

DDL9000

DC Catenary Protection Catenary voltage up to 3 kV



Our DDL9000 protection relay protects the fixed electric traction installations responsible for supplying the catenaries with direct current up to 3 kV.

Thanks to a hybrid acquisition of currents and voltages (through sensors or IEC 61850-9-2 SV), it facilitates the operation of your railway electrical network.

Based on more than 40 years of experience in this field, our DDL9000 relay is part of our 9000 Series designed for monitoring and controlling railway systems.



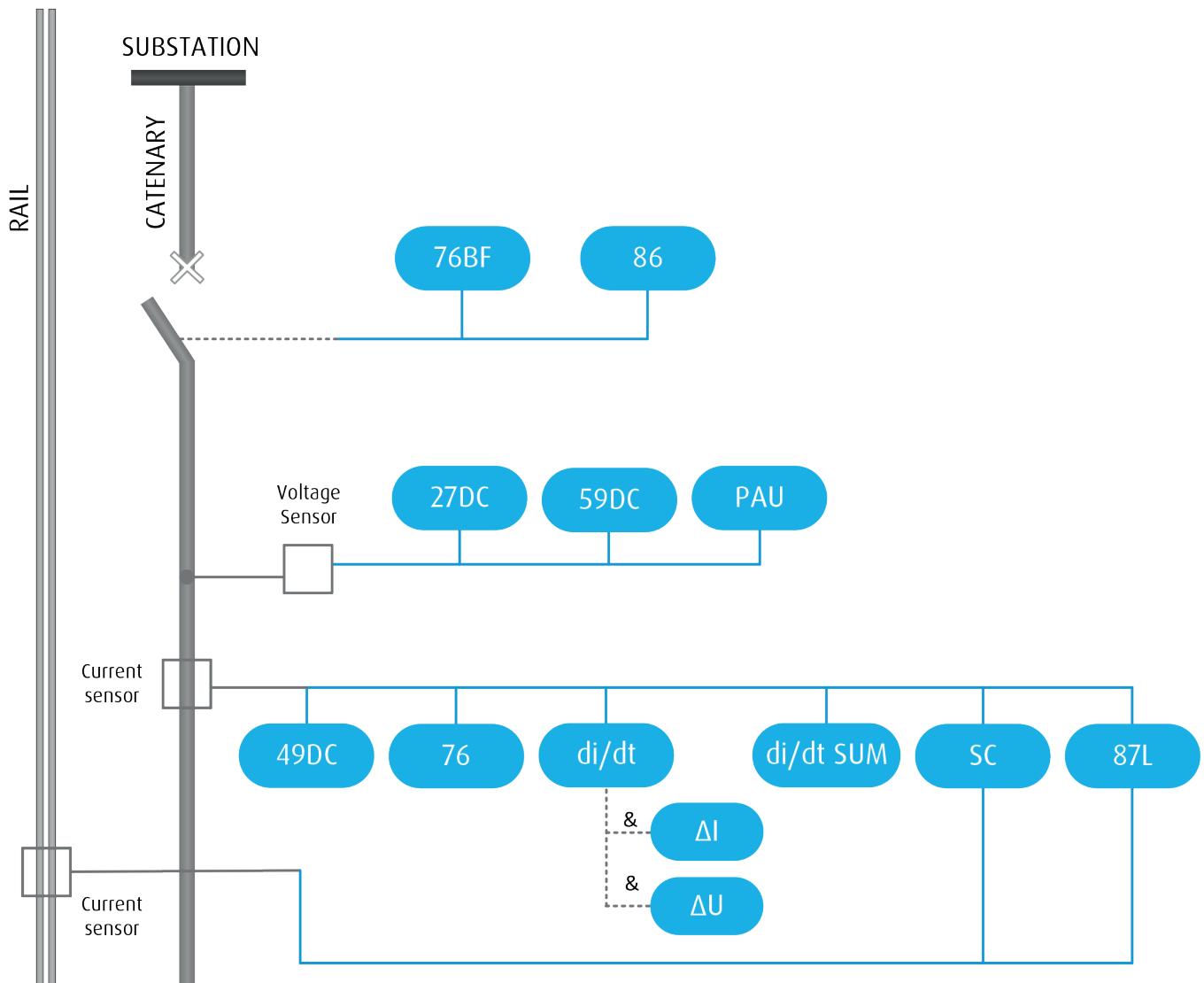
- High resolution colour touch screen
- Embedded web server
- IEC 61850 ed2 or Modbus servers
- 2x16 A circuit breaker outputs
- 12 configurable digital outputs
- 18 configurable digital inputs
- 16 configurable LEDs
- 48 VDC to 125 VDC \pm 10% power supply
- 19" - 3U - 355 mm rack

- Performance
 - Instantaneous tripping time in less than 30 ms
 - Sampling rate: 4 kHz
 - Operating temperature: -5 °C to 55 °C
- Main standards
 - Design according to IEC 60255
 - EMC according to IEC 61000-4-*
 - Communication according to IEC 61850
 - CE marking according to IEC 60255-27

OUR TRADEMARKS



FUNCTIONAL SCHEME



PROTECTION FUNCTIONS

- [27DC] [59DC] Catenary voltage monitoring
- [76BF] Breaker failure function
- [76-1] [76-2] Overcurrent function
- [di/dt] Rate of change of current function
 - AND criteria: [ΔI] Delta I current deviation
 - AND criteria: [ΔU] Voltage drop monitoring function
- [87L] De-icing differential function
- [di/dt SUM] Rate of change of summed current function
- [49DC] Cable thermal overload function
- [PAU] Presence and lack of catenary voltage

MONITORING FUNCTIONS

- [SC] Sensors monitoring
- [86] Circuit breaker monitoring
- Disturbance recording



OVERCURRENT FUNCTION (POSITIVE & NEGATIVE) [76]

Settings	Value	Comments
Instantaneous confirmation time delay	0 to 100 ms 1 ms step	1 setting for both positive and negative component
Threshold enabling 1 (\pm)	Yes / No	Positive / Negative
Threshold enabling 2 (\pm)	Yes / No	Positive / Negative
Resetting percentage	90 to 99% 1% step	Positive / Negative
Threshold 1 (\pm) and Threshold 2 (\pm)	10 A to 10,000 A 10 A step	Positive / Negative
Time delay threshold 1 (\pm)	10 ms to 2 min 10 ms step	Positive / Negative
Time delay threshold 2 (\pm)	10 ms to 2 min 10 ms step	Positive / Negative

RATE OF CHANGE OF CURRENT FUNCTION (POSITIVE & NEGATIVE) [di/dt]

Settings	Value	Comments
Instantaneous confirmation time delay	0 to 100 ms 1 ms step	1 setting for both positive and negative component
di/dt function enabling (\pm)	Yes / No	Positive / Negative
Switch-on threshold E (\pm)	1 A/ms to 250 A/ms 1 A/ms step	Positive / Negative
Tripping threshold D (\pm)	1 A/ms to 250 A/ms 1 A/ms step	Positive / Negative
Time delay TMD (\pm)	5 ms to 400 ms 1 ms step	Positive / Negative

DELTA I CURRENT DEVIATION [ΔI]

Settings	Value
Instantaneous confirmation time delay	0 to 100 ms 1 ms step
Resetting percentage	90 to 99% 1% step
Current deviation ΔI	10 A to 10,000 A 10 A step
Time delay ΔI	5 ms to 400 ms 1 ms step

VOLTAGE DROP MONITORING FUNCTION [ΔU]

Settings	Value
Instantaneous confirmation time delay	0 to 100 ms 1 ms step
Voltage drop ΔU	0 to 2,000 V 10 V step
Undervoltage threshold	0 to 3,000 V 10 V step

RATE OF CHANGE OF SUMMED CURRENT FUNCTION (POSITIVE & NEGATIVE) [di/dt SUM]

Settings	Value	Comments
Inhibition delay after switching on	40 ms to 30 s 10 ms step	1 setting for both positive and negative component
Instantaneous confirmation time delay	0 to 100 ms 1 ms step	1 setting for both positive and negative component
di/dt summing function enabling (\pm)	Yes / No	Positive / Negative
Switch-on threshold E (\pm)	1 A/ms to 2,000 A/ms 1 A/ms step	Positive / Negative
Tripping threshold D (\pm)	1 A/ms to 2,000 A/ms 1 A/ms step	Positive / Negative
Time delay TMD (\pm)	5 ms to 400 ms 1 ms step	Positive / Negative



CABLE THERMAL OVERLOAD FUNCTION [49DC]

Settings	Value
Thermal alarm threshold enabling	Yes / No
Ibase current	100 to 10,000 A 10 A step
Thermal alarm threshold	10 to 100% 1% step
Thermal time constant	4 min to 180 min 1 min step

DE-ICING DIFFERENTIAL FUNCTION [87L]

Settings	Value
De-icing threshold enabling	Yes / No
Differential threshold enabling	Yes / No
Instantaneous confirmation time delay	0 to 100 ms 1 ms step
Resetting percentage	90 to 99% 1% step
De-icing threshold	10 A to 10,000 A 10 A step
De-icing delay	0 to 60 min 1 min step
Differential threshold	10 A to 10,000 A 10 A step
Differential delay	10 ms to 400 ms 10 ms step

BREAKER FAILURE [76BF]

Settings	Value
Breaker failure time delay	0.1 s to 2 s 10 ms step
Monitoring of the interlocks position	Without f/o o/o o/o AND f/o

CATENARY VOLTAGE MONITORING [27DC] [59DC]

Settings	Value
Instantaneous confirmation time delay	0 to 100 ms 1 ms step
Undervoltage resetting percentage	101 to 110% 1% step
Overvoltage resetting percentage	90 to 99% 1% step
Undervoltage alarm threshold enabling	Yes / No
Undervoltage trip threshold enabling	Yes / No
Overvoltage alarm threshold enabling	Yes / No
Overvoltage trip threshold enabling	Yes / No
Undervoltage alarm threshold	20 to 100% 1% step
Undervoltage trip threshold	20 to 100% 1% step
Overvoltage alarm threshold	100 to 140% 1% step
Overvoltage trip threshold	100 to 140% 1% step
Undervoltage time delay	0 to 3,600 s 0.1 s step
Overvoltage time delay	0 to 3,600 s 0.1 s step
Trip operation for undervoltage condition	Yes / No
Trip operation for overvoltage condition	Yes / No



PRESENCE AND LACK OF CATENARY VOLTAGE [PAU]

Settings	Value
Instantaneous confirmation time delay	0 to 100 ms 1 ms step
Lack of voltage resetting percentage	101 to 110% 1% step
Presence of voltage resetting percentage	90 to 99% 1% step
Presence of voltage resetting percentage	Yes / No
Presence of voltage threshold 2 enabling	Yes / No
Lack of voltage threshold 1 enabling	Yes / No
Lack of voltage threshold 2 enabling	Yes / No
Presence of voltage threshold 1	60 to 110% 1% step
Presence of voltage threshold 2	60 to 110% 1% step
Lack of voltage threshold 1	20 to 80% 1% step
Lack of voltage threshold 2	20 to 80% 1% step
Trip operation for lack of voltage threshold 1 condition	Yes / No
Lack of voltage threshold 1 delay	0.1 to 60 min 0.1 s step
Trip operation for lack of voltage threshold 2 condition	Yes / No
Lack of voltage threshold 2 delay	0.1 to 60 min 0.1 s step

SENSORS MONITORING FUNCTION [SC]

Settings	Value
Catenary sensor	
Monitoring threshold	50 to 90% 1% step
Time-delay alarm	1 min to 1,440 min 1 min step
WD on sensor fault	Yes / No
Rail sensor	
Monitoring threshold	50 to 90% 1% step
Time-delay alarm	1 min to 1,440 min 1 min step
WD on sensor fault	Yes / No

COMMUNICATION FUNCTION

Settings	Value
Connection time out	0 to 10 s 100 ms step
Modbus RTU	
Slave number	1 to 255
Transmission format	8-N-1 8-N-2 8-E-1 8-O-1
Speed transmission	9,600 / 19,200 / 38,400 / 57,600 / 115,200 Bd
Modbus TCP	
IP address	XXX.XXX.XXX.XXX
Port	1 to 65,535 (fault 502)



DISTURBANCE RECORDING	
Settings	Value
Pre-time	0 s to 6 s 0.1 s step
Enable according to criteria	Yes / No

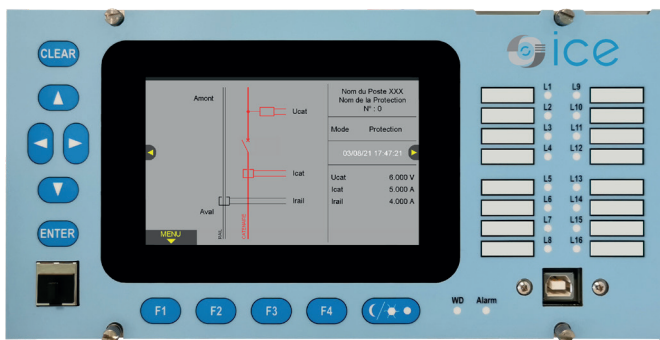
ENVIRONMENT & INFLUENCES	
Criteria	Standards
Product standard	
Common requirements	NF EN 60255-27
Insulation coordination	
Dielectric strength 2 kVac except COM access 500 Vac	NF EN 60255-27 NF EN 50124-1
Environmental influence tests on equipment	
Degree of protection of the enclosure IP43 on the front face, IK07	NF EN 60529 IEC 62262
Climatic environment <ul style="list-style-type: none"> • Operation: -5°C to +55°C • Storage : -40°C to +70°C 	IEC 60068-2-1 IEC 60068-2-2
Humid atmosphere operation (40°C; 93% HR)	IEC 60068-2-78
Mechanical environment	
Vibrations 10-500 Hz <ul style="list-style-type: none"> • Behaviour 1 g • Endurance 2 g 	IEC 60255-21-1
Shock <ul style="list-style-type: none"> • Behaviour 5 g-11 ms • Endurance 15 g-11 ms 	IEC 60255-21-2
EMC	
Emission and immunity	IEC 60255-26 NF EN 50121-5 NF EN 61000-4-30 NF EN 61000-4-3 NF EN 61000-4-4 NF EN 61000-4-5
CE marking	
Low Voltage Directive EMC directive RoHS directive	2014/35/UE 2014/30/UE 2011/65/UE

ADVANCED CONNECTIVITY

Compliant with the requirements of the IEC 61850 edition 2 standards, our DDL9000 relay also incorporates the following communication features:

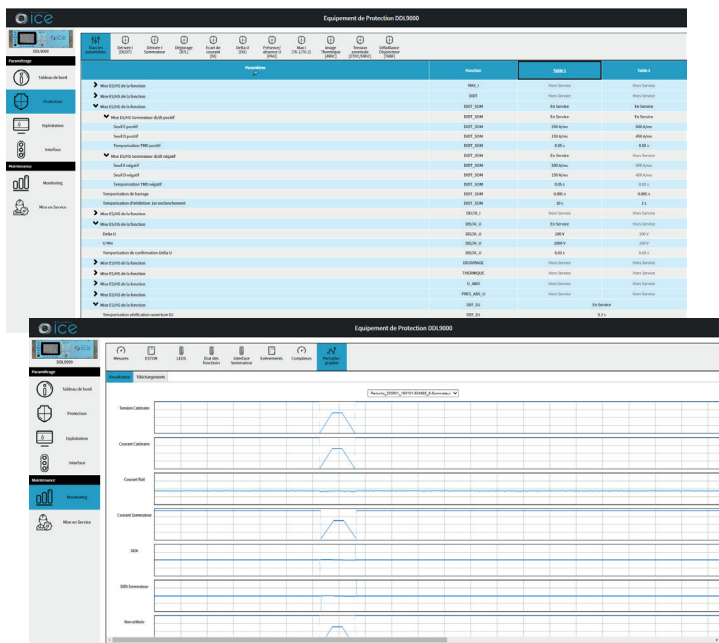
- IEC 61850-8-1 (MMS) and IEC 61850-9-2 (SV) synchronised by PTP 1588
- Modbus (serial and over TCP/IP) – 2 separate parameter sets
- Https (Configuration by Embedded Web Server)
- Time synchronisation by NTP
- Network redundancy via HSR/PRP (Option)
- SFP cage (Ethernet RJ45 reception or optic fibre choice)

HMI AND OPERATION



- 800x480 colour touch screen
- Navigation directly from the screen or via the dedicated keys
- 16 configurable LEDs

WEB INTERFACE



- Interface easily accessible with a web browser, locally via the USB type b interface or via the Ethernet port
- Convenient tool that simplifies and speeds up operations of:
 - Diagnostic
 - Setup
 - Equipment commissioning

TECHNICAL CHARACTERISTICS

Current inputs: Catenary, Rail (2)

- $U_n = 5$ or 10 V
- Primary value from $1\ 000$ A to $10\ 000$ A
- Withstand a permanent 12 V | 20 V 1 s

Voltage inputs: Catenary (1)

- $U_n = 5$ or 10 V
- Primary value from 500 V to $4\ 000$ V
- Nominal value from 500 V to $3\ 500$ V
- Withstand a permanent 2 U_n

Digital inputs: 18

- Proofreading of inputs status
- Power supply: 48 VDC to 125 VDC $\pm 10\%$
- Current: ≥ 2 mA

CB outputs: 2

- Trip relay
 - DC voltage withstand: 300 V
 - Continuous current: 16 A
 - Breaking capacity: $4,000$ VA
- Output control

Digital outputs: 12

- Signalling relays
 - DC voltage: 300 V
 - Continuous current: 6 A
 - Breaking capacity: $1,500$ VA
 - Max switching time: 10 ms (activation and deactivation)
- Coil/contact insulation: 4 kV
- Output control

Performance

- Instantaneous tripping time < 30 ms
- Sampling rate: 4 kHz

Dimensions

- $19''$ - $3U$ - 355 mm rack

Recordings

- $1,000$ events
- 32 disturbance records in COMTRADE format

Communication protocols

- IEC 61850 edition 2
 - IEC 61850-8-1 (GOOSE, MMS)
 - IEC 61850-2 SV with IEEE 1588 PTP sync
- Network redundancy
 - PRP (Parallel Redundancy Protocol)
 - HSR (High-availability Seamless Redundancy)
- Modbus
- Configuration via HTTPS (Embedded Web server)

Power supply

- 48 V to 125 V $\pm 10\%$

Operating temperature

- From -5 °C to $+55$ °C