THYTRONIC

PRO N

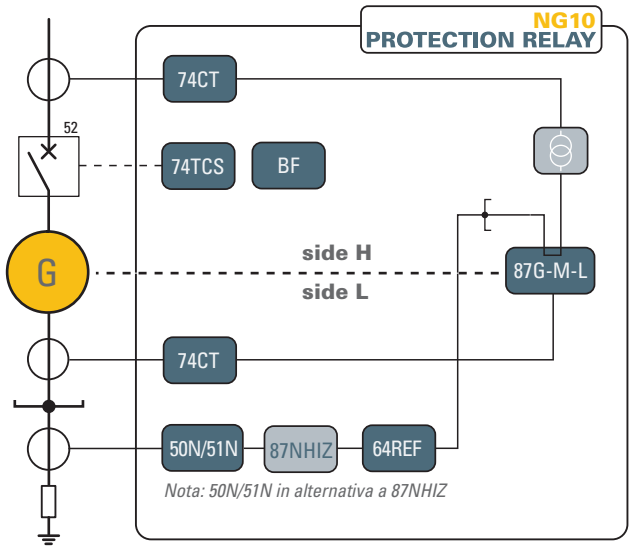
NG10

GENERATOR PROTECTION RELAY

RESTRAINED DIFFERENTIAL
FOR GENERATORS / MOTORS / SHORT LINES

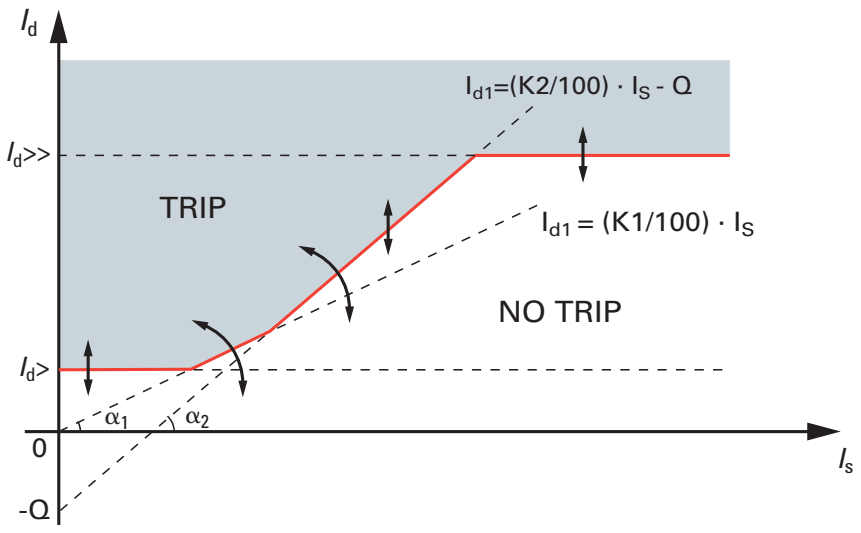
APPLICATION

The relay type NG10 provides sensitive, high operating speed and selective differential protection against phase-to-phase and phase-to-ground short circuits of motors/generators or short lines.



- Protective & control functions

50N/51N-87NHIZ	Residual overcurrent or high impedance restricted ground fault
64REF	Biased restricted differential ground fault
87G-M-L	Double slope biased differential for generators, motors and short lines
BF	Breaker Failure
74CT	Side H CTs monitoring
74CT	Side L CTs monitoring
74TCS	Trip circuit supervision



— Firmware updating

The use of flash memory units allows on-site firmware updating.

— Construction

According to the hardware configurations, the protection relay can be shipped in various case styles depending on the required mounting options (flush, projecting mounting, rack or with separate operator panel).

— Measuring inputs

- Three phase current inputs for the H side
- Three phase current inputs for the L side
- One residual current input

For all inputs the rated currents are independently selectable to 1 A or 5 A through DIP-switches.

— Binary inputs

Two binary inputs are available with programmable active state (active-ON/active-OFF) and programmable timer (active to OFF/ON or ON/OFF transitions).

— Output relays

Six output relays are available (two changeover, three make and one break contacts); each relay may be individually programmed as normal state (normally energized, de-energized or pulse) and reset mode (manual or automatic).
A programmable timer is provided for each relay (minimum pulse width). The user may program the function of each relay in accordance with a matrix (tripping matrix) structure.

— Metering

NG10 provides metering values for phase and residual currents, making them available for reading on a display or to communication interfaces.
Input signals are sampled 16 times per period and the RMS value of the fundamental component is measured using the DFT (Discrete Fourier Transform) algorithm and digital filtering.
On the base of the direct measurements, the calculated residual current, the stabilization currents, the sequence currents, the thermal image, the differential phase currents, minimum-peak-fixed-rolling demand, mean-minimum-maximum absolute phase currents are processed.
The measured signals can be displayed with reference to nominal values or directly expressed in amperes.

— Blocking input/outputs

One output blocking circuit and one input blocking circuit are provided.
The output blocking circuits of one or several Pro_N relays, shunted together, must be connected to the input blocking circuit of the protection relay, which is installed upwards in the electric plant. The output circuit works as a simple contact, whose condition is detected by the input circuit of the upwards protection relay. For long distances, when high insulation and high EMC immunity is essential, a suitable pilot wire to fiber optic converter (BFO) is available.

— Differential protection for generators, motors and short lines

In order to correct any polarity reversals or phase cyclic sequence, equal amplitude and phase currents on the two sides of differential protection, the relay performs the compensation of amplitude, polarity, to phase and cyclic sequence and zero sequence currents.
In the case of internal compensation, the compensation is calculated by the relay as follows:

- Calculation of the difference (mismatching) between the CT primary rated current and rated current of the sides of the protected object
- Choice of the primary rated current of CT as the reference for the compensation of current amplitude (Inref)
- Choosing the side (RefSide) that compensations in current amplitude are related.

The polarity compensation (Polarity matching) allows us to consider each input current with its angular phase or with opposite phase angle, thus allowing the correction of any reverse polarity sw amperometric due to link errors.

— Communication

Multiple communication interfaces are implemented:

- One RS232 local communication front-end interface for communication with ThySetter setup software
- Two back-end interfaces for communication with remote monitoring and control systems by:
  - RS485 port using ModBus® RTU, IEC 60870-5-103 or DNP3 protocol,
  - Ethernet port (RJ45 or optical fiber) using ModBus/TCP protocol.

— MMI (Man Machine Interface)

The user interface comprises a membrane keyboard, a backlight LCD alphanumeric display and eight LEDs.
The green ON LED indicates auxiliary power supply and self diagnostics, two LEDs are dedicated to the Start and Trip (yellow for Start, red for Trip) and five red LEDs are user assignable.

— Modular design

In order to extend I/O capability, the NG10 hardware can be customized through external auxiliary modules:

- MRI - Output relays and LEDs
- MID16 - Binary inputs
- MCI - 4...20 mA converter
- MPT - Pt100 probe inputs.

— Control and monitoring

Several predefined functions are implemented:

- Circuit Breaker commands and diagnostic.
- Activation of two set point profiles.
- Phase CTs monitoring side H and L (74CT).
- Logic selectivity.
- Trip circuit supervision (74TCS).
- Remote tripping.

User defined logic may be customized according to IEC 61131-3 standard protocol (PLC).

Circuit Breaker commands and diagnostic

Several diagnostic, monitoring and control functions are provided:

- Health thresholds can be set; when the accumulated duty (ΣI or ΣI^2t), the number of operations or the opening time exceeds the threshold an alarm is activated.
- Breaker failure (BF); breaker status is monitored by means 52a-52b and/or through line current measurements.
- Trip Circuit Supervision (74TCS).
- Breaker control; opening and closing commands can be carried out locally or remotely.

Logic selectivity

With the aim of providing a fast selective protection system some protective functions may be blocked (pilot wire accelerated logic). To guarantee maximum fail-safety, the relay performs a run time monitoring for pilot wire continuity and pilot wire shorting. Exactly the output blocking circuit periodically produces a pulse, having a small enough width in order to be ignored as an effective blocking signal by the input blocking circuit of the upwards protection, but suitable to prove the continuity of the pilot wire. Furthermore a permanent activation (or better, with a duration longer than a preset time) of the blocking signal is identified, as a warning for a possible short circuit in the pilot wire or in the output circuit of the downstream protection.

The logic selectivity function can be realized through any combination of binary inputs, output relays and/or committed pilot wires circuits.

— Programming and settings

All relay programming and adjustment operations may be performed through MMI (Keyboard and display) or using a Personal Computer with the aid of the ThySetter software.

The same PC setup software is required to set, monitor and configure all Pro_N devices.

Two session level (User or Administrator) with password for sensible data access are provided.

— Self diagnostics

All hardware and software functions are repeatedly checked and any anomalies reported via display messages, communication interfaces, LEDs and output relays.

Anomalies may refer to:

- Hw faults (auxiliary power supply, output relay coil interruptions, MMI board...).
- Sw faults (boot and run time tests for data base, EEPROM memory checksum failure, data BUS,...).
- Pilot wire faults (break or short in the wire).
- Circuit breaker faults.

— Event storage

Several useful data are stored for diagnostic purpose; the events are stored into a non volatile memory.

They are graded from the newest to the older after the "Events reading" command (ThySetter) is issued:

- Sequence of Event Recorder (SER)
  The event recorder runs continuously capturing in circular mode the last three hundred events upon trigger of binary input/output.
- Sequence of Fault Recorder (SFR)
  The fault recorder runs continuously capturing in circular mode the last twenty faults upon trigger of binary input/output and/or element pickup (start-trip).
- Trip counters

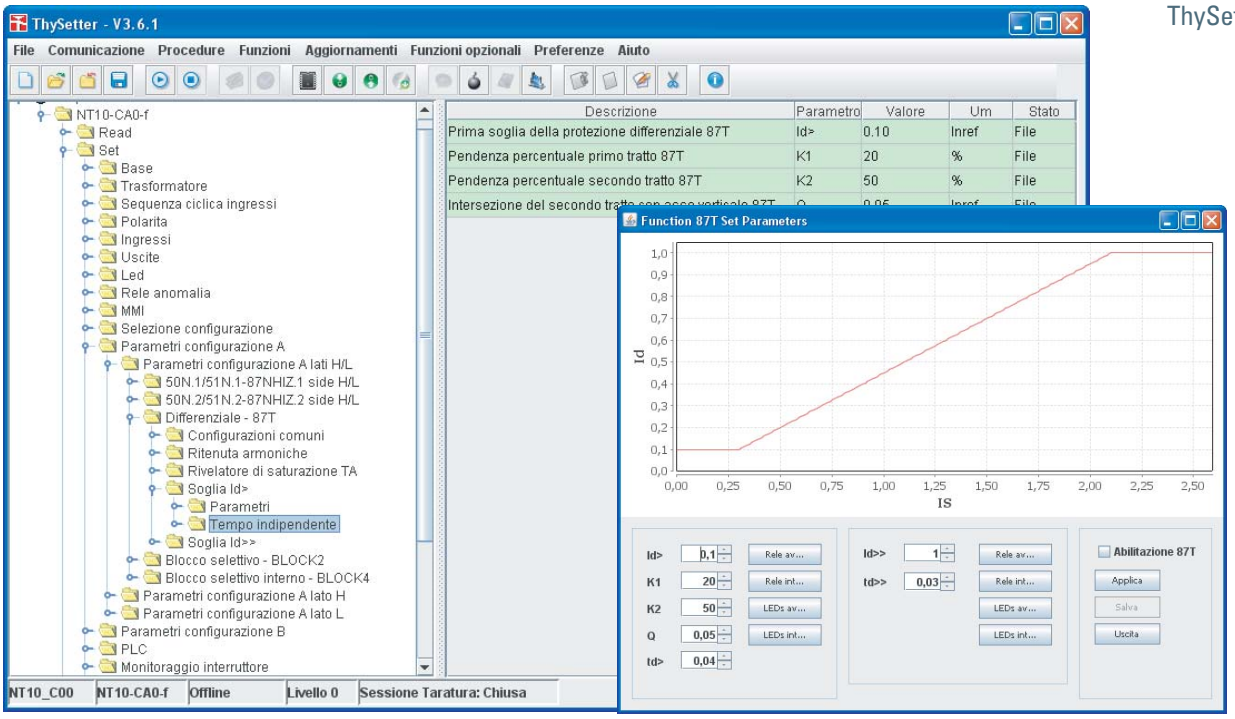
— Digital Fault Recorder (Oscillography)

Upon trigger of tripping/starting of each function or external signals, the relay records in COMTRADE format:

- Oscillography with instantaneous values for transient analysis.
- RMS values for long time periods analysis.
- Logic states (binary inputs and output relays).

Note - A license for Digital Fault Recorder function is required, for purchase procedure please contact Thytronic.
The records are stored in nonvolatile memory

ThySetter



SPECIFICATIONS

GENERAL

— Mechanical data

Mounting:	flush, projecting, rack or separated operator panel
Mass (flush mounting case)	2.0 kg

— Insulation tests

Reference standards	EN 60255-5
High voltage test 50Hz	2 kV 60 s
Impulse voltage withstand (1.2/50 µs)	5 kV
Insulation resistance	>100 MΩ

— Voltage dip and interruption

Reference standards	EN 61000-4-29

— EMC tests for interference immunity

1 MHz damped oscillatory wave	EN 60255-22-1	1 kV-2.5 kV
Electrostatic discharge	EN 60255-22-2	8 kV
Fast transient burst (5/50 ns)	EN 60255-22-4	4 kV
Conducted radio-frequency fields	EN 60255-22-6	10 V
Radiated radio-frequency fields	EN 60255-4-3	10 V/m
High energy pulse	EN 61000-4-5	2 kV
Magnetic field 50 Hz	EN 61000-4-8	1 kA/m
Damped oscillatory wave	EN 61000-4-12	2.5 kV
Ring wave	EN 61000-4-12	2 kV
Conducted common mode (0...150 kHz)	EN 61000-4-16	10 V

— Emission

Reference standards	EN 61000-6-4 (ex EN 50081-2)
Conducted emission 0.15...30 MHz	Class A
Radiated emission 30...1000 MHz	Class A

— Climatic tests

Reference standards	IEC 60068-x, ENEL R CLI 01, CEI 50

— Mechanical tests

Reference standards	EN 60255-21-1, 21-2, 21-3

— Safety requirements

Reference standards	EN 61010-1
Pollution degree	3
Reference voltage	250 V
Overvoltage	III
Pulse voltage	5 kV
Reference standards	EN 60529
Protection degree:	
• Front side	IP52
• Rear side, connection terminals	IP20

— Environmental conditions

Ambient temperature	-25...+70 °C
Storage temperature	-40...+85 °C
Relative humidity	10...95 %
Atmospheric pressure	70...110 kPa

— Certifications

Product standard for measuring relays	EN 50263
CE conformity	
• EMC Directive	2004/108/EC
• Low Voltage Directive	2006/95/EC
Type tests	IEC 60255-6

COMMUNICATION INTERFACES

Local PC RS232	19200 bps
Network:	
• RS485	1200...57600 bps
• Ethernet 100BaseT	100 Mbps
Protocol	ModBus® RTU/IEC 60870-5-103/DNP3, TCP/IP

INPUT CIRCUITS

— Auxiliary power supply Uaux

Nominal value (range)	24...48 Vac/dc, 115...230 Vac/110...220 Vdc
Operative range (each one of the above nominal values)	19...60 Vac/dc
	85...265 Vac/75...300 Vdc
Power consumption:	
• Maximum (energized relays, Ethernet TX)	10 W (20 VA)
• Maximum (energized relays, Ethernet FX)	15 W (25 VA)

— Phase current inputs - sides H and L

Nominal current I_n	1 A or 5 A selectable by DIP Switches
Permanent overload	25 A
Thermal overload (1s)	500 A
Rated consumption (for any phase)	≤ 0.002 VA (I_n = 1 A)
	≤ 0.04 VA (I_n = 5 A)

— Residual current input - IE

Nominal current I_{En}	1 A or 5 A selectable by DIP Switch
Permanent overload	25 A
Thermal overload (1s)	500 A
Rated consumption	≤ 0.006 VA (I_{En} = 1 A), ≤ 0.012 VA (I_{En} = 5 A)

— Binary inputs

Quantity and type	2 dry inputs
Max permissible voltage	19...265 Vac/19...300 Vdc
Max consumption, energized	
3 mA	

— Block input (Logic selectivity)

Quantity	1
Type	polarized wet input (powered by internal isolated supply)
Max consumption, energized	5 mA

OUTPUT CIRCUITS

— Output relays K1...K6

Quantity	6
• Type of contacts K1, K2	changeover (SPDT, type C)
• Type of contacts K3, K4, K5	make (SPST-NO, type A)
• Type of contacts K6	break (SPST-NC, type B)
Nominal current	8 A
Nominal voltage/max switching voltage	250 Vac/400 Vac
Breaking capacity:	
• Direct current (L/R = 40 ms)	50 W
• Alternating current (λ = 0,4)	1250 VA
Make	1000 W/VA
Short duration current (0,5 s)	30 A

— Block output (Logic selectivity)

Quantity	1
Type	optocoupler

— LEDs

Quantity	8
• ON/fail (green)	1
• Start (yellow)	1
• Trip (red)	1
• Allocatable (red)	5

GENERAL SETTINGS

— Rated values

Relay nominal frequency (f_n)	50, 60 Hz
Relay phase nominal current - sides H and L (I_{nH}, I_{nL})	1 A, 5 A
Phase CT nominal primary current (I_{npH}, I_{npL})	1 A...20.0 kA
Relay residual nominal current (I_{En})	1 A, 5 A
Residual CT nominal primary current (I_{En1p}, I_{En2p})	1 A...20.0 kA
Protected device nominal current (I_{ng})	1A ...20.0 kA
Primary nominal current choised as reference (I_{nref}) [1]	- A
Side reference for compensation (*Refside*) [1]	- (H/L)
Current matching type (*Matchtype*)	
	INTERNAL/EXTERNAL

Note 1 - Calculated by the relay

— Binary input timers

ON delay time (IN1 t_{ON}, IN2 t_{ON},...IN5 t_{ON}) 0.00...100.0 s
OFF delay time (IN1 t_{OFF}, IN2 t_{OFF},...IN5 t_{OFF}) 0.00...100.0 s
Logic Active-ON/Active-OFF

— Relay output timers

Minimum pulse width (t_{TR}) 0.000...0.500 s

— Input sequence

Phase current sequence side H (*I-SequenceH*)
IL1-IL2-IL3 Base
IL1-IL3-IL2, IL2-IL1-IL3, IL2-IL3-IL1, IL3-IL1-IL2, IL3-IL2-IL1
Phase current sequence side L (*I-SequenceL*)
IL1-IL2-IL3 Base
IL1-IL3-IL2, IL2-IL1-IL3, IL2-IL3-IL1, IL3-IL1-IL2, IL3-IL2-IL1

— Polarity

Polarity terminals C09-C10 (IL1H)	NORMAL/REVERSE
Polarity terminals C11-C12 (IL2H)	NORMAL/REVERSE
Polarity terminals C13-C14 (IL3H)	NORMAL/REVERSE
Polarity terminals C15-C16 (IE)	NORMAL/REVERSE
Polarity terminals C01-C02 (IL1L)	NORMAL/REVERSE
Polarity terminals C03-C04 (IL2L)	NORMAL/REVERSE
Polarity terminals C05-C06 (IL3L)	NORMAL/REVERSE

PROTECTIVE FUNCTIONS

— Thermal protection with RTD thermometric probes - 26

Alarm
- Alarm threshold θ_{ALx} (x=1...8) 0...200 °C
- Operating time $t_{\theta ALx}$ (x=1...8) 0....100 s

Trip
- Trip threshold $\theta>_x$ (x=1...8) 0...200 °C
- Operating time $t_{\theta>x}$ (x=1...8) 0....100 s

Note: The element becomes available when the MPT module is enabled and connected to Thybus

— Residual overcurrent or high impedance restricted ground fault - 50N/51N - 87NHIZ

$I_E>$ Element
- $I_E>$ Curve type ($I_E>$Curve) INDIPENDENTE
  IEC/BS A, B, C, ANSI/IEEE MI, VI, EI, EM
- $I_{E1}>$ Reset time delay ($t_{E1>RES}$) 0.00...100.0 s

Definite time
- 50N/51N First threshold definite time ($I_{E>def}$) 0.005...10.00 I_{En}
- $I_{E>def}$ Operating time ($t_{E>def}$) 0.04...200 s

Inverse time
- 50N/51N First threshold inverse time ($I_{E1>inv}$) 0.005...2.00 I_{En}
- $I_{E>inv}$ Operating time ($t_{E>inv}$) 0.02...60.0 s

$I_E>>$ Element
- $I_E>>$ Reset time delay ($t_{E>>RES}$) 0.00...100.0 s

Definite time
- 50N/51N Second threshold inverse time ($I_{E>>def}$) 0.005...10.00 I_{En}
- $I_{E>>def}$ Operating time ($t_{E>>def}$) 0.03...10.00 s

$I_E>>>$ Element
- $I_E>>>$ Reset time delay ($t_{E>>>RES}$) 0.00...100.0 s

Definite time
- 50N/51N Third threshold definite time ($I_{E>>>def}$) 0.005...10.00 I_{En}
- $I_{E>>>def}$ Operating time ($t_{E>>>def}$) 0.03...10.00 s

— Low impedance restricted ground fault - 64REF

64REF Minimum threshold ($I_{REF>}$) 0.05...2.00 I_{En}
64REF Intentional delay ($t_{REF>}$) 0.03...60.00 s

— Differential - 87G-M-L

CT saturation detector
- 87T Saturation detector enable (S_{at-Det}) ON/OFF
- 87T Saturation detector reset intentional delay ($t_{Sat-Det-RES}$) 0.00...0.50 s

$I_d>$ Element Definite time
- 87 First threshold definite time ($I_d>$) 0.05...2.00 I_{nref}
- 87T First stretch slope percentage (*K1*) 10...50%
- 87T Second stretch slope percentage (*K2*) 25...100%
- 87T Second stretch Intersection with vertical axis (*Q*) 0.00...3.00 I_{nref}
- 87T First threshold operating time 0.04 s

$I_d>>$ Element Definite time
- 87T Second threshold definite time ($I_d>>$) 0.5...30.00 I_{nref}
- 87T Second threshold operating time 0.03 s

— Breaker failure - BF

BF Phase current threshold ($I_{BF>}$) 0.05...1.00 I_{nH}
BF Time delay (t_{BF}) 0.06...10.00 s

— Selective block - BLOCK2

Selective block IN:
- BLIN Max activation time for phase protections (t_{B-Iph}) 0.10...10.00 s
- BLIN Max activation time for earth protections (t_{B-IE}) 0.10...10.00 s

Selective block OUT:
- BLOUT Dropout time delay for phase protections (t_{F-Iph}) 0.00...1.00 s
- BLOUT Drop-out time delay for ground protections (t_{F-IE}) 0.00...1.00 s
- BLOUT Drop-out time delay for phase and ground protections ($t_{F-Iph/IE}$) 0.00...1.00 s

— CT supervision - 74CT side H

74CT Threshold ($S_H<$) 0.10...0.95
74CT Overcurrent threshold ($I_{(H)*}$) 0.10...1.00 I_{nH}
$S_H<$ Operate time ($t_{S(H)<}$) 0.03...200 s

— CT supervision - 74CT side L

74CT Threshold ($S_L<$) 0.10...0.95
74CT Overcurrent threshold ($I_{(L)*}$) 0.10...1.00 I_{nL}
$S_L<$ Operate time ($t_{S(L)<}$) 0.03...200 s

— Circuit Breaker supervision

Number of CB trips (*N.Open*) 0...10000
Cumulative CB tripping currents (*SumI*) 0...5000 I_{nH}
CB opening time for I^2t calculation ΣI^2t (t_{break}) 0.05...1.00 s
Cumulative CB tripping I^2t (*SumI^2t*) 0...5000 $I_{nH}^2 \cdot s$
CB max allowed opening time ($t_{break}>$) 0.05...1.00 s

— Pilot wire diagnostic

BLOUT1 Diagnostic pulses period (*PulseBLOUT1*)
OFF - 0.1-1-5-10-60-120 s
BLIN1 Diagnostic pulses control time interval (*PulseBLIN1*)
OFF - 0.1-1-5-10-60-120 s

METERING & RECORDING

— Measured parameters

Direct:
- Frequency *f*
- Fundamental RMS phase currents side H I_{L1H}, I_{L2H}, I_{L3H}
- Fundamental RMS phase currents side L I_{L1L}, I_{L2L}, I_{L3L}
- Fundamental RMS residual current I_E

Calculated:
- Calculated residual current I_{EH}
- Maximum current between I_{L1}-I_{L2}-I_{L3} side H and L I_{LmaxH}, I_{LmaxL}
- Minimum current between I_{L1}-I_{L2}-I_{L3} side H and L I_{LminH}, I_{LminL}
- Average current between I_{L1}-I_{L2}-I_{L3} side H and L I_{LH}, I_{LL}
- Compensated phase currents side H I_{L1cH}, I_{L2cH}, I_{L3cH}
- Compensated phase currents side L I_{L1cL}, I_{L2cL}, I_{L3cL}
- Stabilization currents (87 element) I_{SL1}, I_{SL2}, I_{SL3}
- Differential currents I_{dL1}, I_{dL2}, I_{dL3}
- Stabilization current (64REF element) I_{ESH}

On demand:
- Phase fixed currents demand side H I_{L1FIXH}, I_{L2FIXH}, I_{L3FIXH}
- Phase rolling currents demand side H I_{L1ROLH}, I_{L2ROLH}, I_{L3ROLH}
- Phase peak currents demand side H I_{L1MAXH}, I_{L2MAXH}, I_{L3MAXH}
- Phase minimum currents demand side H I_{L1MINH}, I_{L2MINH}, I_{L3MINH}
- Phase fixed currents demand side L I_{L1FIXL}, I_{L2FIXL}, I_{L3FIXL}
- Phase rolling currents demand side L I_{L1ROLL}, I_{L2ROLL}, I_{L3ROLL}
- Phase peak currents demand side L I_{L1MAXL}, I_{L2MAXL}, I_{L3MAXL}
- Phase minimum currents demand side L I_{L1MINL}, I_{L2MINL}, I_{L3MINL}

— Event recording (SER)

Number of events	300
Recording mode	circular

Trigger:
- Start and trip of any enabled protection or control function
- Binary inputs switching (off/on and on/off)
- Power ON and power OFF (auxiliary power supply)
- Setting changes

Data recorded:

• Event counter (resettable by ThySetter)	0...10^9
• Event cause	binary input/output relay/setting changes
• Time stamp	Date and time

— Fault recording (SFR)

Number of faults	20
Recording mode	circular

Trigger:

• External trigger	binary input set as Fault trigger
• Element and control pickup	output relays OFF-ON transition

Data recorded:

• Time stamp	Date and time
• Fault cause	start, trip, binary input
• Fault counter (resettable by ThySetter)	0...10^9
• Phase currents side H and side L	I_{L1Hr}, I_{L2Hr}, I_{L3Hr}, I_{L1Lr}, I_{L2Lr}, I_{L3Lr}
• Residual current	I_{Er}
• Differential currents	I_{dL1r}, I_{dL2r}, I_{dL3r}
• Binary inputs state	IN1, IN2...INx
• Output relays state	K1...K6...K10
• Fault cause info (operating phase)	L1, L2, L3

— Digital Fault Recorder (Oscillography)

File format	COMTRADE
Records	depending on setting [1]
Recording mode	circular
Sampling rate	16 sample/cycle

Trigger setup:

• Pre-trigger time	0.05...1.00 s
• Post-trigger time	0.05...60.00 s
• Trigger from inputs	IN1, IN2...INx
• Trigger from outputs	K1...K6...K10
• Communication	ThySetter

Set sample channels:

• Instantaneous phase currents side H	i_{L1H}, i_{L2H}, i_{L3H}
• Instantaneous phase currents side L	i_{L1L}, i_{L2L}, i_{L3L}
• Compensated phase currents side H	i_{L1cH}, i_{L2cH}, i_{L3cH}
• Compensated phase currents side L	i_{L1cL}, i_{L2cL}, i_{L3cL}
• Stabilization currents (87 element)	i_{SL1}, i_{SL2}, i_{SL3}
• Differential currents	i_{dL1}, i_{dL2}, i_{dL3}
• Instantaneous residual current	i_E

Set analog channels (Analog 1...12):

• Frequency	f
• Fundamental RMS phase currents side H	I_{L1H}, I_{L2H}, I_{L3H}
• Fundamental RMS phase currents s side L	I_{L1L}, I_{L2L}, I_{L3L}
• Fundamental RMS residual current (measured)	I_E
• Fundamental RMS residual currents (computed)	I_{EH}
• Compensated phase currents side H	I_{L1cH}, I_{L2cH}, I_{L3cH}
• Compensated phase currents side L	I_{L1cL}, I_{L2cL}, I_{L3cL}
• Stabilization currents (87 element)	I_{SL1}, I_{SL2}, I_{SL3}
• Differential currents	I_{dL1}, I_{dL2}, I_{dL3}
• Stabilization current (64REF element)	I_{ESH}
• Temperature	T_1...T_8

Set digital channels (Binary 1...16):

• Output relays state	K1...K6...K10
• Binary inputs state	IN1, IN2...INx

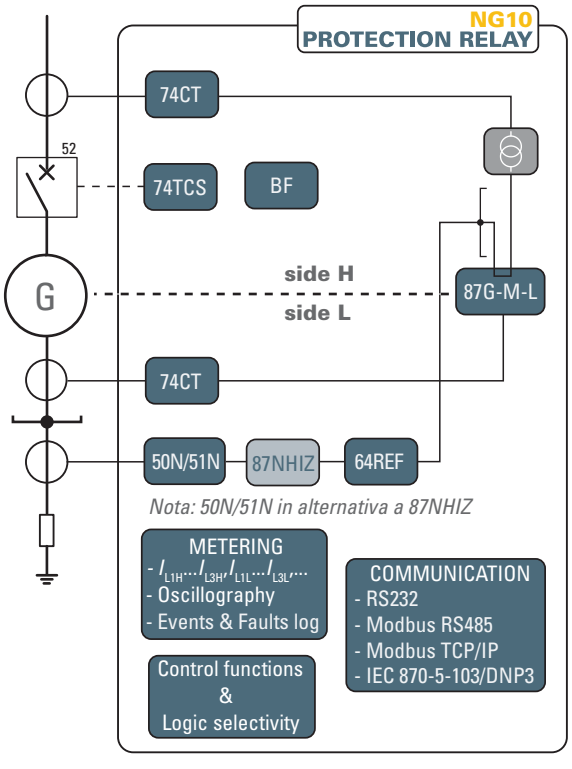
Set digital channels from 87G-M-L states (Binary 17...32):

• Start state $I_{d>}$	$I_{d>\text{-L1 ST}}$, $I_{d>\text{-L2 ST}}$, $I_{d>\text{-L3 ST}}$
• Trip state $I_{d>}$	$I_{d>\text{-L1 TR}}$, $I_{d>\text{-L2 TR}}$, $I_{d>\text{-L3 TR}}$
• Start state $I_{d>>}$	$I_{d>>\text{-L1 ST}}$, $I_{d>>\text{-L2 ST}}$, $I_{d>>\text{-L3 ST}}$
• Trip state $I_{d>>}$	$I_{d>>\text{-L1 TR}}$, $I_{d>>\text{-L2 TR}}$, $I_{d>>\text{-L3 TR}}$
• Saturation detector start state	$SatDet_{ST}$

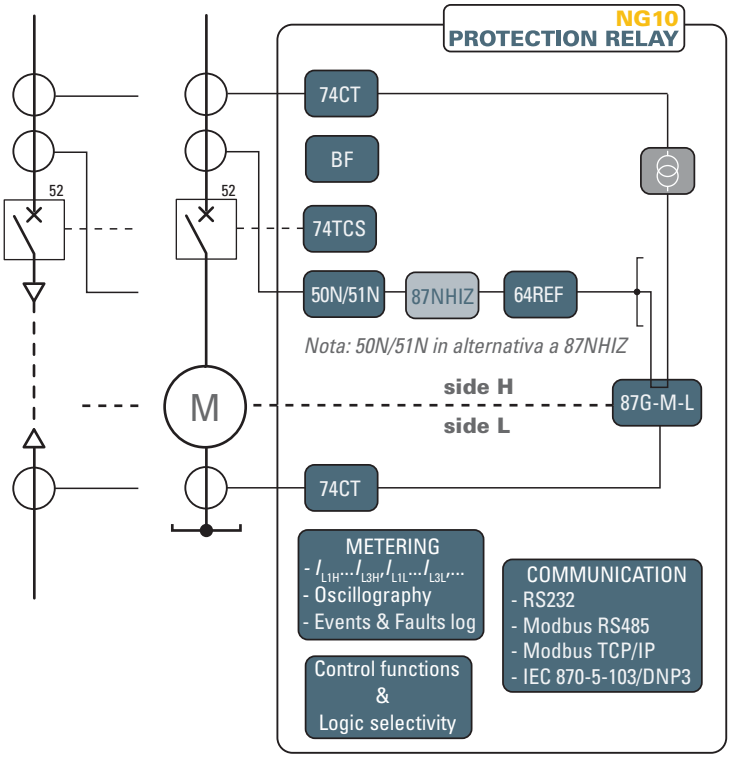
Note [1] - For instance, with following setting:

• *Pre-trigger time time*	*0.25 s*
• *Post-trigger time*	*0.25 s*
• *Sampled channels*	i_{L1H}, i_{L2H}, i_{L3H}, i_{L1L}, i_{L2L}, i_{L3L}, i_{dL1}, i_{dL2}, i_{dL3}, i_E
• *Analog channels*	I_{L1H}, I_{L2H}, I_{L3H}, I_{L1L}, I_{L2L}, I_{L3L}, I_{dL1}, I_{dL2}, I_{dL3}, I_E
• *Digital channels*	*K1, K2, K3, K4, K5, K6, IN1, IN2*

up to 200 records can be stored with f = 50 Hz

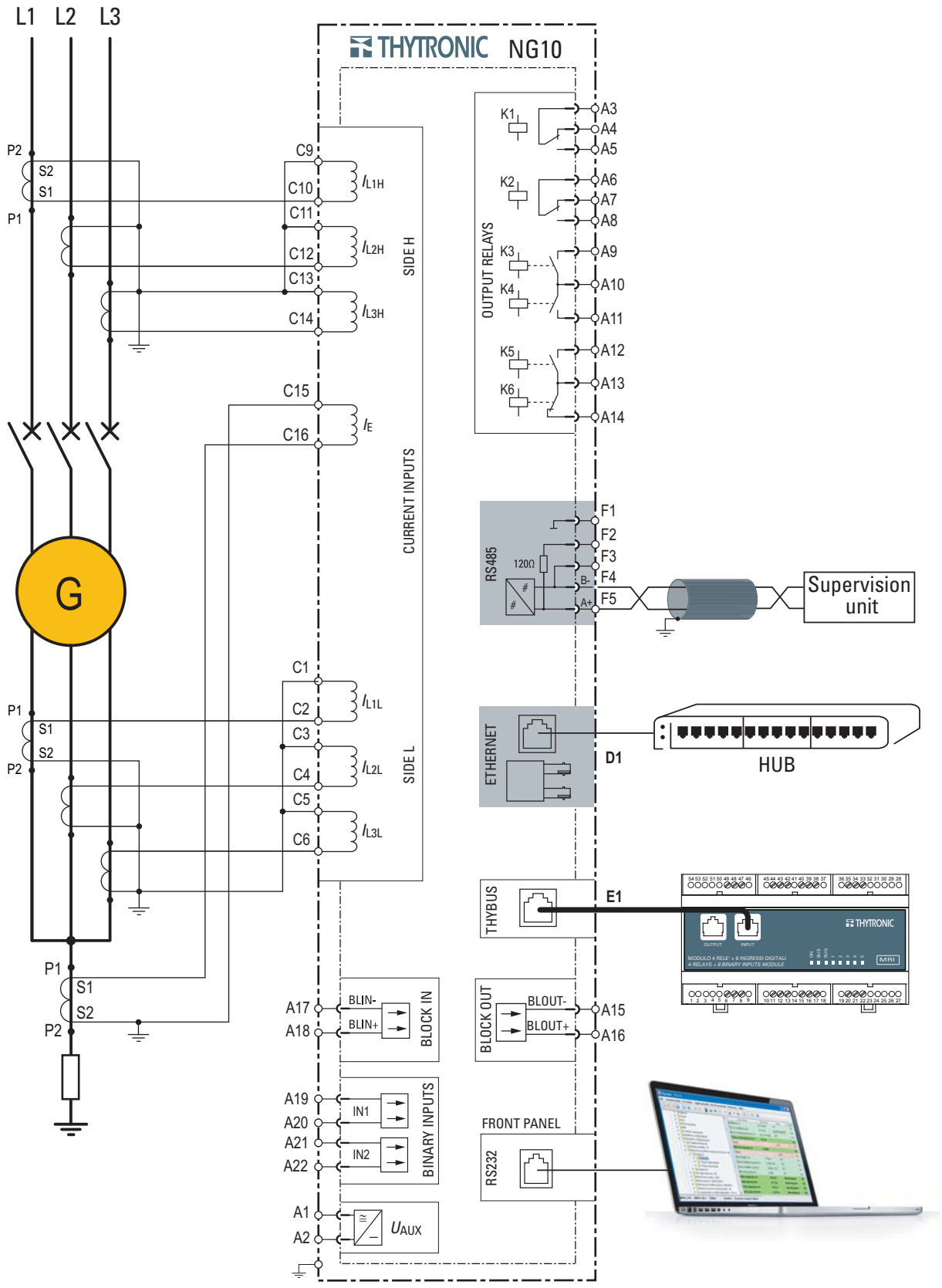


Generator protection example



Short line and motor protection example

— Connection diagram example

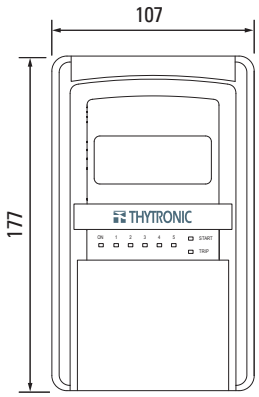


NOTE
- Incoming currents to the protected device must match to the the reference current inputs of the relay, with current direction leaving the protected device must match current output from the current inputs of the relay.
- Incoming currents in the reference terminals of of the relay current inputs are considered positive, the outgoing negative.
- This convention applies to indicate the CTs polarity toward the protected device.

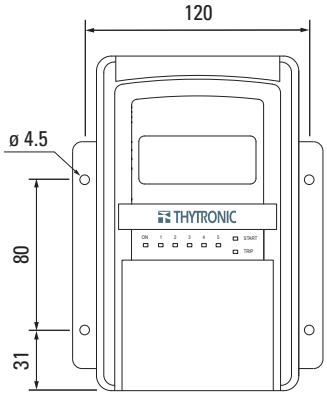
Differential (87G) and restricted earth fault protection (64REF) for a Generator

DIMENSIONS

FRONT VIEW

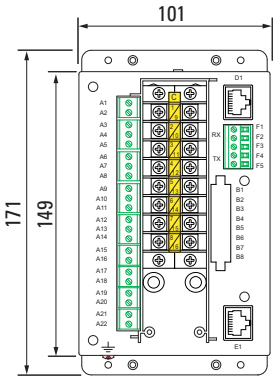


FLUSH MOUNTING

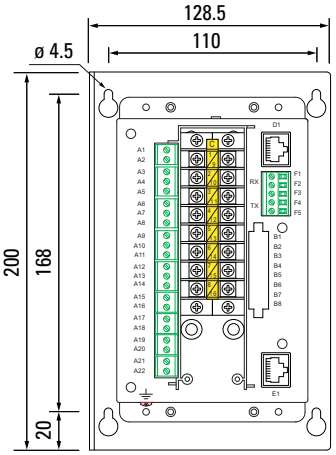


PROJECTING MOUNTING

REAR VIEW

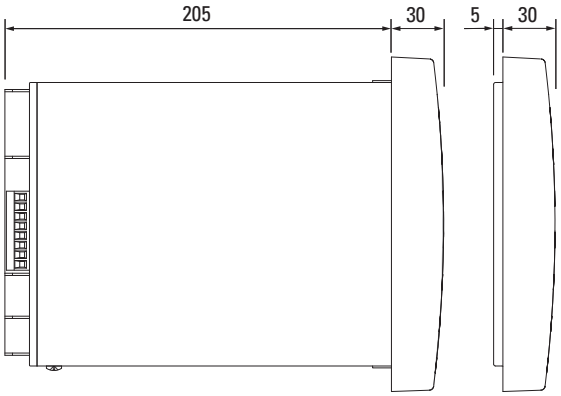


FLUSH MOUNTING



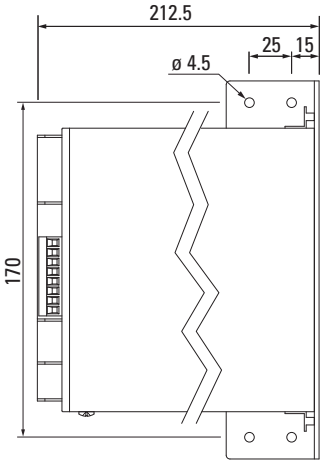
PROJECTING MOUNTING
(Separate operator panel)

SIDE VIEW

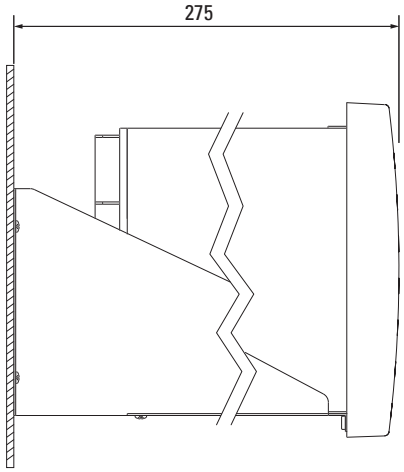


FLUSH MOUNTING

SEPARATE
OPERATOR PANEL

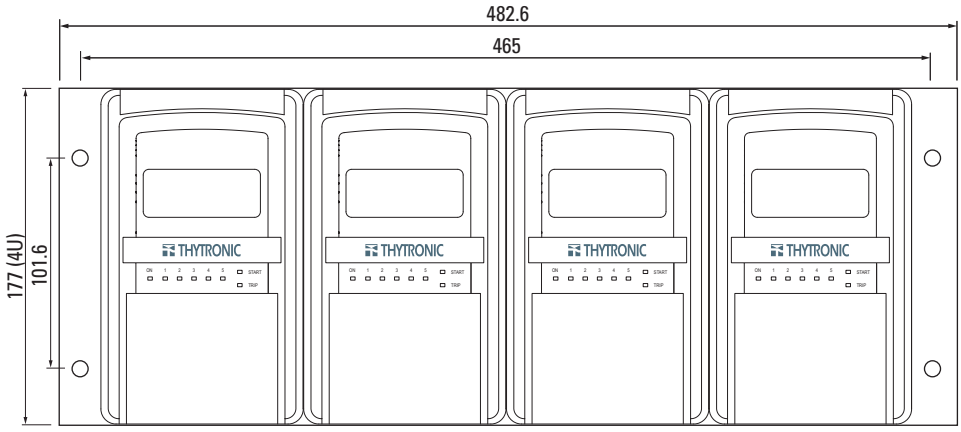


PROJECTING MOUNTING
(Separate operator panel)

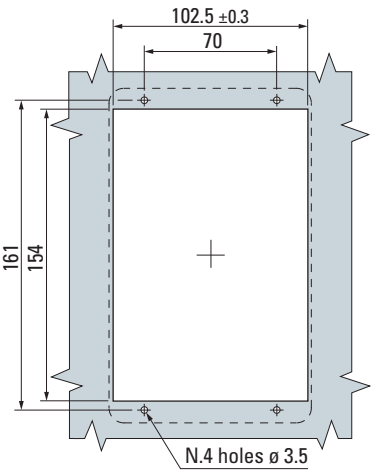


PROJECTING MOUNTING
(Stand alone)

RACK MOUNTING



FLUSH MOUNTING CUTOUT



Headquarter: 20139 Milano - Piazza Mistral, 7 - Tel. +39 02 574 957 01 ra - Fax +39 02 574 037 63
Factory: 35127 Padova - Z.I. Sud - Via dell'Artigianato, 48 - Tel. +39 049 894 770 1 ra - Fax +39 049 870 139 0

www.thytronic.it **www.thytronic.com** **thytronic@thytronic.it**