



RL-PROTECT

Multicurve feeder protection relay

1. INTRODUCTION

RL-PROTECT is a digital relay designed to offer a complete over-current protection for DC metro and railways feeders. RL-PROTECT is connected to isolated transducers to monitor the feeder current and voltage. A large panel of customizable conditions allows exhaustive detection of different types of line faults.

2. MEASURED MAGNITUDES

- ◆ The line current is measured by means of an isolated CT installed on the busbar. Current measurement is unidirectional or bidirectional.
- ◆ The line voltage (optional) is measured by means of an isolated resistive divider.

3. TRIGGER CONDITIONS

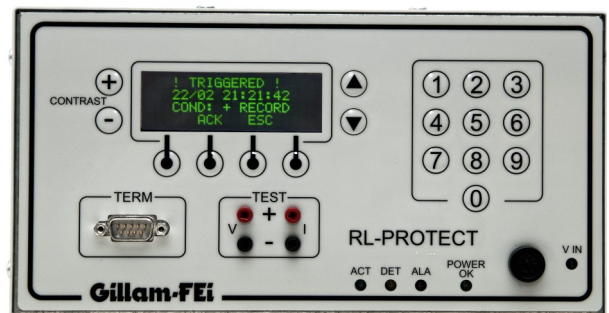
3.1 I-dependent conditions

For each current direction, the user is able to customize the various faults detection algorithms available :

- ◆ *di/dt detection*
di/dt analysis allows detecting long distance and/or resistive short-circuits. di/dt analysis allows efficient discrimination between line faults and inrush currents produced by traction equipment.
- ◆ *Delta I condition*
The analysis of Delta I condition allows the quick detection of short or medium distance short-circuits. The analysis is based on the evolution of the current versus time.
- ◆ *Overcurrent condition*
Time delayed detection of maximum current.

The RL-PROTECT associates performant faults detection, oscillography and system history recording.

A modern and intuitive man-machine interface allows easy use of the RL-PROTECT.



3.2 V-dependent conditions

- ◆ *Undervoltage condition*
Time delayed detection of minimum voltage.
- ◆ *Overvoltage condition*
Time delayed detection of maximum voltage.

3.3 Temperature-dependent conditions

- ◆ *Thermal image*
The thermal image of the catenary supply cable is computed to protect the plastic cables against overheating.
- ◆ *Breakure Failure Detection*
A specific monitoring of leak current is performed after breaking order to ensure the correct operation of the switchgear. Breaker failure detection allows to open upstream / downstream protection.



4. OUTPUT RELAY

Interfacing to the HV switchgear, the output relay gives the breaking order.

5. DIGITAL INPUTS

- ◆ 110/48 Vdc DI allow the RL-PROTECT to :
- ◆ Monitor the HV switchgear position
- ◆ Switch between different sets of parameters (see Setup and Maintenance)

6. DIGITAL OUTPUTS

110VDC DO allow to :

- ◆ Monitor the breaking relay position
- ◆ Monitor the alarm status
- ◆ Monitor the watchdog status
- ◆ Monitor the working set of parameters
- ◆ Monitor a breaker failure alarm

7. SETUP AND MAINTENANCE

- ◆ Configuration

Two sets of parameters are available and are selectable according to the electrical configuration of catenaries.

- ◆ Supervision

Logbook : every action is recorded and timestamped with a millisecond accuracy.

Oscillo-perturbography : when a fault occurs, I, di/dt and V curves are recorded in non-volatile memory. The last 40 events are kept in memory.

- ◆ Password protection

Different access levels are granted depending on the user's privileges. Read-only and Read-modify access is protected by a configurable password.

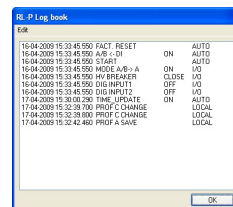
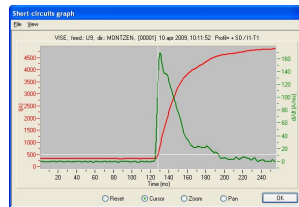
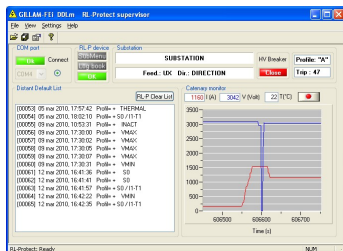
8. USER INTERFACE

- ◆ Local configuration

An interface composed of an LCD display and a keypad allow the user to configure the RL-PROTECT and view the logbook.

- ◆ Local supervision

A graphical user interface (GUI) running under Windows™ is also available. The graphical interface allows, in addition to the functionalities granted by the LCD display, to exploit the data collected by the perturbography.



- ◆ Remote supervision

Modbus RTU protocol is available through one RS-485 fieldbus. A complete remote supervision is possible by a substation automaton or a control centre.



9. COMMUNICATION

RS-232 : one RS-232 DTE serial line is available on the SUB-D9 connector located on the equipment front panel. It supports local supervision.
RS-485 : one RS-485 2 or 4 wires fieldbus is available on the lower connection panel and supports remote supervision.

10. DETAILED CHARACTERISTICS

Mechanics

- ◆ L x D x H (in mm) 250 x 135 x 135 (bottom connectors not included)
- ◆ Fixing 2 anchors for symmetrical rail DIN
- ◆ Connectors located on the lower part
- ◆ Weight 2,2 kg

Power supply

- ◆ Input voltage range 110 Vdc version : 50-150 Vdc
48 Vdc version : 15-65 Vdc
- ◆ Power consumption < 15 Watts

Measured inputs (secondary side)

- ◆ Current measurement input +/- 10V
- ◆ Voltage measurement input +/- 10V or optical fiber
- ◆ Tests points
 - on front panel
 - instantaneous reading on the display

Current probe

- ◆ Catenary current different models available until $\pm 20.000A$
- ◆ Supported probe type
 - open-type sensor (Hall effect)
 - closed-type sensor (Hall effect)
 - shunt + isolated amplifier
- ◆ Probe offset monitoring integrated

Voltage probe

- ◆ Catenary voltage For 750V, 1.5kV and 3kV DC network
- ◆ Probe type
 - Primary (MV) powered
 - Fiber optic insulated resistive divider

Microprocessor

- ◆ Frequency 29.4912 MHz
- ◆ Flash memory 512 kB
- ◆ Non-volatile memory 128 kB
- ◆ Integrated logic Watchdog, real time calendar

ADC section

- ◆ Accuracy 12 bits
- ◆ Number of channels 8
- ◆ Filtering 50 Hz and harmonics rejection
- ◆ Filtering 50 Hz and harmonics rejection



Digital inputs

- ◆ Nominal voltage 110 Vdc or 48 Vdc version
- ◆ Typical current 6 mA nominal

Digital outputs

- ◆ Voltage Max 300 Vdc/240 Vac
- ◆ Typical current 200mA

Breaking relay

- ◆ Voltage 110 Vdc
- ◆ Current 8A
- ◆ Breaking capacity 8A (on inductive load)
- ◆ Polarity NO NC

HMI interface

- ◆ Keypad 20 keys
- ◆ LCD display 4 x 20 characters
- ◆ Backlight Adjustable contrast

Dielectric rigidity (50Hz, 1 min)

- ◆ Power supply 2.5 kV_{eff}
- ◆ Digital inputs 2 kV_{eff}
- ◆ Digital outputs 2.5 kV_{eff}
- ◆ Breaking relay 2.5 kV_{eff}

Standards

- ◆ CEI 60850 Railway applications—Supply voltages of traction systems
- ◆ EN 50121-5 Railway applications—Electromagnetic compatibility—Part 5 : Emission and Immunity of fixed power supply installations and apparatus
- ◆ IEC 60255-5 Electrical Relays—Part 5: Insulation coordination for measuring relays and protection equipment—Requirements and tests
- ◆ EN 50123-7-1, -2, -3 Measurement, control and protection devices for specific use in d.c. traction systems
- ◆ EN 61000-4-2 Electrostatic Discharges immunity
- ◆ EN 61000-4-3 Radiated immunity
- ◆ EN 61000-4-4 Electrical Fast Transients immunity
- ◆ EN 61000-4-5 Surges immunity
- ◆ EN 61000-4-6 Conducted immunity
- ◆ EN 61000-4-8 Magnetic field immunity
- ◆ EN 61000-4-12 Oscillatory waves immunity