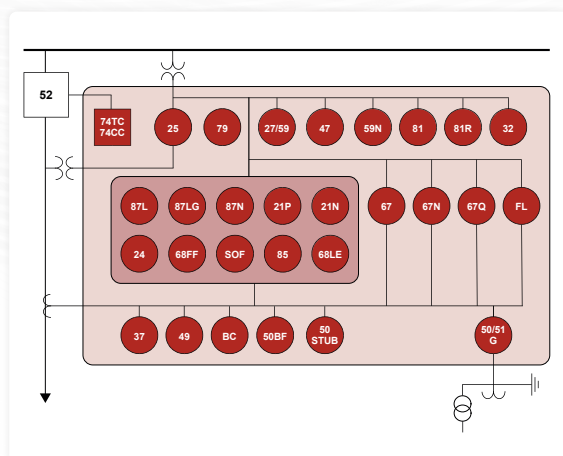## Line differential protection

INGEPAC™ EF LD is 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 **high flexibility** in the definition of the protection and control schemes using the same relay model.

Applications

- Main or backup protection for cables, overhead or mixed lines in transmission and subtransmission
- Main protection for breaker and a half schemes lines
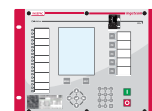

Protection functions
87, 87LG, 87N
V/f Overexcitation and 5th harmonic
Directional supervision
Error CT
Saturation detector
Capacitive current compensation
86
21 Quadrilateral and MHO
High speed zone
Zone 1 extension
Double line adaptation, series

compensation and algorithm for CVT's
3x50/51 (67), 50N/51N (67N)
50G/51G
46TOC (67Q), 46IOC(67Q)
46BC Broken conductor detection
Second harmonic restraint
Second and fifth harmonic blocking
SOTF
27, 59, 59N, 47
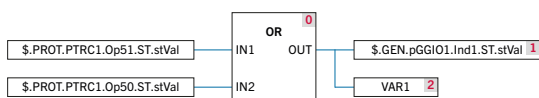81M/m, 81 ROCOF
37 Undercurrent

49 Thermal image
32 Power units
Stub bus
85 Teleprotection (21, 67/67Q)
68LE, 68FF
78 Power swing
25 Synchrocheck
79 Single-pole/three-pole auto-reclose
Breaker failure (50BF) with single-pole / three-pole trip
Fault Locator
Breaker Supervision

Local HMI
4,9" display
Graphical displays
I/O/L/R pushbuttons
19 LEDs
Keyboard

IEC 61131-3 logics

Synchronization
IEEE 1588 v2
IRIG-B
SNTP

Communications
Protocols: IEC 61850, IEC 60870-5-103/104, DNP3, Modbus, PROCOME
Redundancy: PRP, HSR, D-link failure, switch mode
Web services: HTTP/HTTPs, FTP/sFTP, SSH

Data acquisition
SOE (1000), faults (20)
Oscillography (12 analog and 100 digital channels)
Measurements: I, V, P, U, Q, f, T, etc.

INSULATION AND ELECTROMAGNETIC TESTS

Electromagnetic compatibility requirements	IEC 60255-26
Dielectric withstand	IEC 60255-27
Insulation resistance measurement	IEC 60255-27
Voltage impulse	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
Immunity to conducted, common mode disturbances	IEC 61000-4-16
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
Withstand to radiated electromagnetic interference from transceivers	IEEE 37.90.2

CLIMATIC TESTS

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 TESTS

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

CE UKCA CYBERSECURITY

MAIN FEATURES

Suitable for to 2 and 3 end zones, and for lines with intermediate transformer

1 or 2 links (serial, multi-mode or single-mode fibre optic), being possible to stablish single or redundant communication between devices

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)

Automatic activation and blocking of 21 and 67 function as 87L backup units, when teleprotection communications channel is down or restored

High precision in direct measurements (class 0.2 in currents and voltages)

Wide range current inputs allowing the same device to be connected to 1 A and 5 A CT secondary

Through the front USB you can access the equipment to retrieve reports and equipment CID, load an external CID, load the firewall configuration or update the equipment firmware

Synchronization from communications protocols, SNTP, IEEE 1588 v2 (PTP), demodulated IRIG-B input or PPS input, pacFactory or display

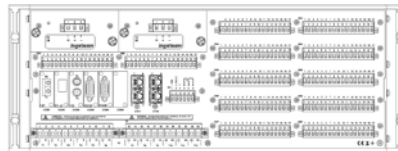Web server for monitoring and setting without needing additional software

Cybersecurity features: sFTP, HTTPs, firewall, audit log, password accessing, RBAC, LDAP, session management, etc.

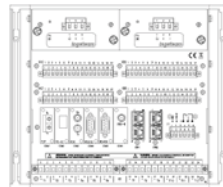Acquisition of Sampled Values as per IEC 61869-9 (NCIT) and IEC 61850-9-2LE (SAMU) standards (optional)

HARDWARE OPTIONS

Mounting options
· 19" 4U rack (up to 6 I/O slots)

· ½ x 19" 5U rack (up to 2 I/O slots)

Power supply
· 24, 48, 125 and 220 Vdc
· Power: 40 W
· Optionally redundant power supply

Optional
· High break contact outputs
· High speed outputs

Boards options
· CPU: 6 DI + 4 DO
· 11 DI + 9 DO
· 32 DI
· 16 DI + 8 DO
· 16 DI + 16 DO
· 16 DI + 8 AI (mA)
· 8 DI + 8 DO
· 11 RTD + 4 AO
    100 Ω platinum, 100 Ω nickel, 120 Ω nickel, 10 Ω copper

Communication ports
Front:
· RJ45
· USB
Rear:
· Up to 2 Ethernet (FO or RJ45)
· Up to 6 serial (FO, RS232, RS485)
Between devices:
· 1 or 2 links (serial, single-mode fibre optic, IEEE C37.94 fibre optic multi-mode)
· Optionally G703 also with transducer

Optional IP54 front protection

SOFTWARE

All the devices in the INGEPAC™ product range can be accessed using powerful software tools developed by Ingeteam which run on Windows®

Application specifically designed for simple and user-friendly access to the equipment

INGESYS eFS

Ingeteam ELECTRIFYING A SUSTAINABLE FUTURE

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