
MORE
eXTENDED MODULAR RELAYS
XMR-T
MORE ADVANCED,
HIGH-END IEDs
FOR PROTECTING,
MONITORING AND
CONTROLLING ELECTRIC
POWER SYSTEMS.
THYTRONIC

THYTRONIC

XMR-T TRANSFORMER PROTECTION RELAYS

XMR-T is a part of XMORE platform, the complete range of IEDs for Medium Voltage application.

XMR-T the comprehensive solution for two or three windings transformer protection.

ACCURATE MEASUREMENTS

Enhancements to protect and analyze power system operation in disturbance conditions:

- **Up to 12 analogue inputs**
- **32 sample for cycle Oscillography fault recording**
- **64 sample for cycle measurement for accuracy of protection element**

HARDWARE AND SOFTWARE MODULARITY

Customization of the product from the basic solution to the more complex configuration:

- **Plug in modules for HW expansion**
- **Licensable SW Pack**
- **I/O's cards**
- **Analogue (PT100, 4-20mA) cards**
- **Communication cards**

TIME SYNCRONIZATION

Enhanced Time synchronization solution for SOE recording:

- **Precision Time Protocol PTP according to IEC1588**
- **SNTP**

COMMUNICATION SECURITY

Communication Security through redundancy protocol and Cyber Security package :

- **High available Seamless Redundancy support HSR**
- **Parallel Redundancy Protocol support PRP**
- **Rapid Spanning Tree Protocol RSTP**
- **Advanced built in Cyber Security**

NETWORK CONNECTIVITY

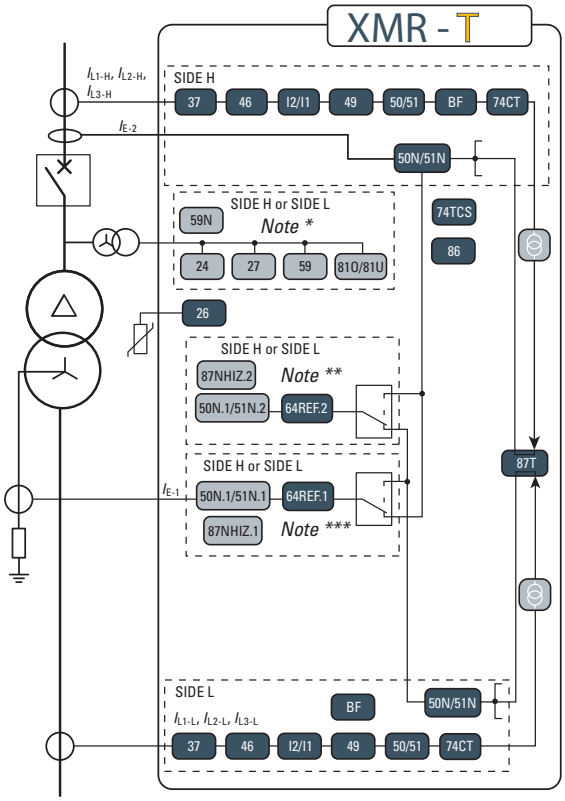
Widely implemented in Smart Grid and Substation Automation System:

- **IEC61850 Ed.2**
- **IEC 60870-5-103**
- **Modbus (Serial/TCP)**
- **DNP3 (Serial/TCP)**

AUTOMATION CONTROL & MONITORING

Enhanced tools and solutions for Grid Automation

- **IEC1131 PLC embedded**
- **Switchgear Monitoring/Control**
- **Switchgear OPEN/CLOSE local keys**
- **Multi shot Automatic Reclosing**
- **Multiple setting Profile**
- **CB health monitoring**
- **CT's monitoring**



Standard Protective & control elements

HW Pack optional configuration

24 (L or H)	Overflux (Side L or Side H)
26	Pt100 thermal probes
27 (L or H)	Undervoltage (Side L or Side H)
37 (L, H, T)	Undercurrent (Side L, Side H, Side T)
46 (L, H, T)	Negative sequence overcurrent (Side L, Side H, Side T)
I2/I1 (L, H, T)	Negative/positive sequence current ratio (Side L, Side H, Side T)
49 (L, H, T)	Thermal image (Side L, Side H, Side T)
50/51 (L, H, T)	Phase overcurrent (Side L, Side H, Side T)
50N/51N/87NHIZ1[2]-21[3]	Residual overcurrent/ High impedance restricted earth fault
59 (L or H)	Phase overvoltage (Side L or Side H)
59N (L or H)	Residual overvoltage (Side L or Side H)
64REF.1 (L or H or T)	Biased restricted differential ground fault (Side L or Side H)
64REF.2 (L or H or T)	Biased restricted differential ground fault (Side L or Side H)
67N	Directional earth fault overcurrent
81O/81U (L or H)	Over-Underfrequency (Side L or Side H)
87T (L or H)	Double slope biased differential for transformers (Side L or Side H)
BF Side (L, H, T)	Circuit breaker failure (Side L, Side H, Side T)
74CT	CT supervision
74TCS (L, H, T)	Trip circuit supervision (Side L, Side H, Side T)

*Note *: 59N alternative to 24,27,59,81O and 81U*
*Note **: 50N.2/51N.2 alternative to 87NHIZ.2*
*Note ***: 50N.1/51N.1 alternative to 87NHIZ.1*

To enable protection:

- **Function 26** (thermometric protection with Pt100 modules)
- **Function 86** (Lock-out)

XMR relay needs special hardware modules. So, these functions can be enabled only with the presence of the relative module.

MEASURING INPUTS WITH INDUCTIVE CTS AND VTS

- Eleven phase current inputs and one residual current input, with nominal currents independently selectable at 1 A or 5 A through sw setting with the addition of an external analog input module
- One residual voltage input, with programmable nominal voltage within range 50...130 V (UER =100 V)

BINARY INPUTS

Up to 53 binary (depending upon configurations) inputs are available with programmable active state (active-ON/ active-OFF) and programmable timer (active to OFF/ON or ON/OFF transitions).
The reset of relay can be associated with each digital input.

OUTPUT RELAYS

Up to 31 output relays are available (changeover, make and break contacts); each relay may be individually programmed as normal state (normally energized, de-energized or pulse) and reset mode (manual or automatic).

LOCK-OUT RELAY

Master trip bistable latching relay allows the direct use in tripping circuit eliminating the need of additional auxiliary relay.

MODULAR DESIGN

In order to extend I/O capability, the Xmore hardware can be customized through internal auxiliary boards end external module:

- Output relays
- Binary inputs and external modules:
  - 8 relays and 16 digital inputs
  - Pt100 probe inputs board
  - 32 Inputs board
  - 6 Current loop output module
  - 4 Block relays module

BLOCKING INPUT/OUTPUTS

The output blocking circuits of one or several xMore 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.

Due to increase I/O capacity the following external expansion modules are available:

- XMRI Module 8 relays + 16 digital inputs
- XMR16 Module 16 relays
- XMID32 Module 32 digital inputs
- XMPT Module 8 PT100
- XMCI Module 6 analogue outputs (4÷20mA)

METERING

Xmore provides metering values for phase and residual currents, phase and residual voltage, 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.
With DFT the RMS value of 2nd harmonic of phase current is also measured.
On the base of the direct, phase, calculated (min, max, ...), displacement, sequence, harmonic and demand phase measures are processed.

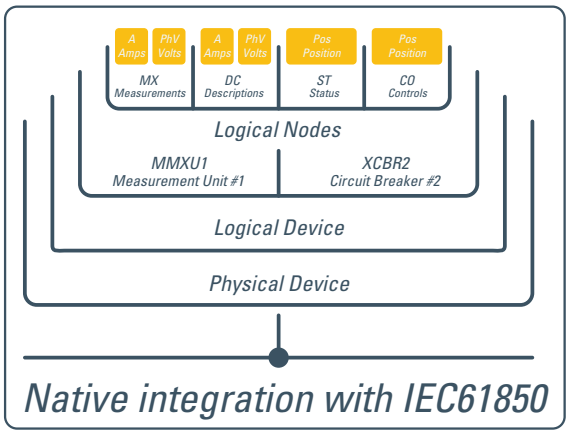
MMI (MAN MACHINE INTERFACE)

The user interface comprises a membrane keyboard, a backlight LCD wide display, a touchscreen keyboard and sixteen LEDs with customizable functions.
The green OK LED indicates auxiliary power supply and self diagnostics, two LEDs are dedicated to the Start and Trip (yellow for Start, red for Trip).

COMMUNICATION

Multiple communication interfaces are implemented:

- One Ethernet local communication front-end interface for communication with ThyVisor setup software
- Back-end interfaces for communication with remote monitoring and control systems by:
  - Multiple RS485 port
  - Ethernet TX + RS485
  - Ethernet FX with RS485
  - Double Ethernet TX
  - Double Ethernet FX
  - Double Ethernet FX with RSTP
  - Double Ethernet TX + RSTP



CONTROL AND MONITORING

Several predefined functions are implemented:

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

Moreover user defined logic must be customized in accordance with IEC 61131-3 protocol by means programmable logic controller (PLC).

Circuit Breaker

Several diagnostic, monitoring and control functions are provided:

- Health thresholds can be set; when the accumulated duty (SI or SI2t), 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

Virtual I/O

Through ThyVisor tool the type of operation and links between thirty-two outputs (Virtual Output - VOUT1 ... 32) and thirty-two virtual inputs (Virtual Inputs - VIN1 ... VIN32) may be defined using RPC or IEC 61850 communication protocols over Ethernet network. Special features are:

- Availability of thirty-two inputs and thirty-two outputs independently programmable by the user
- Simplify wiring using one channel as the Ethernet
- Eliminate the need to install communication devices and / or external conversion
- Significantly reduce costs
- Dynamically change from sw connections and associated functions

The virtual I / O can be usefully employed for:

- Transmit information between protections installed in distance
- Achieve accelerated logic discrimination in which some protection elements can be blocked by the activation of the downstream protection start
- Circuit Breaker commands, Selection of setting profiles, Remote trip, etc...

Logic selectivity

With the aim of providing a fast selective protection system some protective functions may be blocked.
The selectivity logic may be accomplished by:

- output relays and logic inputs
- virtual input and output with messages on Ethernet network

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, with small width in order to be ignored as an effective blocking signal by the input blocking circuit of the upstream protection, but suitable to prove 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.

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 setting time
- Each threshold can be increased for a setting time

Second harmonic restraint

To prevent unwanted tripping of the protective functions on transformer inrush current, the protective elements can be blocked when the ratio between the second harmonic current and the relative fundamental current is larger than a user programmable threshold. The function can be programmed to switch an output relay so as to cause a blocking protection relays lacking in second harmonic restraint.

SYNCHRONIZATION METHODS

Devices that share the same file server must have synchronized clocks so that the timestamps are consistent.
Two synchronization systems are available:

- SNTP (Network Time Protocol)
- IEC 1588

SELF DIAGNOSTICS

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

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 one thousend 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.
All records are stored in non-volatile memory

CYBERSECURITY

Cybersecurity features implemented in XMR-P help to mitigate cyber threats.

- Secured communication between XMR-P protection relays and associated tool by ***SSH*** (***S***ecure ***SH***ell) protocols
- Compliant to NERC CIP, ISO/IEC 27001:2013 and IEC62351 standard requirements
- Password based user authentication
- ***R***ole ***B***ased ***A***ccess ***C***ontrol (***RBAC***) authorization management
- Secured log storage (***Syslog*** Service)

SPECIFICATIONS

GENERAL

MECHANICAL DATA

Mounting:	flush or rack
Mass (flush mounting case)	5 kg

INSULATION TESTS

Reference standards	EN 60255-5, IEC60255-27
High voltage test 50Hz	2 kV 60 s
Impulse voltage withstand (1.2/50 ms)	5 kV
Insulation resistance	>100 MW

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	IEC60255-27
Pollution degree	3
Reference voltage	250 V
Overvoltage	III
Pulse voltage	5 kV
Reference standards	EN 60529
Protection degree:	
▸ Front side	IP54
▸ 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:

▸ Ethernet 100BaseT	100 Mbps

Network:

▸ RS485	1200...57600 bps
▸ Ethernet 100BaseT [1]	100 Mbps
Protocol	ModBus® RTU/IEC 60870-5-103/DNP3, TCP/IP, IEC61850 Level A

Note [1] Two redundant port selectable with TX + TX or FX + FX connections. The secondary port is activated in the event of failure of the primary port or by means of hw-sw switching command.

INPUT CIRCUITS

AUXILIARY POWER SUPPLY UAUX

Nominal value (range)	24 ...110 V_{AC}/V_{DC}
	110...230 V_{AC}/V_{DC}
Operative range (each one of the above nominal values)	19...132 V_{AC}/V_{DC}
	75 V_{AC}/V_{DC} .... 300 V_{AC}
Maximum (energized relays, Ethernet FX)	25 W (35 VA)

PHASE CURRENT INPUTS WITH INDUCTIVE CTS

▸ Rated current In	1 A or 5 A selectable by sw
▸ Permanent overload	25 A
▸ Thermal overload (1 s)	500 A
▸ Rated consumption (for any phase)	≤ 0.002 VA (In = 1 A)
	≤ 0.04 VA (In = 5 A)
▸ Connections	M4 terminals

RESIDUAL CURRENT INPUT

▸ Rated current IEn	1 A or 5 A selectable by sw
▸ Permanent overload	25 A
▸ Thermal overload (1 s)	500 A
▸ Rated consumption ≤ 0.006 VA (I_{En} = 1 A),	≤ 0.012 VA (I_{En} = 5 A)
▸ Connections	M4 terminals

RESIDUAL VOLTAGE INPUT WITH INDUCTIVE VTS

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

BINARY INPUTS

Quantity	7..53
Type	dry inputs
Max permissible voltage	19...265 Vac/19...300 Vdc
Max consumption, energized	3 mA

OUTPUT CIRCUITS

OUTPUT RELAYS

Quantity	7..31
Type of contacts (default):	
K1, K2	changeover (SPDT, type C)
K3, K4, K5, K6, K31 make	(SPST-NO, type A)
Rated current	8 A
Rated voltage/max switching voltage	250 Vac/400 Vac
Short duration current (0,5 s)	30 A
Make	1000 W/VA
Minimum switching load	300 mW (5 V/ 5 mA)

Breaking capacity:

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
Minimum switching load 300 mW	(5 V/ 5 mA)
Life:	
Mechanical	10^6 operations
Electrical	10^5 operations

BLOCK INPUT (LOGIC SELECTIVITY)

Quantity	1
Type	optocoupler

BLOCK OUTPUT (LOGIC SELECTIVITY)

Quantity	1
Type	optomosfet

LEDS

Quantity	21
▸ ON/fail (green)	1
▸ Start (yellow)	1
▸ Trip (red)	1
▸ Local	1
▸ Remote	1
▸ Allocatable (green/yellow/red)	16

MAIN SETTINGS

RATED VALUES

Voltage measure	U_E or U
Relay nominal frequency (f_n)	50, 60 Hz
Relay residual nominal current (I_{En})	1 A, 5 A
Residual CT nominal primary current (I_{Enp})	1 A...10 kA
Relay nominal voltage (phase to phase) - (U_n)	50...130 V or 200...520 V
Relay nominal voltage (phase-to-ground)	$E_n = U_n/\sqrt{3}$
Relay residual nominal voltage (calculated)	$U_{ECN} = U_n \cdot \sqrt{3} = 3 \cdot E_n$
Relay phase nominal current (I_n)	1 A, 5 A
Phase CT nominal primary current (I_{np})	1 A...10 kA
Relay residual nominal voltage (direct measure) (U_{En})	50...130 V
Residual primary nominal voltage (phase-to-phase) · √3 (U_{Enp})	50 V...500 kV

BINARY INPUT TIMERS

ON delay time (IN1 t_{ON}...IN10 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

INPUT SEQUENCE (SIDE L, SIDE H, SIDE T)

Phase current sequence	(*I-SequenceL*) IL1-IL2-IL3, IL1-IL3-IL2, L2, IL1, IL3,.....
Phase current sequence	(*I-SequenceH* IL1-IL2-IL3, IL1-IL3-IL2, L2, IL1, IL3,.....
Phase current sequence	(*I-SequenceT* IL1-IL2-IL3, IL1-IL3-IL2, L2, IL1, IL3,.....

POLARITY

A1-A2 (A1-A2 POL) polarity	NORMAL/REVERSE
A3-A4 (A3-A4 POL) polarity	NORMAL/REVERSE
A5-A6 (A5-A6 POL) polarity	NORMAL/REVERSE
A7-A8 (A7-A8 POL) polarity	NORMAL/REVERSE
B1-B2 (B1-B2 POL) polarity	NORMAL/REVERSE
B3-B4 (B3-B4 POL) polarity	NORMAL/REVERSE
B5-B6 (B5-B6 POL) polarity	NORMAL/REVERSE
B7-B8 (B7-B8 POL) polarity	NORMAL/REVERSE
C1-C2 (C1-C2 POL) polarity	NORMAL/REVERSE
C3-C4 (C3-C4 POL) polarity	NORMAL/REVERSE
C5-C6 (C5-C6 POL) polarity	NORMAL/REVERSE
C7-C8 (C7-C8 POL) polarity	NORMAL/REVERSE

PROTECTION FUNCTIONS

Full description about parameters, thresholds and timings ranges is available in relevant equipment documentation.

BASE CURRENT IB [1] (SIDE L, SIDE H, SIDE T)

Base current (I_B) 0.10...2.50 I_n

Note - For the CTs versions the basic current I_B represents the rated current of the protected device (line, transformer, motor...) referred to the nominal current of the CT's. If the secondary rated current of the line CT's equals the rated current oft he relay, as usually happens, the I_B value is the ratio between the rated current of the protected element and the CT's primary rated current.

STARTING CONTROL SET

CLP Input source (*CLP Source*) IRUN/CB
IRUN Threshold (IRUN) 0.10 I_B

OVEREXCITATION - 24

(U/f)AL Element
- Alarm threshold definite time (U/f)ALdef 0.50...2.00 Un/fn
- Operating time t(U/f)ALdef 0.10...100.0 s

(U/f)> Element
- Curve type (U/f>Curve) DEFINITE, IEC/BS A, B, C

Definite time
- First threshold definite time (U/f)>def 0.50...2.00 Un/fn
- Operating time (t(U/f)>def) 0.10...100.0 s

Inverse time
- First threshold inverse time (U/f)>inv 0.50...2.00 Un/fn
- Operating time (t(U/f)>inv) 0.10...100.0 s

(U/f)>> Element
- Second threshold definite time (U/f)>>def 0.50...2.00 Un/fn
- Operating time (t(U/f)>>def) 0.10...100.0 s

THERMAL PROTECTION WITH PT100 THERMOMETRIC PROBES - 26

The measure of temperature is acquired by a MPT module with eight PT100 thermometric probes (RTD Resistive Thermal Device), for each thermometric probe an alarm (**Th_{ALx}**) and a trip adjustable threshold are provided (**$Th>_x$**), with adjustable operating time (**t_{ThALx}** and **$t_{Th>x}$**).

UNDERVOLTAGE - 27

Common configuration:
- Voltage measurement type for 27 (Utype27) Uph-ph/Uph-n
- 27 Operating logic (Logic27) AND/OR

U< Element
- U< Curve type (U<Curve) DEFINITE, INVERSE [2]

Definite time
- 27 First threshold definite time (U<def) 0.05...1.10 Un/En
- U<def Operating time (tU<def) 0.03...100.0 s

Inverse time
- 27 First threshold inverse time (U<inv) 0.05...1.10 Un/En
- U<inv Operating time (tU<inv) 0.10...100.0 s

U<< Element

Definite time
- 27 Second threshold definite time (U<<def) 0.05...1.10 Un/En
- U<<def Operating time (tU<<def) 0.03...100.0 s

UNDERCURRENT - 37 (SIDE L, SIDE H, SIDE T)

Each phase current is compared with adjustble threshold (**$I<_{def}$**), if at least one of the three currents goes down (**LOGIC OR**) or when all the three currents go down (**LOGIC AND**) the threshold a Start command is issued, after expiry of associated operate time (**$t<_{def}$**), a trip command is issued; if instead the currents exceed the threshold, the element is restored.

NEGATIVE SEQUENCE FOR LINE-TRANSFORMER - 46 (SIDE L, SIDE H, SIDE T)

I_2> Element
- I_2> Curve type DEFINITE,
- I_2> Reset time delay ($t_2>_{RES}$) 0.00...100.0 s

Definite time
- 46LT First threshold definite time ($I_{2>def}$) 0.100...10.00 I_n
- $I_{2>def}$ Operating time ($t_2>_{def}$) 0.03...200 s

Inverse time
- 46LT First threshold inverse time ($I_2>_{inv}$) 0.100...10.00 I_n
- $I_{2>inv}$ Operating time ($t_2>_{inv}$) 0.02...60.0 s

I_2>> Element
- I_2>> Reset time delay ($t_2>>_{RES}$) 0.00...100.0 s

Definite time for CTs versions
- 46LT Second threshold definite time ($I>>_{def}$) 0.100...40.00 I_n
- $I_2>>_{def}$ Operating time ($t_2>>_{def}$) 0.03...10.00 s

NEGATIVE SEQUENCE CURRENT / POSITIVE SEQUENCE CURRENT RATIO - I2/I1 (SIDE L, SIDE H, SIDE T)

I_{21}> Element
- I_{21CLP}> Activation time ($t_{21CLP>}$) 0.00...100.0 s

Definite time
- I_2/I_1 First threshold definite time ($I_{21}>_{def}$) 0.10...1.00
- $I_{21}>_{def}$ Operating time ($t_{21}>_{def}$) 0.04..15000 s

THERMAL IMAGE FOR LINE-TRANSFORMER - 49 (SIDE L, SIDE H, SIDE T)

Common configuration:
- Initial thermal image $\Delta\theta_{IN}$ (Dth_{IN}) 0.0...1.0 $\Delta\theta_B$
- Reduction factor at inrush (K_{INR}) 1.0...3.0
- 49 Second harmonic restraint ($Dth_{2ndh\text{-}REST}$) OFF/ON

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 $\Delta\theta$ ($Dth>$) 1.100...1.300 $\Delta\theta_B$

PHASE OVERCURRENT - 50/51 (SIDE L, SIDE H, SIDE T)

I> Element
- I> Curve type (I>Curve) DEFINITE,
- I_{CLP}> Activation time ($t_{CLP>}$) 0.00...100.0 s
- I> Reset time delay ($t>_{RES}$) 0.00...100.0 s

Definite time for CTs versions
- 50/51 First threshold definite time ($I>_{def}$) 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
- $I>_{inv}$ Operating time ($t>_{inv}$) 0.02...60.0 s

I>> Element
- Type characteristic DEFINITE or I^2t
- I>> Reset time delay ($t>>_{RES}$) 0.00...100.0 s

Definite time for CTs versions
- 50/51 Second threshold definite time ($I>>_{def}$) 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
- $I>>_{inv}$ Operating time ($t>>_{inv}$) 0.02...10.00 s

I>>> Element
- I>>> Reset time delay ($t>>>_{RES}$) 0.00...100.0 s

Definite time for CTs versions

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

RESIDUAL OVERCURRENT - 50N/51N OR HIGH IMPEDANCE RESTRICTED EARTH FAULT - 87N (1 - 2) (SIDE L, SIDE H, SIDE T)

I_E> Element

- I_E> Curve type (I_E>Curve) DEFINITE,
- 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 ($I_E>_{inv}$) 0.010...2.00 I_{En}
- $I_E>_{inv}$ within CLP ($I_{ECLP>inv}$) 0.010...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 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 ($t_E>>_{def}$) 0.03...10.00 s

I_E>>> Element

- $I_{ECLP}>>>$ Reset time delay ($t_E>>>_{RES}$) 0.00...100.0 s

Definite time

- 50N/51N Third threshold definite time ($I_E>>>_{def}$) 0.002...10.00 I_{En}
- $I_{ECLP}>>>_{def}$ within CLP ($I_{ECLP>>>def}$) 0.002...10.00 I_{En}
- $I_{ECLP}>>>_{def}$ Operating time ($t_E>>>_{def}$) 0.03...10.00 s

OVERVOLTAGE - 59

Common configuration:

- Voltage measurement type for 59 (Utype59) [1] U_{ph-ph}/U_{ph-n}
- 59 Operating logic (Logic59) AND/OR

U> Element

- U> Curve type (U>Curve) DEFINITE, INVERSE [2]

Definite time

- 59 First threshold definite time ($U>_{def}$) 0.50...1.50 U_n/E_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/E_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/E_n
- $U>>_{def}$ Operating time ($t_U>>_{def}$) 0.03...100.0 s

RESIDUAL OVERVOLTAGE - 59N

Common configuration:

- 59N Operating mode from 74VT external (*74VText59N*) OFF/Block

U_E> Element

- U_E> Curve type (U_E>Curve) DEFINITE, INVERSE
- 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

U_E>>> Element

- U_E>Z> Reset time delay ($t_{UE>>RES}$) 0.00...100.0 s
- 59N Third 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

LOW IMPEDANCE RESTRICTED EARTH FAULT - 64REF (1 - 2)

Minimum threshold (IREF>) 0.05...2.00 I_{En}
Intentional delay (tREF>) 0.03...60.00 s

DIRECTIONAL EARTH FAULT - 67N

Common configuration:

- 67N Operating mode (*Mode67N*) *I/I·cos*
- Residual voltage measurement type for 67N - direct/calculated (*3VoType67N*) [3] U_E / U_{EC}
- 67N Multiplier of threshold for insensitive zone (*M*) 1.5...10.0
- 67N Operating mode from 74VT internal (*74VTint67N*) OFF/Block/Not directional
- 67N Operating mode from 74VT external (*74VText67N*) OFF/Block/Not directional

I_{ED}> Element

- I_{ED}> Curve type DEFINITE
- I_{ED}> Reset time delay ($t_{ED}>_{RES}$) 0.00...100.0 s

Definite time

67N First threshold definite time ($I_{ED}>_{def}$ - $U_{ED}>_{def}$)

- Residual current pickup value 0.002...10.00 I_{En}
- Residual voltage pickup value 0.004...0.500 U_{En}
- Characteristic angle 0...359°
- Half operating sector 1...180°
- $I_{ED}>_{def}$ Operating time ($t_{ED}>_{def}$) 0.05...200 s

Inverse time

67N First threshold inverse time ($I_{ED}>_{inv}$ - $U_{ED}>_{inv}$)

- Residual current pickup value 0.002...2.00 I_{ED}
- Residual voltage pickup value 0.004...0.500 U_{En}
- Characteristic angle 0...359°
- Half operating sector 1...180°
- $I_{ED}>_{inv}$ Operating time ($t_{ED}>_{inv}$) 0.02...60.0 s

I_{ED}>> Element

- I_{ED}> Curve type (I_{ED}>>Curve) DEFINITE
- I_{ED}>> Reset time delay ($t_{ED}>>_{RES}$) 0.00...100.0 s

Definite time

67N Second threshold definite time ($I_{ED}>>_{def}$ - $U_{ED}>>_{def}$)

- Residual current pickup value 0.002...10.00 I_{En}
- Residual voltage pickup value 0.004...0.500 U_{En}
- Characteristic angle 0...359°
- Half operating sector 1...180°
- $I_{ED}>>_{def}$ within CLP ($I_{EDCLP}>>_{def}$) 0.002...10.00 I_{En}
- $I_{ED}>>_{def}$ Operating time ($t_{ED}>>_{def}$) 0.05...10.00 s

Inverse time

67N Second threshold inverse time ($I_{ED}>>_{inv}$ - $U_{ED}>>_{inv}$)

- Residual current pickup value 0.002...2.00 I_{En}
- Residual voltage pickup value 0.004...0.500 U_{En}
- Characteristic angle 0...359°
- Half operating sector 1...180°
- $I_{ED}>_{inv}$ within CLP ($I_{EDCLP>>inv}$) 0.002...2.00 I_{En}
- $I_{ED}>_{inv}$ Operating time ($t_{ED}>>_{inv}$) 0.02...10.00 s

I_{ED}>>> Element

- CLP Activation time ($t_{EDCLP>>>}$) 0.00...100.0 s
- $I_{ED}>>>$ Reset time delay ($t_{ED}>>>_{RES}$) 0.00...100.0 s

Definite time

67N Third threshold definite time ($I_{ED}>>>_{def}$ - $U_{ED}>>>_{def}$)

- Residual current pickup value 0.002...10.00 I_{En}
- Residual voltage pickup value 0.004...0.500 U_{En}
- Characteristic angle 0...359°
- Half operating sector 1...180°
- $I_{ED}>>>_{def}$ within CLP ($I_{EDCLP}>>>_{def}$) 0.002...10.00 I_{En}
- $I_{ED}>>>_{def}$ Operating time ($t_{ED}>>>_{def}$) 0.05...10.00 s

I_{ED}>>>> Element

- CLP Activation time ($t_{EDCLP>>>>}$) 0.00...100.0 s
- $I_{ED}>>>>$ Reset time delay ($t_{ED}>>>>_{RES}$) 0.00...100.0 s

Definite time

67N Fourth threshold definite time ($I_{ED}>>>>_{def}$ - $U_{ED}>>>>_{def}$)

- Residual current pickup value 0.002...10.00 I_{En}
- Residual voltage pickup value 0.004...0.500 U_{En}
- Characteristic angle 0...359°
- Half operating sector 1...180°
- I_{ED}>>>>$_{def}$ within CLP (I_{EDCLP}>>>>$_{def}$) 0.002...10.00 I_{En}
- I_{ED}>>>>$_{def}$ Operating time (t_{ED}>>>>$_{def}$) 0.05...10.00 s

IED>>>>> Element

- CLP Activation time ($t_{EDCLP>>>>>}$) 0.00...100.0 s
- I_{ED}>>>>> Reset time delay (t_{ED}>>>>>$_{RES}$) 0.00...100.0 s

Definite time

67N Fifth threshold definite time (I_{ED}>>>>>$_{def}$ - U_{ED}>>>>>$_{def}$)

- Residual current pickup value 0.002...10.00 I_{En}
- Residual voltage pickup value 0.004...0.500 U_{En}
- Characteristic angle 0...359°
- Half operating sector 1...180°
- I_{ED}>>>>>$_{def}$ within CLP (I_{EDCLP}>>>>>$_{def}$) 0.002...10.00 I_{En}
- I_{ED}>>>>>$_{def}$ Operating time (t_{ED}>>>>>$_{def}$) 0.05...10.00 s

Intermittent ground faults discrimination

- Start 59N reset time delay ($t_{ED>6RRIC59N}$) 0.01...2.00 s
- Start 67N reset time delay ($t_{ED>6RRIC67N}$) 0.01...2.00 s
- Residual voltage threshold ($I_{ED>6-UE>}$) 0.040...1.500
- Operate time (t_{ED}>$_6$) 0.05...60.0 s
- Maximum failure time for inhibition (t_{ED}>$_{6Inb}$) 0.05...60.0 s
- Inhibition holding time (t_{ED}>$_{61s}$) 0.05...60.0 s

Evolutive ground faults discrimination

- Start 59N reset time delay ($t_{ED>7RRIC}$) 0.01...2.00 s
- Observation activation delay ($t_{ED>7RAO}$) 0.01...2.00 s
- Residual voltage threshold (I_{ED}>$_{7-UE>}$) 0.040...1.500 U_{En}
- Observation time (t_{ED}>$_{7-O}$) 0.05...60.0 s

OVERFREQUENCY - 81O

f> Element

Definite time

- 81O First threshold definite time (f>$_{def}$) 1.000....1.200 f_n
- f>$_{def}$ Operating time (t_f>$_{def}$) 0.05...100.0 s

f>> Element

Definite time

- 81O Second threshold definite time (f>>$_{def}$) 1.000....1.200 f_n
- f>>$_{def}$ Operating time (t_f>>$_{def}$) 0.05...100.0 s

UNDERFREQUENCY - 81U

f< Element

Definite time

- 81U First threshold definite time (f<$_{def}$) 0.800...1.000 f_n
- f<$_{def}$ Operating time (t_f<$_{def}$) 0.05...100.0 s

f<< Element

Definite time

- 81U Second threshold definite time (f<$_{def}$) 0.800...1.000 f_n
- f<$_{def}$ Operating time (t_f<$_{def}$) 0.05...100.0 s

f<<< Element

Definite time

- 81U Third threshold definite time (f<$_{def}$) 0.800...1.000 f_n
- f<$_{def}$ Operating time (t_f<$_{def}$) 0.05...100.0 s

f<<<< Element

Definite time

- 81U Fourth threshold definite time (f<$_{def}$) 0.800...1.000 f_n
- f<$_{def}$ Operating time (t_f<$_{def}$) 0.05...100.0 s

DIFFERENTIAL FOR TRANSFORMER - 87G-87M-87T

Harmonic restraint

- 2nd harmonic restraint (2nd-REST>) 10...80% Id
- 5th harmonic restraint (5th-REST>) 10...80% Id
- Restraint reset intentional delay (tHREST-RES) 0.00...10.00 s
- Cross-harmonic restraint enabling (CROSS H-RES) ON/OFF

CT saturation detector

- Saturation detector enable (Sat-Det) ON/OFF
- Saturation detector reset intentional delay (tSat-Det-RES) 0.00...0.50 s

Id> Element Definite time

- First threshold definite time (Id>) 0.05...2.00 Inref
- First stretch slope percentage (K1) 10...50%
- Second stretch slope percentage (K2) 25...100%
- Second stretch Intersection with vertical axis (Q) 0.00...3.00 Inref
- First threshold operating time 0.04 s
- Intentional delay (td>) 0.00...60.00 s

Id>> Element Definite time

- Second threshold definite time (Id>>) 0.5...30.00 Inref
- Second threshold operating time 0.03 s
- Intentional delay (td>>) 0.00...60.00 s

BREAKER FAILURE - BF (SIDE L, SIDE H, SIDE T)

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 prot. (t_{B-IPh}) 0.10...10.00 s
- BLIN Max activation time for ground prot. (t_{B-IE}) 0.10...10.00 s

Selective block OUT:

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

INTERNAL SELECTIVE BLOCK - BLOCK4

- Output internal selective block dropout time for phase protections (t_{F-IPh}) 0.00...10.00 s
- Output internal selective block dropout time for ground protections (t_{F-IE}) 0.00...10.00 s

SECOND HARMONIC RESTRAINT - 2ndh-REST (SIDE L, SIDE H, SIDE T)

Second harmonic restraint threshold (I_{2ndh}>) 10...50 %
I_{2ndh}> Reset time delay ($t_{2ndh>RES}$) 0.00...100.0 s

CT SUPERVISION - 74CT (SIDE L, SIDE H, SIDE T)

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 - 74TCS

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

PILOT WIRE DIAGNOSTIC

BLOUT1 Diagnostic pulses period 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

DEMAND MEASURES

Fixed demand period (t_{FIX}) 1...60 min
Rolling demand period (t_{ROL}) 1...60 min
Number of cycles for rolling on demand ($N._{ROL}$) 1...24

ARC FLASH (SIDE L - SIDE H - SIDE T)

Measure Mode (ARC Measure) 1...4 samples
Minimum pulse width 10...2000 ms (step 1 ms)
Enable ArcFlash IL 0.10...40.00 In (step 0.01 In)
Enable ArcFlash IE 0.01...10.00 In (step 0.01 In)
Test fibers timer 0...240s (step 1s)

METERING & RECORDING

Full description about measures is available in relevant equipment documentation.

Typology	Measure	Symbol
Direct	Locked frequency	f_L
	U voltage frequency	f_U
	Phase currents (Side L - SideH - Side T)	I_{L1L}, I_{L2L}, I_{L3L}
		I_{L1H}, I_{L2H}, I_{L3H}
		I_{L1T}, I_{L2T}, I_{L3T}
	RMS value of fundamental com. for residual current 1	I_{E1}
	RMS value of fundamental com. for residual current 2	I_{E2}
	U phase to phase voltage	U
	Residual voltage	U_E
L1 phase	Compensated phase current (Side L - Side H - Side T)	I_{L1cL}
		I_{L1cH}
		I_{L1cT}
	Stabilization phase current	I_{SL1}
	Differential phase current	I_{DL1}
	2nd harmonic of differential phase current	$I_{DL1\text{-}2^{nd}}$
	5th harmonic of differential phase current	$I_{DL1\text{-}2^{th}}$
L2 phase	Compensated phase current (Side L - Side H - Side T)	I_{L2cL}
		I_{L2cH}
		I_{L2cT}
	Stabilization phase current	I_{SL2}
	Differential phase current	I_{DL2}
	2nd harmonic of differential phase current	$I_{DL2\text{-}2^{nd}}$
	5th harmonic of differential phase current	$I_{DL2\text{-}2^{th}}$
L3 phase	Compensated phase current (Side L - Side H - Side T)	I_{L3cL}
		I_{L3cH}
		I_{L3cT}
	Stabilization phase current	I_{SL3}
	Differential phase current	I_{DL3}
	2nd harmonic of differential phase current	$I_{DL3\text{-}2^{nd}}$
	5th harmonic of differential phase current	$I_{DL3\text{-}2^{th}}$
Calculated	Calculated residual current (Side L - Side H - Side T	I_{ECL}
		I_{ECH}
		I_{ECT}
	Stabilization current 1	I_{ES1}
	Stabilization current 2	I_{ES2}
	Thermal image	DThetaL
		DThetaH
		DThetaT
	Flux $U_{max/f}$	U/f
	Maximum current between I_{L1L}-I_{L2L}-I_{L3L}	I_{LmaxL}
	Minimum current between I_{L1L}-I_{L2L}-I_{L3}	I_{LminL}
	Average current between I_{L1L}-I_{L2L}-I_{L3}	I_{LL}
	Maximum current between I_{L1H}-I_{L2H}-I_{L3H}	I_{LmaxH}
	Minimum current between I_{L1H}-I_{L2H}-I_{L3H}	I_{LminH}
	Average current between I_{L1H}-I_{L2H}-I_{L3H}	I_{LH}
	Maximum current between I_{L1T}-I_{L2T}-I_{L3T}	I_{LmaxT}
	Minimum current between I_{L1T}-I_{L2T}-I_{L3T}	I_{LminT}
	Average current between I_{L1T}-I_{L2T}-I_{L3T}	I_{LT}
Displacement	Displacement angle of U_E respect to I_{E2}	PhiE

Typology	Measure	Symbol
Sequence	Positive sequence current (Side L)	I_{1L}
	Negative sequence current (Side L)	I_{2L}
	Negative sequence/positive sequence current ratio (Side L)	I_{2L}/I_{1L}
	Positive sequence current (Side H)	I_{1H}
	Negative sequence current (Side H)	I_{2H}
	Negative sequence/positive sequence current ratio (Side H)	I_{2H}/I_{1H}
	Positive sequence current (Side T)	I_{1T}
	Negative sequence current (Side T)	I_{2T}
	Negative sequence/positive sequence current ratio (Side T)	I_{2T}/I_{1T}
2nd Harmonic	2nd harmonic of phase currents (Side L)	$I_{L1L...3\text{-}2^{nd}}$
	Max of the 2nd harmonic phase currents/Fundamental component percentage ratio I_{2nd}/I_L (Side L)	$I_{\text{-}2^{nd}L}/I_{LL}$
	2nd harmonic of phase currents (Side H)	$I_{L1H...3\text{-}2^{nd}}$
	Max of the 2nd harmonic phase currents/Fundamental component percentage ratio I_{2nd}/I_L (Side H)	$I_{\text{-}2^{nd}H}/I_{LH}$
	2nd harmonic of phase currents (Side T)	$I_{L1T...3\text{-}2^{nd}}$
	Max of the 2nd harmonic phase currents/Fundamental component percentage ratio I_{2nd}/I_L (Side T)	$I_{\text{-}2^{nd}T}/I_{LT}$
Demand phase (Side L)	Phase fixed currents demand	$I_{L1...3FIXL}$
	Phase rolling currents demand	$I_{L1...3ROLL}$
	Phase peak currents demand	$I_{L1...3MAXL}$
	Phase minimum currents demand	$I_{L1...3MINL}$
Demand phase (Side H)	Phase fixed currents demand	$I_{L1...3FIXH}$
	Phase rolling currents demand	$I_{L1...3ROLH}$
	Phase peak currents demand	$I_{L1...3MAXH}$
	Phase minimum currents demand	$I_{L1...3MINH}$
Demand phase (Side T)	Phase fixed currents demand	$I_{L1...3FIXT}$
	Phase rolling currents demand	$I_{L1...3ROLT}$
	Phase peak currents demand	$I_{L1...3MAXT}$
	Phase minimum currents demand	$I_{L1...3MINT}$
PT100	Temperature Pt1...Pt8	T1...T8

EVENT RECORDING (SER)

Number of events	1000
Recording mode	circular
Trigger:	
Start/Trip of enabled protection or control element	
Binary inputs switching (OFF/ON or ON/OFF)	
Data recorded:	
Counter (resettable by ThyVisor)	$0...10^9$
Time stamp	Date and time

FAULT RECORDING (SFR)

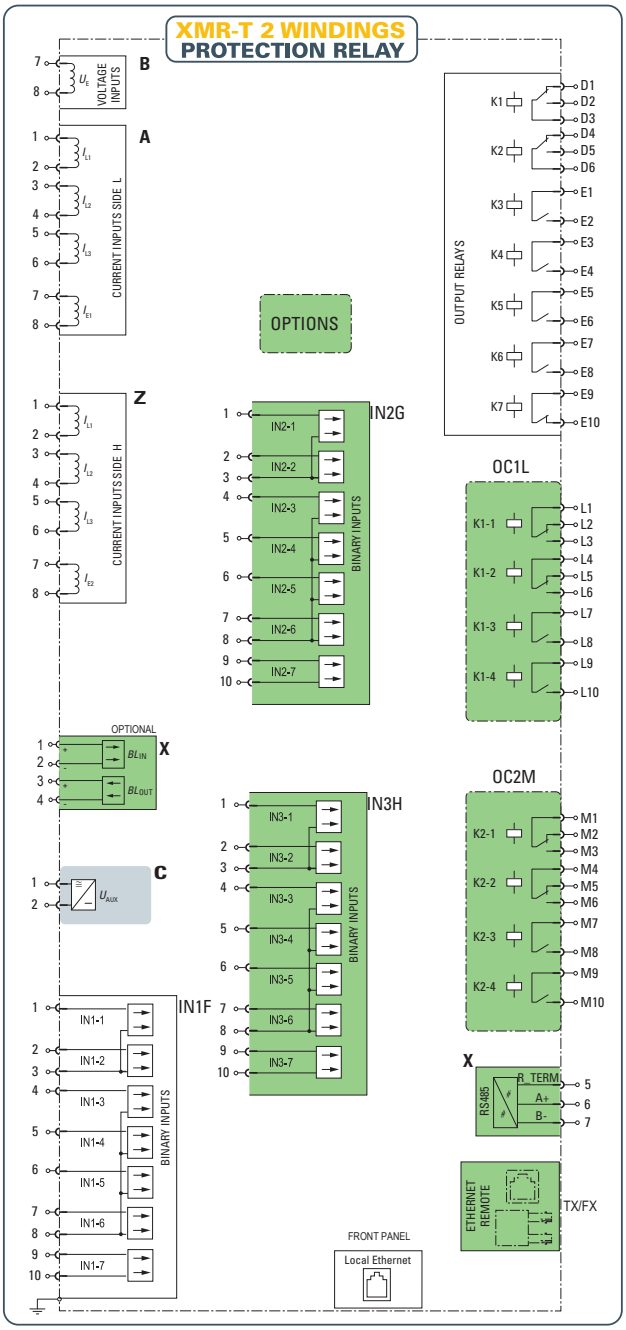
Number of faults	20
Recording mode	circular
Trigger:	
Output relays of enabled protection or control element	(OFF-ON)
External trigger (binary inputs)	IN1-1...IN1-16, IN2-1...IN2-16

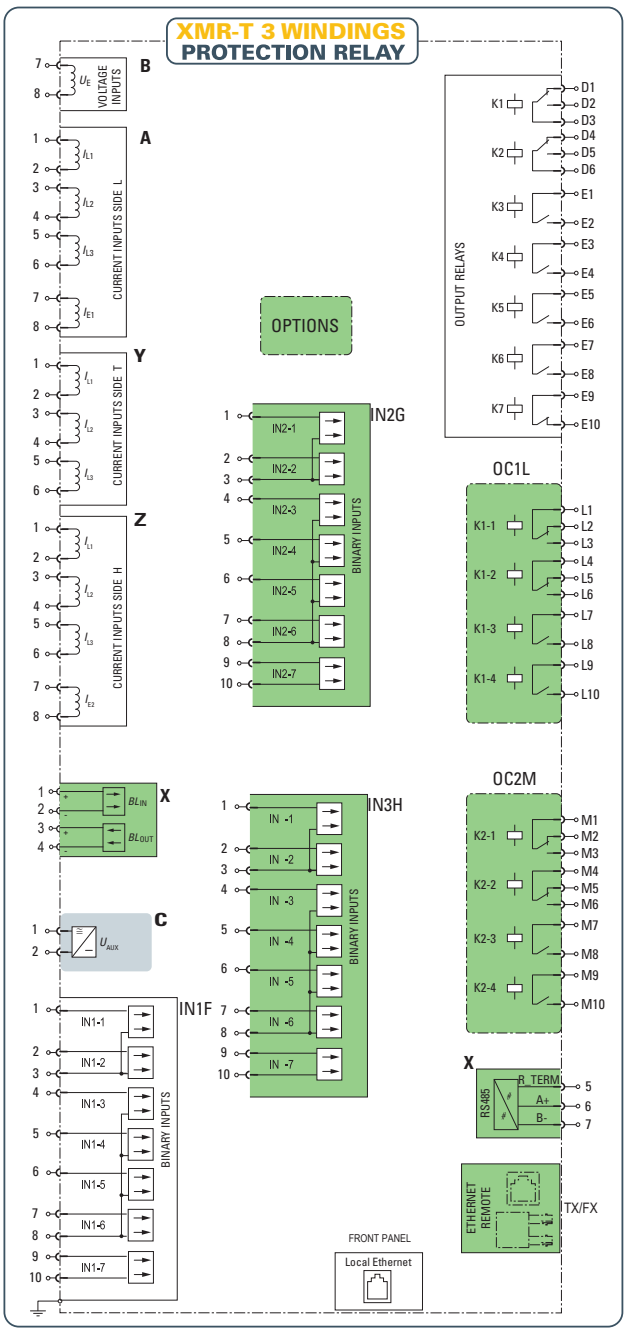
DIGITAL FAULT RECORDER (DFR)

File format	COMTRADE
Records	depending on setting[1]
Recording mode	circular
Sampling rate	32 samples per cycle
Trigger setup(*)	
Pre-trigger time	0.05...1.00 s
Post-trigger time	0.05...60.00 s
Set sample channels(*)	
Instantaneous phase currents	i_{L1}, i_{L2}, i_{L3}
Instantaneous residual current	i_E
Number of settable analogue channels(*)	***from 1 up to 12***
Number of settable digital channel(*)	***from 1 ut to 12:***

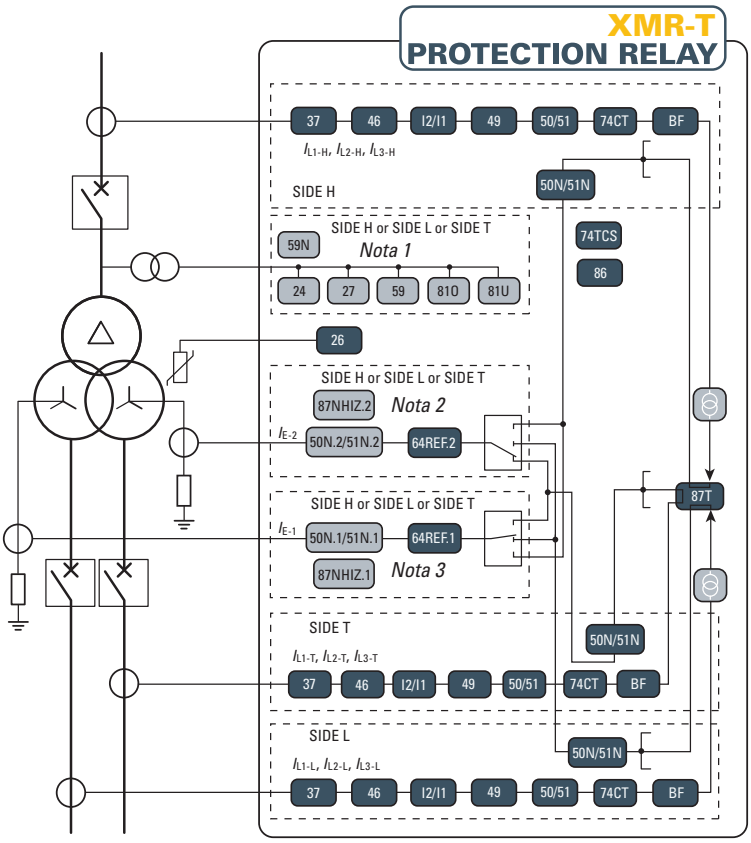
(*) Consult equipment manual for associated parameters description.

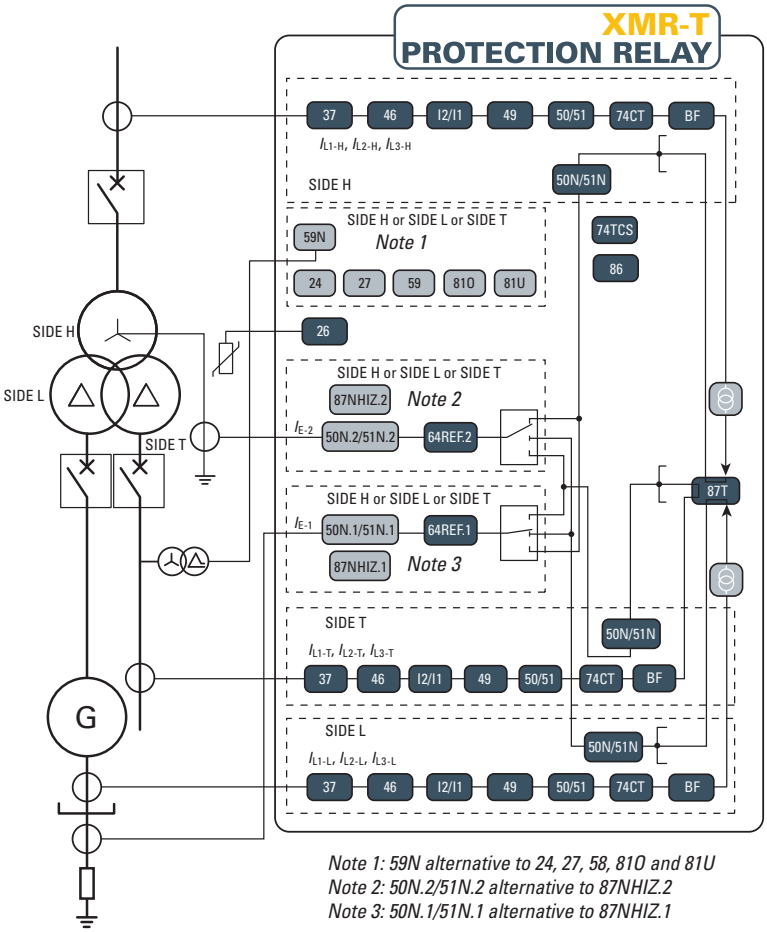
INPUT/OUTPUT BASIC SCHEME





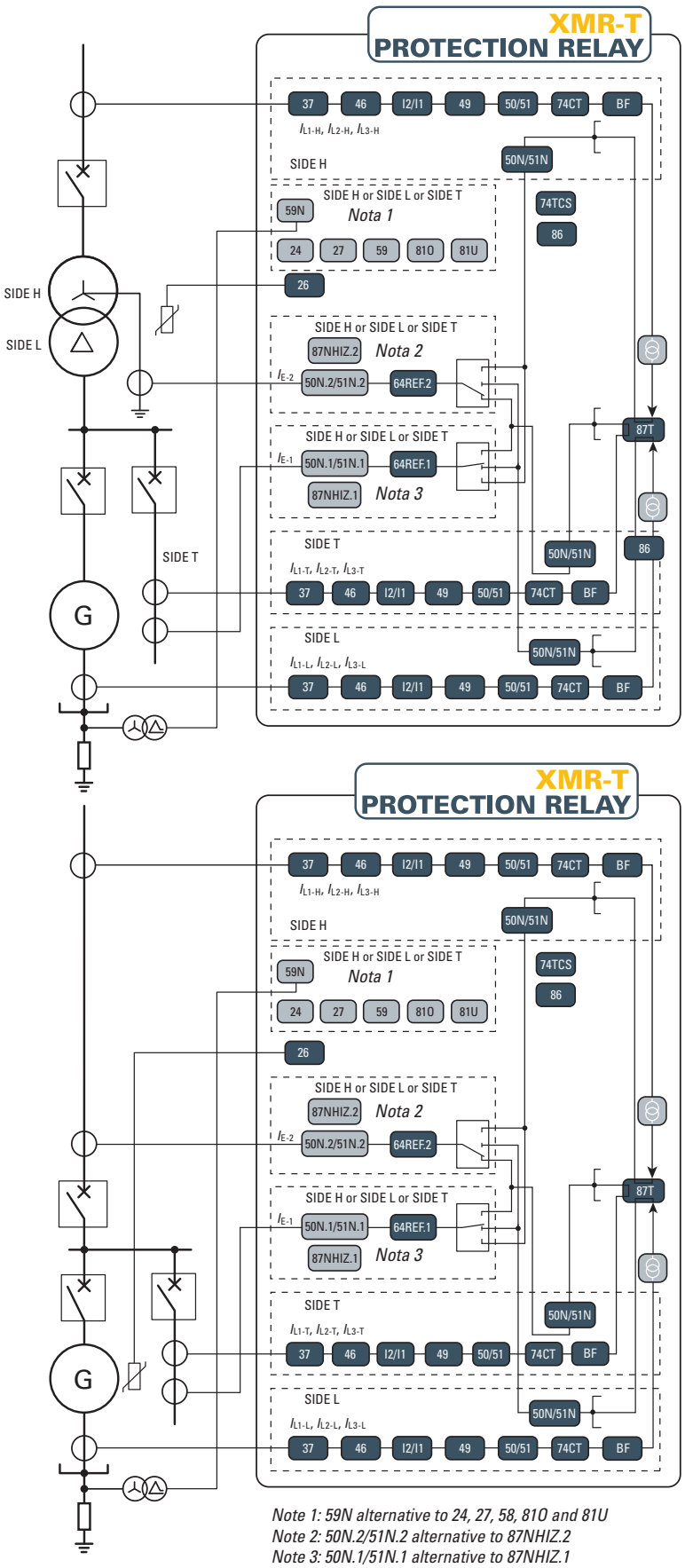
PROTECTIVE FUNCTIONS





Note 1: 59N alternative to 24, 27, 58, 81O and 81U
Note 2: 50N.2/51N.2 alternative to 87NHIZ.2
Note 3: 50N.1/51N.1 alternative to 87NHIZ.1

PROTECTIVE FUNCTIONS



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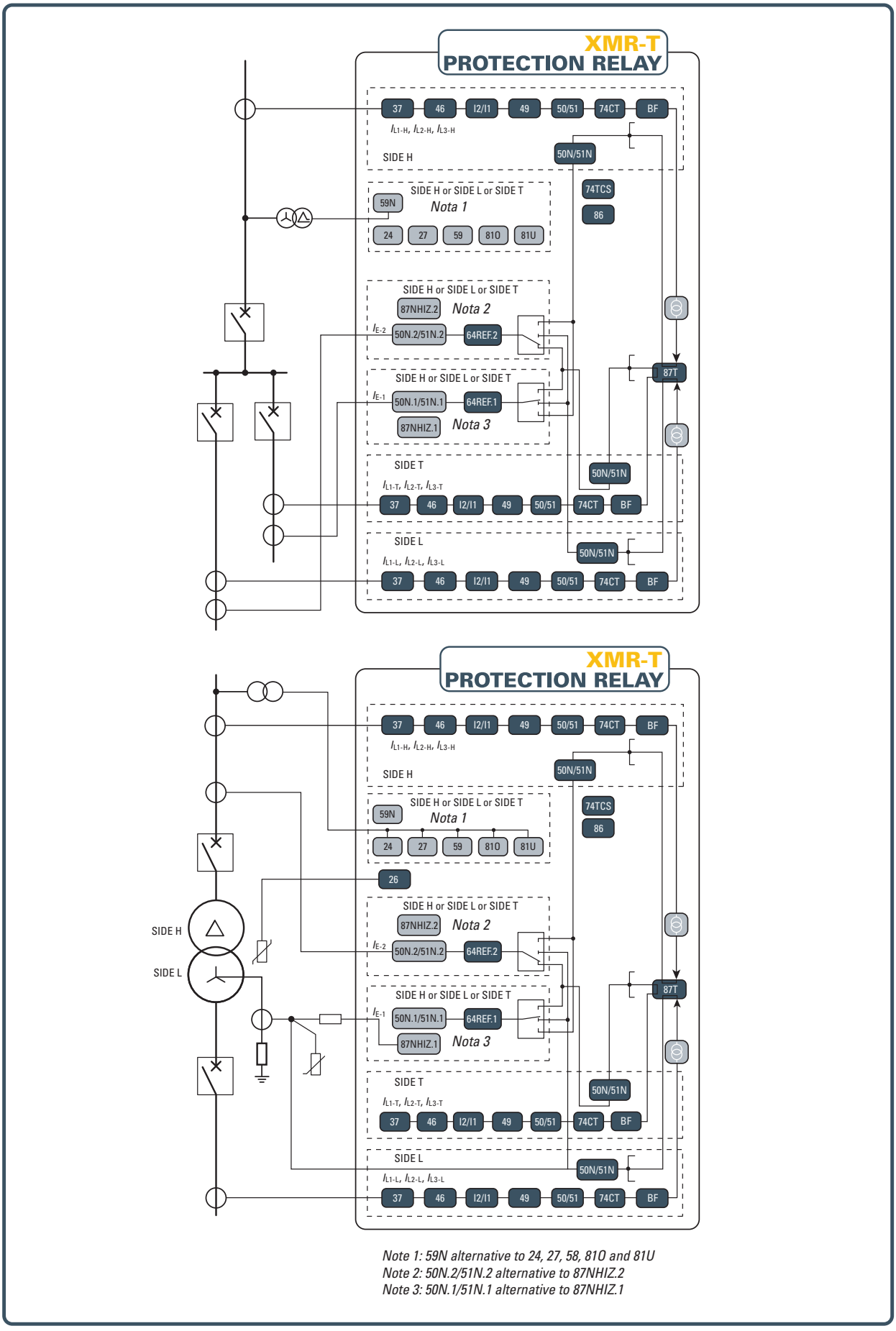
Note 2: 50N.2/51N.2 alternative to 87NHIZ.2
Note 3: 50N.1/51N.1 alternative to 87NHIZ.1

PROTECTIVE FUNCTIONS



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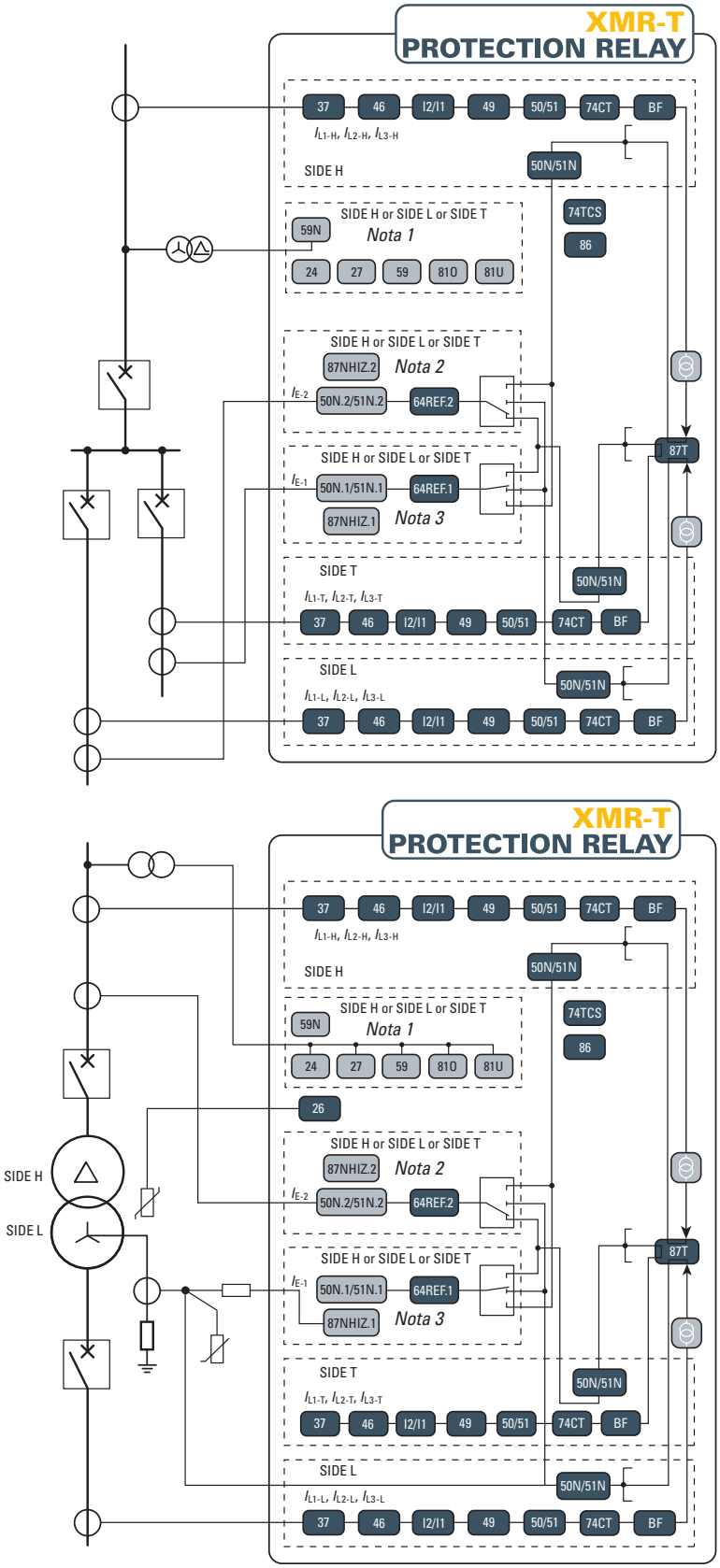
PROTECTIVE FUNCTIONS



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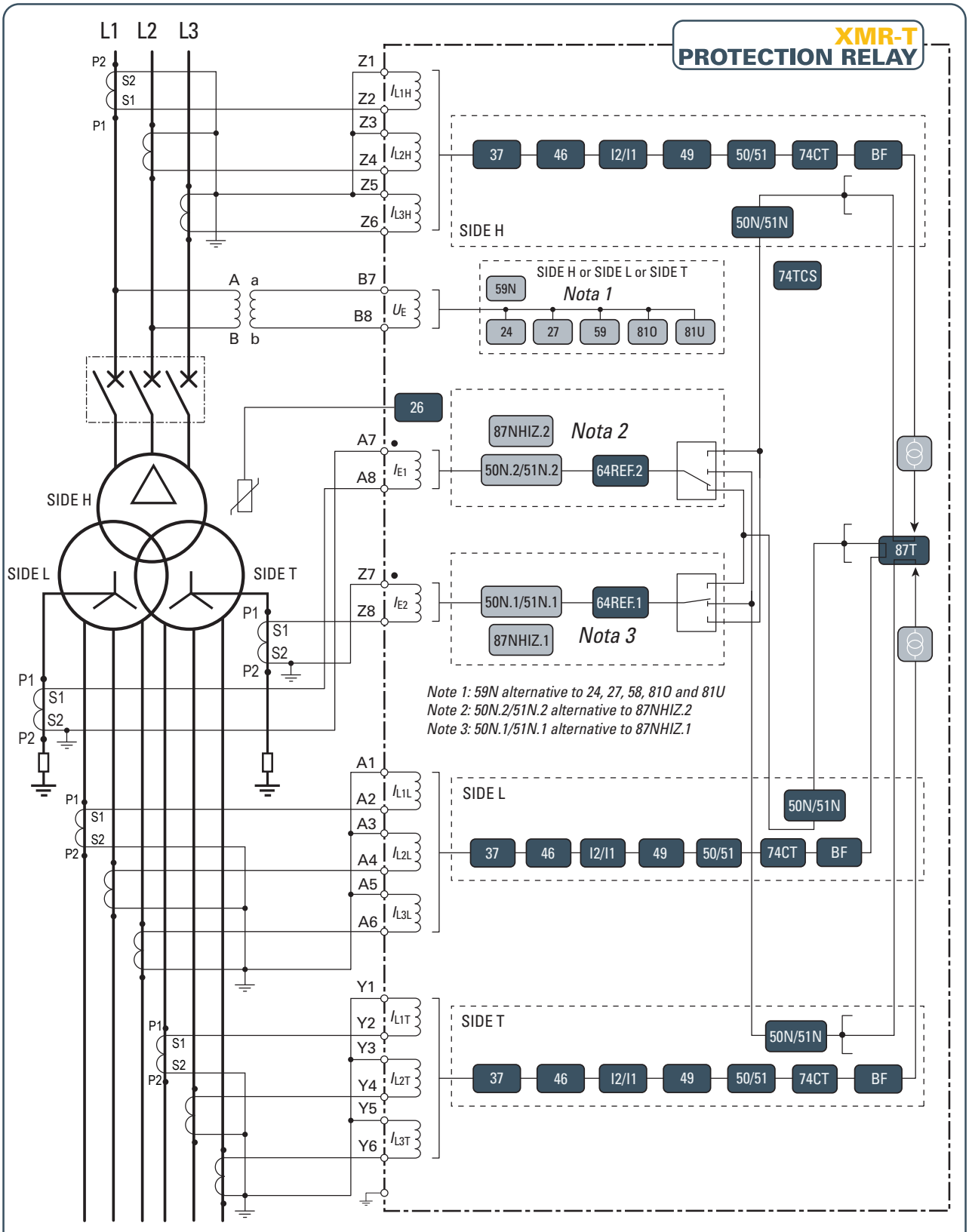
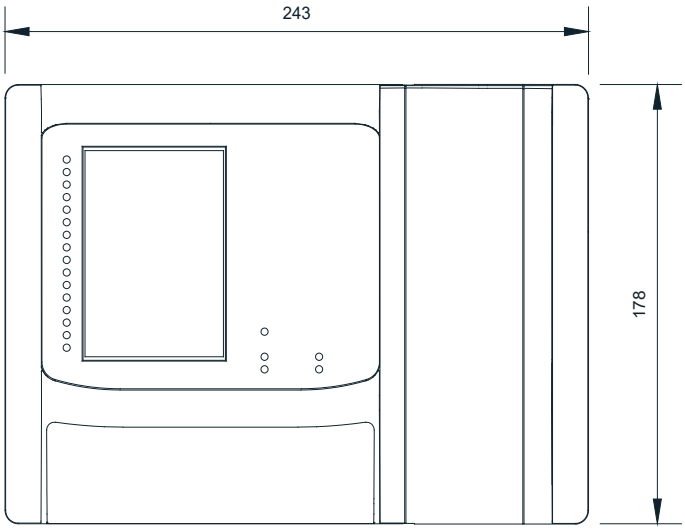
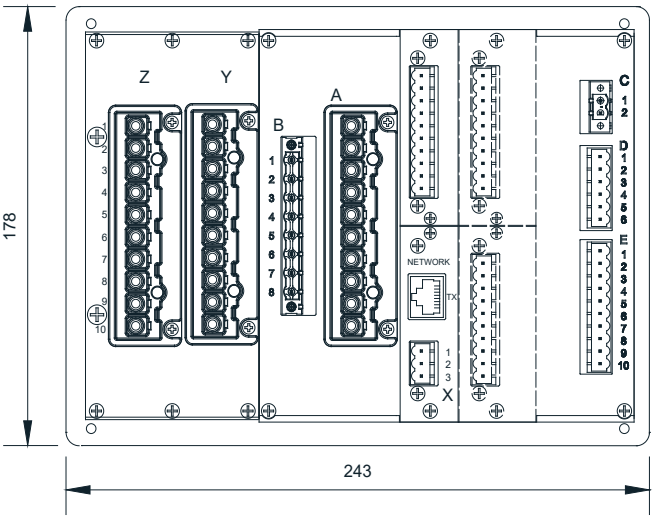


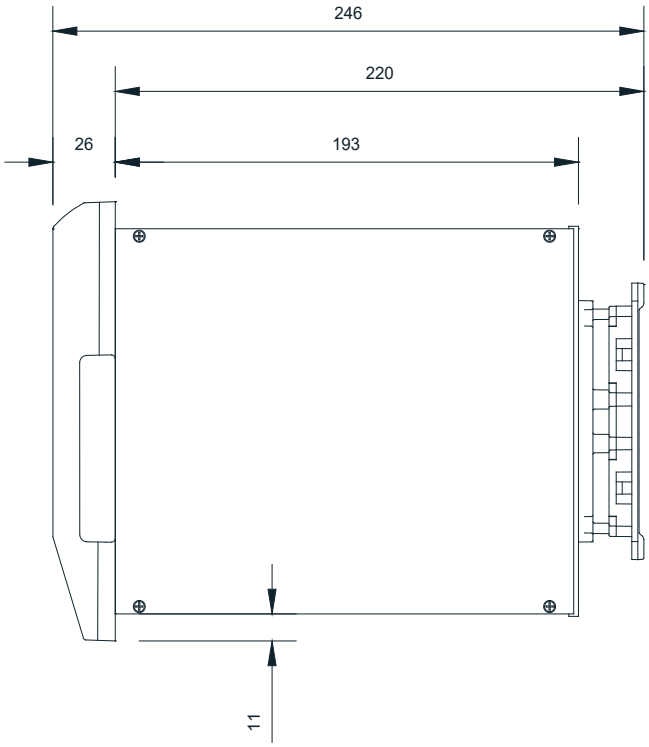
NOTE
- Incoming currents to the protected transformer must match to the the reference current inputs of the relay, with current direction leaving the protected transformer must match current output from the current inputs of the relay.
- Incoming currents in the reference terminals of of the relay current inputs are considered positive, the outgoing negative.
- This convention applies to indicate the P1 CTs polarity toward the protected transformer.

Differential protection for three windings transformer

DIMENSIONS







In relation to the evolution of materials and technical standards, THYTRONIC reserves the to modify without notice data and dimensions inside this data sheet

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