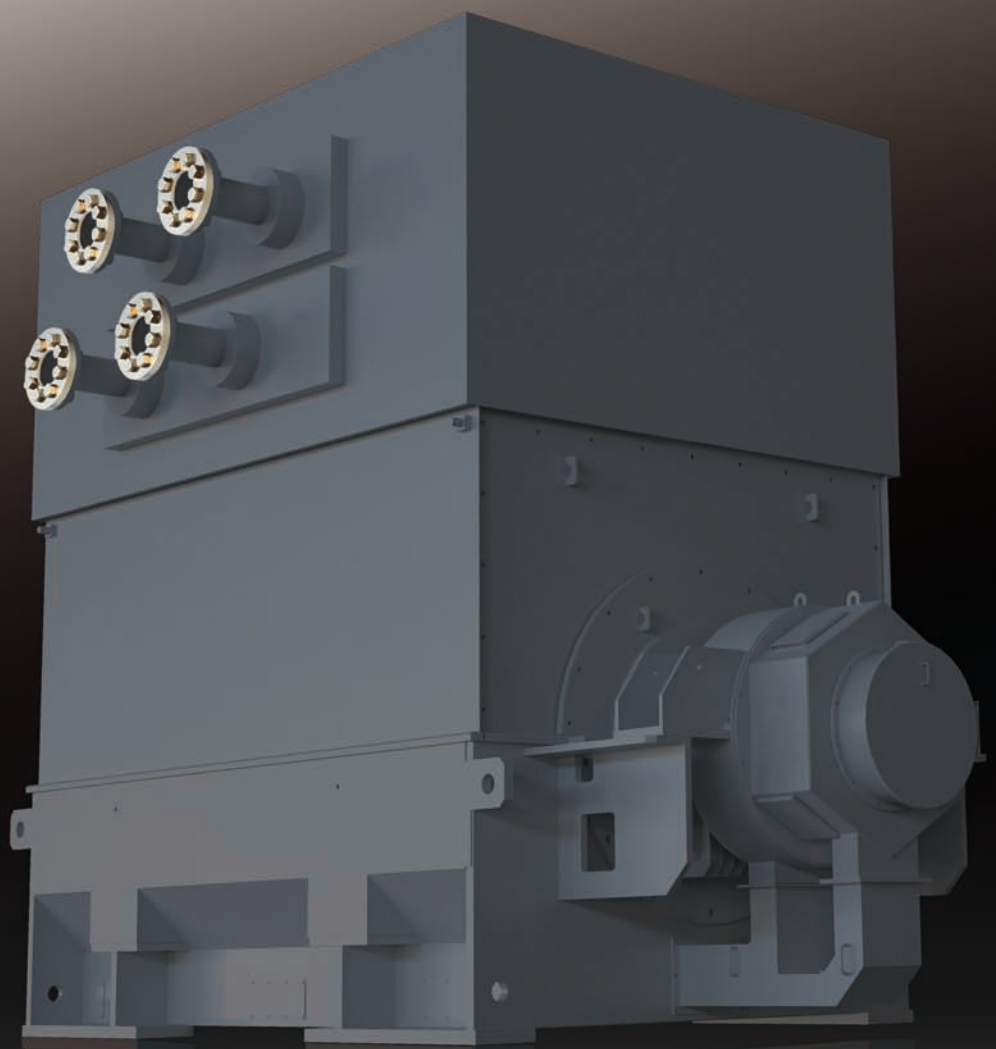
MEIDEN

Meiden 4-Pole Synchronous Generators

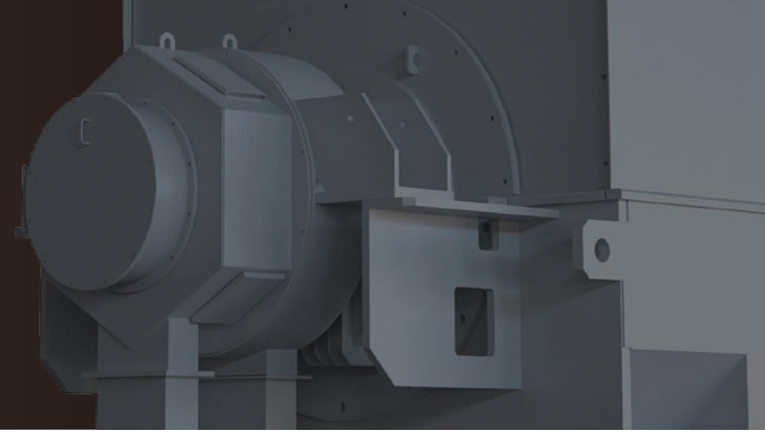


Our high-quality, high-efficiency, and compact generators respond to multiplex needs of our customers.

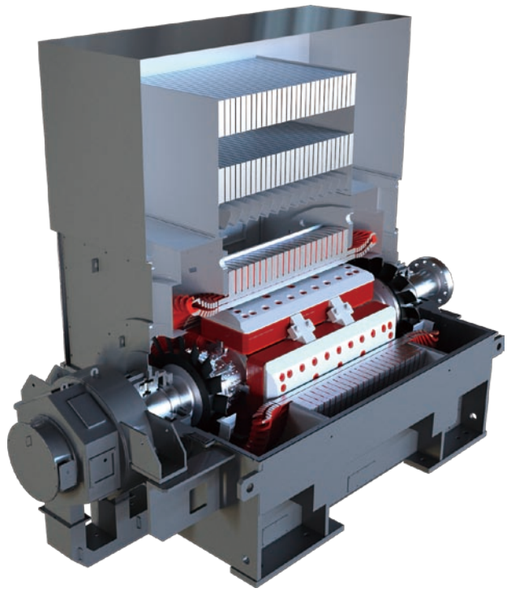
Empower for new days

Since Meidensha was founded in 1897, our generators have always been in line with social needs through our research and development (R&D) activities.
Under the motto of "**leading our customers to a prosperous future with assured safety and pleasure,**" we have manufactured high-performance 4-pole synchronous generators that contribute to society.

4 POLE



Features



- High efficiency
- Compact and light weight
- High reliability
- Flexible solutions
- Fast delivery
- Easy maintenance

Scope of manufacture

Rotation speed (min^{-1})	No. of Poles	Output (MVA) 10 20 30 40 50 60
1500/1800	4	

Standard specifications

Item		Standard	Changes in ratings
Service conditions	Ambient temperature	-15～40°C	Please specify when deviating from standard ratings
	Altitude	1000m or below	
	Relative humidity	90% max.	
Type of rating		Continuous	Please specify when deviating from standard ratings
Output		10～60MVA	
Voltage		3,3kV・6,6kV・11kV・11,5kV・13,8kV	
Power factor		80% (lagging)	
Frequency		50Hz・60Hz	
No. of poles		4	
Applicable standard		JEC2130・IEC60034	
Protection		IP44・IP54・IP55	
Cooling system		※TEWAC・CACA	
Thermal class		155(F)	
Temperature rise limit		155(F)	130(B)
Rotor type		Salient pole	
Lubrication system		Forced lubrication	
Bearing support system		Both sides	
Excitation system		Brushless excitation with PMG (permanent magnet generator)	Brushless excitation with excitation transformer

※TEWAC：Totally Enclosed Water to Air Cooled
CACA：Totally Enclosed Air to Air Cooled

Applications

Generators driven by steam or gas turbines are used by private users and power companies, both home and overseas. They are also used as a regular, emergency-purpose, or peak-cut power supply in a variety of applications such as in manufacturing plants, petrochemical plants, iron works, power plants, IT industries, and building power supplies.

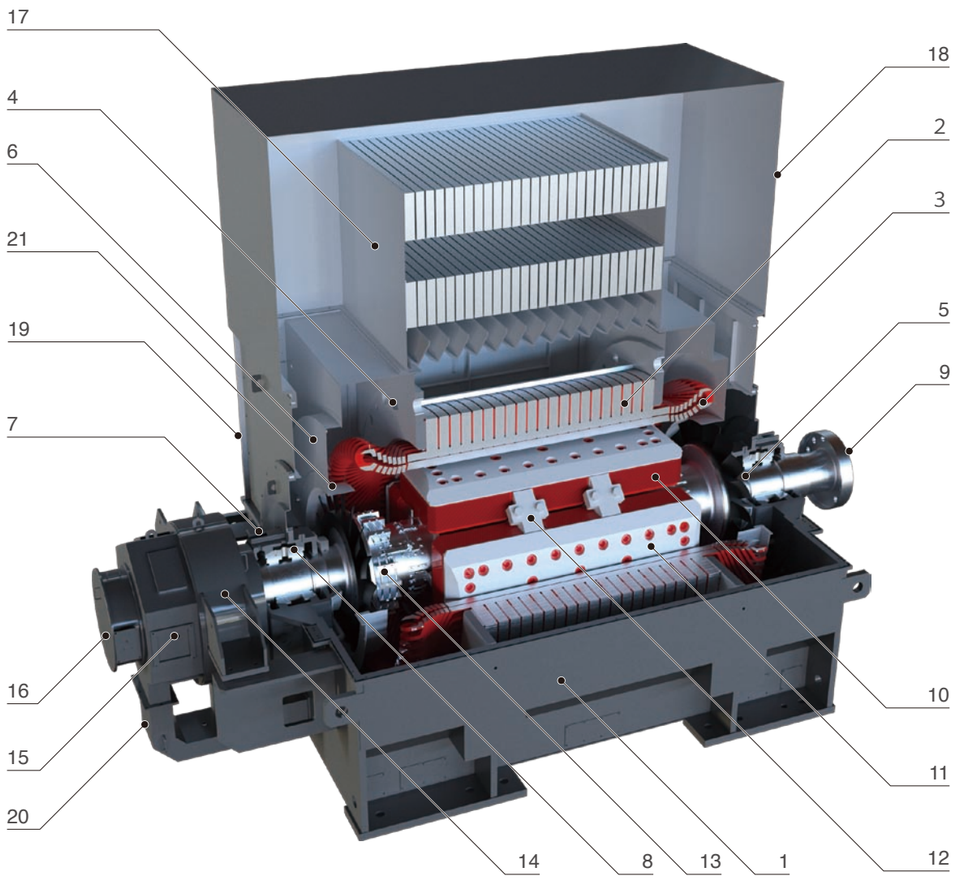
Manufacturing plants, petrochemical plants, and iron works

Power plants

IT industries and building power supplies

Construction of 4-Pole synchronous generators

- Cross-sectional view

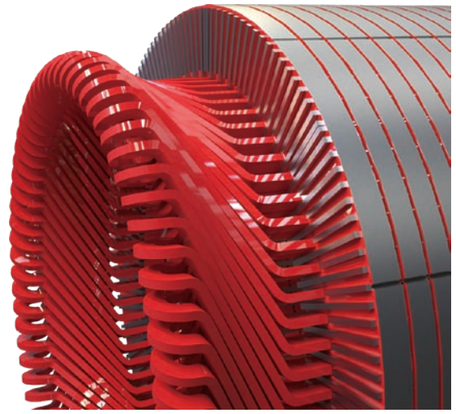


Names of parts					
1	Stator frame	8	Bearing metal	15	Rotary rectifier
2	Stator core	9	Shaft	16	Permanent magnet generator
3	Armature winding	10	Field winding	17	Air cooler
4	Stator core clamper	11	Pole shoe	18	Air cooler cover
5	Cooling fan	12	Coil clamp	19	Cover
6	Inner cover	13	Discharge resistor	20	Air duct
7	Bearing box	14	AC exciter	21	Air guide

Stator

- Armature winding

The armature winding is insulated by the most updated Meidensha technologies. It is designed to withstand a long duration of operation and is manufactured under rigorous quality control. Coils are fitted in the stator core slots and fixed by wedges. After the coil ends are connected and bound, the winding as a whole is treated by vacuum pressure impregnation (VPI). The VPI treatment is effective in eliminating voids among coils and the core and coil assembly can be rigidly united. Insulation characteristics are excellent both electrically and mechanically.

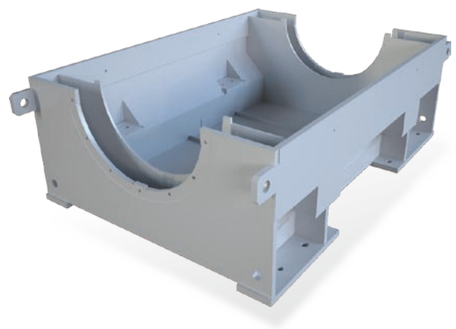


- Stator core

To reduce iron loss, the stator core is composed of high-quality surface-insulated silicon steel laminations, which are in turn punched into stacks. The core is provided with air ducts so that cooling air can effectively chill the core and coils. Both ends of core stacks are clamped into an assembly by welding the keys and clampers arranged on the core rear surface.

- Stator frame

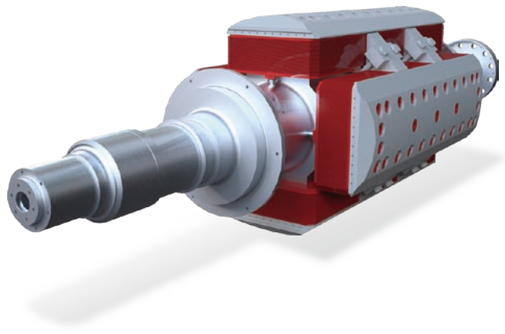
The stator frame comes in a welded steel-plate construction. The half part of stator and rotor under the shaft center are fitted into the frame.The stator core is tightened from both ends with clamp and the stator core is supported.The bearing housings are fitted at the frame ends and sustained weight of the rotor.The frame is designed to yield strength and rigidity enough to sustain the weight of the total generator. Strength against an impact load in the case of a sudden short-circuit is taken into consideration.



Rotor

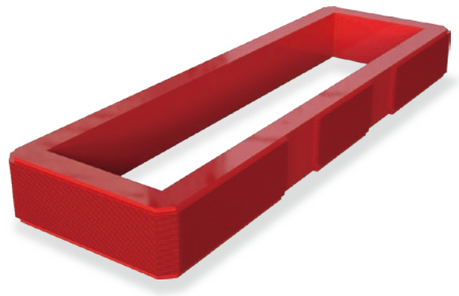
• Shaft and magnetic poles

The shaft is produced by shaving out a forged carbon steel block. The section to be joined with a turbine is fabricated to make a perfect coupling.
Massive salient poles are processed so that the center of the forged shaft has the shape of a cross. Each pole is fitted with a field winding. The field windings are fixed by the use of the pole shoes bolt-fastened to the respective poles and the coil clampers that are arranged among the poles.



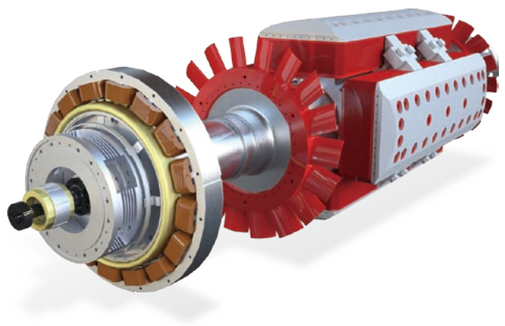
• Field winding

The field windings are formed by welding flat copper wires. After the treatment of layer insulation, the winding overall is made stiff by thermal curing and pressing. The completed field winding offers a sufficient strength and durability against many years of operation.



• Mechanical balance

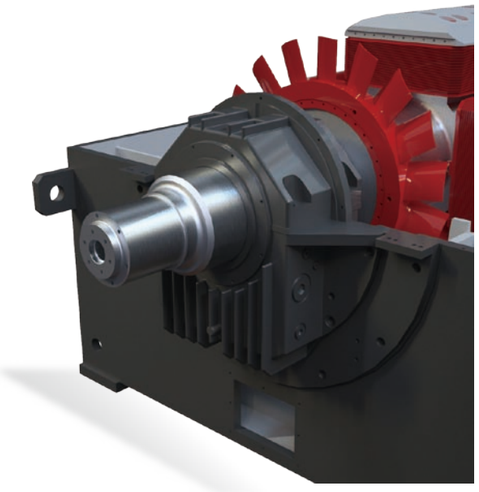
A subject to keep in mind for 4-pole machines is a solution for mechanical balancing both static and dynamic. The generator is manufactured based on this subject in the respective processes of the selection of materials, machining, and assembly. Mechanical balancing is always checked and adjusted through the examination of static balancing and running balancing.
This balancing is assured even after many years of operation.



Bearing

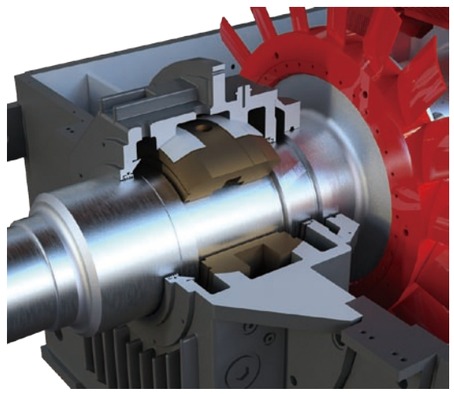
• Bearing

A sleeve bearing of the forced lubrication system is used. A spherical bearing seat is used to absorb any shaft distortion between the bearing and the bearing box. The bearing is made of a cast iron shell lined with a precisely machined white metal.



• Shaft current interrupter

The generator uses an insulation system to prevent a shaft current for the security of the bearing. Since insulation is provided inside the bearing, high reliability is assured and there is no influence by dust and contamination. It is unnecessary to provide for any insulation for external wiring.



• Main terminal construction

In standard construction, six (6) main terminals (3 on the output side and 3 on the neutral point side) are accommodated. Lead wires are brought out toward the generator side.
The main terminals can be brought out on either side of the right or left. Generally, the terminals on the output side are located opposite those on the neutral point side. They can, however, be installed in a lower position as requested.
The shape of the terminal box can change according to the cable type and cable connections.

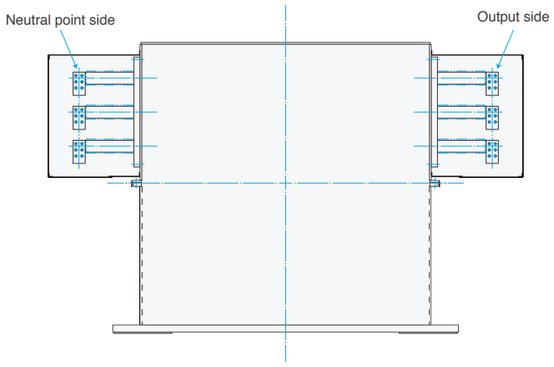


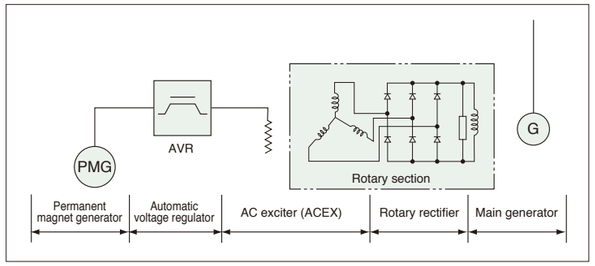
Diagram of Main Terminal Construction

Brushless Excitation System

• Brushless excitation system

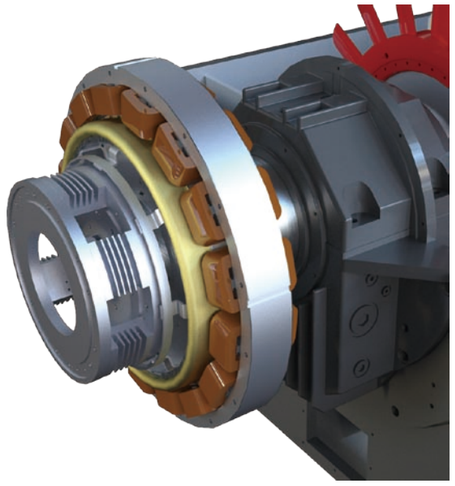
The standard brushless excitation system is composed of an AC exciter (ACEX), a rotary rectifier, and a permanent magnet generator (PMG).

It is also possible to use an exciting transformer (EXTR) instead of a PMG.



• AC exciter (ACEX)

The AC exciter is a 3-phase rotary armature type synchronous generator that is composed of the stator for the field and the rotor for the armature. The rotor, together with the PMG, is overhung on the counter-turbine side of the generator bearing.



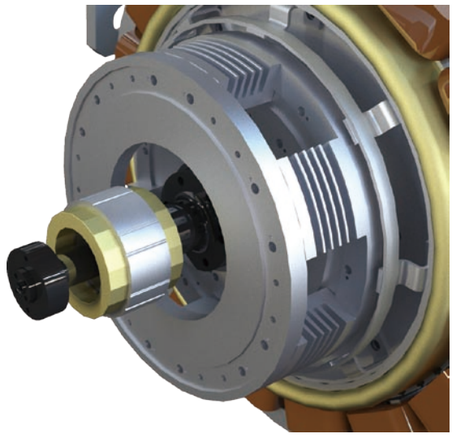
• Rotary rectifier

The rotary rectifier is composed of silicon rectifier elements mounted on the cooling block and a surge absorber. The silicon rectifier elements are connected to establish a 3-phase full-wave rectifier circuit. These elements are selected with ample tolerance for current capacity and peak inverse voltage. Commutation surges generated in the rectifier are disposed of by a surge absorber connected in parallel to each element. Protection against induced voltage in the field due to switching in a phase difference is covered by a discharge resistor connected in parallel to the field winding.

• Permanent magnet generator (PMG)

A permanent magnet generator (PMG) is used as a sub-exciter. There is no need for any initial excitation unit.

For the purpose of protecting system coordination, a sufficient amount of sustained short-circuit current can be supplied.



Protection and cooling systems

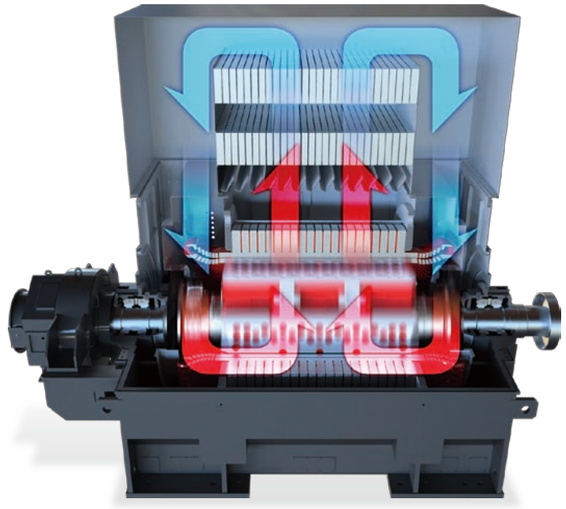
• Protection system

The standard protection system is a totally enclosed splash-proof type (IP44). The totally enclosed tube ventilation type or drip-proof protection type is also available.

When the totally enclosed tube ventilation type is adopted, the external ventilation resistance covered by a generator’ s self-cooling fan is approximately 300Pa. If the duct resistance exceeds this level, an additional cooling fan should be installed.

• Cooling system

Since the generator is enclosed, a cooling fan attached to the rotor is used to cool the generator by circulating its internal air. An air cooler is installed in the midst of the circulation passage. In this system (IC8A1W7 as standard), warm air is chilled by this cooler.
The air cooler is installed on top of the generator (top mount system).



Totally enclosed cooling system

• Air cooler

The air cooler uses finned tubes with high heat-transfer efficiency. Both ends of the tubes are expanded and joined with holes provided on the side panels.

Cooler materials are chosen according to the water quality. Phosphor deacidification copper tubes are generally adopted for industrial water. Cupro-nickel tubes are used for brine.

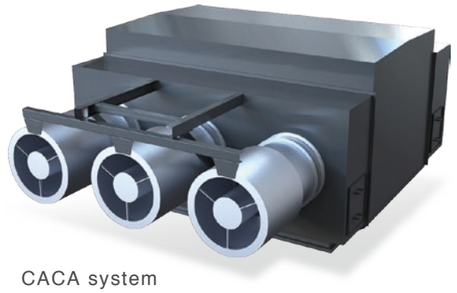
When brine is used, corrosion-proof zinc is attached to the water chamber to prevent corrosion due to a battery effect.

A water receptacle is installed between the air cooler and the stator to prevent the intrusion of water if water leakage should occur.

A margin is taken into account for the number of cooling tubes. If any cooling tube is damaged, operation can be continued by plugging the broken tube.

For another type of cooler, the air-cooling type (CACA) can be adopted if it is difficult to acquire cooling water.

TEWAC system



CACA system

Digital Automatic Voltage Regulator (AVR) TYPE YNEX06D

• General description

The Meiden AVR [YNEX06D] is adopted as a standard AVR unit. The digital automatic voltage regulator (AVR) [YNEX06D] covers the functions of conventional analog automatic voltage regulators. If two units of this type are used, the functions of a dual system become available. Since a variety of options are used, space saving is possible for switchboards.

• General specifications

Item		Specifications
Main-circuit elements		IGBT
Control system		PID control
Weight		7.8kg
Control source voltage (Duplex power supply)	DC source	Input: DC24V 3A or below
	AC source	Input: AC110V 40～240Hz 0.7A or below
Capacity of source fault output contact		Load current 150mA or below
Rated input voltage		AC110V or AC 220V 40～240Hz
Rated output current		DC20A
Bus VT		AC110V 0.5VA or below
Generator VT		AC110V 0.5VA or below
Generator CT		AC5A 0.5VA or below
Operating temperature		–20～60°C (hot start)
Relative humidity		95% or below No dew condensation
Storage temperature		–20～70°C
Altitude		1000m or below
Cooling system		Natural air cooling

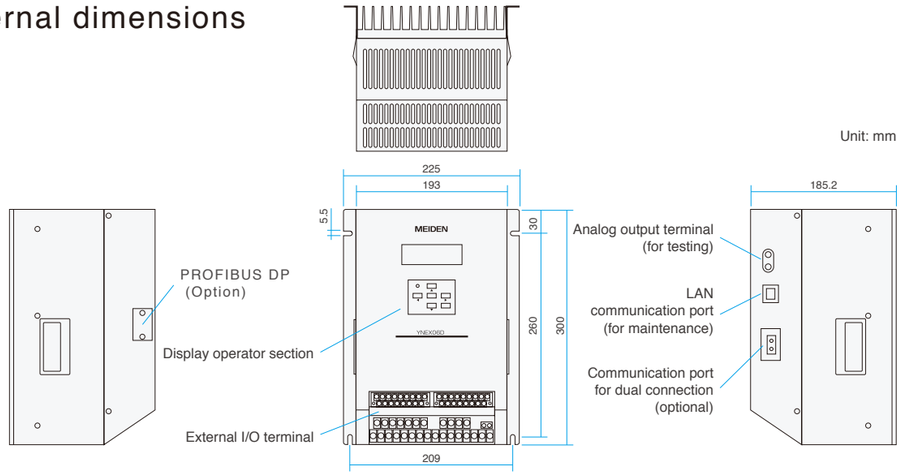
• List of functions

Item	Specifications	
Automatic voltage regulation (AVR)	Voltage control range (90H)	90～110%
	Voltage control accuracy	Within ±0.5%
	Full stroke time	60 sec.
Automatic field current regulation (AFIR)	Field current control range (70E)	0～130%
	Field current control accuracy	Within ±0.5%
	Full stroke time	60 sec.
Voltage buildup control function	Smooth start system	0=100 sec.
	Step start system	—
Crosscurrent compensation function	Setting range	0～10%
V/Hz function	Voltage droop system / Setting value (Droop point is set)	70～100% (Default: 85%)
Field overcurrent function (76E)	Operating value	105～130%
Power factor control・ reactive power control functions (APFR・AQR) Formula: Q = A + BP	Setting range for Item A	–1.0～1.0PU
	Setting range for Item B	–0.7～0.7cosϕ
	Reactive power control accuracy	Within ±2%
	Power factor control accuracy	Within ±2°
Reactive power limitation function (VARL)	Overcurrent limit (OCL), over-excitation limit (OEL), Under-excitation limit (UEL)	
	OCL boundary setting	0～100%
	Lagging side setting	10 points max.
	Leading side setting	10 points max.
Options	Exciter diode fault detection function (DFDR)	
	Line drop compensation function (LDC), Voltage compensation rate: 0～10%	
	Power stabilizer function (PSS), 3-lead lagging / 4-lead lagging (Default: 3-lead lagging)	
	Automatic sync closure function	
	Synchronism detection function	
	Dual function (Serial connection, 480.6kB fixed)	
	Communication function (PROFIBUS DP) *1	

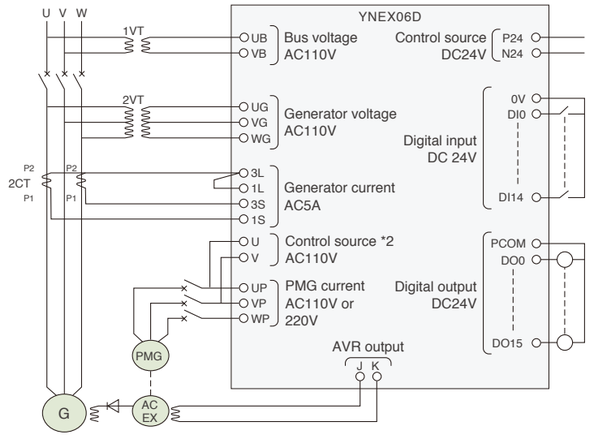
*1 PROFIBUS DP is the trademark or registered trademark of PROFIBUS User Organization.

• External dimensions

Unit: mm

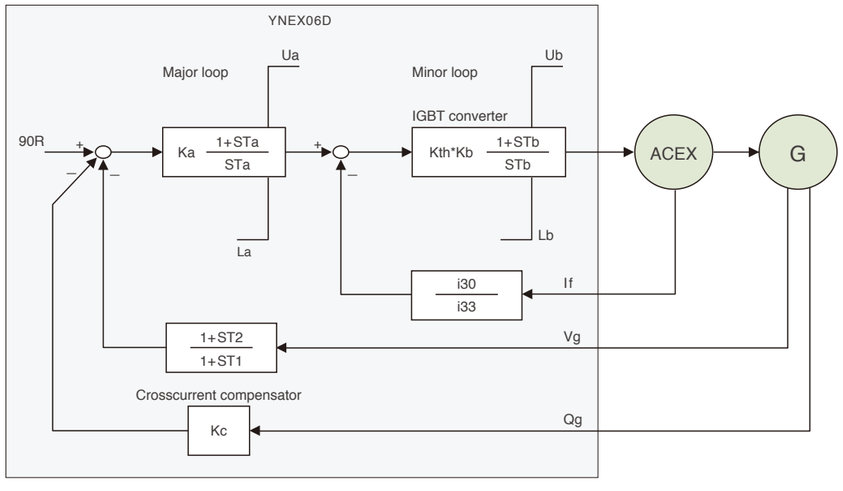


• Connection diagram



*2 When PMG voltage is 220V, an auxiliary transformer has to be installed.

• Block diagram



MEIDENSHA CORPORATION

ThinkPark Tower, 2-1-1, Osaki, Shinagawa-ku, Tokyo, 141-6029 Japan

www.meidensha.com

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