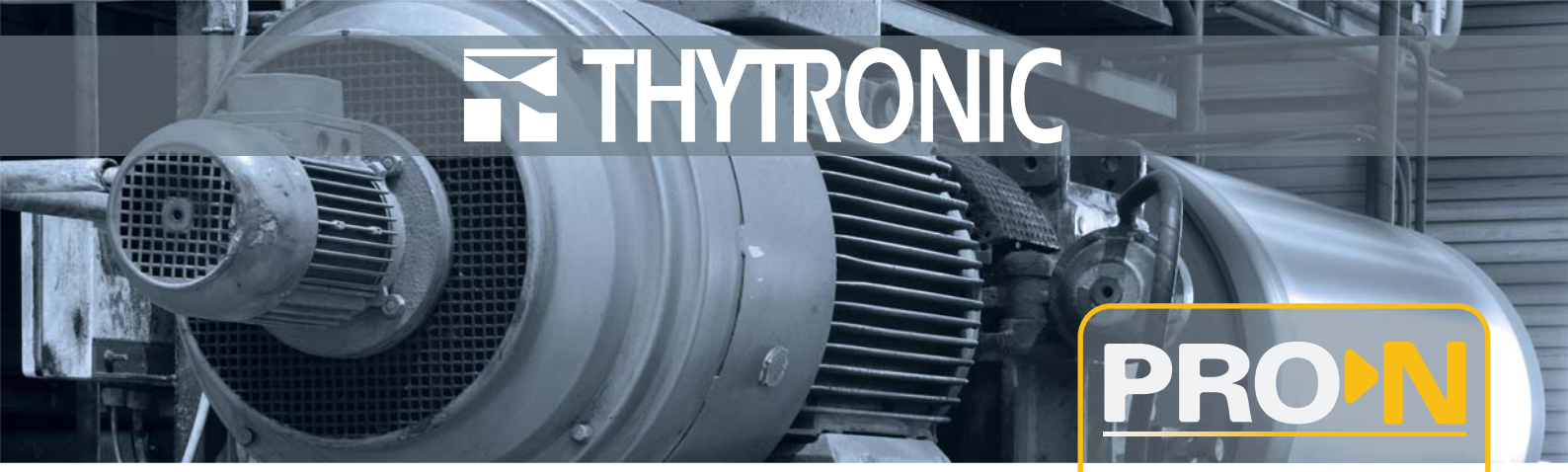


THYTRONIC

PRO N

NM10

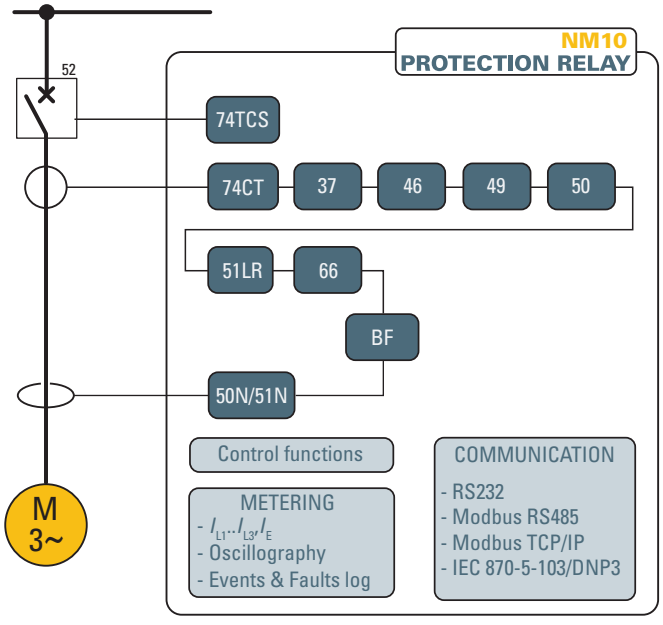
MOTOR PROTECTION RELAY

THE BASIC SOLUTION
FOR SMALL / MEDIUM SIZE MOTOR PROTECTION

— Application

The relay type NM10 can be used for protection of small/medium size motors in LV and MV systems powered through lines of:

- Any length in solidly or low resistance grounded systems
- Small length in ungrounded or Petersen coil and/or high resistance grounded systems.



- Protective & control functions

26	Thermal protection with RTD probes (optional)
37	Undercurrent
46	Negative-sequence overcurrent
49	Thermal image
50/51	Phase overcurrent
50S/51LR/14	Locked rotor
50N/51N	Residual overcurrent
66	Maximum number of startings (Restart inhibition)
BF	Circuit breaker failure
74CT	CT supervision
74TCS	Trip circuit supervision

— Measuring inputs
Three phase current inputs and one residual current input, with nominal currents independently selectable at 1 A or 5 A through DIP-switches.

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

— Two set point profiles (A,B)
Two independent groups of settings are provided. Switching from profiles may be operated by means of MMI, binary input and communication.

— Construction
According to the hardware configurations, the NM10 protection relay can be shipped in various case styles depending on the required mounting options (flush, projecting mounting, rack or with separate operator panel).

— 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).
Several presettable functions can be associated to each input.

— Modular design
In order to extend I/O capability, the NM10 hardware can be customized through external auxiliary modules:
- MRI - Output relays and LEDs.
- MID16 - Binary inputs.
- MCI - 4...20 mA converters.

MPT - Pt100 thermal probes.

— 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 upstream in the electric plant. The output circuit works as a simple contact, whose condition is detected by the input circuit of the upstream protection relay.
Use of suitable pilot wire to fiber optic converters (BFO) allows to perform fast and reliable accelerated logic selectivity on radial and closed ring networks.

— 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 according to a matrix (tripping matrix) structure.

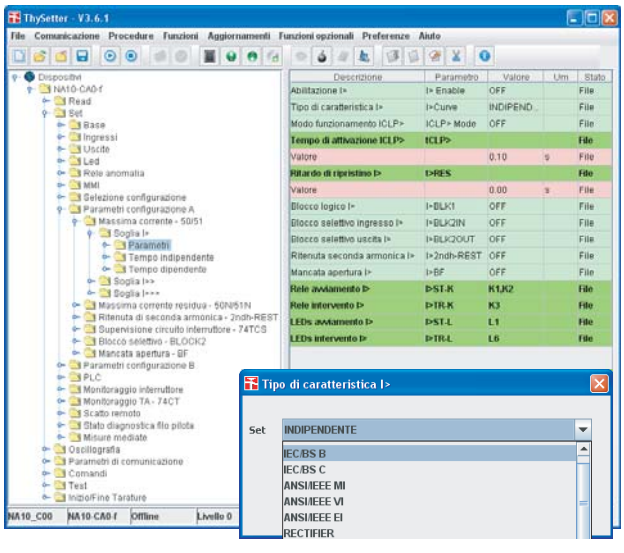
— MMI (Man Machine Interface)
The user interface comprises a membrane keyboard, a backlight LCD alphanumeric display and eight LEDs.
The green ON LED indicates auxiliary power supply and self diagnostics, two LEDs are dedicated to the Start and Trip (yellow for Start, red for Trip) and five red LEDs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

— 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.

— 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.
Full access to the available data is provided:
- Read status and measures.
- Read/edit settings (on-line or off-line edit).

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

ThySetter



— Control and monitoring

Several predefined functions are implemented:

- Activation of two set point profiles
- Phase CTs monitoring (74CT)
- Logic selectivity
- Cold load pickup (CLP) with block or setting change
- Trip circuit supervision (74TCS)
- Remote tripping
- Synchronization
- Circuit Breaker commands and diagnostic

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

Circuit Breaker

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

Cold Load Pickup (CLP)

Cold load pickup element prevents unwanted tripping in case of temporary overcurrents produced at the motor starting.
Three different operating modes are provided:

- OFF - the function is disabled
- Each protective element can be blocked for a programmable time
- Each threshold can be increased for a programmable time.

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 upstream protection, but suitable to prove the continuity of the pilot wire.

— 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.

— Metering

NM10 provides metering values for phase and residual currents, making them available for reading on a display or to communication interfaces.
Input signals are sampled 24 times per period and the RMS value of the fundamental component is measured using the DFT (Discrete Fourier Transform) algorithm and digital filtering.
With DFT the RMS value of 2nd, 3rd, 4th and 5th harmonic of phase current are also measured.
On the base of the direct measurements, the 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.

— 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 event recorder runs continuously capturing in circular mode the last twenty events upon trigger of binary input/output and/or element pickup (start-trip)
- Trip counters.

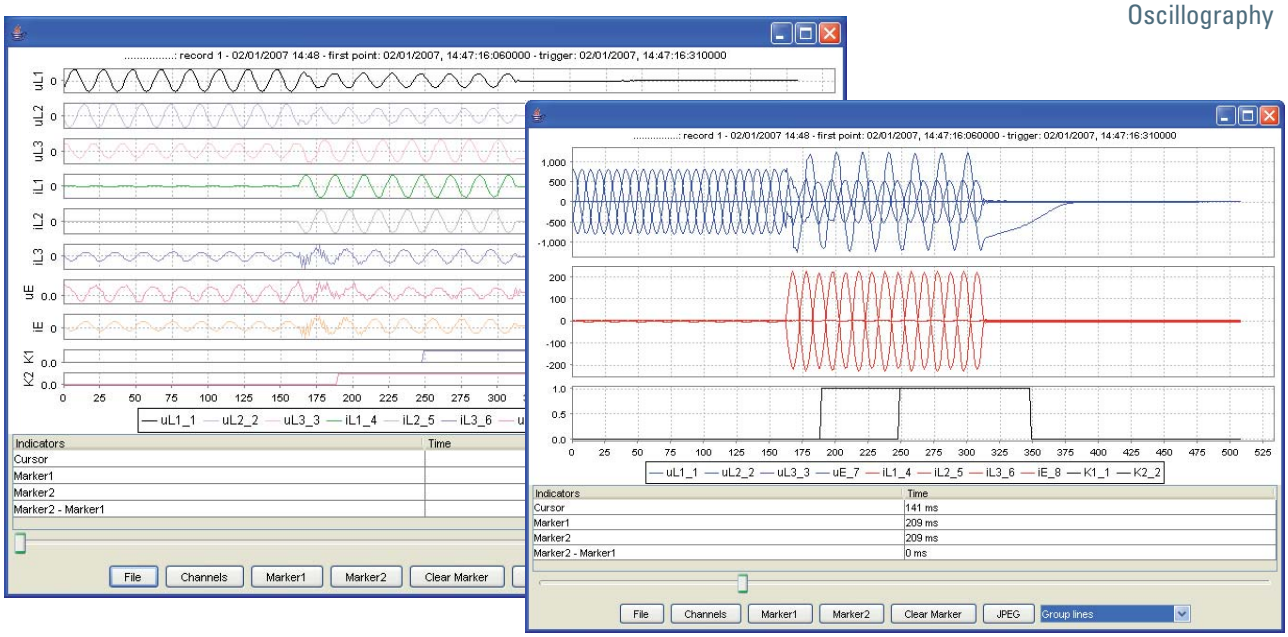
— Digital Fault Recorder (DFR)

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 of the measured signals 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

Oscillography



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	89/336/EEC
• 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

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

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	2
Type	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 phase nominal current I_n	1 A, 5 A
Phase CTs nominal primary current I_{np}	1 A...10 kA
Relay residual nominal current I_{En}	1 A, 5 A
Residual CT nominal primary current I_{Enp}	1 A...10 kA
Relay nominal frequency f_n	50, 60 Hz

— Binary input timers

ON delay time (IN1 t_{ON}, INx t_{ON})	0.00...100.0 s
OFF delay time (IN1 t_{OFF}, INx 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

PROTECTIVE FUNCTIONS

— Base current - IB

Base current (I_B)	0.20...1.50 I_n

Note - Assuming that the secondary rated current of the line CT's equals the rated current of the relay, as usually happens, the I_B value is the ratio between the rated current of the protected motor and the primary rated current of the CT's.

— 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

— Undercurrent - 37

I< Element

• $I<$ Inhibition time ($t_{inh}<$)	0.00...200 s

Definite time

• 37 First threshold definite time ($I<_{def}$)	0.30...1.00 I_B
• $I<_{def}$ Operating time ($t<_{def}$)	0.10...600 s

— Negative sequence overcurrent - 46

$I_2>$ Element

• $I_2>$ Curve type ($I_2>$Curve)	DEFINITE IEC/BS A, B, C, ANSI/IEEE MI, VI, EI, EM, I^2t
• $I_{2CLP}>$ Activation time ($t_{2CLP>}$)	0.00...200 s
• $I_2>$ Reset time delay ($t_{2>RES}$)	0.00...100.0 s

Definite time

46 First threshold definite time ($I_{2>def}$)	0.10...1.00 I_B
• $I_{2>def}$ within CLP ($I_{2CLP>def}$)	0.10...5.00 I_B
• $I_{2>def}$ Operating time ($t_{2>def}$)	0.03...200 s

Inverse time

• 46 First threshold inverse time ($I_{2>inv}$)	0.10...1.00 I_B
• $I_{2>inv}$ within CLP ($I_{2CLP>inv}$)	0.10...5.00 I_B
• $I_{2>inv}$ Operating time ($t_{2>inv}$)	0.02...60.0 s

$I_2>>$ Element

• $I_{2CLP}>>$ Activation time ($t_{2CLP>>}$)	0.00...200 s
• $I_2>>$ Reset time delay ($t_{2>>RES}$)	0.00...100.0 s

Definite time

• 46 Second threshold definite time ($I_{2>>def}$)	0.10...1.00 I_B
• $I_{2>>def}$ within CLP ($I_{2CLP>>def}$)	0.10...5.00 I_B
• $I_{2>>def}$ Operating time ($t_{2>>def}$)	0.03...200 s

— Thermal image - 49

Common configuration:

• Initial thermal image $\Delta\theta_{IN}$ (Dth_{IN})	0.0...1.0 $\Delta\theta_B$
• Overload coefficient on starting (K_{ST})	1.0...3.0
• Negative sequence current heating coefficient (K_2)	0...10
• Heating time constant $\tau+$ ($T+$)	1...200 min
• Cooling time constant $\tau-$ ($T-$)	1.0...6.0 $\tau+$
• Dth_{CLP} Operating mode ($Dth_{CLP\ Mode}$)	Blocking/Change setting
• Dth_{CLP} Activation time (t_{DthCLP})	0.00...200 s

• DthAL1 Element

• 49 First alarm threshold $\Delta\theta_{AL1}$ (Dth_{AL1})	0.3...1.0 $\Delta\theta_B$

DthAL2 Element

• 49 Second alarm threshold $\Delta\theta_{AL2}$ (Dth_{AL2})	0.5...1.2 $\Delta\theta_B$

Dth> Element

• 49 Trip threshold $\Delta\theta$ ($Dth>$)	1.2 $\Delta\theta_B$

— Phase overcurrent - 50/51

I> Element

• $I>$ Curve type ($I>$Curve)	DEFINITE IEC/BS A, B, C, ANSI/IEEE MI, VI, EI RECTIFIER, EM, I^2t
• $I_{CLP}>$ Activation time ($t_{CLP>}$)	0.00...200 s
• $I>$ Reset time delay ($t_{>RES}$)	0.00...100.0 s

Definite time

• 50/51 First threshold definite time ($I_{>def}$)	0.100...40.0 I_n
• $I_{>def}$ within CLP ($I_{CLP>def}$)	0.100...40.0 I_n
• $I_{>def}$ Operating time ($t_{>def}$)	0.04...200 s

Inverse time

• 50/51 First threshold inverse time ($I_{>inv}$)	0.100...20.00 I_n
• $I_{>inv}$ within CLP ($I_{CLP>inv}$)	0.100...20.00 I_n
• $I_{>inv}$ Operating time ($t_{>inv}$)	0.02...60.0 s

I>> Element

• $I>>$ Curve type ($I>>$Curve)	DEFINITE, I^2t
• $I_{CLP}>>$ Activation time ($t_{CLP>>}$)	0.00...200 s
• $I>>$ Reset time delay ($t_{>>RES}$)	0.00...100.0 s

Definite time

• 50/51 Second threshold definite time ($I>>_{def}$)	0.100...40.0 I_n
• $I>>_{def}$ within CLP ($I_{CLP>>def}$)	0.100...40.0 I_n
• $I>>_{def}$ Operating time ($t>>_{def}$)	0.03...10.00 s

Inverse time

• 50/51 Second threshold inverse time ($I>>_{inv}$)	0.100...20.00 I_n
• $I>>_{inv}$ within CLP ($I_{CLP>>inv}$)	0.100...20.00 I_n
• $I>>_{inv}$ Operating time ($t>>_{inv}$)	0.02...10.00 s

I>>> Element

• $I_{CLP}>>>$ Activation time ($t_{CLP>>>}$)	0.00...200 s
• $I>>>$ Reset time delay ($t>>>_{RES}$)	0.00...100.0 s

Definite time

• 50/51 Third threshold definite time ($I>>>_{def}$)	0.100...40.0 I_n
• $I>>>_{def}$ within CLP ($I_{CLP>>>def}$)	0.100...40.0 I_n
• $I>>>_{def}$ Operating time ($t>>>_{def}$)	0.03...10.00 s

— Locked rotor - 50S/51LR/14

$I_{LR}>$ Element

• $I_{LRCLP}>$ Operating mode (*Mode 51LR*)	With/without speed contr.
• $I_{LRCLP}>$ Activation time ($t_{LRCLP>}$)	0.00...200 s

Definite time

• 51LR First threshold definite time ($I_{LR>def}$)	0.90...8.00 I_B
• $I_{LR>def}$ Operating time ($t_{LR>def}$)	0.10...200 s

— Residual overcurrent - 50N/51N

$I_E>$ Element

• $I_E>$ Curve type ($I_E>$Curve)	DEFINITE IEC/BS A, B, C, ANSI/IEEE MI, VI, EI, EM
• $I_{ECLP}>$ Activation time ($t_{ECLP>}$)	0.00...200 s
• $I_E>$ Reset time delay ($t_{E>RES}$)	0.00...100.0 s

Definite time

• 50N/51N First threshold definite time ($I_{E>def}$)	0.002...10.00 I_{En}
• $I_{E>def}$ within CLP ($I_{ECLP>def}$)	0.002...10.00 I_{En}
• $I_{E>def}$ Operating time ($t_{E>def}$)	0.04...200 s

Inverse time

• 50N/51N First threshold inverse time ($I_{E>inv}$)	0.002...2.00 I_{En}
• $I_{E>inv}$ within CLP ($I_{ECLP>inv}$)	0.002...2.00 I_{En}
• $I_{E>inv}$ Operating time ($t_{E>inv}$)	0.02...60.0 s

$I_E>>$ Element

• $I_{ECLP}>>$ Activation time ($t_{ECLP>>}$)	0.00...200 s
• $I_E>>$ Reset time delay ($t_{E>>RES}$)	0.00...100.0 s

Definite time

• 50N/51N Second threshold definite time ($I_{E>>def}$)	0.010...10.00 I_{En}
• $I_{E>>def}$ within CLP ($I_{ECLP>>def}$)	0.010...10.00 I_{En}
• $I_{E>>def}$ Operating time ($t_{E>>def}$)	0.03...10.00 s

$I_E>>>$ Element

• $I_{ECLP}>>>$ Activation time ($t_{ECLP>>>}$)	0.00...200 s
• $I_{ECLP}>>>$ Reset time delay ($t_{E>>>RES}$)	0.00...100.0 s

Definite time

• 50N/51N Third threshold definite time ($I_{E>>>def}$)	0.010...10.00 I_{En}
• $I_{ECLP>>>def}$ within CLP ($I_{ECLP>>>def}$)	0.010...10.00 I_{En}
• $I_{ECLP>>>def}$ Operating time ($t_{E>>>def}$)	0.03...10.00 s

— Maximum number of startings (Restart inhibition) - 66

Control window (t_C)	1...60 min
N_{ST} (Starts inside t_C)	1...30
T_{ST} (Cumulative start time inside t_C)	1...600 s
66 Inhibition time (t_{IN})	0...60 min

— Breaker failure - BF

BF Phase current threshold (I_{BF}>)	0.05...1.00 I_n
BF Residual current threshold (I_{EBF}>)	0.01..2.00 I_{En}
BF Time delay (t_{BF})	0.06...10.00 s

— Selective block - BLOCK2

Selective block IN:

- BLIN Max activation time for phase protections ($t_{B\text{-}IPh}$) 0.10...10.00 s
- BLIN Max activation time for ground protections ($t_{B\text{-}IE}$) 0.10...10.00 s

Selective block OUT:

- BLOUT Dropout time delay for phase elements ($t_{F\text{-}IPh}$)0.00...1.00 s
- BLOUT Drop-out time delay for ground elements ($t_{F\text{-}IE}$) 0.00...1.00 s
- BLOUT Drop-out time delay for phase and ground elements ($t_{F\text{-}IPh/IE}$) 0.00...1.00 s

— CT supervision - 74CT

74CT Threshold (*S<*)	0.10...0.95
74CT Overcurrent threshold (*I**)	0.10...1.00 I_n
S< Operating time (t_S<)	0.03...200 s

— Circuit Breaker supervision

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

METERING & RECORDING

— Measured parameters

Direct:

- Frequency — f
- Fundamental RMS phase currents — I_{L1}, I_{L2}, I_{L3}
- Fundamental RMS residual current — I_E

Calculated:

- Thermal image — DTheta
- Maximum current between I_{L1}-I_{L2}-I_{L3} — I_{Lmax}
- Minimum current between I_{L1}-I_{L2}-I_{L3} — I_{Lmin}
- Average current between I_{L1}-I_{L2}-I_{L3} — I_L

Sequence:

- Positive sequence current — I_1
- Negative sequence current — I_2
- Negative sequence current/positive sequence current ratio — I_2/I_1

2nd harmonic:

- Second harmonic phase currents — $I_{L1\text{-}2nd}$, $I_{L2\text{-}2nd}$, $I_{L3\text{-}2nd}$

3rd harmonic:

- Third harmonic phase currents — $I_{L1\text{-}3rd}$, $I_{L2\text{-}3rd}$, $I_{L3\text{-}3rd}$
- Third harmonic residual current — $I_{E\text{-}3rd}$

4th harmonic:

- Fourth harmonic phase currents — $I_{L1\text{-}4th}$, $I_{L2\text{-}4th}$, $I_{L3\text{-}4th}$

5th harmonic:

- Fifth harmonic phase currents — $I_{L1\text{-}5th}$, $I_{L2\text{-}5th}$, $I_{L3\text{-}5th}$

Demand phase currents:

- Phase fixed currents demand — I_{L1FIX}, I_{L2FIX}, I_{L3FIX}
- Phase rolling currents demand — I_{L1ROL}, I_{L2ROL}, I_{L3ROL}
- Phase peak currents demand — I_{L1MAX}, I_{L2MAX}, I_{L3MAX}
- Phase minimum currents demand — I_{L1MIN}, I_{L2MIN}, I_{L3MIN}

— Event recording (SER)

Number of events	300
Recording mode	circular

Trigger:

- Output relays switching — K1...K6...K10
- Binary inputs switching — IN1, IN2...INx
- 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 inputs) — IN1, IN2...INx
- Element pickup (OFF-ON transition) — Start/Trip

Data recorded:

- Time stamp — Date and time
- Fault cause — start, trip, binary input
- Fault counter (resettable by ThySetter) — $0...10^9$
- Fundamental RMS phase currents — I_{L1r}, I_{L2r}, I_{L3r}
- Fundamental RMS residual current — I_{Er}
- Thermal image — *DTheta*-r
- 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	24 samples per 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 currents — i_{L1}, i_{L2}, i_{L3}, i_E

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

- Frequency — f
- Fundamental RMS phase currents — I_{L1}, I_{L2}, I_{L3}, I_1, I_2
- Fundamental RMS residual current — I_E
- Fundamental RMS positive and negative seq. currents I_1, I_2
- Negative sequence / positive sequence current ratio — I_2/I_1
- Temperature — *T1...T8*

Set digital channels (Digital 1...12):

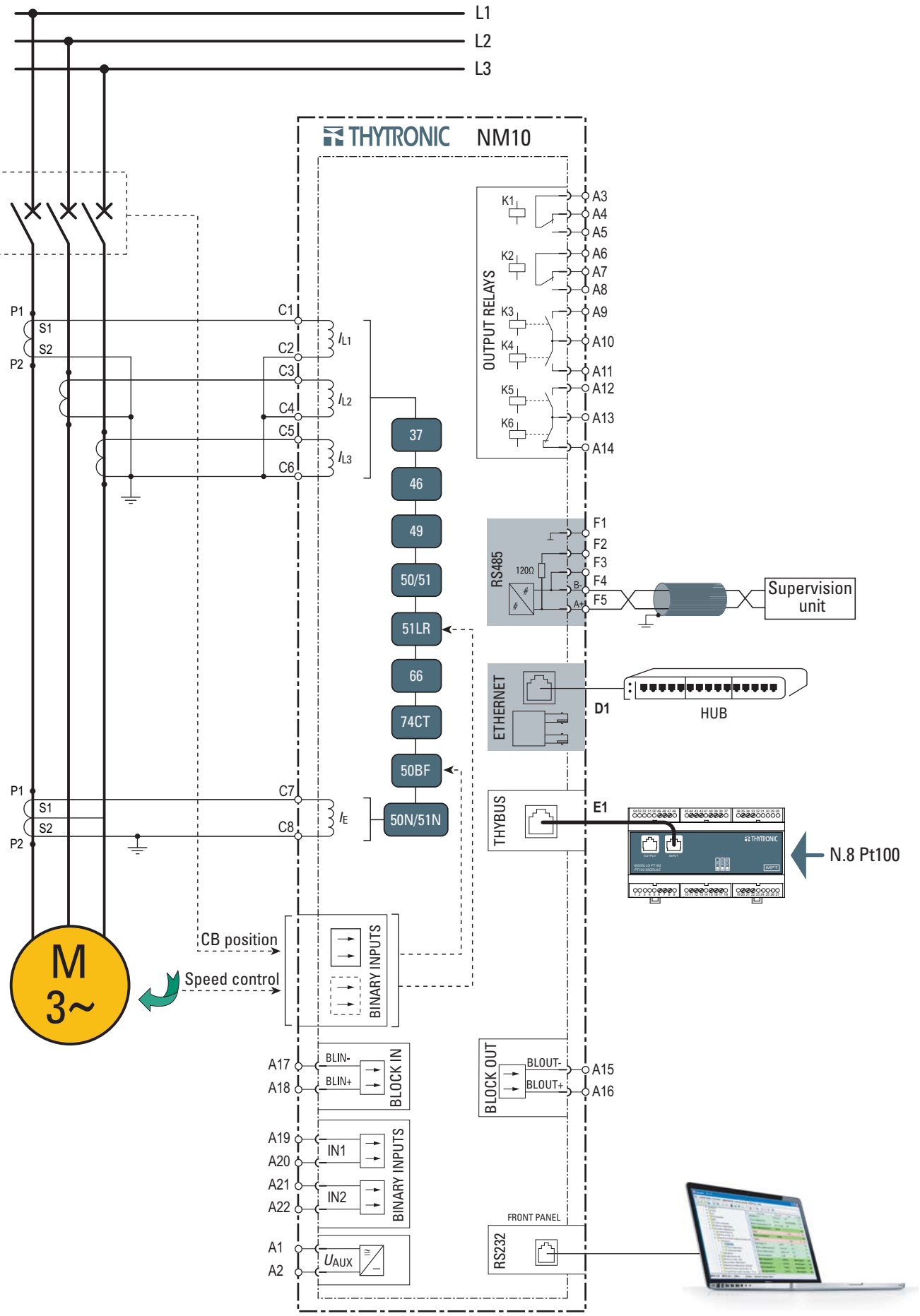
- Output relays state — K1...K6...K10
- Binary inputs state — IN1, IN2...INx

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

- Pre-trigger time and Post-trigger time — 0.25 s
- Sampled channels — i_{L1}, i_{L2}, i_{L3}, i_E
- Analog channels — I_{L1}, I_{L2}, I_{L3}, I_E, I_1, I_2
- Digital channels — K1, K2, K3, K4, K5, K6, IN1, IN2

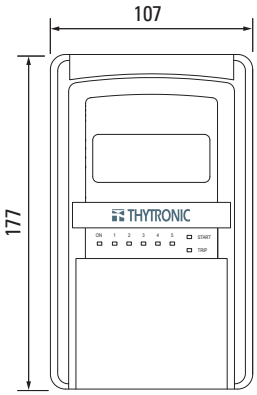
up to 450 records can be stored with f = 50 Hz

— Connection diagram example

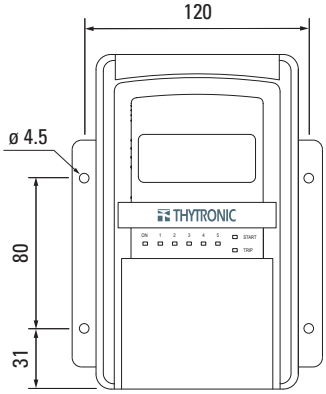


DIMENSIONS

FRONT VIEW

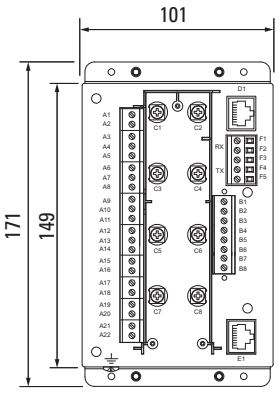


FLUSH MOUNTING

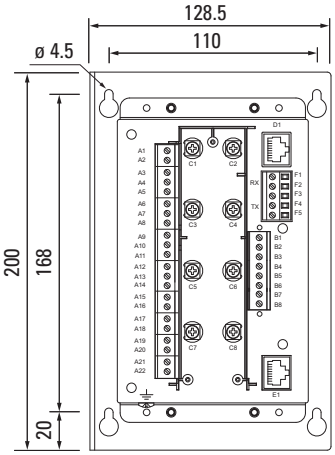


PROJECTING MOUNTING

REAR VIEW

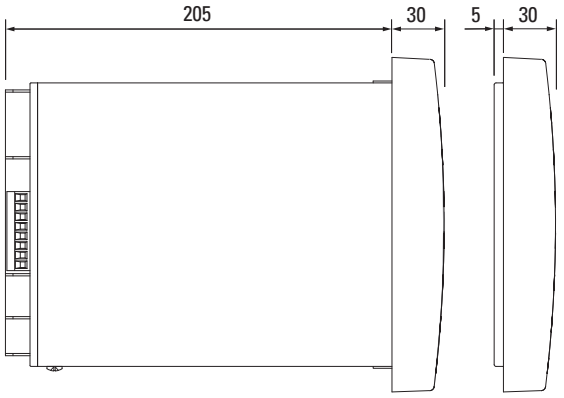


FLUSH MOUNTING



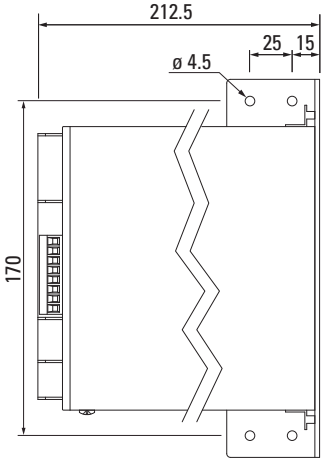
PROJECTING MOUNTING
(Separate operator panel)

SIDE VIEW

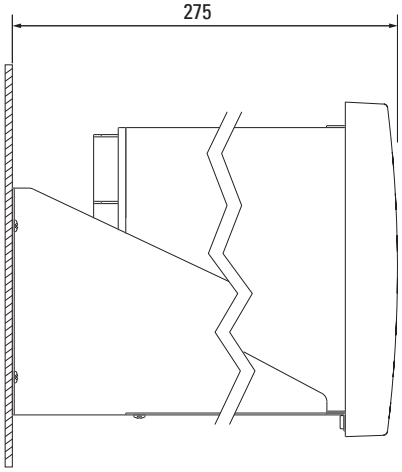


FLUSH MOUNTING

SEPARATE
OPERATOR PANEL

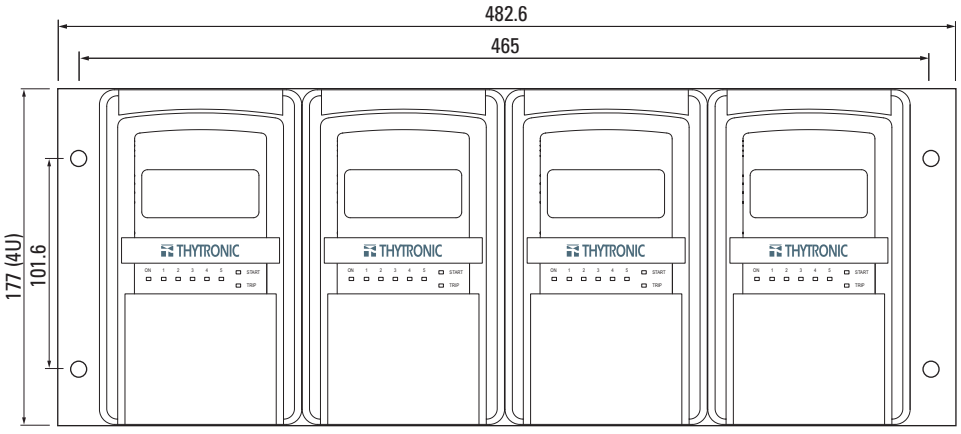


PROJECTING MOUNTING
(Separate operator panel)

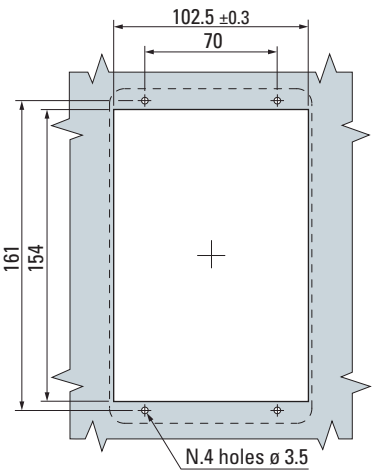


PROJECTING MOUNTING
(Stand alone)

RACK MOUNTING



FLUSH MOUNTING CUTOUT



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