THYTRONIC

NV11B MULTIFUNCTION VOLTAGE RELAY

Application

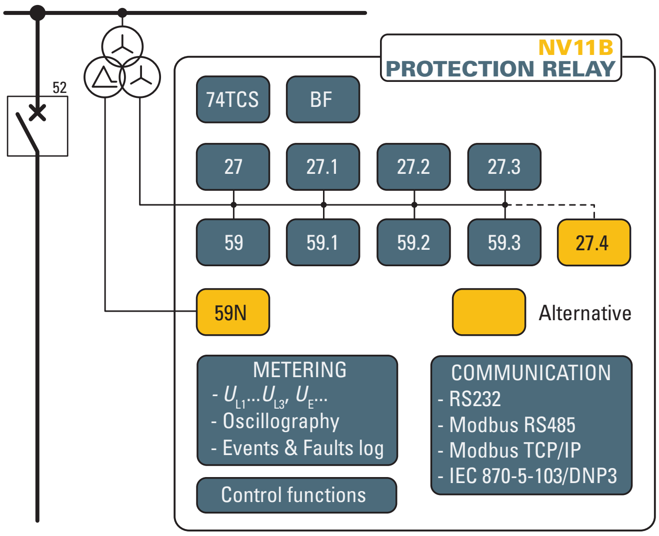
The relay type NV11B can be typically used in HV, MV and LV distribution systems, on transformers or for electrical machines.
It can be used for system decoupling, load shedding and load transfer protection.
Inside the NV11B device both the three-polar (27, 59) and unipolar (27.1, 27.2, 27.3, 27.4 and 59.1, 59.2, 59.3) undervoltage and overvoltage elements are available.

Measuring inputs

Three phase voltage inputs, (phase-to-ground or phase-to-phase), with programmable nominal voltages within range 50...130 V (U_R=100 V) or 200...520 V (U_R=400 V) and one residual voltage input, with programmable nominal voltage within range 50...130 V (U_{ER}=100 V).

Protective functions

27	Three-polar phase undervoltage
27.1	Unipolar phase undervoltage
27.2	Unipolar phase undervoltage
27.3	Unipolar phase undervoltage
27.4	Unipolar phase undervoltage (alternative to 59N)
59	Three-polar phase overvoltage
59.1	Unipolar phase overvoltage
59.2	Unipolar phase overvoltage
59.3	Unipolar phase overvoltage
59N	Residual overvoltage (alternative to 27.4)
BF	Circuit breaker failure



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).

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.

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.

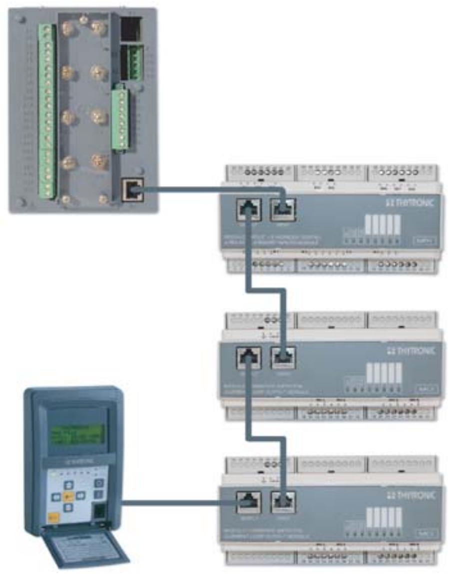
Firmware updating

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

Modular design

In order to extend I/O capability, the NV10 hardware can be customized through external auxiliary modules:

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



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.

Control and monitoring

Several predefined functions are implemented:

- Activation of two set point profiles
- Trip circuit supervision (74TCS)
- Remote tripping
- Synchronization
- Circuit Breaker commands and diagnostic

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

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,...)
- Circuit breaker faults.

Metering

NV11B provides metering values for phase, residual voltages and frequency, making them available for reading on a display or to communication interfaces. Voltages 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.
The measured voltages can be displayed with reference to nominal values or directly expressed in volts.
With DFT the RMS value some harmonic are also measured.

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).

Communication

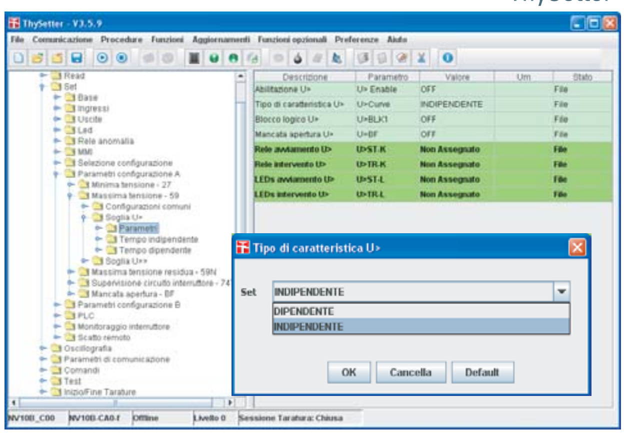
Multiple communication interfaces are implemented:

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

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	89/336/EEC
• Low Voltage Directive	73/23/EEC
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)

Voltage inputs

Reference voltage U_R	100 V or 400 V selectable on order
Nominal voltage U_n	50...130 V or 200...520 V selectable by sw
Permanent overload	1.3 U_R
1s overload	2 U_R
Rated consumption (for any phase)	≤ 0.5 VA

Residual voltage input

Reference voltage U_{ER}	100 V
Nominal voltage U_{En}	50...130 V selectable by sw
Permanent overload	1.3 U_{ER}
1s overload	2 U_{ER}
Rated consumption	≤ 0.5 VA

Binary inputs

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

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 nominal voltage (U_n)	50...130 V or 200...520 V
Relay residual nominal voltage (direct measure) (U_{En})	50...130 V
Relay residual nominal voltage (calculated) (U_{ECN})=$U_n \cdot \sqrt{3}$	50...130 V
Line VT primary nominal voltage (U_{np})	50 V..500 kV
Residual primary nominal voltage (phase-to-phase) · √3 (U_{Enp})	50 V...500 kV

Binary input timers

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

Relay output timers

Minimum pulse width	0.000...0.500 s

FUNCTIONS

☐ Three-polar Undervoltage - 27
Common configuration:
- 27 Operating logic (*Logic*27) AND/OR

U< Element
- *U<* Curve type (*U<*Curve) DEFINITE / INVERSE [1]

Definite time
- 27 First threshold definite time ($U_{<def}$) 0.05...1.10 U_n
- $U_{<def}$ Operating time ($t_{U<def}$) 0.03...100.0 s

Inverse time
- 27 First threshold inverse time ($U_{<inv}$) 0.05...1.10 U_n
- $U_{<inv}$ Operating time ($t_{U<inv}$) 0.10...100.0 s

U<< Element
Definite time
- 27 Second threshold definite time ($U_{<<def}$) 0.05...1.10 U_n
- $U_{<<def}$ Operating time ($t_{U<<def}$) 0.03...100.0 s

Note [1] - The mathematical formula for INVERSE curves is:

$$t = 0.75 \cdot t_{U<inv} / [1-(U/U_{<inv})]$$

where:
t = trip time (in seconds)
$t_{U<inv}$ = operating time setting (in seconds)
U = input voltage
$U_{<inv}$ = threshold

☐ Unipolar Undervoltage - 27.1
$U_{(1)}<$ Element
- $U_{(1)}<$ Curve type ($U_{(1)}<$Curve) DEFINITE / INVERSE [1]

Definite time
- 27 First threshold definite time ($U_{(1)<def}$) 0.05...1.10 U_n
- $U_{(1)<def}$ Operating time ($t_{U(1)<def}$) 0.03...100.0 s

Inverse time
- 27 First threshold inverse time ($U_{(1)<inv}$) 0.05...1.10 U_n
- $U_{(1)<inv}$ Operating time ($t_{U(1)<inv}$) 0.10...100.0 s

$U_{(1)}<<$ Element
Definite time
- 27 Second threshold definite time ($U_{(1)<<def}$) 0.05...1.10 U_n
- $U_{(1)<<def}$ Operating time ($t_{U(1)<<def}$) 0.03...100.0 s

☐ Unipolar Undervoltage - 27.2
$U_{(2)}<$ Element
- $U_{(2)}<$ Curve type ($U_{(2)}<$Curve) DEFINITE / INVERSE [1]

Definite time
- 27 First threshold definite time ($U_{(2)<def}$) 0.05...1.10 U_n
- $U_{(2)<def}$ Operating time ($t_{U(2)<def}$) 0.03...100.0 s

Inverse time
- 27 First threshold inverse time ($U_{(2)<inv}$) 0.05...1.10 U_n
- $U_{(2)<inv}$ Operating time ($t_{U(2)<inv}$) 0.10...100.0 s

$U_{(2)}<<$ Element
Definite time
- 27 Second threshold definite time ($U_{(2)<<def}$) 0.05...1.10 U_n
- $U_{(2)<<def}$ Operating time ($t_{U(2)<<def}$) 0.03...100.0 s

☐ Unipolar Undervoltage - 27.3
$U_{(2)}<$ Element
- $U_{(3)}<$ Curve type ($U_{(3)}<$Curve) DEFINITE / INVERSE [1]

Definite time
- 27 First threshold definite time ($U_{(3)<def}$) 0.05...1.10 U_n
- $U_{(3)<def}$ Operating time ($t_{U(3)<def}$) 0.03...100.0 s

Inverse time
- 27 First threshold inverse time ($U_{(3)<inv}$) 0.05...1.10 U_n
- $U_{(3)<inv}$ Operating time ($t_{U(3)<inv}$) 0.10...100.0 s

$U_{(3)}<<$ Element
Definite time
- 27 Second threshold definite time ($U_{(3)<<def}$) 0.05...1.10 U_n
- $U_{(3)<<def}$ Operating time ($t_{U(3)<<def}$) 0.03...100.0 s

☐ Unipolar Undervoltage - 27.4[1]
$U_{(4)}<$ Element
- $U_{(4)}<$ Curve type ($U_{(4)}<$Curve) DEFINITE / INVERSE [2]

Definite time
- 27 First threshold definite time ($U_{(4)<def}$) 0.05...1.10 U_n
- $U_{(4)<def}$ Operating time ($t_{U(4)<def}$) 0.03...100.0 s

Inverse time
- 27 First threshold inverse time ($U_{(4)<inv}$) 0.05...1.10 U_n
- $U_{(4)<inv}$ Operating time ($t_{U(4)<inv}$) 0.10...100.0 s

$U_{(4)}<<$ Element
Definite time
- 27 Second threshold definite time ($U_{(4)<<def}$) 0.05...1.10 U_n
- $U_{(4)<<def}$ Operating time ($t_{U(4)<<def}$) 0.03...100.0 s

Note [1] - The element is alternative to the 59N thresholds

Note [2] - The mathematical formula for INVERSE curves is:

$$t = 0.75 \cdot t_{U(x)<inv} / [1-(U/U_{(x)<inv})]$$

where:
t = trip time (in seconds)
$t_{U(x)<inv}$ = operating time setting (in seconds)
U = input voltage
$U_{(x)<inv}$ = threshold
x = 1, 2, 3, 4

☐ Three-polar Overvoltage - 59
Common configuration:
- 59 Operating logic (*Logic*59) AND/OR

U> Element
- *U>* Curve type (*U>*Curve) DEFINITE / INVERSE [1]

Definite time
- 59 First threshold definite time ($U_{>def}$) 0.50...1.50 U_n
- $U_{>def}$ Operating time ($t_{U>def}$) 0.03...100.0 s

Inverse time
- 59 First threshold inverse time ($U_{>inv}$) 0.50...1.50 U_n
- $U_{>inv}$ Operating time ($t_{U>inv}$) 0.10...100.0 s

U>> Element
Definite time
- 59 Second threshold definite time ($U_{>>def}$) 0.50...1.50 U_n
- $U_{>>def}$ Operating time ($t_{U>>def}$) 0.03...100.0 s

Note [1] - The mathematical formula for INVERSE curves is:

$$t = 0.5 \cdot t_{U>inv} / [(U/U_{>inv})-1]$$

where:
t = trip time (in seconds)
$t_{U>inv}$ = operating time setting (in seconds)
U = input voltage
$U_{>inv}$ = threshold

☐ Unipolar Overvoltage - 59.1
$U_{(1)}>$ Element
- $U_{(1)}>$ Curve type ($U_{(1)}>$Curve) DEFINITE / INVERSE [1]

Definite time
- 59 First threshold definite time ($U_{(1)>def}$) 0.50...1.50 U_n
- $U_{(1)>def}$ Operating time ($t_{U(1)>def}$) 0.03...100.0 s

Inverse time
- 59 First threshold inverse time ($U_{(1)>inv}$) 0.50...1.50 U_n
- $U_{(1)>inv}$ Operating time ($t_{U(1)>inv}$) 0.10...100.0 s

$U_{(1)}>>$ Element
Definite time
- 59 Second threshold definite time ($U_{(1)>>def}$) 0.50...1.50 U_n
- $U_{(1)>>def}$ Operating time ($t_{U(1)>>def}$) 0.03...100.0 s

☐ Unipolar Overvoltage - 59.2
$U_{(2)}>$ Element
- $U_{(2)}>$ Curve type ($U_{(2)}>$Curve) DEFINITE / INVERSE [1]

Definite time
- 59 First threshold definite time ($U_{(2)>def}$) 0.50...1.50 U_n

- $U_{(2)>def}$ Operating time ($t_{U(2)>def}$) 0.03...100.0 s

Inverse time
- 59 First threshold inverse time ($U_{(2)>inv}$) 0.50...1.50 U_n
- $U_{(2)>inv}$ Operating time ($t_{U(2)>inv}$) 0.10...100.0 s

$U_{(2)}$>> Element

Definite time
- 59 Second threshold definite time ($U_{(2)>>def}$) 0.50...1.50 U_n
- $U_{(2)>>def}$ Operating time ($t_{U(2)>>def}$) 0.03...100.0 s

Unipolar Overvoltage - 59.3

$U_{(3)}$> Element
- $U_{(3)}$> Curve type ($U_{(3)}$>Curve) DEFINITE / INVERSE [1]

Definite time
- 59 First threshold definite time ($U_{(3)>def}$) 0.50...1.50 U_n
- $U_{(3)>def}$ Operating time ($t_{U(3)>def}$) 0.03...100.0 s

Inverse time
- 59 First threshold inverse time ($U_{(3)>inv}$) 0.50...1.50 U_n
- $U_{(3)>inv}$ Operating time ($t_{U(3)>inv}$) 0.10...100.0 s

$U_{(3)}$>> Element

Definite time
- 59 Second threshold definite time ($U_{(3)>>def}$) 0.50...1.50 U_n
- $U_{(3)>>def}$ Operating time ($t_{U(3)>>def}$) 0.03...100.0 s

Note [1] - The mathematical formula for INVERSE curves is:

$$t = 0.5 \cdot t_{U(x)>inv} / [(U/U_{(x)>>inv})-1]$$

where:

t = trip time (in seconds)
$t_{U>inv}$ = operating time setting (in seconds)
U = input voltage
$U_{>inv}$ = threshold
x = 1, 2, 3

Residual overvoltage - 59N[1]

Common configuration:
- Residual voltage measurement for 59N - direct/calculated (*3V0Type*59N)[2] U_E / U_{EC}
- 59N Operation from 74VT external (*74VText*59N) *OFF/Block*

U_E> Element
- U_E> Curve type (U_E>Curve) DEFINITE / INVERSE [3]
- U_E> Reset time delay ($t_{UE>RES}$) 0.00...100.0 s

Definite time
- 59N First threshold definite time ($U_{E>def}$) 0.01...0.70 U_{En}
- $U_{E>def}$ Operating time ($t_{UE>def}$) 0.07...100.0 s

Inverse time
- 59N First threshold inverse time ($U_{E>inv}$) 0.01...0.50 U_{En}
- $U_{E>inv}$ Operating time ($t_{UE>inv}$) 0.10...100.0 s

U_E>> Element
- U_E>> Reset time delay ($t_{UE>>RES}$) 0.00...100.0 s
- 59N Second threshold definite time ($U_{E>>def}$) 0.01...0.70 U_{En}
- $U_{E>>def}$ Operating time ($t_{UE>>def}$) 0.07...100.0 s

Note [1] - The element is alternative to the 27.4 element

Note [2] If the phase-to-phase voltages or the phase voltages from VT on different sides are measured, the residual voltage U_E from the vector sum of three phase voltages can not be used

Note [3] - The mathematical formula for INVERSE curves is:

$$t = 0.5 \cdot t_{UE>inv} / [(U/U_{E>inv})-1]$$

where:

t = trip time (in seconds)
$t_{UE>inv}$ = operating time setting (in seconds)
U_E = residual input voltage
$U_{E>inv}$ = threshold

Breaker failure - BF

BF Time delay (t_{BF}) 0.06...10.00 s

Circuit Breaker supervision

Number of CB trips (*N.Open*) 0...10000
CB max allowed opening time ($t_{break>}$) 0.05...1.00 s

METERING

Measures

Direct:
- Frequency f
- Input voltages U_{L1}, U_{L2}, U_{L3}
- Residual voltage U_E [1]

Calculated:
- Calculated residual voltage U_{EC}
- Maximum voltage between U_{L1}-U_{L2}-U_{L3} U_{Lmax}
- Average voltage between U_{L1}-U_{L2}-U_{L3} U_L

Sequence:
- Negative sequence voltage U_2

3rd harmonic:
- Third harmonic residual voltage U_{E-3rd}

Event storage

Sequence of Event Recorder (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

Sequence of Fault Recorder (SFR)

Number of faults 20
Recording mode circular

Trigger:
- External trigger (binary inputs) IN1, IN2
- 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) $0...10^9$
- Input voltages U_{L1r}, U_{L2r}, U_{L3r}
- Residual voltages (measured and calculated) U_{Er} [2], U_{ECr}
- Frequency f_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 [2]
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 voltages u_{L1}, u_{L2}, u_{L3}, u_E [1]

Set analog channels (Analog 1...12):
- Frequency f
- Input voltages U_{L1}, U_{L2}, U_{L3}
- Residual voltage (measured and calculated) U_E [1], U_{EC}

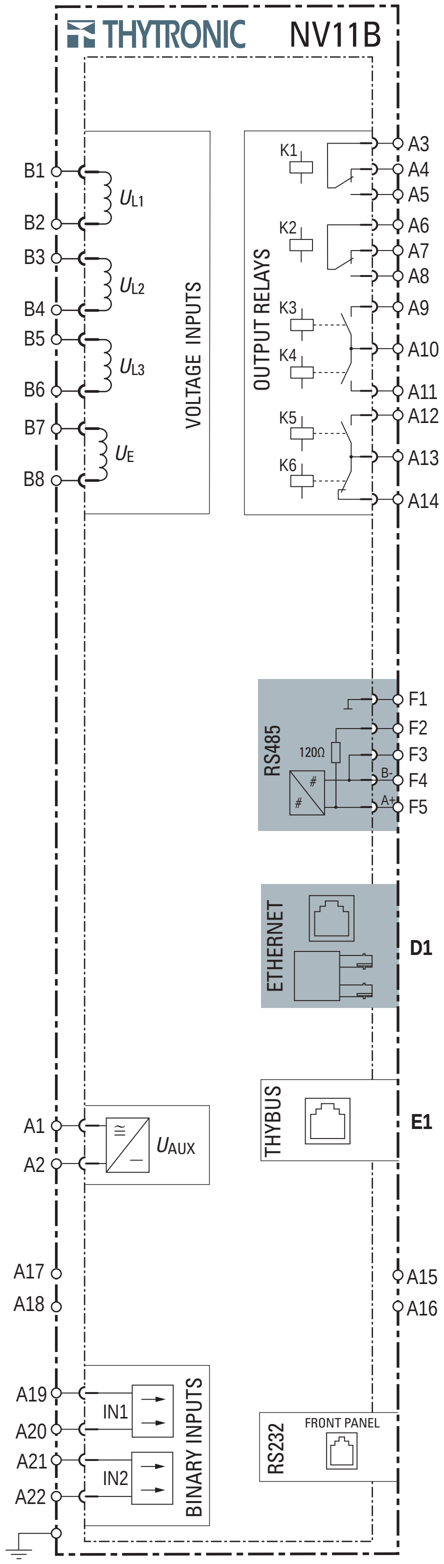
Set digital channels (Digital 1...12):
- Output relays state K1...K6...K10
- Binary inputs state IN1, IN2...INx

Note [1] - The u_E, U_E and U_{Er} symbols are maintained, even when the input circuit is not used for the measurement of residual voltage (g: 27.4 threshold)

Note [2] - For instance, with following setting:
- *Pre-trigger and Post-trigger time* 0.25 s
- *Sampled channels* u_{L1}, u_{L2}, u_{L3}, u_E [1]
- *Analog channels* U_{L1}, U_{L2}, U_{L3}, U_E [1]
- *Digital channels* K1, K2, K3, K4, K5, K6, IN1, IN2

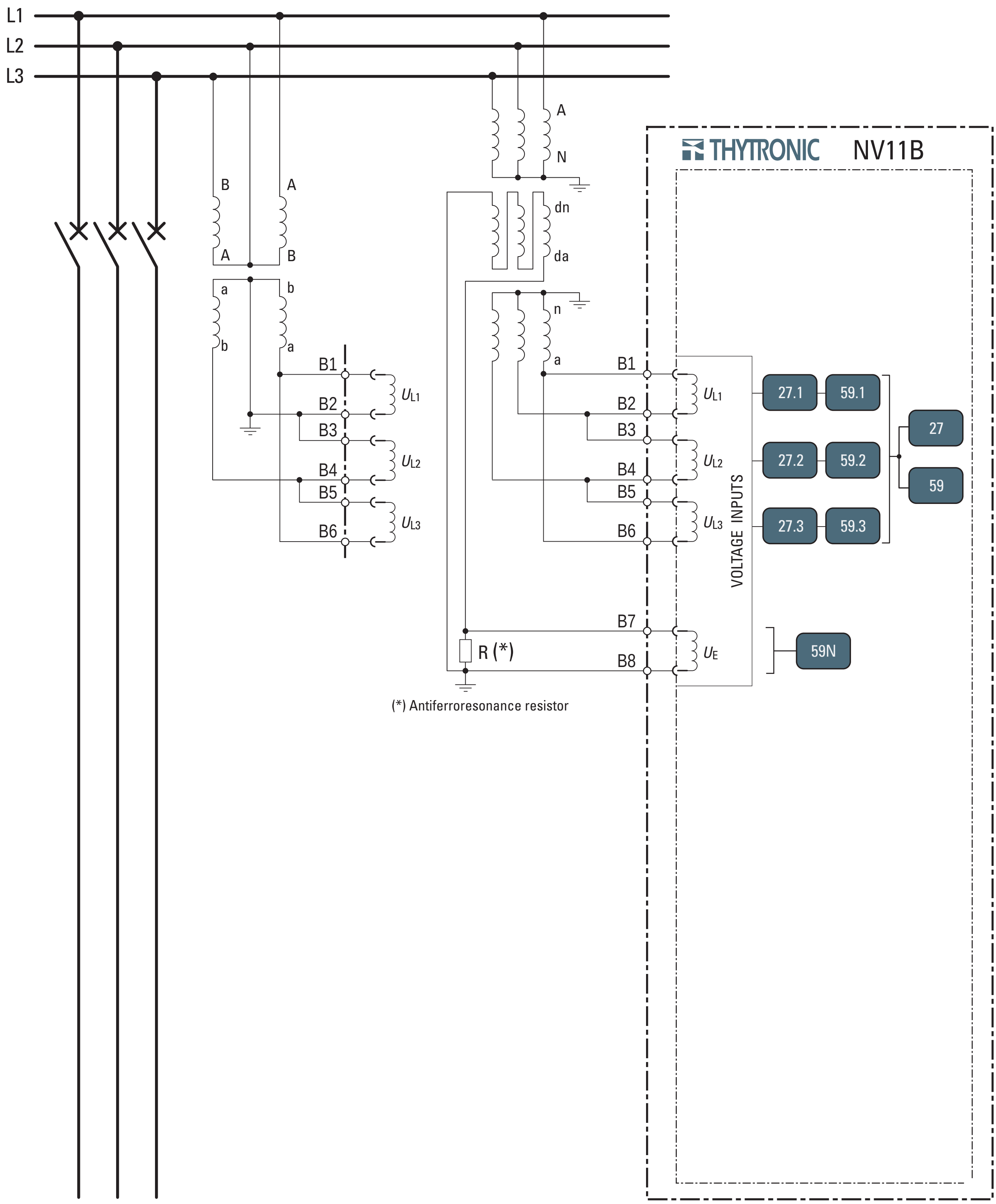
More than three hundred records can be stored with f = 50 Hz

I/O and communication ports



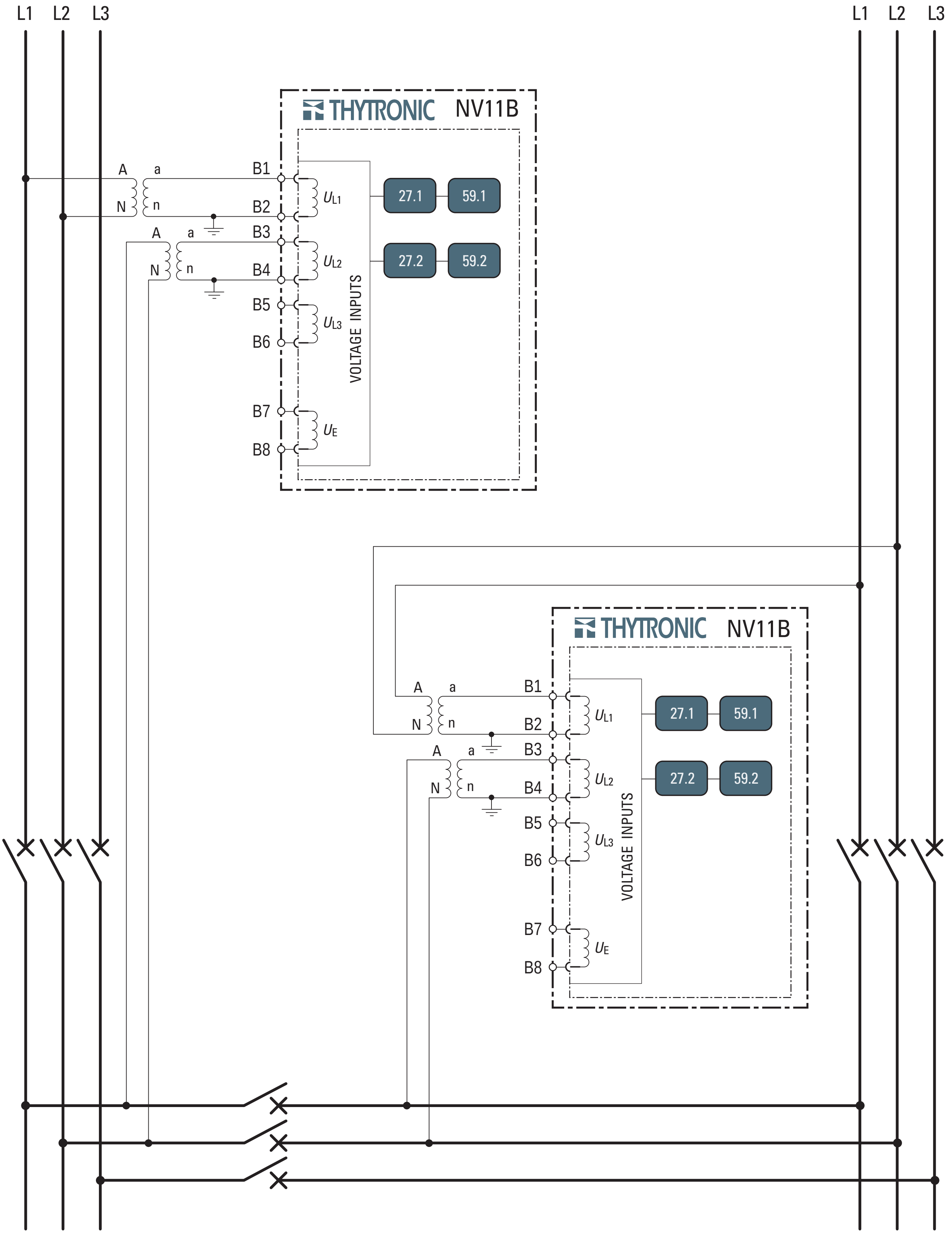
NV10P-I-O.ai

Connection diagram example

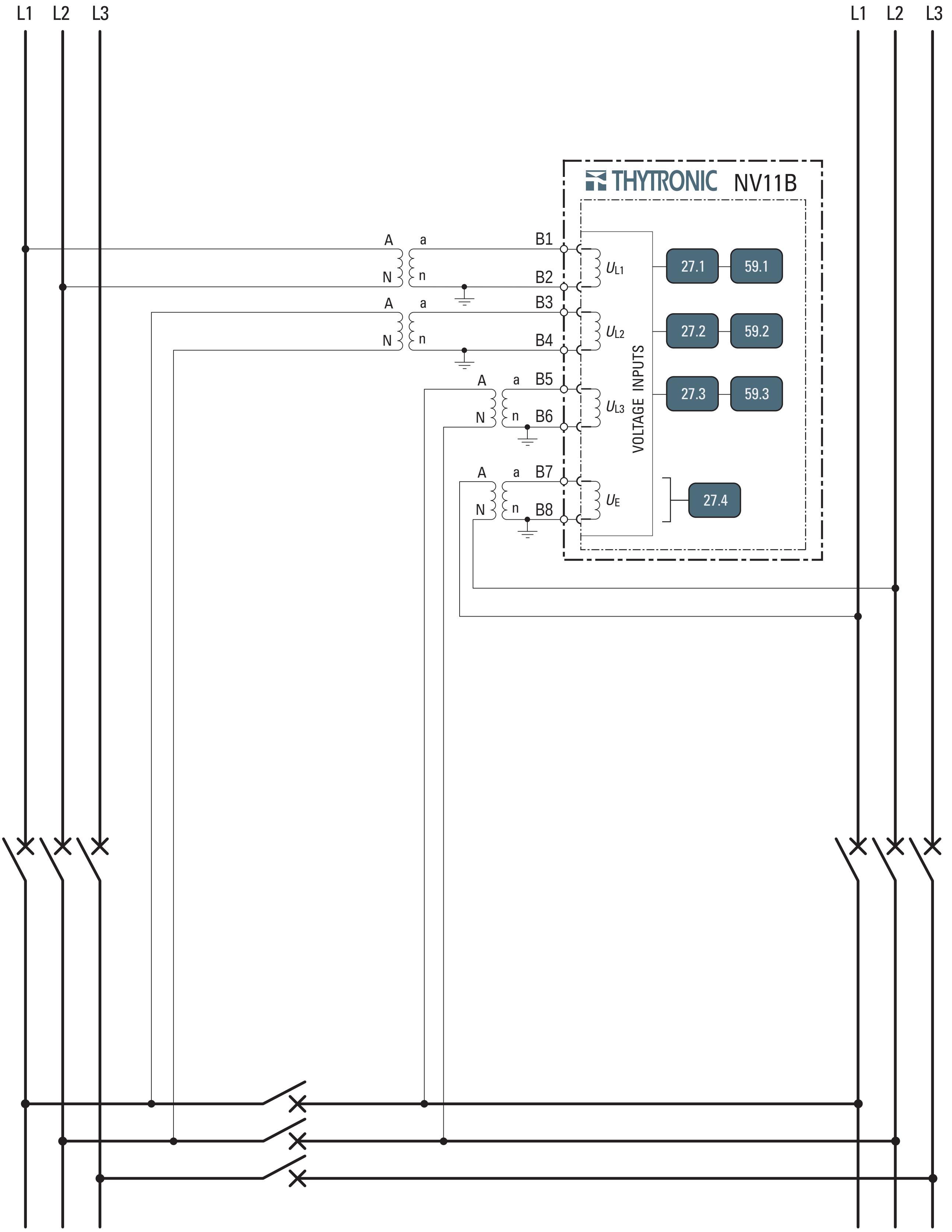


Connection diagram with phase-to-phase voltage inputs (star connected secondary VTs or "V" connections VTs)

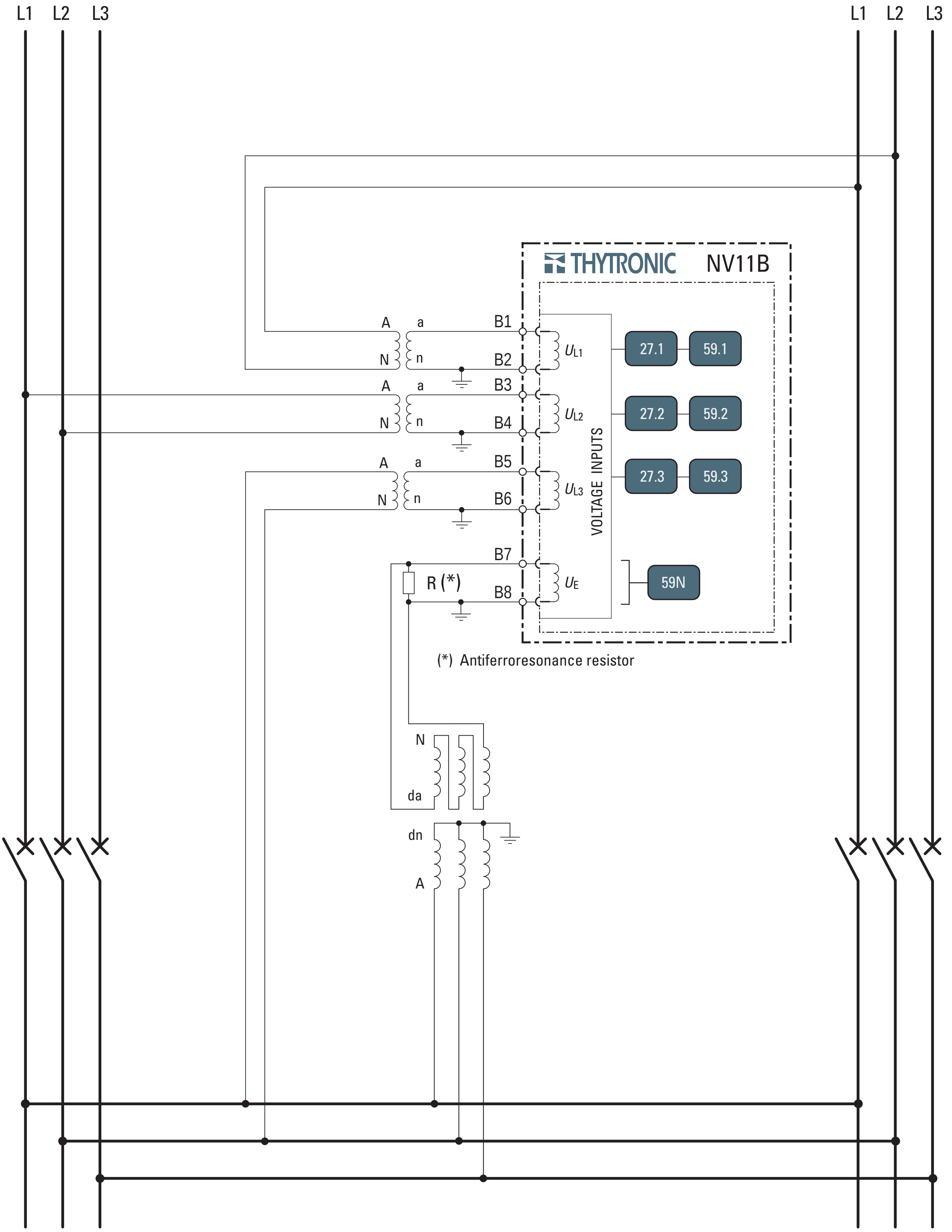
☐ Application example of the NV11B relay with unipolar protective functions



Application example of the NV11B relay with four unipolar protective functions



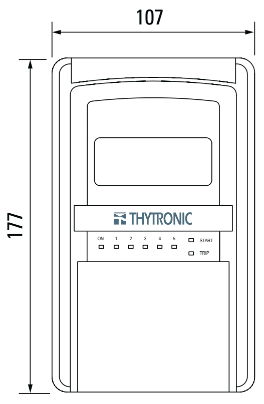
Application example of the NV11B relay with three unipolar protective functions and residual voltage protection



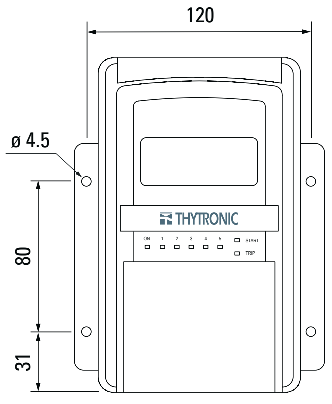
(*) Antiferroresonance resistor

DIMENSIONS

FRONT VIEWS

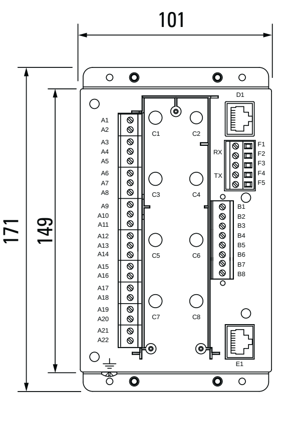


FLUSH MOUNTING

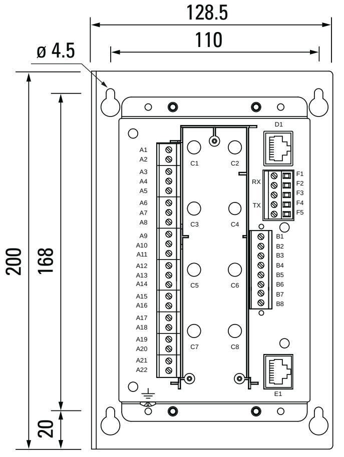


PROJECTING MOUNTING

REAR VIEWS

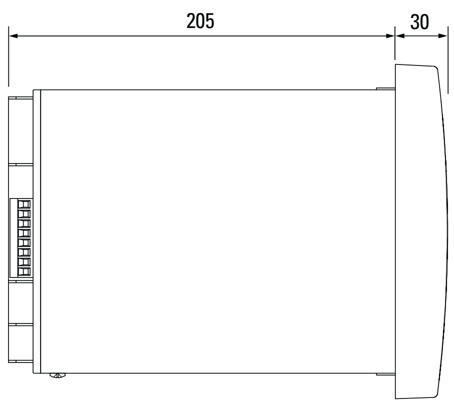


FLUSH MOUNTING

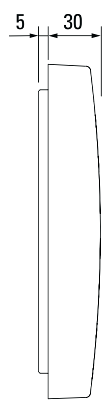


PROJECTING MOUNTING
(Separate operator panel)

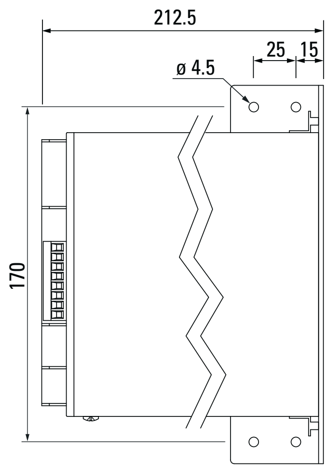
SIDE VIEWS



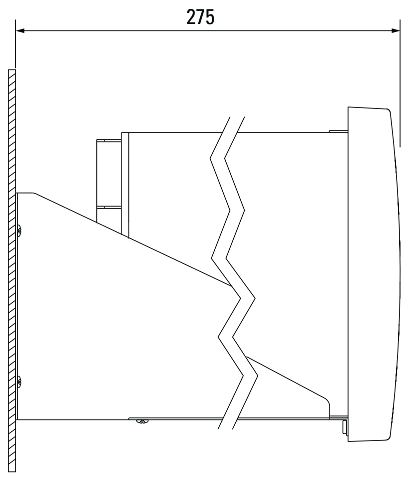
FLUSH MOUNTING



SEPARATE
OPERATOR PANEL

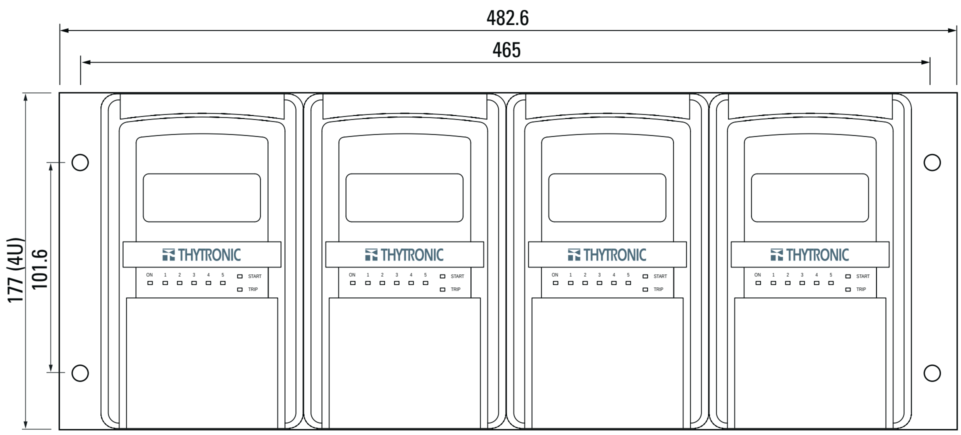


PROJECTING MOUNTING
(Separate operator panel)

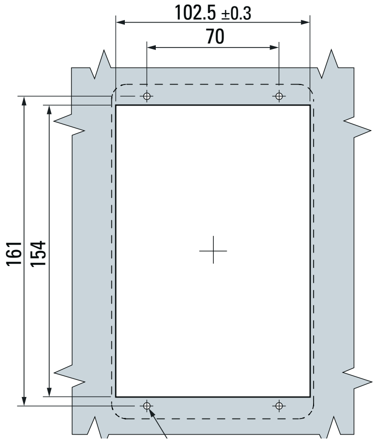


PROJECTING MOUNTING
(Stand alone)

RACK MOUNTING



FLUSH MOUNTING CUTOUT



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