



# Introduction to WS700

Spot/Seam control, monitor and machine sequencer  
for 50/60Hz resistance welding.

For s/w version 1.27

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Document revision 0



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- Welding controls.
- Thyristors and power supplies
- Power Inverters.
- Meters and Monitors.
- Training and Support.
- Consultancy.



# Table of contents

4.	Functions	26.	Edit printer setup	49.	Copy Program
5.	...functions	27.	..print format:table	50.	I/O status
6.	Users connections	28.	..print format:ASCII-HEX	51.	Low-force approach (optional)
7.	Dimensions	29.	...printer connections	52.	...low-force approach
8.	Mounting	30.	Initialise all data	53.	.....low-force approach
9.	Global parameters	31.	Edit program	54.	Disabling edits
10.	Program parameters (x64)	32.	..edit program	55.	Pop-up current meter
11.	Keypad and indicators	33.	....edit program(seam)	56.	Operation: basic spot weld – no weld faults
12.	Menus	34.	.....edit program(1/2 cycle)	57.	Operation: basic spot weld – weld fault
13.	..menus	35.	Edit limits	58.	Operation: repeat spot weld
14.	Diagnostic screen	36.	Edit Events	59.	Operation: pulsation spot weld
15.	Status messages	37.	Electrode menu	60.	Operation: upslope and downslope
16.	Main menu	38.	Stepper status	61.	Operation: upslope and downslope
17.	Configuration menu	39.	Edit Stepper	62.	Operation: roll-spot welding
18.	Edit configuration	40.	Stepper presets	63.	Operation: seam welding (dual heat)
19.	...edit configuration	41.	Edit counter	64.	Operation: seam welding (pre-heat)
20.	.....edit configuration	42.	Weld log	65.	Operation: Retract/Hi-lift
21.	Edit calibration	43.	View log	66.	WS98-700 PC software
22.	...calibration	44.	Sequencer		
23.	.....calibration	45.	Sequencer Menu		
24.	Edit Output Map	46.	...edit sequence		
25.	Edit Input Map	47.	Sequencer statements		
		48.	Example sequence		

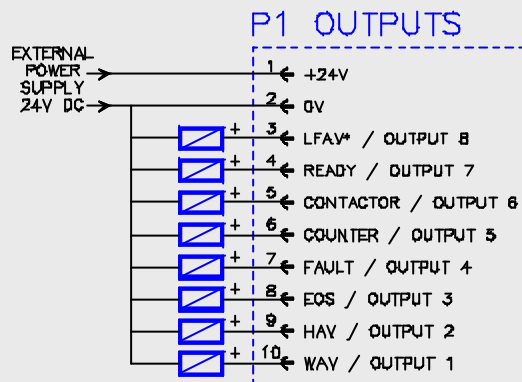
# Functions

- Spot / Repeat / Roll-spot / Seam(dual heat)/Seam(pre-heat)/half-cycle welding.
- Dual weld intervals plus pulsation, upslope and downslope.
- Constant current regulation.
- 64 programmes (internal or external selection).
- Current monitoring (high/low/pre limits), programmable blocking.
- Proportional valve controller (0..10V). Selectable units (kN/lbf)
- Pressure monitoring (high/low limits).
- Programmable outputs (events).
- Machine sequencer logic.
- Programmes may be linked together for multiple spot sequences.
- Contactor timer.
- Retract/high-lift control.

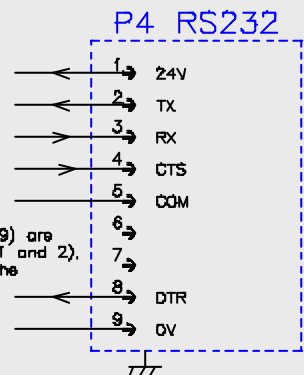
# ...functions

- Low-force approach.
- Head-lock function.
- Weld counter (programmable blocking).
- Heat stepper (programmable blocking).
- Pop-up current meter.
- Weld history log.
- Primary or Secondary feedback via Toroid or CT.
- Toroid, CT and PV calibration functions.
- Toroid test function.
- Disable edit function.
- Large backlit 4x20 lcd display.
- RS232 port, for PC communications and print out of weld data.

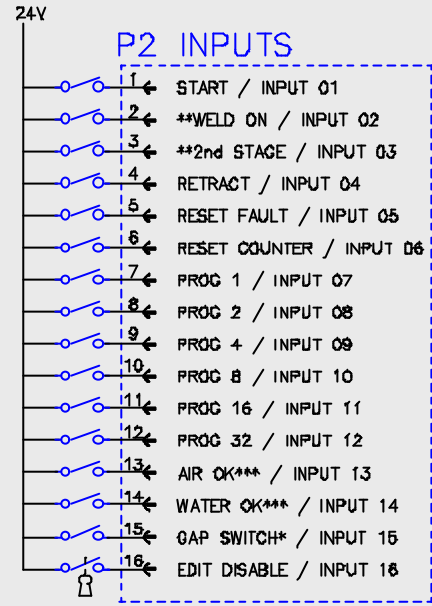
# Users connections



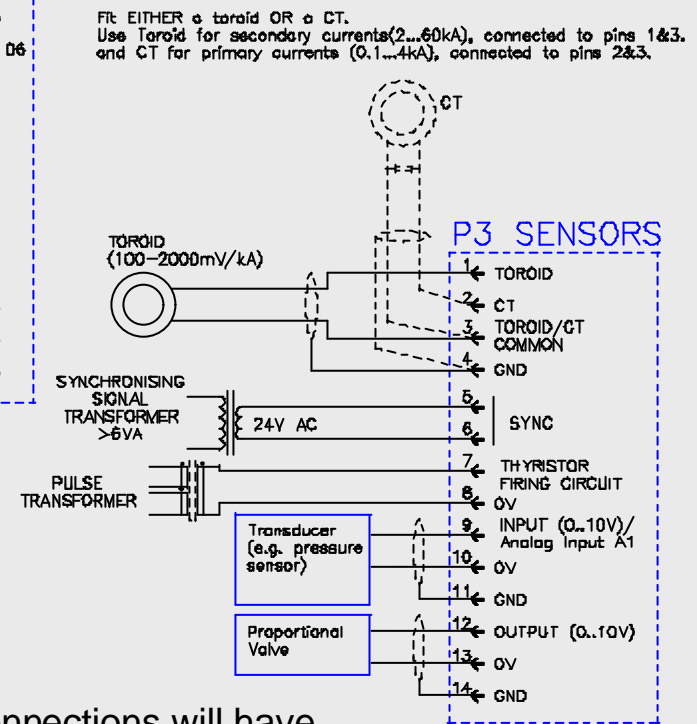
WAY AND HAV OUTPUTS RATED 500mA @ 24V DC.  
ALL OTHER OUTPUTS RATED 100mA @ 24V DC



NOTES:  
24V(pin 1) and 0V(pin 9) are connected to P1 (pins 1 and 2), and are isolated from the RS232 signals.

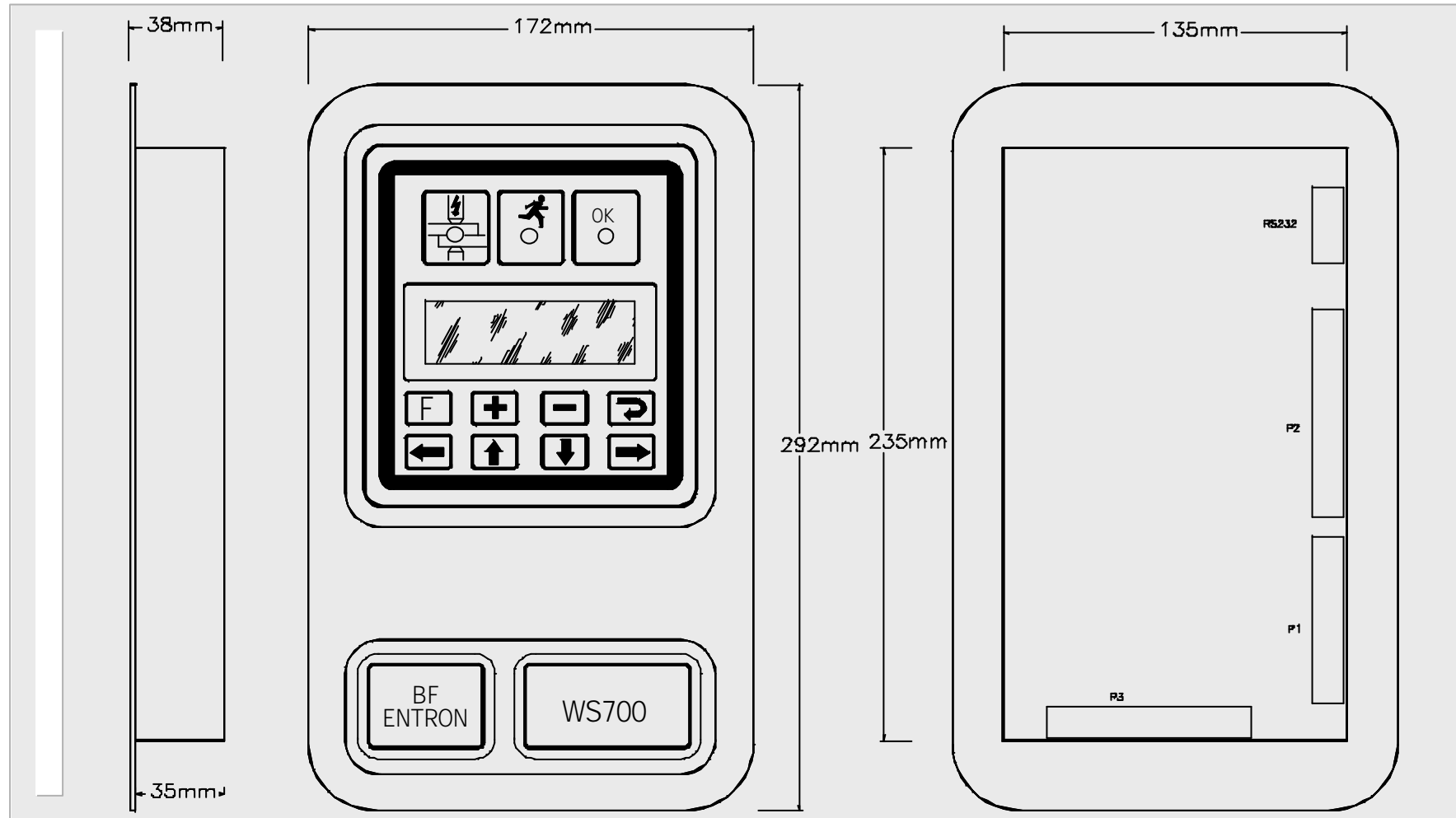


NOTES:  
\* Gap switch input and LFAV output are for use with low-force approach function (V1.06 onward).  
\*\* These inputs must be linked out if not used.  
\*\*\* Air and water switch inputs are available on V1.27 onward.



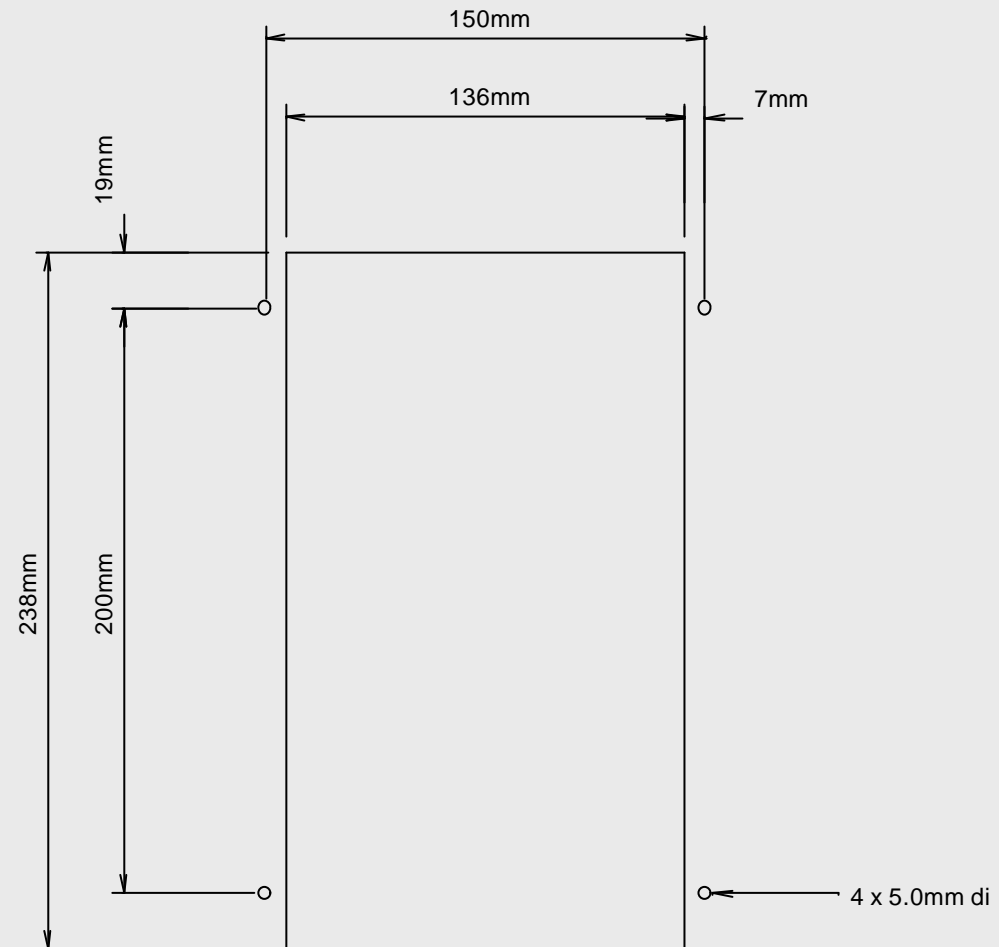
Note that if the timer is supplied fitted into a case, some connections will have been pre-wired by BF Entron. See the case wiring diagram for details.

# Dimensions



# Mounting

To mount a WS700 timer into a panel, you will need to cut an aperture and drill holes as shown here:



# Global parameters

## Configuration

- Sequence
  - Spot / Roll-spot /
  - Seam(2-heat/pre-heat) /
  - ½-cycle(alt/+/-)
- Retract:
  - (Simple / Hi-lift+ / Hi-lift-)
- Frequency (50/60 Hz)
- Contactor time (0..200 s)
- Blanking (On/Off)
- Await Pressure (On/Off)
- Toroid test (On/Off)
- Sensor (Toroid/CT)
- Heat range(High/Low)
- Head-lock/Stop/Continue on fault
- Low-force time (0..99 cycles)
- Sequencer (On/Off)
- Air Water check (On/Off)

## Stepper

- Stepper on/off.
- Stop /continue at end
- Curve(10 point, interpolated)

## Calibration

- Toroid sensitivity(100..2000 mV/kA)
- Toroid attenuation factor (1..4)
- CT S/P ratio (1:1..199:1)
- CT S/P offset (-1kA..+1kA)
- Pressure (2 points, kN/V or lbf/V)

## Counter

- Actual count (0..9999).
- Terminal count(0..9999).
- Stop at end/continue at end.
- Synchronise with log (Yes/No)

## Output Map

- Normal/Event/Sequencer (x8)

## Input Map

- Normal/Sequencer (x16)

## Sequencer

- Up to 250 statements

# Program parameters (x64)

## Weld program

- Pre-squeeze (0..99 cycles)
- Squeeze (0..99 cycles)
- Weld1 (0..99 cycles)
- Cool1(0..99 cycles)
- Weld2(0..99 cycles)
- Cool2(0..99 cycles)
- Pulses(0..9)
- Upslope(0..99 cycles)
- Downslope (0..99 cycles)
- Hold(0..99 cycles)
- Off(0..99 cycles)
- Pressure (0..10V)
- Heat 1(0..99.9%)
- Heat 2(0..99.9%)
- Current 1 (0..60kA)
- Current 2 (0..60kA)
- Balance (seam only)
- Normal/Link program

## Monitor limits

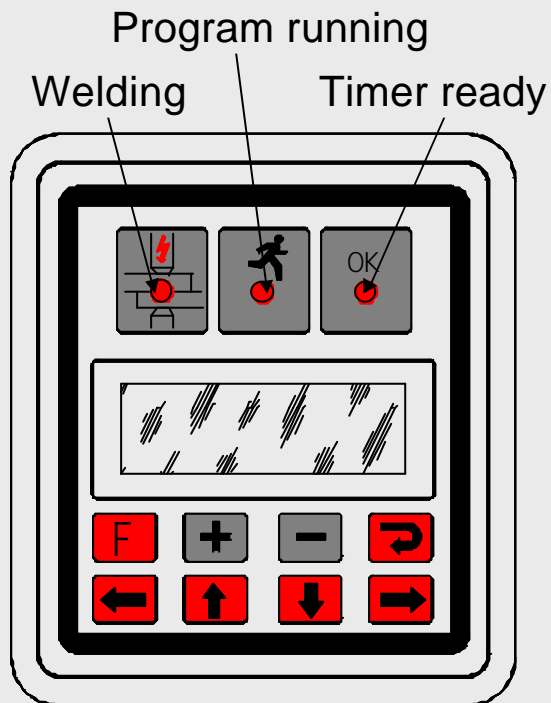
- Current monitor On/Off
- Current low limit,weld1 (0..99%)
- Current high limit,weld1 (0..99%)
- Current pre-limit,weld1 (0..99%)
- Current low limit,weld2 (0..99%)
- Current high limit,weld2 (0..99%)
- Current pre-limit,weld2 (0..99%)
- Pre-limit count (0..99)
- Pressure monitor On/Off
- Pressure low limit (0..99%)
- Pressure high limit (0..99%)

## Events

- 4 x 4 trigger points

# Keypad and indicators

## LED Indicators

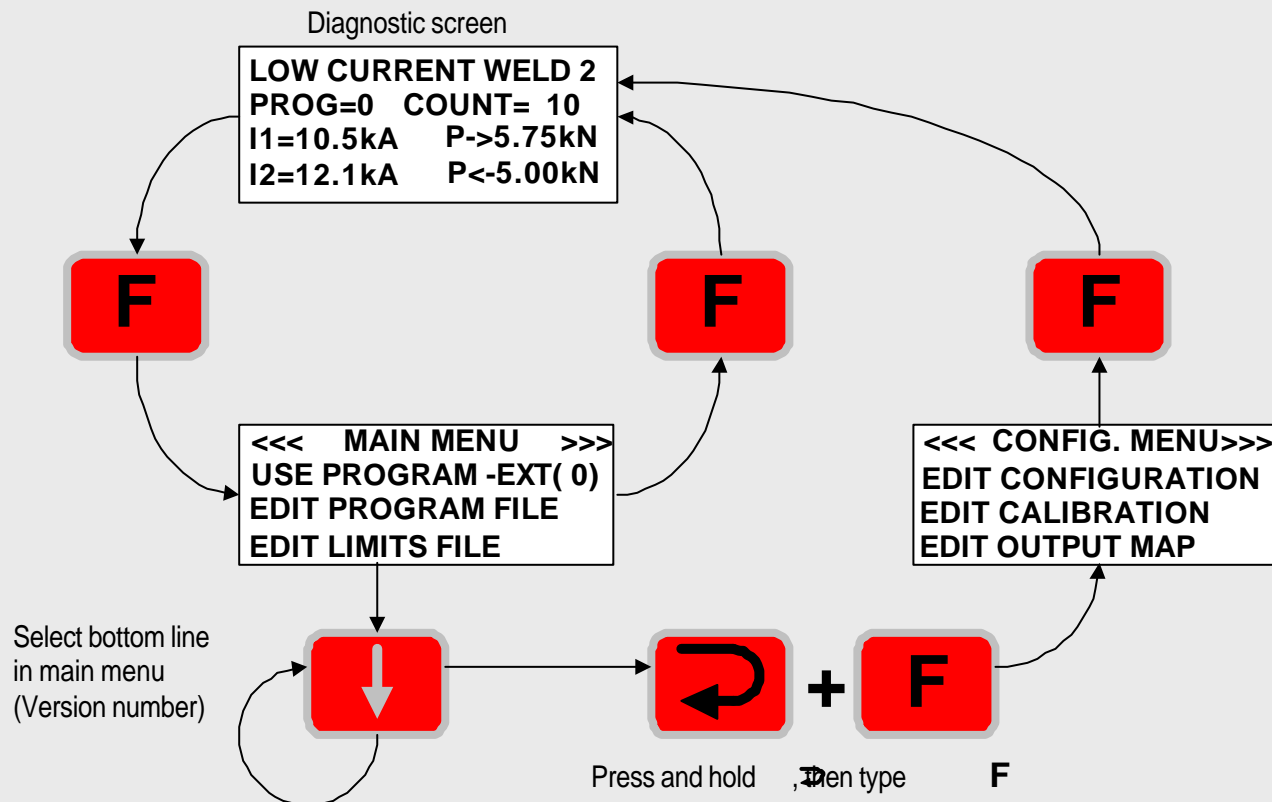


## Using the keypad

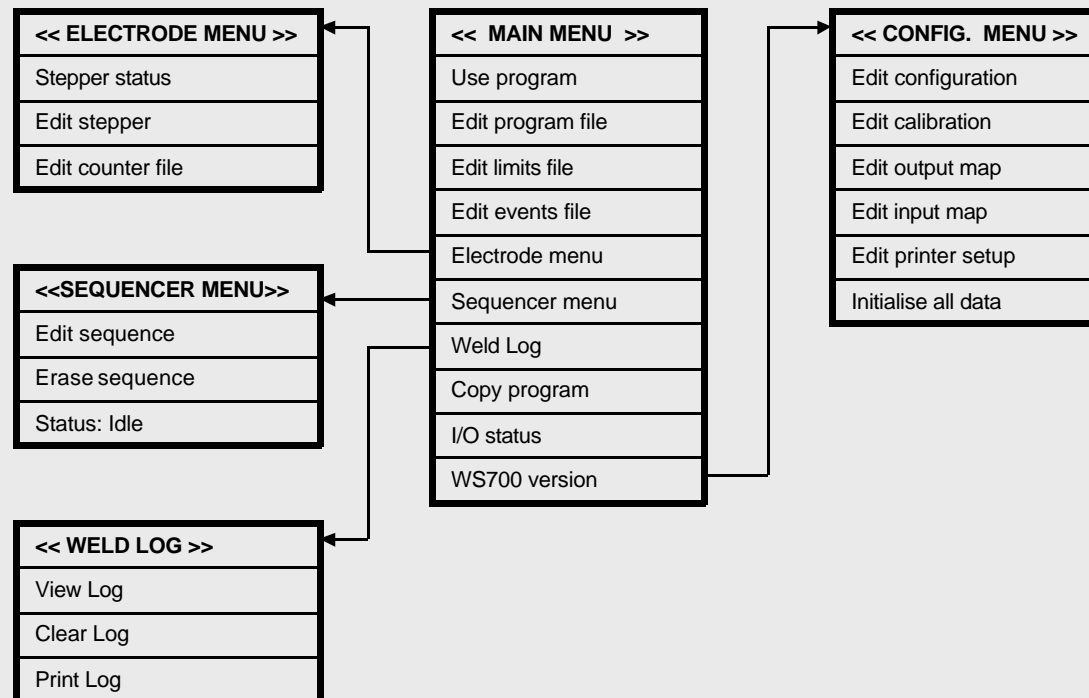
- Press the **F** (function) key to return to the previous screen, or to move between menu screens (see menus).
- The selected function or parameter will flash.
- Use the **← ↑ ↓ →** keys to select a different function or parameter. The visible window will scroll when required.
- Press the **↻** key to access the selected function.
- Press the **+** or **-** keys to alter the selected parameter. Press **+** and **-** together to set a parameter to 0 or its minimum value.
- On some screens, certain keys can have a special function. These are noted on the page describing that screen.

# Menus

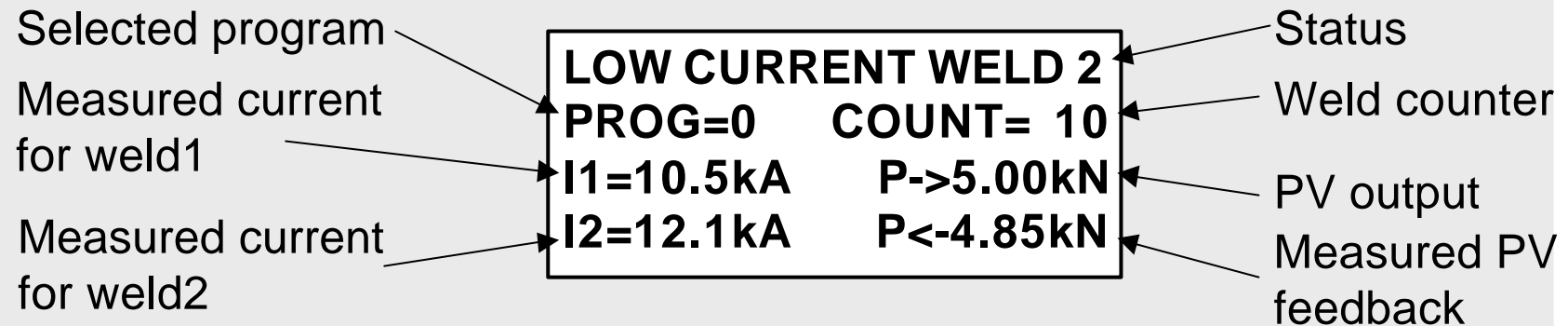
The various functions of the timer are arranged into a set of menus and screens. The diagrams below shows how these are organized and accessed:



# ..menus



# Diagnostic display



*Note that some elements may not be visible, if that feature is not being used.*

**Status:** diagnostic error messages. If more than one exists, these are flashed sequentially.

**Selected program:** this is the program no. that is presently selected.


**Measured current:** the RMS current measured during the last weld.

**Weld counter:** the present value in the counter (updates after each weld)

**Stepper %complete:** shows the progress along the stepping curve.

**PV output:** The output from the PV controller is determined by the pressure parameter in the selected program.

**Measured PV feedback:** the dynamic value measured from the feedback channel.

- Press the **F** key to move to the Main menu screen.
- Press  to reset faults (same action as external input).

# Status messages

The description (abbreviated) appears on the top line of the diagnostic screen.

Description	Advice
No errors	
Configuration error	Edit the configuration file
No synchronising signal	Check 27V AC sync. signal source / Check frequency in configuration file
Counter end	Reset counter
Retract not ready	Operate retract input
Data error	Edit program
Weld off	Close Weld-on switch
No current (weld 1)	Check secondary circuit / check toroid connection
No current (weld 2)	Check secondary circuit / check toroid connection
Low current (weld 1)	Check secondary circuit or adjust parameters
Low current (weld 2)	Check secondary circuit or adjust parameters
Pre-alarm (weld 1)	Check secondary circuit or adjust parameters
Pre-alarm (weld 2)	Check secondary circuit or adjust parameters
High current (weld 1)	Check secondary circuit or adjust parameters
High current (weld 2)	Check secondary circuit or adjust parameters
Low pressure	Check air system or adjust parameters
High pressure	Check air system or adjust parameters
Toroid overrange	Reduce current, or use an external signal attenuator
Toroid short circuit	Inspect toroid connection
Toroid open circuit	Inspect toroid connection
Gap switch open	See Low-force section in manual
Low-force time low	See Low-force section in manual
Low-force time high	See Low-force section in manual
Sequencer error	Edit sequencer program
Headlocked	Operate reset fault input
No Air	Check Air sensor on Input 13
No Water	Check Water sensor on Input 14
Stepper prewarning	Advance warning of electrode service
End of Stepper	Service electrodes and reset stepper

# Main menu


**USE PROGRAM -EXT( 0)**  
**EDIT PROGRAM FILE**  
**EDIT LIMITS FILE**  
**EDIT EVENTS FILE**  
**ELECTRODE MENU**  
**SEQUENCER MENU**  
**WELD LOG**  
**COPY PROGRAM**  
**I/O STATUS**  
**WS700 VERSION 1.27**

Visible  
window

Change this parameter to select which program will be run when a start input is given. Set this parameter to **EXT** if you wish to select programmes via the external inputs (the external value will be shown in brackets).

For information only

- Press the **F** key to return to the diagnostic screen.

**Note:** To access the **Configuration menu**, select the 'version' line on the main menu (last line), hold down the  key, then press the **F** key.


# Configuration menu

**EDIT CONFIGURATION**  
**EDIT CALIBRATION**  
**EDIT OUTPUT MAP**  
**EDIT INPUT MAP**

**EDIT PRINTER SETUP**  
**INITIALISE ALL DATA**

Visible  
window

- Press the **F** key to return to the diagnostic screen.

**Note:** To access the **Configuration menu**, select the 'version' line on the **main menu** (last line), hold down the  key then press the **F** key.

# Edit configuration

<<<CONFIGURATION>>>  
SEQUENCE:SPOT  
SIMPLE RETRACT  
FREQUENCY 50Hz  
CONTACTOR TIME 10 s  
BLANKING Off  
AWAIT PRESSURE On  
TOROID TEST On  
SENSOR TOROID  
HEAT RANGE HIGH  
STOP ON FAULT  
LOW-FORCE 25 cycles  
SEQUENCER On  
AIR / WATER CHECK On

Visible  
window

- Sequence: **Spot / Roll-spot / Seam(2-heat) / Seam(pre-heat)/ 1/2-cycle alternating / 1/2-cycle positive/ 1/2-cycle negative.**
- Retract: **Simple / Hi-lift+ / Hi-lift-**. Set to **Simple** if not required.
- Frequency: **50 Hz / 60Hz** : Set to the frequency of your mains supply.
- Contactor time (**0..200 s**): this is the delay (in seconds) after a weld, before the contactor output is turned off. Set to 0 if not required.
- Blanking (**On/Off**): When set to **On**, the first 2 cycles of weld current will be excluded from the measurement and limit testing process.

# ..edit configuration

- **Await Pressure (On/Off):** When set to **On**, the sequence will pause between end of squeeze and start of weld1, until the pressure feedback lies within the pressure limits.
- **Toroid test (On/Off):** When set to **On**, the resistance of the toroid is tested while the timer is idle. The resistance must lie between 10 and 100 Ohms. Values outside this range will prevent the timer from starting.
- **Sensor: Toroid / CT :** Select the type of feedback sensor which you are using. Usually, a toroid will be used for sensing on the secondary, and a CT is used for sensing on the primary. Most British Federal equipment has a CT built into the control, avoiding the need for an external sensor.
- **Heat range (High/Low):** High corresponds to a control range of 30-130'. Low corresponds to a control range of 50-150'. Select the LOW range for machines with a poor power factor, or when exceptionally low currents are required.

# ....edit configuration

- **Stop on fault (Head-lock/Stop/Continue)** :If **Head-lock** is selected, then when a weld fault is detected, the weld air-valve signal is held on and no further welds are permitted, until a fault reset is given. If **Stop** is selected, then when a weld fault is detected, the weld air-valve opens as normal, but no further welds are permitted, until a fault reset is given. If **Continue** is selected, then further welds will be permitted, regardless of the status of the previous weld.
- **Low-force (0..99 cycles)**: this is the time allowed for the electrodes to reach the set gap and close the limit switch (see section on low-force approach). Set to 0 to disable the low-force function.
- **Sequencer (On/Off)**: If **On** is selected, then the sequencer is active, and welds are started via sequencer statements. If **Off** is selected, then the sequencer is disabled, and welds can be started via the START input.
- **Air/Water checking (On/Off)**: If **On** is selected, then inputs 13 and 14 are tested prior to initiation. Both inputs must be on to enable welding. If **Off** is selected, these inputs are ignored.

# Edit calibration

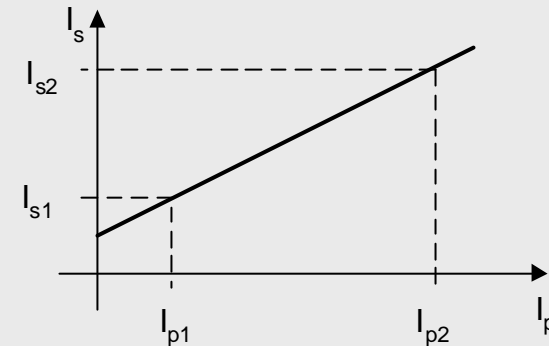
<<< CALIBRATION >>>  
TOROID: 150 mV/kA  
TOROID FACTOR x1  
S/P RATIO 50:1  
S/P OFFSET 0 A  
PRESSURE UNITS=kN  
Pt1: 9.99kN @ 10.0V  
Pt2: 0.00kN @ 0.00V

Visible  
window

- **Toroid**: sensitivity of the measuring coil (toroid), expressed in mV/kA.
- **Toroid Factor**: the ratio of the external attenuator which is required to measure currents >60kA
- **S/P ratio & Offset**: See next page for details.
- **Pressure**: relationship between the PV controller output voltage and actual tip force. This is expressed by entering two 'test' point values (Pt1, Pt2), which then define a straight-line relationship. The units are selectable (kN or lbf).

# ...calibration

- If the sensor (Toroid or CT) is measuring the primary current, the timer can display secondary values. It does this by calculation based on the **Secondary to Primary ratio (S/P ratio)** and offset (**S/P offset**) parameters.
- To determine the correct values, do the following:



- Set the S/P ratio to 1:1 in the calibration.
- Set the S/P offset to 0 in the calibration.
- Do a short circuit weld at a low heat in PHA mode, and measure the secondary current ( $I_{s1}$ ) with a meter. Note the corresponding value ( $I_{p1}$ ) on the timer status screen.
- Do a short circuit weld at a high heat in PHA mode, and measure the secondary current ( $I_{s2}$ ) with a meter. Note the corresponding value ( $I_{p2}$ ) on the timer status screen.
- Calculate and enter S/P ratio =  $(I_{s2} - I_{s1}) / (I_{p2} - I_{p1})$
- Calculate and enter S/P offset =  $I_{s2} - (I_{p2} \times \text{S/P ratio})$

# .....calibration

- If you do not have a suitable meter, or you do not wish to do the calculations, you can still use primary feedback by doing the following:
  1. Set the S/P ratio = **transformer turns ratio** in the calibration.
  2. Set the S/P offset to 0 in the calibration.
- If you do not know the **transformer turns ratio**, then use a value of 50:1 as many welding transformers will be approximately this figure.
- The current readings on the timer will be shown in kA, and the timer will regulate (in CCR mode) to these figures, but they will not tie-up with a meter (i.e. the numbers are not absolute, but in 'scaled' Amps).



If you require precise and absolute settings then you must either:

- Do the procedure and calculations (see previous page)

**OR**

- Use secondary feedback from a toroid, and set the sensitivity correctly.

# Edit Output Map

<<< OUTPUT MAP >>>

Output Q1: WAV

Output Q2: HAV

Output Q3: EOS

Output Q4: FAULT

Output Q5: COUNTER

Output Q6: CONTACTOR

Output Q7: READY

Output Q8: LFAV

Visible  
window

Each output may be independently set up as either:

- the standard function assigned (see users connections).

or

- as an EVENT output.

or

- as a SEQUENCER output.

When an output is mapped to 'event', it may be programmed to operate at any point in the welding sequence, via an event program.

When an output is mapped to 'sequencer', it may be programmed to operate under the control of the sequencer program.

# Edit Input Map

<<< INPUT MAP >>>

Input I01: START

Input I02: WELD ON

Input I03: 2nd STAGE

Input I04: RETRACT

Input I05: RES.FAULT

Input I06: RES.COUNT

Input I07: PROG 1

Input I08: PROG 2

Input I09: PROG 4

Input I10: PROG 8

Input I11: PROG 16

Input I12: PROG 32

Input I13: Reserved

Input I14: Reserved

Input I15: GAPSWITCH

Input I16: EDIT DIS.

Visible  
window

Each input may be independently set up as

either:

- the standard function assigned (see users connections).

or

- as a SEQUENCER input.

When an input is mapped to 'sequencer', it may be used as part of the sequencer program.

Note that inputs I01 and I02 have special functions, and may only be mapped to standard.

# Edit Printer setup

```
<<< PRINTER SETUP >>>
PRINT                ALL
LINES PER PAGE      68
FORMAT              TABLE
```

- Note that the *Print weld log* function will operate independently of the settings made here.

- **PRINT:** select-  
OFF (no printing).  
ALL (print every weld).  
FAILS (only print failed welds).  
PASSES (only print good welds).
- **LINES PER PAGE:** set this to the number of lines which your printer can produce on each sheet of paper .
- **FORMAT:**  
TABLE: tabulated output, suitable for driving a printer.  
ASCII-HEX: fixed length message suitable for data logging etc. on a PC

# ...print format :table

After each weld, the timer sends out a line of text, as shown in the example below. Additionally, a heading will be printed every n lines, where n is the value set for *lines per page*.

COUNT	PROG	I1	I2	FORCE	ERROR
1	0	10.5kA	15.5kA	5.45kN	LOW CURRENT WELD2
2	5	7.65kA	10.4kA	4.05kN	
3	10	0 A	12.5kA	5.05kN	
4	0	0 A	0 A	5.40kN	WELD OFF
5	5	7.50kA	10.8kA	4.00kN	
6	10	0 A	12.5kA	5.10kN	
7	0	10.5kA	16.5kA	5.40kN	HIGH CURRENT WELD2
8	5	7.50kA	10.8kA	4.00kN	
9	10	0 A	12.5kA	5.15kN	
10	0	10.5kA	16.0kA	5.45kN	

# ...print format :ASCII-HEX

After each weld, the timer sends out the following message:

```
[COUNT][PROG][CURRENT1][CURRENT2][PRESSURE][STATUS][CR]
```

where

COUNT=value in counter after weld (4 characters).

PROG=program number used for weld (2 characters).

CURRENT1=current measured during weld1 interval (4 characters). Units = Amps.

CURRENT2= current measured during weld2 interval (4 characters). Units = Amps

PRESSURE=pressure measured at end of weld (4 characters). Units = 0.01 kN / 1 lbf

STATUS=8 characters.

CR= Carriage return (hex 0D).

All data is leading zero padded, to ensure a fixed-length message (27 characters, including CR).

All data is sent most significant digit first, and in ASCII-HEX format.

i.e. data=2003 (decimal) =07D3(hex)

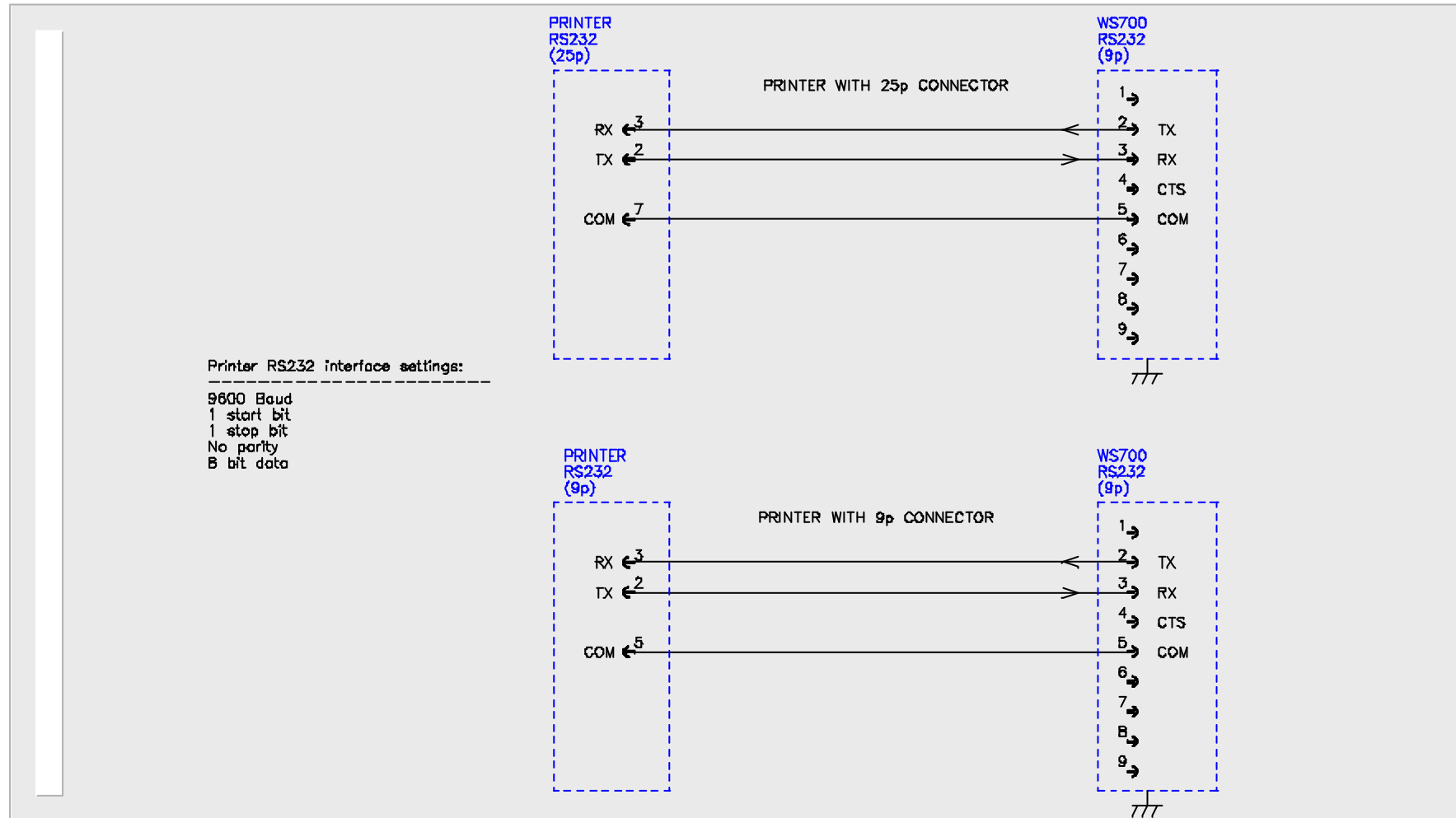
characters sent= [0][7][D][3]

ASCII equiv.= [hex 30][hex 37][hex 45][hex 33]

The STATUS field is a 32 bit array of 1-bit flags, encoded as follows:

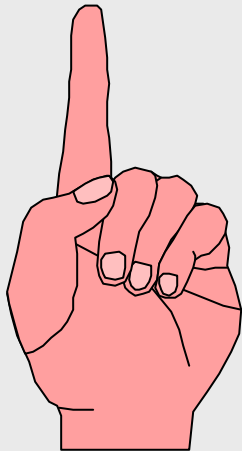
Bit #	Description	Bit #	Description	Bit #	Description	Bit #	Description
0	Configuration error	8	No current (weld 1)	16	Low pressure	24	Sequencer error
1	No synchronising signal	9	No current (weld 2)	17	High pressure	25	Headlocked
2	Counter end	10	Low current (weld 1)	18	Toroid overrange	26	Reserved
3	Counter blocking	11	Low current (weld 2)	19	Toroid short circuit	27	Reserved
4	Timer not ready	12	Pre-alarm (weld 1)	20	Toroid open circuit	28	Reserved
5	Retract not ready	13	Pre-alarm (weld 2)	21	Gap switch open	29	Reserved
6	Data error	14	High current (weld 1)	22	Low-force time low	30	Reserved
7	Weld off	15	High current (weld 2)	23	Low-force time high	31	Reserved

# ...printer connections



# Initialise all data

The **Initialise** function provides a convenient means of setting all of the data in the timer to a known initial state. This can be useful when first setting up a system.



**Caution:** When you use the **Initialise** function, you will lose all previously stored data in the timer.

After an **initialise** operation, you should edit the configuration files (configuration, calibration, mapping etc.), to suit your installation. You will then need to set-up any welding programmes etc. which you wish to use.

# Edit program

```
<<< PROGRAM 0 >>>  
I1=7.50kA 25.0% PHA  
I2=10.0kA 50.0% CCR  
PV=5.00kN@5.00V NORM  
PSQ= 0 SQZ= 10  
W1 = 0 C1 = 0  
W2 = 10 C2 = 0  
Pulses(W2-C2) = 1  
UPS= 3 DWN = 0  
HLD= 10 OFF = 0
```

Visible window

**PHA**=Phase angle mode. The current and heat parameters are independently adjustable. No current regulation takes place.

**CCR**=Constant current regulation mode. The current parameter is adjustable, but the heat is automatically determined by the timer, as it regulates the current to the set level.

**UPS**= Upslope time, **DWN**= Downslope time

# ..edit program

```
<<< PROGRAM 0 >>>  
I1=7.50kA 25.0% PHA  
I2=10.0kA 50.0% CCR  
PV=5.00kN@5.00V NORM
```

```
PSQ= 0 SQZ= 10  
W1 = 0 C1 = 0  
W2 = 10 C2 = 0  
Pulses(W2-C2) = 1  
HLD= 10 OFF = 0
```

Set **OFF** time to 0 for single spot operation. If **OFF** time>0, then repeat operation will occur.

Visible window

**NORM** = normal spot weld operation.  
**LINK** = linked spot operation.

**LINK**ed operation provides a means of chaining programmes together so that a single start signal generates a sequence of programmes. At the end of a linked program, the next program (numerically ascending) is automatically selected and run, and so on, until either a program set to **NORMAL**, or the last program (63) is reached.

# ....edit program(seam)

```
<<< PROGRAM 0 >>>  
I1=7.50kA  25.0%  PHA  
I2=10.0kA  50.0%  CCR  
BALANCE = 4.5%
```

Visible  
window

```
PV=5.00kN@5.00V  
PSQ= 0    SQZ= 10  
W1 = 0    C1  = 0  
W2 = 10   C2  = 0  
UPS= 3    DWN = 0  
HLD= 10
```

**BALANCE** : This control is used to balance the current when using pulsed seam welding. It may be adjusted dynamically (i.e. while the machine is running).

If the timer is configured for seam welding, then the program screen changes as shown above, in order to present only the relevant parameters..

# .....edit program( $\frac{1}{2}$ -cycle)

```
<<< PROGRAM 0 >>>  
I1=7.50kA 25.0%  
I2=10.0kA 50.0%  
PV=5.00kN@5.00V
```

```
PSQ= 0 SQZ= 10
```

```
W1 = 0 C1 = 0
```

```
W2 =  $\frac{1}{2}$ 
```

```
HLD= 10 OFF = 0
```

Visible  
window

**$\frac{1}{2}$ -cycle welding:** Weld times may be set to 0 or to one  $\frac{1}{2}$ -cycle only. Constant current regulation (CCR) and program linking are not available.

Set **OFF** time to 0 for single spot operation. If **OFF** time>0, then repeat operation will occur.

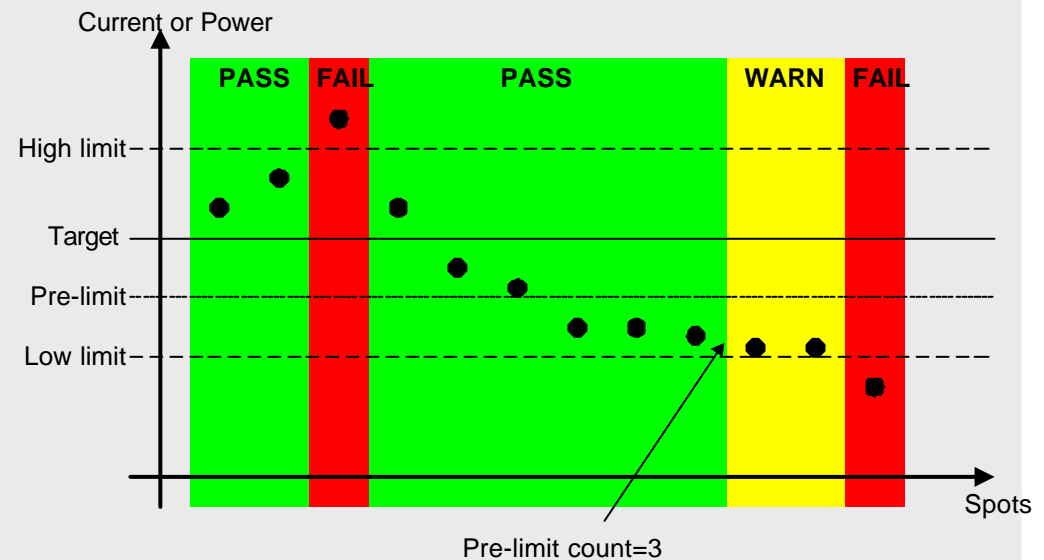
If the timer is configured for  $\frac{1}{2}$ -cycle welding, then the program screen changes as shown above, in order to present only the relevant parameters.

# Edit limits

```
<<< LIMITS PROG 0 >>>  
CURRENT: MONITOR On  
LOW1=15% HIGH1=10%  
PRE-LIMIT1= 5%  
LOW2=10% HIGH2= 8%  
PRE-LIMIT2= 5%  
PRE-LIMIT COUNT = 3  
PRESSURE MONITOR On  
LOW= 8% HIGH= 8%
```

Visible window

The **PRE-LIMIT COUNT** is the number of successive welds which must fail the pre-limit level test, before a warning is produced.



# Edit Events

```
<<< EVENTS PROG 0 >>>  
Ev1: 1=on @SQZ + 2  
Ev2: 1=off @HLD + 5  
Ev3: 6=on @W1 + 5  
Ev4: 6=off @W2 + 3
```

Visible  
window

e.g. Turn on output 6,  
5 cycles into the  
Weld 1 interval.

- Each welding program may have up to 4 events defined.

- Each event can turn one output on or off.

- To disable an event, set it's output to '?'.  
(Note: The apostrophe is a single quote character.)

Note: The outputs used must be mapped to 'EVENT' for correct operation.  
(see *Edit Output Map*)

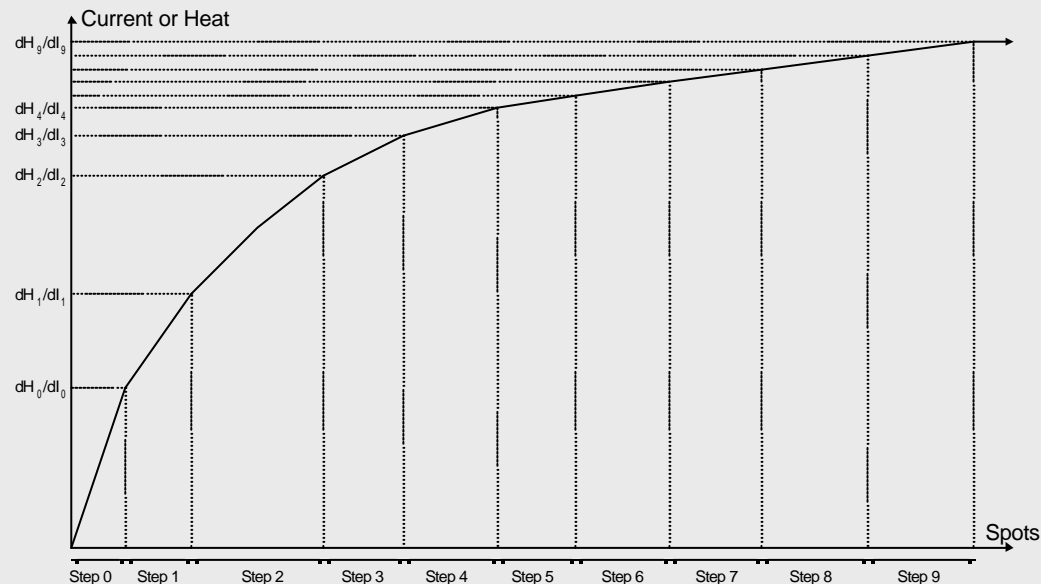
# Electrode menu

**<< ELECTRODE MENU >>**  
**STEPPER STATUS**  
**EDIT STEPPER**  
**EDIT COUNTER FILE**

A stepper is programmed by means of a curve which will provide values of heat and current increments, related to the number of spots done. The curve is defined by a set of 10 points. The timer provides interpolation between these points.

Electrode management is provided via a combination of stepper and counter functions. The stepper and counter share a common output and input.

The stepper provides a means of gradually increasing the current, to compensate for electrode wear.




# Stepper status

```
<< STEPPER STATUS >>  
SPOTS DONE= 45  
[RESET] 12%  
dH= 2.5% dl= 500A
```

Visible window

The number of spots made since the last reset. This may be changed to alter the working position on the curve.

The percentage done of the total number of spots, also shown as a bar-graph.

Select this field and press  to reset this stepper (same function as external input).

dH= additional %heat being applied (+HEAT from table).  
dl= additional current being applied.(+AMPS from table).

## Outputs:

Output 'Counter/End of stepper' comes on at the end of the last step.

A 'Prewarning' message is given for the duration of step 9.

# Edit stepper

```
<<< STEPPER on >>>
CONTINUE AT END
SPOTS +HEAT +AMPS
0: 10 1.0% 100 A
1: 50 1.5% 200 A
2: 100 2.0% 300 A
3: 100 2.5% 400 A
4: 100 3.0% 500 A
5: 100 3.5% 600 A
6: 100 4.0% 700 A
7: 100 4.5% 800 A
8: 150 5.0% 900 A
9: 200 5.5% 1000 A
[PRESET #3]
```


Visible window

Enable or disable the stepper.

**Be aware!** The counter and the heat stepper share a common input and output.

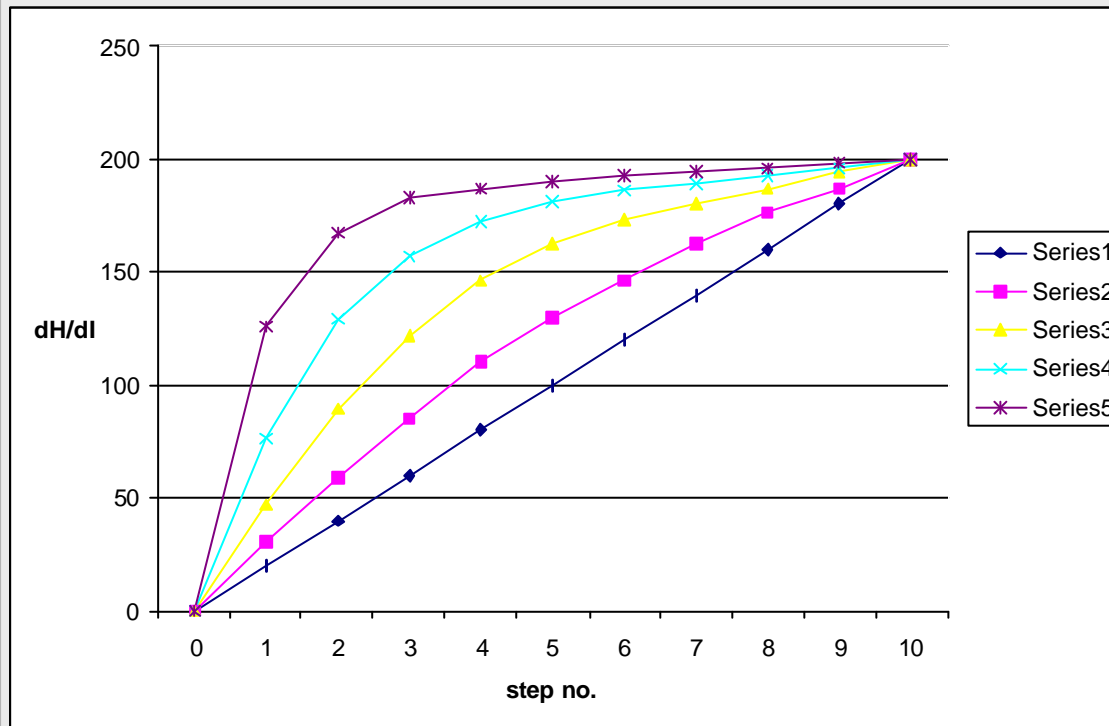
If ***continue at end*** is selected, then at the end of the last step, further welding can take place as normal, but the stepper output will remain on. There is no further increase in current.

If ***stop at end*** is selected, then no further welding may take place until a stepper reset is given.

**Quick set-up:** Enter values in step 9 only, to define the finishing point, select the PRESET field, edit the preset number (see next page), and then press  to load this stepper with a preset curve.

**Note:** PHA mode will make use of both the +HEAT(dH) and +AMPS(dI) parameters. CCR mode uses only the +AMPS(dI) parameter, as the heat is self-adjusting.

# Stepper presets



When a preset curve is loaded, the data is obtained from a table which holds the 5 curves shown.

The step sizes (spots) are all made the same as for step 9, and the +HEAT(dH) and +AMPS(dI) parameters are obtained by applying the values in step 9 to the curve as a scaling factor.

# Edit counter

```
<<<  COUNTER  >>>
COUNT NOW = 431
COUNT UP TO 500
STOP AT END
SYNC. WITH LOG Yes
```

## Be aware!

The counter and the heat stepper share a common input and output.

Set **count up to** to zero, to disable the counter.

**Count now** is incremented after every weld. When **count up to** is reached, the counter output is activated.

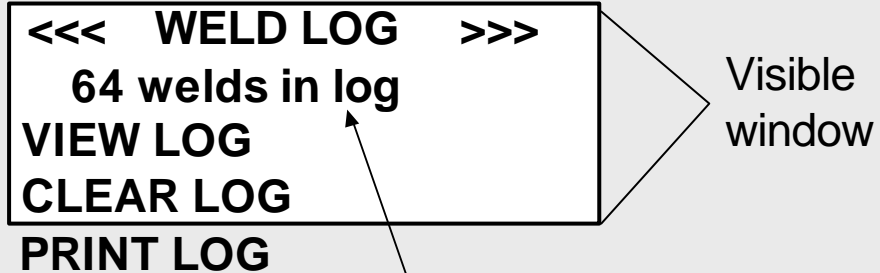
If **stop at end** is selected, then no further welding may take place until a counter reset is given.

If **continue at end** is selected, then further welding can take place as normal, but the counter output will remain on.

**Count now** is reset to zero by activating the counter reset input.

**Sync with log:** If set to **Yes**, then the log will be cleared when the counter is reset. If set to **No**, then the log and counter are independent.

# Weld log



<<< **WELD LOG** >>>  
64 welds in log  
**VIEW LOG**  
**CLEAR LOG**  
**PRINT LOG**

The diagram shows a menu box with a right-pointing arrow labeled 'Visible window'. An arrow points from the text 'The number of welds presently held in the log.' to the text '64 welds in log'.

Visible window

The number of welds presently held in the log.

The timer records the currents from each weld into the weld log. The log can hold information from up to 64 welds (after this, the oldest record will be discarded).

To see the information for each weld, select the VIEW LOG function.

The log can be cleared (emptied) by using the CLEAR LOG function. See also counter *sync with log* function.

The PRINT LOG function will send the entire log contents to the RS232 (printer) port.

# View log

Press the + or - keys to select the log record  
( 1= most recent weld,  
64= oldest weld).

Program used  
for this weld

**<LOG 1> W2 FAIL**  
**PROG= 0 COUNT= 10**  
**I1= 6.54kA ( 6.50kA)**  
**I2= 7.29kA ( 8.50kA)**

Status for this weld

Value in the counter  
for this weld

Actual current  
measured

Target current  
(from program)

Page 1

PV output  
(from program)

Pressure input  
(from feedback)

**<LOG 1> W2 FAIL**  
**PROG= 0 COUNT= 10**  
**P->5.40Kn P<-5.35kN**

Page 2

Note that if either of I1 or I2 are not shown, then that interval was not used.

•Press     to switch between pages.

# Sequencer

The sequencer provides a means of controlling a small machine, via a series of logic statements. The statements are executed sequentially in the order in which they appear.

The START input is used to trigger execution of the sequence, and must be maintained. On release of the START signal, the sequence is reset.

With the sequencer configured (see edit configuration), the START signal cannot be used to start a weld. Instead, welds are started via statements within the sequence.

The functions available consist of various input, output, memory, delay, counter and weld operations. It is also possible to program subroutines up to 8 levels deep.

The following resources are available:

Statements(lines)		Up to 249 max.
Outputs	8	Q1 to Q8
Inputs	16	I01 to I16
Memory	8	M1 to M8 (non-volatile)
Counters	8	C1 to C8 (non-volatile)
Analog inputs	1	A1

Non-volatile values are retained, even if power is lost.  
Note that the inputs and outputs are shared with the welding controller and event timer (see Input map and Output map).

# Sequencer Menu

**EDIT SEQUENCE** ←  
**ERASE SEQUENCE** ←  
**PRINT SEQUENCE** ←  
**STATUS: IDLE**

Enter new statements, parameters etc. ,or edit the existing sequence (see edit sequence).

Erase the entire sequence –use with caution!  
You will be asked to confirm the operation before the erase takes place.  
An erased sequence cannot be restored.

**For information only:**

**Off:** the sequencer is turned off (see edit configuration)

**Idle:**the sequencer is turned on, and waiting for the START input.

**Line n:** the sequence is running and is executing line n.

List the sequence on a printer (or a PC running a program such as 'Hyperterminal') connected to the RS232 port.  
(see printer connections).

# ...edit sequence

On the edit sequence screen, the keys have the following functions:

At any time:

- Press the **↑** or **↓** keys to change the selected line. The entire line will flash. The screen will scroll when required.
- Press the **➤** key to insert a new (blank) line. The line number will be shown.
- Press the **F** key to return to the sequencer menu screen.

When entire line is flashing:

- Press **+** and **-** together to delete the selected line
- Press the **+** or **-** keys to alter the selected statement type.
- Press the **←** key to momentarily see the selected line number.
- Press the **←** or **→** keys to select a parameter (parameter only will flash).

When parameter only is flashing:

- Press the **+** or **-** keys to alter the selected parameter.
- Press **+** and **-** together to set 0 or minimum value.

# Sequencer statements

The following table lists the available logic statement types:

Statement	Range	Function
Line nnn	1..249	Line number within sequencer file ( has no effect)
---- STEP nnn ----	1..999	Has no effect, but serves as the target for a JUMP or GOSUB statement, or as a logical divider in the program
AWAIT INPUT Inn ON	1..16	Waits for Input nn to be ON
AWAIT INPUT Inn OFF	1..16	Waits for Input nn to be OFF
OUTPUT Qn ON	1..8	Turns ON Output n
OUTPUT Qn OFF	1..8	Turns OFF Output n
MEMORY Mn ON	1..8	Sets Memory bit n (non-volatile)
MEMORY Mn OFF	1..8	Clears Memory bit n (non-volatile)
DELAY nn.n s	0.1..99.9 s	Waits for specified time
JUMP nnn	1..999	Program continues at specified STEP number.
GOSUB nnn	1..999	Program continues with the subroutine at the specified STEP number. (Note maximum of 8 nesting levels)
RETURN		Return from subroutine
COUNTER Cn = xxx	n=1..8, x=1..999	Loads Counter n with the value xxx (non-volatile)
DECREMENT COUNTER Cn	1..8	The value in Counter n is reduced by 1 (non-volatile)
IF Cn>ZERO, JUMP xxx	n=1..8, x=1..999	If the value in Counter n is <u>not</u> zero, then continue at STEP xxx. If the value in Counter n is zero, then continue at the next statement
IF Qn ON, JUMP xxx	n=1..8, x=1..999	If Output Qn is <u>ON</u> , then continue at STEP xxx. If Output Qn is OFF, then continue at the next statement
IF Qn OFF, JUMP xxx	n=1..8, x=1..999	If Output Qn is <u>OFF</u> , then continue at STEP xxx. If Output Qn is ON, then continue at the next statement
IF Mn ON, JUMP xxx	n=1..8, x=1..999	If Memory Mn is <u>ON</u> , then continue at STEP xxx. If Memory Mn is OFF, then continue at the next statement
IF Mn OFF, JUMP xxx	n=1..8, x=1..999	If Memory Mn is <u>OFF</u> , then continue at STEP xxx. If Memory Mn is ON, then continue at the next statement
IF Inn ON, JUMP xxx	n=1..16, x=1..999	If Input Inn is <u>ON</u> , then continue at STEP xxx. If Input Inn is OFF, then continue at the next statement
IF Inn OFF, JUMP xxx	n=1..16, x=1..999	If Input Inn is <u>OFF</u> then continue at STEP xxx. If Input Inn is ON, then continue at the next statement
WELD (Prog=nn)	nn=0..63, EXT	Execute weld sequence. The program number is determined by the parameter nn. If nn=EXT, then the program number will be read from the external selection inputs. The sequencer

# Example sequence

Statement	Range	Function
<b>AWAIT ANALOG n&lt;mm V</b>	n=1 0.0<=mm<=10.0	Waits for Analog input n to be less than mm Volts.
<b>AWAIT ANALOG n&gt;mm V</b>	n=1 0.0<=mm<=10.0	Waits for Analog input n to be greater than mm Volts.
<b>IF ANALOG n&lt;mm V, JUMP xxx</b>	n=1 0.0<=mm<=10.0	If Analog input n is less than mm Volts, then continue at STEP xxx, otherwise continue with the next statement.
<b>IF ANALOG n&gt;mm V, JUMP xxx</b>	n=1 0.0<=mm<=10.0	If Analog input n is greater than mm Volts, then continue at STEP xxx, otherwise continue with the next statement.


A short example program:

<b>---- STEP 1 ----</b>	
<b>AWAIT INPUT I03 ON</b>	Part detector
<b>---- STEP 2 ----</b>	
<b>OUTPUT Q8 ON</b>	Clamp ON
<b>DELAY 0.5</b>	Pause
<b>---- STEP 3 ----</b>	
<b>WELD (Prog=1)</b>	Weld operation using program 1
<b>OUTPUT Q8 OFF</b>	Clamp off
<b>---- STEP 4 ----</b>	
<b>OUTPUT Q7 ON</b>	Signal job done by flashing output until START released
<b>DELAY 0.4</b>	Flash 'On' time
<b>OUTPUT Q7 OFF</b>	
<b>DELAY 0.2</b>	Flash 'Off' time
<b>JUMP 4</b>	Loop back to create flashing effect

# Copy program

```
<<< COPY PROGRAM >>>  
FROM: 0  
TO: 1  
GO
```

Copy a program (and associated limit and event files) to any other program, or to all other programmes.

- The **TO** parameter can be set to **ALL** if required (i.e. copy 1 program to all others).
- Select the last line ( **GO** ), then press the  key to execute the copy function. This line will briefly show **COPY DONE**, when the function is complete.

# I/O Status

<<< I/O STATUS >>>	
I01:START	Off
I02:WELD ON	On
I03:SEQUENCER	On
I04:EVENT	Off
I05:RES.FAULT	Off
I06:RES.COUNT	Off
....	
....	
etc.	

Visible  
window

This screen can be used to observe the status of all the discrete inputs and outputs.  
Each input or output is labeled to show how it is mapped.  
i.e. standard function / event / sequencer.  
(see edit input map and edit output map)

# Low-force approach

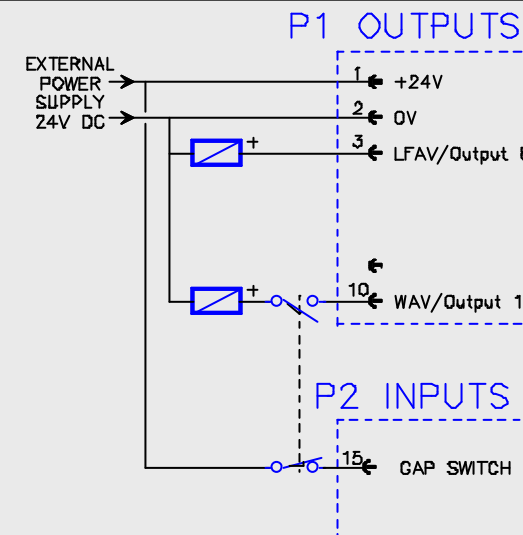
The low-force approach function can only be used with a suitably equipped machine.

- The output LFAV is used to close the electrodes under low pressure.
- The gap switch must then open within 12 cycles of the time set in the configuration parameter.
- Providing the gap switch opens within the set time, the WAV output is then energised to finally close the electrodes under welding pressure.
- If the gap switch does not open at the correct time (e.g. due to an obstruction), the sequence is aborted, and LFAV output turns off, thus opening the electrodes.

## Typical connections to Timer

**Note:** Map Output Q1 to WAV and Output Q8 to LFAV.  
(see 'Edit Output Map')

Map input I15 to GAPSWITCH  
(see edit input map)



# ...low-force approach

## Diagnostics

If the gap switch opens too late, then the sequence is aborted, and the following error message is displayed on the diagnostic display:

### **LOW-FORCE TIME LOW**

In this case, check the operation of the head and gap switch, or increase the low-force parameter in the timer configuration.

If the gap switch opens too early, then the sequence is aborted, and the following error message is displayed on the diagnostic display:

### **LOW-FORCE TIME HIGH**

In this case, check the operation of the head and gap switch, or decrease the low-force parameter in the timer configuration.

# .....low-force approach

The gap switch is normally closed when the machine is idle. The timer checks this, and in the event that it detects that the switch is open, the following error message is displayed on the diagnostic display:

## **GAP SWITCH OPEN**

In this condition, the **READY** led will go out, and it will not be possible to start a welding sequence. Check the operation of the head and gap switch.

The low-force function can be turned off by setting the configuration parameter to zero. If low-force is ON, then outputs Q1 and Q8 must be mapped to WAV and LFAV, and input I15 must be mapped to GAPSWITCH, otherwise the timer will not operate, and the display will show

## **CONFIG.ERROR (LF)**



**WARNING:** Low-force approach is a safety feature, and must only be adjusted by suitably trained and qualified personnel. Always consult your machine manual.

# Disabling edits

Normally, a user can access the parameters via the keypad on the front of the timer, and make any changes, as required. Under some circumstances, it may be desirable to prevent such general access.

The timer provides an input called 'EDIT DISABLE', which can be used to block all parameter edits. With this input on, it will still be possible to view parameters, but no changes are permitted via the keypad.

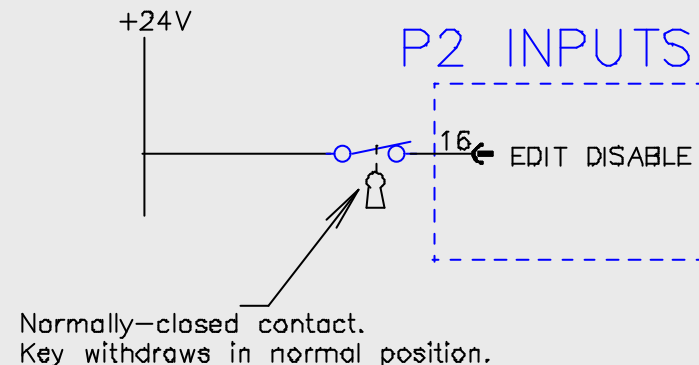
If edits are attempted, the display will briefly show

**\*\* EDITS DISABLED \*\***

and the edit will be blocked.

It is suggested that this input is controlled via a key-switch, such that only the key-holder is able to open the switch, and thus be able to edit parameters.

## Typical connections to Timer





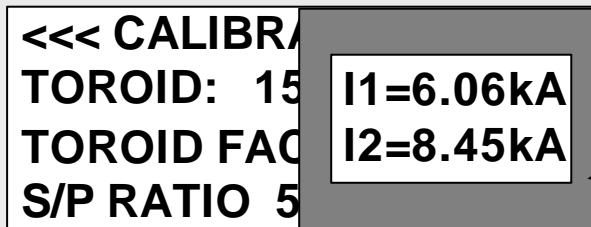
If this feature is not required, simply leave this input unconnected.

# Pop-up current meter

The timer will measure the current on both the weld1 and weld 2 intervals, and this is displayed on the diagnostic screen.


Often, when programming the timer, you will need to refer to these current measurements. In order to avoid having to switch between screens, there is a convenient pop-up current meter window, which allows you to view the measured currents without leaving the screen you are on.

The pop-up meter is activated by pressing the  key. To close the pop-up window, press the  key again.

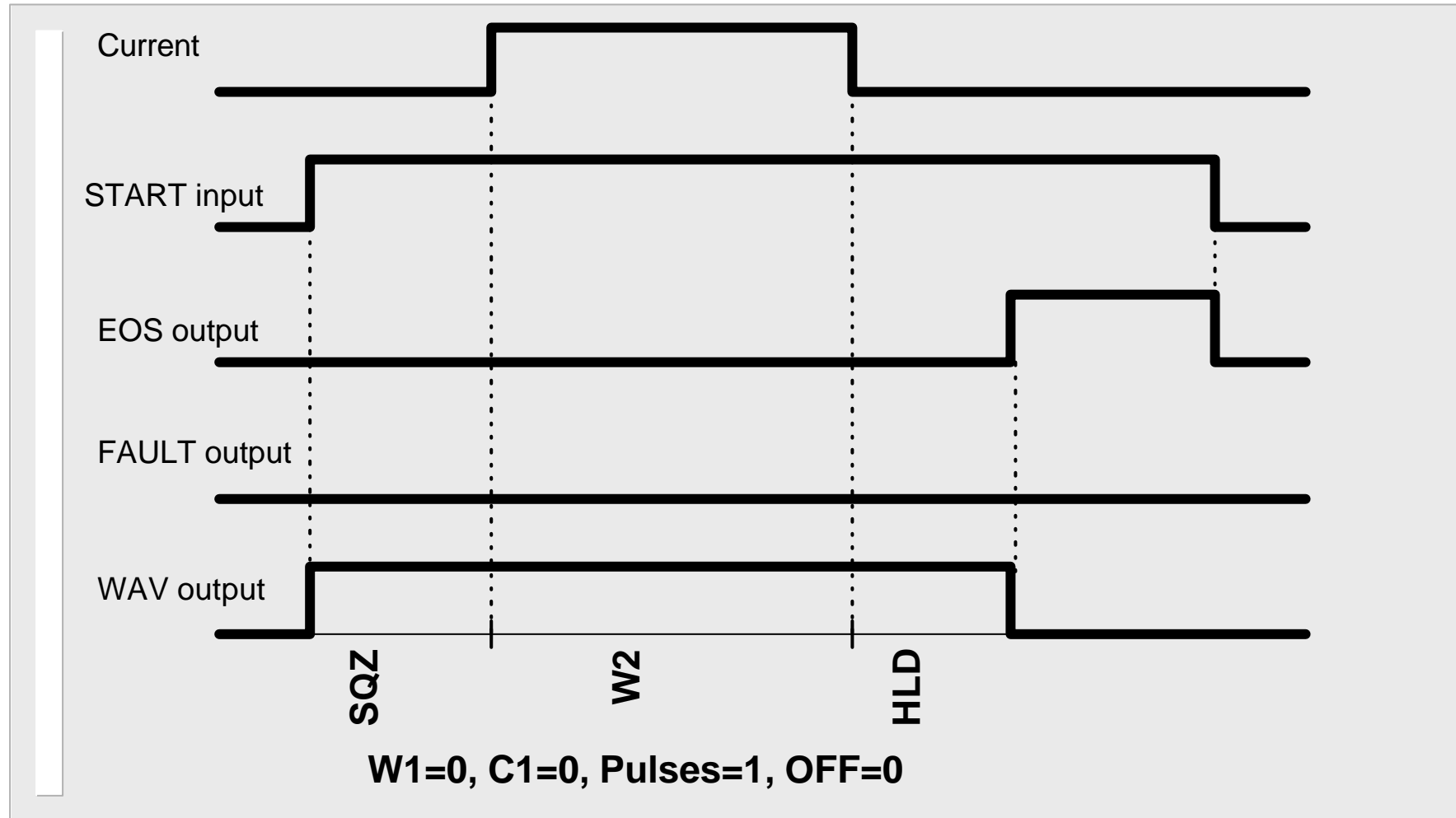


Pop-up window

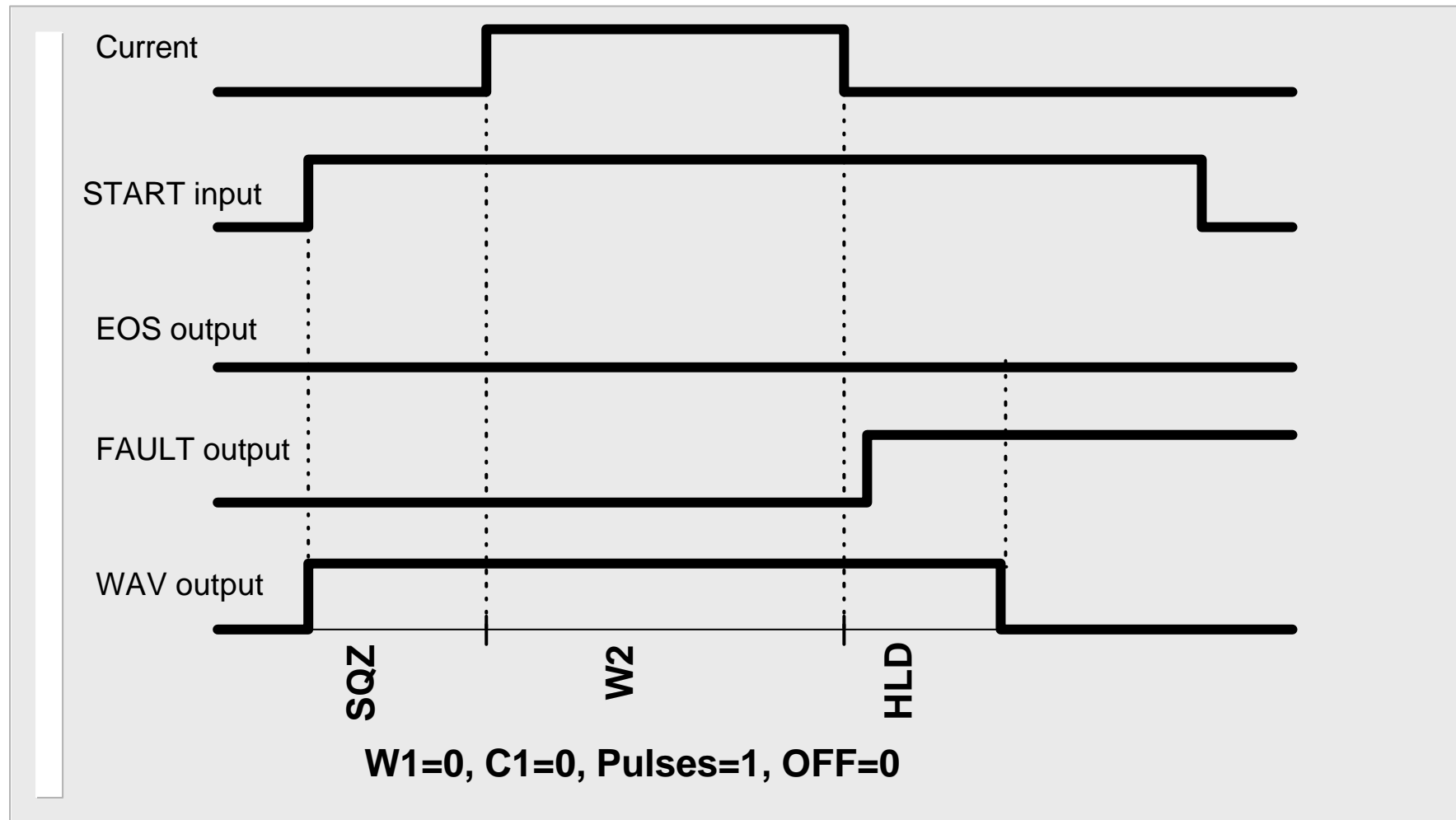
Note that the window may not show both weld1 and weld2, if either interval was not used.

Some screens use the  key for another purpose (such as selecting an item from a list). In this case, the pop-up meter is not available from that screen.

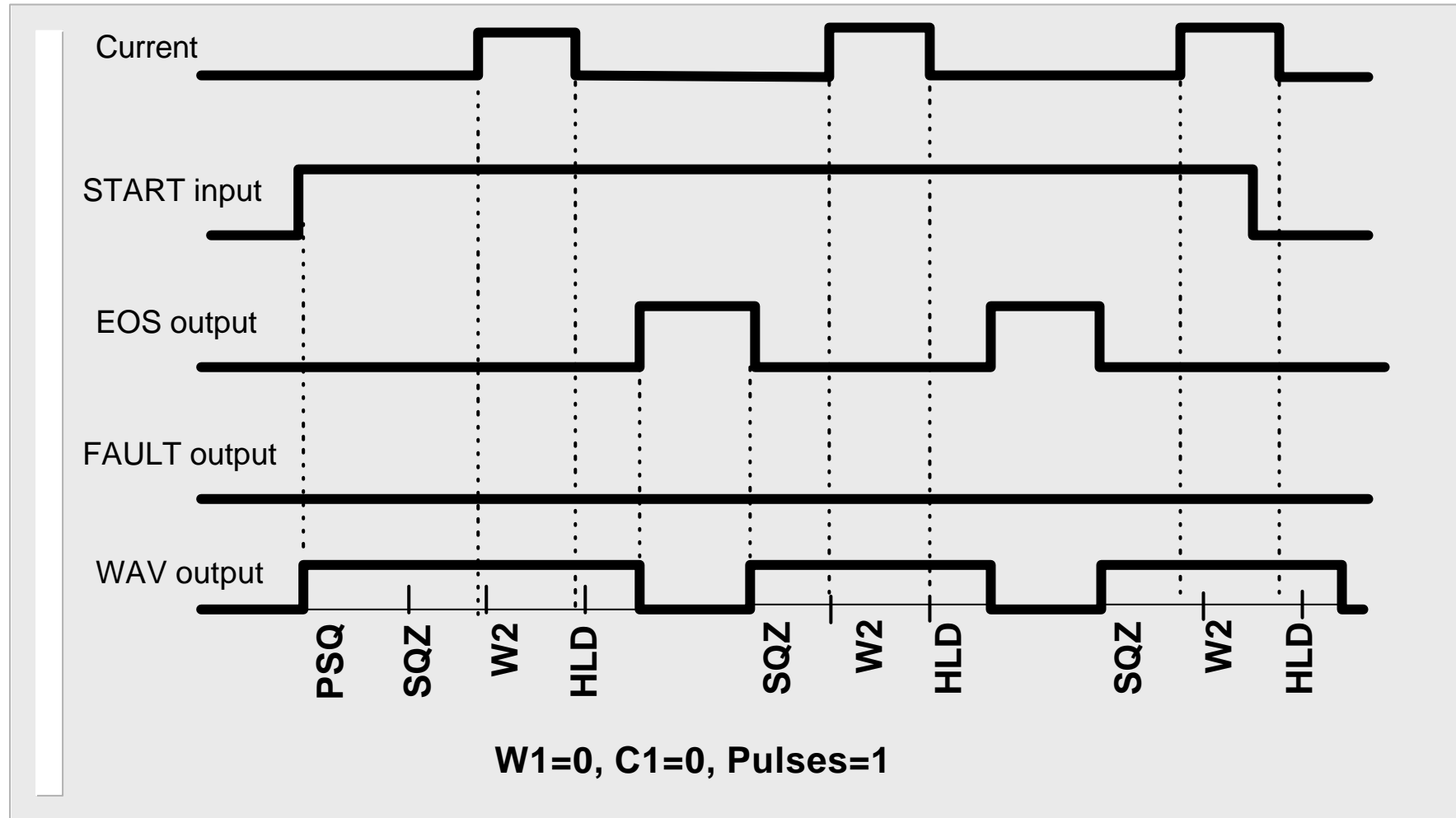
# Operation: basic spot weld – no weld faults



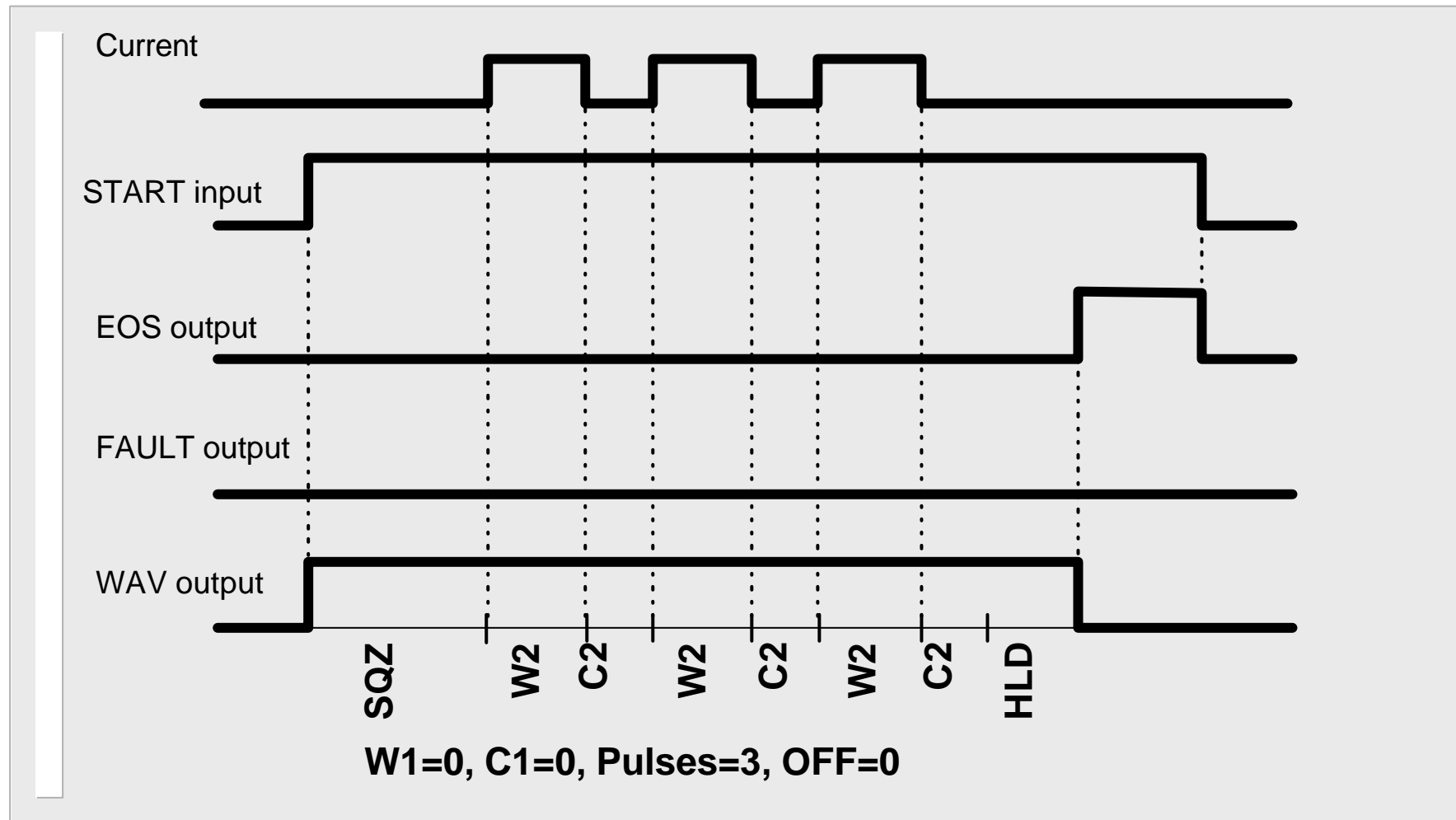
# Operation: basic spot weld – weld fault



# Operation: repeat spot weld

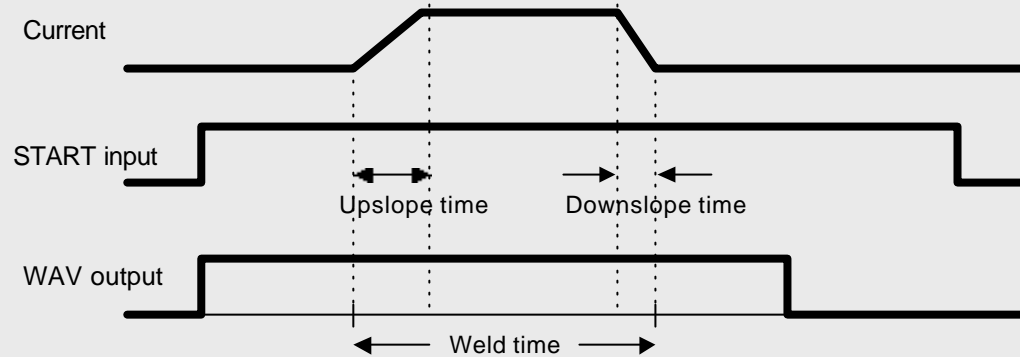


# Operation: pulsation spot weld



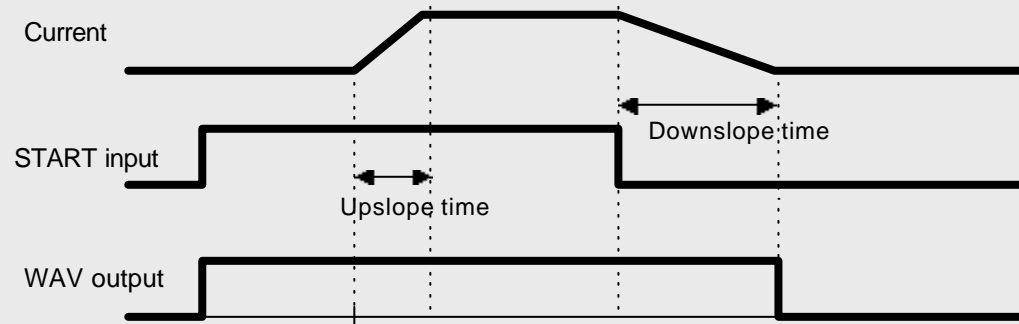
# Operation: Upslope and Downslope

## Spot



The upslope and downslope times are part of the overall weld time – they **do not** add to the weld time.

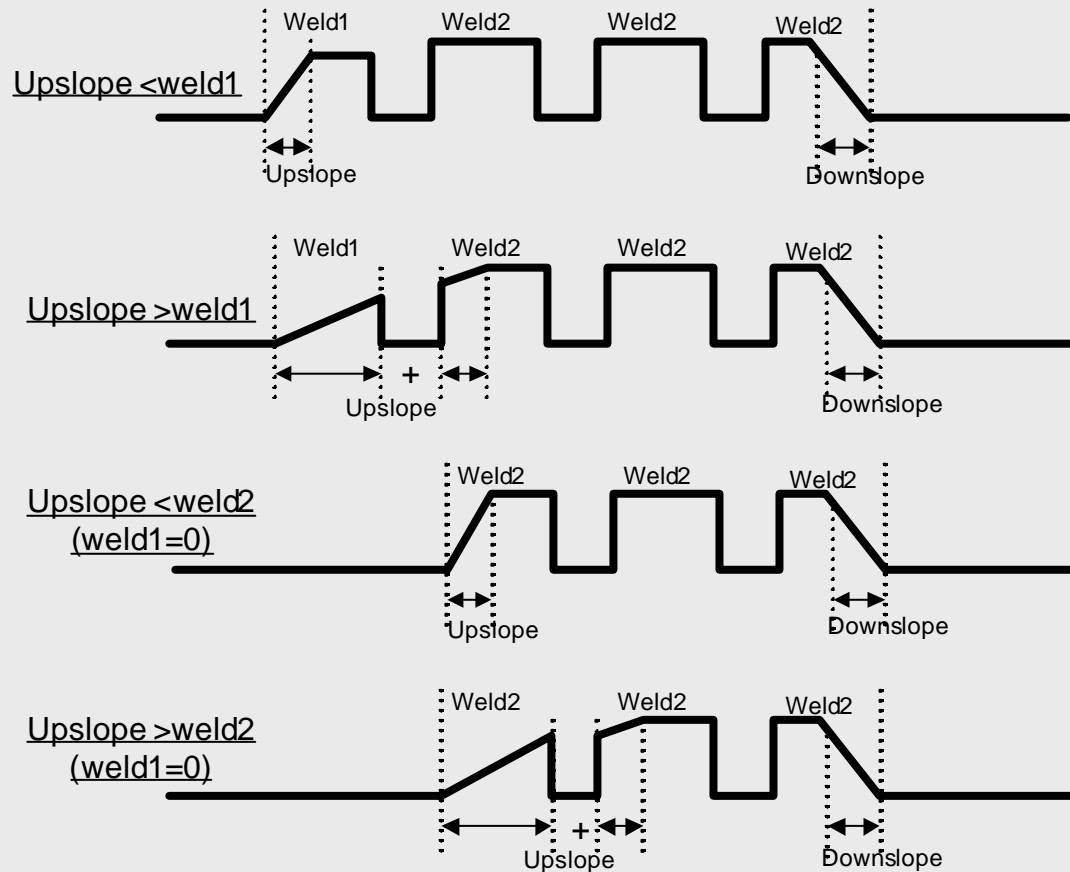
## Seam



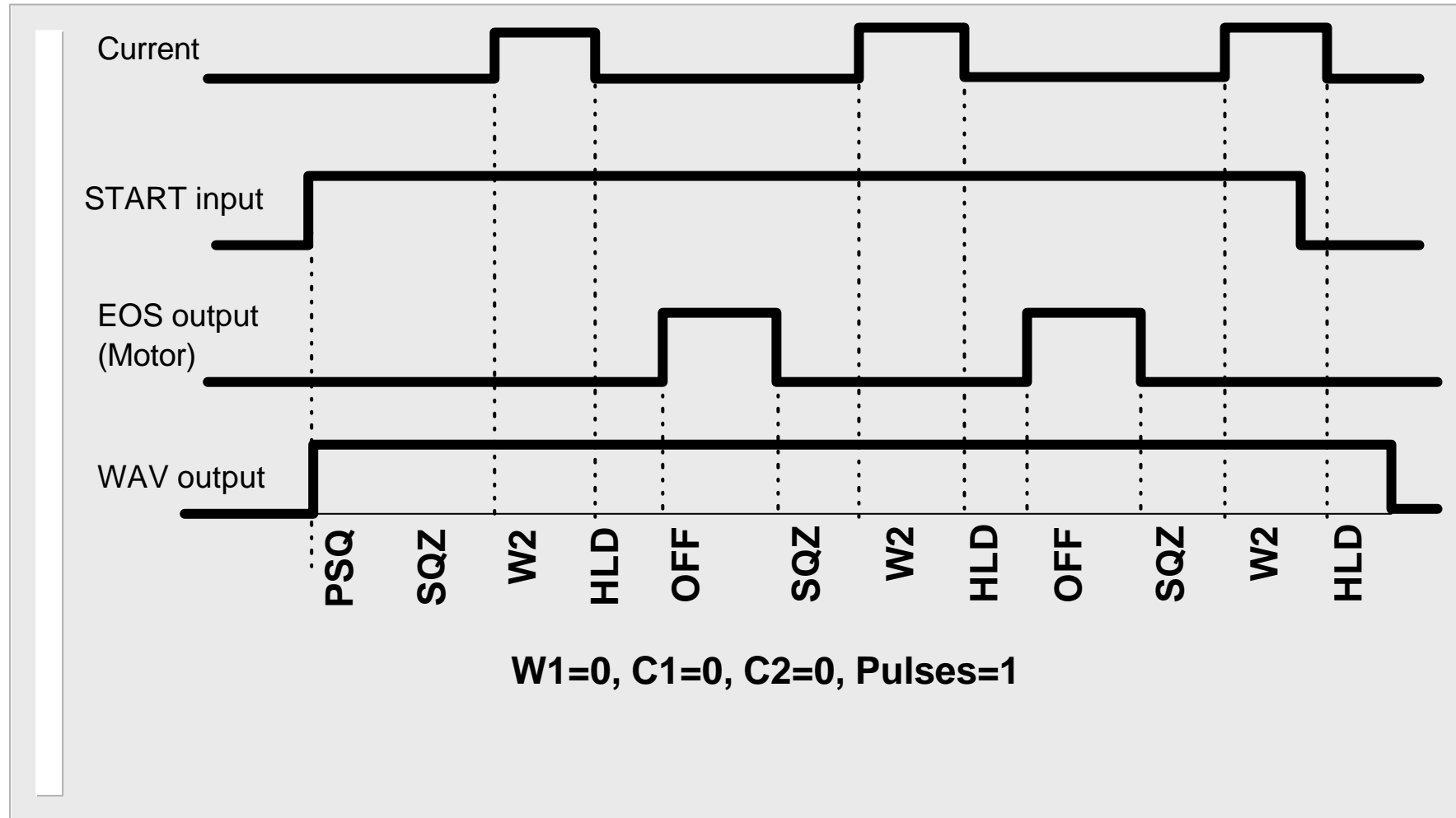
Note that for seam welds, the downslope time begins when the initiation input turns off.

# Operation: Upslope and Downslope

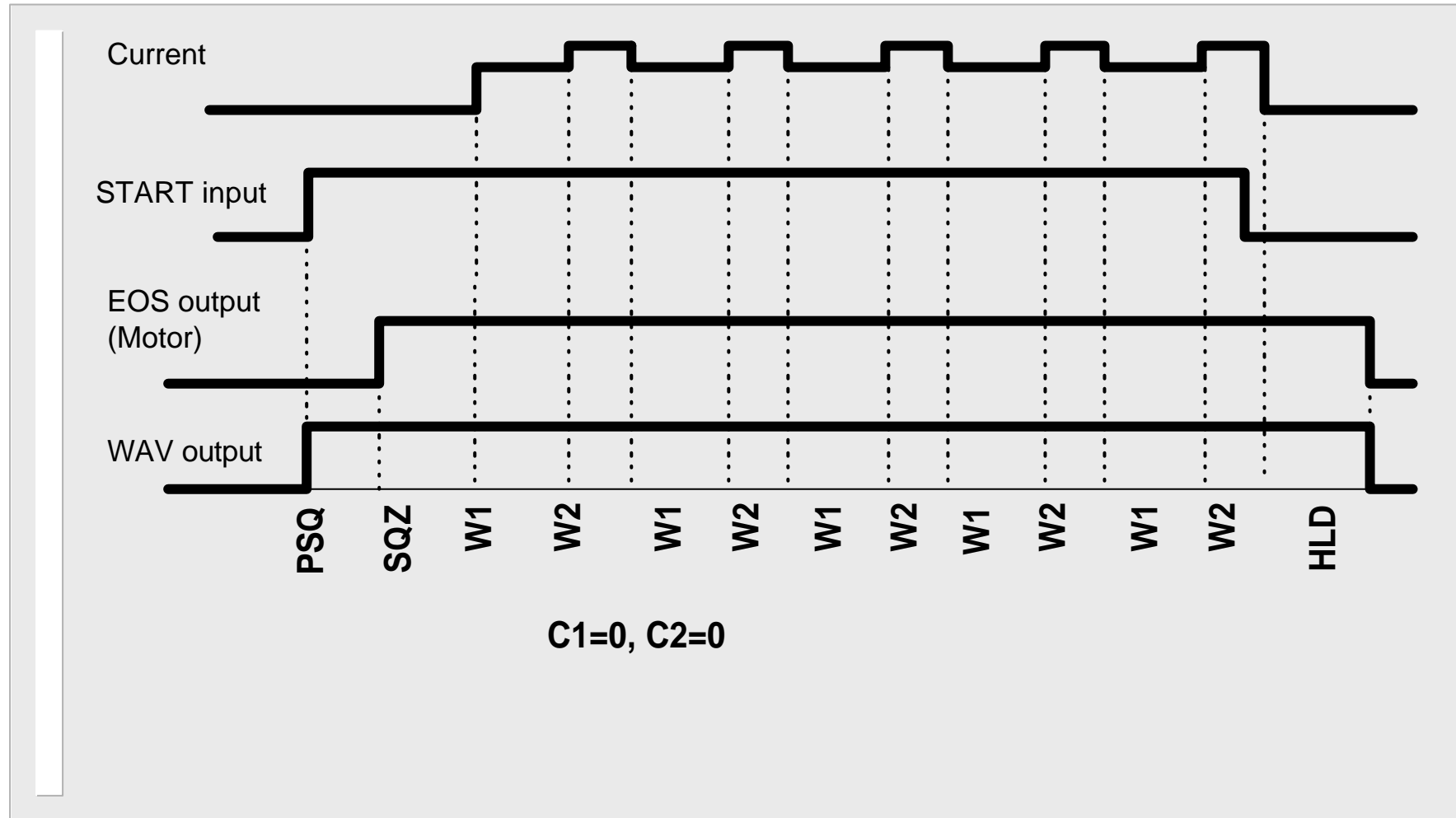
Upslope and downslope times will be distributed across more than one pulse, when necessary.



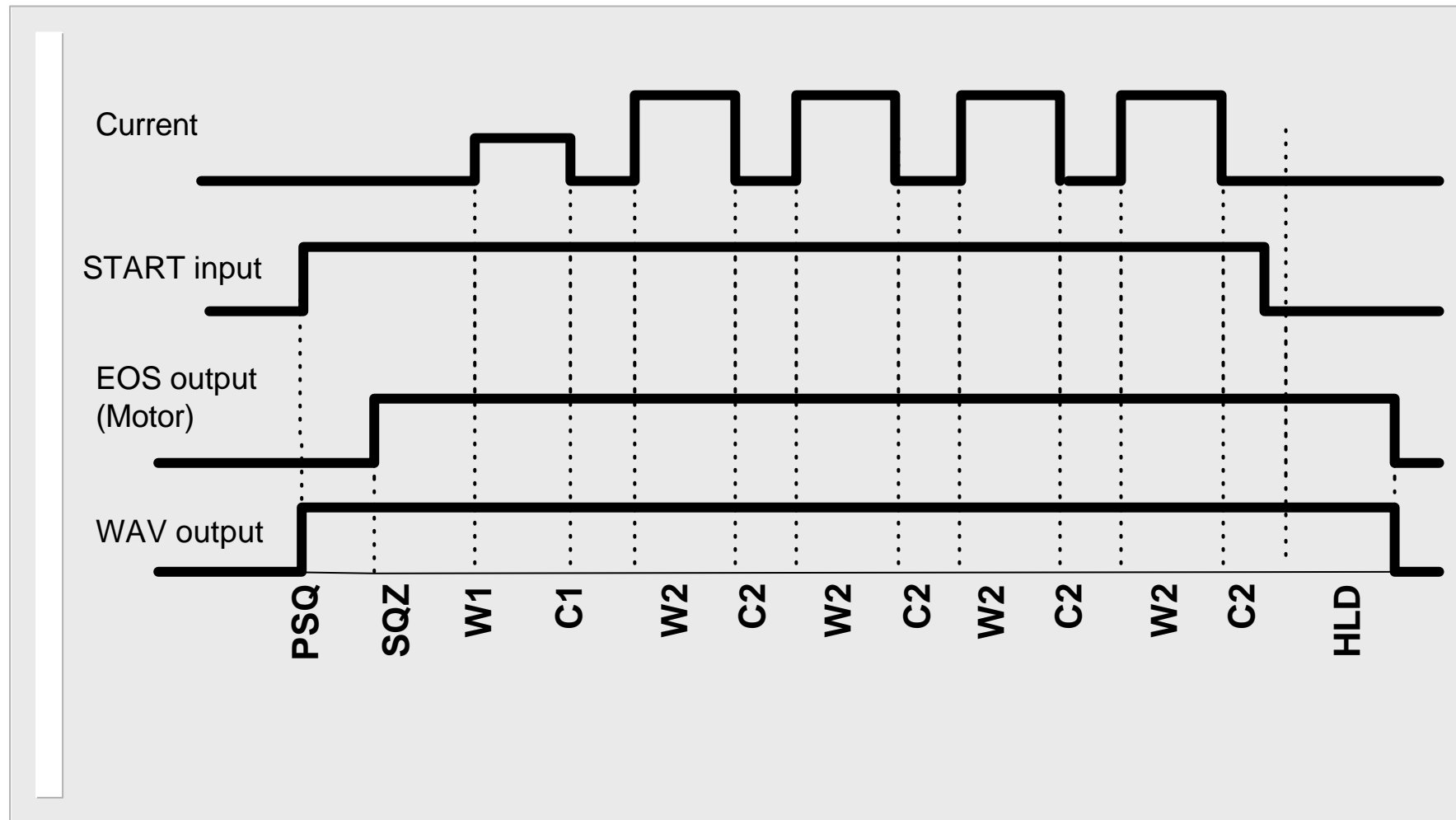
# Operation: roll-spot welding



# Operation: seam welding (dual heat)



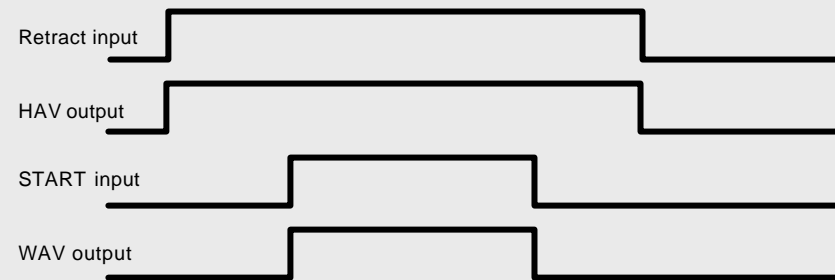
# Operation: seam welding (pre-heat)



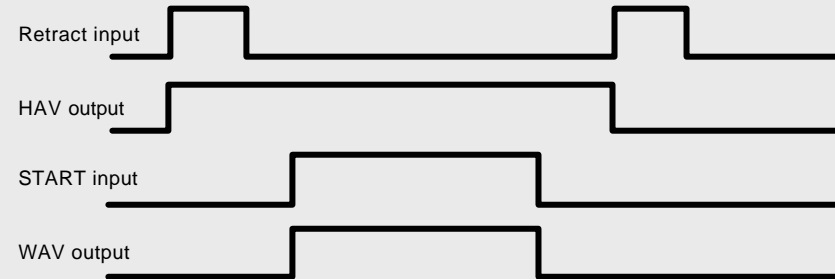
# Operation: Retract/Hi-lift

The retract operating mode (**Simple/Hi-lift+/Hi-lift-**) is set in the configuration file.

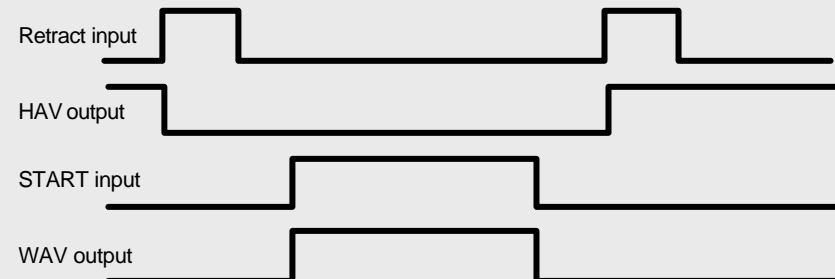
Simple



Hi-lift+



Hi-lift-



# WS98-700 PC software



WS98-700 PC software is available for use with the WS700 timer. This offers the user the ability to program and monitor the welding control, and to back-up all of the programmed data on a PC.

WS98-700 is available on CDROM, and works with all versions of Microsoft Windows™ (98 onwards). Contact BF Entron for more details.

