

HighPROTEC

MCDGV4 GENERATOR DIFFERENTIAL PROTECTION

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 not only phase, earth current, voltage, frequency and power protection, but also 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)
- ▶ 2 elements overexcitation protection (overfluxing) e. g. for the protection of the step-up transformer during run-up (V/f)
- ▶ 2 elements underexcitation in order to detect faulty excitation
- ▶ Overload (Stator) / Thermal replica for the detection of long lasting minor over-currents
- ▶ 6 elements (voltage dependent) over-current protection (ANSI/IEC/51C/51V)
- ▶ Multiple reverse power elements for the protection of the prime mover (Pr, P, Q, S, PF...)
- ▶ Negative phase sequence protection
- ▶ 2 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
- ▶ Optional temperature supervision via external URTD-box with 12 sensors

Interconnection Package

- ▶ FRT (LVRT): Settable FRT-Profiles, optional AR coordinated
- ▶ QV-Protection: Undervoltage-Reactive
- ▶ Power protection
- ▶ Automatic Reconnection
- ▶ Frequency protection: 6 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: 20 faults
- ▶ Event recorder: 300 events
- ▶ Trend recorder: 4000 non volatile entries

PC Tools

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

Control

- ▶ up to six breakers (or isolators/ grounding switches)
- ▶ Breaker wear

Communication Options

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



New Features - Release 3.7

- ▶ VDE-AR-N 4110; VDE-AR-N 4120
- ▶ G99 Issue 1 Amendment 6
- ▶ Improved frequency and ROCOF precision
- ▶ 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).

Commissioning Support

- ▶ 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

Cyber Security

- ▶ Menu for the activation of BDEW-White-paper-compliant 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)
- ▶ Multi-Password-Level

Logic

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

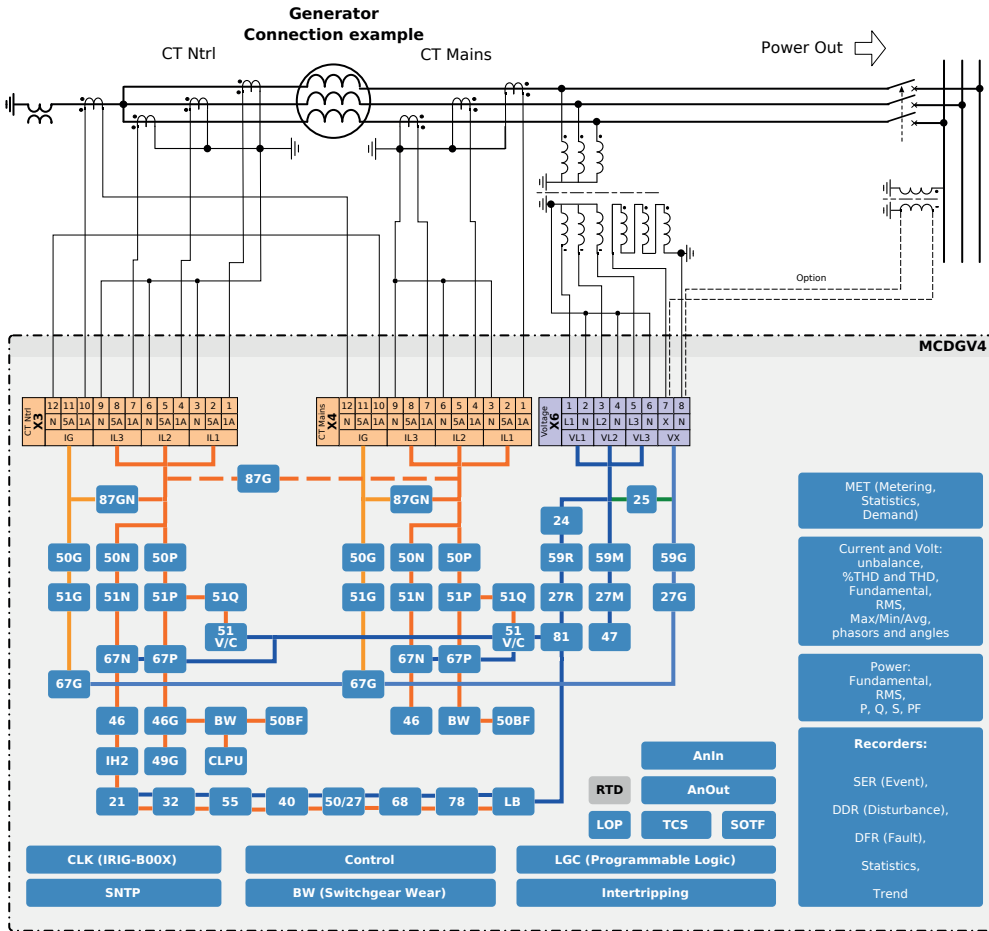
Time Synchronisation

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

Functional Overview

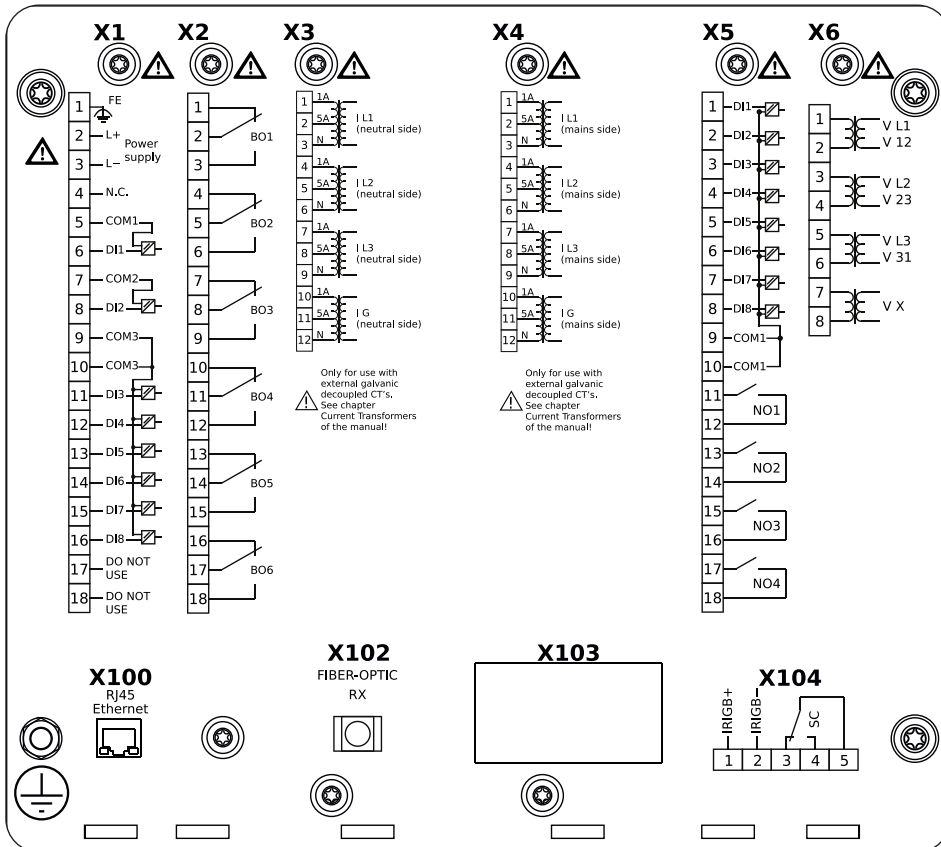
Protective Functions		ANSI	IEC 61850
Generator differential protection, Id>, Id>>	2	87G	PDIF
Generator- and step-up transformer differential protection (block/unit protection)		87GT	PDIF
Restricted earth fault IdG>, IdG>>	4	64REF / 87N	PDIF
I, time overcurrent and short circuit protection, all elements 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	6	50P, 51P, 67P 51C 51V 51Q	PTOC
I2>, unbalanced load protection with evaluation of the negative phase sequence currents	2	46	PTOC
Generator unbalanced	1	46G	PTOC
Overload protection with thermal replica and separate pick-up values for alarm and trip functions	1	49	PTTR
IH2/In, inrush detection with evaluation of the 2nd harmonic	1	Inrush	PHAR
IG, earth overcurrent and short circuit protection, all elements can be configured for directional (multi-polarising) or non-directional supervision. Various reset options (instantaneous, definite time, reset characteristics according to IEC and ANSI).	4	50N/G, 51N/G, 67N/G	PTOC
IE, sensitive earth overcurrent- and short circuit trip, all steps directional or non-directional	4	50Ns, 51Ns, 67Ns	PTOC
V<, V>, V(t)<, under- and overvoltage protection, time dependent undervoltage protection	6	27, 59	PTOV, PTUV
Voltage asymmetry supervision (V012) V1, under and overvoltage in positive phase sequence system V2, overvoltage in negative phase sequence system	6	47	PTOV, PTUV
Each of the six frequency protection elements can be used as: f< fs, df, dt, ROCOF, DF/DT, vector surge, ...	6	81U/O, 81R, 78	PTOF, PTUF, PFRC, PPAM
VX, residual voltage protection or bus bar voltage for Synch Check or 100% - stator ground fault via evaluation of third harmonic	2	27TN / 27A / 59A / 59N	PTOV, PTUV
Phase distance (backup) protection	2	21P	PDIS
Power swing blocking		68	PPAM
Load blinder			
Out of step tripping (pole-slip protection)		78	PPAM
ExP, External alarm and trip functions	4		GAPC
PQS, Power protection	6	32, 37	PDOP, PDUP
PF, Power factor	2	55	PUPF
FRT (Fault Ride Through including controlled by AR-feature)	27 (t)	27 (t, AR)	
Q(V) Protection (undervolt. dep. directional reactive power protection with reclosing disengaging)			PTUV
10-Minutes-Mean-Square-Sliding Supervision: adjustable according to VDE-AR 4105			
Synchrocheck		25	RSYN
Volts / Hertz	2	24	PVPH
Loss of field (excitation)	2	40	PDUP
Inadvertent energization		50/27	PIOC
Optional Supplemental Devices			
URTD box: RTD temperature supervision via optional RTD-Box with 12 sensors		26	PTTR
XR1: Rotor earth fault protection (DIN-Rail-Mounting)		64R	
Control and Logic			
Control: Position indication, supervision time management and interlockings for up to 6 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	1	50BF, 62BF	RBRF
TCS, trip circuit supervision	1	74TC	SCBR
LOP, loss of potential	1	60FL	
FF, fuse failure protection via digital input	1	60FL	
CTS, current transformer supervision	1	60L	
CLPU, cold load pickup	1		
SOTF, switch onto fault	1		PSOF
THD supervision			
Breaker wear with programmable wear curves			
Recorders: Disturbance recorder, fault recorder, event recorder, trend recorder			RDRE

Functional Overview in ANSI / IEEE C37.2 Form



● Standard ● Option ● RTD (ANSI 26/38/49): requires URTD box (separate hardware)

Connections (Example)



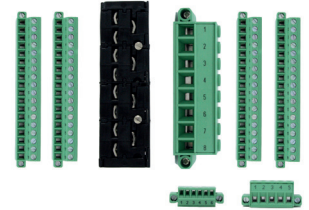
19 " Variants Available!

See Order Form on page 4, housing type "rack mounting"



<https://docs.SEGelectronics.de/hpt-2>

Terminals Available Separately!



Order codes HPTTERMKIT-1 ... -5 For MCDGV4-2A/B: HPTTERMKIT-5 For MCDGV4-2C/D: HPTTERMKIT-4 The terminal kits allow for making all required wirings in advance, thus speeding up the installation and commissioning work.

Approvals / Standards



certified regarding UL508 (Industrial Controls)

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

certified by EAC (Eurasian Conformity)



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



Component certificate regarding the German grid code standard VDE-AR-N 4110 (2018-11) Component certificate regarding the German grid code standard VDE-AR-N 4120 (2018-11)

Complies with G99 Issue 1 Am. 6. Complies with IEEE 1547-2003. Amended by IEEE 1547a-2014. Complies with ANSI C37.90-2005.

PROTECTION MADE SIMPLE.

Order Form MCDGV4

Generator Differential Protection

MCDGV4 -2

Version 2 with USB, enhanced communication and user options

Analog In Analog Out	Digital Inputs	Binary output relays	Voltage inputs	Housing	Large display	
0/0	16	11	0-800 V	B2	X	A
2/2	8	11	0-800 V	B2	X	B
0/0	24	11	0-300 V	B2	X	C
0/0	16	16	0-300 V	B2	X	D

Hardware variant 2

Phase Current 5 A/1 A, Ground Current 5 A/1 A	0
Phase Current 5 A/1 A, Sensitive Ground Current 5 A/1 A	1

Housing and mounting

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

Communication protocol

Without protocol	A*
Modbus RTU, IEC 60870-5-103, DNP 3.0 RTU RS485/terminals	B*
Modbus TCP, DNP 3.0 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, IEC 60870-5-103, DNP 3.0 RTU optic fiber/ST-connector	F*
Modbus RTU, IEC 60870-5-103, DNP 3.0 RTU RS485/D-SUB	G*
IEC 61850, Modbus TCP, DNP 3.0 TCP/UDP, IEC 60870-5-104 Ethernet 100MB/RJ45	H*
IEC 60870-5-103, Modbus RTU, DNP 3.0 RTU RS485/terminals	I*
Modbus TCP, DNP 3.0 TCP/UDP, IEC 60870-5-104 Ethernet 100 MB/RJ45	J*
IEC 61850, Modbus TCP, DNP 3.0 TCP/UDP, IEC 60870-5-104 Optical Ethernet 100MB/LC duplex connector	K*
Modbus TCP, DNP 3.0 TCP/UDP, IEC 60870-5-104 Optical Ethernet 100MB/LC duplex connector	L*
IEC 60870-5-103, Modbus RTU, DNP 3.0 RTU RS485/terminals	M*
IEC 61850, Modbus TCP, DNP 3.0 TCP/UDP, IEC 60870-5-104 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
Voltage inputs	4 (0 ... 800 V, for variants MCDGV4-2 A and MCDGV4-2 B) or 4 (0 ... 300 V, for variants MCDGV4-2 C and MCDGV4-2 D)
Digital inputs	Switching thresholds adjustable via software
Analog inputs (Variant B)	0 ... 20mA / 4 ... 20mA / 0 ... 10V
Analog outputs (Variant B)	0 ... 20mA / 4 ... 20mA / 0 ... 10V
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 (Front)	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

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<http://www.SEGelectronics.de>

Technical Documents:

<https://docs.SEGelectronics.de/mcdgv4-2>



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