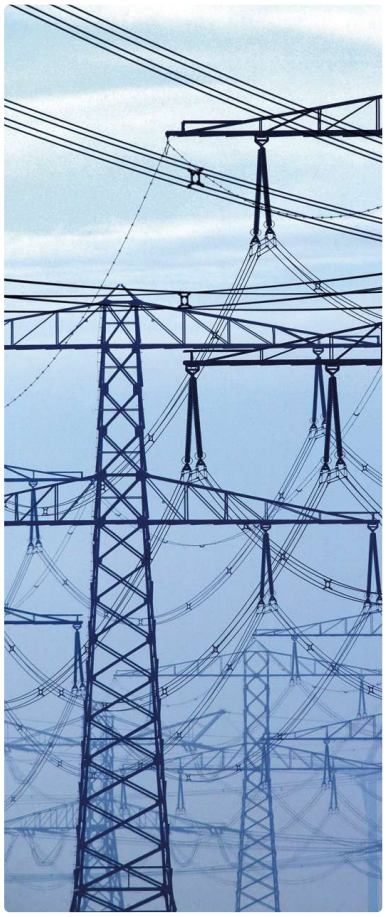
INGEPAC EF LD

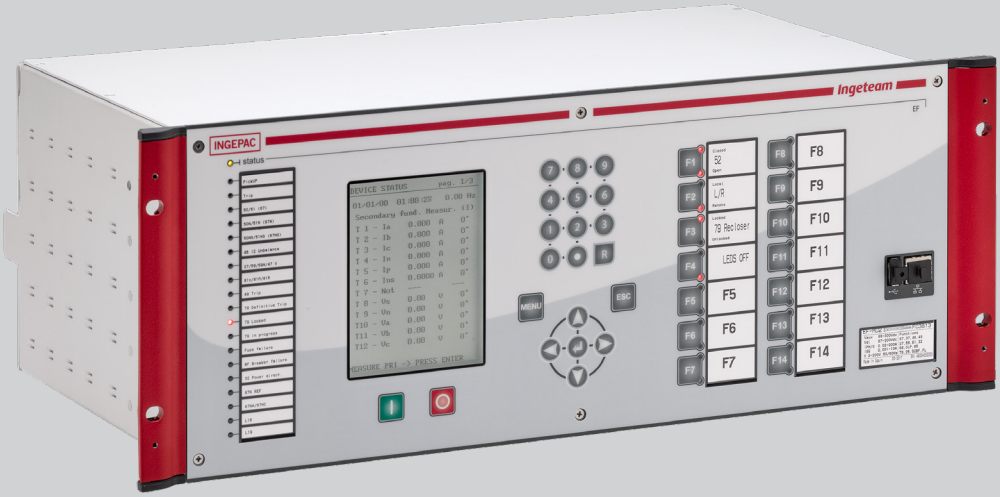
Line differential protection relay



Software

All the equipment in the INGEPAC™ family can be accessed using powerful software tools developed by Ingeteam and which run on Windows®.
The application software is specifically designed for simple and user-friendly access to the equipment.

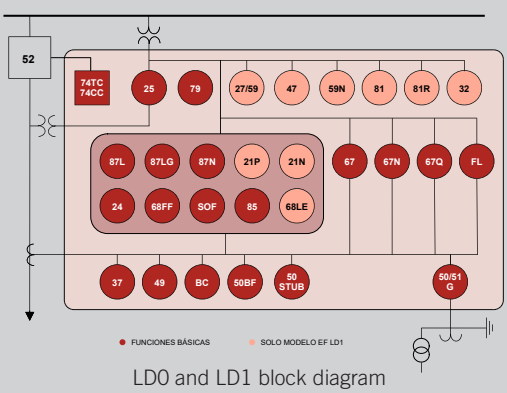
INGESYS EFS



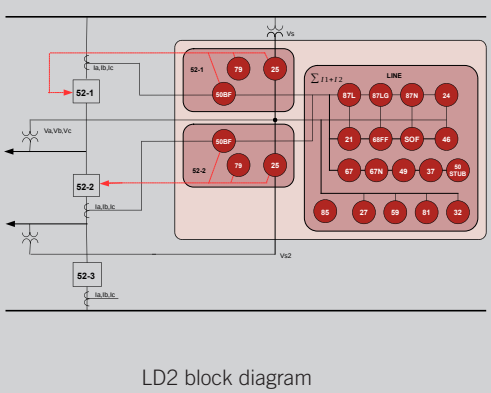
INGEPAC™ EF LD is a phase-segregated line differential protection relay, designed for **main protection of power lines and underground cables** on all voltage levels. INGEPAC™ EF LD supports **dual CT inputs** to monitor both breakers individually, that making it the best solution suitable for **multibreaker schemes**, such us breaker and a half or ring applications.

INGEPAC™ EF LD includes a complete **distance protection scheme of 5 zones**, in order to increase the security in case of failure of the communication channel, providing a **high flexibility** in the definition of the protection and control schemes using the same relay model.

Its design is compliant with all the requirements of standards in the electrical sector, including **IEC 61850**. INGEPAC™ EF LD provides comprehensive and detailed information, by means of its **monitoring and events recording capabilities**, these being fundamental elements in an electrical grid's improvement process.



LD0 and LD1 block diagram



LD2 block diagram

Differential functions
87 Line differential protection (instantaneous and restrained)
2nd harmonic restraint and block (cross blocking)
87LG Ground differential protection
Directional supervision
Saturation detector
Capacitive current compensation
87N REF Restricted Earth Fault
V/f Overexcitation and 5th harmonic
86
Distance functions (LD1 and LD2 models)
Quadrilateral and MHO (5 zones)
Zone 1 extension
High speed zone
Double line adaptation
Supervision units: overcurrent, directional
Algorithm for CVT's (Capacitive Voltage Transformers)
General protection functions
SOTF Switch onto fault
27 (LD1 and LD2)
59 (LD1 and LD2)
59N Neutral overvoltage (LD1 and LD2)
47 V2 overvoltage (LD1 and LD2)
81M/m (LD1 and LD2)
81R Rate of Change of Frequency (LD1 and LD2)
32 Power units (LD1 and LD2)
3x50/51 (67)
50N/51N (67N)
50G/51G Earthing overcurrent
46TOC (67Q), 46IOC (67Q)
46BC Broken conductor detection
2nd harmonic restraint
2nd and 5th harmonic blocking
37 Undercurrent
49 Thermal image
Stub bus
21 Teleprotection (LD1 and LD2)
67/67Q Teleprotection (LD1 and LD2)
50BF Breaker failure with single-pole / three-pole trip
Monitoring units
68LE Load encroachment
68FF Fuse failure
78 Power swing
Fault locator
Breaker monitoring
kI2 per pole
Closing and trip circuit monitoring
Excessive number of trips
Dead line / open pole detector
Breaker status logic
Pole discrepancy
Automation
25 Synchronism check
79 Single-pole/three-pole auto-reclose
Grid coupling
Data acquisition functions
Phase and neutral current
A and B side voltage
Active and reactive power
Active and reactive energy counters, both directions
Chronological historical events and fault recording
Oscillography
Measurement historical report
Breaker monitoring

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Ingeteam

Overview

INGEPAC EF

Insulation and electromagnetic tests

Dielectric withstand	IEC 60255-27
Insulation resistance measurement	IEC 60255-27
Impulse voltage	IEC 60255-27
Electrostatic discharge immunity	IEC 61000-4-2
Radiated radiofrequency electromagnetic field immunity	IEC 61000-4-3
Electrical fast transient / burst immunity	IEC 61000-4-4
Surge immunity	IEC 61000-4-5
Immunity to conducted disturbances, induced by radiofrequency fields	IEC 61000-4-6
Power frequency magnetic field immunity	IEC 61000-4-8
Impulse magnetic field immunity	IEC 61000-4-9
Damped oscillatory magnetic field immunity	IEC 61000-4-10
Ripple on dc input power port	IEC 61000-4-17
Damped oscillatory wave immunity	IEC 61000-4-18
Voltage dips, short interruptions and voltage variations immunity	IEC 61000-4-29
Power frequency immunity	IEC 60255-22-7
Withstand to radiated electromagnetic interference from transceivers	IEEE 37.90.2
Measurements of radiated and conducted radiofrequency disturbances	EN 55022

Climatic

Cold	IEC 60068-2-1
Dry heat	IEC 60068-2-2
Change of temperature	IEC 60068-2-14
Damp heat, cyclic	IEC 60068-2-30
Damp heat steady	IEC 60068-2-78
External protection level	IEC 60529

Mechanical

Vibrations	IEC 60255-21-1
Shock and bump	IEC 60255-21-2
Seismic	IEC 60255-21-3

Main features

- Suitable for lines with 2 and 3 end zones, and for lines with intermediate transformer
- 1 or 2 serial links (RS232, multi-mode or single-mode fibre optic), being possible to establish single or redundant communication between devices.
- Distance protection: five zones on which MHO or quadrilateral characteristic can be applied independently; each zone can be set as forward, reverse or non-directional
- Independent analysis per each phase combination (AN, BN, CN, AB, BC, CA), characteristic (quadrilateral and MHO) and zone
- Single-phase or three-phase trip, applicable with or without teleprotection schemes
- Backup units: overcurrent, overvoltage, undervoltage, frequency, etc.
- Distance units supervision: power swing, load encroachment, fuse failure, etc.
- Automatic activation and blocking of 21 and 67 function as 87L backup units, when teleprotection communications channel is down or restored
- Algorithm for application with capacitive voltage transformers (CVT)
- Fault locator
- Automatic reclose with different timings for single-pole or three-pole trips and for application in breaker-and-a-half and ring schemes
- Synchronism checking functions for one or two breakers, depending on model
- Communication protocols: IEC 61850 Ed.1 and 2, DNP 3.0, IEC 60870-5-103, IEC 60870-5-104, PROCOME
- Graphical and textual logic programming based on IEC 61131-3
- Chronological events record, fault reports, load curves and oscillography
- Metering: current, voltage, power, power factor, energy, frequency, negative sequence current, demand maximeter, THD, fundamental values and RMS
- Front panel for setting and display: 4.9” monochromatic graphic display, programmable function keys with 2 LED each, 19 programmable LED and 1 fixed two-colour hardware status LED, numerical keypad, menu keys and 9 programmable graphics pages
- USB and RJ45 Ethernet ports on the front
- Synchronisation from communications protocols, SNTP, IEEE 1588 (PTP), demodulated IRIG-B input or PPS input
- Web server for monitoring and setting without needing additional software
- Cybersecurity features: sFTP, HTTPs, firewall, audit log, password accesing

Options

- Two housing types: 5U 1/2 x 19” rack and 4U 19” rack, which can contain the following modules in different configurations:
  - 11 digital inputs and 9 digital outputs
  - 16 digital inputs and 16 digital outputs
  - 16 digital inputs and 8 digital outputs
  - 32 digital inputs
  - 16 digital inputs and 8 analog inputs
  - 16 digital inputs and 8 analog inputs (4 isolated)
  - 8 digital inputs, 4 digital outputs and 4 High Break Current outputs
  - 8 digital inputs, 4 digital outputs and 4 High Speed-High Break Current outputs
  - 8 digital inputs and 8 digital outputs
- Selectable rear port connectivity: up to 6 serial communications, up to 2 Ethernet communications
- Serial ports in glass fibre optic (multi-mode or single-mode), plastic fibre optic, RS232 or RS485
- Ethernet ports in glass fibre optic or RJ45
- 1 or 2 OF single-mode channels for differential protection or IEEE C37.94 fibre optic, optionally G703 also with transducer
- HSR, PRP and D-Link communications redundancy
- Captures analog measurements using Sampled Values (SV) protocol, through IEC 61850-9-2 or IEC 61869-9 standards
- Remote inputs capturing and outputs using INGEPAC RIO
- Redundant power supply

Applications

- Main or backup protection for cables, overhead or mixed lines in transmission and subtransmission
- Main protection for breaker and a half schemes lines
- Redundant or double protection schemes as main unit
- Grid automation

CE

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