OTTO ARC SYSTEMS, INC.

SERVICE MANUAL

ODEL: OW-Arc 400

- ✧ **Safety Depends on You!**
- ✧ **DO NOT install, repair this equipment without reading this manual and the safety precautions contained throughout!**
- ✧ **MOST IMPORTANTLY, think before you act and be careful!**

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Dear Reader

Thank you for choosing OTTO ARC SYSTEM, INC. This instruction manual will help you get to know your new machine. Read the manual carefully and you will soon be familiar with all the great features.

Please also take special note of the safety instruction – and observe them! In this way, you will help to ensure more safety at you product location. And of course, if you treat your machine carefully, this definitely helps to prolong its enduring quality and reliability – things which are both essential prerequisites for getting outstanding results.

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Contents

Safety Instructions

For your own safety!

Warning: Observe accident prevention regulations.

Ignoring the following safety procedures can be fatal.

◆ Before undertaking welding tasks, put on prescribed dry protective clothing, e.g. gloves.
◆ Protect eyes and face with protective visor.

Electric shocks can be fatal

◆ The machine may only be connected to correctly earthed sockets.
◆ Only operate with intact connection lead including protective conductor and safety plug.
◆ An improperly repaired plug or damaged mains cable insulation can cause electric shocks.
◆ The machine may only be opened by qualified and authorized personnel.
◆ Before opening, pull out the mains plug. Switching off is not sufficient. Wait for 2 minutes until capacitors are discharged.
◆ Always put down welding torch, stick electrode holder in an insulated condition.

Even touching low voltages can cause you to jump and lead to accidents, so:

◆ Safeguard yourself against falls, e.g. from a platform or scaffolding.
◆ When welding, operate earth tongs, torch and work-piece properly, not in ways for which they are not intended. Do not touch live parts with bare skin.
◆ Only replace electrodes when wearing dry gloves.
◆ Never use torches or earth cables with damaged insulation.

Smoke and gases can lead to breathing difficulties and poisoning.

◆ Do not breathe in smoke and gases.
◆ Ensure that there is sufficient fresh air.
◆ Keep solvent vapors away from the arc radiation area. Chlorinated hydrocarbon fumes can be converted into poisonous phosgene by ultraviolet radiation.

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Work-piece, flying sparks and droplets are hot

◆ Keep children and animals well away from the working area. Their behavior is unpredictable.
◆ Move containers with inflammable or explosive liquids away from the working area.
◆ There is a danger of fire and explosion.
◆ Never heat explosive liquids, dusts or gases by welding or cutting. There is also a danger of explosion if apparently harmless substances in closed containers are able to build up excess pressure when they are heated.

Take care to avoid fire hazards

◆ Any kind of fire hazards must be avoided. Flames can form e.g. when sparks are flying, when parts are glowing or hot slag is present.
◆ A constant check must be kept on whether fire hazards have been created in the working area.
◆ Highly inflammable objects, such as matches and cigarette lighters for example, must not be carried in trouser pockets.
◆ You must ensure that fire extinguishing equipment – appropriate to the welding process is available close to the welding work area and that easy access is possible.
◆ Containers in which fuels or lubricants have been present must be thoroughly cleaned before welding begins. It is not sufficient simply for the receptacle to be empty.
◆ After a work-piece has been welded, it must only be touched or brought into contact with inflammable material when it has cooled down sufficiently.
◆ Loose welding connections can completely destroy protective conductor systems of interior installations and cause fires. Before beginning welding work, ensure that the earth tongs are properly fixed to the work-piece or welding bench and that there is a direct electrical connection from the work-piece to the power source.

Noise exceeding 70 dBA can cause permanent hearing damage

◆ Wear suitable earmuffs or plugs.
◆ Ensure that other people who spend time in the working area are not inconvenienced by the noise.

Secure gas cylinder

◆ Place shielding gas cylinders in the holders provided for them and secure with safety chains.
◆ Take care when handling cylinders; do not throw or heat, guard against them toppling over.
◆ When moving by crane, take off the gas cylinder from the welding machine.

Caution: Interference by electrical and electromagnetic fields if possible e.g. from the welding machine or from the high-voltage pulses of ht ignition unit.

◆ As laid down in electromagnetic compatibility standard EN50199, the machines are intended for use in industrial areas; if they are operated e.g. in residential environments problems can occur in ensuring electromagnetic compatibility.
◆ The functioning of heart pacemakers can be adversely affected when you are standing near the welding machine.
◆ Malfunctioning of electronic equipment in the vicinity of the welding location is possible.
◆ Other mains supply leads, trip leads, signal and telecommunications leads above, under and near the welding device may be subject to interference.

Warning: Electromagnetic interference must be reduced to such a level that with no longer constitutes interference.

Possible reduction measures:

◆ Welding machines should be regularly maintained
◆ Welding leads should be as short as possible and run closely together on or near to the ground.
◆ Selective shielding of other leads and equipment in the environment can reduce radiation.

Caution: Repairs and modifications may only be carried out by authorized, trained, specialist personnel.

The warranty becomes null and void in the event of unauthorized interference.

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Our operating instructions will provide you with an introduction into the safe use of the machine.

Therefore please read them carefully and only start with when you are familiar with them.

Transportation and installation!

The machine may only be transported and operated in an upright position.

Before carrying away or moving, please pull out main plug and place the machine properly.

Ambient conditions

This machine must not be operated and storage in any area where any risk of explosion exists.

The following conditions must be observed during operation:

Temperature range of the ambient air

✧ During welding: -10°C to +40°C;
✧ For transport and storage: -25°C to +55°C;
✧ Using the appropriate coolant;
Relative air humidity

✧ Up to 50% at 40°C
✧ Up to 90% at 20°C
The ambient air must be free of unusual amounts of dust, acids, corrosive gases or substances, etc., assuming these are not produced by the welding process.

Examples of unusual operating conditions:

✧ Unusual corrosive smoke,
✧ Vapour,
✧ Excessive oil vapour,
✧ Unusual vibrations or jolts,
✧ Excessive quantities of dust such as grinding dust etc.,
✧ Severe weather conditions,
✧ Unusual conditions near the coast or on board ship.
When setting up the machine, ensure a free inlet and outlet of air. The machine is tested to protection class IP23.

1. **Preface**

   ✧ OW-Arc400 power source is one of the most important new developed orbital welding power sources in 2008~2009, which is using of BECKHOFF control modular from Germany, standard TIG400 inverter, and we develop new generation control pendant which is easily for programming, operation, display and service etc. We may encounter problem during the practical application, so we hope to perfect the power source as early as possible under all departments' efforts.

   ✧ Please read OW-Arc400 welding power source operator's manual and ensures you are master of basic operation before reading the service manual.

2. Machine description

2.1 Main function

✧ 1 set, protective gas control

✧ 1 set, compressed air control

✧ 1 set, circuit water control

✧ 2 set, DC drive control (incl. 4 set direction signal, 2 set simulation signal)

✧ 2 set, step drive control

✧ 1 set, inverter enable control

✧ 1 set, inverter high frequency control

✧ 1 set, inverter simulation output

✧ 1 set, inverter current sampling

✧ 1 set, voltage sampling (inverter voltage or torch voltage, incl. temporary voltage switch and sampling voltage switch function)

✧ 4 set, error signal sampling (incl. inverter error, arc ignition failure, work-piece short, water test)

✧ 1 set, remote pendant control (RS232 communication)

✧ 1 set, torch panel control (keyboard matrix scan)

2.2 Components description

OW-Arc400 is made up of:

✧   Beckhoff screen, 1 set;

✧   Beckhoff module, 1 set

✧   Control transformer;

✧   DC24V power switch, 2set;

✧   Power board, 1 set;

✧   Interface board, 1 set;

✧   Inductance board, 1 set;

✧   DC drive board, 1 set;

✧   DC drive interface board (voltage converter: 15V~24V), 1 set;

✧   10C8 filter board, 4 set;

✧   Protective gas circuit, 1 set;

✧   Compressed air circuit, 1 set;

✧   Water circuit, 1 set;

✧   TIG400 inverter, 1 set (OW-Arc400 alarm signal is 24V; the rests are 15V.)

2.3 System components layout

We need to open three covers for maintenance, i.e. top cover, left cover and right cover. Please refer to pictures below:

※ Open the left cover for inspection: inverter power amplifier board, inverter mainboard, high frequency board, BH interface board, inductance board, pump, water detection, inverter heat dissipation fan, water circuit cooling fan.

Inverter mainboard

BH interface board

Inverter heat dissipation fan

Inverter power amplifier board

Inductance board

Water circuit cooling fan

Water detection

Pump

High frequency board

Left View
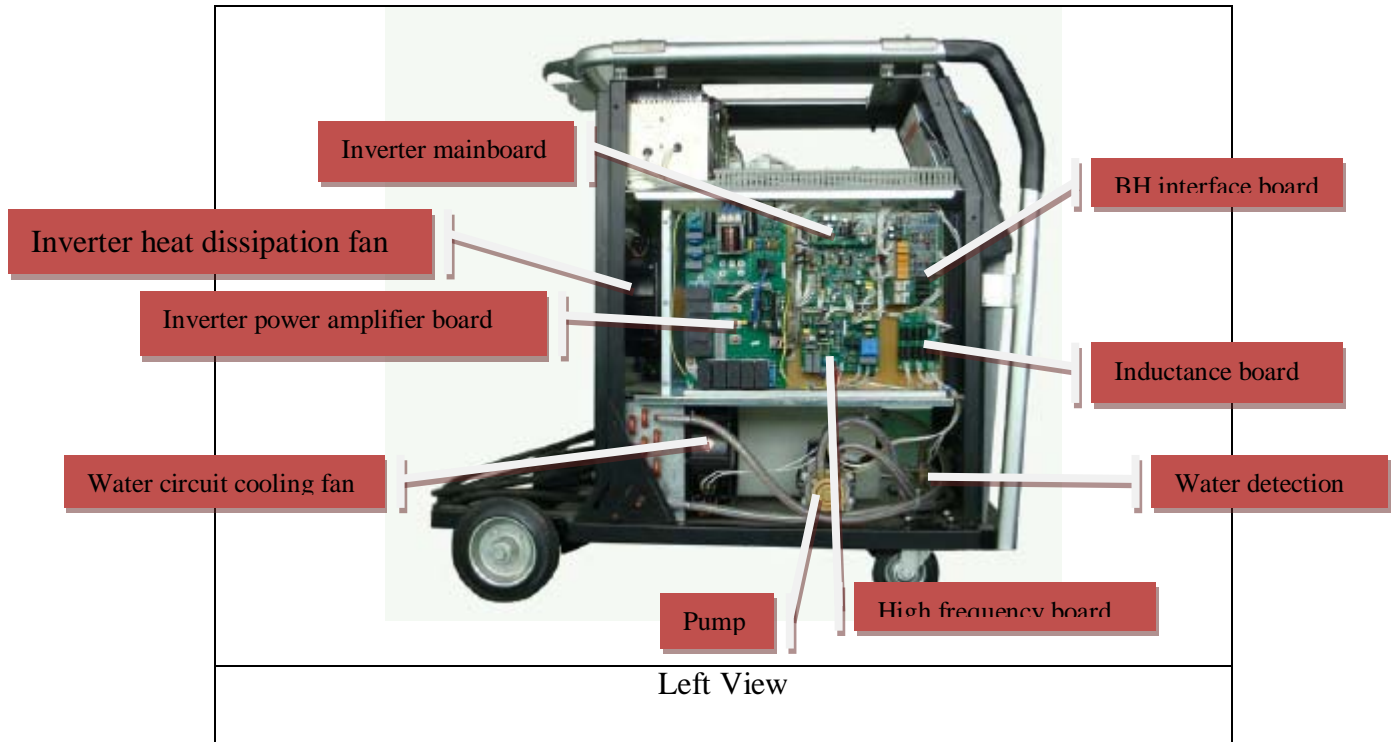
※ Open the right cover for inspection: inverter output, DC drive board, aviation plug

DC drive board · Aviation plug · Inverter output
Right View
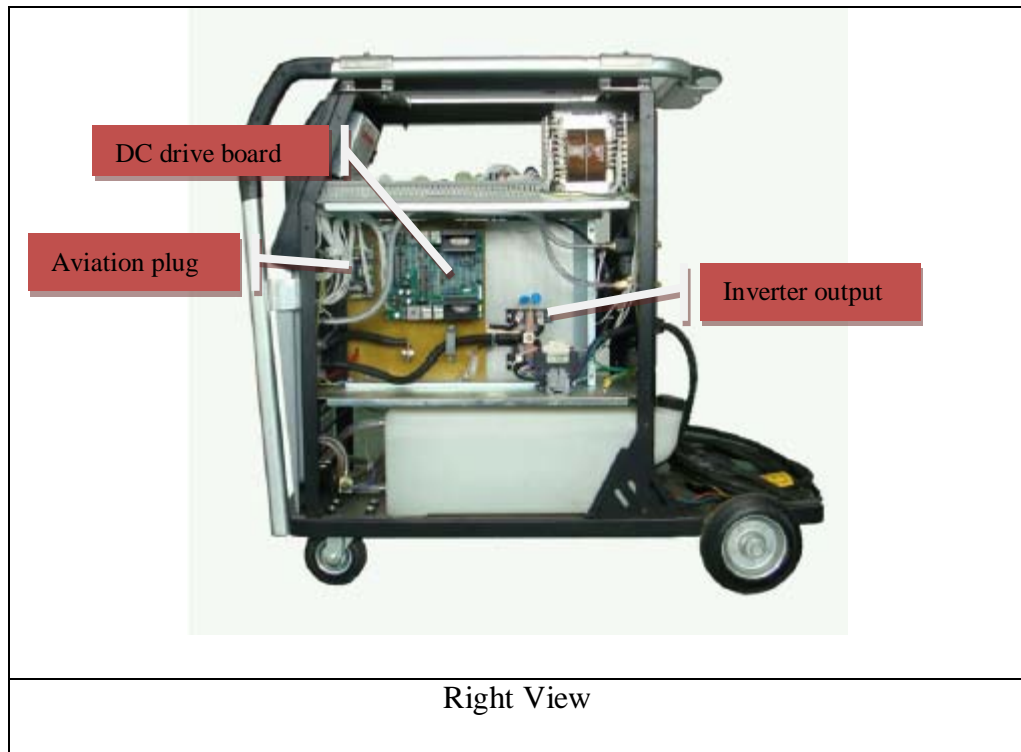
※ Open the top cover for inspection: control transformer, power switch, Beckhoff modular, display, BH power board, 10C8 (1), 10C8 (2), 10C8 (3).

Power switch / Transformer / BECKHOFF modular / BH power board / 3 piece 10C8 / Display
Top View
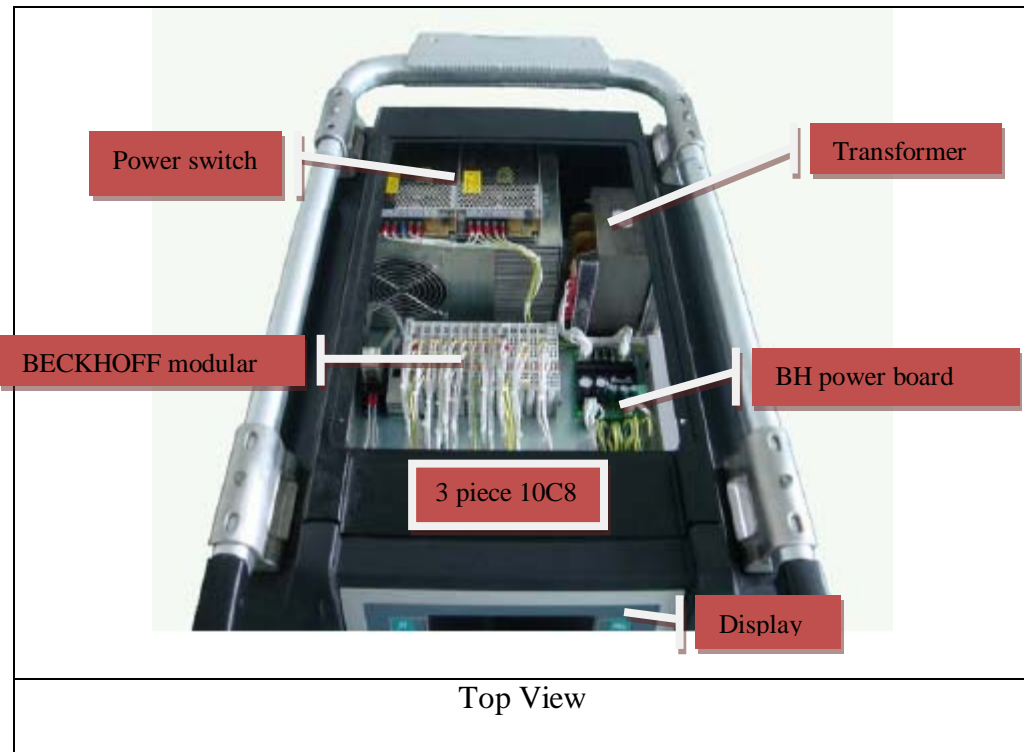
3. Beckhoff modular description

3.1 OW-Arc400 power source Beckhoff modular

※ Beckhoff screen, 1 set;

※ Beckhoff modular, 1 set

Communication Number

Connection port Number

Connection port
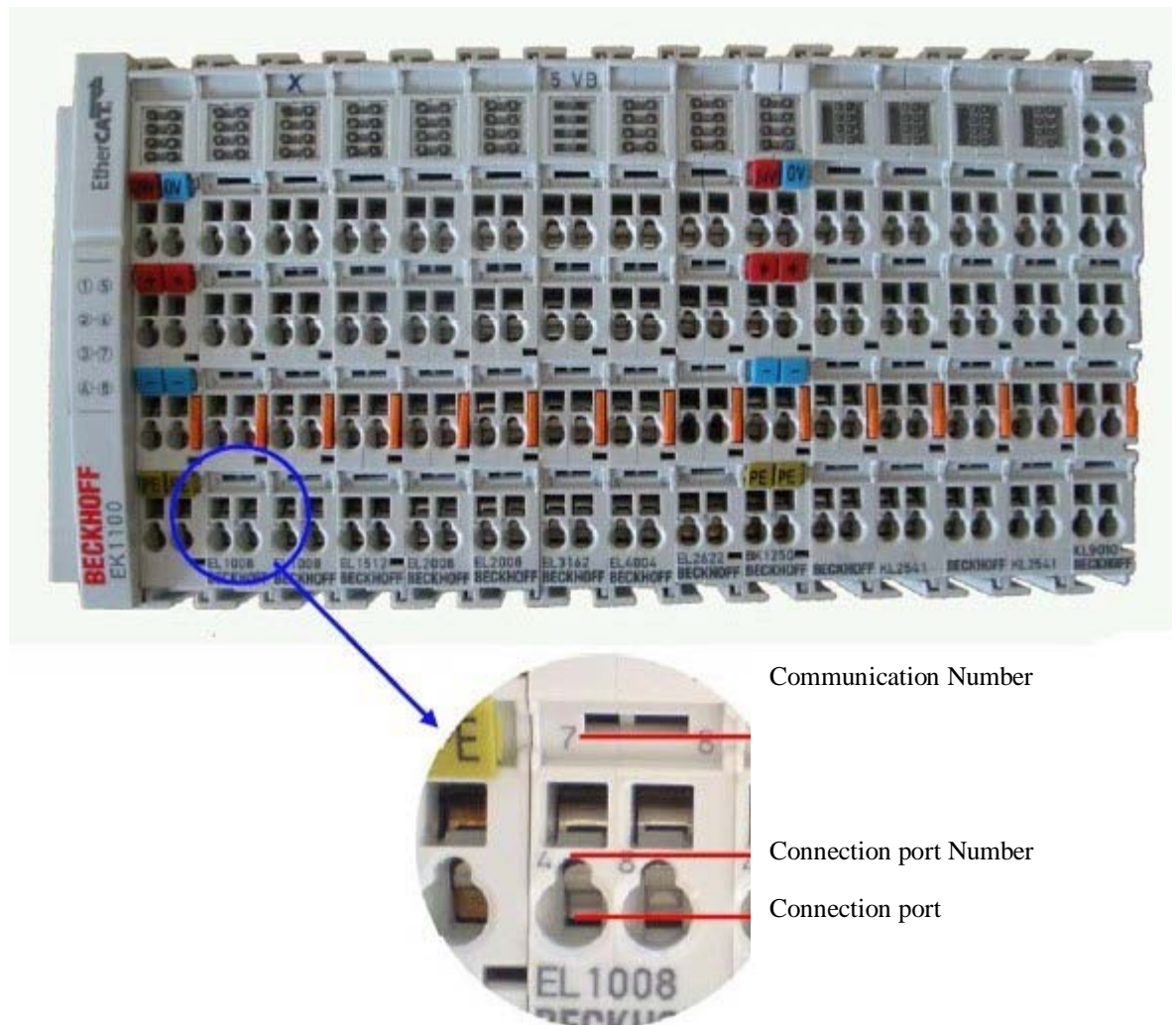
Beckhoff modular appearance

Notice:

1) All the Beckhoff modular is installed in sequence (The sequence is EK1100, EL1008*2, EL1512, EL2008*2, EL3162, EL4004, EL2622, BK1250, KL2541*2, KL9010);

2) There are two sets of number beside the port for the ELxxxx series modular, one set is connection port number (near the connection port), and another set is communication number (far away the connection port). Please refer to the picture above.

3) Beckhoff modular power supply: a, BUS power – provide power for communication; b, external power – provide all the external control signal; c, KL2541 drive power supply – provide step motor. All the three power supply is mutually independent. Please be careful when you execute the measurement.

   ※ BUS power: EK1100 (24V interface) and BK1250 (0V interface);

   ※ External power: EK1100 ("+" interface) and BK1250 ("-" interface). EL1512 ("+" interface) and EL3162 ("-" interface) are also connected. All the "+" are equipotential points, meanwhile all the "-" are equipotential points as well. All the "-" interface are normally used for external power supply measurement;

   ※ KL2541 drive power supply: KL2541 interface 4' (+) and 8' (-);

3.2 Beckhoff screen
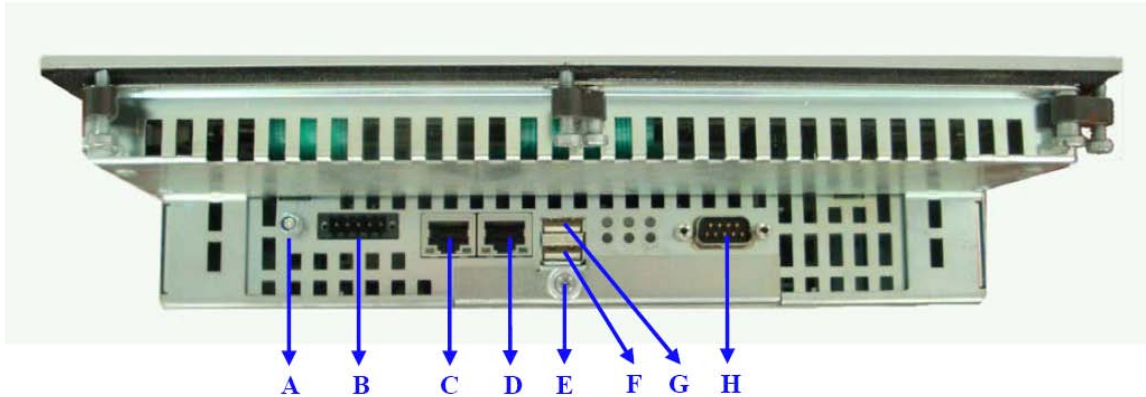
Item	Interface	Channel	Function	Note
A	/	/	Grounding bolt	
B	X106	24V IN	Power interface	
C	X104	LAN2 10/100M	Connect to PC	Reverse connection of X104 and X105 are not allowed
D	X105	LAN1 10/100M	Connect to EK1100 X1 IN interface	
E	/	/	Cover screw (used for Flash and battery replacement)	
F	X102	USB1.1	USB socket	
G	X103	USB2.0	USB socket	
H	X101	COM1	RS232 interface	

3.3 EK1100 / EtherCAT coupler

EK1100 coupler is used for the connection of EtherCAT (the screen) and EtherCAT terminal (ELxxxx). One modular is made up of one EK1100 coupler

and sever (MAX 65535) EtherCAT terminal and one BUS end terminal. The coupler and E BUS signal will converter with each other though LAN.

The coupler connects to the Beckhoff screen through X1 IN LAN port (up), and connects to other EtherCAT device through X2 OUT (down) on the same BUS.

Function						
Item	Terminal	Interface	Channel	Function	Status	Note
1		24V	/	BUS power 24V+		
2		0V	/	BUS power 24V-		
3		+	/	External power +		Two set of "+" connected.
4	EK1100	+	/	External power +		
5		-	/	External power -		Two set of "-" connected.
6		-	/	External power -		
7		PE	/	Grounding		
8		PE	/	Grounding		

3.4 EL1008 / 8-channel digital input terminal, 24V DC

EL1008 digital input terminal interface includes 8 set of digital input. 15V~30V is Logic 1, -3V~5V is Logic 0. All the channel status is showed by corresponding LED indicator. The light on is 1, and light off is 0.
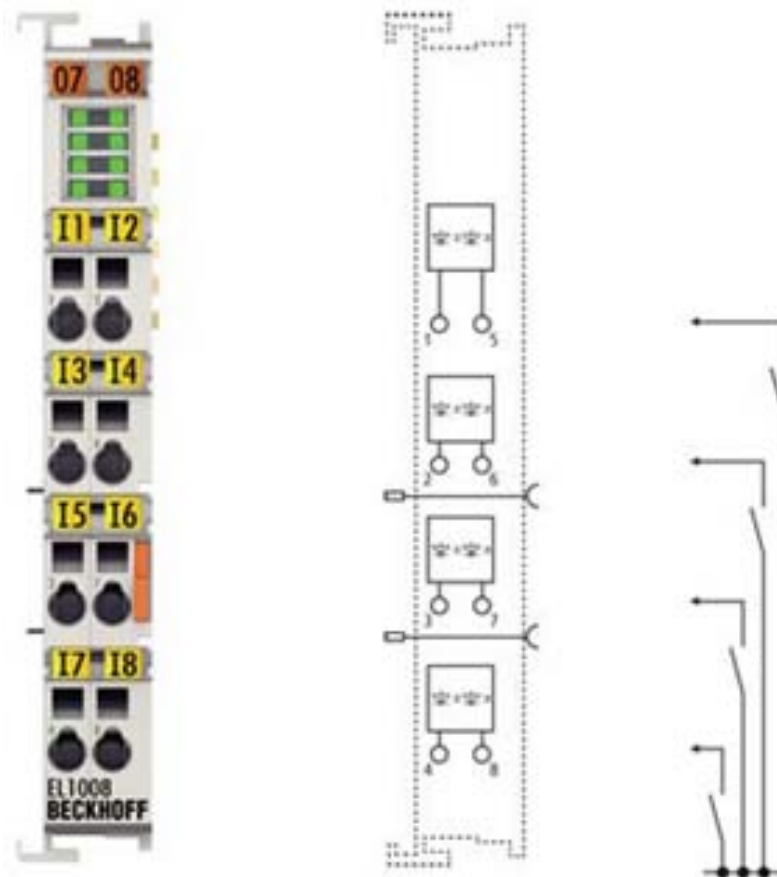
Function						
Item	Terminal	Interface	Channel	Function	Status	Note
1		1	Input 1	Inverter error		
2	EL1008	2	Input 2	Arc ignition OK		
3	(1)	3	Input 3			Two set of "+" connected.
4		4	Input 4			

5		5	Input 5			Two set of "-" connected.
6		6	Input 6			
7		7	Input 7	Work-piece short		
8		8	Input 8	Water pressure test		

Function						
Item	Terminal	Interface	Channel	Function	Status	Note
1		1	Input 1	S0		
2		2	Input 2	S1		
3		3	Input 3	S2		Two set of "+" connected.
4	EL1008	4	Input 4	S3		
5	(2)	5	Input 5	PSTOP	1: ON; 0: OFF	Two set of "-" connected.
6		6	Input 6	Head clamp	1: ON; 0: OFF	
7		7	Input 7	Head release	1: ON; 0: OFF	
8		8	Input 8			

3.5 EL1512 / 2-channel plus/minus counter terminal, 24V DC, 1kHz

EL1512 counter terminal to measure pulse signal. We use DC drive encoder feedback signal to determine rotation position and other related control.

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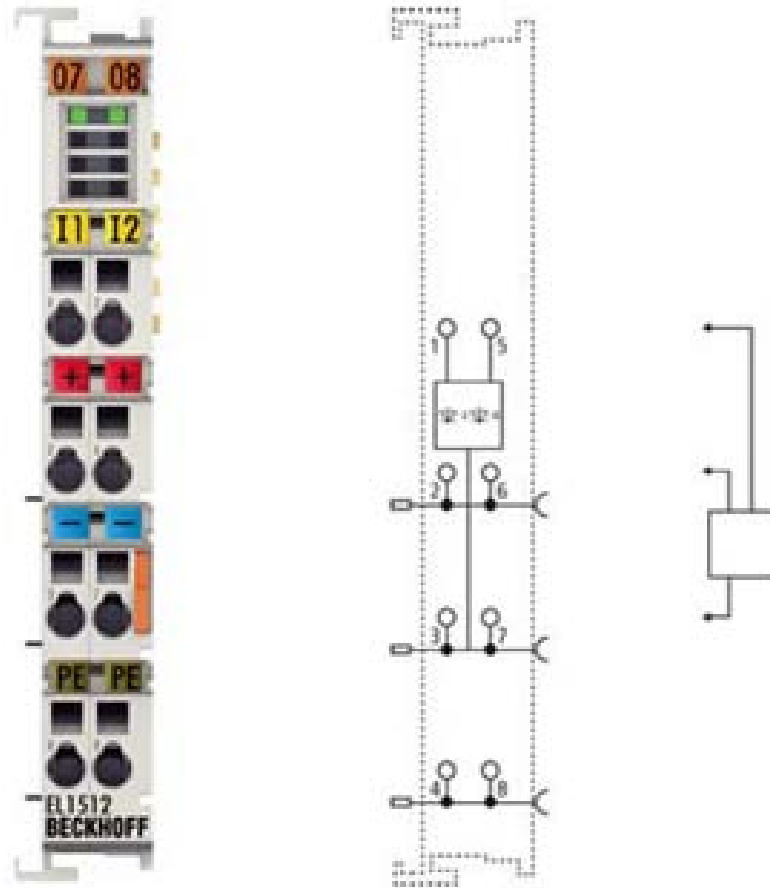
Function						
Item	Terminal	Interface	Channel	Function	Status	Note
1		1	F			
2		2	+	External power 24V+		
3		3	-	External power 24V-		
4	EL1512	4	1			
5		5	P	Encoder feedback		
6		6	+	External power 24V+		
7		7	-	External power 24-		

8		8	2			

3.6 EL2008 / 8-channel digital output terminal, 24V DC, 0.5A

EL2008 digital input terminal includes 8 channels digital output interface. Each channel maximum current is 0.5A. All the channel status is showed by corresponding LED indicator. The light on is 1, and light off is 0.
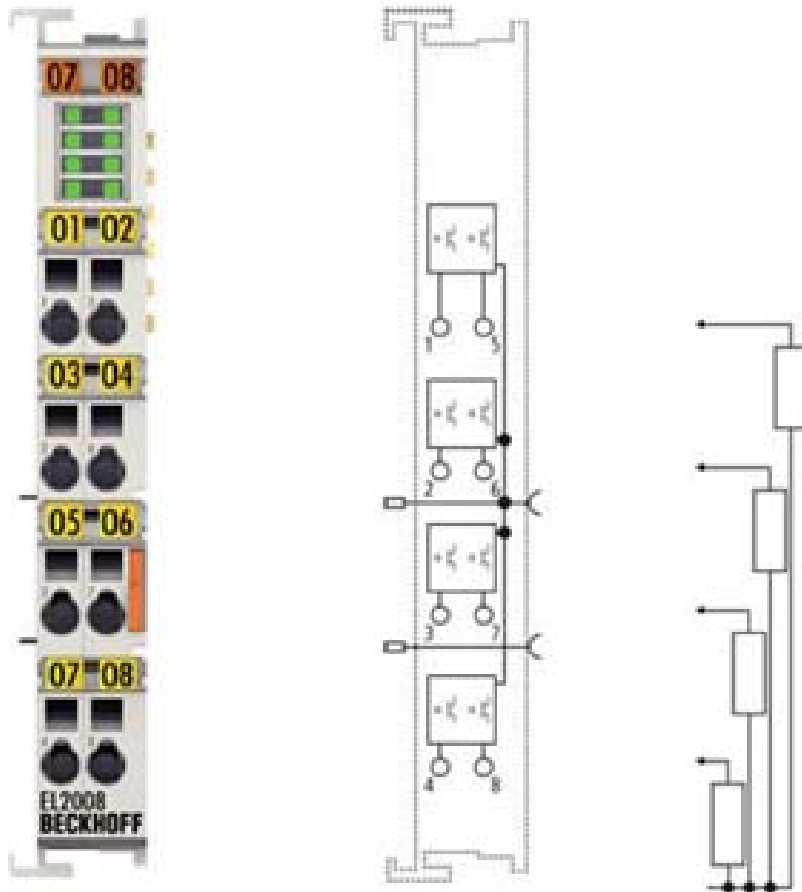
Function						
Item	Terminal	Interface	Channel	Function	Status	Note
1	EL2008	1	Output	Gas I	1: gas on; 0:	

	(1)		1		gas off	
2		2	Output 3	Gas II	1: gas on; 0: gas off	Reserved
3		3	Output 5	Temporary voltage	1: cut off; 0: connect	
4		4	Output 7	Sampling switch	1: inverter; 0: head	
5		5	Output 2	Rotation leftwards	1: start; 0: stop	
6		6	Output 4	Rotation rightwards	1: start; 0: stop	
7		7	Output 6	Wire feeding leftwards	1: start; 0: stop	
8		8	Output 8	Wire feeding rightwards	1: start; 0: stop	

Function						
Item	Terminal	Interface	Channel	Function	Status	Note
1	EL2008 (2)	1	Output 1	L1		To head control panel send 1
2		2	Output 3	L2		To head control panel send 2
3		3	Output 5			
4		4	Output 7			

5		5	Output 2	Water pump control	1: start; 0: stop	
6		6	Output 4	Compressed air valve control	1: start; 0: stop	
7		7	Output 6			
8		8	Output 8			

3.7 EL3162 / 2-channel analog input terminal 0~10V

EL3162 analog input terminal is able to get signal between 0V~10V. There are 2 input channels for this terminal, respectively used for current sampling and voltage sampling.
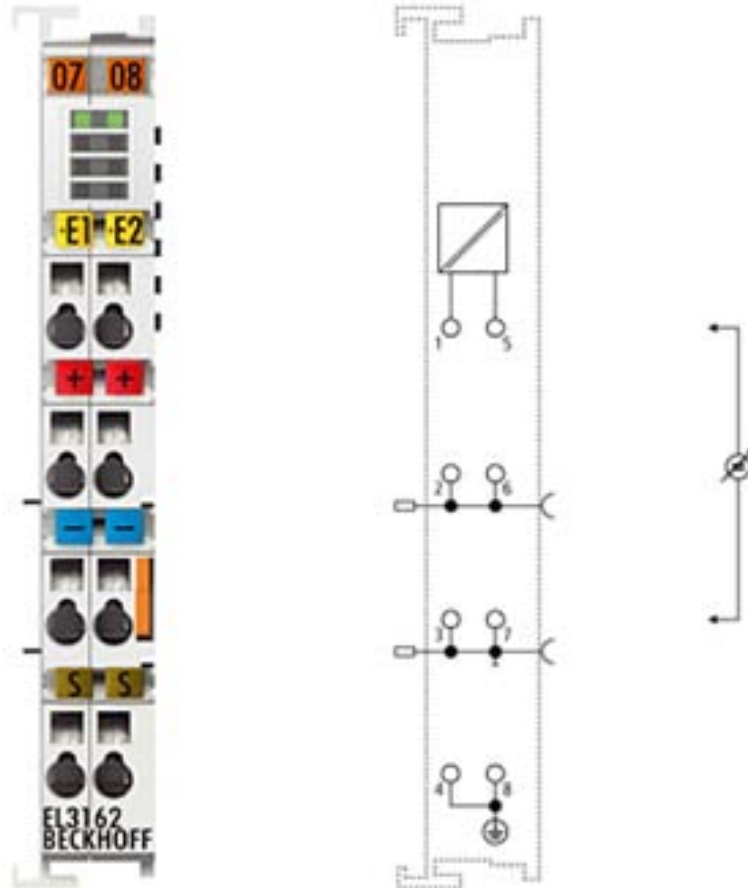
Function						
Item	Terminal	Interface	Channel	Function	Status	Note
1	EL3162	1	Channel 1	Current sampling	0~10V corresponding to 0~400A	
2		2	+	External power 24V+		
3		3	-	External power 24V-		
4		4	S	Shielding		

				interface		
5		5	Channel 2	Voltage sampling	0~10V corresponding to 0~60V	
6		6	+	External power 24V+		
7		7	-	External power 24V-		
8		8	S	Shielding interface		

3.8 EL4004 / 4-channel analog output 0~10V

EL4004 analog output terminal is to output 0~10V signal. There are four output channels on this terminal, respectively used for inverter current control, rotation speed control and wire feeding speed control.
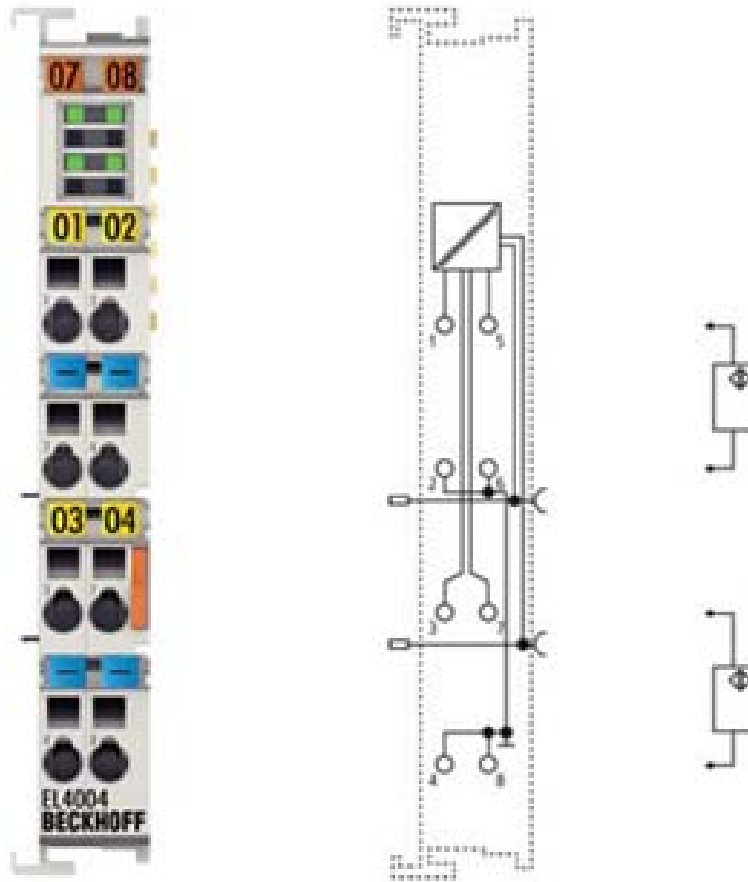
Function						
Item	Terminal	Interface	Channel	Function	Status	Note
1		1	Channel 1	Current control	0~10V corresponding to 0~400A	
2		2	G			
3	EL4004	3	Channel 3	Rotation control	0~10V corresponding to 55~1100Hz	
4		4	G			
5		5	Channel	Wire feeding	0~10V corresponding to	

			2	control	55~1100Hz	
6		6	G			
7		7	Channel 4			
8		8	G			

3.9 EL2622 / 2-channel relay output terminal

There are two independent relay inside of EL2622 output terminal, each relay has one single normal open contact, which respectively used for inverter start control and high frequency start control.
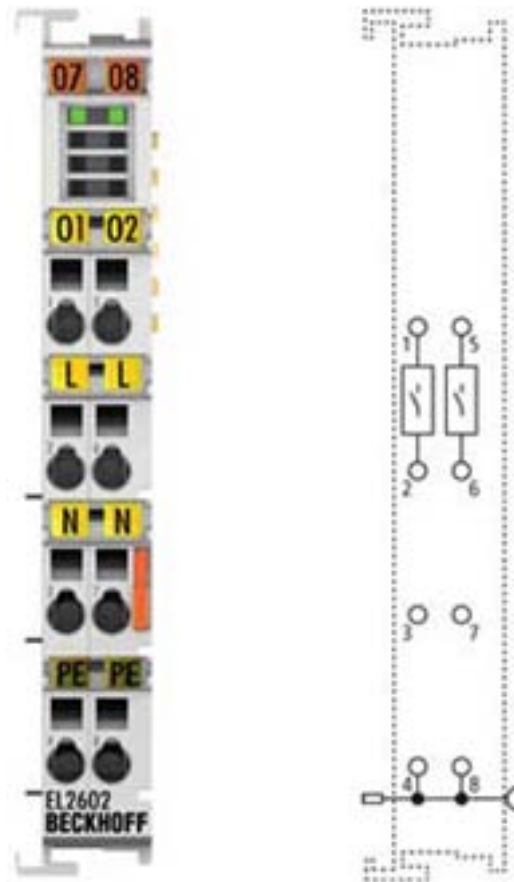
Function						
Item	Terminal	Interface	Channel	Function	Status	Note
1		1	Channel 1	Current start	1: start; 0: stop	
2		2	Channel 1			
3	EL2622	3	/			
4		4	PE			
5		5	Channel 2	High frequency start	1: start; 0: stop	
6		6	Channel 2			

7		7	/			
8		8	PE			

3.10 BK1250 / connection of E-BUS and K-BUS terminal module compact coupler

In the BUS station application mixing with E-BUS terminal module (ELxxxx) and K-BUS terminal module (KLxxxx), BK 1250 is called "BUS coupler with terminal module shell". BK 1250 is able to combine 300 kinds of K-BUS terminal module (including special terminal module) and high-speed communication, and big bandwidth EtherCAT terminal module very well.

Function						
Item	Terminal	Interface	Channel	Function	Status	Note
1		24V	/	BUS power 24V+		
2		0V	/	BUS power 24V-		
3		+	/	BUS power 24V+		
4	EL1250	+	/	BUS power 24V+		E, K BUS
5		-	/	BUS power 24V-		switchover
6		-	/	BUS power 24V-		
7		PE	/	Grounding		
8		PE	/	Grounding		

3.11 KL2541 / step motor terminal, 50V DC, 5A

KL2541 step motor terminal is used for medium performance step motor. We only need to adjust several parameters, and KL2541 will be able to be suitable for particular motor and application. 64 micro-step to ensure the motor running stable and accurate.
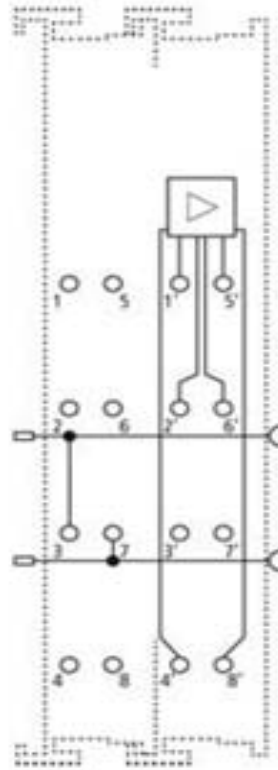
Function						
Item	Terminal	Interface	Channel	Function	Status	Note
1	KL2541 (1)	1'	A	AVC motor	A, A' a pair of coil	Double-terminal module, left terminal - empty
2		2'	B		B, B' a pair of coil	
3		3'				
4		4'	Drive power +			
5		5'	A'		A, A' a pair of coil	
6		6'	B'		B, B' a pair of coil	

7		7'			
8		8'	Drive power -		

Function						
Item	Terminal	Interface	Channel	Function	Status	Note
1	KL2541 (2)	1'	A	OSC motor	A, A' a pair of coil	Double-terminal module, left terminal - empty
2		2'	B		B, B' a pair of coil	
3		3'				
4		4'	Drive power +			
5		5'	A'		A, A' a pair of coil	
6		6'	B'		B, B' a pair of coil	
7		7'				
8		8'	Drive power -			

3.12 KL9010 / K-BUS end terminal

KL9010 K-BUS end terminal is used for end of K-BUS terminal module (KLxxxx). No external connection.

4. PCB board description

4.1 BH connection board

✧ Function: provide temporary voltage, temporary voltage switchover, sampling voltage switchover, relay control, voltage convert. Please refer to the attachment.
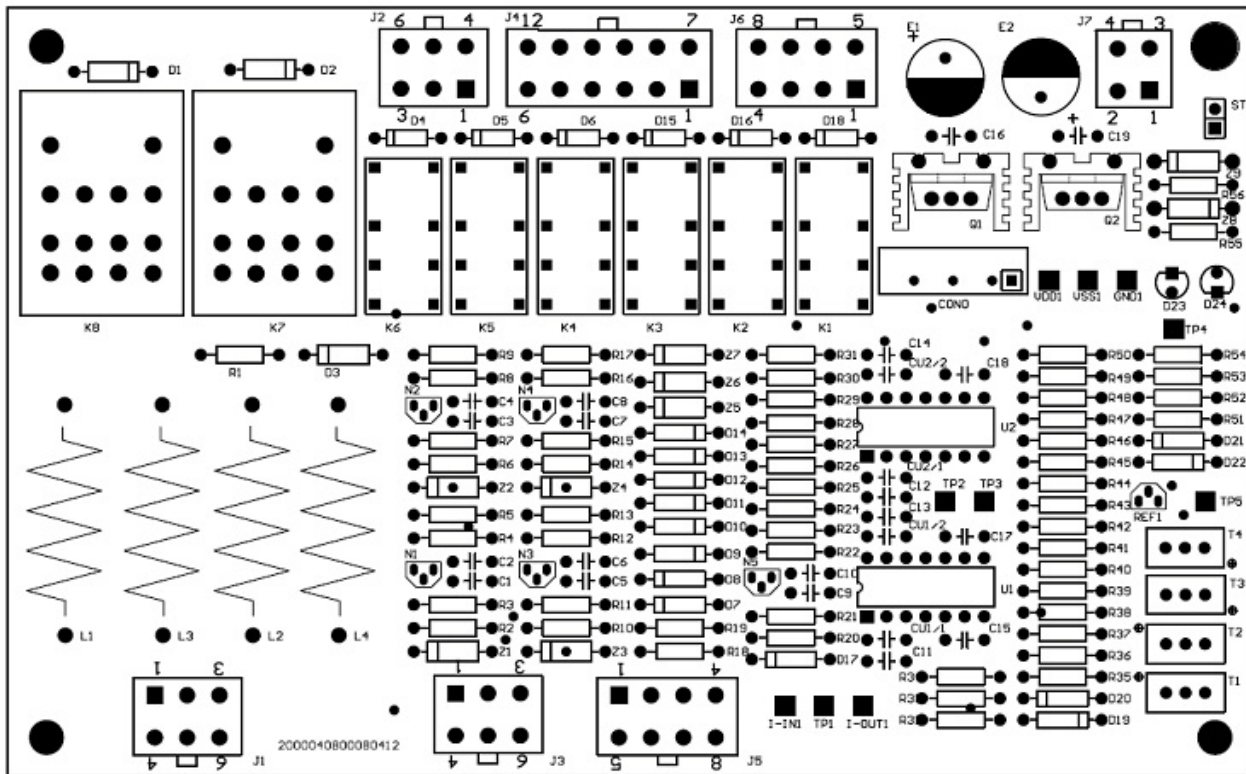
Plug Number	Pin Number	Function	Pin Number	Function
J1	J1-1	Torch +	J1-4	Inverter +
	J1-2	Empty	J1-5	Empty
	J1-3	Torch -	J1-6	Inverter -

J2	J2-1	AC220V input	J2-4	AC220V output
	J2-2	Empty	J2-5	Empty
	J2-3	AC220V input	J2-6	AC220 output
J3	J3-1	Empty	J3-4	Empty
	J3-2	Empty	J3-5	Empty
	J3-3	Empty	J3-6	Empty
J4	J4-1	Air valve power DC24+	J4-7	Protective gas valve
	J4-2	Air valve power DC24+	J4-8	Compressed air valve
	J4-3	Empty	J4-9	Empty
	J4-4	Empty	J4-10	Empty
	J4-5	Empty	J4-11	Empty
	J4-6	Empty	J4-12	Empty
J5	J5-1	Empty	J5-5	Empty
	J5-2	Empty	J5-6	Voltage feedback
	J5-3	Empty	J5-7	Work-piece short signal
	J5-4	Empty	J5-8	GND
J6	J6-1	Protective gas valve	J6-5	Empty
	J6-2	Compressed air valve	J6-6	Temporary voltage switchover
	J6-3	Empty	J6-7	Water pump control
	J6-4	Empty	J6-8	Sampling voltage switchover
J7	J7-1	DC24V+ input	J7-3	GND
	J7-2	DC34V- input	J7-4	GND

4.2 BH power board

✧ Function: provide step motor DC power, Beckhoff modules external power, control pendant power, BH interface board power. Please refer to the attachment.
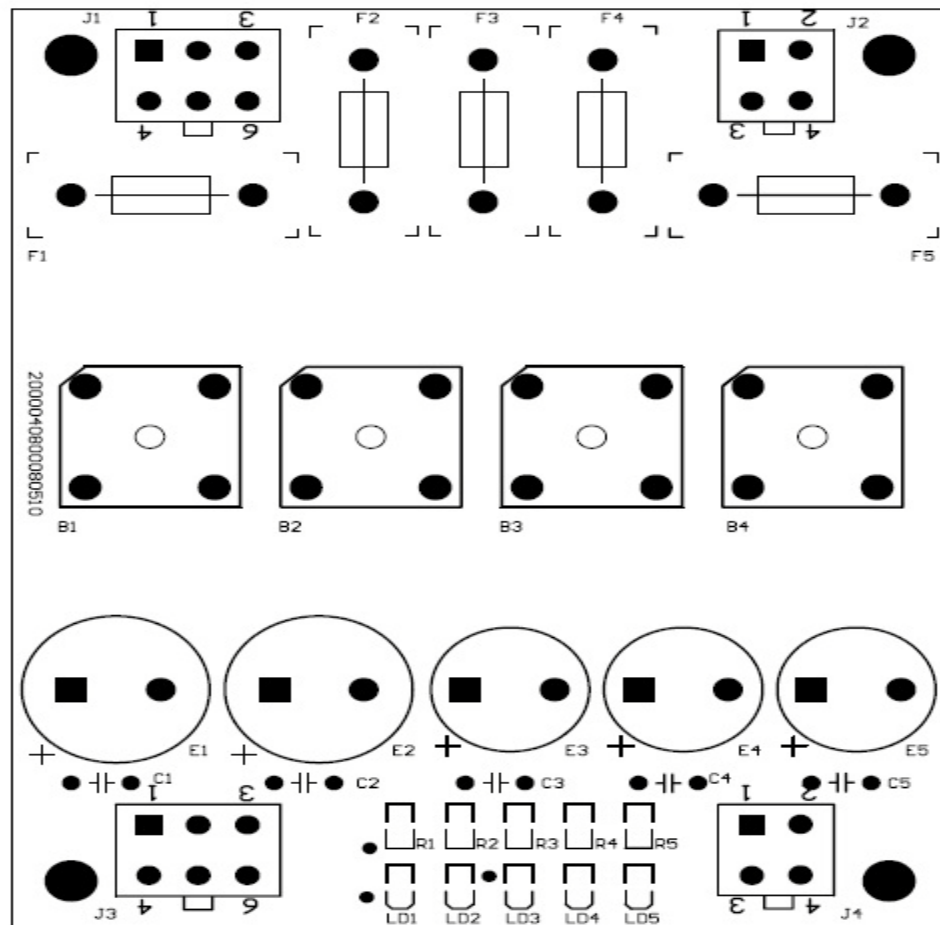
Plug Number	Pin Number	Function	Pin Number	Function
J1	J1-1	Step motor drive input (AC17V~AC34V)	J1-4	Step motor drive input (17V~AC34V)
	J1-2	Beckhoff module external	J1-5	Beckhoff module external

		power (AC18V)		power (AC18V)
	J1-3	Control pendant power (AC8.5V)	J1-6	Control pendant power (AC8.5V)
J2	J2-1	BH interface board power input (AC18V)	J2-4	0V
	J2-2	BH interface board power input (AC18V	J2-5	0V
J3	J3-1	Step motor drive input + (DC24V~DC50V)	J3-4	Step motor drive input - (DC24V~DC50V)
	J3-2	Beckhoff module external power + (DC24V)	J3-5	Beckhoff module external power - (DC24V)
	J3-3	Control pendant power - (DC12V)	J3-6	Control pendant power - (DC12V)
J4	J4-1	BH interface board power output (DC24V+)	J4-3	BH interface board power output (0V)
	J4-2	BH interface board power output (DC24V-)	J4-4	BH interface board power output (0V)

4.3 DC drive adapter board

✧ Beckhoff digital signal is 24V and DC drive direction control signal is 15V. It is to switchover the corresponding voltage.
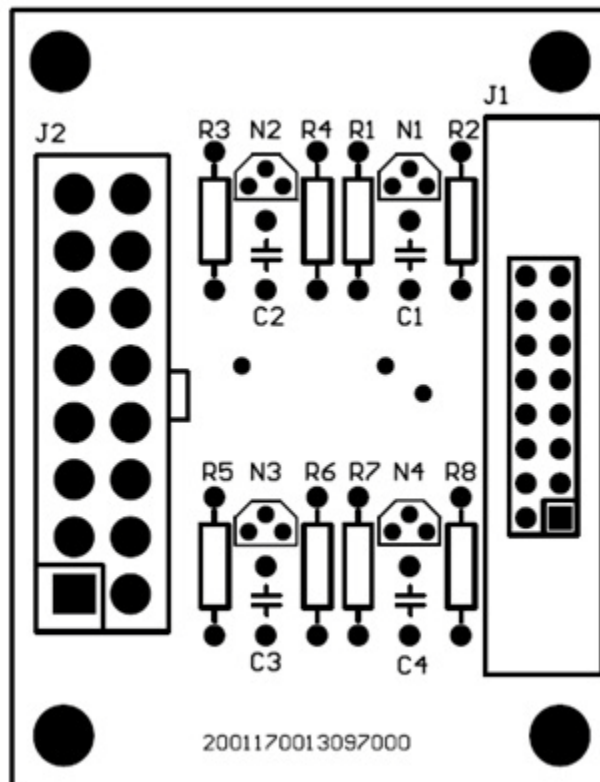
Plug Number	Pin Number	Function	Pin Number	Function
J1 (Flat cable plug)	J1-1	VCC (empty)	J1-9	D/A (wire feeding speed)
	J1-2	VCC (empty)	J1-10	SURW (empty)
	J1-3	ROTL (rotation rightward)	J1-11	L (empty)
	J1-4	ROTL (rotation leftward)	J1-12	GND
	J1-5	D/A (rotation speed)	J1-13	GND
	J1-6	SURR (encoder feedback)	J1-14	VSS (empty)
	J1-7	WIRER (wire feeding rightward rotation)	J1-15	Empty
	J1-8	WIREL (wire feeding leftward rotation)	J1-16	Empty
J2 (Mini plug)	J2-1	VCC (empty)	J2-9	D/A (wire feeding speed)
	J2-2	VCC (empty)	J2-10	SURW (empty)
	J2-3	ROTL (rotation rightward)	J2-11	L (empty)
	J2-4	ROTL (rotation leftward)	J2-12	GND
	J2-5	D/A (rotation speed)	J2-13	GND
	J2-6	SURR (encoder feedback)	J2-14	VSS (empty)
	J2-7	WIRER (wire feeding rightward rotation)	J2-15	Empty
	J2-8	WIREL (wire feeding leftward rotation)	J2-16	Empty

4.4 Filter board 10C8, 4 piece

✧ Function: filtering. It is able to replace with each other.
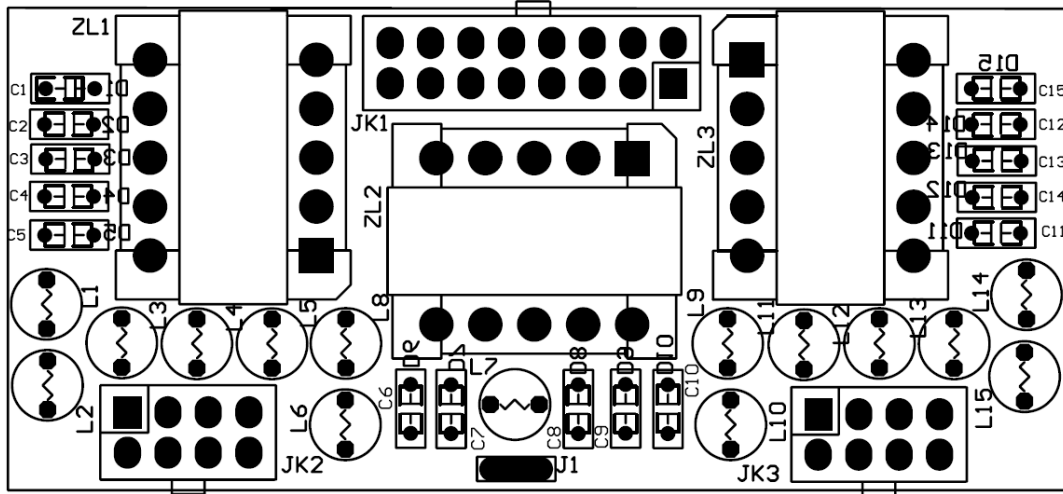
Notice: The pin number of JK3, JK2 in the table below is corresponding to the positioned pin number on JK1 and they communicate with each other. Therefore the sequence may reverse.

Filter board 10C8 (1) interface table:

Plug Number	Pin Number	Function	Pin Number	Function
JK1	JK1-1	Control pendant power: 0V	JK1-9	Control pendant power: +12V
	JK1-2	EK1100-2: +24V (external power)	JK1-10	EK1100-3: 0V (external power)
	JK1-3	Empty	JK1-11	Empty
	JK1-4	Empty	JK1-12	Empty
	JK1-5	Control pendant RS232 communication: 0V	JK1-13	Control pendant RS232 communication: RXD
	JK1-6	Control pendant RS232 communication: TXD	JK1-14	Empty

	J1-7	Power switch (2): 0V	JK1-15	Power switch (1): 0V
	J1-8	Power switch (2): +24V	JK1-16	Power switch (1): 24V
JK3	JK3-8	BH power board J3-6: 0V	JK3-4	BH power board (1): 0V
	JK3-7	BH power board J3-2: +24V	JK3-3	BH power board (1): +24V
	JK3-6	Empty	JK3-2	Empty
	JK3-5	Empty	JK3-1	Empty
JK2	JK2-8	PC RS232 communication: 0V	JK2-4	PC RS232 communication: TXD
	JK2-7	PC RS232 communication: RXD	JK2-3	Empty
	JK2-6	PC: 0V	JK2-2	EK1100-5: 0V (communicate with power source)
	JK2-5	PC: +24V	JK2-1	EK1100-1: +24V (communicate with power source)

Filter board 10C8 (2) interface table:

Plug Number	Pin Number	Function	Pin Number	Function
JK1	JK1-1	Empty	JK1-9	DC drive adapter board: wire feeding speed
	JK1-2	DC drive adapter board	JK1-10	Empty
	JK1-3	Empty	JK1-11	DC drive adapter board:

				wire feeding rotation leftward
	JK1-4	Empty	JK1-12	Empty
	JK1-5	BH power board J3-1: +24V	JK1-13	BH power board: J3-4: 0V
	JK1-6	Empty	JK1-14	DC drive adapter board: rotation leftward
	J1-7	DC drive adapter board: rotation speed	JK1-15	DC drive adapter board: 0V (GND)
	J1-8	DC drive adapter board: rotation encoder feedback	JK1-16	DC drive adapter board: rotation rightward
JK3	JK3-8	Empty	JK3-4	EL4004-5: wire feeding speed
	JK3-7	EL2008 (2)-8: wire feeding rotation rightward	JK3-3	Empty
	JK3-6	Empty	JK3-2	EL2008 (2)-7: wire feeding rotation leftward
	JK3-5	Empty	JK3-1	Empty
JK2	JK2-8	KL2541-4' (step motor drive power +)	JK2-4	KL2541-8' (step motor drive power -)
	JK2-7	Empty	JK2-3	EL2008 (2)-5: rotation leftward
	JK2-6	EL4004-3: rotation speed	JK2-2	EL1512-3: 0V
	JK2-5	EL1512-5: rotation	JK2-1	EL2008(2)-6: rotation

		encoder feedback		rightward

Filter board 10C8 (3) interface table:

Plug Number	Pin Number	Function	Pin Number	Function
JK1	JK1-1	Inverter board: power error	JK1-9	Inverter board: arc ignition successful (I>0)
	JK1-2	BH interface board J5-7: work-piece short	JK1-10	Empty
	JK1-3	Empty	JK1-11	Empty
	JK1-4	Inverter board:	JK1-12	Empty
	JK1-5	Inverter board:	JK1-13	Inverter board: current setup
	JK1-6	Inverter board:	JK1-14	Empty
	J1-7	Empty	JK1-15	Empty
	J1-8	High frequency board: high frequency start	JK1-16	High frequency arc ignition board: high frequency start
JK3	JK3-8	EL1008 (1)-1: power error	JK3-4	EL1008(1)-2: arc ignition successful (I>0)
	JK3-7	EL1008(1)-7: work-piece short	JK3-3	Empty
	JK3-6	Empty	JK3-2	Empty
	JK3-5	EL3162-1: current feedback	JK3-1	Empty
JK2	JK2-8	EL2622-1: inverter start	JK2-4	EL4004-1: current setup
	JK2-7	EL4004-6: 0V (GND)	JK2-3	Empty

	JK2-6	Empty	JK2-2	Empty
	JK2-5	EL2622-5: high frequency start	JK2-1	EL2622-6: high frequency start

Filter board 10C8 (4) interface table:

Plug Number	Pin Number	Function	Pin Number	Function
JK1	JK1-1	OSC motor: B2	JK1-9	OSC motor: A2
	JK1-2	OSC motor: B1	JK1-10	OSC motor: A1
	JK1-3	Empty	JK1-11	Empty
	JK1-4	Empty	JK1-12	Empty
	JK1-5	Empty	JK1-13	Empty
	JK1-6	Empty	JK1-14	Empty
	J1-7	AVC motor: B2	JK1-15	AVC motor: A2
	J1-8	AVC motor: B1	JK1-16	AVC motor: A1
JK3	JK3-8	KL2541(2)-6: B2	JK3-4	KL2541(2)-5: A2
	JK3-7	KL2541(2)-2: B1	JK3-3	KL2541(2)-1: A1
	JK3-6	Empty	JK3-2	Empty
	JK3-5	Empty	JK3-1	Empty
JK2	JK2-8	Empty	JK2-4	Empty
	JK2-7	Empty	JK2-3	Empty
	JK2-6	KL2541(1)-6: B2	JK2-2	KL2541(1)-5: A2
	JK2-5	KL2541(1)-2: B1	JK2-1	KL 2541(1): A1

4.5 DC drive board

✧ Function: two sets of DC drive. The first version OW-Arc series power source use modified DC drive board (reason: Beckhoff provides 24V digital signal, but our DC drive direction control signal requires 15V, therefore we modified the voltage distribution). In the subsequent version, we add one more DC drive adapter board.
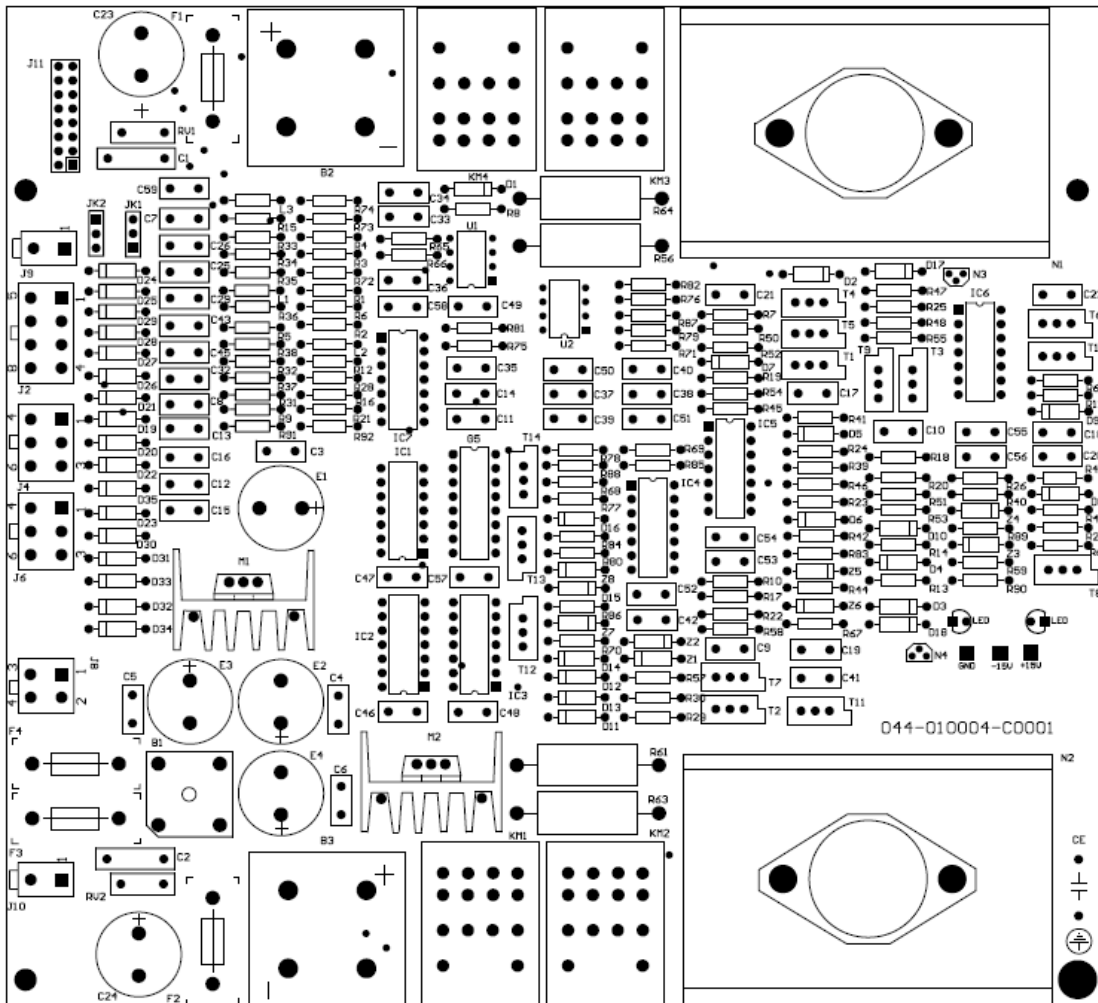
Plug Number	Pin Number	Function	Pin Number	Function

J11 (Flat cable plug)	J11-1	VCC (empty)	J11-9	D/A (wire feeding speed)
	J11-2	VCC (empty	J11-10	SURW (empty)
	J11-3	ROTR (rotation rightward)	J11-11	L (empty)
	J11-4	ROTL (rotation leftward)	J11-12	GND
	J11-5	D/A (rotation speed)	J11-13	GND
	J11-6	SURR (encoder feedback)	J11-14	VSS (empty
	J11-7	WIRER (wire feeding rightward rotation)	J11-15	Empty
	J11-8	WIREL (wire feeding leftward rotation)	J11-16	Empty
J2	J2-1	Empty	J2-5	Empty
	J2-2	Empty	J2-6	Empty
	J2-3	Empty	J2-7	Empty
	J2-4	Empty	J2-8	Empty
J4	J4-1	Rotation U+	J4-4	+15V
	J4-2	Rotation U-	J4-5	Rotation feedback
	J4-3	+15V	J4-6	0V
J6	J6-1	Wire feeding U+	J6-4	+15V
	J6-2	Wire feeding U-	J6-5	Wire feeding feedback
	J6-3	+15V	J6-6	0V
J8	J8-1	AC 0V	J8-3	AC 18V
	J8-2	Empty	J8-4	AC 18V

J9	J9-1	AC 42V	J9-2	AC 0V
J10	J10-1	Ac 42V	J10-2	AC 0V

4.6 Inductance board

✧ Function: filtering high frequency.
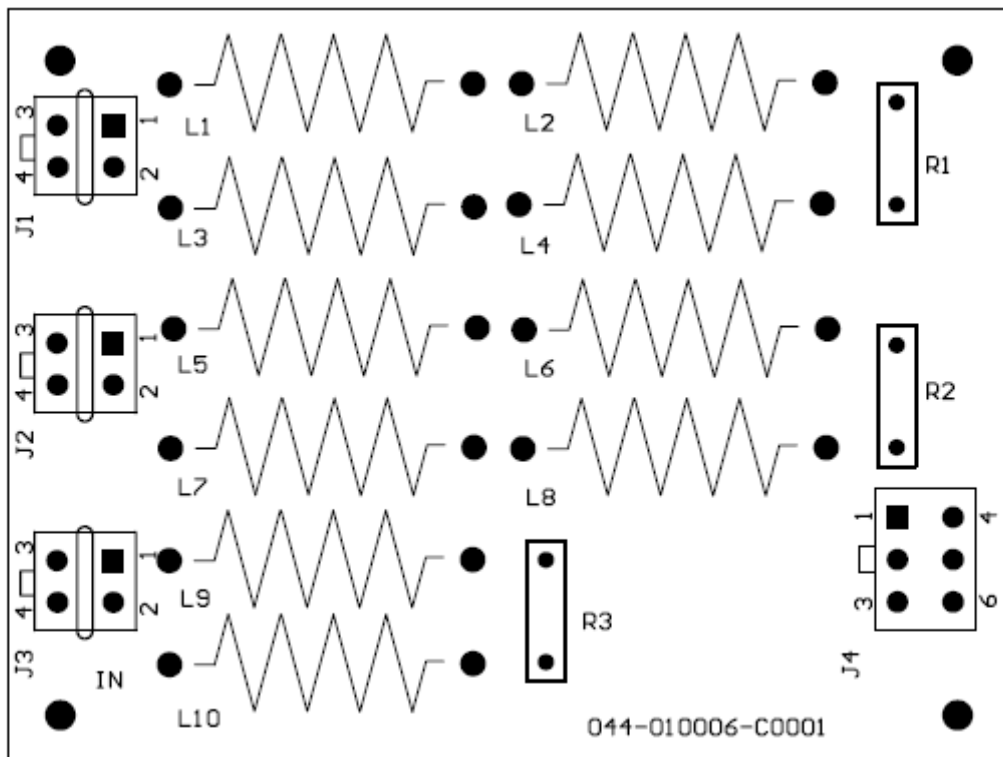
Plug Number	Pin Number	Function	Pin Number	Function
J1	J1-1	High frequency arc ignition board J5: -	J1-3	Empty
	J1-2	Empty	J1-4	High frequency arc ignition board J3: +

J2	J2-1	Torch voltage: -	J2-3	Empty
	J2-2	Empty	J2-4	Work-piece: +
J3	J3-1	Empty	J3-3	Empty
	J3-2	Empty	J3-4	Empty
J4	J4-1	BH interface board J1-3: torch -	J4-4	BH interface board J1-1: torch +
	J4-2	BH interface board J1-6: inverter -	J4-5	BH interface board J1-4: inverter +
	J4-3	Empty	J4-6	Empty

5. Machine schematic diagram

5.1 Machine control description

➢ OW-Arc 400 program is preloaded in Beckhoff screen, the screen itself is originally industrial PC, which connects and communicates with Beckhoff module group via the Ethernet. Using of the Beckhoff modules is equal to one set of PLC, respectively to the functions in terms of digit input, digit output, analog input, analog output, replay output, counting, and drive etc.

➢ In OW-Arc 400, digit input signal includes all fault signal inspection and head button scan receive; digit output signal includes gas control water pump control, temporary voltage switchover, sampling voltage switchover, DC motor direction control, and head button scan send; analog input signal includes welding current sampling, and welding voltage sampling; analog output signal includes welding current setup and DC motor (rotation, wire feeding) rotation speed control; relay output signal includes inverter start and high frequency start; drive includes AVC motor drive and OSC motor drive.

- ➢ Control system power supply:
    - ■ Beckhoff screen DC24V power supply; power supply mode: DC24V power switch.
    - ■ Beckhoff modules communication DC24V power supply; power supply mode: DC24V power switch.
    - ■ Beckhoff modules external DC24V power supply; power supply mode: transformer control → BH power board (current rectify).
    - ■ Step motor drive module (KL2541) drive power DC8V-DC50V power supply; power supply mode: transformer control→ BH power board (current rectify).
    - ■ Control pendant DC12V power supply; power supply mode: transformer control → BH power board (current rectify).
    - ■ BH interface board ±24V power supply; power supply mode→ BH power board (current rectify).
    - ■ DC drive board AC18V~0V~AC18V power supply; power supply mode: transformer control.
    - ■ DC drive board AC42V*2 power supply; power supply mode: transformer control.
- ➢ Beckhoff system input logic signal "1" is 15V~30V, logic signal "0" is 3V~5V. Therefore the inverter board alarm signal output is increase from 15V to 24V, this is the critical difference between OW-Arc 400
- ➢ Beckhoff system output logic signal "1" is Beckhoff external power supply voltage (approximately 24V); logic signal "0" is 0V. Therefore the DC drive adapter board is added to control DC motor direction, which is to converter 24V logic "1" voltage to available 15V logic "1" voltage.
- ➢ Beckhoff system analog output signal is 0~10V power source inverter control

voltage, DC drive voltage, i.e. 0~10V is corresponding to current 0~400A, rotation speed 55Hz~1.1 KHz.

➢ Beckhoff system analog input signal is 0~10V. Welding current is 0~400A, the corresponding ratio adjustment is on inverter board, for instance 0~10V is corresponding to 0~400A; welding voltage is 0~60V, the corresponding ratio adjustment is on BH interface board, for instance 0~10V is corresponding to 0~60V.

5.2 Machine power supply

➢ AC 3*380 (3*415 and 3*460)V for OW-Arc 400 input.

➢ Contactor switch KM1 is used after AC380 power connected.

➢ Contactor switch KM1 is control by S1 on control panel.

5.3 Upper layer cooling fan control

➢ The EL1512 interface 6 (+) and interface 7 (-) provide power to the upper layer cooling fan. The fan will run after power connected.

5.4 Gas control

➢ Protective gas is controlled by protective gas valve through EL2008 (1) interface 1 which connecting to J6-1 pin on BH interface board, and control of the K1 relay on BH interface board. The protective gas valve working voltage is DC24V, which is provided by BH interface board.

➢ Compressed air is controlled by compressed air valve through EL2008 (2) interface 1which connecting to J6-2 pin on BH interface board, and control of the K2 relay on BH interface board. The compressed air valve working voltage is DC24V, which is provided by BH interface board.

5.5 Water pump control

➢ Water pump is controlled by water pump relay through EL2008 (2) interface 5 which connecting to J6-7 pin on BH interface board, and control of the K7 relay on BH interface board. The water pump working voltage is AC220V, which is converted by control transformer self-couple from AC380V. The water heat eliminate cooling fan working voltage is AC220V, which connects to water pump power cable.

5.6 Inverter start control

➢ Inverter start is controlled by EL2622 communication port 1 signal (interface 1, interface 2). It is connected to JK10-5 pin on inverter board through 10C8 (3) filtering board.

5.7 Inverter high frequency control

➢ Inverter start is controlled by EL2622 communication port 2 signal (interface 5, interface 6). It is connected to JK1-1 pin and JK1-2 pin on inverter high frequency arc ignition board through 10C8 (3) filtering board.

5.8 Current control

➢ The current is control by EL4004 interface 1 output 0~10V. It is connected to JK10-1 pin on inverter board through 10C8 (3).

5.9 Rotation control

➢ The rotation direction is control by EL2008 (1) interface 5, interface 6. It is connected to J11-3 pin and J11-4 pin on DC drive board through 10C8 (2)

filtering board and DC drive adapter board.

➢ Rotation speed is controlled by EL4004 interface3 output 0~10V. It is connected to J11-5 pin on DC drive board through10C8 (2) filtering board.

5.10 Wire feeding control

➢ The wire feeding is control by EL2008 (1) interface 7, interface 8. It is connected to J11-7 pin and J11-8 pin on DC drive board through 10C8 (2) filtering board and DC drive adapter board.

➢ Wire feeding speed is controlled by EL4004 interface5 output 0~10V. It is connected to J11-9 pin on DC drive board through10C8 (2) filtering board.

5.11 AVC control

➢ AVC step motor is controlled by KL2541 (1). The head model is critical important during the programming, otherwise the power source will not drive the AVC properly.

5.12 OSC control

➢ OSC step motor is controlled by KL2541 (2). The head model is critical important during the programming, otherwise the power source will not drive the AVC properly.

5.13 Warning gathering

➢ Inverter error warning ("inverter error" on the screen): it is provided by JK10-12 pin on inverter board, and it is connected toEL1008 (1) interface 1 through 10C8 (3) on filtering board. 1: normal; 0: error.

➢ Arc ignition failed warning: it is provided by JK10-8 pin on inverter board, and

it is connected to EL1008 (1) interface 2 through 10C8 (3) on filtering board. 1: failed; 0: successful.

➢ Work-piece short warning: it is provided by J5-7 pin on the BH interface board, and it is connected to EL1008 (1) interface 7 through 10C8 (3) on filtering board. 1: normal; 0: short.

➢ Water pressure inspection warning ("lack of water" on the screen): the water inspection sensor connects to EL1008 (1) interface 8directly, and the EL3162 interface 6 provides power for water inspection sensor. 1: have water; 0: lack of water.

5.14 Rotation counting

➢ The DC drive board provides rotation counting, and it is connected to EL1512 interface 5 through DC drive adapter board, 10C8 (2) filtering board.

5.15 Current sampling

➢ The inverter board JK10-2 pin provides 0~10V analog for current sampling, and it is connected to EL3162 interface 1 through 10C8 (3) filtering board.

5.16 Voltage sampling

➢ Torch voltage sampling: by 1-pin of 4-pin aviation plug (+) and 9pin of 9-pin-of 9-pin aviation plug through inductance board after high frequency filtering to BH board J1-1 pin (+) and J1-3 pin (-).

➢ Inverter voltage sampling: by J3 pin (+) and J5 pin (-) on inverter high frequency arc ignition board through inductance board after high frequency filtering to BH board J1-4 pin (+) and J1-6 pin (-).

➢ The two voltage signals are on BH interface board, and controlled by K8 relay

switch through EL2008 (1) interface 4 (notice: temporary voltage is connected here, and it is controlled by K6 relay switch though EL2008 (1) interface 3). After rectification and ratio adjustment, converter the voltage from 0~60V to 0~10V and provide to EL3162 interface 5 through J5-6 pin on BH interface board.

5.17 Control pendant

➢ In order to coordinate with OW-Arc series power source, we develop new control pendant model: RTC06. The RTC06 uses of DSP2407 as processor with 128x64 LCD display, 4*7 input keyboard and RS232 communication.

➢ The control pendant is totally different from RTC01

➢ There is only one button board for RTC01 control pendant button matrix function, it has 6m cable connecting with the power source, and communicate to CPU board through I2C communication mode after scanning and recognized by 8574.

➢ There are one button board and one control board for RTC06 control pendant matric function, and it is connecting to the Beckhoff screen through RS232 communication mode after scanning and recognized by control board.

➢ RCT06 control pendant 14-pin AMP aviation plug each pin description: 1-pin: DC12V "-"; 2-pin: DC12V "+"; 3-pin: RS232 communication; 4-pin: RS232 communication receive; 5-pin: RS232 communication send; 6-pin: shielding.

5.18 Welding head control panel

➢ In order to compatible with various function on different head.

➢ The head control penal is controlled by EL2008 (2) interface 1 and interface 2 signal matrix scanning, the EL1008 (2) interface 1~ interface 4 to receive button

signal and recognize button message.

➢ The emergency stop button, head clamping button and head release buttons are not in the matrix, but their voltages DC24V are provided BK1250/+, EL1008 (2) interface 5 (emergency stop), interface 6 (clamp), and interface 7 (release) scan and recognize.

6. Troubleshooting

6.1 Power on (>40s), screen no response (dark screen).

➢ Under normal condition, dark screen 25s, the main screen pops up after 40s (including dark screen time).

➢ Check power supply, OW-Arc 400 power supply is controlled by power switch, which is contactor switch, power input is AC380V (415V or 460V).

➢ Check power switch output, i.e. power switch (1) and power switch (2), both of them output should be DC24V.

➢ Check screen power supply plug DC24V supply.

➢ If all the check phenomena is normal, then we could judge the screen is broken. Change the screen.

6.2 Power on, the screen shows Windows desktop, but the system does not run program automatically.

➢ Turn off the machine, restart the machine. If the phenomenon is still happen, we could judge it is the software error. Please contact OTTO ARC Technology Center and reload the program.

6.3 Power on, the system automatically run program, but only emergency button is available, all the other buttons are not available.

➢ Check Beckhoff modules (observe the LED lights on the modules to determine whether it is under normal condition or not, and the most obvious phenomena is the LED lights on EL2008 (2) interface 1, interface2 is continuously flash under standby status.)

➢ If the LED lights flash is normal.

■ Check control pendant, change the control pendant if it is available.

■ Check the connection cable broken or not between the control pendant and screen (RS232 communication cable).

➢ If the LED lights do not flash.

■ Check all Beckhoff modules terminals are connected properly.

■ Check the 24V voltage between "+24V, 0V" on EK1100.

■ Check the 24V voltage between "+, -" on EK1100 (the voltage here between 22V ~28V is normal.)

■ Check the Ethernet cable connection from screen to modules (LAN1 on screen to X1 IN on EK1100).

6.4 There is warning message and cannot cancel.

➢ Display "inverter error" warning. This warning is normally caused by EL1008 (1) interface 1 input signal.

■ Firstly of all, check and ensure the Beckhoff modules are working properly (observe the LED lights flash).

■ Ensure the EL 1008 (1) interface 1 LED light status and interface 1 voltage. If the voltage>15V, we could determine it is the module or software problem; if the voltage <5V, please check as follow:

■ Check the inverter board JK10-12 pin voltage. If the voltage>15V, we could determine it is the connection problem; if the voltage<5V, please check as

follow:

- Check the inverter board JK10-4 pin voltage. This point provides DC24V power for inverter warning signal.
- If all the checks could not solve the problem, we could determine it is the inverter board is breakdown.

➤ Display "work-piece short" warning. This warning is normally caused by EL1008 (1) interface 7 input signal.

- First of all, check and ensure the Beckhoff modules are working properly (observe the LED lights flash).
- Check if the tungsten touches the work-piece or not.
- Check the LED lights on EL1008 (1) interface 7 and interface 7 voltage. If the voltage>15V, then we could determine it is the module or software problem; if the voltage<5V, please check as follow:
- Check BH interface board is under normal condition or not: VDD=+15V, VSS=-15V.
- Check the TP1 voltage on BH interface board. If the voltage<5V, we could determine it is BH interface board problem. We have to be careful that if the sampling cable "+" and "-" connect wrongly, there is no temporary voltage; K6 close will cut temporary voltage; CON0 damage will disconnect temporary voltage.

➤ Display "lack of water" warning. This warning is normally caused by EL1008 (1) interface 8 input signal.

- First of all, check and ensure the Beckhoff modules are working properly (observe the LED lights flash).
- Ensure the water pump is working properly, if it does not work properly, please refer to "point 6.10, water pump does not work" to solve the problem.

■ If the water pump is working properly, check the water inspection sensor connection cable (one terminal connects to DC24V+, another terminal connects to EL1008 (1) interface 8).

■ If the connection and DC24V power supply are no problem, please check the water circuit and ensure sure there is no bending or blocking.

■ If all the checks could not solve the problem, we could determine it is the water inspection sensor is breakdown.

➢ Display "arc ignition failure" warning. This warning is normally caused by EL1008 (1) interface 2 input signal. Please refer to "point 6.12, arc ignition failed".

6.5 Inching rotation, wire feeding motor does not work.

➢ First of all, check and ensure the Beckhoff modules are working properly (observe the LED lights flash).

➢ Inching rotation, press wire feeding button, you could hear the relay operate sound.

➢ If the relay does operate

■ Check 0~10V analog value, during the inching movement, the analog value is 8V. Rotation analog output: EL 4004 interface 3; wire feeding analog output: EL4004 interface 5.

■ Check the analog interface on DC drive board.

■ Press the button on control pendant for inching movement, and test the corresponding motor voltage on DC drive board (it is dozens grades voltage). If you could get the value, we could determine it is the motor or motor connection cable problem; if you could not get the value, we could determine it is the DC drive board problem.

➤ It the relay does not operate.

■ Check EL2008 (1) interface 5 (rotation leftward), interface 6 (rotation rightward), interface 7 (wire feeding rotation leftward), interface 8 (wire feeding rotation rightward). In the first version sample machine, the logic relationship is: 1 is stop and 0 is start; in the subsequent version machine, because of using DC drive adapter board, the logic relationship is changed to 1 is start and 0 is stop.

■ Check DC drive board direction signal is controlled or not.

■ Change the DC drive board.

6.6 AVC and OSC motor do not work.

➤ First of all, check and ensure the Beckhoff modules are working properly (observe the LED lights flash).

➤ Confirm that the setup head model the same as actual head.

➤ Check if any warning on KL2541 module (yellow or red LED light).

➤ Check KL2541 module power supply. KL2541 interface 4' is "+", KL2541 interface 8' is "-" (the value between DC8V~DC50V is all acceptable).

➤ Check step motor connection cable. Method: cut off the power, use multi-meter "Ohm" position, respectively test the resistance value between interface 1' and 5', 2' and 6' on KL2541. Under normal condition, it is able to get dozens grade ohm resistance value; if there is no value, please check the connection cable between the KL2541 and step motor based on circuit diagram.

➤ If there is no abnormal phenomenon, restart the power source. If the problem still happens, we could determine that it is KL2541 problem or software error.

6.7 Touch lift function does not work.

➢ First of all, check and ensure the Beckhoff modules are working properly (observe the LED lights flash).

➢ Move down the torch and touch the work-piece, check the EL1008 (1) interface 7 LED light status and interface 7 voltage.

➢ If the EL1008 (1) interface 7 LED light is still on.

■ Short step motor aviation plug 7-pin and sampling aviation plug 1-pin, observe EL1008 (1) interface 7 LED light status. Light is on: please check as follow; light is off: sampling cable problem.

■ Short 1-pin and 3-pin on BH interface board, observe EL1008 (1) interface 7 LED light status. Light is on: please check as follow; light is off: connection cable problem.

■ Check if the K8 relay operates or not, under standby status, the relay should not operate.

■ If there is no abnormal phenomenon, we could determine it is BH interface board problem.

➢ If the LED light on EL1008 (1) interface 7 is off.

■ Check the voltage on EL1008 (1) interface 7. Voltage<5V, please check as follow; voltage>5V, module problem.

■ Please check the step motor according to "point 6.6 AVC and OSC motor do not work".

6.8 Start welding process, no protective gas.

➢ The protective gas is control by EL2008 (1) interface 1. 1: start; 0: stop.

➢ First of all, check and ensure the Beckhoff modules are working properly (observe the LED lights flash).

➢ Check EL2008 (1) interface 1 LED status and interface 1 voltage. If there is

24V voltage: please check as follow; if there is no 24V voltage: module or software problem.

➢ Check BH interface board J6-1 pin voltage. If there is 24V voltage: please check as follow; if there is no 24V voltage: connection cable problem.

➢ Check protective gas valve connection cable voltage. If there is 24V voltage: please check as follow; if there is no 24V voltage: BH interface board problem.

6.9 No compressed air.

➢ Compressed air valve is control by EL2008 (2) interface6. 1: start; 0: stop.

➢ First of all, check and ensure the Beckhoff modules are working properly (observe the LED lights flash).

➢ On the head body control penal, press "clamp" and observe EL1008 (2) interface6 LED light. If the light is off: check the control panel and module connection cable; if the light is on: please check as follow.

➢ Check EL2008 (2) interface 6 LED status and interface 6 voltage. If there is 24V voltage: please check as follow; if there is no 24V voltage: module or software problem.

➢ Check BH interface J6-2 pin voltage. If there is 24V voltage: please check as follow; if there is no 24V voltage: connection problem.

➢ Check the voltage for compressed air valve. If there is 24V voltage: valve problem; if there is no 24V voltage: BH interface board problem.

6.10   Water pump does not work.

➢ The water pump is controlled by EL2008 (2) interface 5. 1: start; 0: stop.

➢ Check EL2008 (2) interface LED status and interface 5 voltage. If there is 24V voltage: please check as follow; if there is no 24V voltage: module or software

problem.

➢ Manually let K7 relay on BH interface board operate. Observe water pump works or not.

➢ If the water pump works.

■ Check the connection cable between EL2008 (2) interface 5 and BH board J6-7 pin.

➢ If the water pump does not work.

■ Check the voltage (AC220V) between J2-1 pin and J2-2 pin on BH board. If there is voltage; please check as follow; if there is no voltage: please check the AC220V connection here according to the circuit diagram.

■ Check the voltage (AC220V) between J2-3 pin and J2-4 pin on BH board. If there is voltage; please check as follow; if there is no voltage: relay problem.

■ Check water pump voltage (AC220V). If there is voltage: water pump problem; if there is no voltage: connection problem.

6.11   No high frequency.

➢ High frequency start is close-loop controlled by EL2622 channel 2 (interface 5 and interface 6). 1: start; 0: stop.

➢ First of all, please confirm the "-" and "+" cables are connected properly, tungsten electrode is installed properly with suitable distance to the work-piece.

➢ Start welding, observe EL2622 interface 5 LED light status. If the light is off: module or software problem; if the light is on: high frequency is started, please check as follow.

➢ Short JK1-1 pin and JK1-2 pin on high frequency board directly. If there is high frequency: connection cable problem; if there is no high frequency: inverter or

head problem.

6.12   Arc ignition failed.

➢ Observe the high frequency strikes moment, if the system and control pendant have restoration phenomena, check power source grounding cable and control pendant grounding cable, meanwhile keep away from any other high frequency disturbing source and try again.

➢ Please ensure there is no system warning. If any, please refer to "pint 6.4, there is warning message and cannot cancel" and check.

➢ Please ensure the protective gas is provided normally, if not, please refer to "point 6.8, start welding process, no protective gas" and check.

➢ Please ensure high frequency is normal, if not, please refer to "point 6.11, no high frequency" and check.

➢ Check and ensure the open circuit voltage is under normal condition. When check open circuit, please plug out the JK1 plug on high frequency board 10C3 (no high frequency). Use the multi-meter "volt" position (DC220V) to test the power source output "+" and "-", under normal condition, the voltage is approximately DC 75V.

➢ If the open circuit voltage is normal.

  ◼ Use tungsten electrode to scratch between the tungsten and work-piece to see if it is able to ignite the arc, if arc is ignited: please check the gas and high frequency.

  ◼ If scratching still could not ignite arc: please check the inverter and check if inverter error or phase lack.

➢ If open circuit voltage is abnormal (no voltage or low voltage).

  ◼ The inverter start is close-loop controlled by EL2622 channel 1 (interface 1

and interface 2). 1: start; 0: stop.

■ Check EL2622 interface 1 LED light status and interface 1 voltage. If voltage≈24V: module or software problem; if voltage≈0V: please check as follow.

■ Check inverter board 10CB1 JK10-5 pin. If voltage≈24V: connection cable problem; if voltage≈0V, main board or inverter problem.

6.13　Arc stops after ignited.

➢ Observe arc stopping moment, if the system and control pendant have restoration phenomena, check power source grounding cable and control pendant grounding cable, meanwhile keep away from any other high frequency disturbing source and try again.

➢ Ensure there is no warning, if warning comes out, please refer to "point 6.14, there is warning message and cannot cancel" and check.

➢ Please check if the arc stops because the distance between the tungsten and work-piece is too big or too small.

6.14　After pre-melt, normal welding process does not execute.

➢ Check rotation motor.

➢ Check if the encoder feedback signal is sent to EL1512 interface 5 properly.

6.15　Welding current does not match setup value.

➢ Test EL4004 interface 1 voltage output value (multi-meter is used for DC welding, and oscillograph is used for pulsing welding), calculate and compare the actual value and setup value match or not (0~10V is corresponding to 0~400A).

➢ If they match.

- Test inverter board JK10-1 pin voltage (multi-meter is used for DC welding, and oscillograph is used for pulsing welding), check if it is the same as EL4004 interface 1 voltage. If they are the same: inverter problem; if they are not the same: connection problem.

➢ In they do not match.

- Disconnect EL4004 interface 1 connection and measure the voltage here, if it does not match, we could determine it is module or software problem.

6.16　Rotation speed does not match setup value.

➢ First of all, choose correct head model and work-piece OD on the power source.

➢ Test EL4004 interface 3 voltage output value (oscillograph is used for pulsing rotation), calculate and compare the actual value and setup value match or not (0~10V is corresponding to 55Hz~1.1 KHz).

➢ If they match.

- Test DC drive board J11-5 pin voltage (oscillograph is used for pulsing rotation) check if it is the same as EL4004 interface 3 voltage. If they are the same: DC drive board or motor problem; if they are not the same: connection problem.

➢ If they do not match.

- Disconnect EL4004 interface 3 connection and measure the voltage here, if it does not match, we could determine it is module or software problem.

6.17　Wire feeding speed does not match setup value.

➢ First of all, choose correct head model and work-piece OD on the power source.

➢ Test EL4004 interface 5 voltage output value (oscillograph is used for pulsing

rotation), calculate and compare the actual value and setup value match or not (0~10V is corresponding to 55Hz~1.1 KHz).

➢ If they match.

■ Test DC drive board J11-9 pin voltage (oscillograph is used for pulsing rotation) check if it is the same as EL4004 interface 5 voltage. If they are the same: DC drive board or motor problem; if they are not the same: connection problem.

➢ If they do not match.

■ Disconnect EL4004 interface 5 connection and measure the voltage here, if it does not match, we could determine it is module or software problem.

6.18   AVC motor outofstep or does not move.

➢ First of all, choose correct head model on the power source.

➢ Check and ensure standard motor is used for the head.

6.19   OSC motor outofstep or does not move.

➢ First of all, choose correct head model on the power source.

➢ Check and ensure standard motor is used for the head.

6.20   Current display value abnormal.

➢ Test EL3162 interface 1 voltage input value (multi-meter is used for DC welding, and oscillograph is used for pulsing welding), calculate and compare the actual value and setup value match or not (0~10V is corresponding to 0~400A).

➢ If they match.

■ We could determine it is module or software problem.

➢ In they do not match.

■ Test inverter board JK10-2 pin voltage (multi-meter is used for DC welding, and oscillograph is used for pulsing welding), check if it is the same as EL3162 interface 1 voltage. If they are the same: inverter board problem; if they are not the same: connection problem.

6.21 Voltage display value abnormal.

➢ Test EL3162 interface 5 voltage input value (multi-meter is used for DC welding, and oscillograph is used for pulsing welding), calculate and compare the actual value and setup value match or not (0~10V is corresponding to 0~60V).

➢ If they match.

■ We could determine it is module or software problem.

➢ In they do not match.

■ Test BH interface board J5-6 pin (multi-meter is used for DC welding, and oscillograph is used for pulsing welding), check if it is the same as EL3162 interface 5 voltage. If they are the same: please check as follow; if they are not the same: connection problem.

■ Test the J1 output voltage on BH interface board (pin-1and& pin-3 are torch voltage, pin-4 and pin-6 are inverter voltage), both of the voltage here should be corresponding to the actual voltage (approximately 10V). If they match: BH interface board problem; if they do not match: sampling cable or torch problem.

6.22 Arc stop during welding process.

➢ If arc stop phenomenon happens, we have to differentiate it is the control

problem or inverter problem.

➢ If you judge it is control problem, please check if the Beckhoff modules run under normal condition or not.

➢ Please ensure protective gas supply is under normal condition.

➢ Please ensure the inverter "start" signal breaks off and current analog (by oscillograph) are under normal condition or not.

➢ If there is no abnormal phenomenon, our initial assessment is inverter problem.

■ Check Hall sensor feedback signal.

■ Check program if the value, i.e. if the base/peak value time is too small (<0.1s), if peak value and base value ratio is too big (>3:1), if base value current is too small (<30A).

■ Check the inverter board version, if it is the old version, please try to combine R23 and capacitance 103, replace C9 by capacitance 104 to solve the problem.

6.23   No downslope or downslope process abnormal.

➢ Please refer to "point 6.22, arc stop during welding process".

6.24   Other occasional fault phenomenon.

➢ For the other faults phenomena which are not listed here are considered occasional failure. Please cut off the power (>30s) and restart the system. Please contact Engineering Technology Center if you could not solve the problem.

7. Appendix

> **Appendix includes:**

OW-Arc 400 connection diagram, 1 set	7 pages
OW-Arc 400 module connection diagram, 1 set	3 pages

8. User's Record

Please complete and retain with your personal records.

Model:	
Serial Number:	
Purchase Date:	
Distributor Contact:	

Maintenance Record:

Net Wire

CP6619-0001-0020

LAN1
LAN2

COM1   Power

2 3 5   PE − +
                   65 63

Power Source (2)

EK1100

X1
IN

3 2 1   − + 0V +24V
83 81 67 69

J3
DC12V/24V
BH Power Board

BK1250 (1) −7   83
EL1008 (2) −5   319
BK1250 (1) −6   81
                47
                55
                45 53

JK3
1 5 2 6 3 7 4 8
0V 24V +12V 0V

10C8(1)

EL2008 (2) −3
75 73 71 397 69 67

JK2
8 4 7 3 1 2 6 5
0V RXD TXD +24V 0V

JK1
0V +12V +24V 0V 0V
16 15 8 7 14 13 6 5 4 11 3 10 2 9 1
TXD RXD 0V
                389 89 87 85 391 387 385 83 81 79 77

EL1008*2
EL1502
EL2008*2
EL3162
EL4004
EL2622

BK1250

3 2 1   − + 0V +24V
83 81 67 69

Power Supply (1)

Connection Plug
14 Wire

14 13 12 11 10 9 8 7 6 5 4 3 2 1
        391 389 387 385 89 87 85 79 77

Handle Romote
RTC07

KL2541 (1)
KL2541 (2)
KL9010

Electrical Drawings 1

OTTO ARC SYSTEM, INC.,

S1

2

401

403

KM1

L1 L2 L3

L11 L21 L31

L12 L22 L32

0V L110V L21380V 415V 460V

Main Transformer

0V 24V
403 401

BH Transformer
AC 380V

L32 L24

L24 L32
5 6

9 10

KH1

L33 L13

M

Fan For
Inverter
Output

Power Supply(1)
HF100W-S-24
PE N L
3 5
V+ V-
7 9

JK1
10C8 (1)

Power Supply(2)
HF100W-S-24
PE N L
3 5
V+ V-
63 65

PC
Power

L32 L22 L12

Inverter
Output

OTTO ARC SYSTEM, INC.,

Electrical Drawings 2

Electrical Drawings 3

OTTO ARC SYSTEM, INC.,

Main Transformer

If you want to choose input voltage, you just move L12 wire to the voltage you want (AC460V, AC415V, AC380V) in main transformer

Main Transformer

- 460V
- 415V
- 380V
- L21
- L11 0V
- 0V
- 24V 401
- 0V 403

Main Transformer

Terminal	Label
3	
L32	0V
5	0V
L24	AC220V
L12	AC380V
8	AC415V
9	AC460V

- 4 — 0V
- 5 — 0V
- 6 — AC220V
- 7 — AC380V
- 8 — AC415V
- 9 — AC460V

Transformer secondaries

Winding	0V terminal	Signal terminal
AC24V/0.5A	12	16 / 15
	43	41
AC42V/0.5A	0V 28	29
	39	37
AC42V/0.5A	0V 26	27
	35	33
AC18V/1A	0V 23	31
	31	
AC18V/1A	0V 24	29
	29	27
AC10V/1A	0V 13	14
	25	23
AC18V/4A	0V 19	20
	21	19
AC18V/5A	0V 17	18
	17	15

JK3 10CB1 Inverter Output

J9 J10 J8

DC Driver Power Supply

J2
- 2
- 3
- 1

J1
- 6
- 3
- 4
- 1
- 5
- 2

BH电源板 (BH Connection Board)

J4
- 2 — DC−24V — 61
- 3 — 0V — 59
- 1 — DC+24V — 57

J7 BH Connection Board

J3
- 6 — 0V — 55
- 3 — DC12V — 53
- 4 — 0V — 51
- 1 — DC24V — 49

10C8 (1)
JK2

- 5 — 0V — 47
- 2 — DC24V — 45

Stepping motor power supply

10C8 (1)
JK2

Electrical Drawings 4

OTTO ARC SYSTEM, INC.,

No.2 Stepping Motor
KL2541（2）

A1	B1	A2	B2	DC	0V
1	2	5	6	4	8
123	125	127	129	159	161

Magnet Ring:Two
Round

No.1 Stepping Motor
KL2541（1）

A1	B1	A2	B2	DC	0V
1	2	5	6	4	8
137	139	141	143	159	161

Magnet Ring:Two
Round

159
161

10C8（2）

J1
BH
Connection
Board
BH100

205
203
201
199

2	5	1	4	6	3	J4

Inductance
Board

143 141 139 137

| 6 | 4 | 7 | 1 |
| 3 | 5 | 2 | 8 |

JK2

129 127 125 123

| 1 | 2 | 6 | 3 |
| 5 | 4 | 7 | 8 |

JK3

10C8（4）

JK1

1	2	4	J3
4	3	2	1	J1
4	3	2	1	J2

229 227 225 223

229 227

| 16 | 8 | 15 | 7 | 14 | 6 | 13 | 5 | 12 | 4 | 11 | 3 | 10 | 2 | 9 | 1 |

221 219 217 215   213 211 209 207

J5 —   10C3
J3   Inverter Output

225   223

Magnet Ring
9 wires

207 209 211 213   215 217 219 221

| 1 | 3 | 2 | 4 | 5 | 7 | 6 | 8 | 9 | HC4 |

| 1 | 3 | 2 | 4 | HC7 |

225   Workpiece

223   Torch

AVC
Motor

OSC
Motor

OTTO ARC SYSTEM, INC.,

Electrical Drawings 5

Electrical Drawings 6

OTTO ARC SYSTEM, INC.,

EL2008(2)

L1	1	325
L2	2	327
	3	397
Pump	4	
	5	117
Compress	6	115
	7	
	8	

EL1008(2)

S0	1	311
S1	2	313
S2	3	315
S3	4	317
PSTOP	5	319
Clamp	6	321
Slack	7	323

BK1250/+

HC1
Buttons on welding head
board 14 wires

311	1	
313	2	
315	3	
317	4	
	5	
	6	
81	7	
323	8	
81	9	
325	10	
327	11	
319	12	
321	13	
81	14	

Electrical Drawings 7

OTTO ARC SYSTEM, INC.,