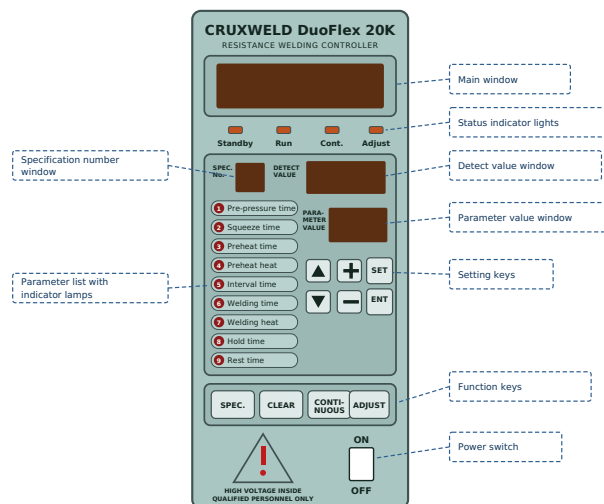


AC Resistance Welding Machine

DuoFlex 20K

Spot & seam welding controller — constant conduction-angle type

Controller Instruction Manual



**Read this manual carefully before use, to ensure the safety of the equipment and of people.
Keep this instruction manual properly for reference.**

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 Take notice of

- Please do not disassemble, modify or repair this controller yourself, and do not carry out operations other than the instructions given for this equipment. If the equipment works abnormally and needs to be overhauled, please entrust the work to Cruxweld after-sales service, to avoid unnecessary losses.
- Do not open the cover during use and do not touch the internal parts of the controller. There is a high voltage inside the equipment when it is working, and touching it may cause a serious accident.
- Make sure that the housing of the device is well earthed.
- Cut off the power supply before any inspection, and wait until the internal capacitors have discharged.

Thank you for choosing the Cruxweld **DuoFlex 20K** AC resistance welding machine controller. Please read this manual carefully before using it, to ensure the safety of the equipment and of people. Keep this instruction manual properly for reference.

This controller is used on spot welding machines, butt welding machines, seam (roll) welding machines and projection welding machines. The welding sequence, the conduction angle (heat) and the number of cycles for each step of the sequence are set from the front panel, and are stored in the controller so that the same weld can be repeated exactly.

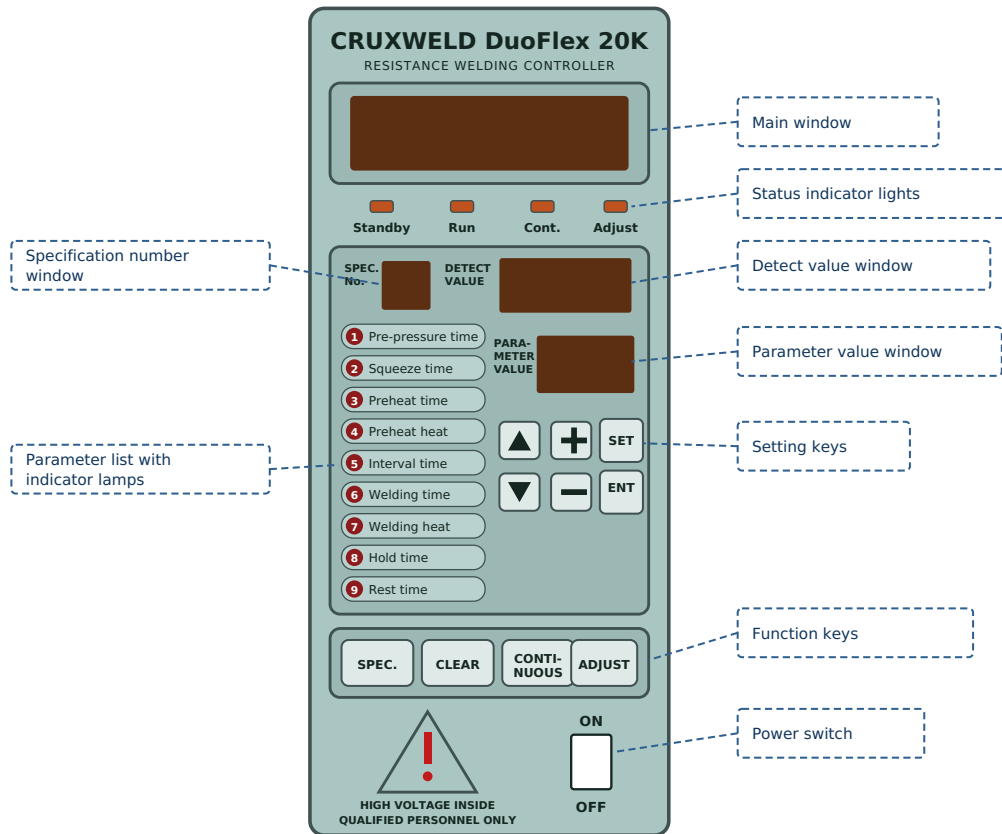
Note: throughout this manual, time is expressed in **cycles** of the mains supply.
1 cycle = 20 milliseconds on a 50 Hz supply.

1. Technical Parameters

Parameter	Parameter value
Working environment	Temperature $\leq 45\text{ }^{\circ}\text{C}$; humidity $\leq 85\text{ }\%$; no strenuous movement or impact; no corrosive gases and no conductive dust
Working power supply	380 V AC, 50 Hz $\pm 5\text{ }\%$
Drive capacity	Thyristor (controllable silicon) module, discharge $\leq 2000\text{ A}$
Motion output	2-way output, DC 24 V / 200 mA per set
Whole unit power consumption	$\leq 30\text{ W}$
Chassis size	90 × 300 × 260 mm
Counting range	0 - 9999
Pre-pressure time	0 - 999 cycles
Squeeze (pressurising) time	0 - 999 cycles
Preheat (warm-up) time	0 - 999 cycles
Preheat heat	0 - 999 (conduction angle)
Interval time	0 - 999 cycles
Welding time	0 - 999 cycles
Welding heat	0 - 999 (conduction angle)
Hold (pressure preservation) time	0 - 999 cycles
Rest (suspension) time	0 - 999 cycles

Note: 1 cycle = 20 milliseconds.

2. Control Panel Description



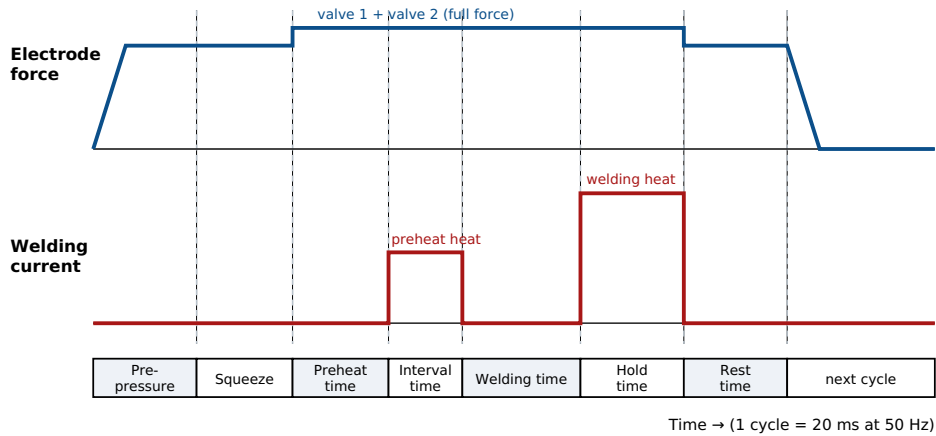
DuoFlex 20K front panel

2.1 Windows, indicators and keys

Item	Function
Main window	In normal mode it shows the welding count value. In query, setup and extended mode it shows the mode code H-01, H-02 or H-03.
Status indicator lights	Standby — the controller is powered and waiting. Run — a welding sequence is running. Continuous — continuous (repeat) mode is selected. Adjust — mechanical-motion or mould-position adjustment state is selected.
Specification number window	Shows the number of the welding specification (program) that is selected.
Detect value window	Shows the number of the parameter being viewed or set (-XX), and the monitored value.
Parameter value window	Shows the value of the parameter selected in the parameter list. In setup mode the last digit flashes.
Parameter list	Nine indicator lamps, 1 to 9, show which step of the sequence the displayed value belongs to: pre-pressure time, squeeze time, preheat time, preheat heat, interval time, welding time, welding heat, hold time, rest time.
▲ / ▼	Select the parameter number (move up and down the parameter list).
+ / -	Increase or decrease the flashing digit. Press and hold for rapid change.
SET	Enter setup mode; in setup mode it shifts to the next digit. Long press (about 2 s) enters extended mode.
ENT (Confirm)	Saves the set parameters and returns to normal mode.
SPEC.	Selects the specification (program) number. A long press (about 2 s) in the normal state clears the count value of the main window to 0.
CLEAR	Clears the displayed value.
CONTINUOUS	Selects single-point welding or continuous welding.
ADJUST	Short press — mechanical motion adjustment. Long press (about 2 s) — mould position adjustment.
Power switch	ON / OFF switch for the controller.

3. The Welding Sequence

The controller runs the following sequence each time a start signal is received. Each step is set separately, in cycles of the mains supply (1 cycle = 20 ms), and the two heat settings are set as a conduction angle from 0 to 999.



Welding sequence — electrode force and welding current against time

No.	Step	What happens
1	Pre-pressure time	Air valve 1 operates and the electrodes close on the work; no current flows.
2	Squeeze time	Air valve 2 operates and the full electrode force builds up; no current flows.
3	Preheat time	Current flows at the preheat heat setting.
4	Preheat heat	Conduction angle used during the preheat time (0 – 999).
5	Interval time	Current is off; the weld nugget cools slightly before the main pulse.
6	Welding time	Current flows at the welding heat setting — the weld is made.
7	Welding heat	Conduction angle used during the welding time (0 – 999).
8	Hold time	Current is off but the electrode force is maintained while the weld solidifies.
9	Rest time	The electrodes open. In continuous mode, the next cycle starts after this time.

4. Operating Modes and Action Settings

4.1 Extended-mode functional parameters

Press and hold the **SET** key for about 3 seconds. The main window shows **H-03**, the specification number window shows **2**, the detect value window shows the parameter number (001 / 002 / 003 ...) and the parameter value window shows the value. The functional parameters are as follows.

Parameter	Value	Function
2.001	0	Spot welding — air valves 1 and 2 move at the same time.
	1	Butt welding — pre-pressure starts air valve 1; pressurising starts air valve 2; at the end of the pressure period air valve 1 stops, and air valve 2 stops at the end.
	2	Seam welding — pre-pressure starts air valve 1; pressurising starts air valve 2; at the end of pressure preservation air valve 2 stops, and at the rest period air valve 1 stops. The cycle then repeats; the discharge start time is selectable.
	3	Projection (convex) welding — pre-pressure starts air valve 1; pressurising starts air valve 2; at the end of pressure preservation air valve 2 stops, and air valve 1 stops at the end.
2.002	0	The first start signal starts the welding process; the second start signal ends it; the process also ends naturally.
	1	In continuous state the start signal starts welding and the welding process ends naturally. In seam welding: first start signal — air valve 1 starts; second start signal — welding starts; third start signal — welding ends.
2.003	0	During seam welding, discharge during the preheating time.
	1	When welding, discharge while pressurised.
2.004	0	Seam welding process: preheating and spacing.
	1	Seam welding process: spacing, then welding.
2.005	0	The action time is half a cycle, and the discharge time is the full cycle.
	1	The action time and the discharge time are both full cycles.
2.006	0	The start signal time must exceed the pre-pressure time.
	1	Accept the start-up signal for welding.
2.007	—	Reserved.

4.2 Continuous state, movement and foot-pedal function

2.001	2.002	Function
0	0	First continuous state of spot welding : the first start signal starts the welding process and the second start signal ends it.
0	1	Second continuous state of spot welding : start signal in, the welding process cycles; start signal again, the welding process ends.
1	0	First continuous state of butt welding : the first start signal starts the welding process and the second start signal ends it.
1	1	Second continuous state of butt welding : start signal in, the welding process cycles; start signal again, the welding process ends.
2	0	First continuous state of seam welding : the pedal is closed once to start welding, and the welding stops when the pedal is closed a second time.
2	1	Second continuous state of seam welding : ● first operation — the first 24 V output starts and stays on; ● second operation — the second 24 V output starts and the seam welding cycle begins; ● third operation — the controller enters pressure preservation and rest.

Seam welding state, discontinuous function: keeping the pedal closed starts welding, and welding stops when the pedal is released.

5. Features of the Controller

1. **Specification No. 1:** long press the **SPEC.** key to select specification number one.
2. **Regular (normal) mode:** the controller enters normal mode by default after booting. In this mode the **main window** shows the welding count value and the **parameter value window** shows the set welding heat value. The welding start signal is only accepted in this mode. When the controller is in another mode, press **ENT** to return to normal mode.
3. **Query mode:** from normal mode press **▲** or **▼** to enter query mode. The counting window shows **H-01**, the detect value window shows **-XX** (XX is the parameter number) and the parameter value window shows the value of that parameter. Press **▲** or **▼** again to step through the parameter numbers and their values. In this mode the **+** and **-** keys are inactive — values can only be viewed, not changed. Press **ENT** to return to normal mode.
4. **Setup mode:** from normal mode or query mode press **SET** to enter setup mode. The counting window shows **H-02**, the detect value window shows **-XX** (the parameter number), and the parameter value window shows the value with the last digit flashing. In this mode press **+** or **-** to change the flashing digit; press and hold for rapid change; press **SET** to shift to the next digit; press **▲** or **▼** to change the parameter number. Press **ENT** to save the settings and return to normal mode.
5. **Extended mode:** from normal mode or query mode, long press **SET** (about 2 seconds) to enter extended mode. The counting window shows **H-03**, the specification number shows **2 . .** and the monitoring value shows **001 / 002**. The functional parameters described in section 4.1 are set in this mode.

5.1 Other actions

● Mechanical motion adjustment

Short press the **ADJUST** key so that the **Adjust** indicator lamp is continuously lit; the controller then enters the mechanical action adjustment state. When a welding start signal is received in this state, the electrode movement is exactly the same as during welding, but the thyristor is not triggered, so no current flows. This state is used to check whether the air circuit, the mechanical structure and the settings are normal. Press the **ADJUST** key briefly again; when the **Adjust** lamp goes out, the adjustment state is left.

● Mould position adjustment

Long press the **ADJUST** key (about 2 seconds) so that the **Adjust** indicator lamp flashes; the controller then enters the mould position adjustment state. When the first welding start signal is received in this state, the electrode head closes and stays down until the second welding start signal is received. The thyristor is not triggered at any point in this process. This state is used to check whether the position of the upper and lower electrodes (the mould) is accurate. Press the **ADJUST** key briefly again; the **Adjust** lamp lights continuously and the controller returns to the mechanical adjustment state.

● Clearing the counter

In the normal state, long press the **SPEC.** key (about 2 seconds); the count value in the main window is set to 0.

Attention
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Always carry out the first trial of a new setting in the mechanical motion adjustment state, so that the electrode movement and the air circuit can be checked before any current flows. Keep hands clear of the electrodes while the machine is under power.
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6. Wiring Method

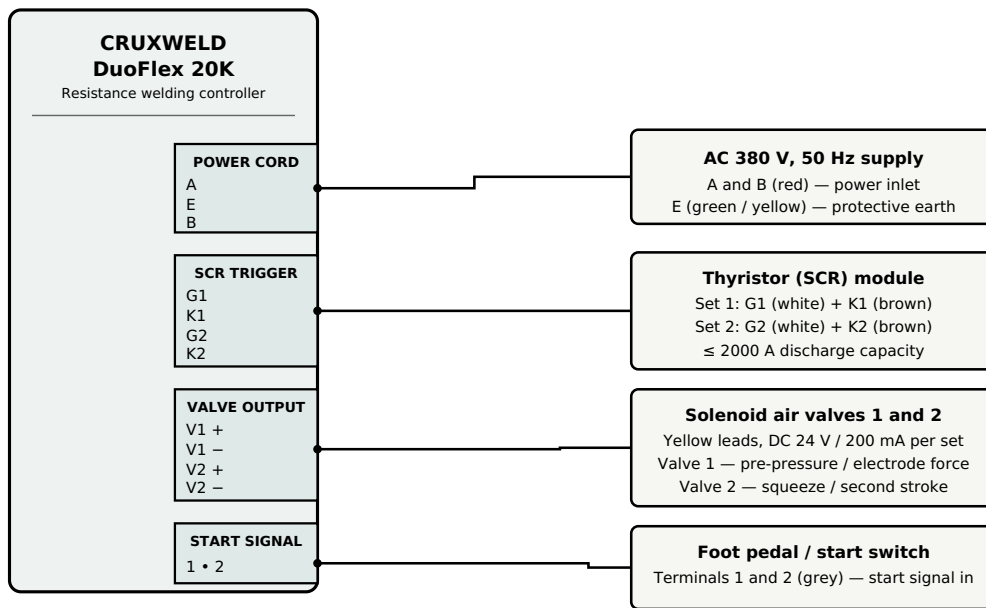
6.1 Terminal descriptions

Terminal	Name	Function description
Power supply A, Earth, Power supply B	Power cord	Power supply A (red) and power supply B (red): power inlet. Earth (green / yellow): protective earth connection.
K1, K2, G1, G2	Thyristor (silicon-controlled) trigger terminal	G1 (white) and K1 (brown): gate and cathode of the first set of thyristors. G2 (white) and K2 (brown): gate and cathode of the second set of thyristors.
Air valve 1+, air valve 1–, air valve 2+, air valve 2–	Pneumatic valve output end	Air valve 1+ and air valve 1– (yellow): pneumatic valve 1 output. Air valve 2+ and air valve 2– (yellow): pneumatic valve 2 output. DC 24 V / 200 mA per set.
Foot pedal +, foot pedal –	Start signal input	Terminals 1 and 2 (grey): start signal input from the foot pedal or start switch.

Warning

Follow the connection diagram strictly. A wiring error may burn out the controller and the thyristor module. Switch off and isolate the supply before making or changing any connection, and make sure the housing is earthed.

6.2 Connection diagram



Connection of the DuoFlex 20K controller to the supply, the thyristor module, the air valves and the foot pedal

7. Steps to Use

1. Check that the wiring of all external devices is correct — air valves, start switch, transformer and thyristor control.
2. Switch on the welding machine and the controller power supply. The **Adjust** and **Standby** indicator lights come on.
3. Check that the parameter values are correct.
4. Use the **CONTINUOUS** key to select single-point welding or continuous welding mode.
5. Operate the welding start switch to check that the cylinder and the rest of the mechanism work properly. **Make sure this step is carried out in the mechanical motion adjustment state**, so that no current flows.
6. Short press the **ADJUST** key so that the **Adjust** indicator light goes out.
7. Operate the welding start switch to weld.
8. Switch off the controller and the welding machine power supply after welding.

Before the first production weld, make a test weld on a sample of the same material and thickness, and check the weld nugget. Adjust the welding heat and welding time until the required weld strength is obtained, then record the specification number for that job.

8. Application Examples

8.1 Welding in single-point mode

1. Press the **SPEC.** key and set the specification number to 1. Press the **SET** key; the parameter window starts to flash and the controller enters setup mode. Use **SET** to shift to the digit to be changed, press **+** or **–** to adjust the welding parameter, and press **▲** or **▼** to move to the next parameter number. Press **ENT** to complete the setting of specification 1.
2. Check the indicator lights: the **Adjust** indicator light is off and the **Continuous** indicator light is off.
3. One weld is made each time the foot pedal is pressed.

8.2 Welding in continuous mode

1. Press the **SPEC.** key and set the specification number to 1. Press the **SET** key; the parameter window starts to flash and the controller enters setup mode. Use **SET** to shift, press **+** or **–** to adjust the welding parameter, and press **▲** or **▼** to move to the next parameter number. Press **ENT** to complete the setting of specification 1.
2. Check the indicator lights: the **Adjust** indicator light is off and the **Continuous** indicator light is on.
3. After the first press of the pedal the program loops; after the second press the program stops.

9. Precautions

1. Follow the wiring diagram strictly. A wiring error may burn out the controller and the thyristor control module.
2. There is a high voltage inside the controller. Do not open the controller while it is energised, to avoid electric shock or unnecessary damage.
3. The terminals and sockets should be checked regularly by qualified personnel, so that problems are dealt with in good time.
4. Cut off the power supply before carrying out any inspection.
5. Keep the controller clean and dry. Do not allow welding spatter, oil or conductive dust to collect on or inside the housing.
6. Make sure the housing is well earthed at all times.

Service
For spare parts and service support, contact Cruxweld at support@cruxweld.com or +91 8800 882 983 , quoting the model DuoFlex 20K .



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DuoFlex 20K — AC Resistance Welding Machine Controller

The specifications and technical content of this product are subject to change without notice.