

Inoflex

HD Series Medium Voltage AC Drive

— High-performance and large-capacity MV drive for technique-oriented market



About INOVANCE



汇川苏州二期厂区

Shenzhen Inovance Technology Co., Ltd. (Stock code: 300124) is a leading industrial automation product and solution provider, dedicated to R&D, manufacturing and sales of automation control products. Targeting at high-end equipment manufacturers, we are committed to achieving a win-win situation with customers based on our solid automation control technologies with IPRs. We have maintained a mature business model through which customized solutions have been constantly and rapidly delivered to customers.

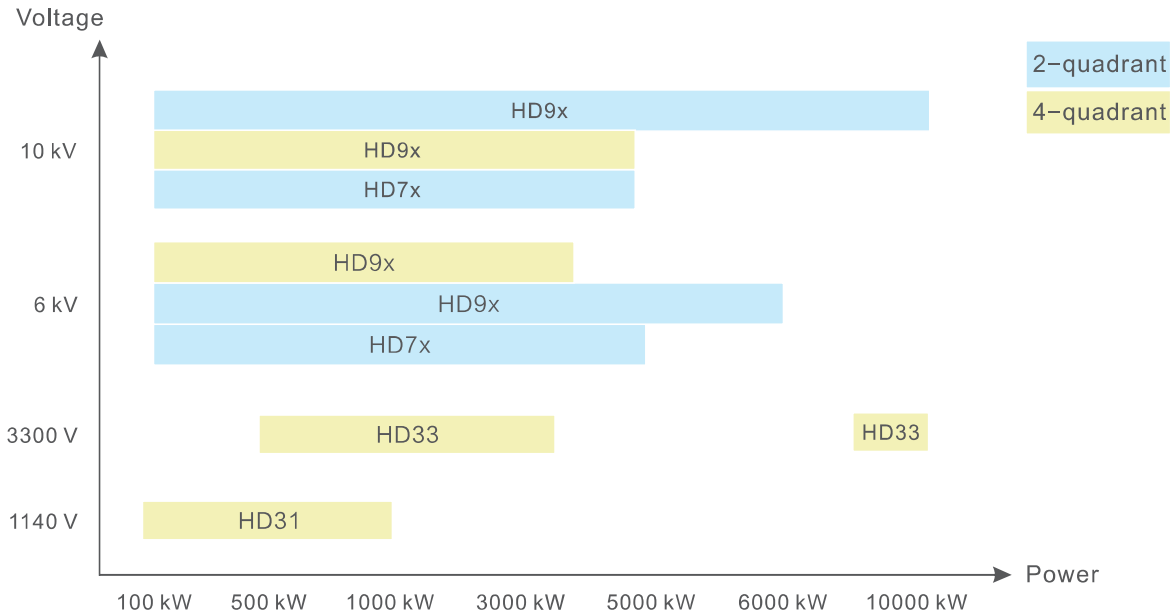
Our offering provides low/mid-voltage AC drives, PLCs, HMIs, servo drives, motors, photoelectric encoders, integrated and special drives, and renewable energy products, etc. We are now taking up the largest market share in domestic low-voltage section and have obtained a leading position in various segmentation markets with our all-round integrated and special drives.

As a national high-tech enterprise, we have obtained quite a number of patents. Till the end of 2012, there are 121 invention patents, 112 utility model patents, 32 design patents and 49 software copyrights authorized or applied. Besides, we have mastered various core platform technologies covering the fields of high-performance vector control inverter, PLC, servo, and PMSM. Attracting and cultivating talents is our constant pursuit. Till now, Inovance has already owned a large group of professional R&D experts dedicated to development of core platform technologies, application technologies and new products.

Service Network



Inovance HD Series MV AC Drives



Introduction to HD9x/HD7x/HD3x

HD9x — cascading MV drive



Features: Medium voltage vector drive based on 2/4-quadrant and sync/asynchronous motor control design, able to be configured with bypass structure

Voltage range: 3 to 10 kV

Topology: Power cell cascading

Applications:

- Energy-saving application in petrifaction, electricity, municipal construction
- Hoisting application, such as mining
- Variable frequency application with large capacity (above 10 MW)

Advantages:

- High efficiency, high power factor, low harmonics;
- High-performance VC technology: precise speed regulating;
- Remote drive at up to 20 km

HD7x — high end MV drive



Features: High performance medium voltage AC drive dedicated to specific segment markets, with cascading power cells

Voltage range: 3 to 10 kV

Topology: Power cell cascading

Applications:

- Markets and industries with special requirement for variable frequency drive

Advantages:

- Stay close to high-end customer requirements;
- Customized; with creative functions;
- High-performance VC technology

HD3x — three-level MV drive



Features: High performance medium voltage vector drive based on 2/4-quadrant and sync/asynchronous motor control design; configured with three-level neutral point clamped topology

Voltage range: 1140 to 3300 V

Topology: Three-level neutral point clamped drive (multi-pulse rectifier or AFE)

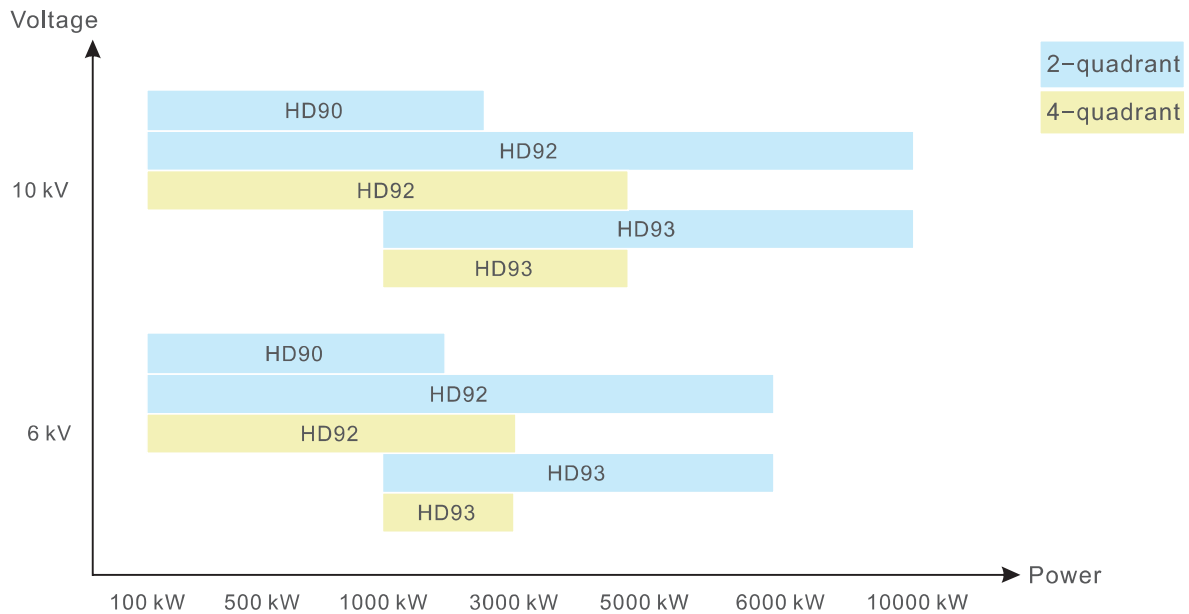
Applications:

- Explosion-proof variable-frequency drive (without enclosure)
- Metallurgical rolling mill
- Wind power current transformer

Advantages:

- Compact structure, high power density;
- High-performance VC technology smooth speed regulating output control curves;
- Simple and easy maintenance

Inovance HD9x Series MV AC Drives



Introduction to HD90/HD92/HD93

HD90 — general vector MV drive (for async motor)

HD92 — high performance vector MV drive (for async motor)

HD93 — high performance vector MV drive (for sync motor)



Features: Medium voltage vector drive with cascading power cells, developed based on 2/4-quadrant and asynchronous motor control design and using general vector algorithm
Voltage range: 3 to 10 kV
Applications:
 ■ Fan and pump applications with square torque load

Features: High performance medium voltage vector drive with cascading power cells, developed based on 2/4-quadrant and asynchronous motor control design and using flux linkage closed-loop vector algorithm, able to be configured with bypass structure
Voltage range: 3 to 10 kV
Applications:
 ■ High-end applications with high dynamic response, such as hoisters, conveyors and test beds

Features: High performance medium voltage vector drive with cascading power cells, developed based on 2/4-quadrant and synchronous motor control design and using flux linkage closed-loop vector algorithm, compatible with various excitation modes, able to be configured with bypass structure
Voltage range: 3 to 10 kV
Applications:
 ■ Hoisters, exhaust blowers, blast furnace blowers, air compressors

HD9x Basic Data

Designation Rules

HD9x-J100/2500-DN

① ② ③ ④ ⑤ ⑥ ⑦

<p>① Product type: HD: Inovance medium voltage drive</p>	<p>③ Input voltage class: A: 1 kV B: 2.3 kV C: 3 kV D: 3.3 kV E: 4.2 kV F: 6 kV G: 6.6 kV H: 7.2 kV J: 10 kV K: 11 kV L: 13.8 kV</p>	<p>④ Output voltage: (unit: kV) Example: "060" represents 6 kV.</p>
<p>② Series code: 90: General-purpose vector type (for async motor) 92: High-performance vector type (for async motor) 93: High-performance vector type (for sync motor)</p>		<p>⑤ Rated capacity: (unit: kVA)</p>
		<p>⑥ R: With energy feedback D: Without energy feedback</p>
		<p>⑦ B: With bypass N: Null</p>

Application Examples



- Application field: coal mine
- Load: conveyor



- Application field: coal mine
- Load: mine hoist



- Application field: steel plant
- Load: > 30 sets of fans and pumps



- Application field: coal mine
- Load: air compressor



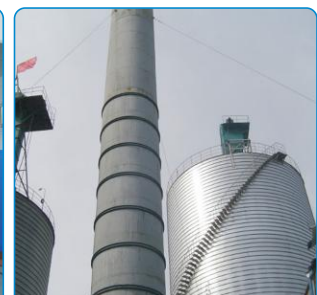
- Application field: steel plant
- Load: large-capacity sync motor (main sintering fan)



- Application field: power plant
- Load: draught fans and feed pumps



- Application field: air compressor plant
- Load: variable-frequency power source

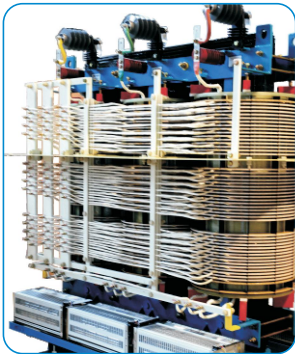


- Application field: cement plant
- Load: high-temperature fans and dust blowers

HD9x Structure

Transformer Cabinet

- A phase shifting transformer is adopted on the input side, which forms multi-pulse rectifying mode. This greatly improves the current waveform and power factor on the grid side, and reduces harmonic pollution to the grid caused by the equipment.
- The transformer adopts class H insulation. Medium-voltage windings use pancake winding technique and iron core uses high permeability cold-rolled electrical steel strips. All these guarantee high reliability and strong resistance to short-circuit.



Power Cell Cabinet



Power Cell



- A 3 kV power cell cabinet consists of nine power cells. Every three cascaded cells constitute a phase, which generates $4N+1$ ($N = 3$) PWM waves. The three phases are in Y connection and directly provide 3 kV power.
- A 6 kV power cell cabinet consists of 15 or 18 power cells. Every five or six cascaded cells constitute a phase, which generates $4N+1$ ($N = 5$ or 6) PWM waves. The three phases are in Y connection and provide 6 kV power.
- A 10 kV power cell cabinet consists of 24 or 27 power cells. Every eight or nine cascaded cells constitute a phase, which generates $4N+1$ ($N = 8$ or 9) PWM waves. The three phases are in Y connection and provide 10 kV power.



- The power cell adopts a topological structure consisting of an AC-DC-AC three-phase rectifier and a single-phase inverter. The three-phase full bridge diode rectifier at the rectifier side converts the input three-phase AC to DC and filters the current with a capacitor. SPWM control is performed on the single-phase IGBT H-bridge at the inverter side and the IGBT H-bridge performs single-phase AC sine wave output.
- Based on high-speed communication with the system control board via optical fiber, the cell control board implements IGBT ON/OFF control, outputs waveform and transmits information (about faults and status of power cells) to the system control board.

Cooling Fan

- The cooling fan has the advantages of large air flow, sufficient margin, long service life and high stability, which meets the requirements of the medium-voltage AC drive for heat dissipation and improves stability of the drive.



HMI

- InoTouch HMI (developed by Inovance) works with the ARM subsystem of the system control board to implement human-machine interactive functions, such as status display, parameter setting and viewing, fault reporting, operation curves, operation logs, and realizing of control commands.

- With creative interface and multiple ports, InoTouch HMI facilitates onsite extension and connection with the user system.



Control Cabinet

The system control board mainly consists of ARM, DSP and FPGA.

- The ARM subsystem implements parameter setting, fault and status recording, and communication with the HMI, PC applications, communication extension card and DSP.
- The DSP subsystem implements motor control algorithms, and works with the A/D and D/A modules to collect and output system voltage and current.
- The FPGA subsystem generates pulses of power cells, collects status of power cells, and communicates in real time with the cell control board via the fiber interface board.



HD9x Performance Advantages

Advantages of HD90

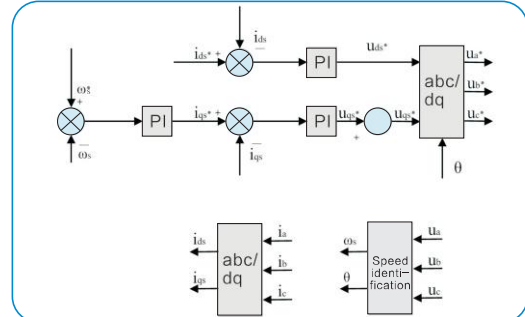
General vector control technology

Introduction

The stator current is decoupled into excitation variable and torque variable based on the d-q axis theory, to realize control of DC motor via simulated natural decoupling.

Technical strength

Wide speed regulating range;
Reliable operation;
Easy commissioning



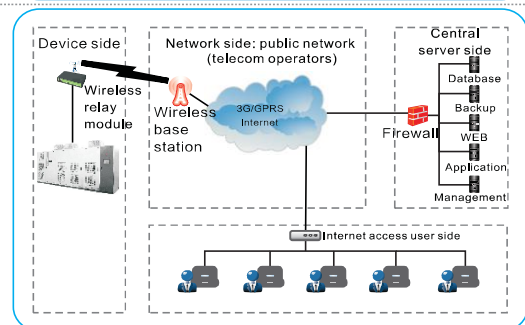
Remote monitoring

Introduction

In wireless communication mode, the data center collects and monitors onsite data of the variable-frequency drive in real time via 3G communication technology.

Technical strength

Guarantee a safer system with timely alarm reporting;
Reduce workload for onsite maintenance such as data collecting and monitoring;
Accurate data recording;
Reduce customers' investment on the physical layer of the OSI architecture by using wireless monitoring.



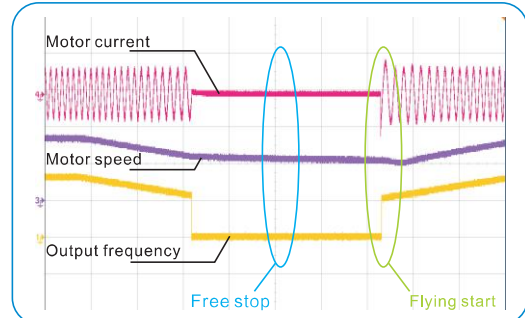
Start-on-fly

Introduction

The AC drive starts without knowing the motor speed, and automatically detects frequency until finding the frequency that matches the real speed of the motor. Then, the drive outputs control signals to make the motor run to the reference frequency.

Technical strength

Reduce impact of instantaneous power on manufacturing;
Reduce impact on the power grid.



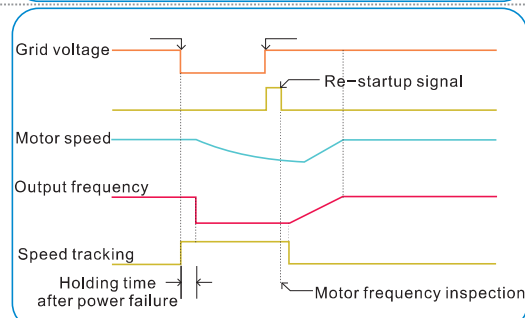
Auto start after power on & voltage ride through

Introduction

The system can guarantee normal operation for 5 periods when the grid voltage instantly drops or fluctuates. After 5 periods, the system automatically conducts de-rating operation. The MV drive stops 9s after the power fails.

Technical strength

Guarantee continuous manufacturing;
Improve manufacturing efficiency.



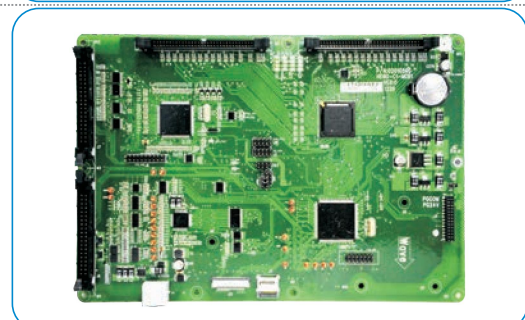
Highly reliable components

Introduction

Reliable high-quality components, including IGBTs, rectifiers, capacitors, main control chips (ARM, DSP, FPGA) and fans are used to ensure high reliability and good cooling effect.

Technical strength

Guarantee reliable operation;
Guarantee long service life of product.



Advantages of HD92

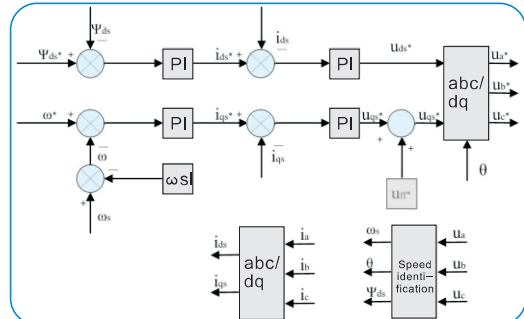
Async motor flux linkage closed-loop vector algorithm

Introduction

The flux linkage and current are decoupled based on the d-q axis theory, to realize closed-loop control. Running curves of the motor are fully obtained from the basic layer of vector control, thus realizing flux linkage closed-loop control of the motor.

Technical strength

High control precision;
Fast current loop response during acceleration.
750 rad/s torque response during low-frequency running.



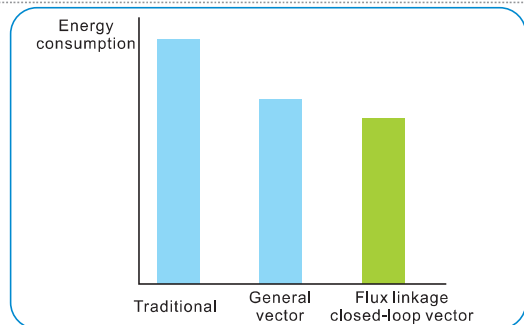
Energy-saving

Introduction

Closed-loop control;
Reduce excitation current when requirement for the motor torque is low;
Improve efficiency of the motor.

Technical strength

Effectively reduce motor consumption;
With better energy-saving effect, compared with general vector algorithm.



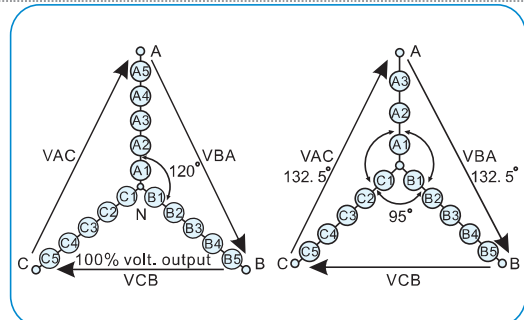
Asymmetric mechanical bypass technology

Introduction

Bypass structure with mechanical contactor ON and OFF;
Separated bypass control system;
Asymmetric bypass technology.

Technical strength

Safe, timely, reliable;
Voltage output capability is increased by 20% at most, compared with traditional structure.



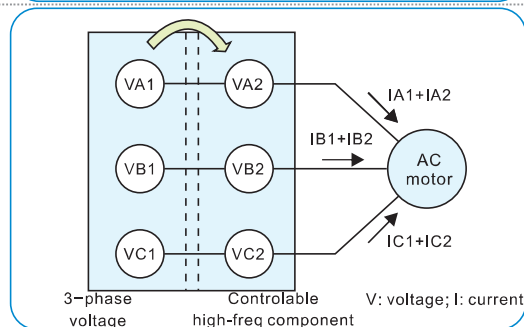
Fast superposing freq. braking technology

Introduction

Controllable high-frequency component is superposed to the output voltage vector via vector algorithm, which enables the motor to generate larger resistance torque in reverse direction, and thus speeds up the deceleration braking of motor.

Technical strength

Shorten the motor deceleration time (by almost 40%) and meet strict requirements of many processes for the deceleration time.



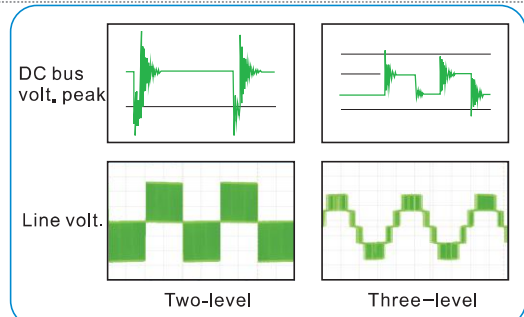
Four-quadrant three-level technology

Introduction

Power cells adapt 3-level neutral point clamped technology;
Mature cascading structure of power cells;
Advanced AFE control mode.

Technical strength

Compact structure, small size, high power density;
Reliable feedback of energy to the power grid, with high efficiency;
Smooth output curves.



*Note: HD92 series has the same advantages with HD90 series.

HD9x Performance Advantages

Advantages of HD93

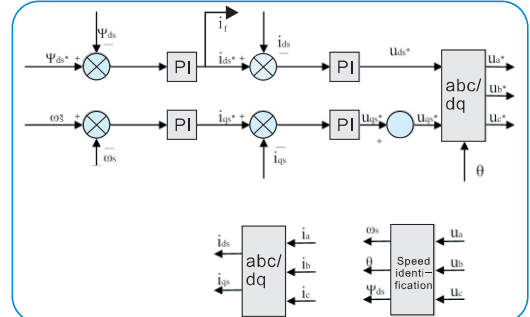
Sync motor flux linkage closed-loop vector control

Introduction

According to the structure and excitation features of synchronous motor, the flux linkage and current are decoupled based on the d-q axis theory, to realize closed-loop control. Running curves of the motor are fully obtained from the basic layer of vector control, thus realizing flux linkage closed-loop control of the motor.

Technical strength

Realize control of motor power factor;
High control precision, fast torque response.



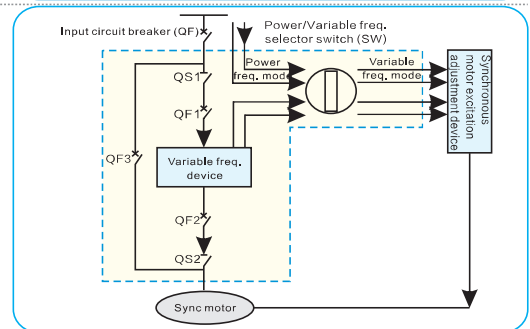
Various excitation modes for synchronous motors

Introduction

Perfectly compatible with various excitation modes for synchronous motors, including brush and brushless electro excitation (DC, AC).

Technical strength

Coordinative control of synchronous motor speed output and excitation device;
Good current control effect;
Easy commissioning.



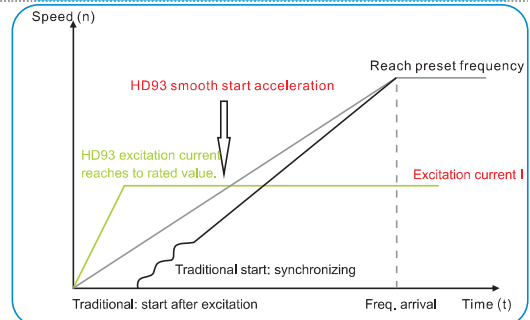
Vector start synchronization technology

Introduction

Dynamic excitation with variable-frequency start of synchronous motor is used, which optimizes the synchronizing process of the motor.

Technical strength

Smooth and no-impact start;
Good effect of excitation current control and large start torque.



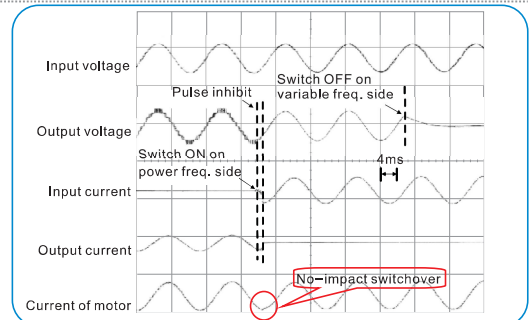
Syn-transfer technology

Introduction

With unique phase lock and frequency lock technologies, the MV drive can be synchronized with the grid in only a few seconds. This enables the variable-frequency speed-regulating switchover system to smoothly switch from variable frequency to power frequency (or vice versa) with no impact.

Technical strength

Reduce the impact of motor switchover on the grid to the minimum.
Shorten the time of frequent startup of multiple motors.
Protect the motor and prolong its service life.



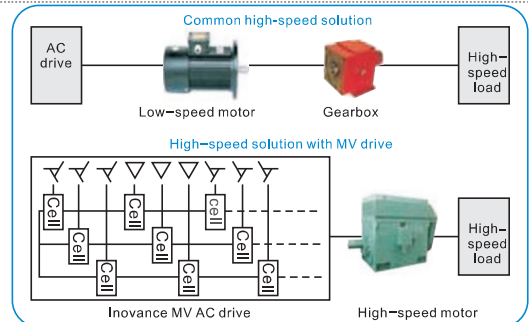
High-speed PMS control technology

Introduction

Hd93 series MV drive is compatible with both electro excitation and excitation for PMSM. It can work with a motor to realize wider speed regulating range.

Technical strength

Stable and reliable;
Realize running of motor at 120 Hz and above.



HD9x Platform Advantages

R&D

Large R&D investment

R&D team: around 500 engineers
Invest 10% of previous year's sales volume on R&D

IGBT test platform

Simulation analysis of different limit working conditions (stray inductance, temperature simulation) of IGBT
Pre-research analysis of high volume drives

Strong-electricity finite element analysis platform

Topology simulation analysis
Busbar current simulation analysis

Simulation analysis of drive algorithm and heat design

Algorithm simulation, comparison and verification
Thermal simulation analysis for structure design



Vibration test bed



Walk-in high and low temperature
-humidity test chamber

Factory Test

All-round system test procedure

An all-round full-load voltage test platform is equipped to satisfy full-load tests of our low and medium voltage AC drives, to ensure that drives are 100% tested upon delivery.

This test platform is able to conduct full-load tests of voltage classes including 380V, 690V, 1140V, 3kV, 6kV and 10kV, with a maximum load of 20MW. It can also perform full-load tests for small, medium and high voltage motors and satisfy testing requirements of two/four-quadrant systems, which guarantees product quality.



Other Technical Features

Motor temperature inspection

Temperature protection for motor windings and bearing

Large heat design margins

High-quality fans are used, which guarantees large cooling volume and high reliability;
Large heat design margins guarantees good cooling effect.

Self-adaptive output voltage

System adjusts the output voltage in real time when the grid voltage at input side fluctuates;
Significant fluctuation of grid voltage has little impact on the motor;
Speed regulating efficiency is guaranteed.

Various types of bus interfaces

CAN, Modbus and PROFIBUS buses are supported.

Self-adaptive acceleration/deceleration

Avoid overcurrent/overvoltage due to short acceleration or deceleration time, to ensure best acceleration/ deceleration time under normal production conditions.

Adaptive capacity of wide voltage

System continues normal operation when the grid voltage fluctuates to between -35% and 10% of the rated voltage.

HD9x Operating Interface



Exquisite high-vision display

- 65,536 true color display, supporting JPG/BMP/GIF format graphics; more vivid display, wider angle of view;
- High-resolution/brightness LCD, using LED backlight, which is more energy-saving and environment-friendly

User-oriented functions

- Easy software update via USB flash disk or SD card
- Export of data such as historical faults, alarms, and operating curves via USB flash disk

Multi-language texts

- Online switchover of multi-language texts
- Texts of different languages can be imported and exported through an Excel file.

HD9x Monitoring Software

Simple control, all-round functions

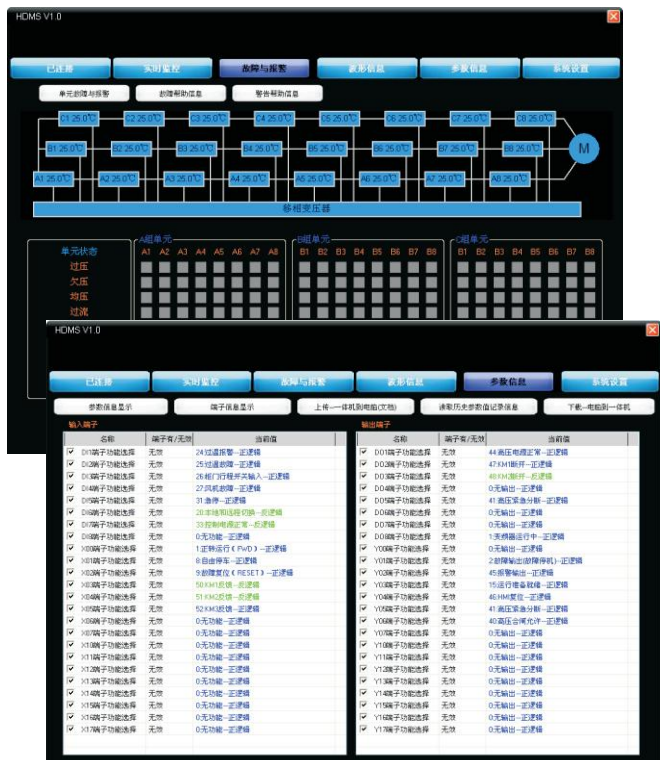
- Setting up bi-directional communication between the monitoring software and the HD series MV AC drive
- Monitoring the operating status, parameters and terminals of the MV AC drive in real time
- Modifying, saving, uploading and downloading parameter and terminal data in real time
- Displaying operating waveforms in real time

User-friendly interface

- The monitoring interface is clean and clear, and easy to use.

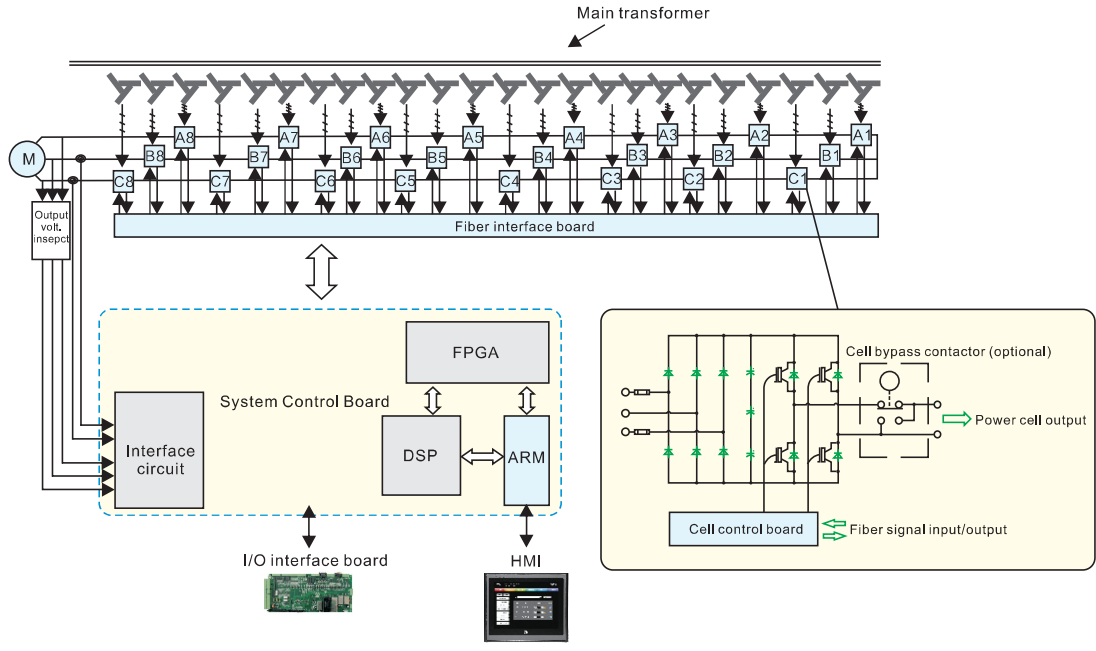
Customer-oriented

- Free upgrade of software compatibility

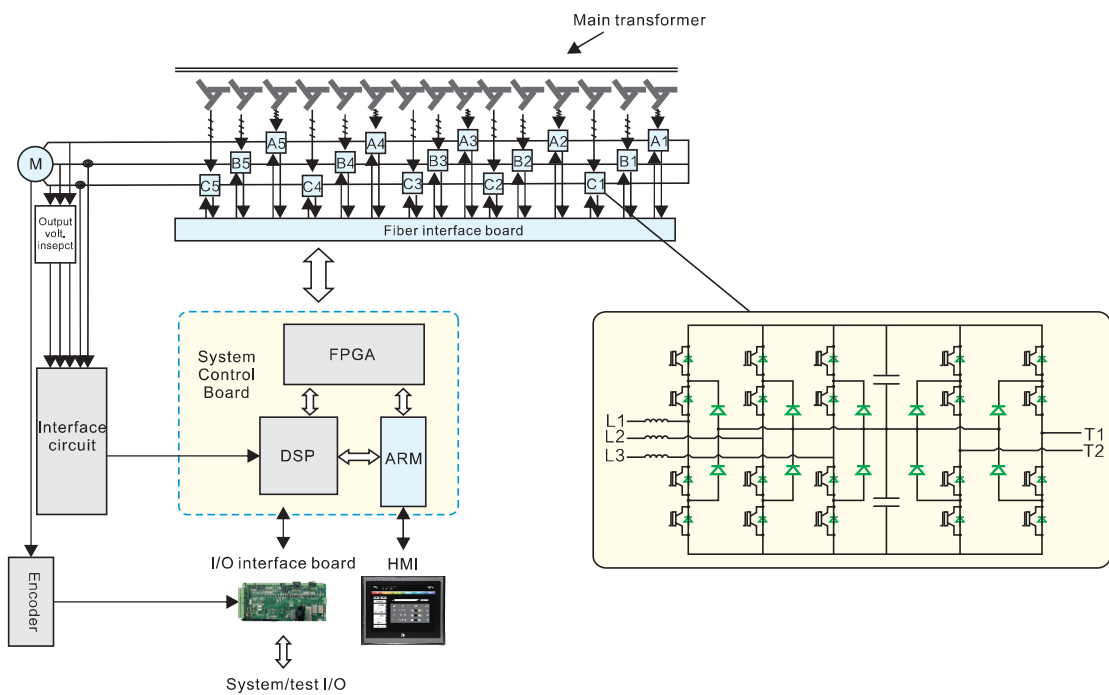


HD9x Topology

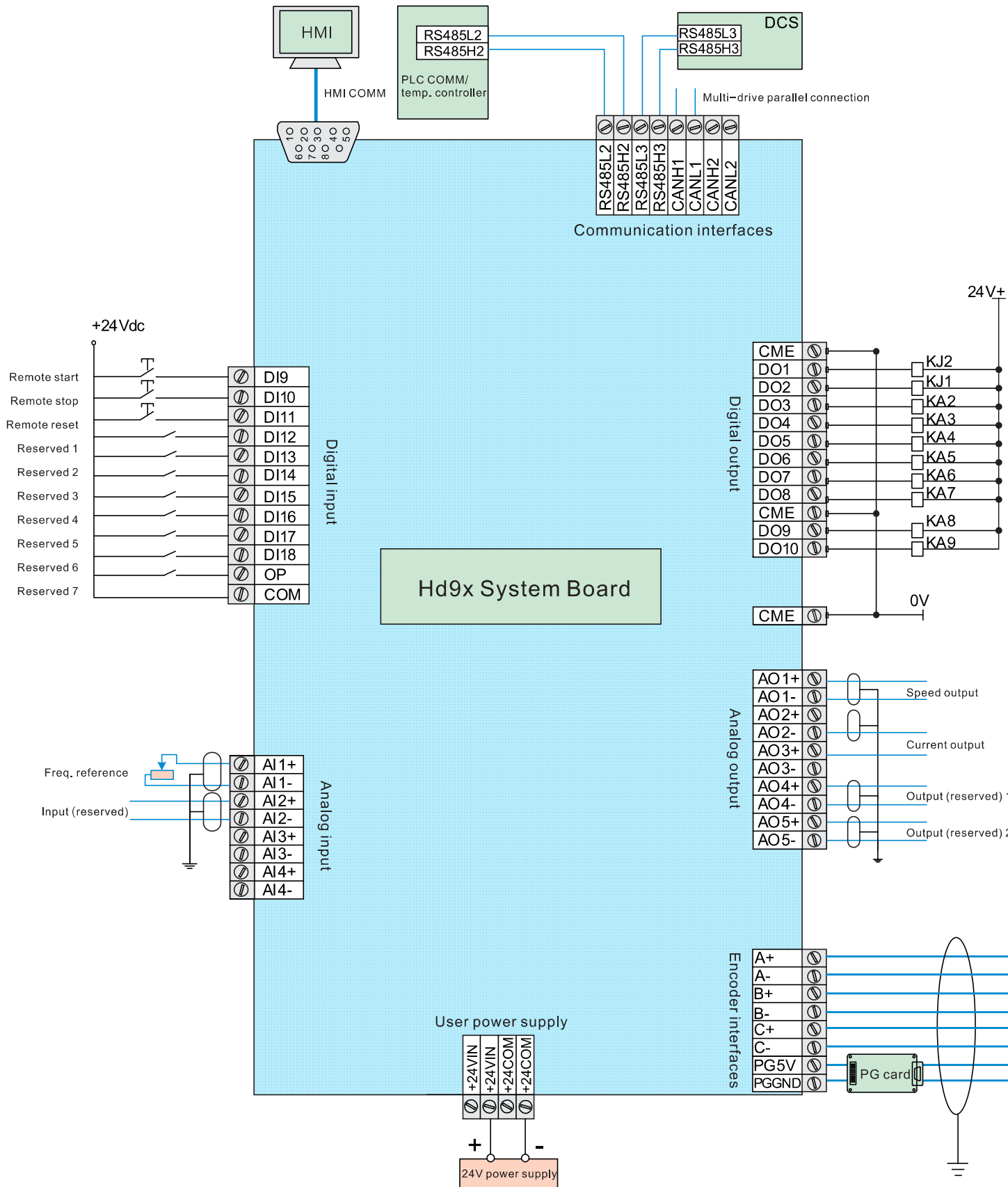
Two-quadrant (10 kV)



Two-quadrant (10 kV)

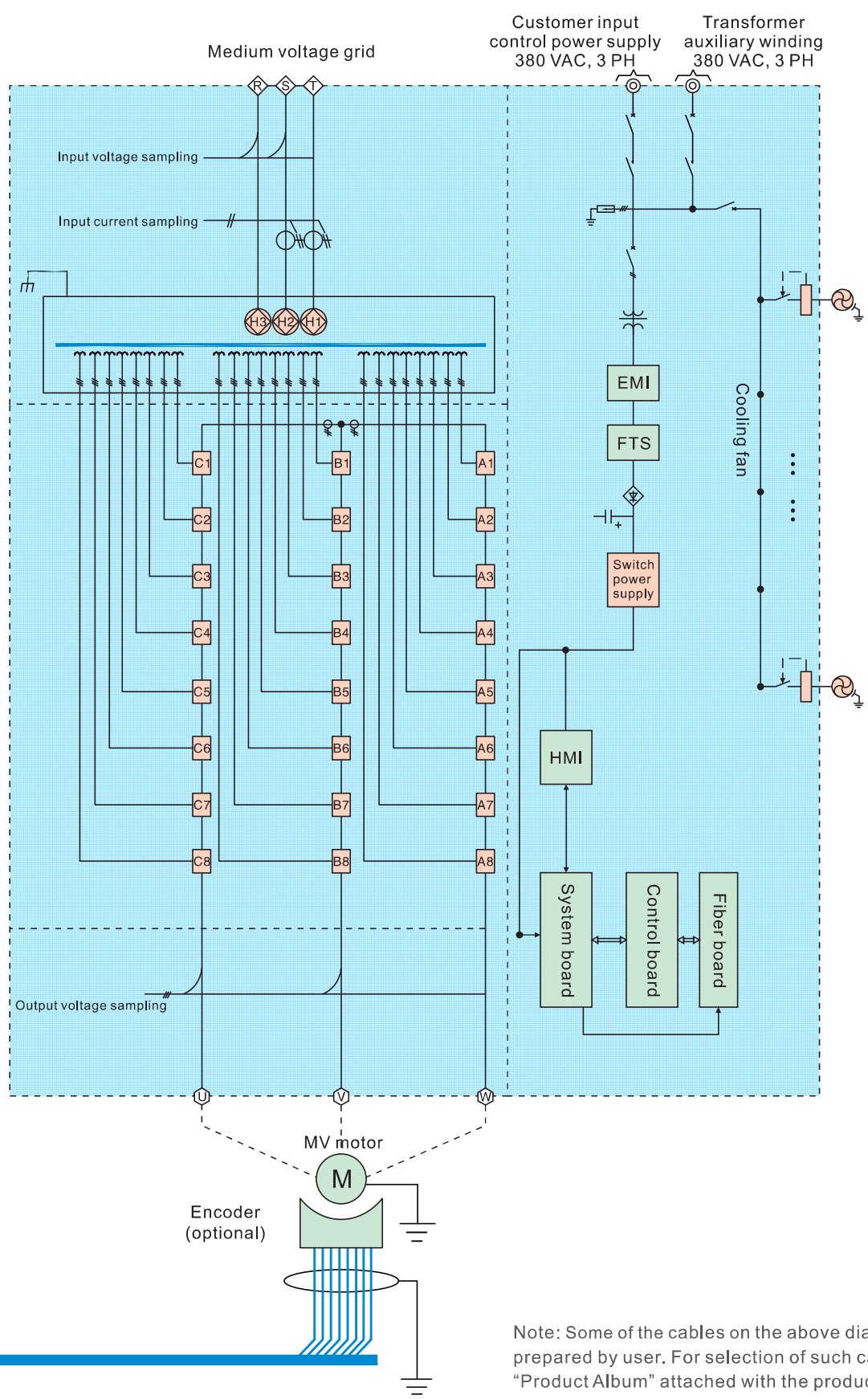


HD9x System Wiring Diagram





- High volt. trip
- High volt. closing allowed
- Main power indicator
- Ready
- RUN indicator
- STOP indicator
- Fault indicator
- Alarm indicator
- HMI reset
- Reserved 1



Note: Some of the cables on the above diagram need to be prepared by user. For selection of such cables, refer to the "Product Album" attached with the product delivered.

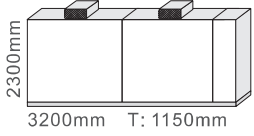
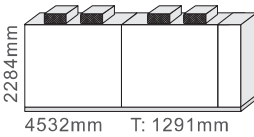
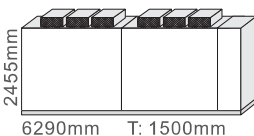
HD9x Electrical Specifications & Mounting Dimensions

Two-quadrant System Electrical Specifications

Item	Voltage	6 kV Series	10 kV Series
Input	Rated input voltage	3-phase 50/60 Hz, 6 kV	3-phase 50/60 Hz, 10 kV
	Voltage fluctuation range	± 10%: full-load running; -10% to +35%: allows long-time derating running	
	Frequency range	50/60 Hz ±10%	
	Cell input voltage	690 V	
	Input power factor	≥ 0.95 (above 20% load)	
	Input current harmonics	≤ 2%; Comply with IEEE519-1992 and GBT14549-93 standards	
Output	Output voltage range	0 to 6 kV	0 to 10 kV
	Output capacity range	230 to 7000 kVA	250 to 12500 kVA
	Cell output voltage	690 V	
	Output frequency range	0 to 50/60 Hz; Max. 330 Hz; 120 Hz and above need customization	
	Speed range	40:1 (V/F), 100:1 (SVC), 200:1 (CLVC)	
	Speed accuracy	±0.5 % (SVC); ±0.2 % (CLVC)	
	Torque response	> 750 rad/s	
	Startup torque	0.5 Hz/150% (SVC); 0 Hz/180% (CLVC)	
Technical scheme	Power cell cascading; AC-DC-AC; medium voltage input and output		
Control mode	SVC, CLVC, V/F		
Rectifier	Three-phase full-bridge diode rectifier		
Inverter	IGBT inverter bridge		
Acce/Dece time	0.1 to 6500s; Requirement of above 6500s needs customization.		
Start/Stop control	Local/Remote		
Control system	ARM, DSP, FPGA, CPLD, HMI		
Display	Touch screen/LCD (in Simplified Chinese)		
Overload capacity	60s for 120% of rated current		
Whole-machine efficiency	≥ 97%		
Fuse protection for inverter	With fuse at input side of the power cell		
Electrical isolation	Using optical fiber		
Input filter	Not necessary		
Output filter	Not necessary		
Power factor compensation	Not necessary		
Power cell protection	Over-voltage, under-voltage, voltage-sharing, input phase loss, over-current, overheat, communication		
System protection	Protection for motor over-capacity, output over-capacity, output short-circuit, output/input grounded, input over-current/voltage, input imbalance, cooling fanfault, inverter overheat/tripping, door switch interlock protection, and etc		
MTBF	50000 hours		
Communication ports	CANbus, Modbus, PROFIBUS (special customization requirement can be satisfied)		
Switching value input	x 10: dry contact relay		
Switching value output	x 16: dry contact relay		
Analog input	x 4: 4 to 20 mA or 0 to 10 V		
Analog output	x 5: 4 to 20 mA or 0 to 10 V		
Working environment	Indoor		
Temperature	-10°C to +40°C (de-rated use: +40°C to +50°C; preheat is required at ≤ -10°C)		
Humidity	5% to 95%, no condensation		
Altitude	≤ 1,000 m (de-rated while above 1,000 m)		
Total equipment noise	≤ 75 dB		
Cooling mode	Forced air cooling		
IP level	IP30		
Type of cabinet	GGD type		
Inlet/Outlet mode	Down in down out/up in up out (special customization requirement can be satisfied)		
Control power	380 VAC ± 10% three-phase four-wire		

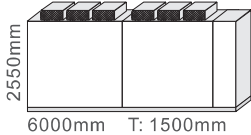
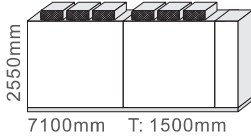
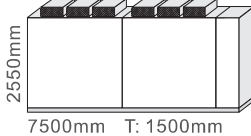
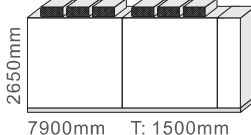
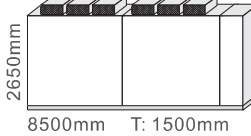
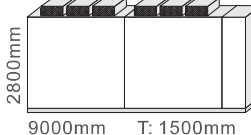
Two-quadrant System Mounting Dimensions

10 kV Series

	Power of Adatable Motor (kW)	Drive Model	Output Capacity (kVA)	Size (W x D x H mm)	Weight (kg)
 <p>2300mm 3200mm T: 1150mm</p>	250	HD9x-J100/315	315	3200 x 1150 x 2300	2.4
	280	HD9x-J100/355	355	3200 x 1150 x 2300	2.5
	315	HD9x-J100/400	400	3200 x 1150 x 2300	2.5
	355	HD9x-J100/450	450	3200 x 1150 x 2300	2.6
	400	HD9x-J100/500	500	3200 x 1150 x 2300	2.7
 <p>2300mm 3200mm T: 1390mm</p>	450	HD9x-J100/560	560	3200 x 1390 x 2300	3
	500	HD9x-J100/630	630	3200 x 1390 x 2300	3.2
	560	HD9x-J100/710	710	3200 x 1390 x 2300	3.3
 <p>2300mm 3450mm T: 1390mm</p>	630	HD9x-J100/800	800	3450 x 1390 x 2300	3.4
	710	HD9x-J100/900	900	3450 x 1390 x 2300	3.75
	800	HD9x-J100/1000	1000	3450 x 1390 x 2300	3.8
	900	HD9x-J100/1120	1120	3450 x 1390 x 2300	3.9
 <p>2284mm 4532mm T: 1291mm</p>	1000	HD9x-J100/1250	1250	4532 x 1291 x 2284	4.3
	1120	HD9x-J100/1400	1400	4532 x 1291 x 2284	4.5
	1250	HD9x-J100/1600	1600	4532 x 1291 x 2284	4.7
	1400	HD9x-J100/1800	1800	4532 x 1291 x 2284	5.1
	1600	HD9x-J100/2000	2000	4532 x 1291 x 2284	5.2
	1800	HD9x-J100/2250	2250	4532 x 1291 x 2284	5.7
 <p>2455mm 6300mm T: 1500mm</p>	2000	HD9x-J100/2500	2500	6300 x 1500 x 2455	8.2
	2300	HD9x-J100/2800	2800	6300 x 1500 x 2455	8.2
	2500	HD9x-J100/3150	3150	6300 x 1500 x 2455	9.4
	2700	HD9x-J100/3375	3375	6300 x 1500 x 2455	11
	2800	HD9x-J100/3500	3500	6300 x 1500 x 2455	11
	3250	HD9x-J100/4000	4000	6300 x 1500 x 2455	11
	3500	HD9x-J100/4500	4500	6300 x 1500 x 2455	11
	3800	HD9x-J100/4750	4750	6300 x 1500 x 2455	11
 <p>2455mm 6290mm T: 1500mm</p>	4000	HD9x-J100/5000	5000	6295 x 1500 x 2455	13.2
	4500	HD9x-J100/5600	5600	6295 x 1500 x 2455	13.2
	5000	HD9x-J100/6300	6300	6295 x 1500 x 2455	13.2

HD9x Electrical Specifications & Mounting Dimensions

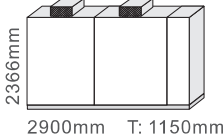
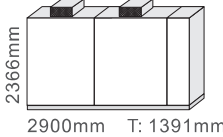
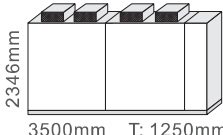
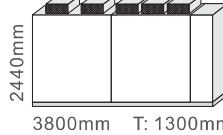
Two-quadrant System Mounting Dimensions | 10 kV Series

	Power of Adatable Motor (kW)	Drive Model	Output Capacity (kVA)	Size (W x D x H mm)	Weight (kg)
 <p>2550mm 6000mm T: 1500mm</p>	5600	HD9x-J100/7000	7000	6000 x 1500 x 2550	15
 <p>2550mm 7100mm T: 1500mm</p>	6300	HD9x-J100/8000	8000	7100 x 1500 x 2550	17
 <p>2550mm 7500mm T: 1500mm</p>	7100	HD9x-J100/9000	9000	7500 x 1500 x 2550	18
 <p>2650mm 7900mm T: 1500mm</p>	8000	HD9x-J100/10000	10000	7900 x 1500 x 2650	20
 <p>2650mm 8500mm T: 1500mm</p>	9000	HD9x-J100/11250	11250	8500 x 1500 x 2650	21
 <p>2800mm 9000mm T: 1500mm</p>	10000	HD9x-J100/12500	12500	9000 x 1500 x 2800	22.2

Notes:

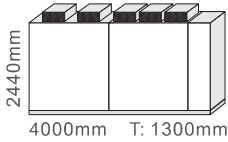
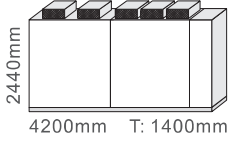
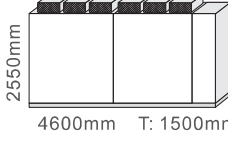
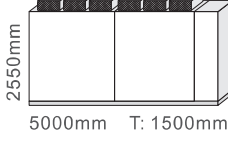
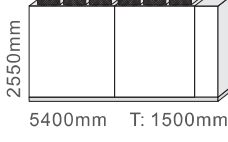
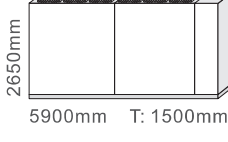
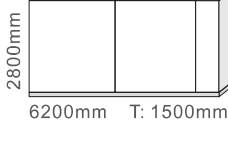
- Capacity of the medium voltage AC drive can be adjusted based on customer requirements.
- The size and weight data given above is for reference only. Data given in actual technical agreement shall prevail.
- Input and output voltages of standard HD models are the same.
- The size given above does not include height of the cooling fan. To install the cooling fan, an extra of 600mm is needed.
- The size and weight given above are calculated from the combination of the control cabinet, power cell cabinet and inverter unit, and does not include the bypass cabinet.
- Minimum clearances for equipment placement:
 - Equipment front to wall: 1500 mm;
 - Equipment back to wall: 1000 mm;
 - Equipment side to wall: 800 mm;
 - Equipment top to ceiling: 1000 mm.

Two-quadrant System Mounting Dimensions | 6 kV Series

	Power of Adatable Motor (kW)	Drive Model	Output Capacity (kVA)	Size (W x D x H mm)	Weight (kg)
 <p>2366mm 2900mm T: 1150mm</p>	250	HD9x-F060/315	315	2900 x 1150 x 2366	2.1
	280	HD9x-F060/355	355	2900 x 1391 x 2366	2.3
 <p>2366mm 2900mm T: 1391mm</p>	315	HD9x-F060/400	400	2900 x 1391 x 2366	2.4
	355	HD9x-F060/450	450	2900 x 1391 x 2366	2.44
	400	HD9x-F060/500	500	2900 x 1391 x 2366	2.5
	450	HD9x-F060/560	560	2900 x 1391 x 2366	2.6
	500	HD9x-F060/630	630	2900 x 1391 x 2366	2.77
	560	HD9x-F060/710	710	3500 x 1250 x 2346	3
 <p>2346mm 3500mm T: 1250mm</p>	630	HD9x-F060/800	800	3500 x 1250 x 2346	3.1
	710	HD9x-F060/900	900	3500 x 1250 x 2346	3.3
	800	HD9x-F060/1000	1000	3500 x 1250 x 2346	3.5
	900	HD9x-F060/1120	1120	3500 x 1250 x 2346	3.7
	1000	HD9x-F060/1250	1250	3500 x 1250 x 2346	3.8
	1120	HD9x-F060/1400	1400	3800 x 1300 x 2440	4.3
 <p>2440mm 3800mm T: 1300mm</p>	1250	HD9x-F060/1600	1600	3800 x 1300 x 2440	4.5
	1400	HD9x-F060/1800	1800	3800 x 1300 x 2440	4.7
	1600	HD9x-F060/2000	2000	3800 x 1300 x 2440	5

HD9x Electrical Specifications & Mounting Dimensions

Two-quadrant System Mounting Dimensions | 6 kV Series

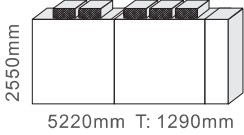
	Power of Adatable Motor (kW)	Drive Model	Output Capacity (kVA)	Size (W x D x H mm)	Weight (kg)
 <p>2440mm 4000mm T: 1300mm</p>	1800	HD9x-F060/2250	2250	4000 x 1300 x 2440	5.2
	2000	HD9x-F060/2500	2500	4000 x 1300 x 2440	6.5
 <p>2440mm 4200mm T: 1400mm</p>	2300	HD9x-F060/2800	2800	4200 x 1400 x 2440	6.6
	2500	HD9x-F060/3150	3150	4200 x 1400 x 2440	7
	2700	HD9x-F060/3375	3375	4200 x 1400 x 2440	7.1
	2800	HD9x-F060/3500	3500	4200 x 1400 x 2440	7.2
	3200	HD9x-F060/4000	4000	4200 x 1400 x 2440	8.5
 <p>2550mm 4600mm T: 1500mm</p>	3550	HD9x-F060/4500	4500	4600 x 1500 x 2550	11
 <p>2550mm 5000mm T: 1500mm</p>	4000	HD9x-F060/5000	5000	5000 x 1500 x 2550	11.2
 <p>2550mm 5400mm T: 1500mm</p>	4500	HD9x-F060/5600	5600	5400 x 1500 x 2550	11.2
 <p>2650mm 5900mm T: 1500mm</p>	5000	HD9x-F060/6300	6300	5900 x 1500 x 2650	13.5
 <p>2800mm 6200mm T: 1500mm</p>	5600	HD9x-F060/7000	7000	6200 x 1500 x 2800	15.2

Four-quadrant System Electrical Specifications

Item	Voltage	6 kV Series	10 kV Series
Input	Rated input voltage	3-phase 50/60 Hz, 6 kV	3-phase 50/60 Hz, 10 kV
	Voltage fluctuation range	-20% to +15%: full-load running; -20% to +35%: allows long-time derating running	
	Frequency range	50/60 Hz \pm 10%	
	Cell input voltage	1000 V	
	Input power factor	\geq 0.95 (above 20% load)	
	Input current harmonics	\leq 2%; Comply with IEEE519-1992 and GBT14549-93 standards	
Output	Output voltage range	0 to 6 kV	0 to 10 kV
	Output capacity range	315 to 4000 kVA	315 to 5000 kVA
	Cell output voltage	1160 V	
	Output frequency range	0 to 50/60 Hz; Max. 120 Hz; 120 Hz and above need customization	
	Speed range	100:1 (SVC); 200:1 (CLVC)	
	Speed accuracy	\pm 0.5 % (SVC); \pm 0.01 % (CLVC)	
	Torque response	$>$ 750 rad/s	
	Startup torque	0.5 Hz/150% (SVC); 0 Hz/200% (CLVC)	
Technical scheme	Power cell cascading; AC-DC-AC; medium voltage input and output		
Control mode	SVC, CLVC		
Rectifier	AFE full control rectifier		
Inverter	Multi-level		
Acce/Dece time	0.1 to 6500s; Requirement of above 6,500s needs customization.		
Start/Stop control	Local/Remote		
Control system	ARM, DSP, FPGA, CPLD, HMI		
Display	Touch screen/LCD (in Simplified Chinese)		
Overload capacity	60s for 180% of rated current; instant protection for 220% of rated current;		
Whole-machine efficiency	\geq 97%		
Fuse protection for inverter	With fuse at input side of the power cell		
Electrical isolation	Using optical fiber		
Input filter	Not necessary		
Output filter	Not necessary		
Power factor compensation	Not necessary		
Power cell protection	Over-voltage, under-voltage, voltage-sharing, input phase loss, over-current, overheat, communication		
System protection	Protection for motor over-capacity, output over-capacity, output short-circuit, output/input grounded, input over-current/voltage, input imbalance, cooling fanfault, inverter overheat/tripping, door switch interlock protection, and etc		
MTBF	75000 hours		
Communication ports	CANbus, Modbus, PROFIBUS (special customization requirement can be satisfied)		
Switching value input	x 10: dry contact relay		
Switching value output	x 16: dry contact relay		
Analog input	x 4: 4 to 20 mA or 0 to 10 V		
Analog output	x 5: 4 to 20 mA or 0 to 10 V		
Working environment	Indoor		
Temperature	-10°C to +40°C (de-rated use: +40°C to +50°C; preheat is required at \leq -10°C)		
Humidity	5% to 95%, no condensation		
Altitude	\leq 1,000 m (de-rated while above 1,000 m)		
Total equipment noise	\leq 75 dB		
Cooling mode	Forced air cooling		
IP level	IP30		
Type of cabinet	GGD type		
Inlet/Outlet mode	Down in down out/up in up out (special customization requirement can be satisfied)		
Control power	380 VAC \pm 10% three-phase four-wire		

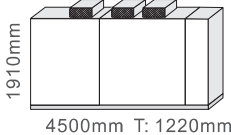
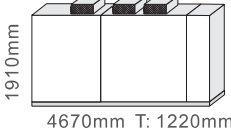
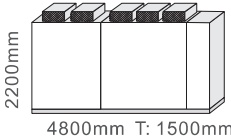
HD9x Electrical Specifications & Mounting Dimensions

Four-quadrant System Mounting Dimensions | 10 kV Series

	Power of Adatable Motor (kW)	Drive Model	Output Capacity (kVA)	Size (W x D x H mm)	Weight (kg)
 <p>2550mm 5220mm T: 1290mm</p>	250	HD9x-J100/315-R	315	5220 x 1290 x 2550	4000
	315	HD9x-J100/400-R	400	5220 x 1290 x 2550	4200
	400	HD9x-J100/500-R	500	5220 x 1290 x 2550	4400
	450	HD9x-J100/560-R	560	5220 x 1290 x 2550	4600
	500	HD9x-J100/630-R	630	5220 x 1290 x 2550	4750
	560	HD9x-J100/710-R	710	5220 x 1290 x 2550	4850
	630	HD9x-J100/800-R	800	5220 x 1290 x 2550	5000
	710	HD9x-J100/900-R	900	5220 x 1290 x 2550	5250
	800	HD9x-J100/1000-R	1000	5220 x 1290 x 2550	5400
	900	HD9x-J100/1120-R	1120	5220 x 1290 x 2550	5850
	1000	HD9x-J100/1250-R	1250	5220 x 1290 x 2550	6000
	1120	HD9x-J100/1400-R	1400	5220 x 1290 x 2550	6350
	1250	HD9x-J100/1600-R	1600	5220 x 1290 x 2550	6550
	1400	HD9x-J100/1800-R	1800	5220 x 1290 x 2550	7350
	1600	HD9x-J100/2000-R	2000	5220 x 1290 x 2550	7600
1800	HD9x-J100/2250-R	2250	5220 x 1290 x 2550	7700	
 <p>2200mm 6000mm T: 1500mm</p>	2000	HD9x-J100/2500-R	2500	6000 x 1500 x 2200	7900
	2500	HD9x-J100/3150-R	3150	6000 x 1500 x 2200	8100
	3150	HD9x-J100/4000-R	4000	6000 x 1500 x 2200	8300
	4000	HD9x-J100/5000-R	5000	6000 x 1500 x 2200	8500

Note: Four-quadrant products include HD92 series and HD93 series.

Four-quadrant System Mounting Dimensions | 6 kV Series

	Power of Adatable Motor (kW)	Drive Model	Output Capacity (kVA)	Size (W x D x H mm)	Weight (kg)
 <p>1910mm 4500mm T: 1220mm</p>	250	HD9x-F060/315-R	315	4500 x 1220 x 1910	3100
	315	HD9x-F060/400-R	400	4500 x 1220 x 1910	3200
	400	HD9x-F060/500-R	500	4500 x 1220 x 1910	3300
	450	HD9x-F060/560-R	560	4500 x 1220 x 1910	3400
	500	HD9x-F060/630-R	630	4500 x 1220 x 1910	3500
	560	HD9x-F060/710-R	710	4500 x 1220 x 1910	3800
 <p>1910mm 4670mm T: 1220mm</p>	630	HD9x-F060/800-R	800	4670 x 1220 x 1910	4000
	710	HD9x-F060/900-R	900	4670 x 1220 x 1910	4300
	800	HD9x-F060/1000-R	1000	4670 x 1220 x 1910	4400
	900	HD9x-F060/1120-R	1120	4670 x 1220 x 1910	4800
	1000	HD9x-F060/1250-R	1250	4670 x 1220 x 1910	5000
 <p>2200mm 4800mm T: 1500mm</p>	1250	HD9x-F060/1600-R	1600	4800 x 1500 x 2200	5300
	1600	HD9x-F060/2000-R	2000	4800 x 1500 x 2200	5500
	2000	HD9x-F060/2500-R	2500	4800 x 1500 x 2200	5700
	2500	HD9x-F060/3150-R	3150	4800 x 1500 x 2200	5900
	3150	HD9x-F060/4000-R	4000	4800 x 1500 x 2200	6100

Notes:

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- The size and weight given above are calculated from the combination of the control cabinet, power cell cabinet and inverter unit, and does not include the bypass cabinet.
- Minimum clearances for equipment placement:
 - Equipment front to wall: 1500 mm;
 - Equipment back to wall: 1000 mm;
 - Equipment side to wall: 800 mm;
 - Equipment top to ceiling: 1000 mm.

Note: Four-quadrant products include HD92 series and HD93 series.



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