AC310 Universal AC Drive Service Manual

(Veichi Electric Technical Service Department)

(Note 1: This maintenance manual related circuit diagrams, using the AC310 series 2.2KW machine as a reference, the control board screen printing diagrams and other power segments of the power board different points, in the appendix will be prompted, the appendix according to each power segment circuit is divided into 3 power segments, each power segment select a specific power segment.

There will be tips in the appendix, the appendix according to the different circuits in each power section, roughly divided into three power sections, each power section to select a specific power as a practical example to explain the differences and similarities, details.

(Note 2: AC310 general-purpose AC drive is still in the process of continuous optimisation of the hardware circuit, so sometimes there may be inconsistencies between the specifications of the actual components and the specifications on the circuit diagram.

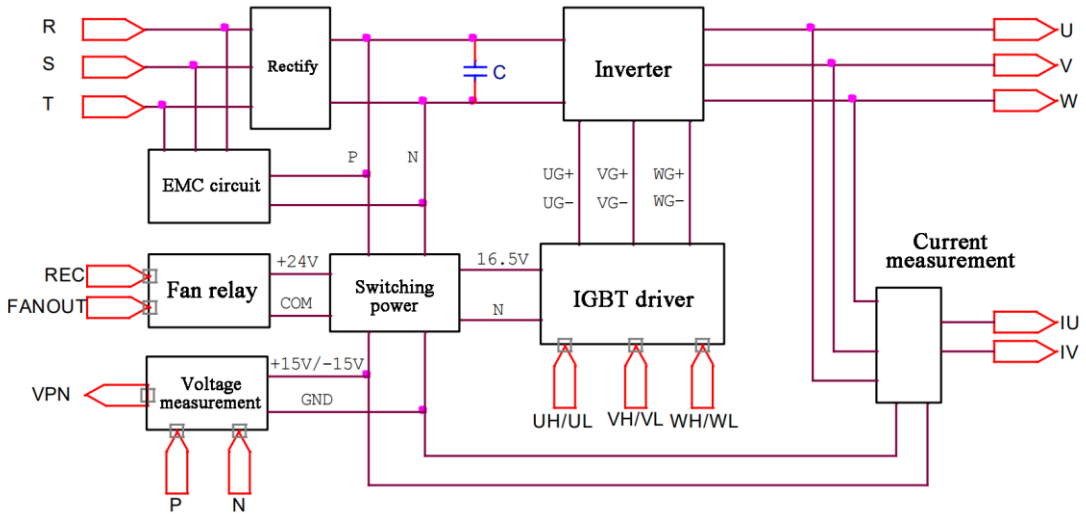
(Note 3: This service manual involves hardware design circuit diagrams, and should not be distributed privately.)

Catalog

Chapter 1 Summarize

1.1 The Working Principle of the AC Drive

The working principle of the AC drive is shown in Fig. 1, the input of the AC drive is AC, which is rectified by the rectifier bridge composed of six diodes and filtered into DC by capacitor C. The voltage at the primary side of the switching power supply transformer is taken from the busbar voltage, and the switching power supply voltage is obtained through the switching power supply related devices, which provides the voltage for the drive circuits, fan relays, and control boards, etc.; the DC power is then inverted into the frequency-variable and voltage-variable alternating current (AC) through the AC drive module composed of the IGBTs and the renewal diodes, and the waveforms of the voltages are Pulse-width modulation (PWM) waveforms.



1.1.1 Rectifier Bridge

The rectifier section consists of six rectifier tubes forming a three-phase rectifier bridge to rectify the three-phase AC full-wave rectification of the power supply into DC. If the line voltage of the power supply is UL, then the average DC voltage UD after three-phase full-wave rectification will be: UD=1.35×UL

The line voltage of our three-phase power supply is 380V, so the average voltage after full-wave rectification: UD = 1.35 × 380V = 513V. This is calculated to be the average value of the bus voltage, corresponding to there is a maximum value: UDmax

= 1.414 × 380 = 538V

1.1.2 Detachable Capacitor

Electrolytic capacitors in the AC drive is the main role of filtering, filtering capacitors are connected in parallel at the output of the rectifier power supply circuit, to reduce the AC pulsating ripple coefficient, smooth the DC output of a kind of energy storage device; filtering capacitors not only make the power supply DC output is stable, reduce the alternating pulsating ripples on the impact of the electronic circuits, and at the same time can absorb the current fluctuations generated in the course of the electronic circuits and the interference through the AC power string into the electronic circuits to make the work of the electronic circuit more stable performance.

1.1.3 Switching Mode Power Supply

The voltage at the primary side of the switching power supply transformer is taken from the DC bus voltage, and through the switching power supply circuit, it gets +24V, ±15V, +5V, 16.5V and other voltages are obtained through the switching power supply circuit to provide voltages for the drive circuit, current detection, fan relay circuit, voltage detection and so on, so as to ensure the normal operation of the frequency converter.

1.1.4 Inverter Module

It consists of IGBT tubes and six diodes. By controlling the switching sequence and switching time of the IGBT tubes, the AC drive turns the DC power into AC power with variable frequency and voltage, and the voltage waveform is pulse width modulated waveform.

（Note: The output voltage waveform of the AC drive is a pulse-width modulated waveform, but the output current is measured as a sinusoidal waveform in practice, because the motor is an inductive load, which makes the output sinusoidal waveform）

1.2 Common Device Overhaul Method

1.2.1 Detect Diode

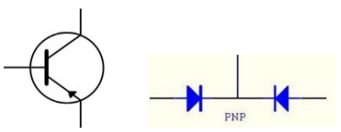
Digital multimeter diode file open-circuit voltage of about 2.8V, the red pen is connected to the positive, the black pen is connected to the negative, the measurement of the current provided by about 1mA, the display value for the diode forward voltage drop approximation, the unit is mV or V. Silicon diode forward conduction voltage drop of about 0.3 ~ 0.8V, reverse bias shows the diode open-circuit voltage. The germanium diode germanium forward conduction voltage drop is about 0.1~0.3V. And the forward voltage drop of the more powerful diode is smaller, and the reverse bias shows the open-circuit voltage of the diode. If the measured value is less than 0.1V, it means that the diode breaks down, at this time both forward and reverse conduction. If the forward and reverse are open, it means that the diode is open.

1.2.2 Detect Triode

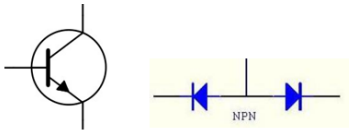
The triode has two PN junctions, the emitter junction (be) and the collector junction (bc), which can be measured in the same way as the diode. In the actual measurement, the forward and reverse voltage drops between each two pins should be measured, a total of 6 times, of which 4 times show open circuit, only two times show the voltage drop value (why only 2 times show the data, because the triode is in the triode, the voltage drop value is not displayed).

There are two times to show the voltage drop value (why only two times to show the data, because the transistor in the measurement of the static value of the equivalent diagram shown in the figure below), otherwise the transistor is bad or special transistors (such as resistance transistors, Darlington transistors, etc., can be distinguished by the model number and the ordinary transistors). In two measurements with values, if the black or red pen is connected to the same pole, the pole is the base pole, the smaller measurement value is the collector junction, and the larger one is the emitter junction, because the base pole has been judged, and the collector and emitter can be judged accordingly. At the same time, it can be judged: if the black pen is connected to the same pole, the transistor is PNP type; if the red pen is connected to the same pole, the transistor is NPN type; the one with a voltage

drop of about 0.7V is a silicon tube, and the one with a voltage drop of about 0.3V is a germanium tube.



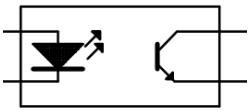
PNP model



NPN model

1.2.3 Optocoupler

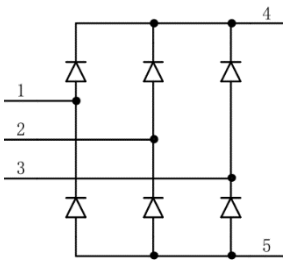
The circuit principle and symbols of commonly used optocouplers are shown in the following figure:



One side is a light-emitting diode, the voltage drop is about 1V, the other side is a transistor, some only lead out c, e, measurement of forward and reverse are cut off, if all three legs lead out, the measurement characteristics are the same as the above transistor (mostly NPN tubes). When using a multimeter to make the diode forward conduction, at this time with another multimeter to measure the transistor c to e conduction voltage drop of about 0.15V; disconnect the diode connected to the multimeter, the transistor c to e cutoff, indicating that the optocoupler is good.

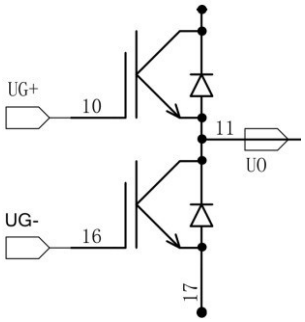
1.2.4 Static Measurements of Rectifier Bridges

Three-phase bridge rectifier electrical schematic diagram, points 1, 2 and 3 are RST inputs, points 4 and 5 are P and N. Measurement method is the same as that of a normal diode.



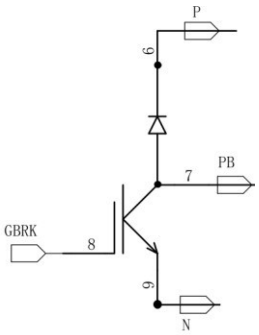
1.2.5 Static Measurements of AC Drive Continuity Diodes

Schematic diagram of the AC drive unit, the measurement method is the same as ordinary diodes. Measurement of the IGBT diode to determine the damage. Just put a meter pen into the U, V, W output, a meter pen on the P or N, you can measure the good or bad.



1.2.6 Static Measurement of Brake Units

Brake Unit Schematic



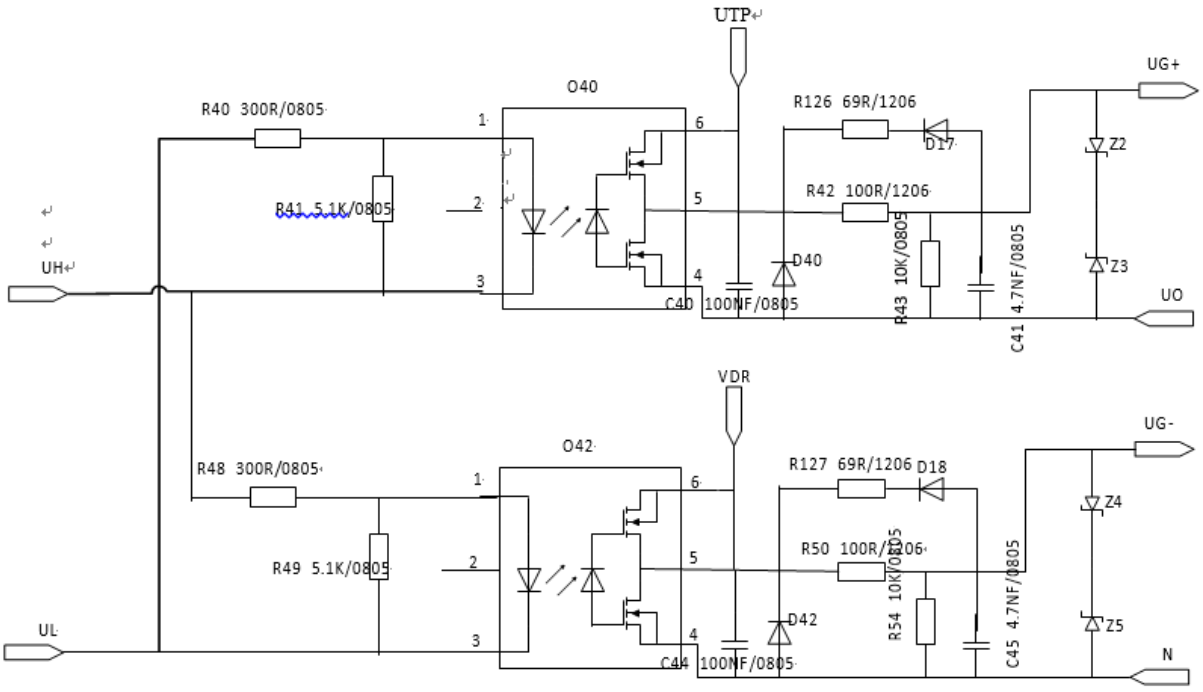
GBRK is the braking signal in the diagram. Connect a braking resistor between terminals P and PB, refer to the instruction manual for specifications.

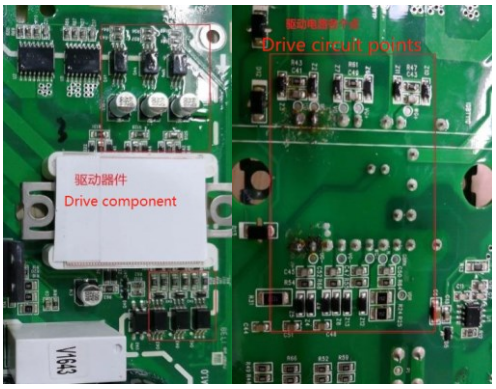
No.	Description
①	DC-side fuse (optional)
②	Liquid-cooled converter module
③	Motor

Table 2-7 Main circuit description

Chapter 2 Testing and Repairing of Power Supply Boards

2.1 Driver Circuit





1. Circuit components driver circuit

According to the received DSP drive signal to control the switch of IGBT, optocoupler primary drive signal sampling interlocking form. ACPL-W314 drive optocoupler minimum output current is 0.4A, the maximum output current is 0.6A, to meet the IGBT drive

capability. Due to the bootstrap topology does not have a negative voltage, the need to shorten the shutdown time to ensure that the dead zone, drive to increase a shutdown loop, shutdown

After the diode is on, the driver resistor is connected in parallel.

Diodes such as D40 are used to reverse clamp the output of the optocoupler, preventing the optocoupler pin 5 to pin 4 ground from generating too large a negative voltage when the IGBT is turned on, resulting in optocoupler output abnormalities.

The value of the gate capacitance is related to the small voltage spike caused by the continuity of current to the tube after the IGBT is turned off, and a too small value of this voltage spike may lead to false turn-on.

2. Fault type

No output, output out of phase, module damage, SC

3. Inspection Method:

Static detection:

W314 On-circuit detection

1	3	4	5	6	Multimeter Diode
+	-				1.22
		+	-		0.23
		+		-	0.64
			+	-	0.76

Detection of IGBT gate resistance (2.2kw machine)

UG+	VG+	WG+	UG-	VG-	WG-	GBRK
U0	V0	W0	N	N	N	N
5.2K	5.2K	5.2K	10K	10K	10K	10K

Problems with the drive resistor may be due to a damaged drive resistor, or a damaged module.

Dynamic detection:

■ Voltage between VDR and N when not running: 16.5±1V (DC)

Note: R151 is a 0Ω resistor on the P-line. Failure of this resistor will result in no power to the bus voltage disconnect and thus no power to the switching power supply.

■ Measurement of relevant drive voltage points during operation:

Red pen		VG+	WG+	UG-	VG-	WG-

Black pen	V0	W0	N	N	N
AC file	8-9V	8-9V	8-9V	8-9V	8-9V
Single measurement	8.03V	8.01V	8.20V	8.20V	8.20V

When the drive voltage is at a positive value, the drive is turned on, and at a negative value, the drive is turned off, so use the AC gear to measure it.

■ Measurement of normal voltage points during operation:

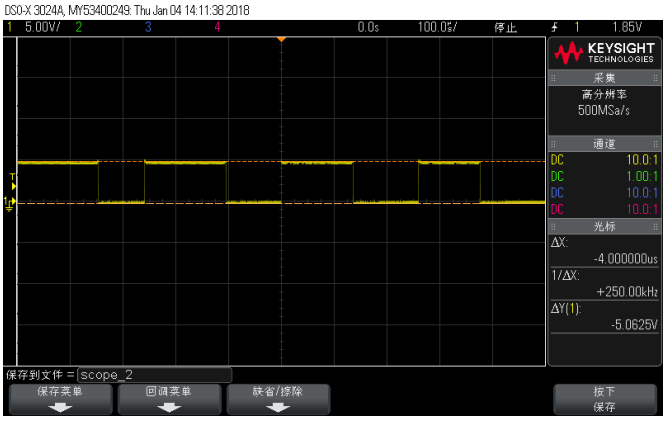
Red pen	UTP	VTP	VTP
Black pen	U0	V0	W0
DC grade	16V	16V	16V

The UTP, VTP, and WTP voltages are generated by the VDR, if there is a problem there, the drive voltage generated by the switching power supply is faulty Problems.

Measure the voltage of the drive signal on the control board when it is not in operation (DC phase).

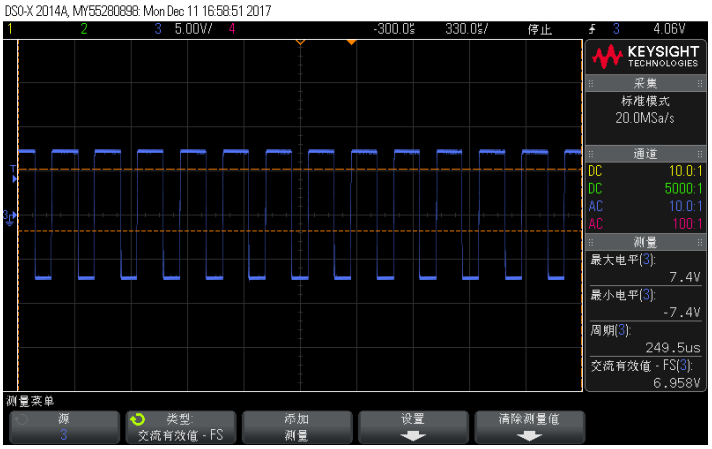
UH	UL	VH	VL	WH	WL	
GND						
5V	5V	5V	5V	5V	5V	

Waveforms of one of the drive signals and GND outputs during operation: as follows (if the output waveforms are abnormal, the control board is abnormal)



Measure the voltage of each drive signal and GND is about 11.5v when running with ACgear.

■ Use two ripple probes (pay attention to isolation) to connect to the upper and lower arm drivers of the same phase (directly soldered to the IGBT pins), power up and run the whole machine, and test the driving waveforms. (If there is no waveform, the module may be damaged, or the UH, UL, VH, VL, WH, WL provided on the control board may be defective.).



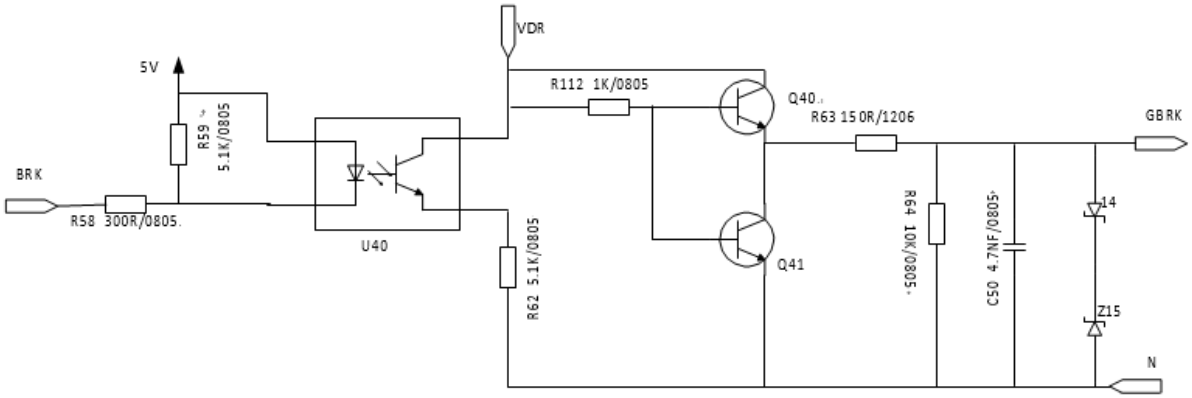
4. Damage-prone devices

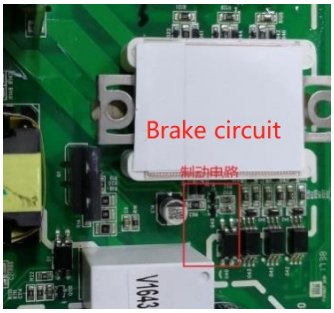
Driver optocoupler, voltage regulator

5. Device bit number and specification

Driver Resistors R126=R127=R128=R129=R130=R131=68R0	Gate Resistor/Capacitor R43/R54/R61/R68/R47/R55=1002/080
Voltage regulator BZT52C16	Driver Optocoupler ACPL-W314-500E
Thyristor MBR0540T1G D40/D42/D44/D45/D41/D43 1N4148WS D17/D18/D19/D20/D21/D22	Other R40/R48/R56/R65/R44/R51=3000/0805 R41/R49/R57/R66/R45/R52=5101/0805 C40/C44/C48/C51/C42/C46=104/0805

2.2 Brake Driver Circuit





1. Circuit composition

Isolation photocoupler, transistor, voltage regulator

2. Fault type:

Overvoltage fault, braking resistor burned out, module damage 3, overhaul mode

Static detection

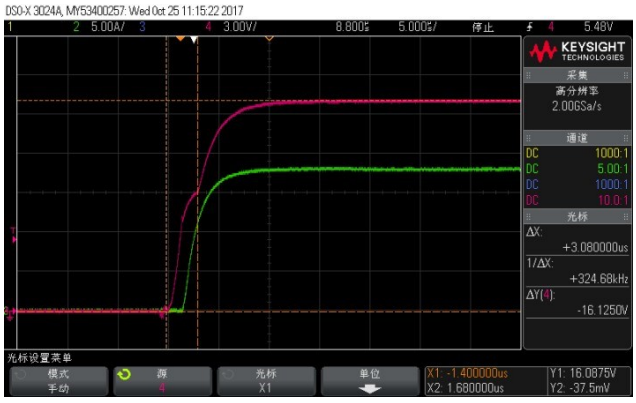
According to the appendix provides a variety of device detection methods for overhaul, but also need to test the braking circuit of the brake diode is good or bad.

Dynamic detection

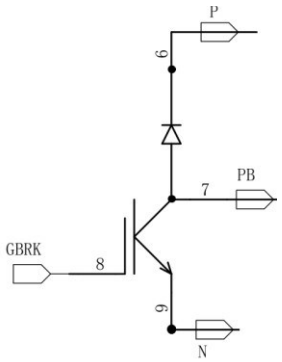
- When the brake is not consumed, the control signal BRK voltage is 5V, and when the brake is turned on, the BRK voltage point is 0.455 (the pulse voltage changes from 5V to 0.455V).

  Before braking, the voltage of GBRK and N point is zero, and when braking is on, the voltage of GBRK and N point is about 16V. Use the oscilloscope to capture the graph as follows: (Note: to turn on the energy consumption braking) Use the ripple probe to connect to the brake tube driver (directly soldered to the IGBT pin), regulate the power supply to the energy consumption braking point (the default is about 680VDC), and observe whether the brake tube is turned on or not. CH2: Braking current CH4: Brake

tube driver



Brake circuit schematic:



The braking resistor is connected between PB and PJ when the voltage between GBRK and N is about 16 V. Refer to the selection manual for the braking resistor.

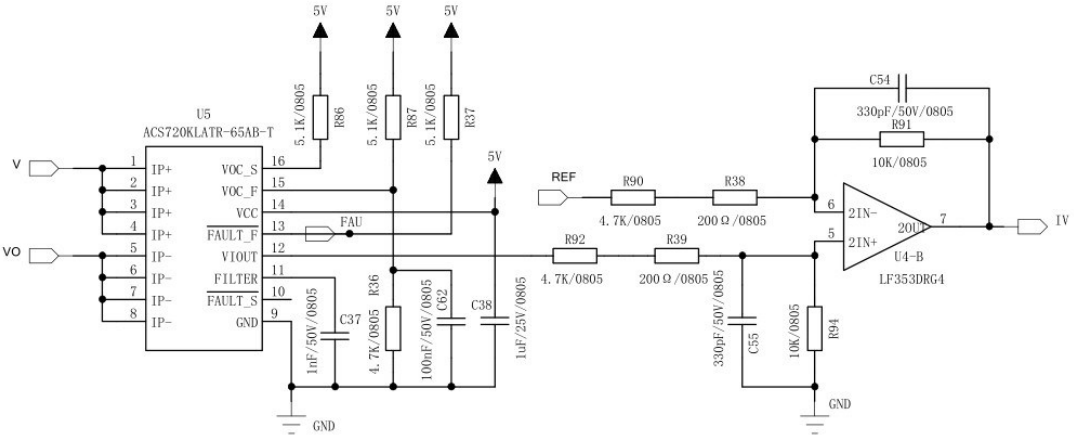
4. Damage-prone devices

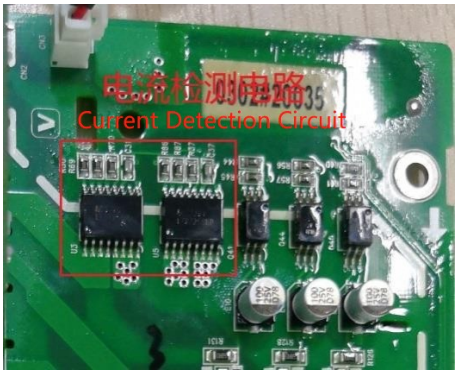
Optocouplers, transistors

5. Device bit number and specification

Transistors Q40=MMBT4401LT1(NPN) Q41=MMBT4403LT1(PNP)	Gate Resistor/Capacitor R64=1002/0805 C50=472/0805
Voltage regulator Z14/Z15= BZT52C16	Driver Optocoupler U40=EL2501S(K)
R58=3000/0805 R59/R62=5101/0805	R112=1001/0805 R63=1500/1206

2.3 Current Detection Circuit

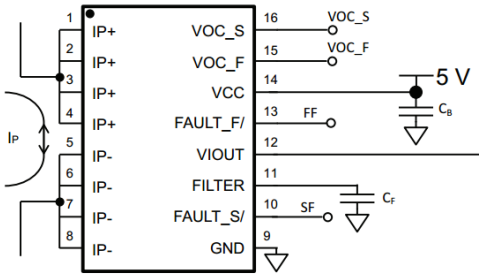




1. Circuit composition

ACS720 current chip is used for sampling, the chip outputs 1.5V bias voltage with zero current and provides a 1.5V REF. The sampling signal is calculated by the operational amplifier and sent to the control board.

In addition, the internal circuit of the chip detects a delay of 4us, which is a large delay for the overcurrent protection function, so the internal overcurrent protection function is introduced.



The ACS720 has a user-configurable double-fault function, with fast and slow fault outputs for short-circuit and overcurrent fault detection. Using the fast protection pins VOC_F and FAULT_F/, the device sends out a low FAULT signal within 1.5us when the

current reaches the set overcurrent point, which is connected to the FAU pin to protect the system from SC; and using the slow protection pins VOC_S and FAULT_S/, the corresponding OC signal is pulled low, causing the COLSE signal to go high and blocking the outputs. When the current reaches the set overcurrent point, the chip sends out a low-level signal of FAULT within 1.5us, and connects this signal to the FAU pin to protect the system from SC.

2. Fault type

E.HAL, E.OL2, E. OC, E.OLF

3. Detection method

Static detection

(Note that the current detection chip ACS720 is on at pins 1 to 8 during measurement because the detection chip is differential current detection, which can well suppress external magnetic field interference). (Note that pins 1 to 8 of the current detection chip ACS720 are energized during measurement because the detection chip is a differential current detection chip, which can well suppress the interference of external magnetic field)

Dynamic detection:

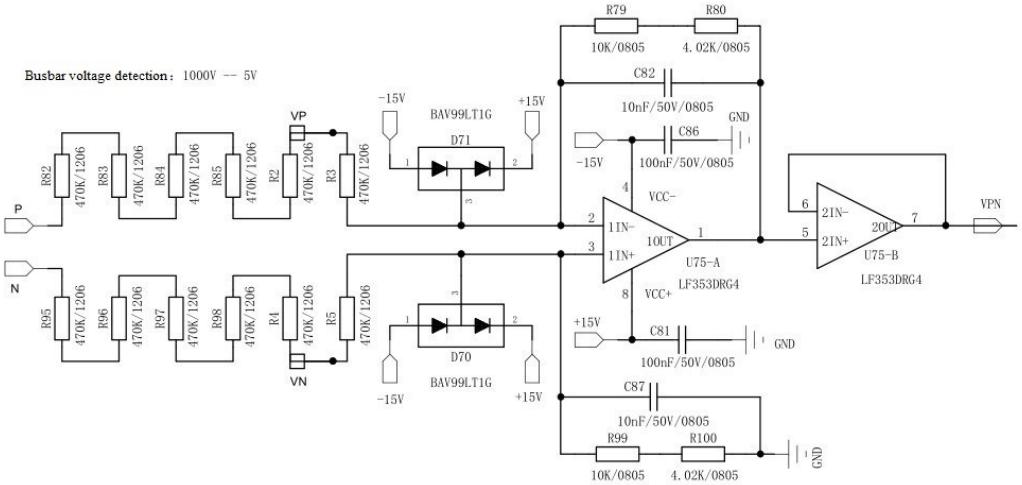
When powering up, look at pin 14 of the current detecting chip to see if there is 5V voltage, pin 12 and REF pin correspond to 1.5V, which corresponds to 5V at pins 13, 15, and 16 when normal, if the output voltage of pin 12 is abnormal when other voltages are normal, then the current detecting chip is abnormal.

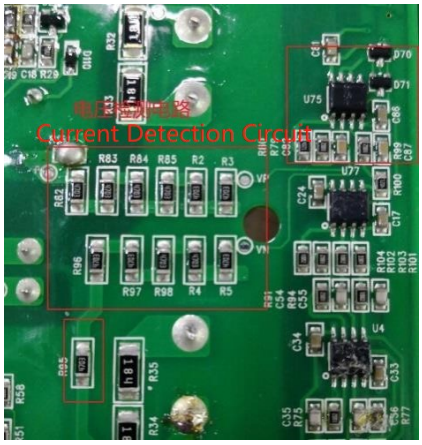
4. Damage-prone devices ICs, op amps

5. Device bit number and specification

Capacitors C31/C37=1nf/0805 C14/C62/C33/C34=100nf/ 0805 C32/C38=1uf/0805 C35/C36/C55/C54=330pf/	Resistive R30/R69/R70/R86/R87/R37=5101 /0805 R7/R36/R74/R76/R90/R92=4701/ 0805
Sampling chip U3/U5=ACS720KLATR-65AB-T	Op amp U4=LF353DRG4

2.4 Busbar Voltage Detection Circuit





1. Circuit composition

The bus voltage sampling circuit is a high-resistance isolation circuit that utilizes multiple resistors in series for isolation and then differential amplification by operational amplifiers.

2. Fault type

Inaccurate bus voltage display, overvoltage, undervoltage

3. Inspection methods

Static detection

If the VPN voltage value is incorrect during the test (dynamic detection has a measurement method), please test the following parts

(i) Op-amp U75=LF353DRG4; (ii) Test the voltage divider resistor; (iii) Diodes D70 and D71 to replace the damaged devices, and then test the

VPN voltage point to ensure that the detection value is correct.

Dynamic detection

1. Use the DC adjustable voltage regulator to connect to the P-N terminal of the machine under test, and hang the multimeter pen on the P-N, and set the multimeter to DC voltage (DC); note that the software voltage correction factor is 100% before testing. Compare the value displayed by multimeter and keyboard

2. Measure the voltage at this point of the VPN: (get the VPN voltage from the voltage scaling relationship)

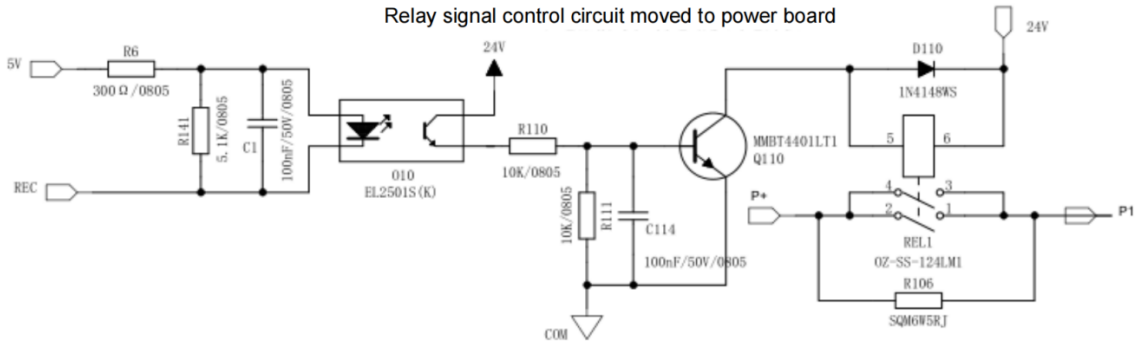
S2 model	T3 model
579V homologous 5V	**1000V homologous 5V**

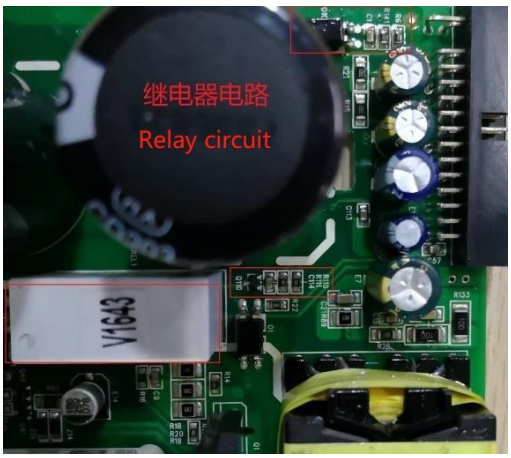
4. Vulnerable components op amps

5. Device bit number and specification

Resistive R82/R83/R84/R85/R2/R3=470K/1206 R4/R5/R95/R96/R97/R98=470K/1206	Double diode D70/D71=BAV99LT1G
Op amp U75=LF353DRG4	R79/R99=10K/0805 R80/R100=4.02K/0805 C82/C87=10Nf/0805 C86/C81=100NF/0805

2.5 Relay Control Circuit





1. Circuit composition

Controls the 24V power switch according to the received DSP drive signal to control the relay to close and disconnect

2. Failure type

Operation undervoltage, soft start resistor burned out, no vibration

3. Inspection Methods

Static test Overhaul according to the various device detection methods provided in the appendix Dynamic test

After static testing, rule out device abnormalities.

When the DC adjustable voltage source is used to energize the bus voltage, the signal source from the CPU changes from high level (5V) to low level (RCE level changes from high to low and the main relay opens), and when the voltage is under-voltage, the signal source from the CPU changes from low to high (5V) (RCE level changes from high to low and the main relay opens), and the signal source from the CPU changes from low to high (5V) (RCE level changes from high to low and the main relay opens).

(RCE level changes from high to low, the main relay is disconnected), when undervoltage, the signal source from CPU changes from low level to high level (5V).

After normal power-on, check whether the primary side of the optocoupler is about 0.5V, and whether the secondary side and COM voltage is 24V, if both are normal, then consider whether the relay is damaged.

Measure the resistance value, if there is resistance value and the same as the silkscreen value, the resistance is normal, if different and infinity, it means burned out, replace it.

Put the relay into DC24V, when it is good, the coil will absorb, and the multimeter will measure that the coil is on. Relay is good. Measurement does not conduct, the relay is damaged

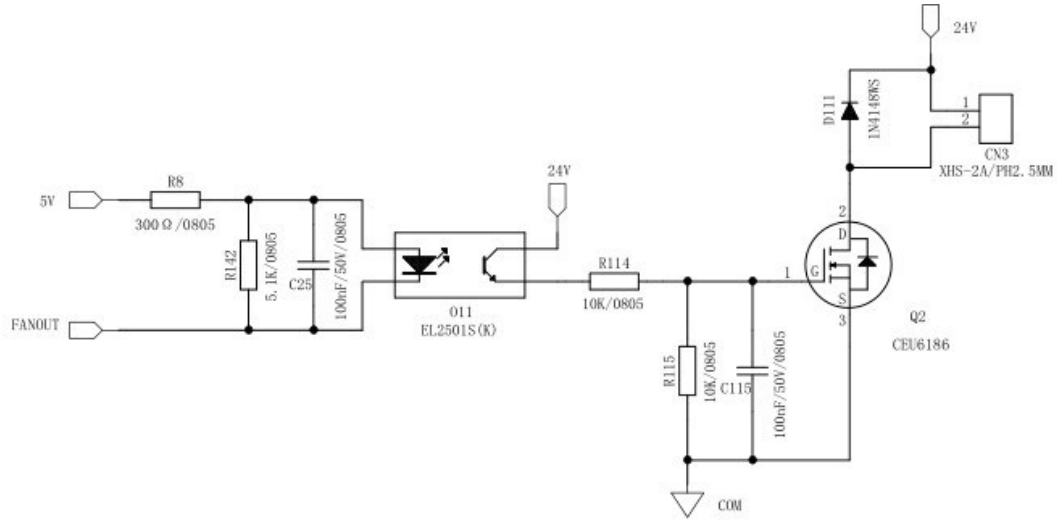
4. Damage-prone devices

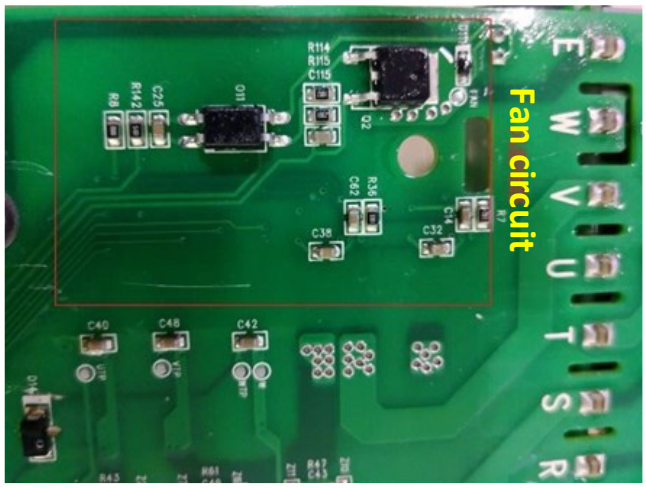
Optocouplers, transistors

5. Device bit number and specification

Resistance R6=300Ω/0805 R141=5.1K/0805 R110/R11=10K/0805	Capacitance C1/c114=100nf/0805 Triode Q110=MMBT4401LF1
Optocoupler O10=EL2501S(K)	Relay SQM:6W150RJ

2.6 Fan Control Circuit





1. Circuit configuration:

According to the received DSP drive signal, through the optocoupler output, drive MOS tube control fan 24V power output.

Compared with the previous fan drive, if the fan of AC310 AC drive is short-circuited, the software will reboot itself twice, combined with the fail-safe function F10.14, it will report the fault E.040, and other switching power supply voltages will not be affected.

2. Types of faults

Over-temperature failure, keyboard no display, power hiccups, fan uncontrolled

3. Method of overhaul

Static detection

The CPU outputs the FANOUT signal at a high level (5V) after normal power-on, and the FANOUT signal is low (0.5V or less) when the fan is running.

- Check the fan for damage and replace the damaged fan.

- Detect the relay according to the various device detection methods provided in the appendix for overhaul.

Note: The fan circuit is driven by a MOS tube (Q2), so it is necessary to focus on detecting the static value of the MOS tube (Q2).

Dynamic Detection

- After normal power-up, change the fan operation mode to fan running after power-up, check the fan power socket voltage, 0V before running, 24V after running, if the fan is connected at this time, the power supply hiccups are judged to be a short-circuited fan, the voltage of FAUOUT when the fan is running is a low level of 0.455V or so, and the voltage of FAUOUT is 5V when the fan is not running. 5V when FAUOUT is not running.

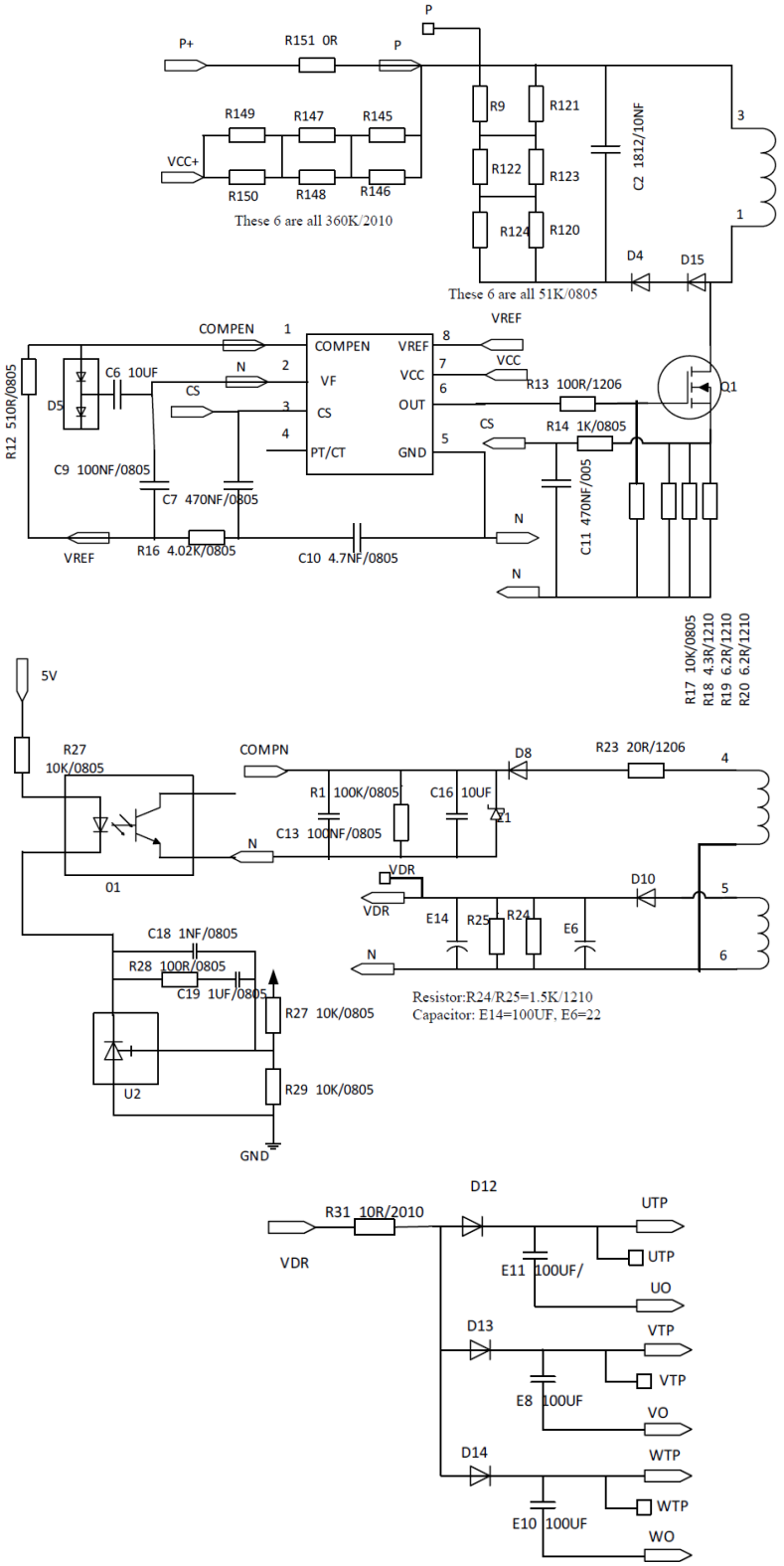
4. Easy to damage the device

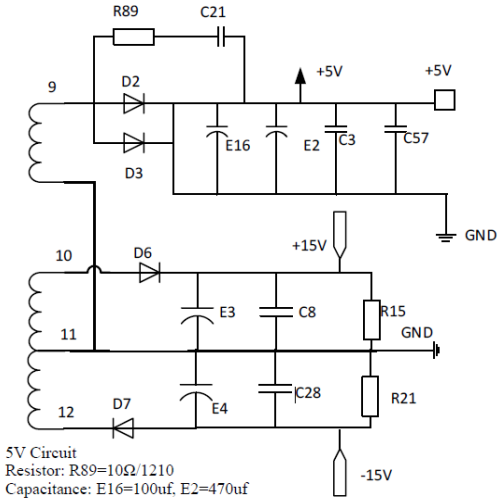
Optocoupler, MOS tube

5. Device bit number and specifications

Resistance R8=300Ω/0805 R142=5.1k/0805 R114/R115=10K/0805	Capacitance C25/C115=100nf/0805 MOS tube Q2=CEU6186
Optocoupler O11=EL2501S(K)	Diode D110=1N4148WS

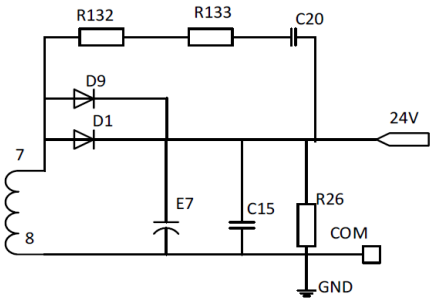
2.7 Switching Power Supply



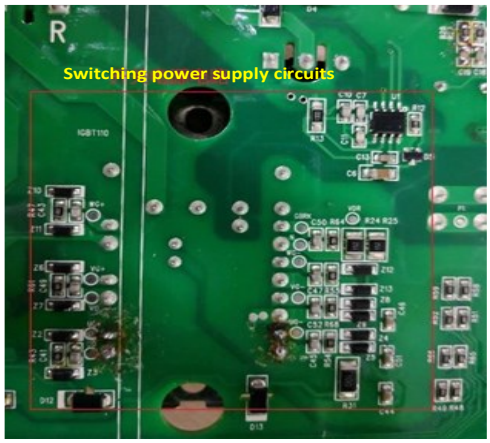


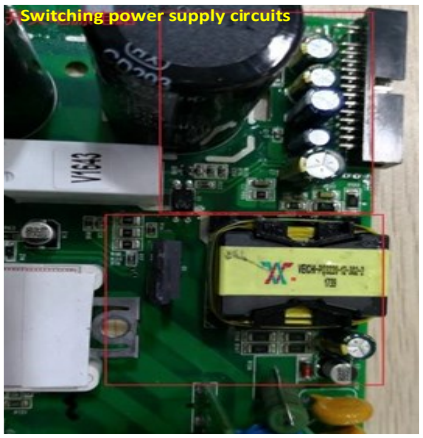
5V Circuit
Resistor: R89=10Ω/1210
Capacitance: E16=100uf, E2=470uf
C3=100NF/0805、C57=1UF/0805
C21=1NF/0805 Diode：D2/D3=US1J

15V Circuit
Resistor: R15=2K/0805
Capacitor: E3=220UF, C8=100NF/0805
Diode: D6=USIM
-15V Circuit
Resistor: R21=2K/0805
Capacitance: E4=220UF, C12=100NF/0805
Diode: D7=USIM



Resistor: R132/R133=10Ω/2010, R26=3K/1206
Capacitors: E7 = 330UF, C20 = 470PF / 1206, C15 = 100NF / 080
Diode: D9/D11=USIM





1. Circuit descriptions

Item	Design specifications					Unit
Rated output voltage of winding	5	15	-15	VDR/16.5	24	V
Output voltage range	5.05~4.95	14.25~15.75	-14.25~-15.75	15.7~17.3	22.8~25.2	V
Load current	650	150	100	120	450	mA

2. Fault type

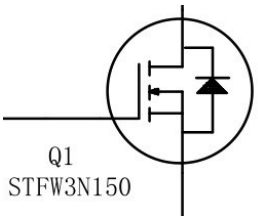
Driver output abnormality, fan abnormality, relay non-suction, no display on power, etc.

(Note: R151 on the P line is a 0Ω resistor, if the resistor fails, it will lead to bus voltage disconnection without power, which will lead to the switching power supply has no power, resulting in no display, so, in the absence of display, to detect whether the 0Ω resistor is normal)

3. Method of overhaul

Static detection

1. Detect the starting resistor, voltage divider resistor, shunt resistor resistance value, whether the phenomenon of resistance damage, replace the damaged resistor; Second, measure the switching tube (Q1 = STFW3N150), usually switching power supply does not work, a large part of the reason is because of the switching tube is broken, resulting in damage to the chip UC3844, therefore, if the switching tube is damaged, replace the Mos tube



MOS tube static measurement

G	D	S	Diode range
	-	+	0.494
-		+	0.661
	+		-
+			-

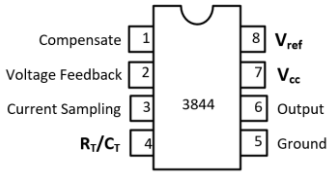
2. Each output diode

Dynamic detection

Measure both ends of the capacitor through the voltage range of a multimeter

- Check the power output of each circuit
- Check drive power output
- Corresponding voltage on the corresponding diode at the switching power supply.

D9, D11	D6	D7	D2, D3	D10
24V	15V	-15V	5V	16.5V



- Measure the voltage regulator Z1 voltage at the switching power supply, should be about 12V (12V under no load, 14V or so under loaded conditions), the 12V is for the UC3844 pin 7 to provide the operating voltage (3844 in the foot of the under-voltage lockout function of 10V), if it is not a stable 12V, then it shows that the switching power supply UC3844 front-end failure, to find the VCC power supply circuit; UC2844 corresponding to the corresponding 8-pin voltage of 5V, the voltage is for the 3844 pin 4 to provide oscillating voltage, the absence of the voltage will also lead to switching power supply problems; with an oscilloscope to measure the 6-pin and 5-pin, 6-pin there will be a current pulse, the test does not have the current pulse, basically the 3844 problem, and if all of the above tests are normal, then the 3844 problem. If all the above tests are normal, then the 3844 itself and the previous circuit are basically no problem, you only need to test the corresponding vice-side voltage circuit and the corresponding voltage feedback circuit.
- In the past, there will be a switching power supply short-circuit hiccups phenomenon, that is, to measure the transformer voltage on the secondary side of the transformer will be a moment, a moment without the phenomenon of the need to test the corresponding D4, D15 diode whether the diode is broken, the diode is broken, is caused by the switching power supply failure rate of the device is very high; in the case of D8 diode, to see if it is damaged,

the diode is the VCC auxiliary power supply circuit diode. This diode is the diode on the circuit of the VCC auxiliary power supply.

- In the past, the switching power supply at the majority of problems, UC3844, MOS tubes, voltage regulators, diode

4. Easy to damage the device

UC3844, voltage regulator, MOS tube

5. Device bit number and specifications

IC U1=UC3844 MOS Tube Q1=STFW3N150	Transformer T1=VEICHI-PQ322Q
5V Circuit Resistor: R89=10Ω/1210 Capacitor: E16=100uf, E2=470uf C3=100NF/0805, C57=1UF/0805 C21=1NF/0805 Diode: D2/D3=US1J	15V Circuit Resistor: R15=2K/0805 Capacitor: E3=220UF, C8=100NF/0805 Diode: D6=USIM -15V Circuit Resistor: R21=2K/0805 Capacitance: E4=220UF, C12=100NF/0805 Diode: D7=USIM
24V Circuit Resistor: R132/R133=10Ω/2010, R26=3K/1206 Capacitor: E7=330UF, C20=470PF/1206, C15=100NF/0805 Diode: D9/D11=USIM	VDR Circuit Resistor: R24/R25=1.5K/1210 Capacitor: E14=100UF, E6=220UF Diode: D10=USIM
VCC circuit (circuit with UC2844 compensation terminal inside) Resistor: R1=100K/0805, R23=20Ω/1206 Capacitor: C13=100NF/0805, C16=10UF, E5=100UF Voltage regulator: Z1=ZM4746A Compensation terminal circuit Resistor: R27=R29=10K/0805, R28=100Ω, R22=300OΩ Capacitor: C18 = 1NF/0805, C19 =	Transformer primary side Resistor: R145/ R146/ R147/ R148/ R149/ R150/ =360K/2010 R9/R121/R122/R123/R124/R120=51K/0805 R19/R20=6.2Ω/1210, R17=10K/0805 R14=1K/0805, R13=100Ω/1206 R16=4.02K/0805, R12=510Ω/0805 Capacitor: C2=10NF, C7/C11=470PF, C10=4.7NF/08058, C9=100NF

1UF/0805 Optocoupler: O1=EL250IS Controllable precision voltage regulator: U2 = TL431AIDBZR	Diode: D4/D15=US1M D5=BAV99LFIG

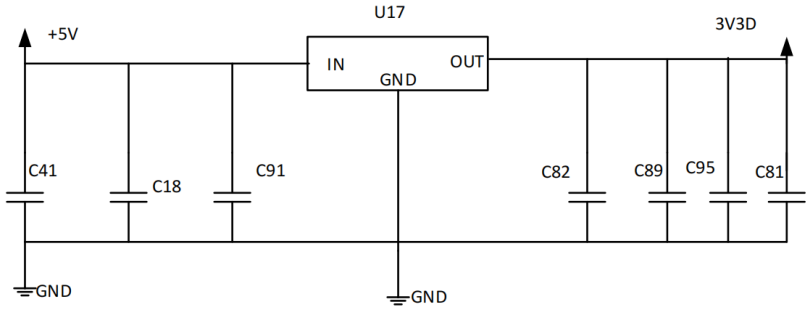
Chapter 3 AC300CON-A1.0 Control Board Introduction and Brief Detection and Maintenance

3.1 Summary of IC Related Information

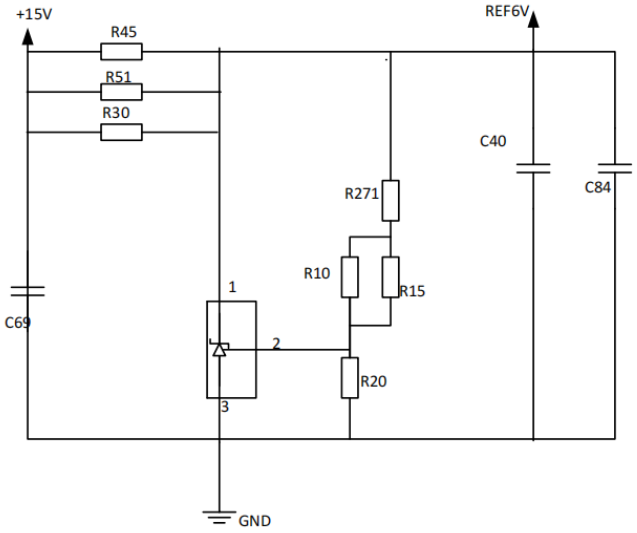
Bit number	Name	Control Information	Specification
O9, O1, O3, 02, O4	General Optocoupler	Multi-function terminals X1-X5 in sequence	EL3H4
O7	General Optocoupler	Relay switch signal	EL3H7(B)(TA)-G
O6	General Optocoupler	Y terminal signal	EL3H7(B)(TA)-G
U20	Op-Amps	Analog AI1, AI2 inputs	LF353DRG4
U12	Op-Amp	Analog AO output	TL084IDR
U4	Op-Amp	Current sampling (IU, IV, IW)	TL084IDR
U4	Op-Amp	VPN Op amp	TL084IDR
U9	Comparator	IU Overcurrent/wave-by-wave current limit comparator	LM239DR
U8	Comparator	IV Overcurrent/wave-by-wave limit comparator	LM239DR
U7	Comparator	IW Overcurrent/wave-by-wave current limit comparator	LM239DR
U10	Octal Driver	Drive Signal: UH/UL/VH/VL/WH/WL	SN74ACT244PWR
U1	485 Communication	485 Communication Chip	SP485EEN-L
U16	485 Communication	External 485 keyboard communication	SP485EEN-L
U6	Memory	Memory IC	AT24C32D-SSHM-T
U3	Programmable IC	CPU	SN74LV74ADR
U11	Logic Chip	System Failure Hardware Blocking Point IC	SN74LV74ADR
U15	Reset Chip	Reset Chip	SP809EK

U5	Octal Driver	Y, Relay, Fan, Contactor, Brake Outputs	SN74ACT244PWR
U2	Logic Chips	Keypad Logic Chip	74HC595D
U13	CPU	Keypad CPU	XMC1100-T016F0032

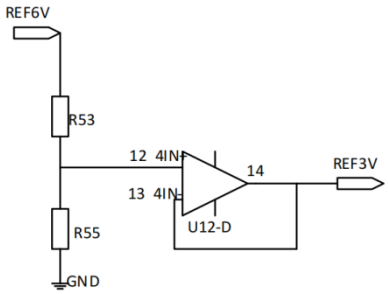
3.2 Access to Voltage Points on the Control Board



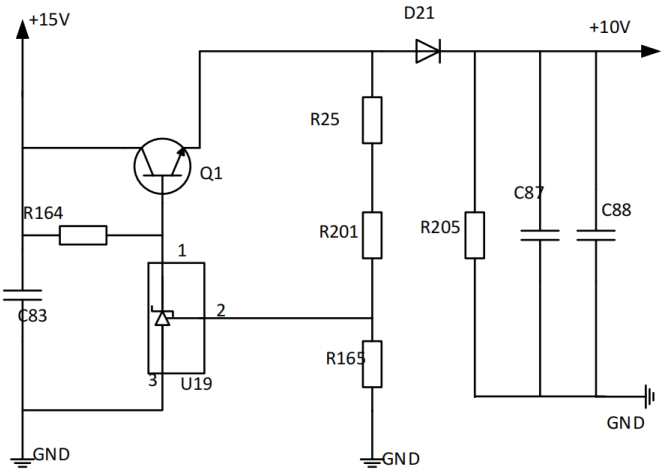
C41/C18/82/89/C95=2.2UF /0402
U17=AMS1117-3.3



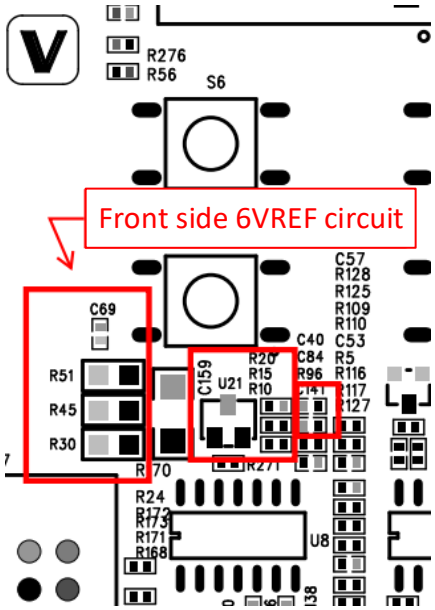
Resistor:
R45/R51/R30=1K/0805，
R20=10K/0402, R271=14.04K
Controlled precision voltage regulator:
U21=TL431AIDBZR
Capacitors:
C69/C84=100NF/0402
C40=2.2UF/0402

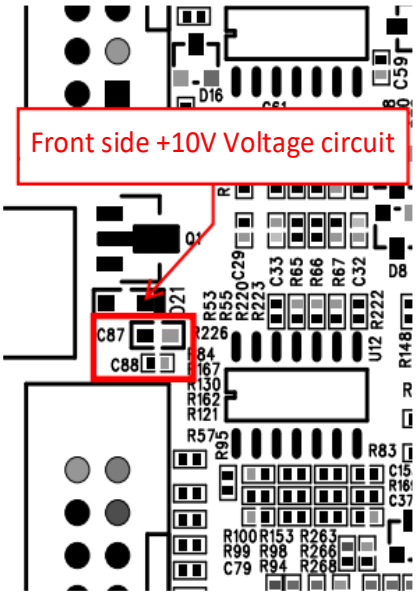


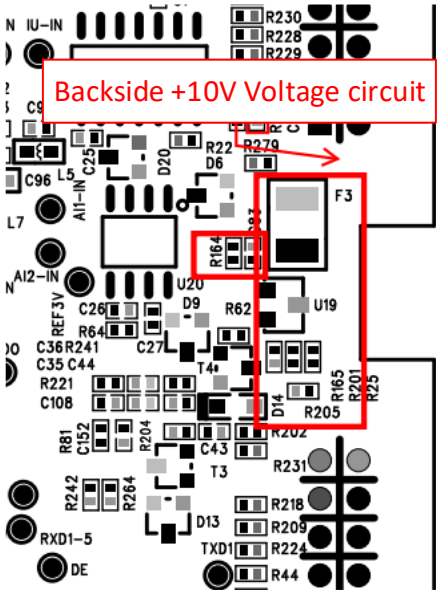
U12=TL084IDR Resistor: R55/R53=1K/0402

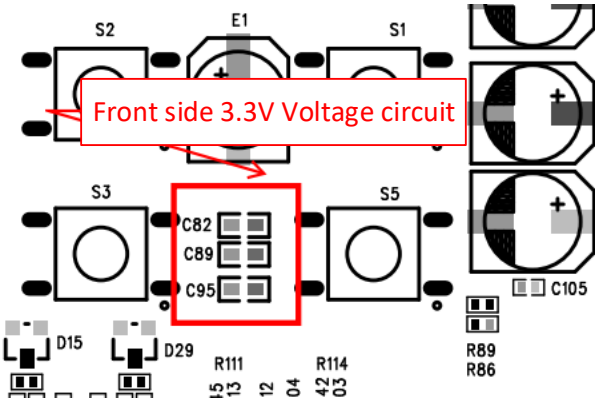


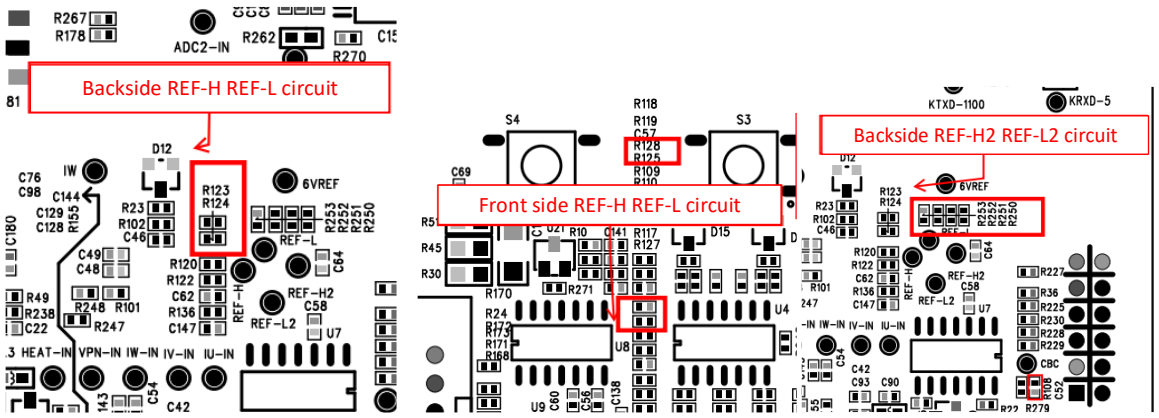
Capacitors:
C83/C88=100NF/0402,
C87=2.2UF/0603
Resistors:
R25/R205=20K/0402，
R164=2K/0402,
R201=12K/0402,
R165=10K/0402
Triode：Q1=2S C2873



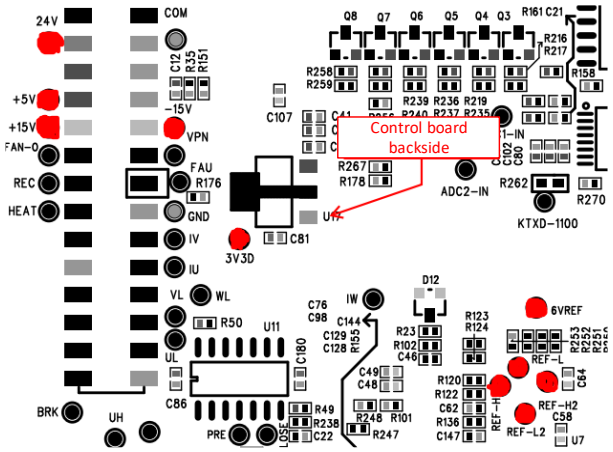








- Output detection at each voltage point: Measure the voltage value of each circuit with a multimeter at DC level.



Red Pen	24V	15	-15	10	3V3D	REF6V
Black Pen	COM	GND				
Range	±1.2V	±0.75	±0.75	±0.2V	±0.06V	±0.12V
Red Pen	REF-H	REF-L	REF-H2	REF-L2	REF3V	
Black Pen	GND					
Voltage	4.755V	1.245V	4.304	1.696V	3V	
	4.665 ～ 4.862	1.207 ～ 1.257	4.204 ～ 4.376	1.667 ～ 1.735	±0.05V	

- The ±15V and 24V on the control board are taken directly from the power board, 3V3D and 10V are converted from 5V and 15V respectively.
- 3.3V voltage is for MCU power supply, if the voltage is high, it will lead to CPU damage; if it is low, it will make the CPU not work, and +10V, 24V voltage is convenient for customers to use, it is easy for some terminals to set the signals. pins 13, 25, 38, 46, 61, 68, 79, and 93 on the CPU are all 3.3V voltage.

- There are reference voltages on the control board: REF6V, REF3V. REF6V is converted from 15V, REF6V provides voltage references for OC and CBC, i.e., REF-H, REF-L, REF-H2, REF-L2, and REF3V is converted from REF6V (i.e., this voltage). REF3V is converted from REF6V (i.e., if there is a problem with this output voltage, the OC fault will be misreported or not reported, and no progressive current limiting will be performed); REF3V is the reference power supply for the ADC module of the DSP.

3V3D Circuit components	10V Circuit components
Capacitors: C41/C18/82/89/C95=2.2UF/0402 U17=AMS1117-3.3	Capacitors: C83/C88=100NF/0402 C87=2.2UF/0603 Resistors: R25/R205=20K/0402， R164=2K/0402 R201=12K/0402, R165=10K/0402 Triode: Q1=2SC2873
	Controllable precision voltage regulator: U19=TL431AIDBZR

REF6V Circuit components	REF3V Circuit components
Resistors: R45/R51/R30=1K/0805, R20=10K/0402 R271=14.04K Controllable precision voltage regulator: U21=TL431AIDBZR Capacitors: C69/C84=100NF/0402 C40=2.2UF/0402	U12=TL084IDR Resistor: R55/R53=1K/0402

3.3 Detection and Maintenance Optocoupler Unit Circuits

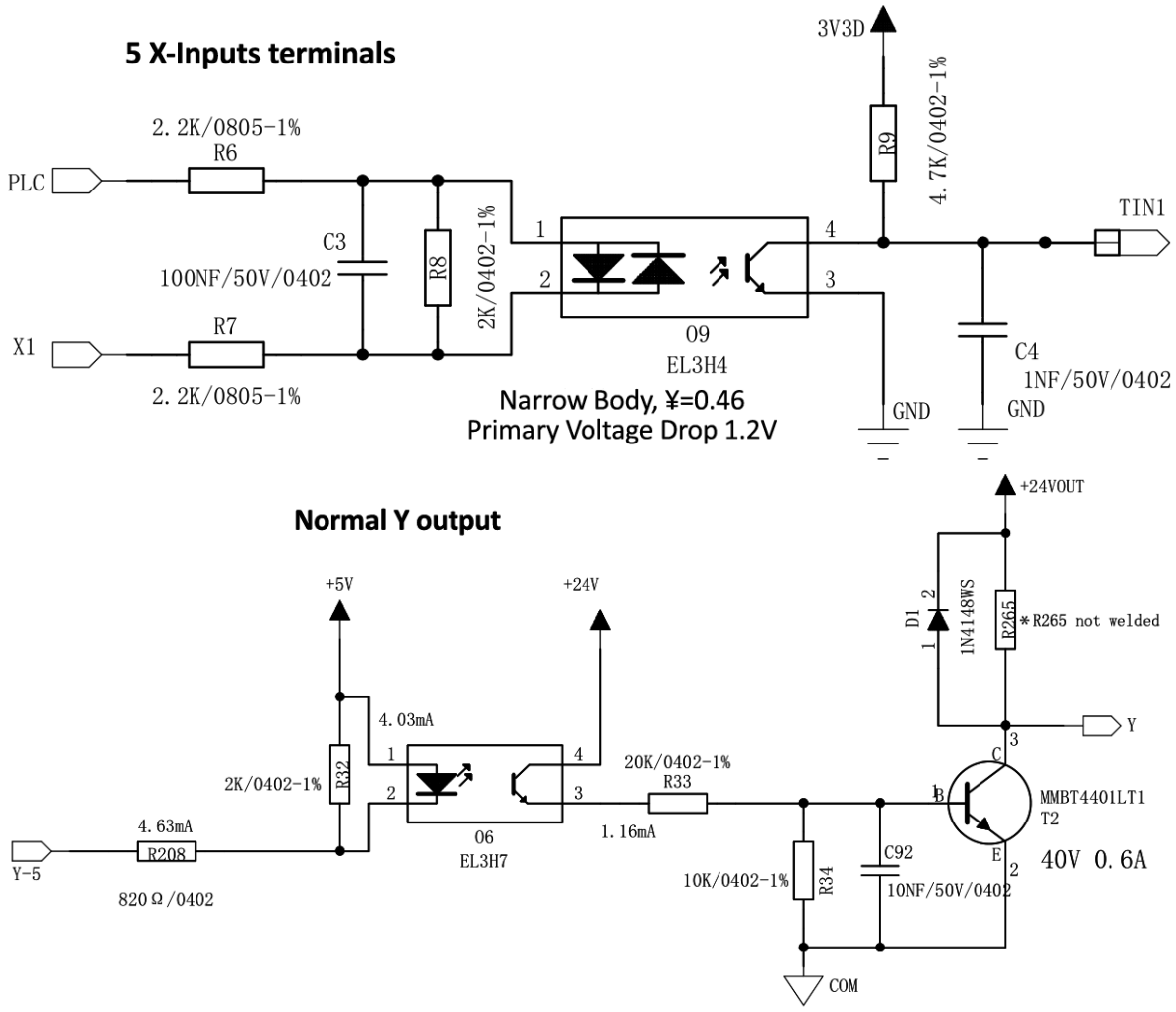
1. Circuit descriptions

- Function: External multi-function terminal inputs and outputs are optically isolated from the internal signals of the control board.
- Ordinary Optocoupler: EL3H7 (relay, Y output); EL3H4 (5-way X input), PUL input and ordinary input X5 multiplexed.

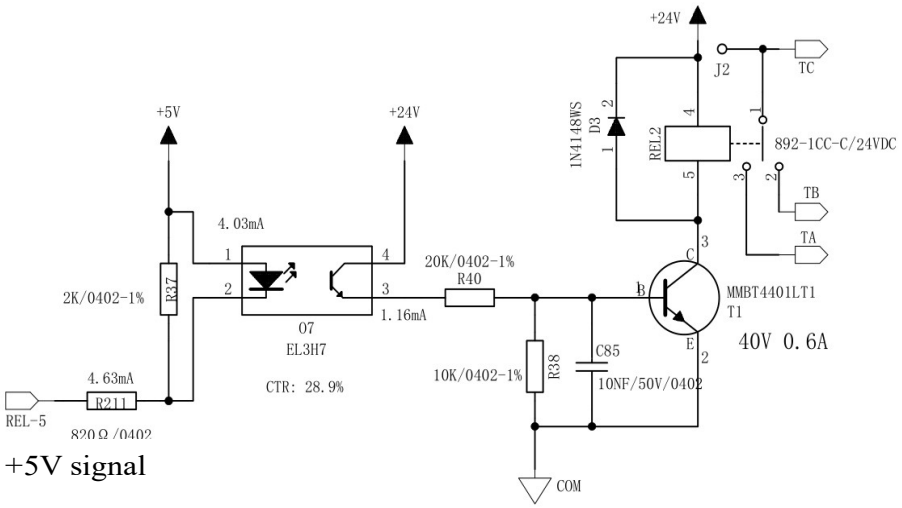
Note 1: At this time, the maximum support for 5KHZ output, external PG card PUL input support for a maximum of 50KHZ)

Note 2: When PLC connects to 24V, X input is active low; when PLC connects to COM, X input is active high.

The following are the multi-function terminal input, Y terminal output, and relay output circuits.



Relay output circuit



2. Type of fault

Terminal input and output signals are not normal, signal command action is abnormal

3. Inspection Methods See Optocoupler and Triode Inspection Methods, and Inspection Resistors for inspection methods.

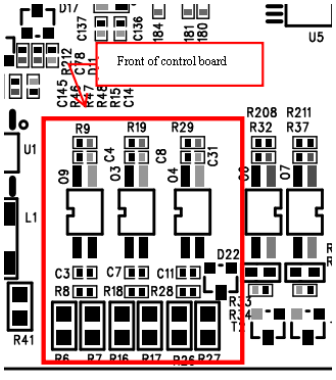
4. Device Bit Number and Specification

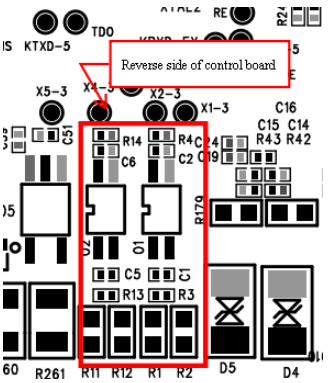
3.3.1 X Input Circuit Detection and Maintenance

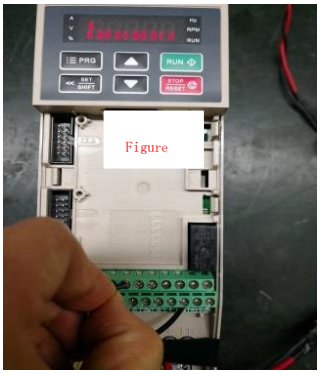
Short the +24V to the PLC, use the wire to short the COM and X1 terminals, check the C-14 (as in Fig. 1). There is a corresponding signal on the display.

X2, X3, X4, X5, terminals are tested in the same way as X1.

Detect X1-X5 function abnormality, display problem, detect the corresponding signal transmission optocoupler, and replace the faulty optocoupler.





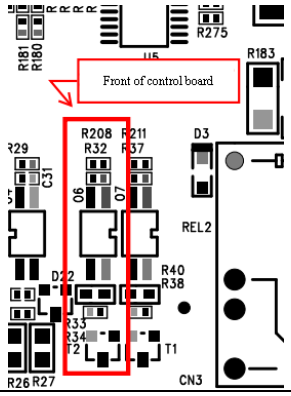


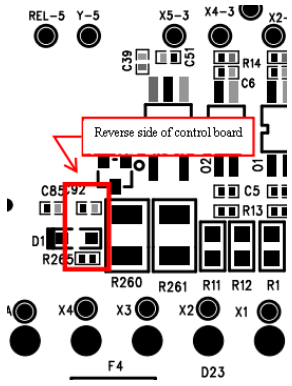
Resistances R6/R7/R16/R17/R26/R27/R11/R12/R1/R2=2.2k/0805 R8/R18/R28/R13/R3=2K/0402 R9/R19/R29/R14/R4=12K/0402	Optocoupler O9、O1、O3、O2、O4=EL3H4 Capacitors C3/C7/C11/C5/C1=100nf/0402

3.3.2 Y Output Detection and Maintenance

1. After power on, use multimeter DC voltage to measure the voltage of Y port to COM, the voltage is below 1V is qualified; after running, the voltage of Y port to COM is below 24±0.75V is qualified.

2. If the detected voltage value is abnormal, the Y terminal function is abnormal, check O6 and T2, replace the damaged components.



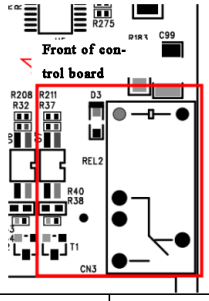


Resistances R208=820Ω/0402 R32=2K/0402 R33=20K/0402 R34=10K/0402 Capacitors C92=10NF	Optocoupler O6=EL3HL triode (vacuum tube or transistor) T2=MMBT4401LT1 Diodes D1=1N4148WS

3.3.3 Relay Detection and Maintenance

1. TA-TC is normally open, TB-TC is normally closed, in case of failure, TA-TC is normally closed, TB-TC is normally open.

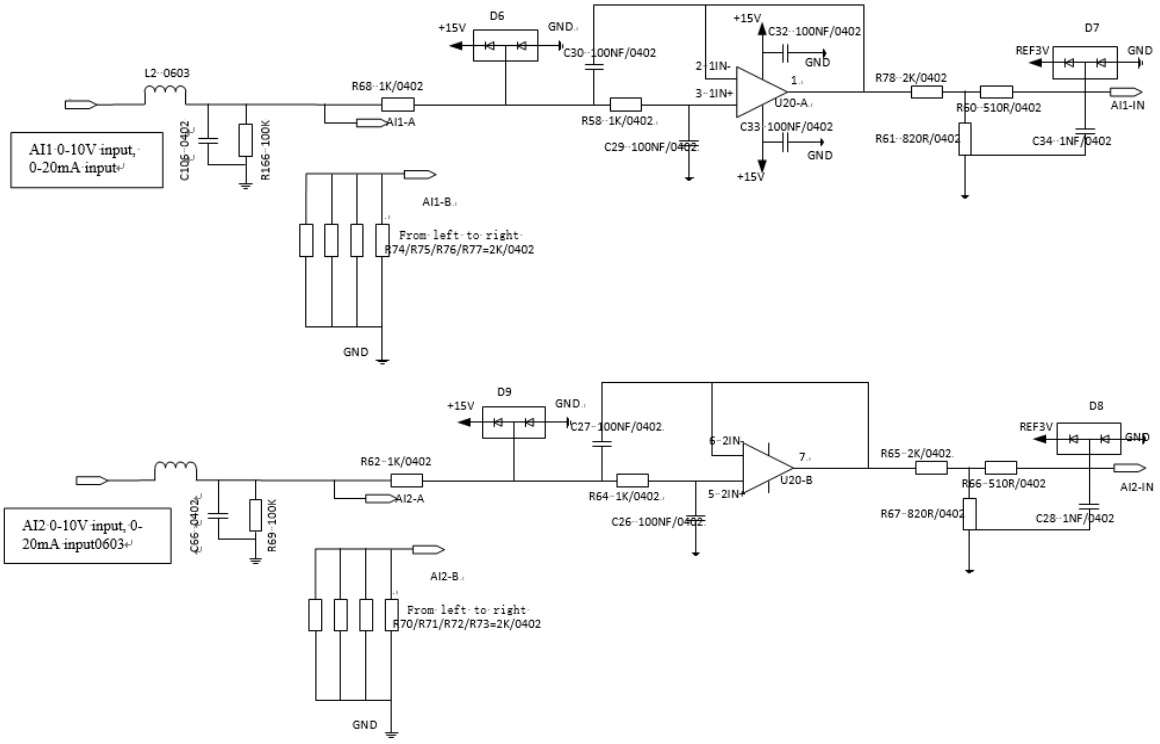
2. TA-TB-TC output is abnormal, relay REL does not work, test O7, T1, REL2 is damaged.

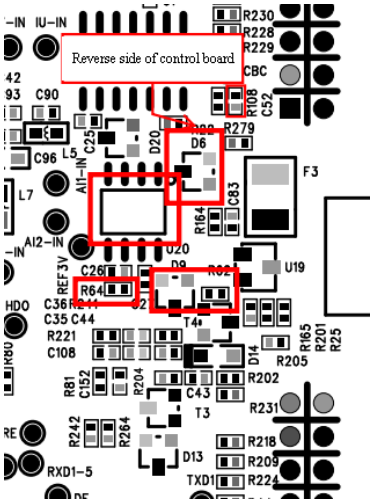


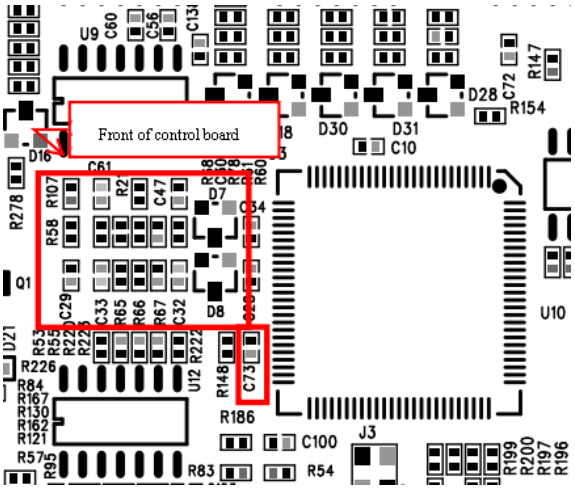
R211=820Ω/0402 R37=2K/0402 R40=20K/0402 R38=10K D3=1N4148WS	C85=10NF O7=EL3H7 T1=MMBT4401LT1 REL2=892-1CC-C/24VDC

3.4 Analogue Signal Detection and Maintenance

3.4.1 Analogue Input Signal Test (AI1, AI2): Voltage 0-10V; Current 0-20mA







- To test the 0-10V input voltage function (with the dip-switch set to the voltage input of AI1 or AI2): use a potentiometer with +10V, AI1 or AI2 and GND connected to each pin of potentiometer 3, rotate the potentiometer and check C00.16 or C00.17.

If the voltage varies within 0-10V, it is normal. As shown in Fig. 1 (without operation) and Fig. 2 (when operating at maximum frequency).

Figure 1

Figure 2

- To test the input voltage 0-20mA function (DIP switch to AI1 or AI2 current input): Use a potentiometer (potentiometer is 500Ω), connect potentiometer 3 pins to +10V, AI1 or AI2, and GND in turn, rotate the potentiometer, and check C00.16 or C00.17, if the voltage varies within 0-10V, then it is normal.

(1) Type of fault

Terminal input signal is not normal, signal command action is abnormal

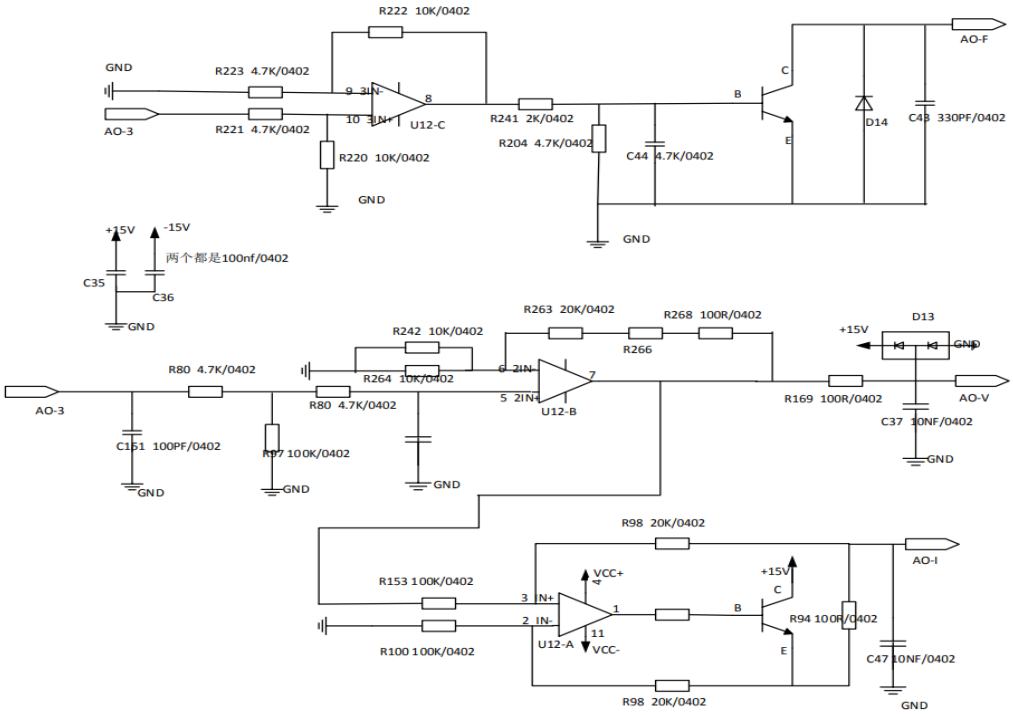
(2) Inspection Methods

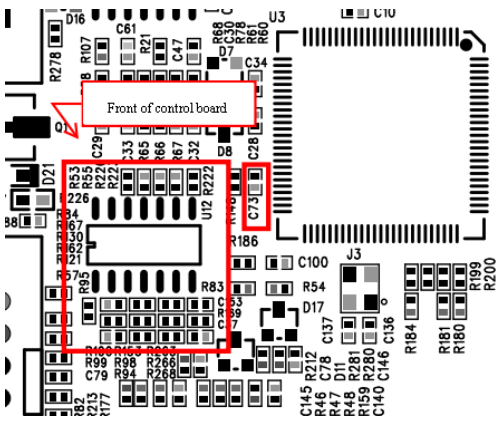
In the circuit to damage the inductor L2, L4, and op-amp U20, resistances gear to test whether the inductor is damaged, damaged resistances will be very large, not damaged resistances have dozens of ohms, according to the static overhaul mode, the first test of the above devices whether there are anomalies, there are abnormalities in the replacement of the device; there is no anomaly and then go to test the other resistances, capacitor parts

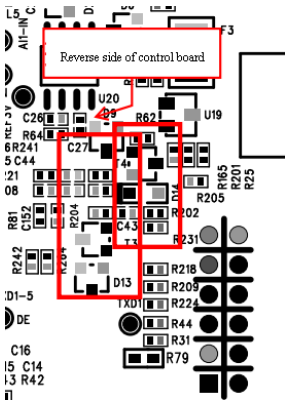
(3) Device bit number and specification

AI1 Op amp: U20-A=LF353DRG4 Inductor: L2=0603/FBMA160808 Resistor: R166=100K/0402, R58/R68=1K/0402, R78=2K/0402, R60=510Ω/0402 R74/ R75/ R76/ R77=2K/0402 SMD Dual Diode: D6/D7=BAV99LT1G Capacitor:C29/C33=100NF/0402, C106=10NF/0402, C34=1NF, C30=220NF/0402
AI2 Op-amp: U20-B=LF353DRG4 Inductor: L4 = 0603/FBMA160808 Resistors: R69=100K/0402, R62/R64=1K/0402, R65=2K/0402, R66=510Ω/0402 R74/ R75/ R76/ R77=2K/0402 SMD Dual Diode: D8/D9=BAV99LT1G Capacitor:C26=100NF/0402, C66=10NF/0402, C28=1NF, C27=220NF/0402

3.4.2 Analogue Output Signal (AO1, AO2): Voltage 0-10V; Current 4-20mA ,0-20mA; Frequency Signal 0-50KHZ







- Test the output voltage: DIP switch to A01 or AO2 voltage ON terminal, at this time parameter setting F03.37=0, F03.38=1, check C00.20 or C00.21, then press the start button, there will be voltage from 0-10V (after parameter setting or use multimeter DC gear, measure +10V).

F03.38=1, check C00.20 or C00.21, then press the start button, there will be a voltage from 0-10V (after the parameters are set up or use a multimeter DC gear, measure the voltage between +10V and GND, the operation will be from 0V to 10V). Figure 3 (Run to maximum

frequency).

- Test the output current: DIP switch to A01 or AO2 current ON terminal, at this time, parameter setting F03.37=1 or 2, F03.38=1, check C00.20 or C00.21, then press the start button, there will be a current from 4-20mA or 0-20mA. (After the parameter setting is done, or connect +10V to GND with 500Ω resistances, measure the voltage at both ends of resistances with DC gear of multimeter, the operation will be from 0V to 10V, then it is qualified; or directly use the current gear of multimeter to measure the current value). (After the parameters are set, or use 500Ω resistances to connect +10V and GND, and measure the voltage at both ends of the resistances with the DC gear of the multimeter, and the operation will be from 0V to 10V, then it is qualified; or use the current gear of the multimeter to measure the current value directly). As shown in Fig. 4 (running to the maximum frequency)
- Test the output frequency: DIP switch to A01 or AO2 frequency ON terminal, at this time the parameter setting F03.37 = 3, F03.38 = 1, check C00.20 or C00.21, then press the start button, there will be a frequency from 0.2Khz-50Khz.
- (After setting the parameters, measure the output frequency with an oscilloscope), as shown in Fig. 5 (running to the maximum frequency).

Figure 3

Figure 4

Figure 5

1. Type of fault

Terminal output signal is not normal, signal command action is abnormal

2. Inspection Methods

In the AO analogue output, it is easy to appear is the damage of op-amp U12, as well as the damage of transistor T3, T4, according to the static maintenance method, the first detection of the above devices whether there is any abnormality, there is anomaly replacement devices; there is no abnormality and then go to test other resistors and capacitors.

3. IC Pin Voltage

Note 1: In the measurement of IC pin voltage, are to GND measurement, it is best to use an oscilloscope to measure (multimeter will be less accurate, using a multimeter in the measurement of voltage, easy to touch other pins), such as the use of a voltmeter to measure, there will be a difference

Note 2: The data measured at this point is the default AO output voltage.

9 pin	1.2V	5 pin	1.6V	3 pin	13.1V
10 pin	1.2V	6 pin	1.6V	2 pin	11.5V
8 pin	3.9V	7 pin	10V	1 pin	15V

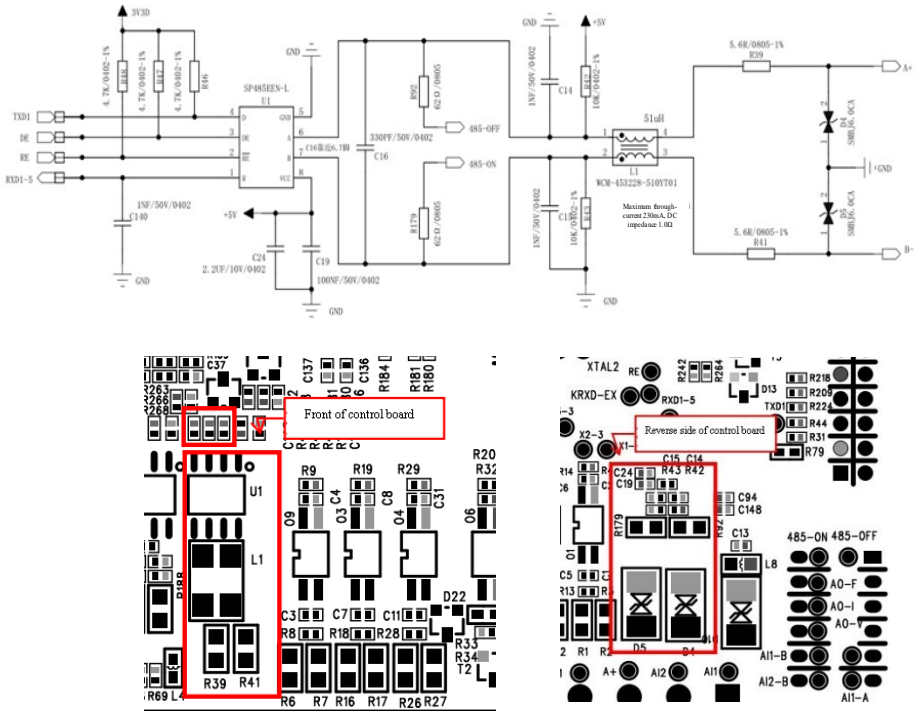
4. Device bit number and specification

AO Output Circuit Components
Pulse output Resistance: R21/R23=4.7K/0402, R222=10K/0402, R241=2K/0402, R204 Op-amp: U12-C=TL084IDR Triode: T4=MMBT4401LT1 Capacitance: C44=100PF/0402, C43=300PF/0402
Voltage output Resistances: R97=100K/0402, R80/R81=4.7K/0402, R242/R246=10K/0402, R266 R268=100Ω, R263=20K/0402 Capacitor: C151=100PF
Current output Resistance: R153/R100=100K/0402, R98/R99=20K/0402, R95=510Ω, R94=100Ω, Capacitor: C79=200NF/0402 Op amp: U12-A = TL084IDR Triode: T3 = MMBT4401LT1

3.5 RS485 Communication Circuit

1. Circuit description

RS485 Communication Circuit



RS485 communication is a typical half-duplex communication. With SP485EEN-L as the core and its peripheral circuits, up to 32 machines can communicate. 。

RS-485 uses balanced transmission and differential reception, and therefore has a strong ability to suppress common mode interference. The bus transceiver has a high sensitivity and can detect voltages as low as 200mV, so that the transmitted signal can be recovered from kilometers away.

As half-duplex communication, only one point can be in the transmit state at any time, therefore, the transmit circuit must be controlled by an enable signal.

2. Input and output interface definitions and their metrics

Input side	Interface definition	Related notes
	A+	A+ input/output interface for RS485 communication.
	B-	B- input/output interface for RS485 communication.
	The amplitude of A+ relative to B- is +5V, with a threshold of not less than 200mV, which usually requires enough margin to include termination. Resistances will reduce the signal amplitude, but can reduce the signal reflection, but is beneficial to the reliability of communication.	
Output side	RXD1	A+/B- Differential input signals processed by the SP485EEN-L and fed to the CPU

Input side	TXD1	TXD1 signal from CPU
Output side	A+	TXD1 Differential signal A+ processed by SP485EEN-L
	B-	TXD1 Differential signal B- after SP485EEN-L processing

Receiver(1)

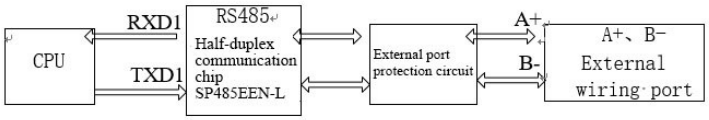
DIFFERENTIAL INPUTS A–B	ENABLE $\overline{RE}$	OUTPUT R
$V_{ID} \geq 0.2$ V	L	H
–0.2 V < V_{ID} < 0.2 V	L	?
$V_{ID} \leq -0.2$ V	L	L
X	H	Z
Open	L	?

Driver(1)

INPUT D	ENABLE DE	OUTPUTS	
		A	B
H	H	H	L
L	H	L	H
X	L	Z	Z

Voltage difference between transmitter AB: +2V ~ +6V: Logic positive level voltage -2V ~ -6V: Logic negative level voltage Voltage difference between receiver AB: >+200mv: Logic positive level voltage <-200mv: Logic negative level voltage

3. Implementation method and key device selection



2. Type of fault

Abnormal communication, communication failure reported

3. Inspection Methods

Method 1: Communicate directly with 485 through the serial port of the computer, and check whether the communication is good or not.

Method 2: Or use two AC drives to communicate, use oscilloscope to measure the port voltage (differential signal) according to the voltage difference between AB to judge whether there is any abnormality.

Concrete way:

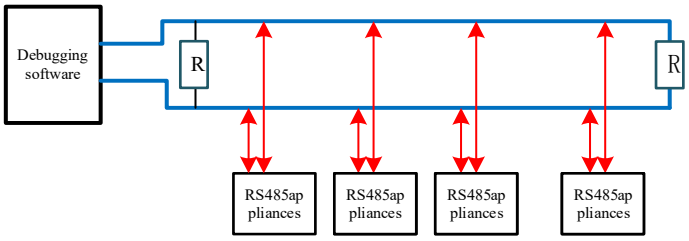
- Build two sets of AC300CON-A1.0 platforms
- A+ connected to A+, B- connected to B-

- Communication master (parameter Fd.00 is 1, Fd.09 is 0022), slave (parameter Fd.00 bit 0, F0.02 is 2, F0.03 is 6), change the frequency of the master, the frequency on the slave is synchronised with the master signal
- Swap the master and slave parameters and repeat the above operation

RS485 communication failure is usually due to the damage of 485 communication IC U1, common mode inductor L1, TSS tube D4/D5, test and replace the bad devices, external keypad RS485 communication test method is consistent with the above.

4. Repair Tips

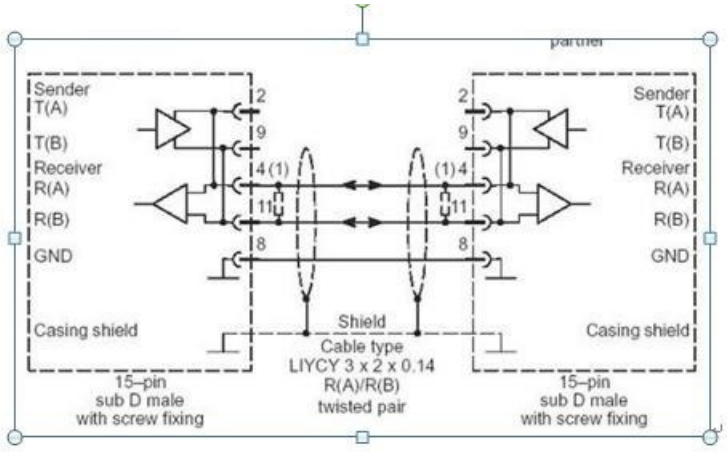
- When communicating with multiple AC drives or over long distances, care should be taken to detect whether 120Ω terminal resistances have an effect on communication (i.e., whether removing 120Ω and the presence of 120 ohms has an effect on communication). As shown in the figure（R=120Ω）



- Shielded cable single PE or double PE (as shown in SHIELD)

. Two operating grounds, GNG, are connected (PIN8 pin, as shown

- Serial 485 signal isolator

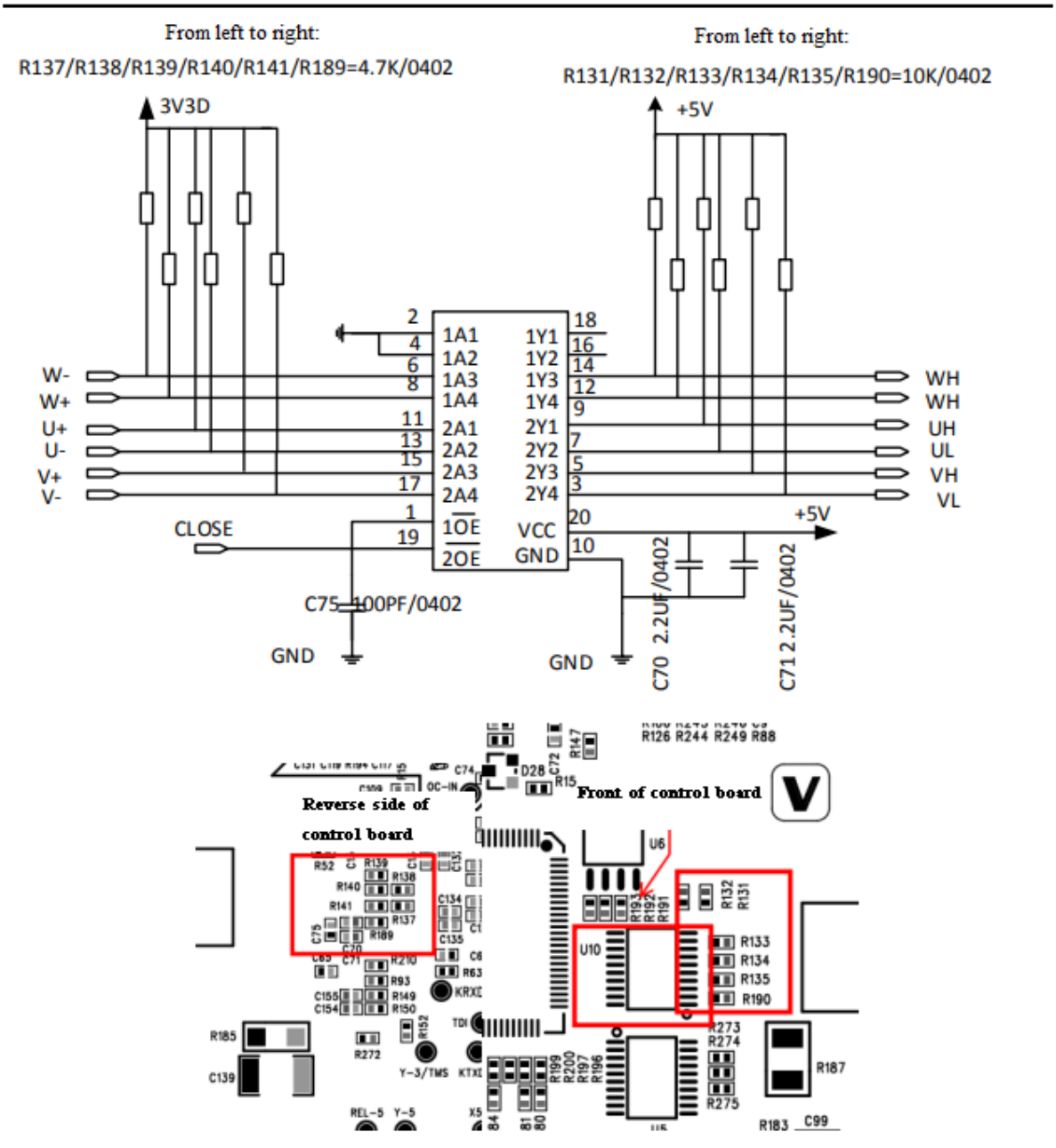


5. Device bit number and specification

485 Communication IC	U1=SP485EEN-L

Common Mode Inductors	L1=WCM-453228-510YT01（Maximum permissible current 230mA）
TSS Tube	D4/D5=WES806S， Breakdown voltage: 6.67~7.37V
Resistances	R39/R41=5.6K/0805，R42/R43=10K/0402，R92/R179=62Ω R46/R47/R48=4.7K
Capacitors	C14/C15=1NF/0402，C19=100NF/0402，C24=2.2UF/10V

3.6 Drive Signal Processing Circuit



1. Circuit Description:

This module is mainly used for shaping the seven drive signals from the CPU and enhancing the drive capability of the drive signals to provide suitable drive waves for the IGBT module. In the event of a fault, the CLOSE signal output from the hardware blocking circuit of the system fault becomes high, resulting in no output from the drive signal processing circuit, which leads to blocking of the drive and protection of the machine.

2. Type of fault

UVW no output (driver board normal), output phase loss, output unbalance

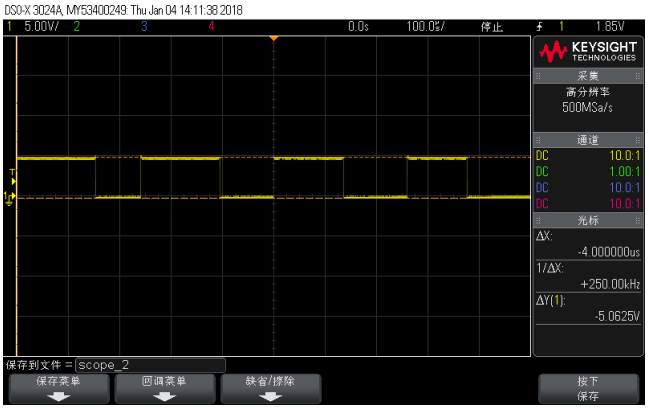
3. Inspection Methods

After powering on, measure whether the given voltages (3.3V and 5V) on both sides of the chip are normal, especially whether there is 5V on pin 20 of the chip; measure the change of the CLOSE signal, when there is a fault, the CLOSE signal output from the system fault hardware blocking circuit becomes high level.

Corresponding voltage when not in operation (DC phase)

UH	UL	VH	VL	WH	WL	
GND						
5V	5V	5V	5V	5V	5V	

Waveforms of one of the drive signals and GND outputs during operation: as follows (if the output waveforms are abnormal, the control board is abnormal)

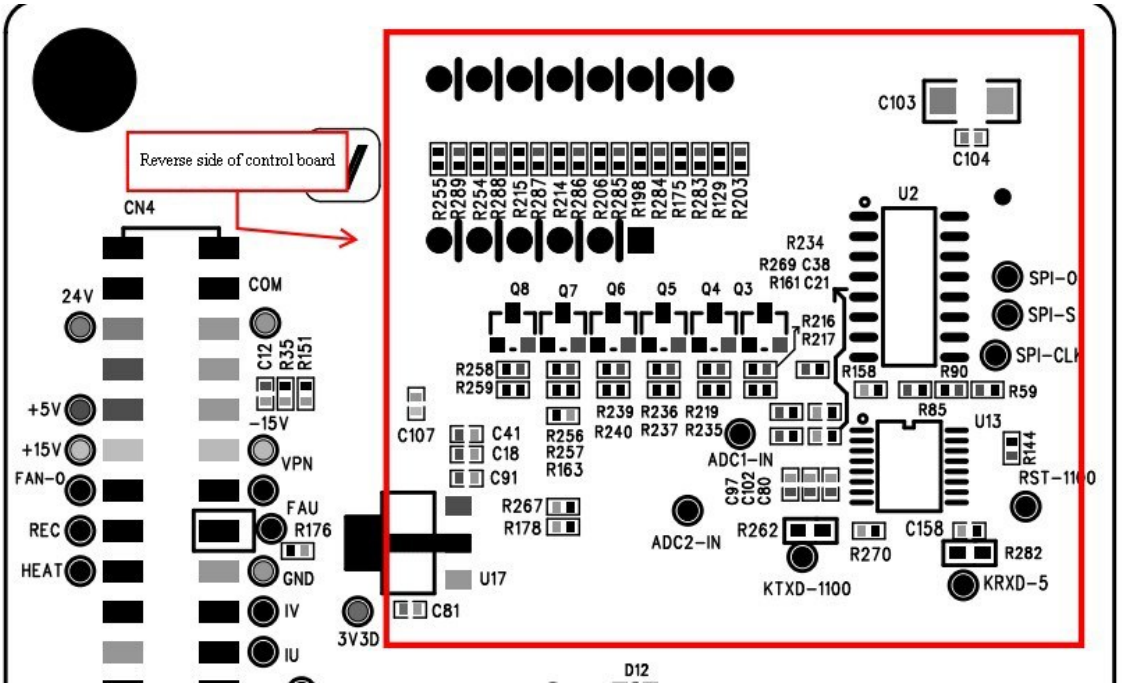


Measured in AC mode during operation, the voltage of each drive signal and GND is about 11.5v.

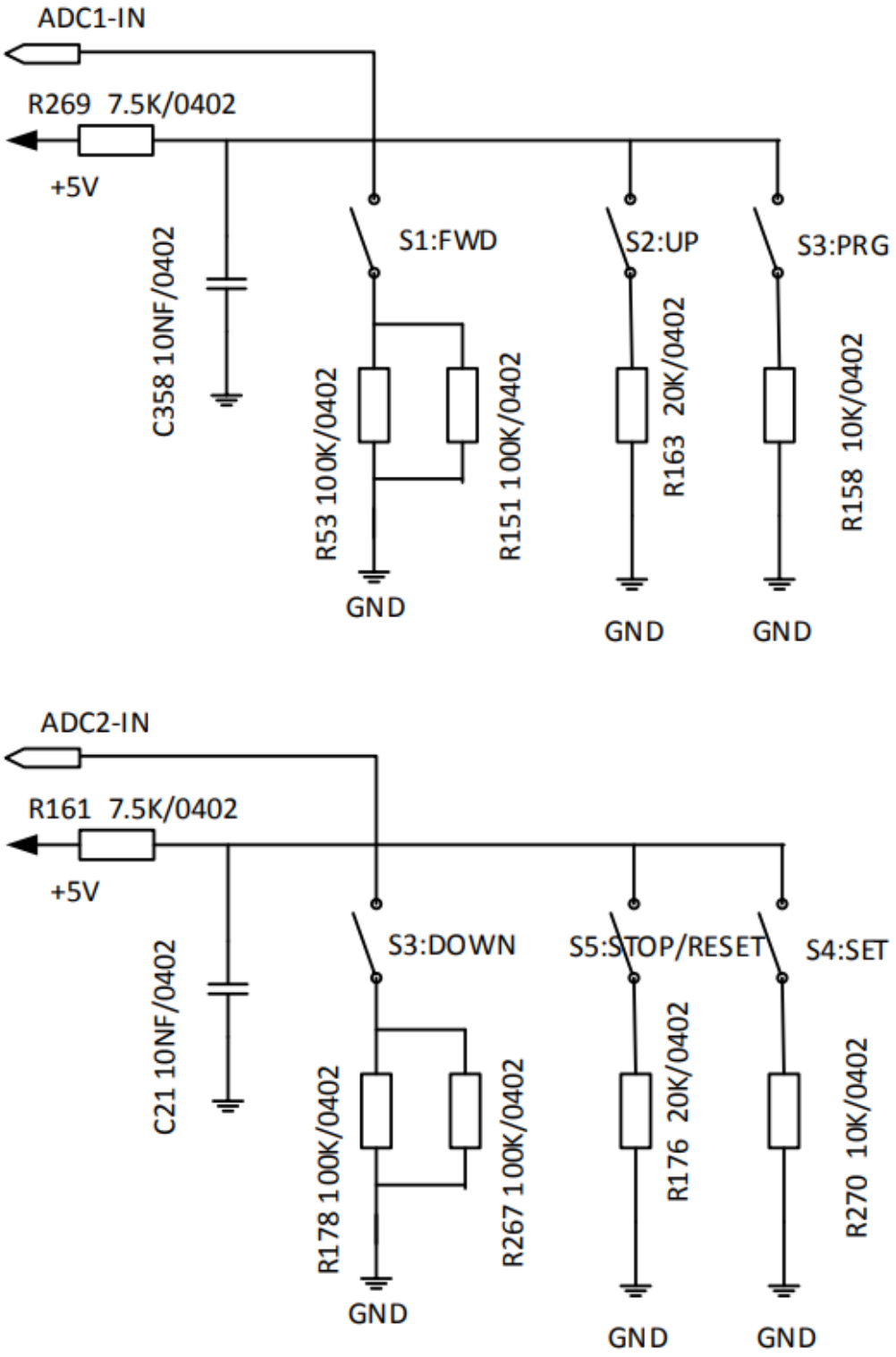
4. Device bit number and specification

Resistances R137/R138/R139/R140/R141/R189=4.7K/0402 R131/R132/R133/R134/R135/R190 IC U10=SN74ACT244PWR	Capacitors C70=2.2UF/0402 C71=100NF/0402 C75=100P

3.7 Keyboard Circuitry



3.7.1 Keypad Key Circuit:



AC300CON1-V1.0 keypad adopts the analogue amplitude detection method to realize the

key identification function. Pressing different keys generates different voltages, so that the CPU (the CPU (U13) is the keypad CPU, which is different from the CPU of the control board) can read which key is working, and the corresponding digital tube can display the corresponding value; there are 6 physical keys, corresponding to: RUN, UP (up key), PGR; DOWM (down key), STOP/RESET, SET; the key circuitry of AC300CON1-V1.0 is the same as the keypad circuitry of the control board. There are 6 physical keys, corresponding to: RUN, UP (up key), PGR; DOWM (down key), STOP/RESET, SET; key circuitry:

2. Fault type

No display, no action or mis-action of keys

3. Inspection methods

Keyboard key failure, power on, check whether the 5V power supply is normal, and then go to measure the corresponding resistances, capacitance is normal, the circuit, fewer devices, easy to troubleshoot

4. Device bit number and specification

RUN, UP (Up key), PGR group circuit devices:	**DOWM, STOP/RESET, SET group circuit devices:**
ResistorR269=7.5K/0402， R163=20K/0402 R35=R151=100K/0402, R158=10K/0402 Capacitor: C38=10NF/0402	Resistor: R161=7.5K/0402 ， R270=10K/0402 R178=20K/0402, R176=100K/0402 Capacitor: C38=10NF/0402

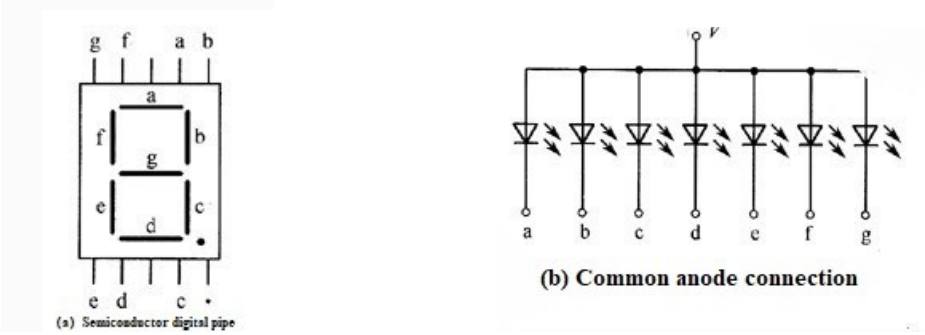
3.7.2 Keypad Display Circuit

1. Circuit description: In the display circuit , using a common anode digital tube, common anode digital tube characteristics of the positive pole of a uniform high level; in the display circuit is the most important is the corresponding U13 keyboard CPU and U2 latch chip, to make the common-anode digital tube digital tube is effective, according to the segment selection of the cathode of the LED as well as the chip selection of the digital tube, the given low level, you can display the corresponding data.

2. Type of fault: No display, display less strokes

3. Overhaul method

- Digital tube overhaul



Digital tube repair in accordance with the above digital tube connection diagram and diode repair can be judged good or bad.

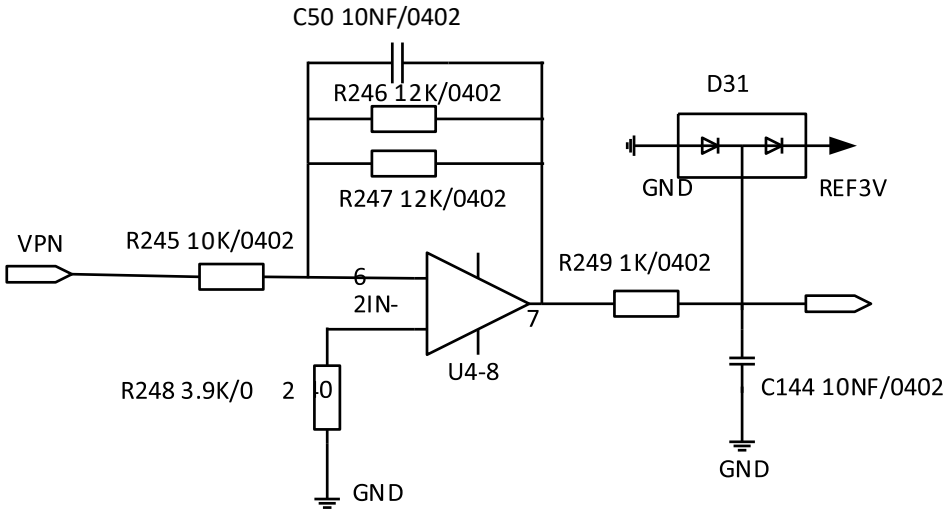
- The U2 in this circuit is an 8-bit 3-state shift register/output latch chip, check whether the voltage on the left and right side of the chip is abnormal, and whether pin 16 is supplied with 5V; the pull-up resistor of the chip is 10K on pins 1 to 7 and pin 15, corresponding to the voltage of 5V; the pull-up resistor of pins 10, 11, 12 and 14 is 4.7K, and the level of the pull-up is 5V; the voltage of pin 13 is 3.3V. (Note: damage to the pull-up resistor will cause the chip to work abnormally, so it is necessary to measure the pull-up resistor); an abnormality of this chip will lead to the cathode of the segment selection LED or a digital light of the chip selection. 3.3V, (Note: damage to the pull-up resistor will cause the chip to work abnormally, so it is very necessary to measure the pull-up resistor); abnormalities in the chip will lead to problems with the cathode of the segment-selected LEDs or with the chip-selected digital light, which will lead to no display or fewer strokes; in the keypad circuit, the most important is the keypad CUP U13, which requires 5V for the chip to operate (pin 6),damage to this chip leads to abnormalities in the keypad and display circuits, so this chip is the core of the keyboard circuit.

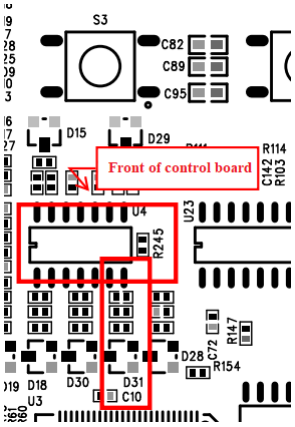
4. Device bit number and specification

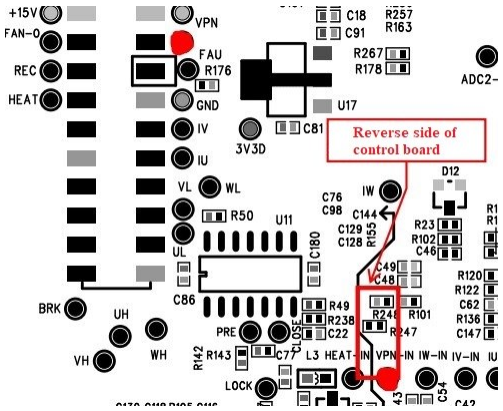
Name/Bit number	Model	Quantity
Programmable IC	U13=XMC1100-T016F0032 Resistors and capacitors connected to the chip Pin 16: Resistor R144=10K/0402, connect to 5V voltage Resistors on pins 13 and 14 are R262 and R268 in that order, both 10Ω/0402. Pin 6, connected to 5V, also connected to GNG Capacitance:	1
Logic chip	U2=74HC595D	1
	Resistor and capacitor connected to the chip Resistor: R59=R85=R90=R56=R276=10K/0402 R234=R203=R283=R284=R285=R286=R287=R288=R289=0402 Capacitor:C20=C23=2.2UF/0402	
Digital tube	JH-3505ASR1AK（common anode）	1
When the key is	**Pushbutton S1 circuit**:	

U13 command circuit	Resistor: R217=2K/0402，R126=4.7K/0402，triode: Q3 **Pushbutton S2 Circuit**: Resistor: R235=2K/0402，R219=4.7K/0402，triode: Q4 **Pushbutton S3 Circuit**: Resistor: R237=2K/0402，R236=4.7K/0402，triode: Q5 **Pushbutton S4 Circuit**: Resistor: R240=2K/0402，R239=4.7K/0402，triode: Q6 **Pushbutton S5 Circuit**: Resistor: R257=2K/0402，R256=4.7K/0402，triode: Q7 **Pushbutton S6 Circuit**: Resistor: R259=2K/0402，R258=4.7K/0402，triode: Q8	

3.8 VPN Detection and Maintenance





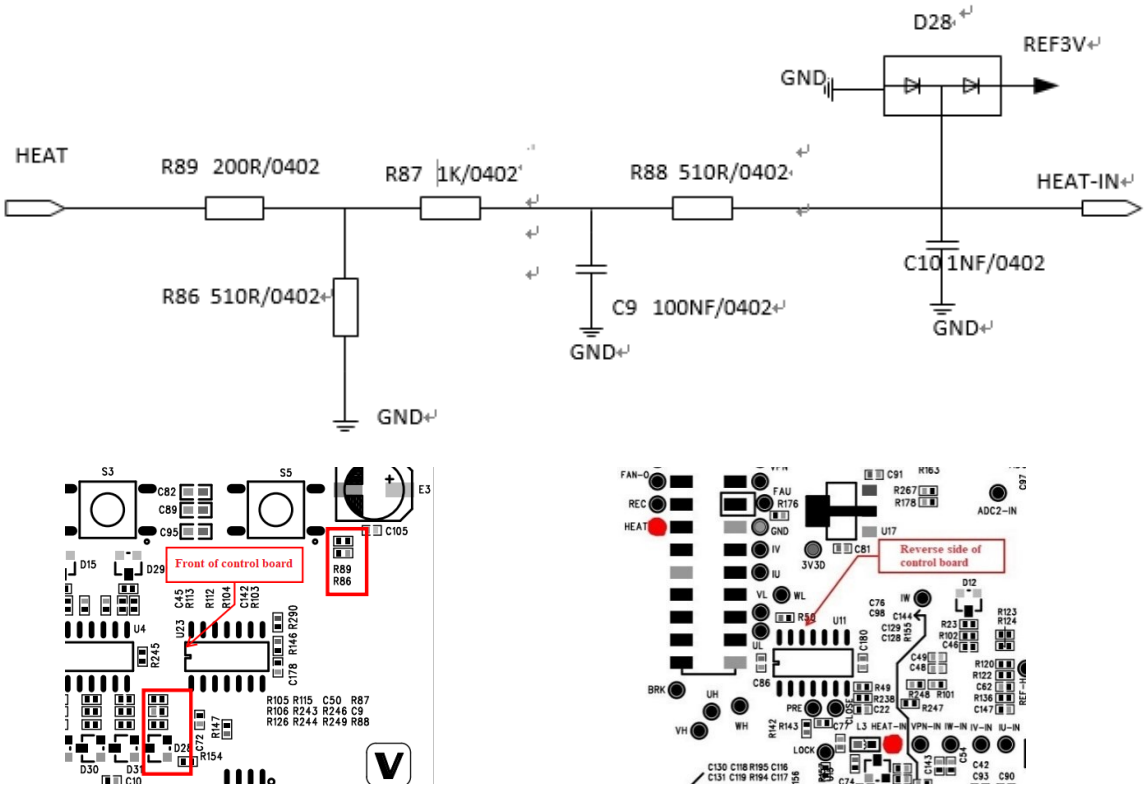


Red pen	VPN	VPN-IN
Black pen	GND1	
Voltage range）	T2 model: Bus voltage 579V corresponds to 5V T3 model: bus voltage 1000V corresponds to 5V	DSP Input Voltage Range -0.3V to 4.6V

1. If the VPN consistent unchanged, the power board voltage detection circuit is abnormal, test the power board VPN detection circuit.

2. If the VPN-IN voltage is abnormal, then the VPN input signal circuit failure, common failure is U4 TL084IDR damage, replace the device in the test.

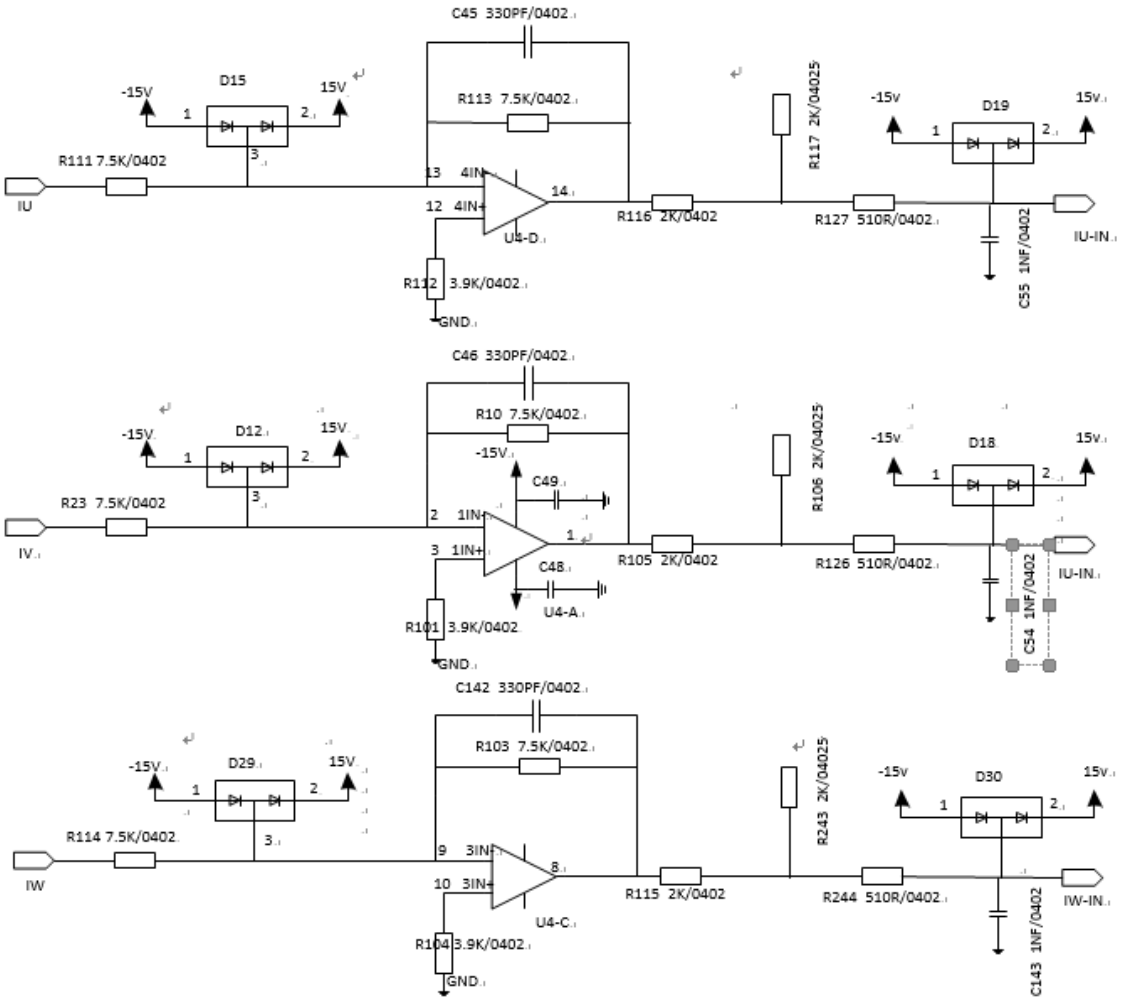
3.9 OH Fault Detection and Maintenance

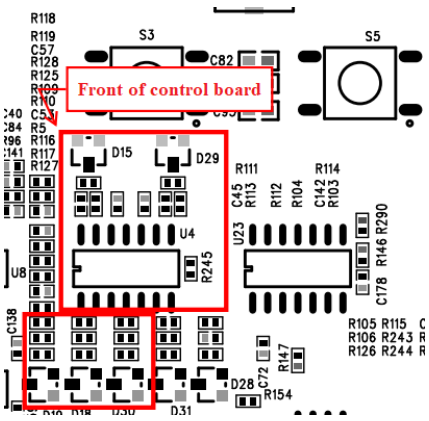


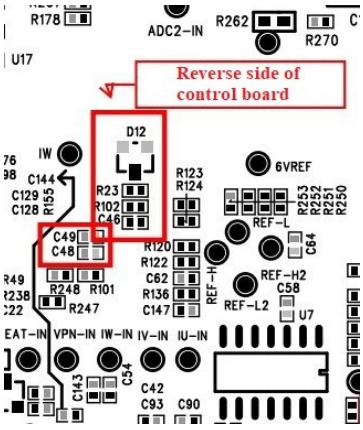
1. GND1 as a reference ground, measuring HEAT, the normal voltage is 0.5V-1V. If the HEAT voltage is abnormal, the power board voltage detection circuit is abnormal, test the power board voltage detection circuit.

2. HEAT -IN abnormal voltage, for the control board input circuit module temperature collection failure, replace the corresponding resistors: R86, R87, R88, R89, or capacitors C9, C10.

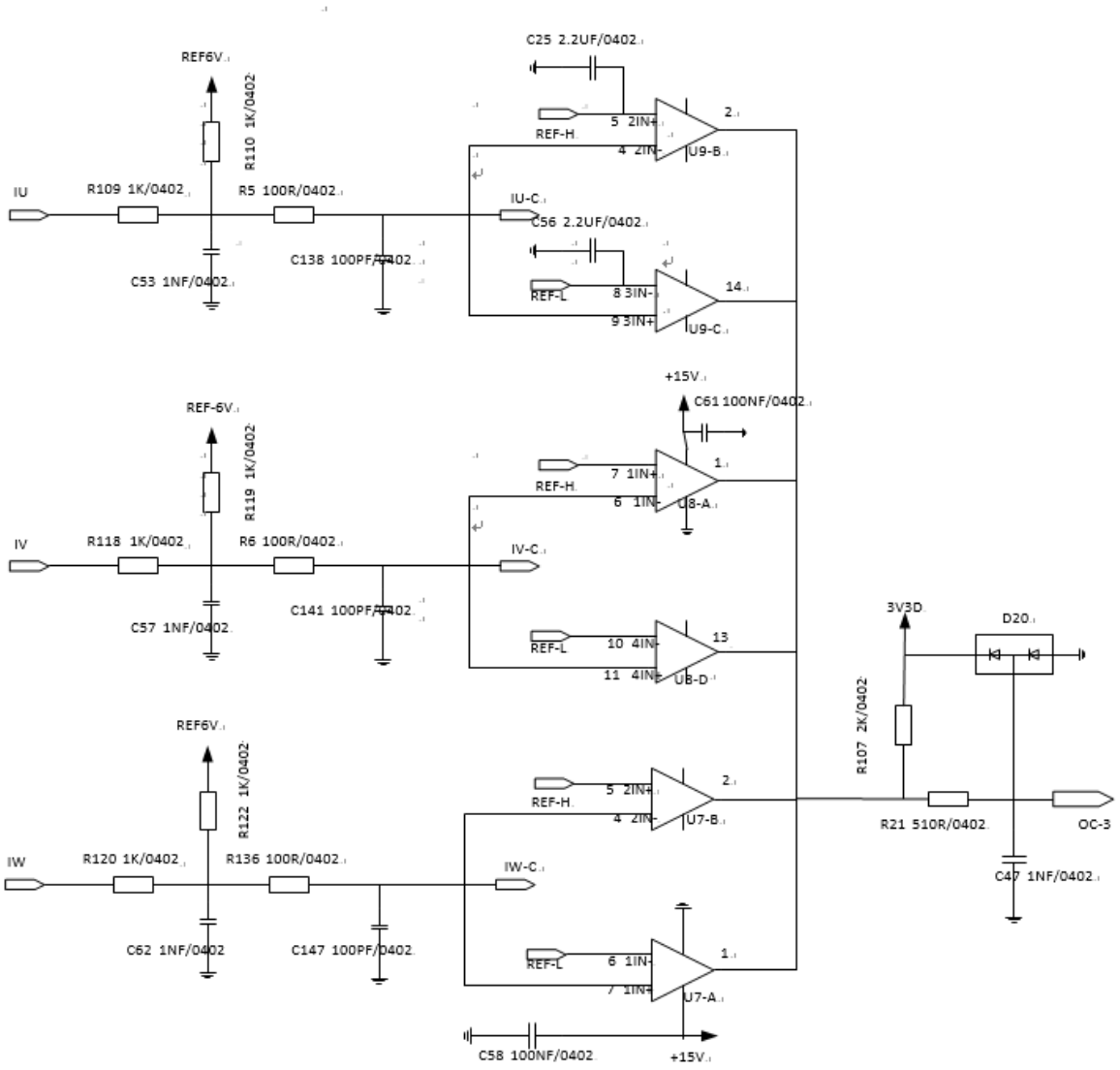
3.10 Current Acquisition Detection and Maintenance

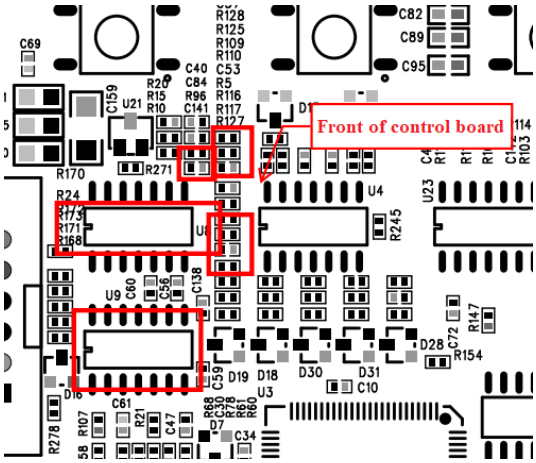


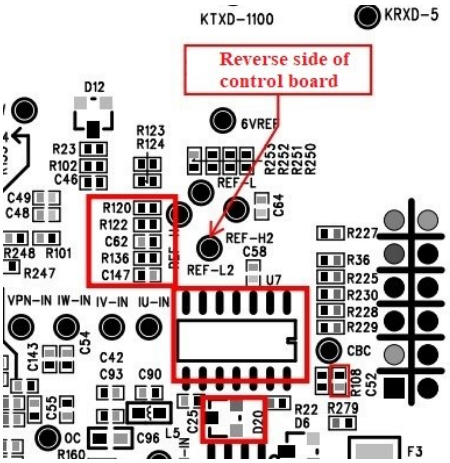




3.11 OC Fault Detection and Maintenance







1. Circuit description: in the OC detection circuit, OC threshold for the rated current 2.7 times, in the circuit used in the comparator U7, U8, U9, the comparator provides the reference voltage REF-H, REF-L, the collection of the current IU, IV, IW into the resistor has a voltage, compared with the reference voltage, when between the two benchmarks, will not report a fault, beyond the benchmark will report fault OC.

2. Fault type: OC1, OC2, OC3, OC4.

3. The detection method the first test resistor, capacitor, normal in the circuit is often damaged devices may be comparator U7, U8, U9, in the case of inaccuracy of the reference voltage REF-H, REF-L will also report a fault OC (reference voltage inaccuracy, according to the previous voltage point test maintenance methods), but also need to test R107 there is a foot whether the 3.3V voltage.

4. IC pin voltage

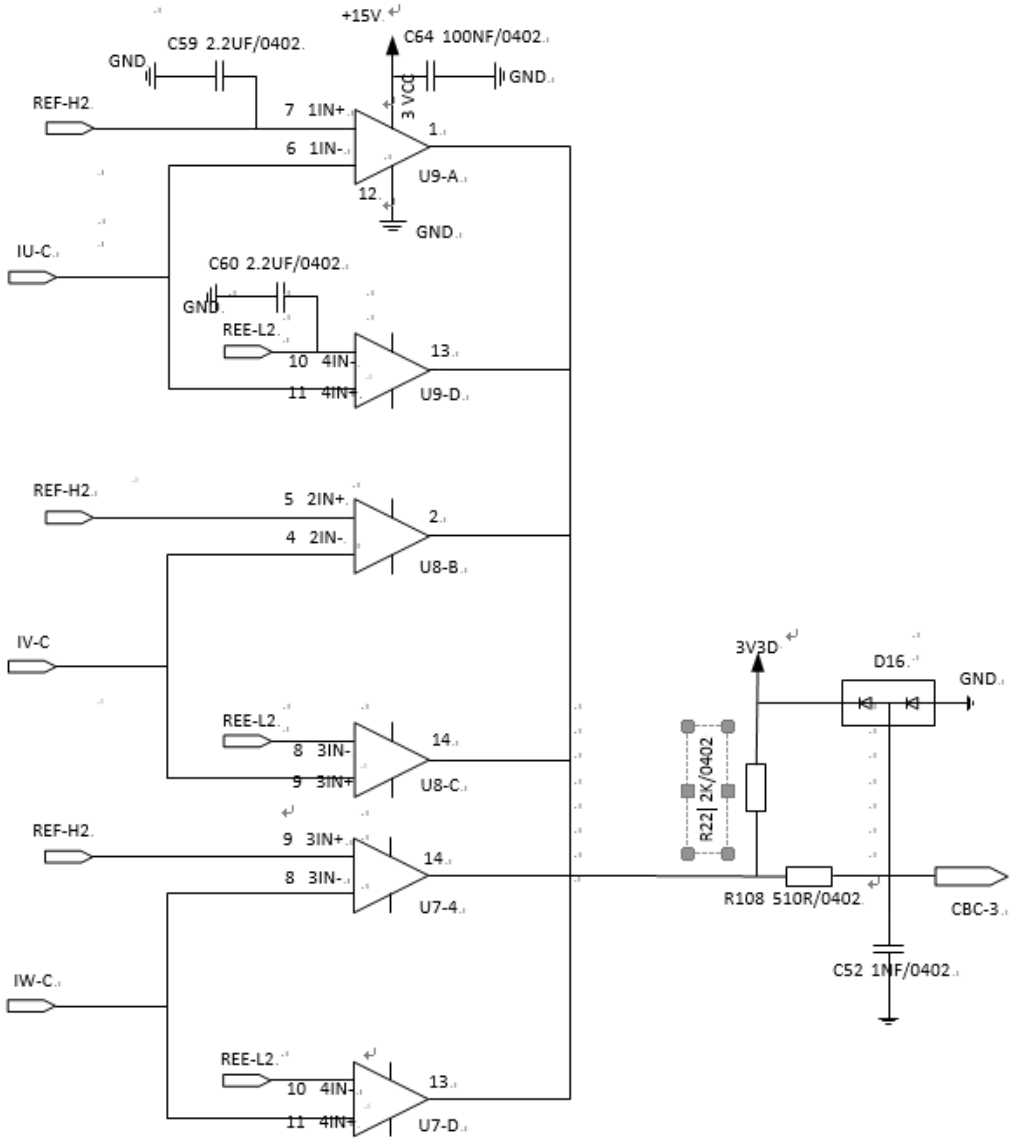
Note: In the measurement of IC pin voltage, are GND measurement, it is best to use an oscilloscope to measure (multimeter will be less accurate, with a multimeter in measuring voltage, easy to touch other pins), such as a voltmeter to measure, there will be different.

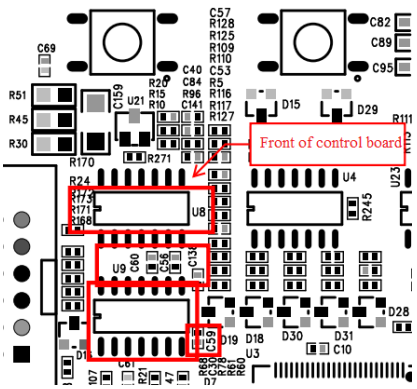
U9 5	4.7V	U9 8 pin	1.2V	U8 7	4.7V	U8 10 pin	1.2V
U9 4	3.0V	U9 9 pin	3V	U8 6	3.0V	U8 11 pin	3.0V
U9 2 pin	3.3V	U9 14 pin	3.2V	U8 1 pin	3.1V	U8 13 pin	3.1V

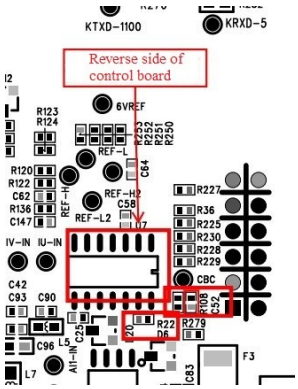
5. Device bit number and specification

IU Comparator Circuit Comparator: U9 = LM239DR Resistor: R109 = R110 = 1K/0402, R5 = 100R Capacitor:C5=1NF, C138=100PF, C56/C25=2.2UF
IU Comparator Circuit Comparator: U8=LM239DR Resistor: R118=R119=1K/0402, R96=100R Capacitor: C5=100NF/0402
IU Comparator Circuit Comparator: U8=LM239DR Resistor: R118=R119=1K/0402, R96=100R Capacitor: C5=100NF/0402
Dual chip diode: D20=BAV99LT1G Resistor: R107=2K/0402, R21=510R Capacitor: C47=1NF/0402

3.12 Wave-by-Wave Current Limit Comparison Circuit







1. Circuit description: In the AC drive wave-by-wave current limiting (CBC) is very

important, wave-by-wave current limiting can effectively prevent overcurrent, whether it is a short-circuit or a sudden change in the current of the load suddenly added, when the current reaches the wave-by-wave current limiting point, blocking the drive signal, so as to shut down the drive to realize the overcurrent protection of the IGBT, so as to ensure that the IGBT will not be damaged by overcurrent. To make the wave-by-wave current limiting function normal, the corresponding control signals must be normal, so that there is a corresponding wave-by-wave current limiting comparison circuit on the control board, when the current exceeds the wave-by-wave current limiting point, the CPU sends out a command to limit the current, and the wave-by-wave current limiting threshold set by our company is 2 times of the rated current.

2. Fault type: Wave-by-wave current limiting function will not be entered.

3. Detection method: Test the corresponding SMD double diode, replace the comparator U7, U8, U9 if the resistor and capacitor are normal, if the above fault occurs, it is not only a problem of the circuit, but also a problem of the circuit before generating IU-C, IV-C, IW-C signals.

4. IC Pin Voltage

Note: In the measurement of IC pin voltage, are on the GND measurement, it is best to use an oscilloscope to measure (multimeter will be less accurate, with a multimeter in the measurement of voltage, easy to touch the other pins), such as a voltmeter to measure, there will be different.

U9 7	4.2V	U9 10 pin	1.6V	U8 5	4.2V	U8 8 pin	1.6V
U9 6	2.8V	U9 11 pin	2.8V	U8 4	2.8V	U8 9 pin	2.8V
U9 1 pin	3.2V	U9 13 pin	3.2V	U8 2 pin	3.2V	U8 14 pin	3.3V

5. Device bit number and specification

Comparator: U7/U8/U9=LM239DR Capacitor: C59/C60=2.2UF/0402，C64=100NF，C52=1NF Resistor: R22=2K/0402，R108=510R Dual chip diode: D16=BAV99LT1G

Chapter 4. Common Faults Quick Maintenance

(Note: All control signals are processed by the CPU. If the CPU is damaged or does not work, it will cause a malfunction, so after eliminating other malfunctions, finally check whether there is a problem with the CPU).

4.1 No Display on Power-up

1. Damaged module

Cause: The rectifier part of the module is damaged, resulting in no or low voltage at the busbar and no display.

Measurement method: Measure the rectifier static value of the module.

Solution: Replace the IGBT.

2. Switching power supply failure

Cause: The voltage generated in the switching power supply is faulty, resulting in the inability to supply power to the control board, which leads to no display.

Measurement method: Measure whether the voltage generated in the switching power supply is abnormal.

Solution: according to the switching power supply repair method to repair.

3. Control board problems countermeasure: Replace the control board with a good board. If the fault is eliminated, it is the problem of the control board. In the control board may be the CPU and the keyboard display circuit have a problem.

Detect CPU-related circuits: Measure whether the +5V power supply is good, if +5V is normal, the +3.3V power supply generation circuit for repair; then test the reset chip U15 whether there is a problem; followed by an oscilloscope in the crystal oscillator at both ends of the GND measurement, should be a sinusoidal wave.

4. Detect the keyboard display circuit (keyboard damage, or damage to the standard network interface cable connected to the keyboard): According to the previously mentioned the repair method to detect

Solution: If the damage of the corresponding device is detected, replace it directly, if there is no failure above, then it is CPU failure.

5. Note: R151 is a 0Ω resistor on the P line, if the resistor fails, it will cause the bus voltage to be cut off and no power will be supplied, resulting in no power to the

switching power supply, which will lead to no display, so, when there is no display, test whether the 0Ω resistor is normal.

4.2 Power-up or Operating Undervoltage (L.U.1, E.LU2), Overvoltage (E.OU1/2/3/4) Fault

The power supply is added to the normal voltage value (380VAC/510VDC), and the undervoltage fault is still displayed. Possible causes and countermeasures:

1. Voltage calculation error on the control board

Cause: The voltage on the control board is calculated incorrectly, causing the CPU to misreport undervoltage and overvoltage.

Measurement method: according to the maintenance of the control board VPN circuit maintenance

2. Power board VPN acquisition circuit errors

Cause: Errors in the VPN acquisition circuit on the power supply board cause the voltage on the control board to be calculated incorrectly, and the CPU mistakenly reports undervoltage or overvoltage.

Measurement method: According to the method of repairing the VPN circuit on the power supply board.

3. When the 24V switching power supply fails, the relay cannot be absorbed, so there will be voltage loss on the charging resistor, resulting in undervoltage.

4. If the voltage level is set incorrectly, undervoltage will be reported. When the voltage level of S2 is set to the voltage level of T3, an undervoltage fault will be reported.

5. If the input voltage at the site is too high or too low, an overvoltage or undervoltage fault will be reported.

6. Add a suitable braking resistor to release the excess energy from the bus voltage so that overvoltage is not reported.

7. Energy braking point is set too high, resulting in overvoltage. (Note that overvoltage suppression is turned off when energy braking is used)

8. The overvoltage suppression point is not turned on, resulting in overvoltage.

4.3 OC Fault (OC1, OC2, OC3, OC4)

1. IGBT module short circuit.

Cause: IGBT module AC drive short-circuit, short-circuit upper and lower bridge, short-circuit with ground, resulting in excessive current and thus report OC.

Measurement method: Measure according to the measurement method of IGBT module
Solution: Replace the IGBT module.

2. Failure of the current detection circuit on the power supply board

Cause: Failure of the circuit (failure of the current detection chip, Hall device, current detection resistor circuit), which causes the collected current to fail, causing the CPU to make incorrect judgment.

Measurement method: Detect according to the current detection circuit method.

3. Failure of the OC comparison circuit on the control board.

Cause: Circuit failure, resulting in CPU judgment error.

Measurement method: Test according to the OC comparison circuit maintenance method.

4.4 E.SC Fault

1. IGBT module short circuit

Cause: IGBT module AC drive short-circuit, phase to phase short-circuit, resulting in excessive current to report OC.

Measurement method: Measure according to the measurement method of IGBT module.

2. Electromagnetic interference

Cause: The existence of electromagnetic interference leads to problems in the transmission of weak electrical signals from the control board, thus reporting E.SC failure. Solution: Ground the wire, and then the interference flows out through the earth.

3. Current detection chip failure

In the current detection circuit of the power supply board, we mentioned that the current detection chip fast protection feet VOC_F and FAULT_F/ When the current reaches the set overcurrent point, the chip sends out a FAULT low-level signal within 1.5us, and connects this signal to the FAU function foot, so that the system reports SC protection.

4. The direct cause of E.SC failure is that the FAU signal is pulled down. The normal FAU signal is high, and when the FAU goes low, the CLOSE signal goes high, blocking the driver output.

4.5 OH Fault

1. The fan is blocked; the fan does not rotate or the speed is too low.
Checking method: Check with the normal fan, or use a speed tester to measure. If the fan is normal, then check whether the driving circuit is faulty, (Note: in high-power machines is sure to open the fan to see whether the fan is blocked)
Solution: Replace the fan or overhaul its driving circuit.
2. IGBT module temperature detection unit failure This circuit failure will lead to false alarms.
3. IGBT module thermal paste is less or heat sink is not qualified.
4. Failure of OH detection circuit on the control board.
Check method: Replace the control board with a good one to see if it fails.
Countermeasure: According to the control board OH repair method to repair.
5. The site temperature is too high, or the ventilation of the place where the AC drive is installed is not very good.

4.6 Relay Non-suction Fault

1. Switching power supply 24V generates wrong voltage
Cause: Relay will not close until 24V.
Solution: according to the switching power supply maintenance way to repair
2. Relay circuit is faulty.
Solution: Repair according to the relay circuit.

4.7 Inconsistent Voltage Values Generated by the Switching Power Supply

1. Measure whether the switching MOS tube (Q1=STFW3N150) is damaged.
2. Measure the voltage at both ends of the regulator Z1 at the switching power supply when powering up, it should be about 12V.
3. Whether UC3844 is damaged.
4. In the switching power supply maintenance to the diode damage.

4.8 Output Out of Phase (E.OLF)

1. Whether the driving circuit on the power supply board is abnormal
Cause: If there is a problem with one phase of the driving circuit on the power supply board, resulting in no voltage output from the item, it will report a fault.

Solution: Repair according to the driving circuit of the power supply board.

2. Whether the driving circuit on the control board is abnormal.

Cause: If there is a problem with one phase of the driving circuit on the control board, resulting in no voltage output on the power supply board, the fault will be reported.

Solution: Repair according to the driving circuit of the control board.

3. IGBT module damage

Cause: If there is a problem with one phase of IGBT AC drive, there is no voltage output on the power supply board, and the fault will be reported.

Solution: Replace the IGBT module.

4. Abnormal current detection circuit.

Cause: The principle of output phase loss is whether the output voltage and current of AC drive are balanced within a certain error, so the current detection circuit will also report fault. The current detection circuit will also report a fault.

Solution: Check according to the current detection method.

4.9 Current Detection Fault (E.HAL)

1. Damaged IGBT module

Cause: IGBT AC drive is damaged, resulting in three-phase imbalance of output current, thus reporting a fault.

2. Failure of current detection circuit on the power supply board

Cause: Circuit failure (current detection chip, Hall device, current detection resistor circuit failure), thus the collected current is faulty, causing the CPU to make wrong judgment.

Measurement method: According to the current detection circuit method to detect.

3. Failure of the current acquisition circuit on the control board.

Cause: Circuit failure, causing CPU judgment error.

Measurement method: Test according to the current acquisition circuit maintenance method