}{2}$ 19"
2 lines of 16 characters
1 LED for watchdog and 2 LED user programmable
NPDT 620: 275 x 155 x 249 mm
NPDT 630: 275 x 226 x 339 mm
NPDT 620: 10 kg
NPDT 630: 12 kg

Characteristics

- 2 plagues de tensions auxiliaires
- Two ranges of auxiliary supply voltages
- Configuration and parameter setting by local keypad or by off-line or on-line PC
- Relay configuration reading and saving by PC
- Measurement of electrical data:
 - transformer primary and secondary currents (NPDT 620 and 630) and tertiary currents (NPDT 630)
 - phase differential currents (R, S, T)
 - phase through currents (R, S, T)
 - display of CT measurements expressed in primary current
- Vector group compensation function
- Instantaneous high-set
- Low-set with bias curve
- Detection of transformer inrush (2nd harmonic)
- Detection of magnetising currents (5th harmonic)
- Stability during CT saturation, using 2nd and 3rd harmonic measurement
- Stability for out-of-zone faults
- Stability to DC currents
- Suppression of external earth fault component
- Configuration and communication software under Windows® 95, 98, NT, 2000, XP
- User interface allowing access to all functions
- Correction of CT rating by checking the no-load balance
- Commissioning tests:
 - differential function
 - check of phase sequence and phase displacements according to the transformer type
 - harmonic percentages for inrush and over-fluxing function
 - threshold of restricted earth function (option) and check of internal and external transformer zone
- Time stamping of internal events with 1 ms resolution
- Event recording: 250 locally recorded events, retained in the event of loss of auxiliary supply
- Storage of measurements
- Local/remote acknowledgment of events
- Disturbance recording according to Comtrade format: eight 52-period recordings
- Remote setting, remote reading of measurements, counters, alarms and parameter settings
- Remote reading of disturbance and event log
- Self-diagnosis: RAM, ROM, EEPROM, output relays, A/D converters, auxiliary supply, cycles of software run, hardware anomaly

Options

- Modbus® Communication through RS 485, 2 or 4 wires, for telemetering and telesignalling
- Restricted earth-fault protection, to protect against faults between the windings and the earth

Functional diagram

