iQ Series

ULTRASONIC PROBE SYSTEM

AiM

Automation Interface Guidelines

Contents

System Inputs/Outputs

System I/O Cable Pinouts

Pin	Color	Description
J5-1	BLK/RED	+22V CURRENT LIMITED POWER SUPPLY (*500mA MAX*)
J5-2	RED/BLK	+22V RETURN (*iQ CHASSIS GROUND*)
J5-3	BLK/WHT	E-STOP OUTPUT
J5-4	WHT/BLK	E-STOP INPUT
J5-5	BLK/GRN	REMOTE SETUP SELECTION BIT 0 INPUT
J5-6	GRN/BLK	REMOTE SETUP SELECTION BIT 1 INPUT
J5-7	BLK/BLU	REMOTE SETUP SELECTION BIT 2 INPUT
J5-8	BLU/BLK	REMOTE SETUP SELECTION BIT 3 INPUT
J5-9	BLK/YEL	AUTOMATION CYCLE STOP INPUT
J5-10	ORN/BLK	FRONT PANEL LOCKOUT INPUT
J5-11	BLK/BRN	ISOLATED INPUT COMMON
J5-12	BRN/BLK	ULTRASOUND ACTIVATION/CYCLE START INPUT
J5-13	BLK/ORN	ISOLATED ULTRASOUND COMMON
J5-14	ORN/BLK	ANALOG DISTANCE INPUT (0-10VDC)
J5-15	RED/WHT	ANALOG AMPLITUDE INPUT (0-10VDC)
J5-16	WHT/RED	ANALOG GROUND
J5-17	RED/GRN	ANALOG POWER OUTPUT (0-10VDC)
J5-18	GRN/RED	ANALOG AMPLITUDE OUTPUT (0-10VDC)
J5-19	RED/BLU	ULTRASOUND STATUS OUTPUT
J5-20	BLU/RED	ANY FAULT STATUS OUTPUT
J5-21	RED/YEL	OVERLOAD STATUS OUTPUT
J5-22	YEL/RED	BAD PART STATUS OUTPUT
J5-23	RED/BRN	GOOD PART STATUS OUTPUT
J5-24	BRN/RED	READY STATUS OUTPUT
J5-25	RED/ORN	MPC READY STATUS OUTPUT
J5-26	ORN/RED	ISOLATED OUTPUT COMMON

Note: The descriptions shown are for the default I/O settings. Almost all Inputs are programmable to other input functions and all outputs to other output functions. The exception is the ULTRASOUND ACTIVATION / CYCLE START INPUT which cannot be programmed to another function. For other functions and detailed signal descriptions, please refer to the product manual.

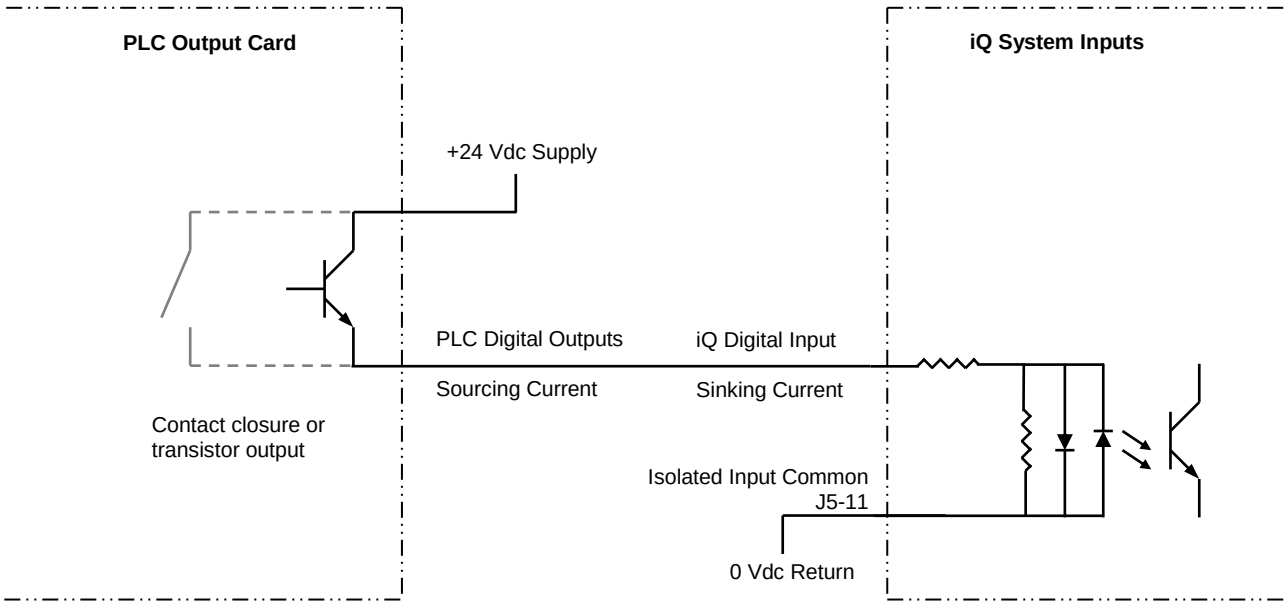
System Input/Output Cables

Part Number	Length
200-2119-03M	3 meters
200-2119-05M	5 meters
200-2119-07M	7 meters
200-2119-09M	9 meters
200-2119-11M	11 meters
200-2119-13M	13 meters

System Inputs Description

All System Inputs are optically isolated from the internal circuits and can be connected to sinking or sourcing PLC output cards. The inputs will draw approximately 1mA with a 24Vdc supply. The Systems Inputs can also be configured for a contact closure if necessary.

Connecting an Input to a PLC Sourcing Output Card



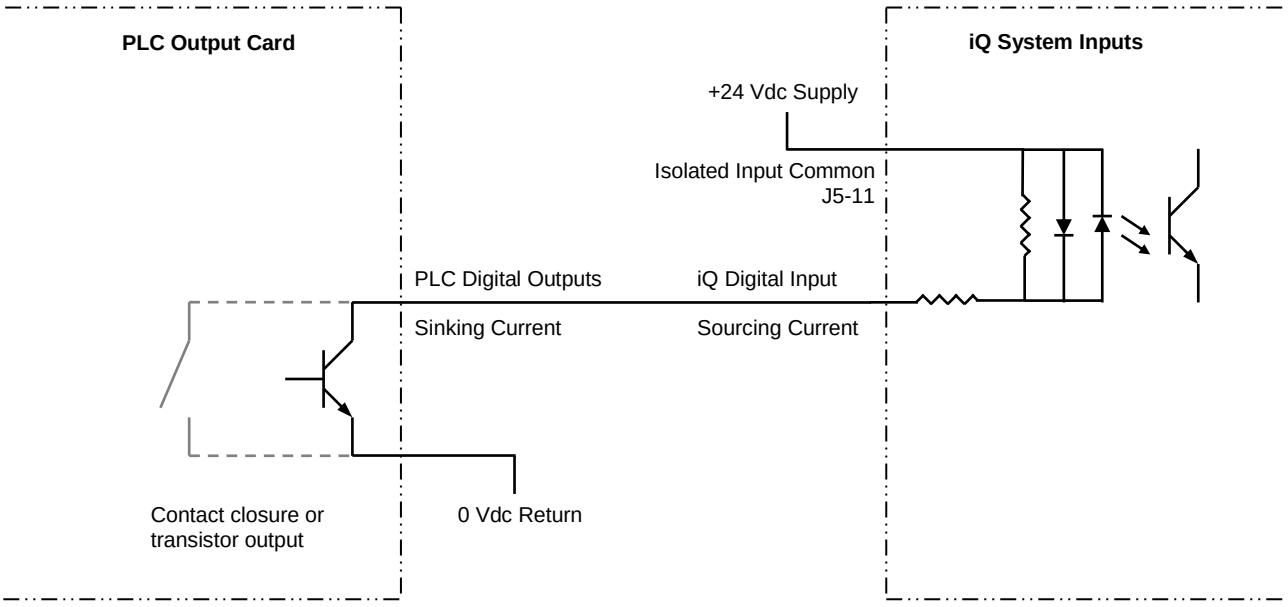
Notes:

1. All System Inputs share the same isolated common (J5-11) except Ultrasound Activation/Cycle Start Input (J5-12) which has a separate isolated common (J5-13). It is critical that the isolated commons are connected to +24 Vdc Supply or 0 Vdc Return.

2. J5-1 can be used in place of the 24 Vdc supply. If so, J5-11 must be connected to J5-2. Use J5-13 in place of J5-11 for the Ultrasound Activation/Cycle Start Input.

Warning: Any connection to the Ultrasound Activation/Cycle Start Input (J5-12) should be disabled during an emergency stop condition.

Connecting an Input to a PLC Sinking Output Card



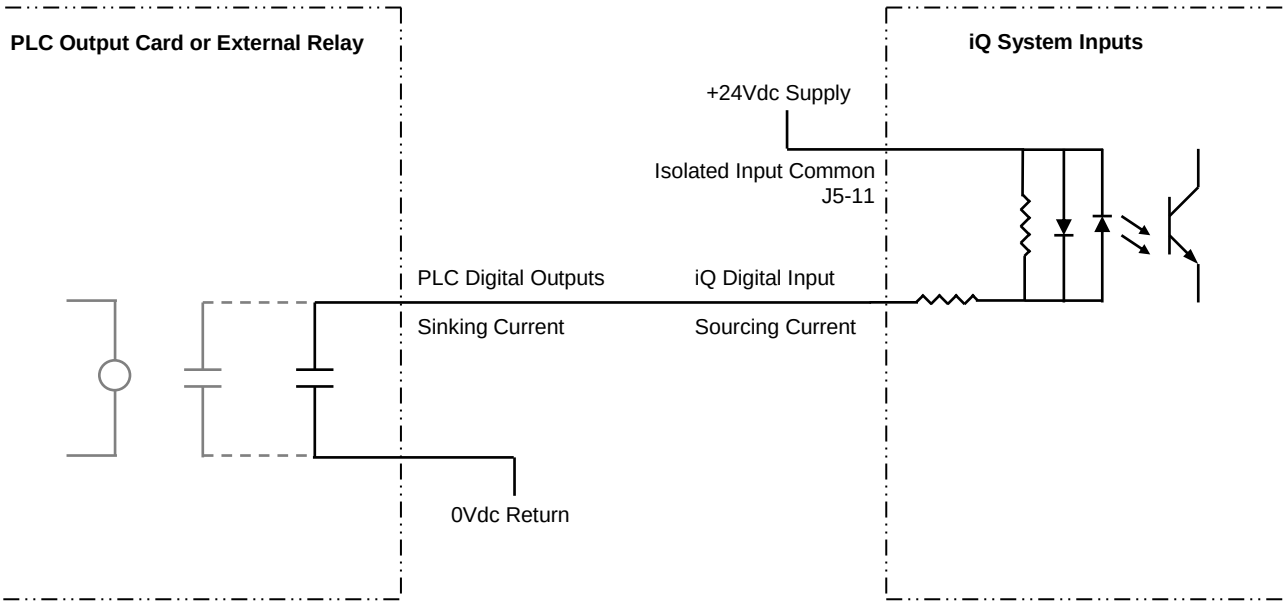
Notes:

1. All System Inputs share the same isolated common (J5-11) except Ultrasound Activation/Cycle Start Input (J5-12) which has a separate isolated common (J5-13). It is critical that the isolated commons are connected to +24 Vdc supply or 0 Vdc Return.

2. J5-1 can be used in place of the 24 Vdc supply. If so, J5-11 must be connected to J5-1 and 0 Vdc Return to J5-2. Use J5-13 in place of J5-11 for the Ultrasound Activation/Cycle Start Input.

Warning: Any connection to the Ultrasound Activation/Cycle Start Input (J5-12) should be disabled during an emergency stop condition.

Connecting an Input to a Relay Contact Closure



Notes:

1. All System Inputs share the same isolated common (J5-11) except Ultrasound Activation/Cycle Start Input (J5-12) which has a separate isolated common (J5-13). It is critical that the isolated commons are connected to +24 Vdc supply or 0 Vdc Return.

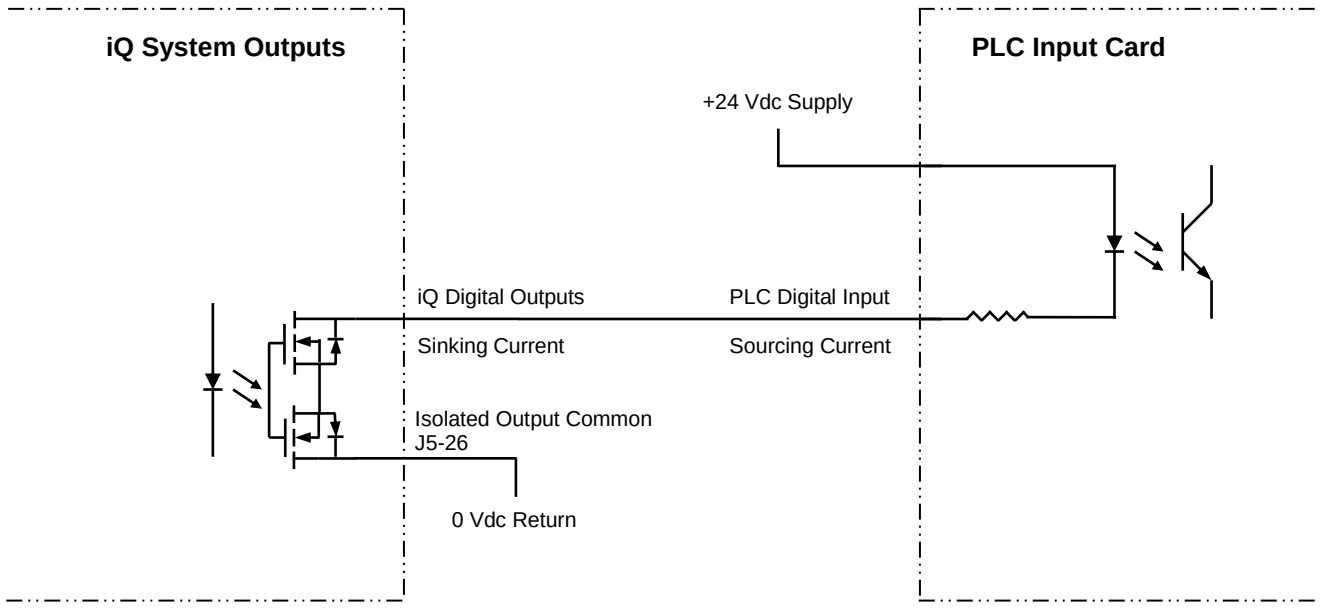
2. Dukane's current limited power supply can be substituted for the +24 Vdc supply above. Connect J5-1 to Isolated Common (J5-11) and 0 Vdc Return to J5-2. Use J5-13 in place of J5-11 for the Ultrasound Activation/Cycle Start Input. Connecting the System Inputs in this way would be similar to activating DPC series System Inputs.

Warning: Any connection to the Ultrasound Activation/Cycle Start Input (J5-12) should be disabled during an emergency stop condition.

System Output Description

All System Outputs are optically isolated from the internal circuits and can be connected to sinking or sourcing PLC input cards. When J5-1 is used to power the outputs, the total maximum output current for all outputs combined is 250mA. If an external supply is used, as shown in the drawing below, each output can sink or source up to 500mA.

Connecting an Output to a PLC Sourcing Input Card

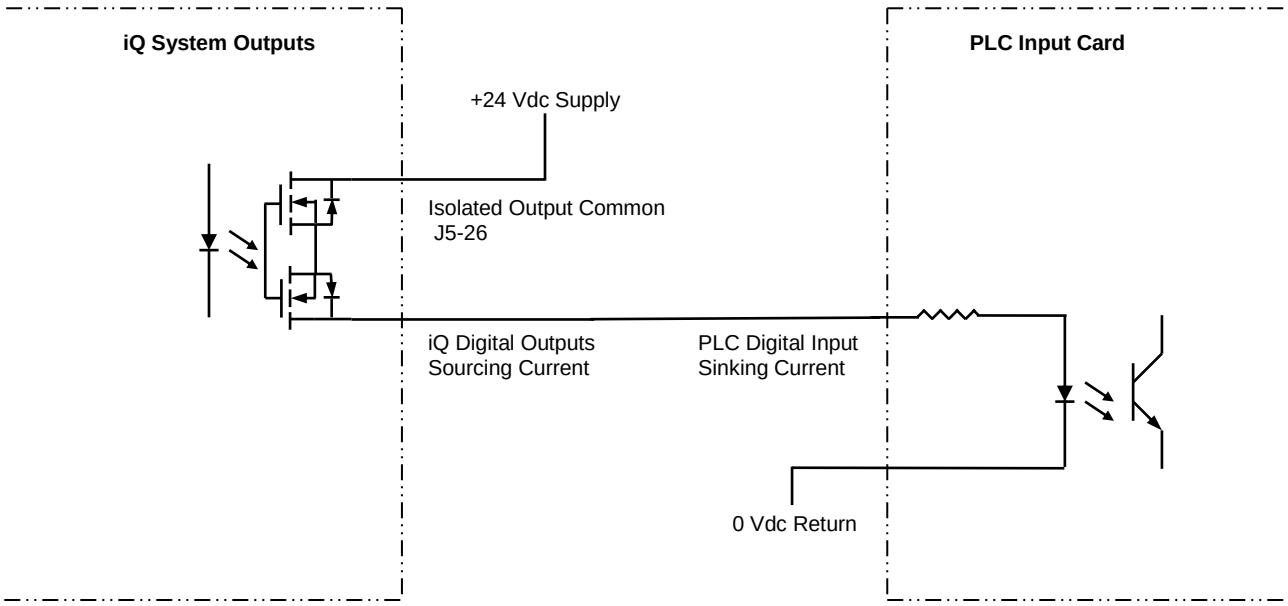


Notes:

1. All System Outputs share the same isolated common (J5-26). It is critical that the isolated output common is connected to +24 Vdc supply or 0 Vdc Return.

2. J5-1 can be used in place of the 24 Vdc supply. If so, J5-26 must be connected to J5-2.

Connecting an Output to a PLC Sinking Input Card

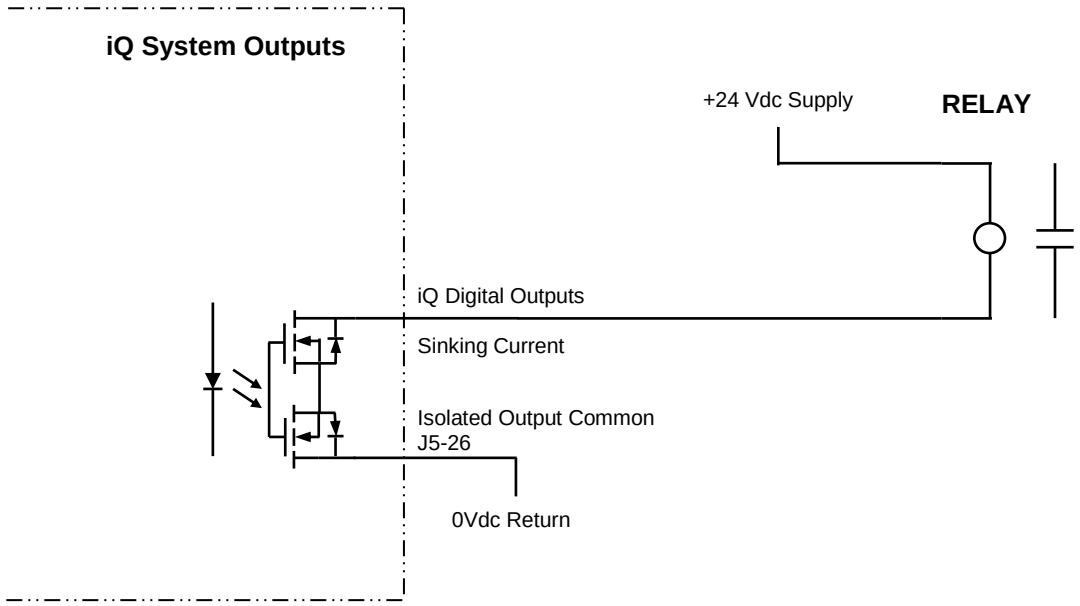


Notes:

1. All System Outputs share the same isolated common (J5-26). It is critical that the isolated output common is connected to +24 Vdc supply or 0 Vdc Return.

2. J5-1 can be used in place of the 24 Vdc supply. If so, J5-26 must be connected to J5-1 and 0 Vdc to J5-2.

Connecting an Output to a Relay Contact Closure



Notes:

1. All System Outputs share the same Isolated Common (J5-26). It is critical that the isolated output common is connected to +24 Vdc supply or 0 Vdc Return.

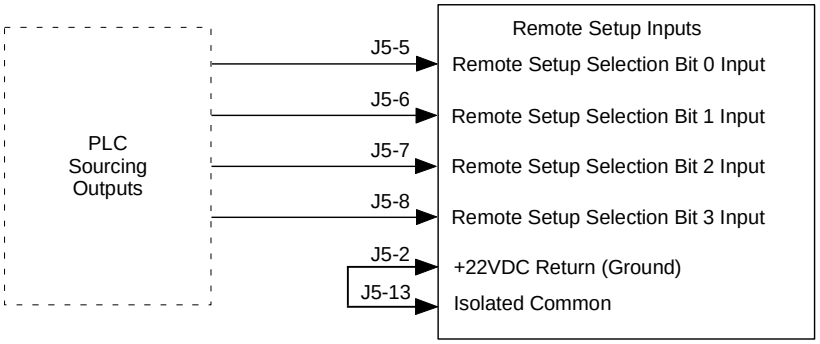
2. J5-1 can be used in place of the 24 Vdc supply. If so, J5-26 must be connected to J5-2.

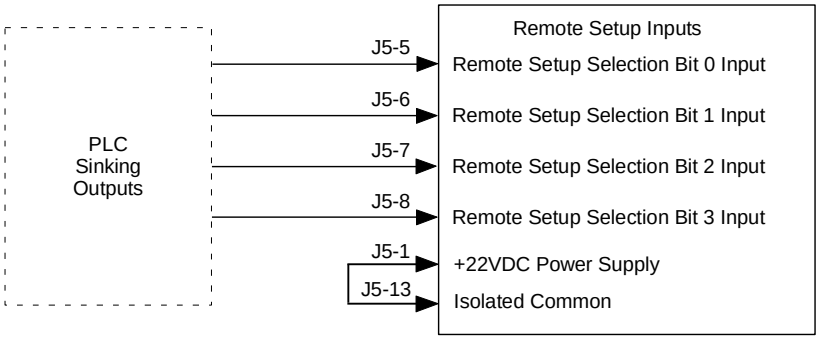
Remote Setups

These system inputs receive a Binary code from the automation that is used to select a setup, anMPC probe, or both to be used for the next welding cycle. Selections 17-32 are reserved and are not available (N/A). An external +24VDC supply can be used instead of the generator internal supply. See the drawings on pages 4 and 5 for more information.

Remote Setup Switching

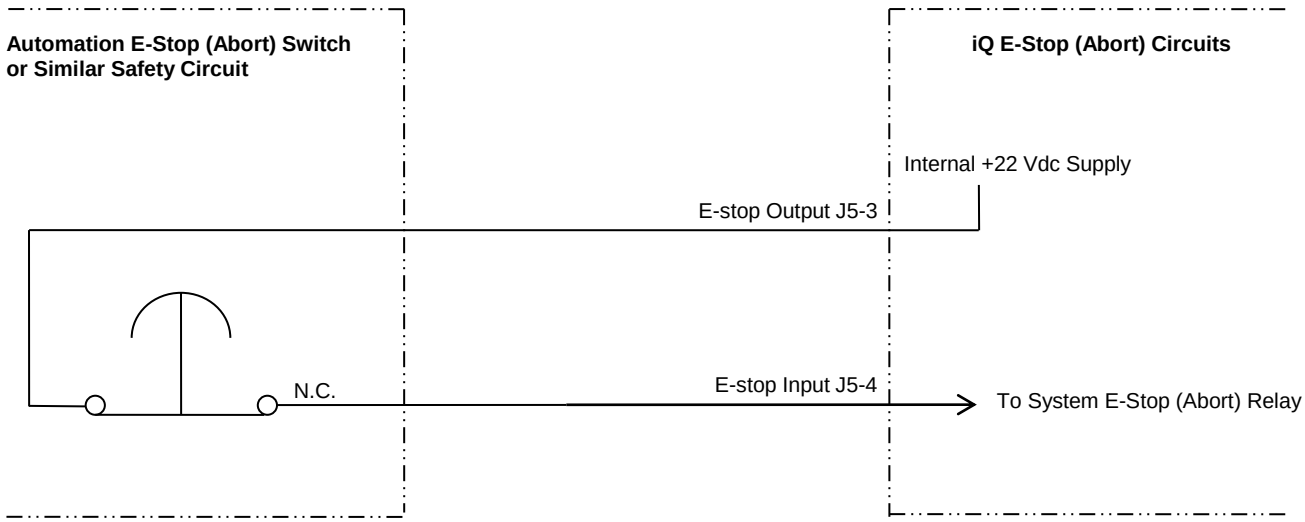
J5-8	J5-7	J5-6	J5-5	Setup/Probe Selected
0	0	0	0	1
0	0	0	1	2
0	0	1	0	3
0	0	1	1	4
0	1	0	0	5
0	1	0	1	6
0	1	1	0	7
0	1	1	1	8
1	0	0	0	9
1	0	0	1	10
1	0	1	0	11
1	0	1	1	12
1	1	0	0	13
1	1	0	1	14
1	1	1	0	15
1	1	1	1	16





Connecting an Automation Safety Circuit

WARNING: Consult the appropriate local regulatory agency (OSHA, UL, CE, etc.) regarding all of the safety requirements for your automated machine. Dukane is not responsible for injuries related to improper safety circuits or safety guarding used in an automated machine. EN 12100 and EN 60204-1 safety standards are recommended.



Notes:

1. To operate the AiM Generator, J5-3 and J5-4 must be maintained in a closed connection. If the connection between J5-3 and J5-4 is opened, the ultrasonic output will be disabled.

2. The iQ AiM generator is shipped whith an E-Stop jumper plug for testing, etc. purposes. However this plug is not reccomended for use during production operation.

iQ AiM Automation Controlled Probe Generator Timing Diagrams

AiM Weld-by-Automation Timing Diagram

Normal Weld Cycle: A normal weld by automation cycle lasts as long as the U/S Activate input is active. This cycle shows the timing between activation/deactivation of the U/S Activate input, U/S Status output and Ready Status output signals.

The Ready Status Output: The Ready Status output is used to determine if the generator is ready to start a new weld cycle. As shown in Figure 1, the Ready Status output requires a minimum of 2ms to change to its deactivated state after the U/S Activate input is activated. At the end of a normal cycle, the Ready Status output requires a minimum of 12ms to change to its activated state after the U/S Activate input has deactivated. It is possible that the stack ring down time (stack stops vibrating), which is stack and application dependent, will make this time much longer. For correct operation, a PLC controlling an AiM generator must account for this timing shown below before checking the Ready Status output.

The U/S Status Output: The U/S Status output is used to determine when the generator ultrasound output to the ultrasonic stack is active. As shown in Figure 1, the U/S Status output requires a minimum of 3ms to change to its on state. At the end of a normal cycle, the U/S Status output requires a minimum of 12ms to change to its deactivated state after the U/S Activate input has deactivated. For correct operation, a PLC controlling an AiM generator must take into account the timing shown in Figure 1 before checking the U/S Status output.

Weld Cycle with an Overload: This weld cycle shows the same timing relationship as a normal weld cycle except the ultrasound output, indicated by the U/S Status output, is terminated early due to an overload condition.

The Any Fault and Overload Status Outputs: The Any Fault Status output is used to determine when the generator has terminated the weld cycle due to fault such as an overload as shown in Figure 1. When a Peak Overload occurs, the Any Fault and Overload Status outputs activate at the same time. If the overload is an Average Overload the U/S Status output will not deactive until after the 10ms ramp down completes. The Ready Status output will not activate until the U/S Activate input is turned off, but may take up to 2ms to change to its on state. Due to stack ring down it may be longer before Ready Status changes state. The Any Fault Status output will deactivate the next time the U/S Activate input is turned on, but is delayed up to 2ms. For correct operation, a PLC controlling a AiM generator must take into account the timing shown below before checking the Any Fault, Overload, U/S, and Ready Status outputs.

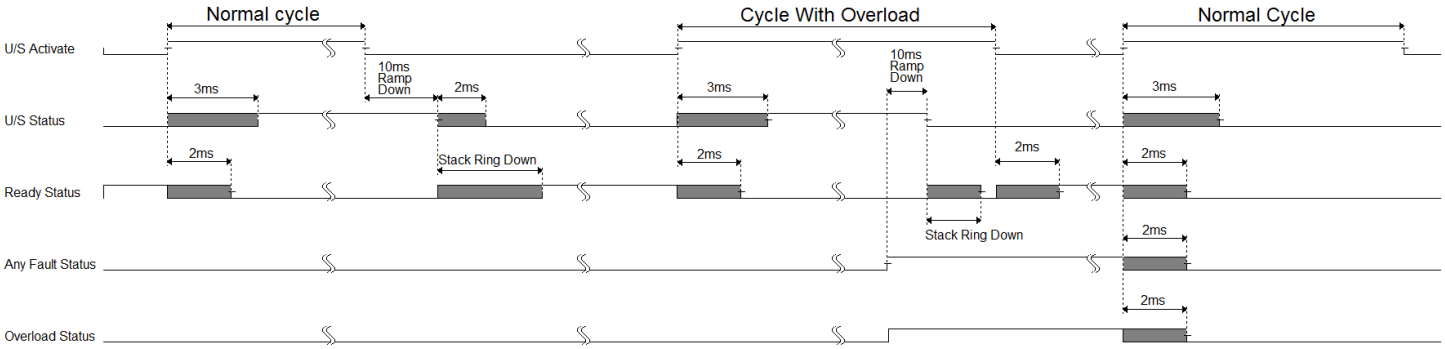


Figure 1: AiM Weld-by-Automation Cycle Timing Diagram

Timing Diagram Notes: All Signals are active high and the Shaded areas indicate that the output could be either high or low. The ≶ symbol indicates a time break so that the time where nothing is happening doesn't need to be shown.

AiM (Weld-by-Time) Timing Diagram

Normal Weld Cycle: This is a Weld-by-Time cycle, meaning the Ultrasound output lasts as long as the Time Setting, which is 200ms in this case.

The Ready Status Output: As with Weld-by-Automation, the Ready Status output should be used to determine if the generator is ready to start a weld cycle. Figure 2 shows that the Ready Status output requires a minimum of 2ms to change to its off state after the U/S Activate input is activated. At the end of the weld time in a normal weld cycle, there is a 10ms Ramp Down followed by any remaining stack ring down time. Since stack ring down time is stack and application dependent it may make this time much longer. Ready Status output activates a minimum of 2ms after ramp down or when the ring down time is complete, whichever occurs last. For correct operation, a PLC controlling an AiM generator must account for the timing shown in Figure 2 before checking the Ready Status output.

The U/S Status Output: The U/S Status output is used to determine when the generator has activated its ultrasound output to the ultrasonic stack. As shown in Figure 1, the U/S Status output requires a minimum of 3ms to change to its activated state. The U/S Status output will deactivate when the weld time plus the ramp down completes and will take up to 2ms to change to it's deactivated state. For correct operation, a PLC controlling an AiM generator must account for the timing shown in Figure 2 before checking the U/S Status output.

Cycle With an Overload: This weld cycle shows the same timing relationship except the ultrasound output, indicated by U/S Status, is terminated early, in this case after 100ms, due to an overload condition.

The Any Fault and Overload Status Outputs: The Any Fault Status output is used to determine when the generator has terminated the weld cycle due to fault such as an overload as shown in Figure 1. When a Peak Overload occurs, the Any Fault and Overload Status outputs activate at the same time. If the overload is an Average Overload the U/S Status output will not deactive until after the 10ms ramp down completes. The Any Fault Status output will deactivate the next time the U/S Activate input is activated, but is delayed up to 2ms. The Ready Status output has the same timing as in the normal weld cycle. A PLC controlling an AiM generator must take into account the timing shown in Figure 2 before checking the Any Fault, Overload, U/S, and Ready Status outputs.

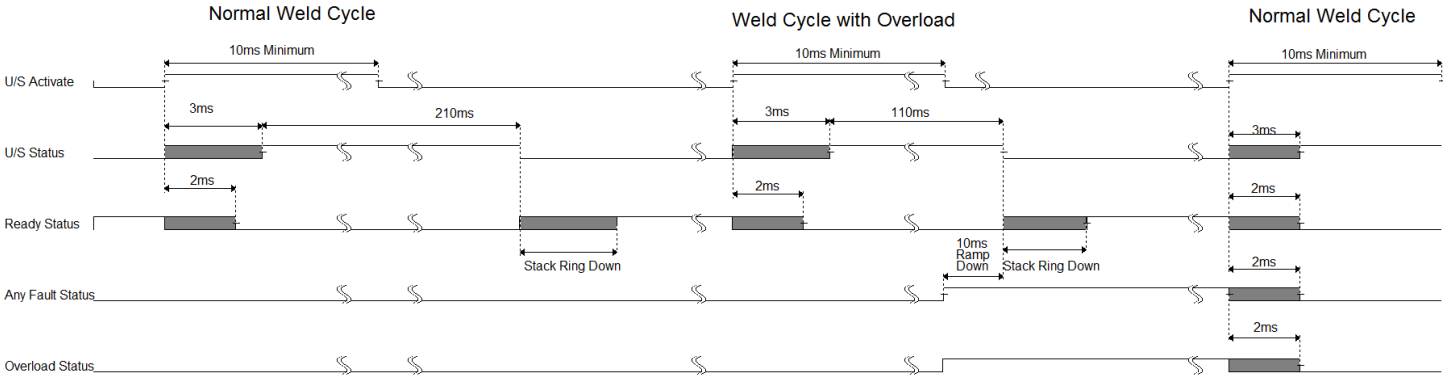


Figure 2: AiM Weld-by-Time Cycle Timing Diagram

Timing Diagram Notes: All Signals are active high and the Shaded areas indicate that the output could be either high or low. The ⟆ symbol indicates a time break so that the time where nothing is happening doesn't need to be shown.

AiM (Weld-by-Energy) Timing Diagram

Good Part Weld Cycle: This is a Weld-by-Energy cycle, meaning the Ultrasound output lasts until the Energy Setting is reached.

The Ready Status Output: As with Weld-by Time, the Ready Status output should be used to determine if the generator is ready to start a weld cycle. As seen in Figure 3, the Ready Status output requires a minimum of 2ms to change to its off state after the U/S Activate input is activated. When the weld energy setting is reached in a normal weld cycle, there is a 10ms Ramp Down followed by the remaining stack ring down time. Since stack ring down time is stack and application dependent it may make this time much longer. The Ready Status output activates after a minimum of 2ms or when the ring down time is complete, whichever occurs last. For correct operation, a PLC controlling an AiM generator must account for the timing shown in Figure 3 before checking the Ready Status output.

The U/S Status Output: The U/S Status output is used to determine when the generator ultrasound output to the ultrasonic stack is active. As shown in Figure 3, the U/S Status output requires a minimum of 3ms to change to its on state. The U/S Status output will deactivate up to 12ms after the weld energy setting is reached. This 12ms consists of the 10ms ramp down and up to 2ms switching time. For correct operation, a PLC controlling an AiM generator must account for the timing shown in Figure 3 before checking the U/S Status output.

The Good Part Status Output: The Good Part output deactivates within 2ms after U/S Activate input is activated. Once the weld energy is reached the good part output will activate within 2ms. As shown in Figure 3 the Good part output activation timing is not affected by the 10ms ramp down.

Cycle With an Bad Part Upper Limit Exceeded: This weld cycle shows the same timing relationship except the ultrasound output, indicated by U/S Status, is terminated early. In this case the cycle is terminated after 100ms, due to an Bad Part Upper Limit exceeded condition.

The Good Part Status Output: The Bad Part Status output activates within 2ms and U/S Status will deactivate within 10ms after the maximum weld time limit is exceeded. The Ready Status output activates within 2ms or when the ring down time is complete, whichever occurs last. The Bad Part Status output will deactivate the next time the U/S Activate input is activated, but is delayed up to 2ms. A PLC controlling an AiM generator must take into account the timing shown in Figure 3 before checking the Bad Part, U/S, and Ready Status outputs.

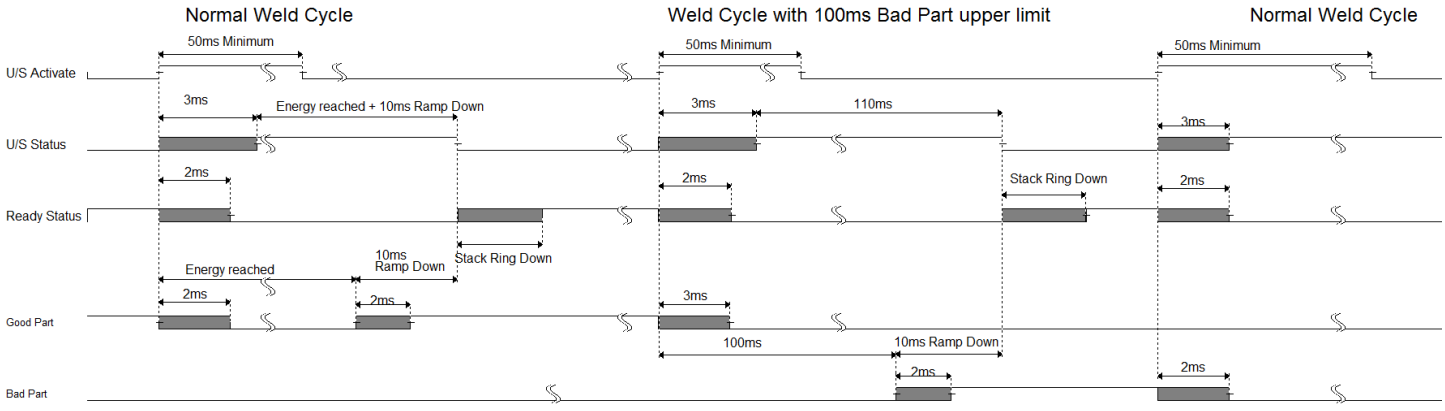


Figure 3: AiM Weld-by-Time Cycle Timing Diagram

Timing Diagram Notes: All Signals are active high and the Shaded areas indicate that the output could be either high or low. The ≶ symbol indicates a time break so that the time where nothing is happening doesn't need to be shown.

AiM With MPCQ (Weld-by-Automation) Timing Diagram

Probe selection changed between weld cycles: Although the probe selection can be changed at any time this method is the safest and most predictable. The PLC program should monitor the MPC Ready output and when it becomes active change the probe selection using the Remote Setup inputs. This will insure that the stack ring down from the previous cycle is finished. After a delay of 4ms, the MPC Ready output will change to inactive (low in this case) again and stay that way for 33ms. See Figure 4 where Remote Setup 0 changes from low to high. The PLC must monitor the MPC Ready output and not turn on the U/S Activate input until MPC Ready is active.

Probe selection changed during a weld cycle: Alternately the Remote Setup inputs can be changed during the weld cycle. The MPC circuitry will not select a new probe when the MPC Ready output is not active. As shown in Figure 4, Remote Setup 0 input is changed to inactive before the weld cycle completes. Once the stack ring down completes the relays switch so that probe 1 is selected almost immediately, but the relay takes up to 8ms to settle. The MPC Ready output will remain inactive for 33ms after ring down completes. The PLC must monitor the MPC Ready output and not turn on the U/S Activate input until the MPC Ready signal is active.

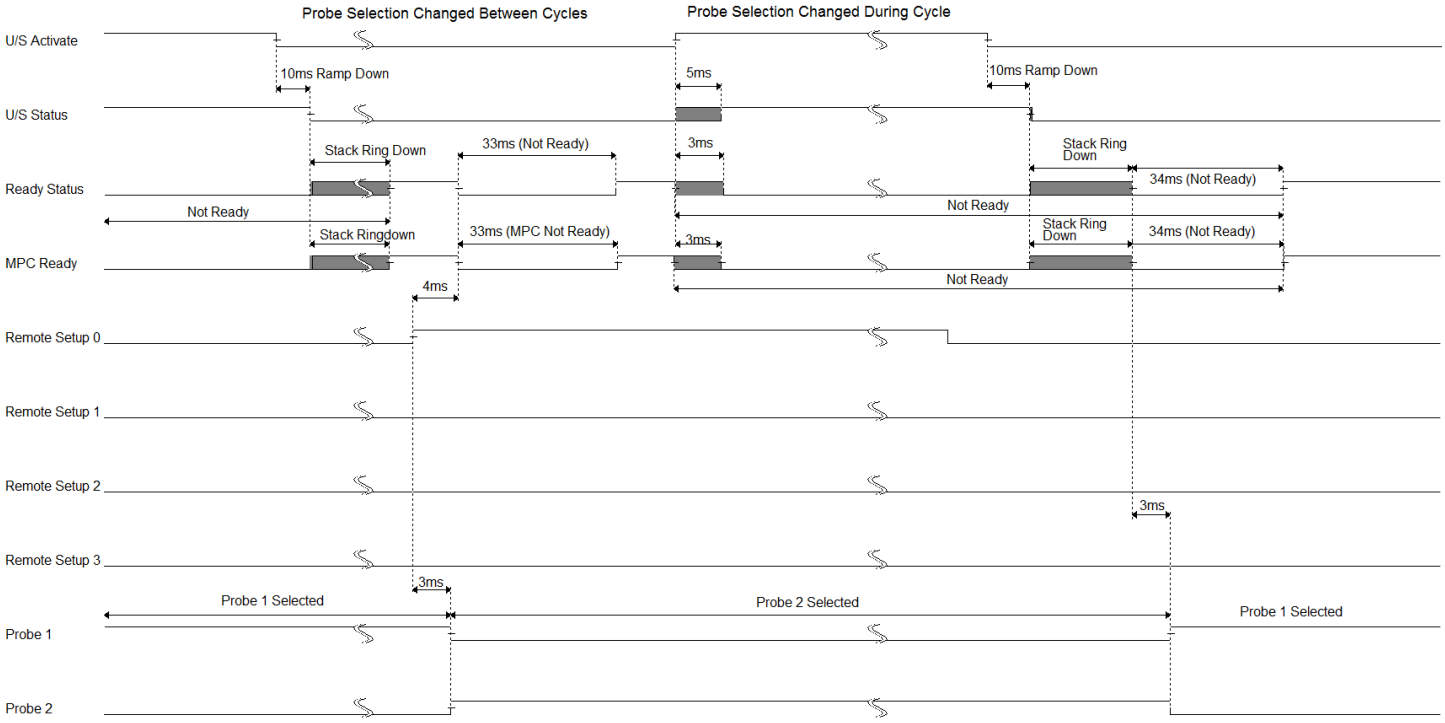


Figure 4 AiM with MPCQ Weld Cycle (Weld-by-Automation)

Timing Diagram Notes: All Signals are active high and the Shaded areas indicate that the output could be either high or low. The ⧘ symbol indicates a time break so that the time where nothing is happening doesn't need to be shown.

AiM Industrial Network Interface

Industrial Ethernet: Dukane iQ AiM generators support Ethernet/IP, Modbus TCP, POWERLINK, PROFINET, EtherCAT, CC-Link and Profibus. Documentation and PLC demo code are available on the included CD or via download. All the I/O discussed earlier in this document are available via any of these protocols. The same rules apply, but the timing is dependent on the protocol and the number of components in the network.

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