
MORE
EXTENDED MODULAR RELAYS
XMR-PS
MORE ADVANCED,
HIGH-END IEDs
BY THYTRONIC,
DESIGNED FOR SPECIAL
APPLICATIONS IN SHORE
CONNECTION SITES.
THYTRONIC

XMR-PS MULTIFUNCTION PROTECTION RELAYS FOR SPECIAL APPLICATION.

The XMR-PS is a multifunction relay for special applications as in **shore connections** plants.

It can manage different frequency and line voltages by a simple configuration switch; it is equipped with a current module to detect plugging fails between the shore main source and the ship distribution line.

Moreover it can be used in power grids with any neutral state (isolated, earthed with high or low value resistance, earthed with Petersen coil (compensated neutral) and any resistance, directly connected to earth) for the following typical applications:

• Protection of radial lines, transformers

With optional SW package, it is also possible to extend its application to:

- Loop lines or long radial lines, generators or transformers in parallel, thanks to directional phase (67) and ground (67N) protections
- For directional monitoring of active and/or reactive power
- As multifunctional motor or generator protection

ACCURATE MEASUREMENTS

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

- **Up to 11 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**
- **ArcFlash module**
- **Analogue (PT100, 4-20mA) cards**
- **Communication cards**
- **Auto-shunt unpluggable current terminal block**

AUTOMATION CONTROL & MONITORING

Enhanced tools and solutions for Grid Automation

- **IEC1131 PLC embedded**
- **Switchgear Monitoring/Control**
- **Switchgear OPEN/CLOSE local keys**
- **Multiple setting Profile**
- **CB health monitoring**
- **CT's and VT's monitoring**

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)**

TIME SYNCRONIZATION

Enhanced Time synchronization solution for SOE recording:

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

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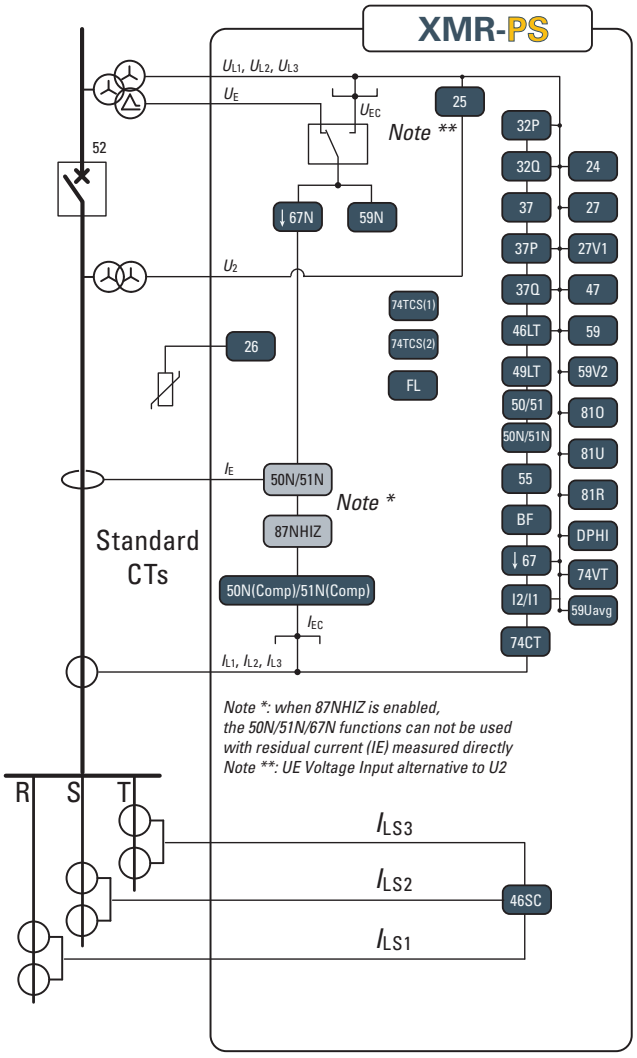


Standard Protective & control elements

SW & HW Pack optional configuration

21	Under impedance
24	Overflux (V/Hz)
25	Synchrocheck
26	Pt100 thermal probes
27	Undervoltage
27V1	Positive sequence undervoltage
32P	Directional active overpower
32Q	Directional reactive overpower
37	Undercurrent
37P	Directional active underpower
37Q	Directional reactive underpower
40	Loss of excitation
46 LT	Negative sequence overcurrent
46 MG	Negative sequence overcurrent
46 SC	Unbalance overcurrent
I2/I1	Negative/positive sequence current ratio
47	Phase reversal
49 LT	Thermal image
49 MG	Thermal image
50/51	Phase overcurrent
50N/51N/87NHIZ *	Residual overcurrent/Restricted earth fault
50N(Comp)/51N(Comp)	Calculated residual overcurrent
51LR(48)/14	Locked rotor
51V	Phase overcurrent voltage restrain
55	Minimum power factor
59	Overvoltage
59N	Residual overvoltage
59V2	Negative sequence overvoltage
59Uavg	Average overvoltage
66	Maximum number of starting
67	Phase directional overcurrent
67N	Ground directional overcurrent
DPHI	Vector jump
81O/81U	Overfrequency and underfrequency
81R	Frequency rate of change
BF	Circuit breaker failure
74CT, 74VT	CT-VT supervision
74TCS(1)	Trip circuit supervision (1)
74TCS(2)	Trip circuit supervision (2)
FL	Fault locator
ArcFlash	ArcFlash

To enable protection:

- **Function 26** (thermometric protection with Pt100 modules)
- **Arc Flash** protection function (made with arc detector)

These functions are HW options, can be enabled only with the presence of the relative module.
The software is modular and the user can decide which protective functions modules need to be activated, granting the maximum flexibility, scalability and easiness of use of the device.

MEASURING INPUTS WITH INDUCTIVE CTS AND VTS

- Three phase current inputs and one residual current input, with nominal currents independently selectable at 1 A or 5 A through sw setting
- Three phase voltage inputs with programmable nominal voltages within range 50...130 V (UR =100 V) and one residual voltage input, with programmable nominal voltage within range 50...130 V (UER =100 V)
- Three currents to detect plugging fails between the shore main source and the ship distribution line, with nominal currents independently selectable at 1 A or 5 A through sw setting

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).

MODULAR DESIGN

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

Internal auxiliary boards

- Output relays
- Binary inputs
- ARCFLASH Module

External modules:

- 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)

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.

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 up to 5th harmonic of phase current are also measured.
On the base of the direct, calculated (min, max, ...), displacement, sequence, power, impedance, harmonic, syncro check, demand phase and energy 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).

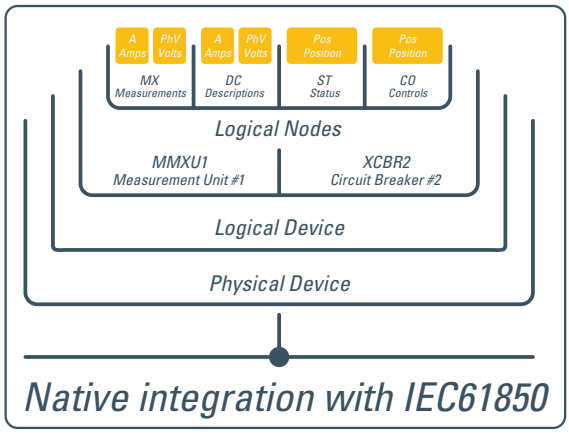
COMMUNICATION

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:
  - Single RS485 port
  - Ethernet TX + RS485
  - Ethernet FX + RS485
  - Double Ethernet TX
  - Double Ethernet FX
  - Double Ethernet FX with RSTP
  - Double Ethernet TX with RSTP

TWO SET POINT PROFILES (A,B)

Two independent settings groups are provided. Switching from profiles may be operated by means of MMI, binary input or communication.



CONTROL AND MONITORING

Several predefined functions are implemented:

- Activation of two set point profiles
- Phase CTs monitoring (74CT)
- Phase VTs monitoring (74VT)
- 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-X help to mitigate cyber threats.

- Secured communication between XMR-X protection relays and associated tool by ***SSH*** (***S***ecure ***SH***ell) protocols
- Password based user authentication
- ***R***ole ***B***ased ***A***ccess ***C***ontrol (***RBAC***) authorization management
- Secured log storage (Syslog Service)Note - .

SPECIFICATIONS

GENERAL

MECHANICAL DATA

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

INSULATION TESTS

Reference standards	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	2014/30/EC
Low Voltage Directive	2014/35/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}/V_{DC}
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	40 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	8 A
Thermal overload (1 s)	100 A
Rated consumption	≤ 0.006 VA (I_{En} = 1 A), ≤ 0.012 VA (I_{En} = 5 A)
Connections	M4 terminals

PHASE VOLTAGE INPUTS WITH INDUCTIVE VTS

Reference voltage U_r	100 V
Nominal voltage U_n	50...130 V adjustable via sw
Permanent overload / 1 s overload	1.3 U_n / 2 U_n
Rated consumption (for any phase)	≤ 0.5 VA

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	Changeover (SPDT, type C)
	Make (SPST-NO, type A)
(base configuration):	
K1, K2	changeover (SPDT, type C)
K3, K4, K5, K6	make (SPST-NO, type A)
K7	break (SPST-NC, type B)
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:

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
OK/fail (green)	1
Start (yellow)	1
Trip (red)	1
Local	1
Remote	1
Allocatable (green/yellow/red)	16

MAIN SETTINGS

RATED VALUES (ALL VERSIONS)

B9-B10 Voltage measure	U_E or V_2
V1-V2 phase correction	0...360 °
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-ground)	$E_n = U_n/\sqrt{3}$
Relay residual nominal voltage (calculated)	$U_{ECN} = U_n \cdot \sqrt{3} = 3 \cdot E_n$
Relay residual nominal voltage (direct measure) (U_{En})	50...130 V
Relay nominal active power (P_n)	$P_n = \sqrt{3} \cdot U_n \cdot I_n = 3 \cdot E_n \cdot I_n$
Relay nominal reactive power (Q_n)	$Q_n = \sqrt{3} \cdot U_n \cdot I_n = 3 \cdot E_n \cdot I_n$
Relay nominal apparent power (S_n)	$S_n = \sqrt{3} \cdot U_n \cdot I_n = 3 \cdot E_n \cdot I_n$
Residual primary nominal voltage (phase-to-phase)√3 (U_{Enp})	50 V...500 kV

RATED VALUES (INDUCTIVE CTS AN VTS VERSIONS)

Relay phase nominal current (I_n)	1 A, 5 A
Phase CT nominal primary current (I_{np})	1 A...10 kA
Relay nominal voltage (phase-to-phase) (U_n)	50...130 V
Line VT primary nominal voltage (phase-to-phase) (U_{np})	50 V..500 kV
Line VT primary nominal voltage - side 2 (U_{n2p})	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

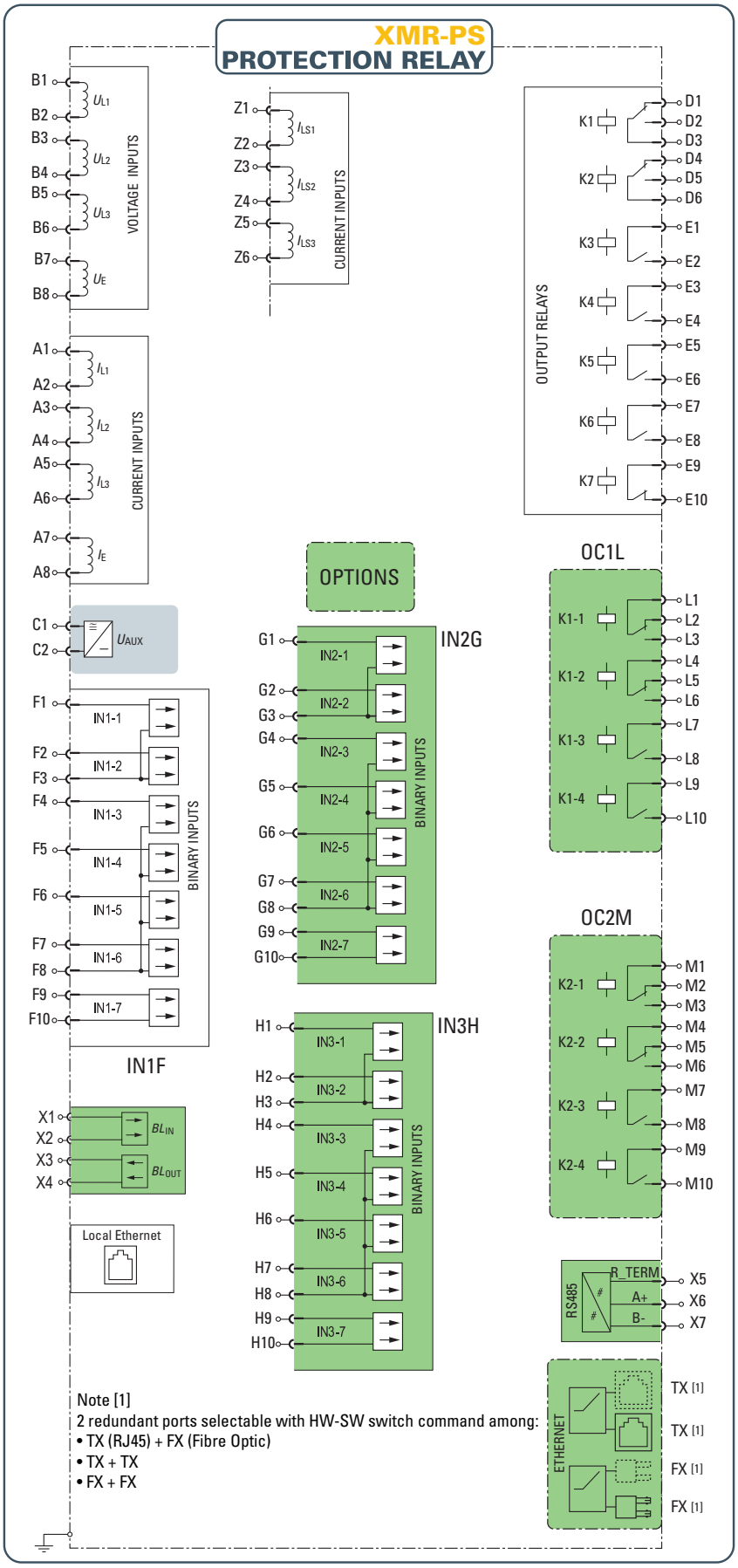
INPUT SEQUENCE

Phase current sequence	(*I-Sequence*)
	IL1-IL2-IL3, IL1-IL3-IL2, L2, IL1, IL3,.....
Phase voltage sequence	(*U-Sequence*)
	UL1-UL2-UL3, UL1-UL3-UL2, UL2-UL1-UL3, ...

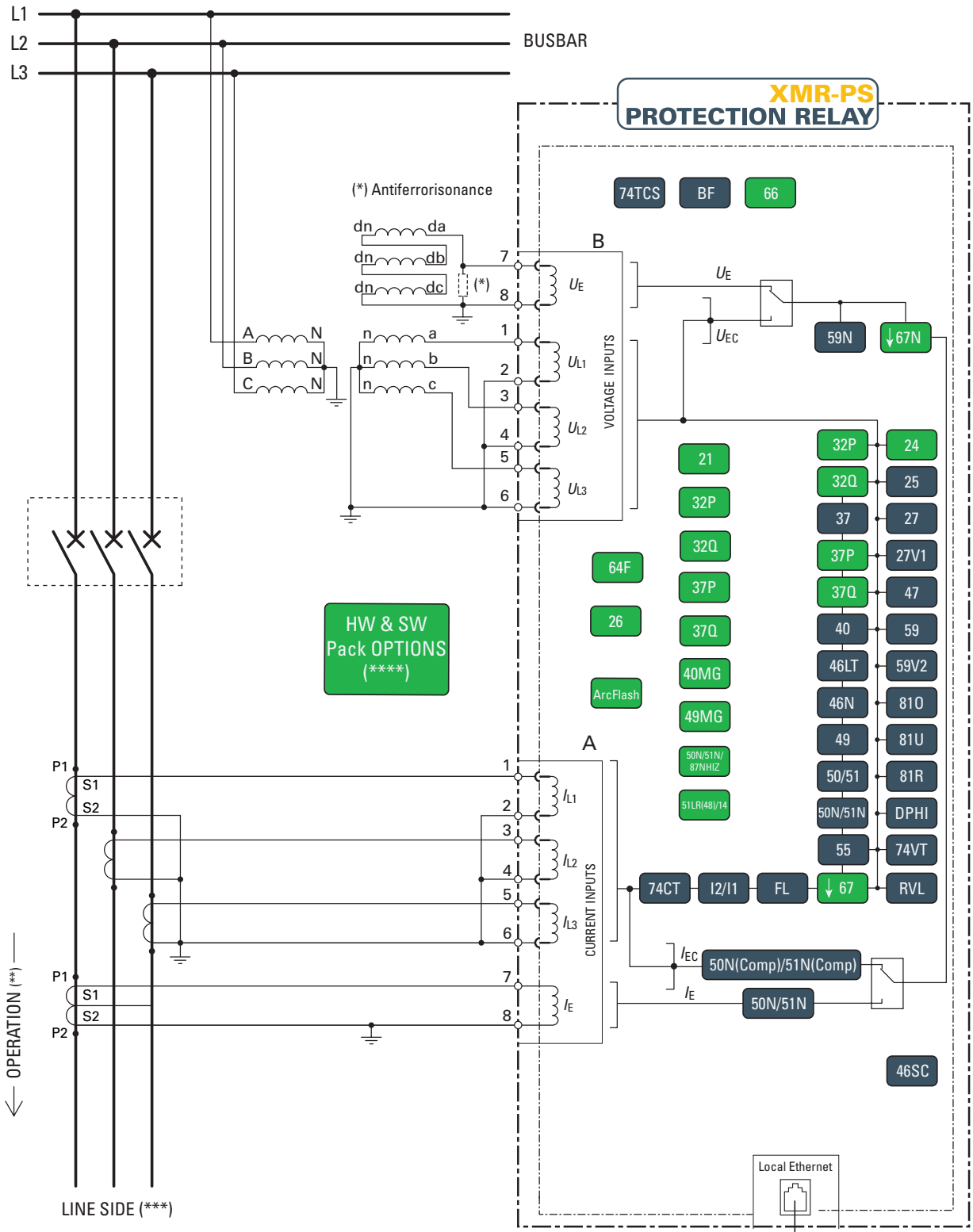
POLARITY

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
Z1-Z2 (Z1-Z2 POL) polarity	NORMAL/REVERSE
Z3-Z4 (Z3-Z4 POL) polarity	NORMAL/REVERSE
Z5-Z6 (Z5-Z6 POL) polarity	NORMAL/REVERSE

INPUT/OUTPUT BASIC SCHEME



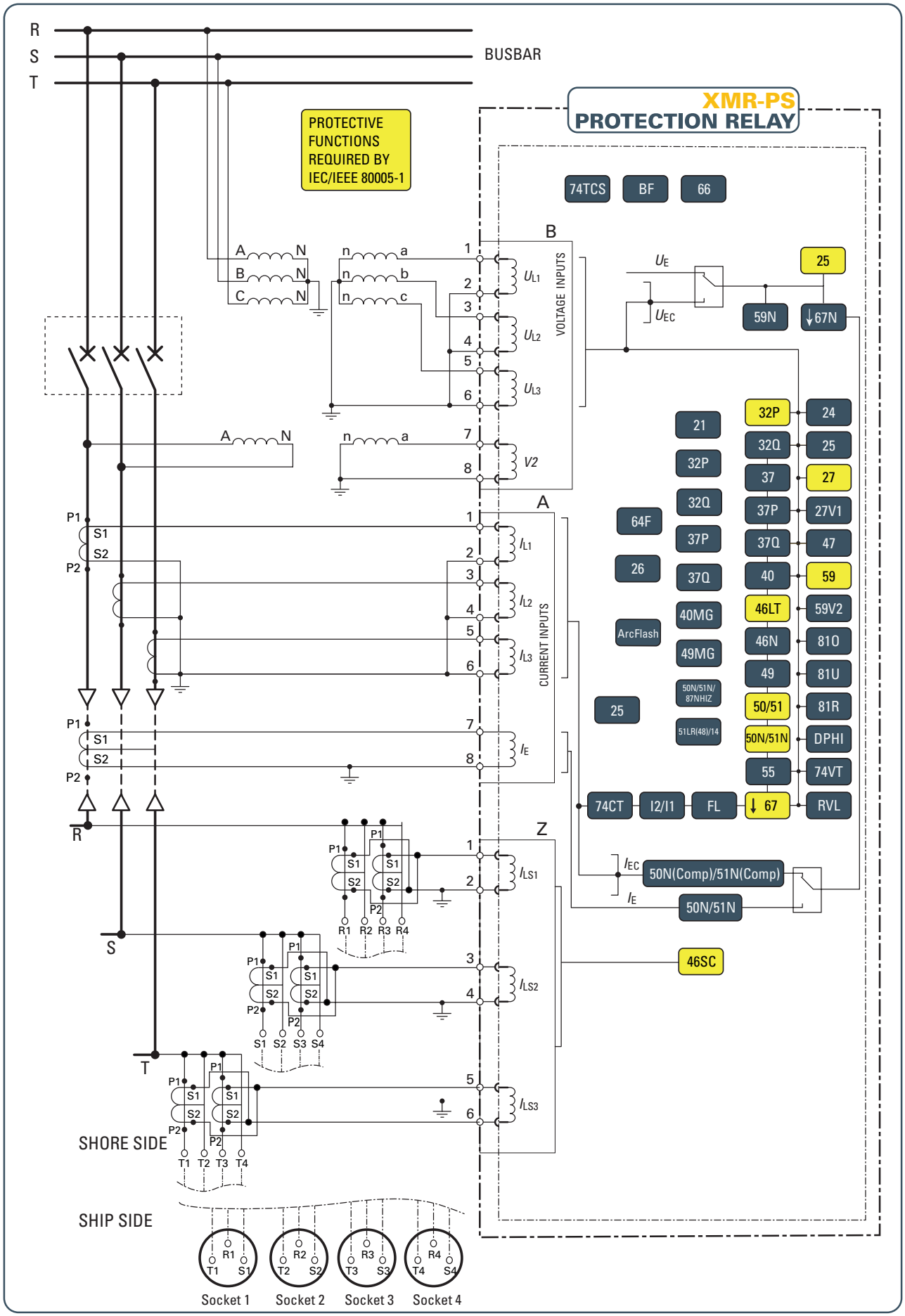
INSERTION SCHEMES



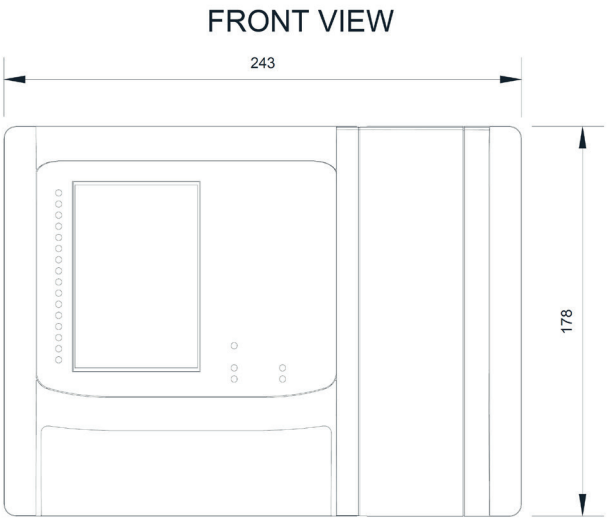
OPERATION(**):
- Operation for 67 elements with characteristic angle adjusted within 0°... 90° or 270°...359° ranges
- Operation for 67N elements with isolated neutral and characteristic angle = 90°

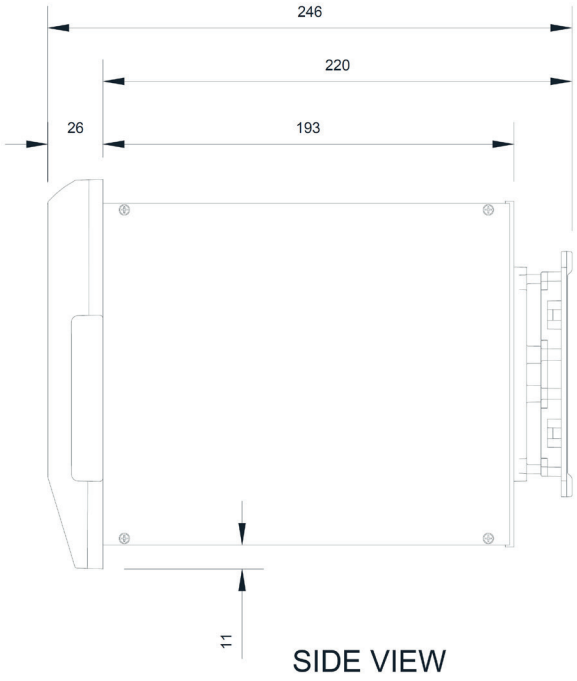
MEASURES(***):
- Positive sign for measurement of active power and energy with passive load
- Negative sign for measurement of active power and energy with generators

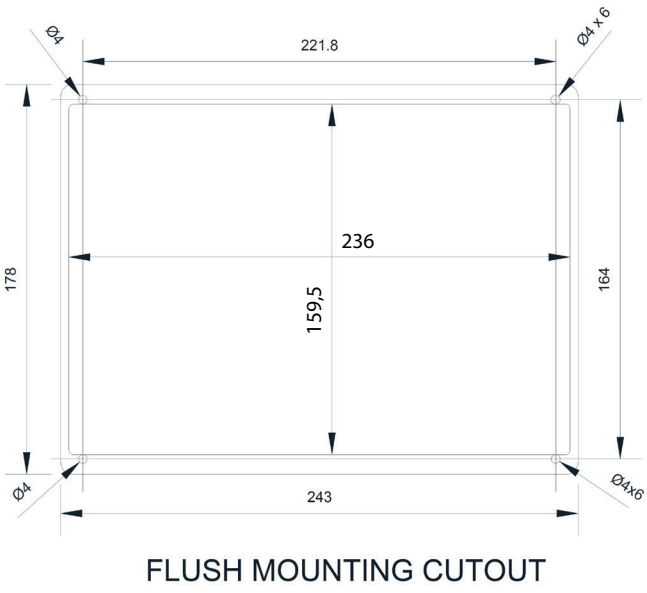
PROTECTION(****):
The protective element groups are defined according to the device code


R
S
T
BUSBAR
XMR-PS
PROTECTIVE RELAY
PROTECTIVE FUNCTIONS REQUIRED BY IEC/IEEE 80005-1
74TCS
BF
66
B
VOLTAGE INPUTS
A
CURRENT INPUTS
Z
U_{L1}
U_{L2}
U_{L3}
V2
I_{L1}
I_{L2}
I_{L3}
I_E
I_{LS1}
I_{LS2}
I_{LS3}
U_E
U_{EC}
25
59N
67N
64F
26
ArcFlash
25
21
32P
32Q
37P
37Q
40MG
49MG
50N/51N/ 87NHIZ
51LR(48)/14
32P
32Q
37
37P
37Q
40
46LT
46N
49
50/51
50N/51N
55
24
25
27
27V1
47
59
59V2
81O
81U
81R
DPHI
74VT
74CT
I2/I1
FL
67
RVL
I_{EC}
I_E
50N(Comp)/51N(Comp)
50N/51N
46SC
SHORE SIDE
SHIP SIDE
Socket 1
Socket 2
Socket 3
Socket 4

DIMENSIONS







In relation to the evolution of materials and technical standards, THYTRONIC reserves the right to modify the data and dimensions contained in this data sheet without prior notice.

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