**PROTECTION MADE SIMPLE.**

# HighPROTEC

# MRDT4    TRANSFORMER DIFFERENTIAL PROTECTION

The various protective functions of the MRDT4 are specifically tailored to the protection of two winding transformers. The device offers in addition to the differential protection various communication and backup protection functions.

Furthermore the MRDT4 can also be used as a cost-optimized generator differential protection device, where it is even possible to have a step-up transformer integrated into the protection zone.

The protection functions of the MRDT4 have been adapted to comply with the requirements of the VDE-AR-N-4110:2018.

**New Features – Release 3.7**

‣ Improved CT Saturation Stabilization
‣ Improved design of the PC tools
‣ Configurable SCADA protocols:
  Modbus, Profibus, IEC 60870-5-103/-104, DNP3

*All HighPROTEC devices have been type tested and fully certified by KEMA Laboratories (IEC 60255-1:2009).*

## All Inclusive:

‣ All protection features without extra charge
‣ Parameter setting and evaluation software
‣ Disturbance record analysis software

## Transformer Phase Differential Protection

‣ Stabilized phase differential protection with transients and C.T. saturation detection
‣ Various selectable transformer groups Zero sequence removal
‣ Three point slope characteristic
‣ High set element (non-restraint)

## Two Elements Ground Differential Protection

‣ Three point slope characteristic
‣ High set element (non-restraint)

## Backup Protection

‣ 4 Elements Overcurrent/short-circuit protection (non-directional)
‣ 4 Elements Earth fault protection (non-directional)
‣ Tripping characteristics:
  DEFT
  ANSI: NINV, VINV, EINV,
  IEC: NINV, VINV, LINV, EINV, RXiDG
  Thermal Flat, IT, I2T, I4T
‣ Two Elements Unbalanced Load Protection

## Comprehensive Measured Values and Statistics

‣ THD (total harmonic distortion)
‣ Current phasors and angles
‣ RMS and fundamental
‣ Sequence currents
‣ Differential currents

## Temperature Protection

‣ Thermal replica
‣ Buchholz (sudden pressure), ext. oil temperature, and aux. temperature protection via digital input
‣ Temperature measurement via external RTD-box (option)

## Supervision

‣ Current transformer supervision
‣ Circuit breaker failure protection
‣ Trip circuit supervision
‣ Cold load pickup
‣ Switch onto fault

## Recorders

‣ Disturbance recorder: 120 s non volatile
‣ Fault recorder: 20 faults
‣ Event recorder: 300 events
‣ Trend recorder: 4000 non volatile entries

## PC Tools

‣ Setting and analyzing software Smart view for free
‣ Including page editor to design own Control pages
‣ SCADApter to re-assign datapoints for Retrofit projects: Modbus, Profibus, IEC 60870-5-103/ -104

## Logic

‣ Up to 80 logic equations for protection, control and monitoring

## Control

‣ 2 breakers (or isolators / grounding switches)
‣ Breaker wear

## Commissioning Support

‣ USB connection
‣ Customizable Display (Single-Line)
‣ Customizable Inserts
‣ Copy and compare parameter sets
‣ Configuration files are convertible
‣ Forcing and disarming of output relays
‣ Fault simulator: current, voltage
‣ Graphical display of tripping characteristics
‣ 8 languages selectable within the relay

## Communication Options

‣ IEC 61850
‣ Profibus DP
‣ Modbus RTU and/or Modbus TCP
‣ IEC 60870-5-103
‣ IEC 60870-5-104
‣ DNP 3.0 (RTU, TCP, UDP)
‣ SCADApter

## Cyber Security

‣ Menu for the activation of security settings (e. g. hardening of interfaces)
‣ Security Logger
‣ Centralized Security Logs (Syslog)
‣ Encrypted Connection Smart view – Device
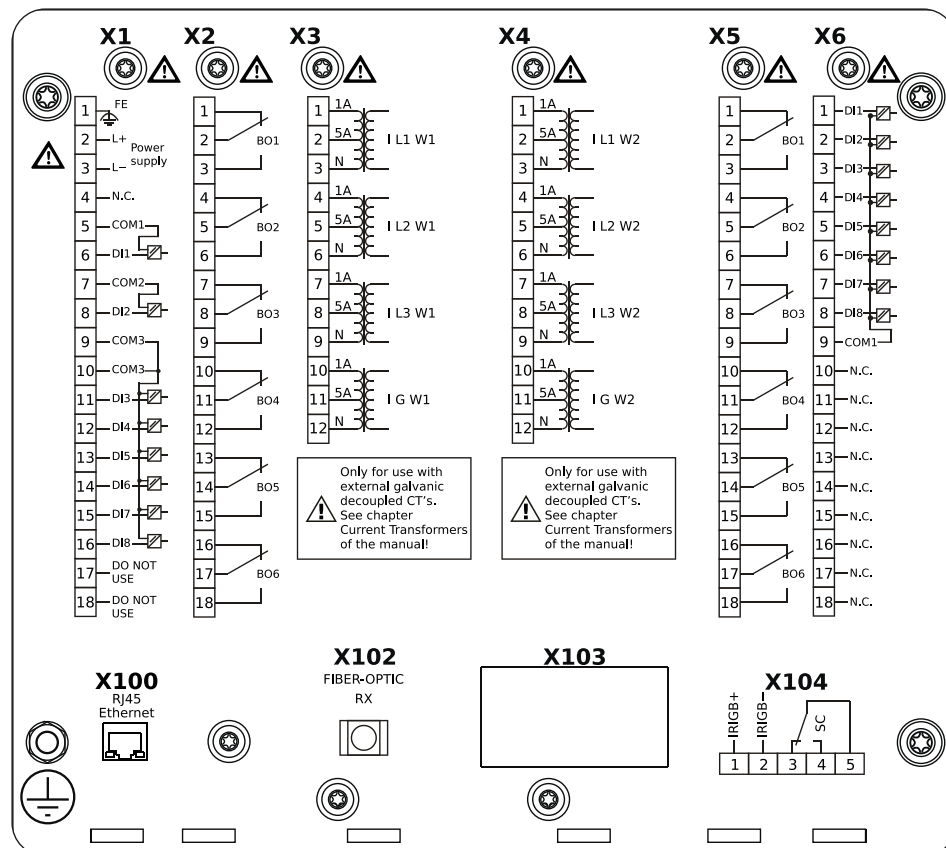‣ Device specific certificates (No man in the middle attacks)

## Time Synchronisation

‣ SNTP, IRIG-B00X, Modbus, DNP 3.0, IEC 60870-5-103/-104

# HighPROTEC

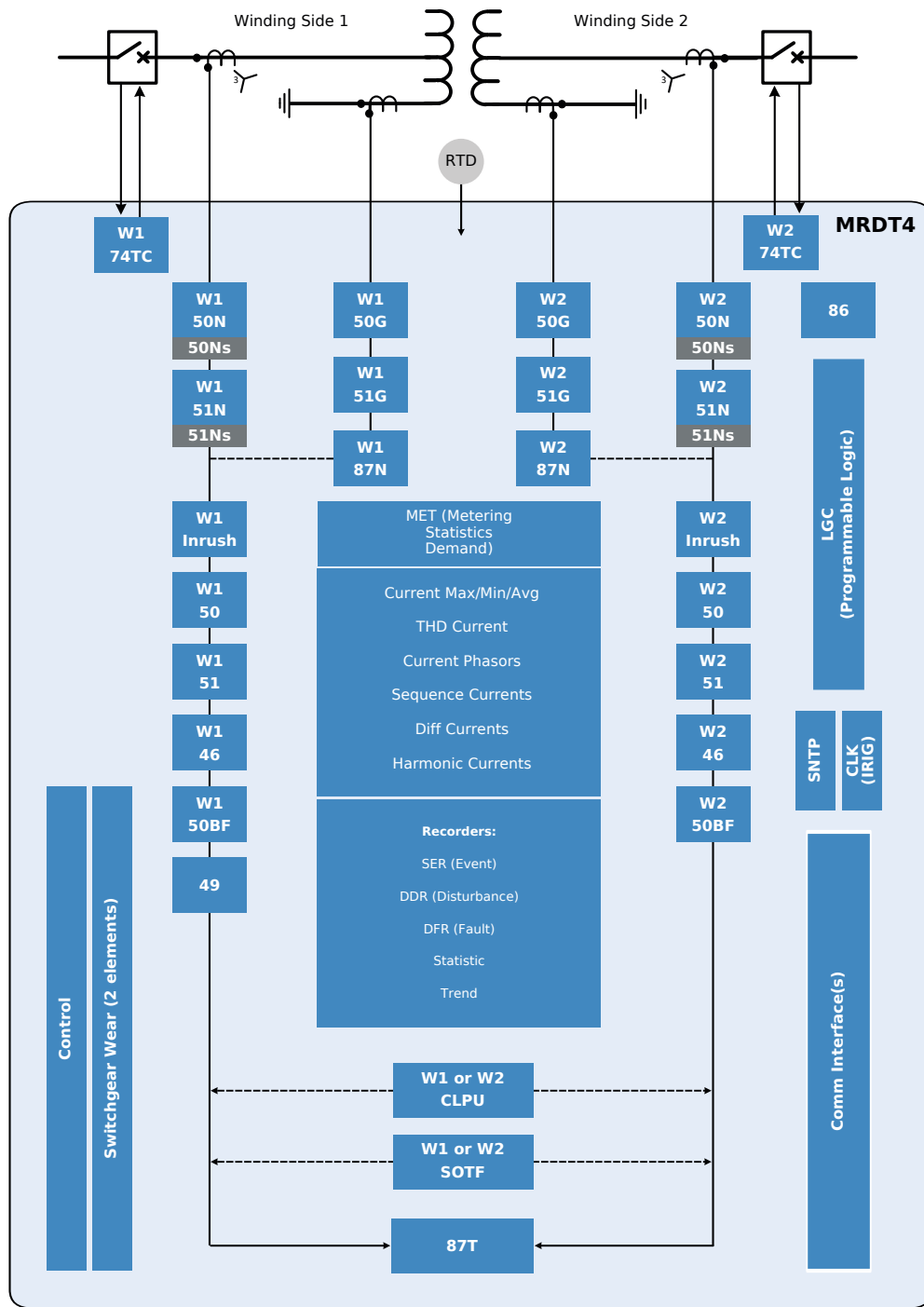## MRDT4    TRANSFORMER DIFFERENTIAL PROTECTION

## Functional Overview

| Protective Functions | | ANSI | IEC 61850 |
|---|---|---|---|
| Transformer differential protection (2 windings), Id: | 1 | 87T | |
| Curve with zero point and three settable slopes and highset element (Id>>), | | | PDIF |
| Inrush stabilisation / detection of 2nd, 4th and 5th harmonics | | | |
| Restricted earth fault IdG, IdG>>, characteristics similar to 87T | 2 | 87TN | PDIF |
| I, time overcurrent and short circuit protection (non-directional) | | | |
| Multiple reset options (instantaneous, definite time, | 4 | 50P, 51P | PTOC |
| reset characteristics according to IEC and ANSI) | | | |
| I2>, unbalanced load protection with evaluation of the negative phase sequence currents | 2 | 46 | PTOC |
| ThR, overload protection with thermal replica for transformers IEC60255-8, alarm and trip threshold | 1 | 49T | PTTR |
| IH2/In, inrush detection with evaluation of the 2nd harmonic | 2 | Inrush | PHAR |
| IG, earth overcurrent and short circuit protection (non-directional) | 4 | 50N/G, 51N/G | PTOC |
| Tremendous reset options (instantaneous, definite time, | | | |
| reset characteristics according to IEC and ANSI | | | |
| ExP, External alarm and trip functions | 4 | | GAPC |
| RTD temperature supervision via optional RTD-Box with 12 sensors | | 26 | PTTR |

| Control and Logic | |
|---|---|
| Control: Position indication, supervision time management and interlockings for 2 breakers | CILO, CSWI, XCBR, XSWI |
| Logic: Up to 80 logic equations, each with 4 inputs, selectable logical gates, timers and memory function | |

| Supervision Functions | | | |
|---|---|---|---|
| CBF, circuit breaker failure protection for both circuit breakers | 2 | 50BF | RBRF |
| TCS, trip circuit supervision | 2 | 74TC | SCBR |
| CTS, current transformer supervision | 2 | 60L | |
| CLPU, cold load pickup | 1 | | |
| SOTF, switch onto fault | 1 | | PSOF |
| BW, breaker wear | 2 | | |
| Non volatile event recorder up to 120 s with 32 samples per cycles | | | |
| THD supervision | | | |

## Connections (Example)

# Functional Overview in ANSI / IEEE C37.2 Form

## Typical Configuration

Winding Side 1    Winding Side 2

RTD

**MRDT4**

| W1 74TC | | | | W2 74TC |

| W1 50N / 50Ns | W1 50G | W2 50G | W2 50N / 50Ns | 86 |

| W1 51N / 51Ns | W1 51G | W2 51G | W2 51N / 51Ns | |

| | W1 87N | W2 87N | | LGC (Programmable Logic) |

| W1 Inrush | MET (Metering Statistics Demand) | | W2 Inrush | |

| W1 50 | Current Max/Min/Avg | | W2 50 | |
| W1 51 | THD Current | | W2 51 | |
| | Current Phasors | | | |
| W1 46 | Sequence Currents | | W2 46 | |
| | Diff Currents | | | |
| W1 50BF | Harmonic Currents | | W2 50BF | SNTP / CLK (IRIG) |

| 49 | Recorders: | | | |
| | SER (Event) | | | |
| | DDR (Disturbance) | | | |
| Control | DFR (Fault) | | | Comm Interface(s) |
| Switchgear Wear (2 elements) | Statistic | | | |
| | Trend | | | |

W1 or W2 CLPU

W1 or W2 SOTF

87T

● Standard    ● Option

RTD — RTD (ANSI 26/38/49): requires URTD box (separate hardware)

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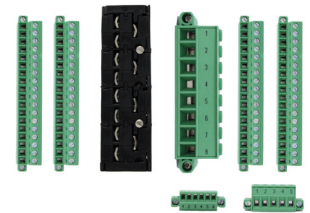
## Approvals / Standards

CE

certified regarding UL508 (Industrial Controls)

certified regarding CSA-C22.2 No. 14 (Industrial Controls)

certified by EAC (Eurasian Conformity)

KEMA Labs — Type tested and certified by KEMA Laboratories in accordance with the complete type test requirements of IEC 60255-1:2009.

Fulfills the requirements of the German grid code standard VDE-AR-N 4110 (2018-11)

Complies with "Engineering Recommendation G99 Issue 1 Amendment 6 - March 2020".

Complies with IEEE 1547-2003.

Amended by IEEE 1547a-2014.

Complies with ANSI C37.90-2005.

# Order Form MRDT4

| Non-Directional Transformer Differential Protection | | | | MRDT4 | -2 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Version 2 with USB, enhanced communication and user options | | | | | | | | | |

| Digital Inputs | Binary output relays | Housing | Large display | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 8 | 7 | B2 | - | | | | | A | |
| 16 | 13 | B2 | - | | | | | D | |

**Hardware variants**

| | |
|---|---|
| Phase Current 5 A/1 A, W1/W2 Ground Current 5 A/1 A | 0 |
| Phase Current 5 A/1 A, W1 Sen. Gr. Curr. 5 A/1 A, W2 Gr. Curr. 5 A/1 A | 1 |
| Phase Current 5 A/1 A, W1 Gr. Curr. 5 A/1 A, W2 Sen. Gr. Curr. 5 A/1 A | 2 |
| Phase Current 5 A/1 A, W1/W2 Sen. Gr. Curr. 5 A/1 A | 3 |

**Housing and mounting**

| | |
|---|---|
| Housing suitable for door mounting | A |
| Housing suitable for 19" rack mounting | B |

**Communication protocol**

| | |
|---|---|
| Without protocol | A* |
| Modbus RTU, IEC60870-5-103, DNP3.0 RTU \| RS485/terminals | B* |
| Modbus TCP, DNP3.0 TCP/UDP, IEC 60870-5-104 \| Ethernet 100 MB/RJ45 | C* |
| Profibus-DP \| optic fiber/ST-connector | D* |
| Profibus-DP \| RS485/D-SUB | E* |
| Modbus RTU, IEC60870-5-103, DNP3.0 RTU \| optic fiber/ST-connector | F* |
| Modbus RTU, IEC60870-5-103, DNP3.0 RTU \| RS485/D-SUB | G* |
| IEC61850, Modbus TCP, DNP3.0 TCP/UDP, IEC 60870-5-104 \| Ethernet 100MB/RJ45 | H* |
| IEC60870-5-103, Modbus RTU, DNP3.0 RTU \| RS485/terminals<br>Modbus TCP, DNP3.0 TCP/UDP, IEC60870-5-104 \| Ethernet 100 MB/RJ45 | I* |
| IEC61850, Mod. TCP, DNP3.0 TCP/UDP, IEC 60870-5-104 \| Opt. Eth. 100MB/LC duplex conn. | K* |
| Modbus TCP, DNP3.0 TCP/UDP, IEC 60870-5-104 \| Opt. Ethernet 100MB/LC duplex connector | L* |
| IEC60870-5-103, Modbus RTU, DNP3.0 RTU \| RS485/terminals<br>IEC61850, Modbus TCP, DNP3.0 TCP/UDP, IEC60870-5-104 \| Ethernet 100 MB/RJ45 | T* |

**Harsh Environment Option**

| | |
|---|---|
| None | A |
| Conformal Coating | B |

**Available menu languages (in every device)**
English / German / Spanish / Russian / Polish / Portuguese / French / Romanian

\* *Within every communication option only one communication protocol is usable.*

*Smart view can be used in parallel via the Ethernet interface (RJ45).*

*The parameterizing- and disturbance analyzing software Smart view can be used without extra costs.*

| | |
|---|---|
| **Current inputs** | 4 (1 A and 5 A) with automatic CT Disconnect |
| **Digital Inputs** | Switching thresholds adjustable via software |
| **Power supply** | Wide range power supply |
| | 24 $V_{DC}$ – 270 $V_{DC}$ / 48 $V_{AC}$ – 230 $V_{AC}$ (−20/+10%) |
| **Terminals** | All terminals plug type |
| **Type of enclosure** | IP54 |
| **Dimensions of housing** | 19" flush mounting:    212.7 mm × 173 mm × 208 mm |
| **(W x H x D)** | 8.374 in. × 6.811 in. × 8.189 in. |
| | Door mounting:    212.7 mm × 183 mm × 208 mm |
| | 8.374 in. × 7.205 in. × 8.189 in. |
| **Weight (max. components)** | approx. 4 kg |

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http://www.SEGelectronics.de

**Technical Documents:**

https://docs.SEGelectronics.de/mrdt4-2