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 package comprises 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.

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)
- Two elements underexcitation in order to detect faulty excitation
- Overload (Stator) / Thermal replica for the detection of long lasting minor overcurrents
- Six elements (voltage dependent) overcurrent protection (ANS/IEC/51C/51V)
- Multiple reverse power elements for the protection of the prime mover (P, P,P,Q,S,…)
- Negative phase sequence protection
- 100% Stator ground fault protection (via third harmonic)
- Multi level undervoltage protection with settable reset ratio
- 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 (Please ask for availability)

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
- Synchro check (Generator to mains, mains-to-mains), options e.g. to switch onto dead bus

RECORDERS

- Disturbance recorder, 120 s non volatile
- Fault recorder
- Event recorder
- Trend recorder: 4000 non volatile entries

COMMISSIONING SUPPORT

- Integrated fault simulator: current and voltage
- Copy and compare parameter sets
- Configuration files are convertible
- Forcing and disarming of output relays

COMMUNICATION OPTIONS

- IEC61850
- Profinbus DP
- Modbus RTU or Modbus TCP
- IEC60870-5-103

CONTROL

- of up to six switchgears
- Switchgear wear
- Exchange of single lines

LOGIC

- Up to 80 logic equations

TIME SYNCHRONISATION

- SNTP, IRIG-800X, Modbus, IEC60870-5-103
# Functional Overview

## Protective Functions

<table>
<thead>
<tr>
<th>Elements</th>
<th>ANSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generator differential protection, $Id&gt;$, $Id&gt;&gt;$</td>
<td>2</td>
</tr>
<tr>
<td>Generator- and step-up transformer differential protection (block/unit protection)</td>
<td>87GT</td>
</tr>
<tr>
<td>Restricted earth fault $IdE&gt;$, $IdE&gt;&gt;$</td>
<td>4</td>
</tr>
<tr>
<td>I, time overcurrent and short circuit protection, all stages can be configured for directional or non-directional supervision. Tremendous reset options (instantaneous, definite time, reset characteristics according to IEC and ANSI).</td>
<td>6</td>
</tr>
<tr>
<td>Voltage controlled overcurrent protection by means of adaptive parameters</td>
<td>51C</td>
</tr>
<tr>
<td>Voltage dependent overcurrent protection</td>
<td>51V</td>
</tr>
<tr>
<td>Negative phase sequence overcurrent protection</td>
<td>51Q</td>
</tr>
<tr>
<td>$I2&gt;$, unbalanced load protection with evaluation of the negative phase sequence currents</td>
<td>2</td>
</tr>
<tr>
<td>Generator unbalanced</td>
<td>1</td>
</tr>
<tr>
<td>Overload protection with thermal replica and separate pick-up values for alarm and trip functions</td>
<td>1</td>
</tr>
<tr>
<td>$H2$, In, inrush detection with evaluation of the 2nd harmonic</td>
<td>1</td>
</tr>
<tr>
<td>$IG$, earth overcurrent and short circuit protection, all stages 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>
</tr>
<tr>
<td>$IE$, sensitive earth overcurrent- and short circuit trip, all steps directional or non-directional</td>
<td>4</td>
</tr>
<tr>
<td>$Vc$, $V5$, $V(t)c$, under- and overvoltage protection, time dependent undervoltage protection</td>
<td>6</td>
</tr>
<tr>
<td>Voltage asymmetry supervision ($V012$)</td>
<td>6</td>
</tr>
<tr>
<td>Each of the six frequency protection stages can be used as: $f&lt;$, $fs$, $df$, $dt$, $ROCOF$, $DF/DT$, vector surge, ...</td>
<td>6</td>
</tr>
<tr>
<td>$VX$, residual voltage protection or bus bar voltage for synchrocheck or 100% - stator ground fault via evaluation of third harmonic</td>
<td>2</td>
</tr>
<tr>
<td>ExP, External alarm and trip functions</td>
<td>4</td>
</tr>
<tr>
<td>PQS, Power protection</td>
<td>6</td>
</tr>
<tr>
<td>PF, Power factor</td>
<td>2</td>
</tr>
<tr>
<td>FRT (Fault Ride Through including controlled by AR-feature)</td>
<td>27 (t)</td>
</tr>
<tr>
<td>Q(V) Protection (undervolt. dep. directional reactive power protection with reclosing disengaging)</td>
<td></td>
</tr>
<tr>
<td>10-Minutes-Mean-Square-Sliding Supervision: adjustable according to VDE-AR 4105</td>
<td></td>
</tr>
<tr>
<td>Synchrocheck</td>
<td>25</td>
</tr>
<tr>
<td>Volts / Hertz</td>
<td>2</td>
</tr>
<tr>
<td>Loss of field (excitation)</td>
<td>2</td>
</tr>
<tr>
<td>RTD temperature supervision via optional RTD-Box with 12 sensors</td>
<td></td>
</tr>
<tr>
<td>Inadvertent energization</td>
<td>50/27</td>
</tr>
</tbody>
</table>

## Control and Logic

**Control**: Position indication, supervision time management and interlockings for up to 6 switchgears

**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>CBF, circuit breaker failure protection</td>
<td>1</td>
</tr>
<tr>
<td>TCS, trip circuit supervision</td>
<td>1</td>
</tr>
<tr>
<td>LOP, loss of potential</td>
<td>1</td>
</tr>
<tr>
<td>FF, fuse failure protection via digital input</td>
<td>1</td>
</tr>
<tr>
<td>CTS, current transformer supervision</td>
<td>1</td>
</tr>
<tr>
<td>CLPU, cold load pickup</td>
<td>1</td>
</tr>
<tr>
<td>SOTF, switch onto fault</td>
<td>1</td>
</tr>
<tr>
<td>THD supervision</td>
<td></td>
</tr>
</tbody>
</table>

**Switchgear wear with programmable wear curves**

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

Generator
Connection example
CT Nth (W1) CT Mains (W2)

Power Out

MCDGV4

Metering, Statistics and Demand
Current and Volt: unbalance, STHD and THD, Fund. and RMS, Max/Min/Avg, phasors and angles
Power: Fund. and RMS, P, Q, S, PF

Recorders
Event
Disturbance
Fault
Statistic
Trend

APPROVALS

certified regarding UL508
(Industrial Controls)
certified regarding CSA-C22.2 No. 14
(Industrial Controls)
certified by EAC
(Eurasian Conformity)

Type tested according to IEC60255-1

CONNECTIONS

X100
X102
X103
X104

FUNCTIONAL OVERVIEW IN ANSI FORM

Generator
Connection example
CT Nth (W1) CT Mains (W2)

Power Out

MCDGV4

Metering, Statistics and Demand
Current and Volt: unbalance, STHD and THD, Fund. and RMS, Max/Min/Avg, phasors and angles
Power: Fund. and RMS, P, Q, S, PF

Recorders
Event
Disturbance
Fault
Statistic
Trend

APPROVALS

certified regarding UL508
(Industrial Controls)
certified regarding CSA-C22.2 No. 14
(Industrial Controls)
certified by EAC
(Eurasian Conformity)

Type tested according to IEC60255-1

CONNECTIONS

X100
X102
X103
X104
**ORDER FORM MCDGV4**

<table>
<thead>
<tr>
<th>Generator Differential Protection</th>
<th>MCDGV4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Digital Inputs</strong></td>
<td><strong>Binary output relays</strong></td>
</tr>
<tr>
<td>16</td>
<td>11</td>
</tr>
<tr>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>24</td>
<td>11</td>
</tr>
<tr>
<td>16</td>
<td>16</td>
</tr>
</tbody>
</table>

**Hardware variants**
- Phase current 1 A/5 A, Ground Current 1 A/5 A
- Phase current 1 A/5 A, Sensitive Ground Current 1 A/5 A

**Housing and mounting**
- Door mounting
- Door mounting 19" (flush mounting)

**Communication protocol**
- Without protocol
- Modbus RTU, IEC60870-5-103, RS485/terminals
- Modbus TCP, Ethernet 100 MB / RJ45
- Profinet DP, optic fiber
- Profinet DP, RS485/D-SUB
- Modbus RTU, IEC60870-5-103, optic fiber
- Modbus RTU, IEC60870-5-103, RS485/D-SUB
- IEC61850, Ethernet 100 MB / RJ45

**Available menu languages**
- English/German/Russian/Polish/Portuguese/French

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


With control functions for up to 6 switchgears and logic up to 80 equations.

* Please ask for availability

Current inputs: 8 (1 A and 5 A) with automatic short-circuiters
Voltage inputs: 4 (0–800 V) or 4 (0–300 V)
Digital Inputs: Switching thresholds adjustable via software
Analog Inputs (Version B): 0.20mA / 4...20mA / 0.10V
Analog Outputs (Version B): 0.20mA / 4...20mA / 0.10V
Power supply: Wide range power supply
Terminals: All terminals plug type
Type of enclosure: IP54
Dimensions of housing: 19" flush mounting: 212.7 mm x 173 mm x 208 mm
Weight (max. components): approx. 4.7 kg / 10.36 lb

© Woodward
All Rights Reserved | 07/2015