RAILWAY
Catenaries Fault Locator

LDN2

LDN2 calculates the location of a fault detected by any protection relay, on AC railway catenaries feeders on conventional network or with autotransformers. Its algorithm is similar to the PDZI800 distance protection.

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

Functionalities
- Distance based fault location **[21FL]**
- Location starts by minimum of impedance criterion
- Location starts by overcurrent criterion
- Location starts by directional criterion
- Alarm undervoltage [27/74]
- Circuit-Breaker Failure detection
- Fault location announced in kilometres or four zones
- Linear or customized modelling of line
- 2 setting groups for two line configurations

Option
- Modbus® communication

ice
Protection & Control

CHARACTERISTICS LDN2

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

19 to 70 – 85 to 255 / DC or AC 50 or 60 Hz
6 W (DC), 6 VA (AC)
20 ms
72 hours

Analogue Inputs
- Phase current inputs

In: 1 or 5A
burden at In < 0.2 VA
continuous rating 3 In, short duration withstand 100 In/1 s
CT setting: primary value from 100 A to 5 000 A
measurement from 0.3 to 24 In

- Recommended CTs
- Phase voltage inputs

30VA 5P5
Un: 100 or 110 V
input impedance > 80 kΩ
continuous rating 240 V, short duration withstand 275V - 1 min
measurement: 200 or 220 V
VT setting: primary value from 1*25 kV, 2*25 kV

- Frequency (50Hz or 60Hz)

measurement: 44,5-55,5 Hz or 54,5-65,5 Hz

Digital Inputs (8)
- Polarizing voltage

20 to 70 Vdc for: 19 to 70 V auxiliary supply range
37 to 140 Vdc for: 85 to 255 V auxiliary supply range

- Level 0
- Level 1
- Burden

< 10Vdc range 19 to 70 V – < 33Vdc range 85 to 255 V
> 20Vdc range 19 to 70 V – > 37Vdc range 85 to 255 V
< 15 mA
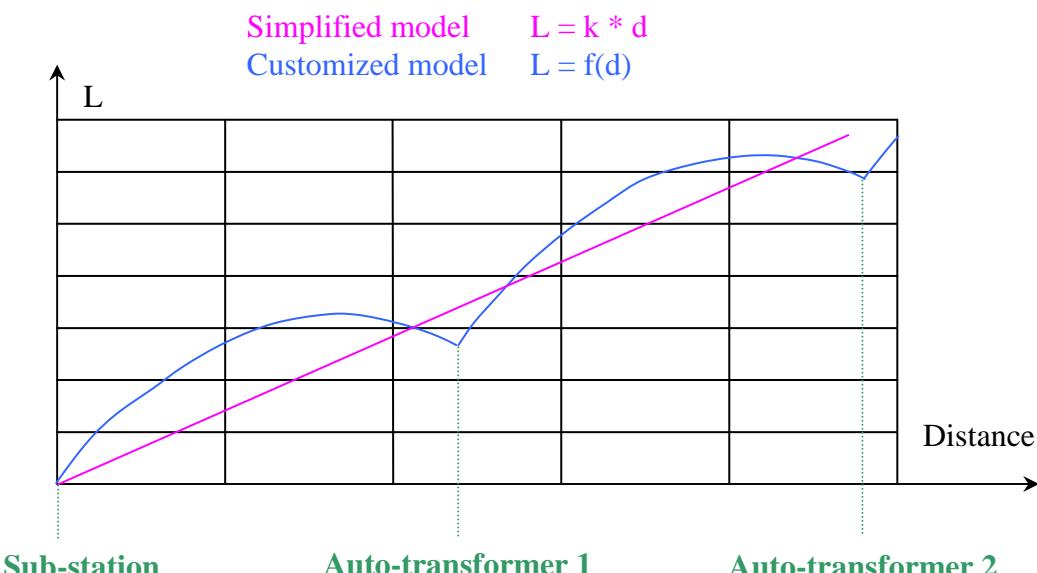
Output Relays (7 + 1WD)
- Relays A, B, E, F:
  signalling

double contact NO, permanent current 8 A
closing capacity 12 A / 4 s
short-circuit current withstand 100 A / 30 ms
breaking capacity DC with L/R = 40 ms: 50W
breaking capacity AC with cos φ = 0.4 : 1250 VA

- Relays C, D, G et WD:
  control, WD : Watchdog

changeover contact, permanent current 16 A
closing capacity 25 A / 4 s
short-circuit current withstand 250 A / 30 ms
breaking capacity _DC with L/R = 40 ms : 50W
breaking capacity AC with cos φ = 0.4 : 1250 VA

Fault Locator [21FL]
- Standard linear reactance
- Calculated linear reactance (option)

0.100 to 0.999 Ω/ km in step of 0.001
2 downloadable characteristics, each one 1000 points in TXT format

- Distance to fault

0.0 to 100.0 km in step of 100 m, accuracy ± 2 % or +/- 100 m

Simplified model $\quad$ L = k * d
Customized model $\quad$ L = f(d)

L

Distance

Sub-station $\qquad$ Auto-transformer 1 $\qquad$ Auto-transformer 2

CHARACTERISTICS LDN2

Minimum of impedance threshold
- Characteristic · parallelogram with 1 downstream stage and 1 upstream stage
- Definite time delay · 0.04 to 0.70 s in step of 0,01 s accuracy ± 2 % with 20 ms
- Adjustment values of lines ± 3 % · In 5A · In 1A
- 1st stage downstream reactance (D11) · 0.2 to 150.0 Ω in step of 0.1 Ω · 1.0 to 750.0 Ω in step of 0.5 Ω
- 1st stage upstream reactance (D12) · 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 (D13) · 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 (D14) · 1.6 to 48.0 Ω in step of 0.1 Ω · 8.0 to 480.0 Ω in step of 0.5 Ω
- Angle of the line θ · 60 to 85° in step of 1° accuracy 1°

Overcurrent thresholds
- Status · in or out of service
- Adjustment threshold In : 1A · 0.40 to 4.00 A in step of 0,02 A accuracy ± 2 %
- Adjustment threshold In : 5A · 2.0 to 20.0 A in step of 0.1 A accuracy ± 2 %
- Definite time delay · 0.04 to 3.00 s in step of 0.01 s accuracy ± 2 % / 20 ms

Directional threshold
- Status · in or out of service
- Characteristic · circular with limitation by two "half-line"
  measure of Ucat and θ angle by the relay
- In: 1A · 0.24 to 1.60 A in step of 0.02 A accuracy ± 2 %
- In: 5A · 1.2 to 8.0 A in step of 0.1 A accuracy ± 2 %
- Definite time delay · 0.50 to 60.00 sec in step of 0.01 sec accuracy ± 2 %
- Adjustment of angle ½ line D1 · 85 to 170° in step of 1° accuracy ± 1°
- Adjustment of angle ½ line D2 · - 80 to - 10° in step of 1° accuracy ± 1°

Catenary Undervoltage alarm [27/74]
- Catenary Undervoltage threshold · 50% to 90% Un in step of 1%

Circuit breaker failure detection
- Time delay · 0.10 to 1.00 sec in step of 0.01
- C.B. management mode · Current cut off

Setting software
- Display · French, English
- Configuration and operating software · Windows® 2000, XP, Vista and 7

MODBUS® Communication (option)
- Transmission · asynchronous series, 2 wires
- Interface · RS 485
- Transmission speed · 300 to 115 000 bauds

Disturbance Recording
- Number of recordings · 4
- Total duration · 52 periods per recording
- Pre fault time · adjustable from 0 to 52 periods

Digital inputs
- Input 1 · Enabling of setting group 2
- Input 2 · External location request
- Input 3 · Request of disturbance recording
- Input 4 · Enabling of overcurrent function
- Input 5 · Enabling of directional function
- Input 6 · Location LCD display reset
- Input 7 · Kilometric Point reset
- Input 8 · Spare

Digital output relays
- Relay A · Fault location signal
- Relay B · SET 2 enabled
- Relay C · Section 1 signal
- Relay D · Section 2 signal
- Relay E · Section 3 signal
- Relay F · Section 4 signal
- Relay G · Catenary undervoltage

Signalling LEDs
- LED 1 · RS485 activity
- LED 2 · RS232 PC connected
- LED 3 · Set 2 enabled
- LED 4 · Events not acknowledged available on RS232 communication port

CHARACTERISTICS LDN2

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 variation rate   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)
  except Digital Outputs, 1 kV differential mode
  except RS485, 3 kV common mode
- Dielectric withstand (50Hz or 60Hz)   IEC / EN 60255-5: common mode 2 kV_{rms} – 1 min
  differential mode for Digital Output 1 kV_{rms} – 1 min
  (open contact)
- Insulation resistance   IEC / EN 60255-5: 500 Vdc - 1 s : > 100 MΩ
- Clearances and creepage distances   IEC / EN 60255-5: rated insulation voltage: 250 V
  pollution degree: 2
  overvoltage category: III

Enclosure safety
- Degree of protection provided by enclosures (IP code)   IEC / EN 60529 : IP51, with front cover

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

CHARACTERISTICS LDN2

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)
- Display   2 lines of 16 characters

Case
- H, W, D without short-circuiting devices   173 x 106.3 x 250 mm (see drawing D37739)
- Weight   3.6 kg

## Connection - codification
- See diagram S38361
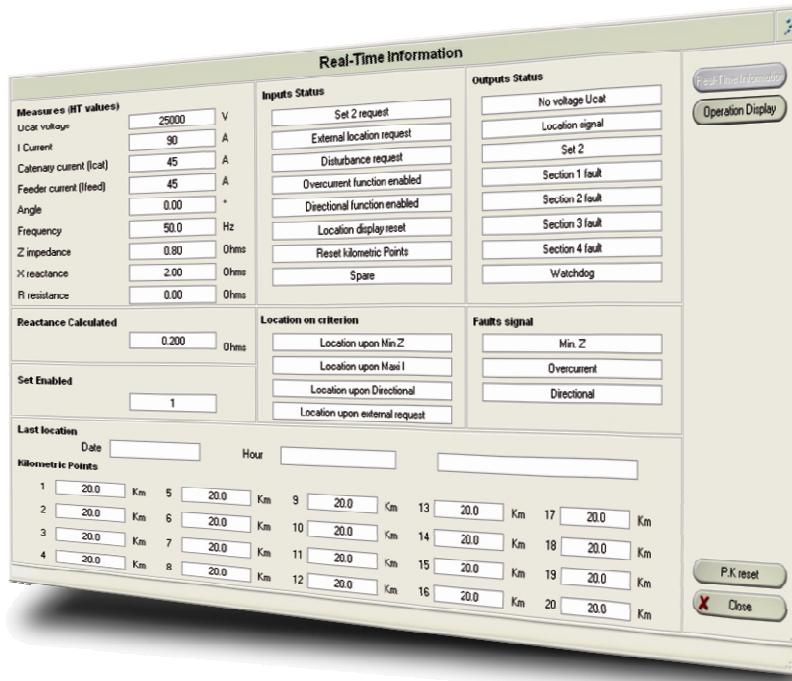
LDN2 – Settings Software
LDN2 settings software helps the User get the best from Fault Locator relay.

LDN2 – Settings Software

User friendly
Diagnosis
Fault analysis
Maintenance tools

Functionalities
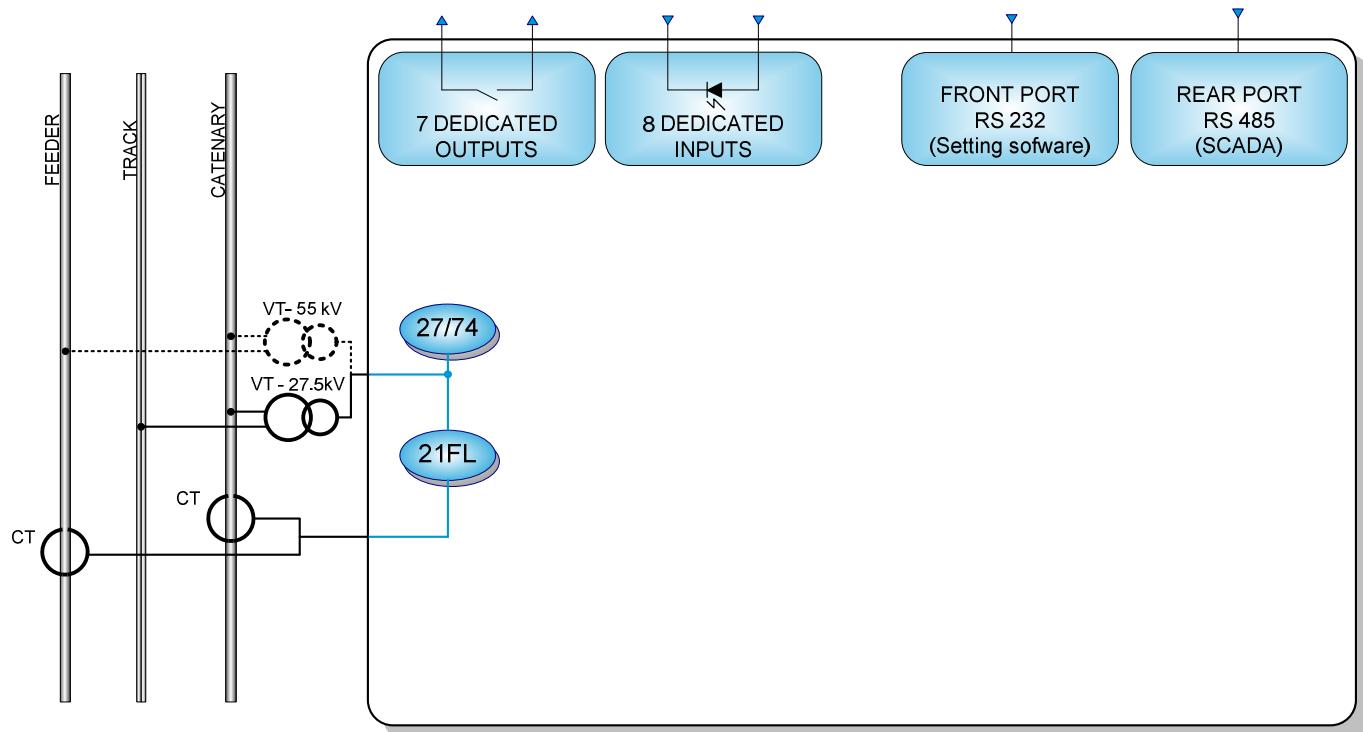
- 2 ranges of auxiliary supply voltages
- Configuration and parameter setting by local MMI or off-line or on-line PC
- Reading and saving relay configuration using PC
- Location of faults in distance with linear locator or user configurable advanced locator
  Measurement of electrical quantities:
  Display expressed in primary values
  Instantaneous values of phase currents and voltage
  Impedance Z, Resistance R, Reactance X, Angle θ of the line
  Display expressed in relative or absolute distance
- Configuration and operation software compatible with Windows® 2000, XP, Vista and 7
- User interface with access to all functions
- Setting software compatible with Windows® 2000, XP, Vista and 7
- Time stamping of internals events with 10 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® standard: storage of four recordings of 52 periods
- Remote reading of disturbance recording and event log
- Self-diagnosis: Memories, output relays, A/D converters, auxiliary supply, cycles of execution of the software, hardware anomaly
- Test of wiring by output relays activation

Options

- Communication by Modbus® : remote signalling, distance to the fault

Functional diagram

afaq ISO 9001 Qualité AFNOR CERTIFICATION

afaq ISO 14001 Environnement AFNOR CERTIFICATION

ice Protection & Control

A525E