NEW FEATURES – Release 3.6
- VDE-AR-N 4110
- G99 Issue 1 Amendment 3
- Wattmetric Ground Fault Protection
- IEC 60870-5-104
- SCADApter for Retrofit
- Usability improvements
- IT Security
- Improved Frequency and ROCOF precision*

COMPREHENSIVE GENERATOR PROTECTION PACKAGE
- The phase and ground differential protection package detects electrical faults within the generator or within the generator and the step-up transformer (unit protection)
- Two elements overexcitation protection (overfluxing) e.g. for the protection of the step-up transformer during run-up (V/f)
  *i5mHz from 45-55 Hz
- Two elements underexcitation in order to detect faulty excitation
- Overload (Statot) / Thermal replica for the detection of long lasting minor overcurrents
- Six elements (voltage dependent) overcurrent protection (ANSI/IEC/S1C/S1V)
- Multiple reverse power elements for the protection of the prime mover (Pr, P, Q, S, P F ...) 
  Negative phase sequence protection
- Two elements phase distance protection
- Out of step tripping
- Power swing blocking
- 100% Stator ground fault protection (via third harmonic)
- Multi level overvoltage protection with settable reset ratio in order to protect the stator winding and the step-up transformer against inadmissible voltages
- Multi level undervoltage protection with settable reset ratio
- Wattmetric Ground Fault Protection
- Inadvertent energization detection in order to detect the inadvertent supply of the mains voltage to the generator during standstill
- Buchholz supervision via digital input
- Unbalanced voltage protection
- Multi-Password-Level
- Optional temperature supervision via external URTD-box with 12 sensors

INTERCONNECTION PACKAGE
The comprehensive interconnection package is summarized within one menu:
- 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

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

TIME SYNCHRONISATION
- SNTP, IRIG-B00X, Modbus,
  DNP 3.0, IEC60870-5-103/-104

APPLICATION
The generator differential protection relay MCDGV4 is a high precision protection for medium and high power generators. The step-up transformer can be integrated into the protection zone (unit protection/ block protection). In addition to the phase and earth differential protection, the device provides a variety of generator-specific protection functions. The “all-inclusive” package comprises also phase, earth current, voltage, frequency and power protection. In addition to that the device offers an undervoltage directional reactive power protection with reconnection function and an adjustable Fault Ride Through (FRT) with AR detection. The intuitive operating concept with plausibility checks and extensive commissioning functions such as the built-in fault simulator allows a safe and time-optimized maintenance and commissioning. The parameter setting and evaluation software Smart view SE can be used consistently across the entire family of devices.
## Functional Overview

### Protective Functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Elements</th>
<th>ANSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generator differential protection, ( I_{ds}, I_{ds} \gg )</td>
<td>2</td>
<td>87G</td>
</tr>
<tr>
<td>Generator- and step-up transformer differential protection (block/unit protection)</td>
<td></td>
<td>87GT</td>
</tr>
<tr>
<td>Restricted earth fault ( I_{ds}, I_{ds} \gg )</td>
<td>4</td>
<td>64RF / 87N</td>
</tr>
<tr>
<td>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</td>
<td>6</td>
<td>50F, 51P, 67P</td>
</tr>
<tr>
<td>ID&gt;, unbalanced load protection with evaluation of the negative phase sequence currents</td>
<td>2</td>
<td>46</td>
</tr>
<tr>
<td>Generator unbalanced</td>
<td>1</td>
<td>46G</td>
</tr>
<tr>
<td>Overload protection with thermal replica and separate pick-up values for alarm and trip functions</td>
<td>1</td>
<td>49</td>
</tr>
<tr>
<td>TH/In, inrush detection with evaluation of the 2nd harmonic</td>
<td>1</td>
<td>Inrush</td>
</tr>
<tr>
<td>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).</td>
<td>4</td>
<td>50N/G, 51N/G, 67N/G</td>
</tr>
<tr>
<td>IE, sensitive earth overcurrent- and short circuit trip, all steps directional or non-directional</td>
<td>4</td>
<td>50Ns, 51Ns, 67Ns</td>
</tr>
<tr>
<td>V&lt;, V&gt;, V(t)&lt;, under- and overvoltage protection, time dependent undervoltage protection</td>
<td>6</td>
<td>27, 59</td>
</tr>
<tr>
<td>Voltage asymmetry protection (VO2)</td>
<td>6</td>
<td>47</td>
</tr>
<tr>
<td>V1, under and overvoltage in positive phase sequence system</td>
<td>6</td>
<td>81U/O, 81R, 78</td>
</tr>
<tr>
<td>Each of the six frequency protection elements can be used as: f&lt;, f5, f6, dt, ROCOF, DF/DT, vector surge, ...</td>
<td>6</td>
<td>27TN / 27A / 59A / 59N</td>
</tr>
<tr>
<td>Phase distance (backup) protection</td>
<td>2</td>
<td>21F</td>
</tr>
<tr>
<td>Power swing blocking</td>
<td>2</td>
<td>68</td>
</tr>
<tr>
<td>Load blinder</td>
<td>4</td>
<td>78</td>
</tr>
<tr>
<td>Out of step tripping (pole-slip protection)</td>
<td>4</td>
<td>78</td>
</tr>
<tr>
<td>EXP, External alarm and trip functions</td>
<td>6</td>
<td>32, 37</td>
</tr>
<tr>
<td>PQS, Power protection</td>
<td>5</td>
<td>55</td>
</tr>
<tr>
<td>PF, Power factor</td>
<td>2</td>
<td>55</td>
</tr>
<tr>
<td>FRT (Fault Ride Through including controlled by AR-feature)</td>
<td>27 (t)</td>
<td>27 (t, AR)</td>
</tr>
<tr>
<td>Q(V) Protection (undervolt. dep. directional reactive power protection with reclosing disengaging)</td>
<td>27 (t)</td>
<td>27 (t, AR)</td>
</tr>
<tr>
<td>10-Minutes-Mean-Square-Sliding Supervision: adjustable according to VDE-AR 4105</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>Synch Check</td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>Volts / Hertz</td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>Loss of field (excitation)</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>Inadvertent energization</td>
<td></td>
<td>50/27</td>
</tr>
</tbody>
</table>

### Optional Supplemental Devices

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>URTD Box</td>
<td>RTD temperature supervision via optional RTD-Box with 12 sensors</td>
</tr>
<tr>
<td>KRT</td>
<td>Rotor earth fault protection (DIN-Rail-Mounting)</td>
</tr>
<tr>
<td>KE2DC</td>
<td>DC current - Loss of excitation, rotating diode failure detection (DIN-Rail-Mounting)</td>
</tr>
</tbody>
</table>

### Supervision Functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBF, circuit breaker failure protection</td>
<td>1</td>
</tr>
<tr>
<td>TCS, trip circuit supervision</td>
<td>1</td>
</tr>
<tr>
<td>IOP, loss of potential</td>
<td>1</td>
</tr>
<tr>
<td>FF, fuse failure protection via digital input</td>
<td>1</td>
</tr>
<tr>
<td>CT, current transformer supervision</td>
<td>1</td>
</tr>
<tr>
<td>CLPU, cold load pickup</td>
<td>1</td>
</tr>
<tr>
<td>SOFT, switch onto fault</td>
<td>1</td>
</tr>
<tr>
<td>THD supervision</td>
<td>1</td>
</tr>
<tr>
<td>Breaker wear with programmable wear curves</td>
<td></td>
</tr>
<tr>
<td>Recorder: Disturbance recorder, Fault recorder, event recorder, trend recorder</td>
<td></td>
</tr>
</tbody>
</table>

### Control and Logic

| Control: Position indication, supervision time management and interlockings for up to 6 breakers |
| Logic: Up to 80 logic equations, each with 4 inputs, selectable logical gates, timers and memory function |
**FUNCTIONAL OVERVIEW IN ANSI FORM**

**Approvals**
- **CE**
- **UL** certified regarding UL508 (Industrial Controls)
- **CSA** certified regarding CSA-C22.2 No. 14 (Industrial Controls)
- **Type tested according to IEC60255-1**
- **EAC** certified by EAC (Eurasian Conformity)
- **TUV NORD** Component certificate regarding the German grid code standard VDE-AR-N 4110 (2018-11)
- **Lloyd’s Register Type Approval Certificate**
- **Type Approval Certificate from CQC China**

**Connections (Example)**

**Connections example**

**Generator**
- **CT Ntril**
- **CT Mains**

**Power Out**

**Current and Volt:**
- Voltage: RMS, Fundamental, Max/Min, phasors and angles
- Power: Fundamental RMS, P, Q, S, PF

**Recorders:**
- SER (Event)
- DDR (Disturbance)
- DFR (Fault)
- Statistics
- Trend

**Fundamental RMS, unbalance, %THD and THD, Max/Min/Avg, phasors and angles**

**Connection example**

**X3**
- CT Mains

**X4**

Complies with “Engineering Recommendation G99 Issue 1 Amendment 3 - May 2018”.
Amended by IEEE 1547a-2014.
Complies with ANSI C37.90-2005.
**ORDER FORM MCDGV4**

**Generator Differential Protection**

Version 2 with USB, enhanced communication and user options

<table>
<thead>
<tr>
<th>Digital Inputs</th>
<th>Binary output relays</th>
<th>Analog Inputs/Outputs</th>
<th>Housing</th>
<th>Large display</th>
<th>Voltage inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>11</td>
<td>0/0</td>
<td>B2</td>
<td>X</td>
<td>0-800 V</td>
</tr>
<tr>
<td>8</td>
<td>11</td>
<td>2/2</td>
<td>B2</td>
<td>X</td>
<td>0-800 V</td>
</tr>
<tr>
<td>24</td>
<td>11</td>
<td>0/0</td>
<td>B2</td>
<td>X</td>
<td>0-300 V</td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>0/0</td>
<td>B2</td>
<td>X</td>
<td>0-300 V</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**

Housing suitable for door mounting

Housing suitable for 19" rack mounting

**Communication protocol**

Without protocol

Modbus RTU, IEC60870-5-103, DNP 3.0 RTU | RS485/terminals

Modbus TCP, DNP 3.0 TCP/UDP, IEC 60870-5-104 | Ethernet 100 MB/RJ45

Profibus-DP | optic fiber/ST-connector

Profibus-DP | RS485/D-SUB

Modbus RTU, IEC60870-5-103, DNP 3.0 RTU | optic fiber/ST-connector

Modbus TCP, DNP 3.0 TCP/UDP, IEC60870-5-104 | Ethernet 100 MB/RJ45

IEC61850, Modbus TCP, DNP 3.0 TCP/UDP, IEC 60870-5-104 | Optical Ethernet 100MB/LC duplex connector

IEC61850, Modbus TCP, DNP 3.0 TCP/UDP, IEC60870-5-104 | Ethernet 100 MB/RJ45

**Harsh Environment option**

None

Conformal Coating

**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 is included in the delivery of HighPROTEC devices.

**Current inputs**

8 (1 A and 5 A) with automatic CT Disconnect

4 (0 … 800 V, for variants “A” and “B”)

or 4 (0 … 300 V, for variants “C” and “D”)

**Voltage inputs**

Switching thresholds adjustable via software

0 … 20mA / 4 … 20mA / 0 … 10V

0 … 20mA / 4 … 20mA / 0 … 10V

**Analog Inputs (Type B)**

24 Vdc – 270 Vdc / 48 Vdc – 230 Vdc (−20/+10%)

All terminals plug type

**Power supply**

IP54

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

19" flush mounting: 212.7 mm x 173 mm x 208 mm

8.374 in. x 6.811 in. x 8.189 in.

Door mounting

212.7 mm x 183 mm x 208 mm

8.374 in. x 7.205 in. x 8.189 in.

**Weight (max. components)**

approx. 4.7 kg / 10.36 lb