DDL800

DC Line Fault Detector

DDL800 performs monitoring of railway and tramway catenaries on DC electrical networks.

DDL800 acts according to rate of rise overcurrent criteria and includes a de-icing monitoring function. A voltage protection is available as well as many operating functions such as a cable thermal image, a recloser with substation management and the check of the correct operation of the high speed circuit breaker.

The optional line test equipment EDL (consult us) confirms the fault elimination before authorizing the closing of the circuit breaker.

As well as the usual protection functions, DDL800 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

- Presence and lack of catenary voltage **(P.L.V.)**
- Substation and catenary voltage comparison **(ΔU)**
- Voltage drop monitoring **(ΔUL)**
- Catenary voltage monitoring **[27DC] [59DC]**
- Recloser management on external trip
- Overcurrent protection **[76-1] [76-2]**
- Rate-of-rise overcurrent protection **(di/dt)**
- Delta I current step protection **(ΔI)**
- De-icing differential protection **[87]**
- Upstream current detection (monitoring of current flowing to substation)
- Cable thermal image **[49DC]**
- Four shot recloser **[82]**
- High speed circuit breaker failure **[76BF]**
- Sensors monitoring **(S.M.)**
- Latching of the output contacts **[86]**
- Programmable line test before reclosure (with optional EDL interface, see application guide)

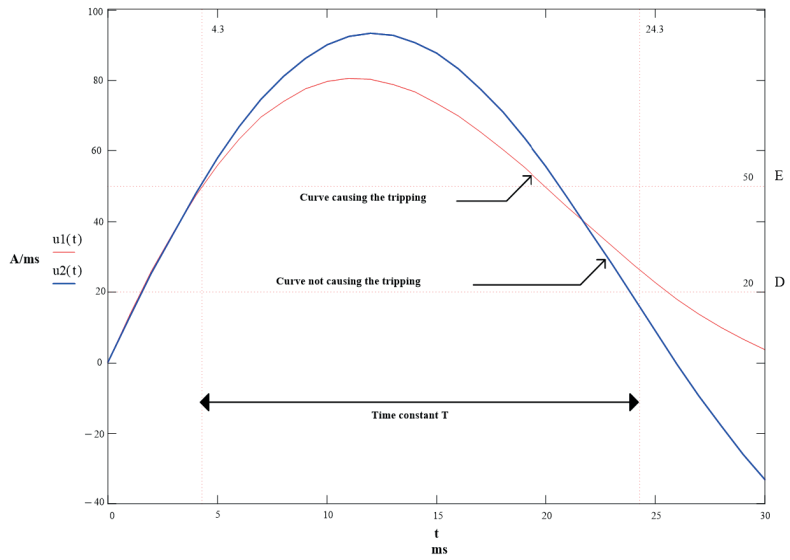
GENERAL CHARACTERISTICS

Auxiliary Supply	
• Auxiliary supply ranges	48 Vdc or 125 Vdc
• Operating range	-20% / +10%
• Maximum consumption	< 30 W, with auxiliary supply of 4 sensors
• Memory backup	72 hours
Measurements	
• DC sensors, current and voltage (contact us for more information)	voltage supply provided: 48 Vdc or +/- 15 Vdc (-10%; +10%)
• Current sensor ($I_{catenary}$, I_{track})	primary value adjustable from 1,000 A to 10,000 A secondary value: 5 or 10 V
• Voltage sensor ($U_{catenary}$, $U_{substation}$)	primary value adjustable from 500 V to 4,000 V rated voltage adjustable from 500 V to 3,500 V secondary value: 5 or 10 V
Analogue inputs	
• Current: 2	$I_{catenary}$, I_{track},
• Voltage: 2	$U_{catenary}$, $U_{substation}$,
Digital inputs (8)	
• Polarizing voltage	48 Vdc or 125 Vdc (according to the auxiliary supply range)
• Level 0	< 10 Vdc range 48 Vdc– < 33 Vdc range 125 Vdc
• Level 1	> 20 Vdc range 48 Vdc – > 37 Vdc range 125 Vdc
• Burden	< 15 mA
Relay outputs (7 + 1 WD)	
• Relays A, B, E, F : (signalling)	double NO contact, permanent current 8 A closing capacity 12 A / 4 s short-circuit current withstand 100 A / 30 ms breaking capacity CC with L/R = 40 ms: 50 W breaking capacity CA with cos φ = 0.4 : 1,250 VA
• Relays C, D, G and 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 CC with L/R = 40 ms : 50 W breaking capacity CA with cos φ = 0.4 : 1,250 VA
Overcurrent protection [76-1] [76-2]	
• 2 thresholds (MAXI1 ; MAXI2)	10 to 10,000 A, step of 10 A
• Operation of MAXI1 and MAXI2	2 programmable mode: non directional / forward only
• Time-delay Ti1 (MAXI1) Time-delay Ti2 (MAXI2)	10 to 250 ms, step of 10 ms 10 ms to 120 s, step of 10 ms
Rate-of-current rise protection (di/dt)	
• Enabling (E) and Disabling (D) thresholds	1 to 250A /ms, step of 1 with D<E
• Fault measuring time TMD	1 to 400 ms, step of 1 ms
Delta I current step protection (ΔI)	
• Step of current (Delta I)	10 to 10,000 A, step of 10 A
• Time constant T for Delta I(t)	1 to 400 ms, step of 1 ms
De-icing differential protection [87]	
• Operating mode	use of 2 sensors for measurement of I_{track} and I_{cat}
• De-icing threshold (I_{track})	10 to 10,000 A, step of 10 A
• De-icing monitoring time	0 to 60 min, step of 1 min
• Differential threshold ($I_{diff} = I_{cat} - I_{track}$)	10 to 10,000 A, step of 10 A
• Differential trip time	10 to 400 ms, step of 10 ms
Operating parameters	
• Pulse time of the trip order (Td)	0.10 to 10.00 s, step of 0.01 s
• Pulse time of the close order (Te)	0.10 to 2.00 s, step of 0.01 s
• Reclosing order after external trip	programmable: yes / no
• Blocking time-delay after external trip	0.10 to 10.00 s step of 0.01 s

GENERAL CHARACTERISTICS

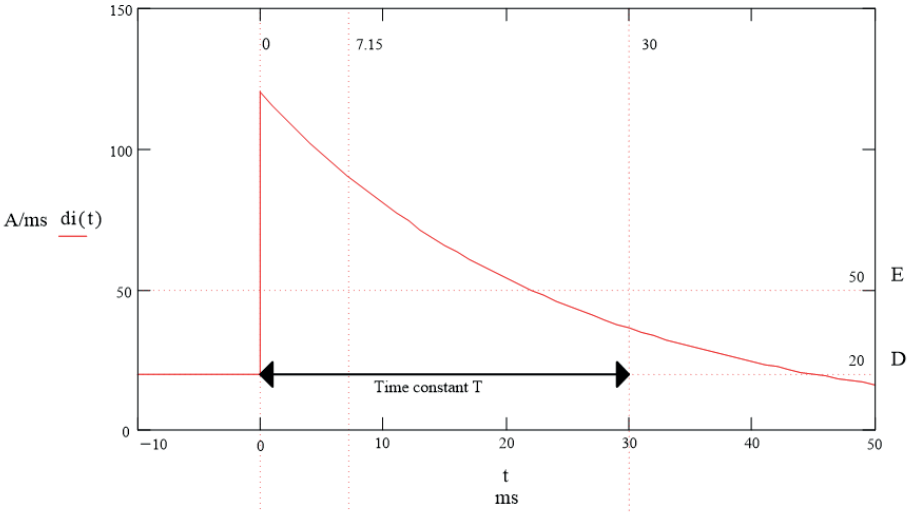
Sensors monitoring (S.M.)	
• Monitoring of the current sensors	programmable for sensor 1 and 2: without / with
• Monitoring threshold (f / calibration offset)	50 to 90%, step of 10%
• Number of samples filtered	1 to 200
• Time-delay alarm	10 to 30 min, step of 1 min
• Assignment of sensor alarm to WD relay	programmable: yes / no

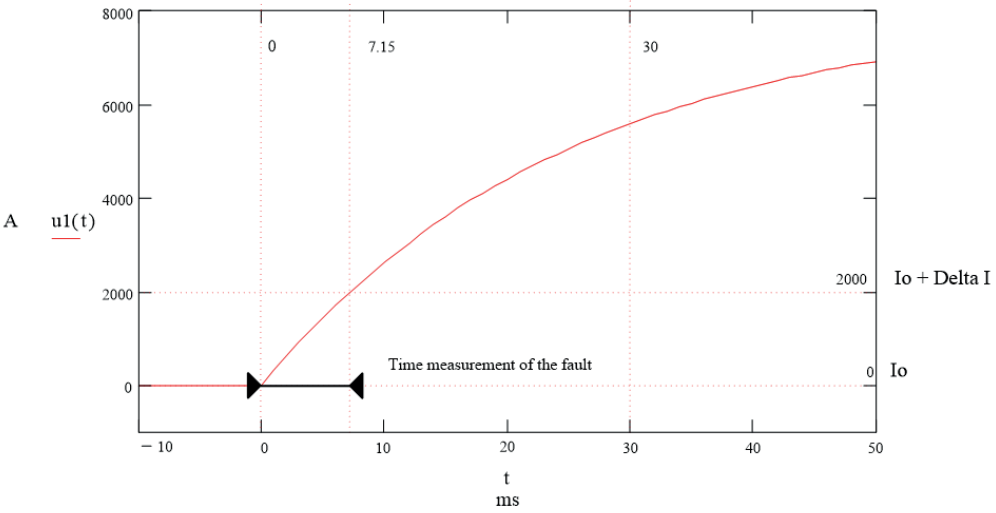
Tripping by Rate-of-current-rise (di/dt)



Function starts if di/dt ≥ E.
Tripping if di/dt > D during TMD.

Tripping by step of current (ΔI)





After reaching threshold E, the DDL records the Io value.
Tripping happens if i(t) > Io + ΔI during T.

GENERAL CHARACTERISTICS

High speed circuit breaker failure [76BF]	
• Breaker failure threshold	10 to 10,000 A step of 10 A
• Breaker failure time delay	0.10 to 10 s step of 0.01 s
• Monitoring of the interlocks position	programmable: without - with c/o - with o/o - with c/o and o/o
Presence and lack of catenary voltage (P.L.V.)	
• Presence of voltage threshold	60 to 120% Un, step of 5% Un
• Lack of voltage threshold	20 to 80% Un with Lack of voltage < Presence of voltage, step of 5% Un
• Lack of voltage Time-delay	0.0 to 10.0 s, step of 0.1 s
• Trip operation for lack of voltage condition	programmable: yes / no
Substation and catenary voltage comparison (ΔU)	
• Undervoltage threshold	5 to 100% Un (substation voltage sensor required) step of 5% Un
Voltage drop monitoring (ΔUL)	
• Load resistance adjustment	0.1 to 10.0 Ω, step of 0.1 Ω
• Voltage drop Time-delay	0.10 to 5.00 s, step of 0.01 s
Catenary voltage monitoring [27DC] [59DC]	
• Undervoltage alarm threshold	20 to 100 % Un, step of 5% Un
• Undervoltage trip threshold	20 to 100 % Un, step of 5% Un
• Trip operation for undervoltage condition	programmable: yes / no
• Overvoltage alarm threshold	100 to 130 % Un, step of 5% Un
• Overvoltage trip threshold	100 to 130 % Un, step of 5% Un
• Trip operation for overvoltage condition	programmable: yes / no
• Trip Time-delay	0.0 to 10.0 s, step of 0.1 s
Cable thermal image [49DC]	
• Heating time constant	4 to 180 min, by step of 1 min
• Cooling time constant	equal to Heating time constant
• Thermal alarm threshold	80 to 100%, step of 1%
• Thermal trip threshold	100 to 10,000 A, step of 10 A
Four shot recloser [82]	
• Number of recloser cycles	1 to 4
• Reclose Time-delay (dead time)	4 time-delays of 0.1 to 100.0 s, step of 0.1 s
• Cycles reclaim time (common to all cycles)	1 to 100 s, step of 1 s
• Reclaim time after manual closing	0.1 to 100.0 s, step of 0.1 s
Digital Inputs assignment	
• User programmable by setting software	
• De-icing order	none or DI 1
• Request of disturbance recording	none or DI 2 (for external order)
• Settings table selection, set 1 – set 2	Fixed: DI 3
• EDL test achieved	Fixed: DI 4
• CB manual trip order	Fixed: DI 5
• CB manual close order	Fixed: DI 6
• Interlock c/o	Fixed: DI 7 (switching device position)
• Interlock o/o	none or DI 8 (switching device position)
• Blocking of the DDL800	none or DI 1
• Blocking of the EDL800	none or DI 2
• Blocking of the recloser	none or DI 8

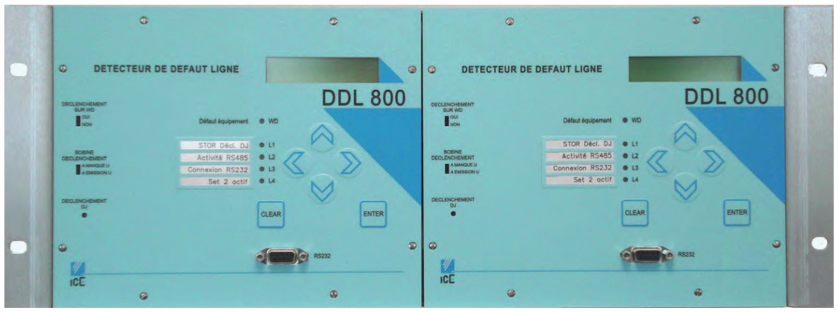
GENERAL CHARACTERISTICS

Digital outputs assignement (continue)	
• User programmable by setting software	
• CB tripping order	Fixed: C (adjustable for CB Shunt Opening Release or Under Voltage Release)
• WD tripping order (adjustable)	none or C (fixed)
• CB trip signalling	A, B, D, E, F, G
• Settings table selected	A, B, D, E, F, G
• Sensors calibration in progress	A, B, D, E, F, G
• De-icing in progress	A, B, D, E, F, G
• De-icing alarm	A, B, D, E, F, G
• CB closing order	D or G
• CB failure	A, B, D, E, F, G
• Voltage presence	A, B, D, E, F, G
• Lack of voltage	A, B, D, E, F, G
• Test EDL order	A, B, D, E, F, G
• Test EDL OK	A, B, D, E, F, G
• Test EDL not OK	A, B, D, E, F, G
• Thermal overload alarm	A, B, D, E, F, G
• Sensor alarm	A, B, D, E, F, G and WD
• Blocking of the closing	A, B, D, E, F, G
• Undervoltage alarm	A, B, D, E, F, G
• Overvoltage alarm	A, B, D, E, F, G
Latching of the output contacts [86]	
• Manual reset for output relays	A, B, E, F (programmable assignment)
• Reset	digital communication or local MMI
Signalling LEDs assignment	
• By setting software	with customisable label
Setting software	
• Display	French, English, Spanish, Italian
• Configuration and operating software	Windows® compatible 2000, XP, Vista and 7 French, English, Spanish, Italian
MODBUS® Communication	
• Transmission	asynchronous series, 2 wires
• Interface	RS485
• Transmission speed	300 to 115,200 bauds
Disturbance recording	
• Number of recordings	12
• Pre fault time	adjustable from 2 to 5 s
• Fault time duration	400 ms with sampling rate of 1 ms
• Post fault time	adjustable from 0.5 to 1 s
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

GENERAL CHARACTERISTICS

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 Output, 1 kV differential mode except RS485, 3 kV common mode
• Dielectric withstand (50Hz or 60Hz)	IEC / EN 60255-5: common mode 2 kVrms – 1 min differential mode for Digital Output 1 kVrms – 1 min (contact open)
• 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
• SNCF French railway standard	EN50123-7-1/2/3, EN50121-1/5 and EN50163
Enclosure safety	
• Degree of protection provided by enclosures (IP code)	IEC / EN 60529 : IP50
Immunity - Conducted distubances	
• 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 robustess - energised	
• Vibrations	IEC / EN 60255-21-1: class 1 - 0.5g
• Shocks	IEC / EN 60255-21-2: class 1 - 5g / 11 ms
Mechanical robustess - 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 falls	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

GENERAL CHARACTERISTICS

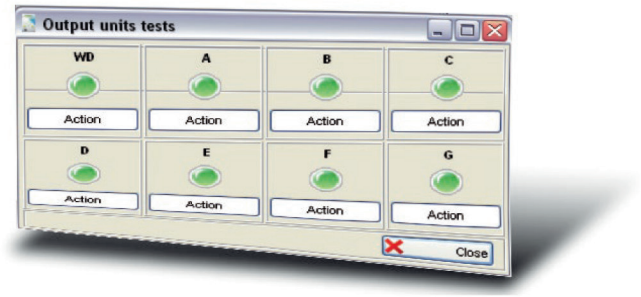


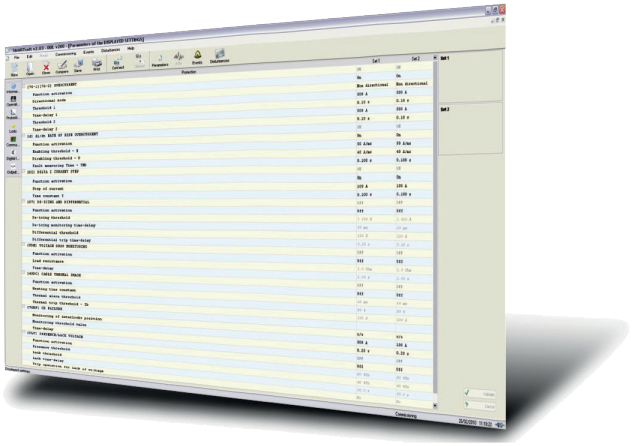
rack 4U – 19» / 2 x DDL800

Presentation	
• Display	2 lines of 16 characters
• LED indication	1 for WD watchdog and 4 user programmable LEDs
• H, W, D (rack 4U – ½ 19" / 1xDDL800)	177 x 270 x 340 mm - Weight: 6.6 kg
• H, W, D (rack 4U – 19" / 2xDDL800)	177 x 483 x 340 mm - Weight: 12.6 kg
• H, W, D (rack 4U – 19" / 1xDDL800 and 1 blank panel)	177 x 483 x 340 mm - Weight: 7 kg
Connection - Codification	
• See diagram S39285	
• See ordering information D40679	

SMARTsoft

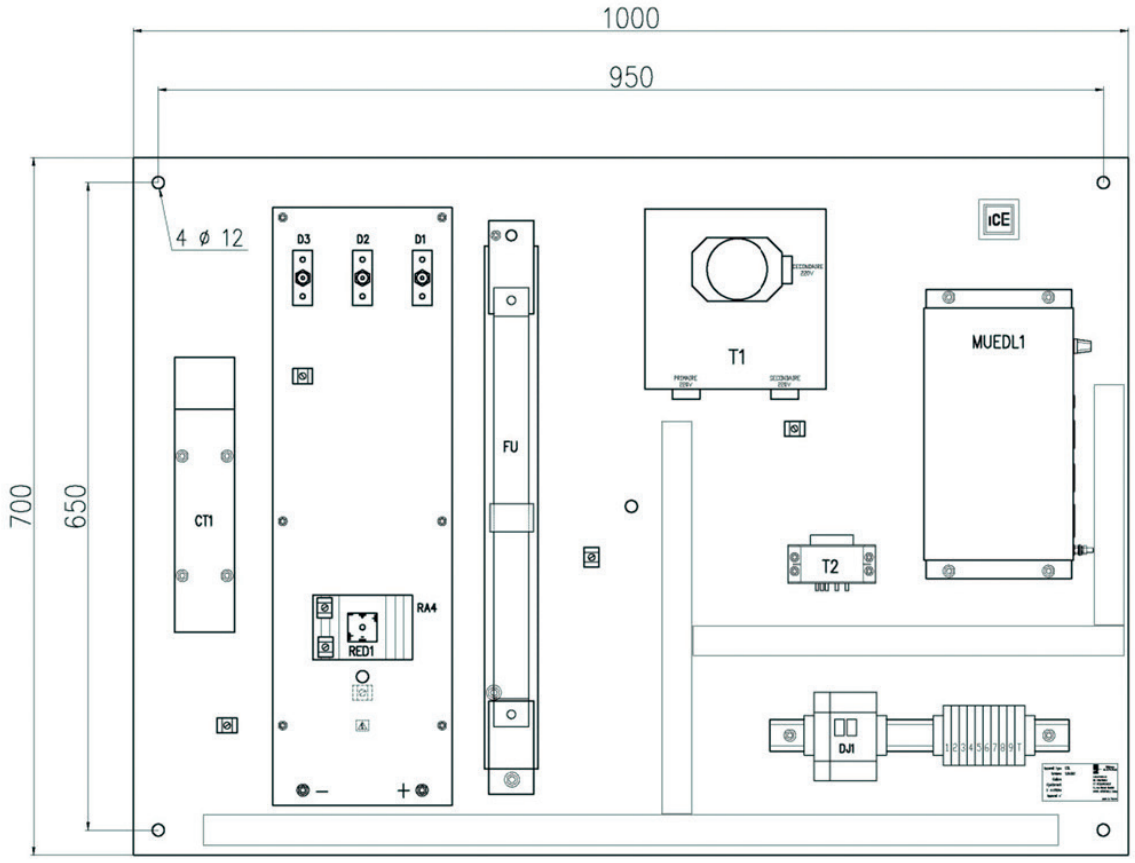
SMARTsoft, integrated software for the Industry, Railway and Transmission ranges, helps the User get the best from NP800 series relays.





- User friendly
- Diagnosis
- Fault analysis
- Maintenance tools

EDL interface (option)



EDL application*

- Link to the DDL800 the mounting plate EDL carries out the test of the catenary before the closing of the feeder circuit breaker by applying to the catenary an AC voltage of 220Vac (50 or 60HZ) by means of a leakage transformer. The EDL checks the presence of a fault per evaluation of this voltage.

EDL characteristics*

- Weight: 35 kg
- Storage: -40°C et +70°C
- Temperature of operation: -5°C +55°C
- Supply: 220 V - 50Hz
- Burden: stand-by position: 0.1A, maximum during the test: 5A

EDL Inputs - Outputs*

- Supply (220 V - 50HZ or 60HZ)
- Test EDL order (from DDL800)
- EDL test achieved (to DDL800)
- CB fault (changeover contact)

*for details, see EDL User's guide

FUNCTIONALITIES

- 2 auxiliary supply voltages
- Storage of the lack and the restoration of the auxiliary voltage (events recorded)
- Configuration and parameter setting by local MMI or off-line or on-line PC
- Reading and saving configuration using PC
- Real time measuring of electrical values : display with primary values of voltage, current and differential current
- 2 setting groups, locally or remotely selectable
- Configuration and operation software SMARTsoft compatible with Windows® 2000, XP, Vista and 7
- Time stamping of internal events with 10 ms resolution
- Event recording : 200 / 250 locally recorded events
- Storing of measures and active setting group
- Local/remote acknowledgement of events
- Disturbance recording according to Comtrade format : storage of the last 12 records
- Remote setting and reading of measurements, counters, alarms and parameter settings
- Self-diagnosis : RAM, ROM, EEPROM, output relays, A/D converters, auxiliary supply, cycles of execution of the software, hardware fault
- 4 user programmable LEDs
- Communication by Modbus®

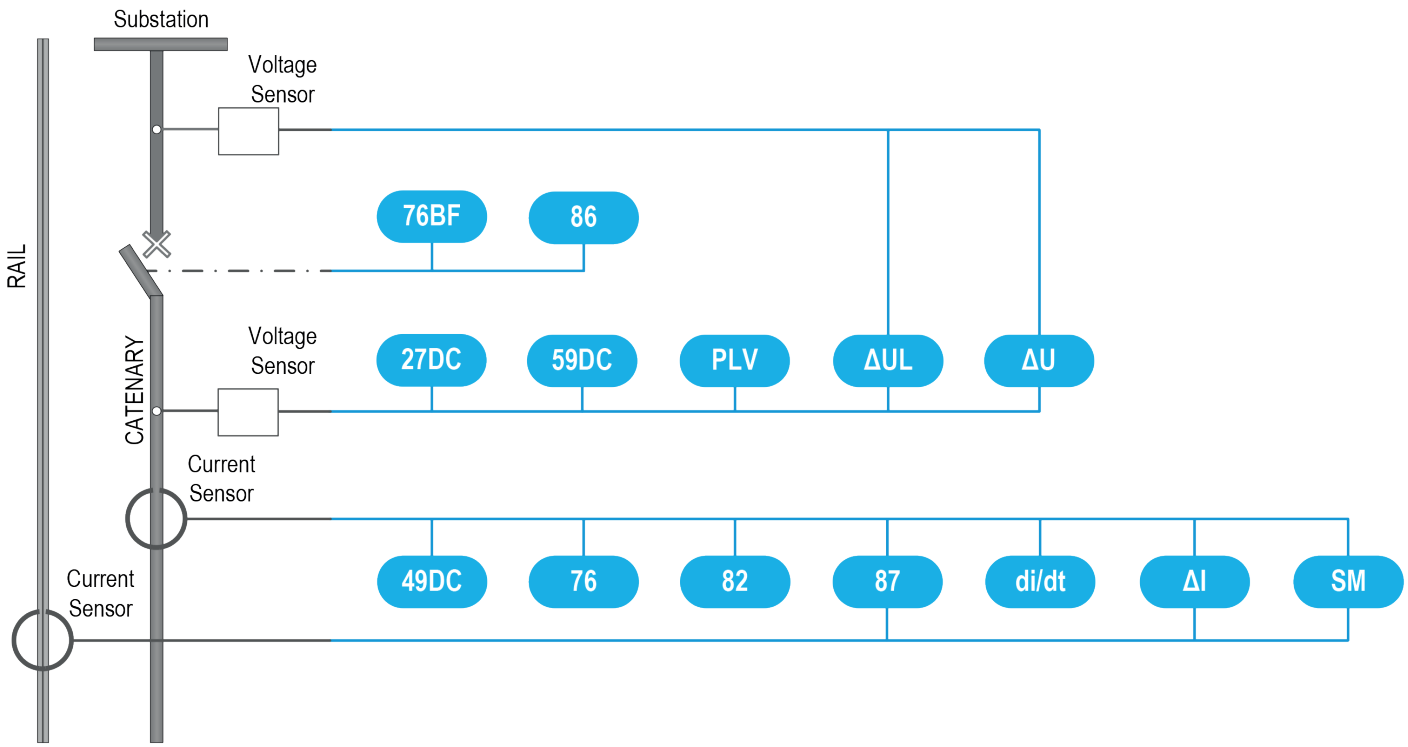
Operating modes

- Calibration mode: adjustment of sensors offset
- Forcing mode: forcing of disturbance recording without tripping
- Manual tripping with memorized event

External options

- DC sensors, current and voltage can be provided: $I_{catenary}$, I_{track}, $U_{catenary}$, $U_{substation}$ (consult us)
- EDL equipment: provides line test to authorise automatic or manual reclosing function (see application guide)

FUNCTIONAL DIAGRAM



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