iPAK2 Technical Manual

Welding control for MFDC spot, projection, roll-spot, seam and multi-welding applications

For firmware version 2.01

iPAK2 Technical Manual

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Issue	Date	Comment
2.00	27-02-19	Initial release
2.00.01	13-06-19	Minor errata corrected
2.00.02	19-06-19	Corrected weld program time range.
2.01	8-08-19	Added Presqueeze to all modes

IMPORTANT SAFETY INSTRUCTIONS

READ ALL INSTRUCTIONS BEFORE USING THE iPAK2

WARNING

DO NOT DISASSEMBLE, REPAIR, OR MODIFY THE iPAK2. These actions can cause electric shock and fire.

- Use only as described in this manual. Use only BF ENTRON recommended accessories and replacement parts.
- Stop operation if any problems occur. If the equipment is not working as it should, has been dropped, damaged, left outdoors, or been in contact with water, contact BF ENTRON.
- Only apply the specified power. Application of a voltage or current beyond the specified range can cause electric shock or fire.
- Do not use damaged plugs or connecting cables.
- Keep water and water containers away from the iPAK2. Water ingress can cause a short circuit, electric shock, or fire.
- Do not insert objects into openings. Do not use with any opening blocked; keep free of dust and debris.
- Do not install the iPAK2 in any of the following environments
    - damp environments where humidity is 90% or higher.
    - dusty environments.
    - environments where chemicals are handled.
    - environments near a high-frequency noise source.
    - hot or cold environments where temperatures are above 40°C or below 0°C, or environments where water will condense.

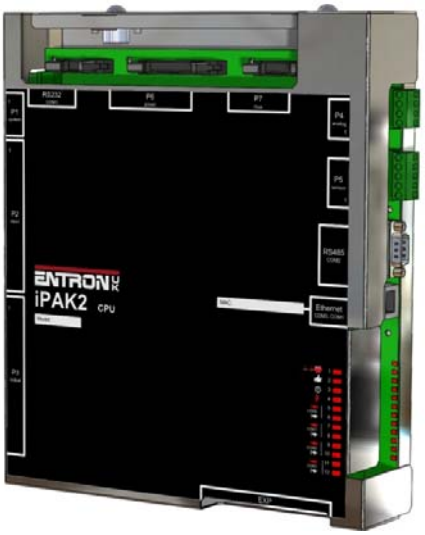
Contents

Introduction

The iPAK2 controller is suitable for MFDC spot, projection, roll-spot, seam and multi-welding welding applications.

The controller supports:

- pre-heat, main heat and post-heat intervals
- force profiles
- multi-gun, multi-air valve applications
- multiple electrodes



The iPAK2 has multiple communication and control options and can be configured by a number of programming options. The Ethernet port supports simultaneous programming and control via a single physical cable.

Short-circuit proof outputs and a guided-contact pilot relay provides enhanced safety. Connection to the power system is via a single ribbon cable. Analog inputs and outputs can be used to drive a proportional air regulator valve for force control.

Operation in Standard mode provides a basic set of features for simple applications. Extended mode adds advanced features for more demanding applications. Choose between Standard or Extended features (Section 12 **Configuration**). The iPAK2 must be restarted after changing this setting.

Features

NetFlash programming	✓
WSP3 programming	✓
Ethernet [1]	✓
RS232	✓
RS485	✓
MODBUS TCP/IP	✓
MODBUS RTU	✓
Analogue inputs [2]	2
Analogue outputs [2]	1
Discrete inputs	16
Discrete outputs [3]	16
Weld programmes	256
Pre-heat	✓
Main heat	✓
Post-heat [5]	✓
Slope	✓
Constant current	✓
Cascade/Mux [5]	8
Multi air valve [4, 5]	8
Aux valves	7
Force profile [5]	✓
Electrodes	8
Real-time clock	✓
Data log (spot welds)	6000
Expansion	✓
Analog control mode [5]	✓

[1] Two ports
[2] 0 to 10 V
[3] 24 V dc, short-circuit proof, monitored
[4] Guided contact safety relay, monitored
[5] Extended feature

The extended features can be enabled for greater flexibility or more demanding applications.

Weld parameters

Prequeeze	✓
Squeeze	✓
Pre-heat	✓
Cool1	✓
Upslope	✓
Main heat	✓
Cool2	✓
Downslope	✓
Pulses	✓
Post-heat [1]	✓
Hold	✓
Off	✓
WAV selection [1]	✓
Motor control	✓
Aux valve control	✓
Retract/Hi-lift	✓
Electrode selection [1]	✓
Force profile [1]	✓
Current monitor	✓
Force monitor	✓
Spot weld	✓
Roll-spot weld [1]	✓
Seam weld [1]	✓

[1] Extended feature

Part number

Model	Part number
iPAK2	01-70-27

Programming options

1.NetFlash

This PC-compatible program displays and allows editing of all welding parameters and status information.

In addition to programming, NetFlash provides backup/restore functions for control data, live data logging to a file and a utility for updating the firmware in the iPAK2.

2. WSP3 Pendant

iPAK2 series controls work with the same WSP3 pendant that is used with EN7000, WS2003 and iPAK (v1). Access to all parameters is provided, plus diagnostic indication.

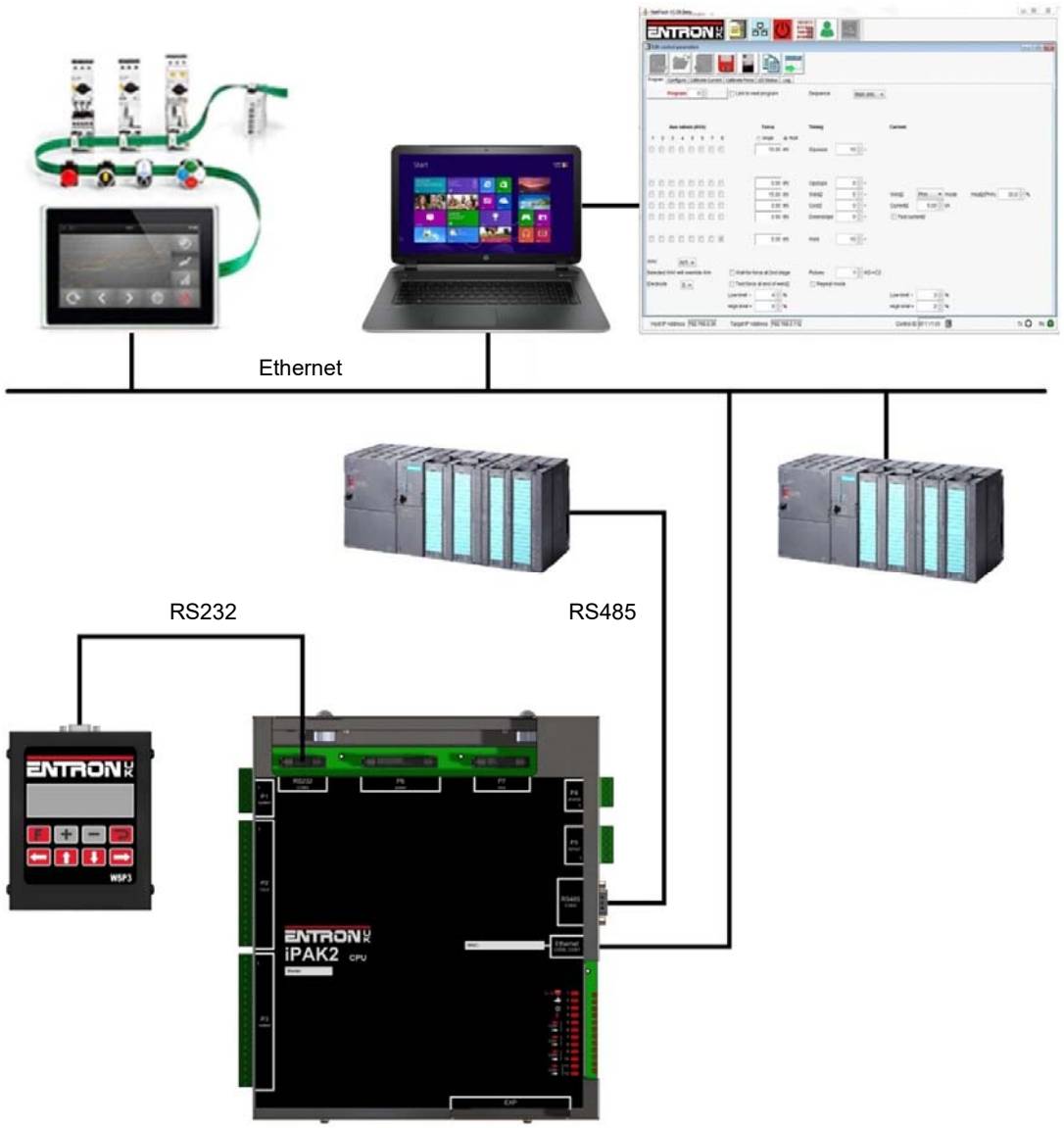
3. MODBUS

A PLC or HMI MODBUS master can be used to program, control and monitor an iPAK2. All parameters are directly mapped to MODBUS registers for easy access. Both MODBUS-TCP/IP (Ethernet) and MODBUS-RTU (RS485) protocols are supported.

4. Ethernet/IP

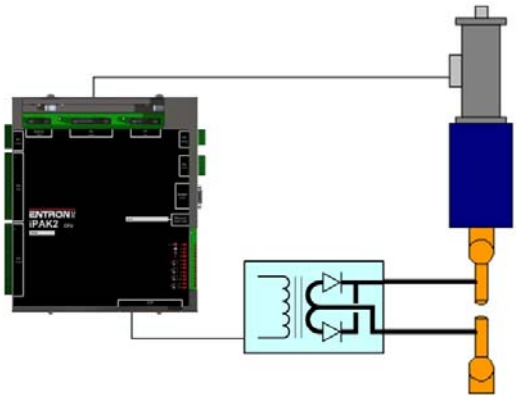
An optional adapter card can be fitted to the expansion port, providing full data access via the EtherNet/IP protocol.

Communications

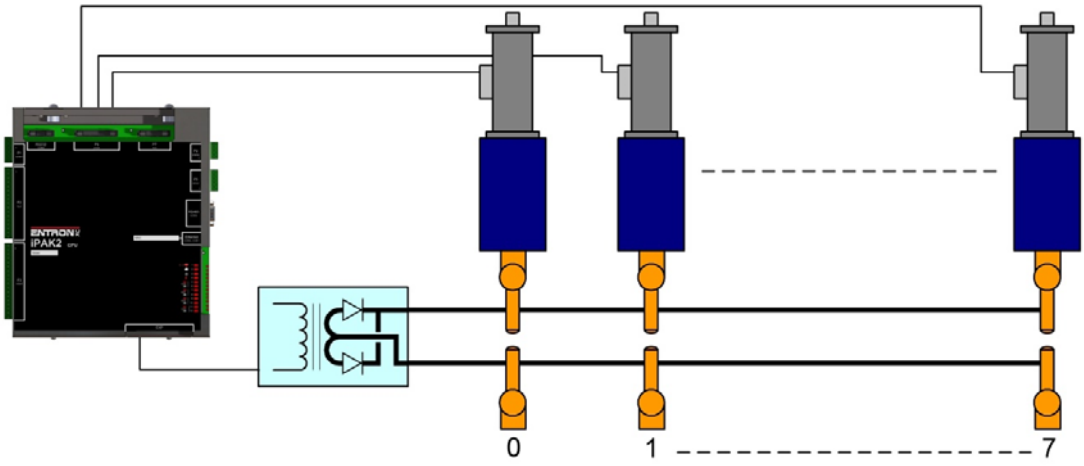


Applications

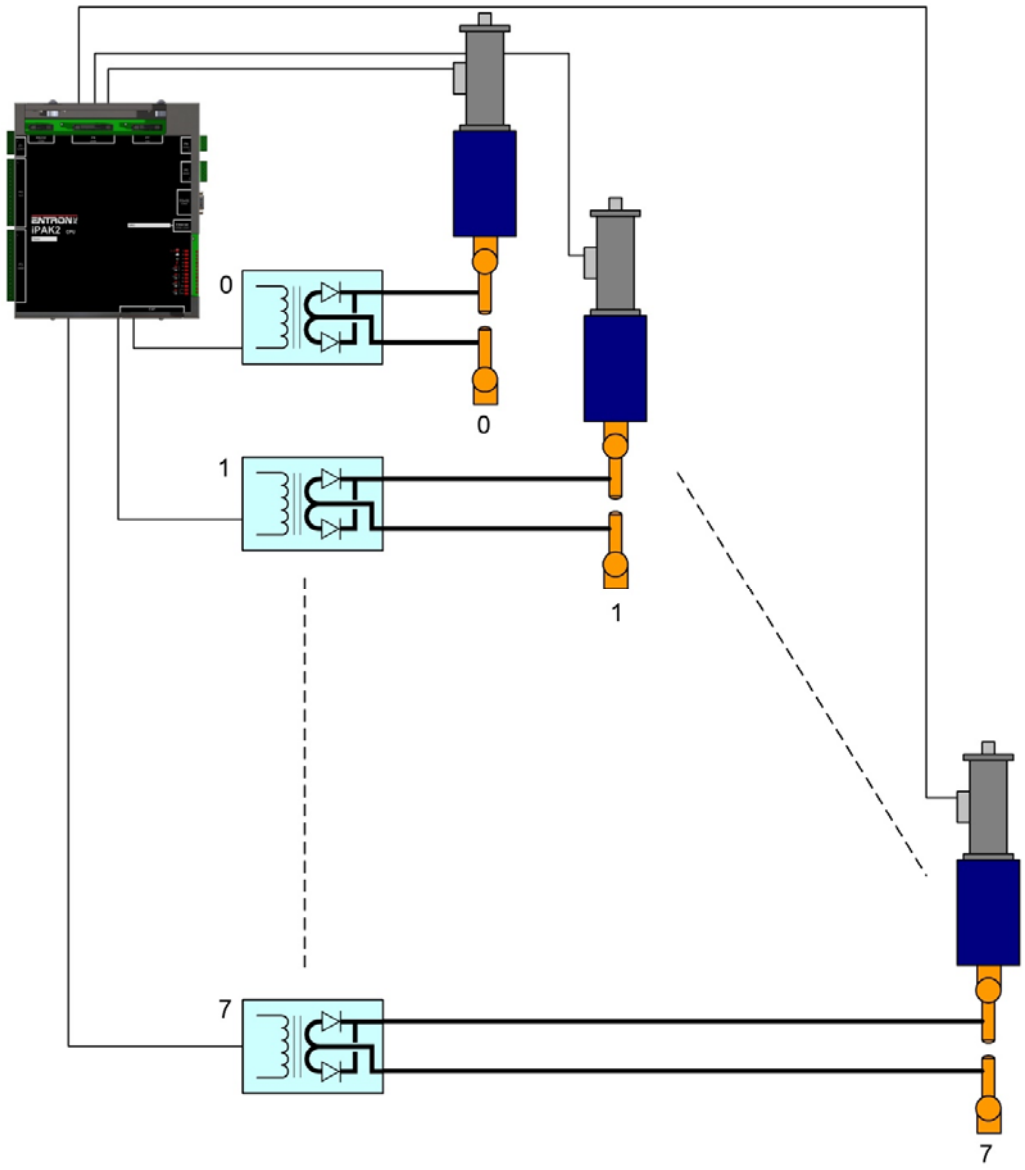
Standard machines, portable/manual guns, robot guns, multi-welders and seam welders.



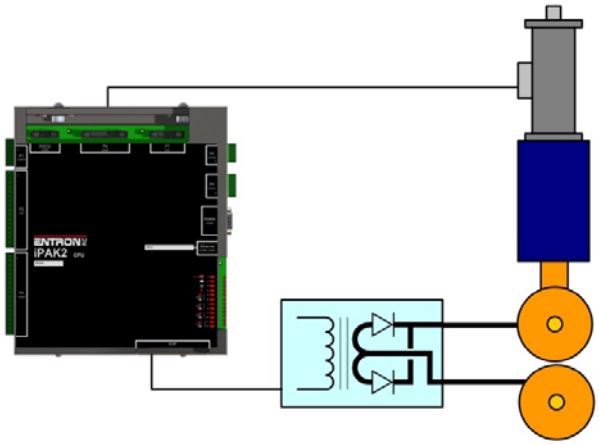
Standard machine



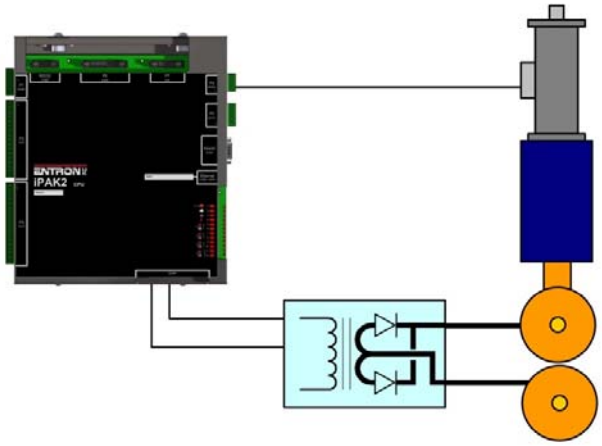
Multi-head machine. Up to eight cylinders, cascade or independent firing.



Multi-welder. Up to 8 transformers and cylinders, cascade or independent firing.



Seam welder with one transformer



Seam welder with a multi-tap transformer

Getting started

iPAK2 mounts directly onto an iPAK inverter. The inverters have maximum primary current ratings as follows:

- 150 A
- 360 A
- 600 A
- 1000 A
- 1500 A (LMI)

For higher currents, multiple LMI modules can be connected together. The standard iPAK family operates with a supply voltage in the range 380-480V AC but lower and higher voltage inverters are available.

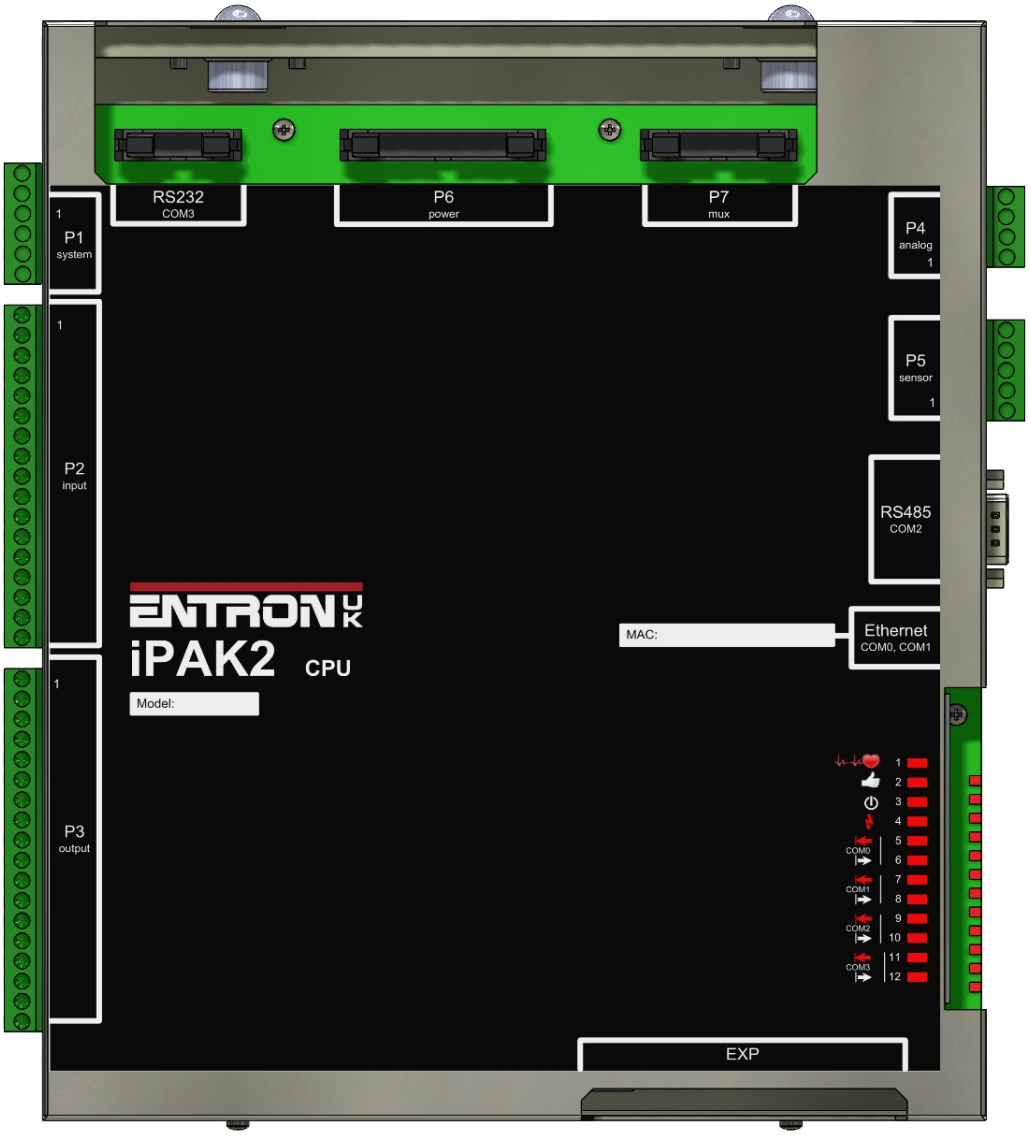
Control connectors

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

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

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

Connector P7 is used for MUX driver cards on systems with more than one transformer.

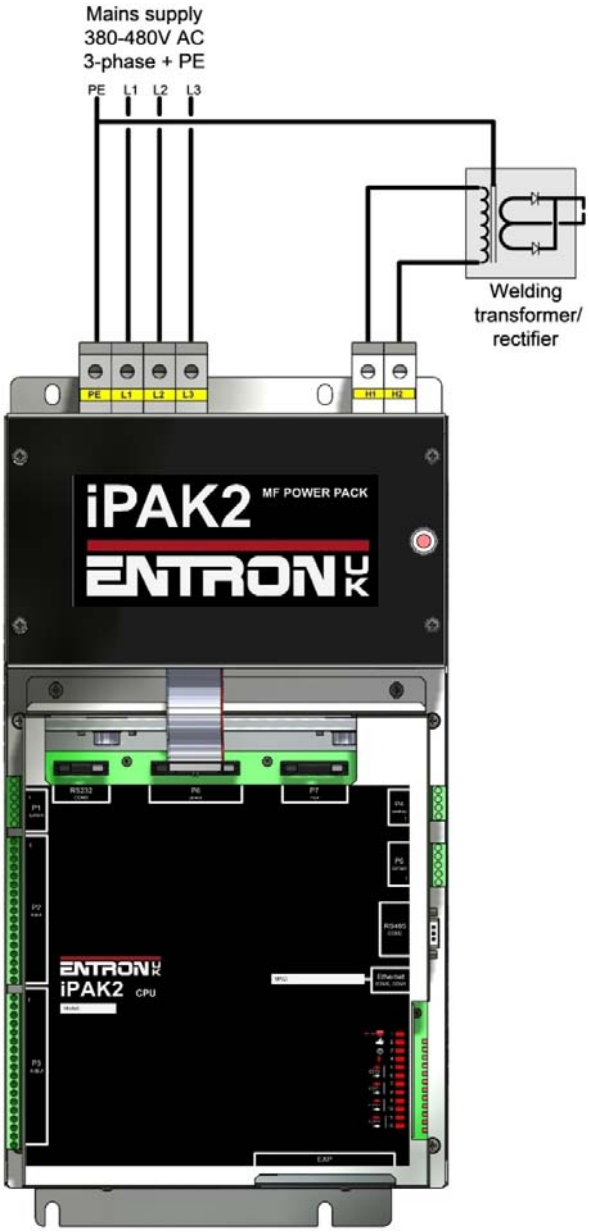


Power connectors

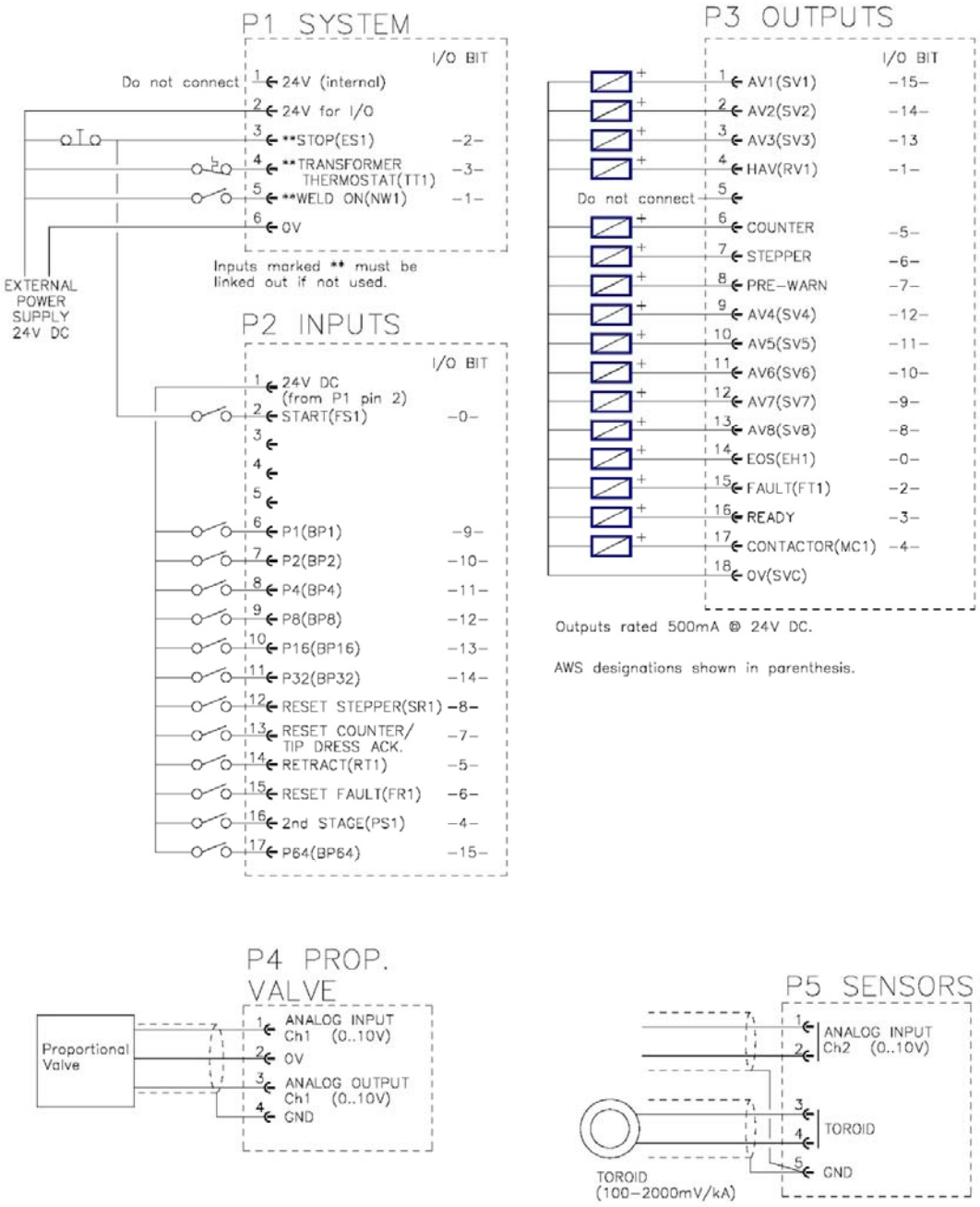
A 3-phase supply via a suitable protective device (such as a circuit breaker) should be connected to the inverter as shown (Terminals L1, L2, L3, PE). A suitable MF welding transformer/rectifier should be connected to the inverter at terminals H1 and H2. The transformer must also be connected to the 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.

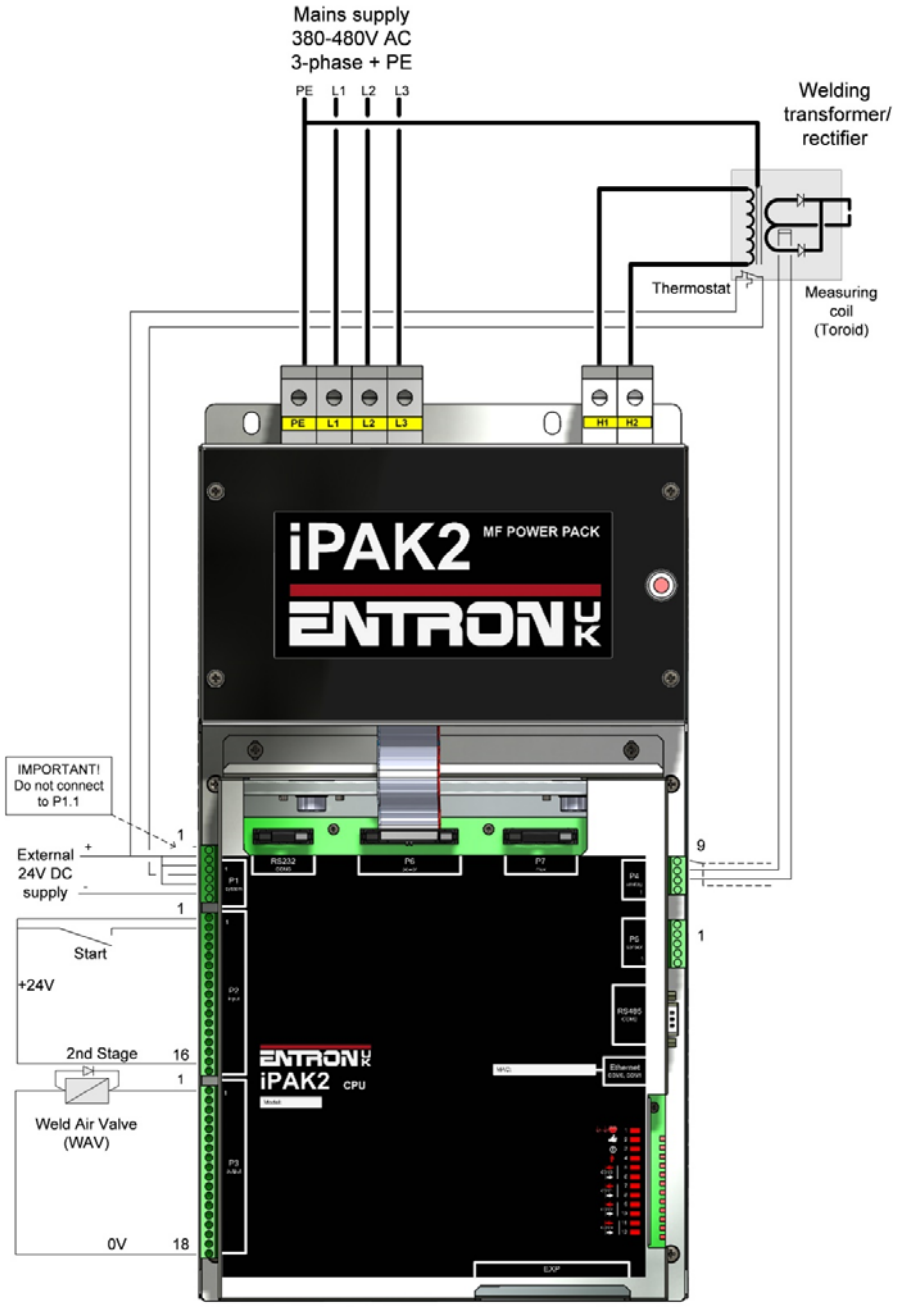


User's connections (discrete)



Initialisation

- Make the basic connections as shown below. Additional connections may be required depending on the application.



- Make sure there is sufficient air pressure and cooling water where necessary.
- Section 13 **Programming**: switch on then use the 'Initialise all data' function to clear the iPAK2's memory.
- Section 12 **Configuration**: set the Configuration parameters appropriately for the application.

- Section 13 **Programming**: edit program 0 to set up a basic weld sequence e.g. Squeeze = 200, Main heat = 100, Hold = 200, Pulses=1, and Main mode = P/W. A welding operation should be possible at this stage. Begin by using the gun short-circuit. The iPAK2 should report the measured current on the diagnostic display.
- Section 7 **Electrode management**: perform the current and CCC calibration procedures.
- Make any other adjustments which may be required and set up other programmes for welding.

Inputs and outputs

iPAK2 uses a number of inputs and outputs to control and monitor the weld sequence.

Inputs

Input	AWS designation	Description
Start	FS1	When this input is activated a weld sequence begins. If the input is removed during the Squeeze interval the sequence is aborted. If the input is maintained through the Squeeze interval but switched off subsequently, the sequence terminates normally.
Weld on	NW1	This input enables the weld current. If this input is inactive a weld sequence will not produce any current.
Stop	ES1	Sequencing is inhibited or aborted if this input is not active.
Thermal	TT1	This input is usually connected to a normally closed thermal contact attached to the weld transformer. Sequencing is inhibited if this input is not active.
2nd stage	PS1	If enabled, iPAK2 checks that the 2nd Stage signal is present before proceeding to weld. The checking is programmable to take place either before or after the Squeeze interval. If the signal is not present iPAK2 waits for the signal before it proceeds. If the Start signal is removed while waiting, the sequence is aborted.
Retract	RT1	This input is used to control the Retract function.
Reset fault	FR1	This input resets the Fault output and clears the status messages. Only momentary application is required (minimum time 40ms).
Reset counter/tip dress acknowledge[1]		Used to reset the counter(s) or acknowledge a tip dress request.
Reset stepper[2]	SR1	Used to reset the stepper(s).
P1	BP1	Program select inputs. Weld program selection is made by applying the binary code for the required program. Programs 0 to 127 can be selected (programs 128 to 255 can still be selected internally or via the fieldbus). If the 'key-switch' security option is selected, then input P64 (on the discrete interface only) is not available. In this case, programs 0 to 63 can be selected (programs 64 to 255 can still be selected internally or via the fieldbus).
P2	BP2	
P4	BP4	
P8	BP8	
P16	BP16	
P32	BP32	
P64	BP64	
Toroid		Input for the toroid. Resistance must be in the range 10 to 300 Ohms.
Analog		0 to 10 V analog input. Can be used to monitor a proportional air regulator valve output or other sensor for force control and monitoring. Also used as the control input in ANALOG mode.

Outputs

Output	AWS designation	Description
EOS	EH1	This output switches on to indicate the end of the weld sequence.
HAV	RV1	Used in conjunction with the Retract input to control the welding head.
Fault	FT1	This output indicates a fault condition.
Ready[3]		This output is active if iPAK2 is ready to weld. The output switches off under some fault conditions.
Contactor	MC1	This output can be used to control an isolation contactor.
Counter/tip dress request		This output indicates that the counter has reached its limit or that a tip dressing operation is required.
Stepper		This output indicates that the stepper has reached its limit.
Pre-warn		This output indicates that the stepper is close to its limit.
AV1		Additional outputs that can be used during the weld sequence.
AV2		
AV3		
AV4		
AV5		
AV6		
AV7		
AV8		
Analog		0 to 10 V analog output. Can be used to drive a proportional air regulator valve for force control

[1] Momentary operation will reset all expired counters. If maintained for more than 5 seconds all counters will be reset, regardless of status.

[2] Momentary operation will reset all expired steppers. If maintained for more than 5 seconds all steppers will be reset, regardless of status.

[3] If iPAK (v1) mode is selected (Section 12 **Configuration**)

- the sense of the READY output is reversed and it signifies NOT READY
- outputs AV4, 5, and 6 are used for MUX selection and are not available

Discrete I/O

The inputs and outputs are accessible via connectors P1, P2, P3, P4 and P5. The connectors are two-part terminals for use with wires up to 1 mm^2

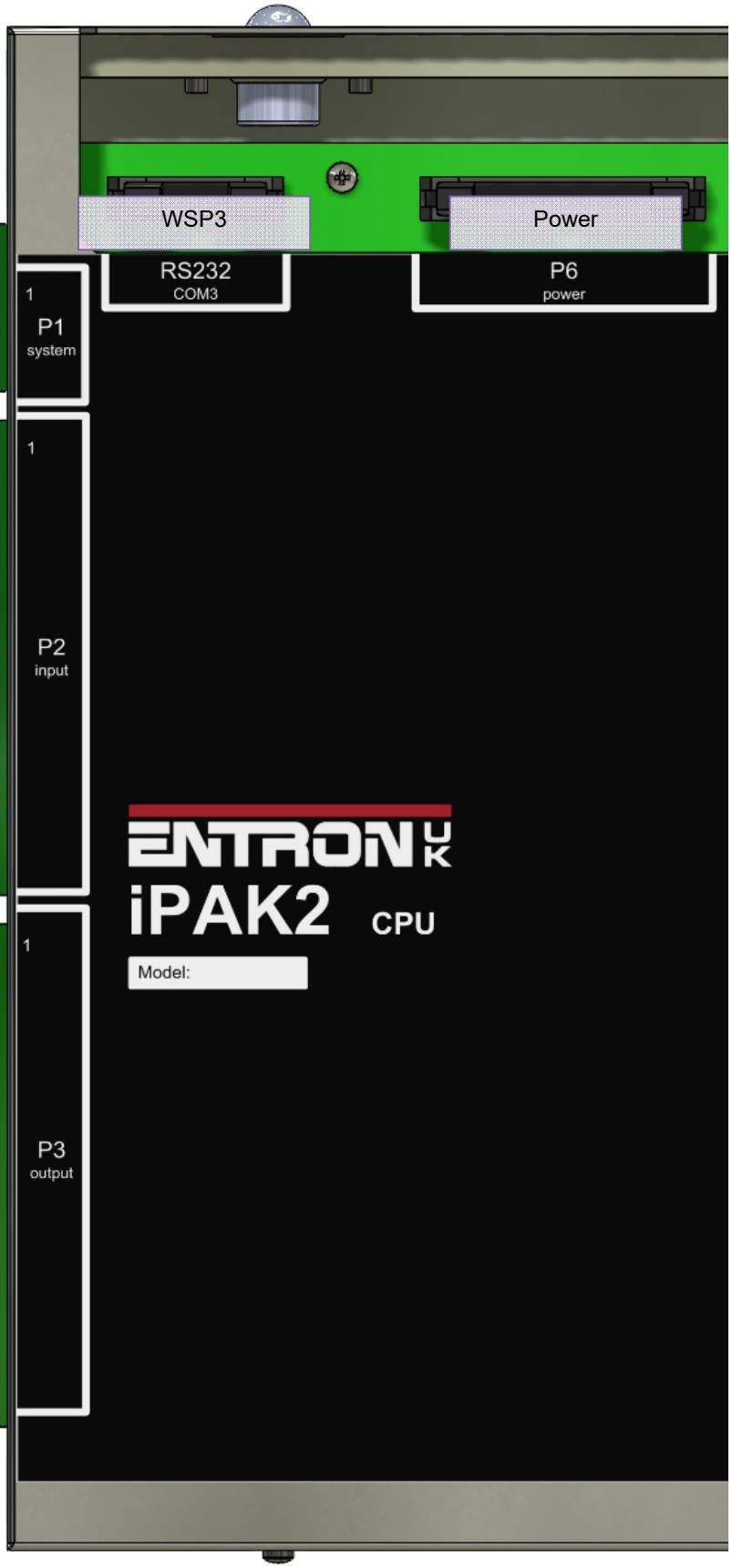
If the iPAK2 is supplied fitted into a case some connections will have been pre-wired by BF ENTRON. See the case wiring diagram for details.

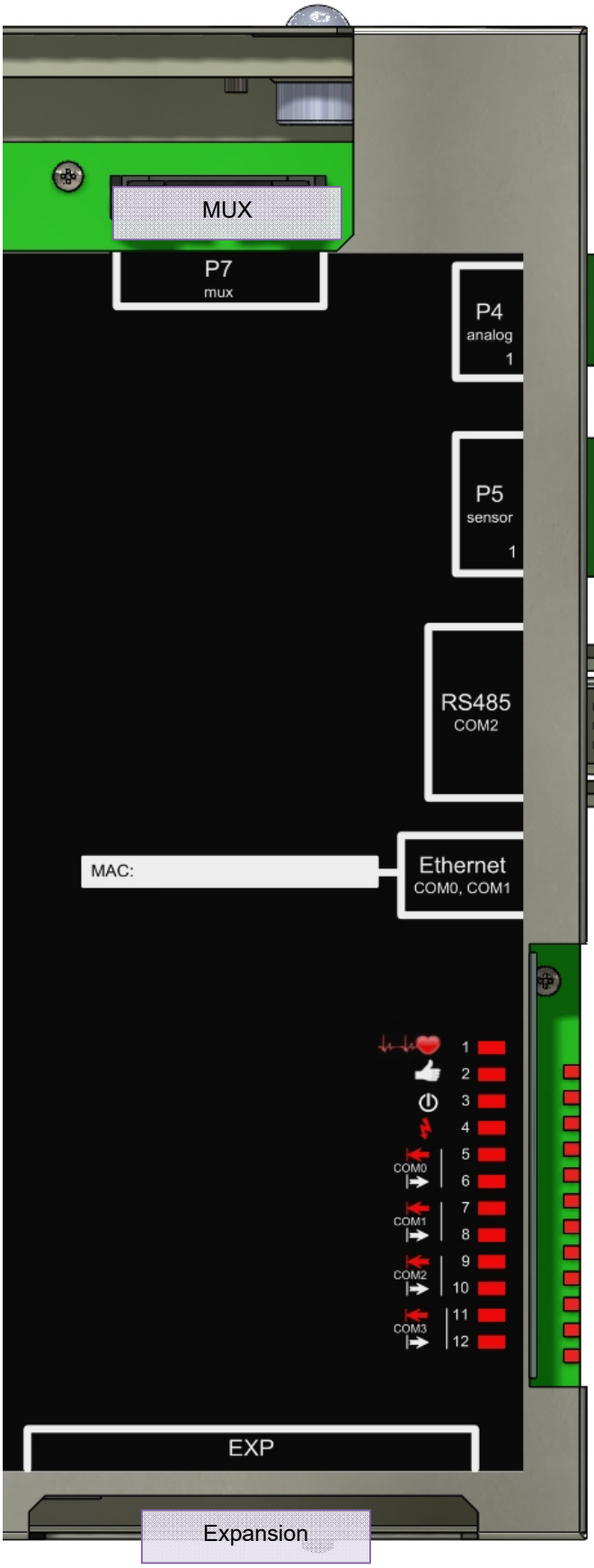
Outputs are rated 500 mA @24 V dc
AWS designations in parenthesis
[1] inputs must be linked if not required

Pin	I/O bit	
1.		24 V (internal)
2.		24 V for I/O
3.	2	Stop (ES1) [1]
4.	3	Transformer thermal (TT1) [1]
5.	1	Weld on (NW1) [1]
6.		0 V

Pin	I/O bit	
1.		24 V (24 VDC)
2.	0	Start (FS1)
3.		
4.		
5.		
6.	9	P1 (BP1)
7.	10	P2 (BP2)
8.	11	P4 (BP4)
9.	12	P8 (BP8)
10.	13	P16 (BP16)
11.	14	P32 (BP32)
12.	8	Reset stepper (SR1)
13.	7	Reset counter/tip dress ack
14.	5	Retract (RT1)
15.	6	Reset fault (FR1)
16.	4	2nd stage (PS1)
17.	15	P64 (BP64)/Edit enable

Pin	I/O bit	
1.	15	AV1 (SV1)
2.	14	AV2 (SV2)
3.	13	AV3 (SV3)
4.	1	HAV (RV1)
5.		Do not connect
6.	5	Counter
7.	6	Stepper
8.	7	Pre-warn
9.	12	AV4 (SV4)
10.	11	AV5 (SV5)
11.	10	AV6 (SV6)
12.	9	AV7 (SV7)
13.	8	AV8 (SV8)
14.	0	EOS (EH1)
15.	2	Fault (FT1)
16.	3	Ready
17.	4	Contactor (MC1)
18.		0 V (SVC)





1. Analog input #1 (0 to 10 V)
2. 0 V
3. Analog output #1 (0 to 10 V)
4. Ground

1. Analog input #2
2. Analog input #2
3. Toroid input
4. Toroid input
5. Ground

MODBUS-RTU

NetFlash
MODBUS-TCP/IP

1. Heartbeat
2. Ready
3. Sequence initiated
4. Weld current
5. Data receive COM0
6. Data send COM0
7. Data receive COM1
8. Data send COM1
9. Data receive COM2
10. Data send COM2
11. Data receive COM3
12. Data send COM3

MODBUS I/O

iPAK2 can be operated via MODBUS instead of using the discrete inputs and outputs.

Both MODBUS TCP/IP (Ethernet) and MODBUS RTU (RS485) protocols are supported.

Write the inputs using MODBUS function 16
Read the outputs using MODBUS function 3

MODBUS access types

Write inputs			
	Type	Value	Description
Function code	UINT	16	Write multiple registers
Read offset	UINT	0	
Read length	UINT	0	
Write offset	UINT	16#8000 (= 32768)	
Write length	UINT	2	

Read outputs			
	Type	Value	Description
Function code	UINT	3	Read holding registers
Read offset	UINT	16#9000 (= 36864)	
Read length	UINT	24	
Write offset	UINT	0	
Write length	UINT	0	

MODBUS mapping (inputs to iPAK2)

Variable	Channel	Address	Type	Description
	Write inputs	%QW0	WORD ARRAY [0..1]	Write multiple registers
	Write inputs [0]	%QW0	WORD	WRITE 16#8000 (= 32768)
Start	Bit 0	%QX0.0	BOOL	
Weld on	Bit 1	%QX0.1	BOOL	
Stop	Bit 2	%QX0.2	BOOL	
Transformer thermal	Bit 3	%QX0.3	BOOL	
2nd stage	Bit 4	%QX0.4	BOOL	
Retract	Bit 5	%QX0.5	BOOL	
Reset fault	Bit 6	%QX0.6	BOOL	
Reset counter	Bit 7	%QX0.7	BOOL	
Reset stepper	Bit 8	%QX1.0	BOOL	
Reserved	Bit 9	%QX1.1	BOOL	
Reserved	Bit 10	%QX1.2	BOOL	
Reserved	Bit 11	%QX1.3	BOOL	
Reserved	Bit 12	%QX1.4	BOOL	
Reserved	Bit 13	%QX1.5	BOOL	
Reserved	Bit 14	%QX1.6	BOOL	
Reserved	Bit 15	%QX1.7	BOOL	
	Write inputs [1]	%QW2	WORD	WRITE 16#8001 (= 32769)
P1	Bit 0	%QX2.0	BOOL	
P2	Bit 1	%QX2.1	BOOL	
P4	Bit 2	%QX2.2	BOOL	
P8	Bit 3	%QX2.3	BOOL	
P16	Bit 4	%QX2.4	BOOL	
P32	Bit 5	%QX2.5	BOOL	
P64	Bit 6	%QX2.6	BOOL	
P128	Bit 7	%QX2.7	BOOL	
Reserved	Bit 8	%QX3.0	BOOL	
Reserved	Bit 9	%QX3.1	BOOL	
Reserved	Bit 10	%QX3.2	BOOL	
Reserved	Bit 11	%QX3.3	BOOL	
Reserved	Bit 12	%QX3.4	BOOL	
Reserved	Bit 13	%QX3.5	BOOL	
Reserved	Bit 14	%QX3.6	BOOL	
Reserved	Bit 15	%QX3.7	BOOL	

MODBUS mapping (outputs from iPAK2)

Variable	Channel	Address	Type	Description
	Read outputs	%IW0	WORD ARRAY [0..23]	Read holding registers
	Read outputs [0]	%IW0	WORD	READ 16#9000 (= 36864)
EOS	Bit 0	%IX0.0	BOOL	
HAV	Bit 1	%IX0.1	BOOL	
Fault	Bit 2	%IX0.2	BOOL	
Ready	Bit 3	%IX0.3	BOOL	
Contactor	Bit 4	%IX0.4	BOOL	
Counter	Bit 5	%IX0.5	BOOL	
Stepper	Bit 6	%IX0.6	BOOL	
Pre-warn	Bit 7	%IX0.7	BOOL	
AV8	Bit 8	%IX1.0	BOOL	
AV7	Bit 9	%IX1.1	BOOL	
AV6	Bit 10	%IX1.2	BOOL	
AV5	Bit 11	%IX1.3	BOOL	
AV4	Bit 12	%IX1.4	BOOL	
AV3	Bit 13	%IX1.5	BOOL	
AV2	Bit 14	%IX1.6	BOOL	
AV1	Bit 15	%IX1.7	BOOL	
	Read outputs [1]	%IW2	WORD	READ 16#9001 (= 36865)
Start	Bit 0	%IX2.0	BOOL	≡ %QX0.0
Weld on	Bit 1	%IX2.1	BOOL	≡ %QX0.1
Stop	Bit 2	%IX2.2	BOOL	≡ %QX0.2
Transformer thermal	Bit 3	%IX2.3	BOOL	≡ %QX0.3
2nd stage	Bit 4	%IX2.4	BOOL	≡ %QX0.4
Retract	Bit 5	%IX2.5	BOOL	≡ %QX0.5
Reset fault	Bit 6	%IX2.6	BOOL	≡ %QX0.6
Reset counter	Bit 7	%IX2.7	BOOL	≡ %QX0.7
Reset stepper	Bit 8	%IX3.0	BOOL	≡ %QX1.0
P1	Bit 9	%IX3.1	BOOL	≡ discrete input P1
P2	Bit 10	%IX3.2	BOOL	≡ discrete input P2
P4	Bit 11	%IX3.3	BOOL	≡ discrete input P4
P8	Bit 12	%IX3.4	BOOL	≡ discrete input P8
P16	Bit 13	%IX3.5	BOOL	≡ discrete input P16
P32	Bit 14	%IX3.6	BOOL	≡ discrete input P32
P64	Bit 15	%IX3.7	BOOL	≡ discrete input P64
	Read outputs [2]	%IW4	WORD	READ 16#9002 (= 36866)
Start	Bit 0	%IX4.0	BOOL	≡ discrete input Start
Weld on	Bit 1	%IX4.1	BOOL	≡ discrete input Weld on
Stop	Bit 2	%IX4.2	BOOL	≡ discrete input Stop
Thermal	Bit 3	%IX4.3	BOOL	≡ discrete input Thermal
2nd stage	Bit 4	%IX4.4	BOOL	≡ discrete input 2nd stage
Retract	Bit 5	%IX4.5	BOOL	≡ discrete input Retract
Reset fault	Bit 6	%IX4.6	BOOL	≡ discrete input Reset fault
Reset counter	Bit 7	%IX4.7	BOOL	≡ discrete input Reset counter
Reset stepper	Bit 8	%IX5.0	BOOL	≡ discrete input Reset stepper
P1	Bit 9	%IX5.1	BOOL	≡ discrete input P1
P2	Bit 10	%IX5.2	BOOL	≡ discrete input P2
P4	Bit 11	%IX5.3	BOOL	≡ discrete input P4
P8	Bit 12	%IX5.4	BOOL	≡ discrete input P8
P16	Bit 13	%IX5.5	BOOL	≡ discrete input P16
P32	Bit 14	%IX5.6	BOOL	≡ discrete input P32
P64	Bit 15	%IX5.7	BOOL	≡ discrete input P64

Variable	Channel	Address	Type	Description
Analog input (mV)	Read outputs [3]	%IW6	WORD	READ 16#9003 (= 36867)
Analog output (mV)	Read outputs [4]	%IW8	WORD	READ 16#9004 (= 36868)
% pulse width	Read outputs [5]	%IW10	WORD	READ 16#9005 (= 36869)
Reserved	Read outputs [6]	%IW12	WORD	READ 16#9006 (= 36870)
Reserved	Read outputs [7]	%IW14	WORD	READ 16#9007 (= 36871)
Status register 0	Read outputs [8]	%IW16	WORD	READ 16#9008 (= 36872)
Stop	Bit 0	%IX16.0	BOOL	Bit 0
Reserved	Bit 1	%IX16.1	BOOL	
Retract not ready	Bit 2	%IX16.2	BOOL	Bit 2
Inverter hot	Bit 3	%IX16.3	BOOL	Bit 3
Transformer hot	Bit 4	%IX16.4	BOOL	Bit 4
Pilot fault	Bit 5	%IX16.5	BOOL	Bit 5
Restart required	Bit 6	%IX16.6	BOOL	Bit 6
Headlock	Bit 7	%IX16.7	BOOL	Bit 7
Reserved	Bit 8	%IX17.0	BOOL	
Reserved	Bit 9	%IX17.1	BOOL	
Reserved	Bit 10	%IX17.2	BOOL	
Reserved	Bit 11	%IX17.3	BOOL	
Reserved	Bit 12	%IX17.4	BOOL	
Reserved	Bit 13	%IX17.5	BOOL	
Reserved	Bit 14	%IX17.6	BOOL	
Test mode	Bit 15	%IX17.7	BOOL	Bit 15
Status register 1	Read outputs [9]	%IW18	WORD	READ 16#9009 (= 36873)
Start on	Bit 0	%IX18.0	BOOL	Bit 16
Weld off	Bit 1	%IX18.1	BOOL	Bit 17
Program inhibited	Bit 2	%IX18.2	BOOL	Bit 18
Output fault	Bit 3	%IX18.3	BOOL	Bit 19
Reserved	Bit 4	%IX18.4	BOOL	
Too many links	Bit 5	%IX18.5	BOOL	Bit 21
Bad link	Bit 6	%IX18.6	BOOL	Bit 22
Maximum current	Bit 7	%IX18.7	BOOL	Bit 23
Toroid over range	Bit 8	%IX19.0	BOOL	Bit 24
CT over range	Bit 9	%IX19.1	BOOL	Bit 25
Maximum pulse width	Bit 10	%IX19.2	BOOL	Bit 26
Calibration error	Bit 11	%IX19.3	BOOL	Bit 27
Reserved	Bit 12	%IX19.4	BOOL	
Reserved	Bit 13	%IX19.5	BOOL	
Reserved	Bit 14	%IX19.6	BOOL	
Reserved	Bit 15	%IX19.7	BOOL	
Status register 2	Read outputs [10]	%IW20	WORD	READ 16#900A (= 36874)
Low force	Bit 0	%IX20.0	BOOL	Bit 32
High force	Bit 1	%IX20.1	BOOL	Bit 33
Low pre-current	Bit 2	%IX20.2	BOOL	Bit 34
High pre-current	Bit 3	%IX20.3	BOOL	Bit 35
Low main current	Bit 4	%IX20.4	BOOL	Bit 36
High main current	Bit 5	%IX20.5	BOOL	Bit 37
Low post-current	Bit 6	%IX20.6	BOOL	Bit 38
High post-current	Bit 7	%IX20.7	BOOL	Bit 39
No 2nd stage	Bit 8	%IX21.0	BOOL	Bit 40
No force	Bit 9	%IX21.1	BOOL	Bit 41
Reserved	Bit 10	%IX21.2	BOOL	
Reserved	Bit 11	%IX21.3	BOOL	
Reserved	Bit 12	%IX21.4	BOOL	
Reserved	Bit 13	%IX21.5	BOOL	
Reserved	Bit 14	%IX21.6	BOOL	
Reserved	Bit 15	%IX21.7	BOOL	

Variable	Channel	Address	Type	Description
Status register 3	Read outputs [11]	%IW22	WORD	READ 16#900B (= 36875)
End of count 0	Bit 0	%IX22.0	BOOL	Bit 48
End of count 1	Bit 1	%IX22.1	BOOL	Bit 49
End of count 2	Bit 2	%IX22.2	BOOL	Bit 50
End of count 3	Bit 3	%IX22.3	BOOL	Bit 51
End of count 4	Bit 4	%IX22.4	BOOL	Bit 52
End of count 5	Bit 5	%IX22.5	BOOL	Bit 53
End of count 6	Bit 6	%IX22.6	BOOL	Bit 54
End of count 7	Bit 7	%IX22.7	BOOL	Bit 55
Reserved	Bit 8	%IX23.0	BOOL	
Reserved	Bit 9	%IX23.1	BOOL	
Reserved	Bit 10	%IX23.2	BOOL	
Reserved	Bit 11	%IX23.3	BOOL	
Reserved	Bit 12	%IX23.4	BOOL	
Reserved	Bit 13	%IX23.5	BOOL	
Reserved	Bit 14	%IX23.6	BOOL	
Reserved	Bit 15	%IX23.7	BOOL	
Status register 4	Read outputs [12]	%IW24	WORD	READ 16#900C (= 36876)
End of electrode 0	Bit 0	%IX24.0	BOOL	Bit 64
End of electrode 1	Bit 1	%IX24.1	BOOL	Bit 65
End of electrode 2	Bit 2	%IX24.2	BOOL	Bit 66
End of electrode 3	Bit 3	%IX24.3	BOOL	Bit 67
End of electrode 4	Bit 4	%IX24.4	BOOL	Bit 68
End of electrode 5	Bit 5	%IX24.5	BOOL	Bit 69
End of electrode 6	Bit 6	%IX24.6	BOOL	Bit 70
End of electrode 7	Bit 7	%IX24.7	BOOL	Bit 71
Reserved	Bit 8	%IX25.0	BOOL	
Reserved	Bit 9	%IX25.1	BOOL	
Reserved	Bit 10	%IX25.2	BOOL	
Reserved	Bit 11	%IX25.3	BOOL	
Reserved	Bit 12	%IX25.4	BOOL	
Reserved	Bit 13	%IX25.5	BOOL	
Reserved	Bit 14	%IX25.6	BOOL	
Reserved	Bit 15	%IX25.7	BOOL	
Status register 5	Read outputs [13]	%IW26	WORD	READ 16#900D (= 36877)
Tip dress 0	Bit 0	%IX26.0	BOOL	Bit 80
Tip dress 1	Bit 1	%IX26.1	BOOL	Bit 81
Tip dress 2	Bit 2	%IX26.2	BOOL	Bit 82
Tip dress 3	Bit 3	%IX26.3	BOOL	Bit 83
Tip dress 4	Bit 4	%IX26.4	BOOL	Bit 84
Tip dress 5	Bit 5	%IX26.5	BOOL	Bit 85
Tip dress 6	Bit 6	%IX26.6	BOOL	Bit 86
Tip dress 7	Bit 7	%IX26.7	BOOL	Bit 87
Reserved	Bit 8	%IX27.0	BOOL	
Reserved	Bit 9	%IX27.1	BOOL	
Reserved	Bit 10	%IX27.2	BOOL	
Reserved	Bit 11	%IX27.3	BOOL	
Reserved	Bit 12	%IX27.4	BOOL	
Reserved	Bit 13	%IX27.5	BOOL	
Reserved	Bit 14	%IX27.6	BOOL	
Reserved	Bit 15	%IX27.7	BOOL	

Variable	Channel	Address	Type	Description
Status register 6	Read outputs [14]	%IW28	WORD	READ 16#900E (= 36878)
Prewarn 0	Bit 0	%IX28.0	BOOL	Bit 96
Prewarn 1	Bit 1	%IX28.1	BOOL	Bit 97
Prewarn 2	Bit 2	%IX28.2	BOOL	Bit 98
Prewarn 3	Bit 3	%IX28.3	BOOL	Bit 99
Prewarn 4	Bit 4	%IX28.4	BOOL	Bit 100
Prewarn 5	Bit 5	%IX28.5	BOOL	Bit 101
Prewarn 6	Bit 6	%IX28.6	BOOL	Bit 102
Prewarn 7	Bit 7	%IX28.7	BOOL	Bit 103
Reserved	Bit 8	%IX29.0	BOOL	
Reserved	Bit 9	%IX29.1	BOOL	
Reserved	Bit 10	%IX29.2	BOOL	
Reserved	Bit 11	%IX29.3	BOOL	
Reserved	Bit 12	%IX29.4	BOOL	
Reserved	Bit 13	%IX29.5	BOOL	
Reserved	Bit 14	%IX29.6	BOOL	
Reserved	Bit 15	%IX29.7	BOOL	
Status register 7	Read outputs [15]	%IW30	WORD	READ 16#900F (= 36879)
Bus fail	Bit 0	%IX30.0	BOOL	Bit 112
Short circuit	Bit 1	%IX30.1	BOOL	Bit 113
Fan failure	Bit 2	%IX30.2	BOOL	Bit 114
Inverter not ready	Bit 3	%IX30.3	BOOL	Bit 115
LMI config. error	Bit 4	%IX30.4	BOOL	Bit 116
LMI error	Bit 5	%IX30.5	BOOL	Bit 117
Duty cycle limit	Bit 6	%IX30.6	BOOL	Bit 118
Reserved	Bit 7	%IX30.7	BOOL	
Reserved	Bit 8	%IX31.0	BOOL	
Reserved	Bit 9	%IX31.1	BOOL	
Reserved	Bit 10	%IX31.2	BOOL	
Reserved	Bit 11	%IX31.3	BOOL	
Reserved	Bit 12	%IX31.4	BOOL	
Reserved	Bit 13	%IX31.5	BOOL	
Reserved	Bit 14	%IX31.6	BOOL	
Reserved	Bit 15	%IX31.7	BOOL	
Pre-heat current (A)	Read outputs [16]	%IW32	DWORD	READ 16#9010 (= 36880)
Main current (A)	Read outputs [18]	%IW36	DWORD	READ 16#9012 (= 36882)
Post-heat current (A)	Read outputs [20]	%IW40	DWORD	READ 16#9014 (= 36884)
Program number	Read outputs [22]	%IW44	WORD	READ 16#9016 (= 36886)
Force[1]	Read outputs [23]	%IW46	WORD	READ 16#9017 (= 36887)

[1] value is multiplied by the scale factor (898.88 for kN or 4 for lbf

Weld control

iPAK2 controls the weld sequence by using the I/O in conjunction with the welding parameters. The parameters are stored in programs so that different materials and machine sequences can be used. There are 256 weld programs.

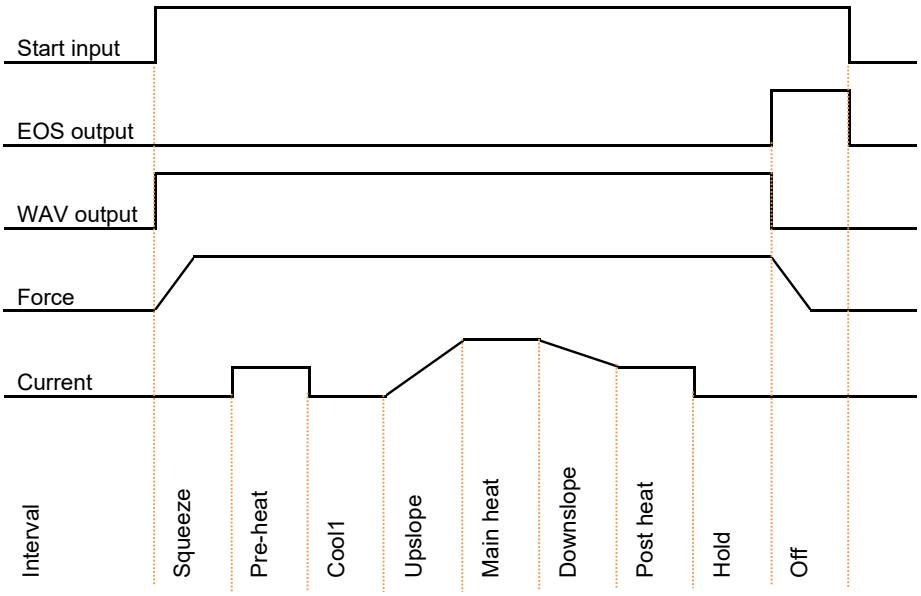
Spot sequence timing

The weld programs contain the following timing parameters.

Parameter	Units	Range	Description
Presqueeze	ms	0 - 1999	The time for the electrodes to close onto the work piece.
Squeeze	ms	0 - 1999	The time between the initial application of the electrode force and the first application of welding current
Pre-heat[1]	ms	0 - 1999	The pre-heat welding current is applied
Cool1[1]	ms	0 - 1999	The material is allowed to cool with electrode force applied
Upslope	ms	0 - 1999	Welding current is increased during this time
Main heat	ms	0 - 1999	The main welding current is applied
Cool2[2]	ms	0 - 1999	The material is allowed to cool with electrode force applied
Downslope	ms	0 - 1999	Welding current is decreased during this time
Post-heat[3]	ms	0 - 1999	The post-heat welding current is applied
Hold	ms	0 - 1999	Electrode force continues after the welding current has finished
Off[4]	ms	0 - 1999	Electrode force is released until the next sequence begins

[1] Pre-heat program option must be enabled to use this feature
[2] Pulsations program option must be greater than 1 to use this feature
[3] Post-heat program option must be enabled to use this extended feature

The diagram shows how the parameters control the sequence. The Presqueeze and Cool2 intervals are not shown.



Upslope can be used on hard, irregular shaped, oxidized and aluminium materials
Downslope can be used to reduce marking and embrittlement

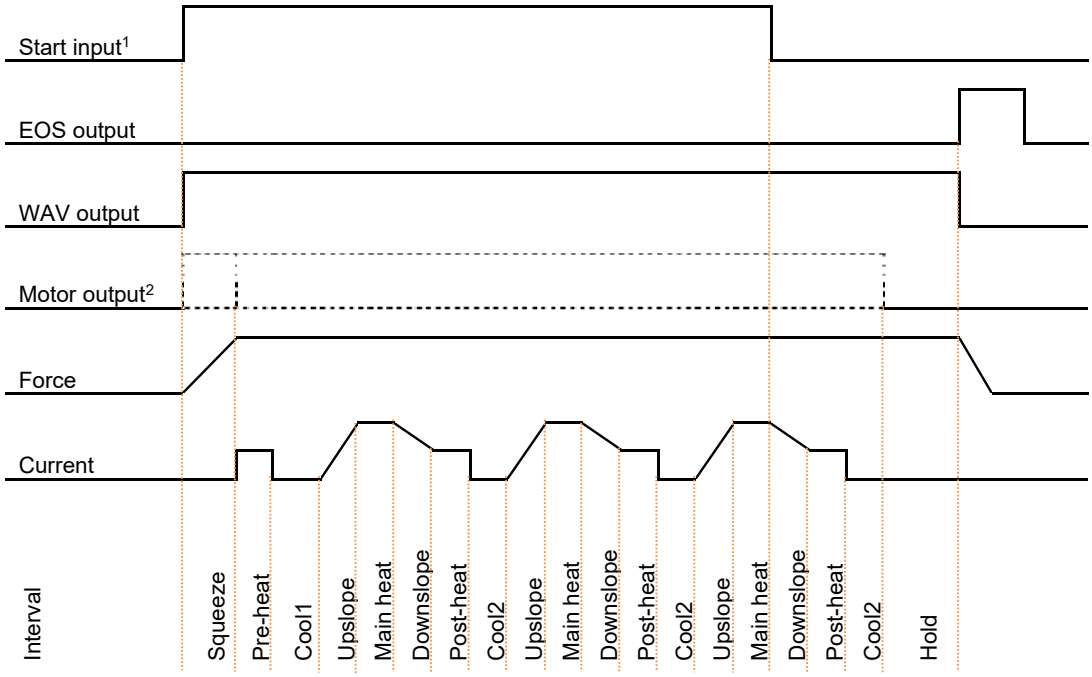
Seam sequence timing (extended feature)

The weld programs contain the following timing parameters. All parameters can be adjusted during the sequence.

Parameter	Units	Range	Description
Presqueeze	ms	0 - 1999	The time for the electrodes to close onto the work piece.
Squeeze	ms	0 - 1999	The time between the initial application of the electrode force and the first application of welding current
Pre-heat[1]	ms	0 - 1999	The pre-heat welding current is applied
Cool1[1]	ms	0 - 1999	The material is allowed to cool with electrode force applied
Upslope	ms	0 - 1999	Welding current is increased during this time
Main heat	ms	0 - 1999	The main welding current is applied
Downslope	ms	0 - 1999	Welding current is decreased during this time
Post-heat[2]	ms	0 - 1999	The post-heat welding current is applied
Cool2	ms	0 - 1999	The material is allowed to cool with electrode force applied
Hold	ms	0 - 1999	Electrode force continues after the welding current has finished

[1] Pre-heat program option must be enabled to use this feature
[2] Post-heat program option must be enabled to use this feature

The diagram shows how the parameters control the sequence. (Presqueeze not shown)



[1] The intervals from Upslope to Cool2 repeat until the Start input is removed.
[2] The operation of the motor output is determined by the 2nd stage test (Section 12 **Configuration**).

Spot current control

The weld programs contain the following current control parameters.

Parameter	Units	Range	Description
Pre-mode[1]		P/W – CCu – CCC	Operating mode of the Pre-heat interval
Pre-heat[1]	%	0.0 – 99.9	The % heat used during the Pre-heat interval
Pre-current[1]	kA	0 – 500	The current used during the Pre-heat interval
Pre-monitor[1]		yes/no	The current can be tested between limits
Main mode		P/W – CCu – CCC	Operating mode of the Main heat interval
Main heat	%	0.0 – 99.9	The % heat used during the Main heat interval
Main current	kA	0 – 500	The current used during the Main heat interval
Main monitor		yes/no	The current can be tested between limits
Post mode[2]		P/W – CCu – CCC	Operating mode of the Post-heat interval
Post heat[2]	%	0.0 – 99.9	The % heat used during the Post-heat interval
Post current[2]	kA	0 – 500	The current used during the Post-heat interval
Post monitor[2]		yes/no	The current can be tested between limits
High limit	%	0 - 99	Current high limit
Low limit	%	0 - 99	Current low limit

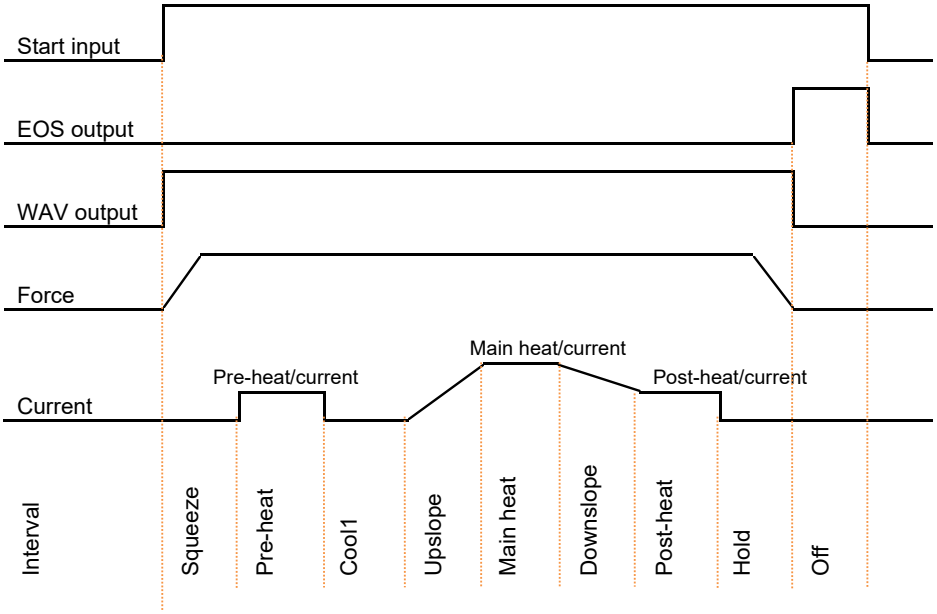
[1] Pre-heat program option must be enabled to use this feature
[2] Post-heat program option must be enabled to use this extended feature

P/W (constant Pulse Width) mode. The current and heat parameters are independently adjustable. The inverter pulse-width is fixed. The current parameter is used for monitoring only.

CCu (Constant Current uncalibrated) mode. The current and heat parameters are independently adjustable. The inverter uses a variable pulse-width to determine and regulate the actual current. The current parameter is used for monitoring only.

CCC (Constant Current Calibrated) mode. The current parameter is adjustable but the heat is automatically determined by the iPAK2 from the calibration data.

The diagram shows how the parameters control the welding current. The Cool2 interval is not shown.



Seam current control (extended feature)

The weld programs contain the following current control parameters.

Parameter	Units	Range	Description
Pre-mode[1]		P/W – CCu – CCC	Operating mode of the Pre-heat interval
Pre-heat[1]	%	0.0 – 99.9	The % heat used during the Pre-heat interval
Pre-current[1]	kA	0 – 500	The current used during the Pre-heat interval
Pre-monitor[1]		yes/no	The current can be tested between limits
Main mode		P/W – CCu – CCC	Operating mode of the Main heat interval
Main heat	%	0.0 – 99.9	The % heat used during the Main heat interval
Main current	kA	0 – 500	The current used during the Main heat interval
Main monitor		yes/no	The current can be tested between limits
Post mode[2]		P/W – CCu – CCC	Operating mode of the Post-heat interval
Post heat[2]	%	0.0 – 99.9	The % heat used during the Post-heat interval
Post current[2]	kA	0 – 500	The current used during the Post-heat interval
Post monitor[2]		yes/no	The current can be tested between limits
High limit	%	0 - 99	Current high limit
Low limit	%	0 - 99	Current low limit

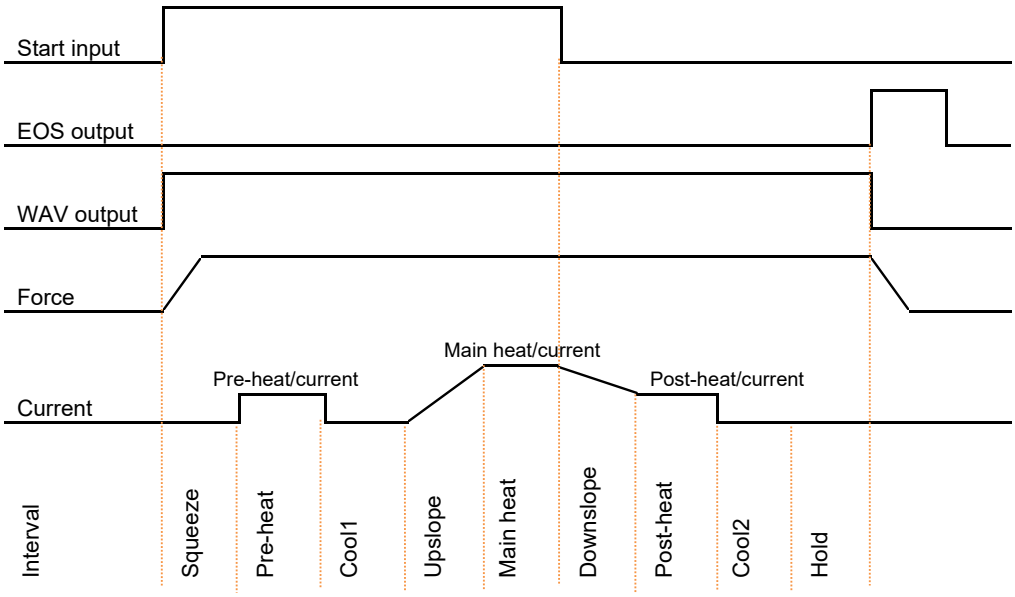
[1] Pre-heat program option must be enabled to use this feature
[2] Post-heat program option must be enabled to use this feature

P/W (constant Pulse Width) mode. The current and heat parameters are independently adjustable. The inverter pulse-width is fixed. The current parameter is used for monitoring only.

CCu (Constant Current uncalibrated) mode. The current and heat parameters are independently adjustable. The inverter uses a variable pulse-width to determine and regulate the actual current. The current parameter is used for monitoring only.

CCC (Constant Current Calibrated) mode. The current parameter is adjustable but the heat is automatically determined by the iPAK2 from the calibration data.

The diagram shows how the parameters control the welding current.



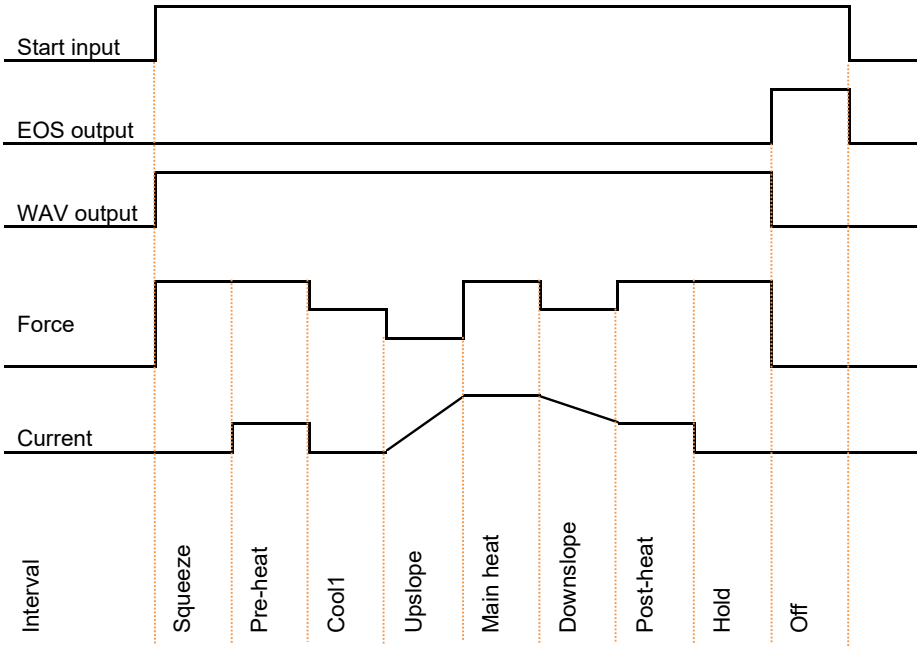
Force control

The weld programs contain the following force control parameters.

Parameter	Units	Range	Description
Squeeze[1]	kN/lbf	variable	Force used from the start of the Squeeze interval
Pre-heat[1]	kN/lbf	variable	Force used from the start the Pre-heat interval
Cool1[1]	kN/lbf	variable	Force used from the start the Cool1 interval
Upslope[1]	kN/lbf	variable	Force used from the start the Upslope interval
Main heat	kN/lbf	variable	Force used from the start of the Main heat interval
Cool2	kN/lbf	variable	Force used from the start of the Cool2 interval
Downslope[1]	kN/lbf	variable	Force used from the start of the Downslope interval
Post-heat[1]	kN/lbf	variable	Force used from the start the Post-heat interval
Hold[1]	kN/lbf	variable	Force used from the start the Hold interval
Off[1,2]	kN/lbf	variable	Force used from the start the Off interval
Wait for force[3]		yes/no	Wait until the applied force has been reached
Test force		yes/no	Test the applied force at the end of the Main interval
High limit	%	0 - 99	Force high limit
Low limit	%	0 - 99	Force low limit

[1] Force profile program option must be enabled to use this extended feature. If the force profile option is disabled the Main heat force is used for the duration of the weld.
[2] Repeat mode program option must be enabled to use this feature.
[3] Occurs at the same time as 2nd stage. If Wait for force is required without 2nd stage, select 2nd stage Before or After Squeeze (Section 12 **Configuration**) and permanently assert the 2nd stage input.

The diagram shows how iPAK2 can control the welding force. The Cool2 interval is not shown.



Valves

iPAK2 controls have eight digital outputs or valves (AV1 – AV8) that can be operated independently during a weld sequence. The valves are categorised as WAV, motor[1] or AUX valves.

- A WAV valve turns on at start of sequence and turns off at the end of the Hold interval.
- The operation of a motor valve is determined by the 2nd stage test (Section 12 **Configuration**).
- An AUX valve may be programmed to come on during any interval of the weld sequence, including the Off time in repeat mode.

Mode	Configuration	WAV function	Motor function	Description
spot	Single electrode	AV1	n/a	AV1 is automatically selected
	Multi-electrode[1]	AV1 – AV8	n/a	Any combination of AV1 to AV8 may be selected
seam[1]	Single electrode	AV1	AV2	AV1 and AV2 are automatically selected
	Multi-electrode[1]	AV1 – AV8	AV1 – AV8	Any combination of AV1 to AV8 may be selected

[1] Extended feature

Valves not being used for the WAV or motor function may be used as AUX valves. WAV/motor settings always override any corresponding AUX settings.

The weld programs contain the following valve control parameters.

Parameter	Units	Range	Description
WAV		AV1 – AV8	WAV output
Motor[1]		AV1 – AV8	Motor output
Squeeze	AV1 – AV8	on/off	Valve states during the Squeeze interval
Pre-heat	AV1 – AV8	on/off	Valve states during the Pre-heat interval
Cool1	AV1 – AV8	on/off	Valve states during the Cool1 interval
Upslope	AV1 – AV8	on/off	Valve states during the Upslope interval
Main heat	AV1 – AV8	on/off	Valve states during the Main heat interval
Cool2	AV1 – AV8	on/off	Valve states during the Cool2 interval
Downslope	AV1 – AV8	on/off	Valve states during the Downslope interval
Post-heat	AV1 – AV8	on/off	Valve states during the Post-heat interval
Hold	AV1 – AV8	on/off	Valve states during the Hold interval
Off[2]	AV1 – AV8	on/off	Valve states during the Off interval

[1] Seam mode only.
[2] Repeat mode program option must be enabled to use this feature.

Options

Each weld program has a number of optional features.

Parameter	Range	Description
Pre-heat	yes/no	Enables or disables the Pre-heat parameters
Post-heat	yes/no	Enables or disables the Post-heat parameters
Pulsations	1 - 99	The number of times the Main heat – Cool2 interval is repeated
Link	yes/no	The next welding program will be started automatically if the input signals are maintained
Repeat	yes/no	The welding program will be repeated if the input signals are maintained
Force profile	yes/no	Use multiple force values during the weld
Inhibit	yes/no	An inhibited program will not run[1]

[1] If an inhibited program is not linked then attempting to run it will produce the error message. If the program is linked, then the program will be skipped and the next linked program will run. This feature may be used to temporarily disable a program in a cascade.

Pulsations can be used to temper the material, control nugget growth and reduce electrode wear. The Start signal must be maintained for the full duration of the sequence if pulsations are set to 10 or more, otherwise the sequence will terminate after 10 pulses.

Program selection

The program that will be used for welding can be selected in one of two ways

- Section 12 **Configuration**: by using the Program Select inputs (external)
- Section 13 **Programming**: by using the Use Program parameter (internal)

If the external method is used, inputs P1 – P64 correspond to the binary value of the program that will be used. If the internal method is used, the Use Program parameter determines the weld program that will be used. The program number can be changed during the weld sequence.

Multi-electrode operation (extended feature)

Each welding program can be assigned an electrode.

Parameter	Units	Range	Description
Electrode		0 - 7	The electrode number

When a program is used, iPAK2 will automatically trigger the correct transformer by referencing the electrode/transformer assignment as described below. In addition, the electrode number is also used to access the appropriate stepper, counter and calibration information

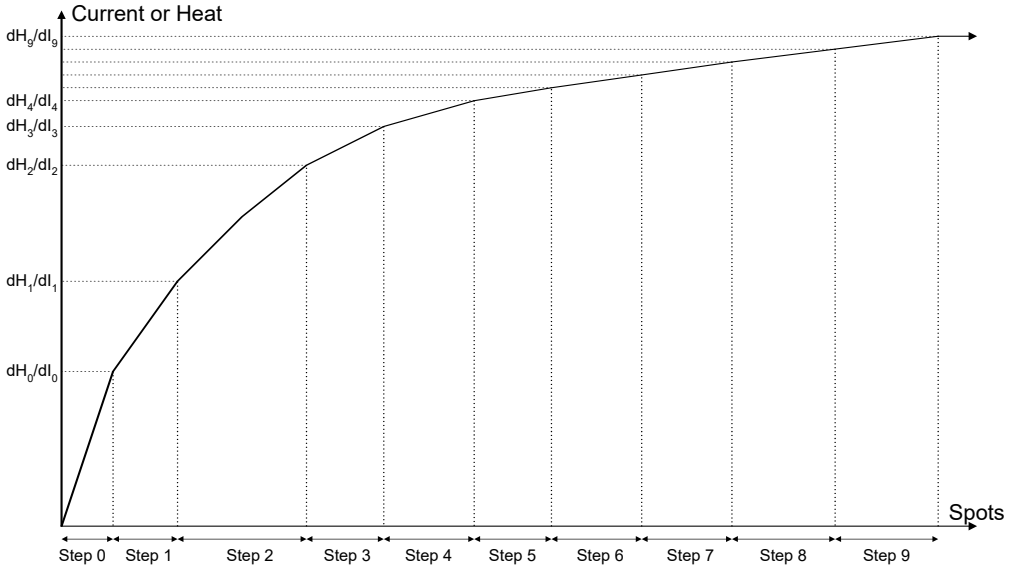
Electrode management

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. The counter counts the number of welds that the electrode has done and allows the electrode to be dressed a number of times before it is replaced. The extended features provide eight steppers and counters that can be assigned to up to eight transformers.

Steppers

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



Parameter	Units	Range	Description
Step		0 - 9	The step number
Spots	welds	0 - 9999	The number of welds in the step
+Heat	%	0.0 - 50.0	The increase in heat during the step
+Current	%	0.0 - 50.0	The increase in current during the step
Preset		1 - 5	Apply predefined values to the stepper curve
Enable stepper		yes/no	Enables or disables the stepper
Stop at end		yes/no	The iPAK2 can inhibit welding at the end of the last step
Spots done	welds	0 - 99999	The number of welds that have been done since the last reset

P/W and CCu modes will make use of both the +Heat and +Current parameters. CCC mode uses only the +Current parameters.

The Stepper output is active at the end of the last step. The Prewarn output is active during the last step.

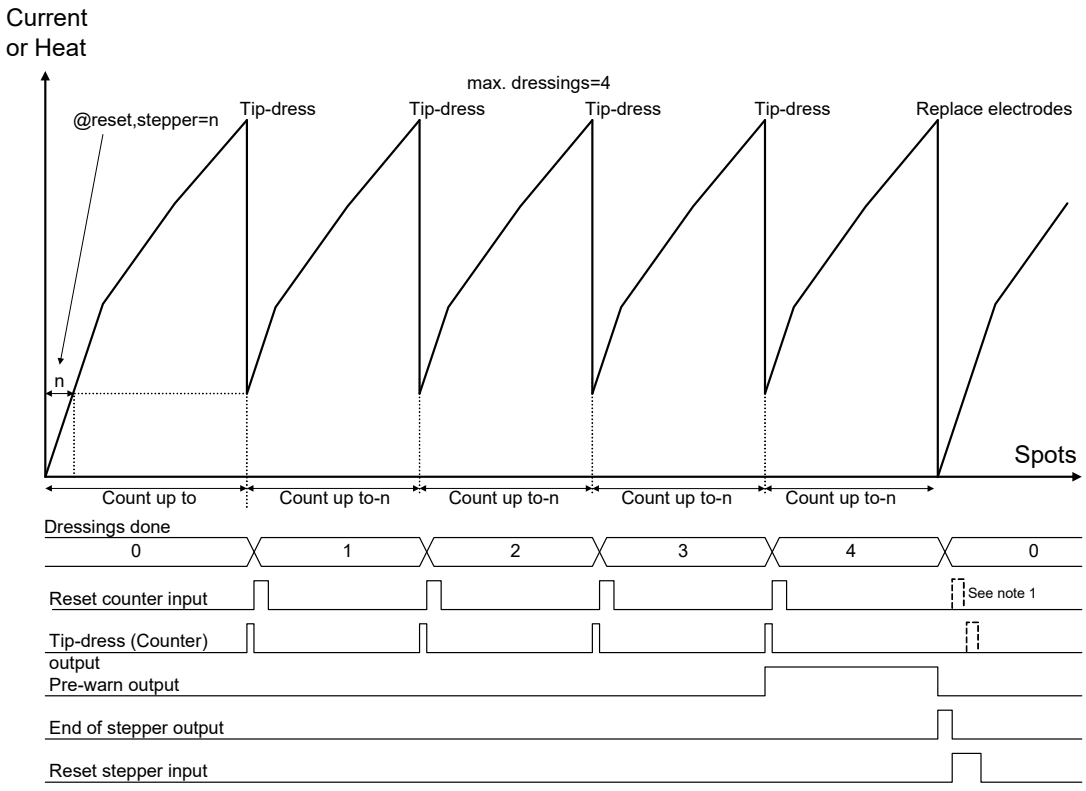
To get started enter the values for Step 9 then select a Preset to load the intermediate values

Counters

A counter is programmed by entering values related to the electrode maintenance and lifetime.

Parameter	Units	Range	Description
Enable counter		yes/no	Enables or disables the counter
Count	welds	0 - 9999	The number of welds that have been done since the last reset
End count	welds	0 - 99999	The maximum number of welds that can be done
Stop at end		yes/no	The iPAK2 can inhibit welding until the counter is reset
Enable tip dress		yes/no	Enables or disables the tip dressing feature
Dressings done		0 - 9999	The number of times the electrodes have been dressed
Max dressings		0 - 9999	The maximum number of times the electrodes can be dressed
Reset to	welds	0 - 9999	The weld count following a tip dress operation

If tip dressing is enabled the iPAK2 will activate the Tip Dress Request output when the Count value is reached.



Current calibration

Current is measured by one of two methods:

1. Primary current is measured by the iPAK2 built-in CT.
2. Secondary current can be measured via an externally connected Toroid (spot weld modes only).

The method is selected by the Configuration parameter Measure (Section 12 **Configuration)**.

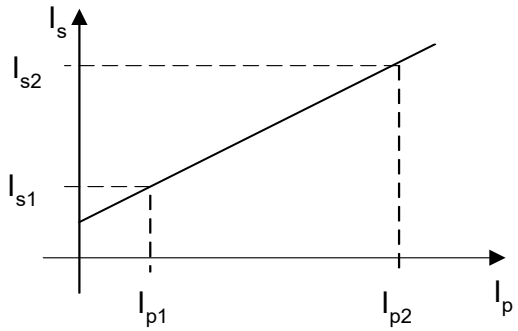
Maximum Primary Current

The inverter chassis has a maximum output current specification dependant on the inverter size. The iPAK2 detects this value on power-up and sets it as an absolute maximum. The output current can be set below this maximum value. It is important to do this before attempting any of the following calibration procedures (Section 12 **Configuration)**.

Current measurement by built-in CT

In order to display secondary current, there are two methods provided for conversion:

1. Turns ratio: The turns ratio may be obtained from the welding transformer data. The displayed secondary current will be the measured primary current multiplied by this value. This method does not allow for losses in the transformer but will provide reasonable accuracy.
2. Points 1&2: This is the more accurate method and also calibrates the iPAK2 to match an external current meter. Two test welds establish the relationship between primary current (as measured by the CT) and secondary current measured using the external meter as follows:
   - Initially, select the turns-ratio method and set the turn ratio to 1:1 so that the iPAK2 measures and displays primary current.
   - Produce a short circuit weld at a low heat in CCu mode and note the primary current (Ip1) from the iPAK2 and the corresponding secondary current (Is1) using an external weld current meter.
   - Repeat the short circuit weld at a higher heat and note again the primary current (Ip2) and secondary current (Is2).
   - Now select the Points 1&2 method and enter the four measurements (Ip1, Is1 and Ip2, Is2).



The iPAK2 uses the characteristic to calculate the secondary current from the measured primary current.

Current measurement by external toroid (spot weld only)

A toroid (Rogowski coil) is connected around the welding transformer secondary. Most such coils have a nominal output of 150 mV/kA. The iPAK2 provides a sensitivity parameter which may be adjusted to provide for absolute matching with an external current meter.

At the nominal 150 mV/kA, iPAK2 will handle signals corresponding to about 50 kA. If the current is expected to exceed 50 kA then it is necessary to use an attenuator device such as a TAM/1 between the toroid and iPAK2. The attenuator will have options for x1, x2, x3, x4 etc. The factor selected should be entered into the iPAK2 so that it is able to calculate the actual current from the (attenuated) measured current.

In multi-electrode or multi-transformer (cascade) systems it may be difficult to arrange toroids for multiple secondary circuits. The toroids need to be switched in and out of circuit at the appropriate moment in the sequence or errors will occur. In these circumstances use the CT measurement method. The CT method has the advantage of not requiring an external toroid.

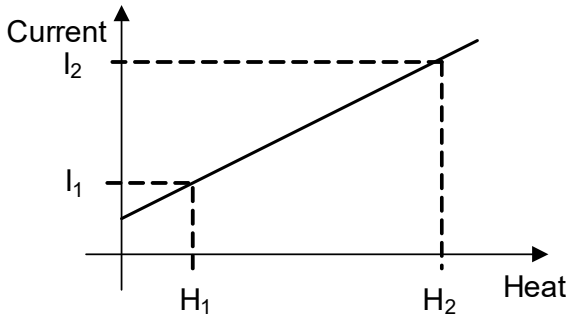
Parameter	Units	Range	Description
Max. primary current	A	0 - max	Limits maximum output
Conversion method		points/ratio	Method used to convert primary current to secondary current
Turns ratio		1 - 999	The turns ratio of the welding transformer
Point 1 (primary)	kA	0 - 32.0	The measured value of primary current at a low heat (Ip1)
Point 1 (secondary)	kA	0 - 500.0	The measured value of secondary current at a low heat (Is1)
Point 2 (primary)	kA	0 - 32.0	The measured value of primary current at a high heat (Ip2)
Point 2 (secondary)	kA	0 - 500.0	The measured value of secondary current at a high heat (Is2)
Toroid	mV/kA	100 - 60000	The sensitivity of the toroid
Toroid factor		1 - 10	The ratio of the external attenuator (1 if no attenuator fitted)

CCC calibration

The current must be calibrated before carrying out the following procedure.

When operating in CCu mode the inverter uses the Heat parameter to determine the output current. In order to be able to control the output current directly in amps it is necessary to establish the relationship between Heat and Current as follows:

- Produce a short circuit weld at a low heat in CCu mode and note the heat setting (H1) from the iPAK2 and the corresponding measured current (I1).
- Repeat the short circuit weld at a higher heat and note Heat (H2) and Current (I2).
- Enter these values as the 'Points 1&2' parameters in CCC calibration.



The iPAK2 will use these values to determine the relationship between Heat and Current. CCC mode can now be selected in the welding schedules and required current programmed directly in amps. The Heat parameter is no longer required.

This calibration also assists the iPAK to produce a rapid rise-time to the desired current without causing any significant transient conditions.

Parameter	Units	Range	Description
Point 1 (heat)	%	0 – 99.9	The set value of low heat (H1)
Point 1 (current)	kA	0 - 500.0	The measured value of current at a low heat (I1)
Point 2 (heat)	%	0 – 99.9	The set value of high heat (H2)
Point 2 (current)	kA	0 - 500.0	The measured value of current at a high heat (I2)

In multi-electrode systems there are separate calibration files for each gun. Each electrode must be calibrated before being used.

Force calibration

The analog input and analog output can be used for force control in terms of kN or lbf when they have been calibrated.

Parameter	Units	Range	Description
OUT Point 1	mV	0 - 10000	Analog output (point 1)
OUT Point 1	kN/lbf		Measured output force (point 1)
OUT Point 2	mV	0 - 10000	Analog output (point 2)
OUT Point 2	kN/lbf		Measured output force (point 2)
IN Point 1	mV	0 - 10000	Analog input (point 1)
IN Point 1	kN/lbf		Measured input force (point 1)
IN Point 2	mV	0 - 10000	Analog input (point 2)
IN Point 2	kN/lbf		Measured input force (point 2)

The relationship between the analog input and output and the electrode force can be determined by measuring the values at two points. The values define a linear relationship between mV and kN/lbf.

The force can be calibrated for each electrode.

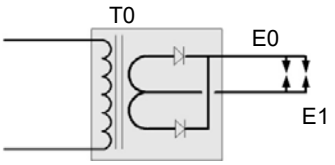
Multi-electrode operation (extended feature)

Multi-electrode operation allows each welding program to be triggered independently and also allows the assignment of an electrode to a transformer.

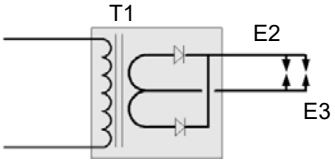
Parameter	Units	Range	Description
Electrode		0 - 7	The electrode number
Transformer		0 - 7	The transformer that the electrode is connected to

The diagram shows how the electrodes can be assigned to transformers

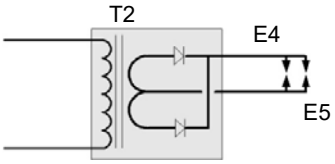
Electrodes 0 and 1 are assigned to transformer 0



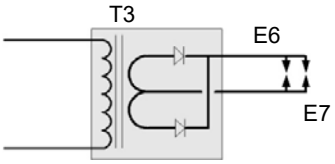
Electrodes 2 and 3 are assigned to transformer 1



Electrodes 4 and 5 are assigned to transformer 2



Electrodes 6 and 7 are assigned to transformer 3



The electrodes are assigned to weld programs in the same way.

Status information

iPAK2 reports a number of conditions to assist with diagnostics, quality control and maintenance. Each condition corresponds to a code which is accessible via MODBUS.

Code	Condition	Action
0	Normal	
1	Stop	Check the Stop input
2	Sync. error	Check 27 V ac sync signal and/or the Frequency parameter in Configuration
3	Retract not ready	Operate the Retract input
4	Inverter hot	Check inverter cooling
5	Transformer hot	Check weld transformer cooling
6	Pilot fault	Safety relay fault. Do not use the iPAK2 and return it for service.
7	Restart required	Restart the iPAK2
8	Headlocked	The welding head is locked because of a fault condition
9	Toroid short circuit	Connection to Toroid (secondary feedback coil) is short-circuit
10	Toroid open circuit	Connection to Toroid (secondary feedback coil) is open-circuit
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Reserved	
16	Test mode	For service use only
17	Start on	The Start input is on following a weld sequence or stop/power-up condition
18	Weld off	Check the Weld On input
19	Program inhibited	The selected weld program is inhibited
20	Output fault	One or more outputs have failed
21	Reserved	
22	Too many links	Too many weld programs are linked together
23	Bad link	A link has been made to a weld program that cannot be used
24	Max. current	Check secondary circuit. Reduce heat/current.
25	Toroid overrange	Reduce current or use an external signal attenuator
26	CT overrange	Check calibration parameters
27	Max. pulse width	Check secondary circuit. Reduce heat/current.
28	Calibration error	Check parameters in calibration program
29	Reserved	
30	Reserved	
31	Reserved	
32	Reserved	
33	Low force	Check the analog input and output circuits and/or adjust force parameters
34	High force	Check the analog input and output circuits and/or adjust force parameters
35	Low pre-current	Check toroid feedback and/or adjust Pre-heat parameters
36	High pre-current	Check toroid feedback and/or adjust Pre-heat parameters
37	Low main current	Check toroid feedback and/or adjust Main heat parameters
38	High main current	Check toroid feedback and/or adjust Main heat parameters
39	Low post-current	Check toroid feedback and/or adjust Post-heat parameters
40	High post-current	Check toroid feedback and/or adjust Post-heat parameters
41	No 2nd stage	Check the 2nd Stage input

42	No force	Check analog input circuit
43	Reserved	
44	Reserved	
45	Reserved	
46	Reserved	
47	Reserved	
48	Reserved	
49	End of count 0	Reset counter 0
50	End of count 1	Reset counter 1
51	End of count 2	Reset counter 2
52	End of count 3	Reset counter 3
53	End of count 4	Reset counter 4
54	End of count 5	Reset counter 5
55	End of count 6	Reset counter 6
56	End of count 7	Reset counter 8
57	Reserved	
58	Reserved	
59	Reserved	
60	Reserved	
61	Reserved	
62	Reserved	
63	Reserved	
64	Reserved	
65	End of electrode 0	Reset stepper 0
66	End of electrode 1	Reset stepper 1
67	End of electrode 2	Reset stepper 2
68	End of electrode 3	Reset stepper 3
69	End of electrode 4	Reset stepper 4
70	End of electrode 5	Reset stepper 5
71	End of electrode 6	Reset stepper 6
72	End of electrode 7	Reset stepper 7
73	Reserved	
74	Reserved	
75	Reserved	
76	Reserved	
77	Reserved	
78	Reserved	
79	Reserved	
80	Reserved	
81	Tip dress 0	Dress the electrodes and then reset counter 0
82	Tip dress 1	Dress the electrodes and then reset counter 1
83	Tip dress 2	Dress the electrodes and then reset counter 2
84	Tip dress 3	Dress the electrodes and then reset counter 3
85	Tip dress 4	Dress the electrodes and then reset counter 4
86	Tip dress 5	Dress the electrodes and then reset counter 5
87	Tip dress 6	Dress the electrodes and then reset counter 6
88	Tip dress 7	Dress the electrodes and then reset counter 7
89	Reserved	
90	Reserved	
91	Reserved	
92	Reserved	
93	Reserved	
94	Reserved	
95	Reserved	
96	Reserved	
97	Prewarn 0	Stepper 0 has completed its 9th step
98	Prewarn 1	Stepper 1 has completed its 9th step
99	Prewarn 2	Stepper 2 has completed its 9th step
100	Prewarn 3	Stepper 3 has completed its 9th step
101	Prewarn 4	Stepper 4 has completed its 9th step
102	Prewarn 5	Stepper 5 has completed its 9th step
103	Prewarn 6	Stepper 6 has completed its 9th step
104	Prewarn 7	Stepper 7 has completed its 9th step
105	Reserved	

106	Reserved	
107	Reserved	
108	Reserved	
109	Reserved	
110	Reserved	
111	Reserved	
112	Reserved	
113	DC bus failure	Check mains supply to inverter
114	Short circuit	Check cables from inverter to welding transformer. Check transformer.
115	Fan fail	Check inverter fans
116	Inverter not ready	Check control connections to inverter
117	LMI config. error	Check connections on LMI modules
118	LMI error	Check indicator panel on LMI modules
119	Duty cycle limit	The allowable duty cycle is being exceeded. Reduce time, current or rate of operation.
120	Reserved	
121	Reserved	
122	Reserved	
123	Reserved	
124	Reserved	
125	Reserved	
126	Reserved	
127	Reserved	
128	Reserved	

History log

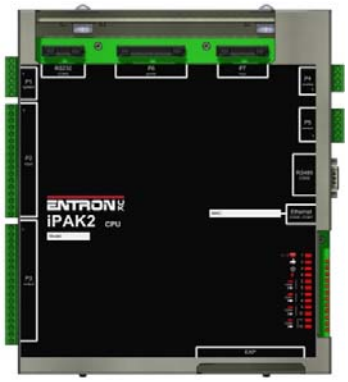
iPAK2 stores the results of the last 6000 spot welds in a history log. Each record contains the following information:

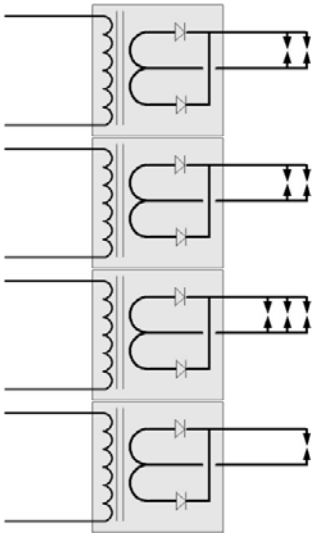
Parameter	Units	Range	Description
Time and date			The time and date when the entry was recorded
Program		0 - 255	The weld program used
Pre-current	kA	0 – 500	The current recorded during the Pre-heat interval
Main current	kA	0 – 500	The current recorded during the Main heat interval
Post-current	kA	0 – 500	The current recorded during the Post-heat interval
Force	kN/lbf	Variable	The force recorded during the weld

The log can be viewed or reset as required.

Multiwelding (extended feature)

iPAK2 allows up to four transformers to be directly connected or up to eight when used with a decoder.





Up to 8 electrodes can be assigned to the welding transformers

The electrode number is determined by the weld program:

Parameter	Units	Range	Description
Electrode		0 - 7	The electrode number

The weld programs can be linked together.

The electrode is assigned to a transformer:

Parameter	Units	Range	Description
Electrode		0 - 7	The electrode number
Transformer		0 - 7	The transformer that the electrode is connected to

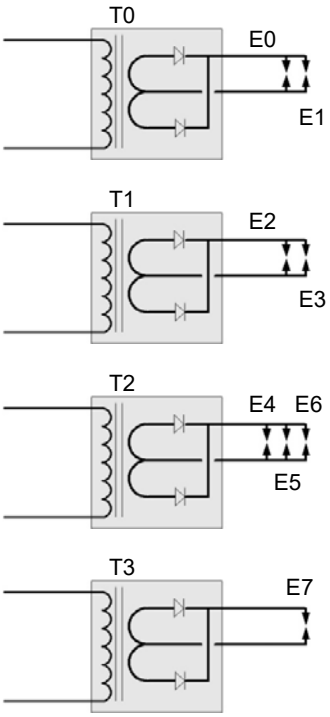
The diagram shows how the electrodes can be assigned to transformers

Electrodes 0 and 1 are assigned to transformer 0

Electrodes 2 and 3 are assigned to transformer 1

Electrodes 4, 5 and 6 are assigned to transformer 2

Electrode 7 is assigned to transformer 3

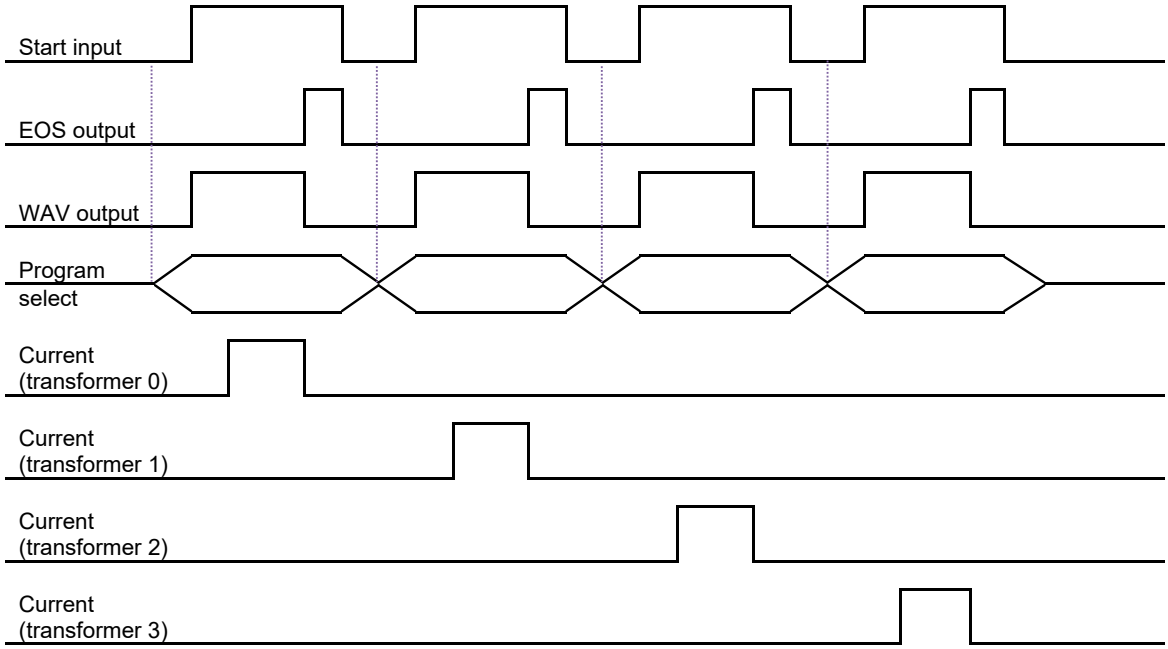


There are two methods available for multiwelding.

- Multi-gun operation allows each welding program to be triggered independently but allows for selection of a transformer and electrode.
- Multi-gun cascade operation allows up to sixteen welding programs to be linked together and triggered from a single start command. The programs then ripple through with minimal time between them, selecting transformers and electrodes on the fly. The linked programs are known as a cascade.

Multi-gun operation

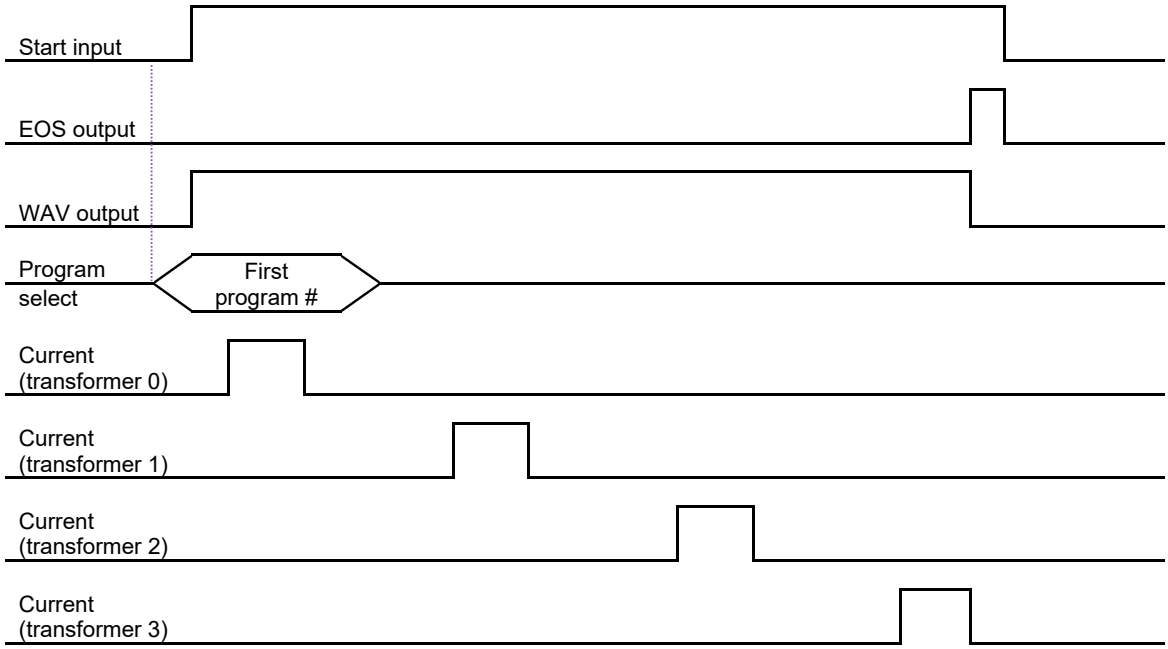
Each welding program is started independently but different electrodes and transformers can be selected.



The WAV output can be a separate output for each program

Multi-gun cascade operation

Different electrodes and transformers can still be selected but the welding programs are linked together and started by a single Start command. Cancelling the Start command at any time will abort the cascade sequence



In multi-gun cascade operation the program select inputs select the first program in the cascade.

If a fault occurs during a cascade sequence:

Stop on fault[1]	Description
Off	Cascade will continue. Fault output will remain on only until next weld.
On	Cascade will pause. Cascade will continue when the fault is reset.

[1] Section 12 **Configuration**

Seam welding (extended feature)

iPAK2 can be used for seam welding applications. The seam program parameters provide a flexible sequence that works in conjunction with the inputs and outputs to produce several different types of seam weld e.g.

- continuous seam
- seam pulsation
- seam modulation
- seam pre-heat
- roll-spot

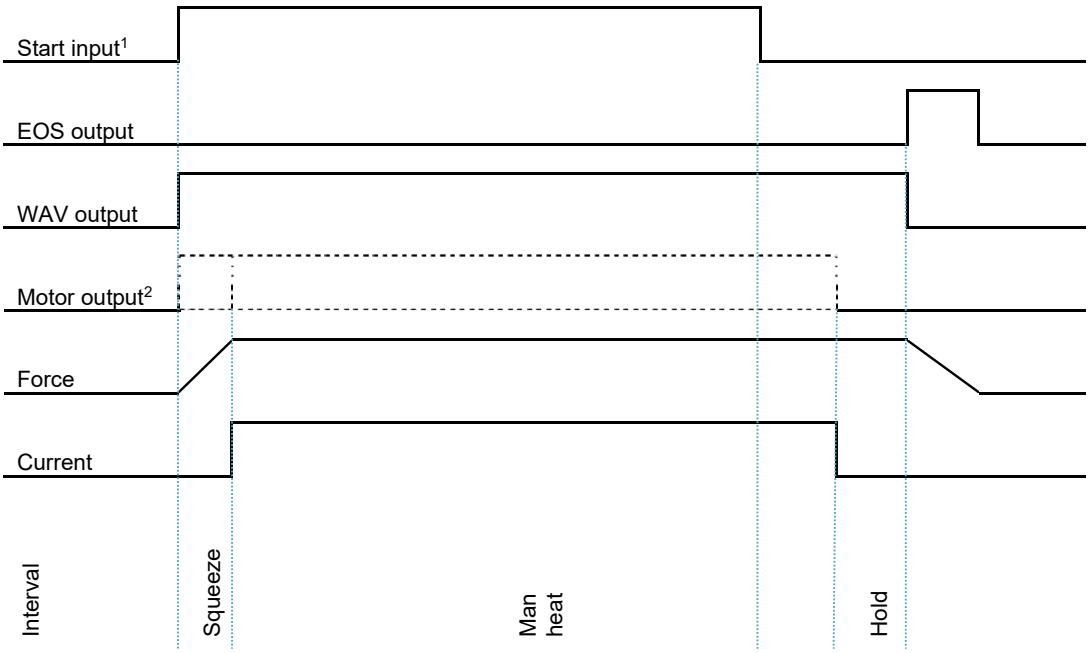
The parameters are described in Section 6 **Weld control** and can be adjusted during the weld. Intervals that are not required may be set to 0.

Continuous seam

A continuous seam weld maintains a set current for the duration of the weld. The following example shows how this type of sequence may be implemented.

Parameter	Setting	Description
Sequence timing		
Presqueeze	ms	The time for the electrodes to close onto the work piece.
Squeeze	ms	The time between the initial application of the electrode force and the first application of welding current
Main heat	ms	The main welding current is applied
Hold	ms	Electrode force continues after the welding current has finished
Current control		
Main mode	P/W – CCu – CCC	Operating mode of the Main heat interval
Main heat	%	The % heat used during the Main heat interval
Main current	kA	The current used during the Main heat interval
Main monitor[1]	yes/no	The current can be tested between limits
Low limit[1]	%	Current low limit
High limit[1]	%	Current high limit
Options		
Pre-heat	no	Disable the Pre-heat parameters
Post-heat	no	Disable the Post-heat parameters

[1] optional



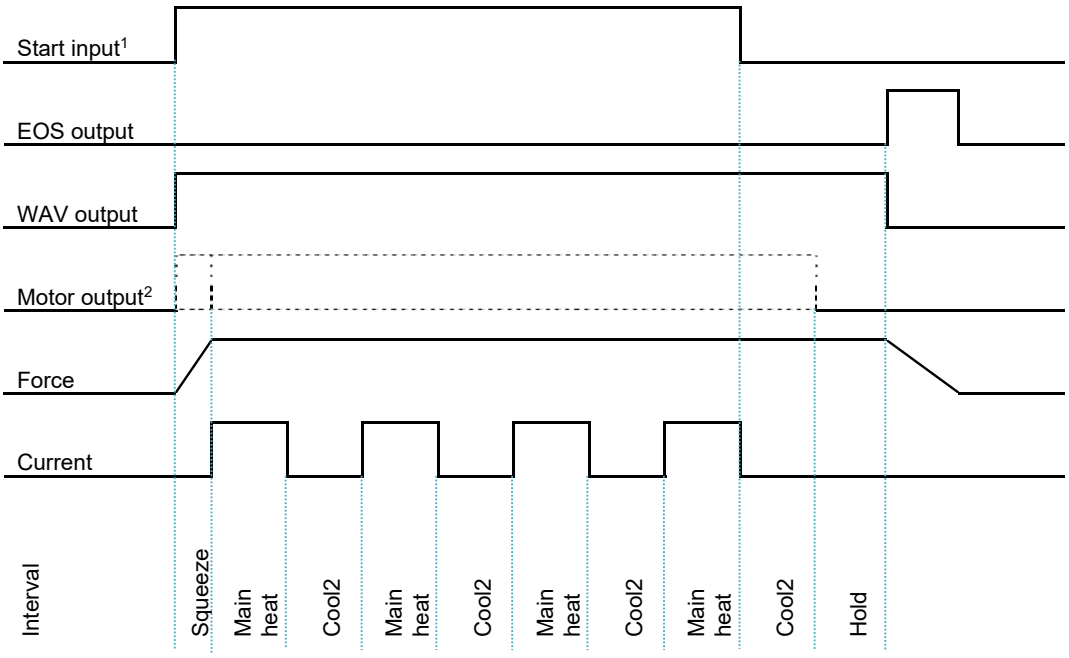
[1] The Main heat interval is repeated until the Start input is removed.
[2] The operation of the motor output is determined by the 2nd stage test (Section 12 **Configuration**).

Seam pulsation

Seam pulsation can be used in applications where a continuous weld is not required. The Main heat and the Cool2 intervals are repeated for the duration of the weld. The following example shows how this type of sequence may be implemented.

Parameter	Setting	Description
Sequence timing		
Presqueeze	ms	The time for the electrodes to close onto the work piece.
Squeeze	ms	The time between the initial application of the electrode force and the first application of welding current
Main heat	ms	The main welding current is applied
Cool2	ms	The material is allowed to cool with electrode force applied
Hold	ms	Electrode force continues after the welding current has finished
Current control		
Main mode	P/W – CCu – CCC	Operating mode of the Main heat interval
Main heat	%	The % heat used during the Main heat interval
Main current	kA	The current used during the Main heat interval
Main monitor[1]	yes/no	The current can be tested between limits
Low limit[1]	%	Current low limit
High limit[1]	%	Current high limit
Options		
Pre-heat	no	Disable the Pre-heat parameters
Post-heat	no	Disable the Post-heat parameters

[1] optional



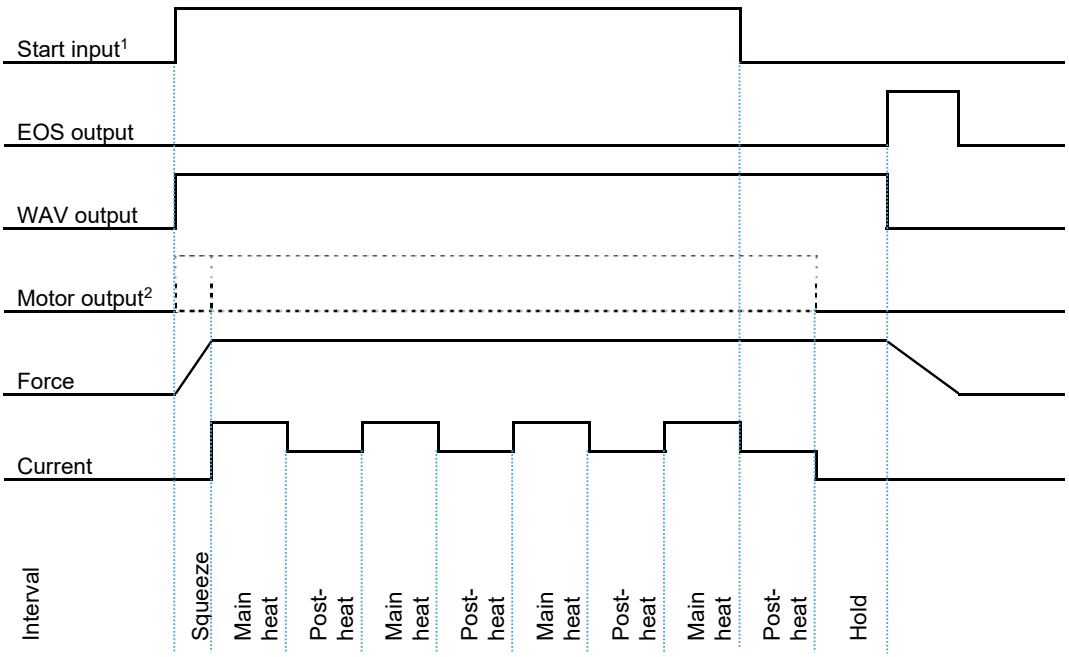
[1] The Main heat – Cool2 intervals are repeated until the Start input is removed.
[2] The operation of the motor output is determined by the 2nd stage test (Section 12 **Configuration**).

Seam modulation

Seam modulation can be used in applications where a change in current is required. Two Heat intervals are repeated for the duration of the weld. The following example shows how this type of sequence may be implemented.

Parameter	Setting	Description
Sequence timing		
Presqueeze	ms	The time for the electrodes to close onto the work piece.
Squeeze	ms	The time between the initial application of the electrode force and the first application of welding current
Main heat	ms	The main welding current is applied
Post-heat	ms	The post-heat welding current is applied
Hold	ms	Electrode force continues after the welding current has finished
Current control		
Main mode	P/W – CCu – CCC	Operating mode of the Main heat interval
Main heat	%	The % heat used during the Main heat interval
Main current	kA	The current used during the Main heat interval
Main monitor[1]	yes/no	The current can be tested between limits
Post mode	P/W – CCu – CCC	Operating mode of the Post-heat interval
Post heat	%	The % heat used during the Post-heat interval
Post current	kA	The current used during the Post-heat interval
Post monitor[1]	yes/no	The current can be tested between limits
Low limit[1]	%	Current low limit
High limit[1]	%	Current high limit
Options		
Pre-heat	no	Disable the Pre-Heat parameters
Post-heat	yes	Enable the Post-heat parameters

[1] optional



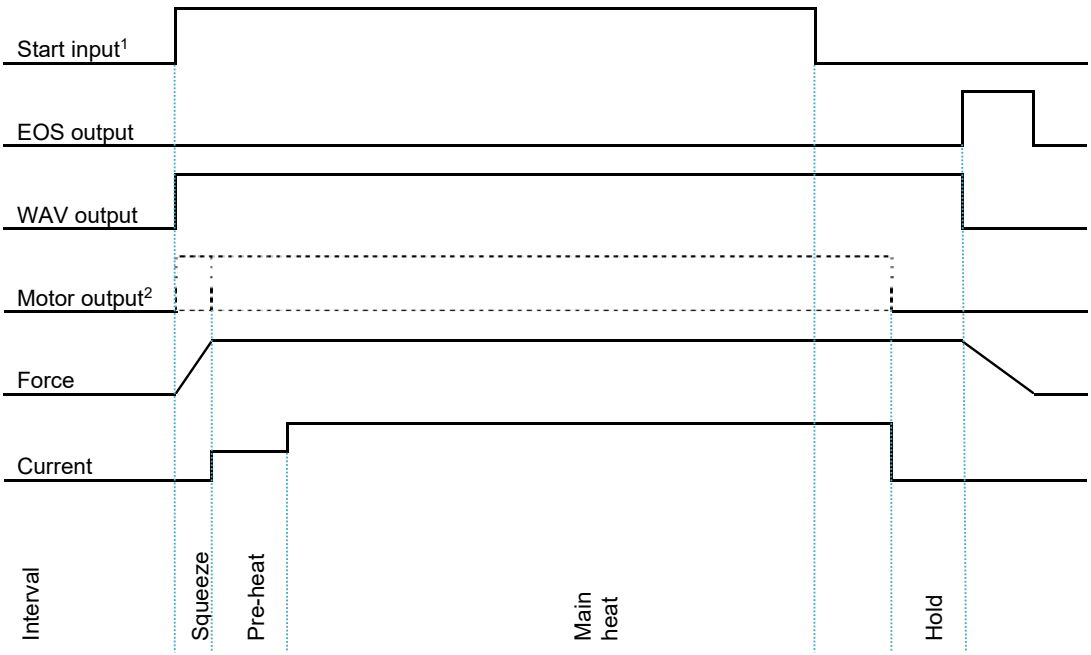
[1] The Main heat – Post-heat intervals are repeated until the Start input is removed.
[2] The operation of the motor output is determined by the 2nd stage test (Section 12 **Configuration**).

Seam pre-heat

Pre-heat can be used in applications where the initial current needs to be different to the main current. The following example shows a continuous seam weld with a pre-heat.

Parameter	Setting	Description
Sequence timing		
Presqueeze	ms	The time for the electrodes to close onto the work piece.
Squeeze	ms	The time between the initial application of the electrode force and the first application of welding current
Pre-heat	ms	The pre-heat welding current is applied
Main heat	ms	The main welding current is applied
Hold	ms	Electrode force continues after the welding current has finished
Current control		
Pre-mode	P/W – CCu – CCC	Operating mode of the Pre-heat interval
Pre-heat	%	The % heat used during the Pre-heat interval
Pre-current	kA	The current used during the Pre-heat interval
Pre-monitor[1]	yes/no	The current can be tested between limits
Main mode	P/W – CCu – CCC	Operating mode of the Main heat interval
Main heat	%	The % heat used during the Main heat interval
Main current	kA	The current used during the Main heat interval
Main monitor[1]	yes/no	The current can be tested between limits
Low limit[1]	%	Current low limit
High limit[1]	%	Current high limit
Options		
Pre-heat	yes	Enable the Pre-heat parameters
Post-heat	no	Disable the Post-heat parameters

[1] optional



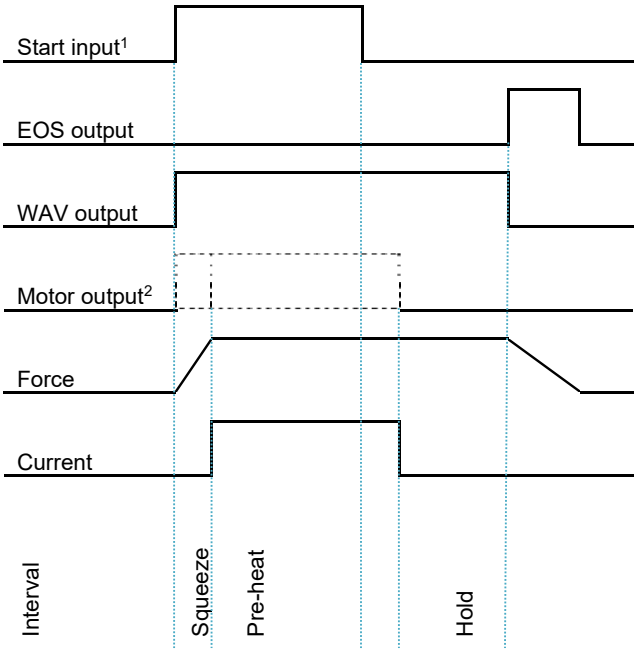
[1] The Main heat interval is repeated until the Start input is removed.
[2] The operation of the motor output is determined by the 2nd stage test (Section 12 **Configuration**).

Seam pre-heat only

Pre-heat can be used in situations when a spot weld is required. The following example shows how to use the pre-heat to produce a spot weld.

Parameter	Setting	Description
Sequence timing		
Presqueeze	ms	The time for the electrodes to close onto the work piece.
Squeeze	ms	The time between the initial application of the electrode force and the first application of welding current
Pre-heat	ms	The pre-heat welding current is applied
Main heat	0	The main welding current is not used
Hold	ms	Electrode force continues after the welding current has finished
Current control		
Pre-mode	P/W – CCu – CCC	Operating mode of the Pre-heat interval
Pre-heat	%	The % heat used during the Pre-heat interval
Pre-current	kA	The current used during the Pre-heat interval
Pre-monitor[1]	yes/no	The current can be tested between limits
Low limit[1]	%	Current low limit
High limit[1]	%	Current high limit
Options		
Pre-heat	yes	Enable the Pre-heat parameters
Post-heat	no	Disable the Post-heat parameters

[1] optional



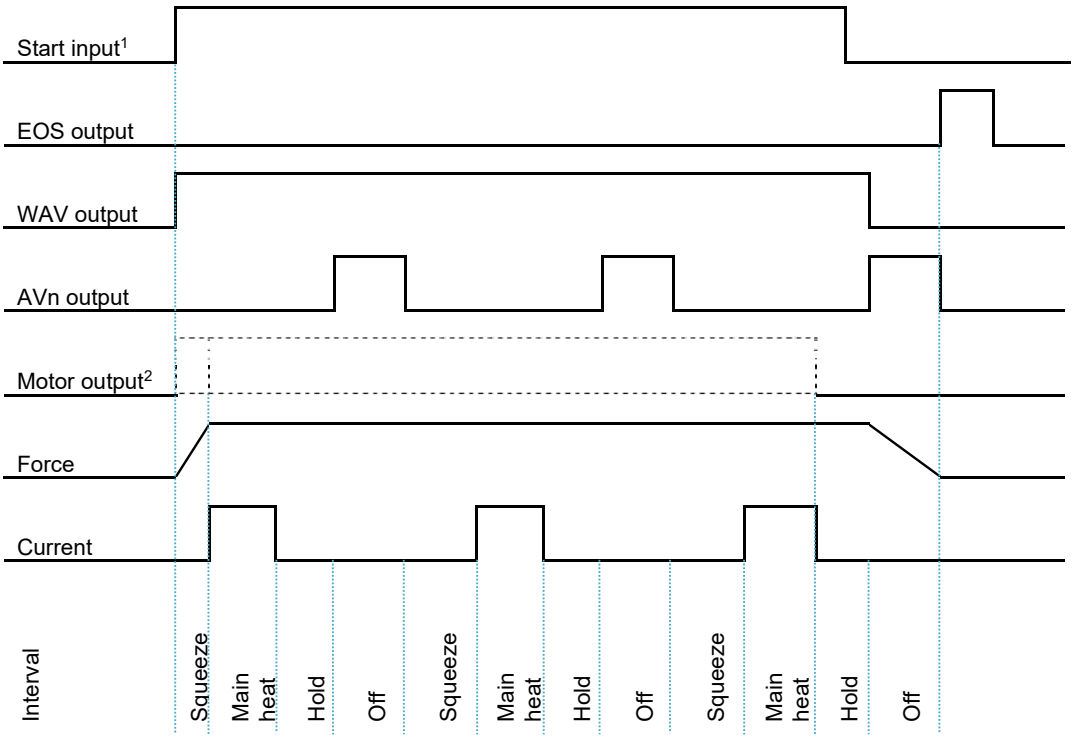
[1] The Pre-heat interval is interlocked.
[2] The operation of the motor output is determined by the 2nd stage test (Section 12 **Configuration**).

Roll-spot

Roll-spot welds can be used in applications where a motor drive output is required between welds. The following example shows how this type of sequence may be implemented.

Parameter	Setting	Description
Sequence timing		
Roll-spot	on	Sets roll-spot mode
Presqueeze	ms	The time for the electrodes to close onto the work piece.
Squeeze	ms	The time between the initial application of the electrode force and the first application of welding current
Main heat	ms	The main welding current is applied
Hold	ms	Electrode force continues after the welding current has finished
Off	ms	The time during which the motor drive operates
Current control		
Main mode	P/W – CCu – CCC	Operating mode of the Main heat interval
Main heat	%	The % heat used during the Main heat interval
Main current	kA	The current used during the Main heat interval
Main monitor[1]	yes/no	The current can be tested between limits
Low limit[1]	%	Current low limit
High limit[1]	%	Current high limit
Valves		
AVn	Off time	Connect the motor drive to the valve that is activated during Off time

[1] optional

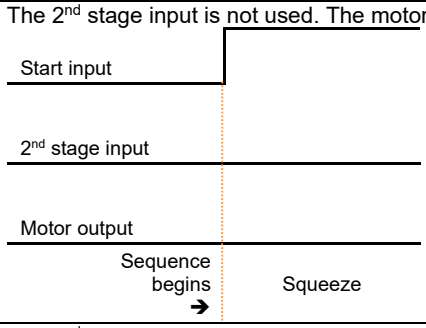
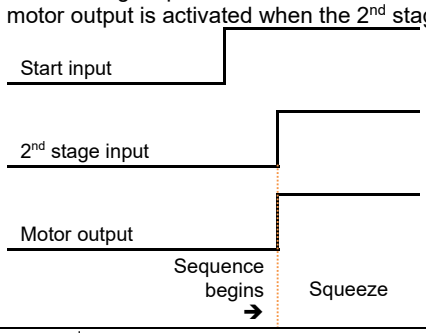
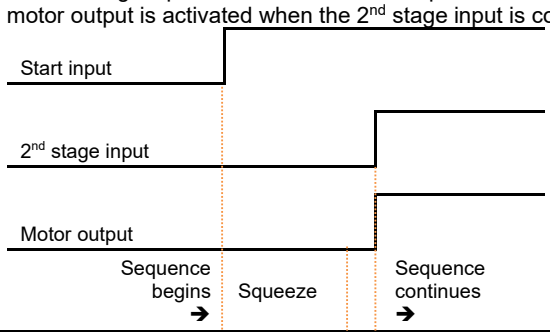


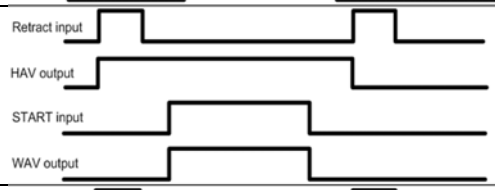
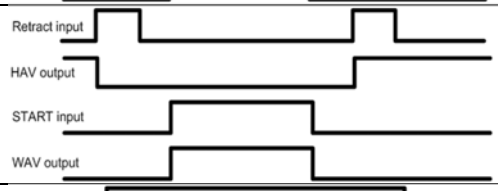
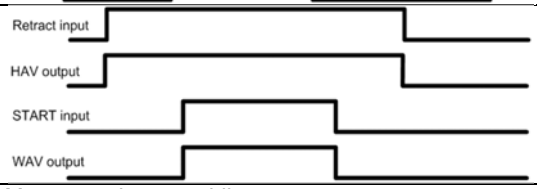
[1] The weld sequence is repeated until the Start input is removed.
[2] The operation of the motor output is determined by the 2nd stage test (Section 12 **Configuration**).

The examples show how the seam weld parameters can be used in any combination to implement several different types of weld sequence.

Configuration

The Configuration parameters affect the operation of the iPAK2.

Parameter	Value	Description
Features	Standard	Use standard features
	Extended	Use extended features
Weld type	Spot	Use spot welding features
	Seam	Use seam welding features
	Analog	Use analog welding features[2]
2nd stage	Off	The 2nd stage input is not used. The motor output is not used[1]. 
	Before Squeeze	The 2nd stage input is checked before the Squeeze interval. The motor output is activated when the 2nd stage input is confirmed[1]. 
	After Squeeze	The 2nd stage input is checked after the Squeeze interval. The motor output is activated when the 2nd stage input is confirmed[1]. 

2nd stage	Once	The 2nd stage input is checked only at the start of a cascade sequence
	Every	The 2nd stage input is checked at the start of every program within a cascade sequence
Retract	Simple	
	Hilift +	
	Hilift -	
	Maintained	
Measure	Primary	Measure primary welding current
	Secondary	Measure secondary welding current (requires a toroid connection)
Regulation	Primary	Regulate primary current
	Secondary	Regulate secondary current (requires a toroid connection)
Ip limit	0 – inverter specific	Sets an upper limit on the inverter output current[3]
Units	Metric	Measure force in KN
	Imperial	Measure force in lbf
Stop on fault	yes/no	The weld air-valve opens as normal but subsequent welds are inhibited until a fault reset is given
EOS on fault	yes/no	The EOS output will be activated
Headlock on fault	yes/no	The weld air-valve output is held on and subsequent welds are inhibited until a fault reset is given
iPAK (v1) mode	yes/no	Changes the sense of the READY output to NOT READY. AV4, 5 and 6 are used for MUX selection.
Program select	External	The Program Select inputs select the weld program
	Internal	The Use Program parameter selects the weld program
Use program	0 - 255	The weld program that will be used if Internal program is selected
Electrodes	Single	Use one electrode for the weld programs
	Multi	Use up to 8 electrodes for the weld programs
I/O source	Discrete	Use the discrete inputs and outputs
	COM0	Use MODBUS TCP/IP (Ethernet) on COM0
	COM1	Use MODBUS TCP/IP (Ethernet) on COM1
	COM2	Use MODBUS RTU (RS485) on COM2
	COM3	Use RS232 on COM3
Analog output	Force	The analog output is used to control force
	Current	The analog output corresponds to the measured weld current
Analog scaling	10V = 0 – 500kA	The analog output scaling
Contactor	0 – 99 seconds	The contactor output is sustained for this time following a weld
Toroid test	Off / On	The connection to an external toroid will be tested. The measured resistance must lie within the range 10 to 300 Ohms.

[1] Seam mode only

2 Analog control

In this mode of operation, the inverter output current can be controlled by applying a 0 to 10 Volt signal to P4 pins 1(+) and 2(-). A Seam sequence is produced, but note:

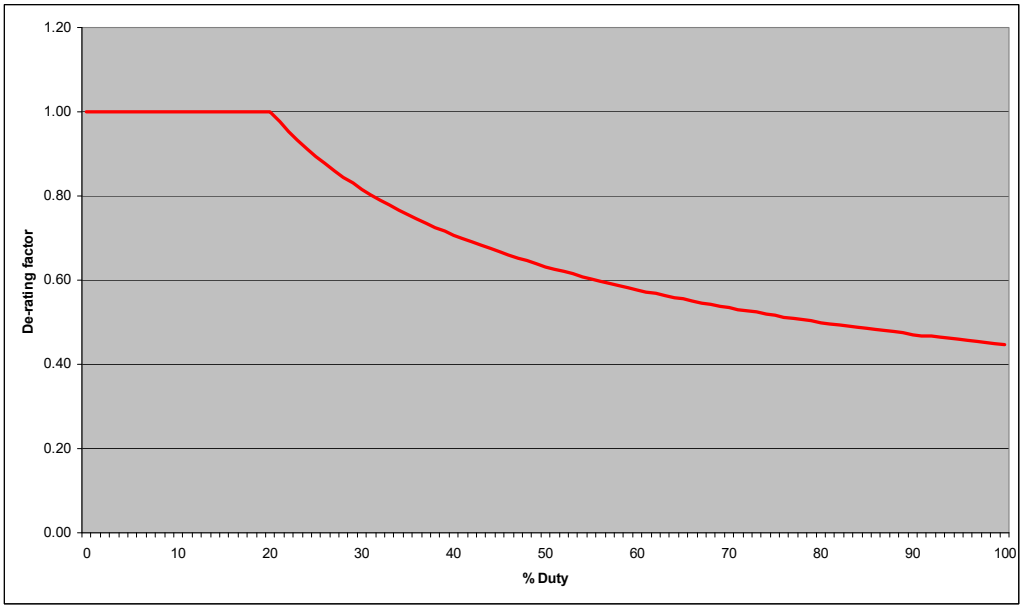
- Pre-heat and post-heat are not available
- Force feedback is not available

The input signal will control a different parameter depending on the mode set in the selected weld program:

Main mode	0 to 10 V input signal controls
P/W	0 to 100% pulse-width
CCu	0 to 100% heat
CCC	0 to 100% current

3 Duty cycle limiter

Duty is calculated over a 2 second averaging time. The inverter rating applies at up to 20% duty. At higher duties the maximum output current must be de-rated as shown by the curve below:



The iPAK2 protects against weld sequences that would exceed the allowable duty cycle. In this event the inverter will

- Stop at the end of a spot weld
- Stop immediately in a seam weld

The READY signal will be de-asserted and an error message given. Further initiation is prohibited. Perform a 'RESET FAULT' operation to clear.

Programming

iPAK2 supports several programming methods:

- NetFlash PC program (Ethernet)
- WSP3 pendant (RS232)
- MODBUS (Ethernet or RS485)
- EtherNet/IP (via optional adapter card) – see separate adapter card manual.

Security

There are two features which can be configured to protect access:

1. Up to five PIN codes can be stored in each control. Users must then enter their code before being granted access permission to edit parameters. All parameters remain viewable (read-only). This feature can be configured to be applied to the WSP3. After initially gaining access, edit permission remains granted for a configurable time-out period.

2. Use of an external switch connected to the P64 input pin. Users are only granted access permission to edit parameters when the switch is activated. By using a key-switch, only the key-holders will be able to make edits. All parameters remain viewable (read-only). When configured, this feature applies to the WSP3.

   Note that if this feature is used, then the P64 (program select bit 64) is no longer available on the discrete signal interface and thus external selection of programs is restricted to the range 0 to 63. This is not normally a problem on manual installations which is typically where security features are required. The full range of programmes (0 to 255) is still available through manual selection or via a network connection.

The above features are configured via the use of NetFlash software. NetFlash itself also has a security feature which can be used to tailor access rights. Users can be allocated usernames, passwords and access levels which restrict users to editing none, some or all parameters, as required. Thus, an administrator can pass copies of NetFlash to various personnel, each having individually permission levels.

Access via network protocols is not restricted as this will generally be via automation systems.

NetFlash

NetFlash is a PC-compatible program which provides a graphical user interface to program and monitor one or more iPAK2s. In addition NetFlash provides backup/restore functions for control data, live data logging to a file and a utility for updating the firmware in the iPAK2.

System requirements

NetFlash is a Microsoft Windows compatible PC program. It requires the latest Java Runtime Environment which is available from https://java.com/download. The minimum screen resolution is 1280 x 1024.

Installation

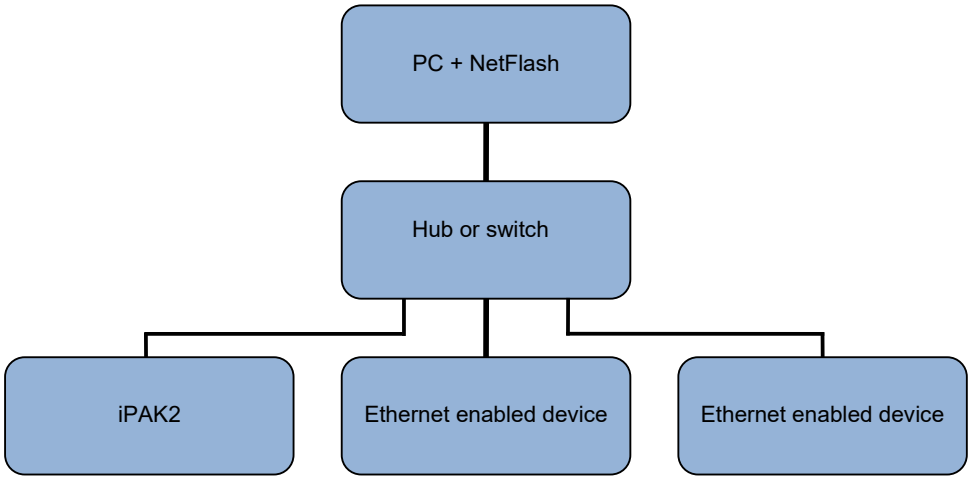
NetFlash does not need to be installed. Copy the NetFlash folder and its contents from the supplied media to the PC and run the NetFlash.exe program.

Removal

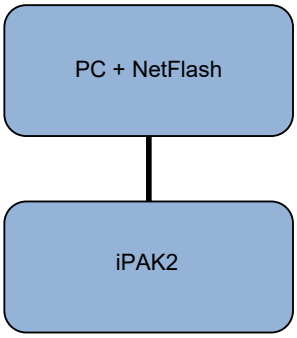
NetFlash does not need to be uninstalled. To remove NetFlash delete the NetFlash folder and its contents from the PC.

Connection

NetFlash uses 10/100 Base-T Ethernet to communicate with the iPAK2.Ensure that the PC has an appropriate Ethernet adapter and that a network connection is in place. Use COM0/1 to connect the iPAK2 to the network



If no network is available the PC can be connected directly to the iPAK2:



Set the IP address in the iPAK2 (Section 15 **Appendix**). Set the IP address in the PC (contact your system administrator). For example:

	IP address	Subnet mask
PC	192.168.0.99	255.255.255.0
Welding control	192.168.0.103	255.255.255.0

Contact the system administrator for further details.

Initialisation

Run the NetFlash.exe program. The home screen is shown:

Displays ENTRON UK contact details

Edit iPAK2 parameters. Allows access to the iPAK2 parameters via the network or from a file.

Network configuration. Locates welding controls on the network

Flash programming tool. Allows the firmware in the iPAK2 to be updated

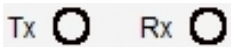
Restart weld control. Restarts the iPAK2 following a change to an application-specific parameter

Security features

Control type

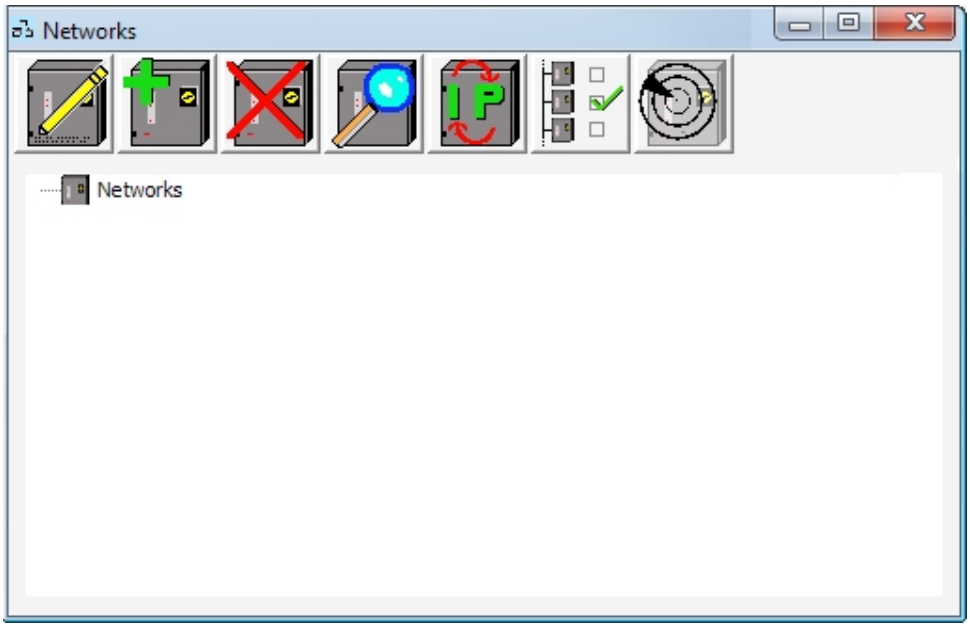
Shows the PC's IP address

Shows the IP address of the target iPAK2



Shows communication activity on the network

Select Network Configuration  . The following screen is shown:



Edit timer location. Welding controls that have been detected on the network can be assigned descriptive names and locations. This function allows the names and locations to be edited.

Add a welding control to the network

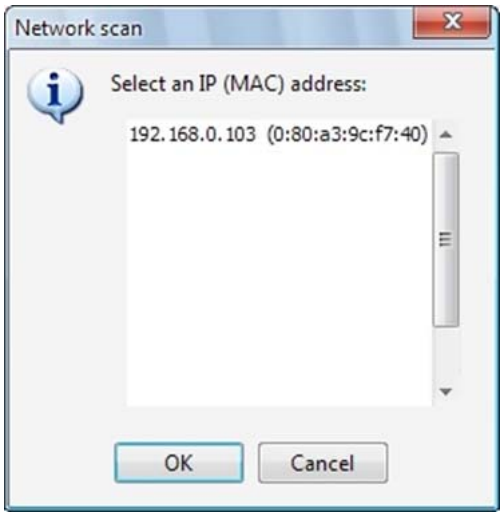
Remove a welding control from the network

Scan for welding controls on the network

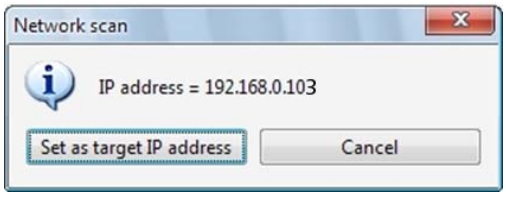
Use the selected welding control as the target welding control when editing

Perform a low-level communications test on the selected welding control

Select Scan network for timers. NetFlash will show the compatible welding controls on the network:

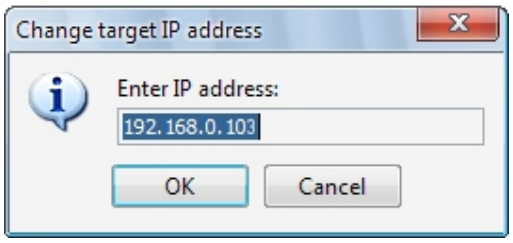


Select an IP address and then select OK. NetFlash will ask if the address should be used as the target welding control for editing:



If Set as target IP address is selected the IP address will be shown as the target IP address:

Alternatively, the target address can be set by using the Edit button:



To add a descriptive name and/or location for the welding control, use the Add welding control function. It is not necessary to do this if only one welding control is being used.

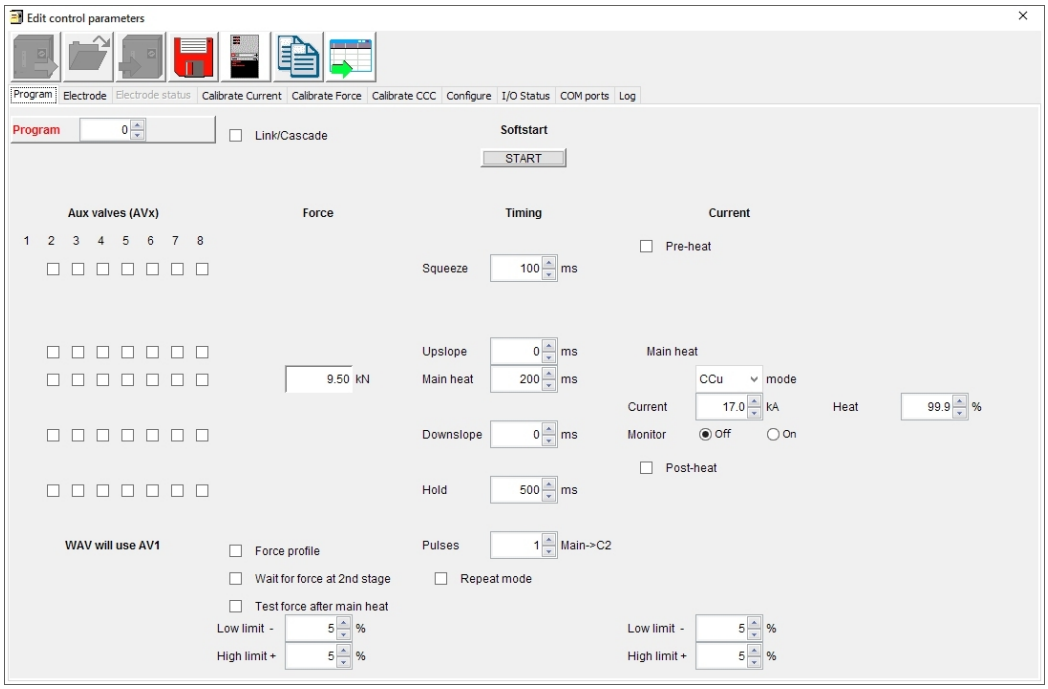
When a welding control has been selected as the target the parameters can be changed.

Parameters

Caution: when parameters are changed in NetFlash they are changed immediately in the iPAK2.

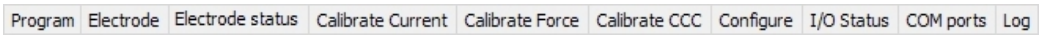
Select the Edit weld parameters function from the home screen.

Select Load from timer. Data will be loaded from the target welding control:



The Program screen is shown. This screen contains the parameters that control the weld sequence for the selected weld program

NetFlash uses tabs to navigate the parameter categories. Select the appropriate tab to edit the parameters:



Other functions are provided:

Show associated parameters in a different category

Save the parameters in a file

Open or close the metrics window. NetFlash shows the results of the last weld and the status messages

Copy programs

Export the parameters to a CSV file

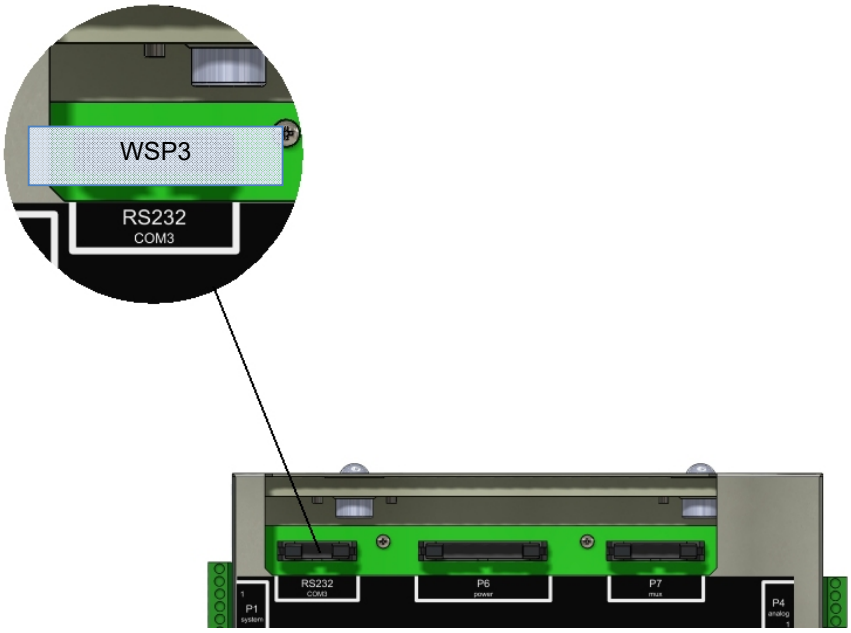
WSP3

Caution: when parameters are changed with the WSP3 they are changed immediately in the iPAK2.

The WSP3 is a hand-held programming pendant with a 20x4 character display and a sealed keypad.

The WSP3 can be used to access diagnostic information in addition to all parameters.

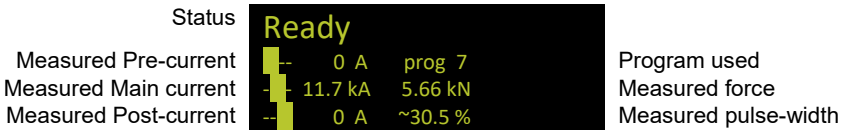
The WSP3 uses RS232 to communicate with the iPAK2 and should be connected to COM3:



Keypad

F	Return to the previous screen or move between menu screens.
← ↑ ↓ →	Select a different function or parameter. The selected function or parameter will flash and the visible window will scroll if required.
↵	Access the selected function.
+ −	Alter the selected parameter. Press both keys together to set the parameter to 0 or to its minimum value.

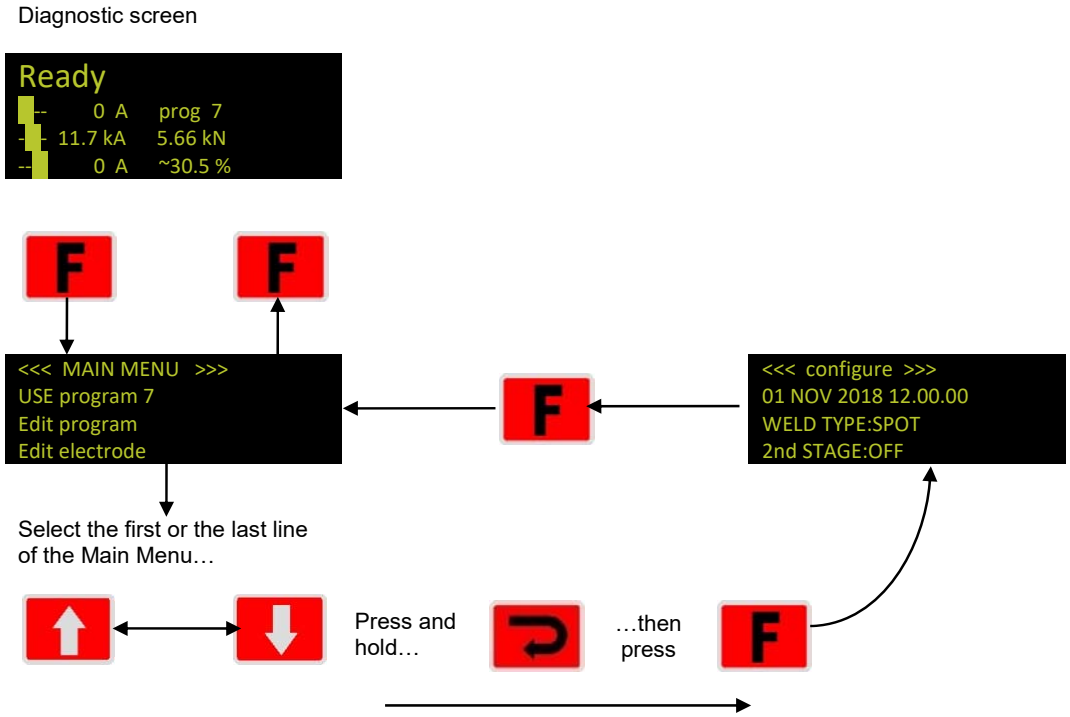
Diagnostic screen

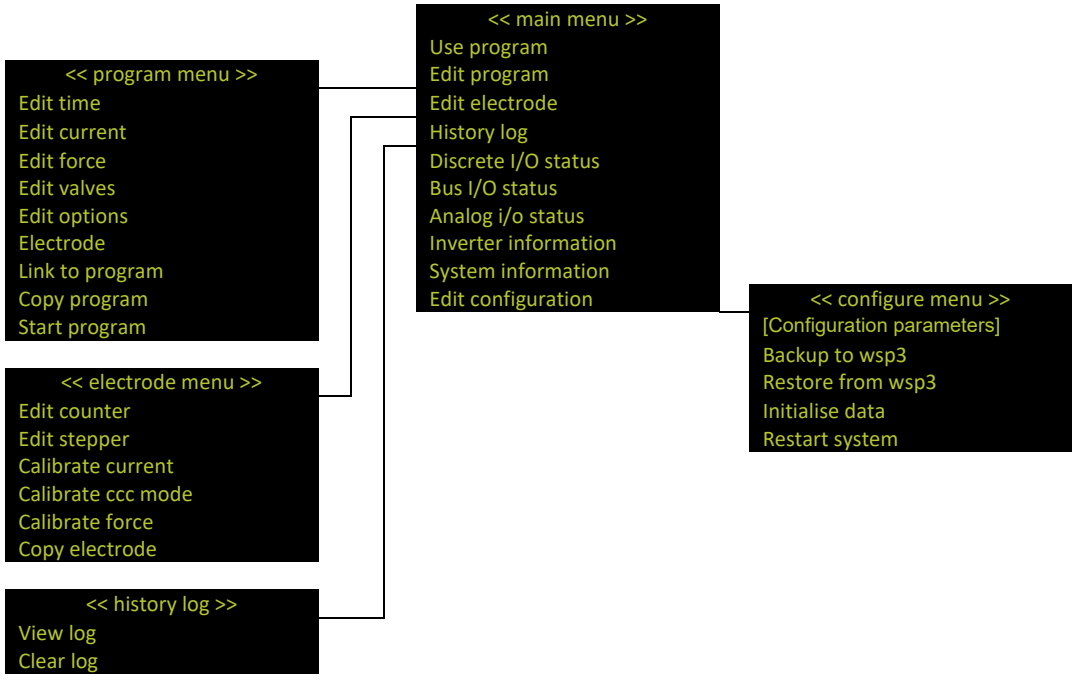


If more than one status message is present they are shown sequentially.

Menus

The functions of the iPAK2 are arranged into a set of menus and screens as follows:





Backup/Restore

The WSP3 allows the data in one iPAK2 to be transferred to another by using the Backup and Restore functions.

- Use the Backup function to make a copy of all the iPAK2's settings. The copy is held within the WSP3. The data in the iPAK2 is unchanged. Note that only one backup can be stored in the WSP3 and that this is overwritten each time the backup function is used.

- Use the Restore function to restore all of the settings in the iPAK2 from a backup stored in the WSP3 pendant. Note that this operation will overwrite all data which was previously stored in the iPAK2. After the restore operation the backup remains in the WSP3.

Initialise data

The Initialise function sets all of the parameters in the iPAK2 to predefined values.

The Initialise function will overwrite all previously stored data in the iPAK2. After an initialise operation, review the configuration and calibration settings and ensure they are appropriate for the application. Also review the welding programs that will be used.

The initialise function can be used when first setting up an iPAK2.

MODBUS

A PLC or HMI MODBUS master can be used to program an iPAK2. All parameters are directly mapped to MODBUS registers for easy access. Both MODBUS-TCP/IP (Ethernet) and MODBUS-RTU (RS485) protocols are supported.

Write the data using MODBUS function 16
Read the data using MODBUS function 3

MODBUS access types

Write data			
	Type	Value	Description
Function code	UINT	16	Write multiple registers
Read offset	UINT	0	
Read length	UINT	0	
Write offset	UINT	variable	
Write length	UINT	1	

Read data			
	Type	Value	Description
Function code	UINT	3	Read holding registers
Read offset	UINT	variable	
Read length	UINT	64	
Write offset	UINT	0	
Write length	UINT	0	

MODBUS mapping

Variable	Address	Type	Description
Weld programs			256 x 64 WORDS
Weld program 0	16#0000 (= 0)	WORD ARRAY [0..63]	
Weld program 1	16#0040 (= 64)	WORD ARRAY [0..63]	
Weld program 2	16#0080 (= 128)	WORD ARRAY [0..63]	
Weld program 3	16#00C0 (= 192)	WORD ARRAY [0..63]	
…	…	…	
Weld program 254	16#3F80 (= 16256)	WORD ARRAY [0..63]	
Weld program 255	16#3FC0 (= 16320)	WORD ARRAY [0..63]	
Electrodes			8 x 64 WORDS
Electrode 0	16#4000 (= 16384)	WORD ARRAY [0..63]	
Electrode 1	16#4040 (= 16448)	WORD ARRAY [0..63]	
Electrode 2	16#4080 (= 16512)	WORD ARRAY [0..63]	
Electrode 3	16#40C0 (= 16576)	WORD ARRAY [0..63]	
Electrode 4	16#4100 (= 16640)	WORD ARRAY [0..63]	
Electrode 5	16#4140 (= 16704)	WORD ARRAY [0..63]	
Electrode 6	16#4180 (= 16768)	WORD ARRAY [0..63]	
Electrode 7	16#41C0 (= 16834)	WORD ARRAY [0..63]	
Calibration			8 x 64 WORDS
Calibration 0	16#5000 (= 20480)	WORD ARRAY [0..63]	
Calibration 1	16#5040 (= 20544)	WORD ARRAY [0..63]	
Calibration 2	16#5080 (= 20608)	WORD ARRAY [0..63]	
Calibration 3	16#50C0 (= 20672)	WORD ARRAY [0..63]	
Calibration 4	16#5100 (= 20736)	WORD ARRAY [0..63]	
Calibration 5	16#5140 (= 20800)	WORD ARRAY [0..63]	
Calibration 6	16#5180 (= 20864)	WORD ARRAY [0..63]	
Calibration 7	16#51C0 (= 20928)	WORD ARRAY [0..63]	
Configuration			1 x 64 WORDS
Configuration	16#6000 (= 24576)	WORD ARRAY [0..63]	

Weld program parameters

Variable	Channel	Address offset	Type	Description
Weld program		%IW0	WORD ARRAY [0..63]	
Attributes	Weld program [0]	%IW0	WORD	
Pre heat	Bit 0	%IX0.0	BOOL	0 = off, 1 = on
Post heat	Bit 1	%IX0.1	BOOL	0 = off, 1 = on
Pre-mode	Bit 2	%IX0.2	BOOL	00 = PHA, 01 = CCu, 11 = CCC
	Bit 3	%IX0.3	BOOL	
Main mode	Bit 4	%IX0.4	BOOL	00 = PHA, 01 = CCu, 11 = CCC
	Bit 5	%IX0.5	BOOL	
Post-mode	Bit 6	%IX0.6	BOOL	00 = PHA, 01 = CCu, 11 = CCC
	Bit 7	%IX0.7	BOOL	
Link mode	Bit 8	%IX1.0	BOOL	0 = off, 1 = on
Repeat mode	Bit 9	%IX1.1	BOOL	0 = off, 1 = on
Wait force	Bit 10	%IX1.2	BOOL	0 = off, 1 = on
Force profile	Bit 11	%IX1.3	BOOL	0 = off, 1 = on
Test force	Bit 12	%IX1.4	BOOL	0 = off, 1 = on
Test pre-current	Bit 13	%IX1.5	BOOL	0 = off, 1 = on
Test main current	Bit 14	%IX1.6	BOOL	0 = off, 1 = on
Test post-current	Bit 15	%IX1.7	BOOL	0 = off, 1 = on
Presqueeze time	Weld program [1]	%IW1	WORD	0 – 1999
Squeeze time	Weld program [2]	%IW2	WORD	0 – 1999
Pre-heat time	Weld program [3]	%IW3	WORD	0 – 1999
Pre-heat	Weld program [4]	%IW4	WORD	0 – 1999
Reserved	Weld program [5]	%IW5	WORD	
Pre-current	Weld program [6]	%IW6	DWORD	0 – 500000
Cool1 time	Weld program [8]	%IW8	WORD	0 – 1999
Main heat time	Weld program [9]	%IW9	WORD	0 – 1999
Main heat	Weld program [10]	%IW10	WORD	0 – 1999
Reserved	Weld program [11]	%IW11	WORD	
Main current	Weld program [12]	%IW12	DWORD	0 – 500000
Cool2 time	Weld program [14]	%IW14	WORD	0 – 1999
Pulsations	Weld program [15]	%IW15	WORD	1 – 99
Post-heat time	Weld program [16]	%IW16	WORD	0 – 1999
Post-heat	Weld program [17]	%IW17	WORD	0 – 1999
Reserved	Weld program [18]	%IW18	WORD	
Post-current	Weld program [19]	%IW19	DWORD	0 – 500000
Hold time	Weld program [21]	%IW21	WORD	0 – 1999
Off time	Weld program [22]	%IW22	WORD	0 – 1999
Upslope time	Weld program [23]	%IW23	WORD	0 – 1999
Downslope time	Weld program [24]	%IW24	WORD	0 – 1999
Squeeze valves[1]	Weld program [25]	%IW25	WORD	
Pre-heat valves[1]	Weld program [26]	%IW26	WORD	
Cool1 valves[1]	Weld program [27]	%IW27	WORD	
Upslope valves[1]	Weld program [28]	%IW28	WORD	
Main heat valves[1]	Weld program [29]	%IW29	WORD	
Cool2 valves[1]	Weld program [30]	%IW30	WORD	
Downslope valves[1]	Weld program [31]	%IW31	WORD	
Post-heat valves[1]	Weld program [32]	%IW32	WORD	
Hold valves[1]	Weld program [33]	%IW33	WORD	
Off valves[1]	Weld program [34]	%IW34	WORD	

[1]	Weld program [nn]	%IXnn.0.0	BOOL	AV1 state 1 = ON
	Weld program [nn]	%IXnn.0.1	BOOL	AV2 state 1 = ON
	Weld program [nn]	%IXnn.0.2	BOOL	AV3 state 1 = ON
	Weld program [nn]	%IXnn.0.3	BOOL	AV4 state 1 = ON
	Weld program [nn]	%IXnn.0.4	BOOL	AV5 state 1 = ON
	Weld program [nn]	%IXnn.0.5	BOOL	AV6 state 1 = ON
	Weld program [nn]	%IXnn.0.6	BOOL	AV7 state 1 = ON
	Weld program [nn]	%IXnn.0.7	BOOL	AV8 state 1 = ON

Weld program parameters (continued)

Variable	Channel	Address offset	Type	Description
Squeeze force	Weld program [35]	%IW35	WORD	0 – 32767[2]
Pre-heat force	Weld program [36]	%IW36	WORD	0 – 32767[2]
Cool1 force	Weld program [37]	%IW37	WORD	0 – 32767[2]
Upslope force	Weld program [38]	%IW38	WORD	0 – 32767[2]
Main heat force	Weld program [39]	%IW39	WORD	0 – 32767[2]
Cool2 force	Weld program [40]	%IW40	WORD	0 – 32767[2]
Downslope force	Weld program [41]	%IW41	WORD	0 – 32767[2]
Post-heat force	Weld program [42]	%IW42	WORD	0 – 32767[2]
Hold force	Weld program [43]	%IW43	WORD	0 – 32767[2]
Off force	Weld program [44]	%IW44	WORD	0 – 32767[2]
Force low limit	Weld program [45]	%IW45	WORD	0 – 99 %
Force high limit	Weld program [46]	%IW46	WORD	0 – 99 %
Selected WAV	Weld program [47]	%IW47	WORD	0 – 7
Current low limit	Weld program [48]	%IW48	WORD	0 – 99 %
Current high limit	Weld program [49]	%IW49	WORD	0 – 99 %
Selected electrode	Weld program [50]	%IW50	WORD	0 – 7
Linked program	Weld program [51]	%IW51	WORD	0 – 255
Last pre-current	Weld program [52]	%IW52	DWORD	0 – 500000
Last main current	Weld program [54]	%IW54	DWORD	0 – 500000
Last post-current	Weld program [56]	%IW56	DWORD	0 – 500000
Reserved	Weld program [58]	%IW58	WORD	
Reserved	Weld program [59]	%IW59	WORD	
Reserved	Weld program [60]	%IW60	WORD	
Attributes	Weld program [61]	%IW61	WORD	
Inhibited	Bit 0	%IX61.0	BOOL	0 = enable, 1 = inhibit
Motor valves[1]	Weld program [62]	%IW62	WORD	
Reserved	Weld program [63]	%IW63	WORD	

[2] Divide value by 898.99 for kN. Divide value by 4 for lbf.

Electrode parameters

Variable	Channel	Address offset	Type	Description
Electrode		%IW0	WORD ARRAY [0..63]	
Attributes	Electrode [0]	%IW0	WORD	
Enable counter	Bit 0	%IX0.0	BOOL	0 = off, 1 = on
Enable tipdress	Bit 1	%IX0.1	BOOL	0 = off, 1 = on
Enable stepper	Bit 2	%IX0.2	BOOL	0 = off, 1 = on
Stop at endcount	Bit 3	%IX0.3	BOOL	0 = off, 1 = on
Stop at endstep	Bit 4	%IX0.4	BOOL	0 = off, 1 = on
Transformer	Electrode [1]	%IW1	WORD	0 – 7
Counter	Electrode [2]	%IW2	WORD	0 – 9999
Endcount	Electrode [3]	%IW3	WORD	0 – 9999
Dressings done	Electrode [4]	%IW4	WORD	0 – 9999
Max dressings	Electrode [5]	%IW5	WORD	0 – 9999
Stepper spots done	Electrode [6]	%IW6	DWORD	Read only
Stepper % done	Electrode [8]	%IW8	WORD	Read only
Stepper reset to	Electrode [9]	%IW9	WORD	0 – 9999
Stepper spots	Electrode [10..19]	%IW10..19	WORD	0 – 9999
Stepper delta H	Electrode [20..29]	%IW20..29	WORD	0 – 500 (% x 10)
Stepper delta I	Electrode [30..39]	%IW30..39	WORD	0 – 500 (% x 10)
Reserved	Electrode[40]-[63]			

Calibration parameters

Variable	Channel	Address offset	Type	Description
Calibration		%IW0	WORD ARRAY [0..63]	
Ip max	Calibration [0]	%IW0	WORD	0 – inverter specific
A out X1	Calibration [1]	%IW1	WORD	0 – 10000 mV
A out Y1	Calibration [2]	%IW2	WORD	0 – 32767
A out X2	Calibration [3]	%IW3	WORD	0 – 10000 mV
A out Y2	Calibration [4]	%IW4	WORD	0 – 32767
A in X1	Calibration [5]	%IW5	WORD	0 – 10000 mV
A in Y1	Calibration [6]	%IW6	WORD	0 – 32767
A in X2	Calibration [7]	%IW7	WORD	0 – 10000 mV
A in Y2	Calibration [8]	%IW8	WORD	0 – 32767
Reserved	Calibration [9]	%IW9	WORD	
Toroid sensitivity	Calibration [10]	%IW10	WORD	1 – 60000 mV/kA
Convert CT	Calibration [11]	%IW11	WORD	0 = use 2-points 1 = use turns ratio
CT X1	Calibration [12]	%IW12	DWORD	0 – 32000
CT Y1	Calibration [14]	%IW14	DWORD	0 – 500000
CT X2	Calibration [16]	%IW16	DWORD	0 – 32000
CT Y2	Calibration [18]	%IW18	DWORD	0 – 500000
CT max	Calibration [20]	%IW20	DWORD	Read only
Turns ratio	Calibration [22]	%IW22	WORD	1 – 999
Reserved	Calibration [23]	%IW23	WORD	
CCC X1	Calibration [24]	%IW24	WORD	0 – 999
CCC Y1	Calibration [25]	%IW25	DWORD	0 – 500000
CCC X2	Calibration [27]	%IW27	WORD	0 – 999
CCC Y2	Calibration [28]	%IW28	DWORD	0 – 500000
Toroid factor	Calibration [30]	%IW30	WORD	1 – 10
Reserved	Calibration[31]-[63]			

Configuration parameters

Variable	Channel	Address offset	Type	Description
Configuration		%IW0	WORD ARRAY [0..63]	
Weld type	Configuration[0]	%IW0	WORD	0 = spot 1 = seam 2 = analog
Second stage	Configuration[1]	%IW1	WORD	
	Bit 0 Bit 1	%IX1.0 %IX1.1	BOOL BOOL	00 = none 01 = before Squeeze 10 = after Squeeze
	Bit 2	%IX1.2	BOOL	Reserved
	Bit 3	%IX1.3	BOOL	0 = check first program 1 = check every program
Retract	Configuration[2]	%IW2	WORD	0 = simple 1 = hilift plus 2 = hilift minus 3 = maintained
Measure	Configuration[3]	%IW3	WORD	0 = primary 1 = secondary
Ip limit	Configuration[4]	%IW4	WORD	0 – inverter specific
Units	Configuration[5]	%IW5	WORD	0 = metric 1 = imperial
Electrodes	Configuration[6]	%IW6	WORD	0 = single, 1 = multi
Fault	Configuration[7]	%IW7	WORD	
Stop	Bit 0	%IX7.0	BOOL	1 = stop on fault
EOS	Bit 1	%IX7.1	BOOL	1 = EOS on fault
Headlock	Bit 2	%IX7.2	BOOL	1 = headlock on fault
iPAK (v1)	Bit 3	%IX7.3	BOOL	1 = use Not Ready sense
Contactor	Configuration[8]	%IW8	WORD	1 - 99 seconds. 0 = off
Program select	Configuration[9]	%IW9	WORD	0 = external, 1 = internal
Internal prog	Configuration[10]	%IW10	WORD	0 - 255
I/O source	Configuration[11]	%IW11	WORD	0 = discrete 1 = MODBUS COM0 2 = MODBUS COM1 3 = MODBUS COM2 4 = RS232 COM3
Regulation	Configuration[12]	%IW12	WORD	0 = primary 1 = secondary
COM2 address	Configuration[13]	%IW13	WORD	1 - 247
COM2 baud code	Configuration[14]	%IW14	WORD	0 = 9600 1 = 19200 2 = 38400 3 = 57600
Bus monitor	Configuration[15]	%IW15	WORD	0 = iPAK (v1) inverter 1 = iPAK2 inverter
Adapter code	Configuration[16]	%IW16	WORD	
Analog output function	Configuration[17]	%IW17	WORD	0 = force 1 = waveform
Analog output scale (10 V =)	Configuration[18]	%IW18	DWORD	0 – 500 kA
Security	Configuration[20]	%IW20	WORD	0 = off 1 = key-switch 2 = PIN on WSP3
Security timeout	Configuration[21]	%IW21	WORD	0 – 10 minutes
Security PIN0	Configuration[22]	%IW22	WORD	1000 - 9999
Security PIN1	Configuration[23]	%IW23	WORD	1000 - 9999
Security PIN2	Configuration[24]	%IW24	WORD	1000 - 9999
Security PIN3	Configuration[25]	%IW25	WORD	1000 - 9999
Security PIN4	Configuration[26]	%IW26	WORD	1000 - 9999
Reserved	Configuration[27]-[38]			
Features	Configuration[39]	%IW39	WORD	0 = standard 1 = extended
Toroid test	Configuration[40]	%IW40	WORD	0 = Off, 1 = On
Reserved	Configuration[41]-[63]			

Tutorials

The iPAK2 has a number of features that can improve weld quality, diagnostics and maintenance. Before each tutorial:

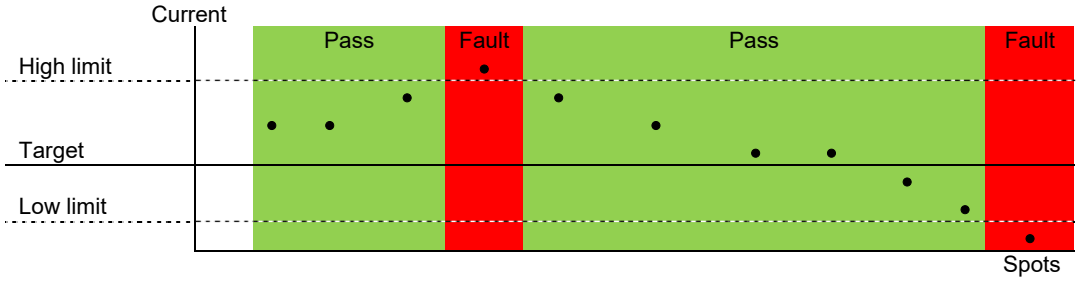
- Section 12 **Configuration**: ensure the Configuration parameters are set appropriately for the application.
- Section 7 **Electrode management**: ensure the Calibration parameters are set.

01 Testing the weld current

The current for each weld can be tested against upper and lower limits.

1. In the weld program, enable the Monitor option for each weld to be tested.
2. Set the Low limit and High limits appropriately. The limits correspond to a percentage of the required current.

If the weld current falls outside the limits, iPAK2 will signal a weld fault.



02 Changing the force during a weld

iPAK2 can change the force during a weld when the force profile option is enabled. The force can be changed at the beginning of any interval. The force output corresponds to the analog output on connector X5.

Parameter	Units	Range	Description
Squeeze[1]	kN/lbf	variable	Force used from the start of the Squeeze interval
Pre-heat[1]	kN/lbf	variable	Force used from the start the Pre-heat interval
Cool1[1]	kN/lbf	variable	Force used from the start the Cool1 interval
Upslope[1]	kN/lbf	variable	Force used from the start the Upslope interval
Main heat	kN/lbf	variable	Force used from the start of the Main heat interval
Cool2	kN/lbf	variable	Force used from the start of the Cool2 interval
Downslope[1]	kN/lbf	variable	Force used from the start of the Downslope interval
Post-heat[1]	kN/lbf	variable	Force used from the start the Post-heat interval
Hold[1]	kN/lbf	variable	Force used from the start the Hold interval

[1] If the force profile option is disabled the Main heat force is used for the duration of the weld.

1. In the weld program, enable the force profile option.
2. In the Force parameters, set the values for each interval. The change takes place at the start of each interval and the force for each interval can be tested against limits.

03 Using the Retract functions

The Retract function allows the welding head to open in two stages.

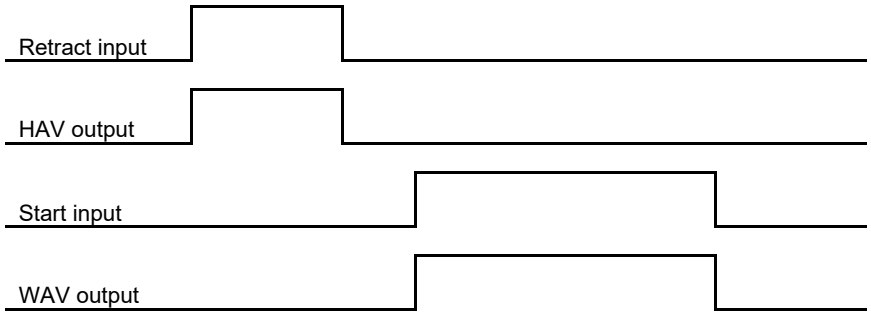
- The fully open position allows the work piece to be positioned between the electrodes.
- The middle position allows the electrodes to close onto the work piece in order to weld.

iPAK2 has four Retract modes that can be used depending on the application. The mode is selected in the Configuration settings.

Simple

When the Retract Input is switched off, the High Lift Air Valve switches off and the electrodes close to the mid position. Welding can proceed in this case.

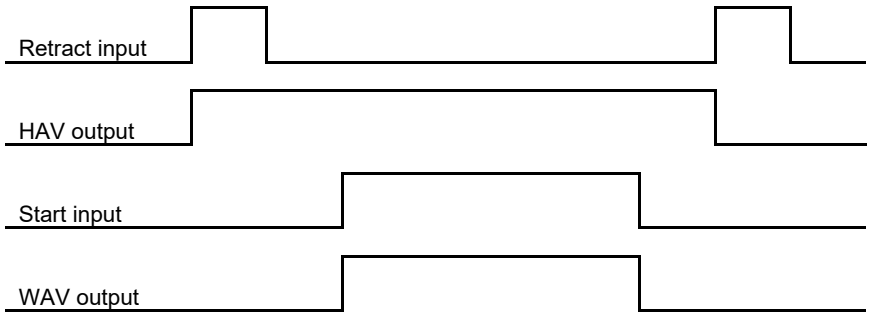
When the Retract Input is switched on, the High Lift Air Valve switches on and the electrodes open fully. Welding will not proceed in this case.



Hi-lift +

A pulse on the Retract Input causes the High Lift Air Valve to switch on and close the electrodes to the mid position. Welding can proceed in this case.

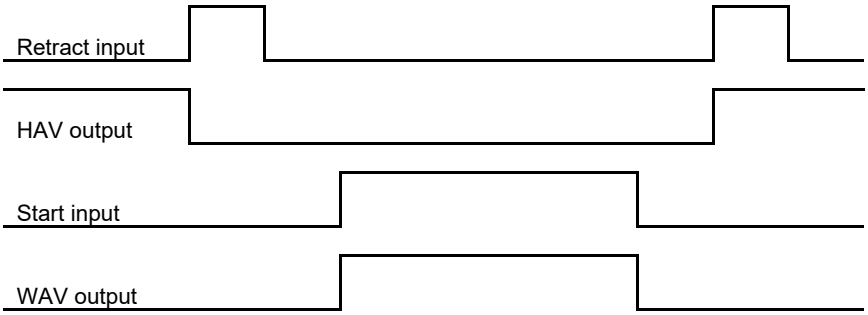
Whilst the High Lift Air Valve is on, a pulse on the Retract Input causes the valve to switch off and the electrodes go to the fully open position. Welding will not proceed in this case.



Hi-lift -

A pulse on the Retract Input causes the High Lift Air Valve to switch off and close the electrodes to the mid position. Welding can proceed in this case.

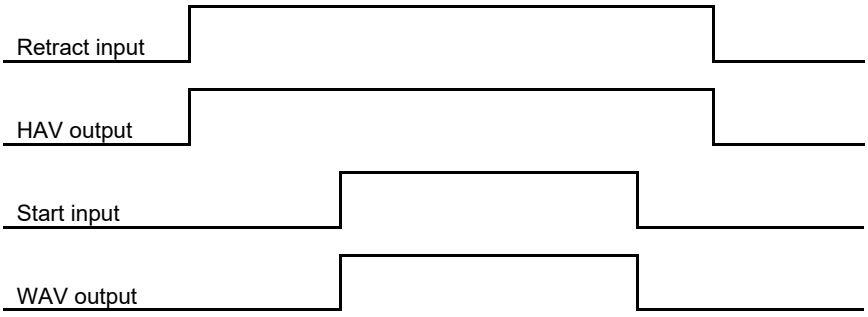
Whilst the High Lift Air Valve is off, a pulse on the Retract Input causes the valve to switch on and the electrodes go to the fully open position. Welding will not proceed in this case.



Maintained

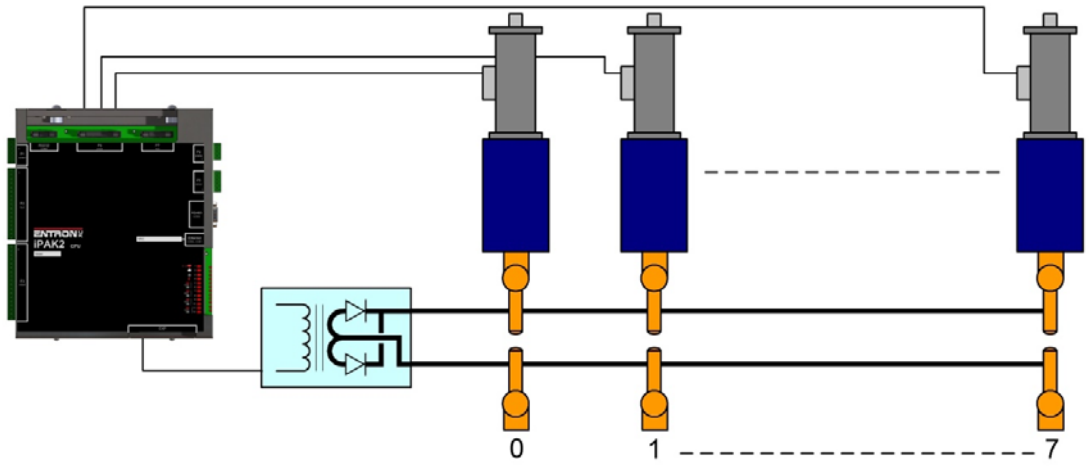
When the Retract Input is switched on, the High Lift Air Valve switches on and the electrodes close to the mid position. Welding can proceed in this case.

When the Retract Input is switched off, the High Lift Air Valve switches off and the electrodes open fully. Welding will not proceed in this case.



04 Using the valves to control a multi-head machine

iPAK2 can be used with welding machines that have multiple welding heads. By assigning one of the iPAK2s AV outputs, each head can be operated individually.



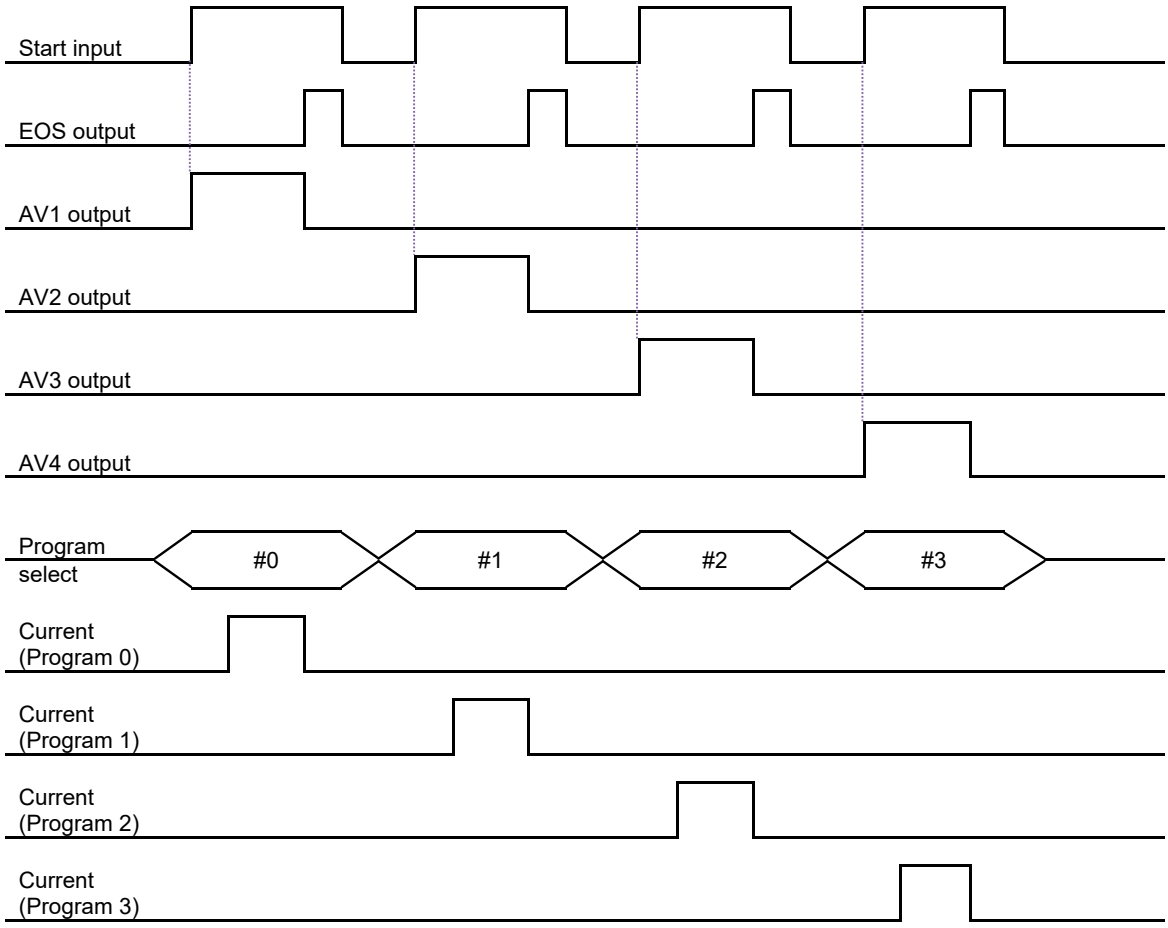
The weld air valve or WAV output is determined by the weld program.

1. In the weld program, use the Valve parameters to select an output that will be used as the WAV
2. The WAV will become active when the Start input is active and will remain active until the end of the weld sequence unless programmed otherwise.

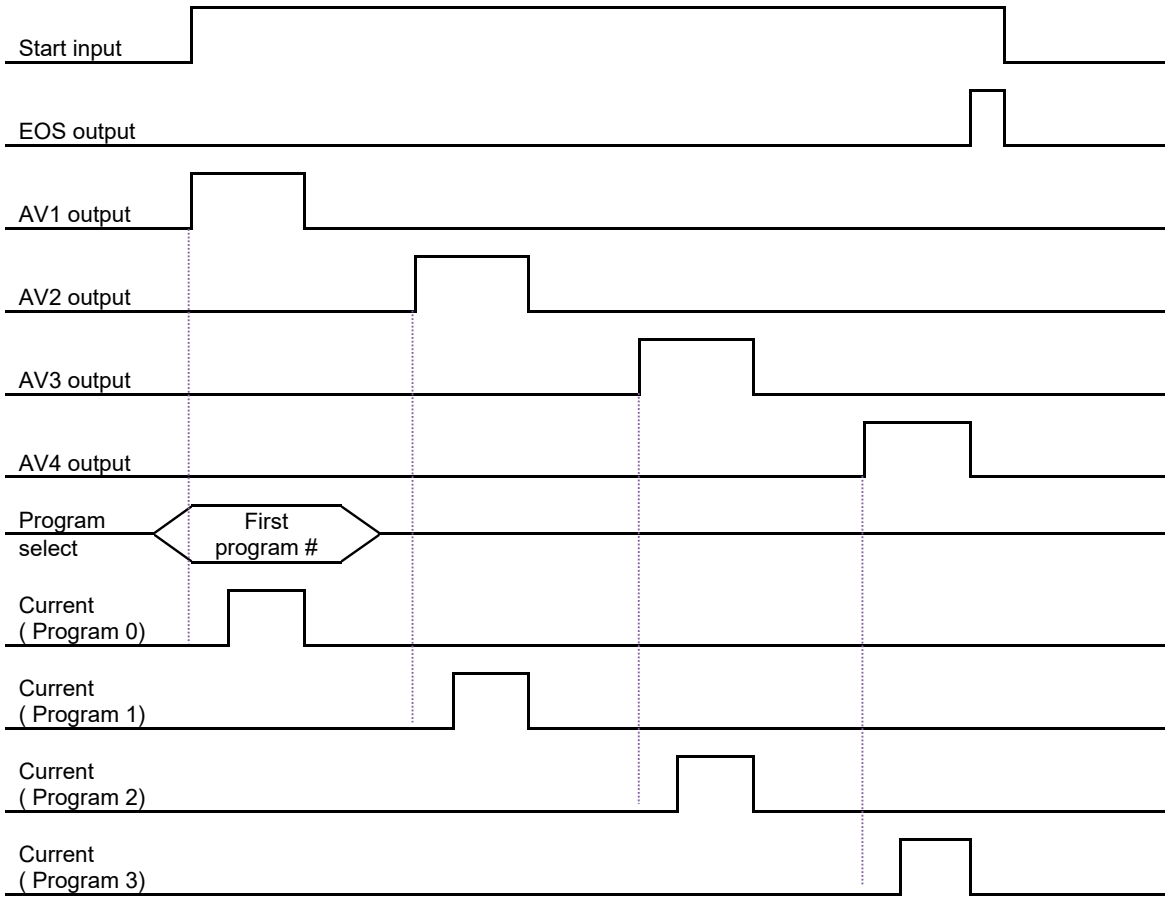
For example:

Program	WAV	Description
0	AV1	Program 0 uses AV1 as the WAV
1	AV2	Program 1 uses AV2 as the WAV
2	AV3	Program 2 uses AV3 as the WAV
3	AV4	Program 3 uses AV4 as the WAV

The diagram shows the operation in multi-gun mode:



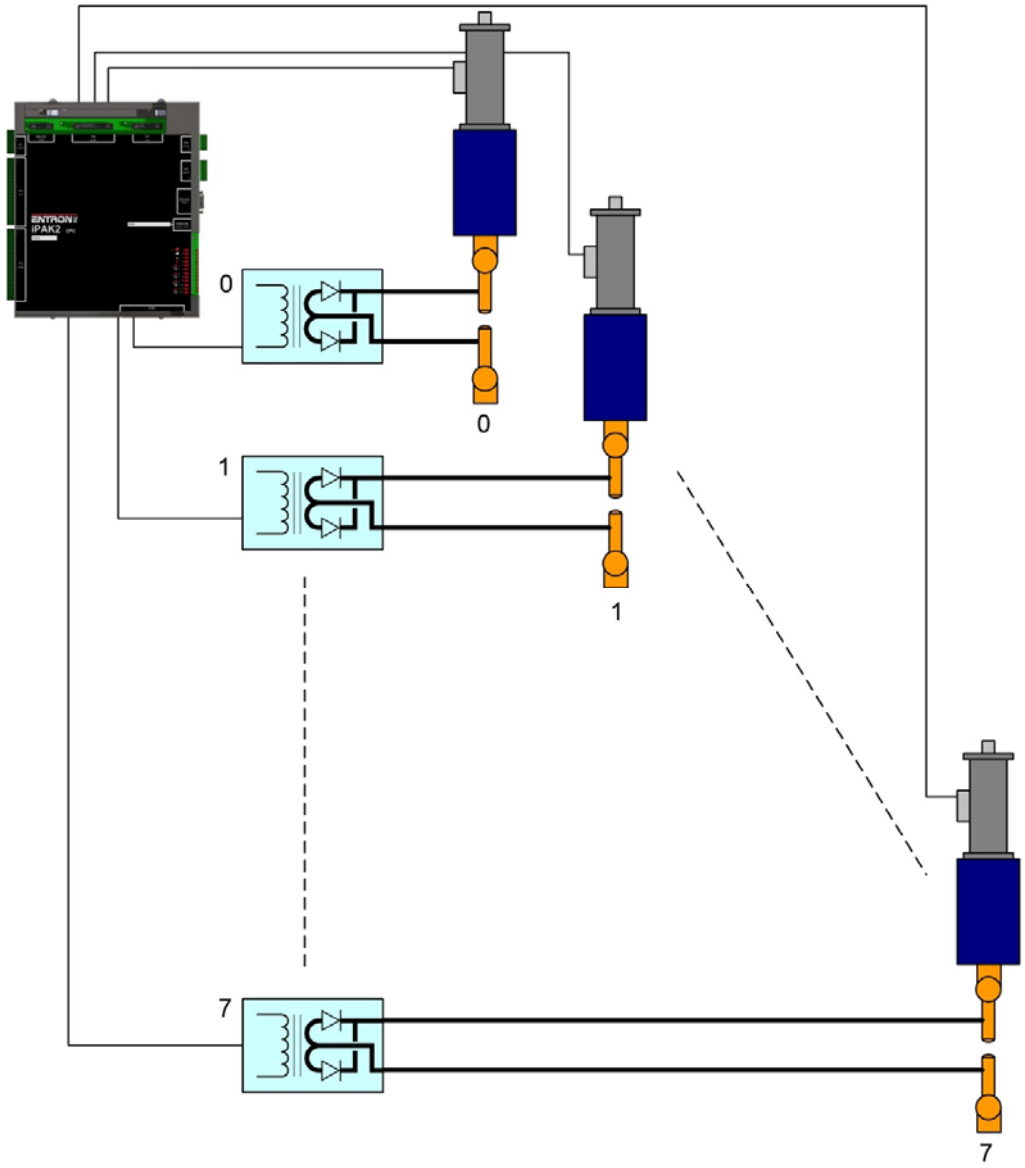
The operation is similar when the programs are linked together in multi-gun cascade mode:



The program select inputs select the first program in the cascade (0 in this example).

05 Controlling a multiwelder

A multiwelder can use different transformers for each welding head.



The welding heads can be controlled as described in the previous tutorial.

1. Choose the transformers that will be assigned to the electrodes. The procedure is described in Section 10 **Multiwelding**.
2. Choose the weld programs that will be using the electrodes.

For example:

Electrode	Transformer	Description
0	0	Electrodes 0, 1 and 2 are assigned to transformer 0
1	0	
2	0	
3	1	Electrodes 3 and 4 are assigned to transformer 1
4	1	
5	2	Electrode 5 is assigned to transformer 2
6	3	Electrodes 6 and 7 are assigned to transformer 3
7	3	

The electrodes can then be assigned to weld programs:

Weld program	Electrode	Description
0	0	Weld programs 0 and 1 are assigned to Electrode 0
1	0	
2	1	Weld programs 2 and 3 are assigned to Electrode 1
3	1	
4	2	Weld programs 4 and 5 are assigned to Electrode 2
5	2	
6	3	Weld programs 6 and 7 are assigned to Electrode 3
7	3	
8	4	Weld programs 8 and 9 are assigned to Electrode 4
9	4	
10	5	Weld programs 10 and 11 are assigned to Electrode 5
11	5	
12	6	Weld programs 12 and 13 are assigned to Electrode 6
13	6	
14	7	Weld programs 14 and 15 are assigned to Electrode 7
15	7	

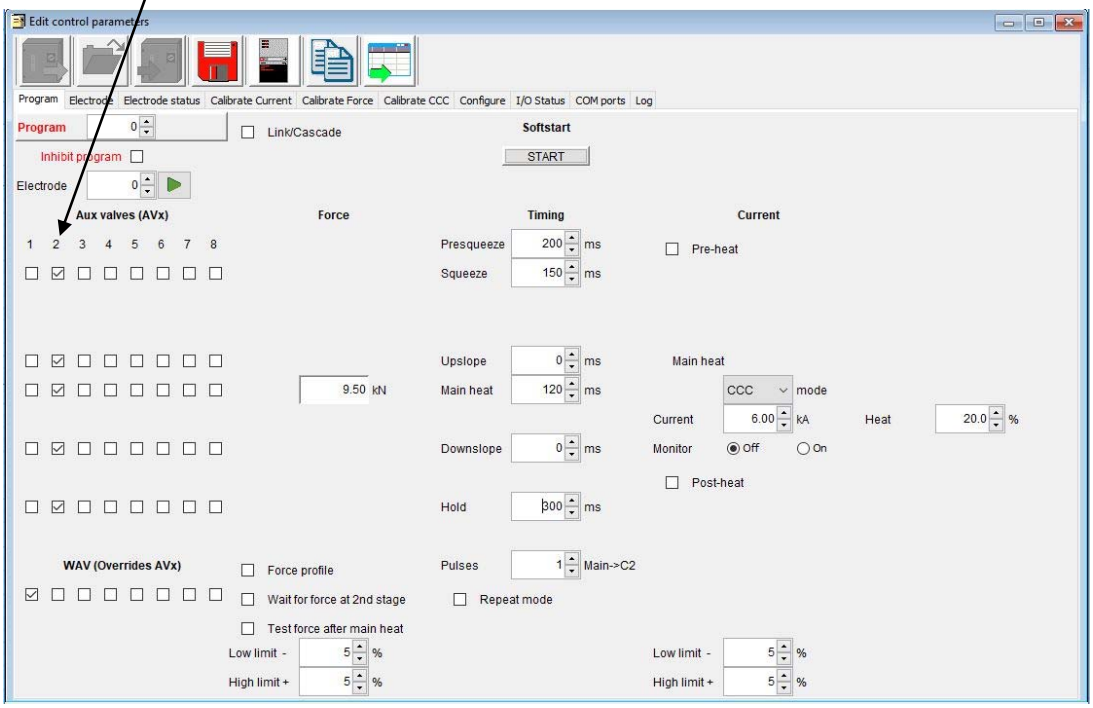
By implication the transformers are used as follows:

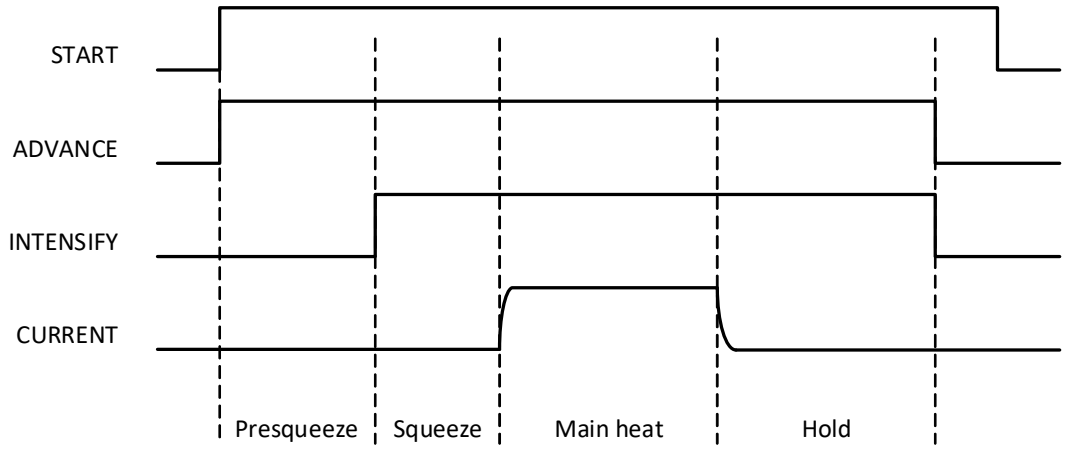
Transformer	Weld programs	Description
0	0, 1, 2, 3, 4, 5	Transformer 0 is used by weld programs 0, 1, 2, 3, 4, and 5
1	6, 7, 8, 9	Transformer 1 is used by weld programs 6, 7, 8 and 9
2	10, 11	Transformer 2 is used by weld programs 10 and 11
3	12, 13, 14,15	Transformer 3 is used by weld programs 12, 13, 14 and 15

06 Controlling an 'Air over Oil' system

An 'Air over Oil' system (also referred to as OHMA) uses compressed air to open and close the electrodes plus a hydraulic intensifier to apply the weld force. This type of system can easily be controlled by the iPAK2 by making use of the programmable AUX valves feature.

1. Connect the air solenoid (ADVANCE) to the AV1(SV1) output (or whichever output you have programmed to provide the WAV function).
2. Connect the hydraulic solenoid (INTENSIFY) to the AV2(SV2) output (or whichever AUX output you wish to use).
3. In your welding schedule(s), set the ***Presqueeze time*** to suit the gun closure, and the ***Squeeze time*** to apply the force pre-weld. Now program the AUX valve chosen in step 2 to come on during all of the intervals which you are using (e.g. ***Squeeze, Main heat, Hold***).

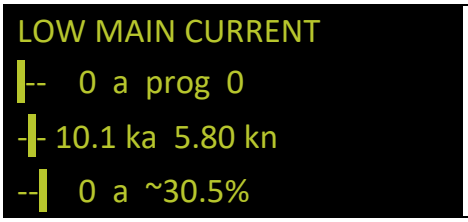




07 Resetting faults

Fault conditions and error messages can be reset in several ways.

WSP3



From the Status screen press 

NetFlash

Use  to select the Metrics window then select the reset button 

Discrete input

Input	Pin number	Description
Reset fault	P2.15	This input resets the Fault output and clears the status messages. Only momentary application is required (minimum time 40ms).

The discrete I/O is described in Section 4 **Discrete I/O**.

Bus input

Input	Channel	Address	Description
Reset fault	Bit 6	%QX0.6	This input resets the Fault output and clears the status messages. Only momentary application is required (minimum time 40ms).

The bus I/O is described in Section 5 **MODBUS I/O**.

Appendix

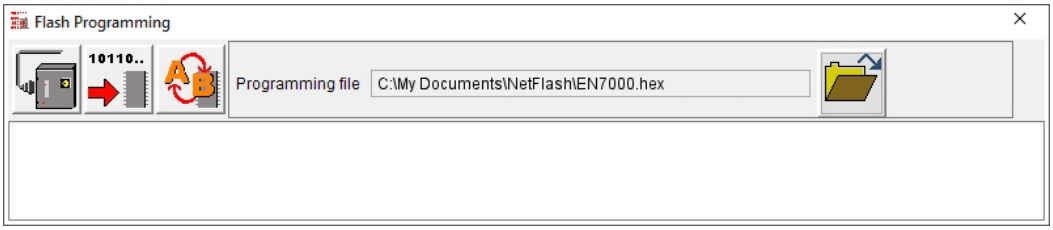
Updating the firmware

The functionality of iPAK2 is determined by firmware stored in reprogrammable memory. iPAK2 has three memories:

Memory	Description
A	Memory A
B	Memory B
BIOS	BIOS memory

The firmware can be transferred to one or more of the memories and then activated when iPAK2 starts. In this way it is possible to retain different firmwares and activate them without having to reprogram iPAK2. When new features become available NetFlash is used to update the firmware.

- Initialise NetFlash and select the target iPAK2 as described in Section 13 **Programming**.
- Select the Flash Programming tool  . The following screen is shown:




Connect to the iPAK2

Start transfer to the iPAK2


Change the active memory


Select the flash file

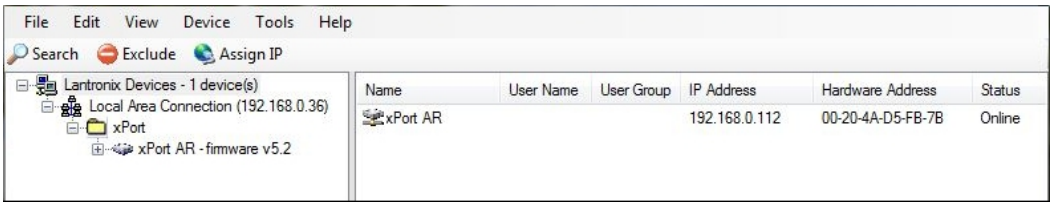
- Select the flash file  . This will be a file with a .hex extension supplied by ENTRON UK.
- Select connect to the iPAK2  . NetFlash will connect to the target control and report the current firmware status.
- Select start transfer to the iPAK2  . Select a memory to re-program and NetFlash will transfer the flash file to the iPAK2.
- If required, select change the active memory  . NetFlash will mark the selected memory for activation. When iPAK2 restarts, the selected memory becomes active.

Setting the IP address

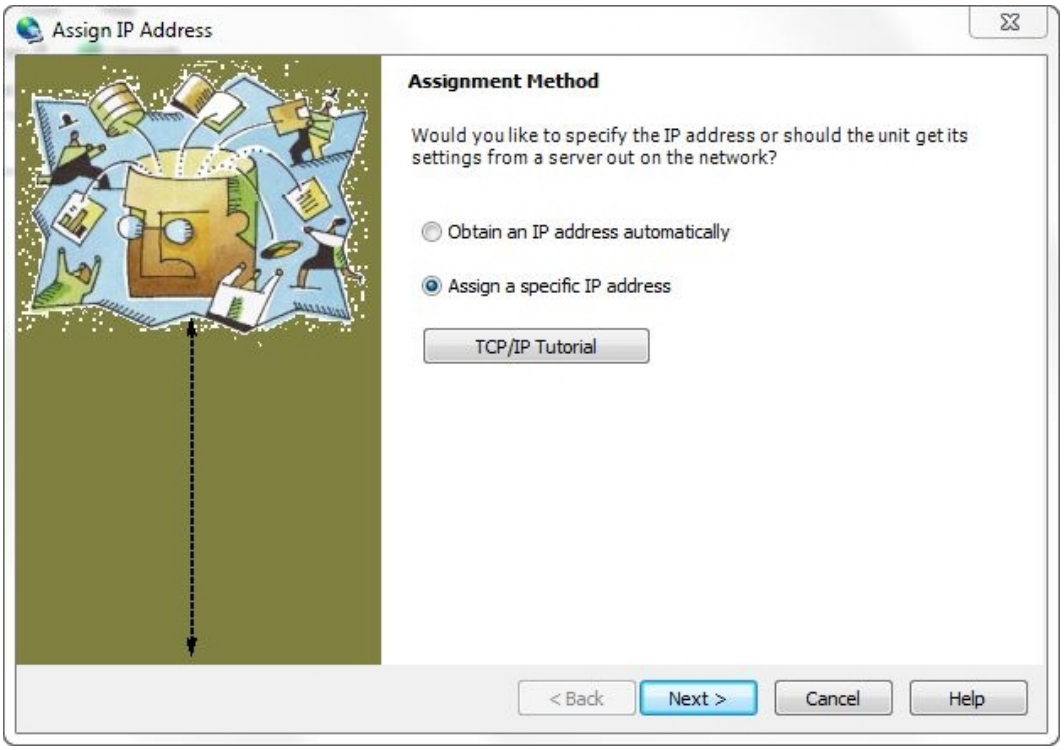
iPAK2 uses a device server for Ethernet communications on COM0 and COM1. The device server is an xPort AR, manufactured by Lantronix www.lantronix.com

To set the IP address of the iPAK2 use Lantronix's DeviceInstaller software
www.lantronix.com/products/deviceinstaller/

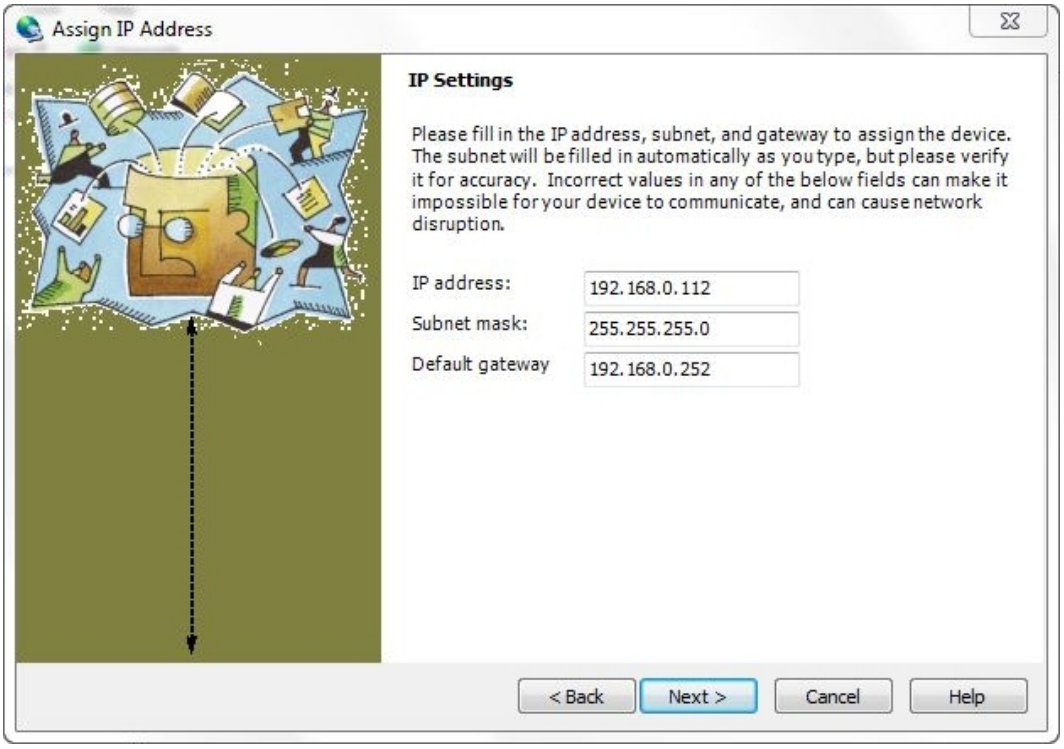
- Download the documentation and Device Installer software. Install the software.
- Follow the instructions in the documentation to search for all Lantronix devices on your network. Device Installer will show the iPAK2 device server in the device list. The example shows an iPAK2/xPort AR with a hardware address of 00-20-4A-D5-FB-7B:



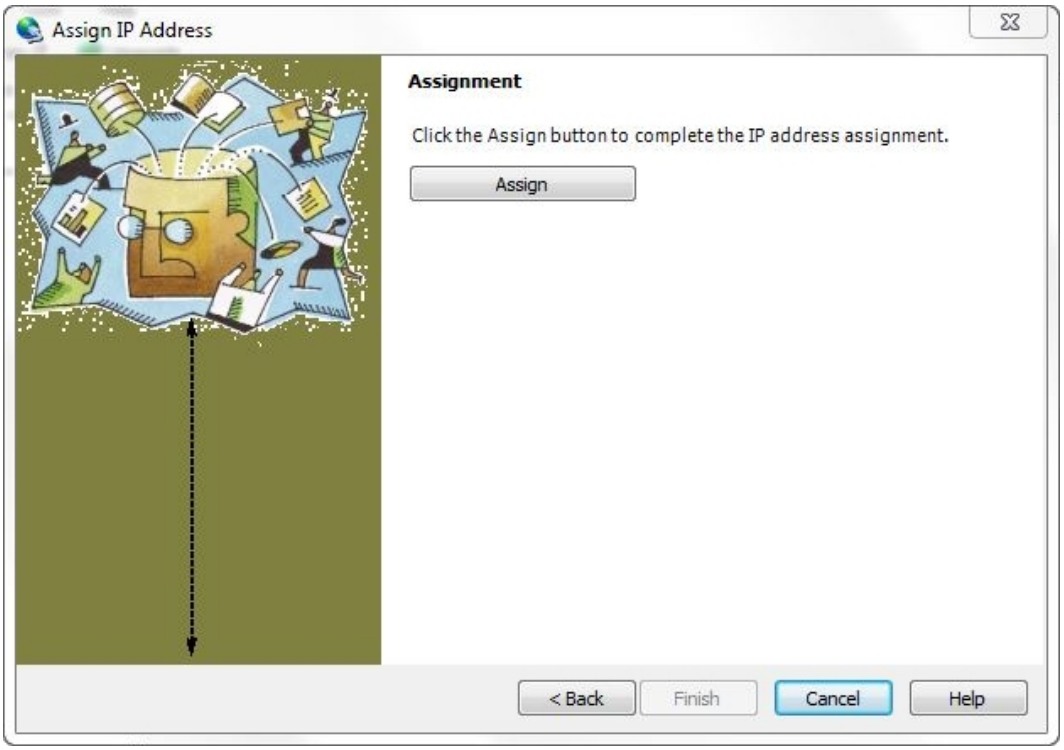
- Select the iPAK2/xPort AR device then select Assign IP:



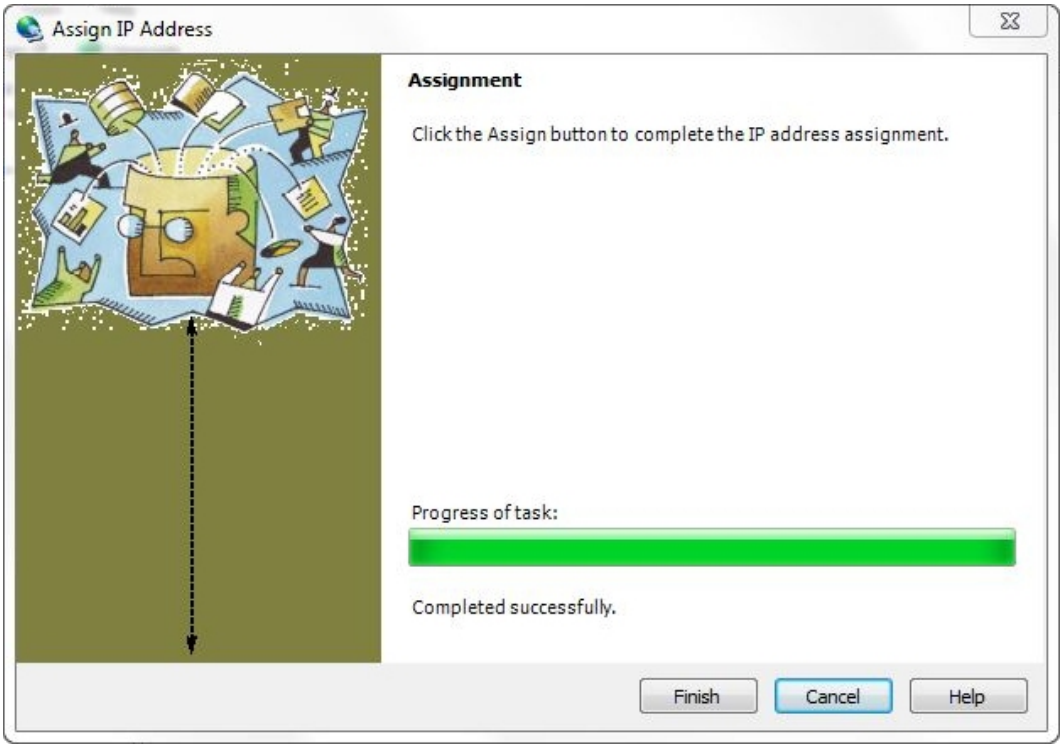
- Select 'Assign a specific IP address' and then select Next:



- Enter the IP address, subnet mask and gateway then select Next:



- Select Assign to complete the assignment. Device Installer will show the progress of the operation:



- Select Finish to return to the main screen.

Terminology

Term	Description
Constant current	Closed loop control of weld current resulting in the weld current being regulated to a programmed value.
CT	See Current transformer.
Current transformer	A coil of wire wound on a circular core. This is used to measure the current in a cable passing through the circular core. iPAK2 can use a CT to measure primary current.
Cool time	The time between weld pulses.
Downslope	A linear decrease in current from the Main heat value to a final value.
Downslope time	Time taken for the welding current to decrease from the Main heat value to a final value.
End of sequence	An output that switches on as the electrodes open on completion of a weld. The output indicates the end of the weld sequence.
EOS	See End of sequence.
HAV	Hi-lift Air Valve. See also Retract.
Heat	A measure of power put into a phase angle controlled (non- constant current) weld. The Heat relates directly to the firing angle on the mains voltage waveform. Expressed as a percentage.
Hold	The time between the last application of current and the electrodes opening. This interval allows the molten material created by the weld process to solidify.
Hold time	The time period following the last weld pulse prior to the electrodes opening. This period allows the molten material to solidify.
IP address	Internet Protocol address. A unique address used by devices on an Ethernet network.
Initiation signal	The signal that starts the weld sequence. See also Start signal
kA	Kilo amp (1000 amps).
kVA	Unit of power (1000 volt amps).
mA	Milliamp (1/1000 amp).
mV	Millivolt (1/1000 volt).
Off time	In a Repeated weld sequence this is the time between sequences.
PHA	See Phase angle control.
Post-heat	The application of current to prevent the weld cooling too quickly.
Pre-heat	The application of current prior to welding for the purpose of burning through plating or surface contamination.
Presqueeze	The time interval in a weld sequence for the electrodes to close onto the work piece.
Primary current	The current in the primary winding of the weld transformer which is the current drawn from the mains whilst welding.
Program select	A group of inputs representing the binary value of the weld program to be used.
Proportional valve	A device for regulating air-line pressure. Controlled by 0 to10 V dc signal.
Pulsations	The number of times the Main heat interval is repeated during the sequence. Successive applications of Main heat are separated by Cool2 time.
Retract	The electrodes have two open positions: fully open to move the weld gun to and from the work piece, and a working position for welding.
Retract air valve	For use on a gun where the electrodes can be opened and closed in two stages. This is an electrically operated valve for admitting air to the air cylinder that controls the electrode movement.
2nd stage	A signal required to allow the weld sequence to proceed.
Secondary current	The current in the secondary winding of the weld transformer which is the weld current.
Squeeze	The time interval in a weld sequence for the electrodes to exert full welding force on

	the work piece.
Squeeze time	The time allowed for the welding electrodes to build up full pressure on the components to be welded.
Start signal	The signal that starts the weld sequence.
Stepper	A program of parameters required for stepping.
Stepping	A technique of progressively increasing the weld current over the course of a large number of welds in order to compensate for the effects of electrode wear.
Thermostat	A switch device that operates at a certain temperature.
Tip dress acknowledge	An input to acknowledge that the electrodes have been dressed.
Tip dress request	An output to indicate that the electrodes require dressing.
Tip dressing	Filing or machining worn electrodes to restore their original shape and dimensions.
Toroid	A device used for sensing current in a cable. The current carrying cable must pass through the toroid.
Upslope	A linear increase in current from an initial value to the Main heat value.
Upslope time	Time taken for current to increase from an initial value to the Main heat value.
VA	Volt amp
WAV	See Weld air valve.
Weld air valve	Electrically controlled valve for admitting air to the air cylinder responsible for forcing the weld electrodes together.
Weld current	High current passed from one electrode to the other, through the components being welded. The current must be large enough to generate sufficient heat to melt the metal and produce a weld.
Weld transformer	Electrical component for converting mains voltage input to low voltage, high current output.