TCW-33EIII Controller for Computer Resistance Welding Machine

TECHNICAL SPECIFICATION

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1. Introduction

1.1 Consistent current/voltage control

Through parameter settings, the consistent current/voltage control function is available for TCW-33EIII controller. The welding current/voltage sampling signal is compared with the settings and the phase-shifting angle of trigger changes automatically, so as to maintain consistent welding current/voltage.

1.2 Current /voltage display

Display primary welding voltage directly under consistent voltage control. Display primary welding current via current transformer sampling or display secondary welding current via induction coil sampling under consistent current control.

1.3 Storage of 9 welding specifications for reference

1.4 Continuous multi specification welding in cycle

Continuous welding of same workpiece at different positions, avoid frequent manual switching of welding specification.

1.5 Pre-heating current, welding current and temper current can be set

Avoid the splash during welding, avoid the tempering of workpiece after welding.

1.6 Gradual current increase and decrease

Avoid splash during welding, avoid defective nugget, and ensure good physical performance.

1.7 Counter

Count the number of welding operations to demonstrate work efficiency conveniently.

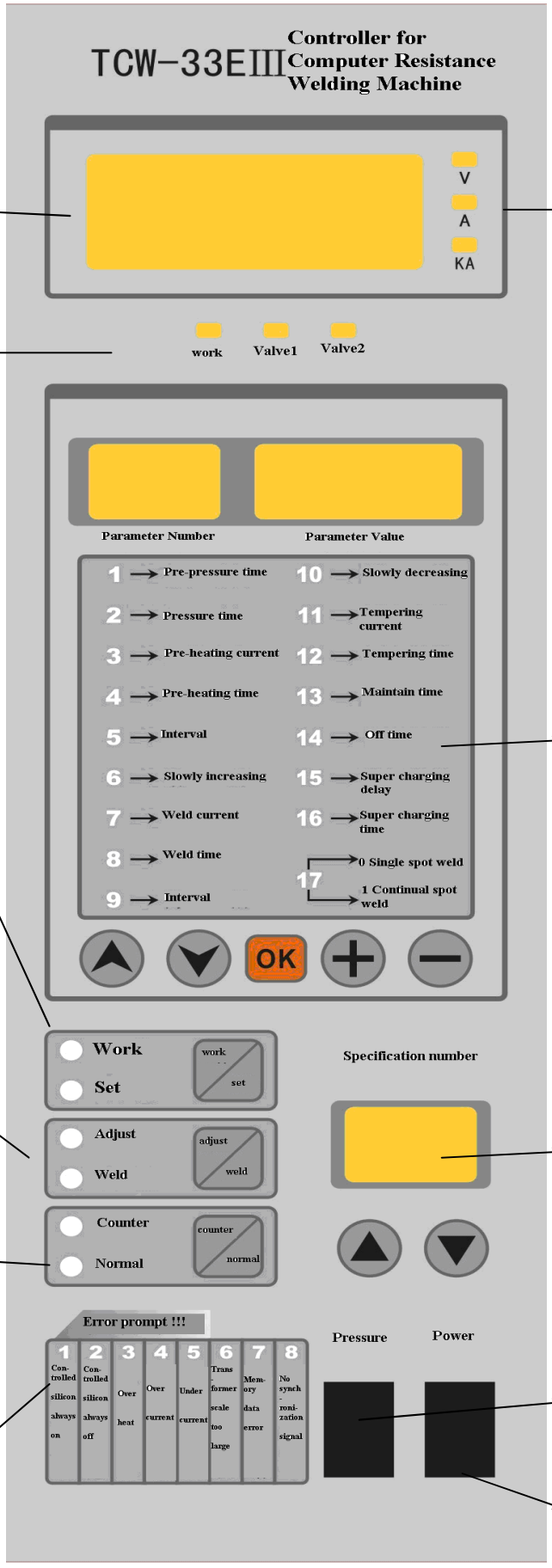
1.8 Diagnosis and automatic protection

In case of any abnormal conditions detected by the controller during operation, the output will be closed automatically and warning sign will be given.

2. Main technical parameters

Parameter	Value
Working environment	Temp. ≤45℃; Humidity≤85%(no condensate); Free of strong magnetic field, heavy vibration or shock, corrosive gas or conductive dust
Power	Single-phase 220-420V AC, 50Hz ± 5%
Input signal	Current transformer signal or voltage input signal
Driving capacity	Silicon-controlled (module), rated current ≤2000A
Motion output	3 groups of output, capacity of each group: DC24V/150mA
Power	≤25W
Automatic grid voltage compensation	For +15% to -25% of rated voltage for grid voltage variation, output current variation: ≤2%
Consistent current trigger method	For ± 15% secondary impedance variation, output current variation: ≤2%
Sampling speed	0.5 wave
Control response speed	1 wave
Pre-pressure, pressure, interval, maintain, off	0-250 waves
Pre-heating, welding, tempering, supercharge, slowly increase, slowly decrease	0-250 waves

3. Panel



Display current during and after welding.

"Work": LED illuminated when welding is initiated.
"Valve1": LED illuminated when main valve output is initiated.
"Valve2": LED illuminated when supercharging valve output is initiated.

Two statuses - work and set - are designed. Click this key to switch, and corresponding LED will illuminate.
Work: Start pedal switch, the controller will apply current specification, now setting of parameters is forbidden.
Set: Edit various parameters of current specification, now you can't start pedal switch for welding.

Tow mode - weld and adjust - are designed. Click this key to switch, and corresponding LED will illuminate.
Weld: Start to apply current specification for welding.
Adjust: Start to output action, without current output, so as to adjust the welding machine mechanically.

Click this key: "Counter" LED illuminates, accumulated welding times displays in window "Parameter value" and is stored automatically; hold this key for 10S to clear. "Normal" LED illuminates, actual parameter value displays in "Parameter value" window.

Error display: "Er xx" displays in parameter value window, showing corresponding error.

"V" LED illuminated: Consistent voltage control. Display welding voltage. Switch the current value into voltage value and its unit is V.

"A" LED illuminated: Consistent current control. Display primary current. The setting current is also primary welding current, its unit is A.

"KA" LED illuminated: Consistent current control. Display secondary welding current. The setting current is also secondary welding current, its unit is KA.

"Parameter list": List of all welding parameters.
Window "Parameter Number": Display numbers of parameters in list; select with key ▲ or ▼. Press and hold key ▲for 5S to enter level-2 menus.
Window "Parameter value": 1. Display value of current parameter, modify it with key + or -. 2. Display outer voltage during running status.

9 specifications stored in controller, number of current specification displayed in window "Specification number". Choose any of the 9 specifications via key ▲▼ to replace current one;.
Running status, meaning applying current specification.
Edit status, set parameters of current specification.

Manual pressure switch

Power switch

4. Programmer

4.1 Specification/Setting of parameters of level-1 menus

17 parameters are set for working of the controller (see following table), which shall be set by the user according to actual usage. To set parameters, set the controller to “Set” status , choose specification number, then press key ▲▼ to choose parameter number, and press key “+” , “-” to set parameter value:

<table>
<tr><th>Parameter</th><th>Scope</th><th colspan="3">Description</th></tr>
<tr><td>Pre-pressure time</td><td>0-250 waves</td><td colspan="3" rowspan="2">After the system starts, the main valve acts, and the electrode moves to the workpiece for pressure lasting for time for output welding current (pre-pressure time + pressure time). ① For single welding, apply parameter “Pre-pressure time” and “Pressure time” in order; ② For continuous welding, apply parameter “Pre-pressure time” as the system starts, and only apply parameter “Pressure time” for every later weld cycle.</td></tr>
<tr><td>Pressure time</td><td>0-250 waves</td></tr>
<tr><td rowspan="3">Pre-heating current</td><td rowspan="3">0-999</td><td rowspan="3">Value of pre-heating current</td><td colspan="2">Consistent voltage control： 0-450V</td></tr>
<tr><td rowspan="2">Consistent current control</td><td>primary： 0-999A</td></tr>
<tr><td>secondary： 0-99.9KA</td></tr>
<tr><td>Pre-heating time</td><td>0-250 waves</td><td colspan="3">Pre-heating current time on workpiece</td></tr>
<tr><td>Interval</td><td>0-250 waves</td><td colspan="3">Time interval from stop of “Pre-heating current” and start of next parameter.</td></tr>
<tr><td>Slowly increase</td><td>0-250 waves</td><td colspan="3">The time for working current reaching “Welding current” slowly from “Pre-heating current” as the interval is 0; or the time for working current reaching “Welding current” slowly from 0 as the interval isn’t 0</td></tr>
<tr><td rowspan="3">Welding current</td><td rowspan="3">0-999</td><td rowspan="3">Value of Welding current</td><td colspan="2">Consistent voltage control： 0-450V</td></tr>
<tr><td rowspan="2">Consistent current control</td><td>primary： 0-999A</td></tr>
<tr><td>secondary： 0-99.9KA</td></tr>
<tr><td>Welding time</td><td>0-250 waves</td><td colspan="3">Welding current time on workpiece</td></tr>
<tr><td>Interval</td><td>0-250 waves</td><td colspan="3">Time interval between stop of “Welding current” and start of next parameter.</td></tr>
<tr><td>Slowly decrease</td><td>0-250 waves</td><td colspan="3">As the interval is 0, meaning the time for working current dropping to “Tempering current” slowly from “Welding current”; as the interval isn’t 0, apply “Tempering current” directly after “Welding time” is over.</td></tr>
<tr><td rowspan="3">Tempering current</td><td rowspan="3">0-999</td><td rowspan="3">Value of tempering current</td><td colspan="2">Consistent voltage control： 0-450V</td></tr>
<tr><td rowspan="2">Consistent current control</td><td>primary： 0-999A</td></tr>
<tr><td>secondary： 0-99.9KA</td></tr>
<tr><td>Tempering time</td><td>0-250 waves</td><td colspan="3">Tempering current time on workpiece</td></tr>
<tr><td>Maintain time</td><td>0-250 waves</td><td colspan="3">The time for electrode maintain pressure on workpiece after the current is off. The main valve is closed after the time is over.</td></tr>
</table>

Off time	0-250 waves	Interval between two welding processes for continuous welding.
Supercharge delay	0-250 waves	Time from start of system to output of supercharging signal
Supercharge time	0-250 waves	Duration for supercharge. If "Off time" is over before the "Supercharge time" is over, the supercharge valve is closed.
Working method	0	Single welding
	1	Continuous welding

Note:

- **In the process of current transformer sampling, if the scale of the current transformer is within 100A, the controller will automatically raise the controlling accuracy to 0.1A, which means the scale of setting current is from 0 to 99.9A;**
- **In the process of induction coil sampling, if the scale of the current transformer is within 10.0KA, the controller will automatically raise the controlling accuracy to 0.01KA, which means the scale of setting current is from 0 to 9.99KA.**

4.2 Setting of parameters of level-2 menus

Press and hold key "▲" in Window "Parameter number" for about 5 Sec. to enter Level-2 menus, corresponding parameters are as follows:

Parameter			Code	Settings	Description
Start method			P	0	Start of pulse signal, dithering removing (suitable for pedal switch)
				1	Start of pulse signal, fast response (suitable for mechanical contact)
				2	Start of switch signal
Consistent current/voltage control			A	0	Consistent voltage control
				1-999	Consistent current control, the setting of parameter is determined by b: b=0: primary current transformer sampling, the value is the scale of current transformer, its unit is A. b=1: secondary induction coil sampling, the value is the scale of induction coil, its unit is KA.
Primary/secondary sampling			b	0	Primary sampling: A is the nominal value on current transformer nameplate, its unit is A
				1	Secondary sampling: A is the nominal value on induction coil nameplate, its unit is KA.
Upper current limit alarm			AH	0-100%	Alarm as actual welding current >settings (1+AH), display over current Er04
Lower current limit alarm			AL	0-100%	Alarm as actual welding current <settings(1-AL), display under current Er05
code bit	4	**Heat protection switch**	AA	0	Over heat protection, connecting normal-open contact of external heat protection devices
				1	Over heat protection, connecting normal-close contact of external heat protection devices
		Auxiliary output	Ab	0	No auxiliary action output in case of error prompts
				1	Give auxiliary action output in case of error prompts
		Consistent current/Consistent heat	AC	0	Consistent voltage/Consistent current (determined by A)
				1	Consistent heat
		Standby parameter	Ad		
		Filtering step	AE	0-5	AE may be set as 0 at normal. Filtering step may be set in case of

		Filtering scope	AF	0-100	interference and filtering shall be started. AF may be set as 20-30 in general.
	5		d	Standby parameter	
		Error prompt method	T	0	Terminate current specification immediately in case of error prompts. Start pedal switch to go on working.
				1	Terminate current specification immediately in case of error prompts. Press key "Work/Set" to clear error prompt before starting pedal switch to go on working.
				2	Close error prompt
		Specification selection	C	0	Apply current specification
				N (1-9)	Apply specification 1 to N in cycle

4.3 Mechanical adjustment

Welding machine requires mechanical adjustment before welding. Two mechanical adjustment methods are as follows:

◆ Press the "Pressure" switch on panel:

If the switch is closed, the main valve is in action. The method can only adjust the main valve.

◆ Setting the parameters as follows:

1. Pre-set the parameters of the specification.
2. Press "adjust/weld" key to illuminate the "adjust LED".
3. Press "work/set" key to illuminate the "work LED".
4. Start the pedal switch, there is only action output in the controller while there is no welding current output.

The method can adjust not only the main valve, but the supercharging valve and auxiliary valve as well.

4.4 Welding

Weld after the setting of parameters and the adjustment. The method is as follow:

1. Press "adjust/weld" key to illuminate the "weld LED".
2. Press "work/set" key to illuminate the "work LED".
3. Put the workpiece between the electrodes, close the pedal switch, and start to weld.

E.g.

One workpiece requires three-pulses welding, the parameters are as follows: Start the pedal switch, then electrode tightly holds the workpiece, and the machine starts to weld after 30 waves; Pre-heat with 10KA current in 3 waves, weld with 18KA current in 5 waves, temper with 10KA current in 3 waves; electrode maintains 15 waves on the workpiece. The work method is single spot weld. Take induction coil sampling and supervising.

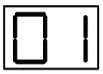
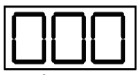
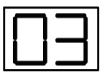
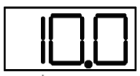
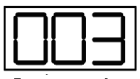
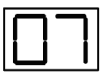
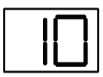
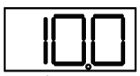
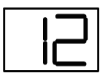
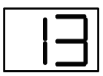
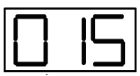
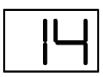
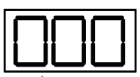
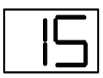
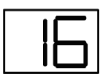
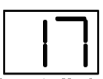
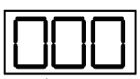
① Take consistent current control and induction coil scale (A) 30.0KA

② Take induction coil sampling (b) b=1

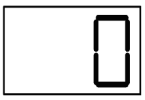
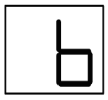
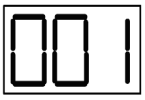
③ Set the parameters:

A. Press "work/set" key to illuminate the "set LED";

B. Press "↻" to set the specification number as 1, which means the setting of following parameters are all according to the NO.1 specification.

Step	Parameter Number	Form	Representation	Parameter setting	Form	Representation
1	Press key ▲ ▼ to set parameter number 1	 Parameter Number	Pre-pressure time	Press key + − to set 30	 Parameter value	Pre-pressure time is 30 waves
2	Press key ▲ ▼ to set parameter number 2	 Parameter Number	Pressure time	Press key + − to set 0	 Parameter value	Single spot weld, the value is 0
3	Press key ▲ ▼ to set parameter number 3	 Parameter Number	Pre-heating current	Press key + − to set 10.0	 Parameter value	Pre-heating current is 10.0KA
4	Press key ▲ ▼ to set parameter number 4	 Parameter Number	Pre-heating time	Press key + − to set 3	 Parameter value	Pre-heating time is 3 waves
5	Press key ▲ ▼ to set parameter number 5	 Parameter Number	Interval	Press key + − to set 0	 Parameter value	the value is 0 according to the requirements
6	Press key ▲ ▼ to set parameter number 6	 Parameter Number	Slowly increase	Press key + − to set 0	 Parameter value	No slowly increase, the value is 0
7	Press key ▲ ▼ to set parameter number 7	 Parameter Number	Welding current	Press key + − to set 18.0KA	 Parameter value	Welding current is 18.0KA
8	Press key ▲ ▼ to set parameter number 8	 Parameter Number	Welding time	Press key + − to set 5	 Parameter value	Welding current output time is 5 waves
9	Press key ▲ ▼ to set parameter number 9	 Parameter Number	Interval	Press key + − to set 0	 Parameter value	the value is 0 according to the requirements
10	Press key ▲ ▼ to set parameter number 10	 Parameter Number	Slowly decrease	Press key + − to set 0	 Parameter value	No slowly decrease , the value is 0
11	Press key ▲ ▼ to set parameter number 11	 Parameter Number	Tempering current	Press key + − to set 10.0 KA	 Parameter value	Tempering current is 10.0KA
12	Press key ▲ ▼ to set parameter number 12	 Parameter Number	Tempering time	Press key + − to set 3	 Parameter value	Tempering current output time is 3 waves
13	Press key ▲ ▼ to set parameter number 13	 Parameter Number	Maintain time	Press key + − to set 15	 Parameter value	After working current is off, the time for electrode to maintain pressure on the workpiece is 15 waves
14	Press key ▲ ▼ to set parameter number 14	 Parameter Number	Off time	Press key + − to set 0	 Parameter value	Single spot weld, the value is 0
15	Press key ▲ ▼ to set parameter number 15	 Parameter Number	Supercharge delay	Press key + − to set 0	 Parameter value	No supercharge, the value is 0
16	Press key ▲ ▼ to set parameter number 16	 Parameter Number	Supercharge time	Press key + − to set 0	 Parameter value	No supercharge, the value is 0
17	Press key ▲ ▼ to set parameter number 17	 Parameter Number	Working method	Press key + − to set 0	 Parameter value	Single spot weld, the value is 0

C. Press and hold key "▲" in Window "Parameter number" for about 5 Sec. to enter Level-2 menus, and input the following parameters:

Step	Parameter Number	Form	Representation	Parameter Setting	Form	Representation
1	Press key ▲▼ to set P	 Parameter Number	Starting method	Press key + − to set 0	 Parameter value	Start of pulse signal, dithering removing
2	Press key ▲▼ to set A	 Parameter Number	Consistent current control	Press key + − to set 30.0	 Parameter value	Induction coil scope is 30KA
3	Press key ▲▼ to set b	 Parameter Number	Secondary Sampling	Press key + − to set 1	 Parameter value	Induction coil sampling

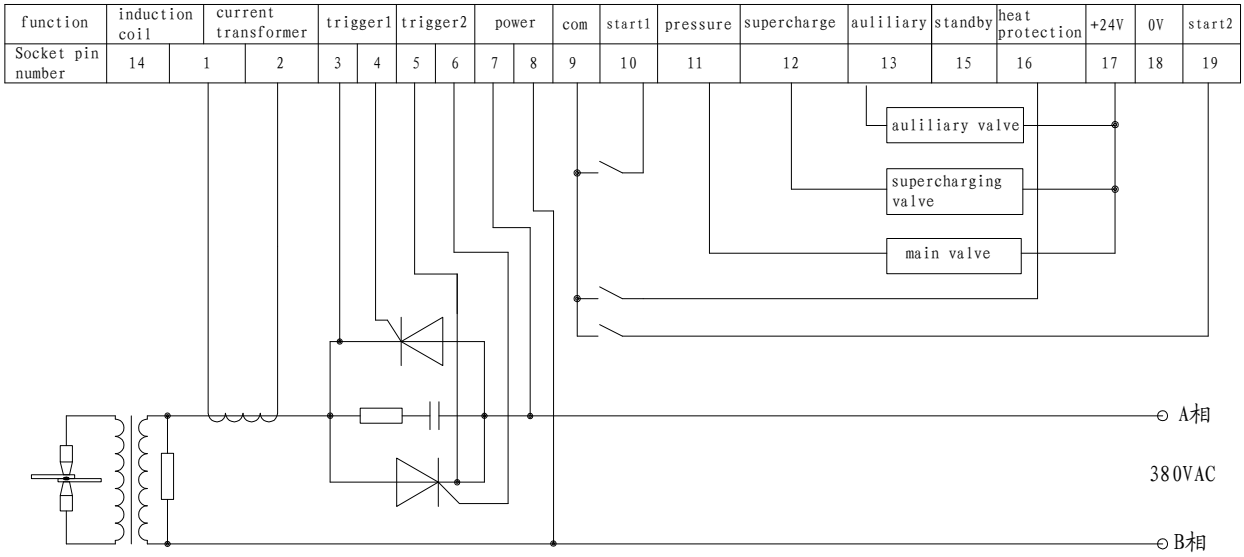
D. Press and hold key "▲" in Window "Parameter number" for about 5 Sec. to quit Level-2 menus.

③ Press "work/set" key to illuminate the "work LED";

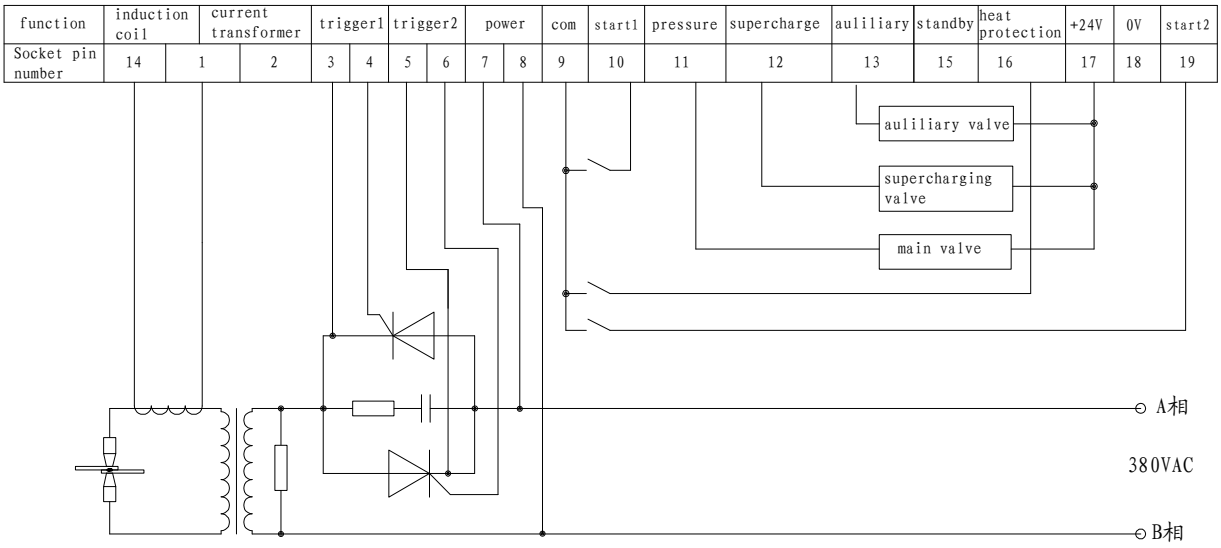
④ Put the workpiece between the electrodes and start the pedal switch to initiate the welding.

5. Circuit diagram

5.1 Primary sampling



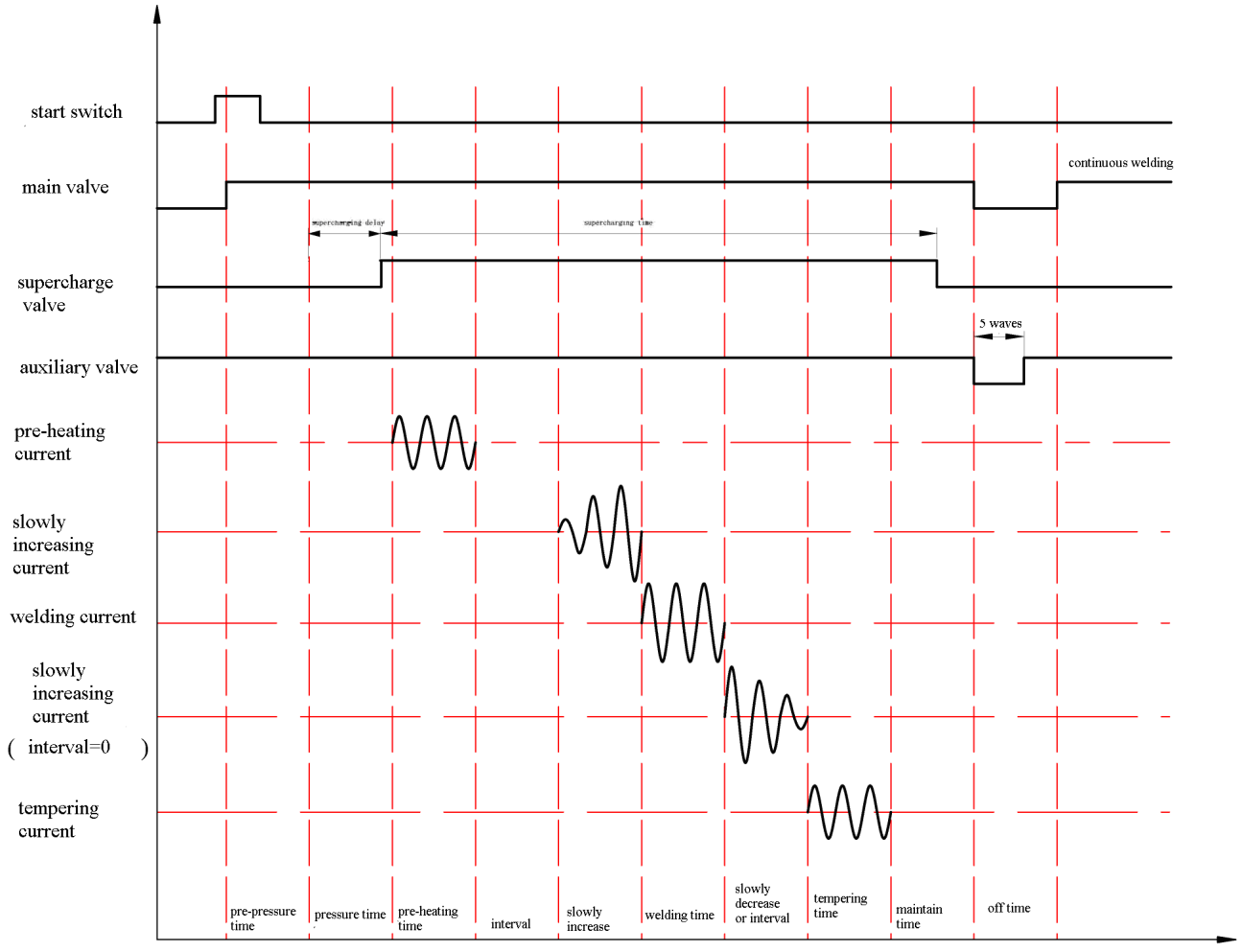
5.2 Secondary sampling



Note:

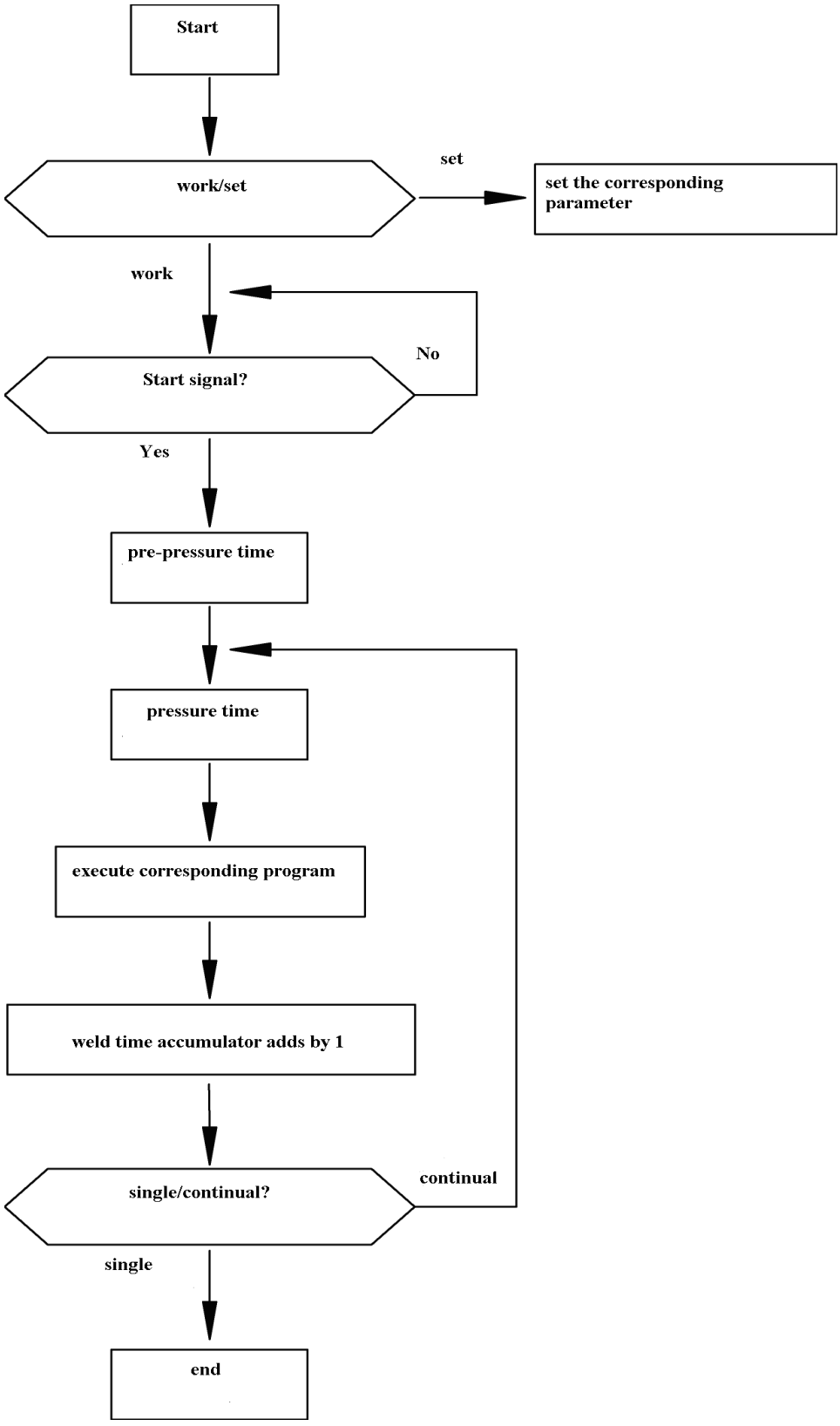
- **Please connect the circuit elements in accordance with the circuit diagram above! If there is no power and appears Er02 error prompt, please exchange sockets No.7 and No.8.**
- **The power supply of valve is 24VDC, and its power should be lower than 3.6W, otherwise there should be an external power supply and a 24V relay.**

6. Time sequence diagram



Note: 1. In case the supercharging time is too long and not over, the supercharging valve will close as "Off time" is over.
2. Slowly decreasing is only available as there is no interval between "Welding time" and "Tempering time".

7. Working flow chart

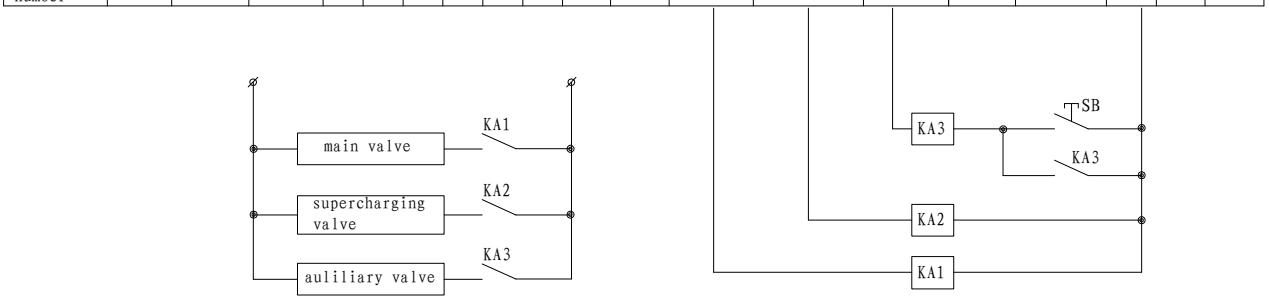


8. Other functions

8.1 Output

Three groups of transistor output are set for this controller, with driving capacity of DC24V/150mA for each. If higher driving capacity is necessary during operation, arrange an additional external DC24V relay (Shown as the following figure).

function	induction coil		current transformer	trigger1		trigger2		power		com	start1	pressure	supercharge	auliliary	standby	heat protection	+24V	0V	start2
Socket pin number	14	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	19



8.2 Double start switch input (note as ordering)

Double start switches are set for this controller. The first start switch is designed to apply current specification (1-9), and the second start switch is dedicated to apply the 9th specification.

8.3 Single-point multi specifications

In total 1-9 welding specifications can be set for this controller and selected by the user. You can select any one of the specifications, or apply 1-9 specifications in cycle (single-point multi specifications). The applied specification is determined by settings of “5” of code “C”.

Single-point multi specifications: In the process of welding, after finishing the present specification, whether to cease or to continue to execute the next specification is determined by the working method of present specification.

1. If the working method of present specification is 0, start the pedal switch, execute the next specification.

2. If the working method of present specification is 1, execute the next specification automatically after finishing the present specification.

3. If the working method of all specifications is 1, the controller executes the welding specifications in circle.

E.g.1

A welding consists of 6 welding specifications:

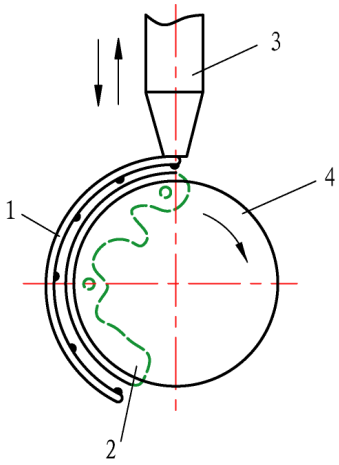
If the working method of specification 1 to 6(parameter 17) is 0, start the pedal switch, the controller will stop to work after finishing the first welding specification, restart the pedal, and the controller will execute the second specification.

If the working method of specification 1 to 6 is 1, start the pedal switch, the controller will execute specification 1 to specification 6 in circle.

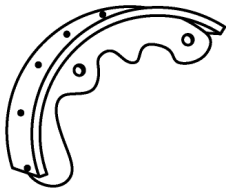
If the working method of specification 1 to 5 is 1, and the working method of specification 6 is 0, start the pedal switch, the controller will execute specification 1 to 6 in order and then stop to work. Restart the pedal switch, again the controller will execute specification 1 to 6 in order and the stop to work.

E.g.2

Use manual feeding point projection welding machine to weld automobile brake shoe. Put the stiffened panel into the lower-wheel fixture and the pneumatic fixture will tightly hold the panel, and then put the bent panel on the stiffened panel for welding. Manually rotate the lower electrode, once the upper electrode press, weld a projection point, after welding all the projection point (suppose there are 6), the machine will stop automatically.



point projection welding



welded brake shoe

1—panel 2—stiffened panel 3—upper electrode 4—lower electrode

Due to the difference in current of different projection point, there are 6 specifications

① set the “work/set” key to set status;

② input the parameters of 6 specification in order, the working method of specification 1 to 5 is “1”(continuous), the working method of specification 6 is “0”(single);

③ enter the level-2 menus, choose code 5 to set the value of C as “6”, and then exit;

④ set the “work/set” key to work status, the “weld/adjust” key to weld status;

⑤ start the pedal switch, execute specification 1 to 6 in order and then stop to work.

Note:

- **In step 2, if the working method of specification 1 to 6 is "0" (single), you need to start the pedal switch every time you weld a projection point (that is every time you execute a welding specification).**

8.4 Three-pulse controller perform single or double-pulse function

"Pre-heating", "Welding" and "Tempering" current pulses are set for three-pulse controller. If working time of certain current pulse is 0, then the current pulse is canceled. So the three-pulse controller can be set to perform single or double pulse function. To use "Welding" pulse only, just set "Pre-heating time" and "Tempering time" to 0; to use "Welding" and "Tempering" pulses, just set "Pre-heating time" to 0. The user can set it according to actual usage.

8.5 Pause

During continuous welding, start pedal switch to stop the controller immediately. Re-start the pedal switch, the controller will apply next specification.

9. Diagnosis and prompt

In case following problems detected by the controller during working, the output will be closed automatically and the following displays:

Item	Code	Description	Reason	Troubleshoot
1	**E r 01**	Controlled silicon always on	In case no output from the controller, one or two tubes of controlled silicon are on	Check the controlled silicon for any damage or wrong wiring
2	**E r 02**	Controlled silicon always off	As the controller outputs pulse, one or two tubes of controlled silicon are off	Check the controlled silicon for any damage or if 7 or 8 wire of controller power is right
3	**E r 03**	Overheat	External heat protection switch acts or abnormal	Check heat protection or corresponding line
4	**E r 04**	Over current	Welding current too high	
5	**E r 05**	Under current	Welding current too low	
6	**E r 06**	Transformer scale too large	sample current too low	Replaced with lower scale transformer
7	**E r 07**	Memory data error	Wrong controller parameter settings	Check parameter settings
8	**E r 08**	No synchronization signal	Synchronization signal lost	Check if the synchronization signal input wire is connected properly