

# Connecting Branson 2000 Series Equipment to Automation

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## FAQ 2000 SERIES AUTOMATION

Q. What is the best tip for automating a Branson welder?

A. Perhaps the best advice is to provide a "manual jog" function where the welder can be cycled by the system control panel without indexing the whole machine. The time saved debugging, optimizing, calibrating and servicing the welder over its lifetime will pay back to the end-user and machine builder many times over the cost of Input hardware and code.

Q. What are the electrical characteristics of the input/output lines in the START and USER I/O cables?

A. They are rated at 10ma. 24Vdc. This is compatible with most PLCs available.

Q. Can't I use 120 Volt AC LOGIC?

A. Not directly. Use relays to interface between the 2 logic levels. Note: use relays with low-power requirement coils, and use back biased diodes to suppress induced back EMF.

Q. But you forgot about the RELAY outputs in your diagrams.

A. They are SOLID STATE relays, and can safely withstand 40 V ac 250 ma, or 24 V dc, 250 ma. So they may be suited better to drive relays, if required to interface to relay coils.

Q. Why do you have so many pins in the USER I/O cable?

A. We combined the alarm and advanced feature connector outputs from the 900 Series with 2000 Series additions to provide maximum features and flexibility while retaining most feature backward compatibility.

Q. What do I do with the UNUSED PINS?

A. You should electrically isolate each unused pin so that shorts to ground and other outputs are avoided. This could possibly damage the USER I/O board and other system components.

Q. Do I ground the shields on the START and USER I/O cables?

A. No; leave the shields from the cables isolated and cut-back so they do not touch ground: this prevents ground loop interference from occurring.

Q. Should I ground the RETURN lines in the START and USER I/O cables?

A. If required: this generally is not a problem. If problems occur, see "OTHER THAN 24 VOLTS"

Q. What are those SQUARE PLASTIC HOUSINGS on the cables?

A. They are ferrites that are used to reduce cross-talk and interference from entering the system. DO NOT remove them.

Q. How LONG can I run the CABLES?

A. Cable sets are available in 8, 15, 25, and on special order 50-foot lengths. Contact Branson Product Support or Customer Service if you have special needs.

Q. Can I run the Branson welder cables in a WIRING TROUGH with other system cables?

A. Generally yes. But, it would be best to avoid other noise trouble source cables or wiring.

(continued next page)

Q. What other system cables might cause a NOISE TROUBLE SOURCE?

A. Avoid wiring of devices such as solenoids, large relays, motors, or anything that has the potential of large inductive currents. Digital devices may also create broad-spectrum noise. Generally, all automation controls can be noise generators.

Q. Why do you require the READY signal to be monitored by the system PLC?

A. The welder mandatory requirements dictate the unit be READY or else the unit will DISREGARD any start command.

Q. Why can't I use a SINGLE START input to signal the welder?

A. This is not preferable as you are running the signals in parallel, and cable capacitance can reduce the noise immunity designed into the controls. The dual inputs are required for the use of manual start switches, and the necessary circuit needs of an actuator welder utilizing solenoid valve control.

Q. Why must I MAINTAIN THE START SIGNAL?

A. This is the way the built-in safety circuits operate. Also, the vast library of error-detection firmware code is based on these same requirements: it will simplify automation system/PLC/welder debugging during system integration. Watch for the PB RELEASE signal, then you can release the START SIGNAL

Q. My machine is CAM driven. Do I need to do anything special?

A. For one thing, monitor the GENERAL ALARM output and send a RESET as soon as the alarm is received. This will allow the power supply to recover from a fault, and go to READY as soon as possible. Otherwise the next weld may be missed if the system is not reset. Also, see WITHOUT A BRANSON ACTUATOR below.

Q. I'm going to use a welder station WITHOUT A BRANSON ACTUATOR. Do I need to use all those cables?

A. If you only need a "stack" (converter/booster/horn) rather than a full featured actuator, you can use the USER I/O cable. This is a feature available in Version 8.05 operating system.

Q. Does it wire up the same way?

A. The USER I/O inputs wire the same way, but the start only needs a SINGLE START input into Pin 1.

Q. But you said you need DUAL START Inputs?

A. Yes, when using a solenoid valve equipped actuator. But in this case we are only controlling ultrasonics. For this function a SINGLE START input works fine.

Q. What can I do to make sure I run at MAXIMUM CYCLE RATE for my machine?

A. You can:

- RESET immediately after an GENERAL ALARM output
- RELEASE the DUAL START inputs immediately after an GENERAL ALARM output
- RELEASE the DUAL START inputs immediately after sensing PB RELEASE output
- If you have a 2000d or 2000f model, and if the stroke length is more than about 0.5 inch, turn on the ACTUATOR CLEAR function and set the distance value to whatever is required to clear the welded workpiece. Use the ACTUATOR CLEAR output to let your PLC index the material handling, rather than wait for the welder to become READY.

(continued next page)

- 2000f models have RAPID TRAVERSE feature built-in; if your stroke is over about 1.0 inch, this may help cycle rate.
- 2000f models have a return speed that is not weld pressure sensitive; it returns at a maximum actuator-safe speed regardless of weld or hold force.
- Never run in an open-loop mode, if possible. Fixed timing can be too short should a fault occur, or may be longer in time than is necessary.

Q. Do all models run at the same CYCLE RATE?

A. See above.

Q. Are there any special requirements for operation with the ACTUATOR UP-SIDE DOWN?

A. Always let Branson know when you plan to run in this manner. Model-specific advice will be provided.

Q. Are there any special requirements for operation with the ACTUATOR HORIZONTAL?

A. Always let Branson know when you plan to run in this manner. Model-specific advice will be provided.

Q. How does EMERGENCY STOP work?

A. Keep in mind that it is meant for EMERGENCY usage only, not for normal head retraction functions. Additional time is allotted for checking the welders' hardware and system status after an EMERGENCY STOP. Note: A front panel or external signal Reset is required after an Emergency Stop to reinitialize the welder. Also see CYCLE ABORT below.

Q. So the CYCLE ABORT function is the preferred fast welder head retraction function?

A. Yes. It does not require the additional time that is allotted for checking the welders' hardware and system status that is used for EMERGENCY STOP.

Q. How does RESET work? Can I hold it on?

A. RESET is only acted upon after a GENERAL ALARM. Do not hold it in the RESET state as it will be ignored.

Q. My system logic uses some value OTHER THAN 24 VOLTS. What do I do?

A. A set of dipswitches are provided on the rear panel slot that contains the USER I/O connector. Setting the switches to OFF (open) converts the 24volt USER I/O to OPEN COLLECTOR configuration. The same voltage/current spec.'s apply when in this mode. (24 volt dc,25ma max.) Use them to control devices that have outputs compatible to your requirements.

Q. Are there any environmental conditions to be concerned about?

A. Any electrical/electronic equipment does not work well in: high humidity (condensing) conditions: also in dusty areas, in particular conductive dust (carbon granule or fiber, charcoal, metal particle, etc.)  
A Fan Filter Kit with instructions can be factory or customer installed for just ordinary dusty areas.  
Always contact your area representative, Branson, Danbury, Product Support or Customer Service should any like conditions or for inquires about explosion-proof requirements.

Q. How much air consumption does the 2000 Series use?

A. 2000 Series products use identical air cylinder sizes as prior models, therefor the air consumption tables from prior series documentation will still apply. (continued next page)

## Cubic Feet of air per Minute per inch of stroke length (each direction)

Cyl. Size	Air Pressure									
	10	20	30	40	50	60	70	80	90	100
1.5	0.00174	0.00243	0.00312	0.00381	0.00450	0.00513	0.00590	0.00660	0.00730	0.00800
2	0.00317	0.00437	0.00557	0.00677	0.00800	0.00930	0.01040	0.01170	0.01300	0.01420
2.5	0.00490	0.00680	0.00870	0.01060	0.01250	0.01440	0.01630	0.01830	0.02040	0.02230
3	0.00680	0.00960	0.01240	0.01520	0.01800	0.02080	0.02350	0.02670	0.02910	0.03190

Use the above table to calculate the air used by the air cylinder.

Add 0.034 cubic foot per second of actual weld time to account for converter cooling air per weld cycle. (2 CFM)

As an example:

3.0 inch aed actuator running at full pressure (100psi) and stroke length (4inches) at a cycle rate of 20 parts per minute = 0.0319 CFM per inch of stroke(from above table) X 8 inches (total stroke is 4 inches down and 4 inches back) equals 0.2552 CFM per stroke. Weld time is 1 second so: 0.034 X 1 equals 0.034 CFM for cooling.

Adding 0.2552 CFM for the cylinder and 0.034 CFM for cooling equals 0.2892 CFM per cycle. Multiply for parts per minute (20) and you get a total of 5.784 CFM.

This would very likely be a worst-case condition any welder could run at. However, we have a slightly different condition for an 2000f/aef welding system. Because the pneumatics are used as differential mode of operation, I would suggest to always use the 100 psi values from the above table to be on the conservative side for sizing airflow, rather than on the actual force values. Still add the same converter cooling values (0.034) as in the prior example.

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## 2000 Series Automation Logic Requirements

Perhaps the best way to approach automating a 2000 Series system is to review how a welder functions when manually operated (left column); then apply the required actions and decisions in the automated machine control's logic (middle column). Optional signals can be used as desired (right column).

Manual Operation	Automated Operation Minimum System Requirement	Automated Operation Optional Features
<p><b>Note:</b> <i>Italicized</i> actions must be done by operator</p>	<p><b>Note:</b> <u>Underlined</u> actions <u>must</u> be done in the order shown by system controls</p>	
<p>The only time it is acceptable to “start” or initiate a cycle is when a welder is in the “ready” state. You initiate the cycle by <i>pressing both start switches simultaneously</i> (within a maximum allowable stagger time of 200 m.s.). The switches <i>must continue to be held closed</i>.</p>	<p><u>Monitor Ready (J3 pin 21 @ 0v)</u></p> <p>If Ready, welder can be started.</p> <p style="text-align: center;"><b>To Start Cycle:</b></p> <p><u>Apply +24v (To start pins 1 &amp; 2 on the actuator connector).</u></p> <p style="text-align: center;"><b>Or:</b></p> <p><u>Close contacts (To start pins 1 &amp; 7, and 2 &amp; 6 on the actuator connector).</u></p>	<p>J3 output signals:</p> <p>General Alarm is off 24v(pin6) Reject Alarm is off 24v (pin5) Suspect Alarm is off- 24v (pin20) Warning Alarm is off- 24v (pin36) Weld On is off- 24v (pin35) Actuator Clear goes off- 24v (pin7)</p>
<p>After the start buttons are pressed the internal S/V (solenoid valve) will be activated allowing the horn to travel toward the workpiece. After the point of contact, force will develop against the workpiece. When the controls sense the trigger force setpoint, the welder advances to the ‘weld on’ state. Ultrasonics will start, and the <i>start switches <u>may now be released</u></i>. (Had either or both start switches been released at any time before now, the welder would abort the cycle, retract back towards the home or rest position, and display an error message.)</p>	<p>Ready changes state; S/V goes on; weld trigger occurs;</p> <p><u>PB Release signal goes on, 0v @ pin 34</u></p> <p style="text-align: center;">Then:</p> <p><u>Apply 0v to start pins 1 &amp; 2 on the actuator connector before welder returns to home position</u></p> <p style="text-align: center;"><b>Or:</b></p> <p><u>Open start pins 1 &amp; 7, 2 &amp; 6 on the actuator connector before welder returns to home position</u></p>	<p>Ready (J3 pin 21 @ 24v)</p> <p>SOL VALVE SRC pin 4 @24v SOL VALVE RTN pin 16 @0v</p> <p>Weld On goes on 0v @pin35</p>
<p>When the weld (ultrasonics) is finished the hold time starts.</p>	<p>Weld on goes off.</p>	<p>Weld On goes off 24v@pin35</p>
<p>When the hold is finished the horn retraction starts.</p>	<p>S/V goes off.</p>	<p>SOL VALVE SRC pin 4@0v SOL VALVE RTN pin 16@0v Actuator clear pin7@0v ACT RTN pin 7@0v at setting</p>
<p>Horn is back to home position. <i>Start switches <u>must be released by now</u></i>. Check for alarms, if any.</p>	<p>Return to Ready state <u>Monitor General Alarm, if any.</u></p> <p><u>Wait for Ready (J3 pin 21 @ 0v)</u></p>	<p>ACT RTN pin 7@24v General Alarm pin 6 for alarm Reject pin 5 @0v for alarm Suspect pin 5 @0v for alarm</p>

## 2000 Series Automation with Actuator Interface

External Dual Signal Start Cycle  
Used on  
Power Supply  
Models

### Minimum Requirements

Cycle state:

start>      < weld time > < hold >      <ready  
<extend>      <retract>

READY

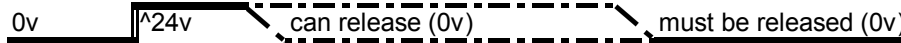
J3 pin 21



all

PB1&2

Base/Start connector on actuator rear input pins1 & 2



all

PB RELEASE

J3 pin 34



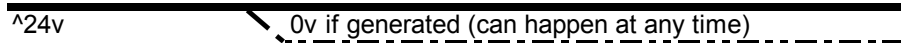
all

### Recommended

### Optional Feature

GENERAL ALARM

J3 pin 6



all

### Specialized

### Optional Features

WELD ON

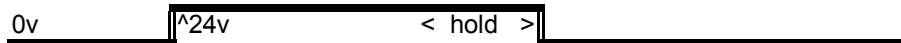
J3 pin 35



all

Sol Valve SRC

J3 pin 4



all

REJECT PART

J3 pin 5



all

SUSPECT PART

J3 pin 20



all but "t"

WARNING ALARM

J3 pin 36



all

ACTUATOR CLEAR

J3 pin 7 (if set to on)



d and f only

Double verticle line triggers the next state or function in time ( || )

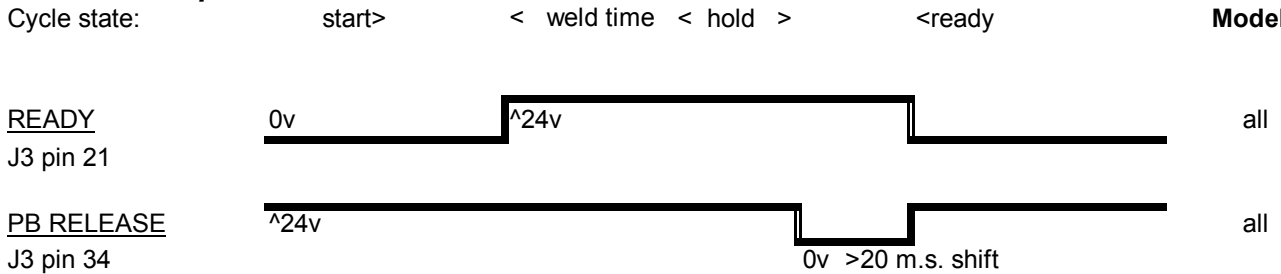
wrs 12/March/02

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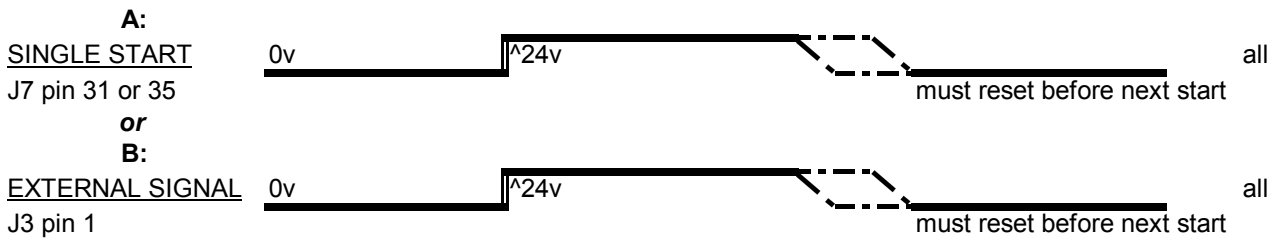
## 2000 Series Automation with Converter Interface

External Single Signal Start Cycle  
Used on  
Power Supply  
Models

### Minimum Requirements

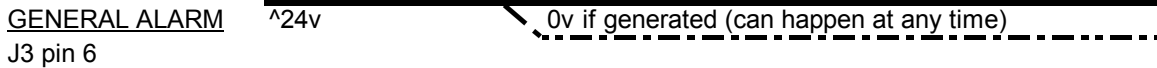


Now choose start function: A (single start) or B (external signal)



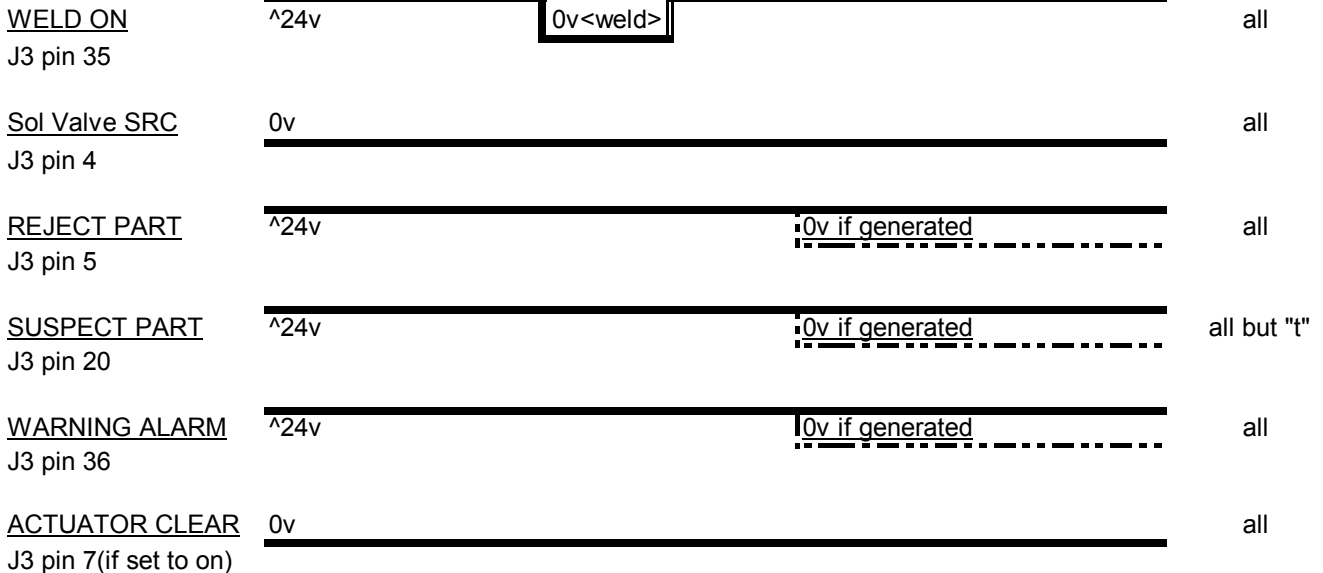
### Recommended

### Optional Feature



### Specialized

### Optional Features



Double vertical line triggers the next state or function in time



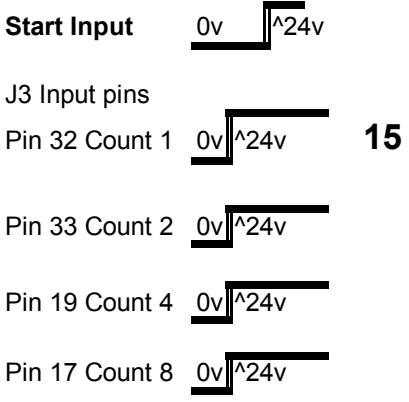
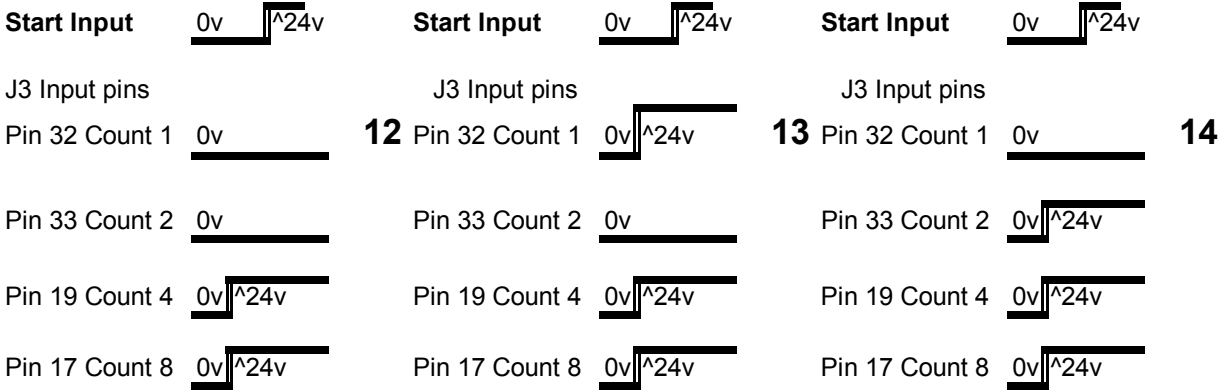
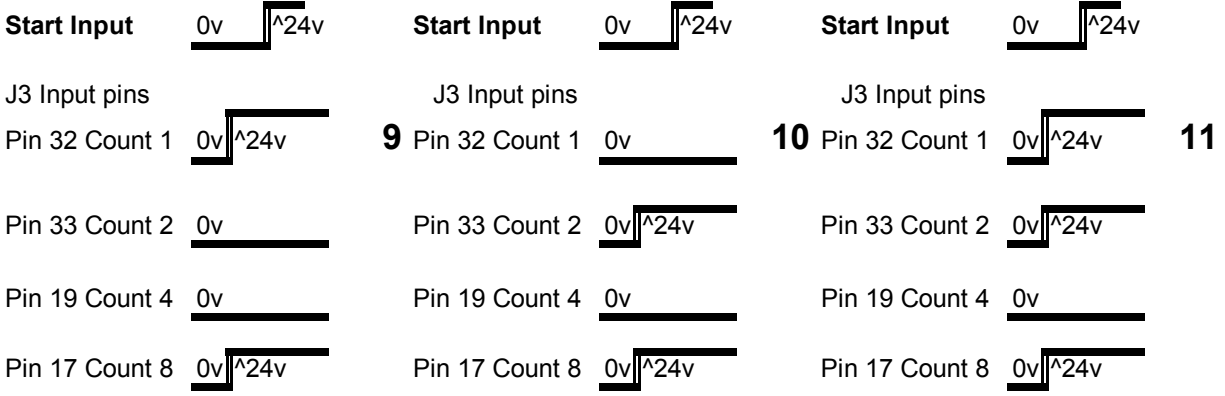
## 2000 Series Automation with Actuator or Converter

## Preset Switching

Input Count	Preset Select	Input Count	Preset Select	Input Count	Preset Select
Start Input		Start Input		Start Input	
J3 Input pins		J3 Input pins		J3 Input pins	
Pin 32 Count 1	0 (last setting)	Pin 32 Count 1	1	Pin 32 Count 1	2
Pin 33 Count 2		Pin 33 Count 2		Pin 33 Count 2	
Pin 19 Count 4		Pin 19 Count 4		Pin 19 Count 4	
Pin 17 Count 8		Pin 17 Count 8		Pin 17 Count 8	
Start Input		Start Input		Start Input	
J3 Input pins		J3 Input pins		J3 Input pins	
Pin 32 Count 1	3	Pin 32 Count 1	4	Pin 32 Count 1	5
Pin 33 Count 2		Pin 33 Count 2		Pin 33 Count 2	
Pin 19 Count 4		Pin 19 Count 4		Pin 19 Count 4	
Pin 17 Count 8		Pin 17 Count 8		Pin 17 Count 8	
Start Input		Start Input		Start Input	
J3 Input pins		J3 Input pins		J3 Input pins	
Pin 32 Count 1	6	Pin 32 Count 1	7	Pin 32 Count 1	8
Pin 33 Count 2		Pin 33 Count 2		Pin 33 Count 2	
Pin 19 Count 4		Pin 19 Count 4		Pin 19 Count 4	
Pin 17 Count 8		Pin 17 Count 8		Pin 17 Count 8	

## 2000 Series Automation with Actuator or Converter

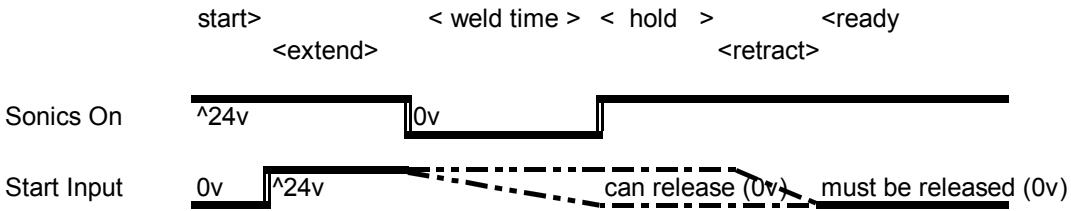
Input Count	Preset Select	Input Count	Preset Select	Input Count	Preset Select
-------------	---------------	-------------	---------------	-------------	---------------



**Note:** # of presets depends on model.  
User Inputs must be set to accept the below settings and Ext Presets to on in the system configuration menu.

- J3 Pin 32 = Preset 1
- J3 Pin 33 = Preset 2
- J3 Pin 19 = Preset 4
- J3 Pin 17 = Preset 8

## Cycle Example



**Note:** Switching to Preset 15 shown as example

J3 Input pins

Pin 32 Count 1 0v 24v

Pin 33 Count 2 0v 24v

Pin 19 Count 4 0v 24v

Pin 17 Count 8 0v 24v

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