

KWG synchronous generators Size 132,160, 200 and 250



Operating manual –English-
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About this manual

This manual covers generators of series KWG-.... brushless synchronous generators of sizes 132, 160, 200 and 250. For the technical and type specific data please refer to the relevant type-related detailed data sheets. The notes on safety and risks as well as the general data shall be applicable to all KWG generators and shall be complied with in any case for reasons of liability.

No part of this operating manual shall be copied, published or disclosed – irrespective of the type and means – unless the express consent of KW-Generator GmbH & Co. KG has been obtained.

Modifications after printing have not been taken into account. Right to technical modifications reserved. Status of manual: V21. (page 8- Table of resistors). Oct.2014.

Norms and regulations

The KWG generator systems are in compliance with the regulations according to DIN EN 60034 / VDE0530 and are in conformity with RoHS.

Application and use of the generators

The generators are components of machines and system intended for industrial and professional use and thus cannot be treated as retail goods.

The generators shall be used only as defined on the nameplate, the type specific data sheet or after specific release. Primarily this refers to significant data such as rated speed, speed range, voltage, output and current as well as the class of protection. The generator outputs shall be protected by appropriate safeguards against over-current and short-circuit and shall not be connected to other power distributions or power generating systems unless the express written approval has been obtained. Single-bearing generators are intended exclusively for attachment to a combustion engine which is in compliance with the applicable, norms, directions and regulations.

Two-bearing generators are typically driven via belts, clutches or directly by the drive unit. It shall be mounted on an absolutely level and suitable surface. When using a belt drive we recommend mounting the generator, for instance, on rails, to keep it mobile. The pull of the belt is to be set accordingly. The maximum radial forced as described below shall not be exceeded. Please do not hesitate to contact KWG-Generator GmbH & Co. KG for assistance in the design of the drive.

Unless indicated otherwise, the generators and attached components are of class of protection IP54 and may be operated and stored in the open. Cleaning by means of high-pressure cleaners is not allowed. The place of installation and use should be selected such that supply of fresh air to the inlet opening of the ventilator hood is as

short as possible. The rated output data of the generators apply to intake and generator ambient temperatures of $< 40^{\circ}\text{C}$, as well as to installation heights of max. 1000 m. If the temperatures and/or the installation heights are exceeded, the output de-rating shall be applicable as described in the following. Operation at temperatures $> 60^{\circ}\text{C}$ shall be allowed only after specific acceptance and release.

The generators shall be used only for the applications specified here and only in accordance with this operating manual. Any other use is deemed misuse and thus not allowed. Improper or unauthorized use of the generators or individual components is not allowed. No liability will be accepted by KW-Generator GmbH und Co. KG in this case.

Warranty

Unless specific warranty regulations are defined in writing for type-related applications and customers, we will grant a warranty according to the general European regulations.

General Safety Instructions



DANGER

Electric machines include dangerous components which are either live or rotate during machine operation.

Thus:

- Improper use,
 - Demounting protective lining, disconnecting safeguards,
 - Poor inspection and maintenance,
- may cause serious personal and property damage.**



The safety officer shall convince himself and ensure that transport, installation, commissioning, operation, inspection, maintenance and repair of the machine are carried out by qualified personnel with the following qualifications:

- Specific technical qualification and experience
- Knowledge of technical norms and applicable laws
- Knowledge of the general national and local system-specific safety regulations
- Ability to detect and avoid dangerous situations.

Work at electric machines shall not be carried out without the approval given by the safety officer; this is applicable to vertical machines where all poles are separated from the mains and the machine is secured against re-connection (including auxiliary circuits).

The generator shall not be operated in environments subject to explosion hazards. The relevant regulations shall be followed!



The generator and its components can be very hot during and after operation. Danger of burning!

Earthing of the neutral conductor of the generator (N, neutral) cancels the protective measure “protective disconnection” and should thus be avoided. If the neutral conductor N shall be earthed, this shall be carried out only by a qualified specialized electrician with due consideration given to the relevant regulations. Efficiency of the electrical protective measure shall be verified by appropriate measurements. Prior to connecting devices at the generator make sure that the devices are switched off. Risk of accident! Uncontrolled starting devices may endanger or injure persons and cause damage or become damaged. Keep children and animals away from the generator during and after the operation of the latter. Arrange for the appropriate precautions. Danger to life due to electric shock, risk of injury and burns!

TRANSPORT AND STORAGE



The generator is delivered ready for installation, screwed on a pallet and sealed by protective foil against water and pollution. We recommend subjecting it to a careful inspection for damage on arrival at the destination. Visible damage, if any, shall be reported directly to the forwarder and KWG. For lifting and moving the generator use the eyelets provided for this purpose. The eyelets at the generator are suitable only to lift the generator. They shall not be used for lifting the whole unit. In addition make sure that suitable lifting tackles are available for the weight of the generator and that all safety precautions have been arranged for transport. In the event that the generator is not commissioned immediately, store it at a protected clean, dry and vibration-free place.

The ball bearings need not be maintained during the period of storage; periodical turning the shaft will prevent corrosion and hardening of the grease.

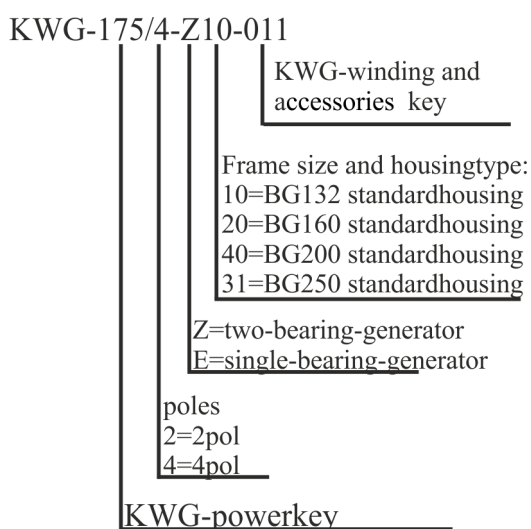
Weight (mass):	BG 132 approx. 35 - 105 kg BG160 approx 130 - 210kg BG200 approx 230 - 270kg BG250 approx 300 – 500 kg
Admissible temperatures:	Transport -25 °C up to +60 °C Storage -20 °C up to +50 °C
Admissible relative humidity:	Transport 95 %, non-condensing Storage 95 %, non-condensing

Type code and serial number of generator

Each KWG generator is provided with a unique serial number and a clear type designation. Both are provided on the nameplate. Provide both numbers for queries, re-orders, required spare parts and extended data.

The serial number can be as follows: **KWG2565**

The type number is structured as follows:



design examples of generators

The most common designs are given in the following.

Symbol	Construction type	Explanation
	IM B3 (B3)	Two-bearing design with feet below and one cylindrical shaft end
	IM B34 (B3/B14)	Two-bearing design with feet below and flange connection at A shield and one cylindrical shaft end
	IM 1202	Single-bearing design with SAE clutch disk
	SAE J609	Single-bearing design with conical shaft

Overview of protection classes

Protection against accidental contact and foreign bodies

1. Ident number	Designation - explanation
0	Not protected
1	Protected against solid foreign bodies with diameter 50mm and larger: The object probe (ball 50 mm) shall not penetrate fully
2	Protected against solid foreign bodies with diameter 0.49in and larger: The object probe (ball 12.5 mm) shall not penetrate fully Note: Typically the ventilation slots in a PC power pack housing...
3	Protected against solid foreign bodies with a diameter of 2.5 mm: The object probe (ball 2.5 mm) shall not penetrate
4	Protected against solid foreign bodies 1 mm and larger: The object probe (ball 1 mm) shall not penetrate
5	Protected from dust: Penetration of dust cannot be prevented fully; but the amount of penetrating dust shall not affect the operation of the device or safety.
6	Dust-proof: No dust penetrates at an under-pressure of 20 mbar in the housing

Protection from water

2. Ident number	Designation - explanation
0	No protection
1	Protected from dripping water: Vertically falling drips shall not have adverse effects
2	Protected from dripping water if the housing is inclined up to 15°: Vertically falling drips shall not have adverse effects if the housing is inclined up to 15° at both sides of the vertical
3	Protected from spray water: Water sprayed at an angle of max. 60° at both sides of the vertical shall not have adverse effects
4	Protected from splashing water: Water splashing against the housing from any direction shall not have adverse effects
5	Protected from jet water: Water jets against the housing from any direction shall not have adverse effects Note: Corresponds to approx. 12.5 liters/min (garden hose) Test period approx. 5 minutes. (Subject to correction)
6	Protected from strong jet water: Strong water jets against the housing from any direction shall not have adverse effects
7	Protected against the effects of temporary submersion in water: Water shall not penetrate in such amounts that adverse effects are caused if the housing is submersed in water under standardized pressure and time conditions
8	Protected from the effects of permanent submersion in water: Water shall not penetrate in such amounts that adverse effects are caused if the housing is submersed permanently in water under pressure and time conditions as agreed between manufacturer and owner. However, the conditions must be more stringent than for basic index 7

General structure

The generators consist of a main revolving-field machine with salient pole rotor and a stationary filed exciter to transfer the exciter output. A rotating rectifier set mounted at the exciter magnet wheel is used to transform the current coming from the exciter magnet wheel. The housing consists of the stator, the bearing shields, the extrusion housing and the extrusion feet as well as a hood to cover the fan impeller at the B end. The terminal box/cable hose can be mounted at 45°. Functional screwing and fastening ducts are provided at the outer side of the housing.



ATTENTION: The screwing and fastening ducts are provided only for the installation of the generator feet, the bearing shields and the KWG accessories. The ducts shall not be used for other attachment parts unless the written release has been obtained. The encapsulated generator controller is arranged in the cover of the terminal box, however, can also be mounted as external component.

Brief technical characteristics

The general data of the KWG generators are given in the following.

They shall be applicable unless other data are specified in the type-specific data sheet.

Output range, total 5 to 100 kVA related to the 50 Hz design;

Speed from 1500 (range up to 3500) and 3000 (range up to 4500) min^{-1} (4/2 poles);

direction of rotation: Two-bearing design anti-clockwise/clockwise rotation; single-bearing design clockwise rotation only,

Voltages: Preferred values 115, 230, 400V related to 50 Hz;

Frequency: Standard values 50 and 60 Hz.

Any other voltages and frequencies shall be agreed upon;

Power factor: $\cos \varphi = 0,8 - 1,0$,

Efficiency of 3-phase windings: approx. 90% at a load of 80%

Efficiency of 1-phase windings: approx. 85% at a load of 75%

Coolant temperature: 40 °C; with output reduction usable up to 60 °C;

System of protection: IP 54, higher types of protection on agreement;

Thermal class: F/H class;

Admissible relative humidity:	Transport 95 %, non-condensing Storage 95 %, non-condensing operating permanent 85% at 25°C operating short time 100% at max. 35°C
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Resistance of standard alternators 3 phase (1 phase)					
	Main winding Stator L1-N (Phase-N) (Ohm)	Main winding Stator L1-L2 (Phase- phase) (Ohm)	Main winding Rotor 2F1-2F2 (Ohm)	Exciter winding Rotor (Phase-phase) (Ohm)	Exciter winding Stator F1-F2 (Ohm)
KWG-090/2-x10-xxx	0,97	1,94	7,2	1,35	28
KWG-110/2-x10-xxx	0,69 (0,171)	1,39 (0,332)	7,65	1,35	28
KWG-145/2-x10-xxx	0,47	0,94	8,82	1,35	28
KWG-190/2-x10-xxx	0,22	0,57	10,07	1,35	28
KWG-230/2-x10-xxx	0,16	0,32	11,75	1,9	14
KWG-300/2-x10-xxx	0,11	0,22	14,20	1,9	14
KWG-175/4-x10-xxx	0,49	1,0	8,3	1,72	14
KWG-240/4-x10-xxx	0,09	0,3	10,76	1,65	14
KWG-180/2-x20-xxx	0,2	0,24	7,62	0,35	10
KWG-250/2-x20-xxx	0,08	0,15	7,55	0,3	10
KWG-360/2-x20-xxx	0,42	0,82	8,87	0,40	10
KWG-200/4-x20-xxx	0,16	0,31	1,70	0,3	10
KWG-270/4-x20-xxx	0,10	0,20	2,11	0,3	10
KWG-370/4-x20-xxx	0,077	0,15	2,69	0,32	10
KWG-350/4-x40-xxx	0,042	0,081	3,00	0,32	10
KWG-270/4-x31-xxx	0,034	0,065	3,17	0,34	14

Resistance Zu-N is approx. ½ of Resistance L1-N. Also for Zv und Zw the same.

Balance quality of rotor: Class 2.5 according to IEC 34-12 / for 2-bearing generators balanced with half fitting key

Ventilation: Self surface-ventilated by rotating fan at B end

Exciter unit: with electronic controller, self-excited,

Set value setting: ± 2.5 % of U_N , with internal trimmer;

Static voltage tolerance: $< \pm 1$ % of U_N and a speed drop of 5 % of n_N ;

Dynamic voltage variation: < 25 % at mains connection/disconnection;

Recovery time: 0.1 to 0.5 s depending on application and generator type;

Permanent short-circuit current: $> 3 \times I_N$ three-phase; $> 6 \times I_N$ single-phase for 3 to 5 s;

Load unbalance: For load unbalance capacity refer to type-specific generator data sheet;

Damper rods in rotor: serienmäßig;

Total harmonic distortion: < 5 % U-N for standard windings and $< 3\%$ U-N for increased requirements;

Short-term overload capacity: 50 % for 2 min,

Permanent overload capacity: Between rated load and 50% overload, back regulation occurs automatically depending on the ambient conditions,

Over-temperature in generator: Depending on the type, the temperature is measured by a sensor integrated in the generator and/or the temperature is determined at the resistance of the winding.

If a temperature threshold is exceeded, the output power is automatically reduced variably.

Over-temperature in generator controller: Each KWG controller measures the controller temperature by a sensor integrated in the controller. If a temperature threshold is exceeded, the exciter output is automatically reduced invariably.

Under-speeds: Possible without limitation;

Storage: Grooved ball bearing at drive end as fixed bearing and floating bearing at the fan end, permanently lubricated bearings in non-leaking C3 design, max. lifetime cycle of bearings: 20000h hours when meeting the ambient conditions, max. radial shaft load at the center of the shaft end:

BG132	2pole	max. 3500N
BG132	4pole	max. 4000N
BG160	2/4pole	max. 6500N
BG200	4pole	max. 8500N
BG250	4pole	max. 11000N

Terminal box

Typically, the terminal box is arranged at the rear of the housing and contains the connections of the stator winding and all additional terminals required for generator operation and monitoring. For customer's connections, waterproof (IP54 to IP67) cable glands are provided, the number and dimensions of which should be agreed. The top terminal box can be turned by 180°. The terminal box may include up to 4 metric or PG threads.

An M32x1.5 thread is standard at the B end. The standard design of the stator winding is sufficiently dimensioned in star connection with led out star point – with due consideration given to the load unbalance.

Sense of rotation and rotary field

For clockwise sense of rotation of the drive (clockwise seen to the shaft end) the time sequence of the phases corresponds to the terminals U-V-W according to DIN EN 60034-8. The phase sequence changes in case of reversal. Anti-clockwise sense of rotation of drive with phase sequence U-V-W is possible.

Behavior in case of under-speed

Under-speeds at the generator will not cause problems. The generator controller limits the exciter current to the maximum admissible current and, at the same time, monitors the temperature at several points. Depending on the ambient conditions, the rated output is presented yet up to 5 % under-speed. For set applications, additional output control is integrated as protection from motor torque overload.

Behavior in case of over-speed

The max. admissible speed shall not be exceeded. Otherwise the rotor may be damaged mechanically due to the high centrifugal forces. The rotor may contact the stator and destroy the generator completely. In addition, the generator controller cannot keep the specified step response times at over-speed. The result would be that the remanence voltage of the generator exceeds the rated voltage and damage the generator or the devices connected to it

INSTALLATION AND COMMISSIONING

Prior to installation

- check whether the data given on the nameplate of the generator meet the system data;
- remove the protective foils and transport guards
- check whether all screws and nuts at the generator are tightened for installation of the system,
- check whether mechanical assembly is correct,
- check whether sufficient cooling air is present and whether it is ensured that the generator does not take in hot air and no hot air is blown to the sides of the generator by other unit ventilators. In addition ensure sufficient space for inspection work (refer to chapter "Care and maintenance"). KWG offers technical assistance for the installation situation.
- for single-bearing generators, check whether the tightening torque of the clutch disk is correct and/or the cone is compressed,
- check whether the system is secured against unauthorized access
- check whether the system is provided with the necessary safeguards according to legal regulations,
- check whether the connections at the terminal board have been made properly,
- check whether the connections have not been confused and no short-circuits exist between generator and external switches,
- start the generator only if it is ensured that the system is disconnected at the main switch or other switch-off devices Risk of accident due to automatically starting machines,
- for connection of system wait until the units reached its rated speed.

In total, the lengths of all connected extension cables shall not exceed the following values:

- max. 250 m at a line cross-section of 2.5 mm²
- max. 109.36 yd at a line cross-section of 1.5 mm²

To ensure safe operation of three-phase generators, the current tapped for consumers should be distributed as uniformly to the three external wires as possible. Make sure not to exceed the maximum current indicated for each socket.

Both bearing shields are provided with a water drain hole which may be closed by a sealing plug by the manufacturer. If the water drain hole is required, check whether it is provided at the bottom side of the generator. Attention: If the generator is installed in inclined position, the water drain hole must always be at the bottom side so that any condensation water or penetrated water can flow off. If necessary, turn the bearing shields towards the housing. Wrong position of the water drain holes will cause penetration of water and failure of the generator.



Alignment

Carefully align the generator and the drive motor.

Incorrect alignment may result in vibration, bearing damage, damage to drive unit, damage to adapter unit (clutch) and unnecessary noise emission.

When using single-bearing generators check the dimensions of connection housing/connection flange and flywheel/shaft cone of drive motor In addition, check the dimensions of the flange and clutch disk/shaft cone of the generator.

Fastening torques

Please keep the following tightening torques in Nm

Application	Thread size					
	M5	M6	M8	M10	M12	M16
Terminal board and electric connections Fastening for minor loading	5	6	12	30	36	-
Fastening for normal loading (Terminal box cover,...)	5	8	14	24	39	-
Fastening for high loading (Feet, flanges, ..)	6,5	11	25	45	75	120

Insulation test

The generator is checked for insulation at high voltage during the final KWG test according to norms. Prior to starting the system and, above all, after longer periods of storage, check the generator for correct insulation at 500 V using an insulation tester. The insulation value of the winding against earth should not exceed 5 M_{ohms}. If this value is not OK, please contact the KWG after-sales service department or KWG directly.

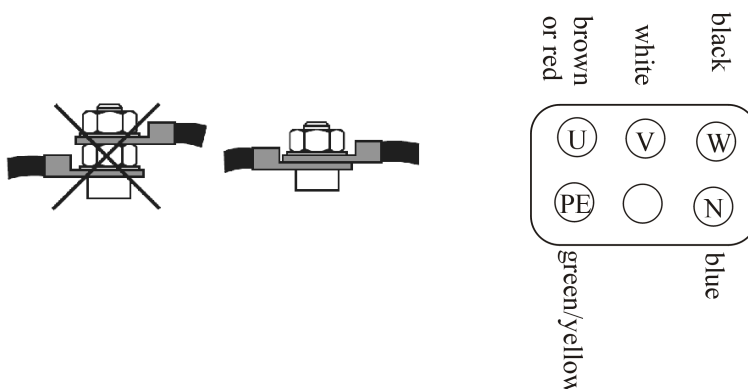
Electric connection and terminal board

Generators with connection at terminal board

Make sure to connect the cable eyelets as shown in the picture. Improper connection may result in over-heating and fire due to too high a contact resistance.

Assignment of terminal board as shown

The bolt size at the terminal boards depends on the types used



Max. current load and fastening torque at KWG-terminal board

The design of the terminal board depends to the particular type of the generator. The following table shows the max. current load of each pin of the terminal board. This must not be exceeded.

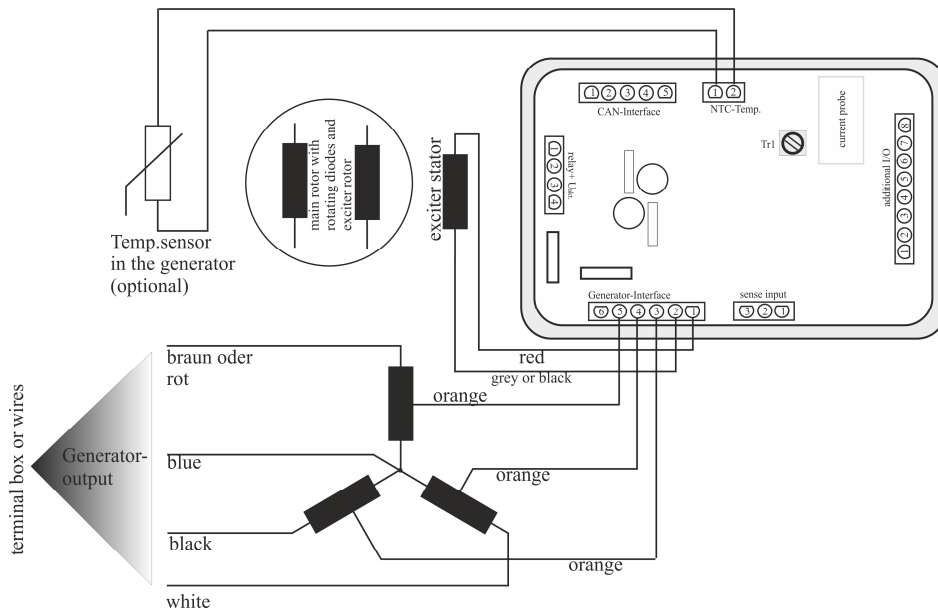
Terminal board	Max. current load (A)	Tightening torque movement (Nm)
M4	16	1,5
M5	25	3
M6	63	5
M8	100	9
M10	160	20
M12	250	25

Generators without connection to terminal board

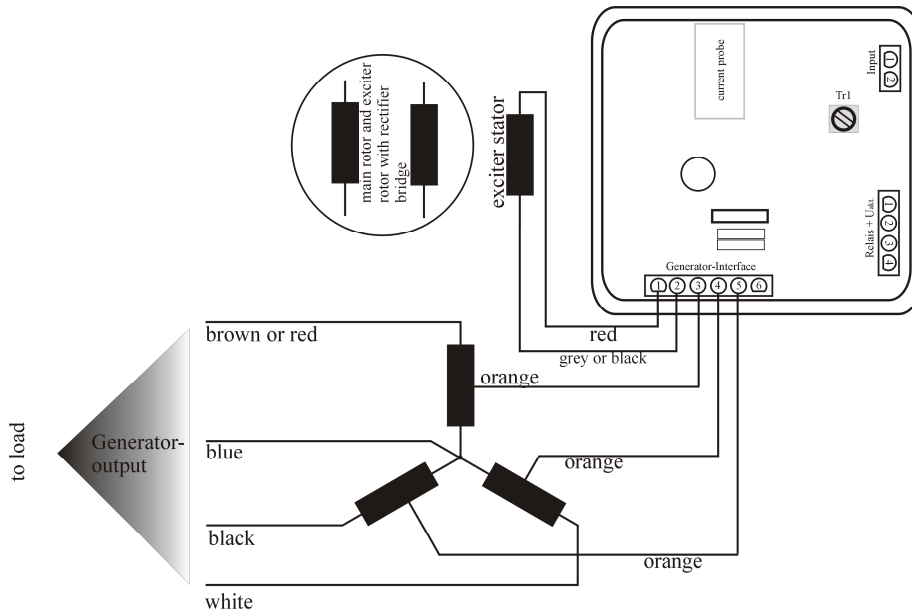
In most cases, cable design with strand in flexible corrugated conduit Separation of corrugated conduit and strand from generator is possible only in the premises of KWG connection of the system is customer-specific, but in most cases by means of cable ring lugs.

Generator controller connection

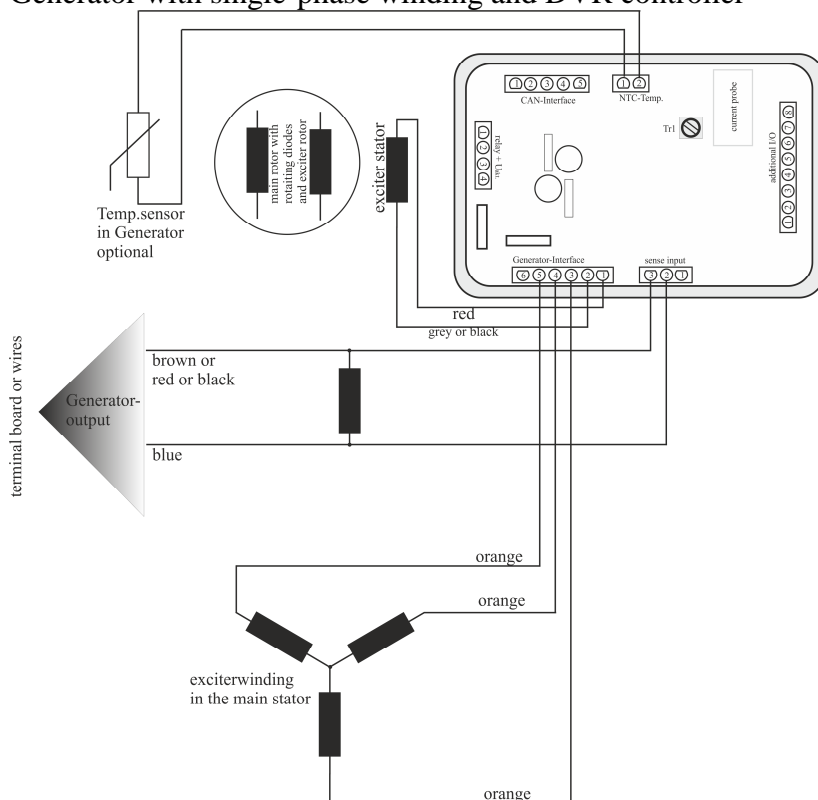
Generator with three-phase voltage winding and DVR controller



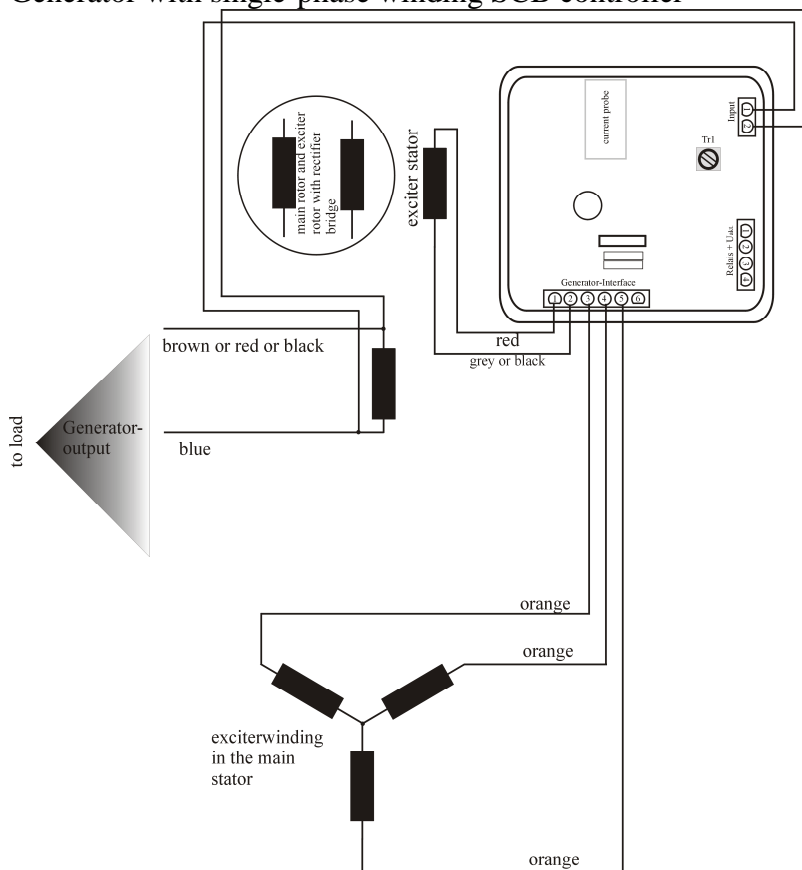
Generator with three-phase voltage winding and SCB controller



Generator with single-phase winding and DVR controller



Generator with single-phase winding SCB controller



Plug assignment of generator controller DVR controller

Generator-Interface

- 1= F1
- 2=F2
- 3=ZU
- 4=ZV
- 5=ZW
- 6=ZN (nc)

CAN-Interface

- 1= LOW
- 2=HIGH
- 3=GND
- 4=+9 to +30V
- 5=+5V

RMS

- 1= PE
- 2= Sense N
- 3= Sense U

Relais-Interface

- 1= Rel1
- 2=Rel2
- 3=Mag-
- 4=Mag+

Sensor

- 1= NTC
- 2=NTC

Additional interface I/O

- 1= +10V ref. out max.20mA
- 2= GND
- 3= analog in
- 4= nc
- 5= digital in +
- 6= digital in -
- 7= digital out -
- 8= digital out +

SCB controller

Generator-Interface

- 1= F1
- 2=F2
- 3=ZU
- 4=ZV
- 5=ZW
- 6= (ZN) nc

INPUT

- 1= Sensor wire
- 2= Sensor wire

Relais-Interface

- 1= Rel1
- 2=Rel2
- 3=Mag-
- 4=Mag+

Description of functions of generator controller

To safely operate the KWG generator use the KWG-GR-xxx generator controller. The voltage controller has been adapted to the safe and stable operation of the relevant type of generator. The system is stable in all operating positions and meets the regulations and requirements of the application. Adaptation is possible only in the premises of KWG because all parameters have been saved in digital form in the generator software.

Modes of operation such as over-load, under-speed, idling, single-phase load and loads at $\cos \phi < 1$ are detected automatically - and responded accordingly - by the generator controller.

ATTENTION! Avoid operating the generator at under-speed because this mode of operation will require more exciter output – due to the principle – and the exciter system and the whole generator will heat up unnecessarily.

The generator controller is connected with the generator by AMP-MATE-N-LOK plug connectors.

Use of potentiometers

The generator controller can compensate the output voltage in the range $\pm 2.5\%$ (type-specific) by means of TR1. Turning clockwise increases the output voltage, turning anti-clockwise reduces it. KWG generator controllers control the output voltage to averaging (AVG), but they can also control the output voltage to the real effective value (TRUE-RMS). For this reason it is important to measure the generator voltage during compensation using a TRUE-RMS / AVG measuring instrument.

Thermal protection

All KWG generators are thermally protected. The temperature is measured in the generator controller. The threshold value here is $85\text{ }^{\circ}\text{C}$. If the temperature exceeds this threshold, the output is reduced until a temperature of max. $85\text{ }^{\circ}\text{C}$ is restored.

Interface options

The KWG generator controller is provided with quite a number of I/O interfaces. In addition to the standard CAN bus in DVR, there are the following options:

- Current sensor,
- Relay output 1 as normally open or normally closed contact
- Direct possibility of voltage supply for 24 V actuator
- Analog voltage input 0-10V DC
- Digital voltage input 12/24V DC
- Digital output via opto coupler
- Interface to KWG insulation monitor

Contact KWG directly for these standard options and other specific options.

Inductive/capacitive load

The standard KWG generator systems are designed both for inductive and capacitive loads of 0.8 – 1.

For non-Ohm loads beyond these values please contact KWG for the de-rating tables.

Interface to KWG insulation monitor

In addition to the independent mode, the KWG insulation monitor offers the feature of communication with the KWG generator controller. The insulation value is put out via the CAN-BUS. At the same time, the insulation value can be processed further in the KWG generator controller and, for instance, control relays.

Operation with insulation monitor

Make sure that the insulation monitor is operational and functional. The DIN EN 61557-8 must be observed. The effectiveness of the test equipment (insulation monitor) must be checked by an internal or external test button for proper operation and compliance. Typically, the effectiveness of the test equipment (insulation monitor) must be checked every working day.

Instructions for demounting from drive unit

Prior to demounting the machine, make sure that the unit cannot be started automatically or manually. In addition, the system must be disconnected and dead.

Provide suitable lifting tackles and transport means. Have all safety precautions arranged for transport.

Disconnect the connection power cables and other cables to the generator terminal box. Prior to loosening the bolts from the machine foot, secure the generator against sliding or falling down. For demounting generators with SAE flange and disk, SAE flange and clutch as well as single-bearing generators with conical shaft please obtain the necessary instructions from KWG.

Maintenance and care

Maintenance work shall be carried out regular and in due time in order to ensure reliable operation of the generator.

In principle, all components of the generator are maintenance-free. Damage to and defects in the generator must be eliminated immediately by authorized and qualified specialists, irrespective of the maintenance intervals. Do not start the generator unless the defects have been eliminated. Repair work shall be carried out by qualified specialists only. Check the generator for undue pollution at regular intervals, clean it, if necessary.

ATTENTION! Cleaning by means of high-pressure cleaners is not allowed!

Inspections at the drive system should be carried out according to the specifications and provisions of the relevant drive/system manufacturer.

This includes also mounted protective covers.

Please follow the maintenance instructions of the drive or system manufacturer. The generator shall be opened only by the manufacturer or authorized persons. It does not contain components which can be replaced or repaired by the operator.

Disposal hints

For the proper disposal of the materials used please read the type-specific data sheet.

Troubleshooting

KWG generators are permitted only for operation with a KWG controller. The system has been tested and documented by the manufacturer. Thus please record the serial number of the generator, the type of generator, the serial number of the controller and the type of controller in case of requests to KWG. If unexpected failure occurs at the generator system, a specialized electrician may carry out the following checks in advance.

Fault	Possible cause	Remedy
Output voltage not correct	<ul style="list-style-type: none"> - Trimmer not adapted to controller - Measuring instrument used not suitable for that purpose 	Setting of trimmer and controller and measuring the output voltage using a correct measuring instrument
Output voltage varies	<ul style="list-style-type: none"> - Controller not matching the generator type - Drive system extremely instable 	Replacing the controller by a correct one Stabilizing the drive system
No output voltage	<ul style="list-style-type: none"> - Connected fuse disconnected - 3-phase short-circuit of output phases - Generator or controller defective 	Replacing and/or activating the fuse Eliminating the output short-circuit Determining - by external excitation of generator – whether generator is functioning properly Refer to KWG instruction “external excitation” If generator is OK, the controller might be defective
Generator becomes too hot	<ul style="list-style-type: none"> - Too hot generator environment - Intake air too hot - Generator intake reduced by foreign bodies - Generator is in normal operating state - Generator is overloaded - Generator is extremely polluted 	Checking ambient conditions and air intake Measuring the temperature at the generator and/or reading out the generator temperature by means of the diagnosis unit and contacting KWG Cleaning the generator
Generator too noisy	<ul style="list-style-type: none"> - Foreign bodies in fan hood - Ball bearings defective - Single-phase over-load - Drive unit not correct 	Remove foreign matter, Have ball bearing checked by a specialist Measuring the phase currents using an ammeter, eliminate overload, if necessary Replace Vee belt and/or set it to correct tensile force Checking the drive for running noise
Mechanical damage to generator	<ul style="list-style-type: none"> - Damage to generator found during maintenance work 	Please contact KWG and submit photograph, if any, showing the damage. Shut down generator until clarification in order to avoid consequential damage

Advanced Troubleshooting

Error: No or low output voltage

- 1) Is a too heavy load connected? In any case, there should be no load connected at this troubleshooting routine.
- 2) Check that the generator is rotating at rated speed. Most controllers are provided with a f/U characteristic. E.g. at a frequency less than 48 Hz, the voltage begins to decrease in a defined ramp down.
- 3) Check that the generator or the generator controller is not too hot. If necessary, cool down and check the output voltage. Should have been the cause of the increased heat, then possibly overload, single-phase overload, dirty excessive contamination of the generator inlet of the ventilation hood or not free or external influence is as exhaust or exhaust manifold near the alternator or the regulator.
- 4) If the output voltage is less than about 4 V (UN) as the generator loose the RETENTION. This can happen when the generator with motor load slowly comes to a standstill. The case that the RETENTION is lost, is very rare.
To eliminate the problem, see "external excitation".
- 5) If the output voltage is about 4V - 50V (UN), then either the regulator or the generator cause damage.
Remove the AVR from the generator. Disconnect the AVR. Are any damage visible?
With unplugged AVR check the resistance value of the windings. (See table).
- 6) The Winding tap or the exciterwinding at single phase generators Zu-Zv-Zw are connect on the 6pol.AMP connector with wires in yellow or orange.

The primary winding is placed usually on a terminal board.
Also can be compare the symmetry of the resistance values with each other.
- 7) Insulation measurement with a special measuring device (DC500V).
Warning: an electrician is needed.
- 8) Seems the generator in all the steps described above, it is to test with the machine running. Start the engine, the output voltage must be measured. To the 6-pin AMP connector red and gray wires increase slowly the voltage (red = +), observe the output voltage. For an output voltage of about 230 V (UN), an exciting current of approximately 0.4-0.7 A DC is required. The voltage required for this purpose can be calculated. FOR EXAMPLE $U = R \cdot I$, $28.5 \cdot 0.4 \text{ A} = 11.4 \text{ V}$. E.g. in most cases you can supply with a 12V or 9V battery.
- 9) If all ok after testing the generator, and yet it does not provide correct output voltage, a further test with a replacement controller is necessary.
- 10) For insiders: check the generator resistance and also the rotating diodes on the exciter rotor.