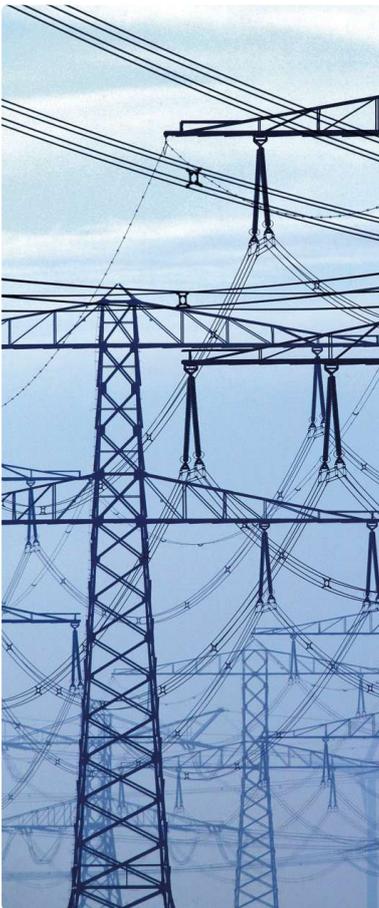# INGEPAC

EF TD — Transformer differential protection

INGEPAC™ EF TD is a range of Intelligent Electronic Devices that provide all the **protection and control functionalities** required for two and three winding power transformers. It also provides **instantaneous and biased differential protection**, with harmonics blocking, as well as low impedance restricted earth fault.

Its design is compliant with all the requirements of standards in the electrical sector, including **IEC 61850**. INGEPAC™ EF TD 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.
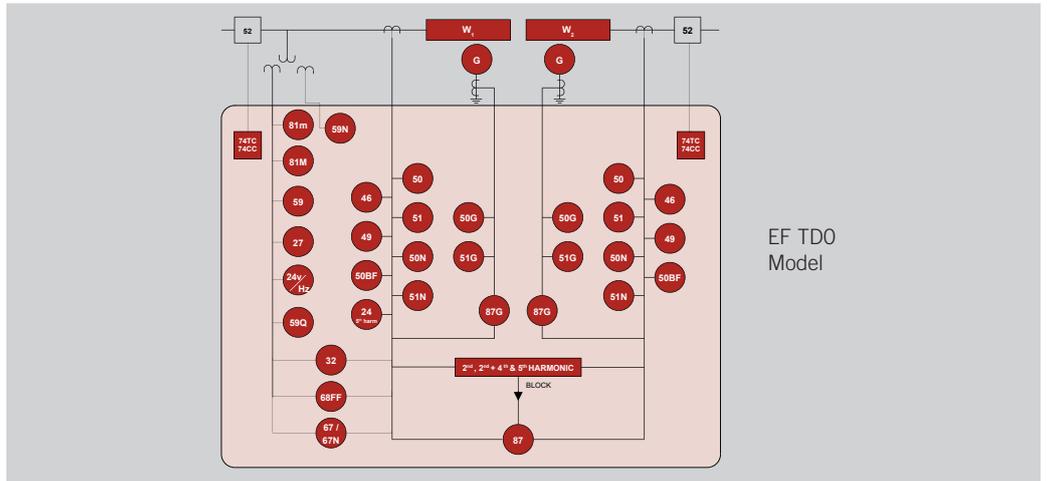
Software

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

EF TD0 Model

Transformer protection functions
87 Instantaneous and biased differential protection for two and three winding transformers
87R Restricted earth fault for transformer and autotransformer, two units
24 Over-excitation (5th harmonic)
24 Over-excitation (V/f)

Voltage and frequency functions
27
59
47 / 59Q Negative sequence
59N Zero sequence

81
81R ROCOF Rate of Change of Frequency

Current functions
3x50/51 (67)
50N/51N (67N)
50G/51G Earthing overcurrent, two units
46TOC (67Q), 46IOC (67Q)
49 Thermal image
32 Power units
51V Voltage controlled overcurrent
Cold Load Pickup
50BF Breaker failure

Monitoring units
68FF Fuse failure
ΣkI2 per pole
Closing and trip circuit monitoring
Excessive number of trips
Open pole detector / Dead line
Breaker status logic

Automation
79 Auto-reclose

Data acquisition functions
Phase and neutral current
Differential and restraint current
Phase-phase and phase-earth voltage

Active and reactive power
Frequency
Power factor
Maximeters
Active and reactive energy counters, both directions
Voltage and current THD
Chronological historical events and fault recording
Breaker monitoring
Oscillography
Measurements historical reports

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

- Protection and control in one single device
- Wide range current inputs allowing the same device to be connected to 1 A and 5 A CT secondary
- Application software specifically designed for simple and user-friendly access to the equipment
- Graphical and textual logic programming based on IEC 61131-3
- Different hardware options allow to define the most suitable configuration for the application
- Complementary functions for responding to primary element failures (breaker failure and trip/close circuits supervision)
- Chronological events record, fault reports, load curves and oscillography
- Historic measurements record, including currents (demand), voltage and power
- Six setting groups for instantaneously adapting the settings to changes in grid configuration without resetting the device
- Circuit breakers monitoring
- Metering: current (individual, biased and differential), voltage, power, power factor, frequency, negative sequence current, demand maximeter, THD (fundamental values and RMS)
- Active and reactive energy counters, in both directions
- Trips, operation openings, energy cut off by the breaker and automatic reclosing operations totalizers
- Front panel with 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 and menu keys
- Digital inputs for control, automation and protection functions
- Digital outputs for control/tripping and signalling
- Ethernet communication RJ45 and USB ports on the front
- Up to 6 serial and 2 Ethernet rear ports
- Communication protocols: IEC 61850 Ed.1 and 2, DNP 3.0, IEC 60870-5-103, IEC 60870-5-104, PROCOME
- 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 contact outputs
  - 8 digital inputs, 4 digital outputs and 4 high speed, high break contact outputs
  - 8 digital inputs and 8 digital outputs
- Selectable rear port connectivity:
  - Up to 6 serial communication ports
  - Up to 2 Ethernet communication ports
- Serial ports in glass fibre optic, plastic fibre optic, RS232 or RS485
- Ethernet ports in glass fibre optic or RJ45
- HSR, PRP, and D-Link redundancy
- Captures analog measurements using Sampled Values (SV) protocol, through IEC 61850-9-2 or IEC 61869-9 standards
- Different models for auxiliary voltages most commonly found in electrical installations
- Basic or extended control features
- IP54 lid
- Nine programmable graphic pages in local display
- RIO module (Remote Input/Output)
- Redundant power supply

Applications

- 2 or 3 windings transformer protection and control
- Autotransformer protection and control
- Grid Automation

CE

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