Introduction to WELDSTAR model WS2003

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

For s/w version 1.69

Document revision 0

**Manufacturers of
advanced welding
controls**

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- Welding controls.

- Thyristors and power supplies

- Power Inverters.

- Meters and Monitors.

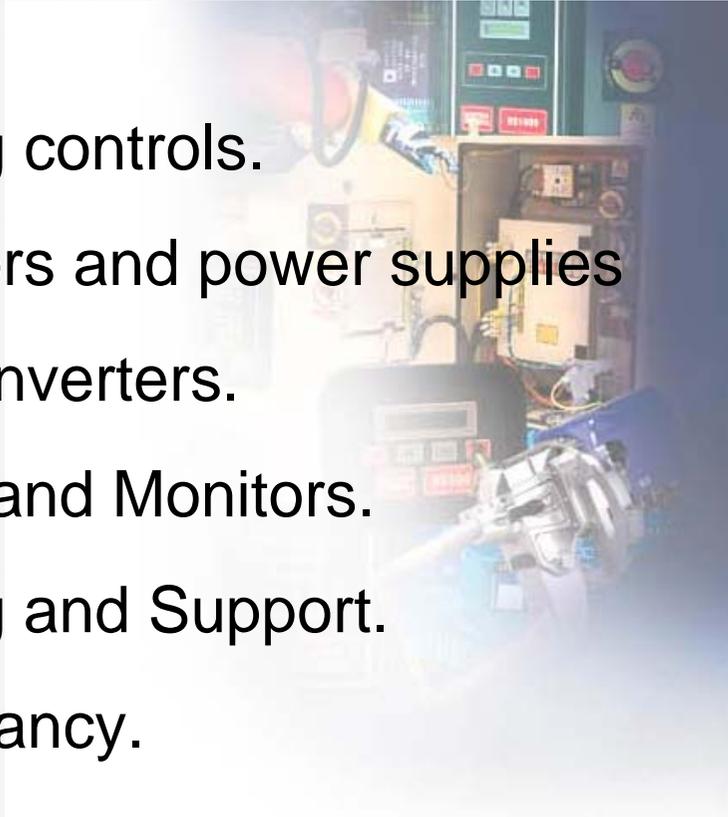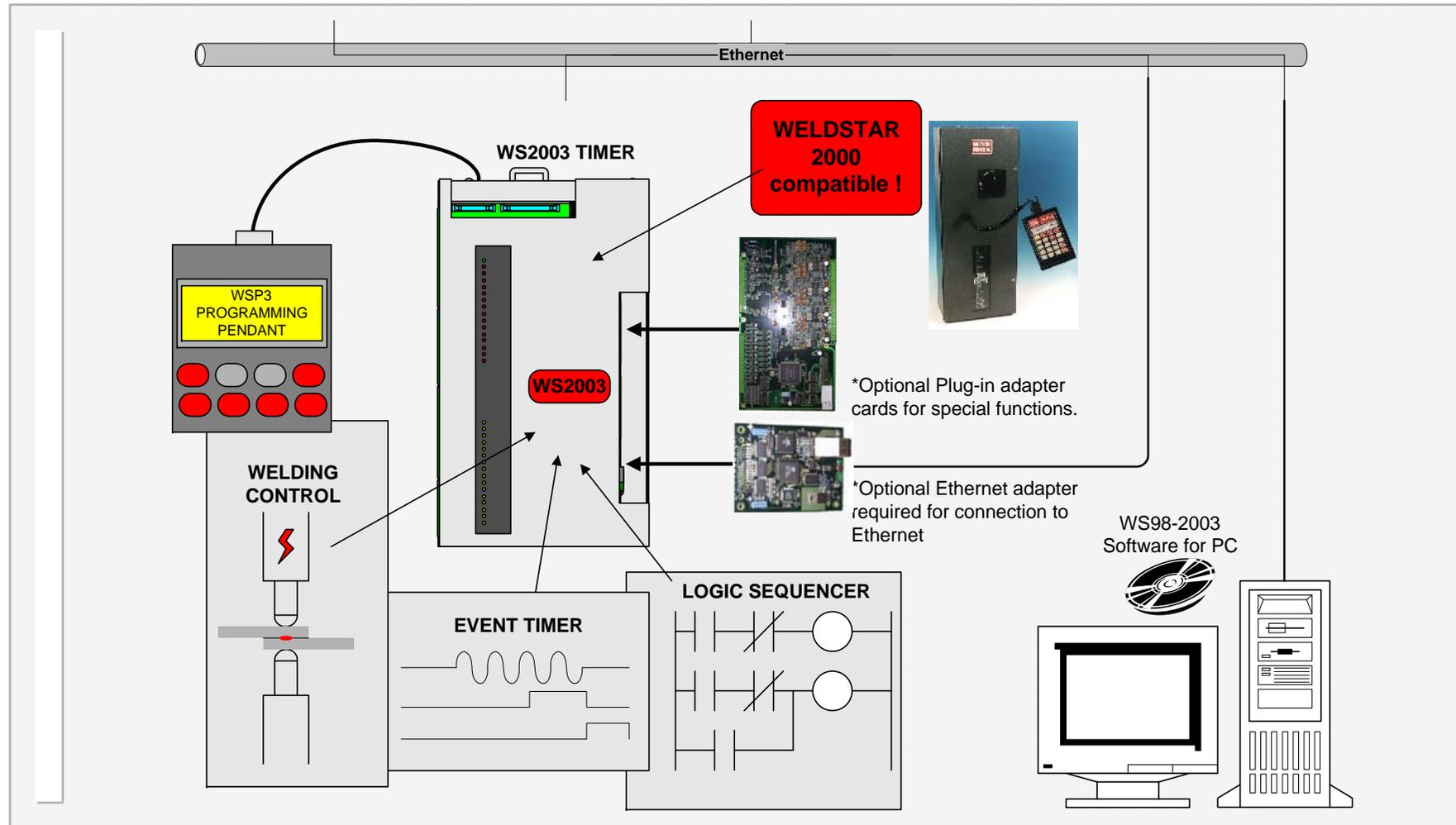- Training and Support.

- Consultancy.

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WELDSTAR model WS2003 System

Ethernet

WS2003 TIMER

WELDSTAR 2000 compatible !

WSP3 PROGRAMMING PENDANT

WS2003

WELDING CONTROL

*Optional Plug-in adapter cards for special functions.

*Optional Ethernet adapter required for connection to Ethernet

LOGIC SEQUENCER

EVENT TIMER

WS98-2003 Software for PC

4

Introduction and overview

This manual details the features of the WS2003 timer, and shows how to program the timer using the WSP3 programmer.

The new WELDSTAR model WS2003 is a direct plug-in replacement for the original WS2000. It will fit into existing cabinets, and will work with the existing power supply. Existing connections are duplicated, including outputs at 110V AC or 24VDC. MF operation is also supported.

A new programming pendant , type WSP3 is available, and provides a larger multi-line display, making programming easy.

A powerful built-in logic sequencer program provides the timer with a flexible means of fully controlling small machines or tooling arrangements, without the need for additional hardware.

A plug-in option board provides a 10/100Base-T Ethernet connection. Units may then be networked to a PC running WS98-2003 software for programming and monitoring purposes.

Fieldbus operation (Profibus, Interbus, DeviceNet Modbus etc.) is supported   via plug-in option boards.

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Functions

- Compatible with original Weldstar 2000
- AC 50/60Hz and MFDC (medium frequency) welding all supported.
- Spot / Repeat /Roll-spot / Seam (dual heat) / Seam (pre-heat) welding.
- Single, dual or OHMA (Air over Oil) gun operation.
- Multiwelding with up to 16 SCR/transformers
- Retract/high-lift control.
- Dual weld intervals plus pulsation, upslope and downslope.
- Constant current regulation.
- Up to 64 programmes with internal or external selection.
- Current monitoring with high, low and pre limits. Programmable blocking and weld retry functions.
- Proportional valve controller (0..10V or 4..20mA).
- Programmable outputs (events).
- Machine sequencer logic
- Welding programmes may be linked together to form complex spot schedules.

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…functions

- Contactor timer.
- Head-lock function.
- Analog output of current waveform.
- Electrode management including stepping, counting and tip-dressing functions, with programmable blocking and preset curves.
- Outputs will drive 24V DC or 110V AC loads.
- Primary or Secondary feedback via Toroid.
- Toroid and PV calibration functions.
- Toroid test function.
- Disable edit function.
- External plug-in programming pendant with large backlit 4x20 lcd display, and data backup facility.
- RS232 port, for PC communications.
- Expandable via plug-in option cards
-         (Ethernet, Profibus, DeviceNet, Interbus, Modbus TCP/IP, Ethernet/IP etc).

…functions

In early 2008, a number of new circuits were added to the original design. These are used to provide the following additional features:

• 0..10v or 4..20mA input for pressure monitoring.
• Two general purpose 0..10V inputs can be used by the sequencer. One of these inputs may be used to connect a CT for current measurement.

Note that these features are not available when running this firmware on the original design.

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Global parameters

Configuration
- Sequence   (Spot / Roll-spot / Seam(2-heat) / Seam(pre-heat)
- Single gun / Dual gun / OHMA gun / Multi-gun / Multi-gun cascade.
- Discrete/Fieldbus I/O
- Retract (x2): (Simple / Hi-lift+ / Hi-lift- / Maintained / OHMA)
- Program select (Binary / 1-of-4)
- SCR select (Binary / 1-of-4)
- Frequency (AC 50 Hz / AC 60 Hz / MF 50Hz / MF 60Hz)
- Contactor time (0..200 s)
- Blanking (On/Off)
- Toroid test (On/Off)
- Sensor (Toroid / CT)
- Heat range (Wide/High/Low)
- EOS mode (Cancel/fixed)
- If fault (Head-lock/Stop/Continue/EOS/No EOS)
- Sequencer (On/Off)
- Toroid attenuation factor (1..4)
- Count/Log sync (On/Off)
- Pressure units (kN/lb)
- Analog output (PV/Current).

Sequencer
- Up to 250 statements

Calibration (x2)
- Sensor sensitivity(100..60000 mV/kA)
- S/P ratio (1:1..199:1)
- S/P offset (-10kA..+10kA)
- Pressure (2 points, kN/V)
- Inverter (2 points, kA/%heat)
- Analog output scale (0..60kA).
- Analog input gain (0.9..2.5)
- Analog input offset(-9.99…+9.99)

Counter (x2)
- Actual count (0..9999).
- Terminal count(0..9999).
- Stop/continue at end.
- Tip dressing (on/off)
- Dressings (0..9999)
- Dress when new (on/off)

Stepper (x2)
- Stepper on/off.
- Stop /continue at end
- Curve(10 point, interpolated)

Output Map
- Normal/Event/Sequencer/Fieldbus (x12)

Input Map
- Normal/Sequencer (x14)

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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..99)
- Hold(0..99 cycles)
- Off(0..99 cycles)
- Pressure (0..100%)
- Heat 1(0..99.9%)
- Heat 2(0..99.9%)
- Current 1 (0..60kA)
- Current 2 (0..60kA)
- Balance (seam only)
- Normal/Link program
- Upslope(0..99 cycles)
- Downslope(0..99 cycles)

Additional parameters for OHMA gun
- OHMA gun open (0..99 cycles)
- OHMA gun close (0..99 cycles)
- OHMA retract open (0..99 cycles)
- OHMA retract delay (0..99 cycles)
- OHMA retract close (0..99 cycles)

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)
- Retry (On/Off)
- Pressure monitor (On/Off)
- Wait for pressure (On/Off)
- Pressure high limit (0..100%)
- Pressure low limit (0..100%)

Events

- 4 x 4 trigger points

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Multiweld parameters

When either *multi-gun* or *multi-gun cascade* modes are selected, the following additional parameters are available:

Transformers

•Electrode number (1..16) for each transformer (x16).

Calibration (extended to x16)

•See 'Global parameters' for parameter list.

Counter (extended to x16)

•See 'Global parameters' for parameter list.

Stepper (extended to x16)

•See 'Global parameters' for parameter list.

Weld program (x64)

•Electrode number(1..16).

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Mounting

If you have purchased a complete system including the WS2003 timer, then the timer will already be mounted in the case.

If you have purchased a timer only kit, then you will need to mount the timer to the rest of your equipment.

The timer is supplied complete with two metal mounting brackets. These brackets need to be fixed to a flat surface, as shown in the diagram.

It is recommended that the four holes for the top bracket are made into vertical slots. The position of the bracket may then be adjusted to give the best fit to the timer.

Top bracket

375

Bottom bracket

4.5 dia.

66.5   97.0   66.5
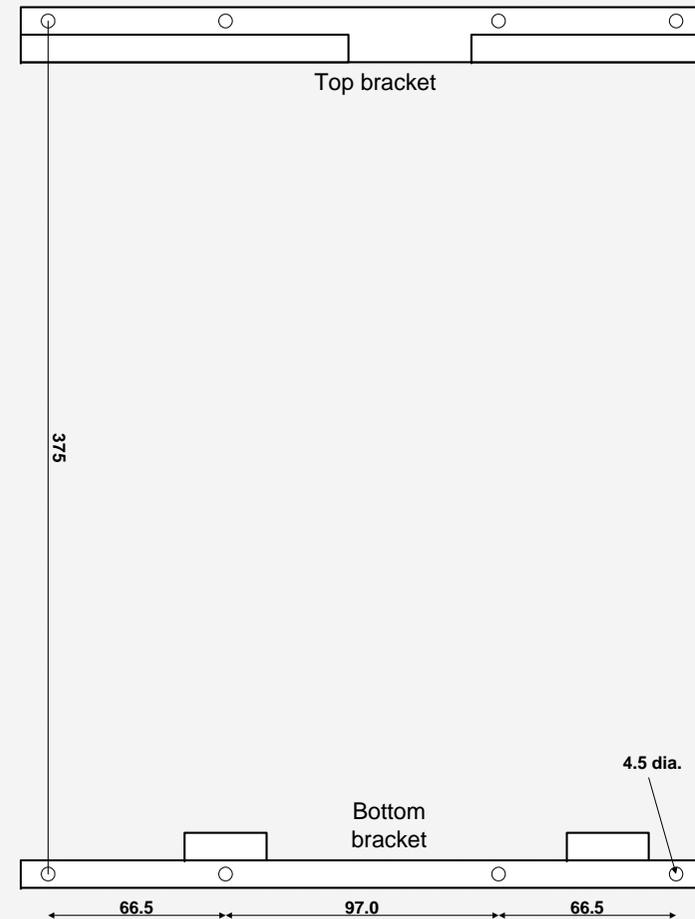
Connectors

Connectors P1,P2,P3,P4,P7,P13 and P14 are two-part terminals, for use with wires up to 1mm^2.

Connectors P5 and P6 are used internally via ribbon cable assemblies, and are not used for users connections.

Connector P7 is the preferred connection for the current measurement toroid. If the WS2003 timer is being retrofitted into an older system, there may already be a toroid connected and routed internally via ribbon P6. In this case, no connection should be made to P7. However, if possible, an existing toroid should be re-routed to P7.

P13 and P14 are not present on units produced before early 2008.
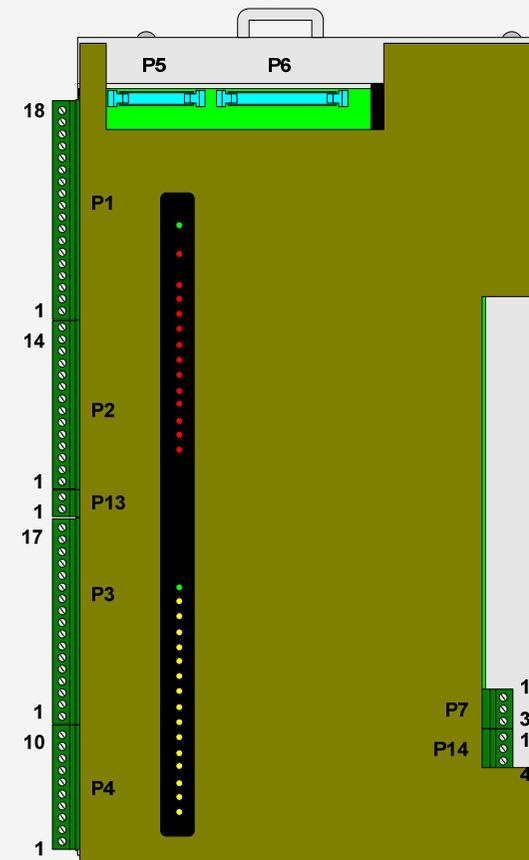
Users connections (discrete)

CONNECTIONS FOR SINGLE GUN/MACHINE/SEAM WELDER   SELECT SINGLE OR DUAL GUN OPERATION VIA TIMER CONFIGURATION FILE

…users connections

CONNECTIONS FOR DUAL GUN OPERATION   SELECT SINGLE OR DUAL GUN OPERATION VIA TIMER CONFIGURATION FILE

START AND PROGRAMME SELECTION INPUTS

BINARY MODE   P3

8	+24V
7	+24V
6	INPUT 14 WELD ON
9	A24V
1	INPUT 09 START1
10	INPUT 11 P1A
11	INPUT 12 P2A
12	INPUT 13 P4A
13	B24V
2	INPUT 10 START2
14	P1B
15	P2B
16	P4B
17	0V EXT

GUN 1 / GUN 2

SELECT BINARY OR 1-OF-4 MODE VIA TIMER CONFIGURATION FILE.
SEE MANUAL FOR PROGRAM SELECTION FORMATS.

1-OF-4 MODE   P3

8	+24V
7	+24V
6	INPUT 14 WELD ON
9	A24V
1	INPUT 09 START 1
3	INPUT 11 START 3
13	B24V
2	INPUT 10 START 2
4	INPUT 12 START 4
17	0V EXT

LINK WELD-ON INPUT IF NOT REQUIRED

ALL INPUTS RATED 24V DC, 10mA.

0V EXT MAY BE EARTHED IF REQUIRED.

OTHER INPUTS

P4

10	0V EXT
9	INPUT 08 RETRACT 1
8	INPUT 07 2nd STAGE 1&2
7	INPUT 06 RESET STEPPER 1
6	INPUT 05 RESET COUNT 1
5	INPUT 04 RETRACT 2
4	INPUT 03 RESET FAULT
3	INPUT 02 RESET STEPPER 2
2	INPUT 01 RESET COUNT 2
1	+24V

LINK 2nd STAGE INPUT IF NOT REQUIRED

IF DRIVING FROM EXTERNAL 24V DC SOURCE, MAKE COMMON CONNECTION TO 0VEXT.
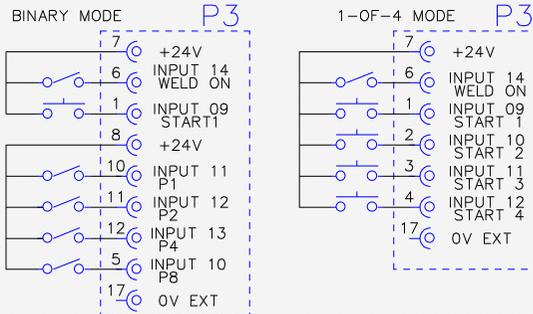
DO NOT CONNECT EXTERNAL +24V SUPPLY TO TERMINALS MARKED +24V ON TIMER.

SOLENOID OUTPUTS

P2

4	
7	
5	WAV 1
6	
8	WAV 2
9	
10	RETRACT 1
11	
12	RETRACT 2
13	
14	

OUTPUT 09 (+/-)
OUTPUT 10 (+/-)
OUTPUT 11 (+/-)
OUTPUT 12 (VOUT-) (+/-)
VOUT+

SOLENOID SUPPLY (VOUT) IS PROVIDED FROM TIMER. USE SOLENOIDS TO SUIT THIS SUPPLY.

SOLENOID OUTPUTS ARE RATED AT 1A @ 110V AC / 3A @ 24V DC.

6,9,11,13 ARE COMMON (VOUT-) AND MAY BE EARTHED IF REQUIRED.

RETRACT OPERATION MUST BE SELECTED VIA TIMER CONFIGURATION FILE.

SIGNAL OUTPUTS

P1

1	END STEPPER 2
2	
3	END STEPPER 1
4	
5	END COUNT 2
6	
7	END COUNT 1
8	
9	CONTACTOR
10	
11	NOT READY
12	
13	FAULT
14	
15	EOS
16	
17	
18	

OUTPUT 01 (+/-)
OUTPUT 02 (+/-)
OUTPUT 03 (+/-)
OUTPUT 04 (+/-)
OUTPUT 05 (+/-)
OUTPUT 06 (+/-)
OUTPUT 07 (+/-)
OUTPUT 08 (+/-)

SIGNAL OUTPUTS ARE SOLID-STATE AND REQUIRE AN EXTERNAL VOLTAGE SOURCE. (110 V AC MAX OR 24V DC).

2,4,6,8,10,12,14,16,17 ARE COMMON AND MAY BE EARTHED IF REQUIRED.

OUTPUTS ARE RATED 0.5A.

External STOP circuit. See cabinet wiring diagram for exact location.

STOP
SCR THERMOSTAT

X1
3
4

POWER CARD
Part No. W293133
Drawing No. 3U3447

IMPORTANT
Inputs and Outputs are shared between the timer, events and sequencer. Use the EDIT INPUT MAP and EDIT OUTPUT MAP functions to configure.

…users connections

CONNECTIONS FOR MULTI−GUN MACHINE

SELECT MODE OF OPERATION VIA TIMER CONFIGURATION FILE

START AND PROGRAMME SELECTION INPUTS

BINARY MODE   P3

Terminal	Label
7	+24V
6	INPUT 14 WELD ON
1	INPUT 09 START1
8	+24V
10	INPUT 11 P1
11	INPUT 12 P2
12	INPUT 13 P4
5	INPUT 10 P8
17	0V EXT

1−OF−4 MODE   P3

Terminal	Label
7	+24V
6	INPUT 14 WELD ON
1	INPUT 09 START 1
2	INPUT 10 START 2
3	INPUT 11 START 3
4	INPUT 12 START 4
17	0V EXT

SELECT BINARY OR 1−OF−4 MODE VIA TIMER CONFIGURATION FILE. SEE MANUAL FOR PROGRAM SELECTION FORMATS.

LINK WELD ON INPUT IF NOT REQUIRED

ALL INPUTS RATED 24V DC, 10mA.

IF DRIVING FROM EXTERNAL 24V DC SOURCE, MAKE COMMON CONNECTION TO 0V EXT.

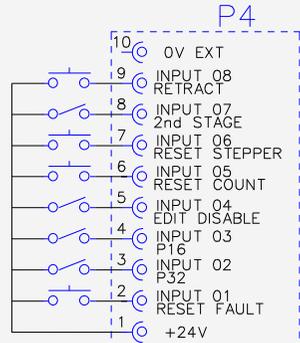DO NOT CONNECT EXTERNAL +24V SUPPLY TO TERMINALS MARKED +24V ON TIMER.

0V EXT MAY BE EARTHED IF REQIRED.

External STOP circuit. See cabinet wiring diagram for exact location.

STOP
SCR THERMOSTAT

X1
3
4

POWER CARD
Part No. W293133
Drawing No. 3U3447

OTHER INPUTS P4

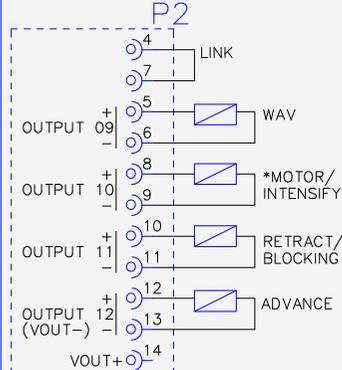| Terminal	Label
10	0V EXT
9	INPUT 08 RESET ALL
8	INPUT 07 2nd STAGE
7	INPUT 06 RESET STEPPER
6	INPUT 05 RESET COUNT
5	INPUT 04 EDIT DISABLE
4	INPUT 03 P16
3	INPUT 02 P32
2	INPUT 01 RESET FAULT
1	+24V

LINK 2nd STAGE INPUT IF NOT REQUIRED

P16/P32 CAN BE USED IN CONJUNCTION WITH P1/2/4/8, TO PROVIDE ACCESS TO PROGRAM NUMBERS ABOVE 15 IN MULTI_GUN MODE.

RESET ALL can be activated in conjunction with either RESET STEPPER or RESET COUNTER, to request that all steppers or counters be reset, otherwise only expired steppers or counters are reset.

IMPORTANT
Inputs and Outputs are shared between the timer, events and sequencer. Use the EDIT INPUT MAP and EDIT OUTPUT MAP functions to configure.

SOLENOID OUTPUTS P2

Terminal	Label
4	LINK
7	
5	OUTPUT 09 WAV
6	
8	OUTPUT 10 SCR BIT 0
9	
10	OUTPUT 11 SCR BIT 1
11	
12	OUTPUT 12 (VOUT−) SCR BIT 2
13	
14	VOUT+

SOLENOID SUPPLY (VOUT) IS PROVIDED FROM TIMER. USE SOLENOIDS TO SUIT THIS SUPPLY.
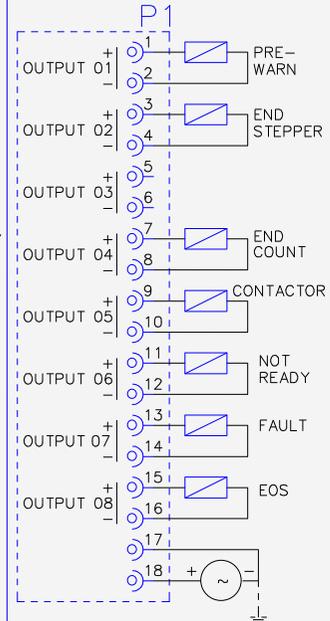
SOLENOID OUTPUTS ARE RATED AT 1A @ 110V AC / 3A @ 24V DC. 6,9,11,13 ARE COMMON (VOUT−) AND MAY BE EARTHED IF REQUIRED.

SIGNAL OUTPUTS P1

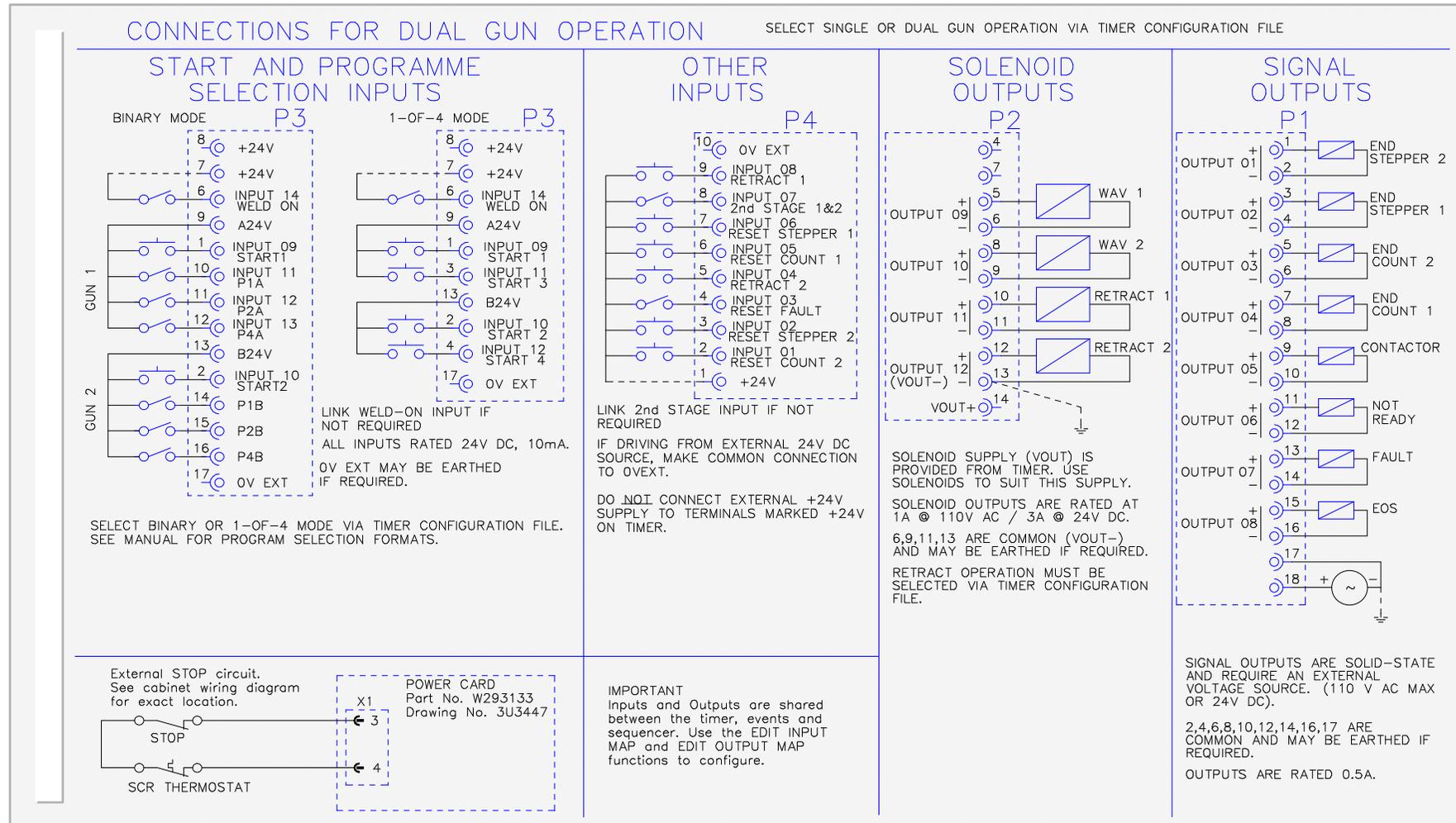| Terminal	Label
1	OUTPUT 01 PRE−WARN
2	
3	OUTPUT 02 END STEPPER
4	
5	OUTPUT 03 SCR BIT 3
6	
7	OUTPUT 04 END COUNT
8	
9	OUTPUT 05 CONTACTOR
10	
11	OUTPUT 06 NOT READY
12	
13	OUTPUT 07 FAULT
14	
15	OUTPUT 08 EOS
16	
17	
18	

SIGNAL OUTPUTS ARE SOLID−STATE AND REQUIRE AN EXTERNAL VOLTAGE SOURCE. (110 V AC MAX OR 24V DC).

2,4,6,8,10,12,14,16,17 ARE COMMON AND MAY BE EARTHED IF REQUIRED.
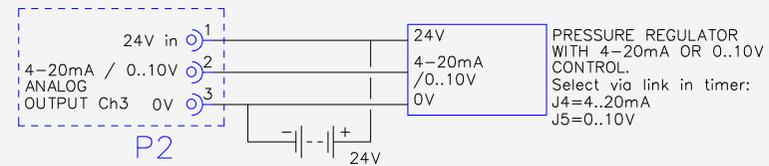
OUTPUTS ARE RATED 0.5A.

…users connections

TOROID INPUT

P7

NOTE: Toroid output should be>250mV
e.g.
For a 150mV/kA toroid, min current =250/150 =1.66kA
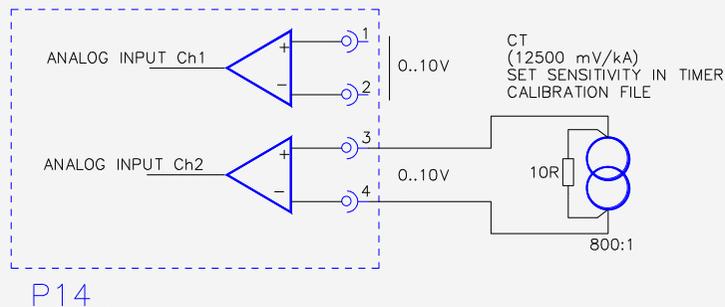For a 1400mV/kA toroid, min current =250/1400=178A

Toroid
(100 to 2000mV/kA)
SET SENSITIVITY IN TIMER
CALIBRATION FILE

PRESSURE CONTROL

REGULATED 24V DC SUPPLY MUST BE CONNECTED TO P2.

24V in 1
4-20mA / 0..10V 2
ANALOG
OUTPUT Ch3   0V 3

P2

24V
4-20mA
/0..10V
0V

PRESSURE REGULATOR
WITH 4-20mA OR 0..10V
CONTROL.
Select via link in timer:
J4=4..20mA
J5=0..10V

24V

These connections are only available on uprated controls, produced after early 2008

ANALOG INPUTS

ANALOG INPUT Ch1 + 1
                   − 2   0..10V

ANALOG INPUT Ch2 + 3
                   − 4   0..10V

CT
(12500 mV/kA)
SET SENSITIVITY IN TIMER
CALIBRATION FILE

10R

800:1

P14
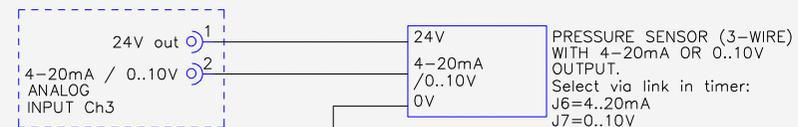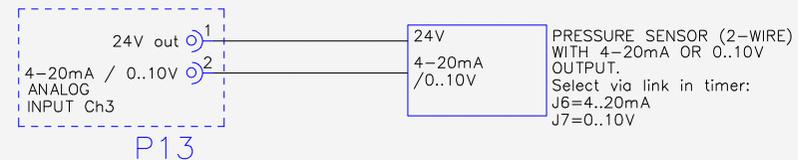
Analog input Ch2 may be used as a general purpose 0..10V input or for current
measurement by connecting an iron−cored CT as shown. When connecting a CT,
the peak signal should not exceed 10V. This gives a current range of 80 A to 800 A
with the arrangement shown, and thus is normally used on primary currents only.
A lower range of 35 A to 360 A may be obtained by substituting the 10 Ohm resistor
for a 22 Ohm and then setting the sensitivity to 27500 mV/kA.

Use of the CT is the recommended method for seam welding.

REGULATED 24V DC SUPPLY MUST BE CONNECTED TO P2 (see above).

24V out 1
4-20mA / 0..10V 2
ANALOG
INPUT Ch3

P13

24V
4-20mA
/0..10V

PRESSURE SENSOR (2−WIRE)
WITH 4-20mA OR 0..10V
OUTPUT.
Select via link in timer:
J6=4..20mA
J7=0..10V

24V out 1
4-20mA / 0..10V 2
ANALOG
INPUT Ch3

P13

0V 3

P2

24V
4-20mA
/0..10V
0V

PRESSURE SENSOR (3−WIRE)
WITH 4-20mA OR 0..10V
OUTPUT.
Select via link in timer:
J6=4..20mA
J7=0..10V

NOTE: in current mode (4..20mA), input at P13 is a current SINK.
Consequently, the connected sensor must be a current SOURCE.
A SINK/SOURCE converter module is available from BF Entron.

Operation with a fieldbus

WS2003 can be operated on a fieldbus, instead of through the discrete I/O connections.

An optional adapter card is required to interface to the required fieldbus. Adapter cards are available for all popular fieldbus types: (Profibus-DP, Interbus-S, DeviceNet, Ethernet TCP/IP/MODBUS, etc.)

The diagram opposite shows, schematically, how the I/O is arranged. Selection between Discrete or Fieldbus operation is via the timer configuration.

The tables on the next page show the fieldbus bit assignments for both single gun/multi-gun and dual-gun operation.

WS2003 I/O routing
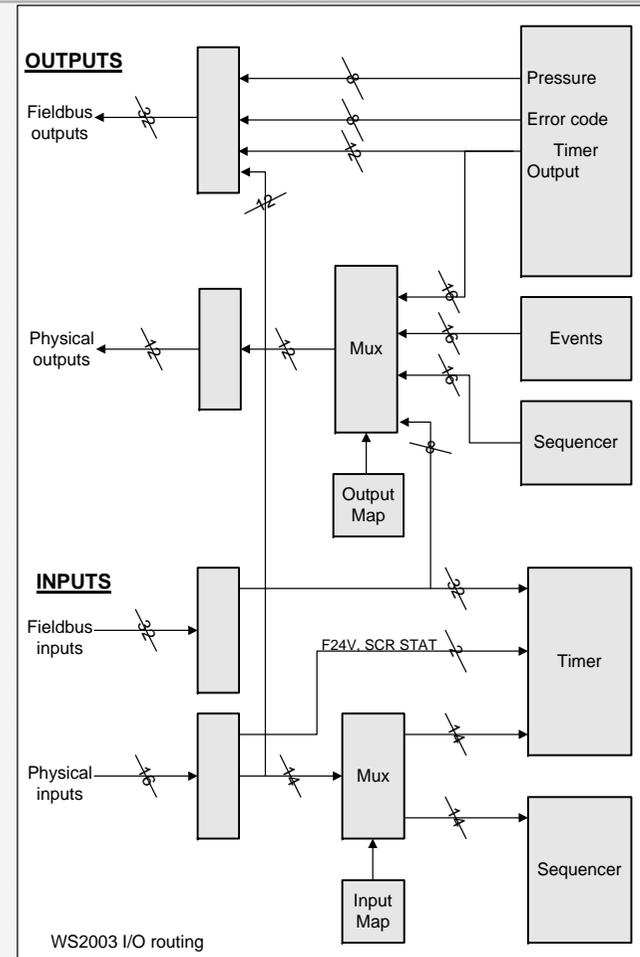
...operation with a fieldbus

Single gun /Multi-gun

INPUT from bus to timer		OUTPUT from timer to bus	
Bit No.	**Function**	**Bit No.**	**Function**
0	START 1	0	Prewarning
1	START 2	1	End of stepper
2	START 3	2	Reserved
3	START 4	3	End of count
4	2nd Stage	4	Contactor
5	Weld on*	5	Not ready
6	Reserved	6	Fault
7	Reserved	7	End of sequence (EOS)
8	Reset counter	8	Weld air valve 1 (WAV 1)
9	Reset stepper	9	Low force air valve (LFAV) / Motor
10	Retract 1 / Reset All	10	Retract air valve 1 (HAV 1)
11	Reserved	11	Reserved
12	Reserved	12	Discrete input I10
13	Reserved	13	Discrete input I11
14	Reserved	14	Discrete input I12
15	Reset fault	15	Discrete input I13
16	Program bit 1	16	Error code bit 1
17	Program bit 2	17	Error code bit 2
18	Program bit 4	18	Error code bit 4
19	Program bit 8	19	Error code bit 8
20	Program bit 16	20	Error code bit 16
21	Program bit 32	21	Error code bit 32
22	Reserved	22	Error code bit 64
23	Reserved	23	Error code bit 128

INPUT from bus to timer		OUTPUT from timer to bus	Map=1	Map=2
Bit No.	**Function**	**Bit No.**		
24	Discrete output Q01	24	Pressure bit 1	Discrete input I1
25	Discrete output Q02	25	Pressure bit 2	Discrete input I2
26	Discrete output Q03	26	Pressure bit 4	Discrete input I3
27	Discrete output Q04	27	Pressure bit 8	Discrete input I4
28	Discrete output Q05	28	Pressure bit 16	Discrete input I5
29	Discrete output Q06	29	Pressure bit 32	Discrete input I6
30	Discrete output Q07	30	Pressure bit 64	Discrete input I7
31	Discrete output Q08	31	Pressure bit 128	Discrete input I8

Dual gun

INPUT from bus to timer		OUTPUT from timer to bus	
Bit No.	**Function**	**Bit No.**	**Function**
0	START 1	0	End of stepper 2
1	START 2	1	End of stepper 1
2	START 3	2	End of count 2
3	START 4	3	End of count 1
4	2nd Stage	4	Contactor
5	Weld on*	5	Not ready
6	Reserved	6	Fault
7	Reserved	7	End of sequence (EOS)
8	Reset counter 1	8	Weld air valve 1 (WAV 1)
9	Reset stepper 1	9	Weld air valve 2 (WAV 2)
10	Retract 1	10	Retract air valve 1 (HAV 1)
11	Reset counter 2	11	Retract air valve 2 (HAV 2)
12	Reset stepper 2	12	Discrete input I10
13	Retract 2	13	Discrete input I11
14	Reserved	14	Discrete input I12
15	Reset fault	15	Discrete input I13
16	Program bit 1	16	Error code bit 1
17	Program bit 2	17	Error code bit 2
18	Program bit 4	18	Error code bit 4
19	Program bit 8	19	Error code bit 8
20	Program bit 16	20	Error code bit 16
21	Program bit 32	21	Error code bit 32
22	Reserved	22	Error code bit 64
23	Reserved	23	Error code bit 128

INPUT from bus to timer		OUTPUT from timer to bus	Map=1	Map=2
Bit No.	**Function**	**Bit No.**		
24	Discrete output Q01	24	Pressure bit 1	Discrete input I1
25	Discrete output Q02	25	Pressure bit 2	Discrete input I2
26	Discrete output Q03	26	Pressure bit 4	Discrete input I3
27	Discrete output Q04	27	Pressure bit 8	Discrete input I4
28	Discrete output Q05	28	Pressure bit 16	Discrete input I5
29	Discrete output Q06	29	Pressure bit 32	Discrete input I6
30	Discrete output Q07	30	Pressure bit 64	Discrete input I7
31	Discrete output Q08	31	Pressure bit 128	Discrete input I8

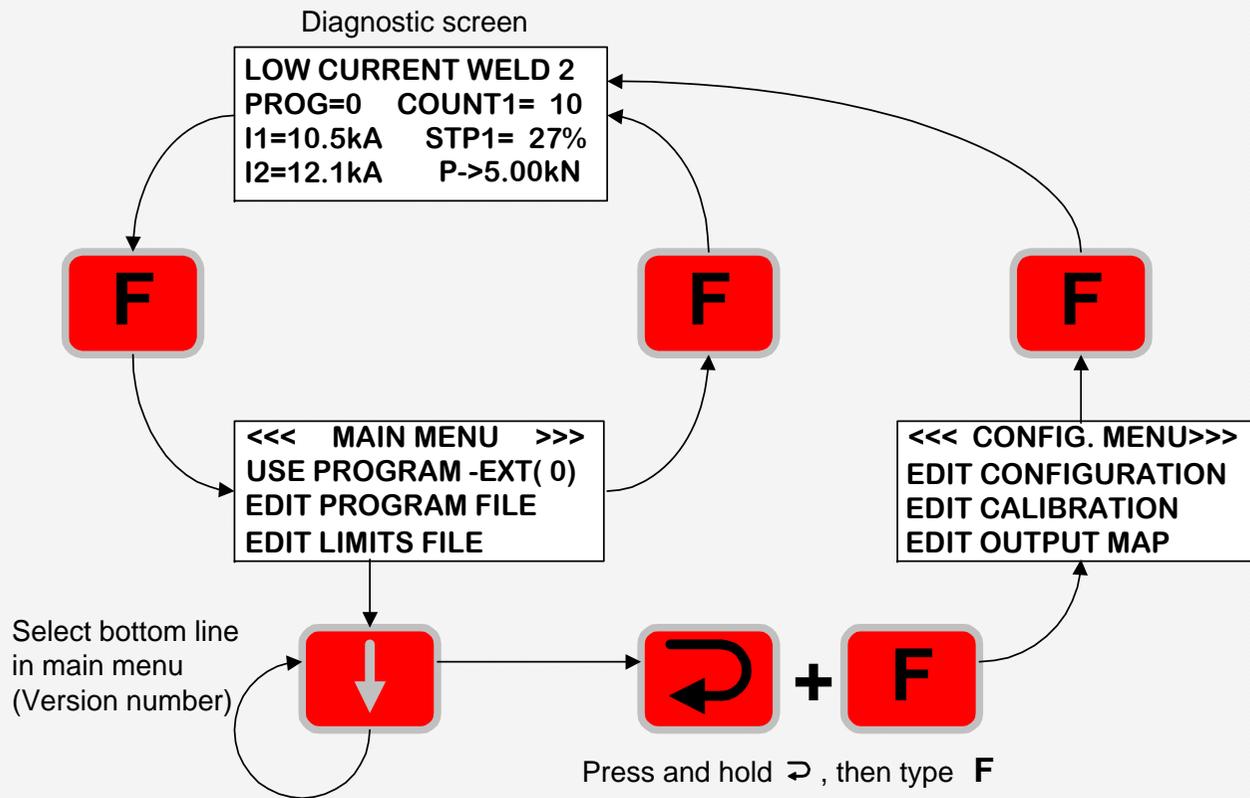*The discrete **Weld on** input must also be <u>on</u> to enable welding.
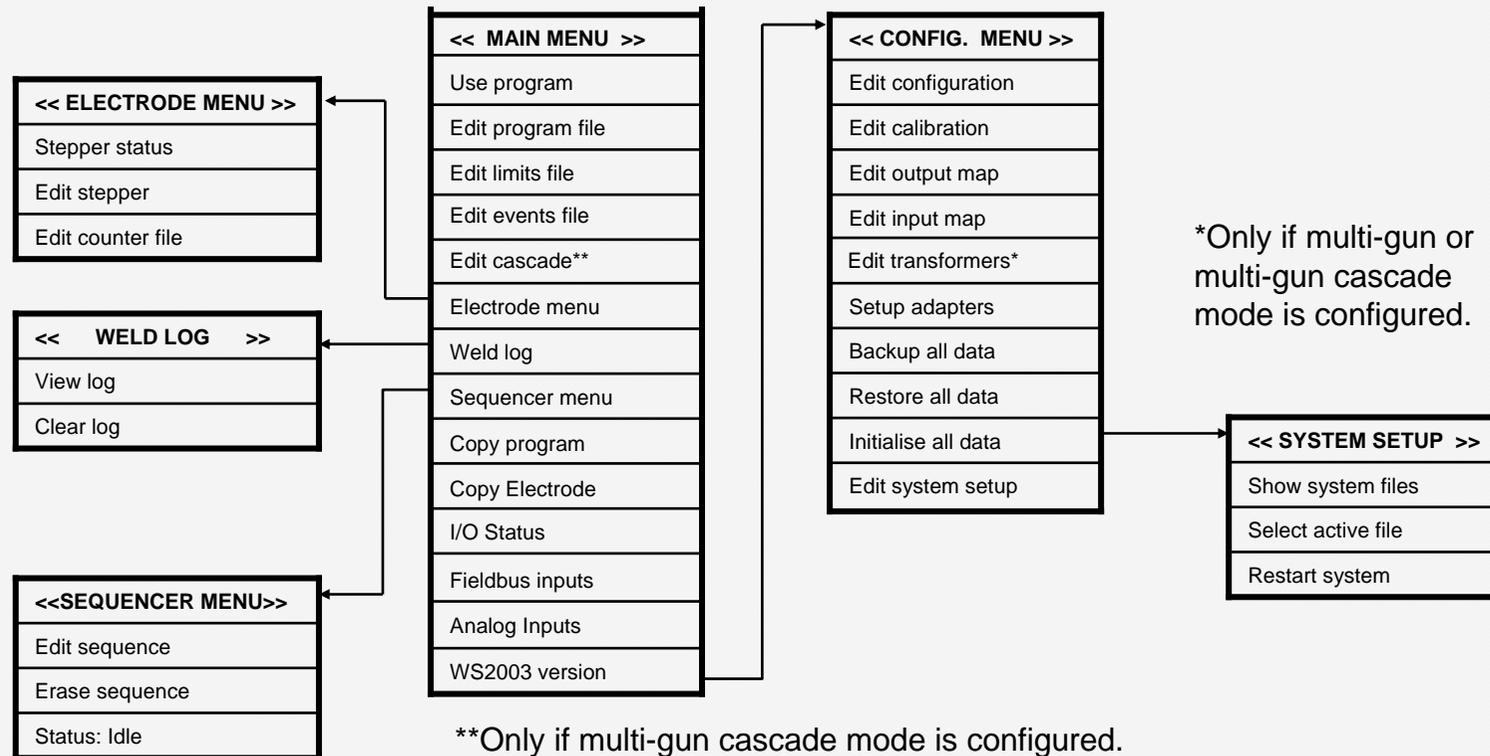
Keypad

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.
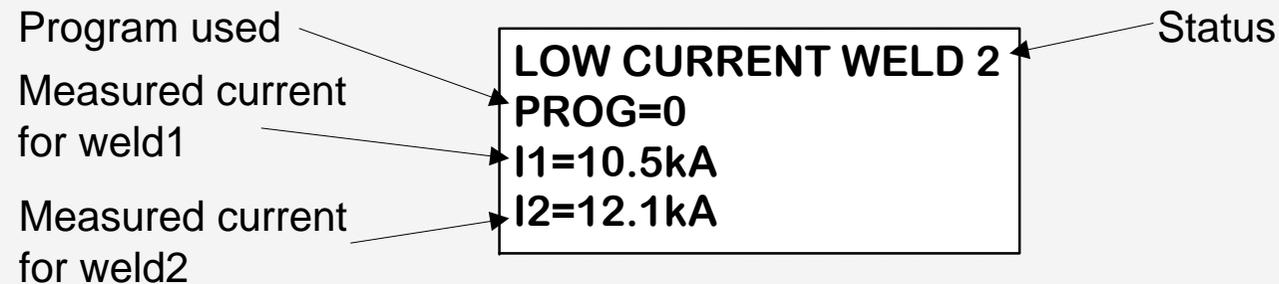
Menus

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:

Diagnostic screen

```
LOW CURRENT WELD 2
PROG=0    COUNT1=  10
I1=10.5kA    STP1=  27%
I2=12.1kA     P->5.00kN
```

F

F

F

```
<<<    MAIN MENU    >>>
USE PROGRAM -EXT( 0)
EDIT PROGRAM FILE
EDIT LIMITS FILE
```

```
<<<  CONFIG. MENU>>>
EDIT CONFIGURATION
EDIT CALIBRATION
EDIT OUTPUT MAP
```

Select bottom line
in main menu
(Version number)

↓ → ↺ + **F**

Press and hold ↺ , then type **F**

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..menus

<< ELECTRODE MENU >>
Stepper status
Edit stepper
Edit counter file

<<   WELD LOG   >>
View log
Clear log

<<SEQUENCER MENU>>
Edit sequence
Erase sequence
Status: Idle

<< MAIN MENU >>
Use program
Edit program file
Edit limits file
Edit events file
Edit cascade**
Electrode menu
Weld log
Sequencer menu
Copy program
Copy Electrode
I/O Status
Fieldbus inputs
Analog Inputs
WS2003 version

<< CONFIG. MENU >>
Edit configuration
Edit calibration
Edit output map
Edit input map
Edit transformers*
Setup adapters
Backup all data
Restore all data
Initialise all data
Edit system setup

*Only if multi-gun or multi-gun cascade mode is configured.

<< SYSTEM SETUP >>
Show system files
Select active file
Restart system

**Only if multi-gun cascade mode is configured.

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Diagnostic screen 1

Program used

Measured current
for weld1

Measured current
for weld2

Status

```
LOW CURRENT WELD 2
PROG=0
I1=10.5kA
I2=12.1kA
```

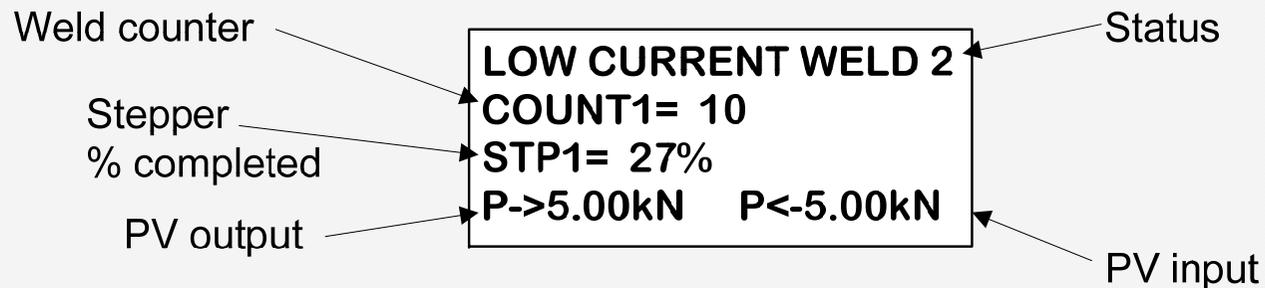*Note that some elements may not be visible, if that feature is not being used.*

Status: diagnostic error messages. If more than one exists, these are flashed sequentially.
Program used: this is the program number that was last used.
Measured current: the RMS current measured during the last weld.

•Press ↻ to reset faults (same action as external input). The counters will also be reset if they have reached the end of count.
•Press ← ↑ ↓ → to change to diagnostic screen 2.

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Diagnostic screen 2

Weld counter

Status

```
LOW CURRENT WELD 2
COUNT1=  10
STP1=  27%
P->5.00kN     P<-5.00kN
```

Stepper
% completed

PV output

PV input

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.
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 ⤴ to reset faults (same action as external input). The counters will also be reset if they have reached the end of count.
•Press ⬅ ⬆ ⬇ ➡ to change to diagnostic screen 2.

Status / error codes

Error codes are sent to the fieldbus (if fitted).

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

Error code	Description	Advice
0	No errors	
1	Configuration error	Edit the configuration file
2	No synchronising signal	Check 27V AC sync. signal source / Check frequency in configuration file
3		
4		
5		
6	Retract not ready	Operate retract input
7	Data error	Edit program
8	Weld off	Close Weld-on switch
9	No current (weld 1)	Check secondary circuit / check toroid connection
10	No current (weld 2)	Check secondary circuit / check toroid connection
11	Low current (weld 1)	Check secondary circuit or adjust parameters
12	Low current (weld 2)	Check secondary circuit or adjust parameters
13	Pre-alarm (weld 1)	Check secondary circuit or adjust parameters
14	Pre-alarm (weld 2)	Check secondary circuit or adjust parameters
15	High current (weld 1)	Check secondary circuit or adjust parameters
16	High current (weld 2)	Check secondary circuit or adjust parameters
17	Config. Changed	Restart the timer (power off/on)
18	No 2nd stage	Check the 2nd stage input
19	Toroid overrange	Reduce current, or use an external signal attenuator
20	Toroid open circuit	Inspect toroid connection
21	Toroid short circuit	Inspect toroid connection
22		
23		
24		
25	Sequencer error	Edit sequencer program
26	STOP or SCR hot	Check external STOP circuit or scr cooling.
27	No 24V supply	Check fuse in timer
28		
29		
30	Headlocked	Operate reset fault input
31	No adapter	Fit adapter or change configuration
32	Fieldbus inactive	Check fieldbus connections / check bus master

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..status / error codes

Error code	Description	Advice
33		
34		
35		
36		
37		
38		
39		
40		
41		
42	Transformer hot	Check water flow to welding transformer / Reduce duty
43		
44		
45	Inverter hot	Check water flow to inverter / Check inverter fans/ Reduce duty
46	Inverter voltage error	Check mains supply to inverter
47		
48		
49		
50	Short circuit	Check cables from inverter to welding transformer/ Check transformer
51	Inverter no current	Check cables from inverter to welding transformer/ Check transformer
52	Earth fault	Check cables from inverter to welding transformer/ Check transformer
53	Inverter disabled	Check control connections to inverter
54	Max. pulse width	Check secondary circuit / Reduce heat/current
55	Max. primary current	Check secondary circuit / Reduce heat/current
56		
57	No Current(Weld off)	Close Weld-on switch
58	Low pressure	Check air pressure system
59	High pressure	Check air pressure system
60	Pressure not ready	Check air pressure system
61	Switch off start	The START signal is still on after a STOP or power-up condition.
62		
63		
64		

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..status / error codes

Error code	Description	Advice
65	Stepper 1 end	Reset stepper 1
66	Stepper 2 end	Reset stepper 2
67	Stepper 3 end	Reset stepper 3
68	Stepper 4 end	Reset stepper 4
69	Stepper 5 end	Reset stepper 5
70	Stepper 6 end	Reset stepper 6
71	Stepper 7 end	Reset stepper 7
72	Stepper 8 end	Reset stepper 8
73	Stepper 9 end	Reset stepper 9
74	Stepper 10 end	Reset stepper 10
75	Stepper 11 end	Reset stepper 11
76	Stepper 12 end	Reset stepper 12
77	Stepper 13 end	Reset stepper 13
78	Stepper 14 end	Reset stepper 14
79	Stepper 15 end	Reset stepper 15
80	Stepper 16 end	Reset stepper 16
81	Stepper 1 prewarn	
82	Stepper 2 prewarn	
83	Stepper 3 prewarn	
84	Stepper 4 prewarn	
85	Stepper 5 prewarn	
86	Stepper 6 prewarn	
87	Stepper 7 prewarn	
88	Stepper 8 prewarn	
89	Stepper 9 prewarn	
90	Stepper 10 prewarn	
91	Stepper 11 prewarn	
92	Stepper 1 prewarn	
93	Stepper 13 prewarn	
94	Stepper 14 prewarn	
95	Stepper 15 prewarn	
96	Stepper 16 prewarn	

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..status / error codes

Error code	Description	Advice
97	Counter 1 end	Reset counter 1
98	Counter 2 end	Reset counter 2
99	Counter 3 end	Reset counter 3
100	Counter 4 end	Reset counter 4
101	Counter 5 end	Reset counter 5
102	Counter 6 end	Reset counter 6
103	Counter 7 end	Reset counter 7
104	Counter 8 end	Reset counter 8
105	Counter 9 end	Reset counter 9
106	Counter 10 end	Reset counter 10
107	Counter 11 end	Reset counter 11
108	Counter 12 end	Reset counter 12
109	Counter 13 end	Reset counter 13
110	Counter 14 end	Reset counter 14
111	Counter 15 end	Reset counter 15
112	Counter 16 end	Reset counter 16
113	Tip-dress 1	Dress electrodes then reset counter 1
114	Tip-dress 2	Dress electrodes then reset counter 2
115	Tip-dress 3	Dress electrodes then reset counter 3
116	Tip-dress 4	Dress electrodes then reset counter 4
117	Tip-dress 5	Dress electrodes then reset counter 5
118	Tip-dress 6	Dress electrodes then reset counter 6
119	Tip-dress 7	Dress electrodes then reset counter 7
120	Tip-dress 8	Dress electrodes then reset counter 8
121	Tip-dress 9	Dress electrodes then reset counter 9
122	Tip-dress 10	Dress electrodes then reset counter 10
123	Tip-dress 11	Dress electrodes then reset counter 11
124	Tip-dress 12	Dress electrodes then reset counter 12
125	Tip-dress 13	Dress electrodes then reset counter 13
126	Tip-dress 14	Dress electrodes then reset counter 14
127	Tip-dress 15	Dress electrodes then reset counter 15
128	Tip-dress 16	Dress electrodes then reset counter 16

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Configuration menu

```
<<<  CONFIG. MENU>>>
EDIT CONFIGURATION
EDIT CALIBRATION
EDIT OUTPUT MAP
 EDIT INPUT MAP
SET-UP ADAPTERS
BACKUP ALL DATA
RESTORE ALL DATA
INITIALISE ALL DATA
EDIT SYSTEM SETUP
```

Visible window

Note: after changing the configuration, you must restart the timer before your changes will take effect.

You can restart the timer by cycling the power, or via the system set-up menu.

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
SINGLE GUN
I/O = DISCRETE
```

Visible window

G1: NO/SIMPLE RETRACT

G2: NO/SIMPLE RETRACT
START = BINARY
SCR SELECT = BINARY
FREQUENCY 50Hz
CONTACTOR TIME 10 s
BLANKING Off
SENSOR = TOROID
TOROID TEST On
HEAT RANGE HIGH
IF FAULT :
EOS, STOP
SEQUENCER   On
TOROID FACTOR x1
COUNT/LOG SYNC Off
UNITS = METRIC
ANALOG OUTPUT = PV

Note: after changing the configuration, you must restart the timer before your changes will take effect.

The diagnostic message 'CONFIG.CHANGED' will appear, and further welding will not be permitted until the timer is restarted

You can restart the timer by cycling the power, or via the system set-up menu.

…edit configuration

- Sequence:**Spot / Roll-spot / Seam(2-heat) / Seam(pre-heat)**.
- **Single gun / Dual gun / OHMA gun / Multi-gun / Multi-gun cascade**: the number/type of welding guns to be controlled.
- I/O Source:**Discrete / Fieldbus(map 1) / Fieldbus(map2)**. Specifies how the timer obtains <u>input</u> signals (<u>outputs</u> are always written to both the discrete and fieldbus interfaces).
- Retract:**Simple / Hi-lift+ / Hi-lift- / Maintained / OHMA**. Set to **Simple** if not required. One Independent setting for each gun.
- Start:**Binary / 1-of-4**. Sets the method of program selection.
- SCR Select: **Binary / 1-of-4**. Sets the method of SCR selection for multi-gun modes only. Use **Binary** with an external BD16 decoder, otherwise use **1 of 4**.
- Frequency:**AC 50 Hz / AC 60Hz / MF 50 Hz / MF 60Hz**: Set to the frequency of your mains supply for AC operation. Set to **MF 50Hz** for MF DC operation with a 50Hz time-base, or set to **MF 60Hz** for MF DC operation with a 60Hz time-base. (Note that MF operation requires an Ethernet/MF adapter board to be fitted).
- 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.
- Sensor (**Toroid / CT**): The current can be measured via an air-cored toroid on P7, or via an iron-cored CT on P14. Be sure to set the sensitivity correctly in the calibration file.
- 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.

......edit configuration

•Heat range **(Wide/High/Low)**: Wide corresponds to a control range of 30-150'. 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. Select WIDE range for machines that need to produce both very high and very low currents.

• If fault **(Continue/Stop/Head-lock/EOS/ No EOS)** :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. If **EOS** is selected, then the EOS signal is always given. If **No EOS** is selected, then no EOS signal is given when there is a weld fault.

•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.

•Toroid Factor **(1..4)**: the ratio of the external attenuator which is required to measure currents>60kA

•Count/Log sync **(On/Off):** If set to *On*, then the log will be cleared when the counter is reset. If set to Off, then the log and counter are independent.

•Units (**Metric/Imperial**): this selects the system of units (e.g kN/lbf etc.)

•Analog out **(PV/Current):** this selects the function on the analog output at P2. If **PV** is selected, then the output follows the setting of the PV parameter in the programmes. If **Current** is selected, then the output will be the measured current waveform. Scale factors for both functions are set in the calibration file. Note that the output is provided as 0..10V or 4..20mA, depending on the setting of pcb jumper J4/J5.

Edit calibration

```
<<< CALIBRATION 1 >>>
TOROID:   150 mV/kA
S/P RATIO  50:1
S/P OFFSET     0 A
```
PRESSURE:
Pt1: 10.0kN @ 100%
Pt2: 0.00kN @ 0.0%
INVERTER:
Pt1: 15.1kA @ 80.0%
Pt2: 6.45kN @ 20.0%
ANALOG: 10V = 10kA
AN.IN GAIN x1.000
AN.IN OFFSET +0.00 V
CCR GAIN (SEAM): 5

Visible window

Only if MF mode selected

Note: there are two separate calibration files for each gun in a dual-gun system, and sixteen calibration files in a multi-gun system.

- **Toroid:** sensitivity of the measuring coil (toroid), expressed in mV/kA.
- **S/P ratio & Offset:** See next page for details.
- **Pressure:** relationship between the PV controller output and actual tip force. This is expressed by entering two 'test' point values, which then define a straight-line relationship.
- **Inverter:** relationship between the %heat output and actual current. This is expressed by entering two 'test' point values, which then define a straight-line relationship. (Only required for MF mode).
- **Analog:** the value of current which corresponds to full scale (10V/20mA) from the analog output at P2.
- **Analog in gain:** value by which the voltage at the analog input (ch 3 only) is multiplied. Use to fine trim the reading, or to match a 5V sensor with the 10V input scale.
- **Analog in offset:** value of the voltage at the analog input (ch 3 only) for a zero reading. Use in conjunction with the gain parameter to match reading to an external meter.
- **CCR gain (Seam):** Adjusts the CCR gain for seam welds only. Set to 5 as a starting point.

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…calibration

•If the sensor (Toroid or CT) is measuring the primary current (AC modes only), the timer can display secondary values. It does this by calculation based on the **S**econdary to **P**rimary ratio (**S/P ratio**) and offset (**S/P offset**) parameters. For MF operation set S/P ratio to 1:1, and set S/P offset to 0.

•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} x S/P ratio)
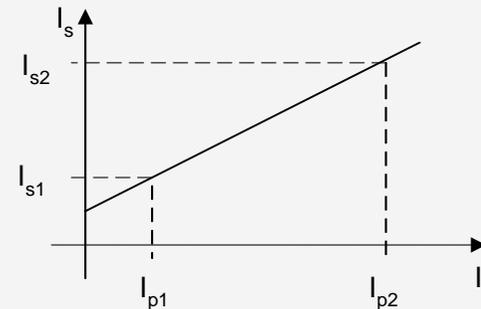
……calibration

•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   >>>
Q01: PRE-WARN
Q02: STEPPER 1
Q03: reserved
```
> Visible window

Q04: COUNTER 1
Q05: CONTACTOR
Q06: READY
Q07: FAULT
Q08: EOS
Q09: WAV1
Q10: MOTOR
Q11: HAV1

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.

or

- as a FIELDBUS output (outputs 1-8 only).

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.
When an output is mapped to 'fieldbus', it will be operated under the direct control of the fieldbus inputs.

Edit Input Map

```
<<<   INPUT MAP   >>>
I01: RESET FAULT
I02: P32
I03: P16
I04: EDIT DISABLE
I05: RESET COUNT
I06: RESET STEPPER
I07: 2nd STAGE
I08: RETRACT
I09: START 1
I10: P8/START 2
I11: P1/START 3
I12: P2/START 4
I13: P4
I14: WELD ON
```

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, or as a discrete input to the fieldbus.
Note that inputs I09 and I14 have special functions, and may only be mapped to standard.

Set-up Adapters

```
<<<        ADAPTERS        >>>
SLOT 1    Ethernet 1.00
SLOT 2    NO ADAPTER
```

The WS2003 timer can be fitted with up to two adapter cards, to provide additional functions. These are fitted into two positions, referred to as slot 1 and slot 2.

This screen can be used to:
•Show what type of adapter cards are fitted.
•Access any parameters required by that adapter. Note that some adapters do not require any parameters.

View of timer with cover removed and two adapter cards fitted.

Slot 1   Slot 2
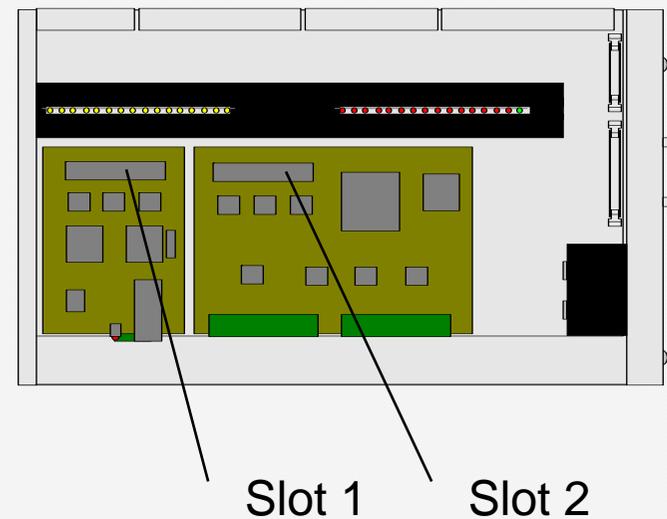
Backup/Restore

The **Backup** and **Restore** functions provide a convenient means of transferring all of your settings from one timer to another.

Backup: Use this function to make a copy of all of your data. The copy is held within the WSP3 pendant. No data in the timer is changed. Note that only one backup can be stored in the WSP3, and that this is overwritten each time the backup function is used.

Restore: Use this function to restore all of your data in the timer, from a backup stored in the WSP3 pendant. Note that this operation will overwrite all data which was previously stored in the timer. After the restore operation, the backup remains in the WSP3.

Before the restore can proceed, a check is made to ensure that the backup data was recorded from the same type of timer (i.e. another WS2003).

WS2003

Backup →

Restore ←

WSP3
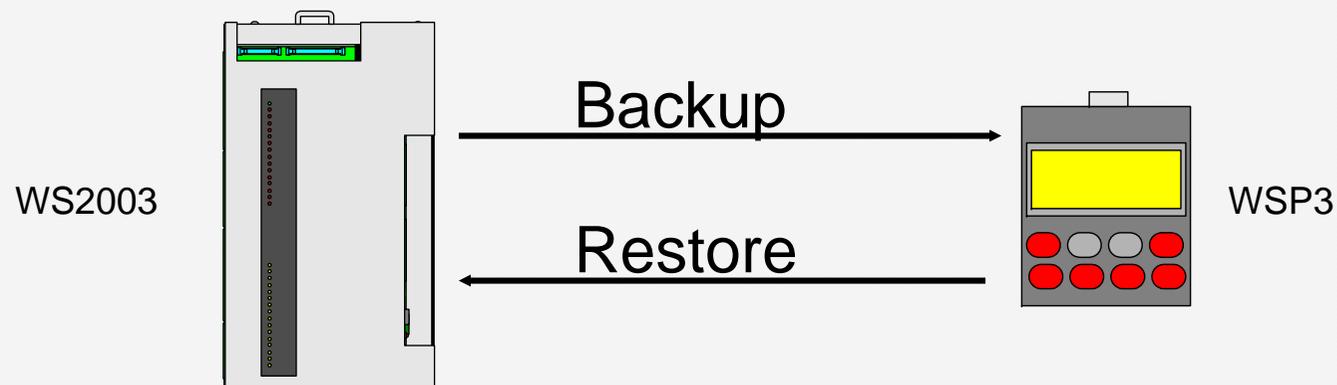
Initialise all data

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 loose 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.

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System set-up menu

```
<<<  SYSTEM SETUP >>>
SHOW SYSTEM FILES
SELECT ACTIVE FILE
RESTART SYSTEM
```
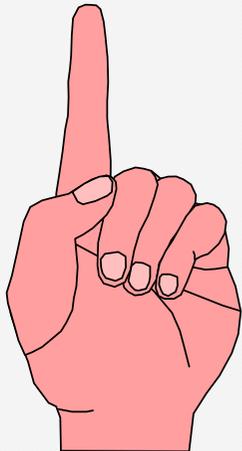
The **WELDSTAR model WS2003** is equipped with two memories, which can be used to store two versions of the operating firmware files. The Edit system set-up menu provides a number of functions for examining and selecting these files.

Caution: These functions should only be used by trained and experienced personnel, as improper use could render the timer inoperable.

Note: The timer will not operate while this menu is selected.

Main menu

```
<<<    MAIN MENU    >>>
USE PROGRAM -EXT( 0)
EDIT PROGRAM FILE
EDIT LIMITS FILE
```
Visible window

EDIT EVENTS FILE
ELECTRODE MENU
SEQUENCER MENU
WELD LOG
COPY PROGRAM
I/O STATUS
FIELDBUS INPUTS
ANALOG STATUS
WS2003 VERSION 1.34

For information only

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 program (AC)

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

PSQ= 0   SQZ= 10
W1 = 0   C1 = 0
W2 = 10   C2 = 0
Pulses(W2-C2) = 1
UPSLOPE = 3
DOWNSLOPE = 0
HOLD = 10
OFF = 0 (SINGLE)

Visible window

PHA=Phase angle mode. The current and heat parameters are independently adjustable. No current regulation takes place. The current parameter is used for monitoring only.

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.

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

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Edit program (MF)

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

Visible window

PSQ= 0   SQZ= 10
W1 = 0   C1   = 0
W2 = 10   C2   = 0
Pulses(W2-C2) = 1
UPSLOPE = 3
DOWNSLOPE = 0
HOLD = 10
OFF = 0 (SINGLE)

UNC=Uncalibrated mode. The current and heat parameters are independently adjustable. Actual current is determined by the inverter. The current parameter is used for monitoring only.

CAL=Calibrated mode. The current parameter is adjustable, but the heat is automatically determined by the timer from the calibration data.

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

..edit program

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

Visible window

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

```
PSQ= 0     SQZ= 10
W1 = 0     C1  =  0
W2 = 10    C2  =  0
Pulses(W2-C2)  = 1
UPSLOPE = 3
DOWNSLOPE = 0
HOLD = 10
OFF =  0  (SINGLE)
```

LINKed 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 **NORM**al, or the last program (63) is reached.

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

Note: If the low-force option is selected in the configuration, then the presqueeze (PSQ) parameter changes to low-force time (LF). See section 'low-force approach'.
If the OHMA system is selected, additional timing parameters will be shown.

….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@50.0%
PSQ= 0     SQZ= 10
W1 = 0    C1  =  0
W2 = 10   C2  =  0
UPSLOPE = 3
DOWNSLOPE= 0
HOLD = 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 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
RETRY  On
PRESSURE: MONITOR  On
                 WAIT  On
LOW = 10%   HIGH=10%
```

Visible window
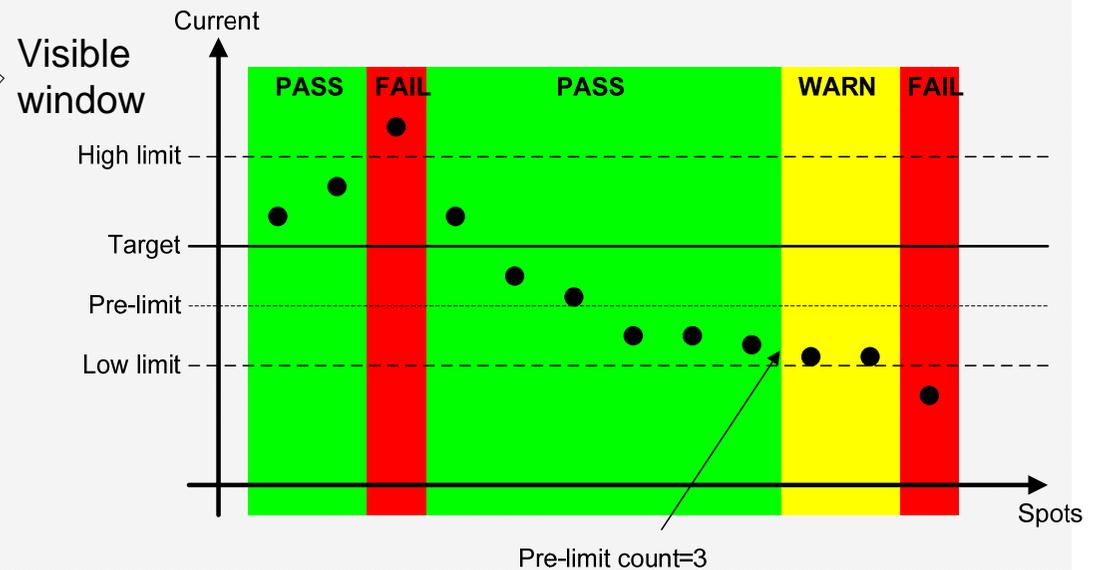
• The **PRE-LIMIT COUNT** is the number of successive welds which can fail the pre-limit level test, before a warning is generated.

• If **RETRY** is **On**, then in the event of the monitor detecting low or no current, the timer will automatically re-weld, without opening the electrodes.

• **Pressure: monitor** Pressure is checked to be within limits at the end of the weld.

• **Pressure: wait** Pressure is checked to be within limits before weld is allowed to start.

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 <u>or</u> off.

•To disable an event, set it's output to '?'.

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

All event outputs will be turned off at the end of the weld program.

An 'Event' can only occur during a welding program.
For actions required outside the welding program, use the sequencer.

Electrode menu

```
<< ELECTRODE  MENU >>
STEPPER STATUS
EDIT STEPPER
EDIT COUNTER FILE
```
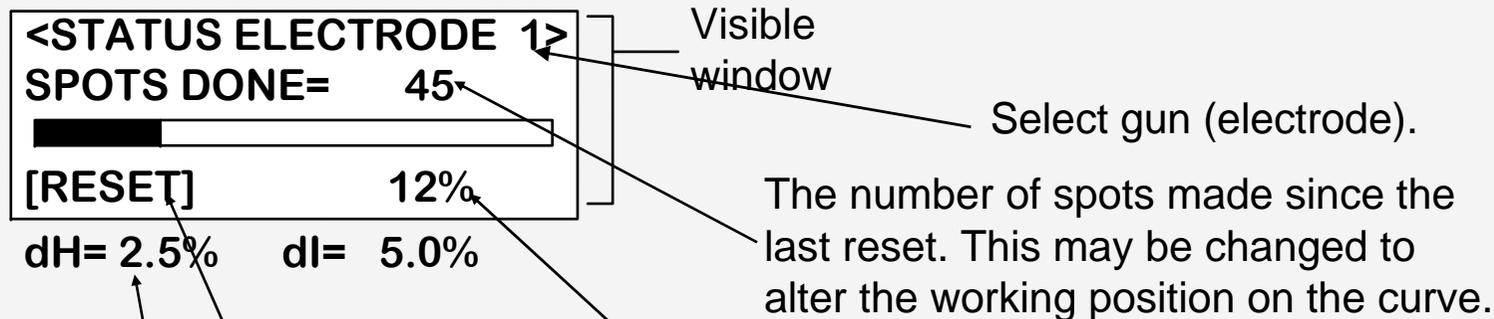
A stepper is programmed by means of a curve which will provide values of heat and current increments, related to the number of spots done. The curve is defined by a set of 10 points. The timer provides interpolation between these points.

Electrode management is provided via a combination of stepper and counter functions.

The stepper provides a means of gradually increasing the current, to compensate for electrode wear. One stepper is provided per gun.

Stepper status

```
<STATUS ELECTRODE  1>
SPOTS DONE=      45
███████░░░░░░░░░░░░░░
[RESET]          12%
```
Visible window

Select gun (electrode).

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

dH= 2.5%   dI= 5.0%

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).
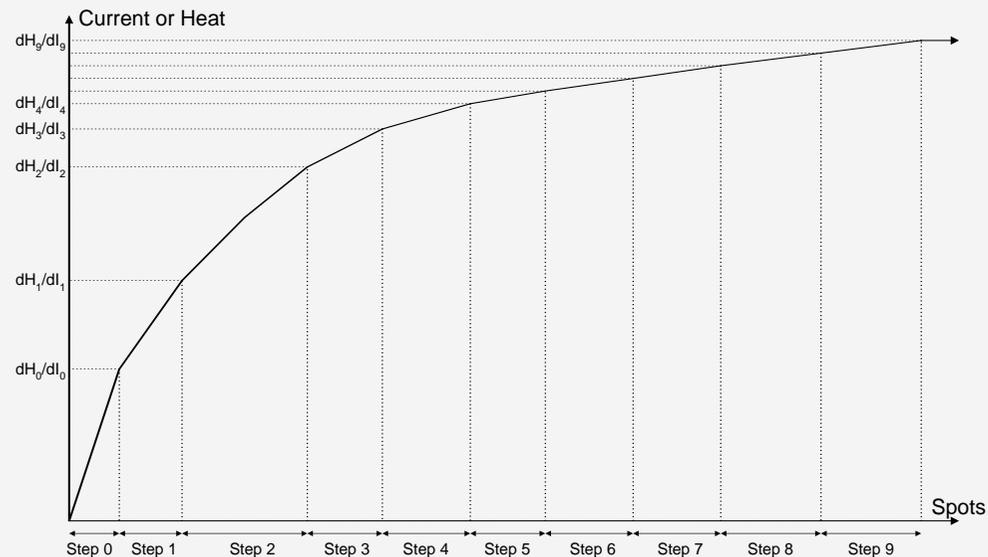
dH = % of programmed heat being added
dI = % of programmed current being added.

Outputs:

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

Output 'Prewarn' comes on during the last step.

If tip-dressing is on, then the outputs behave differently (see edit counter).

Edit stepper

```
<<<   STEPPER  1 on  >>>
CONTINUE AT END
SPOTS  +HEAT  +AMPS
0:   10    1.0%    2.5%
1:   50    1.5%    5.0%
2:  100    2.0%    7.5%
3:  100    2.5%   10.0%
4:  100    3.0%   12.5%
5:  100    3.5%   15.0%
6:  100    4.0%   17.5%
7:  100    4.5%   20.0%
8:  150    5.0%   22.5%
9:  200    5.5%   25.0%
[PRESET #1]
```

Visible window

Enable or disable the stepper.

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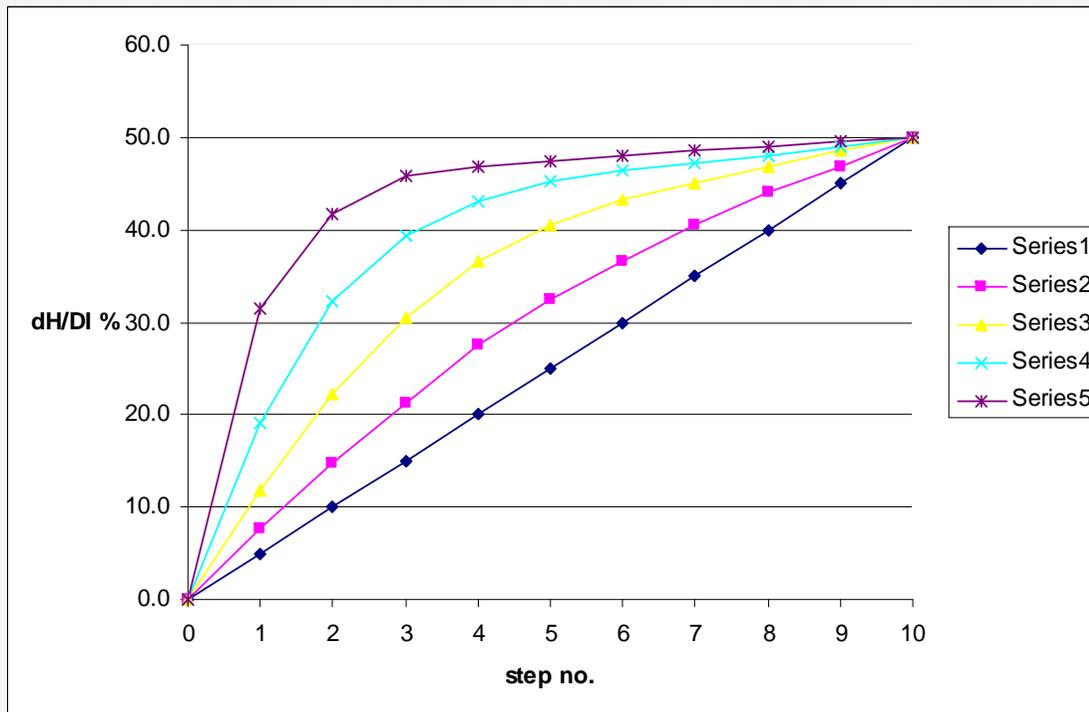
When a preset curve is loaded, the data is obtained from a table which holds the 5 curves shown.

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 1        >>>
COUNT NOW = 431
COUNT UP TO   500
STOP AT END
```
TIP DRESSING On
MAX.DRESSINGS = 10
DRESSINGS DONE = 2
@RESET,STEPPER= 100
DRESS WHEN NEW   On

Note: Counter 1 is used by gun/electrode 1, counter 2 is used by gun/electrode 2, etc.

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

Set *count up to* = 0 to disable a counter.

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.

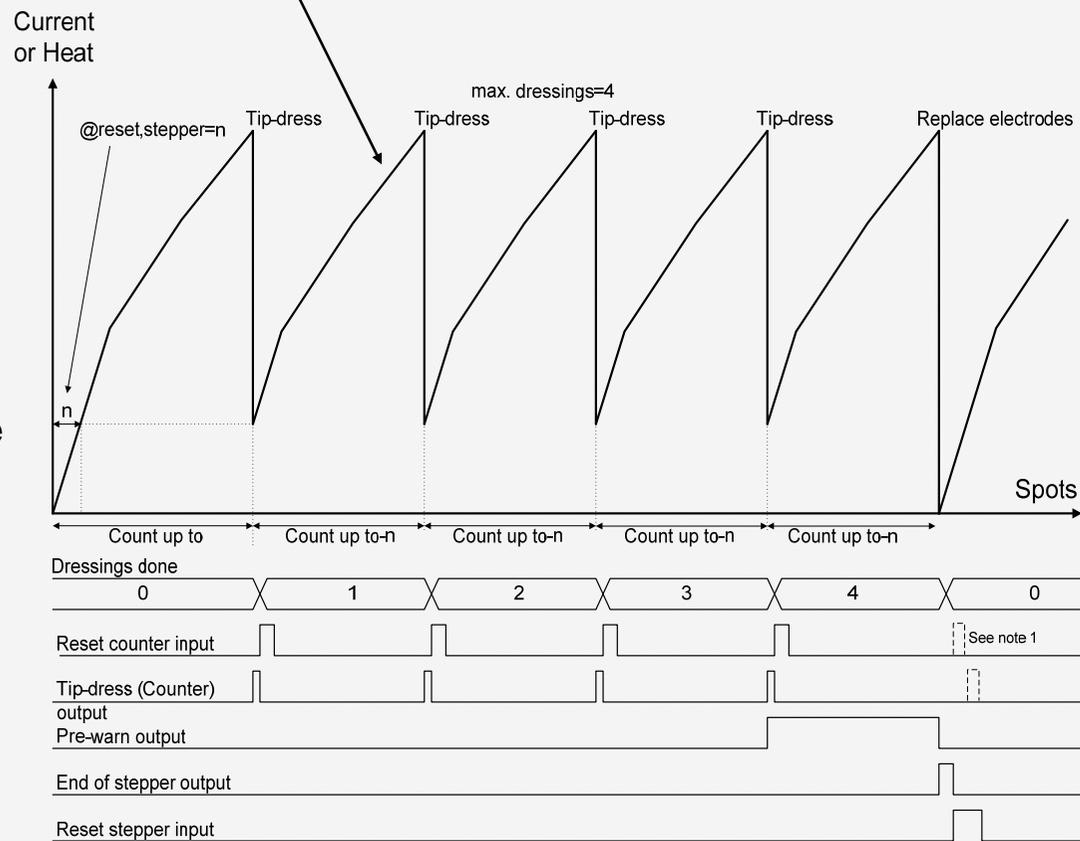# ..edit counter(tip dressing)

```
<<<      COUNTER 1      >>>
COUNT NOW = 431
COUNT UP TO  500
STOP AT END
TIP DRESSING On
MAX.DRESSINGS = 10
DRESSINGS DONE= 2
@RESET,STEPPER= 100
DRESS WHEN NEW   On
```

The counter can be used to control tip-dressing by setting the parameter '**tip-dressing**' to **On**.

Note 1: If '**dress when new**' is set to **On**, then the tip-dress (counter) output will also be activated after a reset stepper operation. This facilitates the dressing of new electrodes.

Stepper curve (see edit stepper)

Current or Heat

max. dressings=4

@reset,stepper=n   Tip-dress   Tip-dress   Tip-dress   Tip-dress   Replace electrodes

n

Spots

| Count up to | Count up to-n | Count up to-n | Count up to-n | Count up to-n |

Dressings done

| 0 | 1 | 2 | 3 | 4 | 0 |

Reset counter input

See note 1

Tip-dress (Counter) output

Pre-warn output

End of stepper output

Reset stepper input

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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 START1 input is used to trigger execution of the sequence, and must be maintained. On release of the START1 signal, the sequence is reset.

With the sequencer configured (see edit configuration), the START1 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	3	A1 to A3

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

<< SEQUENCER MENU >>
EDIT SEQUENCE
ERASE 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.

…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.

…..edit sequence

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..14	Waits for Input nn to be ON
AWAIT INPUT Inn OFF	1..14	Waits for Input nn to be OFF
OUTPUT Qn ON	1..12	Turns ON Output n
OUTPUT Qn OFF	1..12	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 <u>is</u> zero, then continue at the next statement
IF Qn ON, JUMP xxx	n=1..12, 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..12, 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..14, 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..14, 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)	n=0..63,EXT	Execute weld sequence. The program number is determined by the parameter nn. If nn=EXT, then the program number is read from the external selection inputs.
		The sequencer will wait untill the weld reaches 'End of sequence', before continuing with the next statement.

Example sequence

Statement	Range	Function
AWAIT ANALOG n<mm V	n=1.3, 0.0<=mm<=10.0	Waits for Analog input n to be less than mm Volts.
AWAIT ANALOG n>mm V	n=1.3, 0.0<=mm<=10.0	Waits for Analog input n to be greater than mm Volts.
IF ANALOG n<mm V, JUMP xxx	n=1.3, 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.
IF ANALOG n>mm V, JUMP xxx	n=1.3, 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:

----- STEP 1 -----	
AWAIT INPUT I03 ON	Part detector
----- STEP 2 -----	
OUTPUT Q8 ON	Clamp ON
DELAY 0.5	Pause
----- STEP 3 -----	
WELD (Prog = 01)	Weld operation using program number 1
OUTPUT Q8 OFF	Clamp off
----- STEP 4 -----	
OUTPUT Q7 ON	Signal job done by flashing output until START released
DELAY 0.4	Flash 'On' time
OUTPUT Q7 OFF	
DELAY 0.2	Flash 'Off' time
JUMP 4	Loop back to create flashing effect

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Weld log

```
<<<   WELD LOG    >>>
  64 welds in log
VIEW LOG
CLEAR LOG
```

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.

View log (screen 1)

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

Status for this weld

Program used
for this weld

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

Actual current measured

Target current from program

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

• Press ⬅ ⬆ ⬇ ➡   to change to log screen 2.

View log (screen 2)

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

Status for this weld

Value of the counter
used for this weld

Gun (electrode)
used for this
weld

```
<LOG  1>   W2 FAIL
GUN= 1  COUNT=   10
P-> 5.00kN  P<-4.90kN
```

PV output

Measured PV feedback

•Press ⬅ ⬆ ⬇ ➡   to change to log screen 1.

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.

•Press the **+** or **-** keys to alter the selected parameter. 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.

Copy electrode

```
<<<COPY ELECTRODE>>>
FROM: 1
TO: 2
GO
```

Copy a stepper (and associated counter and calibration files) to any other stepper, or to all other steppers.

•Press the **+** or **-** keys to alter the selected parameter. The *TO* parameter can be set to *ALL* if required (i.e. copy 1 stepper 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:RESET FAULT    Off
I02:P32/GAPSW.     On
I03:SEQUENCER      On
I04:EVENT          Off
I05:RESET COUNT    Off
I06:RESET STEPPER Off
....
....
etc.
```

Visible
window

This screen can be used to observe the
status of 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)

Fieldbus input status

```
<<<     BUS INPUTS     >>>
B00:START1             Off
B01:START2             On
B02:START3             Off
B03:START4             Off
B04:2nd STAGE          Off
B05:WELD ON            Off
....
....
etc.
```

Visible window

This screen can be used to observe the status of the fieldbus inputs.
Note that this screen is only available if the timer is configured for fieldbus operation.

Analog Status

<<< ANALOG STATUS >>>
Channel 1 = 0.00 V
Channel 2 = 2.34 V
Channel 3 = 9.55 V

TOROID R = 20 Ω

Visible window

This screen can be used to observe the status of the analog inputs.

• **Analog input channels**: the dynamic voltage at each of the analog inputs.

• **Toroid resistance**: the result of the toroid test, in Ohms. If a measurement>750 Ohms is obtained then the (infinity) symbol is shown. If the toroid test is off, then ??? is shown

Program selection

Programmes can be selected in a variety of different ways, depending on the settings used.

Note: If 2-input binary is selected, then the inputs **START 1** and **2nd STAGE** must be activated within 0.3 s of each other.

> Set these parameters in the configuration file.

> X = don't care, or not connected

Note that if a program number exceeds the maximum (63), then the number will wrap around through 0.
e.g.
If N=62, then N+3=65. Applying wrap-around, N=N-64, giving a final value of N=1.

> Set this parameter from the main menu

Single/ Dual	Binary/ 1of4	Use program	External selection	START input	Program selected	Gun
Single	Binary	N = 0..63	X	1	N	1
		EXT	P=0..63	1	P	1
	1of4	N = 0..15	X	1	N	1
				3	N+16	1
				2	N+32	1
				4	N+48	1
		EXT	X	1	0	1
				3	16	1
				2	32	1
				4	48	1
Dual	Binary	N = 0..31	X	1	N	1
				2	N+32	2
		EXT	$P_1=0..7$	1	P_1	1
			$P_2=0..7$	2	P_2+32	2
	1of4	N = 0..15	X	1	N	1
				3	N+16	1
				2	N+32	2
				4	N+48	2
		EXT	X	1	0	1
				3	16	1
				2	32	2
				4	48	2

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OHMA (Air over Oil) system

The OHMA system uses three valves to control the opening and closing of the electrodes. If Retract is used, the timing of the valve operations is used to control the gap between the electrodes in their mid-position. To enable the OHMA system, you must make appropriate settings in the configuration file.

Weld Stroke

When a Start input is given to the weld control the Blocking valve is switched off and the Advance valve is switched on. This closes the electrodes onto the work-piece. At the end of the '*Gun close*' time, the *2nd stage* input and/or '*wait for pressure*' function is/are checked, before the Intensify valve switches on to provide the electrode force required for welding.

The weld sequence proceeds in the usual way until the end of the *Hold time* when the Advance and Intensify valves switch off. The electrodes then start to open until the Blocking valve switches on and prevents further opening. The timing of the Blocking valve turning on (the *Gun Open* Time) sets the position to which the electrodes open. The *End of Sequence* output operates when the Blocking Valve switches on.

Current

START input

2nd Stage input

EOS output

ADVANCE output

INTENSIFY output

BLOCKING output

Gun close time | Squeeze time | Weld time | Hold time | Gun open time

Gun closing

Gun opening to mid-position

69
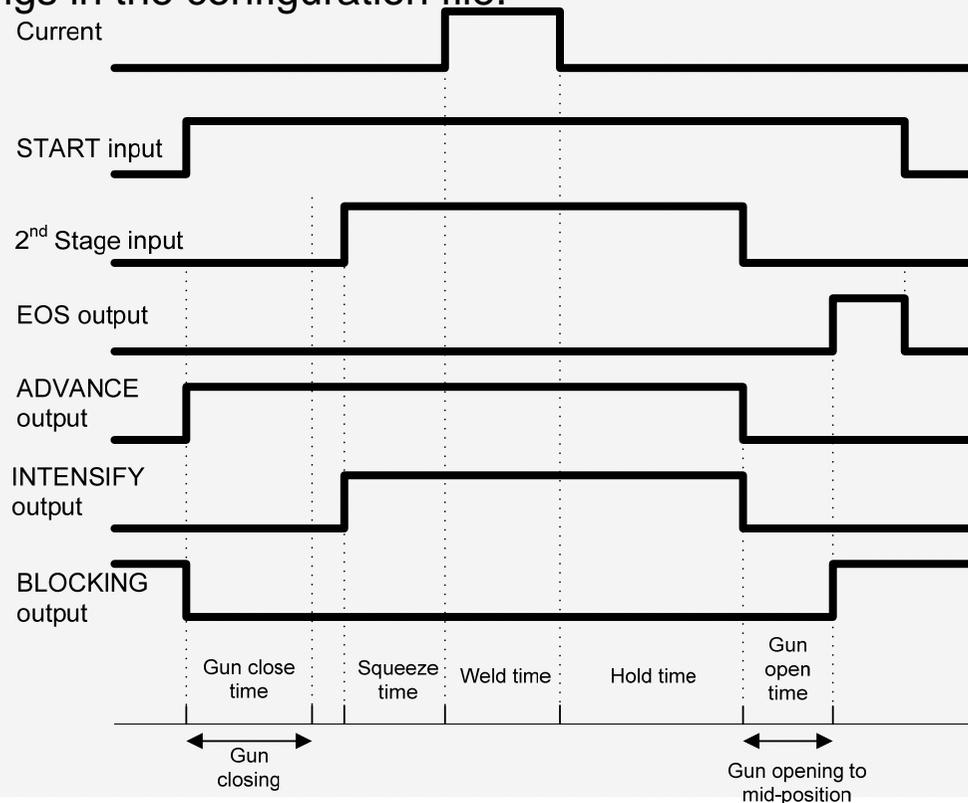
…OHMA system

Retract Stroke

With the electrodes in the fully open position the control will not begin a weld sequence. A Retract input is required to move the electrodes to their mid-position.

When a Retract input is given, the Blocking valve is switched off and the Advance valve is switched on. This starts the electrodes moving towards their mid-position. After the Retract Close time the Advance valve is switched off. The Retract Close Delay time then begins and when complete, the Blocking valve is switched on, halting the movement of the electrodes. Hence, these times control the mid position of the electrodes. In this condition the timer is ready to weld.

When in this "ready" condition, if a Retract input is detected, the Blocking valve is switched off for the duration of the Retract Open time. This allows the electrodes to move to the full open position.

RETRACT input

ADVANCE output

INTENSIFY output

BLOCKING output

Retract close time | Retract delay time

Retract open time

Gun closing to mid-position

Gun fully opening from mid-position
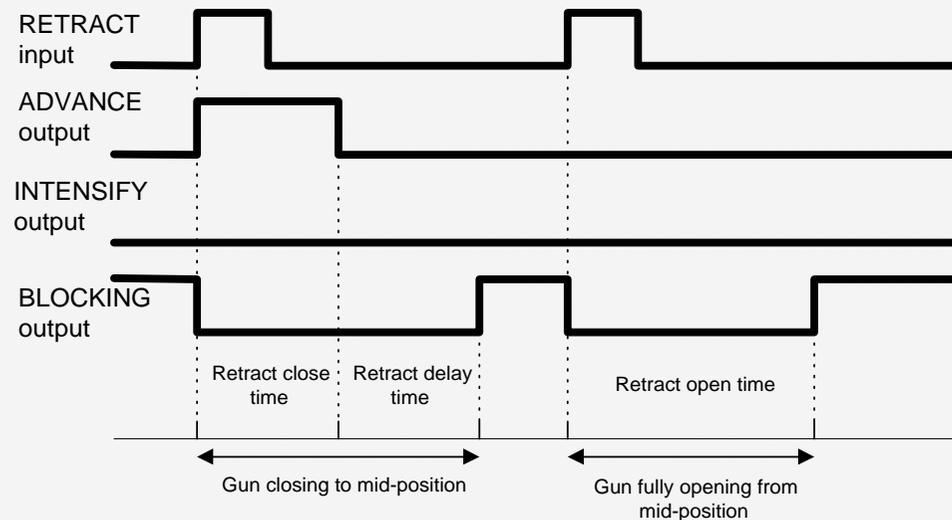
Disabling edits

Normally, a user can access the parameters via the keypad on the WSP3 programming pendant, 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

P4 INPUTS

1 +24V

5 EDIT DISABLE

Normally−closed contact.
Key withdraws in normal position.
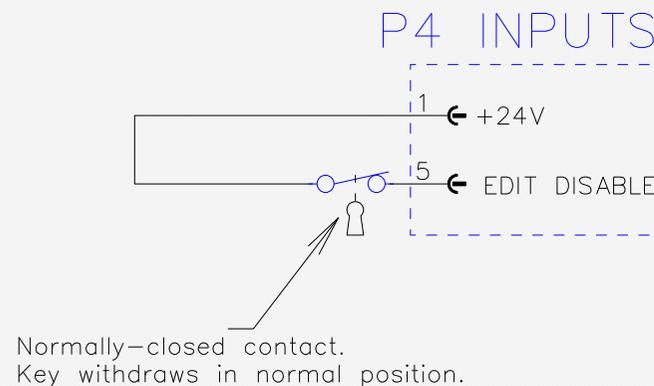
If this feature is not required, simply leave this input unconnected.

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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.
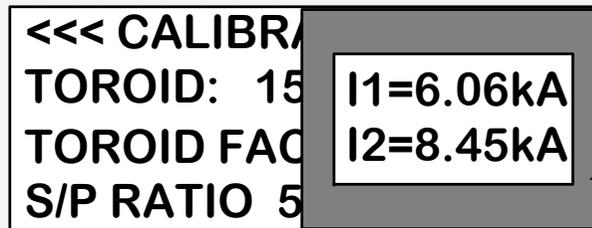
```
<<< CALIBR
TOROID:  15    I1=6.06kA
TOROID FAC     I2=8.45kA
S/P RATIO  5
```
Pop-up window

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.

Replacing a WS2000 timer

If you have an existing installation with a WS2000 timer and a primary toroid, and you are replacing that timer with a WS2003, then use the following procedure:

1. Note the existing settings (weld program), measure the welding current with a meter, and note the current measured by the WS2000.

2. Fit the new timer (WS2003).

3. Adjust the primary toroid calibration trimmer to fully anti-clockwise.

4. Initialise the data in the WS2003.

5. Set the toroid sensitivity to 1400mV/kA

6. Set up the appropriate welding program, using the settings recorded in step 1, but using PHA mode.

7. Weld – measure the current (x) with a meter, and (y) on the timer.

8. Calculate x/y and enter this as the S/P ratio.

9. Weld – the current (z) on the timer should agree with the meter.

10. Enter z (the current value) into the current parameter in the timer program.

11. Weld.

12. Select CCR if required.

Operation: basic spot weld – no weld faults

W1=0, C1=0, Pulses=1, OFF=0

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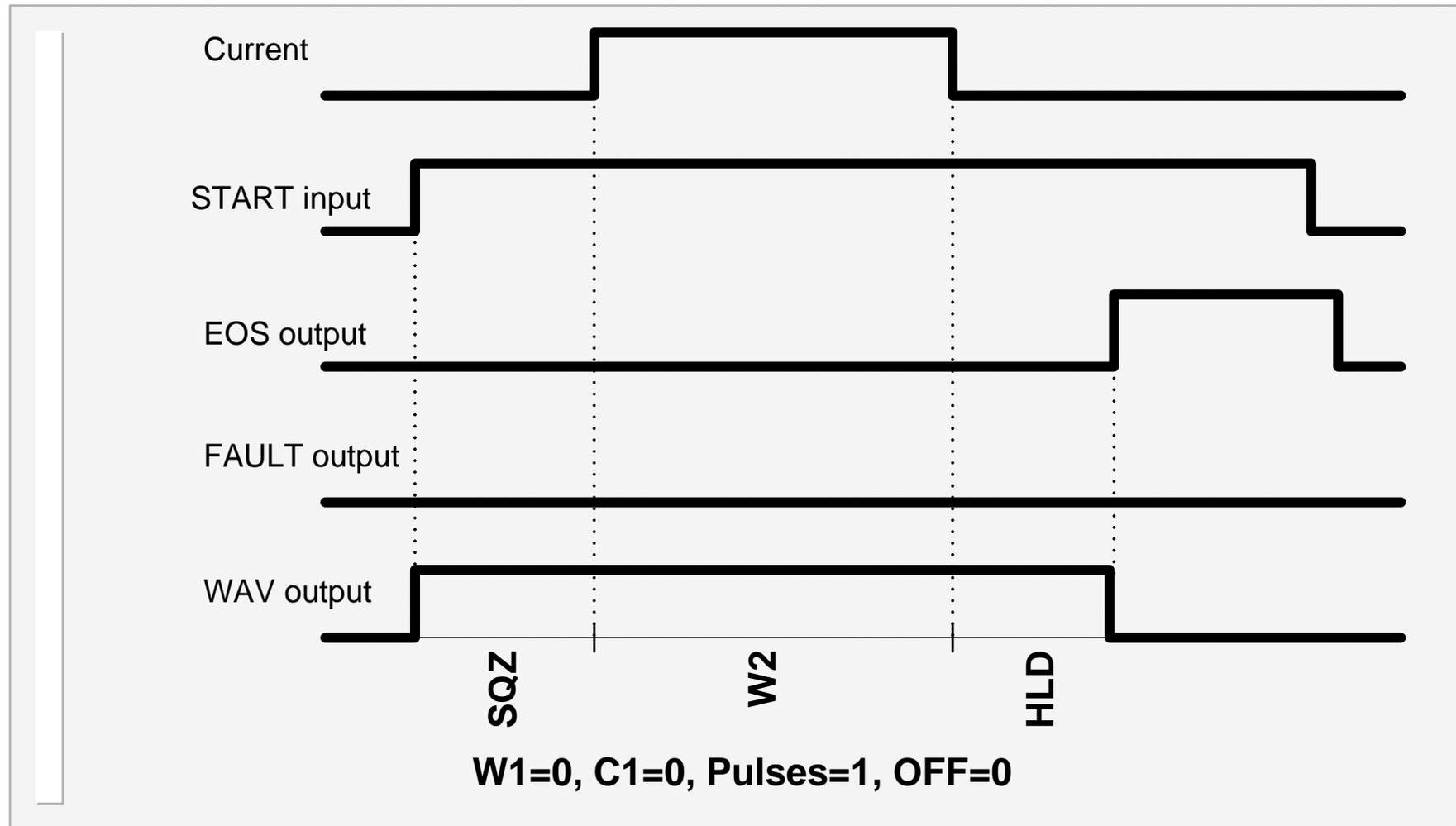
Operation: basic spot weld – weld fault

Current

START input

EOS output

FAULT output

WAV output

SQZ

W2

HLD

W1=0, C1=0, Pulses=1, OFF=0
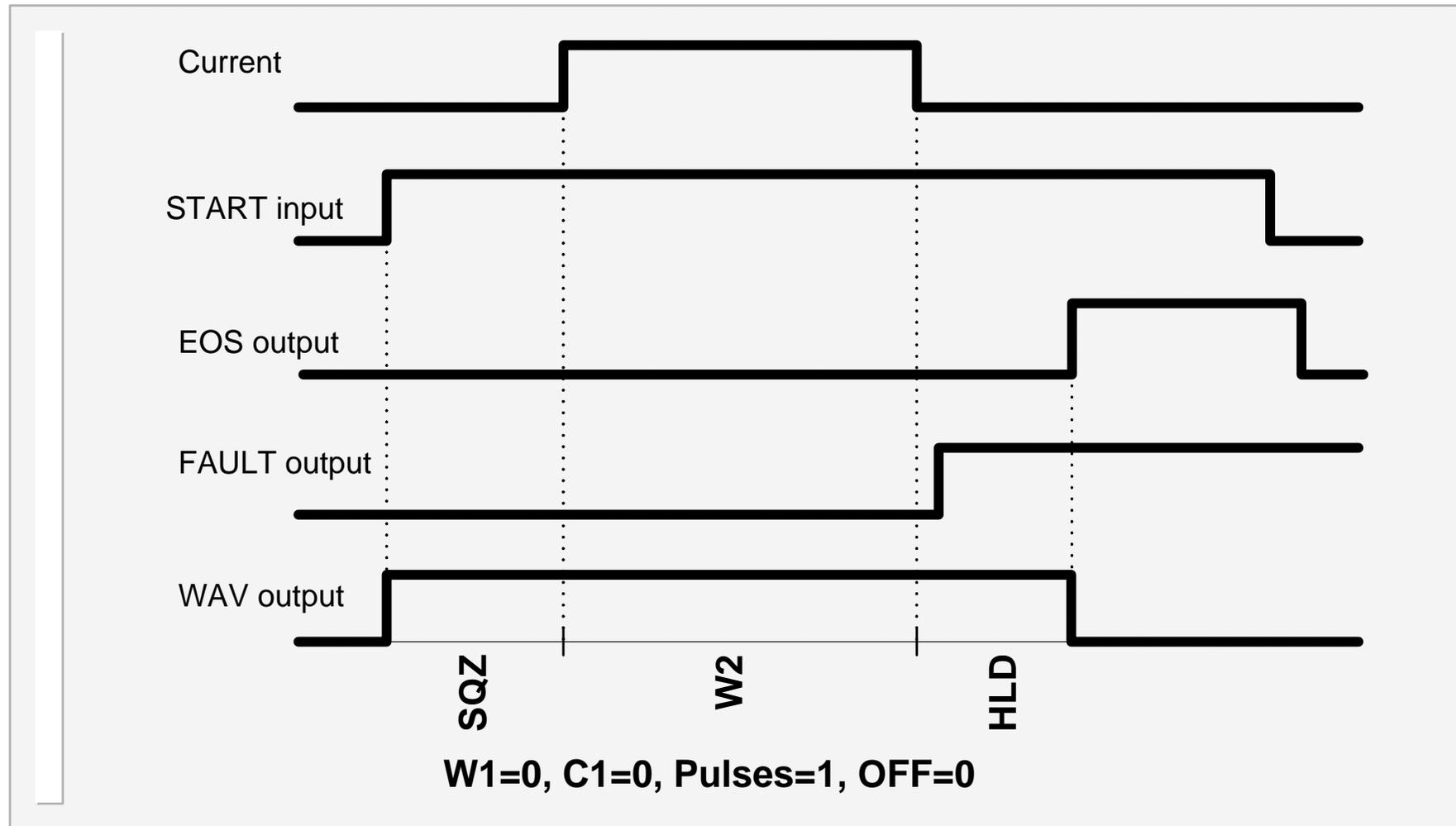
Operation: repeat spot weld

W1=0, C1=0, C2=0, Pulses=1
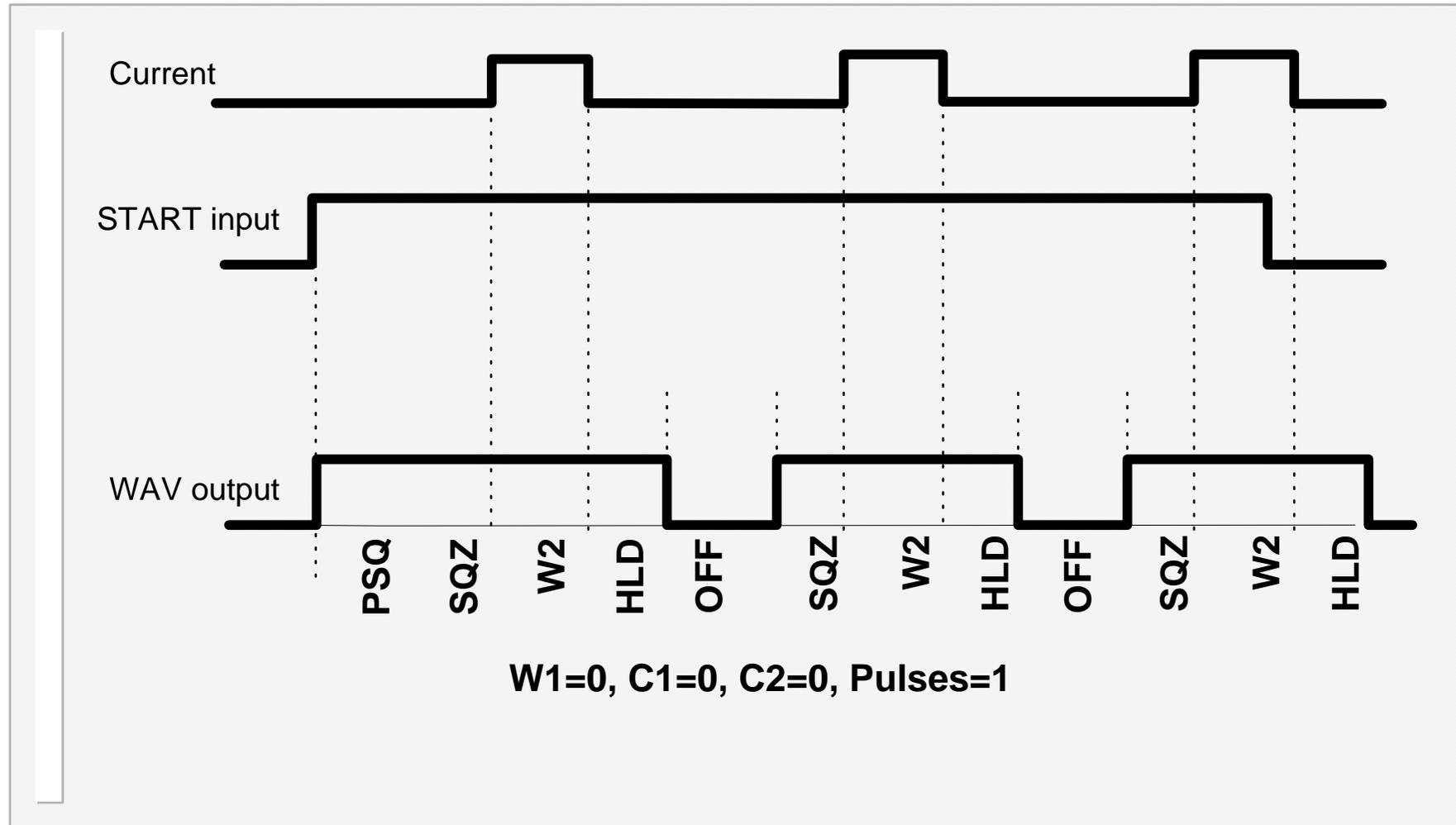
Operation: pulsation spot weld

Current

START input

EOS output

FAULT output

WAV output

SQZ W2 C2 W2 C2 W2 C2 HLD

W1=0, C1=0, Pulses=3, OFF=0

Operation: Upslope and Downslope

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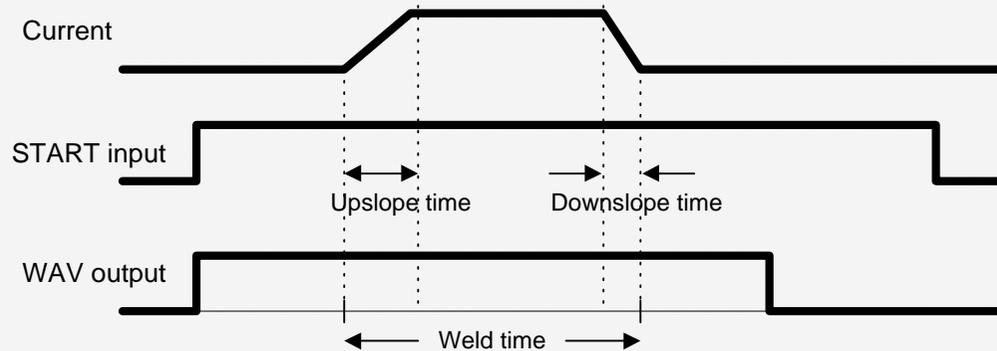
The upslope and downslope times are part of the overall weld time – they **do not** add to the weld time.

Seam
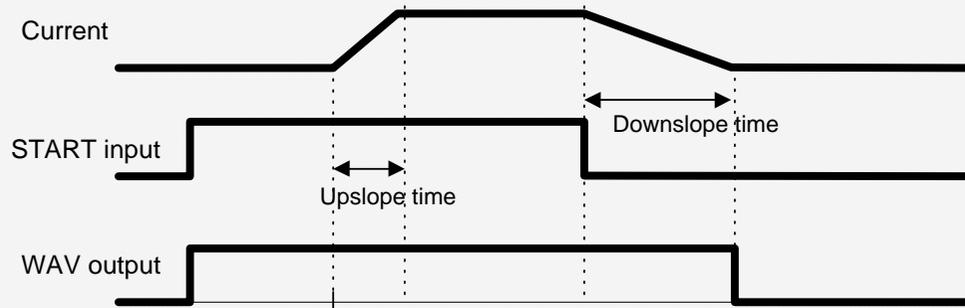
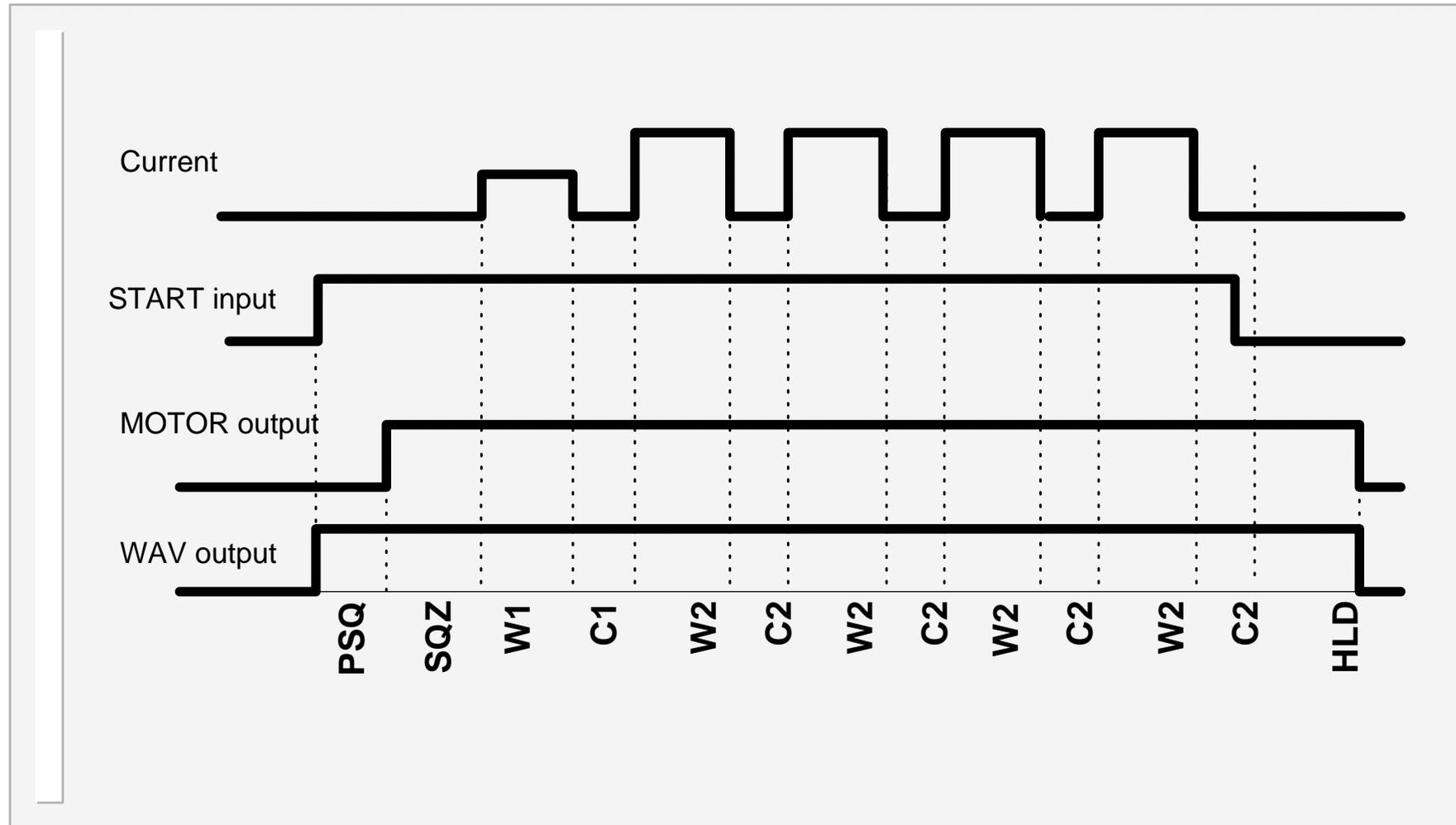Note that for seam welds, the downslope time begins when the initiation input turns off.
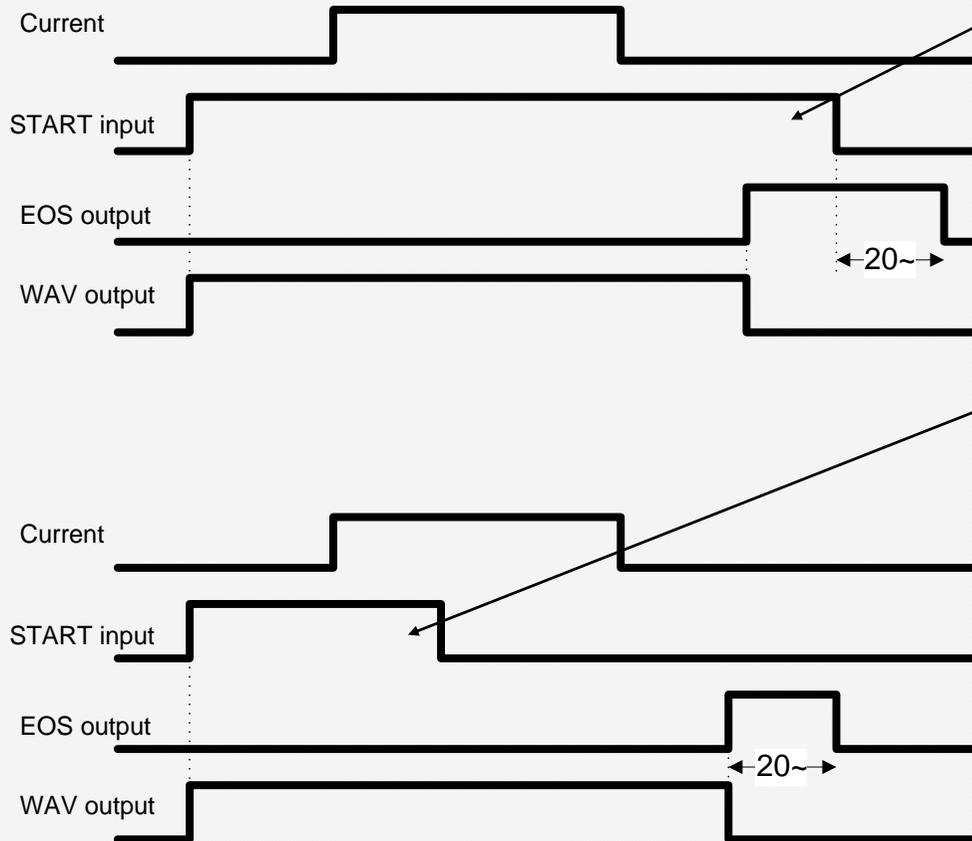
Operation: roll-spot welding

Current

START input

MOTOR output

WAV output

PSQ   SQZ   W2   HLD   OFF   SQZ   W2   HLD   OFF   SQZ   W2   HLD

W1=0, C1=0, C2=0, Pulses=1
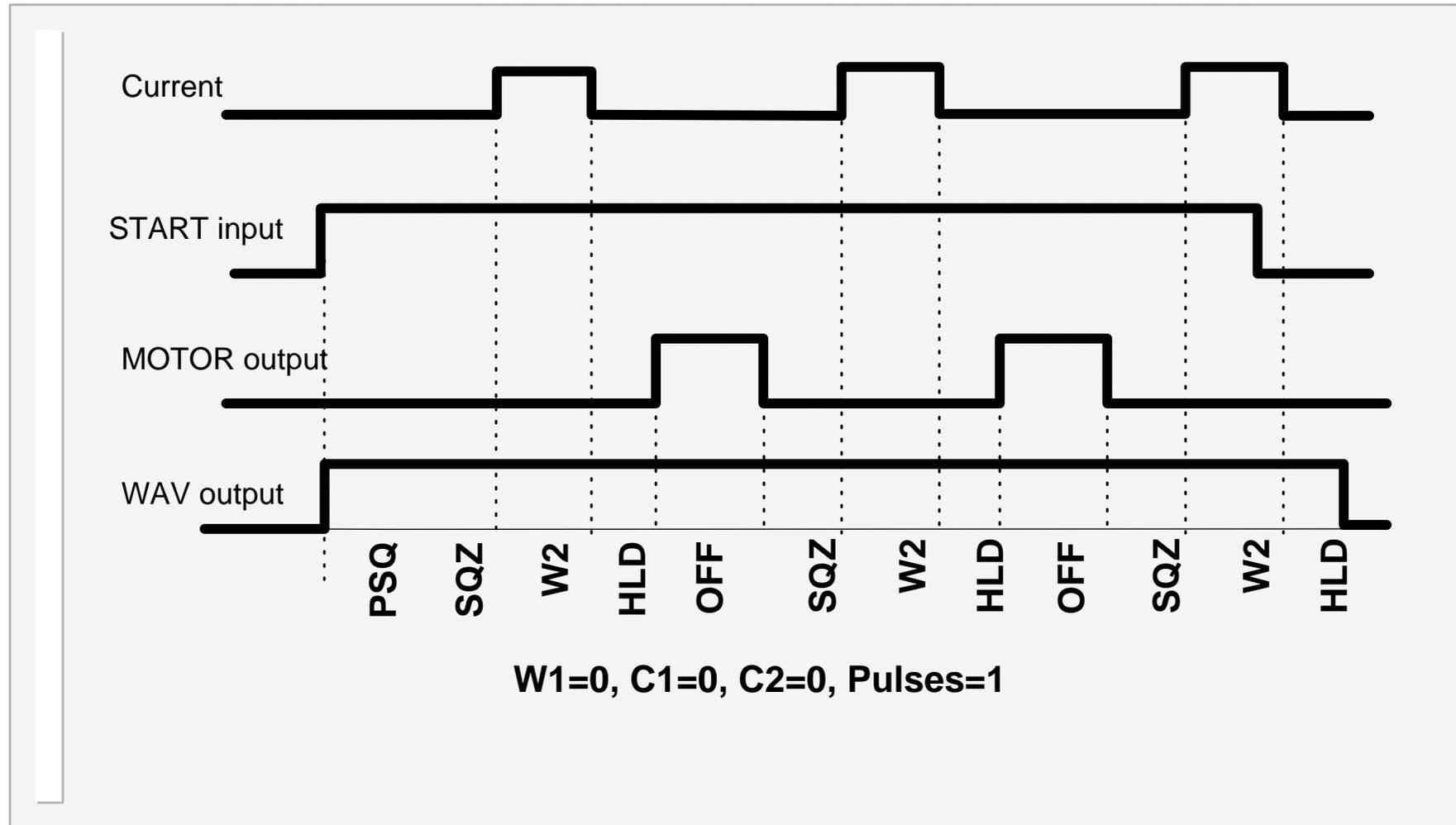
Operation: seam welding (dual heat)

Current

START input

MOTOR output

WAV output

PSQ SQZ W1 W2 W1 W2 W1 W2 W1 W2 W1 W2 HLD

C1=0, C2=0

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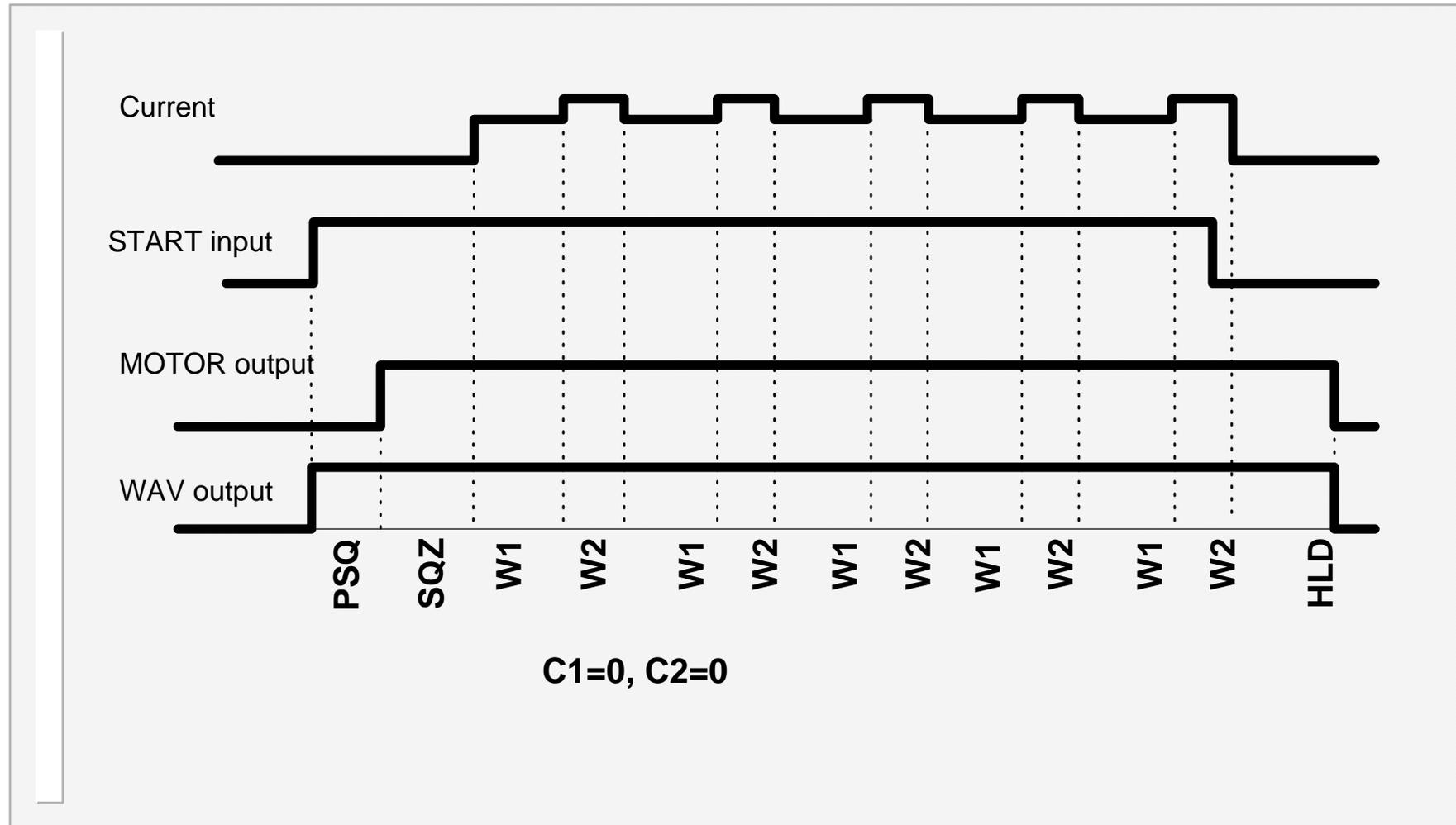
Operation: seam welding (pre-heat)

Current

START input

MOTOR output

WAV output

PSQ · SQZ · W1 · C1 · W2 · C2 · W2 · C2 · W2 · C2 · W2 · C2 · HLD

Operation: EOS signal

Handshake mode: The start signal remains on until EOS is given. When start is removed, EOS goes off immediately (*cancel with start* mode) or after 20 cycles *(fixed pulse* mode). This is the recommended method of operation for automatic systems.
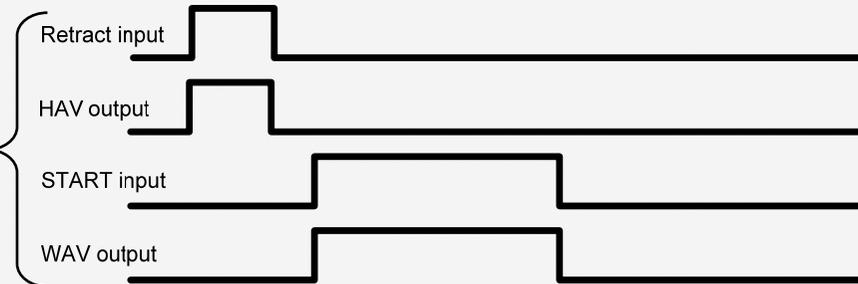
Pulsed mode: The start signal goes off before the end of the hold time. The EOS signal is a fixed pulse of 20 cycles.

If a new start signal is given during the EOS pulse, a new sequence will start immediately. Then EOS will go off immediately (*cancel with start* mode) or at the end of the 20 cycle *pulse (fixed pulse* mode).
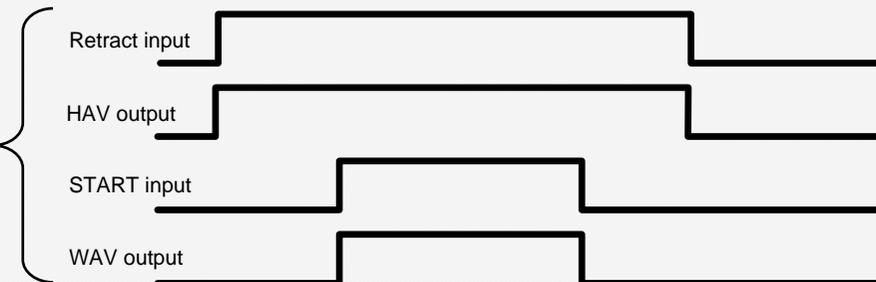
Operation: Retract

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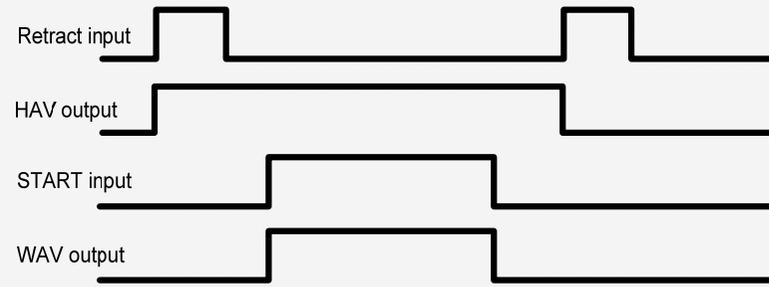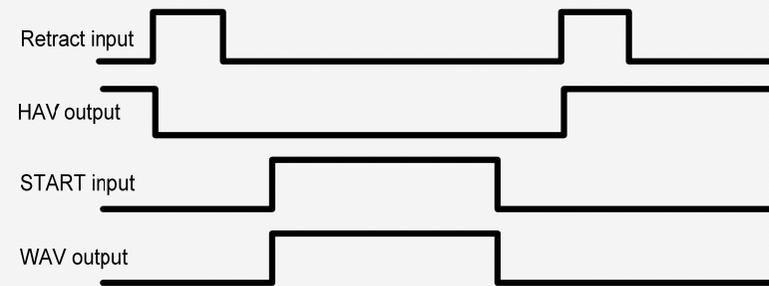/Maintained*) is set in the
configuration file.

No/ Simple

Retract input

HAV output

START input

WAV output

Maintained

Retract input

HAV output

START input

WAV output

Operation: Hi-lift

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

Hi-lift+
- Retract input
- HAV output
- START input
- WAV output

Hi-lift-
- Retract input
- HAV output
- START input
- WAV output

Multiwelding

SCR

Welding transformer
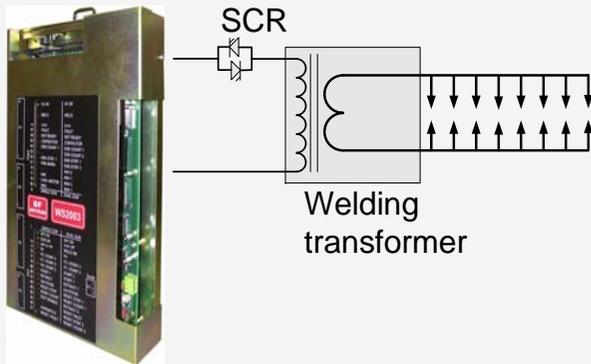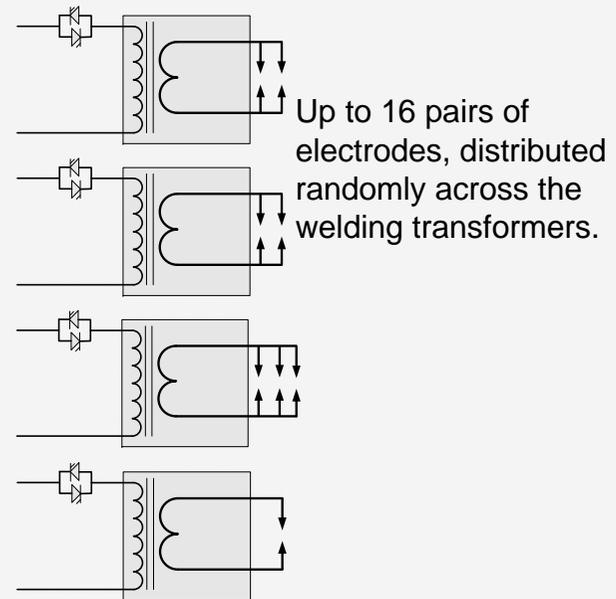
WS2003 configured for single gun use.

Only one transformer/SCR is connected. Electrodes must be closed one pair at a time.

WS2003 configured for multi-gun use.

Up to 16 pairs of electrodes, distributed randomly across the welding transformers.

Up to 16 welding transformers/SCRs when used with BD16 decoder, otherwise up to 4 SCRs.

Up to 16/4 transformers/SCRs can be connected. Up to 16 electrode pairs can be closed at a time. Control can ripple-fire through up to 16 spots, or each spot can be individually triggered. Transformers/SCRs can be different sizes.

Configuring WS2003 for multiwelding

There are two modes available for multiwelding: 'MULTI-GUN' and 'MULTI-GUN CASCADE'.

Multi-gun mode allows each welding program to be triggered independently, in the traditional way, but allows for selection of a transformer and electrode.

In *multi-gun cascade* mode, up to sixteen welding programmes can be grouped together, and triggered from a single start command. The programmes then ripple through with minimal time between them, selecting transformers and electrodes on the fly. The group of programmes is referred to as a *cascade.*

Selection of these modes is made by selecting 'EDIT CONFIGURATION' from the config. Menu:

```
<<<CONFIGURATION>>>
SEQUENCE:SPOT
SINGLE GUN
I/O = DISCRETE
G1: NO/SIMPLE RETRACT
G2: NO/SIMPLE RETRACT
START = BINARY
SCR SELECT = BINARY
FREQUENCY 50Hz
CONTACTOR TIME 10 s
BLANKING Off
SENSOR = TOROID
TOROID TEST On
HEAT RANGE  HIGH
IF FAULT :
EOS, STOP
LOW-FORCE  Off
SEQUENCER  On
TOROID FACTOR x1
COUNT/LOG SYNC Off
PRESSURE UNITS  kN
ANALOG OUTPUT = PV
```

Visible window

Operating mode selection: Press the **+** or **–** keys until either multi-gun or multi-gun cascade is shown.

SCR select: use *BINARY* if the SCRs are equiped with a decoder (such as a BD16), otherwise select *1 of 4*.

Binary: up to 16 SCRs.

1 of 4: up to 4 SCRs

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Electrode/Transformer assignment

The physical arrangement of the electrodes and welding transformers must be entered into the control.

1. From the config. menu, select 'EDIT TRANSFORMERS'.

```
<<< CONFIG. MENU>>>
EDIT CONFIGURATION
EDIT CALIBRATION
EDIT OUTPUT MAP
EDIT INPUT MAP
EDIT TRANSFORMERS
SET-UP ADAPTERS
BACKUP ALL DATA
RESTORE ALL DATA
INITIALISE ALL DATA
EDIT SYSTEM SETUP
```

Visible window

3. Each transformer has a separate calibration file. Perform the calibration procedure (see main manual) for each transformer connected.

In the example shown here:

Electrodes 1 and 2 are attached to Transformer 1.
Electrodes 3 and 4 are attached to Transformer 2.
Electrodes 5 and 6 are attached to Transformer 3.
Electrodes 7 and 8 are attached to Transformer 4.
Electrodes 9..16 are not used.

2. Assign each electrode to a transformer.
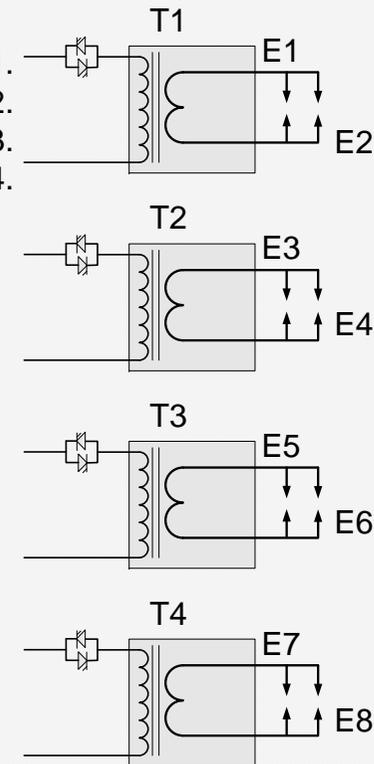
```
<<<TRANSFORMERS>>>
E1 -> T1       E2 -> T1
E3 -> T2       E4 -> T2
E5 -> T3       E6 -> T3
E7 -> T4       E8 -> T4
E9 -> T9       E10 -> T10
E11 -> T11     E12 -> T12
E13 -> T13     E14 -> T14
E15 -> T15     E16 -> T16
```

Visible window

T1 — E1, E2

T2 — E3, E4

T3 — E5, E6

T4 — E7, E8

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Assigning a weld program to an electrode

Each weld program should be assigned to a particular electrode. This is done on the 'EDIT PROGRAM' screen, accessed from the main menu.

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

```
PSQ= 0      SQZ= 10
W1 = 0     C1  =  0
W2 = 10    C2  =  0
Pulses(W2-C2)  = 1
UPSLOPE = 3
DOWNSLOPE = 0
HOLD = 10
OFF =  0  (SINGLE)
ELECTRODE  = 1
```
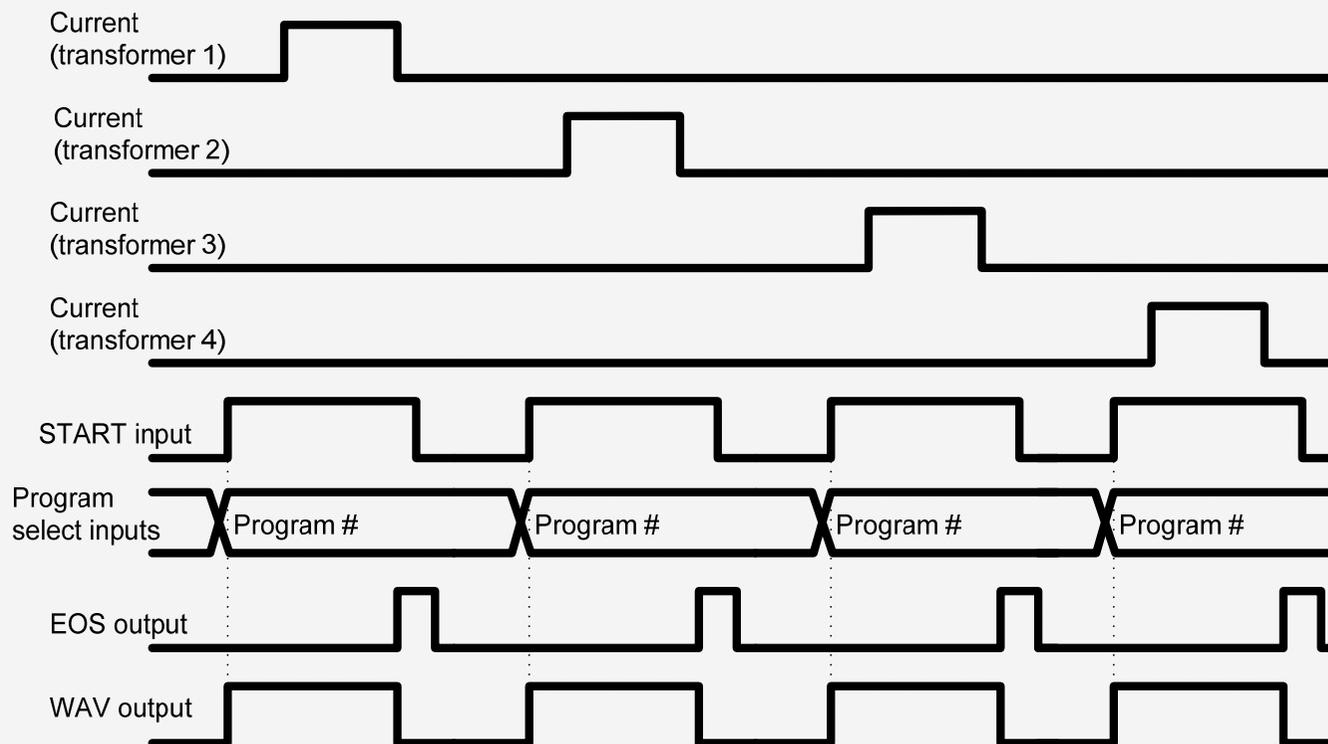
In the example shown here: Weld program 0 is assigned to Electrode 1.

Whenever a program is run, the control will automatically trigger the correct transformer, by referencing the electrode/transformer assignment table, as shown on the previous page. In addition, the electrode number is also used to access the appropriate stepper, counter and calibration information.

Multi-gun operation

Multi-gun mode allows each welding program to be triggered independently, in the traditional way, but allows for selection of a transformer and electrode.

Current
(transformer 1)

Current
(transformer 2)

Current
(transformer 3)

Current
(transformer 4)

START input

Program
select inputs Program # Program # Program # Program #

EOS output

WAV output

Multi-gun cascade operation

In **multi-gun cascade** mode, up to sixteen welding programmes can be grouped together, and triggered from a single start command. The programmes then ripple through with minimal time between them, selecting transformers and electrodes on the fly. The group of programmes is referred to as a **cascade.** Up to 16 cascades may be programmed.

To set up a cascade, select 'EDIT CASCADE' from the main menu.

```
<<<   CASCADE  0  >>>
STEPS = 5
S01:P00->E01->T01  ON
S02:P02->E02->T02  ON
S03:P10->E03->T03  ON
S04:P11->E04->T04  ON
S05:P12->E05->T05  ON
```

Visible window

Individual steps can be turned ON or OFF to assist setting up.

In the example shown here:
The cascade consists of 5 steps, using programmes 0,2,10,11 and 12. Note that the electrode and transformer numbers are automatically assigned, by reference to the electrode number in the selected weld program.

Note that in **multi-gun cascade** mode, the program selection inputs refer to a cascade, and not directly to a weld program.

…multi-gun cascade operation
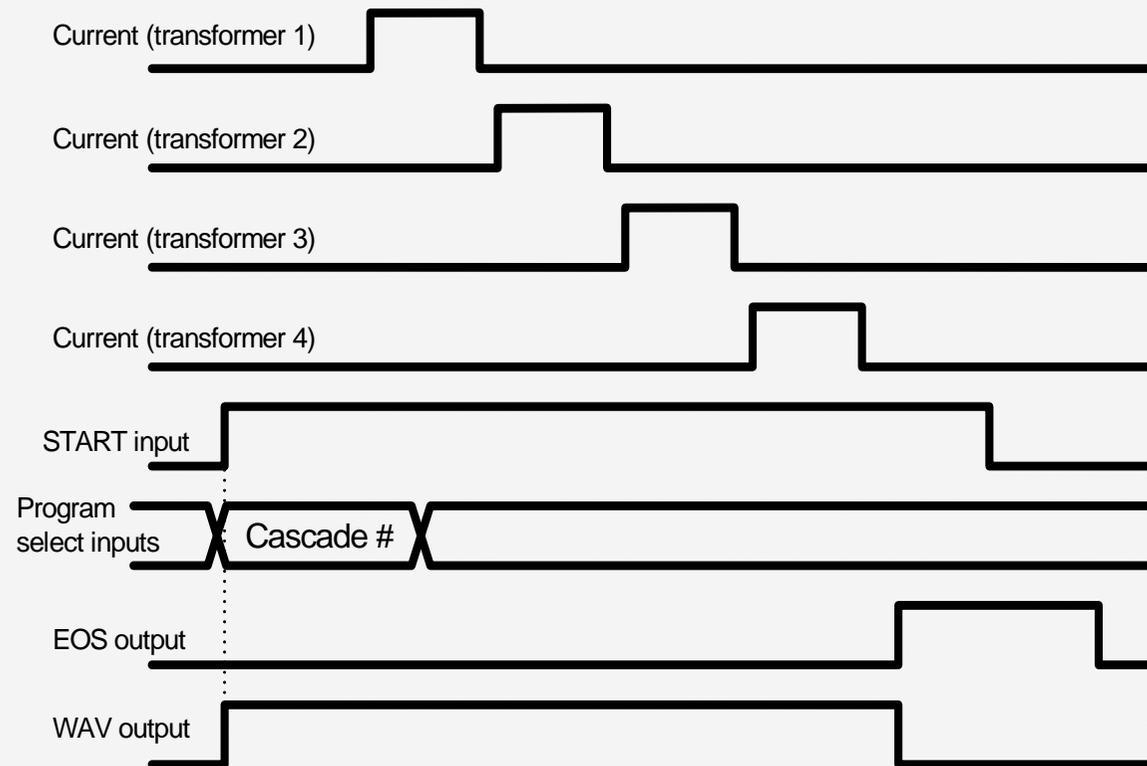
Program selection (multiweld)

Programmes can be selected in a variety of different ways, depending on the settings used.

Set these parameters in the configuration file.

X = don't care, or not connected

Note that if a program number exceeds the maximum (63 or 15), then the number will wrap around through 0.
e.g.
If N=62, then N+3=65. Applying wrap-around, N=N-64, giving a final value of N=1.

Set this parameter from the main menu

Mode	Binary/1of4	Use program	External selection	START input	Program selected
Multi-gun	Binary	N = 0..63	X	1	N
		EXT	P=0..63	1	P
	1of4	N = 0..15	X	1	N
				3	N+16
				2	N+32
				4	N+48
		EXT	X	1	0
				3	16
				2	32
				4	48

Mode	Binary/1of4	Use cascade	External selection	START input	Cascade selected
Multi-gun cascade	Binary	N = 0..15	X	1	N
		EXT	P=0..15	1	P
	1of4	N = 0..3	X	1	N
				3	N+4
				2	N+8
				4	N+12
		EXT	X	1	0
				3	4
				2	8
				4	12

WS98-2003 PC software

WS98-2003 PC software is available for use with the WS2003 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.

Timers may be connected to the PC via RS232 (1 timer only) or via Ethernet (multiple timers on a network).

WS98-2003 is available on CDROM, and works with all versions of Microsoft Windows™ (98 onwards). Contact BF Entron for more details.

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