



# Introduction to WS700B

Control and monitor for brakeshoe resistance welding.

For s/w version 1.05

Document revision 0



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



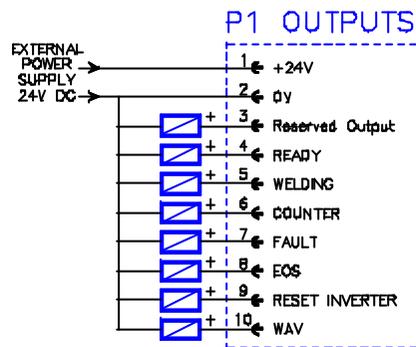
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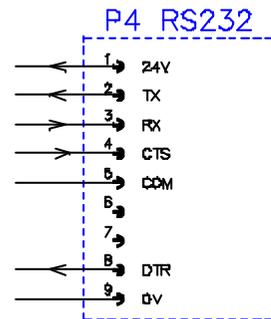
# Functions

- Up to 16 spots per program.
- 64 programmes (internal or external selection).
- Constant current regulation.
- Current monitoring (high/low limits for each spot).
- Proportional valve controller (0..10V).
- Pressure monitoring (high/low limits).
- Part counter (programmable blocking).
- Use on AC, DC or MFDC machines.
- Primary or Secondary feedback via Toroid or CT.
- Toroid and PV calibration functions.
- Toroid test function.
- Large 4x20 lcd display.
- RS232 port, for PC communications and print out of weld data.

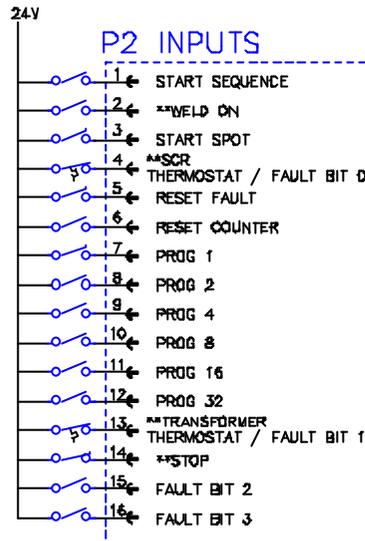
# Users connections



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



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

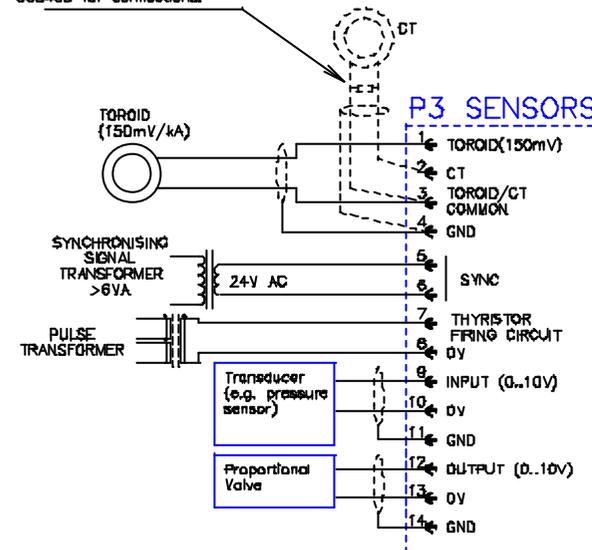


\*\* THESE INPUTS MUST BE LINKED OUT IF NOT USED

Fit EITHER a toroid OR a CT.  
Use 150mV toroid for secondary currents(2...80kA), connected to pins 1&3.  
OR  
Use 1400mV toroid for primary currents(0.1...4kA), connected to pins 1&3.  
OR  
Use CT for primary currents (0.1...4kA), connected to pins 2&3.

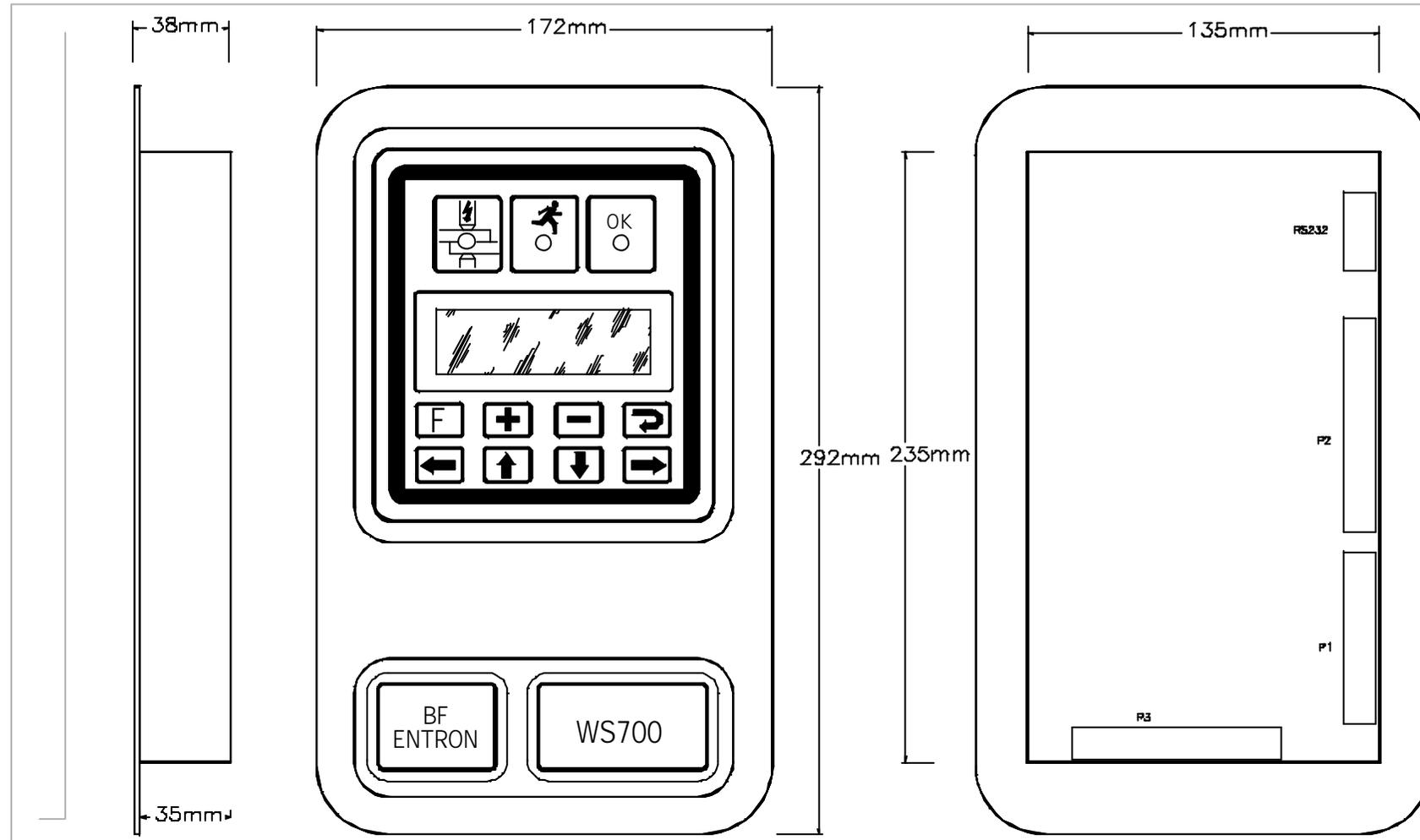
Note: on MF systems, the toroid must be wired to the inverter, and not as shown here.  
See cabinet wiring diagram for details.

The CT should be 800:1 and MUST have a 0.47 Ohm 2.5W load connected across it. This resistor can be provided by either:  
1) connecting a discrete resistor directly across the CT terminals and wiring directly to pins 2 & 3 (as shown here),  
OR  
2) by connecting the CT via Power board type W293133 - see drawing 3U3405 for connections.



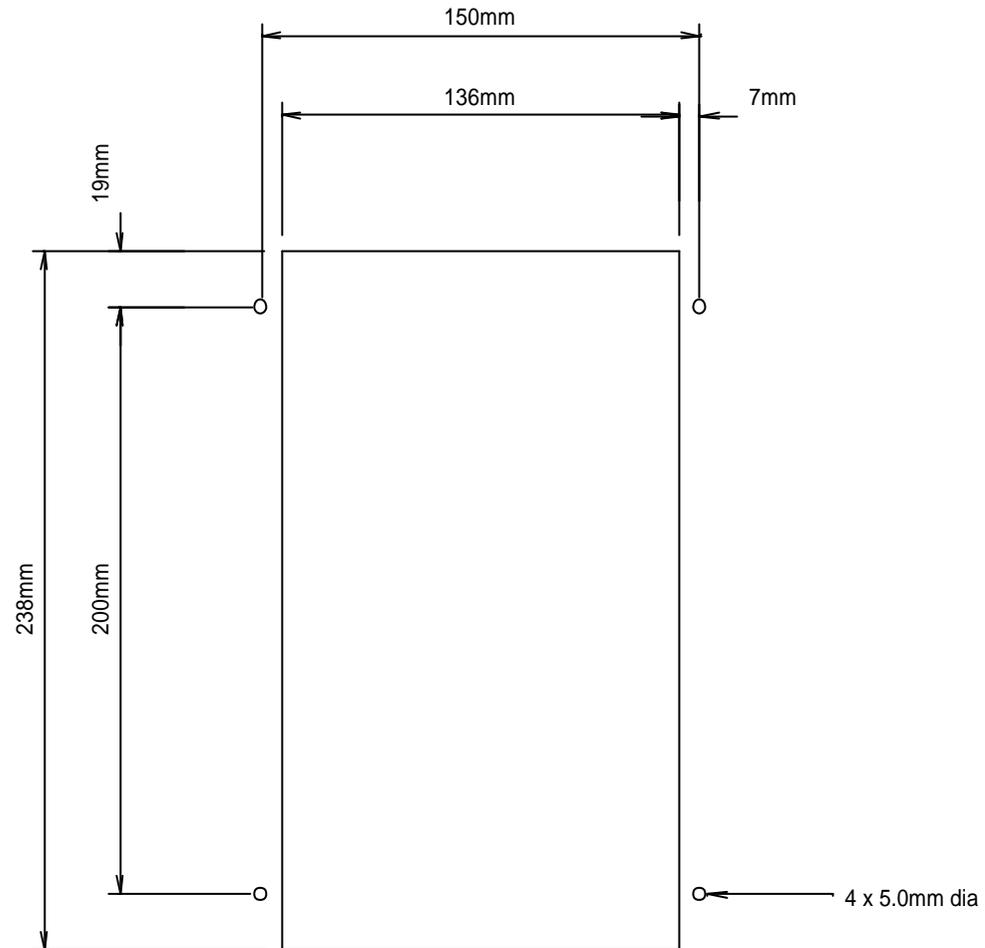
Note that if the timer is supplied fitted into a case, some connections will have been pre-wired by BF Entron. See the case wiring diagram for details.

# Dimensions



# Mounting

To mount a WS700B timer into a panel, you will need to cut an aperture and drill holes as shown here:



# Global parameters

## Configuration

- Frequency (50/60 Hz)
- Fault signal timing
- Blanking (On/Off)
- Await Pressure (On/Off)
- Toroid test (On/Off)
- Sensor (Toroid/CT)
- Heat range (Wide/High/Low)

## Counter

- Actual count (0..9999).
- Terminal count(0..9999).
- Stop at end/continue at end.

## Calibration

- Toroid (100..2000 mV/kA)
- S/P ratio (1:1..199:1)
- S/P offset (-1kA..+1kA)
- Pressure (2 points, kN/V)
- Current (2 points, A/%heat) (for MF)
- Max. Primary current (for MF)

# Program parameters (x64)

## Weld program

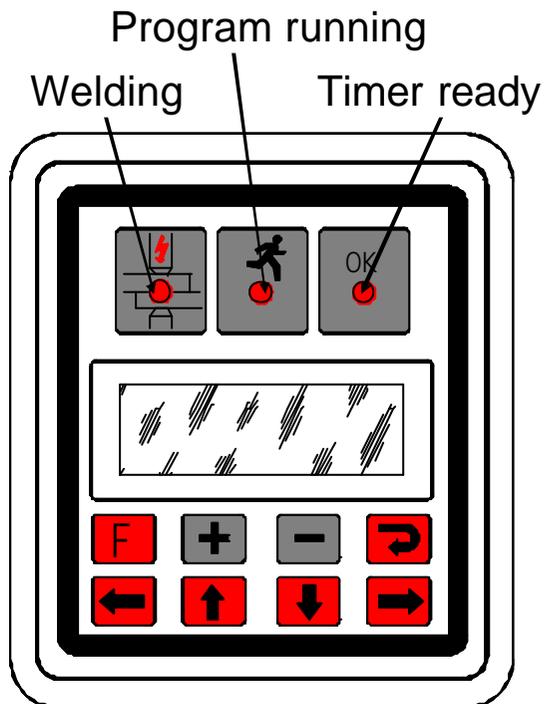
- Spots (1..16)
- Squeeze (0..99 cycles)
- Hold(0..99 cycles)
- Pressure (0..10V)
- For each spot-
  - Cool (0..99 cycles)
  - Weld(0..99 cycles)
  - Heat (0..99.9%)
  - Current (0..60kA)
  - PHA/CCR control

## Monitor limits

- Pressure monitor On/Off
- Pressure low limit (0..99%)
- Pressure high limit (0..99%)
- Current monitor On/Off
- For each spot-
  - Current low limit (0..99%)
  - Current high limit (0..99%)

# Keypad and indicators

## LED Indicators

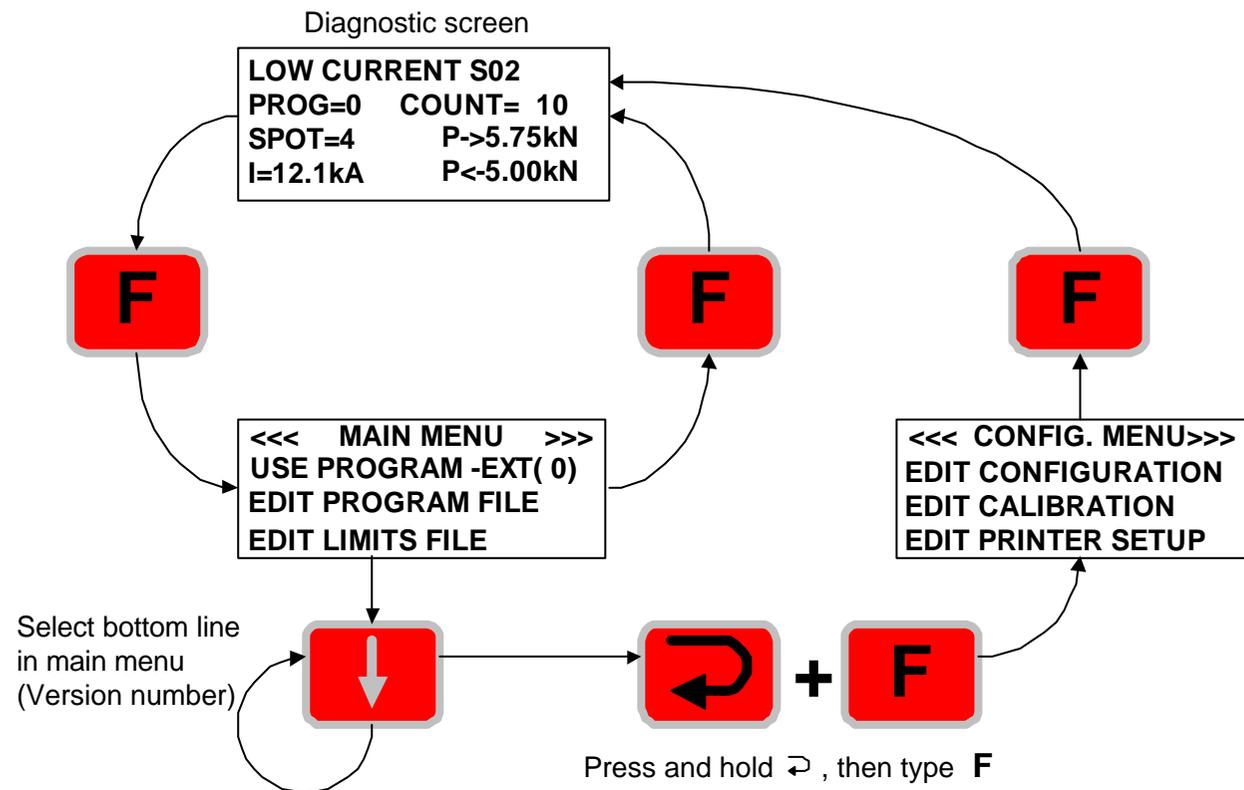


## Using the keypad

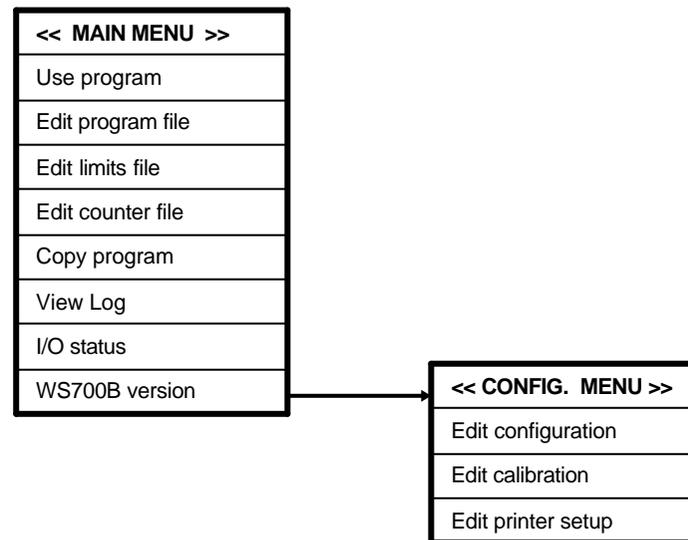
- Press the **F** (function) key to return to the previous screen, or to move between menu screens (see menus).
- The selected function or parameter will flash.
- Use the **← ↑ ↓ →** keys to select a different function or parameter. The visible window will scroll when required.
- Press the **↻** key 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

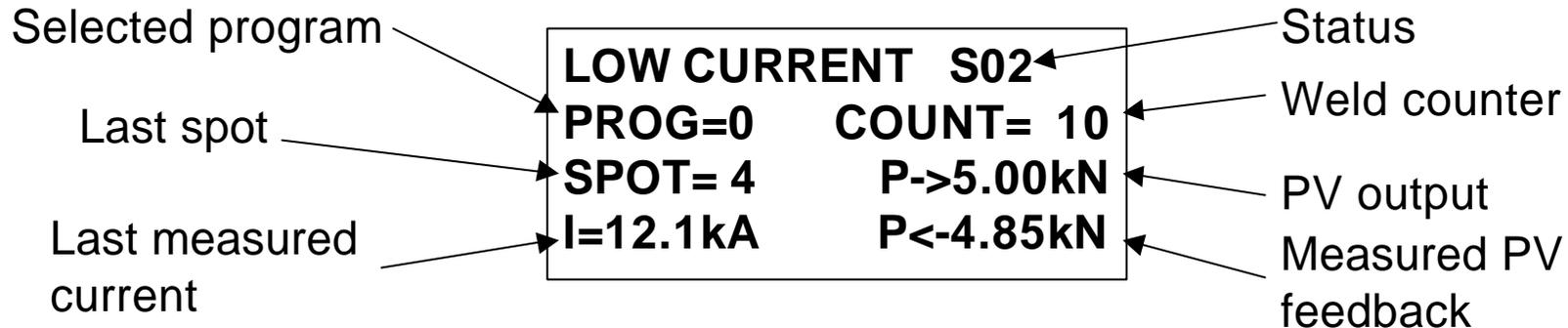
The various functions of the timer are arranged into a set of menus and screens. The diagrams below shows how these are organized and accessed:



# ..menus



# Diagnostic display



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

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

**Last spot:** this is the last spot no. that was used.

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

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

**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 appears on the top line of the diagnostic screen.

<b>Description</b>	<b>Advice</b>
Ready	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
SCR hot	Check cooling of SCR
Data error	Edit program
Weld off	Close Weld-on switch
Sensor overrange	Reduce current, or use an external signal attenuator
Toroid short circuit	Inspect toroid connection
Toroid open circuit	Inspect toroid connection
Transformer hot	Check cooling of transformer/ check connection to thermostat
Process stop	Close the external stop input
No current	Check secondary circuit / check toroid connection
Low current	Check secondary circuit or adjust parameters
High current	Check secondary circuit or adjust parameters
Low pressure	Check air system or adjust parameters
High pressure	Check air system or adjust parameters
MF Short circuit	Check transformer and connections to transformer
MF Earth fault	Check transformer and connections to transformer
MF Voltage error	Check supply voltage
MF Inverter hot	Check cooling water/fans
MF Transformer hot	Check cooling water to transformer
MF Disabled	Check ENABLE input
MF no current	Check connections to secondary toroid/ check secondary circuit is closing
MF Max pulse width	Secondary circuit is limiting the current. Check secondary circuit
MF Max pri current	Inverter is limiting the current. Check secondary circuit

# Main menu

USE PROGRAM -EXT( 0)  
EDIT PROGRAM FILE  
EDIT LIMITS FILE  
EDIT COUNTER FILE  
COPY PROGRAM  
VIEW LOG  
I/O STATUS  
WS700B VERSION 1.00

Visible  
window

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 PRINTER SETUP**

- 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>>>  
FREQUENCY 50Hz  
FAULT OUTPUT AT END  
BLANKING Off**

Visible  
window

**TOROID TEST On  
SENSOR TOROID  
HEAT RANGE HIGH**

# ...edit configuration

- Frequency: **50 Hz / 60Hz** : Set to the frequency of your mains supply.
- Fault output at (**END / FAIL**): When set to **END**, the fault output signal is given after the last spot is completed. When set to **FAIL**, the fault output signal is given as soon as a faulty spot is detected.
- Blanking (**On/Off**): When set to **On**, the first 2 cycles of weld current will be excluded from the measurement and limit testing process.
- 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 AC / Toroid DC / CT(AC) / Toroid (MF) / CT (MF)** : 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 BF Entron equipment has a CT built into the control, avoiding the need for an external sensor. When using a toroid on the secondary, select **Toroid DC** if the machine has a rectifier, otherwise select **Toroid AC**. When using BF Entron inverters with a primary feedback output, select **CT(MFDC)**.

# ...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.

# Edit calibration

**<<< CALIBRATION >>>**

**TOROID: 150 mV/kA**

**CURRENT:**

**Pt1: 5.00kA @ 10.0%**

**Pt2: 9.50kA @ 60.0%**

**CT:**

**S/P RATIO 50:1**

**S/P OFFSET 0 A**

**Ip MAX 1000 A**

**PRESSURE:**

**Pt1: 9.99kN @ 10.0V**

**Pt2: 0.00kN @ 0.00V**

Visible  
window

- Press the **F** key to return to the configuration menu.

# ...edit calibration

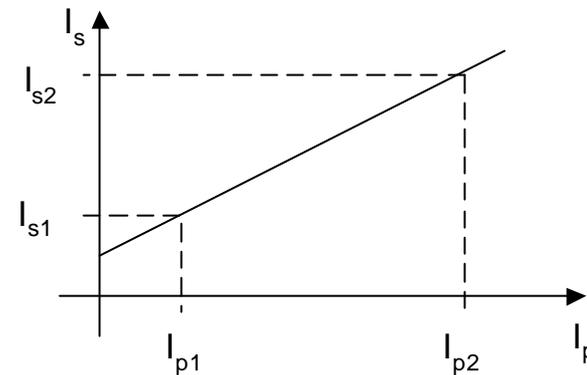
- **Toroid**: sensitivity of the measuring coil (toroid), expressed in mV/kA.
- **Current**: relationship between the heat controller output (% heat) and actual current. This is expressed by entering two 'test' point values, which then define a straight line relationship. This can then be used by the constant current controller to determine the set-point.
- **CT**: See next page "CT calibration" for details.
- **Ip max**: Sets the correct scaling for the CT feedback signal in MF DC mode (Configuration: Sensor CT(MF)).
- **Pressure**: relationship between the PV controller output voltage and actual tip force. This is expressed by entering two 'test' point values, which then define a straight line relationship.

# ....CT calibration

- The CT measures primary current, but the timer will display secondary values. It does this by calculation based on the **S**ecundary to **P**rimary ratio (**S/P ratio**) and offset (**S/P offset**) parameters.

- To determine the correct values,
- do the following:

1. Select 'SENSOR CT' in the configuration.
2. Set the S/P ratio to 1:1 in the calibration.
3. Set the S/P offset to 0 in the calibration.
4. 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.
5. 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.
6. Calculate and enter S/P ratio =  $(I_{s2} - I_{s1}) / (I_{p2} - I_{p1})$
7. Calculate and enter S/P offset =  $I_{s2} - (I_{p2} \times \text{S/P ratio})$



# .....CT calibration

- If you do not have a suitable meter, or you do not wish to do the calculations, you can still use the CT for feedback by doing the following:

1. Select 'SENSOR CT' in the configuration.
2. Set the S/P ratio = **transformer turns ratio** in the calibration.
3. 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 for the CT (see previous page)

**OR**

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

# Edit Printer setup

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

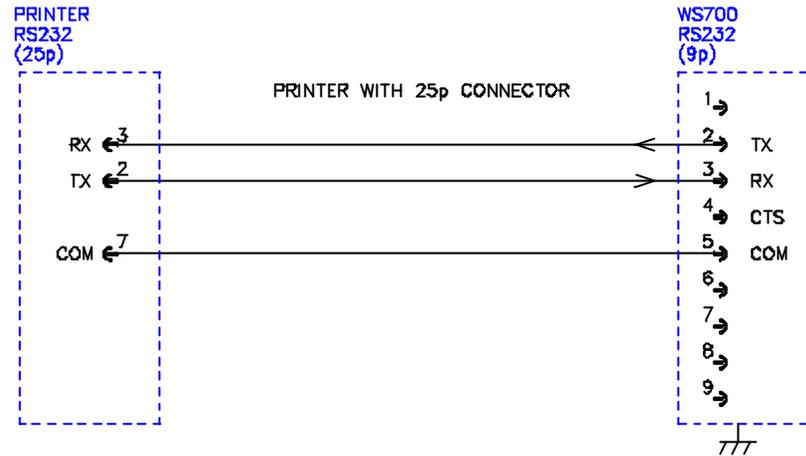
• Press the **F** key to return to the configuration menu.

Example print-out

- **PRINT**: select-OFF (no printing).  
ALL (print every weld sequence).  
FAILS (only print failed weld sequences).  
PASSES (only print good weld sequences).
- **LINES PER PAGE**: set this to the number of lines which your printer can produce on each sheet of paper .

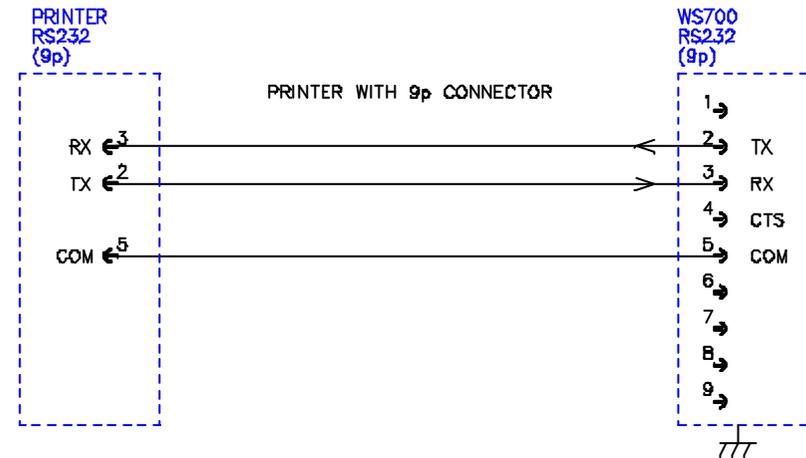
```
COUNT = 1  PROG = 0
SPOT  CURRENT  ERROR
 1    10.5kA   LOW CURRENT S1
 2    12.5kA
 3    12.5kA
 4    12.5kA
 5    12.5kA
 6    12.5kA
 7    13.5kA   HIGH CURRENT WELD2
 8    -
 9    -
etc.
```

# ...printer connections



Printer RS232 interface settings:

9600 Baud  
1 start bit  
1 stop bit  
No parity  
8 bit data



# Edit program

```
<<< PROGRAM 0 >>>
SPOTS= 5
PV=5.00kN 5.00V
SQZ= 10 HLD= 12
I1=10.0kA 50.0% PHA
C1 = 2 W1 = 12
I2=12.5kA 60.0% CCR
C2 = 3 W2 = 10
I3=12.5kA 60.0% CCR
C3 = 1 W3 = 10
I4=12.5kA 50.0% CCR
C4 = 0 W4 = 10
I5=10.0kA 50.0% PHA
C5 = 2 W5 = 12
```

Visible window

Parameters for spot 1

Parameters for spot 5

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.

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

C1=cool time for spot 1. This is a pause before the weld starts and can be used to fine-tune the position of a spot.

# Edit limits

```
<<< LIMITS PROG 0 >>>  
PRESSURE: MONITOR On  
LOW= 8%  HIGH= 8%  
CURRENT: MONITOR On
```

Visible  
window

```
I01 LOW=15% HIGH=10%
```

```
I02 LOW=15% HIGH=10%
```

```
I03 LOW=15% HIGH=10%
```

```
I04 LOW=15% HIGH=10%
```

```
....
```

```
....
```

```
etc.
```

These are the limits for spot 2

These are the limits for spot 4

# Edit counter

```
<<<   COUNTER   >>>  
COUNT NOW = 431  
COUNT UP TO 500  
STOP AT END
```

**Count now** is incremented after every part(brakeshoe). When **count up to** is reached, the counter output is activated. The counter can be disabled by setting **count up to** =0.

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.

# Copy program

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

Copy a program (and associated limit file) 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.

# View Log

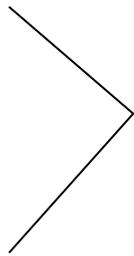
```
<<<   LOG   >>>
PROG= 0  COUNT=  1
I1=10.0kA  50.0%  ERR
I2=12.5kA  60.0%  OK
I3=12.5kA  60.0%  OK
I4=12.5kA  60.0%  OK
....
....
etc.
```

Visible  
window

This screen can be used to observe the current measurements for each spot on the last shoe. **ERR** indicates that an error was detected on this spot.

# I/O Status

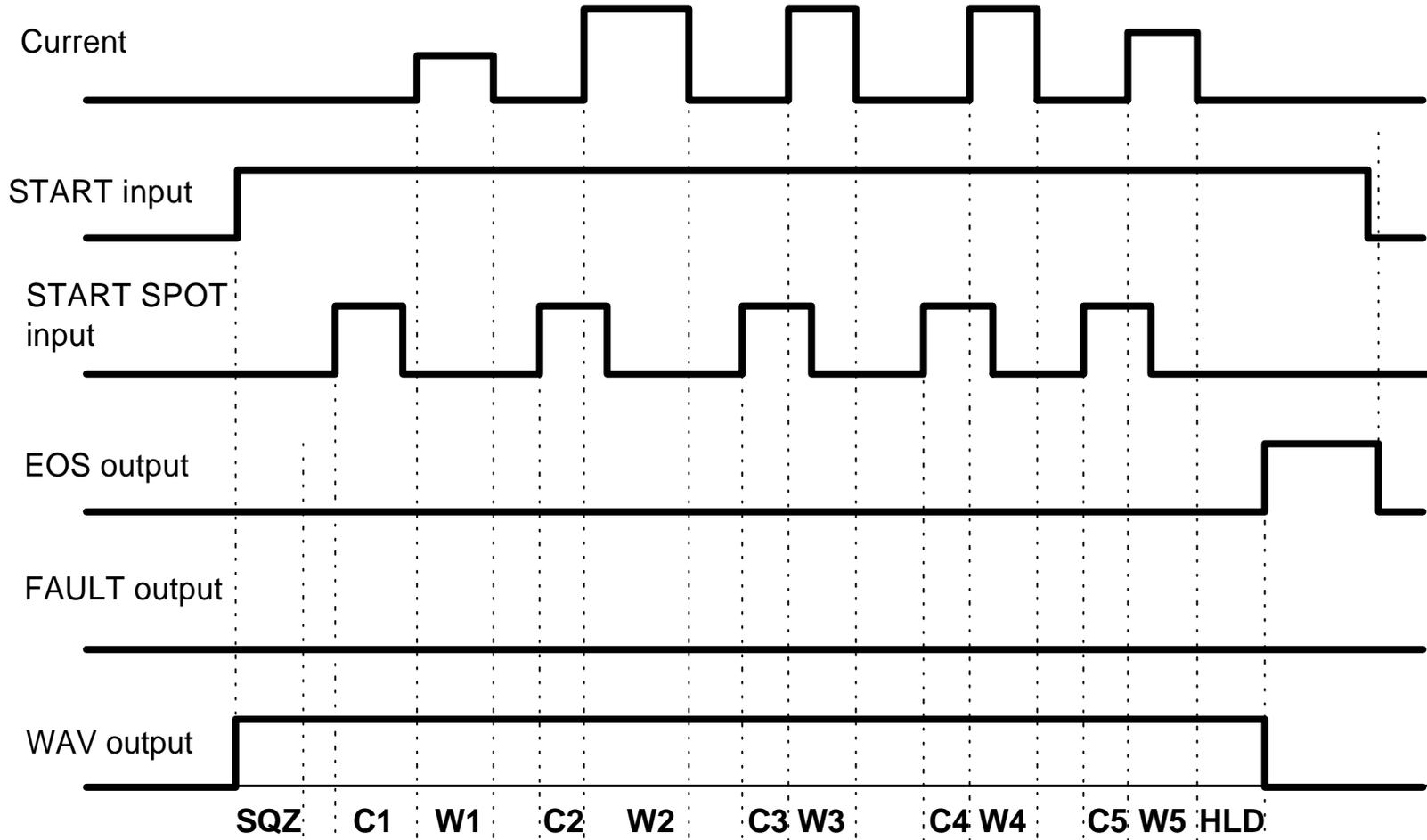
<b>&lt;&lt;&lt; I/O STATUS &gt;&gt;&gt;</b>
<b>START</b> <b>Off</b>
<b>WELD ON</b> <b>On</b>
<b>START SPOT</b> <b>On</b>
<b>SCR THERMOSTAT</b> <b>On</b>
<b>RESET FAULT</b> <b>Off</b>
<b>RESET COUNTER</b> <b>Off</b>
.....
.....
<b>etc.</b>



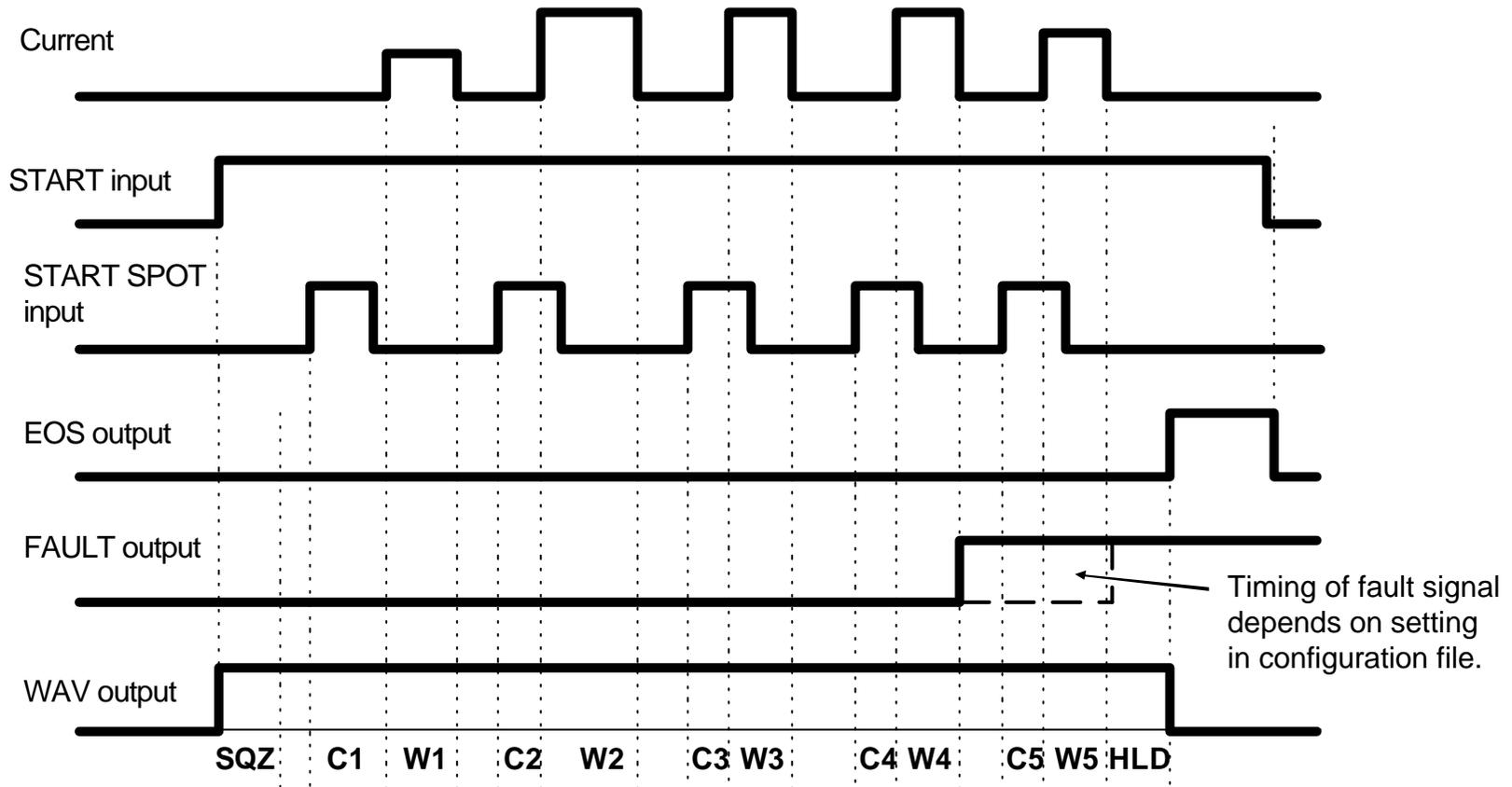
Visible window

This screen can be used to observe the status of all the discrete inputs and outputs.

# Operation: – no weld faults



# Operation: – weld fault on spot 4



# WS98-700B PC software



WS98-700B PC software is available for use with the WS700B 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 the RS232 port.

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

