APPLICATION
The MRA4 is a high precision and reliable protection and control relay. The intuitive setting concept with plausibility test enables reliable and time optimized configuration of the extensive protection function to a variety of applications such as incoming or outgoing feeder protection, network protection and generator protection. The implemented switchgear management guaranties an efficient and safe control and supervision. The device is a bench mark in flexibility and usability and offers various communication options. The hardware is designed for all nominal values in combination with protection and control functionality. The parameterizing and analyzing software Smart view SE is usable for each HighPROTEC device and free of charge.

COMPREHENSIVE PROTECTION PACKAGE
- Six elements phase overcurrent protection directional and non-directional (ANSI/IEC/51C/51V)
- Four elements earth fault protection (directional or non-directional) (multi-polarising)
- Two elements unbalanced load protection
- Voltage protection
  - six elements selectable: V<, V>, V<(t)
- Six elements unbalanced voltage supervision
- Flexible Fourth Voltage measuring input
  - 2 elements VE> or VX (for synch-check)
- Synchro-check options
  - Generator-to-System or System-to-System
- Each of the six elements frequency protection can be used as:
  - f<, f>, ROCOF, vector surge...
- Six elements power protection
  - each can be used as:
    - P>, P<, Pr, Q>, Q<, Qr, S>, S<
- Two elements power factor (PF)

POWER QUALITY
- THD protection

DEMAND MANAGEMENT/PEAK VALUES
- Peak values of current and power, average current and energy demand

INTERCONNECTION PACKAGE
The comprehensive interconnection package is summarized within one menu:
- Non-discriminating active power direction depending load shedding
- FRT (LVRT): Settable FRT-Profiles, optional AR coordinated
- QV-Protection: Undervoltage-Reactive Power protection
- Automatic Reconnection
- Considerably frequency protection package: Six elements configurable as f<, f>, df/dt (ROCOF), Vector Surge
- CB-Intertripping
- Synch Check (Generator to mains, mains-to-mains), options e.g. to switch onto dead bus

SLIDING-MEAN-SQUARE SUPERVISION
- Adjustable (VDE-AR 4105)

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

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 and voltage
- Graphical display of tripping characteristics
- 7 languages selectable within the relay

COMMUNICATION OPTIONS
- IEC61850
- Profibus DP
- Modbus RTU or Modbus TCP
- IEC60870-5-103
- DNP 3.0 (RTU, TCP, UDP)

CONTROL
- 1 breaker
- Breaker wear

LOGIC
- Up to 80 logic equations for protection, control and monitoring

TIME SYNCHRONISATION
- SNTP, IRIG-B00X, Modbus, IEC60870-5-103

PC TOOLS
- Setting and analyzing software
  - Smart view for free
- Including page editor to design own pages

Footnotes:
(1) DFT, True RMS or I2 based
(2) DFT or True RMS based
### Functional Overview

#### Protective Functions

<table>
<thead>
<tr>
<th>Elements</th>
<th>ANSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>50P, 51P, 67P</td>
<td></td>
</tr>
<tr>
<td>51C</td>
<td></td>
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<tr>
<td>51V</td>
<td></td>
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<tr>
<td>51Q</td>
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</tr>
</tbody>
</table>

I, time overcurrent and short circuit protection, all elements can be configured for directional or non-directional supervision. Multiple reset options (instantaneous, definite time, reset characteristics according to IEC and ANSI).

- Voltage controlled overcurrent protection by means of adaptive parameters
- Voltage dependent overcurrent protection
- Negative phase sequence overcurrent protection

2>, unbalanced load protection with evaluation of the negative phase sequence currents

1B, overload protection with thermal replica and separate pick-up values for alarm and trip functions

1H2/In, inrush detection with evaluation of the 2nd harmonic

IG, earth overcurrent and short circuit protection, all elements can be configured for directional (multi-polarising) or non-directional supervision. Tremendous reset options (instantaneous, definite time, reset characteristics according to IEC and ANSI).

V<, V>, V(t)<, under- and overvoltage protection, time dependent undervoltage protection

V1, under and overvoltage in positive phase sequence system

V2, overvoltage in negative phase sequence system

Each of the six frequency protection elements can be used as: f<, fS, df, dt, ROCOF, DF/DT, vector surge, ...

VX, residual voltage protection or bus bar voltage for Synch Check

AR, automatic reclosing

ExP, External alarm and trip functions

PQS, Power protection

PF, Power factor

FRT (optional coordination with AR-feature)

Q(V) Protection (undervolt. dep. directional reactive power protection with reclosing disengaging)

UFLS (non-discriminating active power direction depending load shedding)

10-Minutes-Mean-Square-Sliding Supervision: adjustable according to VDE-AR 4105

Synch Check

#### Control and Logic

Control: Position indication, supervision time management and interlockings for 1 breaker

Logic: Up to 80 logic equations, each with 4 inputs, selectable logical gates, timers and memory function

#### Supervision Functions

<table>
<thead>
<tr>
<th>Elements</th>
<th>ANSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>50BF</td>
<td></td>
</tr>
<tr>
<td>74TC</td>
<td></td>
</tr>
<tr>
<td>60FL</td>
<td></td>
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<tr>
<td>60L</td>
<td></td>
</tr>
</tbody>
</table>

CBF, circuit breaker failure protection

TCS, trip circuit supervision

LOP, loss of potential

FF, fuse failure protection via digital input

CTS, current transformer supervision

CLPU, cold load pickup

SOTF, switch onto fault

Demand management and peak value supervision (current and power)

THD supervision

Breaker wear with programmable wear curves

Recorders: Disturbance recorder, fault recorder, event recorder, trend recorder
**FUNCTIONAL OVERVIEW IN ANSI FORM**

**APPROVALS**

- **CE** certified regarding UL508 (Industrial Controls)
- **UL** certified regarding CSA-C22.2 No. 14 (Industrial Controls)
- **EAC** certified by EAC (Eurasian Conformity)
- Type tested (and certified) regarding IEC60255-1
- **TUV** certified regarding “BDEW-Richtlinie für Erzeugungsanlagen am Mittelspannungsnetz, Ausgabe Juni 2008” (German grid code standard)
- complies with IEEE 1547-2003 amended by IEEE 1547a-2014
- complies with ANSI C37.90-2005

**CONNECTIONS (EXAMPLE)**

- **Fault recorder**
- **Event recorder**
- **Disturbance recorder**
- **Trend recorder**
- **Current and Volt:** unbalance, %THD and THD, Fund. and RMS, Max/Min/Avg, phasors and angles
- **Power:** Fund. and RMS, P, Q, S, PF
- **Metering, Statistics and Demand**
- **Inrush**
- **Current transformer**
- **Voltage transformer**
- **IRIG-B00X**
- **SnTP**
- **Switchgear Wear**
- **Programmable Logic**
- **Intertripping**
- **Operation**
- **Option**
- **Standard**

**SOTF**
- Fault recorder
- Event recorder
- Disturbance recorder
- Current and Volt: unbalance, %THD and THD, Fund. and RMS, Max/Min/Avg, phasors and angles
- Power: Fund. and RMS, P, Q, S, PF
- Metering, Statistics and Demand
- Inrush
- Current transformer
- Voltage transformer
- IRIG-B00X
- SnTP
- Switchgear Wear
- Programmable Logic
- Intertripping
- Operation
- Option
- Standard
**ORDER FORM MRA4-2**

**Directional Feeder Protection**

<table>
<thead>
<tr>
<th>Digital Inputs</th>
<th>Binary output relays</th>
<th>Housing</th>
<th>Large display</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>7</td>
<td>B2</td>
<td>-</td>
</tr>
<tr>
<td>16</td>
<td>13</td>
<td>B2</td>
<td>-</td>
</tr>
</tbody>
</table>

**Hardware variant 2**

- Phase Current 5 A/1 A, Ground Current 5 A/1 A
- Phase Current 5 A/1 A, Sensitive Ground Current 5 A/1 A

**Housing and mounting**

- Door mounting
- Door mounting 19” (flush mounting)

**Communication protocol**

- Without protocol
- Modbus RTU, IEC60870-5-103, DNP3.0 RTU | RS485/terminals
- Modbus TCP, DNP3.0 TCP/UDP | Ethernet 100 MB/RTU
- Profibus-DP | optic fiber/ST-connector
- Modbus RTU, IEC60870-5-103, DNP3.0 RTU | optic fiber/ST-connector
- Modbus RTU, IEC60870-5-103, DNP3.0 RTU | RS485/D-SUB
- IEC61850, Modbus TCP, DNP3.0 TCP/UDP | Ethernet 100 MB/RTU
- Modbus TCP, DNP3.0 TCP/UDP | Ethernet 100 MB/RTU
- Modbus TCP, DNP3.0 TCP/UDP | Optical Ethernet 100 MB/1 LC Duplex Connector
- Modbus TCP, DNP3.0 TCP/UDP | Optical Ethernet 100 MB/1 LC Duplex Connector

**Harsh Environment Option**

- None
- A
- Conformal Coating
- B

**Available menu languages (in every device)**

- Standard English/German/Spanish/Russian/Polish/Portuguese/French

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

The parameterizing- and disturbance analyzing software Smart view can be used in parallel via the Ethernet interface (RJ45).

The parameterizing- and disturbance analyzing software Smart view is included in the delivery of HighPROTEC devices.

**Current inputs**

4 (1 A and 5 A) with automatic CT Disconnect

**Voltage inputs**

4 (0–800 V)

**Digital Inputs**

Switching thresholds adjustable via software

**Power supply**

Wide range power supply

24 $V_{dc}$ - 270 $V_{dc}$ / 48 $V_{dc}$ - 230 $V_{dc}$ (-20% / +10%)

**Terminals**

All terminals plug type

**Type of enclosure**

IP54

**Dimensions of housing (W x H x D)**

- Door mounting: 212.7 mm x 183 mm x 208 mm
  8.374 in. x 7.205 in. x 8.189 in.
- 19” flush mounting: 212.7 mm x 173 mm x 208 mm
  8.374 in. x 6.811 in. x 8.189 in.

**Weight (max. components)**

approx. 4.7 kg / 10.36 lb

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