

RAILWAY

Railway Protection for Traction Group

The digital protection PGTN1 protects transformers for electric traction, in charge of feeding catenaries with 25 kV or 2 X 25 kV, 50 or 60 Hz voltages.

The PGTN1 also features functions that help network operation: assistance to the maintenance of the circuit breakers, disturbance recording.

The PGTN1 provides a minimum of impedance protection, which role is to backup the PDZIN1 main protection.

As well as the usual functions of protection, PDZIN1 relay provides monitoring, measurement and recording of the electrical quantities of the network.

The relays can be set locally, using either the keypad or the RS232 port, or remotely using the RS485 port.

The calculation of electrical values is achieved by Fast Fourier Transforms.

The setting, reading, measuring and recording are all available locally or remotely.

PGTN1



Multifunction

Measures

Events log

Disturbance

Local HMI

Protection functions

- 2 phase thresholds of overcurrent protection [50] [51], with two switchable modes
- 2 thresholds of directional protection [67]
- Under-voltage protection [27]
- Transformer Earth-tank protection [50N]
- Voltage reverse protection
- CB SF6 fault monitoring
- Circuit breaker failure protection [50BF]

Backup for PGTN1

- 3 downstream and 2 upstream zones of minimum of impedance protection [21] (backup)

CHARACTERISTICS PGTN1

Auxiliary supply

- Auxiliary supply ranges
- Typical burden
- Power off withstand
- Memory backup

48 – 110 to 125 Vdc, -20% +10 %
8 W (in survey), 12 W (operating)
30 ms
32 hours

Analogue inputs

- I_{GT} CT: In 1 or 5 A

low and high thresholds: measurement from 0.8 to 8 In -
burden at In < 0.2 VA

continuous rating 3 In, short duration withstand 80 In/1s
display of primary currents up to 32 000 A

- Tank CT

measurement from 0.1 to 4 A – burden at In < 0.2 VA
continuous rating 3 In, short duration withstand 80 In/1s

- U_{GT} ou V_{Ph1} VTs

display of primary currents from 1 to 1 000 A
primary rated value: adjustable from 25 kV to 600 kV

secondary rated value UGT: 100 or 110 V

secondary rated value VPh1: $100/\sqrt{3}$ or $110/\sqrt{3}$ V

burden at Un < 0.2VA

continuous rating 1,5 Un, short duration withstand 1,9 Un/5s

display of primary measures

45-55 or 55-65 Hz

- Frequency

Logical Inputs

- Level 0 / 1
- Burden
- Taking into account time

< 20Vdc / > 34Vdc

between 20 and 40 mA

ignored if < 10ms, taken into account if > 15 ms

Relays Outputs

- Breaking capacity DC with L/R = 40 ms
- Breaking capacity AC with $\cos \varphi = 0.4$
- « Signalling » relays

50W

1250 VA

double contact NO, permanent current 8A

closing capacity 10A/4s -- short-circuit current withstand

100A/30ms

changeover contact, permanent current 16A

closing capacity 25A/4s -- short-circuit current withstand

250A/30ms

- « Tripping » relays

Overcurrent Protection [50] [51]

- Instantaneous operating time
- Resetting percentage
- Adjustment thresholds 1A
- Adjustment thresholds 5A
- Independent time delay

50 ms (trip), 60 ms (signalling) for $I \geq 2 I_s$

95 – 99 %

0.40 to 4.00 A, in step of 0,02 A, accuracy ± 2 %

2.0 to 20.0 A, in step of 0.1 A, accuracy ± 2 %

0.04 to 3.00 s, in step of 0.01 s, accuracy ± 2 % with 20 ms
minimum

inverse, very inverse, extremely inverse

according to IEC 255-4, accuracy 5%

- Timing curves

Undervoltage Protection UGT or UPh1 [27]

- Threshold
- Instantaneous operating time
- Resetting percentage

50 to 90 % Un

from 50 ms to 2.00 s, in step of 10 ms (trip), 60 ms (signalling)

101 – 105 %

Directional Protection [67]

- Characteristic
- Instantaneous operating time
- Resetting percentage
- Slow or fast stage, 1A
- Slow or fast stage, 5A
- Slow stage time delay
- Fast stage time delay
- Adjustment angle $\frac{1}{2}$ line D1
- Adjustment angle $\frac{1}{2}$ line D2

circular with limitation by 2 " $\frac{1}{2}$ lines"

50 ms (trip), 60 ms (signalling) for $I \geq 2 I_s$

95 – 99 %

0.16 to 4.00 A in step of 0.04 A accuracy ± 2 %

0.8 to 20.0 A in step of 0.2 A accuracy ± 2 %

1 to 10 min in step of 1 min accuracy ± 2 %

0.05 to 60 sec in step of 0.01 sec accuracy ± 2 %

85 to 170° in step of 1° accuracy ± 1 °

- 10 to - 80° in step of 1° accuracy ± 1 °

Earth Tank Protection [50N]

- Instantaneous operating time
- Adjustment threshold
- Resetting percentage

50 ms (trip), 60 ms (signalling) for $I \geq 2 I_s$

0.1 to 4.0 A in step of 0.1 A accuracy ± 2 %

95 – 99 %

Voltage Reverse Protection

- V_{ph1}/V_{ph2} threshold
- Instantaneous operating time
- Time delay

between 170° and -15 °

50 ms (trip), 60 ms (signalling) for $I \geq 2 I_s$

0.04 to 2.0 sec in step of 0.01 sec accuracy ± 2 %
(20 ms minimum)

CHARACTERISTICS PGTN1

SF6 Fault Tripping – CB Failure Tripping – External Tripping

- Instantaneous operating time 50 ms (trip), 60 ms (signalling)

Buchholz Fault Tripping

- Instantaneous operating time 50 ms (trip), 60 ms (signalling)

Minimum of Impedance Backup Protection [21]

- Characteristic parallelogram with 3 downstream stages and 2 upstream stages
- Instantaneous operating time 50 ms (trip), 60 ms (signalling)
- Resetting percentage 101 – 105 %
- Independent time delay 0.04 to 0.70 s in step of 0,01 s accuracy $\pm 2\%$ with 20 ms min
- Values of adjustment of lines $\pm 3\%$
 - In 5A In 1A
 - 1st stage downstream reactance 6.0 to 120.0 Ω in step of 0.1 Ω 30.0 to 600.0 Ω in step of 0.5 Ω
 - 1st stage upstream reactance 0.2 to 120.0 Ω in step of 0.1 Ω 1.0 to 600.0 Ω in step of 0.5 Ω
 - 1st stage downstream resistance 1.6 to 24.0 Ω in step of 0.1 Ω 8.0 to 120.0 Ω in step of 0.5 Ω
 - 1st stage upstream resistance 1.6 to 48.0 Ω in step of 0.1 Ω 8.0 to 480.0 Ω in step of 0.5 Ω
 - 1st stage downstream switched reactance 6.0 to 120.0 Ω in step of 0.1 Ω 30.0 to 600.0 Ω in step of 0.5 Ω
 - 2nd stage downstream reactance 6.0 to 120.0 Ω in step of 0.1 Ω 30.0 to 600.0 Ω in step of 0.5 Ω
 - 2nd stage upstream reactance 0.2 to 120.0 Ω in step of 0.1 Ω 1.0 to 600.0 Ω in step of 0.5 Ω
 - 3rd stage downstream reactance 6.0 to 120.0 Ω in step of 0.1 Ω 30.0 to 600.0 Ω in step of 0.5 Ω
- 1st stage time delay T1 0.04 to 0.70 s in step of 0.01 s accuracy $\pm 2\%$ with 20 ms minimum
- 1st stage angle of the line θ_1 60 to 85° in step of 1° accuracy 1°
- Magnetizing current limit 1.6 to 12.0 Ω in step of 0.1 Ω 8.0 to 60.0 Ω in step of 0.5 Ω
- Harmonic 2 threshold 10 to 70 % in step of 1%
- 2nd stage time delay T2AV 0.25 to 0.95 s in step of 0.01 s accuracy $\pm 2\%$ with 20 ms minimum
- 2nd stage time delay T2AM 0.25 to 0.95 s in step of 0.01 s accuracy $\pm 2\%$ with 20 ms minimum
- 3rd stage time delay T3AV 0.50 to 1.20 s in step of 0.01 s accuracy $\pm 2\%$ with 20 ms minimum

Programming

- Display French, English
- Configuration software compatible with Windows 95, 98, 2000, NT, XP
French, English

Communication MODBUS®

- Transmission asynchronous series, 2 or 4 wires
- Interface RS 485
- transmission Speed 300 to 19 200 bauds

Disturbance recording

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

Environment

- Transient impulses 5 ns IEC 801.4 class 4 (equivalent IEC 255-22-4 class 4)
- Shock IEC 255-4 class 3 (5 kV – 1,2/50 μ s)
- Dielectric withstand IEC 255-5 class 3 (2 kVrms – 1 min)
- Insulation resistance > 1 000 M Ω according to IEC 255-5
- EMC emissivity EN 55011 and EN 55022 class A
- EMC susceptibility IEC 255-22 (1/2/4)
- Operating temperature -5 to + 55 °C – IEC 870-2-1/B4
- Vibrations IEC 255.21.1 class 1
- Mechanical shocks IEC 255.21.2 class 1
- E.U. low voltage directive 89/336/CEE dated 03.05.1989
- Water and dust projection IP50

Presentation and dimensions

- Display 2 lines of 16 characters
- Output relay 2 trip outputs, 12 dedicated outputs
- Logical inputs 12, dedicated
- signalling LEDs 1 for Watchdog, 2 dedicated multifunction LEDs
- Height, Width, Depth 6U x ½ 19" : 260 x 210 x 320 mm
- Weight 10 k

Characteristics

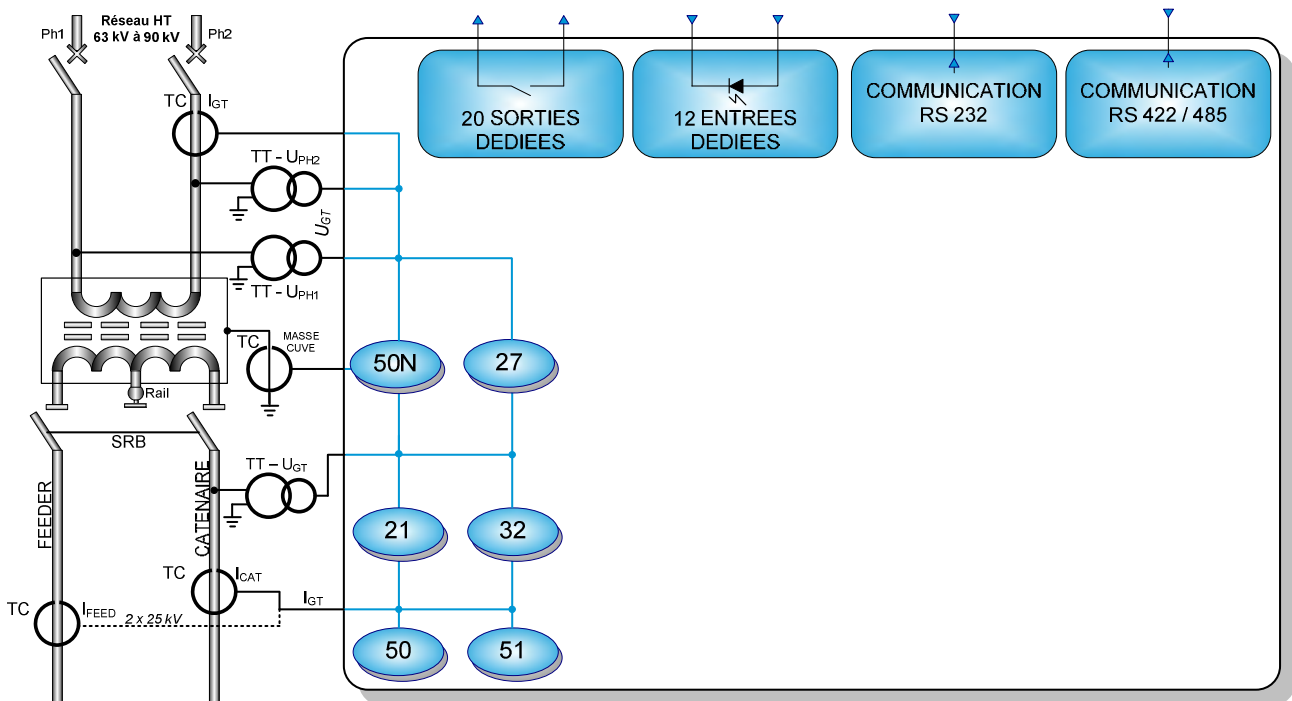
- 2 ranges of auxiliary supply voltages
- Configuration and parameter setting by local HMI or off-line or on-line PC
- Reading and saving relay configuration using PC
- Measurement of electrical quantities:
Transformer current and voltage
Resistance, reactance, impedance and angle of the line
 $V_{ph2}/V_{ph1}, I_{tank}$
Display expressed in primary current and voltage
- Instantaneous alarm thresholds
- 2 phase thresholds of overcurrent protection, with two switchable modes (external input or communication network)
Independent time tripping
Dependent time tripping according to / inverse / very inverse / extremely inverse IEC 255-4 curves
- Directional protection with 2 stages
- Catenary undervoltage protection
- As a PDZIN1 backup, protection of feeder and catenary
Minimum of impedance protection, type parallelogram, with 3 downstream zones and 2 upstream zones
Inhibition of detection of fault when reclosing on auto-transformer by shift of measurement curve
Inhibition of detection of fault due to harmonic H2

- Secured tripping circuit with no-level and transmission orders
- Assistance with circuit breaker maintenance: number of operations and break current I^2 per phase counters, alarms
- Breaker failure monitoring by checking disappearance of the catenary and feeder currents when opening the circuit breaker
- Configuration and operation software compatible with Windows® 95, 98, NT, 2000, XP
- User interface with access to all functions
- Time stamping of internal events with 1 ms resolution
- Event recording: 100 locally recorded events, retained in the event of loss of auxiliary supply
- Storing of measurements and active settings group
- Local/remote acknowledgement of events
- Disturbance recording according to Comtrade format: storage of eight 52 periods recordings
- Remote setting, remote reading of measurements, counters, alarms, and parameter settings
- Remote reading of disturbance recording and event log
- Self-diagnosis: RAM, ROM, EEPROM, output relays, A/D converters, auxiliary supply, cycles of execution of the software, hardware anomaly

Options

- Communication par Modbus® par RS 485, 2 ou 4 fils
- Communication by Modbus®, 2 or 4 wires RS 485
remote measures, remote signalling, distance to the fault, setting in or out of service of the minimum of impedance zones 2 and 3

Functional diagram



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