



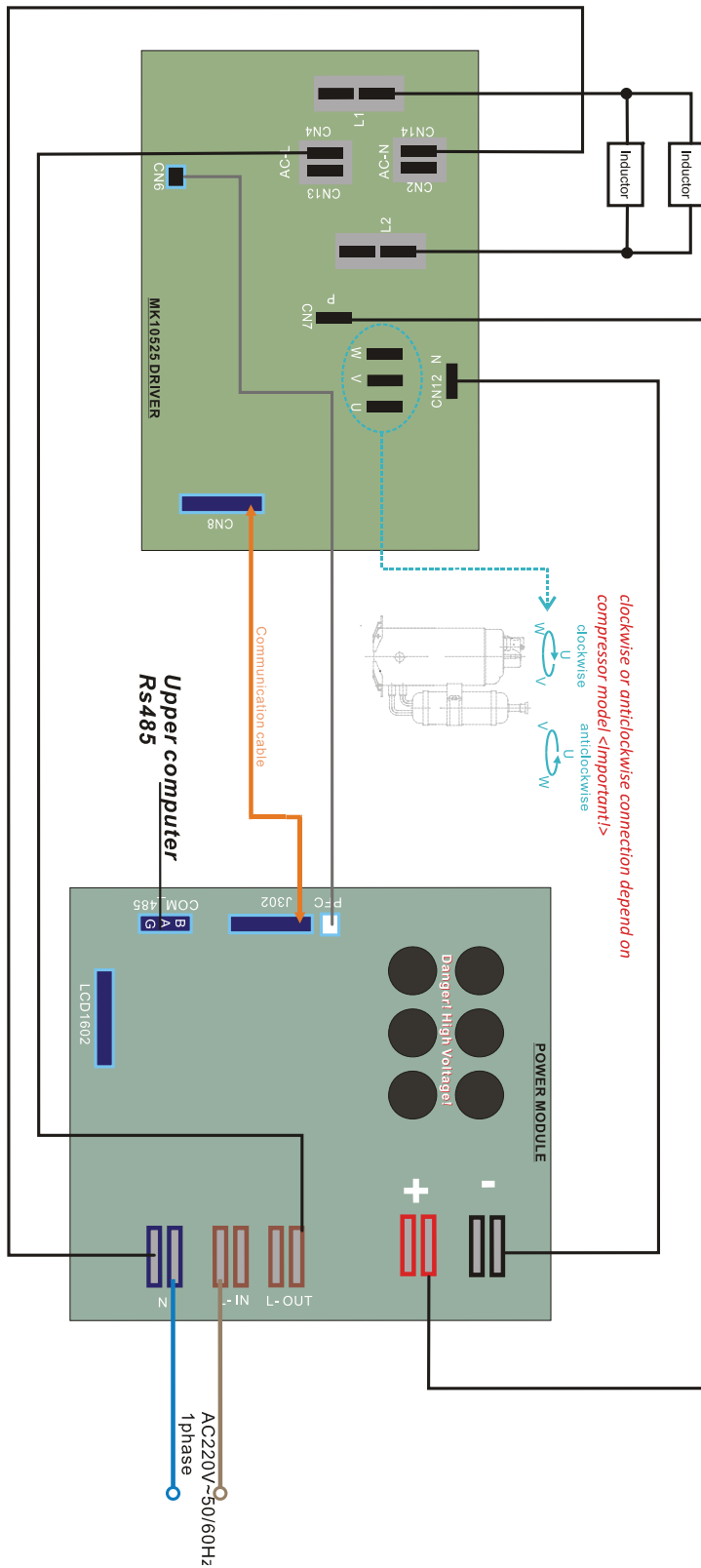
MK10525 15KW DC Inverter Compressor Driver

Documents for sample test

Please read this document before uses!

- Aislu DC Inverter Driver Set includes MK10525 Driver PCB, Power Module PCB, Reactor and Heat Sink. Heat sink is not a standard configured component, it always designed and made by user depend on end user's equipment metal plate (metal enclosure) installation size.
- User should install compressor onto a refrigeration system, there should be condenser and evaporator work with compressor and their specification meet with compressor specification.
- This sample driver is for Compressor model number 5VD420ZAA21 only.
- Please refer to 5VD420ZAA21 compressor specification sheet to design refrigeration system.
- Important: Please do not run 5VD420ZAA21 compressor at speed smaller than 45Hz too long time., if require refrigeration system run low speed (<45Hz) long time, should run back to 60Hz about 1 or 2 minutes for compressor oil return every 30minutes – 1 hour; And please refer to 5VD420ZAA21 compressor using limitation to design compressor speed range for your refrigeration system
- The speed: 1Hz = 60rpm; For example, target run compressor at 60Hz, compressor frequency is 60Hz and mechanical rotating speed is $60\text{Hz} * 60 = 3600\text{rpm}$

1. Hardware/Wiring connection



Please double check wiring connection is correct before connect with power supply.

Important:

There are some connection points may easy confound, please check follow by below steps:

	MK10525 Driver PCB Terminal Name/Number	Power Module PCB Terminal Name/Number	Remark
Step1	CN7/P	POS(DC+)	This is DC power connection, Make sure if this connection is correct, wrong connection could directly broken PCB due to DC power has polarity
Step2	CN12/N	NEG(DC-)	
Step3	AC-L/CN13, CN4	L-OUT	Make sure Driver Board AC-L is connected with Power Module L-OUT
Step4	AC-N/CN2, CN14	N	Make sure Driver Board AC-N is connected with Power Module N
Step5	CN6	PFC	Make sure Driver Board CN6 is connected with Power Module PFC <i>* CN6 on driver PCB socket is black color</i> <i>* PFC on power module PCB socket is white color</i>
Other points: L1, L2 on driver PCB for connect with Reactor, the two reactors are parallel connection. Please refer to wiring connection diagram and check the wiring connection again.			

2. Connect power module to your PC

You may need to use a COM port –RS485 Converter Or USB–RS485 Converter, that can connect with your PC computer COM port or USB port.

There are marked COM-485 on power module PCB; this port for RS485 communication, and there are marked B/A/G pins, B = RX- ; A = TX+ ; G = Grounding.



Make sure G pin of COM-485 is connect with your communication converter grounding pin, wrong connection could damage your computer com port even damage computer mainboard.

3. Connect compressor terminals

Find out the U/V/W terminals on the MK10525 Driver PCB, and use 3 cables connect with U, V, W terminals severally.

There are 3 terminals on compressor, and may not marked U/V/W;

- ➔ Select the cable which one already connect with **U** terminal of MK10525 driver PCB, and connect this cable to any one terminal on compressor.
- ➔ Select the cable which one already connect with **V** terminal of MK10525 driver PCB, and connect this cable to next terminal at the clockwise direction of U terminal which already connected on compressor.
- ➔ Connect the W cable to the remained terminal on compressor

* If connect U/V/W wrong could cause compressor reversed rolling.

4. Use PC software to test compressor

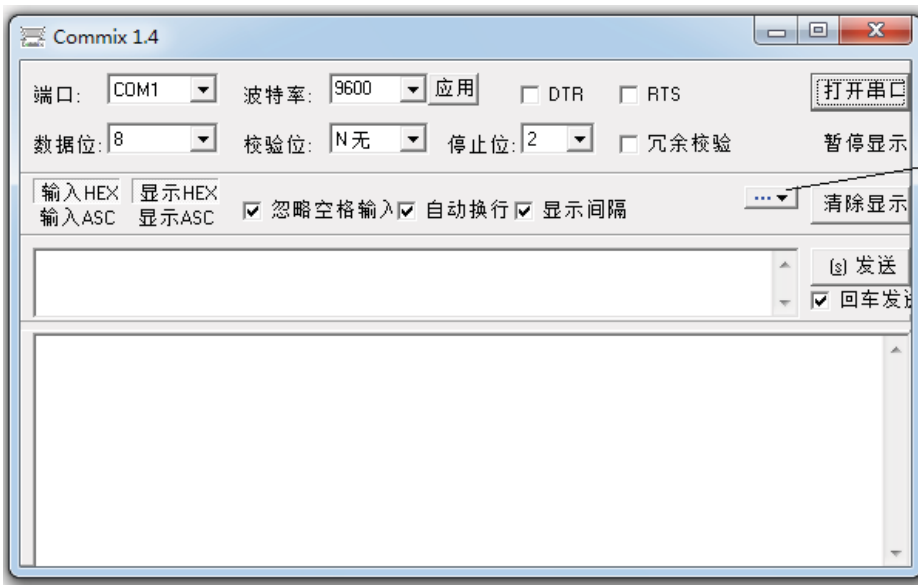
Please double check all cables, communication wire all are connected correct, and then connect this driver set onto power source.

When power on this driver set, 3seconds later, current buffer relay action, and RUN led indicator flashing, LED1 yellow LED on driver PCB 1time/1second flashing.

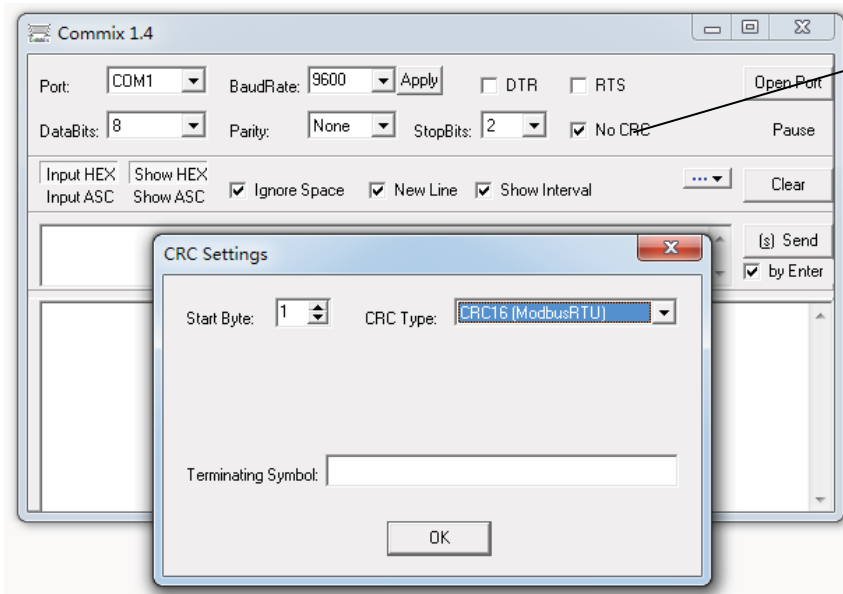
Driver is at standby state.

You can download Commix modbus test software from below link:

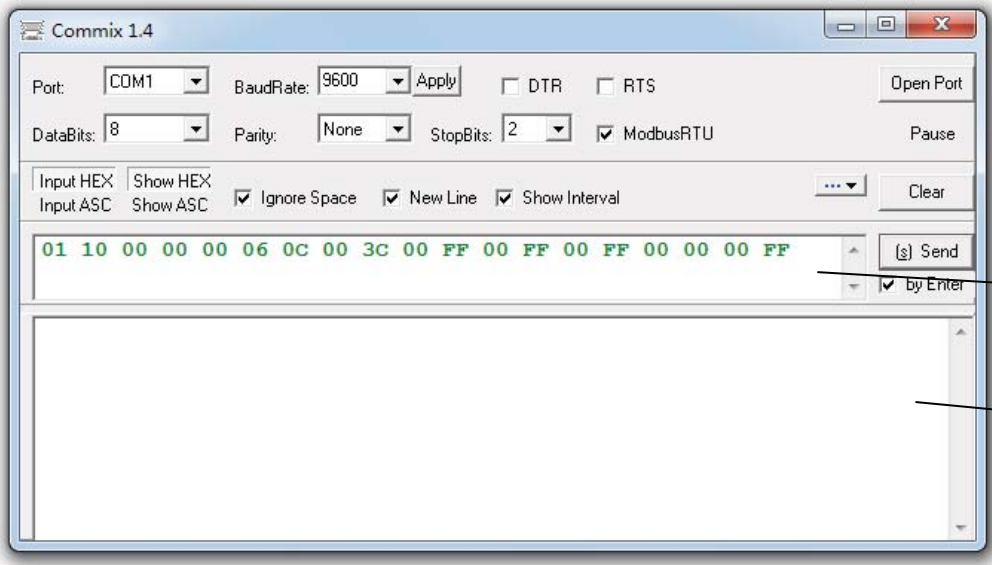
<http://www.aislu.com/software/mktestcom/commix.exe>



Click this button change software to English Interface



Click this to choose CRC type: CRC16
Port: Your computer's Port which connected with Power Module;
Baud Rate: 9600
Data Bit: 8
Parity: None
Stop Bits: 2
Input HEX
Show HEX
And then open port



Input command string in this textbox and then click send

This textbox automatically display MK10525 driver set returned data

There are three types of control commands

1) Function code 01:

For check compressor protection state, fixed command string,

01 01 00 00 00 07 CRC (CRC is automatically generated by Modbus software or upper computer program)

2) Function code: 03:

For check compressor speed, dc voltage, current is on running, fixed command string:

01 03 00 0A 00 03 CRC (CRC is automatically generated by Modbus software or upper computer program)

3) Function code: 10:

For input compressor running parameters (target speed, protection voltage...etc), below is demo command string,

01 10 00 00 00 06 0C 00 3C 00 FF 00 FF 00 FF 00 00 00 FF CRC (CRC is automatically generated by Modbus software or upper computer program)

Please refer to < Modbus Protocol of Aislu Power Module >, and user can design upper-computer/controller control program depend on the test software and the protocol

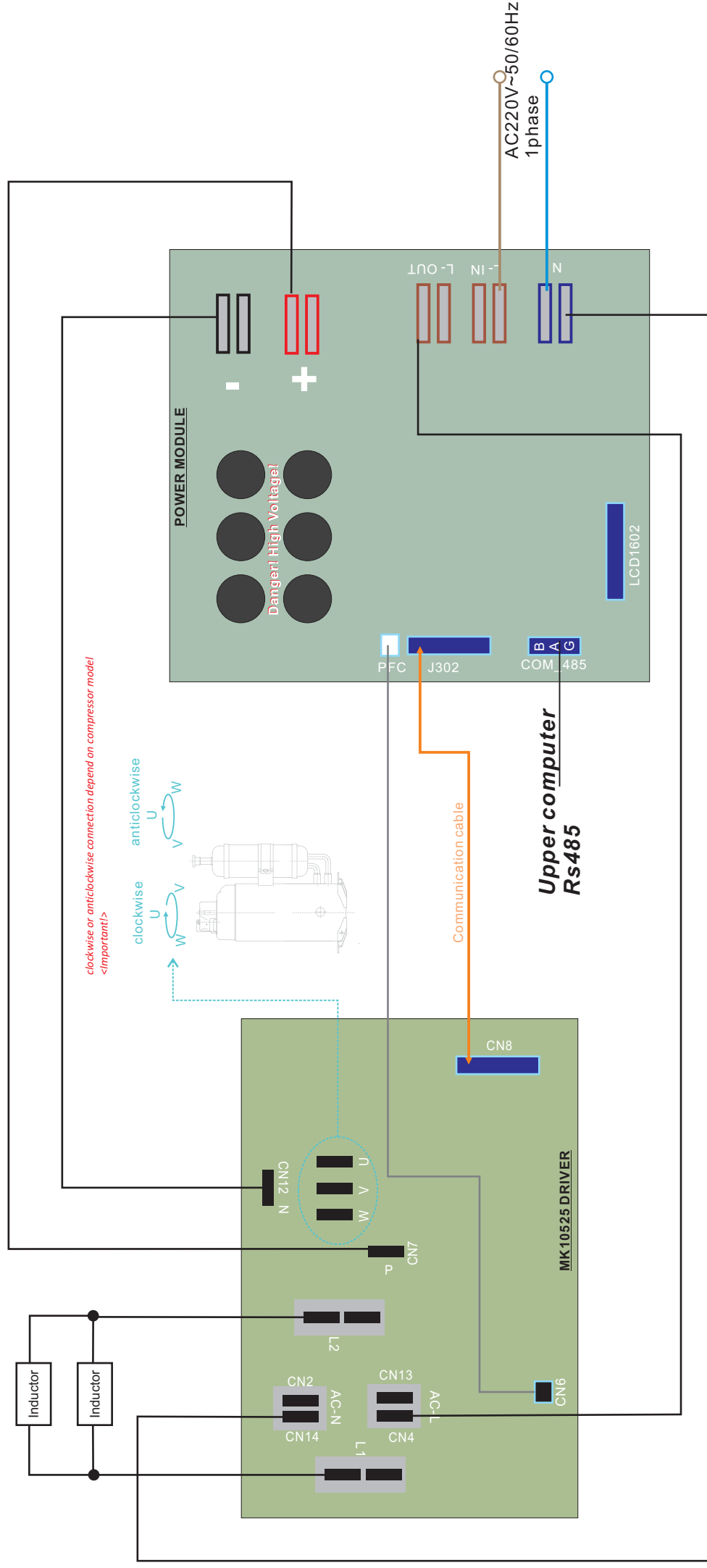
Demo using with Carel PCO plc controller:



Thanks for use Aislu DC Inverter Driver System!

Aislu tech Team

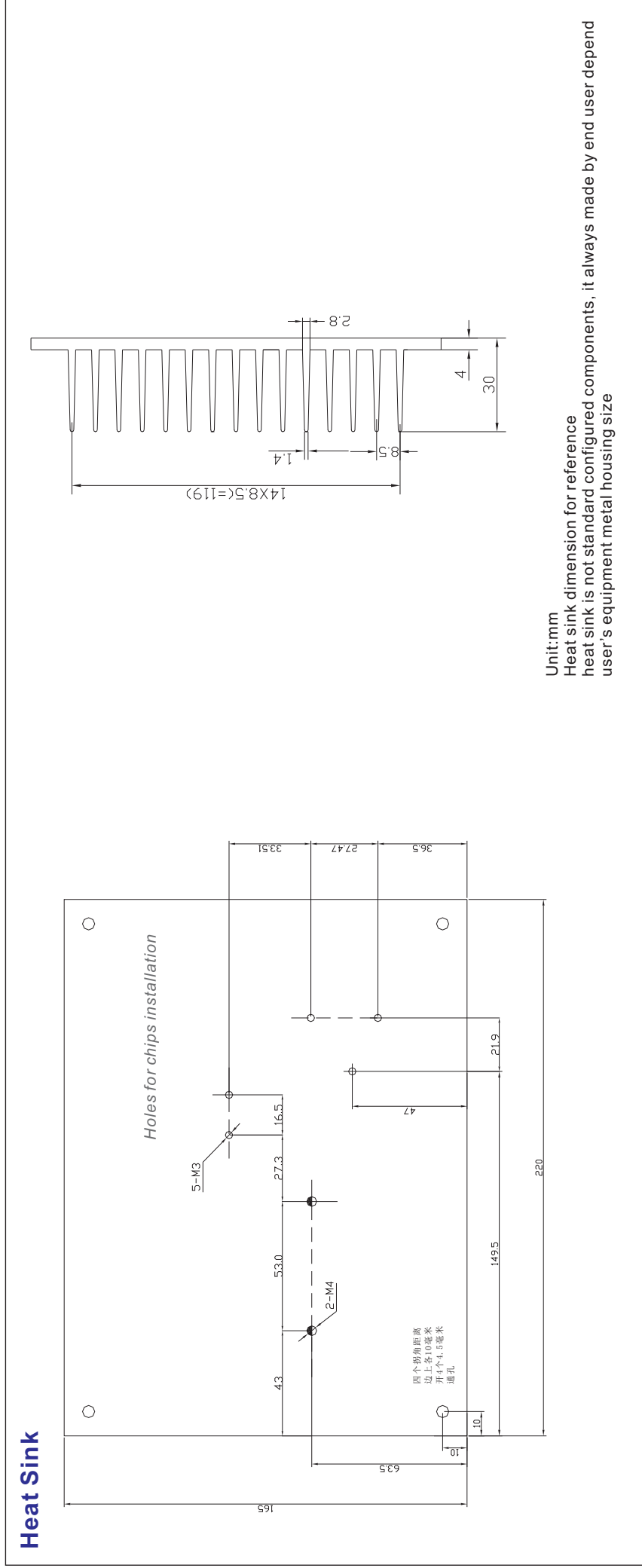
Wiring Connection



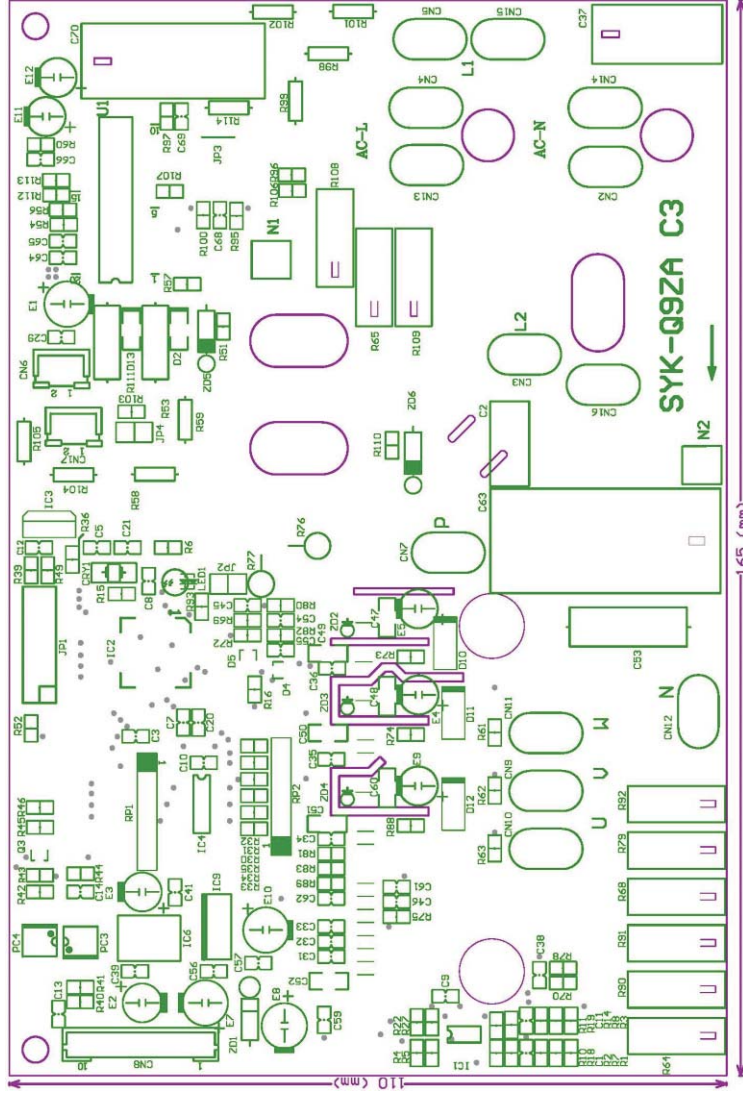
! This driver is used as equipment interior controller, always install or maintain by trained person, Wrong wiring connection could cause board burn or components damage.

Please double check wiring connection is correct before electrify this driver set!

Dimension/Sizes

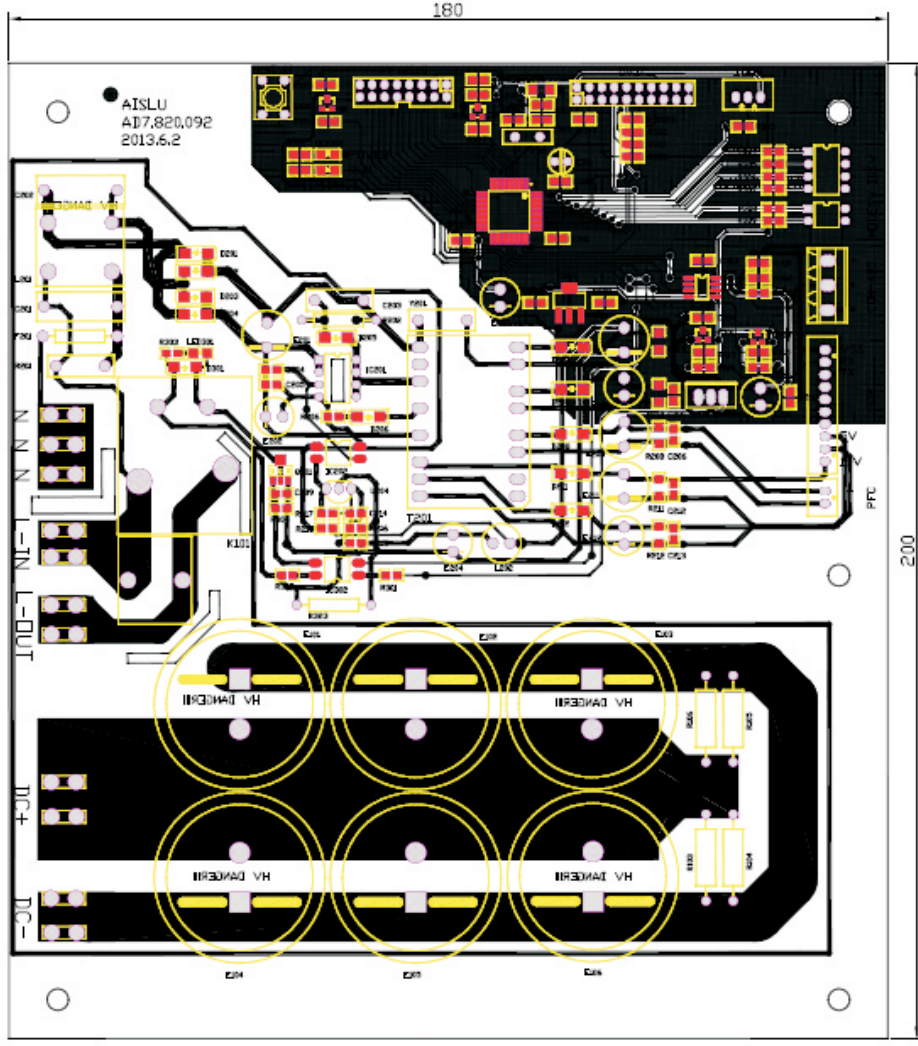


Driver Module



Dimension: L*W
165*110
Max.Height: 35mm

Driver Module



Dimension: L*W
200*180
Max.Height: 50mm

MK10525 Driver Board Yellow LED indicator

There is Yellow LED on MK10525 driver (LED1) PCB; it indicates working or error states through illuminate, Light out, Flash actions;

- (1) **Stand By State:** Compressor stop(Or unconnected compressor), **0.5Hz Flashing**.
- (2) **Working/Running state:** Compressor running, illuminate always.
- (3) **Error/Failure State:** Light out 1 second and illuminate 1 second, then 2Hz flash N times, loop execution, (N times refer below table)

Flash N time, N=(times)	Failure	Description	Remark
1	IPM module Failure	IPM broken or overheat, Communication unnormal, Compressor block.	Check heat sink has well cooling
2	PFC protect	PFC circuit over current	
3	Driving unnormal	Compressor short of phase, or phase sequence wrong, Compressor parameter selection wrong	
4	Current protect	momentary interruption, voltage drop, IPM or compressor abraded	
5	Voltage protection	P, N dc voltage too low or too high	P, N dc voltage normally around 400-420VDC
6	Module over heat protect	IPM module over heat	Should ensure heat sink has fan cool, Normally heat sink share with condenser fan
7	/	/	/
8	Communication error	Check communication wire connection correct	
9	U phase over current	IPM module U phase outputted current peak value too high	
10	V phase over current	IPM module V phase outputted current peak value too high	
11	W phase over current	IPM module W phase outputted current peak value too high	
12	Stall	Compressor motor data wrong in driver software OR compressor unconnected UVW phases.	
13	Fall out step	Compressor motor data wrong in driver software OR starting voltage too low	
14	Current offset	Rectifier bridge hardware failure	
15	Short-phase protect	Compressor short phase	Retain Functionality may not write in software

Notices:

When driver board has errors, the yellow LED flashing program is loop execution, So carefully look at LED, and see Light out 1 second and illuminate 1 second, THEN, begin to count the flashing times. Record the times and find out the errors from above table.



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Modbus Protocol of Aislu Power Module

Document Date: 2013/July/03

Version: AD7.820.094

Communication Basic:

Master as upper computer;

Slave as Aislu Power Module

- 1) Data format: 1 bit start, 8bits data, 2bits stop, No even parity check
- 2) Baud rate: 9600BPS
- 3) Slave Address: manual setup
- 4) Modbus-RTU, 'CRC16' check
- 5) Master polling interval >= 100ms
- 6) Slave received correct data from Master, delay 40ms return data
- 7) Slave received wrong data from Master, no responses, delay 40ms, and re-receiving data from Master
- 8) Master and Slave communication form tables and function code:

Table 1	Function code =1,	
	Master send data to Slave	
Slave Address	0x01	
Function Code	0x01	
Start Address Hi	0x00	
Start Address Lo	0x00	
NO. Of Points Hi	0x00	
NO.Of Points Lo	0x07	
CRC Lo	0xC8(or auto)	
CRC Hi	0x7D(or auto)	

Remark: This function for check the MK10525 driver protection state. Slave return data please see table 2.



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Table 2	Function code =1, Slave return data to Master	
	Slave Address	0x01
Function Code	0x01	
Byte Count	0x01	
Data	Data Bit0 – Bit7 see <i>table2 appendix</i> protection code	
CRC Lo	Depend on system	
CRC Hi	Depend on system	

<i>Table 2 appendix</i>	Table 2, Data value represents meaning		
Content	Description	Protection state	
Bit0	IPM Protection	0:No	1: Yes
Bit1	PFC Protection	0:No	1: Yes
Bit2	Compressor un-normal	0:No	1: Yes
Bit3	Over-voltage protection	0:No	1: Yes
Bit4	Under-voltage protection	0:No	1: Yes
Bit5	Over-current protection/Current inductor fail	0:No	1: Yes
Bit6	Voltage inductor fail*	0:No	1: Yes
Bit7	/ (or reserved bit)	/ (or reserved bit)	

Table 1, Table 2 and Table 2 appendix three tables for use for check driver protection state. And for use function code=1 .



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Table 3	Function code =3,	
	Master send data to Slave	
Slave Address	0x01	
Function Code	0x03	
Start Address Hi	0x00	
Start Address Lo	0x0A(fixed value)	
NO. Of Points Hi	0x00	
NO.Of Points Lo	0x03	
CRC Lo		
CRC Hi		

Remark: CRC is automatic generated by master modbus protocol.

Table 4	Function code =3,	
	Slave return data to Master	
Slave Address	0x01	
Function Code	0x03	
Byte Count	0x06	
Data Hi	0x00	
Data Lo	Compressor frequency on running (nv)*	
Data Hi	0x00	
Data Lo	Input Current (nv)*	
Data Hi	0x00	
Data Lo	DC Voltage (nv)*	
CRC Lo		
CRC Hi		

Remark:

(nv) means the numerical value salve returned.

Compressor frequency on running (nv) = Actual compressor working frequency on running.

Input Current (nv) = Actual working current * 5

DC Voltage (nv) = Actual voltage / 2

Table 3 and Table 4 tables for use for check compressor state. And for use function code=3 .



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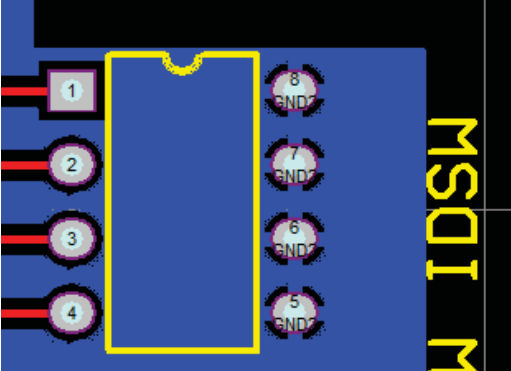
Table 5	Function code =10, (HEX)													
	Master send data to Slave													
Slave Address	0x01													
Function Code	0x10													
Start Address Hi	0x00													
Start Address Lo	0x00(fixed value)													
NO. Of Registers Hi	0x00													
NO. Of Registers Lo	0x06													
Byte Count	0x0C													
Data Hi	0x00													
Data Lo	Compressor target run-frequency													
Data Hi	0x00													
Data Lo	Stop current													
Data Hi	0x00													
Data Lo	Reduce frequency current													
Data Hi	0x00													
Data Lo	Restore current													
Data Hi	0x00													
Data Lo	Control state (0x00)													
Data Hi	0x00													
Data Lo	MK10525 driver max. output current													
CRC Lo														
CRC Hi														
Remark: Compressor target run-frequency = Required compressor working frequency(Hz); Stop current = required driver stop current(A) * 5 Reduce frequency current = required reduce frequency current * 5 Restore current = required restore current * 5 Control state, see below table														
<table border="1"> <thead> <tr> <th>Content</th> <th>Description</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>Bit 0</td> <td></td> <td>0 : NO 1 : YES</td> </tr> <tr> <td>Bit 4</td> <td>Preheat control</td> <td>0 : NO 1 : YES</td> </tr> <tr> <td>Bit 5</td> <td>Force PFC control</td> <td>0 : NO 1 : YES</td> </tr> </tbody> </table>			Content	Description	Remark	Bit 0		0 : NO 1 : YES	Bit 4	Preheat control	0 : NO 1 : YES	Bit 5	Force PFC control	0 : NO 1 : YES
Content	Description	Remark												
Bit 0		0 : NO 1 : YES												
Bit 4	Preheat control	0 : NO 1 : YES												
Bit 5	Force PFC control	0 : NO 1 : YES												
Stop current, reduce frequency current, restore current are calculated by MK10525 software and are not precise value, there is no electronic circuit or equipment for measuring the current value on MK10525 driver.														



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Table 6	Function code =10,	
	Slave return data to Master	
Slave Address	0x01	
Function Code	0x10	
Start Address Hi	0x00	
Start Address Lo	0x0F	
NO. Of Registers Hi	0x00	
NO. Of Registers Lo	0x06	
CRC Lo		
CRC Hi		

9) Setup slave address through pin switch



IDSW, Slave Address Pin Switch		
Pin Position	Value 1	Value0
1	1	0
2	1	0
3	1	0
4	1	0

Read position order: 4 -> 3 -> 2 -> 1
 For example, setup slave address 01,
 Pin position - value
 4-0, 3-0, 2-0, 1-1