Introduction to iPAK

Medium-frequency resistance welding power source, with integrated control,monitor and machine sequencer .

For s/w version 1.57

Document revision 1

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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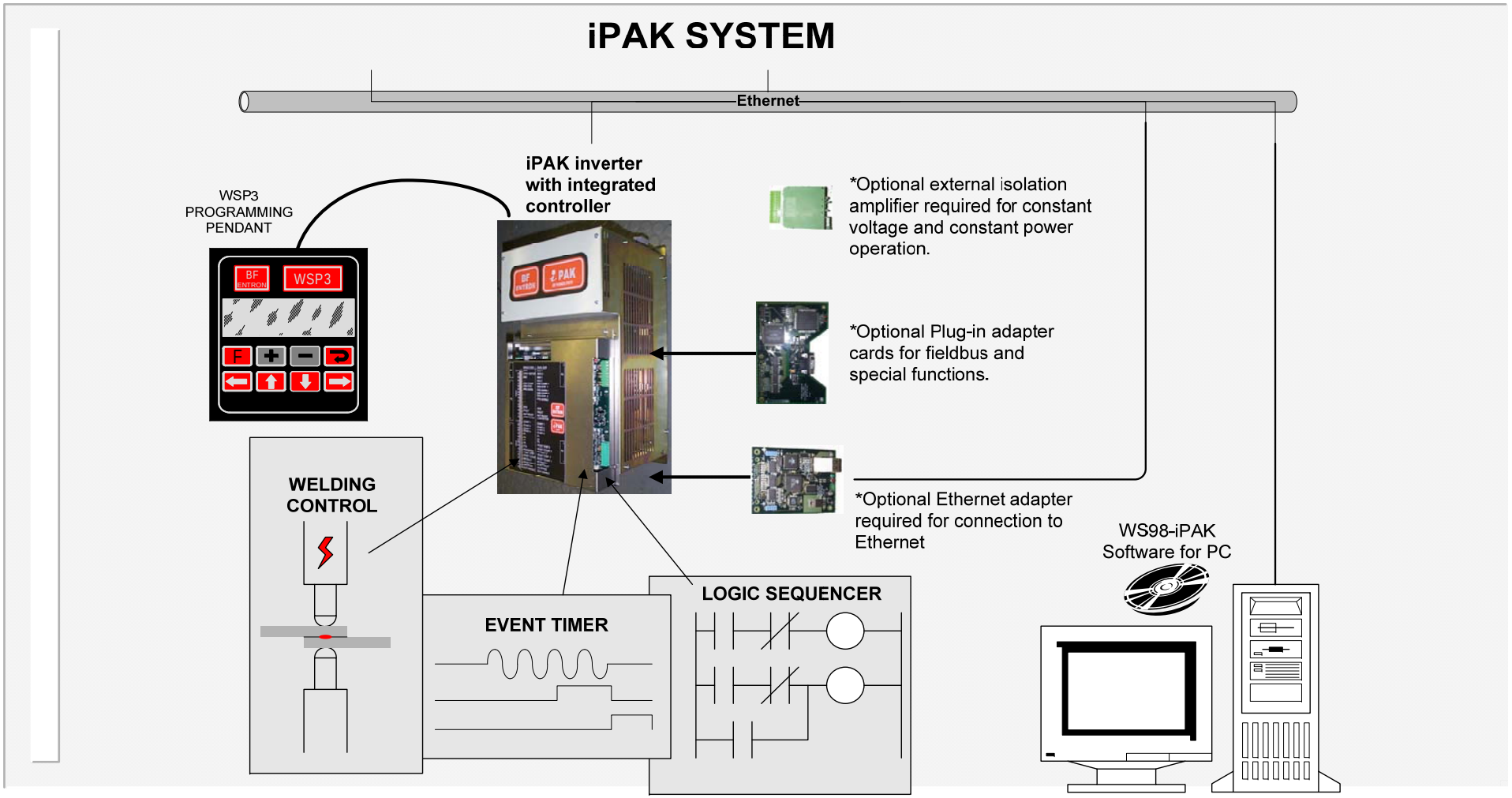
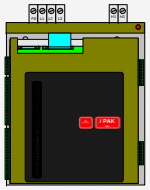
iPAK System


iPAK SYSTEM
Ethernet
iPAK inverter with integrated controller
WSP3 PROGRAMMING PENDANT
WSP3
*Optional external isolation amplifier required for constant voltage and constant power operation.
*Optional Plug-in adapter cards for fieldbus and special functions.
*Optional Ethernet adapter required for connection to Ethernet
WELDING CONTROL
EVENT TIMER
LOGIC SEQUENCER
WS98-iPAK Software for PC

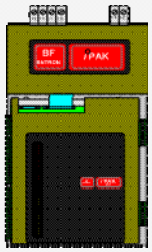
...iPAK System

The standard iPAK family is available in the following sizes (maximum permitted primary current):

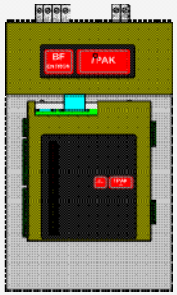
- 150A
- 360A
- 600A
- 1000A



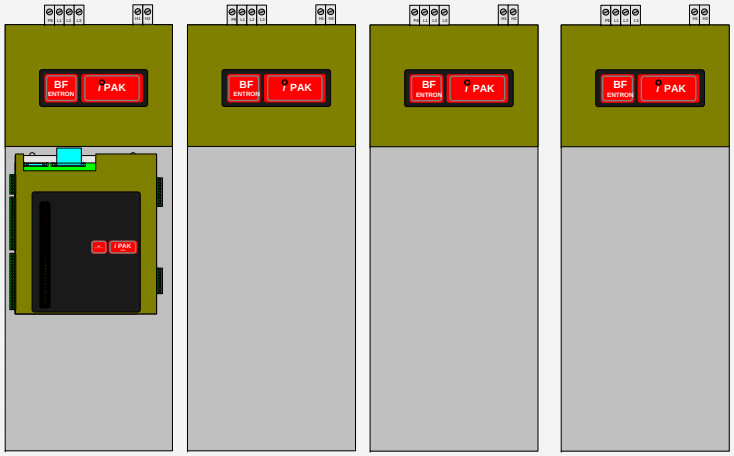
Standard 150A



Standard 360/600A



Standard 1000A



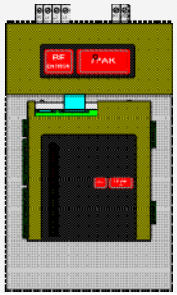
iPAK-LMI modules

The standard iPAK family operates with a supply voltage in the range 380-480V AC.

For lower voltages (190-290V AC) , use iPAK-LV.

For higher voltages (up to 580V AC), iPAK-HV is available.

Drive up to eight transformers with additional MUX switch.



iPAK-HV 360/600A

For higher current applications, iPAK-LMI modules can be connected together to provide the required output:

- 1500A (1 module)
- 3000A (2 modules)
- 4500A (3 modules)
- 6000A (4 modules)

Introduction and overview

This manual details the features of the iPAK cpu, and shows how to program the system using the WSP3 programmer.

iPAK is an integrated timer/controller/inverter system for MF resistance welding. The control section is housed in a cassette type casing, which simply mounts onto the power pack for ease of maintenance.

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

A powerful built-in logic sequencer program provides the iPAK 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-iPAK software for programming and monitoring purposes.

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

Functions

- Spot / Repeat / Roll-spot / Seam(dual heat)/Seam(pre-heat) welding.
- Single, or dual gun operation.
- OHMA (Air over Oil) gun operation.
- Dual weld intervals plus pulsation, upslope and downslope.
- Constant current regulation.
- Constant voltage regulation (requires external isolation amplifier).
- Constant power regulation (requires external isolation amplifier).
- Up to 64 programmes (internal or external selection).
- Current/power monitoring (high/low/pre limits), programmable blocking.
- Measurements log keeps history of recent welds.
- Proportional valve controller (0..10V or 4..20mA).
- Up to 3 analog inputs (2 x 0..10V, plus 1 x 0..10V / 4..20mA).
- Pressure monitoring (high/low limits).
- Programmable outputs (events).
- Machine sequencer logic.
- Welding programmes may be linked together for multiple spot sequences.

…functions

- Retract/high-lift control.
- Contactor timer.
- Head-lock function.
- Electrode management functions, including stepping, counting and tip-dressing, with programmable blocking and preset curves.
- All inputs and outputs 24V DC.
- Toroid and PV calibration functions.
- Toroid test function.
- Analog output of current waveform.
- Disable edit (keyswitch) function.
- External plug-in programming pendant with large backlit 4x20 lcd display, and data backup facility.
- RS232 port, for PC communications and data logging.
- Expandable via plug-in option cards (Ethernet, Profibus, DeviceNet etc).

Global parameters

Configuration

- Sequence (Spot / Roll-spot / Seam(2-heat) / Seam(pre-heat)
- Regulation (primary/secondary).
- Measurement (primary/secondary).
- Single gun / Dual gun / OHMA gun.
- Discrete/Fieldbus I/O
- Retract (x2):
  (Simple / Hi-lift+ / Hi-lift- / Maintained / OHMA)
- Start/Program select (Binary / 1-of-4)
- Contactor time (0..200 s)
- Blanking (On/Off)
- Toroid test (On/Off)
- On Fault (Continue/Stop/Head-lock/EOS/No EOS)
- Sequencer (On/Off)
- Toroid attenuation factor (1..10).
- Sync counter with log (On/Off).
- Units (Metric/Imperial).
- Analog output (PV/Current).

Calibration (x2)

- Toroid sensitivity(100..2000 mV/kA)
- Maximum primary current(0..5000A)
- CT ratio (100…10000)
- S/P ratio (1:1..199:1)
- S/P Trim(-50..+50%)
- S/P offset(-5000..+5000 A)
- Inverter (2 points, kA / kW / %heat)
- Pressure (2 points, kN/V)
- Analog output scale (0..60kA).
- Analog input (ch3) gain (0.9..10.0)
- Analog input (ch3) offset (-9.99..+9.99)

Counter (x2)

- Actual count (0..9999).
- Terminal count(0..9999).
- Stop/continue at end.
- Tip-dressing (On/Off).
- Maximum dressings(0..9999).
- Dressings done(0..9999).
- Reset stepper to(0..99999).

Output Map

- Normal/Event/Sequencer/ Fieldbus (x16)

Input Map

- Normal/Sequencer (x16)

Stepper (x2)

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

Sequencer

- Up to 250 statements

Printer

- Print Off / All / Passes / Fails.
- Lines per page (10..99)
- Format Table / ASCII-HEX

Program parameters (x64)

Weld program

- Pre-squeeze (0..1999 ms)
- Squeeze (0..1999 ms)
- Weld1 (0..999 ms)
- Cool1(0..999 ms)
- Weld2(0..999 ms)
- Cool2(0..999 ms)
- Pulses(0..9)
- Hold(0..999 ms)
- Off(0..999 ms)
- Upslope(0..999 ms)
- Downslope(0..999 ms)
- Pressure (0..100%)
- Heat 1 (0..99.9%)
- Heat 2 (0..99.9%)
- Current 1 (0..60kA)
- Current 2 (0..60kA)
- Power 1 (0..130kW)
- Power 2 (0..130kW)
- Normal/Link program
- Mode 1(P/W,CCu,CCC,CV,POW)
- Mode 2(P/W,CCu,CCC,CV,POW)
- OHMA gun open(0..999ms)
- OHMA gun close(0..999ms)
- OHMA retract open (0..999ms)
- OHMA retract delay (0..999ms)
- OHMA retract close (0..999ms)

Monitor limits

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

Events

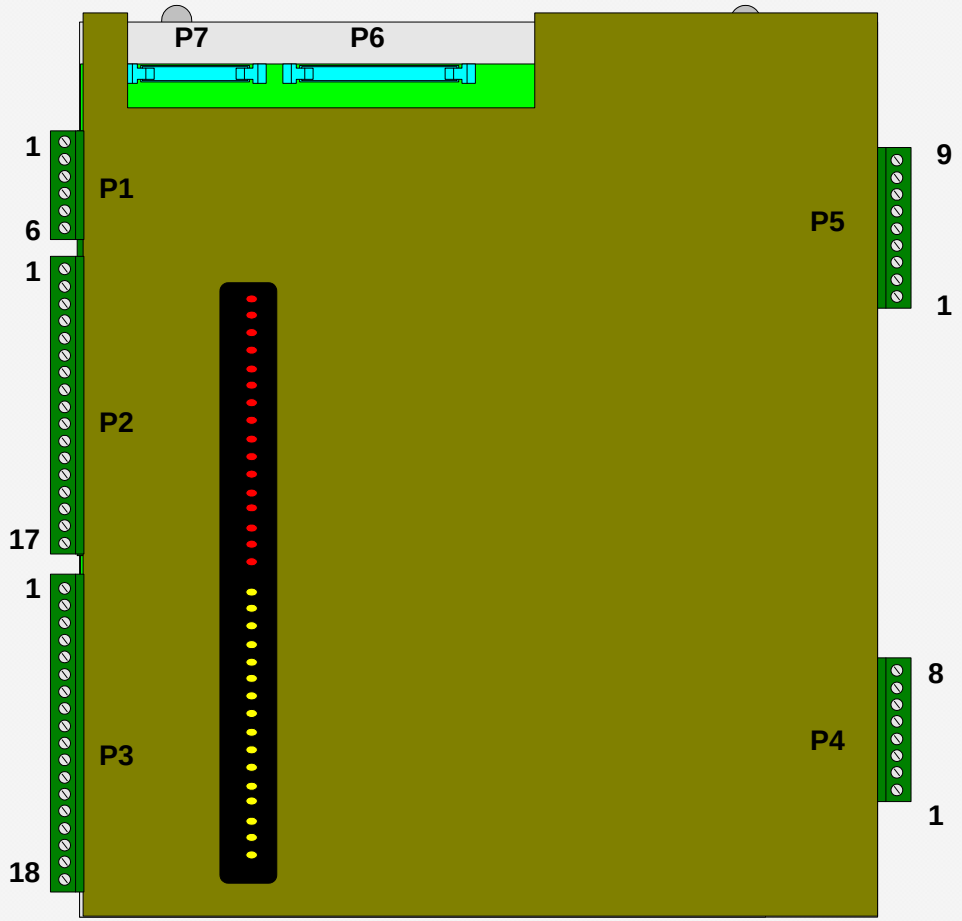
- 4 x 4 trigger points

Connectors (control)

Connectors P1,P2,P3,P4 and P5 are two-part terminals, for use with wires up to 1mm^2.

Connectors P6 is used internally to connect to the inverter power pack, and is not used for users connections.

Connector P7 is the RS232 port, for the connection of the WSP3 programming pendant, or a PC. A ribbon cable assembly is available for converting to the standard 9-way D-sub style of connector.



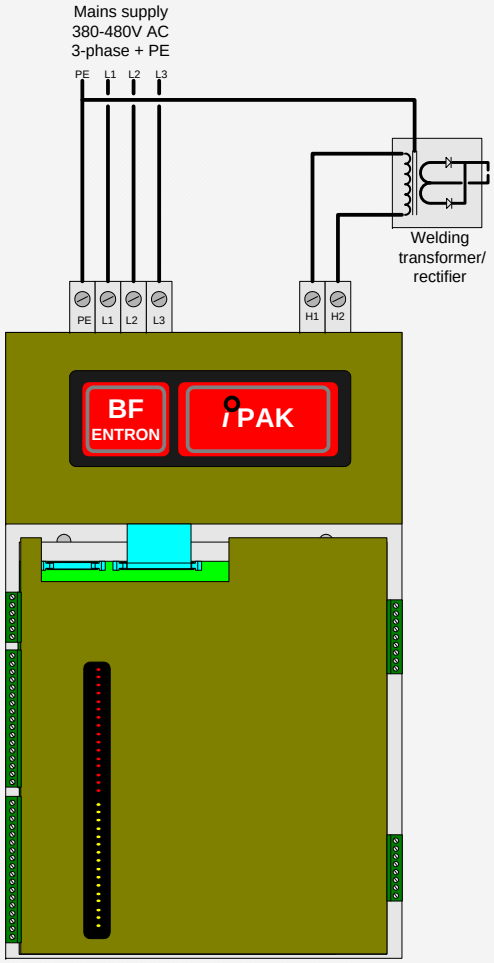
Connectors (power)

A 3-phase supply, via a suitable protective device (such as a circuit breaker) should be connected to the inverter as shown (Terminals L1,L2,L3,PE).

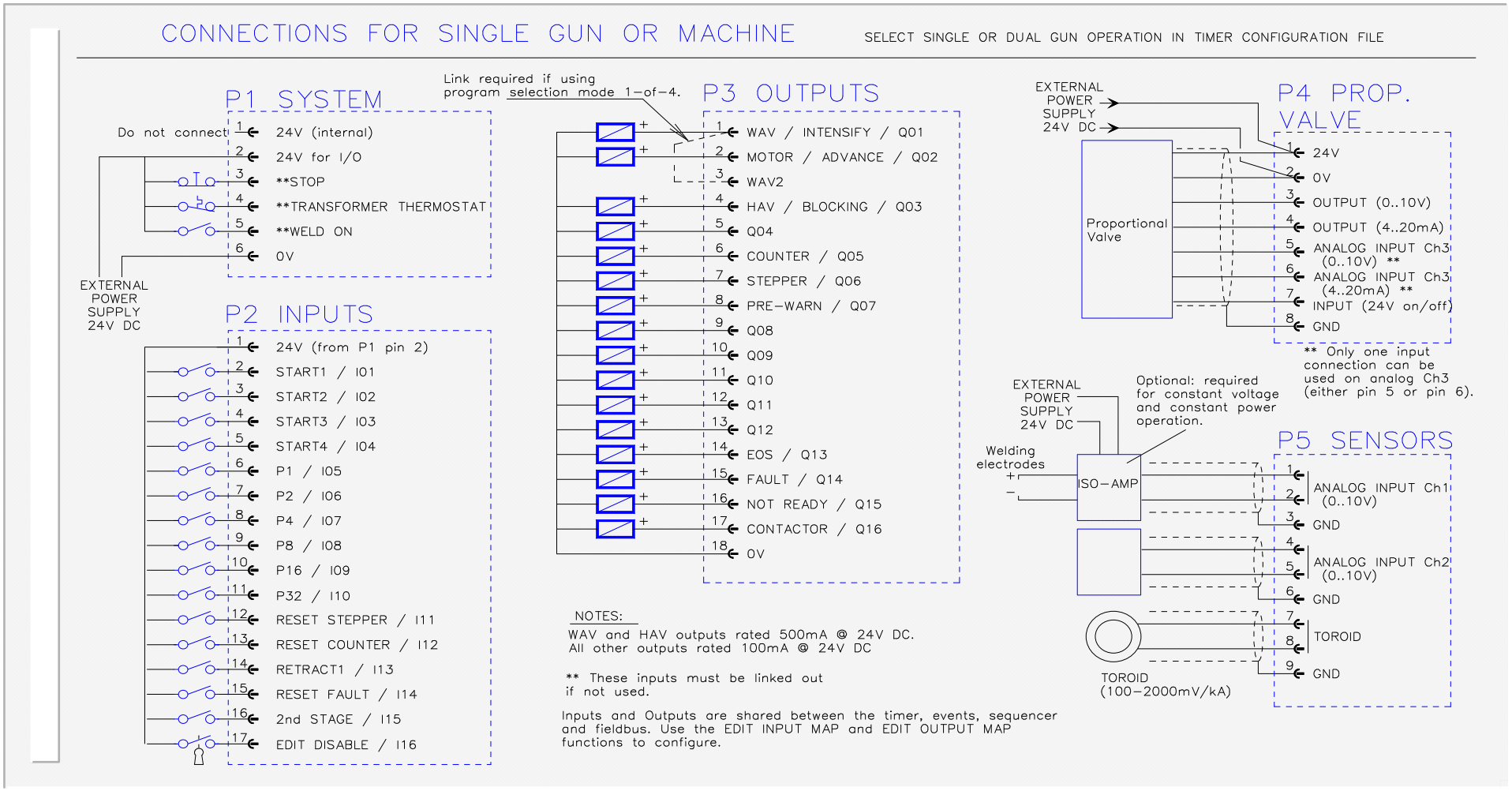
A suitable MF welding transformer/rectifier should be connected to the inverter at terminals H1,H2. The transformer must also be connected to the protective earth (PE).

Additional earthing and/or a protective device is required for the secondary circuit, depending on the application.

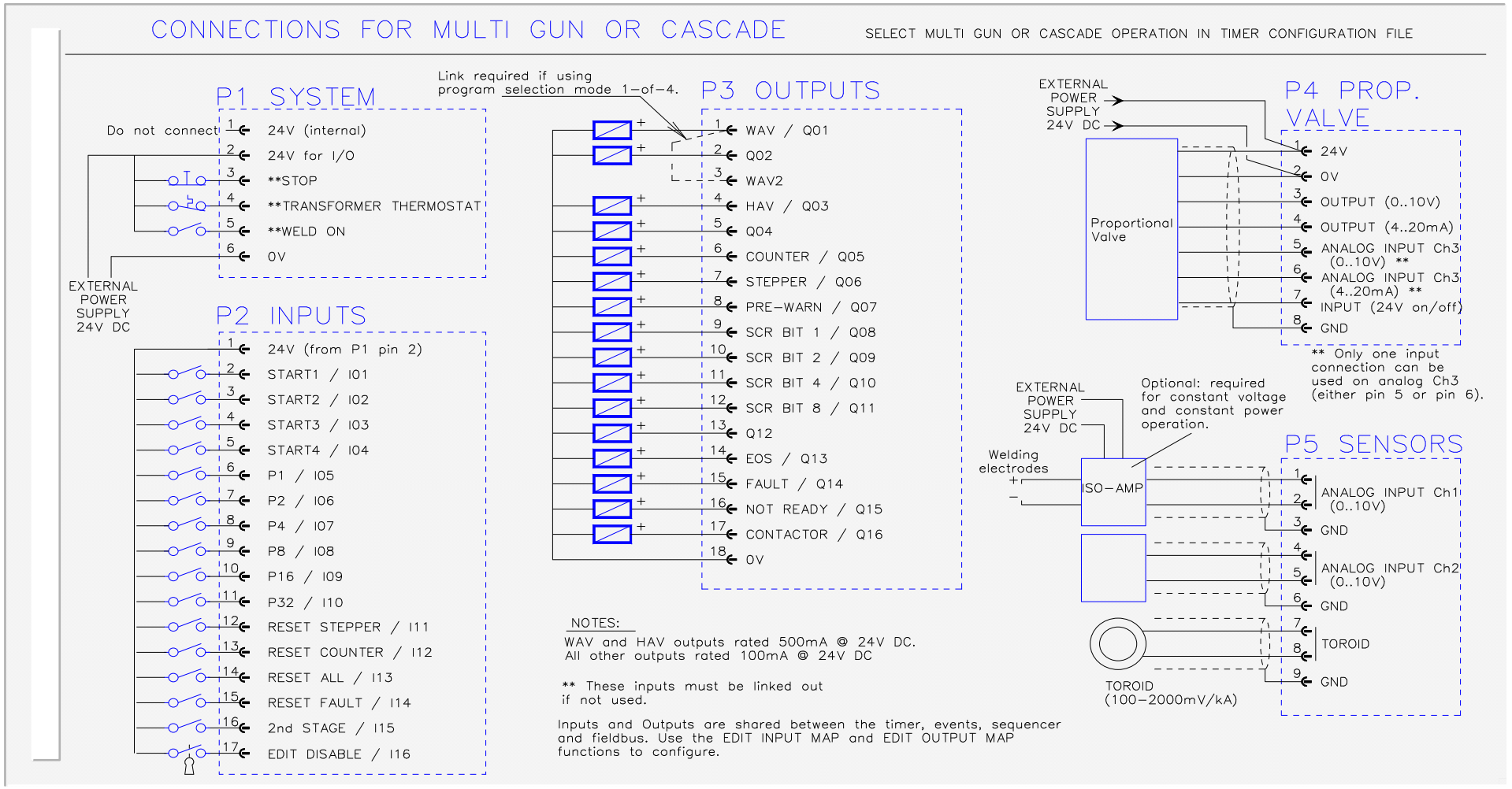
! These tasks must only be carried out by qualified personnel.



Users connections (discrete)

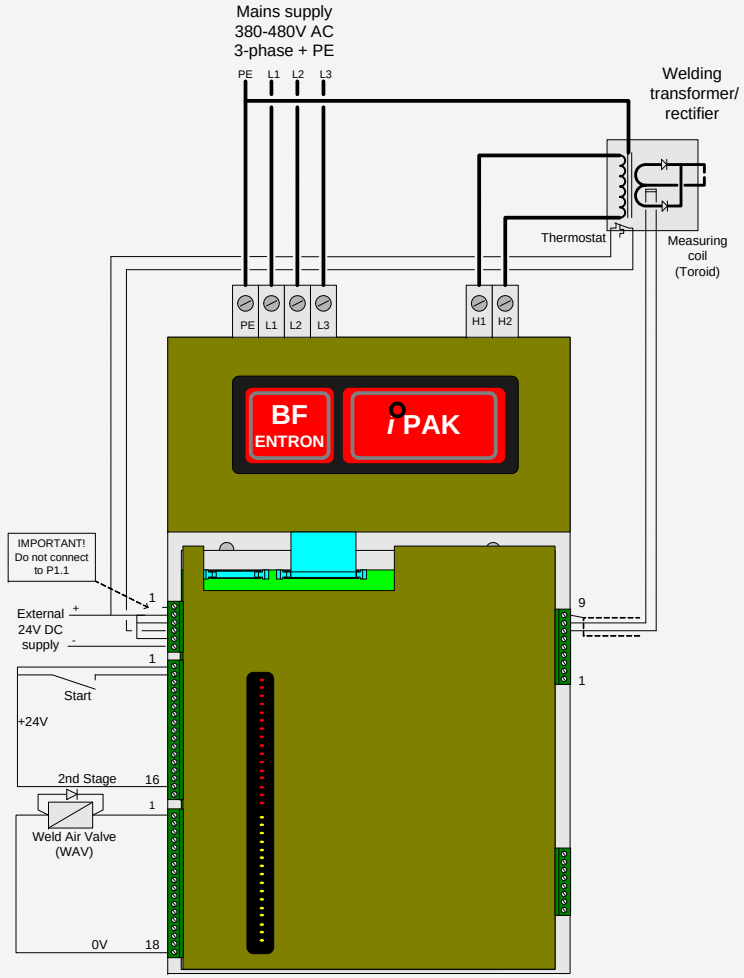


…users connections



Getting started

1. Make the basic connections as shown here. Note that you may require additional connections (see users connections), depending on your installation requirements, but the connection shown here are the most basic which are required in order to run the equipment.
2. Make sure that you have sufficient air pressure, and cooling water where necessary.
3. Switch on, then use the ‘Initialise all data’ function, to clear the iPAK’s memory.
4. Edit the configuration file: set ‘Regulation=primary’ and ‘Blanking=ON’.
5. Edit the calibration file: set the the ‘Max.primary amps’ and ‘S/P ratio’ parameters to suit your equipment (see edit calibration).
6. Edit program 0 to set up a basic weld sequence e.g. SQZ=500ms, W2=200ms, CCu mode, HLD=500ms, Pulses=1, all other intervals=0.
7. You should now be able to perform a welding operation. Begin by using the gun short-circuit (i.e.without metal to be welded). The timer should report the measured current on the diagnostic display.
8. Perform the calibration operation for the toroid sensitivity. Observe the current with an external meter. Set the program heat to give a typical value of welding current on the meter. Adjust the toroid sensitivity (in the calibration file) until the iPAK measurement agrees with the meter.
9. Perform the calibration operations for the inverter current (see edit calibration).
10. You can now proceed to make any other adjustments which may be required, and to set up programmes for welding.



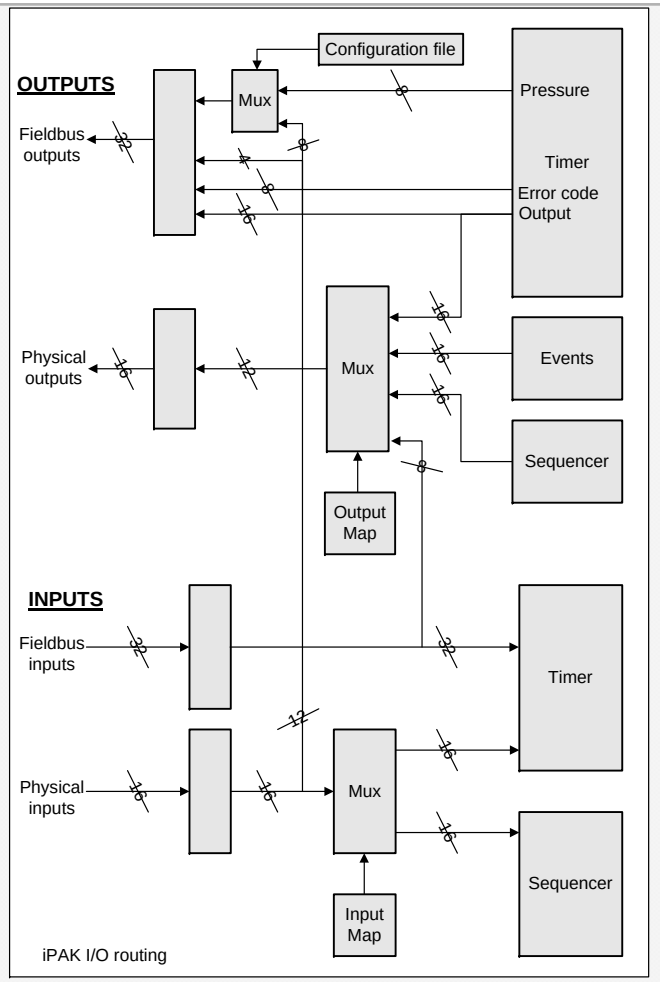
Operation with a fieldbus

iPAK 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 iPAK configuration.

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



...operation with a fieldbus

Single gun

INPUT from bus to timer

Bit No.	Function
0	START 1
1	START 2
2	START 3
3	START 4
4	2nd Stage
5	Weld on*
6	Reserved
7	Reserved
8	Reset counter 1
9	Reset stepper 1
10	Retract 1
11	Reserved
12	Reserved
13	Reserved
14	Reserved
15	Reset fault
16	Program bit 1
17	Program bit 2
18	Program bit 4
19	Program bit 8
20	Program bit 16
21	Program bit 32
22	Reserved
23	Reserved
24	Discrete output Q09
25	Discrete output Q10
26	Discrete output Q11
27	Discrete output Q12
28	Discrete output Q13
29	Discrete output Q14
30	Discrete output Q15
31	Discrete output Q16

OUTPUT from timer to bus

Bit No.	Function	Map=1	Map=2
0	Weld air valve 1 (WAV 1)		
1	Motor		
2	Retract air valve 1 (HAV 1)		
3	Reserved		
4	End of count 1		
5	End of stepper 1		
6	Prewarning		
7	Reserved		
8	Discrete input I5		
9	Discrete input I6		
10	Discrete input I7		
11	Discrete input I8		
12	End of sequence (EOS)		
13	Fault		
14	Not ready		
15	Contactor		
16	Error code bit 1		
17	Error code bit 2		
18	Error code bit 4		
19	Error code bit 8		
20	Error code bit 16		
21	Error code bit 32		
22	Error code bit 64		
23	Error code bit 128		
24		Pressure bit 1	Discrete input I9
25		Pressure bit 2	Discrete input I10
26		Pressure bit 4	Discrete input I11
27		Pressure bit 8	Discrete input I12
28		Pressure bit 16	Discrete input I13
29		Pressure bit 32	Discrete input I14
30		Pressure bit 64	Discrete input I15
31		Pressure bit 128	Discrete input I16

Dual gun

INPUT from bus to timer

Bit No.	Function
0	START 1
1	START 2
2	START 3
3	START 4
4	2nd Stage
5	Weld on*
6	Reserved
7	Reserved
8	Reset counter 1
9	Reset stepper 1
10	Retract 1
11	Reset counter 2
12	Reset stepper 2
13	Retract 2
14	Reserved
15	Reset fault
16	Program bit 1
17	Program bit 2
18	Program bit 4
19	Program bit 8
20	Program bit 16
21	Program bit 32
22	Reserved
23	Reserved
24	Discrete output Q09
25	Discrete output Q10
26	Discrete output Q11
27	Discrete output Q12
28	Discrete output Q13
29	Discrete output Q14
30	Discrete output Q15
31	Discrete output Q16

OUTPUT from timer to bus

Bit No.	Function	Map=1	Map=2
0	Weld air valve 1 (WAV 1)		
1	Weld air valve 2 (WAV 2)		
2	Retract air valve 1 (HAV 1)		
3	Retract air valve 2 (HAV 2)		
4	End of count 1		
5	End of stepper 1		
6	Prewarning 1		
7	End of count 2		
8	End of stepper 2		
9	Prewarning 2		
10	Discrete input I7		
11	Discrete input I8		
12	End of sequence (EOS)		
13	Fault		
14	Not ready		
15	Contactor		
16	Error code bit 1		
17	Error code bit 2		
18	Error code bit 4		
19	Error code bit 8		
20	Error code bit 16		
21	Error code bit 32		
22	Error code bit 64		
23	Error code bit 128		
24		Pressure bit 1	Discrete input I9
25		Pressure bit 2	Discrete input I10
26		Pressure bit 4	Discrete input I11
27		Pressure bit 8	Discrete input I12
28		Pressure bit 16	Discrete input I13
29		Pressure bit 32	Discrete input I14
30		Pressure bit 64	Discrete input I15
31		Pressure bit 128	Discrete input I16

*The discrete **Weld on** input must also be on to enable welding.

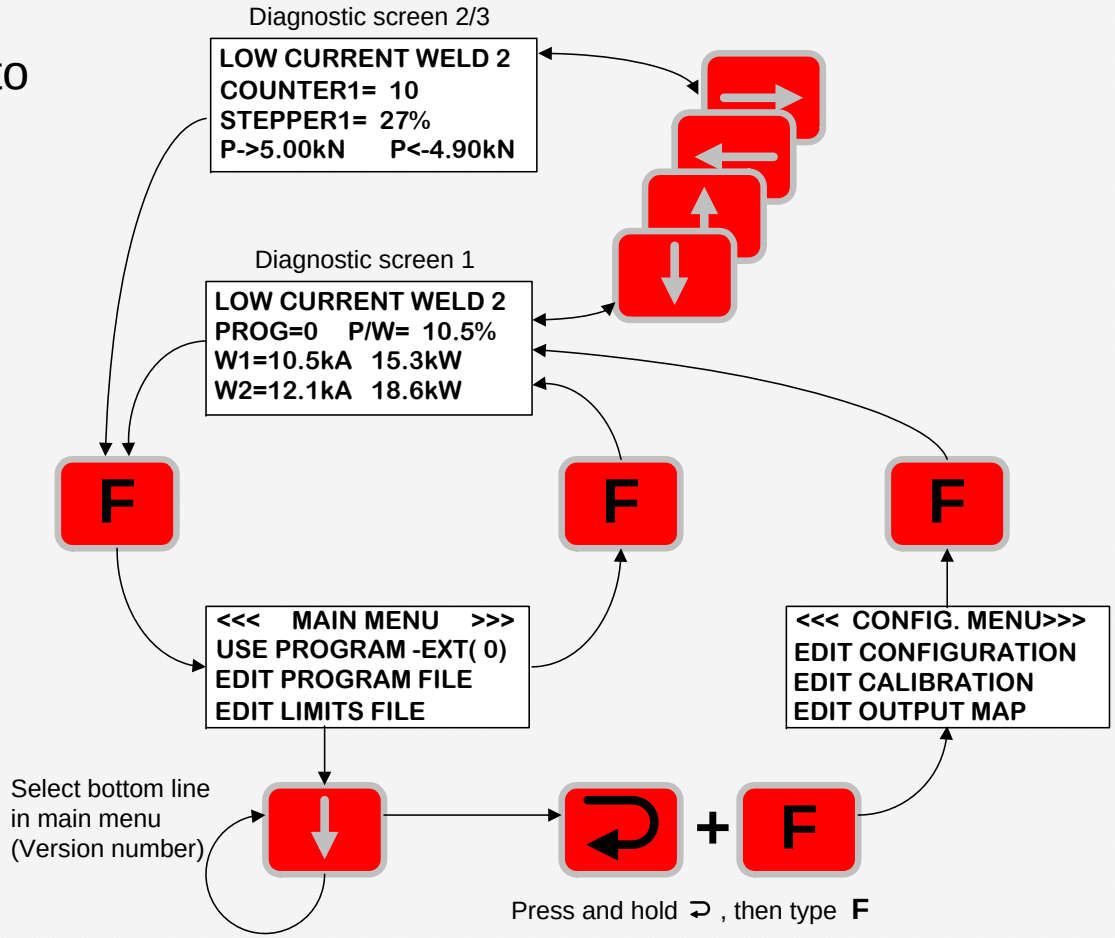
Keypad

Using the keypad

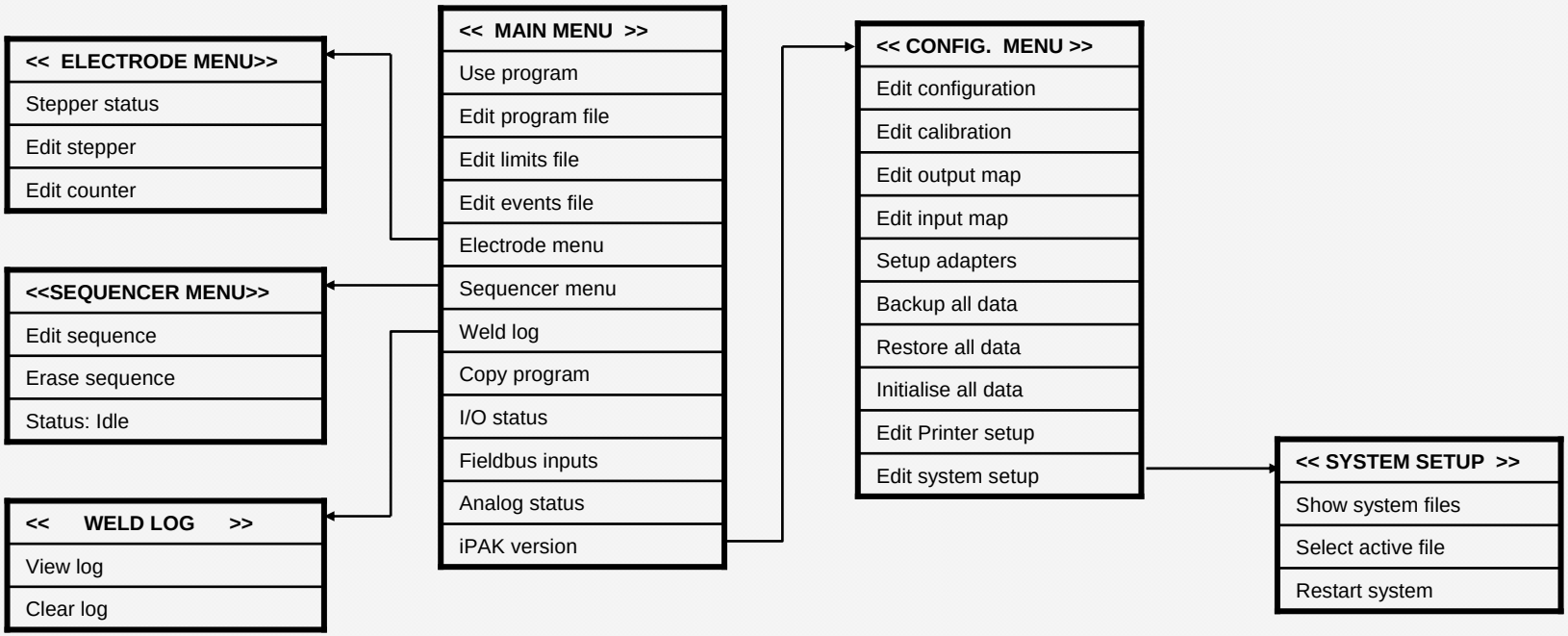
- Press the **F** (function) key to return to the previous screen, or to move between menu screens (see menus).
- The selected function or parameter will flash.
- Use the ⇦ ⇧ ⇩ ⇨ keys to select a different function or parameter. The visible window will scroll when required.
- Press the ↵ key to access 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

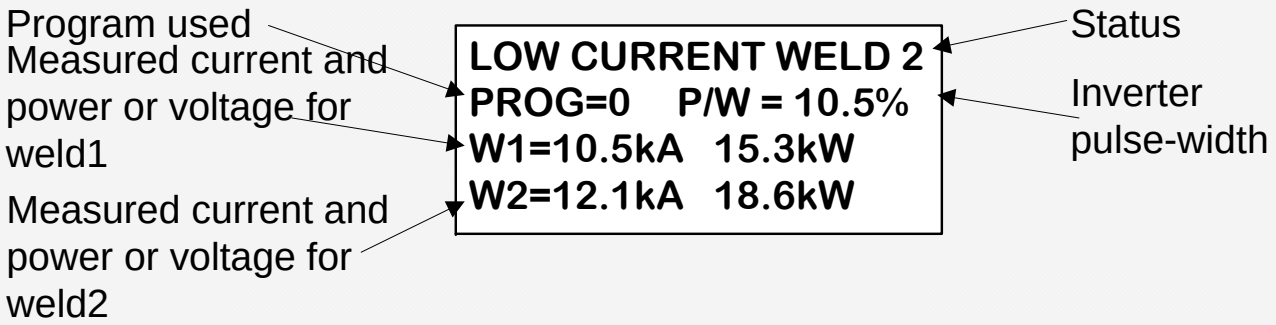
The various functions of the iPAK are arranged into a set of menus and screens. This diagram shows how these are organized and accessed:



..menus


<< ELECTRODE MENU>>
Stepper status
Edit stepper
Edit counter
<<SEQUENCER MENU>>
Edit sequence
Erase sequence
Status: Idle
<< WELD LOG >>
View log
Clear log
<< MAIN MENU >>
Use program
Edit program file
Edit limits file
Edit events file
Electrode menu
Sequencer menu
Weld log
Copy program
I/O status
Fieldbus inputs
Analog status
iPAK version
<< CONFIG. MENU >>
Edit configuration
Edit calibration
Edit output map
Edit input map
Setup adapters
Backup all data
Restore all data
Initialise all data
Edit Printer setup
Edit system setup
<< SYSTEM SETUP >>
Show system files
Select active file
Restart system

Diagnostic screen 1

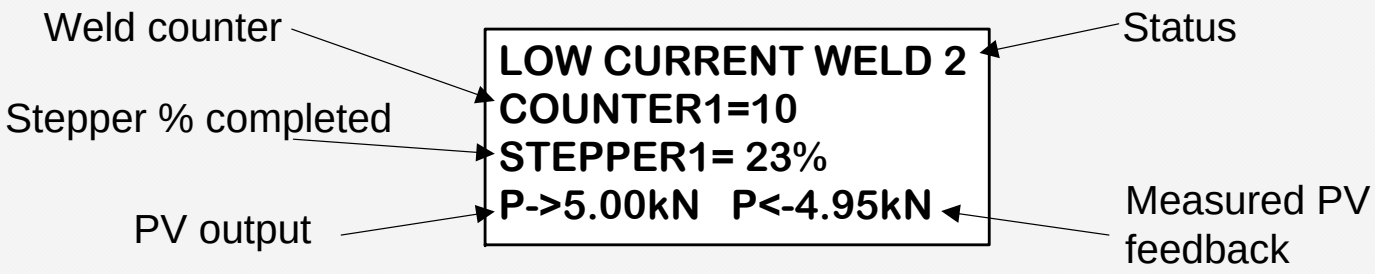


Note that some elements may not be visible, if that feature is not being used.

Status: diagnostic error messages. If more than one exists, these are flashed sequentially.
Program used: this is the program number that was last used.
Pulse-width: the inverter output pulse width, as a percentage of maximum, measured during the last weld.
Measured current: the RMS current measured during the last weld.
Measured voltage: the RMS voltage measured during the last weld.
Measured power: the RMS power 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, or ⇧ ⇩ to change to diagnostic screen 3.

Diagnostic screen 2

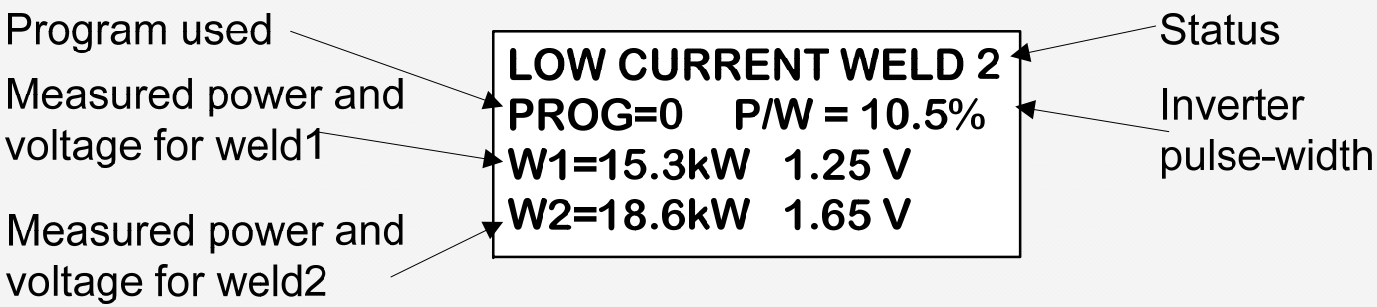


Note that some elements may not be visible, if that feature is not being used.

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 1.

Diagnostic screen 3



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.
Pulse-width: the inverter output pulse width, as a percentage of maximum, measured during the last weld.
Measured voltage: the RMS voltage measured during the last weld.
Measured power: the RMS power measured during the last weld.

This screen is particularly useful when performing the inverter calibration, as it shows the recorded values which will be used (see edit calibration).

- 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 1.

Status / error codes

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

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

Error code	Description	Advice
0	No errors	
1	Configuration error	Edit the configuration file
2	Calibration error	Check parameters in calibration file
3	LMI configuration error	Check connections on LMI modules
4	LMI error	See indicator panel on LMI modules
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	Power-Pak hot	Check inverter cooling (air/water). Reduce duty.
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

Error code	Description	Advice
33		
34		
35		
36		
37		
38		
39		
40		
41	Low pressure	Check operation of PV. Check inlet pressure.
42	High pressure	Check operation of PV. Check inlet pressure.
43	Transformer hot	Check water flow to welding transformer / Reduce duty
44	Stop	Close the external Stop circuit
45	Fan fail	Check inverter fans
46	Waiting for pressure	Check operation of PV. Check inlet pressure.
47	Switch off START	START must be off after a STOP or power-up condition
48	No current(weld off)	Close Weld-on switch
49	Max. pulse width	Check secondary circuit / Reduce heat/current
50	Max. current	Check secondary circuit / Reduce heat/current
51	Short circuit	Check cables from inverter to welding transformer/ Check transformer
52	Ground fault	Check cables from inverter to welding transformer/ Check transformer
53	DC bus failure	Check mains supply to inverter
54	Power-pak not ready	Check control connections to inverter OR wait for power-on delay
55		
56		
57	No voltage signal	Check connections to electrodes and isolation amp.
58	Low power (weld 1)	Check secondary circuit or adjust parameters
59	Low power (weld 2)	Check secondary circuit or adjust parameters
60	High power (weld 1)	Check secondary circuit or adjust parameters
61	High power (weld 2)	Check secondary circuit or adjust parameters
62		
63		
64		

…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 1 prewarn	
74	Stepper 2 prewarn	
75	Stepper 3 prewarn	
76	Stepper 4 prewarn	
77	Stepper 5 prewarn	
78	Stepper 6 prewarn	
79	Stepper 7 prewarn	
80	Stepper 8 prewarn	
81	Counter 1 end	Reset counter 1
82	Counter 2 end	Reset counter 2
83	Counter 3 end	Reset counter 3
84	Counter 4 end	Reset counter 4
85	Counter 5 end	Reset counter 5
86	Counter 6 end	Reset counter 6
87	Counter 7 end	Reset counter 7
88	Counter 8 end	Reset counter 8
89	Tip dress 1	Dress gun 1 and activate reset counter input
90	Tip dress 2	Dress gun 2 and activate reset counter input
91	Tip dress 3	Dress gun 3 and activate reset counter input
92	Tip dress 4	Dress gun 4 and activate reset counter input
93	Tip dress 5	Dress gun 5 and activate reset counter input
94	Tip dress 6	Dress gun 6 and activate reset counter input
95	Tip dress 7	Dress gun 7 and activate reset counter input
96	Tip dress 8	Dress gun 8 and activate reset counter input

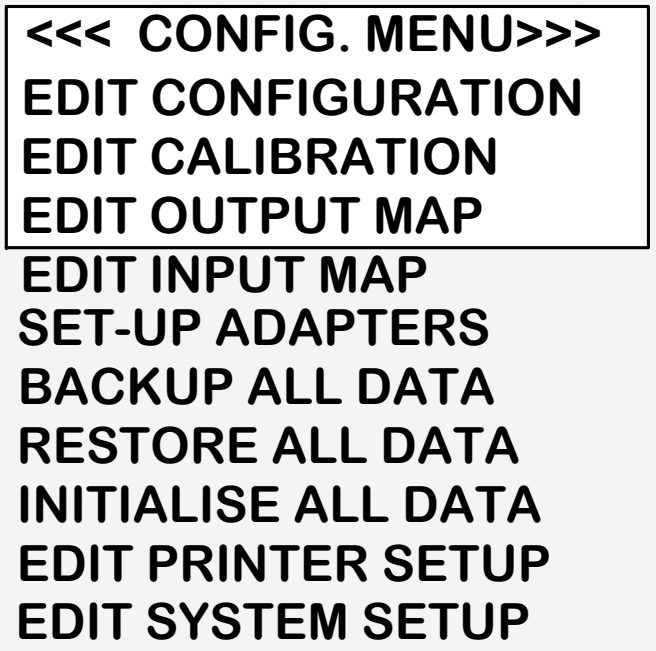
LMI diagnostics

LMI modules each have their own diagnostic indicators. When an iPAK CPU registers an LMI error, refer to the red LED indicators on the modules for a more details. During normal operation, only the +24V (green) LED will be on.

RESET(ON)	The module is not initialised – check connections, check fuse in CPU unit. This LED will light during power-up and whenever a 'fault reset' is given.
RESET (flashing)	There is an error in another module, upstream of this one.
FAN	Check the operation of the fans in the module.
THERMAL	The module is too hot. Check the supply of cooling water.
BUS VOLTAGE	There is insufficient DC bus voltage. Check mains supply.
SHORT CIRCUIT	Check cables from inverter to transformer. Check transformer.
MAX. CURRENT	Reduce heat/current demand in program.
+24V (green)	Always on – indicates status of internal power supply for module.

•Press  to reset faults (same action as external input).

Configuration menu



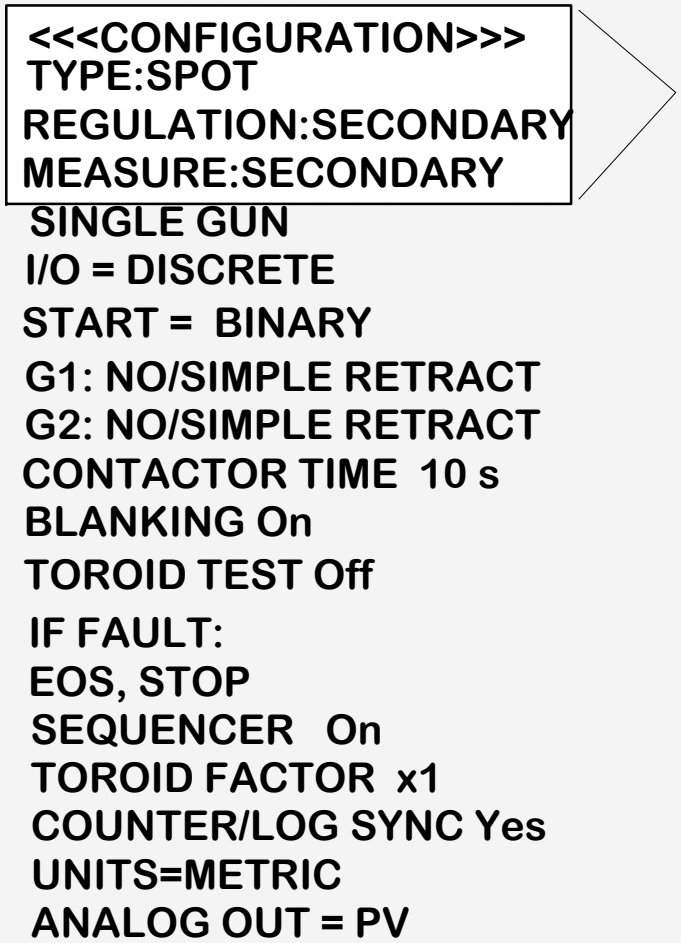
Visible window

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

You can restart the iPAK 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



Visible window

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

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

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

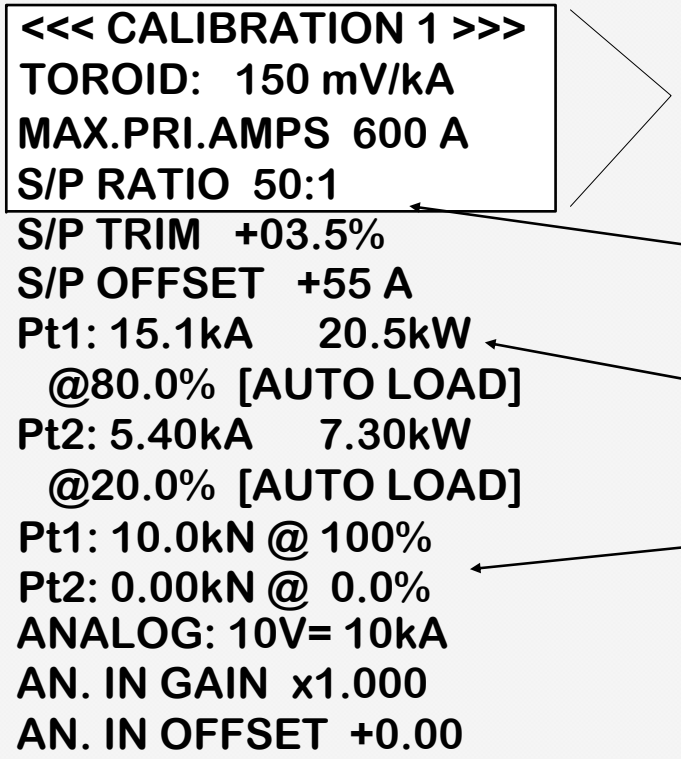
…edit configuration

- Sequence type:**Spot / Roll-spot / Seam(2-heat) / Seam(pre-heat)**.
- Regulation**(Primary/Secondary):** Specifies where the inverter closed loop control feedback is obtained from.
- Measure**(Primary/Secondary):** Specifies where the displayed current measurements are obtained from.
- **Single gun / Dual gun / OHMA gun**: the number/type of welding guns to be controlled.
- I/O Source:**Discrete / Fieldbus(map 1) / Fieldbus(map2)**. Specifies how the iPAK obtains input signals (outputs 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 start and program selection.
- 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 50 ms 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 iPAK is idle. The resistance must lie between 10 and 300 Ohms. Values outside this range will prevent the iPAK from starting.
- 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.

……edit configuration

- 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..10):** the ratio of the external attenuator which is required to measure currents>60kA
- Count/Log sync **(Yes/No):** If set to **Yes**, then the log will be cleared when a counter is reset. If set to **No**, then the log and counters are independent.
- Units **(METRIC/IMPERIAL):** this selects the system of units displayed (kN/lbf, mm/inch etc).
- Analog out **(PV/Current):** this selects the function on the analog output at P4. 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 (pin 3) and 4..20mA (pin 4), but both pins have the same source function.

Edit calibration



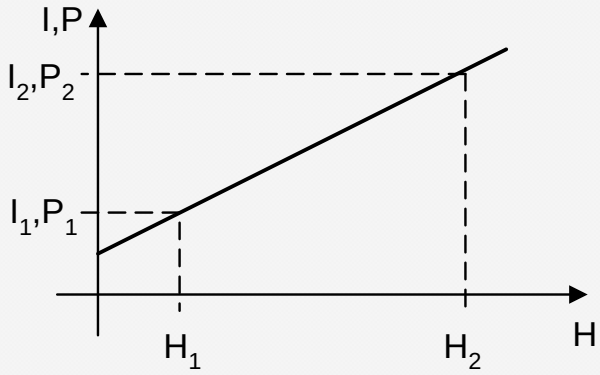
Visible window

Note: there are separate calibration files for each gun in a dual/multi-gun system.

- **Toroid:** sensitivity of the measuring coil (toroid), expressed in mV/kA.
- **Important:** When calibrating the toroid sensitivity, configure for primary regulation and use CCu mode for welding.
- **Max.Pri.Amps:** this must be set to the maximum transformer primary current, or maximum inverter current, whichever is the smaller.
- **S/P ratio:** this must be set equal to the turns-ratio of the welding transformer.
- **S/P Trim & S/P Offset:** Use to calibrate primary current measurements.
- **Pt1/Pt2:** See next page for details.
- **Pt1/Pt2:** 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.
- **Analog:** the value of current which corresponds to full scale (10V/20mA) from the analog output at P4.
- **An.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.
- **An.in offset:** value of the voltage at the analog input (ch 3 only) for a zero reading.

…calibration

•**Pt1/Pt2:** the relationship between the %heat output and actual current/power is expressed by entering two ‘test’ point values, which then define straight-line relationships.



To calibrate the inverter, do the following procedure:

- Do a short-circuit weld at a low heat (H_1) in CCu mode. The iPAK measures the secondary current(I_1) and power(P_1). These values can be observed on the diagnostic screen, or via the pop-up meter window.
- Select [AUTO LOAD] for point 1 (Pt1) on the calibration screen, then press the ↵ key. This will automatically load the measured values into the calibration file.
- Repeat this procedure for point 2 (Pt2), this time using a high heat (H_2) in CCu mode. The iPAK measures the secondary current(I_2) and power(P_2). These values can be observed on the diagnostic screen, or via the pop-up meter window.
- Select [AUTO LOAD] for point 2 (Pt2) on the calibration screen, then press the ↵ key. This will automatically load the measured values into the calibration file.

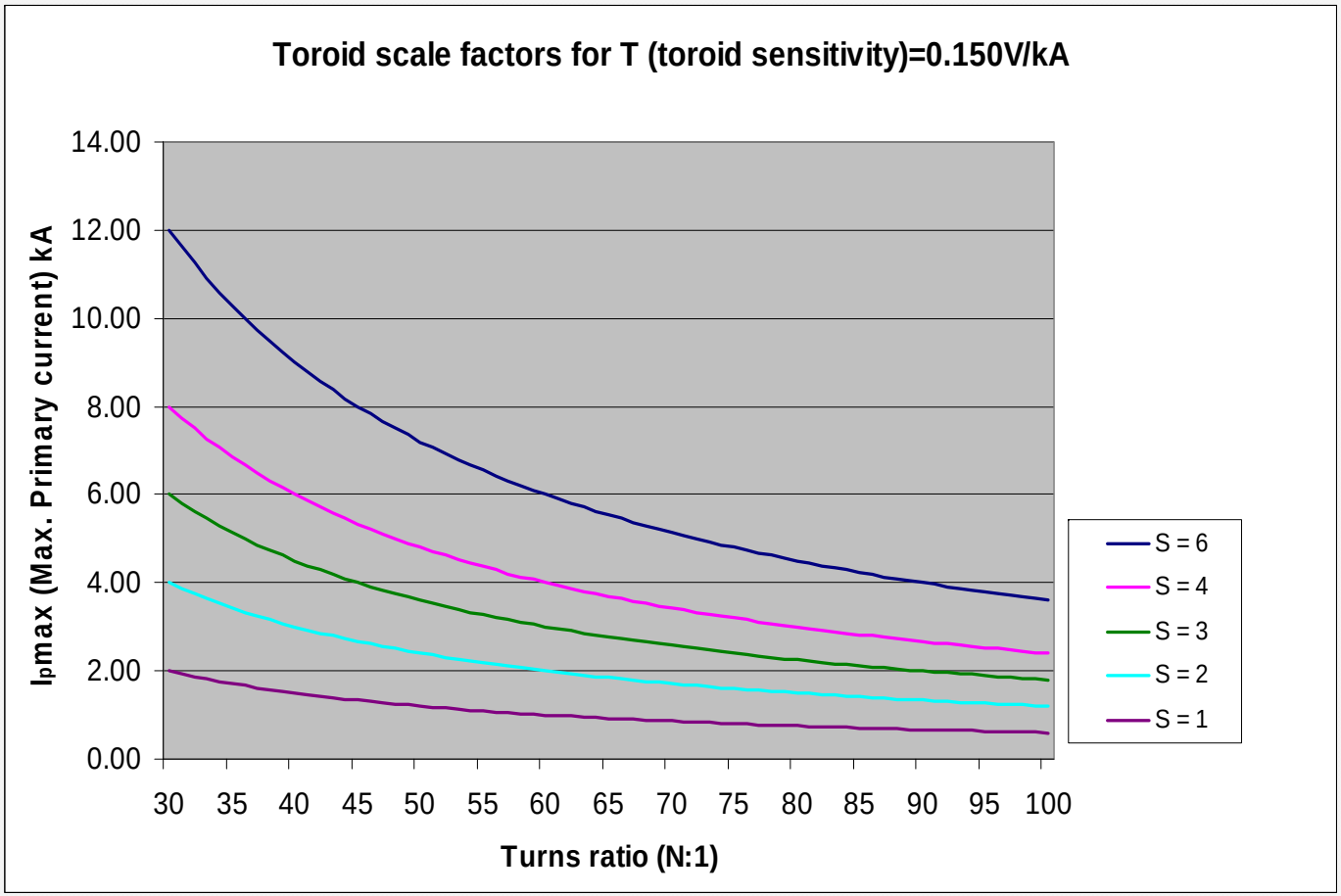
…calibration error

Use the graphs to look up the maximum permitted primary current setting for any given turns ratio and scale factor.
Important: the 'scale factor' setting must match the external toroid attenuator (TAM/1) configuration.

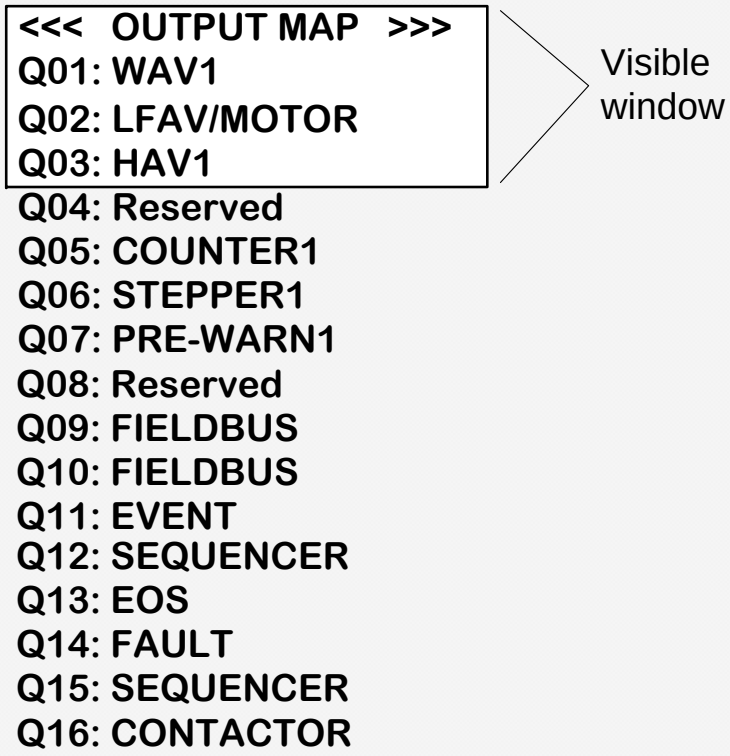
The exact relationship (which must be satisfied in order to avoid a 'calibration error') is:

$I_p max * N * T <= S * 9$

If this is set incorrectly, this will result in a ‘calibration error’ fault (error code E2).



Edit Output Map



Each output may be independently set up as *either*:

- the standard function assigned (see users connections).

or

- as an EVENT output.

or

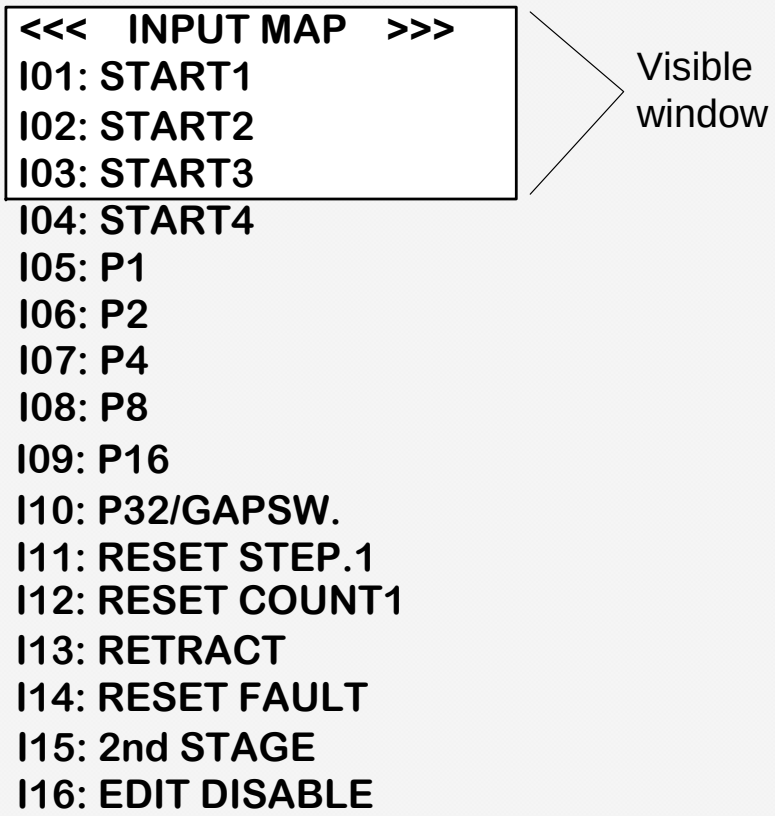
- as a SEQUENCER output.

or

- as a FIELDBUS output (outputs 9-16 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



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 input I01 has a special function, and may only be mapped to standard.

Set-up Adapters

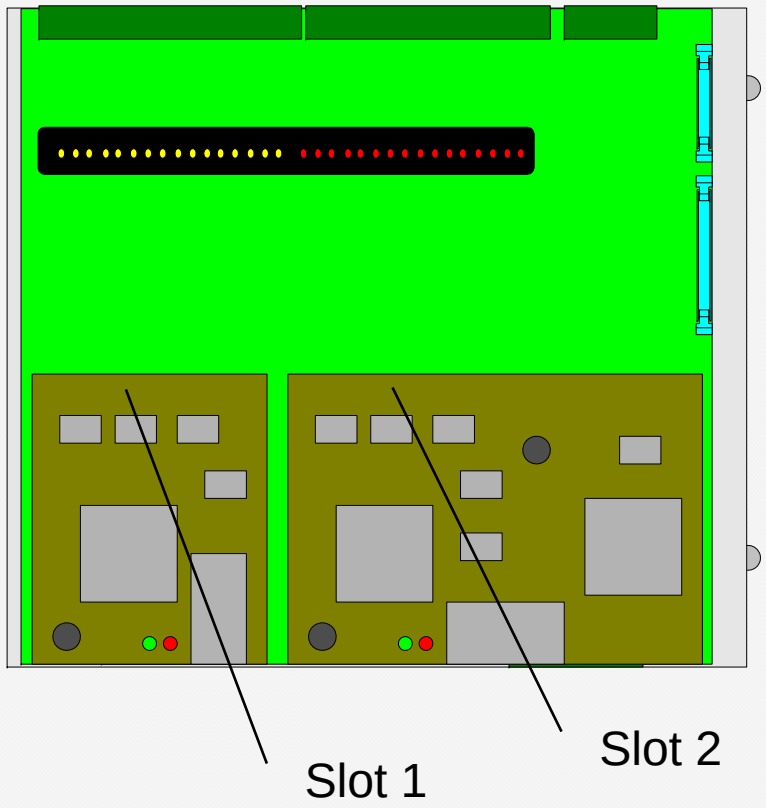
```
<<<    ADAPTERS    >>>
S1   Ethernet 1.01
S2   Profibus-DP
```

The iPAK CPU 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 CPU with cover removed and two adapter cards fitted.



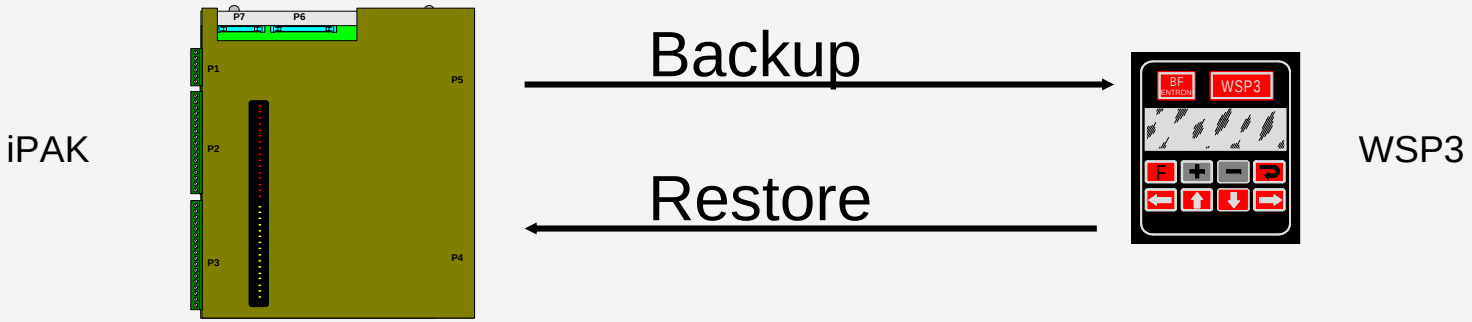
Backup/Restore

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

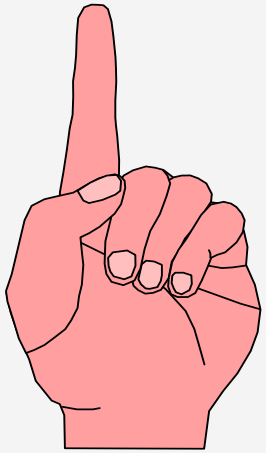
Restore: Use this function to restore all of your data in the iPAK, from a backup stored in the WSP3 pendant. Note that this operation will overwrite all data which was previously stored in the iPAK. After the restore operation, the backup remains in the WSP3.

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 iPAK).



Initialise all data

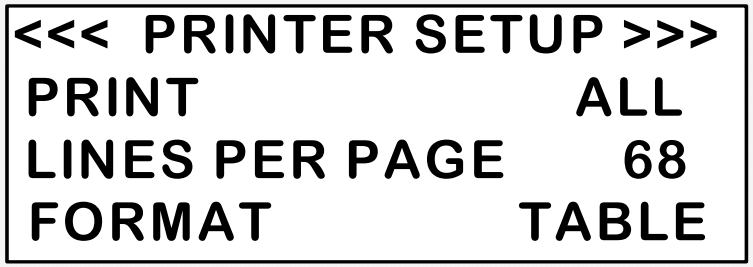
The **Initialise** function provides a convenient means of setting all of the data in the iPAK to a known initial state. This can be useful when first setting up a system.



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

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

Edit Printer setup



You can use this function to send measurements from each weld to a printer, PC or other data logging device. After setting the PRINT parameter, unplug the WSP3 pendant and connect the printer (otherwise you will see the print characters on the WSP3 screen). To use the WSP3 again, plug it back in, and press F.

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

…print format :table

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

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

…print format :ASCII-HEX

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

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

where

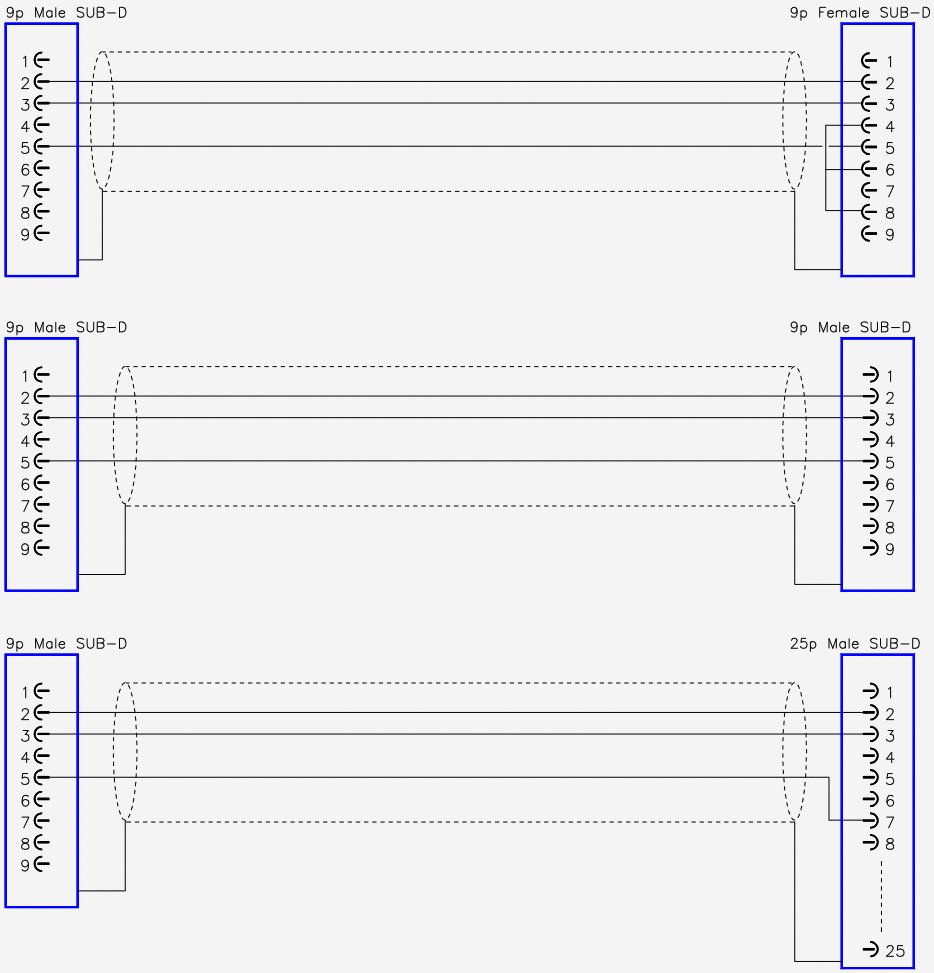
COUNT=value in counter after weld (4 characters).
PROG=program number used for weld (2 characters).
CURRENT1=current measured during weld1 interval (4 characters). Units = Amps.
CURRENT2= current measured during weld2 interval (4 characters). Units = Amps
PRESSURE=pressure measured at end of weld (4 characters). Units = 0.01 kN / 1 lbf
STATUS=24 characters.
CR= Carriage return (hex 0D).

All data is leading zero padded, to ensure a fixed-length message (43 characters, including CR).
All data is sent most significant digit first, and in ASCII-HEX format.
i.e. data=2003 (decimal) =07D3(hex)
characters sent= [0][7][D][3]
ASCII equiv.=[hex 30][hex 37][hex 45][hex 33]

The STATUS field is a 96 bit array of 1-bit flags, encoded as shown on page24/24(status/error messages).

…printer connections

iPAK



PC com port

Printer

9 pin serial port

Printer

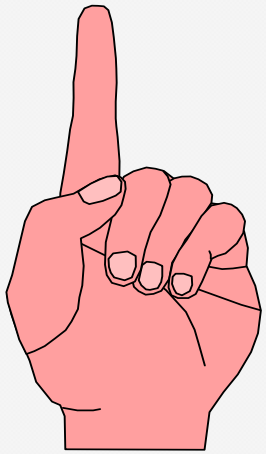
25 pin serial port

Port settings:
19200 Baud
8 Data bits
1 Start bit
1 Stop bit
No parity
No handshake

System set-up menu

```
<<<  SYSTEM SETUP >>>
SHOW SYSTEM FILES
SELECT ACTIVE FILE
RESTART SYSTEM
```

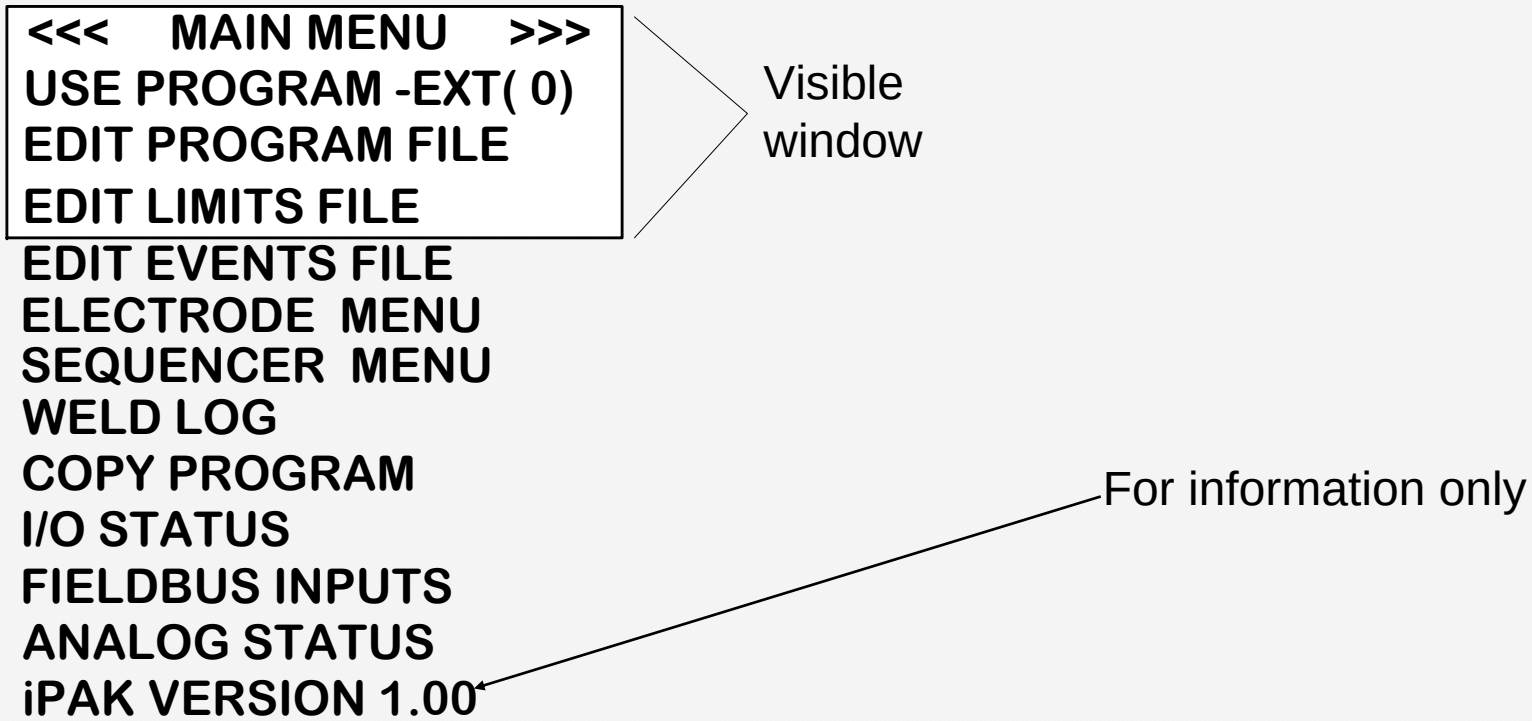
The **iPAK CPU** is equipped with two memories, which can be used to store two versions of the operating firmware files. The Edit system set-up menu provides a number of functions for examining and selecting these files.



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

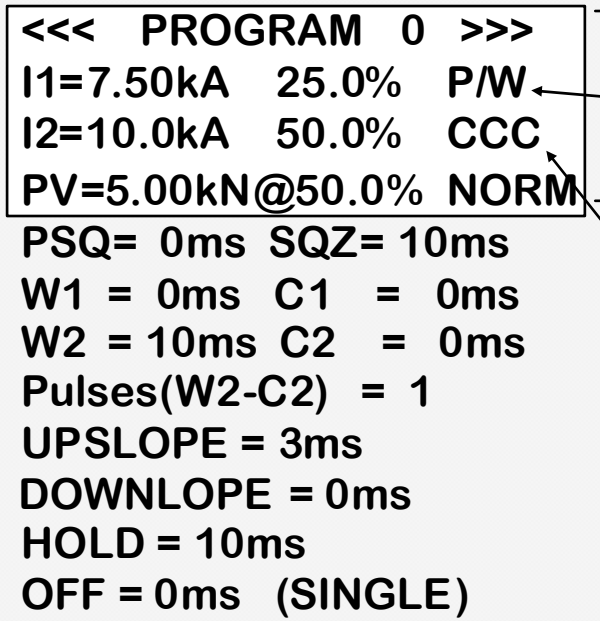
Note: The iPAK will not operate while this menu is selected.

Main 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 program



Visible window

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

P/W= Constant **P**ulse-**W**idth mode**.** The current and heat parameters are independently adjustable. The inverter pulse-width is fixed. The current parameter is used for monitoring only.

CCu=**C**onstant **C**urrent **U**ncalibrated mode. The current and heat parameters are independently adjustable. Actual current is determined by the inverter. The current parameter is used for monitoring only.

CCC=**C**onstant **C**urrent **C**alibrated mode. The current parameter (in kA) is adjustable, but the heat is automatically determined by the iPAK from the calibration data.

CV*=**C**onstant **V**oltage mode. The current parameter is replaced with the voltage parameter. Set up this mode by first using the P/W or CCu mode to determine the voltage required to weld (use the pop-up meter), then select CV and enter this value into the voltage parameter.

POW*=Constant **POW**er mode. The power parameter (in kW) is adjustable, but the heat is automatically determined by the iPAK from the calibration data.

*External isolation amplifier is required for these modes.

..edit program

```
<<<  PROGRAM  0  >>>
I1=7.50kA   25.0%   P/W
I2=10.0kA   50.0%   CCC
PV=5.00kN@50.0%  NORM
PSQ=  0ms  SQZ= 10ms
W1  =  0ms   C1   =   0ms
W2  = 10ms  C2   =   0ms
Pulses(W2-C2)   =  1
UPSLOPE = 3ms
DOWNLOPE = 0ms
HOLD = 10ms
OFF = 0ms   (SINGLE)
```

Visible window

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

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’.

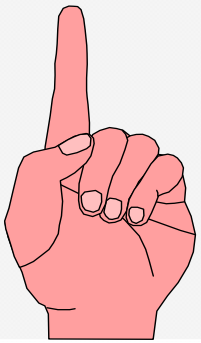
If the OHMA system is selected, additional timing parameters will be shown.

….edit program(seam)

<<< PROGRAM 0 >>>
I1=7.50kA 25.0% P/W
I2=10.0kA 50.0% CCC
PV=5.00kN@50.0%
PSQ= 0ms SQZ = 10ms
W1 = 0ms C1 = 0ms
W2 = 10ms C2 = 0ms
UPSLOPE = 3ms
DOWNLOPE = 0ms
HOLD = 10ms

Visible window

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



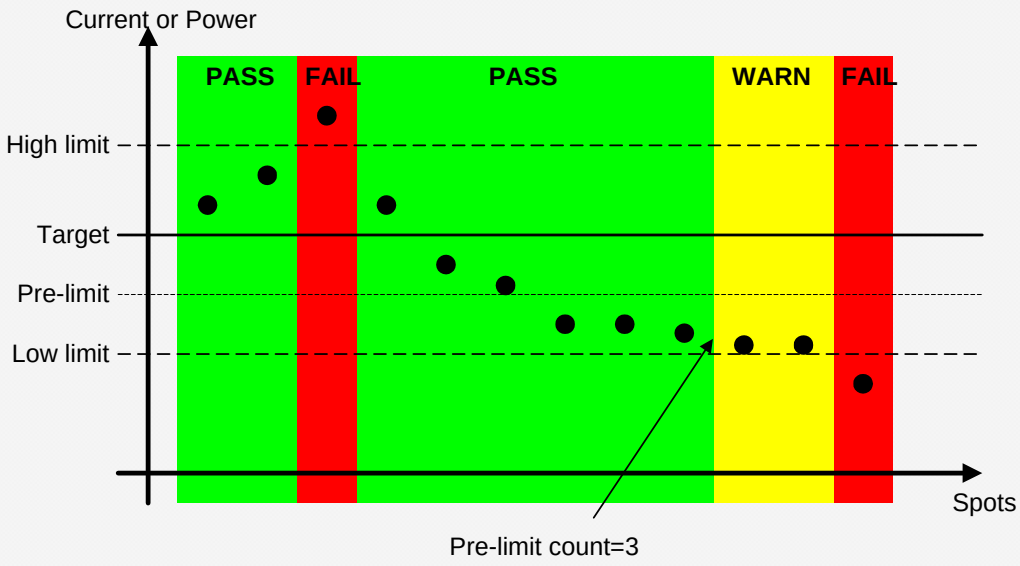
CAUTION! When using an an MF system for seam-welding, the duty is effectively 100%. Make sure that the transformer/rectifier are correctly specified for this duty.

Edit limits

```
<<<  LIMITS PROG  0  >>>
kA/kW: MONITOR On
LOW1=15%   HIGH1=10%
PRE-LIMIT1= 5%
LOW2=10%   HIGH2= 8%
PRE-LIMIT2= 5%
PRE-LIMIT COUNT =  3
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 message is produced.



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

Visible window

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

- Each welding program may have up to 4 events defined.
- Each event can turn one output on or off.
- To disable an event, set its output to '?'.

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

Note. Events cannot be used when seam welding.

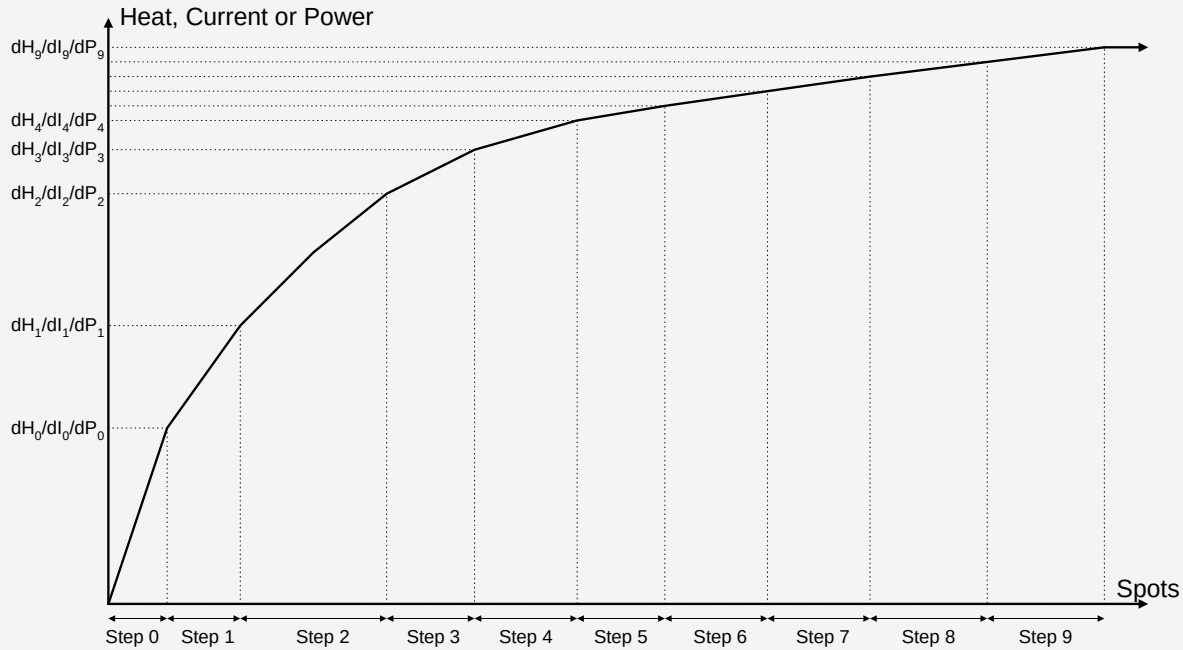
Electrode menu

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

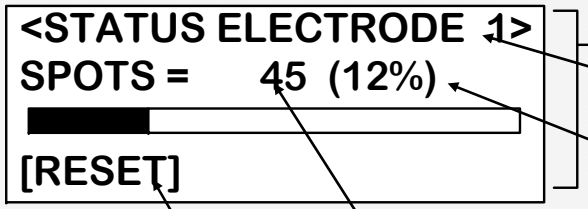
Electrode management is provided via a combination of stepper and counter functions.

The stepper provides a means of gradually increasing the current, to compensate for electrode wear. Two steppers are provided, one per gun.

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



Electrode status



Visible window

Select 1 for gun 1, or 2 for gun 2 (dual-gun mode only).

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

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

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

dH= additional %heat being applied (+HEAT from table).
dI= additional current being applied.(+A from table).
dP=additional power being applied(+W from table).

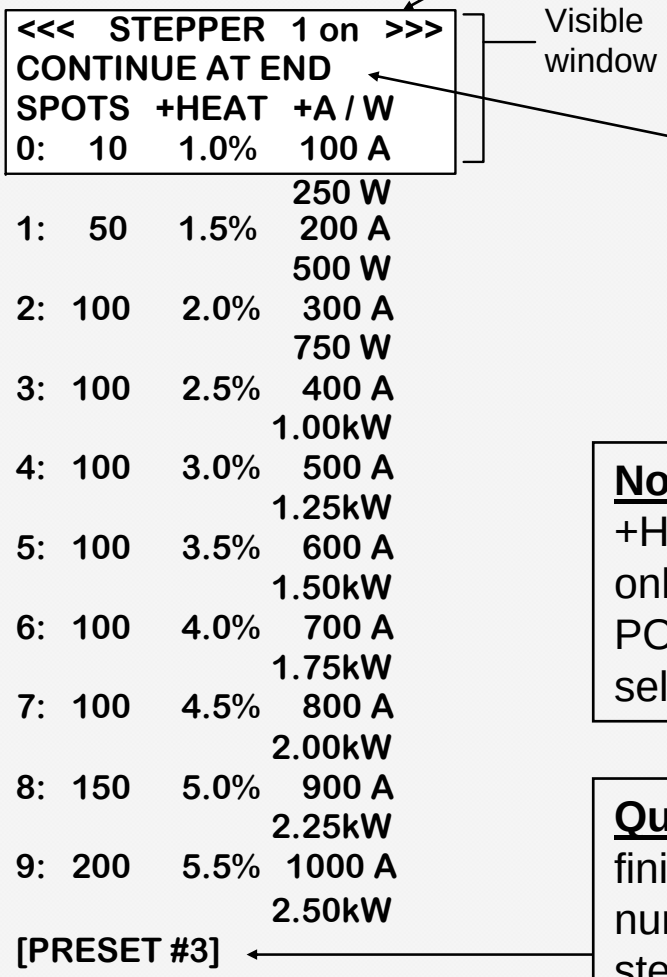
Outputs:

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



Visible window

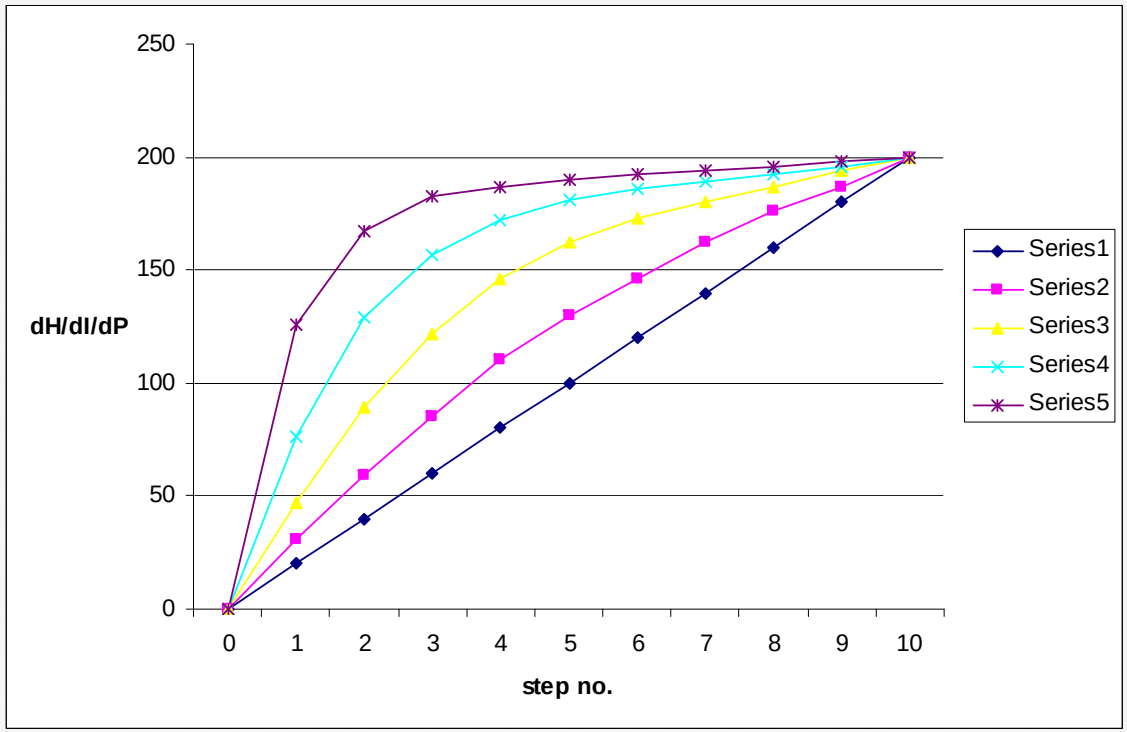
Enable or disable the stepper.

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.

Note: P/W and CCu modes will make use of both the +HEAT(dH) and +AMPS(dI) parameters. CCC mode uses only the +A(dI) parameter, as the heat is self-adjusting. POW mode uses only the +W(dP) parameter, as the heat is self-adjusting.

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.

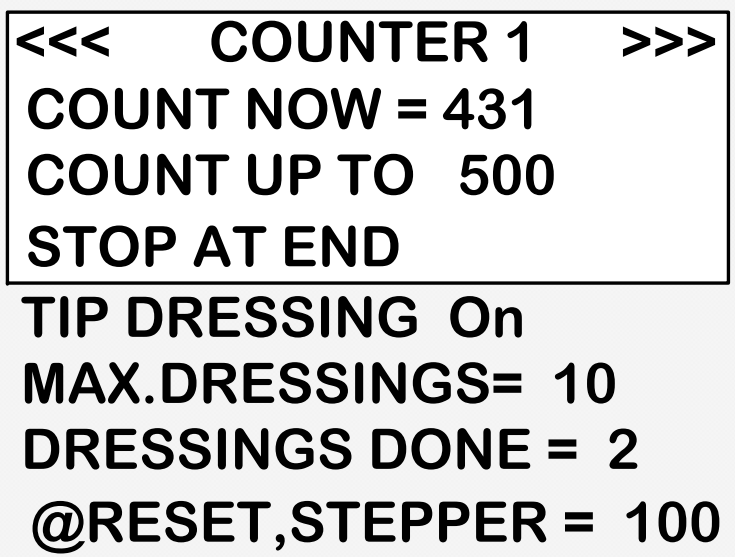
Stepper presets



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), +A (dI) and +W(dP) parameters are obtained by applying the values in step 9 to the curve as a scaling factor.

Edit counter



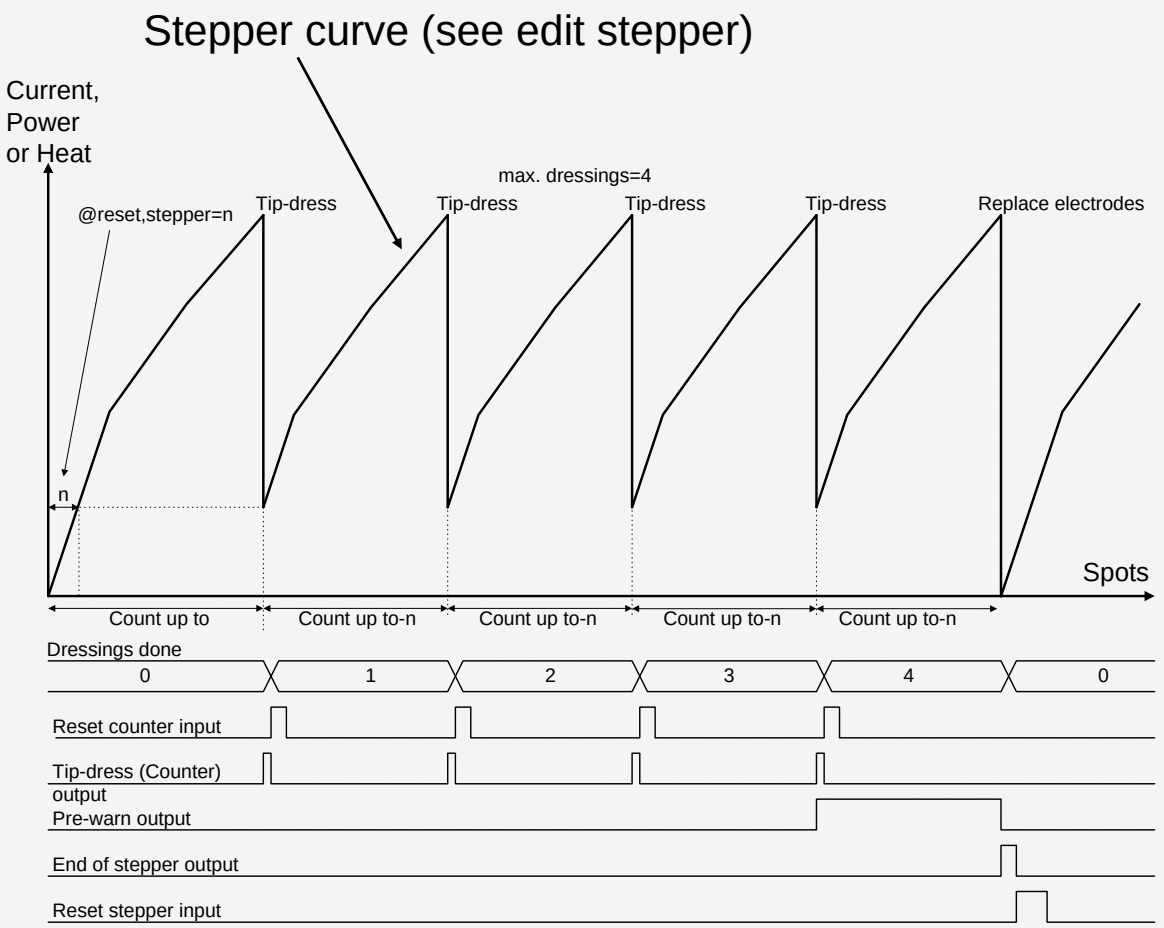
Note: Counter 1 is used by gun 1.
Counter 2 is used by gun 2.

Count now is incremented after every weld. When ***count up to*** is reached, the counter output is activated.
If ***stop at end*** is selected, then no further welding may take place until a counter reset is given.
Set ***count up to*** = 0 to disable a counter.
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
SYNC. WITH LOG   Yes
TIP DRESSING  On
MAX.DRESSINGS=  10
DRESSINGS DONE =  2
@RESET,STEPPER =  100
```

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



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.

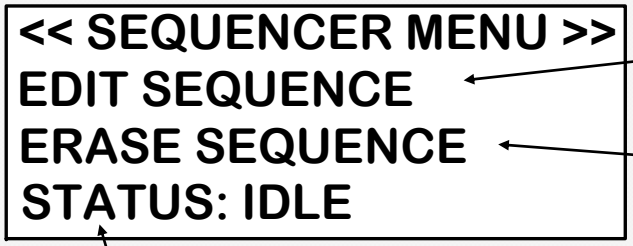
The functions available consist of various input, output, memory, delay, counter and weld operations. It is also possible to program subroutines up to 8 levels deep.

The following resources are available:

Statements(lines)		Up to 249 max.	
Outputs	16	Q1 to Q16	
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



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 not zero, then continue at STEP xxx. If the value in Counter n is zero, then continue at the next statement
IF Qn ON, JUMP xxx	n=1..12, x=1..999	If Output Qn is ON, 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 OFF, 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 ON, 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 OFF, 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 ON, 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 OFF then continue at STEP xxx. If Input Inn is ON, then continue at the next statement
WELD (Prog=nn)	nn=0..63,EXT	Execute weld sequence using program nn. If nn=EXT, the read the program number from the external inputs. The sequencer will wait untill the weld reaches 'End of sequence', before continuing with the next statement.

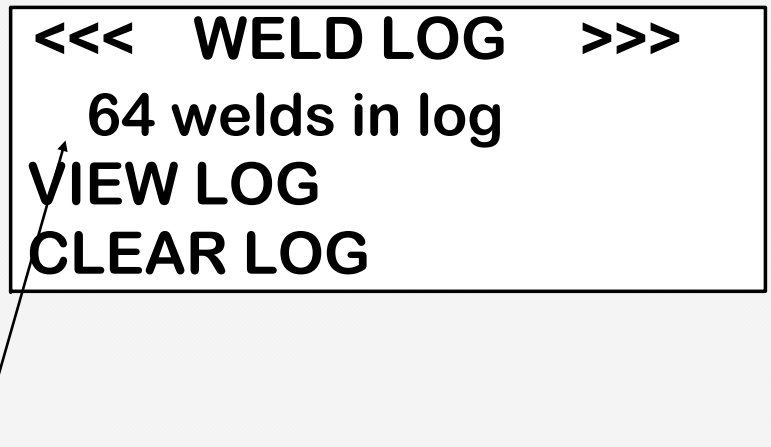
Example sequence

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

Weld log



The number of welds presently held in the log.

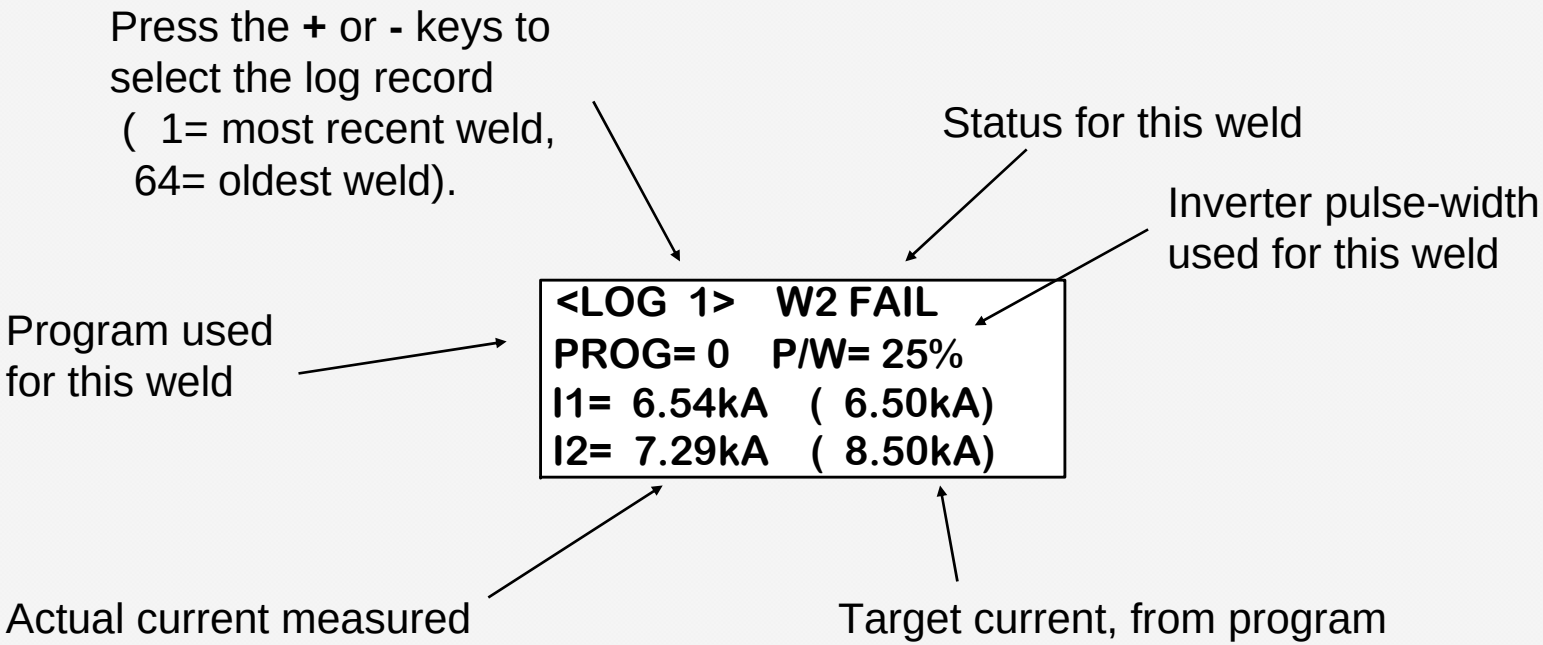
The iPAK records the measurements from each weld into the weld log. The log can hold information from up to 64 welds (after this, the oldest record will be discarded).

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

The log can be cleared (emptied) by using the CLEAR LOG function.

The weld log is not available when seam welding.

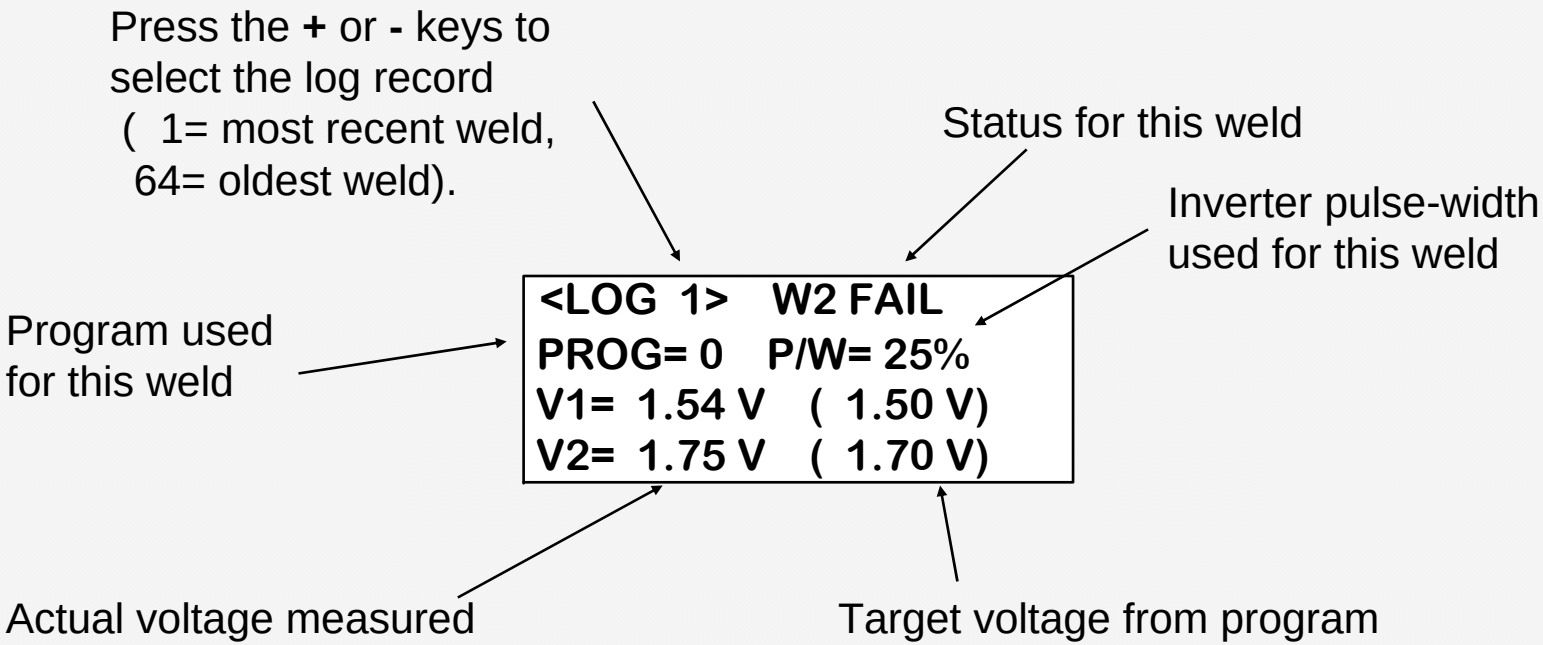
View log (screen 1)



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

•Press ⇦ ⇧ ⇩ ⇨ to change between log screens 1/2/3/4.

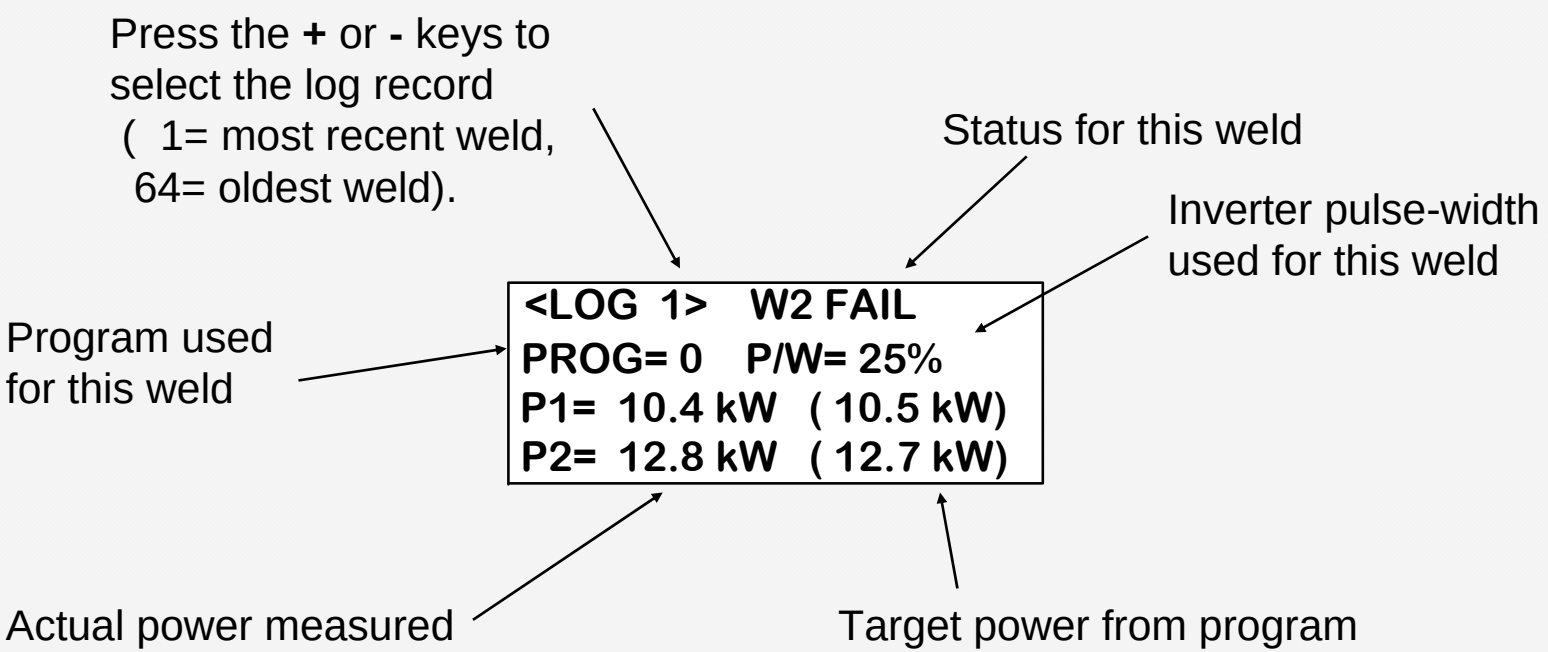
View log (screen 2)



Note that if either of V1 or V2 are not shown, then that interval was not used.

•Press ⇦ ⇧ ⇩ ⇨ to change between log screens 1/2/3/4.

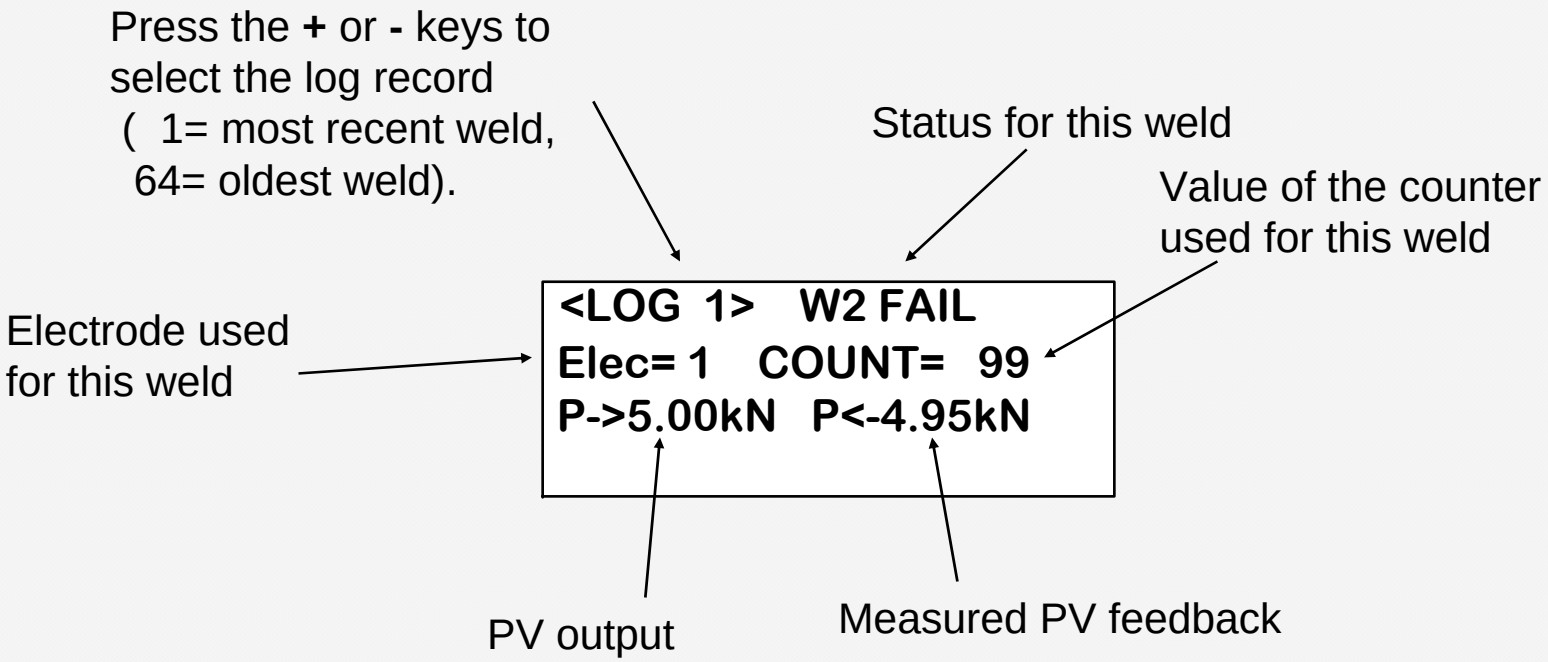
View log (screen 3)



Note that if either of P1 or P2 are not shown, then that interval was not used.

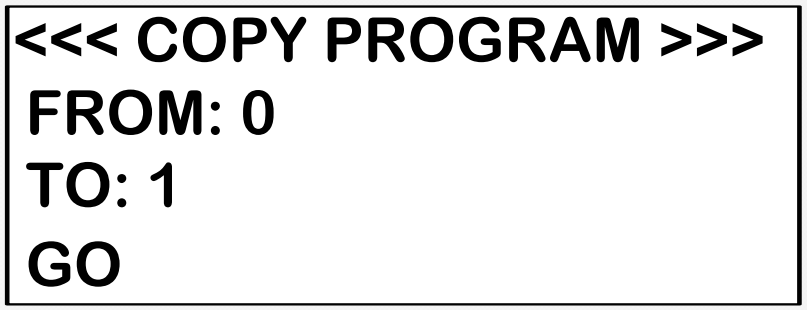
•Press ⇦ ⇧ ⇩ ⇨ to change between log screens 1/2/3/4.

View log (screen 4)



•Press ⇦ ⇧ ⇩ ⇨ to change between log screens 1/2/3/4.

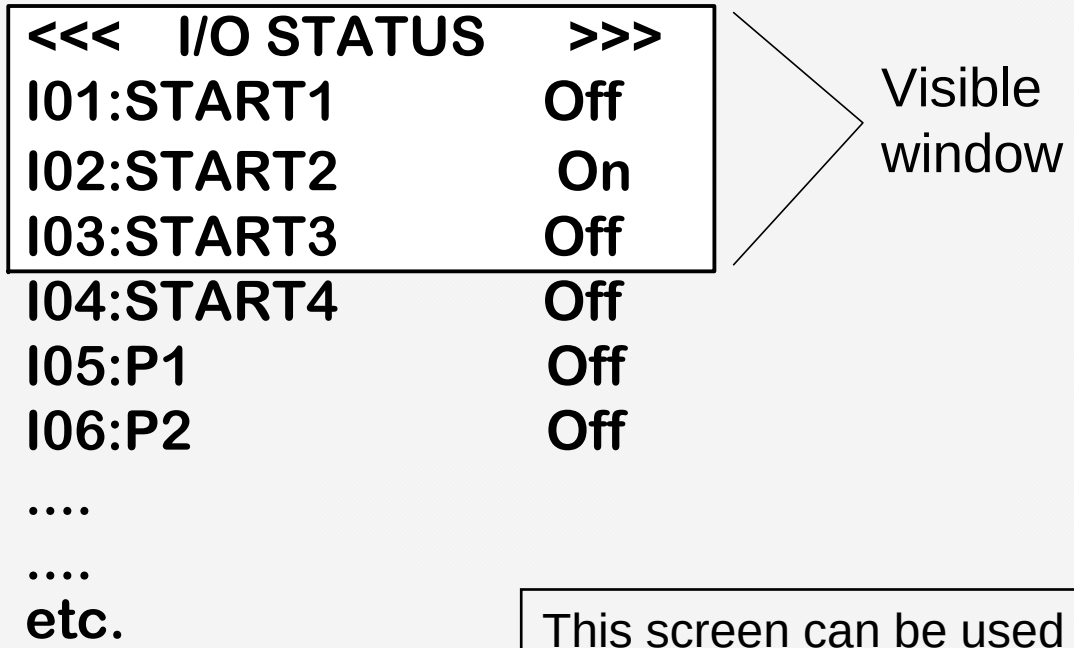
Copy program



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

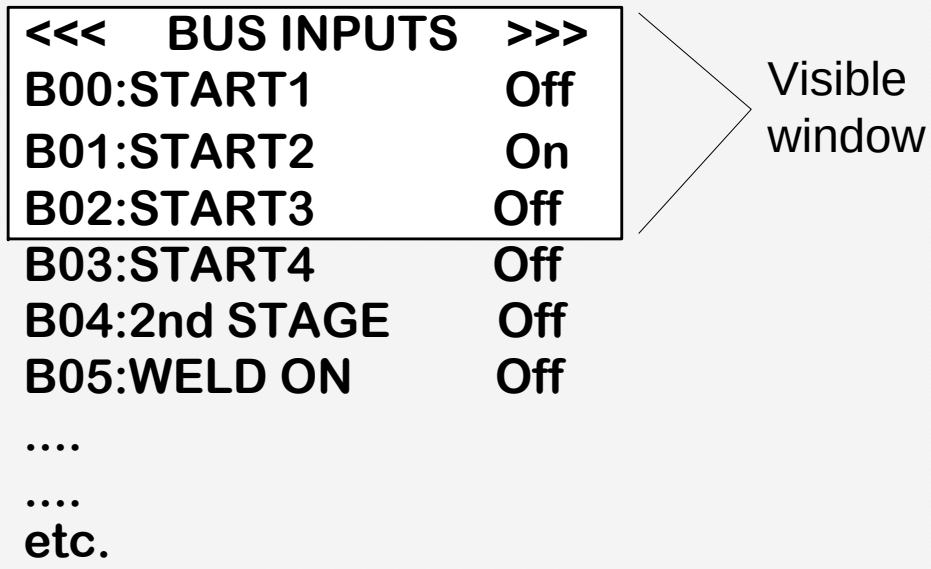
- The ***TO*** parameter can be set to ***ALL*** if required (i.e. copy 1 program to all others).
- Select the last line (**GO**), then press the ↵ key to execute the copy function. This line will briefly show ***COPY DONE***, when the function is complete.

I/O Status



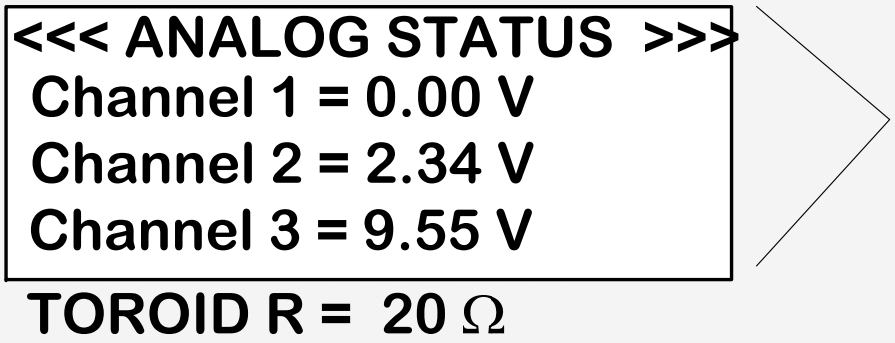
This screen can be used to observe the status of the discrete inputs and outputs.
Each input or output is labeled to show how it is mapped.
i.e. standard function / event / sequencer/fieldbus.
(see edit input map and edit output map)

Fieldbus input status



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

Analog Status



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. This is shown for test calibration and information purposes only, and does not need to be adjusted by the user.

- **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.

Set these parameters in the configuration file.

X = don't care, or not connected

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 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	P=0..15	1	P	1
				3	P+16	1
				2	P+32	1
				4	P+48	1
Dual	Binary	N = 0..31	X	1	N	1
				2	N+32	2
		EXT	P = 0..7	1	P	1
				2	P+32	2
	1of4	N = 0..15	X	1	N	1
				3	N+16	1
				2	N+32	2
				4	N+48	2
		EXT	P=0..7	1	P	1
				3	P+16	1
				2	P+32	2
				4	P+48	2

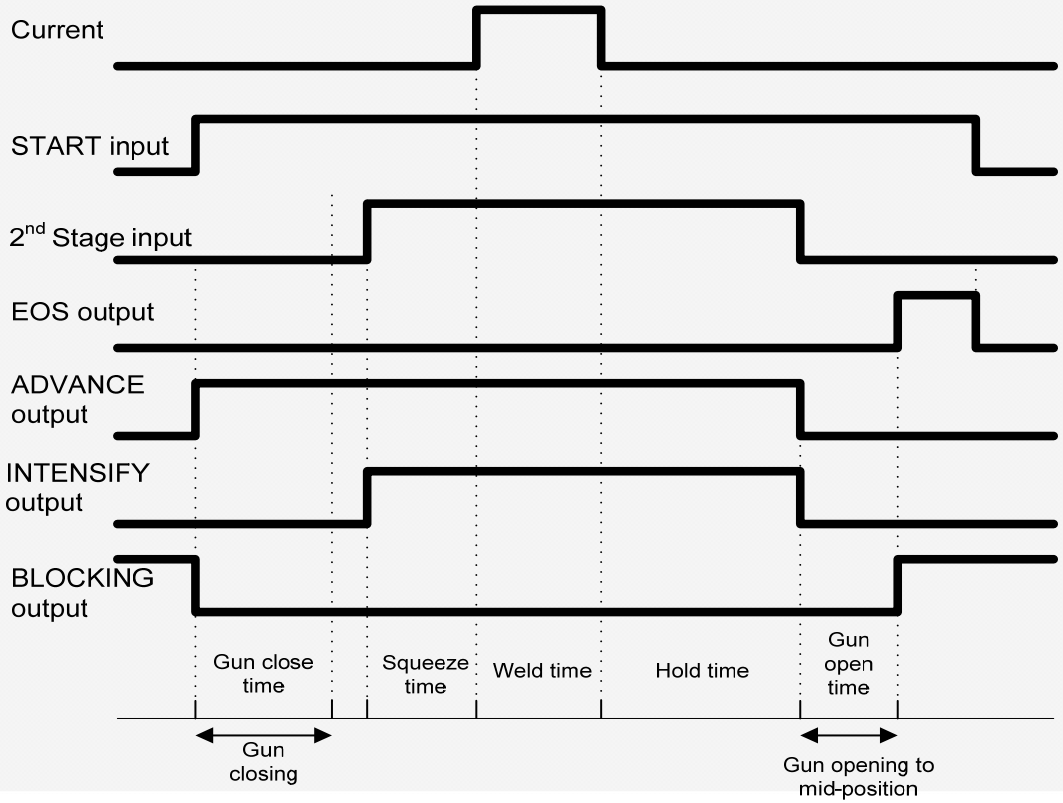
OHMA (Air over Oil) system

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.



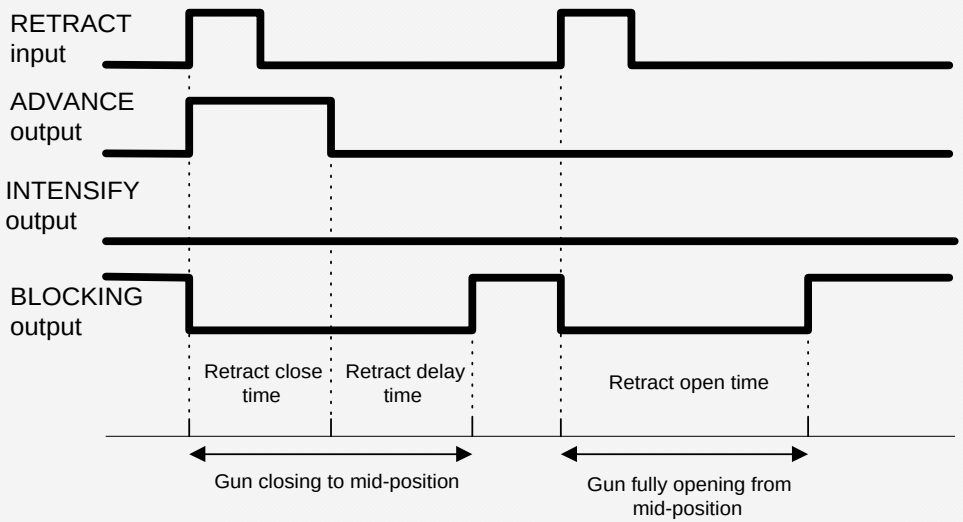
…OHMA system

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.



The following additional parameters will be shown on the programming screen, only if *OHMA retract* is selected:

- Retract close time
- Retract delay time
- Retract open time

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 iPAK 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.

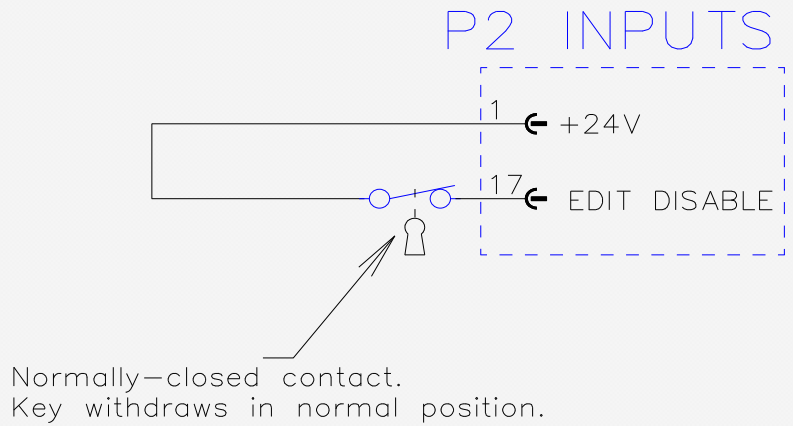
If edits are attempted, the display will briefly show

** 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.

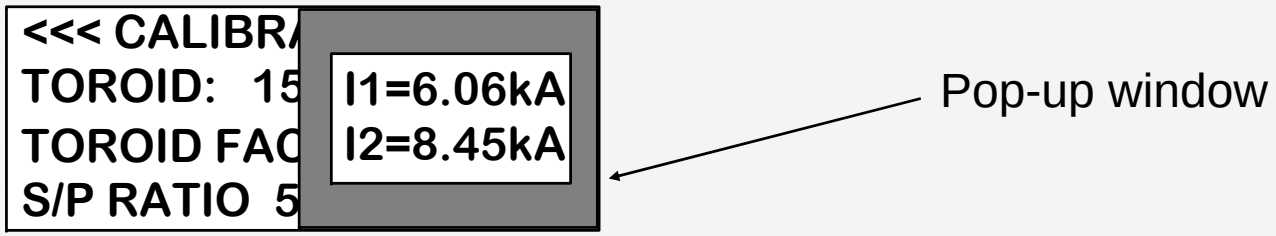
Typical connections to iPAK



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

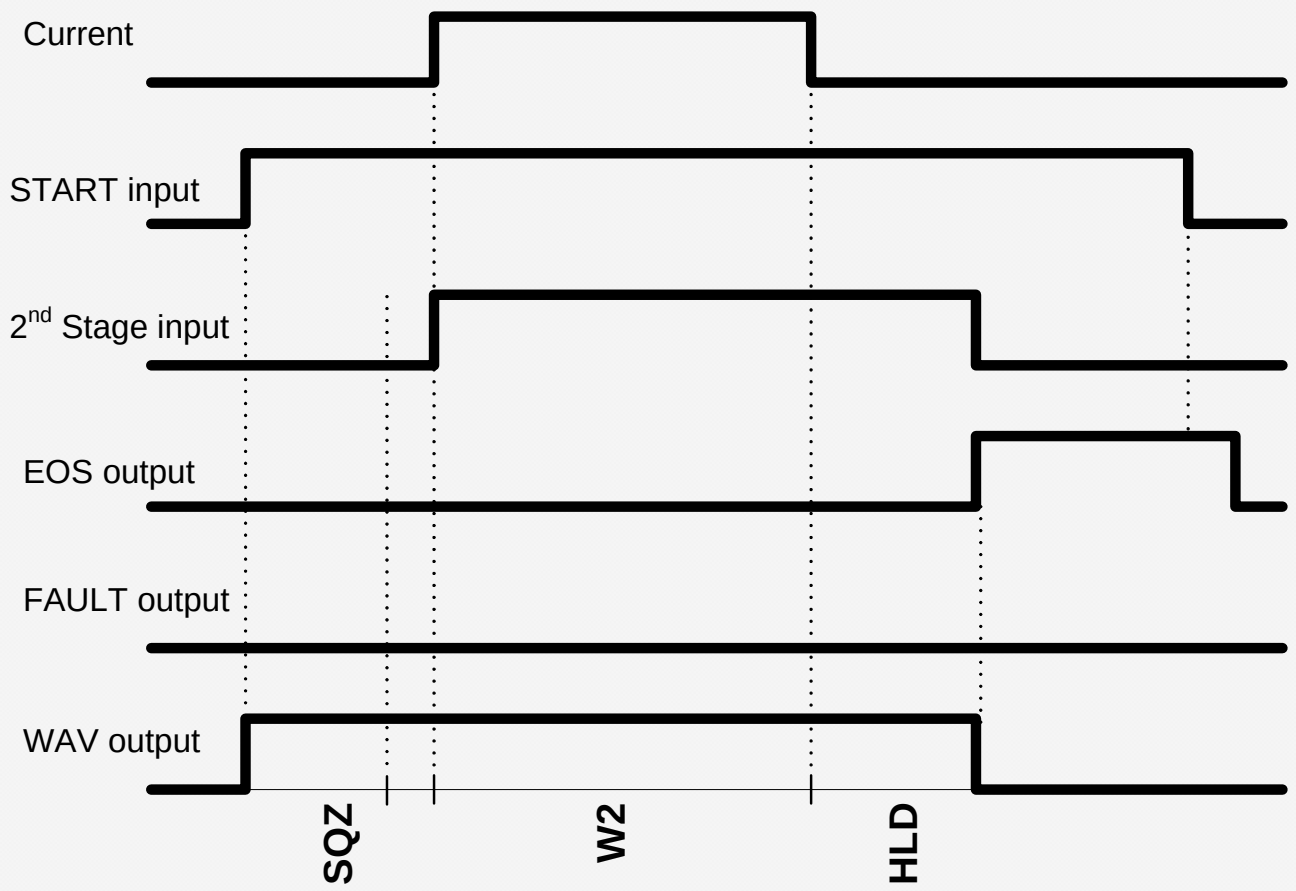
Pop-up meter

The iPAK will measure the current, voltage and power on both the weld1 and weld 2 intervals, and this is displayed on the diagnostic screen.
Often, when programming the iPAK, you will need to refer to these measurements. In order to avoid having to switch between screens, there is a convenient pop-up meter window, which allows you to view the measurements 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. Press **+** or **-** to access voltage and power measurements (V1, V2, P1 P2).



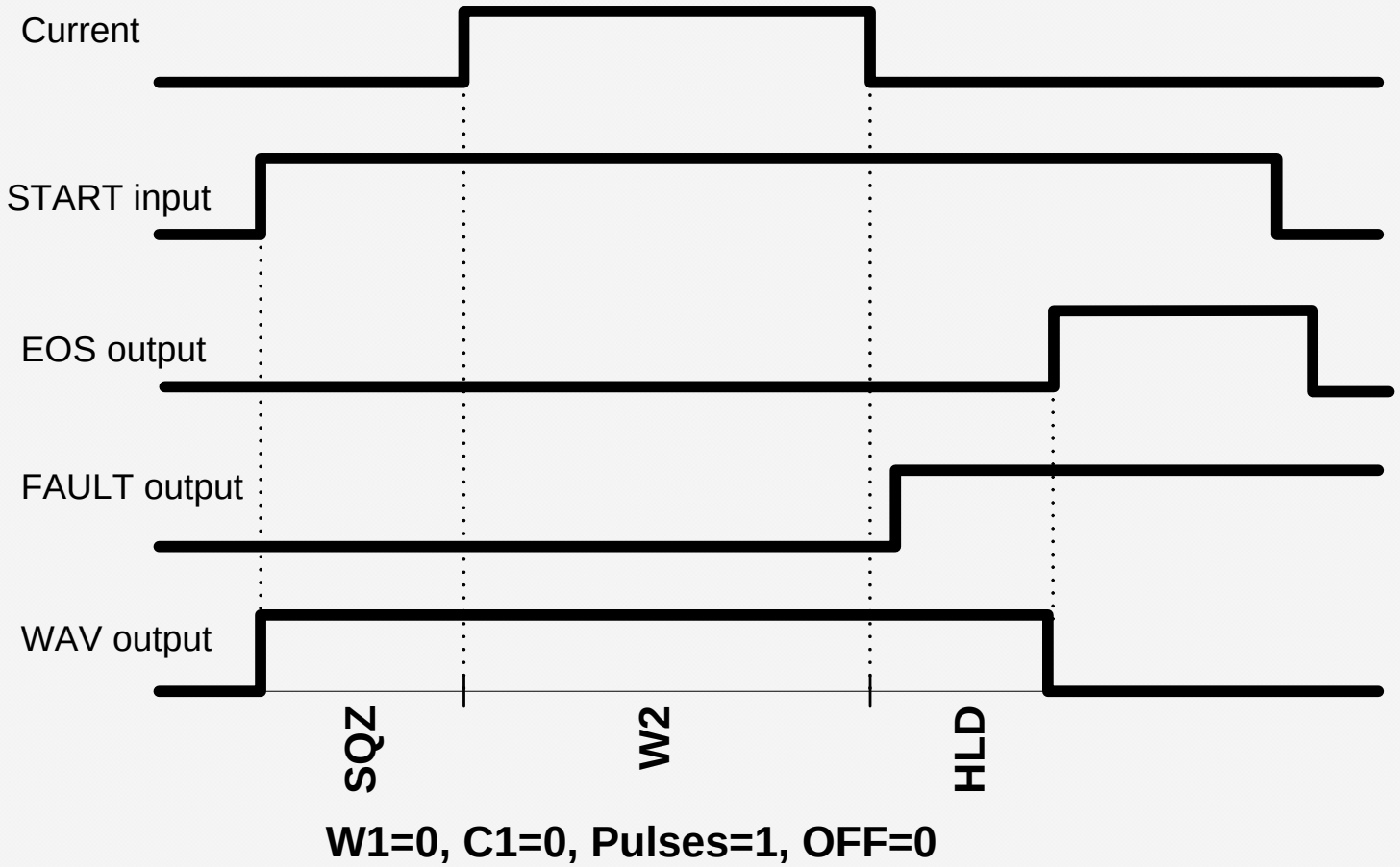
Note that the window may not show both weld1 and weld2, if either interval was not used.
Some screens use the ↩ key for another purpose (such as selecting an item from a list). In this case, the pop-up meter is not available from that screen.

Operation: basic spot weld – no weld faults

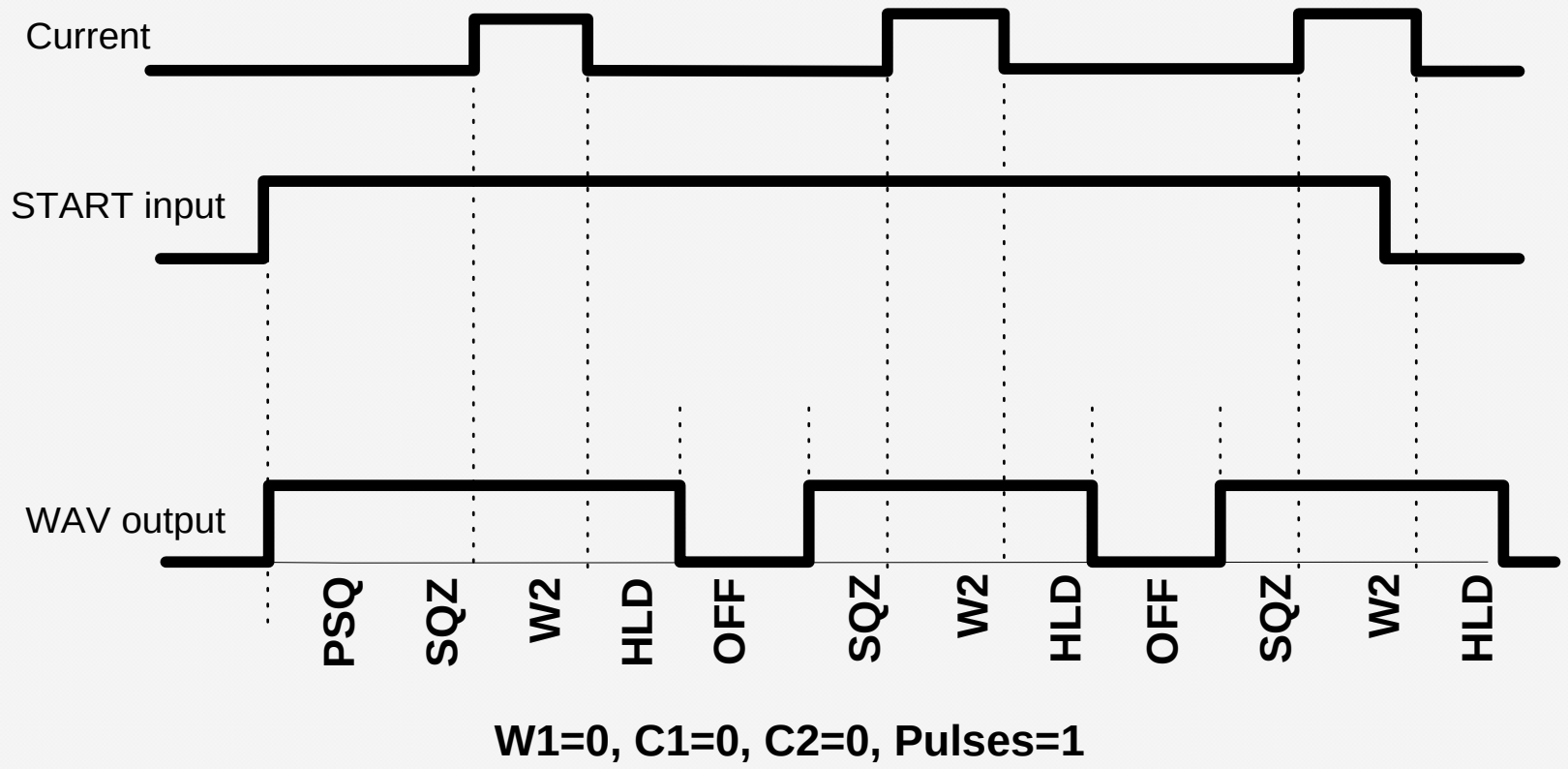


W1=0, C1=0, Pulses=1, OFF=0

Operation: basic spot weld – weld fault

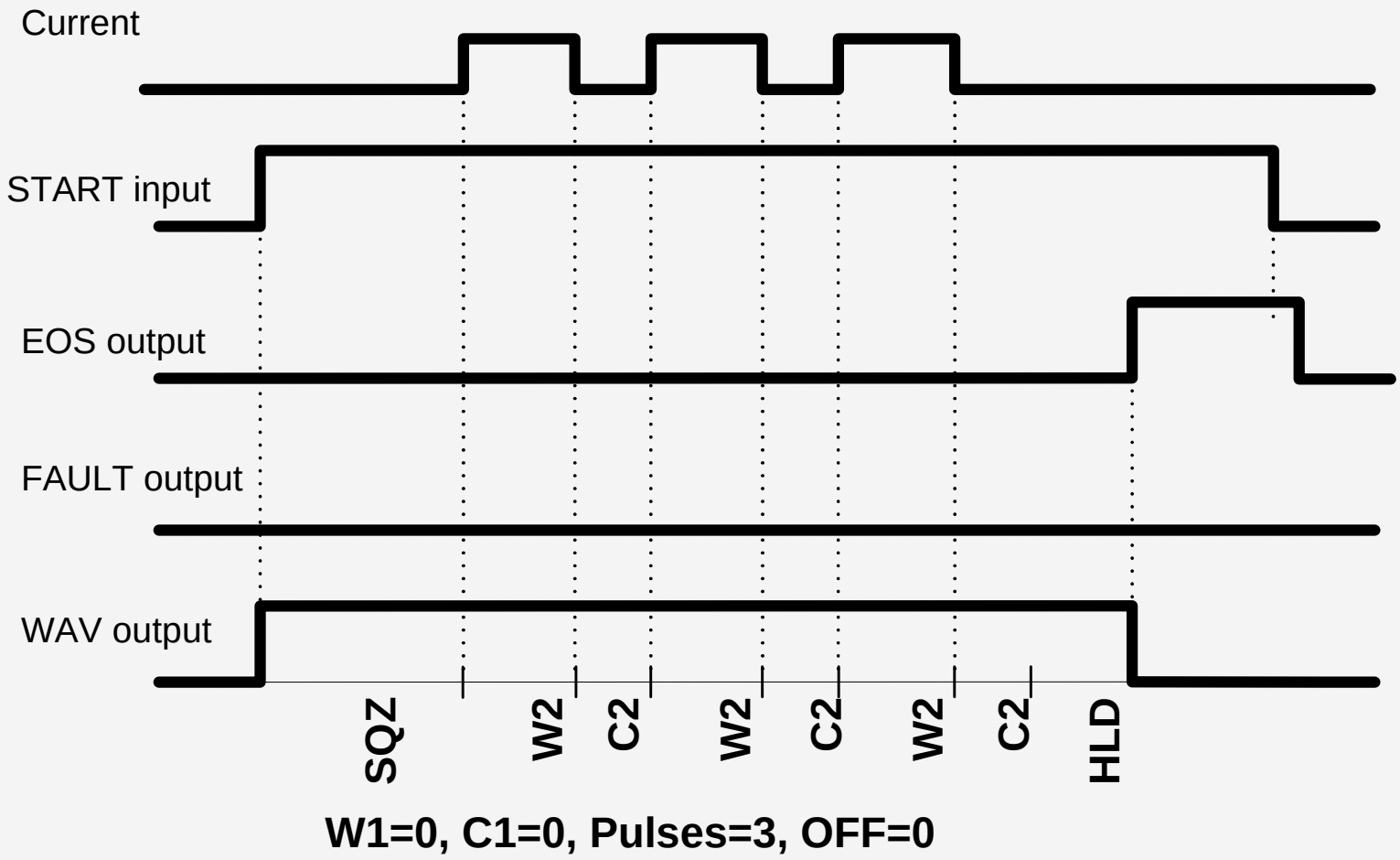


Operation: repeat spot weld



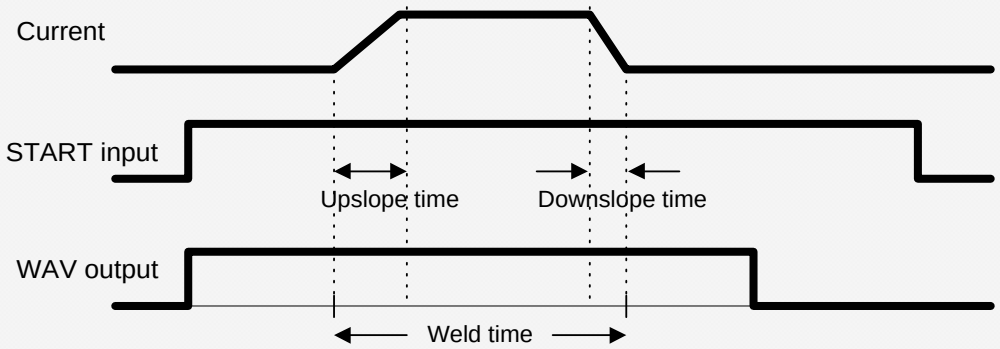
W1=0, C1=0, C2=0, Pulses=1

Operation: pulsation spot weld



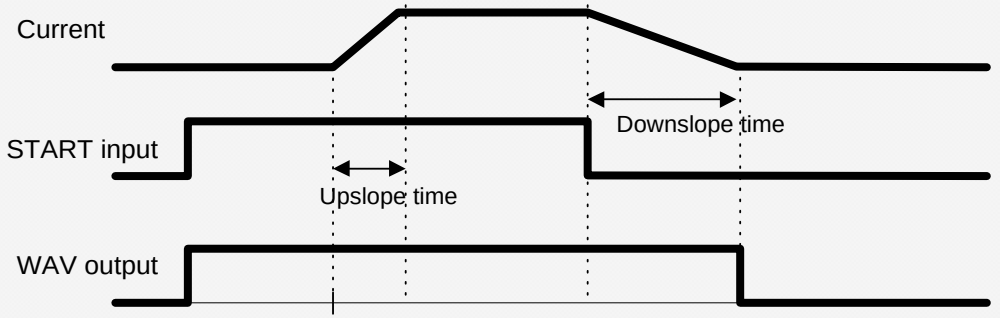
Operation: Upslope and Downslope

Spot



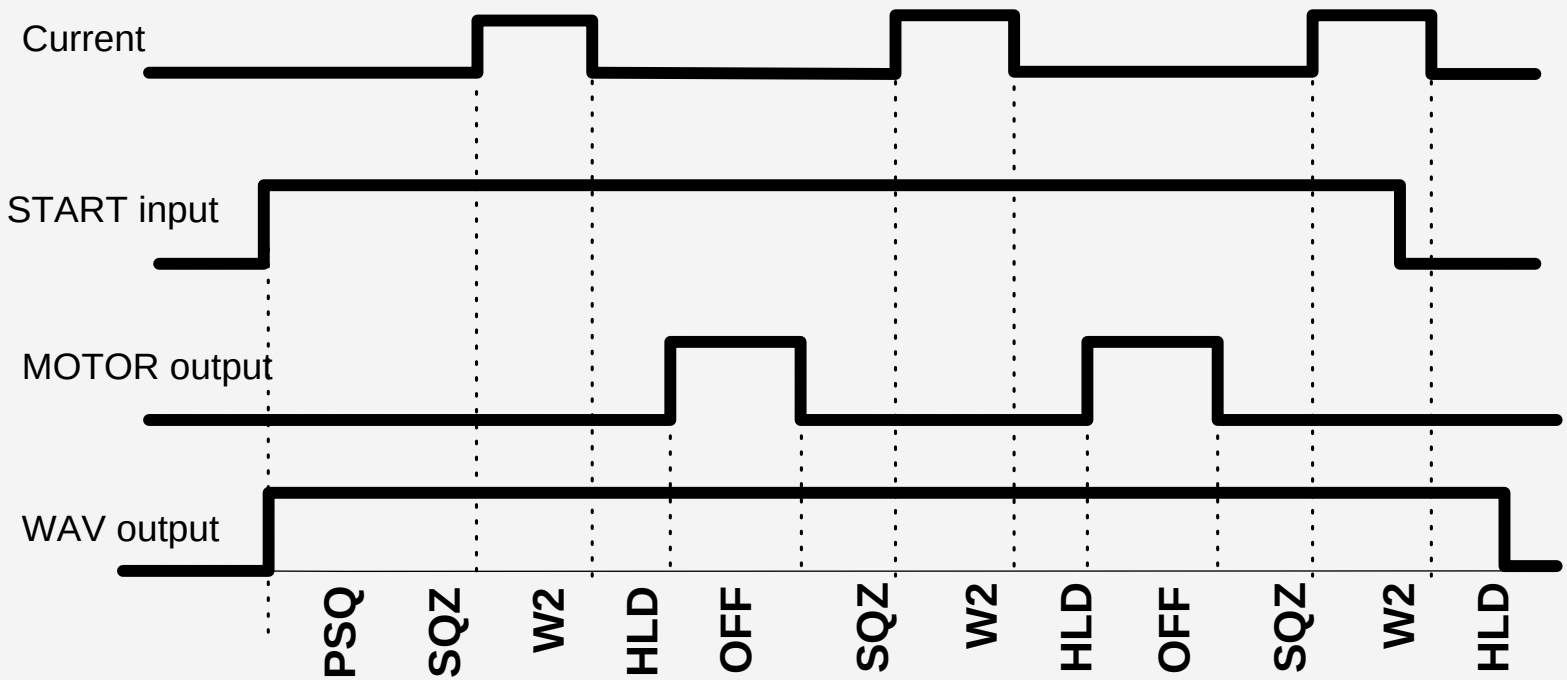
The upslope and downslope times are part of the overall weld time – they **do not** add to the weld time.

Seam



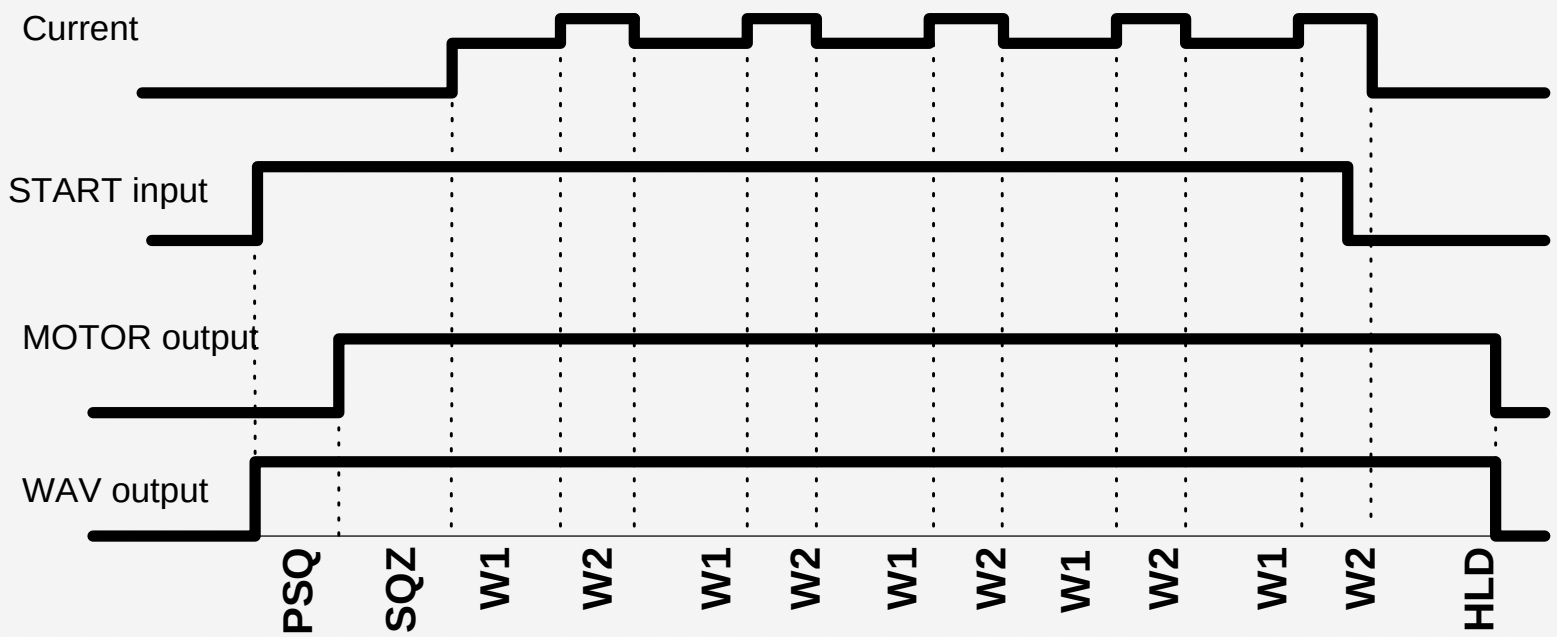
Note that for seam welds, the downslope time begins when the initiation input turns off.

Operation: roll-spot welding



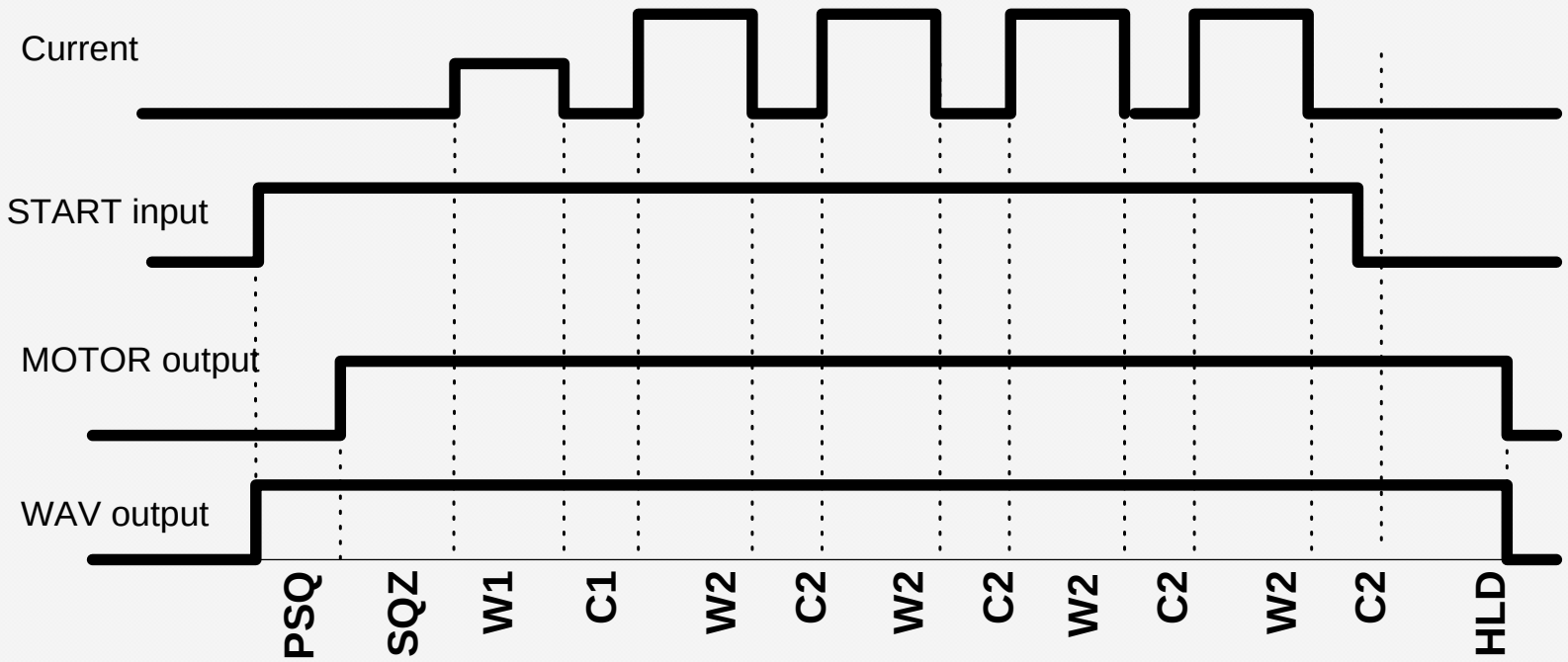
W1=0, C1=0, C2=0, Pulses=1

Operation: seam welding (dual heat)

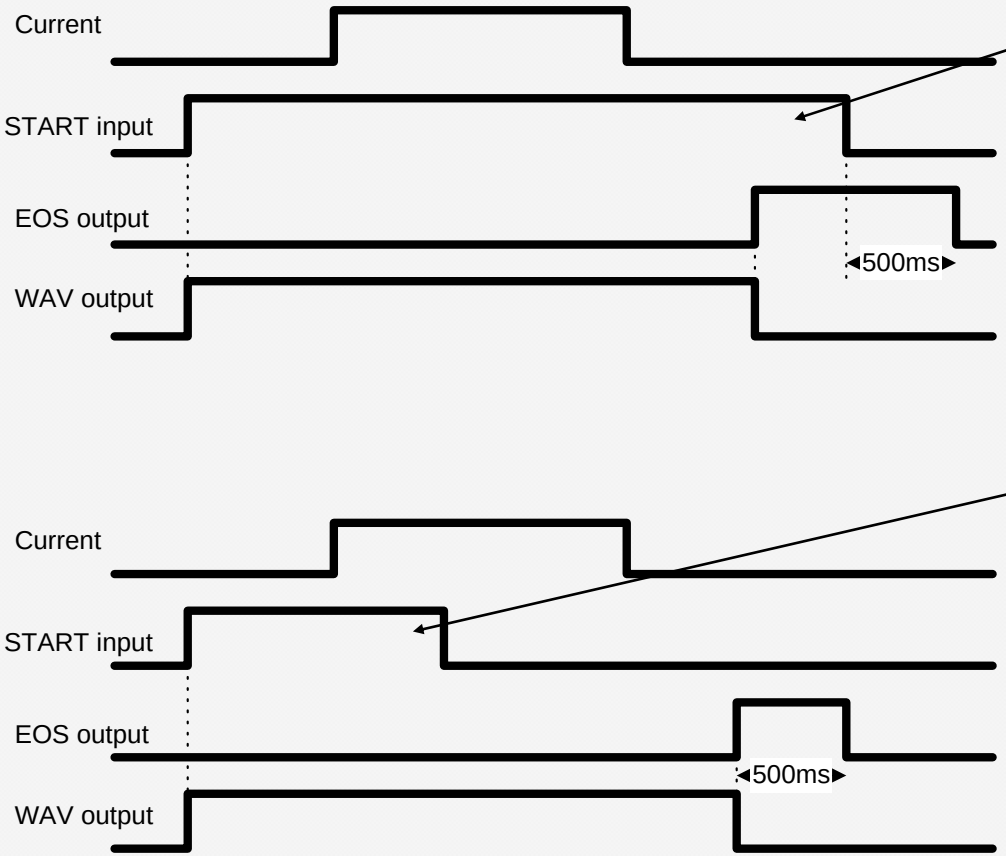


C1=0, C2=0

Operation: seam welding (pre-heat)



Operation: EOS signal



Handshake mode: The start signal remains on until EOS is given. When start is removed, EOS goes off, after 500ms. This is the recommended method of operation for automatic systems.

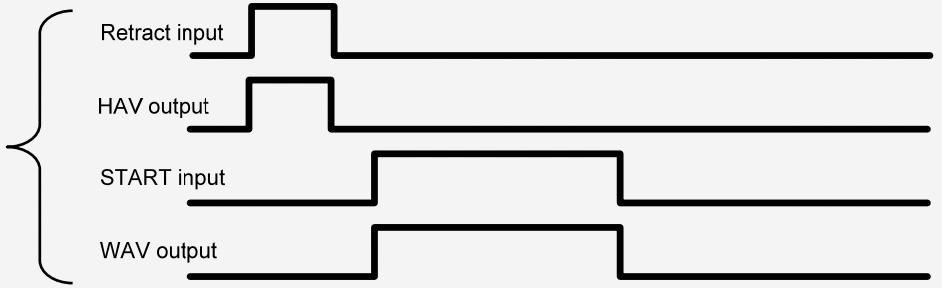
Pulsed mode: The start signal goes off before the end of the hold time. The EOS signal is a fixed pulse of 500ms.

In either mode, if a new start signal is given during the EOS pulse, then EOS will go off and a new sequence will start.

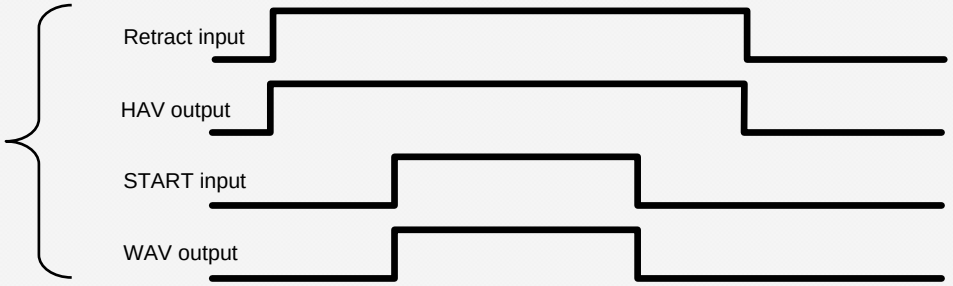
Operation: Retract

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

No/ Simple

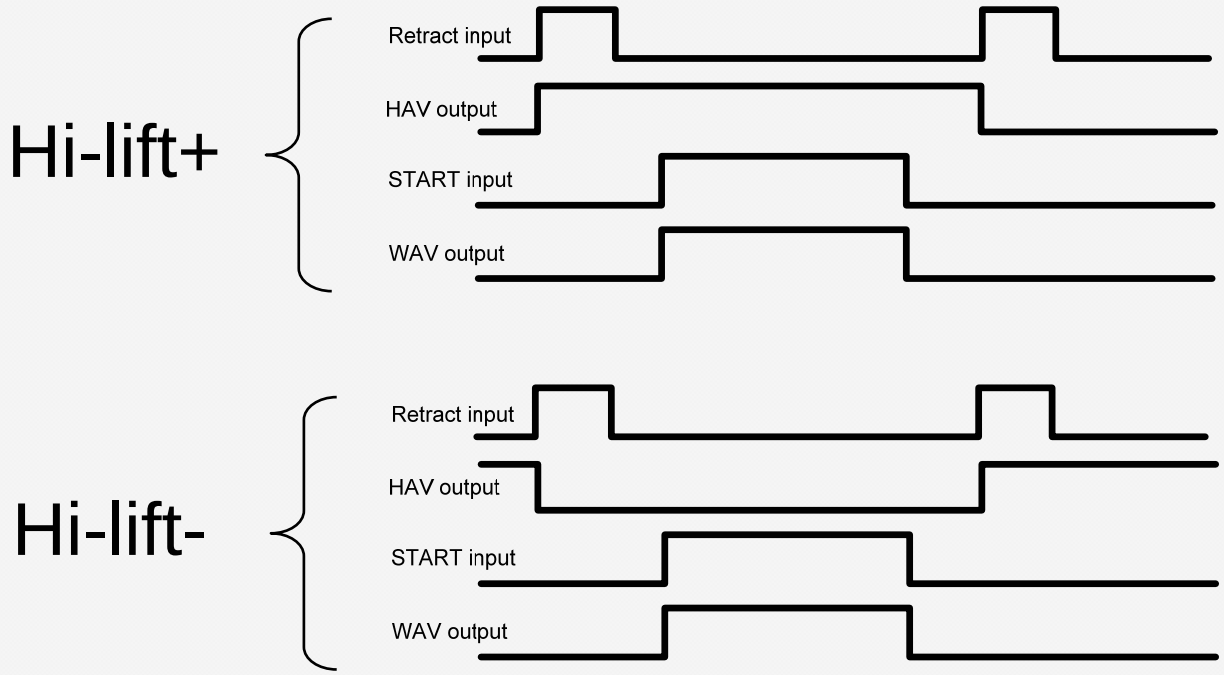


Maintained



Operation: Hi-lift

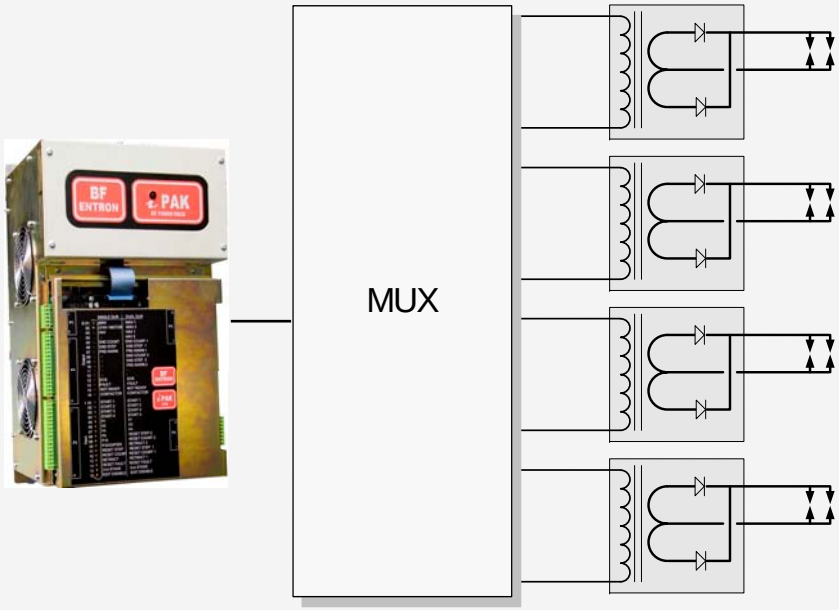
The retract operating mode (***Simple/Hi-lift+/Hi-lift-/Maintained***) is set in the configuration file.



Multi-gun welding

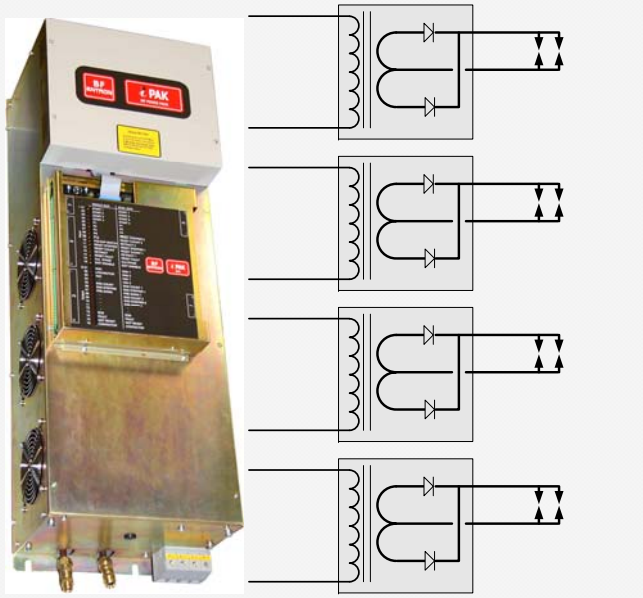
There are two methods for driving more than one power transformer/gun with an iPAK

By connecting to a standard iPAK via a power switch (MUX).



Standard iPAK Power switch Up to 8 welding transformers

By connecting directly to a special type iPAK-MUX.



iPAK-MPX Up to 4 welding transformers

Up to 8 pairs of electrodes can be distributed randomly across welding transformers.
Up to 8 electrode pairs can be closed at a time (4 on MPX types).
Control can ripple-fire through up to 8 spots, or each spot can be individually triggered.

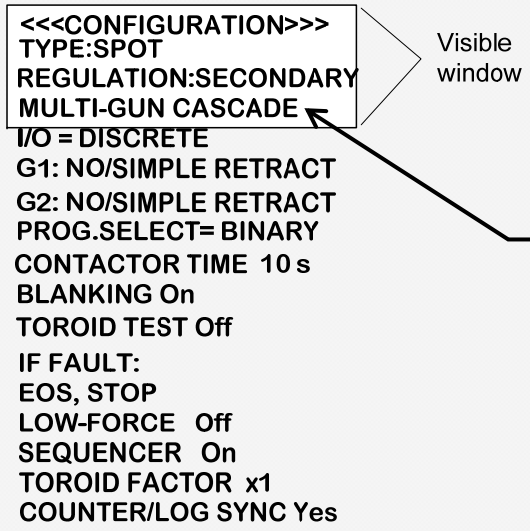
Configuring iPAK for multiwelding

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 eight 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:



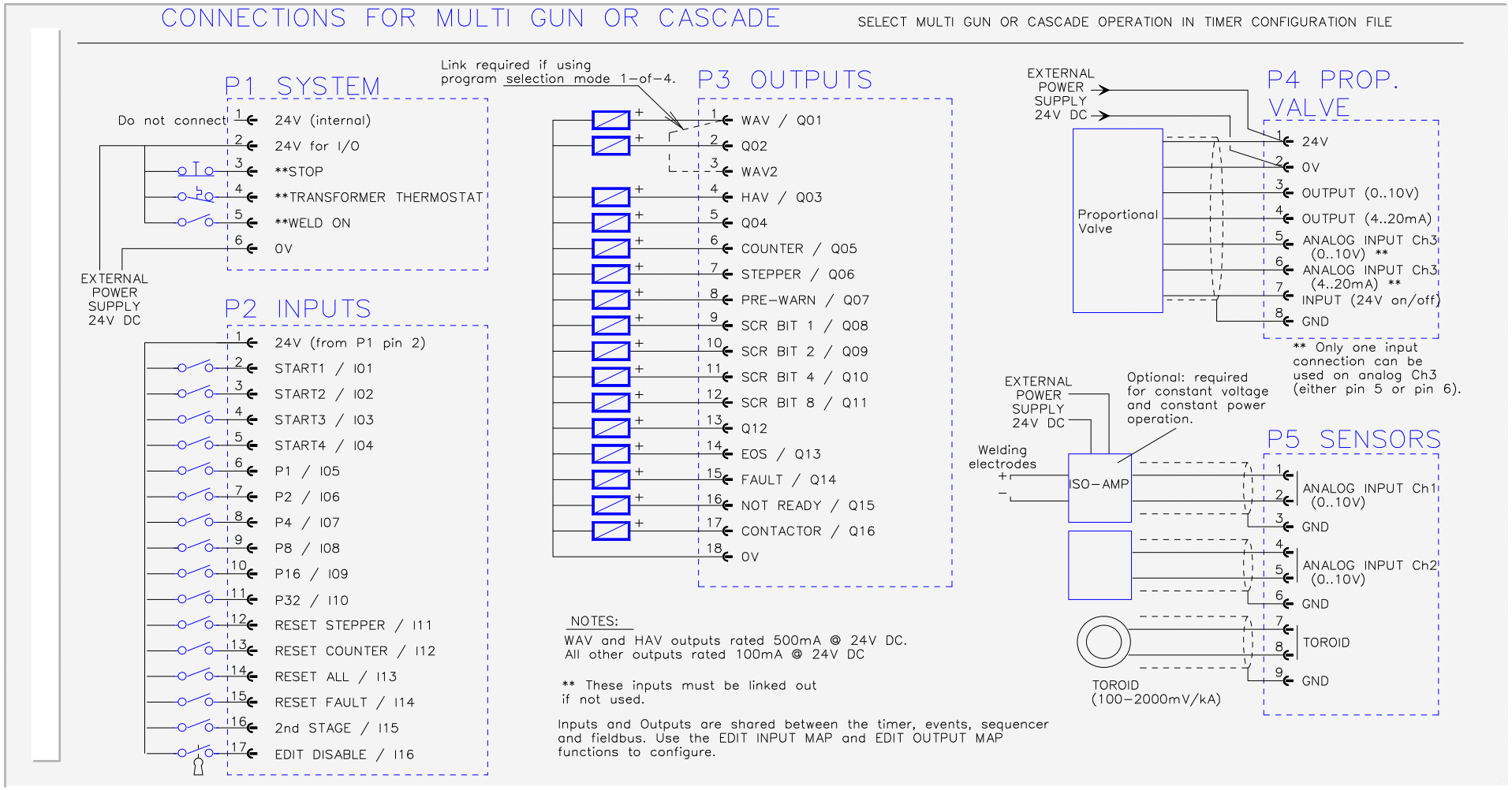
Visible window

Operating mode selection: Press the **+** or **–** keys until the required selection is shown.

Note:

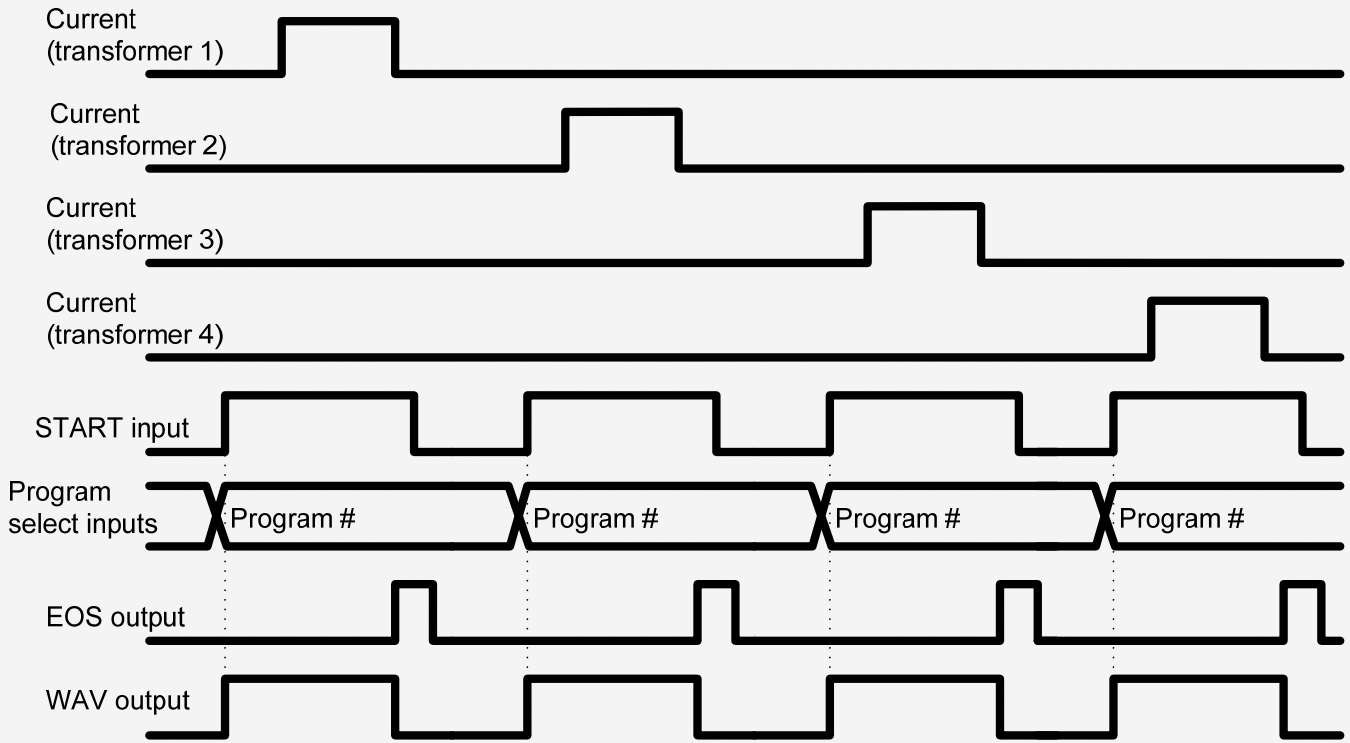
Multiwelding modes can be used on both standard and MPX type iPAKs.

users connections



Multi-gun operation

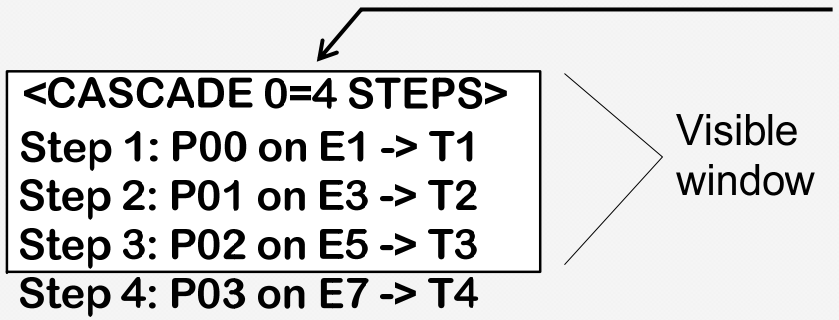
Multi-gun mode allows each welding program to be triggered independently, in the traditional way, but allows for selection of a transformer and electrode.



Multi-gun cascade operation

In ***multi-gun cascade*** mode, up to eight 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.

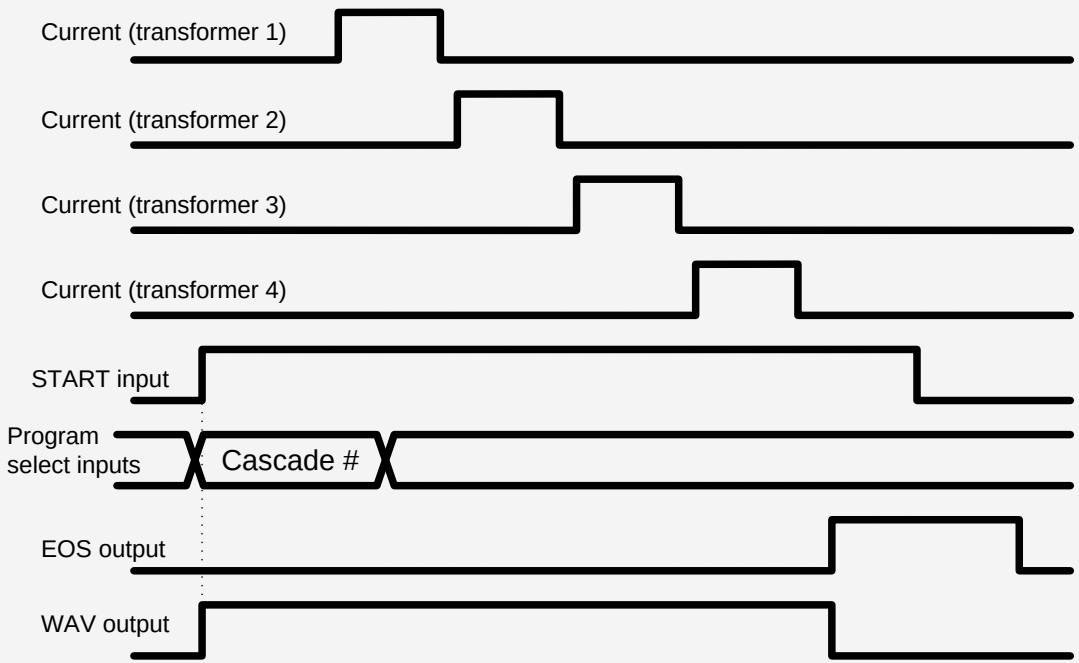
To set up a cascade, select 'EDIT CASCADE' from the main menu.



In the example shown here:
The cascade consists of 4 steps, using programmes 0,1,2 and 3. 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



Note that in ***multi-gun cascade*** mode, the SQUEEZE time from the first step and the HOLD time from the last step are used.

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

2. Assign each electrode to a transformer.

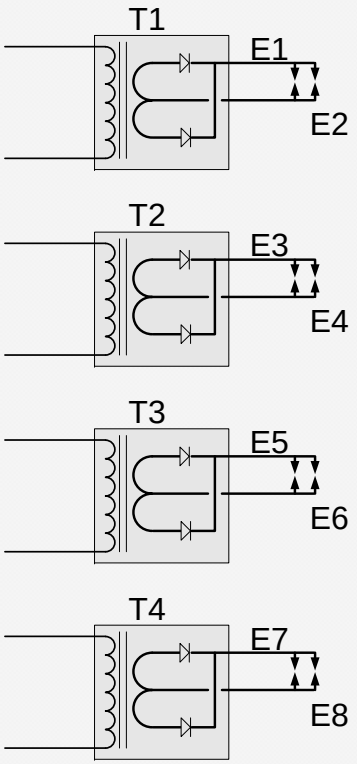
```
<<<TRANSFORMERS>>>
E1 -> T1    E2 -> T1
E3 -> T2    E4 -> T2
E5 -> T3    E6 -> T3
E7 -> T4    E8 -> T4
```

Visible window

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

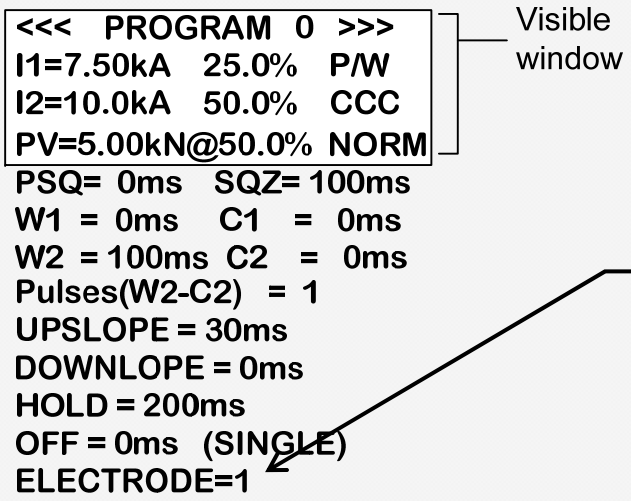
In the example shown here:

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.



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.



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.

Operation with a fieldbus

Multi-gun

INPUT from bus to timer

Bit No.	Function
0	START 1
1	START 2
2	START 3
3	START 4
4	2nd Stage
5	Weld on*
6	Reserved
7	Reserved
8	Reset expired counters
9	Reset expired steppers
10	Reset All
11	Reserved
12	Reserved
13	Reserved
14	Reserved
15	Reset fault
16	Program bit 1
17	Program bit 2
18	Program bit 4
19	Program bit 8
20	Program bit 16
21	Program bit 32
22	Reserved
23	Reserved
24	Discrete output Q09
25	Discrete output Q10
26	Discrete output Q11
27	Discrete output Q12
28	Discrete output Q13
29	Discrete output Q14
30	Discrete output Q15
31	Discrete output Q16

OUTPUT from timer to bus

Bit No.	Function	Map=1	Map=2
0	Weld air valve 1 (WAV 1)		
1	Reserved		
2	Retract air valve 1 (HAV 1)		
3	Reserved		
4	End of counter(s)		
5	End of stepper(s)		
6	Prewarning(s)		
7	Reserved		
8	Discrete input I5		
9	Discrete input I6		
10	Discrete input I7		
11	Discrete input I8		
12	End of sequence (EOS)		
13	Fault		
14	Not ready		
15	Contactor		
16	Error code bit 1		
17	Error code bit 2		
18	Error code bit 4		
19	Error code bit 8		
20	Error code bit 16		
21	Error code bit 32		
22	Error code bit 64		
23	Error code bit 128		
24		Pressure bit 1	Discrete input I9
25		Pressure bit 2	Discrete input I10
26		Pressure bit 4	Discrete input I11
27		Pressure bit 8	Discrete input I12
28		Pressure bit 16	Discrete input I13
29		Pressure bit 32	Discrete input I14
30		Pressure bit 64	Discrete input I15
31		Pressure bit 128	Discrete input I16

Multi-gun Cascade

INPUT from bus to timer

Bit No.	Function
0	START 1
1	START 2
2	START 3
3	START 4
4	2nd Stage
5	Weld on*
6	Reserved
7	Reserved
8	Reset expired counters
9	Reset expired steppers
10	Reset All
11	Reserved
12	Reserved
13	Reserved
14	Reserved
15	Reset fault
16	Cascade Program bit 1
17	Cascade Program bit 2
18	Cascade Program bit 4
19	Cascade Program bit 8
20	Reserved
21	Reserved
22	Reserved
23	Reserved
24	Discrete output Q09
25	Discrete output Q10
26	Discrete output Q11
27	Discrete output Q12
28	Discrete output Q13
29	Discrete output Q14
30	Discrete output Q15
31	Discrete output Q16

OUTPUT from timer to bus

Bit No.	Function	Map=1	Map=2
0	Weld air valve 1 (WAV 1)		
1	Reserved		
2	Retract air valve 1 (HAV 1)		
3	Reserved		
4	End of counter(s)		
5	End of stepper(s)		
6	Prewarning(s)		
7	Reserved		
8	Discrete input I5		
9	Discrete input I6		
10	Discrete input I7		
11	Discrete input I8		
12	End of sequence (EOS)		
13	Fault		
14	Not ready		
15	Contactor		
16	Error code bit 1		
17	Error code bit 2		
18	Error code bit 4		
19	Error code bit 8		
20	Error code bit 16		
21	Error code bit 32		
22	Error code bit 64		
23	Error code bit 128		
24		Pressure bit 1	Discrete input I9
25		Pressure bit 2	Discrete input I10
26		Pressure bit 4	Discrete input I11
27		Pressure bit 8	Discrete input I12
28		Pressure bit 16	Discrete input I13
29		Pressure bit 32	Discrete input I14
30		Pressure bit 64	Discrete input I15
31		Pressure bit 128	Discrete input I16

*The discrete **Weld on** input must also be on to enable welding.

WS98-iPAK PC software

WS98-iPAK PC software is available for use with the iPAK. 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.

iPAKs may be connected to the PC via RS232 (1 iPAK only) or via Ethernet (multiple iPAKs on a network).

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