Medium Voltage Variable Frequency Drive

HIVERT Series

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Hiconics Drive Technology Co., Ltd.

December. 2016

Compact cabinet

● 6kV/315~500kW
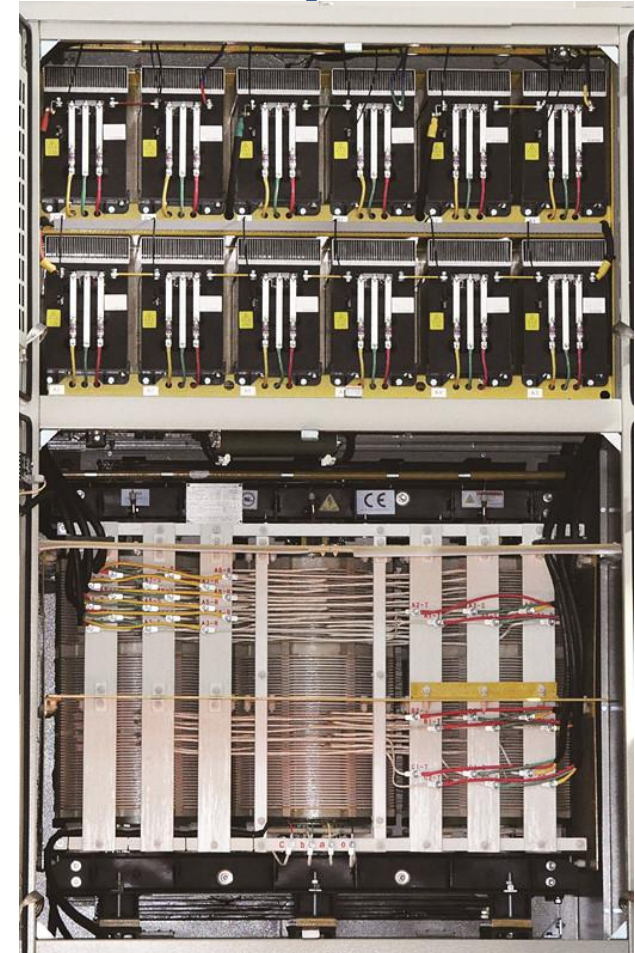● 10kV/400~800kW

HIVERT series MV VFD – Compact cabinet

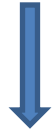**Control Panel**

Power Cell

Power cell (Top) TM (Bottom)

HIVERT series MV VFD – Separate cabinet

HIVERT series MV VFD – Separate cabinet

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Transformer cabinet   Power cell cabinet   Control cabinet

Multipulse phase shift transformer
● Unique Cooling system
● High heat dissipation efficiency

Multiple power cells cascaded technology
● 6kV,6.6kV Composed of 15 Power Cells;
● 10kV,11kV Composed of 27 Power cells.

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Water Cooled MV Drive

HIVERT series MV VFD – Water cooled

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Fully enclosed air-water heat exchange dry type transformer

- Protection level IP42
- No maintenance
- Fully enclosed air-water heat exchange type, not be affected by temperature and dust on site

Power cell cabinet

- Cooling water in parallel contribute to even distribution;
- Independent dissipation duct for lower temperature, longer service life;
- Cooling tap use double closure quick joint, no drainage or linkage during power cell replacement.

Control system

Central-station control for easy and quick entrance to:
- oil immersed transformer temperature；
- water exchanger protection;
- VFD control

Water cooling exchange system

- Stainless for all circulation pipe;
- Independent deionized water device;
- Secondary water cooling with high efficiency;
- Independent PLC monitor system.

HIVERT series MV VFD - All Ratings

Voltage Rating:

- 3.3kV / 4.16kV / 6kV / 6.6kV / 10kV / 11kV as Standard
- Customized Voltage Rating:

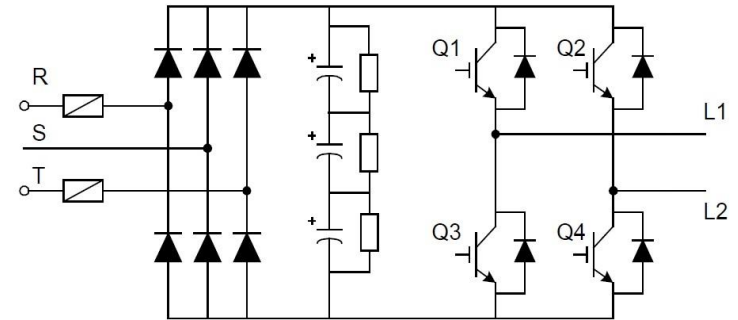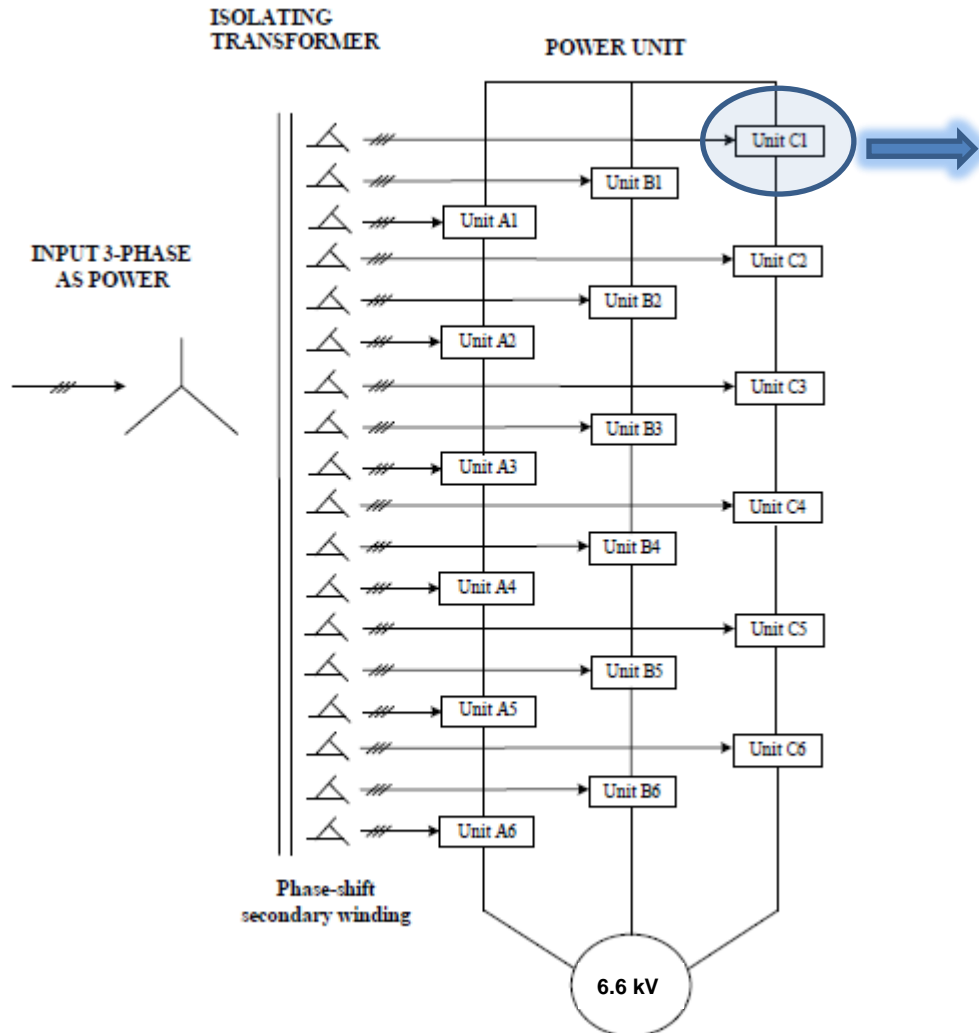 e.g. 11kV input-6.6kV output, 11kV input-3.3kV output

Power Rating:

- from 250kW to 20,000kW
- from 350KVA to 25,000kVA

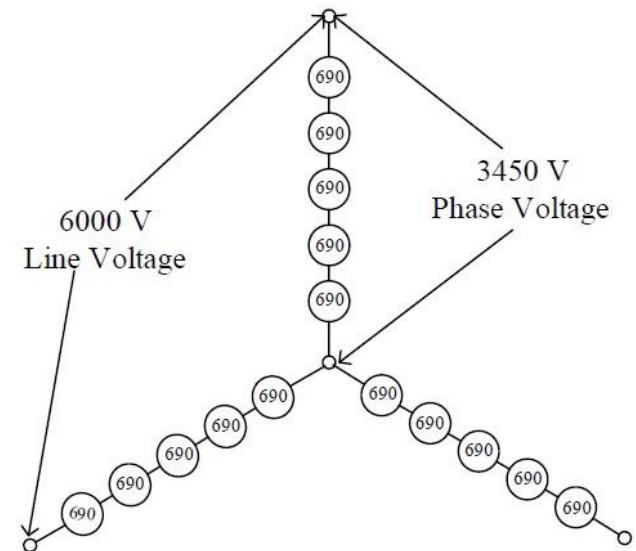## Current Rating:

- from 35A to 1540A
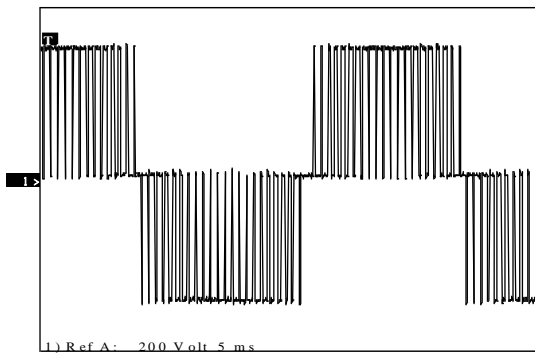
Power cell's topology

HIVERT series MV VFD - Topology

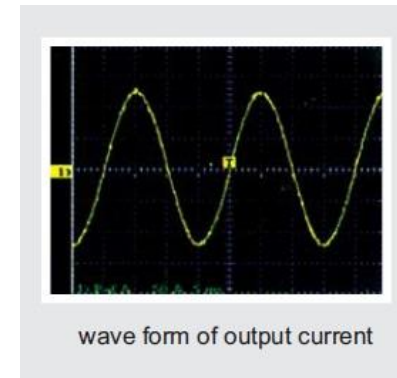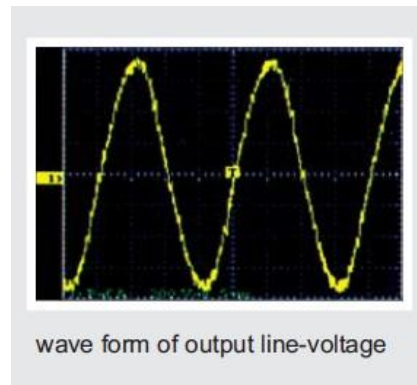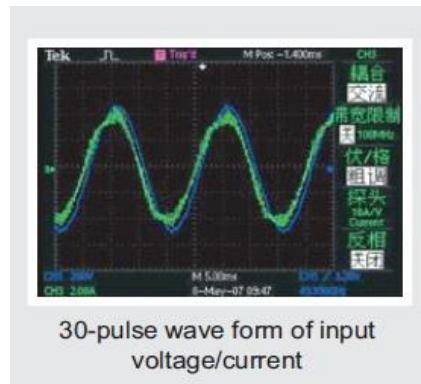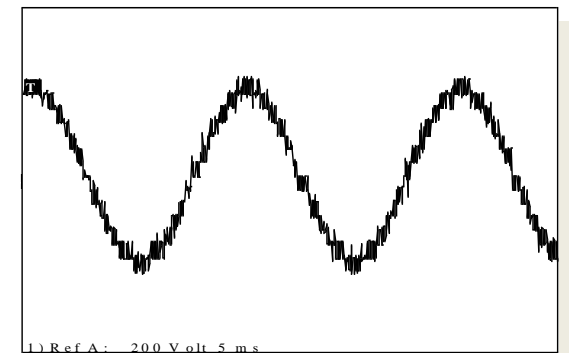| Voltage (kV)	Rectifier (Pulse)	Power Cell (Unit)
2.3	18	9
3.3	18	9
4.16	24	12
6	30	15
6.6	36	18
10	48	24
11	54	27

6kV VFD 5 Power Cells per phase cascade

Each Power Cell (L1 – L2)
PWM Output Waveform

Multi-level Additive Effect
Voltage Output Waveform
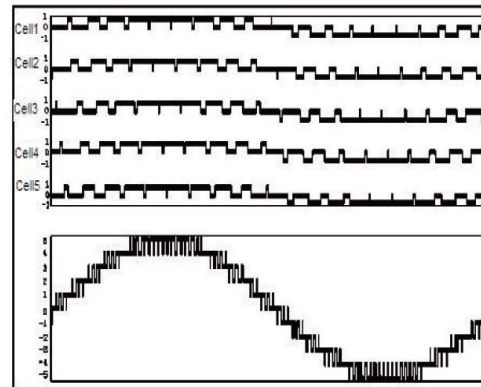
Each Phase (A or B or C)
Voltage Output Waveform

30-pulse wave form of input voltage/current

wave form of output line-voltage

wave form of output current

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Comprehensive and Perfect Technical Performance

- Rated voltage variation: -20%~+15%

- Rated frequency variation: +/- 10%

- Output frequency: 0 ~100Hz, Speed control accuracy: 0.01Hz

- No need output filter, no stress on insulation of motor stator terminals and cables

- No need for the input PF correction capacitor (≥ 0.96)

- Harmonic reflected on mains very low THDV < 5%, comply with IEEE519.

- High efficiency including transformer (≥ 96%)

- Permissible momentary power loss (< 1s)

- Fully protection: Overvoltage, over current, under-voltage, phase loss, overload,

- overheat, earth fault, short circuit…etc.
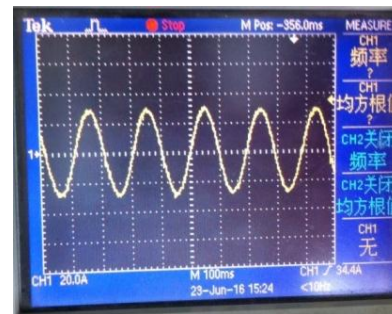
- MTBF > 30,000h, MTTR < 30min

  …

HIVERT series MV VFD - Features
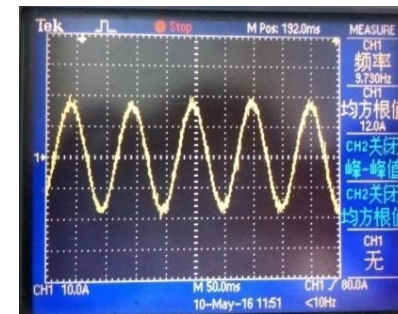
Main controller chips

The main controller chip uses TI's TMS320F28335 digital signal processor, the device has the advantages of high precision, low power consumption, high performance, high peripheral integration, data and program storage capacity, and A/D conversion more accurate and fast. TMS320F28335 has 150MHz high-speed processing capability, 32-bit floating-point processing unit, 6 DMA channels, support ADC, McBSP and EMIF. With up to 18 PWM outputs, six of them are TI's more accurate PWM outputs (HRPWM) and 12-bit 16-channel ADCs. Thanks to its floating-point calculation unit, users can quickly write control algorithms without having to spend too much time and effort on decimal operations, with an average performance improvement of 50% over the previous generation DSPs. At the same time, the application of better control algorithm, so that the waveform of the inverter running at low-frequency current and output harmonics have a significant increase.
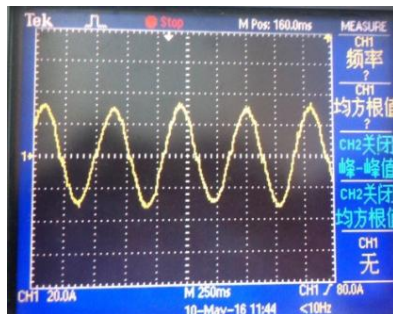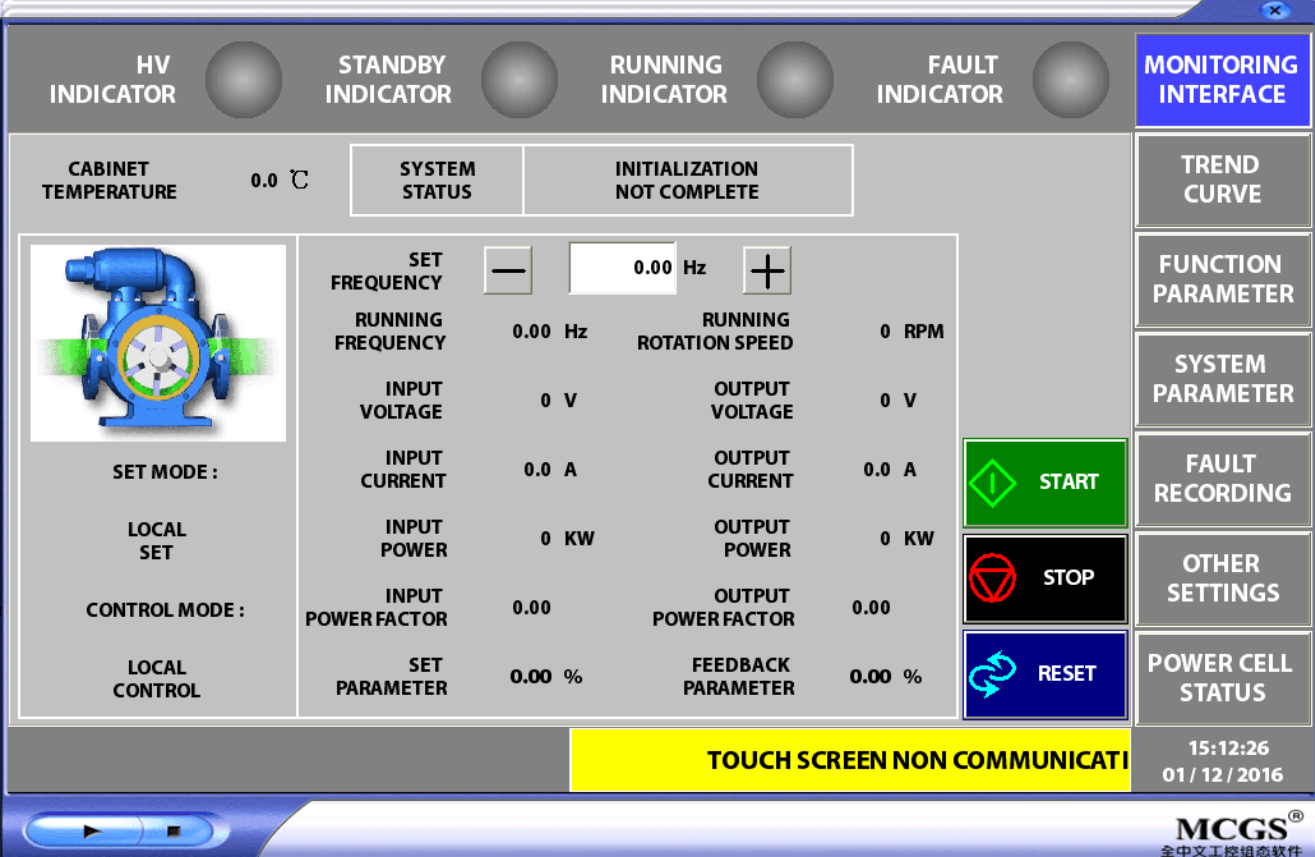

Current waveform at 2 Hz   Current waveform at 5 Hz   Current waveform at 10 Hz

HIVERT series MV VFD - Features

Monitoring HMI

- 10 inch touch screen

- Supporting multi languages

- Control system status and monitoring

- Powerful data control (data logging, diagnostics, and information)

- User-centric convenience (HD display, high data throughput, user-friendly interface)

S7-200 Smart PLC

- Interface logic control device uses Siemens S7-200 SMART PLC as the core. The PLC is equipped with Siemens dedicated high-speed processor chip, and the basic instruction execution time of up to 0.15 µs, 24DI, 16DO, 4AI, 4AO selectable to meet the drive control requirements, to ensure adequate interface and fast computing processing

- The core of the new interface board is S7-200 SMART CPU, the module comes standard with Ethernet interface, support Siemens S7 protocol, TCP / IP protocol, effectively support a variety of terminal connections. In addition, the CPU module is integrated with one RS485 interface. It can communicate with the third-party equipment such as the inverter and touch screen. At the same time, it is equipped with expansion CM01 signal board to realize RS232 / RS485 free communication and support profibus and Ethernet TCP / IP communication protocol.

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Flying start

Also called "speed start", when the motor is still rotating, the drive will automatically estimate the motor speed, and output the same voltage waveform with the motor frequency. When start, current is limited within the rated current, this will not cause over current problem.

Used when the drive automatically restarts after power loss, or Motor switch from network running to drive mode running.
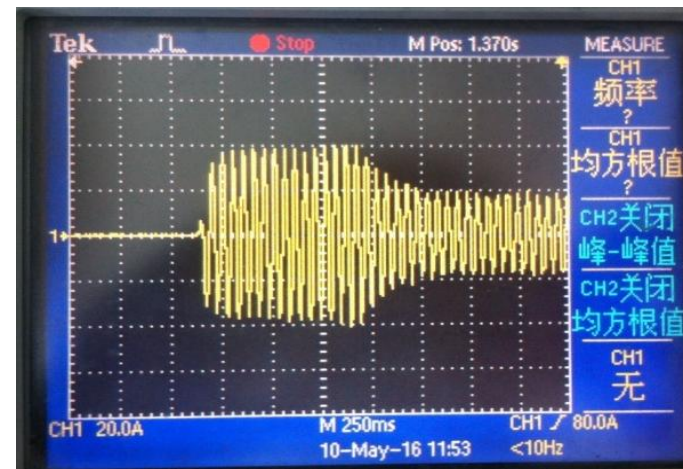

Flying start motor/network waveform

Cell bypass function

- HIVERT MV VFD has the cell bypass function with the additional IGBT circuit in each power cell unit, when the main IGBTs in power cell is tripped and cut-off, the additional IGBTs will be operated immediately without any interruption on the VFD running. Once one power cell has fault, the VFD can remove and isolate 3 power cells (one cell per phase, including one fault power cell) and continues to operate with (N – 1) cells/ per phase at a certain load.
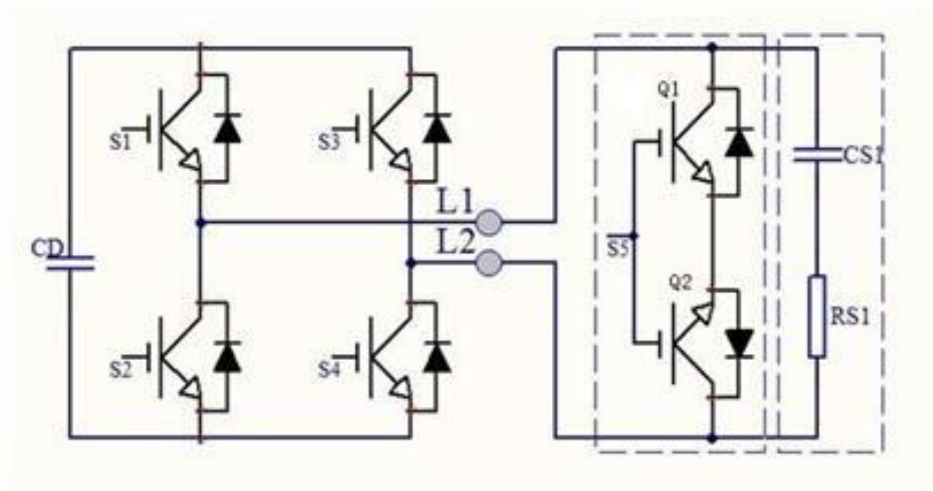
Other features

- **Instant power loss:** When grid voltage drop or power off for less than 1000ms, VFD can run without stop to support process at site.

- **Torque boost:** Increasing the output voltage when at low frequency, to boost the motor torque when running with low speed. This can solve the big torque load starting problem.

- **Double winding motor control**: Double winding motor has higher PF and efficiency, smaller loop circuit increase system capacity. VFD driving the double winding motor can realize full speed with half load, half speed with full load, improve system stability.

- **Neutral point shift:** When 1 power cell fault, other power cells can adjust output voltage to keep normal output voltage, by change phase position to maintain continuous running.

- **Power cell braking function:** It uses for site need quick braking at lower frequency; the energy will be consumed by heat.

HIVERT series MV VFD – Main Components

| Components	Manufacturer	Country
IGBT	INFINEON	Germany
Rectifier	SEMIKRON	Germany
Electrolytic capacitor	NICHICON	Japan
Fan	EBM	Germany
Fiber & interface	Agilent	United states
Drive chip	MITSUBISHI	Japan
Transformer	BB-ELC	China
Relay & MCB	Schneider	France
Terminals	Wago	Germany

HIVERT series MV VFD – Sync transfer system

Synchronous transfer function

- Using phase lock loop technology to adjust the output of the drive, make the frequency, phase position and amplititude match those of the network. Achieve switching motor power from medium voltage drive to the network power (bypass mode) or vice versa (drive mode).

- Multi-motor synchronous transfer function allows users to start multiple (up to 4) MV motors sequentially in drive mode and control the last motor speed.
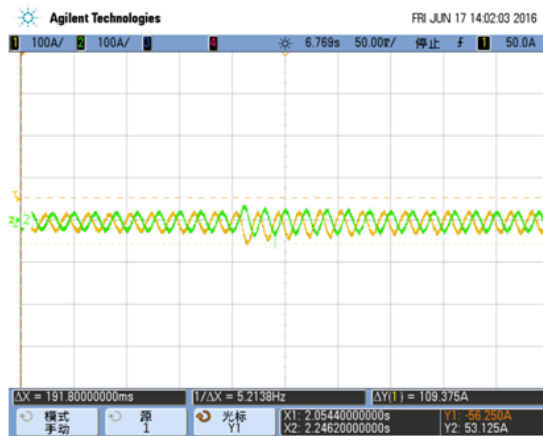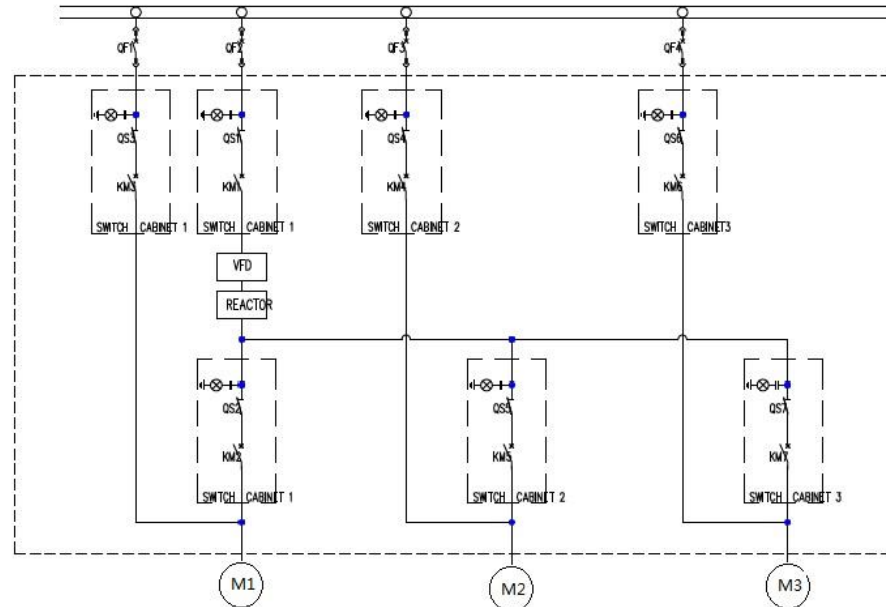
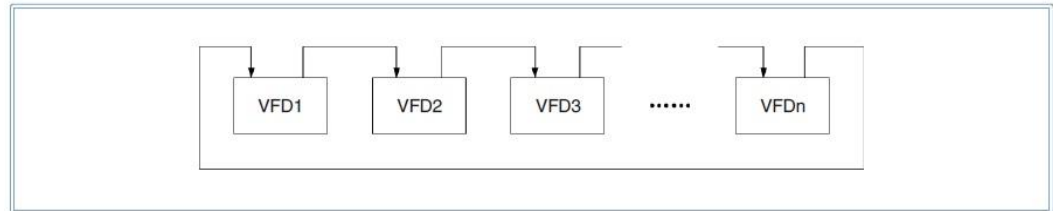**Current valid value 15A, switch peak 31A before sync transfer**
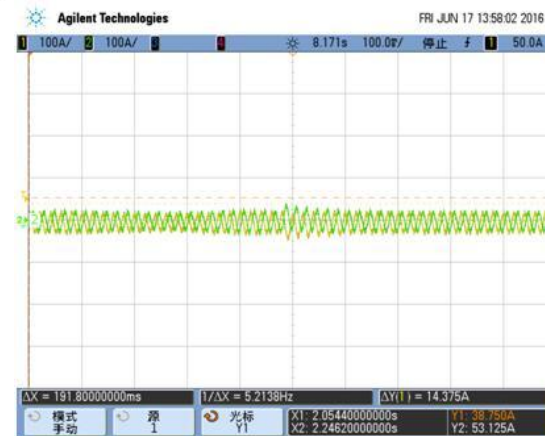
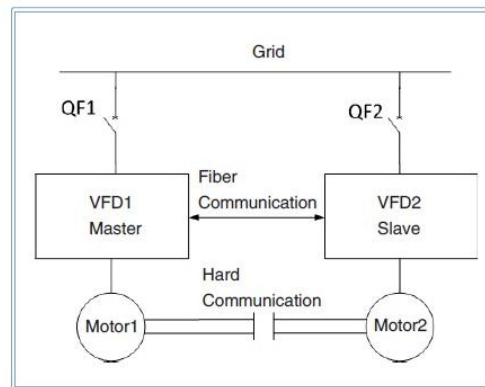**The motor current waveform during sync transfer**

HIVERT series MV VFD – Master-slave Control

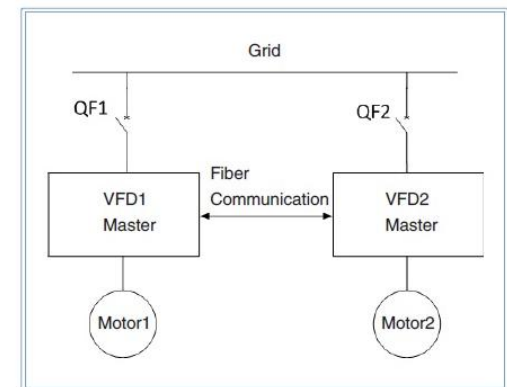
Built-in Sync Controller

- Optic-fiber communication

- Built-in Sync Controller

- Master-slave control mode

- Up to 32 sets of VFDs

- Torque and speed balance

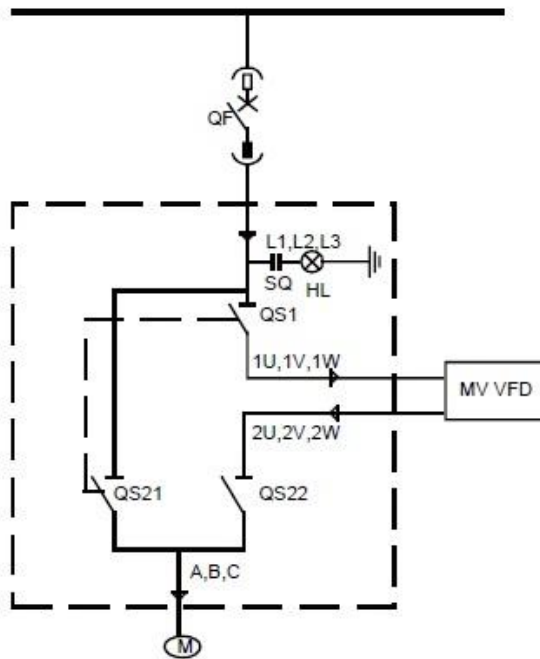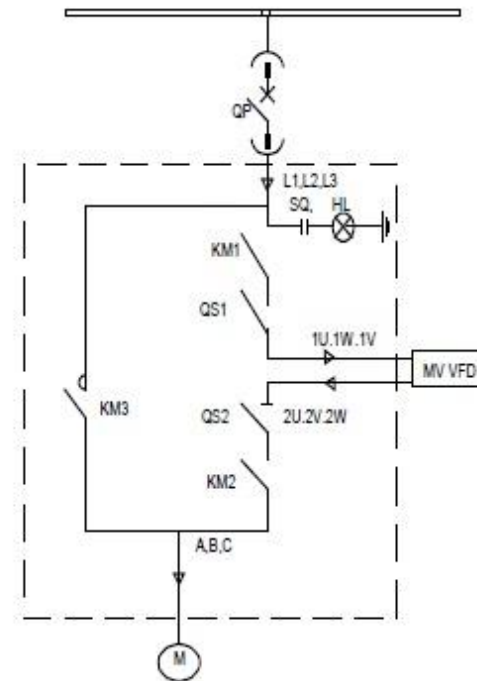- Started or stopped by one signal

Ensure Production Continuously

- Motor can be driven at the power grid mode when VFD has fault

Manual By–pass Cabinet

Auto By–pass Cabinet (with isolated)

Green Technology, Benefit Mankind

THANKS FOR YOUR ATTENTION!

Hiconics Drive Technology Co., Ltd.