



IDrive2000 Series

Medium Voltage Variable Frequency Drive

User Manual

SHANGHAI ISTECH ELECTRIC CO., LTD.

Preface

We appreciate so much for choosing our ISTECH IDrive series medium voltage variable frequency drive.

Our manual includes the instruction of use and attention clauses.

Incorrect use could cause accident and even lead to casualty of life. Before you use our MV Drive, please read carefully of our manual and then use it correctly.

Please pass our manual to end-user. After you used our manual, please do keep it together with MV Drive for in case use.

Instruction rated to safety.

Please carefully read our manual and attached instruction material. Please don't install, operate, maintain and check our inverter before you can right use our inverter.

You can use after you familiar with the knowledge, safety information and relative information of our inverter.

In instruction brochure, we classify two level of dangerous mark, one is dangerous mark, the other is attention mark.

Dangerous mark means inappropriate use will cause dangerous situation like casualty of life.

Attention mark means inappropriate use will cause slight hurt and damager for people or machine.

Please note:

According to different scenario, attention mark level will also cause serious accident. Thus it is the same important as life safety. Please follow strictly these two mark and the related usage content.

Safety clause

1) Confirmation for goods arrival.

Dangerous

If you find component lost or goods and component damage, please stop use. And contact our company. Otherwise, the equipment filled with electricity may cause dangerous, seriously it will cause electric conduction and big fire.

2) Transportation, storage and installation.

Attention:

Please confirm the actual loading weight capacity and position of transport tools.

When use crane to hang on inverter, please let related professional worker handle.

Otherwise, it may accidental fall and cause casualty of life.

Please follow strictly the transportation method indicated by our instruction manual.

Otherwise may cause inverter fall and damage.

Inverter must careful handle, forbidden raining, sun exposure and severe shaking, collision and upside down.

During transport shall also take limited height into consideration.

Please use and store our inverter under below environment.

Environment requirement	Working Temperature	0°C~+45°C
	Relative humidity	≤95%(no condensation)
	Storage Temperature	-20°C~+55°C
	Surrounding environment	Indoor(no corrosive gas or liquid, no flammable and combustible gas or liquid, no conductive dust, salt mist and wet gas cause condensation)
	Altitude	0~1000m: 100% loading capacity; >1000m:derate operate.

3: Wiring

Dangerous
<p>Before wiring, you must cut off all input power supply and turn off the output of UPS power supply.</p> <p>Otherwise it may cause electric conduction and big fire.</p> <p>When doing the wiring, you must let the professional technician finish.</p> <p>Otherwise it may cause electric conduction and big fire.</p> <p>Inverter must proceed with reliable grounding(grounding impedance $< 10\Omega$);</p> <p>Otherwise it Otherwise it may cause electric conduction and big fire.</p> <p>Before wiring, please ensure ‘ urgent stop’ button is under closed position, and also the same as input signal of inverter starter.</p> <p>Precaution sudden switch on, precaution the dangerous of electric conduction.</p> <p>After wiring finished, please indeed check ‘ urgent stop’ circuit action whether can operate regularly;</p> <p>Urgent stop function may irregular lost which will cause major accidents(wiring responsibility belongs to user)</p> <p>Forbid to directly hand touch input of equipment. Input terminal, or input and output cable-contacting inverter cabinet or similar metal conductor.</p> <p>Otherwise it may cause electric conduction or ground fault.</p> <p>Forbid to handle output cable as short circuit.</p> <p>Otherwise it may cause the big fire.</p>
Attention
<p>Please proceed input and output wiring correctly. If input or output wiring is wrong, it will cause damage and even casualty of life.</p> <p>Please confirm the input power voltage of main circuit is the same as rated voltage.</p> <p>Every voltage put on each terminal shall only be the same as manual regulated voltage.</p> <p>Please confirm the reliable connection between cable and right terminal.</p> <p>Please don’t test the voltage endurance of equipment which may cause the inside semiconductor component damage.</p> <p>Please don’t connect similar compensation device or noise filter directly with the main circuit input power terminal which will cause equipment and component damage.</p> <p>Please connect correctly inverter with the cable U, V, W between motor so to avoid the influence of motor’s right rotate direction.</p>

4. Test running

Dangerous

Even though our inverter has gating alarm protection function(as long as transformer, power unit or bypass cabinet is open, inverter will stop running or unable to run), please don't run inverter. Otherwise it will cause electric conduction by touching high voltage terminal and charging circuit.

2. Please don't open cabinet when inverter is charging or running.

Otherwise it will electric conduction.

3. Please don't touch any components of cabinet even though power(include main circuit and control circuit power) switch off, UPS is under operation.

4. Otherwise it will cause electric conduction or component damage.

4. When fault occur, please confirm operation signal is off.(closed situation). Alarm us recovered only after fault is solved.

Otherwise it will cause serious accident and casualty of life.

5. Wiring or checking must under power off more than 15 minutes and make sure UPS power is closed which shall be done by professional technician.

Otherwise it will cause electric conduction.

6. Please don't handle switch when your bare hand is wet with any some liquid.

Otherwise it will cause electric conduction.

7. Please don't change air cooling fan when equipment is running with power.

Otherwise it will cause electric conduction.

Attention

Before test use, please make sure equipment cabinet is closed. Otherwise inverter can not be started.

Before test use, please make sure the output of equipment is separated from loading motor(first test use without loading motor). When parameter is debugged and then run with loading motor. Otherwise it may cause equipment damage.

When parameter is set up, please press the ‘ urgent stop’ button in time and make sure all starter signal is under off situation.

When equipment is running, non-professional technician is not allowed to connect signal tester with circuit board.

Non-professional technician is not allowed to equipment parameters at own will.

5. Operation

Attention

Please follow strict the order of on power. First to control power, second to bypass cabinet and third to transformer cabinet’s high voltage power.

Please follow strict on the order of off power. First to bypass cabinet, second to transformer cabinet’s high voltage power and third to control power.

Please don’t adopt the method of switch on and off of main circuit to control the start and stop of our inverter.

Please attention ‘ start/stop’ button is only functioned under ‘local’ control. It can not applied ‘remote’ control. But ‘ urgent stop’ button is available under any circumstances.

please re-check and set necessary parameter when parameter erased or each parameter is coming back to original factory setting.

If you want to see more special function of our inverter, please draw attention to our follow-up chapter.

It must check and test running our inverter when it being put aside without use after 3 months.

6. Fire prevention

Dangerous
<p>Please avoid our equipment nearby flammable and combustible goods. Otherwise it will cause fire accident.</p> <p>Please cut off the input power of our inverter when our equipment occur burnt smoke and explosion abnormal situation. Other it will cause big fire.</p>

7. usage occasion

Dangerous
<p>Our current IDrive series is applied for controlling three-phase asynchronous electric motor and cannot be applied for single-phase electric motor or other type of E-motor. Otherwise it will cause equipment damage and other unexpected damage.</p> <p>Our inverter series can not be simply applied in occasion related to personal safety.</p> <p>Our product is produced under severe quality control management. But if because of the breakdown of our product which cause predicted damage or lost occasion must carry forward safety protection measure for in case. Otherwise, it will cause severe damage and accident.</p>

8. Maintenance and security check.

Dangerous
<p>Please don't open cabinet and maintain our equipment under inverter running or non-cut off power of our inverter(include main circuit power and control power). Otherwise it will cause electric conduction.</p> <p>Check the normal operation of 'urgent stop' in circuit by pressing the button of 'urgent stop and then cut off the main circuit power and control power. Waiting electrolytic capacitor in power unit discharging 15 minutes and proceed maintenance. Otherwise it will lead to electric conduction.</p> <p>Maintenance, security check and exchange of components must be operated by professional technician Otherwise it will cause electric conduction and fire accidents</p>
Attention
<p>When maintaining some part of electric components, static protection measure shall be taken when human body direct contact some sensitive electric parts.</p> <p>When connecting through the power of control circuit, please don't change cable connecting position and cable terminal position.</p>

9. Abandon solution

Attention
This product is not suitable for EU ROHS environmental protection directives, please cope with as industrial waste.

10. Others

Attention
Don't easily reform our equipment Otherwise it will cause electric conduction and fire accidents.
Attention
The picture used in manual is just for illustration and instruction which is under the open of cabinet and other part case circumstances. But our product must install fully right and appropriate and follow strict on our production.

Catalogue

Preface.....	1
Safety clause	2
Chapter 1 Production introduction	10
1.1. Application Area	10
1.2. Product feature	12
1.3. Technical parameter	13
1.4 Model definition.....	15
1.5 Implement standard.....	16
Chapter 2 work principle.....	18
2.1. Principle introduction.....	18
2.2. Main circuit.....	20
2.3. Control system	22
2.4. Power unit	23
Chapter 3 Component Composition.....	24
3.1. Introduction.....	24
3.2. Transformer cabinet	25
3.3. Control/unit cabinet.....	26
3.4. Master controller	28
3.5. Power unit	29
3.6. Human-man interface.....	30
3.7. Bypass cabinet.....	31
3.8. Other optional item	32
Chapter 4 Installation, Storage and wiring.....	33
4.1. Introduction.....	33
4.2. Check and accept event.....	33
4.3. Transportation and storage	33
4.4. Transport means	34
4.5. Requirement for on-site installation.....	37
4.6.Cabinet fasten and grounding.....	39
4.7.Medium voltage cable fasten and grounding.	39
4.8 User wiring.....	41
4.9 electromagnetic compatibility installation instruction	49
4.10. Insulation method.....	52
Chapter 5, Human-machine interface	53
5.1. Main picture	53
5.2. IDrive status instruction	54
5.3. Unit monitor picture	55
5.4 Parameter set up picture	56
5.5. Parameter check picture	58
5.6. Fault record picture	59
5.7. Operation button	61

Chapter 6 Start and debug	62
6.1. Introduction.....	62
6.2. Debug process and instrument & equipment	63
6.3 Eye check before power on	64
6.4. Converse power on test.	66
6.5. Frequency simulation running test	68
6.6 IDrive without motor test	69
6.7. IDrive running test with motor.....	71
Chapter 7 Function Character	73
7.1. Flying start	73
7.2. Sudden power off and on start.....	73
7.3. Load torque limitation.....	73
7.4. Torque promotion.....	74
7.5. Brake control.....	74
7.6. Open-loop control	75
7.7. Upper machine monitor(Optional).....	75
Chapter 8 Fault remove and maintenance	76
8.1. Introduction.....	76
8.2. Fault and alarm classification.....	76
8.3. IDrive fault and alarm	77
8.4. Unit fault and alarm	84
8.5. Unit fault maintenance	86
8.6. IDrive input protection.....	88
8.7. Fault dealing process.....	88
8.8. Regular maintenance.....	89
Chapter 9 After-sale service	90
9.1. Introduction.....	90
9.2. Quality ensure regulation	90
9.3. Service type and policy	90
9.4. Contact information	92

Chapter 1 Production introduction

1.1. Application Area

IDrive series general medium voltage inverter can be widely used in various global economic industry which is aimed at offering energy-saving solution by providing reliable and steady adjustable medium voltage frequency. It can provide user perfect medium voltage(asynchronous, Synchronous)AC motor soft starter, adjustable speed, energy-saving and intelligent control program. Various industries as below;



Coal, mining

Descale pump, Shush pump, shurry pump
Cleanwater pump, Charge pump, agitator pump
Draining pump, Kiln pump, Dust Extraction Fan
Contra-rotatong fan, axial flow fan



Thermal power electricity Generation

Induced Draft Fan, Primary Air Fan,
Secondary Air fan, Booster Fan, Mill Exhauster
Blower, Condensate pump, Circulating water pump
Boiler feed bump, mortar pump, pumped storage



Cement, Construction

Kiln Induced Draft Fan, Kiln Air Supply Fan
Kiln Outlet Draft Fan, High Temperature Fan
Coal mill, Dust Extraction Fan, Grate Cooler,
Circulating Fan, Raw Mill Fan,
Cement Grinding Mill Fan, Classifier Fan,
Forced Fan



Steel Metallurgy

Blast furnace blower, Induced Draft Fan
Kneading Machine, Compressor, Blower
Dust Extraction Fan, SO₂ Fan, Feed Water pump
Secondary Dust Extraction Fan, Water pump
Dephosphorization pump, descaling pump,
Oxygen compressor, Flushing Cinder Machine
Gas compression pump ect.



Light industrial, Chemical engineering

Gas blower, Booster pump, compressor
Axial flow pump, softened water pump
Feed water pump



Petroleum, Petrochemical, Natural Gas

Booster fan, compressor, pipeline pump
circulating water pump, Oil-submerged pump
Brine pump, transfer pump
Electric submerged pump, Water injection pump,
Feed water pump.



Municipal Engineering

(Water supply, power supply, sewage treatment ect.)
Aeration Fan, Induced Draft Fan, Blower
Booster pump, clean water pump, water supply pump

1.2. Product feature

IDrive general series medium voltage frequency converter is medium voltage(asynchronous, Synchronous) AC motor speed adjustable, drive device which is self R& D by Shanghai Istech Electric Co., Ltd. Below are our features;

Modular power unit design, maintenance and easy check

Our IDrive adopts power unit superposition of series techniques, mature technique and reliable components.

Adopting V/F control of sine wave PWM modulation technique, High precision, fast response and high efficiency.

Inverter is suitable for wide voltage range and is fit for global power grid conditions, user can direct connecting and no need through any filtering device and power element compensation device.

Perfect sine wave input current and no need filter device.

Output voltage possess AVR(Automatic Voltage Regulation) voltage stabilizer and protect motor insulation from over-voltage damage and reduce no-load energy waste.

Torque promotion function which can promote output voltage and output torque under low frequency running.

Fast start function. The function of no need to wait motor still to start. Tracking process approx.3-5 seconds.

The function of self-charge start after high voltage lost which is suitable for grid dual power changing-over and also working condition of grid power lost.

Fast speed dynamic response ability which is suitable for occasion requiring severe acceleration and deceleration speed time.

Advanced current, voltage limit function, and fast and safely drive motor.

Easy operation of full colorful touch screen man-machine interface, powerful function and detailed data.

Standard industrial interface and Ethernet interface, high compatibility standard Modbus, Profibus-DP, TCP/IP agreement which is suitable for various working condition sites.

Compact structure, reasonable layout and reducible installation cost.

IDrive series medium voltage inverter also possess below protection function and features.

Overvoltage, undervoltage protection

Overload, Overheat protection

Short-circuit, grounding, over-current protection

Phase loss protection

Controller power has UPS protection

Controller power fault interlock protection

Power unit and controller use Optical fiber Communication and totally electric insulation.

Communication, fault response interlock protection

Air-cooling fault interlock protection

Accurate and thorough fault record which can inquiry information and reset for fault.

Cabinet open alarm

Note: Regarding the product features and protect function of our IDrive series medium voltage frequency drive, please check detail at ' Chapter 7, function feature' and ' Chapter 8 fault remove and maintenance' description.

1.3. Technical parameter

Charter 1-1 main technical parameter charter

Input	Main circuit power	
	Rated frequency	50Hz/60Hz(± 10%)
	Rated voltage	AC Three phase 3kv, 6kv, 10kv(± 10%) 65%<input voltage<80%, system down to run
	Control Circuit power	
	Frequency	50Hz/60Hz(± 10%)
	Voltage	AC Three phase 380v, three phase four wire system(± 10%) AC single phase 220v(± 10%)
	Capacity	1-5kVA(according to system capacity)
Output	Frequency	0~120Hz
	Voltage	3kV, 6kV, 10kV(special voltage level is also available
	Current	25A~400A

	Power	110kW~5600kW
	Complete machine efficiency	$\geq 97\%$ (rated running, include input transformer)
	Over-load capacity	120%: every 10 minutes allow 1 minutes
		150%: 10s, protect(according to client's requirement)
		180%: instant protection
	Total harmonic wave	$< 2\%$
Control feature	Control way	High performance V/F control, open-loop/closed-loop vector control
	Modulation technique	Optimized SPWM
	Frequency precision	Simulation input: $\pm 0.5\%$ (Maxi. output frequency)
		Digital input: $\pm 0.1\%$ (set input frequency)
	Frequency set resolution	Simulation input: 0.05 Hz (0-10V/4-20mA)
		Digital input: 0.01Hz
	Torque promotion	Manual settable
	The time of speed up/down	1-3600s(According to client's load requirement set), straight line/S curve speed up/down model.
Drive control transmission	Optical fiber transmission	
Operation features	Frequency set	Analog quantity set: 0~10V/4~20mA
		Digital quantity set: local/remote
	Start way	Forward/Reversion control separately
	Stop way	Free stop / controlled stop
	Main running function	Fast speed start, sudden power off re-start, load torque limit
		Frequency hopping, multi-stage running, {superior limit/ inferior limit, start/stop}frequency set
		System self-diagnosis, PID control, remote control
		Automatic power frequency conversion(optional), intelligent unit bypass(optional), Brake function(Optional)
Digital Quantity input	Dry contact: 24 roads(expandable)	
Digital Quantity output	Dry contact: 16 roads(expandable)	

	Analog quantity input	4 roads: 0~10V/4~20mA(expandable)
	Analog quantity output	2 roads: 0~10V/4~20mA(expandable)
Structure Feature	Protection level	IP20(Standard, other level are available according to client requirement.
	Cooling way	Strong air cooling
	Cabinet color	RAL7036(Industrial gray, other colors are available for client's Pantone color.
Working environment requirement	Working temperature	0°C~+45°C
	Relative humidity	≤ 95%(no condensation)
	Storage temperature	-20°C~+55°C
	Surrounding environment	Indoor(No corrosive gas and no combustible gas and oil mist.
	altitude	0~1000m: 100% load capacity, > 1000m: down to run

Note: Our of above chart range please consult our company. If there is any change we may not inform. Please according detailed parameter agreement.

1.4 Model definition

<p>For instant</p> <p>IMV-A8-F8/0075-0</p> <p>Presentation:</p> <p>V/F control which is used for dual-quadrant asynchronous motor, 8 levels system, input and output rated voltage 10kv, output rated current 75A standard medium voltage frequency converter.</p>	IMV---

1.2. Model definition introduction

Name	Meaning								
IMV	Product series number								
-[Unit 1] Motor type	A	V/F control - asynchronous motor - two quadrant							
		'with' speed sensor				'without' speed sensor			
	D	Vector control-asynchronous motor - two quadrant			F	Vector control-asynchronous motor - two quadrant			
	E	Vector control-asynchronous motor - four quadrant			G	Vector control-asynchronous motor - four quadrant			
	H	Vector control- synchronous motor - two quadrant			J	Vector control- synchronous motor - two quadrant			
	I	Vector control - synchronous motor - four quadrant			K	Vector control - synchronous motor - four quadrant			
-[Unit 1] Unit series	3~9	Each phase unit described as from 3~9 in sequence							
	A, B, C	Each phase unit described as 10, 11, 12 pieces.							
-[Unit 1] Input voltage	A	B	C	D	E	F	G	X, Y, Z	
	3kV	3.3kV	4.16kV	6kV	6.6kV	10kV	11kV	Other	
-[Unit 1] Output voltage	3	4	5	6	7	8	9	0,1,2	
	3kV	3.3kV	4.16kV	6kV	6.6kV	10kV	11kV	Other	
-[Unit 1] Current level	Indicate the rated output current of frequency drive, such as 0400 means output current 400A.								
-[Unit 1] Generation code	0~9 means product upgrade code								

1.5 Implement standard

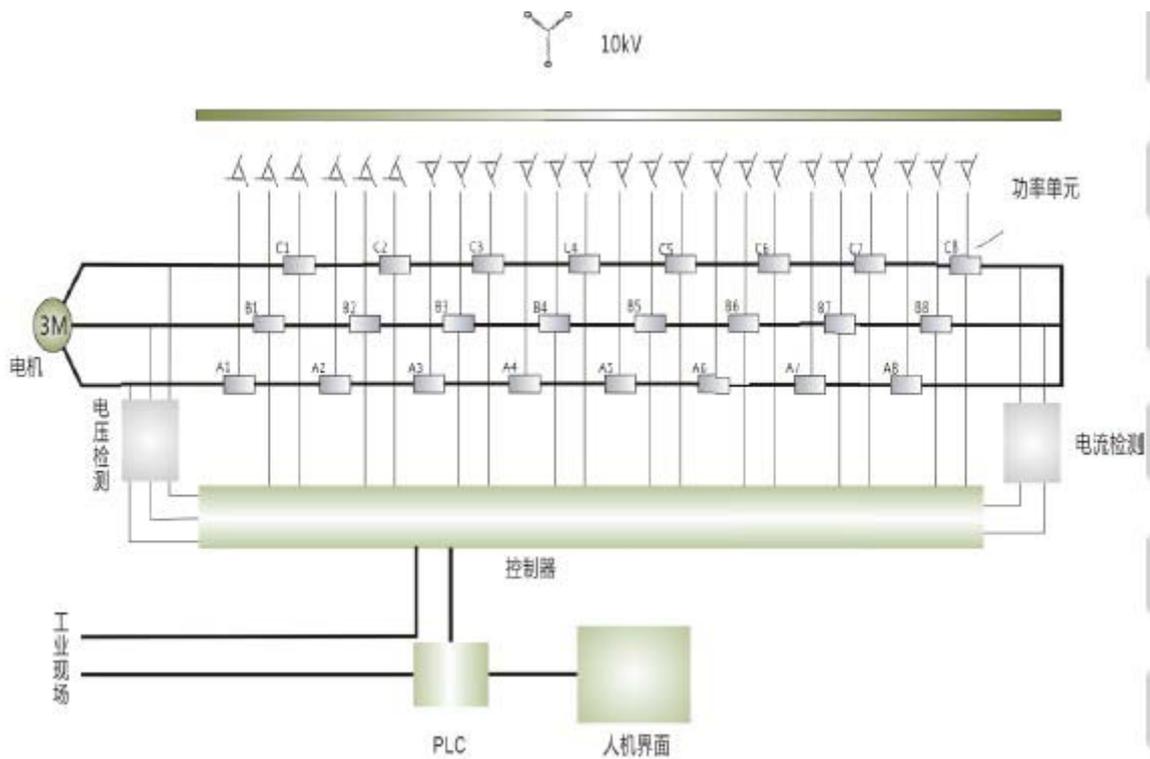
Standard number	Standard name
GB156-2007	Standard voltage
GB/T 1980-2005	Standard frequency
GB 12668-90	The total technical conditions of AC motor semi-conductor frequency adjustable device
GB/T 2423-10	Electrician electric products basic environment test regular vibration(Sine) principle
GB 10233-88	The basic test method of electrical drive control equipment

GB 4208 -2008	Shell protection level(IP code)
GB/T 3859.3-1993	Semi-conductor converter, transformer and inductor
GB/T 3859.2-1993	Semi-conductor converter application principle
GB/T 3859.1-1993	The basic required regulation for semi-conductor converter
GB 13422-92	Electric test method for semi-conductor current converter.
GB/T 14549-93	Grid harmonic wave of electric energy quality in public use
GB 2682	The indicator light and button color of Electric whole set equipment
GB/T 2681	The cable color of electric whole set
IEC 60757-1983	Mark code for color
IEC guide rule 106:1989	The guide line for environmental condition of regulated equipment rated function value
IEC 60038:1983	IEC standard voltage
IEC 60076	Electric transformer
IEC 61800-4:2002	The fourth part of adjustable electric drive system: Normally require voltage above 1kv but not exceed the regulated rated value of AC adjustable electric drive system.
IEC 60050-441:1984	Low-voltage electric terms
IEC 60050-151;2001	The component of Electricity and Magnetism in international electrician term chapter 151
IEC 60050-551:1999	Electricity and electromagnetism in international electrician term chapter 551
IEC 60721-3-3:2008	Environment condition classify for third part environmental parameter group and fixed use in environmental protection site of rated harsh classification.
IEC 60721-3-2:1997	Environment condition classify for third part environmental parameter group and transport in rated harsh classification.
IEC 61800-3:2004	Third part of adjustable electric drive system: electromagnetic compatibility standard and it's particular test method.
IEC 61000-2-4: 2002	electromagnetic compatibility(EMC) second part: environment chapter 4 the compatibility level of low frequency interrupt in industrial device.
IEC 61000-4-7: 2002	electromagnetic compatibility(EMC) forth part: product EMC standard and it's particular test method.

Chapter 2 work principle

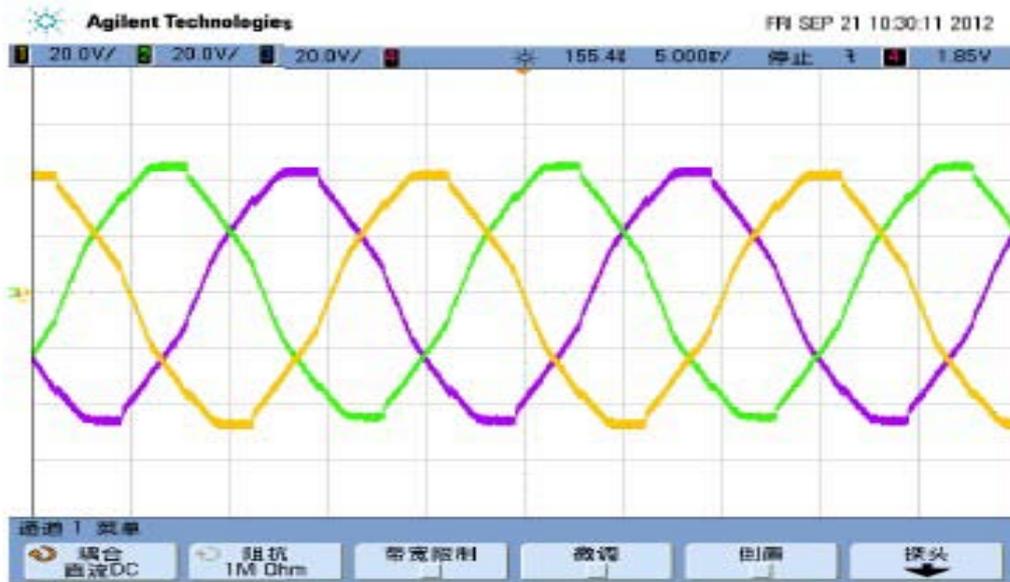
2.1. Principle introduction

Picture 2-1 is the spread structure of our IDrive series medium voltage variable frequency drive system. Take 10kV system as an example; IDrive series medium voltage variable frequency drive adopts Superposition of series for power unit. This system mainly consist by input part, power change part , check protection part and control part.



2.1.1. Input part

The input part of our IDrive series medium voltage variable frequency drive is mainly consist of three part: input switch, control cabinet, input transformer. Input insulated transformer is used to separate input AC high voltage into 3 x N group(this chapter N is unit series)AC low voltage and send to relevant 3 x N power unit and supply electricity for N pieces independent power unit. Between the input primary and secondary winding and the input of each secondary winding group there keeps an relative phase-difference.



2.1.2. Power unit part

Power unit part is mainly consist of 3 x N pieces power unit. Every power unit adopts three-phase bridge non-control rectifier method to rectify input low-voltage AC to low-voltage pulsating direct current and then through capacity wave filtering and finally become middle DC.

Middle DC transmit inverter circuit which consist of four IGBT. i.e. power unit full bridge inverter circuit. Through the switch control of IGBT to realize the status output of power unit output voltage and PWM exchange. IDrive series medium voltage variable frequency converter has fully considered the IGBT protection for overvoltage, over-current situation.

2.1.3. Detection and protection

IDrive series MV Drive has fully considered each component's detection and fault protection in design which conclude as below;

1. Input voltage detection which is used for judging input over-voltage, under-voltage, or phase loss.
2. Middle DC voltage detection which is used for judging the damage of re-generate voltage and capacitor.
3. Input current amplitude detection which is used for judging the equal of the output over-current and load.
4. Transformer's temperature detection which is used for protecting transformer from over-load.
5. Power unit's temperature detection which is used for protecting Power Electronics component.
6. Loads working condition detection(Part model) which mainly is the detection signals of output pressure of water-pump, output wind pressure of fan that contribute to form responsible automatic closed-loop control.
7. Bypass cabinet (Optional), we mainly have power unit bypass and control, whole machine bypass and control etc. When power unit occur fault or problem or whole machine occur fault or

problem, bypass cabinet will protect system from damage and not influence the continuous working of production..

2.1.4. Control part

IDrive series control part mainly consist of master controller, PLC, human-computer interface, upper computer, communication interface.

Master controller is the core part of whole machine. The speed protection of whole machine, quick diagnosis of fault, the control of working status of inverter, the control of data calculation and output which is all proceed by master controller. The master controller communicate with power unit through optical fiber which is used to control the working status of each power electronics in power unit. And in contrary, the working status of each power electronics in power unit through optical fiber transmit to master controller for relative management.

Upper computer(Part model) is mainly used for comprehensive monitor of whole machine's operation, the man-machine interface of user, parameter setting, system fault diagnosis etc.

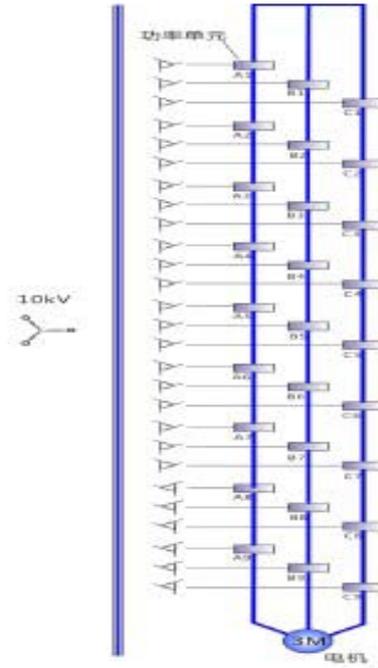
Human-computer interface is consist by industrial touch panel which is used for operation parameter setting, the operation status, the real-time monitor of unit and the fault record's indication and information check for our medium voltage frequency drive.

2.1.5. PLC

In IDrive series we adopt PLC to realize the electric control of equipment. Function mainly include: equipment electricity, various assistant machines' working status, equipment remove, equipment bypass etc.

2.2. Main circuit

IDrive series adopt the topology structure of superposition series of power unit. Among voltage level as 10kv, we adopt the superposition series of 9 units as indicated by below picture2-3.

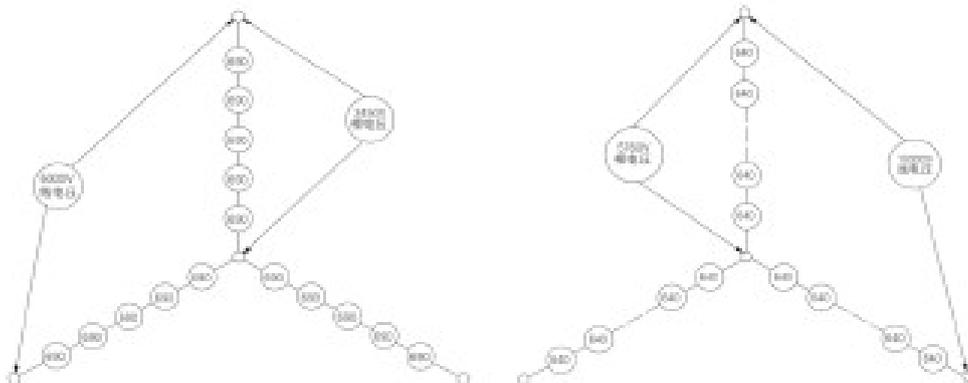


Insulated transformer is dry transformer which adopts strong air-cooling fan and 'Y' type connection achieved by primary side direct connect with inlet wire medium voltage. Secondary winding as extended delta connection. Between secondary winding there is certain phase-difference.

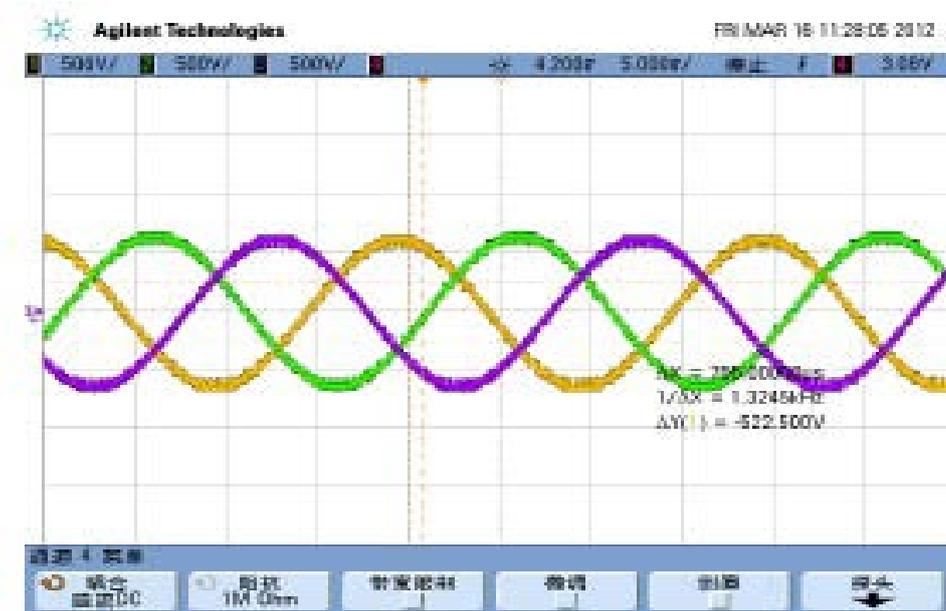
Phase angle=60° / each phase unit.

Secondary winding supply power to power unit. The phase-difference between winding is determined by the quantity of power unit and the level of inverter voltage.

The quantity of power unit 6kv is 15(18)pieces, 10kv is 24(27) pieces. The voltage of power unit is promoted through wave superposition series and three phase output 'Y' type connection, neutral point suspension and thus to get required adjustable frequency three-phase medium voltage power for electric motor.

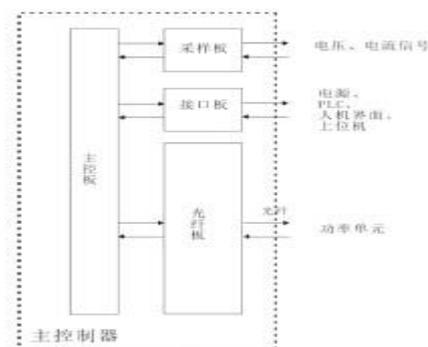


Take 10kv series 8 power unit series as an example, we can get (8)~(0)~(-8) total 17 different voltage level. At the mean time of enhancing voltage level, each level voltage amount decreases a lot and it has reduced dv/dt for motor insulation damage and also reduce a lot of the harmonic wave of output voltage. Below picture is the actual output voltage wave of 5 power unit series.



2.3. Control system

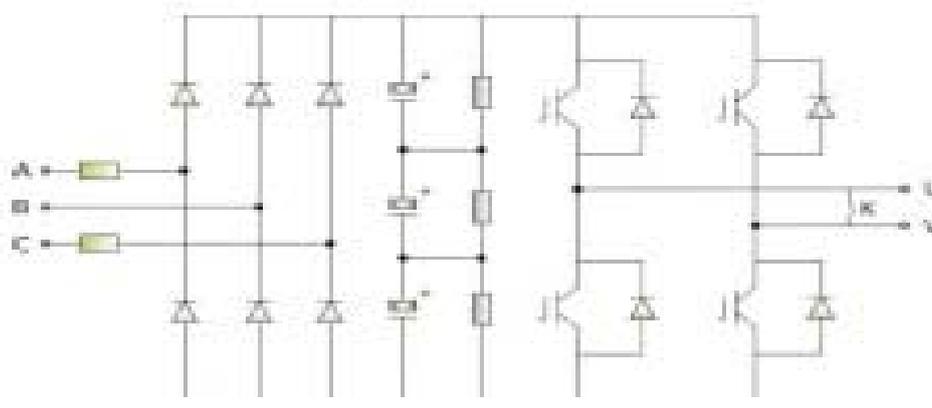
Control system is consist of controller, PLC and human-man interface to accomplish operation, fault alarm handle, indication and back-up copy. Controller is consist of 4 pieces of optical fibers plate, 1 piece of interface plate, 2 pieces of sampling plate, 1 pieces of master control plate and 1 pieces of extended plate. Controller is to accomplish system status collection and power unit control etc. Of which adopt optical fiber technique between power unit's communication, reliable separation of low-voltage and high voltage, fast speed communication, high anti-interference performance which has enhanced system reliability. PLC is mainly to accomplish power system control and user's site technical standard interface; human-man interface is mainly to accomplish system itself control interface and indication status, full English operation interface and also we equip with upper computer software to realize networking control for user. Picture 2-6 is the logic illustration of control system.



2.4. Power unit

IDrive series power unit's function principle as indicated by picture 2-7. 'AC-DC-AC' single-way(one-way) inverter structure. Short called 'H bridge' which is mainly formed by rectifier bridge, electrolytic capacitor and IGBT. Through SPWM control IGBT inverter thus output single-way AC; modularization design, every power unit is the same which is easy for maintenance. Adopting three-phase low-voltage AC input, signal through three-phase non-control bridge full wave rectifying by rectifier and then through electrolytic capacitor wave filtering and finally goes to single-phase inverter circuit. This inverter circuit consist of 4 pieces of IGBT which is formed as 'H' bridge structure.

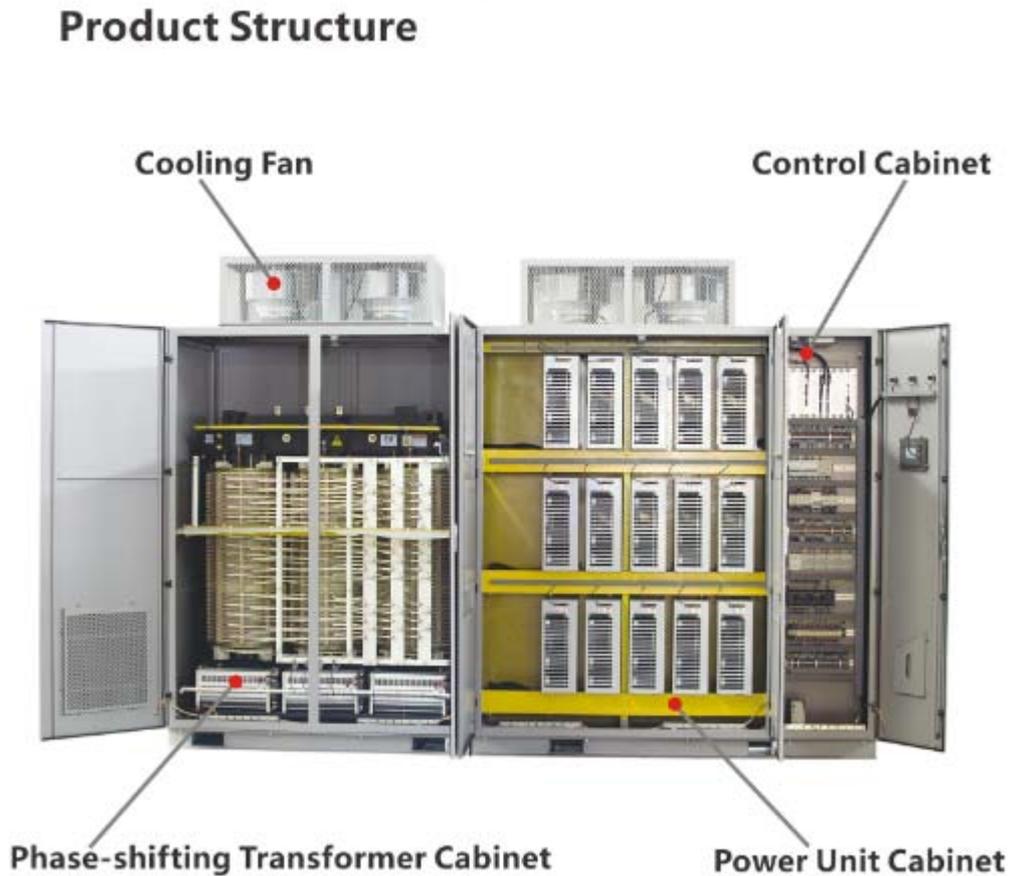
Power unit through optical fiber receiving from master controller controlled signal which is used for controlling 4 pieces of IGBT switch rule. I.e. At the output of every unit to get $0V, \pm U_d$ (U_d is the amplitude of one power unit's DC.) total 3 levels. Bringing every output phase power unit of IDrive in order series(The output A1unit connects with the output A2 unit, And so on, finally connecting the output of A1, B1, C1 three units as midpoint of IDrive).i.e. To realize the output three-phase AC sine wave by level superposition at the output of every phase. There is an over-current protection electrical component(instant fuse)at the input terminal of rectifier circuit.



If every power unit's average input voltage is 690v. After rectifying and wave filtering, unit's direct current is 975v, 4 pieces of IGBT in each unit can divide into two group. That is: upper left and lower left interlock. Upper right and lower right interlock. When upper left and lower right breakover, the output voltage between two ends of U, V is +975v. When lower left and upper right breakover, the output voltage between two ends of U, V is -975v. When upper left and upper right breakover at the same time or lower left and lower right breakover at the same time, the output voltage between two ends of U, V is 0v. At this time, due to every IGBT all parallel connection with continuous free-wheeling diode. Positive and negative direction current all can free circulate and thus at this moment equal as UV two ends short circuit. Picture2-8 is the actual output wave of a single power unit.

Chapter 3 Component Composition

3.1. Introduction



The main composition of IDrive series as picture 3-1 indicated:

Cooling fan:

Select German-made air-cooling fan, powerful heat dissipation function, high reliability and long life-span.

Phase-shifting transformer cabinet:

1. No pollution to power grid and effectively restrain power grid side harmonics(correspond with IEEE519-1992 regulation) which helps remove the bear of common-mode voltage for electric motor.
2. Easy use, direct connect with user's grid and no need any wave filter device and power element compensation device.

Power unit cabinet:

1. Wide range adaptability, power unit superposition series method, perfect sine-wave output,

basically can meet every motor and cable.

2. High reliability, long-life span, high function drive circuit, speed and accurate protection, excellent heat dissipation design, good working condition for power component.

3. Easy maintenance and installation, exquisite circuit layout and structure layout. Small volume and light weight.

Control Cabinet:

1. High precision control, fast speed management-high quality 32-bit floating point processor, equipped with SDRAM and FLASH memory technology.

2. Wide range adaptability, standard industrial interfaces and Ethernet, standard Modbus, Profibus-DP, TCP/IP agreement.

3. Easy operation-full color screen and simple, optimized PC software.

3.2. Transformer cabinet

Transformer cabinet is used for installing isolated transformer and assistant component. As indicated by picture 3-2, mainly include:

Transformer cabinet itself

Insolated transformer

Top air-cooling fan

Isolated transformer side wind blow air-cooling machine.

Transformer temperature control device.

Input current detection device.

Transformer cabinet air-cooling machine control

Transformer cabinet protection circuit.

As indicated by picture 3-2, transformer cabinet equip with phase-shifting transformer supplying power unit three-phase power. In the door of transformer cabinet equip with temperature control device for dry transformer which is used for transformer temperature alarm and over-heat protection. At the inside door of cabinet equip with position switch for the alarm when cabinet door open. At the top of transformer cabinet equip with Centrifugal fan and at the bottom of transformer cabinet equip with wind-blow air-cooling fan with one at the front of winding and the other one at the back side of winding.

Transformer is fixed with base as a whole by screw which is easy for transportation and installation. Cabinet hand ring is only used for hoist transformer cabinet and can't be used for hoisting whole cabinet include transformer cabinet. When whole cabinet need hoist, it must through forklift hole or through transformer hoist hole.

Regarding 3kv and 6kv IDrive, Secondary winding area is at the front right side of transformer connecting with three-phase input cable of power unit. Regarding 10kv IDrive, Secondary winding area is at the front right and back left side of transformer connecting three-phase input cable of power unit. Binding post should one by one match the cable mark. IDrive's three-phase

input and output high voltage is from bottom(Through trench) or side(Through underground) into the back of transformer. The inlet wire of input power is at the upside direct goes to transformer. Output is at downside goes out from power unit. Charging power for motor shall adjust in accordance with the motor's rotation direction. After connecting well of Inlet high voltage cable, it must fix with transformer or cabinet.



3.3. Control/unit cabinet

Control/unit cabinet is used to install control system, power unit and it's assistant component. Power/unit cabinet as indicated by picture 3-3. Control/power cabinet is mainly consist of below part;

- Controller
- UPS(Uninterrupted Power Supply)
- PLC controller
- Human-man interface
- Power unit
- Detection accessory
- Voltage detection board
- Control transformer module
- Output current HALL component
- Output voltage detection board
- Primary wiring room

Secondary wiring room
Centrifuge air-cooling fan



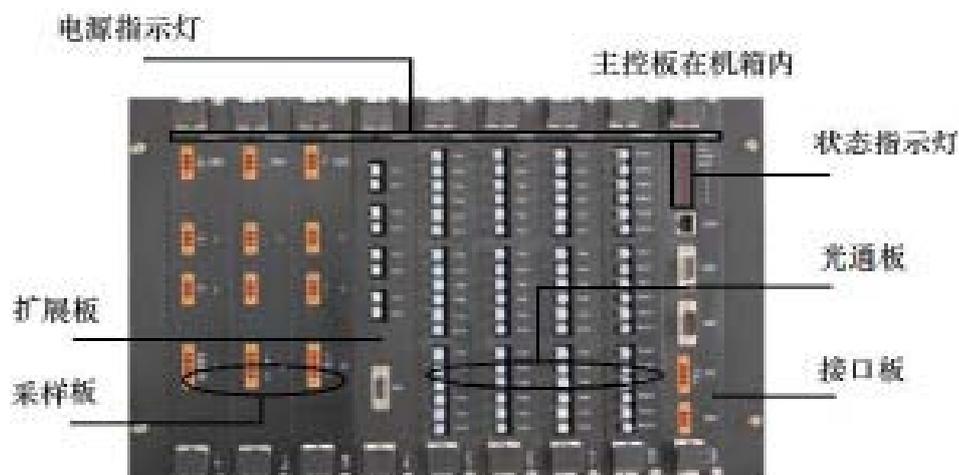
Main component and function introduction:

1. Control cabinet: Mainly consist of control part and power unit part. Of which control cabinet is mainly consist of main controller, PLC, human-man interface to accomplish all kinds of system control, protection, fault alarm solution, indication and user connector etc.
2. Unit cabinet: Mainly consist of power unit, HALL current sensor etc. Power unit is installed and fixed with guideway through 2 screws which is key part to realize frequency converter and power superposition.
3. Current sensor, input and output current of sampling system which is used for various system control and protection.
4. Air-cooling fan install at the top of cabinet and cooperate with air-duct. Cool air flows to power unit through cabinet's window filter layer and take the heat generated by power unit back to rear air-duct and then through top centrifuge fan evacuate hot air outside the unit cabinet so to ensure system working on the proper environment.
5. Dustproof filter net install at the window of cabinet door which is used for blocking dust coming into the power unit.
6. Interlock protection install at position switch of inside cabinet. It sends out alarm when cabinet is open

Take 10kv/1250kw standard product as an example to brief introduce the system composition:

1. Cabinet room, at the front side of cabinet these are controller, PLC, power switch etc. User's secondary terminals is also arranged in control room.
2. IDrive's rated input/output voltage is 10kv, Power unit's rated voltage is 690kv. Each phase 8 power unit series. Unit adopts front and back arrange method. Each front phase inside cabinet has 2 units. Take A phase as an example, from right to left there is A1 and A2. At the back of Unit/Control cabinet each phase 6 units. Same from right to left arrange that is A3, A4, A5, A6, A7, A8. Same phase 8 units are in series by copper bar or cable. And the first unit of three phase is short connected as the center point of 'Y' type connection. Eighth unit of three-phase is right the three-phase output high voltage of IDrive.
3. Power unit is installed at guideway which is fixed by two M8 screws. Air-duct is in the center of cabinet. Cool air flows through front and back cabinet filter layer and all the way up to unit heat radiator and takes away heat generated by power unit to middle air-duct and then through top centrifuge fan evacuate heat outside the cabinet. Outside of cabinet door install with filter layer which is used to block dust coming into power unit cabinet. Inside cabinet door install with position switch which is used for cabinet interlock. It will send out alarm when door is open.

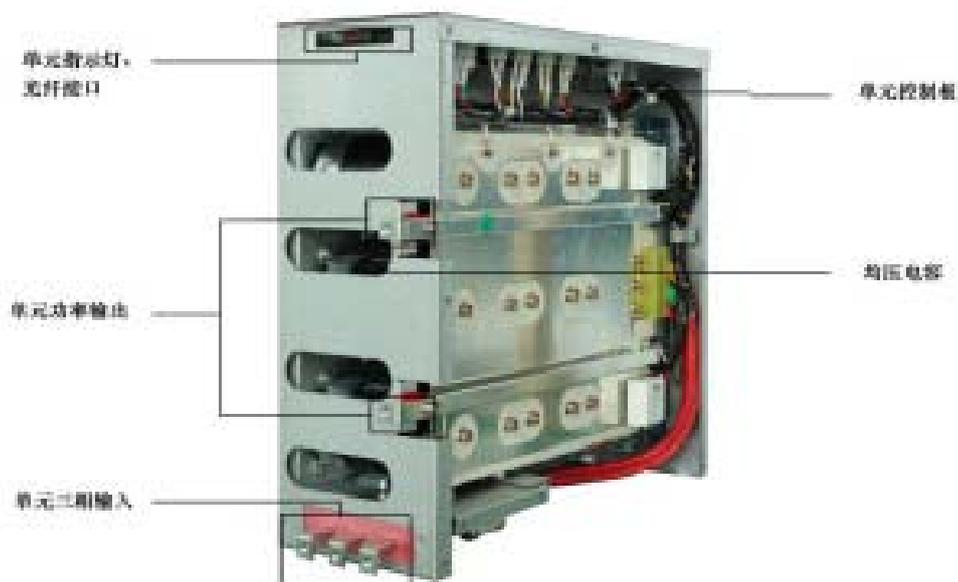
3.4. Master controller



Picture 3-4 Master controller board structure picture.

Master controller include optical fiber board, master control board, signal board, connector board, sampling board and master controller board. Picture 3-4 indication, Regarding detail introduction please kindly check chapter 2 working principle.

3.5. Power unit



Picture 3-5 Power unit actual picture

Power unit (short for unit), as indicated by picture 3-5 which is installed in power unit cabinet. All units have same electric and mechanical parameter which is exchangeable. Unit's three-phase input connects with the secondary winding of main transformer also with fuse for current protection. Output is single-phase, superposition series output. Mainly include below component;

- Rectifier bridge
- Electrolytic capacitor
- IGBT(Insulated Gate Bipolar Translator)
- Unit control board
- Equal resistance
- Absorption capacitor
- Fuse
- Connecting copper bar, wire and insulating material.

After unloading the fixed screws between unit and guideway, input cable, input copper bar and optical fiber connector, it will fully separate unit from unit cabinet and take it down from guideway.

The step of unit installation is just opposite. Put unit into guideway and slightly push forward it to limiting position and tighten screws. After connecting well with input cable and output copper bar and then plug in optical fiber connector.

After the power off of our IDrive, unit still exist dangerous voltage or strong heat which can cause

serious accident. So please must wait at least 15 minutes after LED turned off. And then you can unload optical fiber connector and separate unit. If you need to operate unit inside, you shall only proceed after capacity fully discharged.

3.6. Human-man interface

Human-machine is installed on cabinet door which is consist by touch screen(7.9” backlight industrial screen)that be used to accomplish all kinds of system control, system status indication of IDrive’s parameter such as current, voltage, power, running frequency and also to accomplish over-load alarm, over-current for motor etc. Protect indication positioning and history fault memory and inquiry. Monitor has 7 types of screens;

1. System status screen
2. Function set up screen
3. Parameter set up screen
4. Fault record screen
5. Operation record screen
6. Time set up screen
7. Unit monitor screen

Picture 3-6 indicated the main picture of human-man interface which mainly concludes status instruction and operation selection. Regarding the detail description of human-man interface please kindly see’ Chapter 5 Human-man interface’



Indication light

Only by IDrive occur relative status, indication light will be show up on main screen. In regular situation it is hidden.

1. First yellow 'medium voltage indication light', light on means IDrive is inputting with medium voltage.
2. Second green 'running indication light', light on means IDrive' is running.
3. Third red ' fault indication light' ,light on means serious fault occur. IDrive will stop running and automatically switch off medium voltage. Only after fault solved it can continue to press medium voltage. Light shining means slight fault occur will not affect IDrive continue to run but we need to check the reason of fault and remove fault.

Urgent stop button:

When IDrive or on-site occur urgent situation, or urgent need to cut off IDrive's high voltage power, under this kind of situation please press urgent stop button. When IDrive is under detection and maintenance, urgent stop button must be pressed so to avoid high voltage electric shock.

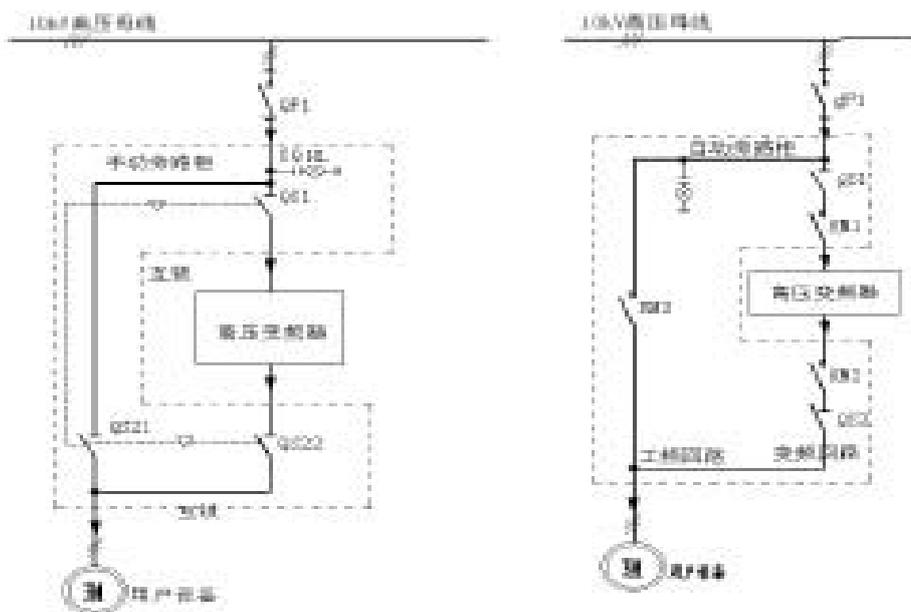
3.7. Bypass cabinet

In actual practise, bypass cabinet is often being applied. Include bypass cabinet and switch cabinet which is cooperating use with IDrive. The function of bypass cabinet is to put motor into power frequency grid when IDrive occur fault so to ensure the continuity of production and also to enhance system reliability.

There are basically two types of cabinet: Manual bypass cabinet and automatic bypass cabinet. Width is about 2cm.

The suggestion of the install position for bypass cabinet: 6kv general bypass cabinet arrange at the left side of IDrive. 10kv general bypass cabinet arrange at the right side of IDrive. Or because of space and position limitation, arrangement and suggestion could be different but need to clarify in technique agreement.

Picture 3-7 indicate main circuit with bypass cabinet. When system allows temporary stop, manual bypass cabinet is adopted through operating personnel proceed switch. Manual bypass cabinet has three knife-switches. QS21 and QS22 is double knives double heads switch which is to ensure the power of power frequency will not direct deliver to output terminal of IDrive.



Picture 3-7 manual(left) and automatic (right) bypass cabinet one circuit diagram.

When system does not allow machine halt, automatic bypass cabinet is the only option. It's switch process automatically realized. Automatic bypass cabinet has three vacuum contactors. Of which KM2 and KM3 must interlock so to ensure the power from power frequency unable to direct deliver to the output terminal of IDrive. Automatic bypass cabinet generally equip with isolating switch. Isolating switch can help IDrive isolated from high voltage power when motor is running under power frequency which is easy for IDrive maintenance and repair.

User's primary cable(Power inlet wire and motor outlet wire) generally enters from the bottom of bypass cabinet. The primary cable between bypass cabinet and IDrive adopts soft wire arrangement in the inside of cabinet.

When adopting manual bypass cabinet, IDrive and power cabinet electric lock. When adopting automatic bypass cabinet, IDrive is interlock with inlet wire contactor KM1 in bypass cabinet. The output of IDrive can supply power for 2 electric motors through change-over switch which can enhance the utilization ratio. When motor is one use and one standby or two motor's working condition is similar, you can adopt this proposal. Chang-over cabinet has 2 types of configuration which is manual change-over or automatic change-over. The width of change-over cabinet is all 1meter which installed at right side of IDrive.

3.8. Other optional item

Power unit bypass function: When unit fault occur, it can offer protection.

Upper IPC(Industrial Personal Computer): To realize network control, real-time monitor the status of IDrive.

Upper monitor software: To realize network control, real-time monitor the status of IDrive.

Chapter 4 Installation, Storage and wiring

4.1. Introduction

This chapter mainly introduce how to install and wiring IDrive and also the required procedure in the process, techniques and relative attention events.

4.2. Check and accept event

Check and accept process

1. Check shipment's list to see whether all equipment is right and complete.
2. Check the possible damage during transportation
3. If occur transportation damage, you shall claim compensation from transportation company.
4. Very important! Before install IDrive, you must read thoroughly and carefully and make sure you understand the content of installation/
5. Attention! Wood block may use to support structure and unit during transport, so please kindly remove before installation.

4.3. Transportation and storage

Transportation:

1. IDrive series is suitable for highway, railway, sea shipment.
2. IDrive series mainly has two means of transportation
 - 1) Whole body transport, transformer cabinet, power unit cabinet and each top fan and fan hood as a whole body for shipment.
 - 2) Separate body shipment: transformer and it's heat dissipation fan and fan hood as a whole body, power unit cabinet and top heat dissipation fan and fan hood as a whole body and separately for independent shipment.

Storage:

Please follow strictly our storage rules for IDrive which regulated in manual ' safety event' . Because environment element affects IDrive's reliability and long life-span in a large degree. So right storage can avoid equipment lost function in advance and also help the afterwards normal operation.

4.4. Transport means

Transport rules:

1. Whole body transport IDrive does not allow the re-separation of transformer cabinet and power unit cabinet for transportation.
2. Separate body transport IDrive need independent handle, re-group and wire arrangement for usage.

Transport method

1. Hoist and Chain hoist
 2. Forklift
 3. Spincycle
 4. Roller wheel

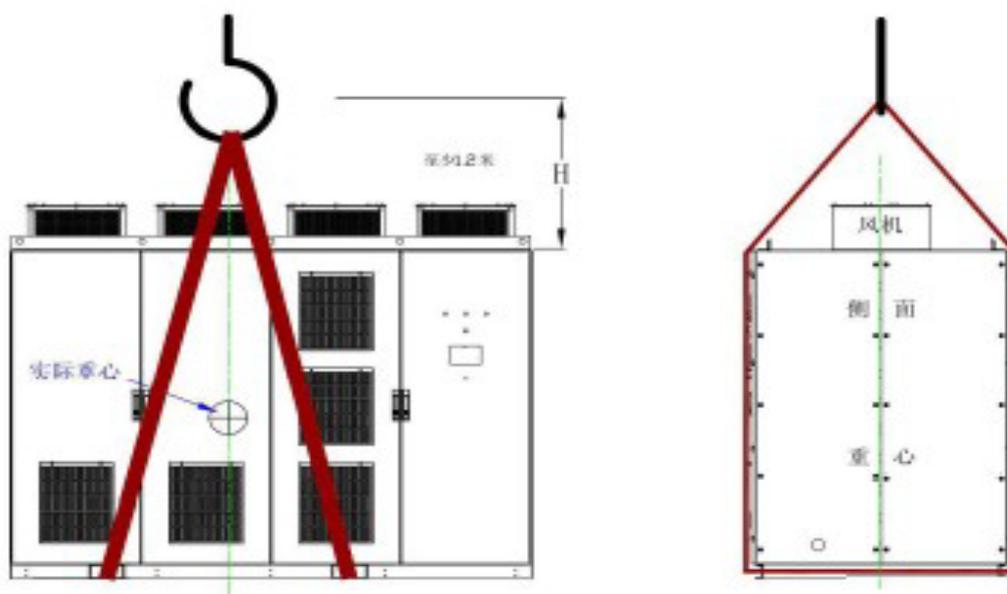
4.4.1. Hoist and Chain hoist

The best way is to use rope pass by under hole and lift by hoist. As indicated by picture 4-1; The key of hoist lifting is the length and strength.

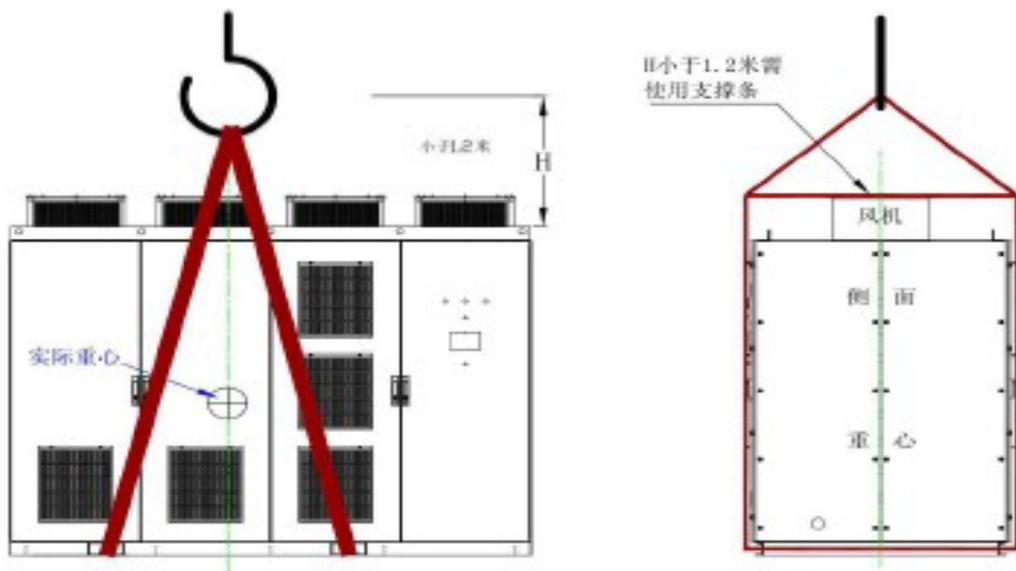
The rope must long enough to ensure hook 1.2 meters up from the top cabinet which can avoid cabinet deformation.

If the distance is not enough, a support wood block must be used. The rope strength must support the weight of IDrive.

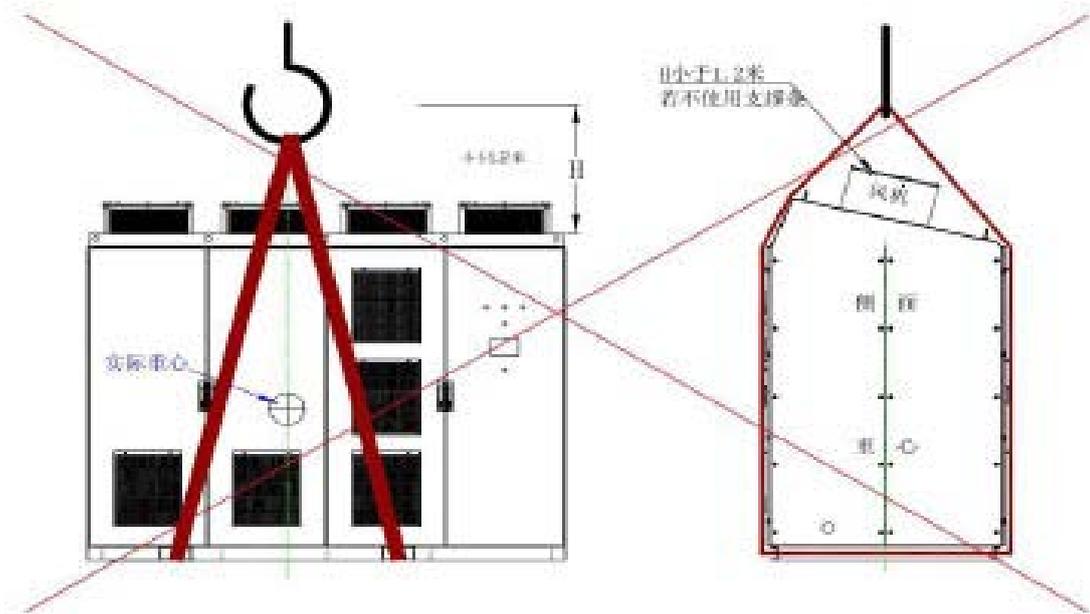
When using rope for hoist, please be attention that the rope must be fitted properly on forklift hole. Try best to match hoist center with IDrive's gravity center.



Picture 4-1 When using rope for hoist, please be attention for the gravity of IDrive and rope length.



Picture4-2 When using rope hoist, if rope length is not long enough, a support block is needed.



Picture 4-3 wrong rope hoist method.

4.4.2. Forklift

When using forklift, forklift must bear relevant weight. The prong length of forklift shall no less than 1 meter. Width shall no more than 19cm. Thickness no more than 5.7cm. The distance

between prong must adjustable between 0.7m to 1.8m. When the length of IDrive is too long, two forklifts can be applied to finish the job in cooperation.

Please be aware that do not let forklift hurt the surface of cabinet. We suggest to use wood block at the corner of prong r as a protection for cabinet surface. Picture as 4-4

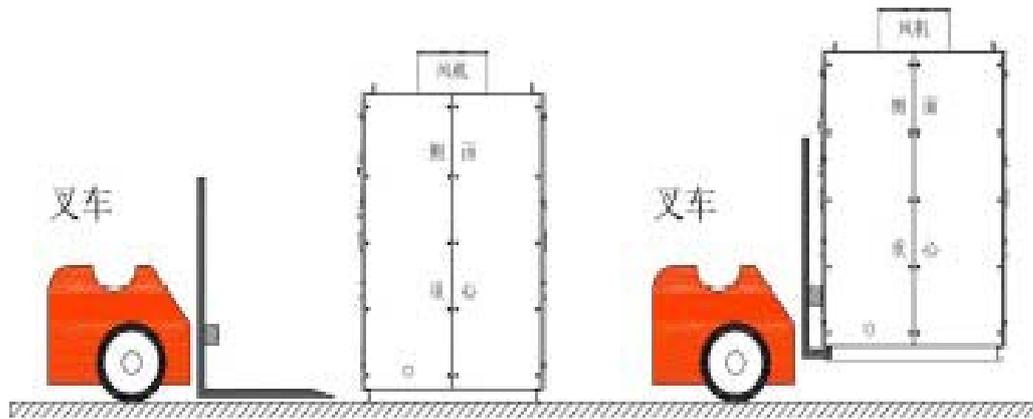
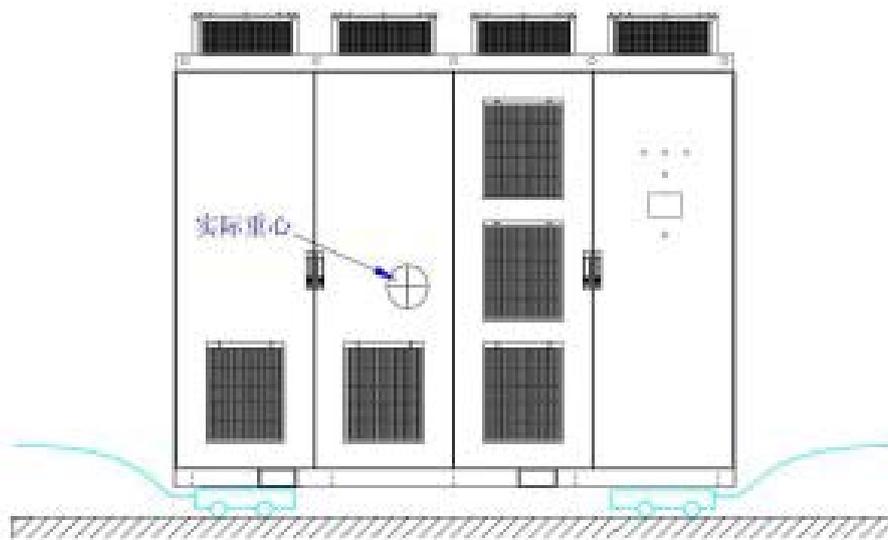


图 4-4 叉车的使用方法

4.4.3. Spincycle

When using spincycle, it must be put cabinet's under base of front and back that is outside of forklift hole. Picture as 4-5.

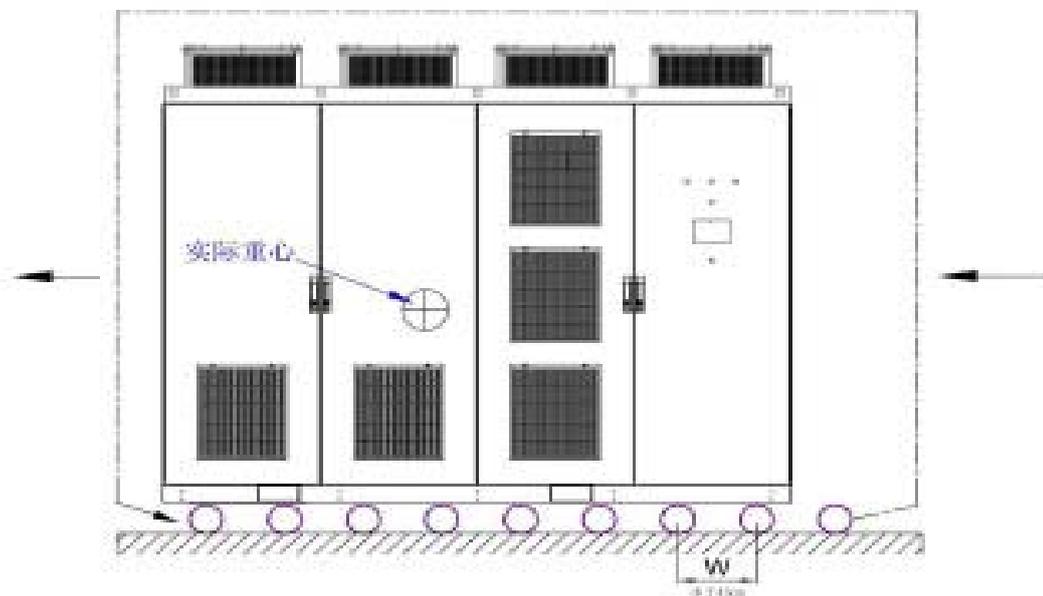
The requirement for Spincycle, diameter must no less than 5cm, length no less than 1.22m. Distance no more than 45.7cm.



Picture 4-5 the usage method of spincycle.

4.4.4. Roller wheel

Roller wheel is the most simple method. Many roller wheels lay side by side on floor. And then cabinet is put above. Circulate moving roller wheel to realize transportation. The distance between roller wheel shall less than 45cm. Picture 4-6.



Picture 4-6 is the use method of roller wheel.

As for small installation space and we can comprehensively use above mentioned methods.

4.5. Requirement for on-site installation

IDrive's on-site must clean, flat, dry and easy for maintenance.

Heat dissipation: Cool air comes into from filter net of IDrive and flows to transformer, power unit etc. Due to axial flow fan installed on the top of cabinet dissipates heat outside cabinet through air-duct. So regarding installation space, the air ventilation and quantity shall be taken into consideration.

Floor: The on-site floor required plain and flat. If the surface of on-site is not flat, the cabinet shape of IDrive will change which will lead to cabinet malposition or unable to open switch cabinet.

Protection: equipment inside the cabinet or partial components are not water-proof and wind-proof. So necessary protection is needed. If inverter is temporarily being put outside, heater must be used inside cabinet so to avoid condensation. If the time is very long, protection cover shall be put above like plastic paper or canvas. These protection is very critical to ensure IDrive's safety and completeness.

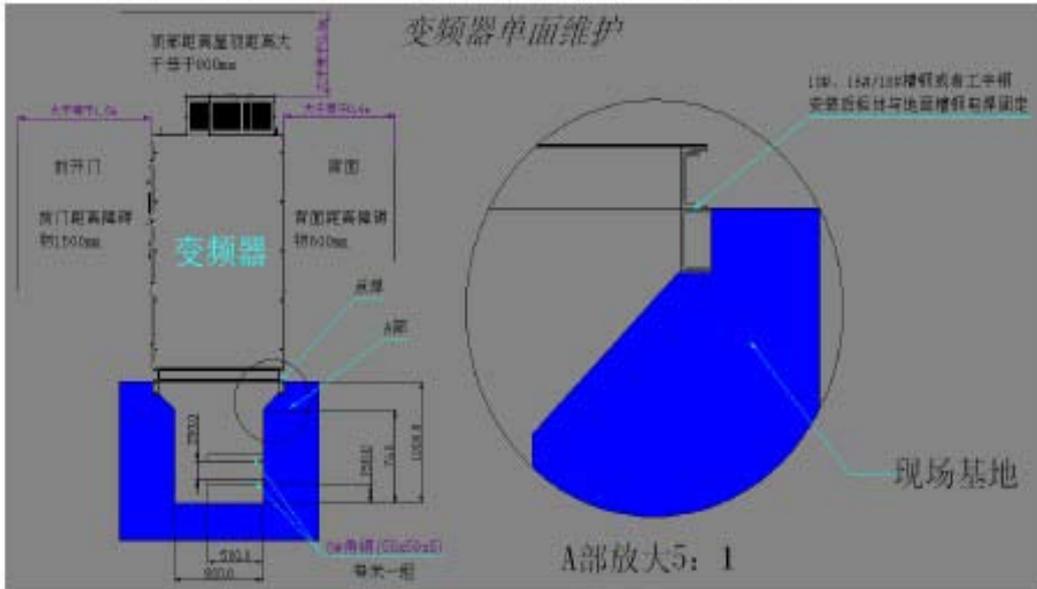
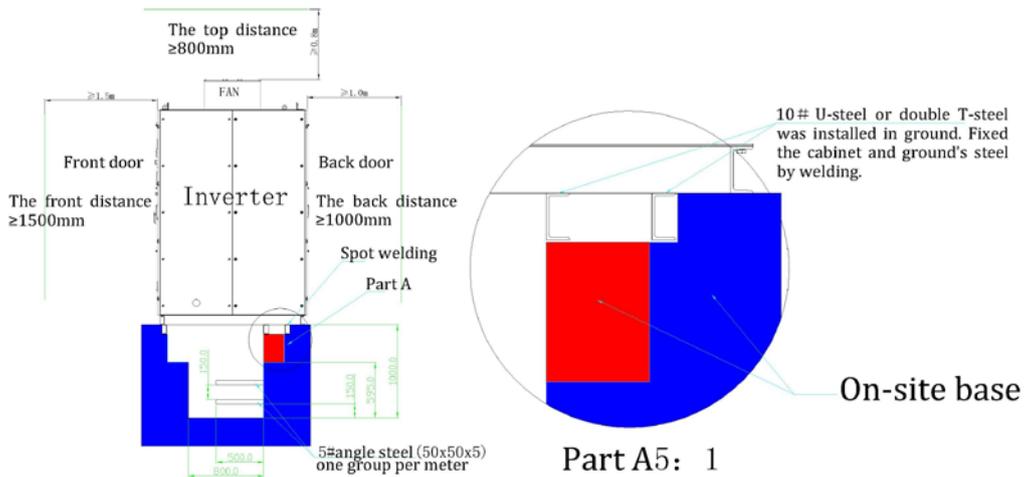


图 4-7 单面维护安装示意图

Picture 4-7 single side maintenance installation picture

MV VFD with double side maintenance



Picture 4-8 double sizes maintenance installation picture

4.6.Cabinet fasten and grounding

IDrive series main circuit and control cable's inlet and outlet connector normally locate in side or bottom of transformer cabinet.(Subject to random picture); The requirements for IDrive as below:

Installation requirement:

1. Suggest the minimum length of cable ditch shall add 1 meters each at left and right under the foundation of all cabinet's length which is easy for wiring and maintenance.
2. The IDrive's base on the ditch adopts 10# channel steel(When IDrive's rated output power \geq 1600kw, it shall adopt 16# channel steel. Above 4000kw adopts 18# channel steel). The specific details shall follow the actual weight of IDrive.
3. When installing, we must leave certain room for the top, front and back of cabinet. Specific size shall follow above picture's definition.
4. As for double size maintenance IDrive, the distance of equipment's back size shall no less than 1000mm. Single maintenance, suggestion size shall no less than 600mm.

Wiring requirement:

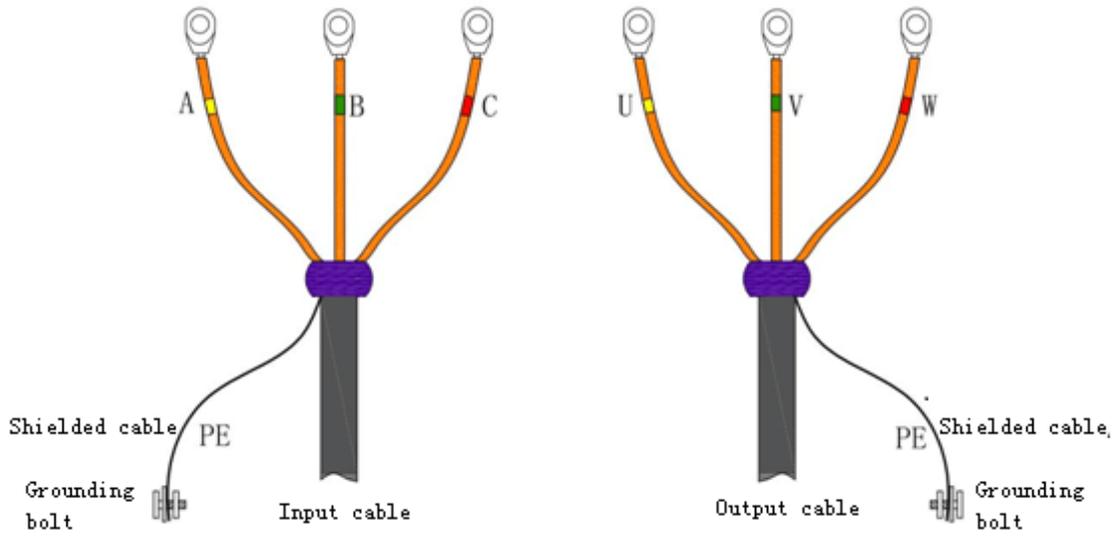
1. When ground installation, we Suggest adopts welding method to fix with base. If the base is already grounding, the IDrive cabinet grounding can achieve through welding with base. Under this situation, we should ensure enough welding spot and the quality of welding spot. We suggest the welding spot shall no less than 8.

2. If base is not grounding, then the grounding of IDrive cabinet will need to realize by additional grounding cables.

4.7.Medium voltage cable fasten and grounding.

Cable making:

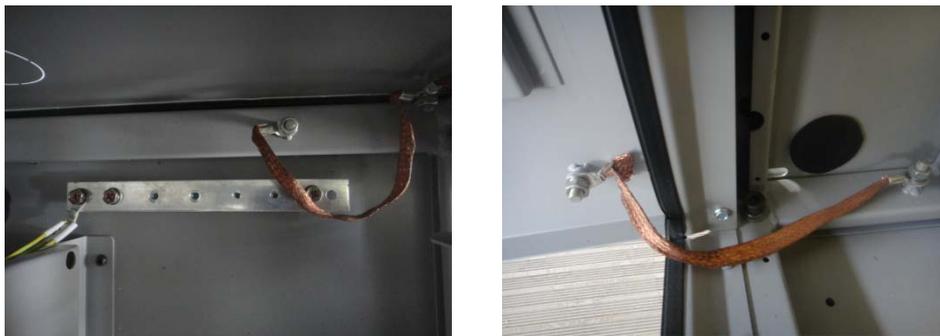
The input and output of IDrive cable is normally armoured cable which is very hard and not easy curved. In order to make wiring easy and beautiful, we should not follow the same length to make cable but rather design a wiring radian in advance. Measure and estimate the stripping length of each core wire and leave certain extra length. By this way, the input and output medium voltage cable will be very beautiful. Picture as 4-9 indicated.



Picture 4-9 medium voltage fasten and grounding.

Cable grounding

1. The shielding layer of medium voltage input and output cable must grounding at site of IDrive. Normally grounding realized in transformer cabinet by the help of grounding bolt.
2. If IDrive is along with ' bypass cabinet ', grounding of IDrive's medium voltage input and output cable in shielding layer can be realized in bypass cabinet.

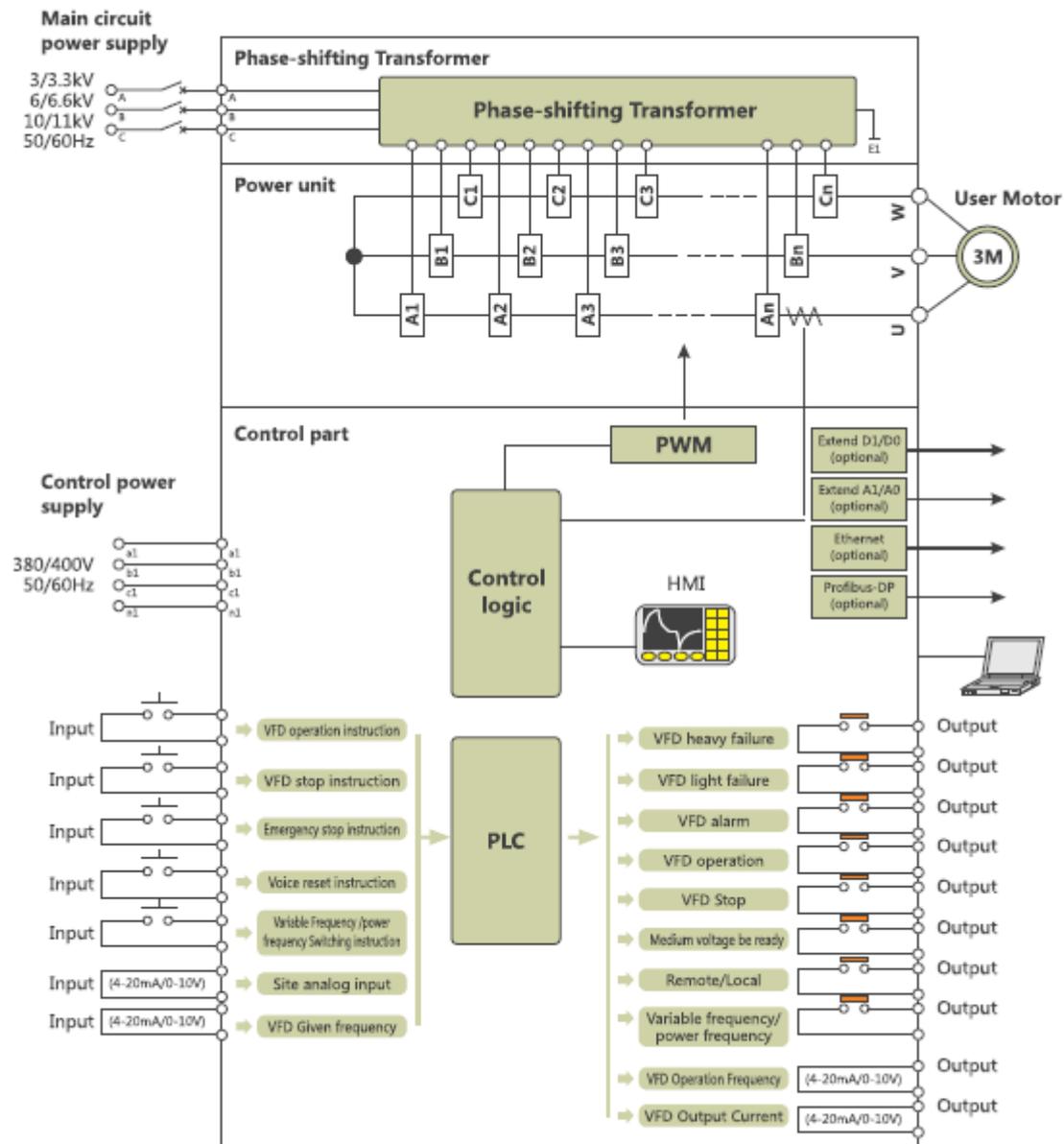


Picture 4-10 bolt grounding and inverter grounding picture.

4.8 User wiring

Standard wiring picture

IDrive series standard wiring picture as indicated below;



Cable option

1. Main circuit suggesting cable selection chart: Chart4:1(Suitable for general type series, not include special and big power type)

Frequency	Rated current (A)	Terminal		Screw specification	Restrain Torque	Cable size (mm ²)
		Function	symbol			
50/60Hz	25~27	Input Output	A.B.C U.V.W	M10	18.0~23.0	22~100
	60	Ground wiring	PE	M5	2.0~2.5	5.5~14
	45~60	Input Output	A.B.C U.V.W	M10	18.0~23.0	22~100
	60	Ground wiring	PE	M5	2.0~2.5	5.5~14
	75	Input Output	A.B.C. U.V.W	M10	18.0~23.0	22~100
	80	Ground wiring	PE	M6	4.0~4.9	5.5~22
	100~125	Input Output	A.B.C. U.V.W	M10	18.0~23.0	38~100
	125	Ground wiring	PE	M8	8.9~10.8	5.5~38
	150~180	Input Output	A.B.C. U.V.W	M10	18.0~23.0	38~100
	180	Ground wiring	PE	M8	8.9~10.8	22~60
	200~250	Input Output	A.B.C. U.V.W	M10	18.0~23.0	60~100
	250	Ground wiring	PE	M10	18.0~23.0	22~150
	280~300	Input Output	A.B.C. U.V.W	M12	31.5~39.5	150~325
	400	Ground wiring	PE	M12	31.5~39.5	60~200
	350~400	Input Output	A.B.C	M12	31.5~39.5	150~325

			U.V.W			
	400	Ground wiring	PE	M12	31.5~39.5	60~200
	600	Input output	A.B.C U.V.W	M10	31.5~39.5	150~325
	600	Ground wiring	PE	M16	78.5~98.0	150~325

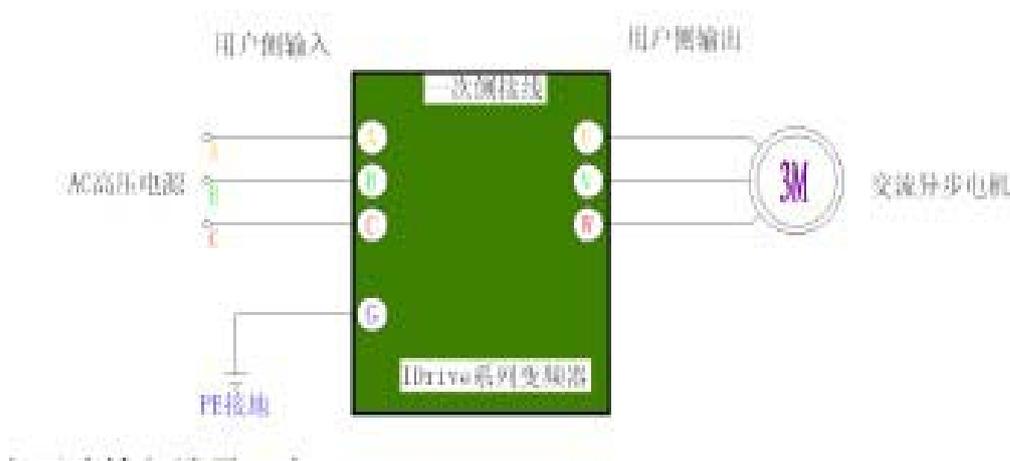
2. Control cable recommendation selection chart,picture4-2

Function	Specification	Screw specification	Restrain torque (N x m)	Cable size(mm2)
Analog quantity input and output	Strand shielded wire	/	/	0.5~1.5
Analog quantity input and output	Insulated PVC armoured cable(CVV)	/	/	1.0~2.5
Communication cable		/	/	0.5~1.5
Control power cable	600v Insulated PVC armoured cable(CVV)	/	/	4.0~8.0

Main circuit wiring:

All user main circuit input wiring terminal is in transformer cabinet. While output terminal could be different according to different types.

1. Main circuit standard wiring picture, picture 4-12

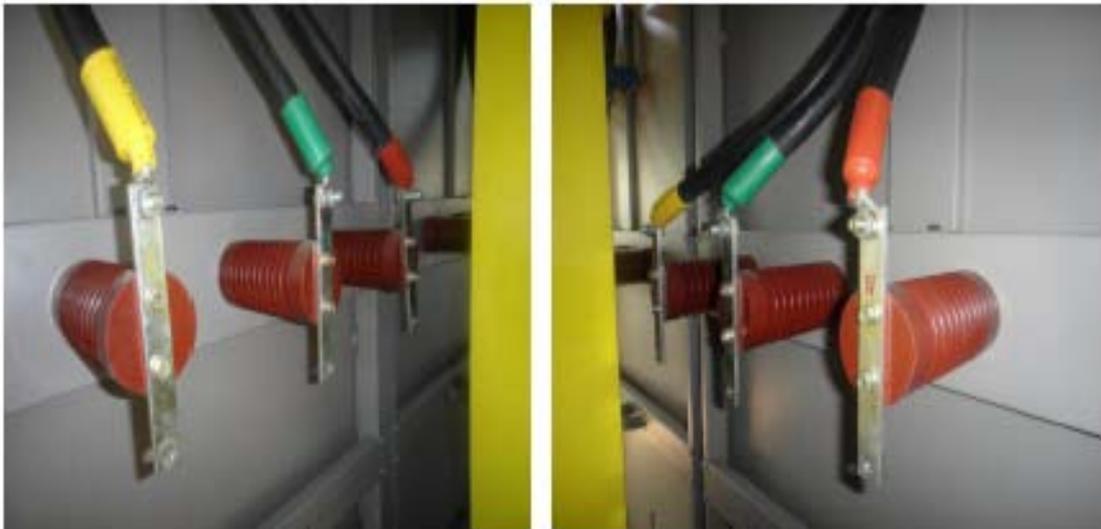


2. Main circuit input terminal, chart 4-3;

Terminal symbol	Signal name	specification
A	Main circuit A phase input	Main circuit AC three-phase input Voltage: 3kv/3.3kv, 6kv/6.6kv, 10kv/13.8kv; Frequency: 50Hz/60Hz
B	Main circuit B phase input	
C	Main circuit C phase input	

3. Main circuit input terminal, chart 4-4:

Terminal symbol	Signal name	Specification
U	Main circuit U phase output	Main circuit AC three-phase output: Voltage: 0~(3kv/3.3kv, 6kv/6.6kv, 10kv/13.8kv); Frequency: 0~(50Hz/60Hz)
V	Main circuit V phase output	
W	Main circuit W phase output	

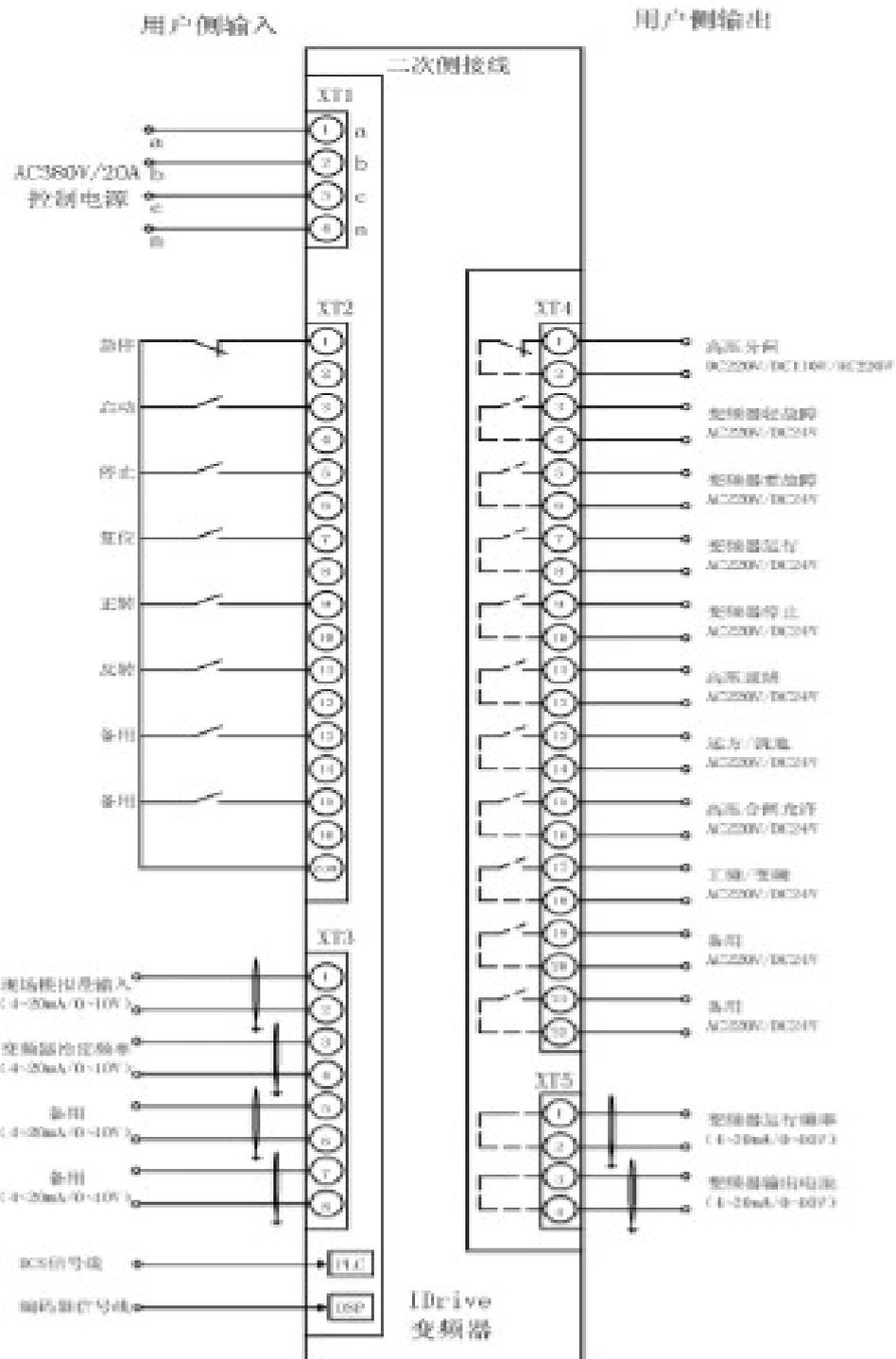


Picture 4-13 Main circuit input wiring terminal reference.

Picture4-14 Main circuit output wiring terminal reference.

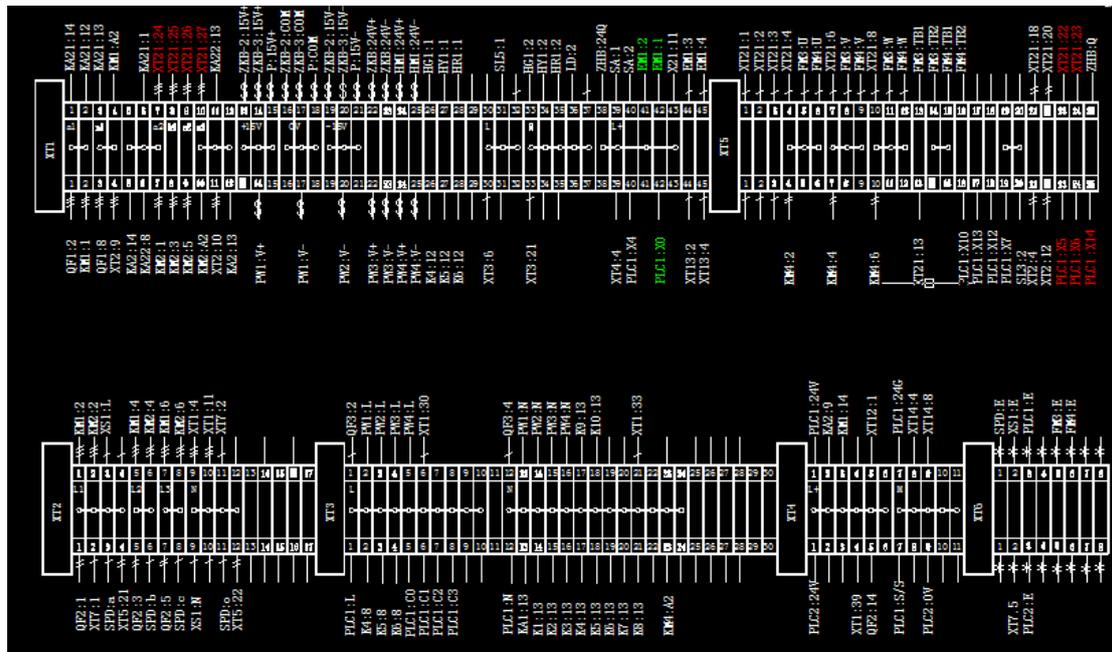
Control wiring

1. Control circuit standard wiring picture, picture 4-15



2. Control wiring terminal row is centered in control cabinet, chart 4-5;

Terminal symbol	row	Function	specification
XT1		Control power	Three phase four wire system: AC 380V/20A, 50/60Hz
XT2		User side input order	DC24V dry contact or AC220V dry contact signal
XT3		Analog quantity input	DC4~20mA or 0~10V signal
XT4		IDrive's output order	DC24V dry contact or AC220V dry contact signal
XT5		Analog quantity output	DC4~20mA or 0~10V signal



Terminal definition:

1. Control power input terminal, chart 4-6:

Type	Terminal fit	Signal name	Specification
Input	XT1-a	Control power a phase input	Control power: AC three-phase input: Voltage: 380V/20A Frequency: 50Hz/60Hz:
	XT1-b	Control power b phase input	
	XT1-c	Control power c phase input	
	XT1-n	Control power 0 wire input	

2. Analog quantity terminal, chart 4-7

Type	Signal name	Signal electrical level	Terminal symbol	Function instruction
Input	Speed(Frequency) Order	DC4~20Ma/0~10V	XT3-3	Speed(Frequency)order input
			XT3-4	Grounding
			XT3-PE	Shield ground
			XT3-1	Closed-loop response signal order input
			XT3-2	Grounding
	Closed loop response Order		XT3-PE	Shield ground
			XT3-5	User definition
			XT3-6	Grounding
	Spare		XT3-PE	Shield ground
	Output		Running frequency	DC4~20mA/0~10 V
XT5-2		Grounding		
XT5-PE		Shield ground		
Output current		XT5-3	Output current output	
		XT5-4	Grounding	
		XT5-PE	Shield ground	

3. Digital quantity terminal, chart 4-8

type	Signal name	Signal electrical level	Terminal symbol	Function instruction
Input	Urgent stop	Terminal input: 1) AC 220V/5A 2) DC 24V/5A 3) DC 48V/5A	XT2-1	Urgent stop IDrive order
			XT2-2	Public earth wire
	Start		XT2-3	Start IDrive order
	XT2-4		Public earth wire	
	Stop		XT2-5	Stop IDrive order
	XT2-6		Public wire	
	Restore		XT2-7	Restore IDrive fault/ alarm order

			XT2-8	Public earth wire
	Corotation		XT2-9	IDrive corotation running order
	Reverse rotation	Terminal input: 1) AC 220V/5A 2) DC 24V/5A 3) DC 48V/5A	XT2-10	Public earth wire
	DSC signal		XT2-11	IDrive's reverse rotation operation order
	Spare		XT2-12	Public earth wire
	Encoder signal		-----	User optional signal
			XT2-13/15	User definition
			XT2-14/16	Public earth wire
			ENC	Control input of IDrive terminal
	High voltage Separating brake	Normally-open contact relay output: 1)DC 220V/5A 2)DC 110V/5A	XT4-1	Subsection user side high voltage order
			XT4-2	Public earth wire
Output	IDrive slight fault	Normally-open contact relay output: 1) AC 220V/5A 2) DC 24V/5A	XT4-3	Slight fault situation output order
	IDrive heavy fault		XT4-4	Ground earth wire
	Running		XT4-5	Heavy fault situation output order
	Stop		XT4-6	Ground earth wire
	High voltage ready		XT4-7	Operation status output order
	Remote/Local		XT4-8	Ground earth wire
	High voltage switch on permission		XT4-9	Stop status output order
			XT4-10	Ground earth wire
			XT4-11	High voltage joint up IDrive order
			XT4-12	Pubic earth wire
			XT4-13	Remote or local control IDrive status order
			XT4-14	Ground earth wire
			XT4-15	Permit user high voltage put into IDrive order
	XT4-16	Ground earth wire		

	Power frequency/ frequency conversion		XT4-17	Power frequency or frequency conversion running status order
			XT4-18	Ground earth wire
	Spare		XT4-19/20	User definition
			XT4-21/22	Ground earth wire

Attention

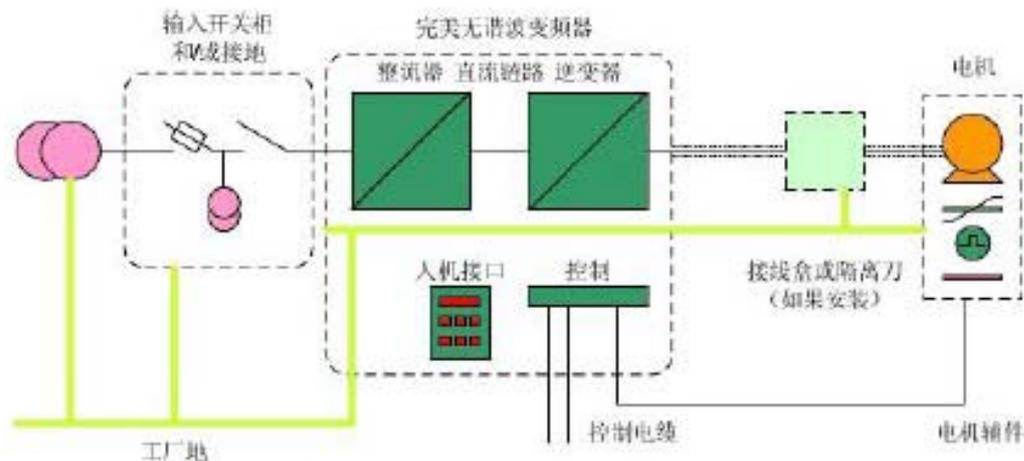
Transformer primary winding has a group of $\pm 5\%$ voltage tap to compensate power voltage. When product leaves factory the tap is 0. The transformer's original secondary winding voltage is changing according to normal exchange rate. Except un-normal situation, please don't change the tap position.

Under some circumstance, independent power unit may separating transport with unit cabinet. After installation please confirm the right connection of input cable wire with optical fiber cable.

Such as cabinet separating transportation, please confirm the right connection of unit with optical fiber between controllers.

4.9 electromagnetic compatibility installation instruction

This instruction introduce the four measures shall be taken into consideration to realize electromagnetic compatibility when install perfect no-harmonic wave inverter. That is: Grounding, shielding, filtering and wiring. Through these measures will reduce IDrive's electromagnetic below rated amount. And also in this way IDrive has realized electromagnetic compatibility.



4.9.1. Grounding

IDrive provide grounding point to ensure cabinet connected with protection area. Grounding point is grounded inside the IDrive's cabinet, picture as symbol  which is located in nearby A.B.C power input cable and the connecting terminal of U.V.W. motor output cable. Each part is all connected inside by yellow, green color wire or black wire winded with yellow or green tape.

All user's connecting cable of protection area shall be short as much as possible and also shall meet all local's grounding installation requirement IDrive series we suggest protection area 'single point grounding' to avoid to cause grounding circulation. All protection area connection need to check during routine maintenance.

4.9.2. Shielding

The purpose of shielding is to protect harmful Radio Frequency electromagnetic radiation interrupt IDrive's system normal working. And at the same time reducing itself to interrupt other equipment running. Because inside of cabinet there are lots of power switch component and micro-controller that will generate electromagnetic radiation. Thus, It is important to handle well of shielding measure when design cabinet and connecting input & output cable.

The cabinet of IDrive has been exquisite designed and test which can effectively resist interruption of electromagnetism. All input and output cable all need shielding which can enhance the electromagnetic compatibility. The cabinet shell itself is actually effective shielding body which can further enhance electromagnetic compatibility.

1. IDrive's cabinet, cable shielding layer, motor shell these three shielding bodies must connected effectively.
2. Cable shielding layer is not allow breakage.
3. The connection between shielding body must maintain low-resistance in MHz frequency segments.
4. We suggest to use specialized connector to achieve shielding layer low-resistance connecting.

4.9.3. Wiring

1. Control and signal wire, try best to use all analog and digital control wire by shielding cable. If there is no shielding cable, we can use twisted pair cable instead. If using twisted pair cable, try best to make twisted pair close to cable terminals. Try best to avoid using public earth wire between different analog signals.

2. Ensure the separation of digital signal wire and analog signal wire. Prohibit wiring high and low voltage signals, large current, small current and low voltage weak signal together. If possible, using double shielding cable to enhance further electromagnetic compatibility.

3. Control and signal cable must separate with power cable.

4. Control and signal cable slot must away from power cable slot at least 200mm.

5. If control and signal cable has to go through power cable, we must try best to keep angle close to 90. Picture 4-18 indicated.

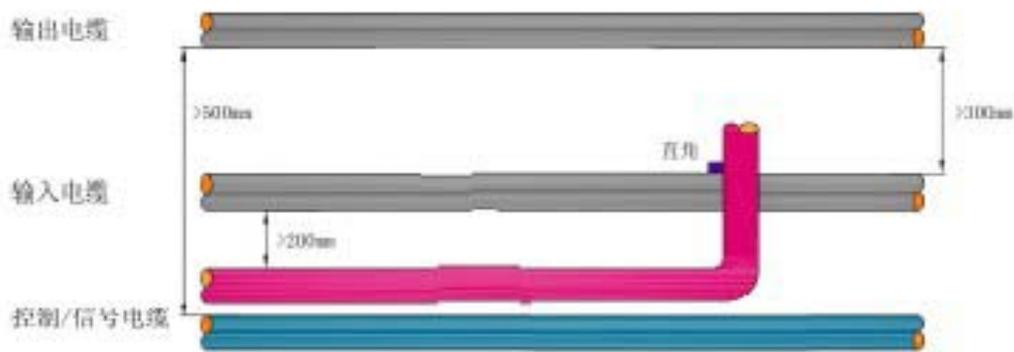


图 4-18 推荐的电缆分隔方式

Picture 4-18 recommendation cable separating method.

6. Power(grid/motor) cable, we suggest all input and output high voltage cable add shielding layer to reduce radio frequency radiation to ensure electromagnetic compatibility. Cable shielding layer need consist by non-magnetism metal group and keep the electric consistency on all cable. The function of banded shield is much better armoured cable and non-banded cable layer, like one shielding layer can also restrain electromagnetic radiation. But the effect of resist-radiation is not better than banded shielding layer.

7. When install cable we must comply with cable factory's recommendation of biggest tensile and minimum curvature diameter requirement.

8. Other cable shielding layer, power, control or signal shall not connect with motor cable shielding layer. Otherwise it will generate very high electric noise.

9. We recommend all IDrive's grid input and motor output cable shielding layer shall connect with protection area only at one side. When adopt armoured cable, it must correctly connect with terminal. Armour connect with terminal in 360 angle. Terminal connects with installation board in 360 angle. And then installation board effectively connects to protection area.

10. Serial communication cable, signal transmission standard(RS232, RS485, Ethernet etc.) and agreement standard(Profibus-DP, Modbus, TCP/IP etc.) will recommend suitable cable type. Please comply with relative standard to implement.

11. Encoder cable---Pulse encoder may direct connect with motor rotor without through electric insulation. This situation mus ensure no insulated bearing being bridged and cause to failure. The same as cable types, we must strictly follow the recommendation of encoder supplier. We must ensure consistency from encoder to IDrive's cable and should not cut off in the middle.

4.10. Insulation method.

When all wiring work finished, we should also measure the insulated resistance of relative circuit which shall comply with the requirements of chart 4-5.

Chart 4-5 insulation requirement chart

Circuit nominal voltage	Megger leve	Insulated resistance
Low-voltage($\leq 50\text{VAC} \leq 120\text{VAC}$)	250VDC	$\geq 0.25\text{M}\Omega$
Medium voltage($\leq 50\text{VAC}, > 120\text{VAC}$)	500VDC	$\geq 0.5\text{M}\Omega$
High voltage($>500\text{VAC}$)	1000VDC	$\geq 1.0\text{M}\Omega$

Chapter 5, Human-machine interface

5.1. Main picture

IDrive series possess a very simple and easy-operation human-machine interface which installed at the control cabinet board of IDrive. Picture 5-1 is indicated as default state of main picture.



Picture 5-1 IDrive series main picture

Date indication:

Indicate output frequency(Hz) of IDrive and output current(A)

Operation area:

IDrive's frequency set up and start, stop, restore and urgent stop operation.

Frequency set up:

1. Input box set up method, Frequency interval increase and decrease. Under the input box method, user can direct input frequency range from 0.00Hz to 50.00Hz which can locally adjust IDrive's running frequency. Under the method of frequency interval, user can press enhance key, such as frequency interval set up as 5Hz, input frequency will increase 5Hz based on original frequency. User can press decrease key, such frequency interval set us as 5Hz, input frequency will decrease 5Hz based on original frequency.
2. IDrive's start, stop, restore and urgent stop all operated by press keys. Of which start and stop

operation interlock. Restore and urgent stop interlock. After IDrive start, we can proceed stop and urgent stop operation. After IDrive stop, we can proceed start and restore operation.

Alarm indication

1. Yellow or red flashing indication light which will be hidden when IDrive is under normal function.
2. When alarm happens, yellow indication light will turn on.
3. When fault happens, red indication light will flash.
4. When press down indication light, it can change to fault record picture.

Picture 5-2IDrive series status picture

Data indication:

1. IDrive AB phase, BC phase, CA phase input voltage and output voltage.
2. IDrive A phase, B phase, C phase input current and output current.
3. Transformer A phase, B phase, C phase temperature.

Data and status indication:

1. IDrive input power, output power and unit cabinet temperature.
2. IDrive status

5.2. IDrive status instruction

Serial number	Status is 0 (Black indication)	Paraphrase	Status is 1 (Red indication)	Paraphrase
1	Probit switch on	IDrive is unable to put on voltage	Permit switch on	IDrive is able to put on high voltage.
2	High voltage not ready	IDrive get high voltage but can not start	High voltage ready	IDrive get the high voltage and can start.
3	Locally	IDrive is in local working status	Remote	IDrive is under remote working status
4	Power frequency	IDrive's bypass cabinet is in the working position	frequency conversion	IDrive's bypass cabinet is in the working position of frequency

		of power frequency		conversion
5	Closed-loop	IDrive's control way is closed-loop	Open-loop	IDrive's control way is open-loop.
6	Converse rotation	IDrive is under converse rotation	Corotation	IDrive is under normal running mode.
7	Stop	IDrive stop running	Running	IDrive is running
8	HMI is communicating with PLC	Human-machine interface is normal communicating with PLC	HMI is off communicating with PLC	Human-machine interface is un-normal communicating with PLC.
9	PLC is communicating with DSP	PLC is normal communicating with main controller	PLC is off communicating with DSP.	PLC is un-normal communicating with main controller.

Running time indication:

1. IDrive single running time and accumulated running time.

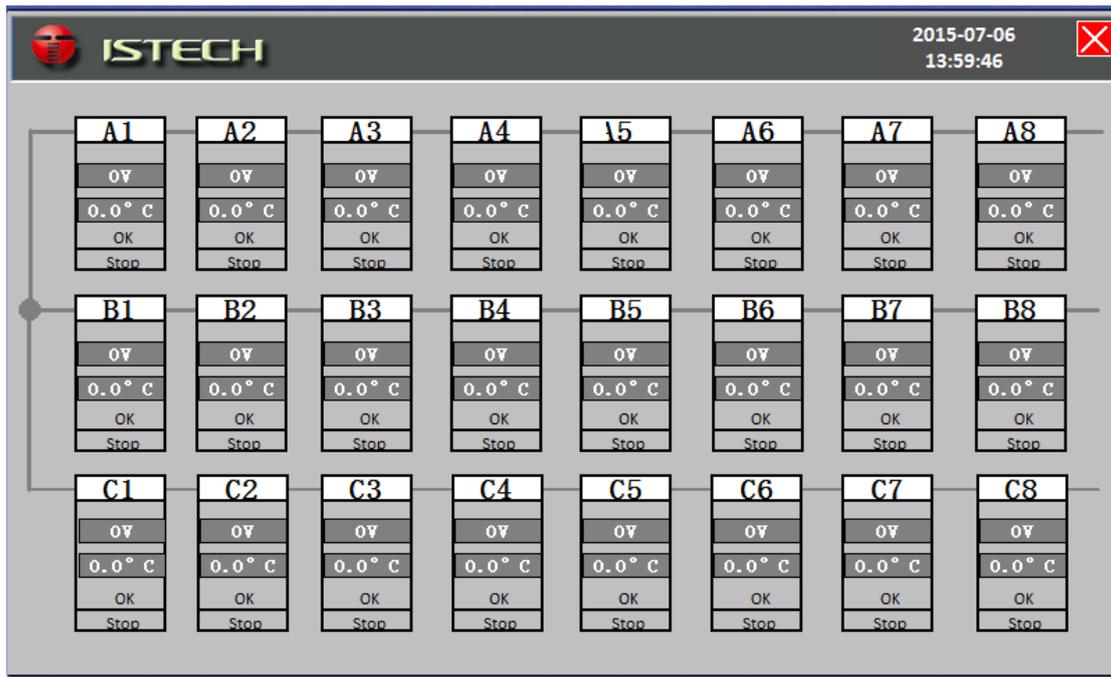
Picture change-over button

Chart 5-3, picture button function

	Main picture	Click can return to main picture
	Lower level picture	Click can get into unit status picture

5.3. Unit monitor picture

Picture 5-3 indicated as 'default status' unit monitor picture.



Picture 5-3 IDrive series unit monitor picture

Unit indication area:

1. It can reflect power unit three phase U,V,W total 24 status. According to the indication of different system series, when there is no unit, default all is 0.
2. Respectively indicate every unit's temperature, DC generatrix voltage, normal/fault status, stop/running status.

If one of unit happens fault, normal status will change to fault status and this unit will indicate fault information.

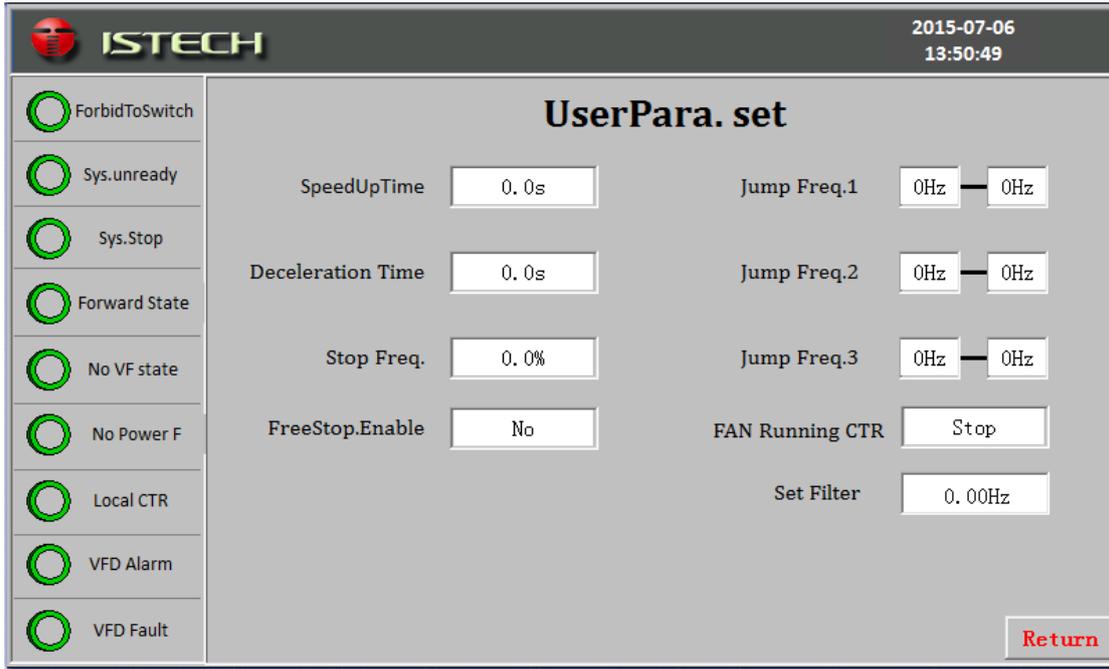
Picture change-over button

Chart 5-4, picture change-over button function

	Main picture	Click it and it will return to main picture
	Upper level picture	Click it and it will return status picture.

5.4 Parameter set up picture

Picture 5-4 indicated as ' default status' of parameter set up picture.



Picture 5-4 IDrive series unit monitor picture

System parameter set up:

Click button you can speed up time, slow down time, stop frequency, frequency hopping point 1, frequency hopping point 2, frequency hopping 3 and adjust frequency interval. If click speed up time button, it will pop out input dialog box like picture 5-5.

Picture 5-5 IDrive series' parameter set up picture.

User can input number in dialog box. Press confirm button to set up parameter. Press cancel button can close the window and parameter will not effect.

1. When press down manual button, PID adjustment set up transfer to manual mode. Picture as indicated by 5-6.
2. Under manual mode, user need to set up goal-number. Kp number, Ki number, Kd number. Observe feedback number and to get to know IDrive's adjustment status.

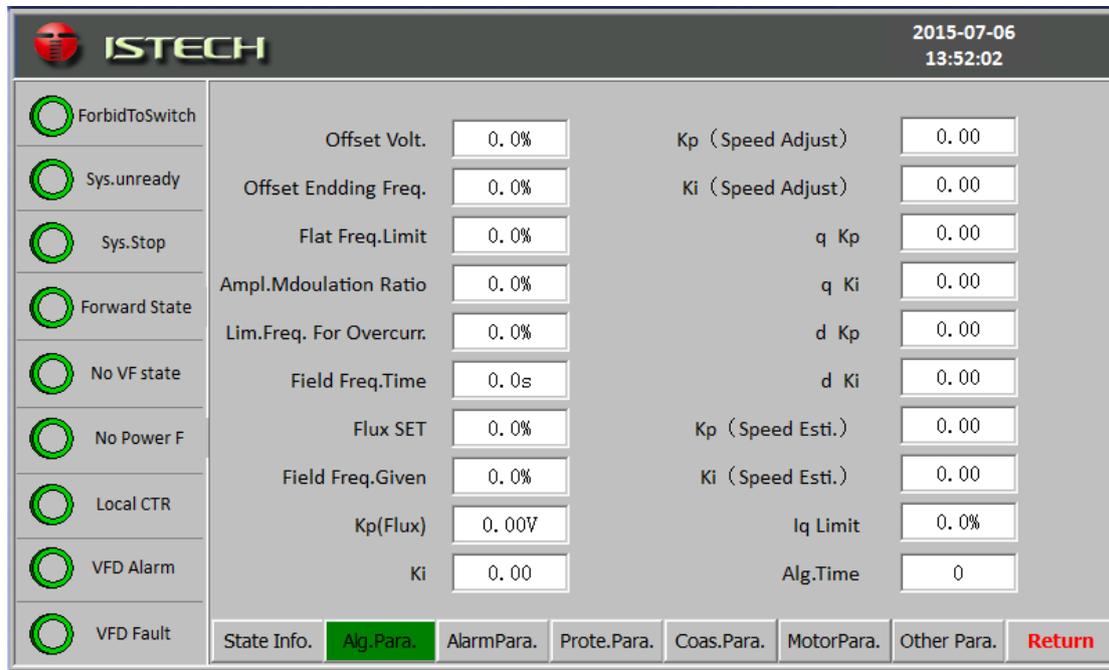
Picture change-over button

Chart 5-5, picture change-over button function

	Main picture	Click to return to main picture
	Lower level picture	Click to enter into parameter check picture

5.5. Parameter check picture

Picture 5-7 indicated as 'default status' parameter check picture.



Picture 5-7 IDrive series parameter check picture.

Parameter check area:

1. Indicate IDrive 37 running parameters, user can only check but can not edit.
2. Parameter check area can divided into 3 sub-main pictures. Click parameter set up sub-main picture you can check all 37 running parameters.

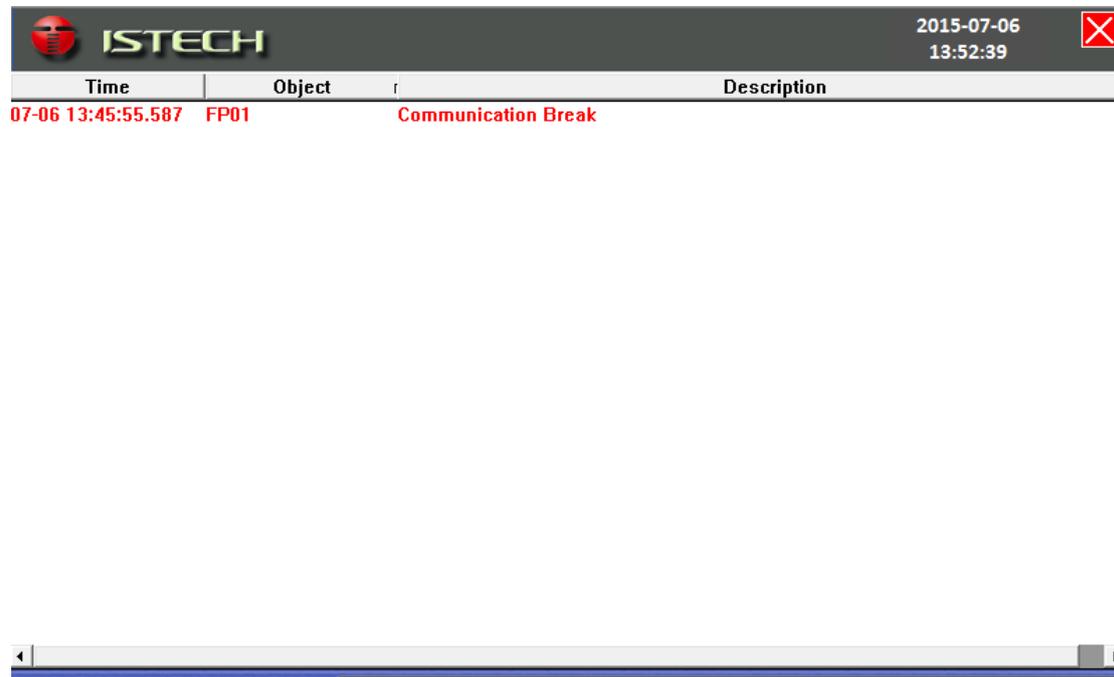
Picture change-over button:

Chart 5-6. Picture change-over button function

	Main picture	Click can return to main picture
	Upper picture	Click can enter into parameter set up picture
	Parameter check sun-main picture	Click can enter into parameter check picture 1. Picture 2. Picture, 3.Picture

5.6. Fault record picture

Picture 5-8 indicated as 'default status' fault record picture



Time	Object	Description
07-06 13:45:55.587	FP01	Communication Break

Picture 5-8 IDrive series fault record picture

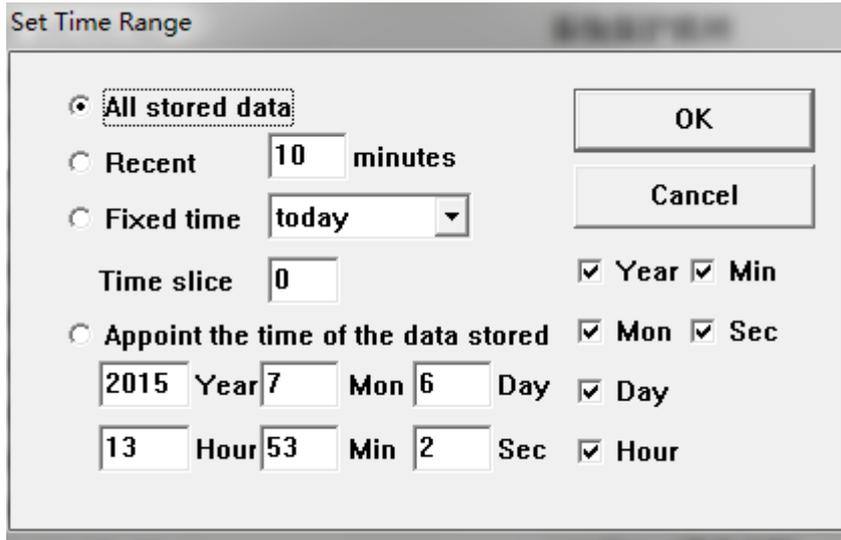
Fault record indication:

1. Indicated happened alarm, fault and disappeared alarm and fault.
2. Indicate alarm and fault happen time and close time. If alarm and fault is not removed, it will not indicate close time. If alarm and fault is removed, it will indicate close time which indicates alarm and fault is removed in recorded time.

Alarm and fault is arranged in time order. At the same time each alarm and fault has corresponding detailed information which is easy for user to analyze fault reason.

Fault record inquiry.

Click button, it will pop out time range set up dialog box. Picture as 5-9 indicated;



Picture 5-9 IDrive series fault record inquiry picture

1. Select all disc-saving data, all alarm and fault since fault record area indication touch screen is running.

2. Select near time, set up the time length such as 10 minutes. Fault area indicate the time length after the present moment. Such as alarm and fault happen within 10 minutes.

3. Select fixed time can click drop-down box, you can choose alarm and record happened at present day, present week, present month, previous day, previous week, previous month. You will also need to set up time division point. Such as set up 0 means everyday 0 as time division point.

4. Select appointed moment disc-saving date which shall set up the amount of second, minute, hour, day, month, year to check time setted up alarm and fault.

Picture change-over button:

Chart 5-7, picture change-over button function

	Main picture	Click return to main picture
---	--------------	------------------------------

5.7. Operation button

Urgent stop:



IDrive control cabinet,” Red mushroom-like urgent stop button”. When IDrive is happening serious damage, you can press this button immediately. IDrive’s controllable high voltage switch will turn off. It can avoid equipment damage and personal injury in the shortest time. When the fault of IDrive is removed, you can spin urgent stop button to restore. This button is effect at any circumstance.

Local/remote operation switch:



IDrive control cabinet,“Local / remote change-over switch”, When change-over turn to left,(Local position), IDrive is only for human-machine interface.Remote box or the start of DCS, stop, restore, frequency adjustment are all non-effetc.

When switch turn to right side(remote position), IDrive operation is only for remote box or DCS. At the moment human-man machine operation is non-effetc.

Remote control box(Optional)

IDrive can equip with remote control box, it has start, stop, restore, urgent stop, corotation, reverse rotation, frequency adjustment and multi-segment selection function which can indicate IDrive’s running frequency, speed, motor rotation speed, motor current information etc.Remote control box can control signal through the connecting of hard connecting wire with IDrive’s secondary input terminal.

Chapter 6 Start and debug

6.1. Introduction

This chapter talks about the necessary required procedure for the success start of IDrive series. From eye check before power on to complete test with high voltage motor., These check or test will proceed in order during the different stages of start process. This chapter will introduce it in a separate way. Every paragraph introduction all contains a series of independent procedure which is for engineering staff or user to put into practice. Some chapter contain several charts to record parameter set up, test data or every error and deviation of relative expectation.

Attention

When high voltage part is filled with electricity, please never switch off system power of heat dissipation. Otherwise, cooling system will stop working. Thus may cause system heavy over-heat and unit damage.

Dangerous

Before debug, please make sure to switch off IDrive's input power and abide by relative operation regulations such as right interlock and alarm board etc.

Dangerous

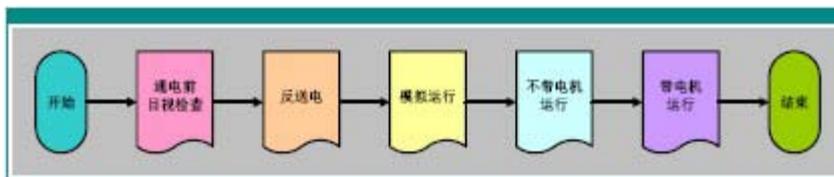
Even though we turn off the high voltage breaker and control power switch, IDrive cabinet still may remain possible existence dangerous high voltage(For example, unit inside capacitor will store power);

Please follow strictly ' Safety event' to proceed.

6.2. Debug process and instrument & equipment

6.2.1 Debug process

Please follow below process to start and debug



Start---->eye check before power on----->reverse power on---->simulation running----->Running without motor----->Running with motor----->done.

6.2.2. Required instrument & equipment

Start debug with below instrument & equipment

Serial No.	Name	Basic specification	Quantity
1	High voltage electroscopescope	Rated voltage>10kV, with sound and light indication	1 piece
2	Insulated glove	Rated voltage > 10kV	1 pair
3	Insulated shoes	Rated voltage >10kV	1 pair
4	Megger	>1kV	1 piece
5	Grounding resistance meter	>10Ω	1 piece
6	Digital multi-tester	DC maxi. voltage: 1000V AC maxi. Voltage: 1000V Maxi. Resistance: <5000MΩ Accuracy ≥ 0.5	1 piece
7	Digital clamp meter	AC current effective value: > 100A Accuracy ≥ 1.0	1 piece
8	infrared temperature measurement gun	-35°C~ +500°C	1 piece
9	Three-phase voltage regulator	capacity: >6kVA	1 set

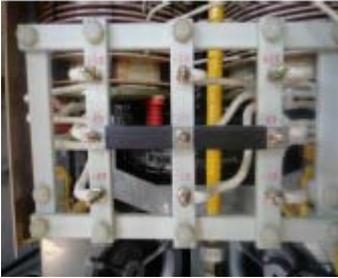
		Input voltage: 380V Input voltage no less than: 0~400V	
10	Digital oscilloscope (Optional)	Double channel insulated oscilloscope, Width>200Mhz, Current Probe: 1:1000(>100A) High voltage probe: 1: 1000(>1000V)	1 set
11	power quality analyzer (Optional)	Power, harmonic, power factor, voltage interruption, voltage dip, voltage swell	1 set
12	Non-contact laser tachometer (Optional)	Measure distance: >2m Rotation range: >3000rpm.	1 piece

6.3 Eye check before power on

IDrive must proceed eye check before power on. According to chart 6-2 verify system whether fit for design.

Chart 6-2 eye check before power on

Procedure	Description
1	Verify IDrive input voltage whether is confirm to IDrive specification. The rated input voltage of IDrive is recorded at the nameplate of inside cabinet.
2	The rated output voltage in IDrive's nameplate shall conform to motor nameplate rated voltage picture as 6-1.
3	Control voltage(Low voltage)must match the rated control voltage of IDrive.
4	Please verify the rated power of motor nameplate with the rated power of IDrive's nameplate. Like left reference picture

	 <p>6-1.</p>
5	<p>1. Confirm input-side neutral point of transformer whether is right.</p> <p>2. Connect with 0 position of transformer's three group winding +5% position, transformer secondary voltage lower 5%;</p>  <p>0 position, transformer secondary voltage is normal.</p> <p>-5% position, transformer secondary voltage increase 5%.</p>
6	<p>Confirm power plug of air-cooling fan is right and tightly connected with power plug seat of transformer cabinet and power unit cabinet. And the rotation direction is in conformity with motor pointed direction.</p>
7	<p>Check all connecting and wiring inside of IDrive and make sure they are all well tightly fastened. And ensure all electric connecting point(include main circuit) marked with fastening mark.</p>
8	<p>Confirm there is no cabinet damage and also do not have serious outside paint comes off. If any, Check the back of damage position or component underneath, cable and the completeness of other material.</p>
9	<p>Check all cable whether has breakage or damage. Ensure they are not naked by friction or inappropriate transportation.</p>
10	<p>Check all terminal row, component, unit and signs of other components or labels whether exist.</p>

	If it not comply with design, please contact supplier.
11	Ensure all protection barrier exists and is right installed.
12	Confirm the right connection of control power with main circuit power and fit for local electric regulation
13	Verify all rightness of user wiring and tightness.
14	When install outside cable of IDrive, it must comply with standard safety working process and local laws and regulations. The protection distance between low voltage cable and other cable must fit for national standard GB/T 11022-2011.
15	Confirm special wire that has follow the design requirement to use as shielding cable which is aimed to ensure electromagnetic compatibility.
16	High voltage cable and low voltage cable must strictly separate and ensure at least 30cm safety distance which is aimed to guarantee electromagnetic compatibility.
17	Confirm IDrive is right and reliable grounding according to local regulation and ensure system single point grounding. Grounding point is at inside of cabinet marked by signal of right picture. 

Note: If any above-mentioned check is different or un-normal from design. Please contact supplier in time.

6.4. Converse power on test.

Below procedure is to test below function:

Check the completeness of input transformer

Check the completeness of unit control board

Activate electrolytic capacitor in the DC generatrix of power unit.

Be ready for IDrive's simulation running

Chart 6-3 IDrive converse power on test

Procedure	Description
1	<p>1) Switch off phase-shifting transformer input side inlet wire or high voltage switch. Switch off IDrive's output to motor side outlet wire or high voltage switch.</p> <p>2) Put user side three-phase four wire system 380VAC capacitor $\geq 6kVA$, a,b,c three-phase cable through three-phase voltage regulator right connect to control cabinet assist 380V three phase terminal block ' XT1'</p>
2	<p>Connect IDrive control power , start UPS (Uninterrupted Power Supply), wait for the finish of IDrive initialization.</p>
3	<p>Open touch screen picture first to status picture, and first check HMI to PLC communication status and PLC to DSP communication status whether connected. And then check transformer's three phase temperature, unit cabinet temperature whether is normal, and then move to unit monitoring picture and wait for conserve power on while observing every unit's generatrix voltage, unit temperature, and unit working status.</p>
4	<p>1) Getting through the input power of three-phase 380VAC of voltage regulator and adjust the output voltage of voltage regulator slowly up to 50V and maintain 10 minutes. Observe and record all unit's generatrix voltage. And also compare the unit generatrix voltage to given reference. When some unit 's generatrix voltage is far smaller than given reference. Cut the power off to check relative unit.</p> <p>2) Continue to slowly turn up output voltage of voltage regulator to 150V and maintain 10 minutes. While observing and record all unit's generatrix voltage.</p> <p>3) Continue to slowly turn up output voltage of voltage regulator to 250V and maintain 10 minutes. While observe and record all unit's generatrix voltage.(When voltage regulator output voltage turn up to approx. 200V, high voltage powered on relay KA2 will appear off and on repeatedly which is normal)</p> <p>4) Continue to slowly turn up output voltage of voltage regulator to 380V and maintain 10 minutes. While observing and recording all unit's generatrix voltage.</p> <p>5) During the converse power on process, pre-charge function will not be activated.</p>
5	<p>Power on finish check:</p> <p>1) Unit drive board power' Green ' indication light whether is lightened.</p> <p>2) Human-man interface power unit DC generatrix voltage function interface, voltage and temperature whether is normal.</p> <p>3) Whether it has fault alarm indication. When press human-man interface restore button whether it can remove relative fault and alarm and make the system ready.</p>

6.5. Frequency simulation running test

Below procedure is to check IDrive control system's running whether is under right operation and protection.

Chart 6-4 IDrive simulation running

Procedure	Description
1	<p>1) Start</p> <p>After converse power on finished, Under the circumstance that IDrive has no fault and alarm, press start button and confirm. The output frequency of human-machine interface started to change and according to speed up time set up from start frequency to settled up frequency. At the same time, the green operation light on control cabinet board is on.</p>
2	<p>2) Stop</p> <p>After frequency running up to settled frequency, please press stop button and confirm. Output frequency decrease from running frequency to stopped frequency, output frequency change to 0Hz. Green running indication light of control cabinet board is off.</p>
2	<p>Fault simulation is to check control system whether is normal work. Fault simulation needed as below:</p> <p>1) entrance guard</p> <p>Open and close power unit cabinet and transformer cabinet door in order and check the indication and fault light status of human-man interface and record the results.</p> <p>2) Fan fault</p> <p>Switch off I1.0, I1.0 input point indication light is off. And then connect I1.0 manual restore, fault remove and record the result.</p> <p>3) dual power switch</p> <p>a. Switch off breaker Q1, KA21 indication light is off. KM21 switch off, KA22 indication light is on. KM22 pull-in, control system is supplied with 380VAC by transformer secondary side.</p> <p>b. Switch on breaker Q1, A21 indication light is on. KM21 pull-in, KA22 indication light is off. KM22 switch off, control system is supplied 380VAC by user side. And record the result.</p> <p>4) Unit and main control communication</p> <p>Random unplug 3 optical fibers at control cabinet , human-machine interface indicate relative unit communication fault. Fault indication light is on, and plug</p>

	back optical fiber and press restore button. Fault is removed. And record the result.
3	Switch off converse power on 380VAC. After waiting 15 minutes and then switch off IDrive's control power. And restore to factory-out status.

6.6 IDrive without motor test

Below procedure is to check IDrive running situation(without motor)

Chart 6-5 IDrive without motor test

Procedure	Description
1	<p>Without motor high voltage operation(Include manual bypass cabinet);</p> <ol style="list-style-type: none"> 1) Switch off user-side high voltage switch cabinet and shake-out breaker. Switch on grounding knife brake to closed position. 2) Withdraw the output cable from bypass cabinet to motor side. 3) Close breaker Q1 and Q2 and get through control power. And start UPS and wait for the finish of IDrive initialization. 4) Open insulated switch QS2in bypass cabinet to IDrive input status. QS1 switch to close brake status(Note: Prohibit operating insulated switch with high voltage) 5) Confirm and close all high voltage cabinet. 6) If we need to put in precharge function, we can manual close breaker Q3. System will control pre-charge process. After the finish of pre-charge, human-man interface will prompt switch off breaker Q3 and then permit high voltage being closed. 7) Switch grounding knife brake of user-side high voltage cabinet to separate position. And shake out breaker to running position. And then close user-side high voltage cabinet.
2	<ol style="list-style-type: none"> 1) Change IDrive's simulation running mode to normal running mode. <p style="padding-left: 40px;">Verify acceleration time, deceleration time, VF curve parameter, unit series, compensation voltage, adjust amplitude adjustment factor parameter.</p>

3	<p>1) Confirm board indicating right input voltage. If input voltage too high or too low, implement below adjustment procedure.</p> <p>2) If input voltage too high and so it need to come down. IDrive factory-out using 0 tap, transformer secondary voltage is normal proportion voltage.</p> <p>3) If input voltage too low or too high, connecting transformer neutral point to -5% or +5% tap.</p>
4	<p>Set up frequency 5Hz, start frequency. Let IDrive running under 10Hz, 15Hz, 20Hz, 25Hz, 30Hz, 35Hz, 40Hz, 45Hz, 50Hz. Record relative output voltage and current wave shape.</p>
5	<p>Test urgent stop:</p> <p>1) Confirm user-side high voltage switch cabinet‘opening coil’ concatenate IDrive control cabinet terminal XT4-1. Switch user-side high-voltage switch cabinet high voltage breaker to test position</p> <p>2) Press down urgent stop button on the cabinet door board. User-side high voltage switch cabinet can effectively opening.</p> <p>3) Under the running circumstance of IDrive, press down ‘Urgent stop’ button, IDrive will automatically block output. And at the same time, user-side high voltage switch cabinet opening, indication light on the cabinet door will turn on.</p> <p>4) Clockwise spin’ opening’ button to pop-up position. Press down ‘ restore button’, fault is removed. Indication light is off.</p>
6	<p>High voltage power on operation without motor(Include manual bypass cabinet)</p> <p>1) Stop IDrive running</p> <p>2) Switch off user-side high-voltage switch cabinet and shake-out breaker. Switch grounding blade brake to closing position</p> <p>3) Wait for 15 minutes. Electrolytic capacitor within power unit cabinet finished discharging.</p> <p>4) Change insulated switch QS1 within bypass cabinet to opening position.</p> <p>5) Switch off breaker Q1 and Q2, switch off control power and close UPS.</p>

6.7. IDrive running test with motor

Below procedure is to check IDrive running situation(With motor)

Chart 6-6 IDrive with motor test

Procedure	Description
1	<p>High voltage power on operation with motor(Include manual bypass cabinet)</p> <ol style="list-style-type: none"> 1) Switch off user-side high voltage switch cabinet, shake-out breaker, switch grounding blade brake to closing position. 2) Connect the cable from bypass cabinet to motor-side output cable in a right and reliable way. 3) Close breaker Q1 and Q2 and get through control power, and start UPS. Wait for the finish of initialization of IDrive controller. 4) Move insulated switch QS2 inside bypass cabinet to IDrive input status. QS1 switch to closing status. (Note: Prohibit operating insulated switch in bypass cabinet with high voltage) 5) Confirm and close all high voltage cabinet 6) If need to put pre-charge function you can hand closing breaker Q3, system will control pre-charge process. After the pre-charge finished, human-machine interface will prompt switch off breaker Q3 and permit high voltage being joined. 7) Move the grounding blade of use-side high voltage switch cabinet to separating position. And shake out brake to running position. Close user-side high voltage cabinet
2	<ol style="list-style-type: none"> 1)Enhance speed up/ down time: Speed up time: 60.0 seconds or longer Speed down time: 60.0 seconds or longer 2)Set up stop frequency: Stop frequency: Recommend 20%. 3)Set up Frequency hopping points According motor resonance point set up range, you can set up at most 3 segment 4)Set up frequency modulation interval: FM interval: recommend 5Hz.

3	System filled with power, it may occur alarm and fault, press down ‘ Fault restore’ button on human-machine interface to restore and remove. If you are unable to remove. Please check ‘ fault remove and maintenance’ chapter content to remove fault and ready for test. If you can not remove, please contact supplier directly.
4	To drive motor with 10Hz. Observe the rotation direction whether is right. If it’s not right, please change-over the rotation direction order position of human-machine interface’ work set up word’
5	Repeat IDrive without motor test’ Procedure 4’:
6	<p>Running with high voltage motor (Include manual bypass cabinet)</p> <ol style="list-style-type: none"> 1) Stop IDrive operation 2) Disconnect user-side high voltage switch cabinet, shake-out breaker, move grounding blaze brake to closing position. 3) Waiting for 15 minutes for the discharging finish of electrolytic capacitor within power unit. 4) Move insulated switch QS1 in bypass cabinet to opening position. <p>Switch off breaker Q1 and Q2, switch control power and shut UPS.</p>

Chapter 7 Function Character

7.1. Flying start

Flying start can also become rotation start. i.e. To start under motor rotating status. IDrive series do not need motor speed sensor. The detection of motor rotation normally adopts power off detection.

By the frequency produced by remanence of induced electromotive force, IDrive according to this frequency and relative output voltage to steady adjust rotating motor and to get expected running status. Picture 7-1 is the flying start wave picture and time order picture.



图 7-1 飞车启动波形图及时序图

7.2. Sudden power off and on start

Sudden power off and on start function is main to ensure load normal operation under given frequency when circuit occur sudden drop or power off.

Due to the unsteady quality of on-site running grid or other on-site factors, it will occur power sudden drop or off status, IDrive adopt bi-directional inverter technique. When detect grid electricity fall, it will start invert charging to ensure IDrive's normal function under short period of time. And to satisfy working situation requires higher reliability. Sudden stop time in functional parameter can be set up by user. And at same time to set up start method as flying start.

7.3. Load torque limitation

IDrive series has fast dynamic response ability which is specially suitable for occasion required harsh acceleration and deceleration time. Under the fast acceleration/ deceleration time and at same time ensure current and voltage limitation safely output and restrain load torque and

drive motor fast, and safely. Picture 7-2 actual measurement of maxi. current voltage limitation and sequence chart.

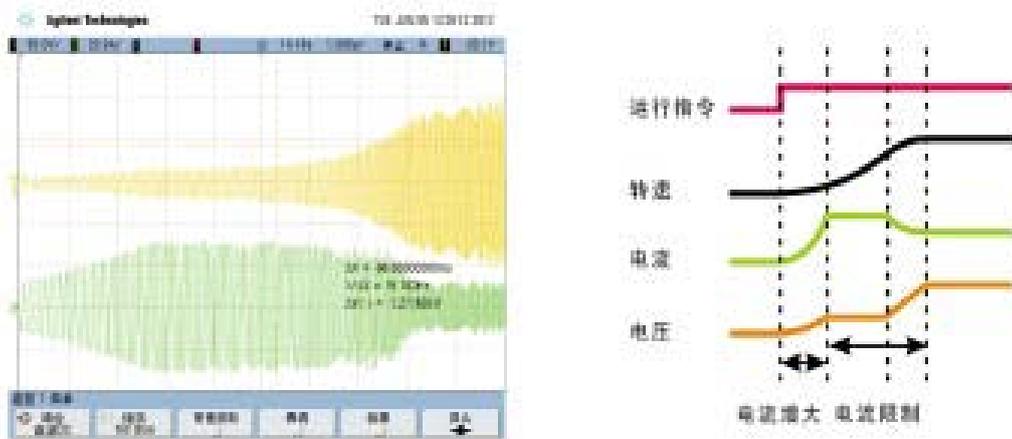


图 7-2 最大电流限制实测波形图及时序图

7.4. Torque promotion

For the constant torque load, if we keep $V/F=\text{constant}$, then we can at the same time ensure air-gap flux, output torque and over-load capability no change. But under low frequency, due to the converse electromotive force is relatively small, we can ignore the influence of motor stator resistance. At this time, we can relatively enhance motor terminal voltage to compensate the influence of stator voltage drop. This method we called Torque promotion.

Under power frequency, the resistance of motor for voltage drop is low. When IDrive running, the motor's resistance is in proportion increase with the frequency decrease. Thus increase relative difference between V and E

Adopt V/F control IDrive, when set up V/F as constant adjustment. With the decrease of frequency, motor Magnetic flux will decrease, Motor torque will also decrease. When frequency drops down very low, motor torque will also become very low and very hard to drag constant torque load motor and even hard to start. Thus we need to increase the output voltage according when under low frequency running. IDrive series torque promotion parameter can be set by manual which is more flexible fit for different working situation.

7.5. Brake control

IDrive adopt direct current to brake. When braking, IDrive's output frequency is 0. Charging asynchronous motor stator winding with direct current. Motor stator form up constant magnetic field. Brake torque is form by rotor drove by transmission machinery cutting stator static magnetic

field. The mechanical energy of transmission system can transfer to electric energy and consume in the rotor circuit of motor through rotor's heat dissipation. This kind of energy consume brake is used in control occasion required accurate motor stoppage or the brake for motor free rotation(such as fan) caused by external force before IDrive system start. DC brake two main parameters: DC brake frequency f and DC brake current I which can through manual set up.

7.6. Open-loop control

Under close-loop running mode, user can set up and adjust the expectation of controlled parameter(like flow, temperature, voltage etc). IDrive can automatically adjust output frequency according to the actual measured value of controlled parameter thus to control the motor rotation and output power. That is controlled parameter is ultimate close to expectation value. We adopt PID control method during the process of automatic adjustment. Normally we set up Integrating factor D as 0. You can also call PI adjustment.

7.7. Upper machine monitor(Optional)

For the convenience remote monitor and parameter set up, IDrive can equip with upper machine software(Optional), upper machine software main function as picture 7-3 which can set up IDrive's running parameter, real-time indication, record running status and history record check.

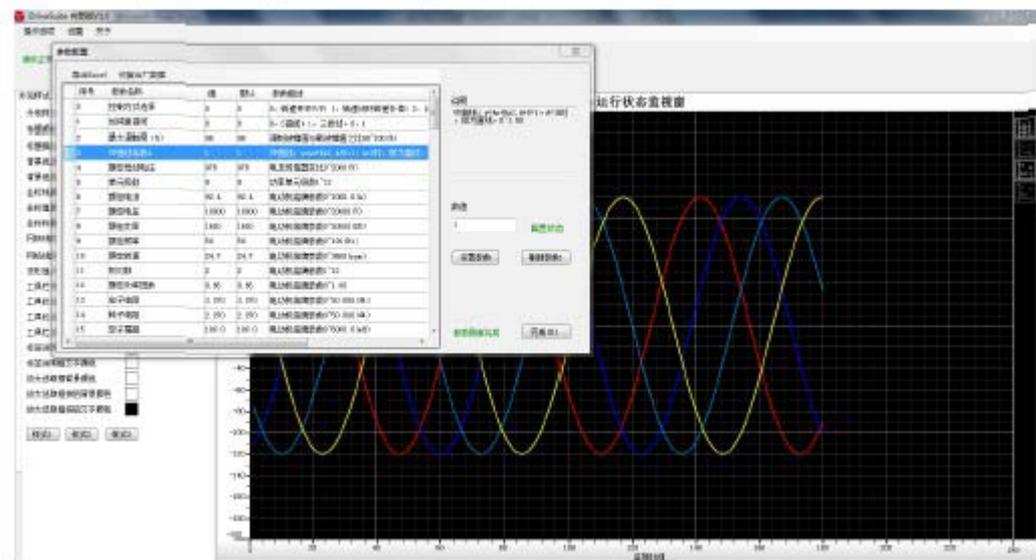


图 7-3 上位机监控软件界面

Chapter 8 Fault remove and maintenance

8.1. Introduction

IDrive series have through on-site running test and can running for a long time without fault.

This chapter front half part is to introduce IDrive series normal fault and pattern of manifestation, behind half part is to introduce fault handle method and IDrive's regular maintenance.

Dangerous

Before check or maintain IDrive, all input power must be cut off.

Attention

Only professional staff through professional training can maintain IDrive series.

8.2. Fault and alarm classification

Under normal circumstance, the alarm indication light and fault indication light(fault indication light is red , alarm indication light is yellow ) on IDrive human-machine interface and cabinet is not on and flash. If master controller software and hardware detect fault and alarm, and then save relative information to fault record and indicate these information on human-machine interface, fault and alarm indication light is on and flash. Fault and alarm maybe is caused by the fault of hardware and software.

Unit fault or alarm is detected by unit control board inside power unit. Every power unit has independent detection circuit. Control system proceed decode, indication and save record according to alarm or fault uploaded by unit.

Normally, Any fault will instant prohibit IDrive stop running and cut off the power supply for motor. Some fault allow use to self define such as degrade or upgrade fault level and change IDrive's response method. Alarm is only for warning, indication and record. But not stop IDrive running. IDrive fault and alarm definition see picture 8-1.

Chart 8-1 'Fault and alarm' type and IDrive response.

Type	IDrive response
Fault	1) Block all IGBT

	<p>2) IDrive will stop freely</p> <p>3) Fault is recorded into history fault record. See history fault record screen</p> <p>4) Fault indicate on human-machine interface</p> <p>5) Fault indication light is on</p>
Alarm	<p>1) Alarm is recorded into alarm record. See history fault record screen</p> <p>2) Alarm is indicated on human-machine interface</p> <p>3) Alarm indication light is on</p>

Attention:

Restore button on human-machine interface, in IDrive stop situation(When IDrive is controlled to stop, it is real stop when IDrive reduce speed below stop frequency), you can manual store fault/alarm.

IDrive happens fault, save and record in order and lock save until fault is removed. It can be removed through manual restore operation. Alarm, save and record in order not lock save. When alarm is removed, it will remove automatically or also through manual restore.

8.3. IDrive fault and alarm

Fault and alarm instruction:

1. 'type' indicate fault (F), alarm (A) or according to definition. Both is OK(F/A)/ (A/F), (F/A) default as fault (F),(A/F) default as alarm(A).

2. 'configuration' indicate fault or alarm whether permit user to change. Permit/prohibit(Y/N). I.e. Fault degrade alarm or alarm upgrade to fault.

“ High voltage input” fault and alarm;

Chart 8-2 ‘High voltage input’ fault and alarm

Serial No.	Fault indication	Type	configuration	Fault reason and solve measure
1	Input phase loss	F	N	<p>Reason:</p> <p>1) Input phase loss</p> <p>Measure</p> <p>1) Check and confirm input three phase cable whether is right</p> <p>2) Check controller board serial 2 “ Sampling</p>

				board" whether is broken.
2	Input over-voltage	A/F	Y	Reason: 1) IDrive's input cable voltage effective value exceed 120% of rated voltage brake value
3	Input under-voltage	A/F	Y	Reason: 1) IDrive 's input cable voltage lower 65% of rated voltage brake value
4	High voltage power loss	F	N	Reason: 1) IDrive input cable voltage effective value is lower than rated voltage brake value. This parameter can set up, default as 20%. Measure 1) Check and confirm three-phase cable whether is right connected. 2) Confirm human-machine interface'power cut voltage' set up whether is right At same time check three-phase input voltage whether is right. 3) Check controller board serial 2'sampling board' whether is broken.

' Motor/ IDrive output' fault and alarm

Chart 8-3 ' Motor/ IDrive output' fault and alarm

Serial No.	Fault indication	Type	configuration	Fault reason and solve measure
1	Encoder without signal (Optional)	A	N	Reason: 1) Software detect no encoder signal. This fault may caused by the encoder broken or encoder terminal broken Measure: 1) Encoder hardware broken

				<p>2) Encoder transmission cable broken</p> <p>3) Check controller board 4'expansion board' whether is broken.</p>
2	Motor over-heat	A/F	Y	<p>Reason:</p> <p>1) When motor running current exceed'overload alarm brake value' trigger; Default 1.1 times over-current 10 minutes.</p> <p>Measure:</p> <p>1) Check' pber-load alarm brake value' parameter whether is right set up.</p> <p>2) Check load motor whether is over-load under long time working</p> <p>3) Check the heat-dissipation system whether is normal.</p>
3	IDrive over-load	A/F	Y	<p>Reason:</p> <p>IDrive output current exceed rated output current 125%, and running time over 1 minutes. Parameter can set up, alarm is on immediately when default parameter is 1.25 times over current. Alarm is not lock save. Successive alarm exceed 1 minutes will upgrade to fault.</p> <p>Measure</p> <p>1) IDrive real running over-load, check motor load status</p> <p>2) Check human-machine interface indication parameter' over-load brake value' and 'over-load time' whether is right.</p> <p>3) Check Hall sensor whether is under normal operation</p> <p>4) Check controller board serial 3'sampling board' whether is broken</p>
4	IDrive over-current	F	N	<p>Reason</p> <p>1)When IDrive output current exceed rated output current 180%, instant protection will on. Over-current protection has 2 level brake value. Parameter can set up. Default is 1.8times over</p>

				<p>current 3s or 1.5 times over current 10s.</p> <p>Measure:</p> <ol style="list-style-type: none"> 1) IDrive real running current, check motor load status 2) Confirm human-machine interface indication parameter 'over-current brake vale 1' or 'Over-current brake value 2' set up whether is right 3) Check HALL sensor whether is right 4) Check controller board serial 'Sampling board' whether is right.
5	Output phase open circuit	F	N	<p>Reason:</p> <ol style="list-style-type: none"> 1) Software detect IDrive to motor's output phase open circuit <p>Measure:</p> <ol style="list-style-type: none"> 1) Check IDrive to motor side all connection whether is right 2) If there is bypass cabinet, check bypass cabinet part whether is working un-normal
6	Torque amplitude limiting	A	N	<p>Reason</p> <ol style="list-style-type: none"> 1) Under acceleration too fast or load sudden change condition, it cost output torque exceed torque setted maxi.reference. Default value: 120% rated torque 1 minute.
7	Torque amplitude limiting speed down	A	N	<p>Reason:</p> <ol style="list-style-type: none"> 1) Under the function of amplitude limiting regulator, regulator output frequency continue lower than system frequency set up value. Default value: 30 minutes. <p>Measure:</p> <ol style="list-style-type: none"> 1) check load condition 2) Check IDrive torque amplitude limiting parameter set up whether is right.

Control power fault and alarm:

Chart 8-4 control power alarm and fault

Serial No.	Fault indication	Type	configuration	Alarm reason and solution measure
1	$\pm 15V$ Power fault	A	N	Reason 1) IDrive HALL sensor power fault Measure 1) Check $\pm 15V$ switch power output whether is un-normal. 2) Check the connection from HALL sensor power to controller ' sampling board' whether is un-normal.
2	24V Power Alarm	A	N	Reason 1) Controller supply power voltage lower than 9V or exceed 27V; Measure 1) Check controller 24 V switch power output whether is un-normal. 2) Check 24V supply power cable connection whether is un-normal.

Air-cooling system fault and alarm

Chart 8-5 air-cooling system fault and alarm

Serial No.	Fault indication	Type	configuration	Fault reason and solution measure
1	Air-cooling fan fault	F	N	Reason 1) Caused by heat dissipation fault on the top of transformer and power unit cabinet. Measure 1)Check connection of fan power and power supply whether is un-normal. 2) Check air-cooling panel whether is stuck by sundries(Other things)

				3) Air fan hardware component damage.
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System control fault and alarm

Chart 8-6 system control fault and alarm

Serial No.	Fault indication	Type	configuration	Fault reason and solution measure
1	Entrance guard fault	F/A	Y	Reason 1) IDrive and power unit cabinet is opened Measure 1) Close IDrive and power unit cabinet, fault is removed. 2) IDrive entrance guard switch is damaged. 3) Check entrance guard switch to PLC detect cable whether is disconnected.
2	Transformer over-temperature alarm	A	N	Reason 1) Phase-shifting transformer work temperature over 120°C Measure 1) Check phase-shifting transformer temperature sensor whether is damaged. 2) Check transformer cabinet's filter whether is blocked by sundries. 3) Phase-shifting transformer bottom or cabinet top heat dissipation fan whether is un-normal. 4) IDrive working environment temperature whether is too high.
3	Transformer over-temperature fault	F	N	Reason 1) Phase-shifting transformer working environment exceed 160°C. Measure 1) Same as above-mentioned 'Transformer over-temperature alarm'
4	Unit cabinet	A	N	Reason

	Over-temperature alarm			<p>1) Unit cabinet working temperature exceed 60°C.</p> <p>Measure</p> <p>1) Check unit cabinet temperature sensor whether is damaged.</p> <p>2) Check unit cabinet filter whether is blocked up</p> <p>3) Unit cabinet top heat dissipation fan whether is normal working.</p> <p>4) IDrive working temperature whether is too high.</p>
5	Unit cabinet Over-temperature fault	F	N	<p>Reason</p> <p>1) Unit cabinet working temperature exceed 70°C.</p> <p>Measure</p> <p>1) Same as above-mentioned 'unit cabinet over-temperature alarm'</p>
6	User 380 Power loss	F	N	<p>Reason</p> <p>1) IDrive control system 380V power loss</p> <p>Measure</p> <p>1) Check user 380V power connection whether is normal.</p> <p>2) Check detection contactor KM1 working weather is normal.</p>

Communication fault and alarm:

Chart 8-7 communication fault and alarm

Serial No.	Fault indication	Type	configuration	Fault reason and solution measure
1	Human-machine interface communication fault	A	N	<p>Reason</p> <p>1) Human-machine interface is failed communicate with PLC</p> <p>Measure</p> <p>1) Check communication cable of human-machine interface and PLC 485 whether is normal.</p>

				2) Two types of 485 connector hardware damage and change relative hardware.
2	Controller communication fault	F	N	Reason 1) PLC is failed to communicate with controller. Measure 1) Check communication cable of PLC and controller whether is normal 2) Two type of connectors hardware is damaged and change relative hardware.
3	Optical fiber communication upper fault	F	N	Reason 1) Controller is unable to receive signal from unit control board. Measure 1) Check the connection of controller and unit control board relative channel interlink optical fiber whether is normal. 2) Check working of unit check board whether is right 3) Check controller whether is normal
4	Optical communication Down fault	F	N	Reason 1) Unit control board is unable to receive signal from controller Measure 1) Same as above-mentioned 'Optical fiber communication upper fault'

8.4. Unit fault and alarm

8.4.1. Unit fault information

Unit fault is caused by circuit of unit control board of every power unit. Controller board receive these fault signals through Optical plate. Chart 8-8 instruction for quick search and unit fault diagnosis.

Chart 8-8 unit fault

Serial No.	Fault indication	Type	configuration	Fault reason and solution measure
1	Phase loss	F	N	Reason 1) One or several unit fuse blow Measure 1) Confirm the reason of fuse blow(If require) repair damage unit and change fuse.
2	Over-heat	A	N	Reason 1) Unit temperature exceed alarm limited value. Default alarm limited value is +85 °C. Measure 1) Check air-cooling system status 2) Check motor load status 3) Change damage unit control board.
3	Drive	F	N	Reason 1) IGBT over-current or short circuit, maybe IGBT damage or unit control board damage. Measure 1) Check motor load status 2) IDrive acceleration time too fast which can adjust human-machine interface‘ acceleration time’ parameter. 3) Change damaged unit control board. 4) Change damaged IGBT, please contact with supplier.
4	Unit power fault	F	N	Reason 1) Unit control board control power supply un-normal. 5V or 15V power un-normal. Unit control board power module damaged. Measure 1) Change unit control board and contact supplier,
5	DC generatrix	F/A	N	Reason

	undervoltage			<p>1) Unit generatrix voltage lower than alarm valve value.</p> <p>2) Unit control board detection voltage damage.</p> <p>3) Adjust human-machine interface‘ DC generatrix under-voltage parameter set up whether is right.</p> <p>Measure</p> <p>1) Check input voltage whether is too low.</p> <p>2) Change unit control board and contact supplier</p>
8	DC generatrix over-voltage	F/A	N	<p>Reason</p> <p>1)Unit generatrix voltage exceed alarm limited value, normally because IDrive reduce speed too fast</p> <p>2) Unit control detection board is damaged.</p> <p>3)Adjust human0machine interface‘ DC generatrix over-voltage’ parameter set up whether is right.</p> <p>Measure</p> <p>1) Check input voltage whether is too high.</p> <p>2) IDrive speed down too fast which can adjust human-machine interface‘deceleration time’ parameter</p> <p>3) Charge unit control board and contact supplier.</p>

8.5. Unit fault maintenance

Phase loss fault

Caused by power unit front side fuse blow. Check fuse and change damaged fuse. And problem or damaged components.

Drive fault

Transistor PN junction carrier cause higher junction resistance, transistor will lead to bigger voltage reduce and consume which cause component damage in advance. Unit Drive Board possess the function of detection component break over and voltage reduce, close IGBT when

fault occur. This fault may be caused by a flaw in the unit control board or noise from the unit control board. Before the power unit is changed, we shall find out the exact reason for the fault. Otherwise, it may happen in an unpredictable situation.

DC generatrix under-voltage fault:

It occurs when the generatrix voltage drops to the value set by the detection circuit on the unit control board. It may be caused by low input high voltage coupling with a load requiring a large current. Or it may be caused by a sudden overload.

Power unit AC power fuse blow can cause this fault. Check the unit fuse and see whether it is all right.

Damaged unit control board sometimes demonstrates wrong indication. Change the flawed or damaged component.

DC Generatrix over-voltage fault:

- 1) Adjust the human-machine interface 'deceleration time' parameter and properly extend the IDrive deceleration time.
- 2) Unit control board detection circuit is interrupted or damaged. Change the unit control board.
- 3) Check the unit input voltage and phase-shifting transformer output voltage to see if they are normal.

Over-heat fault

- 1) Check the unit cabinet top fan to see if it is running normally.
- 2) Check the filter net to see if it is blocked.
- 3) Check the IDrive indoor temperature to see if it is abnormal.
- 4) Ensure every cabinet door is closed, and the heat-dissipation fan is properly installed to ensure good air-cooling flow.
- 5) Check the unit control board to see if it is broken.

Communication fault

1. Check the optical fiber link; if there are any problems, we need to change it.
2. Check or change the unit control board.
3. Check the connection of the controller main board and optical fiber board to see if they are good or damaged.

8.6. IDrive input protection

IDrive main control software integration possess IDrive input side un-normal detection condition and provide protection procedure module. Fault is caused by these procedures which can use proper interlock through output relay or serial communication to switch off IDrive's high voltage input power.

8.6.1. Transformer over-heat fault or alarm

The temperature of all secondary winding of transformer is monitored by two set temperature switch(Normal closed point). First set of temperature switch connector will open when temperature exceed 120°C. While second set connector will open when temperature exceed 160°C. When 120°C connector switch off, it issue out 'Transformer over-temperature alarm'. When 160°C connector switch off, it issue out 'transformer over-temperature fault' signal, it issue out 'Transformer over-temperature fault' and to make IDrive tripping.

8.7. Fault dealing process

After IDrive fault occur, user can refer to below process to proceed fault dealing.

1. Through human-machine interface check various alarm and fault.
2. Read this chapter other parts diagnosis introduction to check possible reason and solving method.
3. If IDrive unreasonable stop and human-machine interface can not indicate, please contact supply for after-sale service.
4. If fault dealing simple can through remote control to instruct user to finish fault dealing. If fault dealing complicated. Supply will send out engineer to repair. And engineer will bring fault dealing relative equipment and tools.
5. Suggest before contact supply after-sale engineer, please collect IDrive fault information as much as possible. If try re-charging high-voltage power, after restoring fault, re-start IDrive to see fault will occur again or try to adopt below 2 points to restore fault.
 - 1) As for standby fault, analyse fault through adjustable unit optical fiber whether it is from unit or main controller. And then through exchange or unit control board change to analyse fault whether is from unit control board or unit other components.

Attention:

<p>When component change is needed, we must check whether new and old component is the same; After exchange unit optical fiber, IDrive is forbidden to test running. Running may cause IDrive's power unit damage.</p>
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8.8. Regular maintenance

Regular check filter net block situation. If air blow is not enough, clean filter net or change filter net.

Regular check power unit control board dust accumulation status. If dust accumulation is very serious, stop machine to clean. During the clean process, be attention on static protection.

If indoor install air conditioner, regular check air condition situation. Ensure indoor temperature not exceed 40 °C, humidity not exceed 90%.

Regular check IDrive whether has smelly or un-normal noise.

Regular check IDrive running situation(Running mode, voltage, current and speed etc.)

Regular need to discharge or recharge UPS after long time no running, which is used for activating battery electrolyte.

When IDrive is no time no running, we need to discharge power unit fully before use it again, which is used for activating electrolytic capacitor electrolyte.

Attention

Any damaged component disposal shall according to local regulation and requirement.

Chapter 9 After-sale service

9.1. Introduction

Shanghai Istech electric Co., Ltd.(Short for Istech) customer service department provide service according to pre-regulated service policy. Service will implement according to within Guarantee time or over Guarantee time.

9.2. Quality ensure regulation

In order to maximum maintain our client benefit, Istech provide certain time quality ensure. Quality regulated as below: All IDrive quality ensure time is 18 months after our product arrived at on-site or 12 months after IDrive start running. Among which early expiry as base. Within quality ensure time, client can have free maintenance. But for force majeure like natural disaster, accident, wrong use and unauthorized disassemble, repair and change thus caused serious damage, Istech will not be responsible for free maintenance.

9.3. Service type and policy

9.3.1. Basic principle

1. To help client solve problem and reduce unnecessary loss, and promote client satisfaction as our basic principle.

2. Obey laws and rules and client's regulation and system.

3. Istech service electrician duty range: Equipment expediting, cargo check, equipment quality issue handle, instruct installation and debugging, participate test running and function acceptance test.

1) Before install and debug, on-site engineer shall hand-over technique to user. Explain and demonstrate proceeding procedure and method. As for important procedure, technician shall confirm and read down on-site procedure, otherwise next procedure is not allowed. Through Istech electric confirm and sign process, if problem happens due to wrong guidance of our technician, Istech will fully be responsible.

2) On-site service technician has the right to deal with any technique and business problem occurred on-site installation. If IDrive happen quality problem, Istech electric will solve problem within regulated time. If Istech entrust user side to solve problem, it must approved by Istech side and bear for relative economic loss.

4) Istech shall communicate with buyer for sending engineer in advance/.

5) Buyer shall cooperate with sending technician and support our service person daily necessary, transportation and communication.

9.3.2. Start debug

Istech offer every free service for starting and debug of new installed IDrive. Debug time is calculated from engineer arrived at on-site. If client reason cause debug delay, our company will charge extra overtime cost.

9.3.3. On-site maintenance

Istech provide IDrive on-site fault maintenance service, service as regulated below;

All fault fits above-mentioned reason within quality ensure time, Istech will responsible for free maintenance.

Exceed quality ensure time, if need maintenance service from Istech, the cost will relatively charged. For detail, please contact Istech's client service department.

On-site service person is to ensure equipment safe, normal running,. Istech will send service person to on-site and provide 'on-site service chart'; If our plan can meet the requirement of engineer, we will change plan chart through negotiation and free charge.

9.3.4. Ship back to factory maintenance

Istech provide maintenance service for fault happened IDrive and other components shipping back to IDrive factory.

Within quality ensure time, this service effect is under IDrive can not maintenance on-site.

Beyond quality ensure time, user can choose whether on-site maintenance or this maintenance. If our plan can not meet the requirement of project, we can change plan through negotiation and charge for free.

9.3.4. Technician maintenance

Istech provide on-site or company technical training. Through training, trainee can further understand the IDrive's working principle and technical features, AC motor principle, frequency transmission basic terms and IDrive regular maintenance and fault dealing etc. Additionally, trainee will learn a certain knowledge of IDrive software control system, menu system etc. Necessary training will improve production efficiency, maxi. improve equipment usage and realize equipment best function. Training content and project shall be the same as the process of project. Training time, number of people, place detail content will be confirm through two sides agreement. This charge is for free.

9.3.6. Predictable maintenance and preserve.

Due IDrive possess high usage rate, long circle time and different working environment features. Normally proceed predictable maintenance according to on-site conditions varies from 6~18 months as a circle time. If high voltage IDrive is running under harsh environment and lack of maintenance, it will reduce equipment use time. At same time, it will also influence production and cause unnecessary economic loss.

Istech insist on providing IDrive running rate as a key point, stressing the importance of equipment maintenance and preserve and provide predictable maintenance and preserve service from client benefit. This service is conclude equipment inside clean, machinery re-positioning, circuit board clean, circuit board selection and necessary protection, system function test, old machinery component repair and change etc. Specific information please contact Istech service department.

9.3.7. Upgrading and function reform

If customer purchase IDrive afterwards would like to add assistive function to enhance running stability. Such as workable technical program by extra equipping with bypass system. Upgrading and reform process as below; Istech service department will first access customer's require demand, and then issue a upgrading or plan reform paper. If customer recognize Istech's proposal and then we will charge relative predictable service fee in advance, and then engineer will go to on-site proceed service. Our service charge is based on 'surplus refund and shortage re-charge' principle to charge final value. Regarding relative on-site detail, please contact Istech service department.

9.4. Contact information

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