



THYTRONIC

SMART line Protection Relays



NA011

FEEDER PROTECTION RELAY

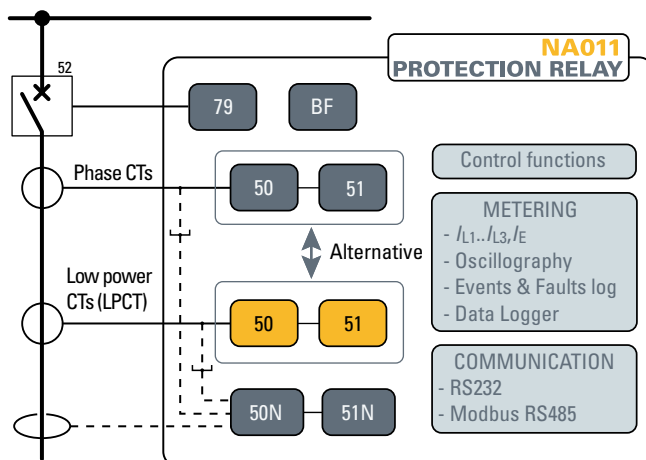
THE ECONOMICAL SOLUTION FOR THE PROTECTION OF LINES
AND TRANSFORMERS WITH AUTOMATIC RECLOSER

— Application

The relay type NA011 can be used in radial networks as feeder or power transformer protection.

In solidly grounded systems the residual overcurrent protection can be used on feeders of any length, while in ungrounded or Petersen coil and/or resistance grounded systems, the residual overcurrent protection can be used on feeders of small length in order to avoid unwanted trippings due to the capacitive current contribution of the feeder on external ground fault.

The NA011 protection relay may be shipped with traditional CTs or low power (LPCT) current inputs; for both versions, the residual overcurrent protection can use the measured (CTs or balanced transformer) or the calculated residual current.



- Protective & control functions

50/51	Phase overcurrent
50N/51N	Residual overcurrent
79	Automatic recloser
BF	Breaker failure

— Phase current inputs

Traditional CTs

Three phase current inputs with secondary nominal currents independently selectable at 1 A or 5 A through DIP-switches.

Low power CTs

Three phase current inputs with primary nominal currents independently selectable through DIP-switches and software.

— Residual current input

Measured residual current

One residual current input with secondary nominal current selectable at 1 A or 5 A through DIP-switches.

Calculated residual current

Residual current is calculated by the vector sum of the three phase currents, measured by three 1A or 5A CTs or by three LPCT type sensors.

— Binary inputs

Three binary inputs are available with predefined functions:

- IN1 - 52b acquisition or external trip
- IN2 - 52a acquisition, external trip or CB Open command
- IN3 - 79 (Enable or Remote), external trip or CB Close command

— Output relays

Four output relays are available (one changeover contact); each relay may be individually programmed as normal state (normally energized or de-energized) 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.

— Construction

The NA011 protection relay case is suitable for flush or rack mounting.

— 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,
- The yellow LED START, no-latched, indicates Start of the I>, I>>, I>>>, IE>, IE>> elements
- The red LED TRIP, no-latched, indicates Trip of the I>, I>>, I>>>, IE>, IE>> elements
- The red LED 1, latched, indicates Trip of the I>, I>>, I>>> elements
- The red LED 2, latched, indicates Trip of the IE>, IE>> elements
- The red LED 3, no-latched, indicates the CB state (CB open)
- The red LED 4, no-latched, indicates the CB state (CB closed)
- The red LED 5, no-latched, indicates the 79 (Reclosure) state:
 - ○ LED off = 79 disabled
 - ● LED on = 79 enabled
 - ◐ LED slow blink = cycle in progress
 - ⊗ LED fast blink = reclosure fail

By means of the  (Open) and  (Close) keys, the circuit breaker commands may be issued.



— 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 ThyVisor software.

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

— Control and monitoring

Several predefined functions are implemented:

- Cold load pickup (CLP) with block or setting change
- Circuit Breaker diagnostic.

Cold Load Pickup (CLP)

Cold load pickup element prevents unwanted tripping in case of temporary overcurrents produced when a feeder is being connected after an extended outage (e.g. motor starting).

Two different operating modes are provided:

- Each protective element can be blocked for a programmable time
- Each threshold can be increased for a programmable time.

— Firmware updating

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

— Communication

Two communication interfaces are implemented:

- One RS232 local communication front-end interface for communication with ThyVisor setup software
- One RS485 port using ModBus® RTU or IEC 60870-5-103 for communication with remote monitoring and control systems.

— 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, ...).
- Sw faults (boot and run time tests for data base, EEPROM memory checksum failure, data BUS,...).

— Metering

NA011 provides metering values for phase and residual currents, making them available for reading on a display or to communication interfaces.

Input signals are sampled 64 times per period and the RMS value of the fundamental component is measured using the DFT (Discrete Fourier Transform) algorithm and digital filtering.

The measured signals can be displayed with reference to nominal values or directly expressed in amperes.

— Data storage

Several useful data are stored into a non volatile memory.

- Sequence of Event Recorder
The event recorder runs continuously capturing in circular mode the last one hundred events upon trigger of binary input/output.
- Sequence of Fault Recorder
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).
- Counters

— Digital Fault Recorder (Oscillography)^[1]

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 1- A licence for the digital fault recorder function is required.

The oscillography records are stored in non-volatile memory.

SPECIFICATIONS

GENERAL

Mechanical data		
Mounting:	flush, rack	
Mass (flush mounting case)	1.2 kg	
Insulation tests		
Reference standards	EN 60255-5	
High voltage test 50Hz	2 kV 60 s	
Impulse voltage withstand (1.2/50 μ s)	5 kV	
Insulation resistance	>100 M Ω	
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
RS485 port	1200...57600 bps
Protocol	ModBus® RTU/IEC 60870-5-103

INPUT CIRCUITS

Auxiliary power supply Uaux		
Nominal value (range)	24...230 Vac/dc	
Operative range	19...265 Vac / 19...300 Vdc	
Power consumption (max)	6 W (9 VA)	
Phase current inputs		
Traditional CTs:		
• Nominal current I_n	1 A or 5 A selectable by DIP Switches	
• Permanent overload	25 A	
• Thermal overload (1 s)	500 A	
• Rated consumption (for any phase)	≤ 0.002 VA ($I_n = 1$ A)	
	≤ 0.04 VA ($I_n = 5$ A)	
• Connections	4 mm ring lugs suitable for M4 screws	
Low power CTs (according to IEC 60044-8 standard):		
• Nominal primary current I_{pn}	100 A	
• Extended primary current (selectable via DIP Switches and sw)	50...1250 A	
• Maximum primary current	12.5 kA	
• Nominal secondary voltage ($I_{np} = 100$ A)	22.5 mV	
• Connections	RJ45 plug	
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	3	
Type	dry inputs	
Max permissible voltage	19...265 Vac/19...300 Vdc	
Max consumption, energized	3 mA	

OUTPUT CIRCUITS

Output relays K1...K4		
Quantity	4	
Command relays K1, K2, K4		
Type of contacts	changeover (SPDT, type C)	
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 ($\lambda = 0.4$)	1250 VA	
Make	1000 W/VA	
Short duration current (0,5 s)	30 A	
Signalling relays K3		
Type of contacts	changeover (SPDT, type C)	
Nominal current	8 A	
Nominal voltage/max switching voltage	250 Vac/400 Vac	
LEDs		
Quantity	8	
• ON/fail (green)	1	
• Start (yellow)	1	
• Trip (red)	1	
• Trip $I>$, $I>>$, $I>>>$ (red)	1	
• Trip $I_{E>}$, $I_{E>>}$ (red)	1	
• 52a - CB position (red)	1	
• 52b - CB position (red)	1	
• 79 - Auto recloser (red)	1	

GENERAL SETTINGS

Rated values		
Phase CT nominal primary current (I_{np})	1 A...5000 A	
Residual CT nominal primary current (I_{Enp})	1 A...5000 A	
Reading	Direct / Relative	
Relay output timers		
Minimum pulse width ($K_1 t_{TR}... K_4 t_{TR}$)	0.01...0.50 s	

PROTECTIVE FUNCTIONS

— Phase overcurrent - 50/51

I> Element

- *I>* Curve type (*I>*Curve) DEFINITE, IEC/BS A, B, C, ANSI/IEEE MI, VI, EI, I2T
- CLP activation time (*t*_{CLP>}) 0.00...100.0 s
- *I>* Reset time (*t*_{RES}) 0.00...100.0 s

Definite time

- 50/51 First threshold definite time (*I*_{def}) 0.100...20.0 *I*_n
- *I*_{def} within CLP (*I*_{CLP>def}) 0.100...20.0 *I*_n
- *I*_{def} Operating time (*t*_{def}) 0.03...10.00 s

Inverse time

- 50/51 First threshold inverse time (*I*_{inv}) 0.100...2.50 *I*_n
- *I*_{inv} within CLP (*I*_{CLP>inv}) 0.100...10.0 *I*_n
- *I*_{inv} Operating time (*t*_{inv}) 0.02...60.0 s

I>> Element

- CLP activation time (*t*_{CLP>>}) 0.00...100.0 s
- *I>>* Reset time (*t*_{RES}) 0.00...100.0 s

Definite time

- 50/51 Second threshold definite time (*I*_{>>def}) 0.100...20.0 *I*_n
- *I*_{>>def} within CLP (*I*_{CLP>>def}) 0.100...20.0 *I*_n
- *I*_{>>def} Operating time (*t*_{>>def}) 0.03...10.00 s

I>>> Element

- CLP activation time (*t*_{CLP>>>def}) 0.00...100.0 s
- *I>>>* Reset time (*t*_{>>>RES}) 0.00...100.0 s

Definite time

- 50/51 Third threshold definite time (*I*_{>>>def}) 0.100...20.0 *I*_n
- *I*_{>>>def} within CLP (*I*_{CLP>>>def}) 0.100...20.0 *I*_n
- *I*_{>>>def} Operating time (*t*_{>>>def}) 0.03...10.00 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, I2T
- CLP activation time (*t*_{ECLP>}) 0.00...100.0 s
- *I_E>* Reset time delay (*t*_{RES}) 0.00...1.00 s

Definite time

- 50N/51N First threshold definite time (*I_E>def*) 0.005...5.00 *I_En*
- *I_E>def* within CLP (*I_ECLP>def*) 0.005...5.00 *I_En*
- *I_E>def* Operating time (*t*_{def}) 0.03...10.00 s

Inverse time

- 50N/51N First threshold inverse time (*I_E>inv*) 0.005...2.00 *I_En*
- *I_E>inv* within CLP (*I_ECLP>inv*) 0.005...2.00 *I_En*
- *I_E>inv* Operating time (*t*_{inv}) 0.02...60.0 s

I_E>> Element

- *I_E>>* Curve type (*I_E>>*Curve) DEFINITE, IEC/BS A, B, C, ANSI/IEEE MI, VI, EI, I2T
- CLP activation time (*t*_{ECLP>>def}) 0.00...100.0 s
- *I_E>>* Reset time delay (*t*_{RES}) 0.00...1.00 s

Definite time

- 50N/51N Second threshold definite time (*I_E>>def*) 0.005...5.00 *I_En*
- *I_E>>def* within CLP (*I_ECLP>>def*) 0.005...5.00 *I_En*
- *I_E>>def* Operating time (*t*_{>>def}) 0.03...10.00 s

Inverse time

- 50N/51N First threshold inverse time (*I_E>inv*) 0.005...2.00 *I_En*
- *I_E>inv* within CLP (*I_ECLP>>inv*) 0.005...2.00 *I_En*
- *I_E>inv* Operating time (*t*_{>>inv}) 0.02...60.0 s

— AutoReclose - 79

- 79 Function mode (79 Mode) Rapid/Rapid+Slow
- Number of delayed reclosures (*N.DAR*) 0...5
- Rapid reclosure dead time (*t*_{rdt}) 0.1...60 s
- Slow reclosure dead time (*t*_{sdt}) 1...200 s
- Reclaim time (*t*_r) 1...200 s
- Slow reclosure fault discrimination time (*t*_d) 0...10 s

METERING & RECORDING

— Measured parameters

- Fundamental RMS phase currents *I*_{L1}, *I*_{L2}, *I*_{L3}
- Fundamental RMS residual current *I_E*

— Digital inputs

- IN1 OFF - 52b - Trip EXT
- IN2 OFF - 52a - Trip EXT - CB Open
- IN3 OFF - 79 Enable - 79 Remote - Trip EXT - CB Close

— AutoReclose - 79

- 79 ActiveMode On - Off
- 79 CycleState Reset - On - Off
- 79 Run On - Off
- 79 Residual-time
- 79 LastEvent

— Counters

- Counter Start *I*>, Counter Start *I*>>, Counter Start *I*>>>
- Counter Start *I_E*>, Counter Start *I_E*>>
- Counter Trip *I*>, Counter Trip *I*>>, Counter Trip *I*>>>
- Counter Trip *I_E*>, Counter Trip *I_E*>>
- Counter 79 RR
- Counter 79 SR
- Counter 79 RDR
- Counter 79 FR P
- Counter 79 FR E
- Counter 79 FR X

— Events recorder

- Number of events 100
- Trigger: K1...K4, IN1, IN2, IN3 switching
- Data recorded:
- Event counter 0...10⁹
- Event cause info (operating phase) L1, L2, L3
- Time stamp Date and time

— Faults recorder

- Number of faults 20
- Trigger:
- Output relays activation (OFF-ON transition) K1...K4
- External trigger (binary inputs) IN1, IN2, IN3
- Element pickup (OFF-ON transition) Start/Trip
- Data recorded:
- Fault counter (F-Number) 0...10⁹
- Fundamental RMS phase currents *I*_{L1}, *I*_{L2}, *I*_{L3}
- Fundamental RMS residual current *I_E*
- Fault cause (F-Cause) start, trip
- Time stamp Date and time

— Digital Fault Recorder (Oscillography)^[1]

- File format COMTRADE
- Number of records 2^[2]
- Recording mode circular
- Sampling rate 16 per power frequency cycle
- Trigger setup
- Pre-trigger time 0...63 T^[3]
- Trigger from inputs IN1, IN2, IN3
- Trigger from outputs K1...K4
- General trigger from start / trip Start, Trip
- Manual trigger ThyVisor
- Trigger from start / trip Start *I*>, *I*>>, ... Trip *I*>...
- Data recorded on analog channels (Analog channel 1...4)
- Instantaneous currents *i*_{L1}, *i*_{L2}, *i*_{L3}, *i_E*
- Fundamental RMS phase currents *I*_{L1}, *I*_{L2}, *I*_{L3}
- Fundamental RMS residual current *I_E*
- Data recorded on digital channel
- Binary inputs state IN1, IN2, IN3
- Output relays state K1...K4
- General trigger from start / trip General Start, General Trip

Note 1 - The oscillography records are stored in non-volatile memory

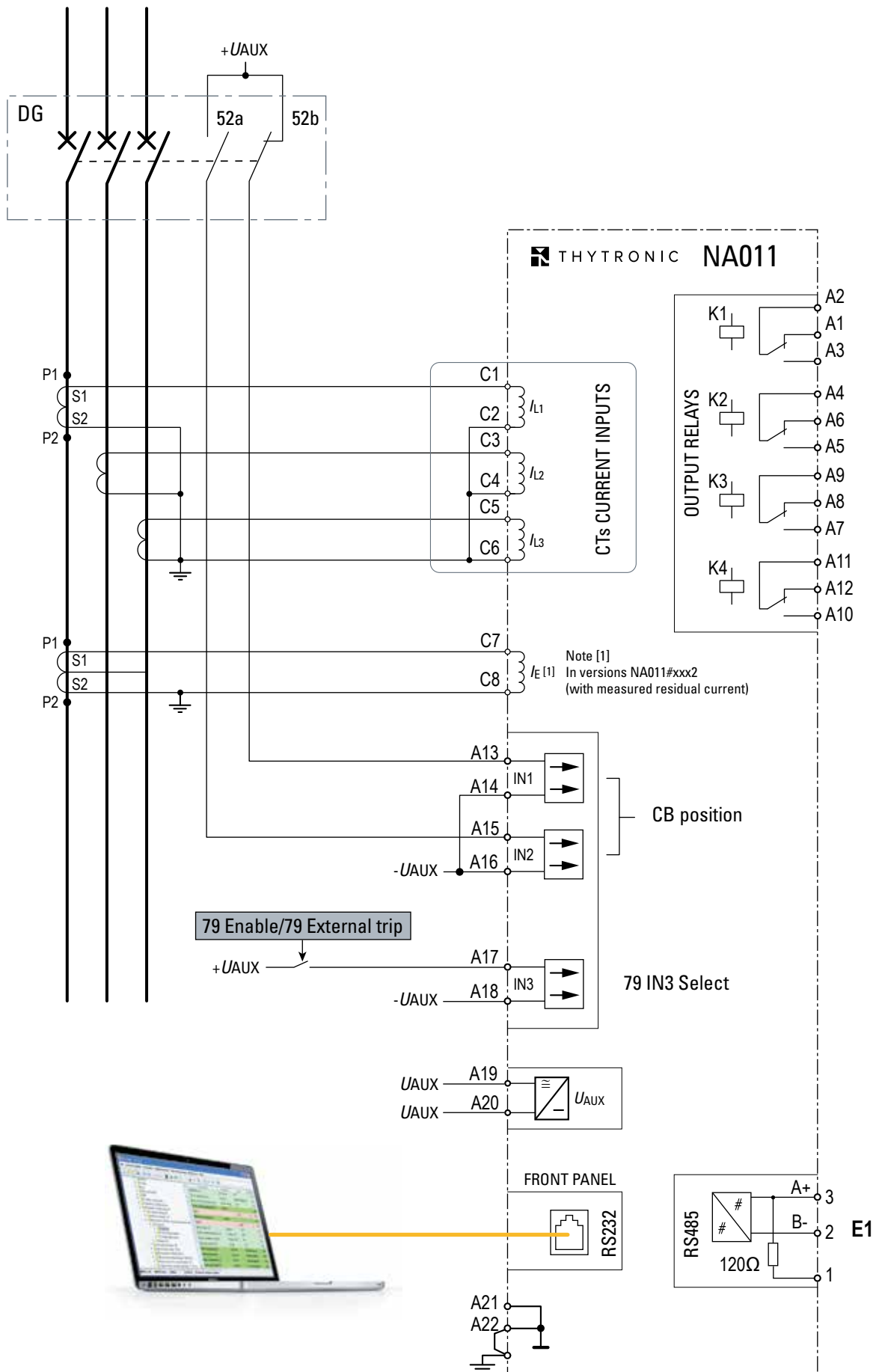
Note 2 - The time duration of the two records is dependent of settings; e.g. the record duration with *f* = 50 Hz is 240 ms with following settings:

- Instantaneous *i*_{L1} current into "Analog channel 1" *i*_{L1}
- Instantaneous *i*_{L2} current into "Analog channel 2" *i*_{L2}
- Instantaneous *i*_{L3} current into "Analog channel 3" *i*_{L3}
- Instantaneous *i_E* current into "Analog channel 4" *i_E*
- Digital channels K1

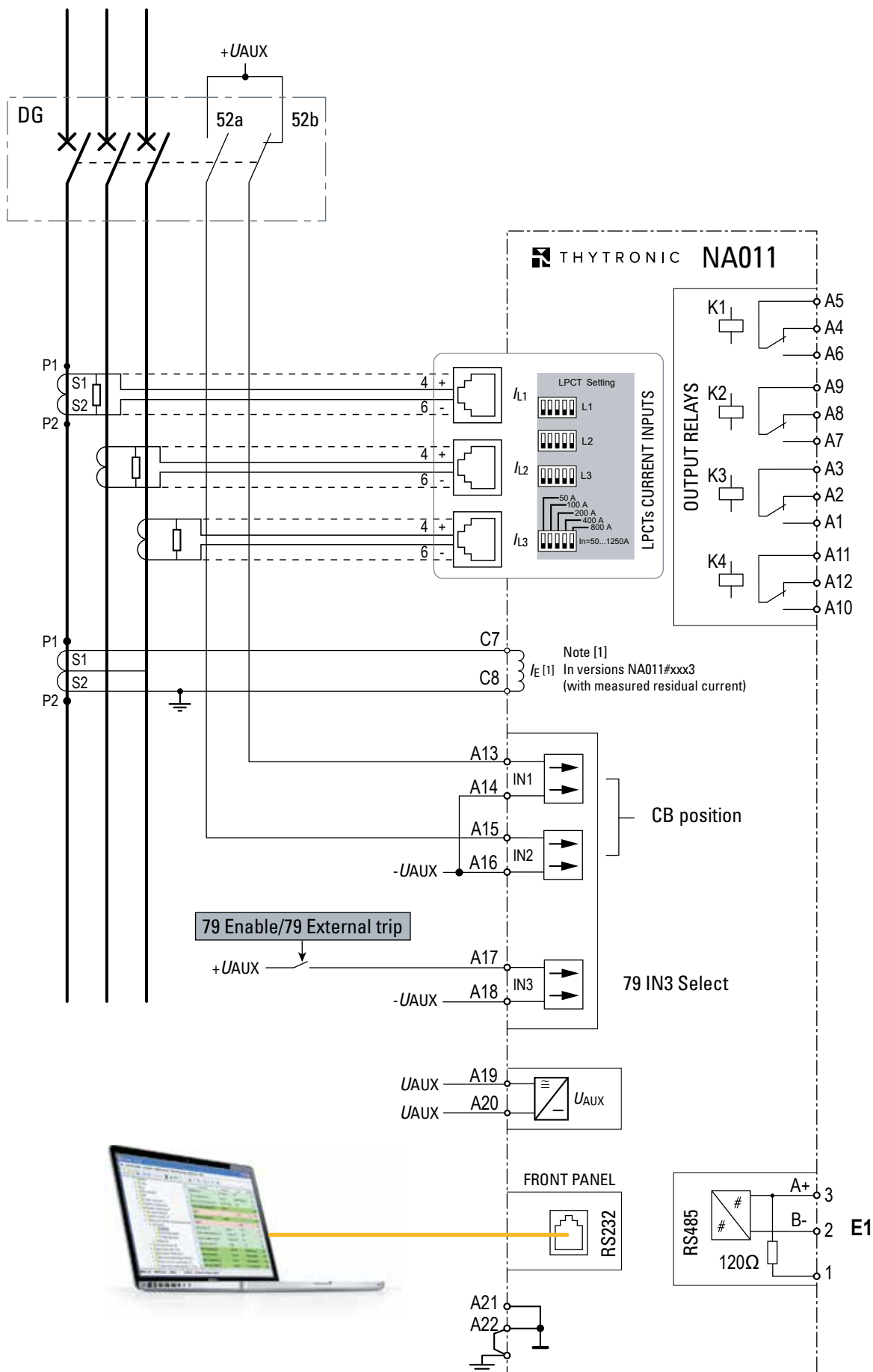
Note 3 - *T* = number of power cycles

Example, with settings *T* = 4 the pre-trigger time is 80 ms with *f* = 50 Hz

— Example of connection diagram with traditional CT inputs and acquisition of CB states and Auto Reclose enable/start

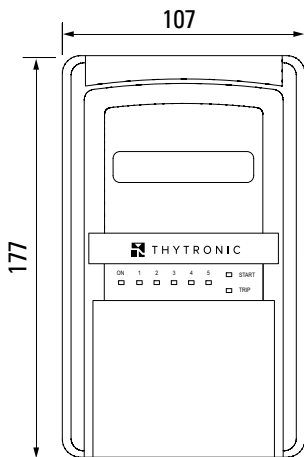


— Example of connection diagram with low power CT inputs and acquisition of CB states and Auto Reclose enable/start

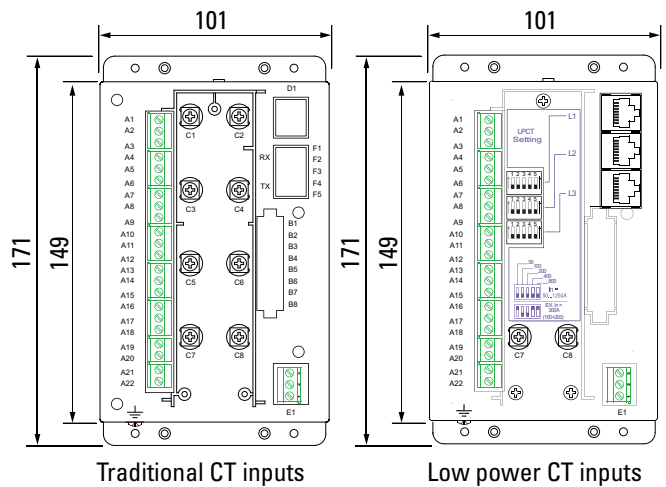


DIMENSIONS

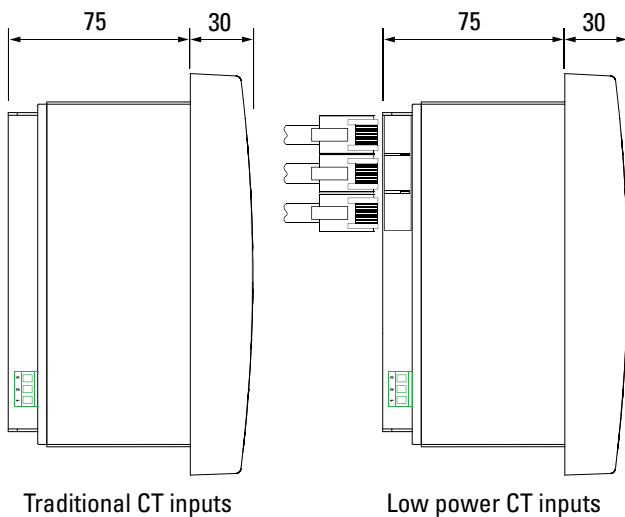
FRONT VIEW



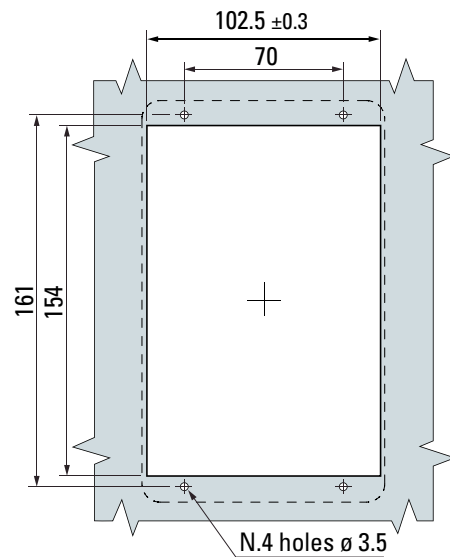
REAR VIEW



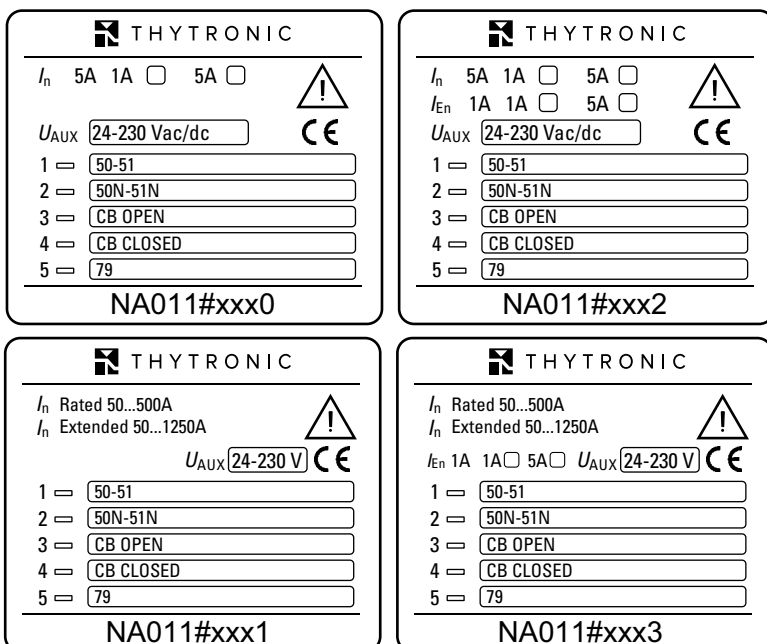
SIDE VIEW



FLUSH MOUNTING CUTOUT



IDENTIFICATION LABEL



LEDS

ON & Diagnostic



Keys  (CB open) and  (CB close) are enabled



THYTRONIC

ENERGY FOR A SAFER FUTURE

A PERSONALISED SERVICE OF THE PRODUCTION, A RAPID DELIVERY, A COMPETITIVE PRICE AND AN ATTENTIVE EVALUATION OF OUR CUSTOMERS NEEDS, HAVE ALL CONTRIBUTED IN MAKING US ONE OF THE BEST AND MOST RELIABLE PRODUCERS OF PROTECTIVE RELAYS. FORTY YEARS OF EXPERIENCE HAS MADE STANDARD THESE ADVANTAGES THAT ARE GREATLY APPRECIATED BY LARGE COMPANIES THAT DEAL ON THE INTERNATIONAL MARKET. A HIGHLY QUALIFIED AND MOTIVATED STAFF PERMITS US TO OFFER AN AVANT-GARDE PRODUCT AND SERVICE WHICH MEET ALL SAFETY AND CONTINUITY DEMANDS, VITAL IN THE GENERATION OF ELECTRIC POWER. OUR COMPANY PHILOSOPHY HAS HAD A POSITIVE REACTION FROM THE MARKET BY BACKING OUR COMMITMENT AND HENCE STIMULATING OUR GROWTH.

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