iQ Series

ULTRASONIC PROBE SYSTEM

LS/LS-E

Automation Interface Guidelines

Index

System Input Cable Pinouts

Pin	Color	Description
J2-1	BLK	+22V CURRENT LIMITED POWER SUPPLY (*250mA MAX*)
J2-2	WHT	+22V RETURN (*iQ CHASSIS GROUND*)
J2-3	RED	REMOTE SETUP SELECTION BIT 0 INPUT
J2-4	GRN	REMOTE SETUP SELECTION BIT 1 INPUT
J2-5	ORN	REMOTE SETUP SELECTION BIT 2 INPUT
J2-6	BLU	REMOTE SETUP SELECTION BIT 3 INPUT
J2-7	WHT/BLK	REMOTE SETUP SELECTION BIT 4 INPUT (*NOT USED*)
J2-8	RED/BLK	ULTRASOUND ACTIVATION / CYCLE START INPUT
J2-9	GRN/BLK	AUTOMATION THRUSTER CONTROL INPUT (*NOT USED*)
J2-10	ORN/BLK	FRONT PANEL CONTROL LOCK
J2-11	BLU/BLK	PRESS INHIBIT FOR HAND PROBES (*DUKANE USE ONLY*)
J2-12	BLK/WHT	SYSTEM LATCH RESET INPUT
J2-13	RED/WHT	ISOLATED COMMON (*SOURCING OR SINKING INPUTS*)
J2-14	GRN/WHT	OPEN CONNECTION
J2-15	BLU/WHT	AUTOMATION CYCLE STOP INPUT

Note: For detailed signal descriptions, please refer to the product manual.

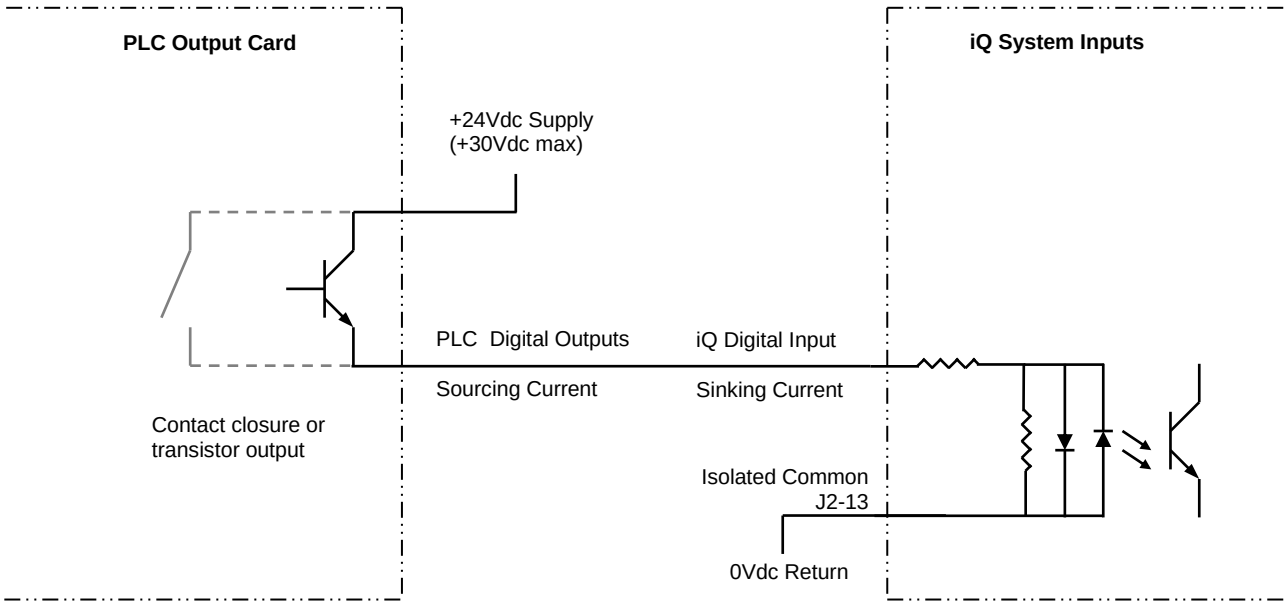
System Input Cables

Part Number	Length
200-1380-03M	3 meters
200-1380-05M	5 meters
200-1380-07M	7 meters
200-1380-09M	9 meters
200-1380-11M	11 meters
200-1380-13M	13 meters

Connecting System Inputs

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 10mA with a 24Vdc supply. The Systems Inputs can also be configured for a contact closure if necessary.

PLC Sourcing Output Card



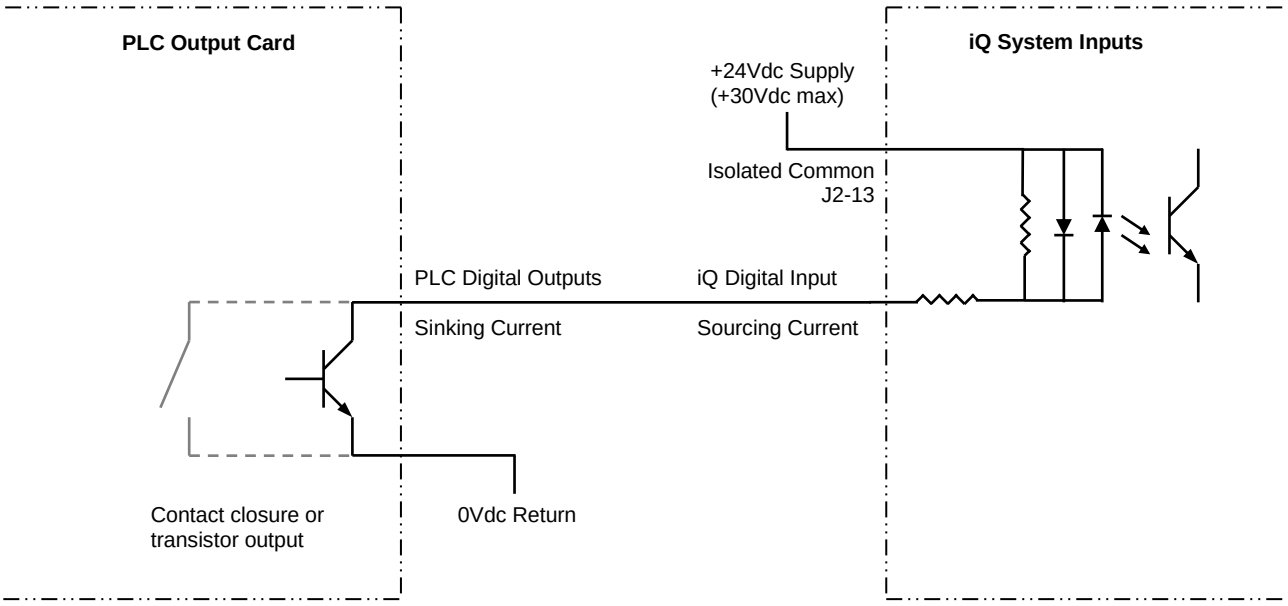
Notes:

1. All System Inputs share the same Isolated Common (J2-13). It is critical that the isolated common is connected to the positive supply or ground.

2. J2-1 can be used in place of the 24Vdc supply. If so, J2-13 must be connected to J2-2.

Warning: Any connection to the Ultrasound Activation/Cycle Start Input (J2-8) or the Automation Thruster Control Input (J2-9) should be disabled during an emergency stop condition.

Connecting a PLC Sinking Output Card



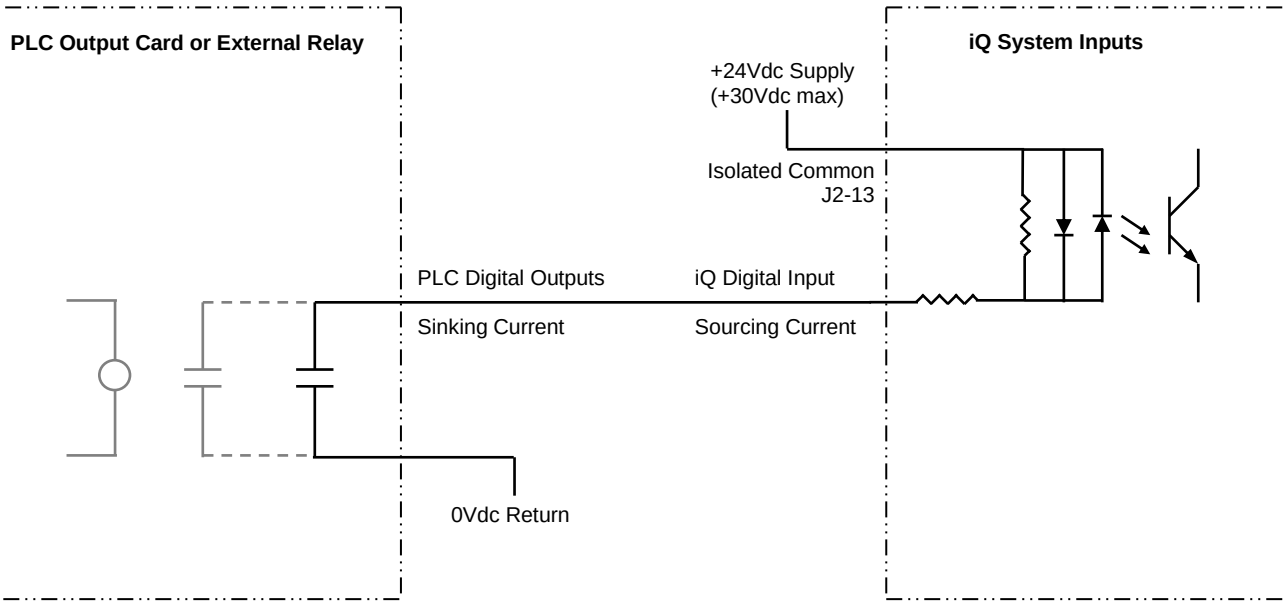
Notes:

1. All System Inputs share the same Isolated Common (J2-13). It is critical that the isolated common is connected to the positive supply or ground.

2. J2-1 can be used in place of the 24Vdc supply. If so, J2-13 must be connected to J2-1 and 0Vdc to J2-2.

Warning: Any connection to the Ultrasound Activation/Cycle Start Input (J2-8) or the Automation Thruster Control Input (J2-9) should be disabled during an emergency stop condition.

Connecting a Relay Contact Closure



Notes:

1. All System Inputs share the same Isolated Common (J2-13). It is critical that the isolated common is connected to the positive supply or ground.

2. Dukane's current limited power supply can be substituted for the +24Vdc supply above. Connecting +22Vdc (J2-1) to Isolated Common (J2-13) would allow a dry contact closure between any System Input and 0V Return (J2-2). 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 (J2-8) or the Automation Thruster Control Input (J2-9) should be disabled during an emergency stop condition.

System Output Cable Pinouts

Pin	Color	Description
J3-1	BLK	+22V CURRENT LIMITED POWER SUPPLY (*250mA MAX*)
J3-2	WHT	OPEN CONNECTION
J3-3	RED	+22V RETURN (*iQ CHASSIS GROUND*)
J3-4	GRN	PROGRAMMABLE STATUS OUTPUT 1
J3-5	ORN	PROGRAMMABLE STATUS OUTPUT 2
J3-6	BLU	ULTRASOUND ACTIVE STATUS OUTPUT
J3-7	WHT/BLK	ANY FAULT STATUS OUTPUT
J3-8	RED/BLK	PRESS TRIGGER STATUS OUTPUT
J3-9	GRN/BLK	SYSTEM OVERLOAD STATUS OUTPUT
J3-10	ORN/BLK	SYSTEM ONLINE STATUS OUTPUT
J3-11	BLU/BLK	PRESS TOP OF STROKE STATUS OUTPUT
J3-12	BLK/WHT	CURRENT LOOP STATUS OUTPUT (*NOT USED*)
J3-13	RED/WHT	ANALOG MONITOR OUTPUTS GROUND (*iQ CHASSIS GROUND*)
J3-14	GRN/WHT	NOT USED (*iQ CHASSIS GROUND*)
J3-15	BLU/WHT	POWER SIGNAL MONITOR OUTPUT (*1mV = 1 WATT*)
J3-16	BLK/RED	AMPLITUDE MONITOR OUTPUT (*10.0V = 100%*)
J3-17	WHT/RED	AMPLITUDE/POWER REGULATION STATUS OUTPUT
J3-18	ORN/RED	MPC SYSTEM READY STATUS OUTPUT (*NOT USED*)
J3-19	BLU/RED	SYSTEM POWER STATUS OUTPUT
J3-20	RED/GRN	BAD PART STATUS OUTPUT
J3-21	ORN/GRN	GOOD PART STATUS OUTPUT
J3-22	BLK/WHT/RED	SYSTEM READY STATUS OUTPUT
J3-23	WHT/BLK/RED	SUSPECT PART STATUS OUTPUT
J3-24	RED/BLK/WHT	ISOLATED COMMON (*SINKING AND SOURCING OUTPUTS*)
J3-25	GRN/BLK/WHT	OPEN CONNECTION

Note: For detailed signal descriptions, please refer to the product manual.

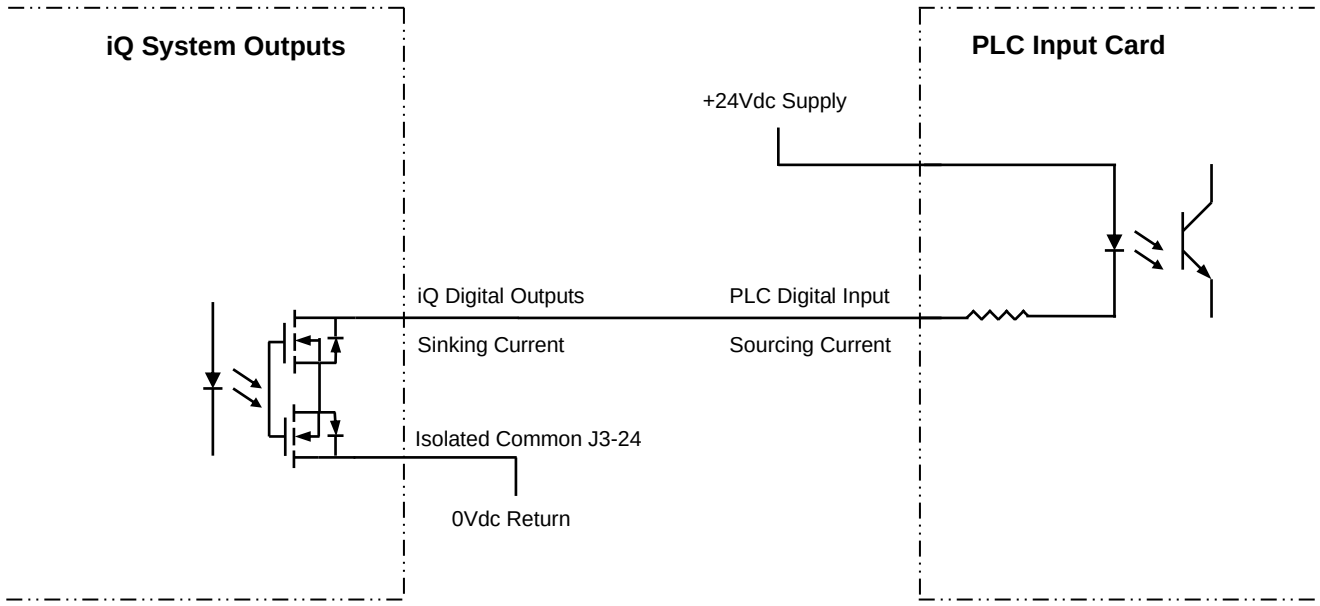
System Output Cables

Part Number	Length
200-1381-03M	3 meters
200-1381-05M	5 meters
200-1381-07M	7 meters
200-1381-09M	9 meters
200-1381-11M	11 meters
200-1381-13M	13 meters

Connecting System Outputs

All System Outputs are optically isolated from the internal circuits and can be connected to sinking or sourcing PLC input cards. When J3-1 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.

PLC Sourcing Input Card

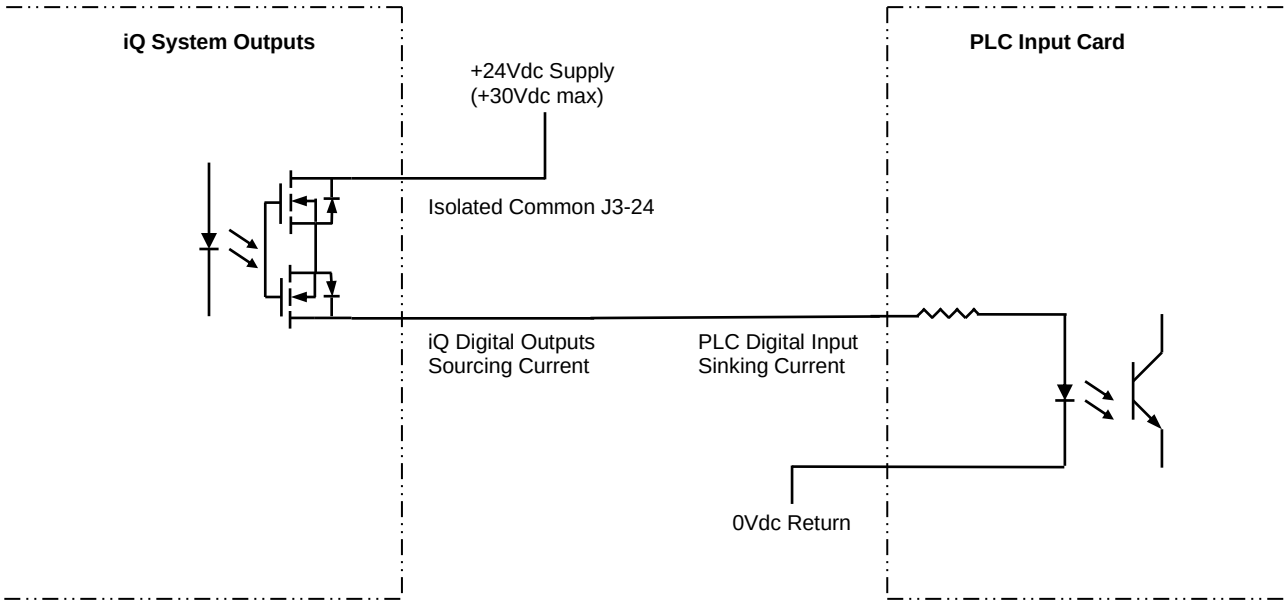


Notes:

1. All System Outputs share the same Isolated Common (J3-24). It is critical that the isolated common is connected to the positive supply or ground.

2. J3-1 can be used in place of the 24Vdc supply. If so, J3-24 must be connected to J3-3.

Connecting a PLC Sinking Input Card

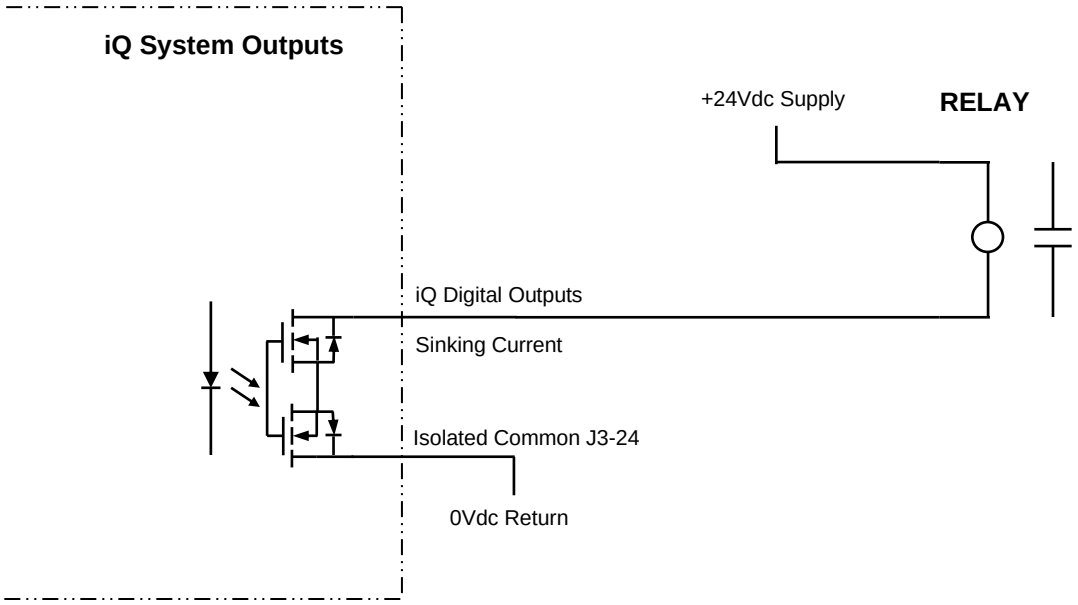


Notes:

1. All System Outputs share the same Isolated Common (J3-24). It is critical that the isolated common is connected to the positive supply or ground.

2. J3-1 can be used in place of the 24Vdc supply. If so, J3-24 must be connected to J3-1 and 0Vdc to J3-3.

Connecting a Relay Contact Closure



Notes:

1. All System Outputs share the same Isolated Common (J3-24). It is critical that the isolated common is connected to the positive supply or ground.

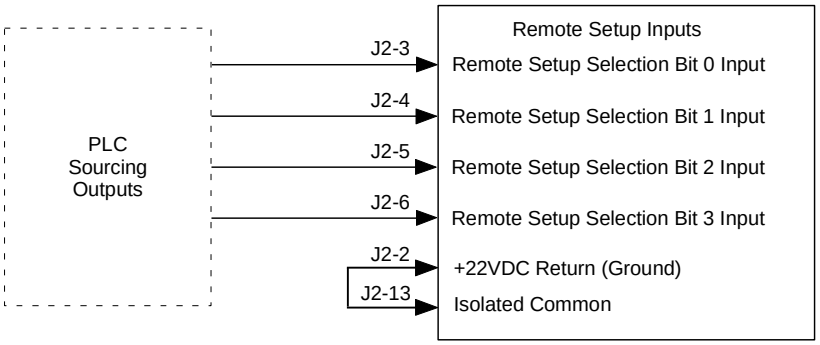
2. J3-1 can be used in place of the 24Vdc supply. If so, J3-24 must be connected to J3-3.

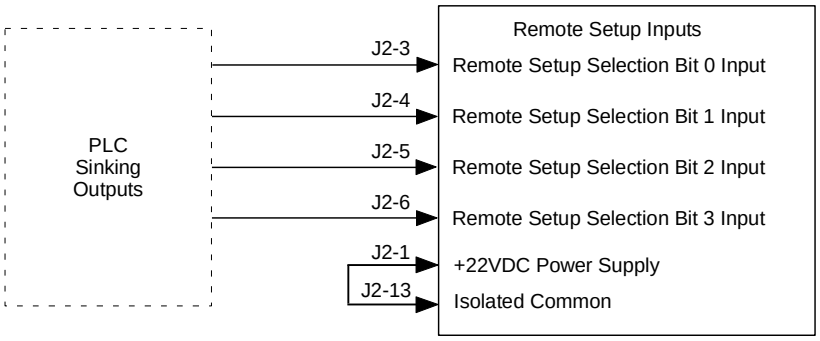
Remote Setup Switching

J2-7	J2-6	J2-5	J2-4	J2-3	Setup Selected
0	0	0	0	0	1
0	0	0	0	1	2
0	0	0	1	0	3
0	0	0	1	1	4
0	0	1	0	0	5
0	0	1	0	1	6
0	0	1	1	0	7
0	0	1	1	1	8
0	1	0	0	0	9
0	1	0	0	1	10
0	1	0	1	0	11
0	1	0	1	1	12
0	1	1	0	0	13
0	1	1	0	1	14
0	1	1	1	0	15
N/A	1	1	1	1	16

J2-7	J2-6	J2-5	J2-4	J2-3	Setup Selected
N/A	N/A	N/A	N/A	N/A	17
N/A	N/A	N/A	N/A	N/A	18
N/A	N/A	N/A	N/A	N/A	19
N/A	N/A	N/A	N/A	N/A	20
N/A	N/A	N/A	N/A	N/A	21
N/A	N/A	N/A	N/A	N/A	22
N/A	N/A	N/A	N/A	N/A	23
N/A	N/A	N/A	N/A	N/A	24
N/A	N/A	N/A	N/A	N/A	25
N/A	N/A	N/A	N/A	N/A	26
N/A	N/A	N/A	N/A	N/A	27
N/A	N/A	N/A	N/A	N/A	28
N/A	N/A	N/A	N/A	N/A	29
N/A	N/A	N/A	N/A	N/A	30
N/A	N/A	N/A	N/A	N/A	31
N/A	N/A	N/A	N/A	N/A	32

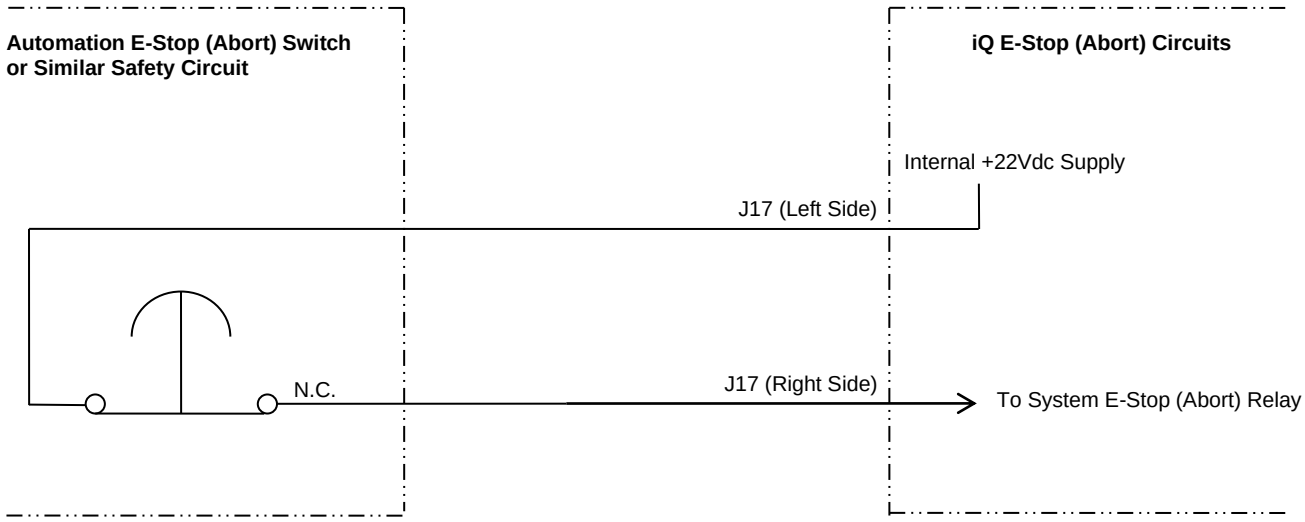
Note: Remote setup mode is available in the LS-E model. It is enabled by selecting “Automation” from the front panel Setup screen. These system inputs receive a Binary code from the automation that is used to select a setup to be used for the next welding cycle. Setup selections 17-32 are reserved and 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.





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 12100-1/-2 and EN 60204-1 safety standards are recommended.



Notes:

1. To operate the LS / LS-E Generator, J17 (Left Side) and J17 (Right Side) must be maintained in a closed connection.

2. If the connection between J17 (Left Side) and J17 (Right Side) is opened, the ultrasonic output will be disabled.

iQ LS / LS-E Automation Controlled Probe Generator Timing Diagrams

LS / LS-E (Weld-by-Automation) Timing Diagram

Normal Weld Cycle - A normal weld cycle lasts as long as the U/S Activate input is in a high state. 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 seen in Figure 1, the Ready Status output requires a minimum of 3ms to change to its deactivated state after the U/S Activate input is activated. For correct operation, a PLC controlling an LS or LS-E Automation generator must delay at least 3ms after activating the U/S Activate input before checking the Ready Status output. At the end of a normal cycle, the Ready Status output requires a minimum of 19.5ms to change to its activated state after the U/S Activate input has deactivated. For correct operation, a PLC controlling an LS or LS-E Automation generator must delay at least 19.5ms after deactivating the U/S Activate input before checking the Ready Status output. It is possible that the stack ring down time (stack stops vibrating), which is stack and application dependent, will make this time much longer.

The U/S Status Output: The U/S Status output is used to determine when the generator has activated its ultrasound ouput to the ultrasonic stack. As seen in Figure 1, the U/S Status output requires a minimum of 5ms to change to its activated state. For correct operation, a PLC controlling an LS or LS-E Automation generator must delay at least 5ms after activating the U/S Activate input before checking the U/S Status output. At the end of a normal cycle, the U/S Status output requires a minimum of 18.0ms to change to its deactivated state after the U/S Activate input has deactivated. For correct operation, a PLC controlling a LS or LS-E Automation generator must delay at least 18.0ms after deactivating the U/S Activate input 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 Status Output: The Any Fault Status output is used to determine when the generator has terminated the weld cycle due to an overload. When an overload occurs, the Any Fault Status output activates at the same time the U/S Status output deactivates. The Ready Status output doesn't activate until the U/S Activate output deactivates. The Ready Status output requires a minimum of 20.0ms to change to its activated state after the U/S Activate input has deactivated. For correct operation, a PLC controlling an LS or LS-E Automation generator must delay at least 20.0ms after deactivating the U/S Activate input before checking the Ready Status output.The Any Fault Status output will deactivate the next time the U/S Activate input is activated, but is delayed up to 3ms.

The Overload Status Output: The Overload Status output is also used to determine when the generator has terminated the weld cycle due to an overload.The Overload Status output has the same timing as the Any Fault Status output and will deactivate the next time the U/S Activate input is activated, but is delayed up to 3ms.

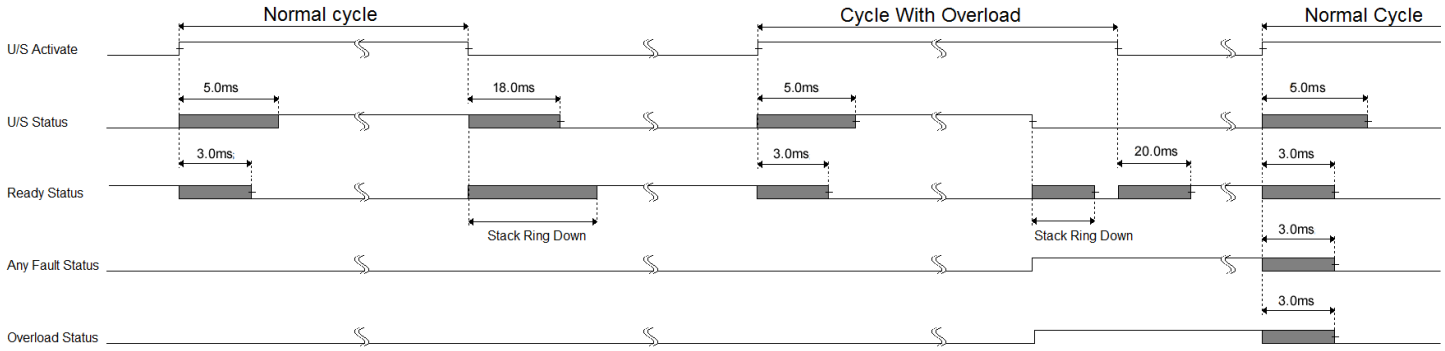


Figure 1: LS / LS-E Weld-by-Automation Cycle Timing Diagram

LS / LS-E (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. A LS / LS-E generator requires communications interface such as Ethernet/IP to configure the weld by Time, Peak Power, and Energy settings. While it is strongly reccomended that the communications network be used instead of the descrete I/O, the network and descete I/O can be used together. Figure 2 shows the timing for weld cycles that were configured via the network interface, but ultrasound is activated using the US Activate input instead of the network. As with Weld-by Automation, the Ready Status output should be used to determine if the generator is ready to start a new weld cycle. As seen in Figure 2, the Ready Status output requires a minimum of 3ms to change to its deactivated state after the U/S Activate input is activated. At the end of the normal weld time, there is stack ring down time, which is stack and application dependent, and may make this time much longer. The Ready Status output activates after a minimum of 1.5ms or when the ring down time is complete, whichever occurs first. For correct operation, a PLC controlling an LS / LS-E generator must delay at least 1.5ms after activating the U/S Activate input before checking the Ready Status output. Since the U/S Status output takes up to 5.0ms to change state, a 5.0ms minimum delay is required when monitoring this output. If a network is connected to the generator, then the US Activation can be controlled by the network. The same is true for monitoring the status outputs. The delays will vary with the network based on network settings, number of devices on the network, etc.

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 Status and Overload Status outputs activate at the same time U/S Status deactivates. The Ready Status output activates after a minimum of 3.0ms or when the ring down time is complete, whichever occurs first. The Any Fault Status and Overload Status outputs will deactivate the next time the U/S Activate input is activated, but are delayed up to 3.0ms.

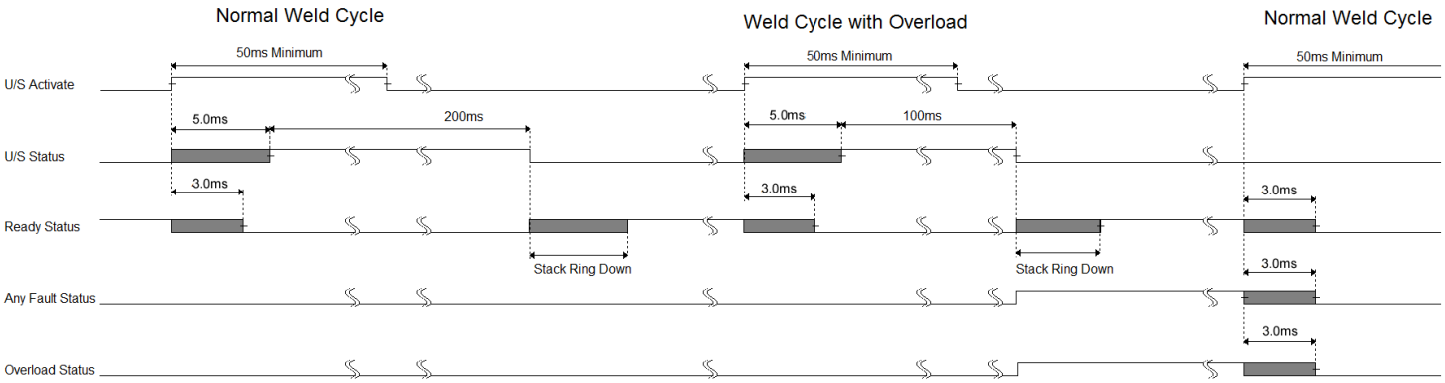


Figure 2: LS / LS-E Weld-by-Time Cycle Timing Diagram

LS / LS-E 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 at least 33ms, the MPC Ready output will change to inactive (low in this case) again and stay that way for 33ms. See Figure 3 where Remote Setup 0 changes from low to high. The PLC should continue to monitor the MPC Ready output and start the next cycle when MPC Ready activates (high in this case).

Probe selection changed during a weld cycle: Alternately the Remote Setup inputs can change during the weld cycle. The MPC circuitry will not select a new probe when the MPC Ready output is not active. As can be seen in Figure 3, 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. In this case the PLC must monitor the MPC Ready output and not activate the U/S Activate input until the MPC Ready signal is active.

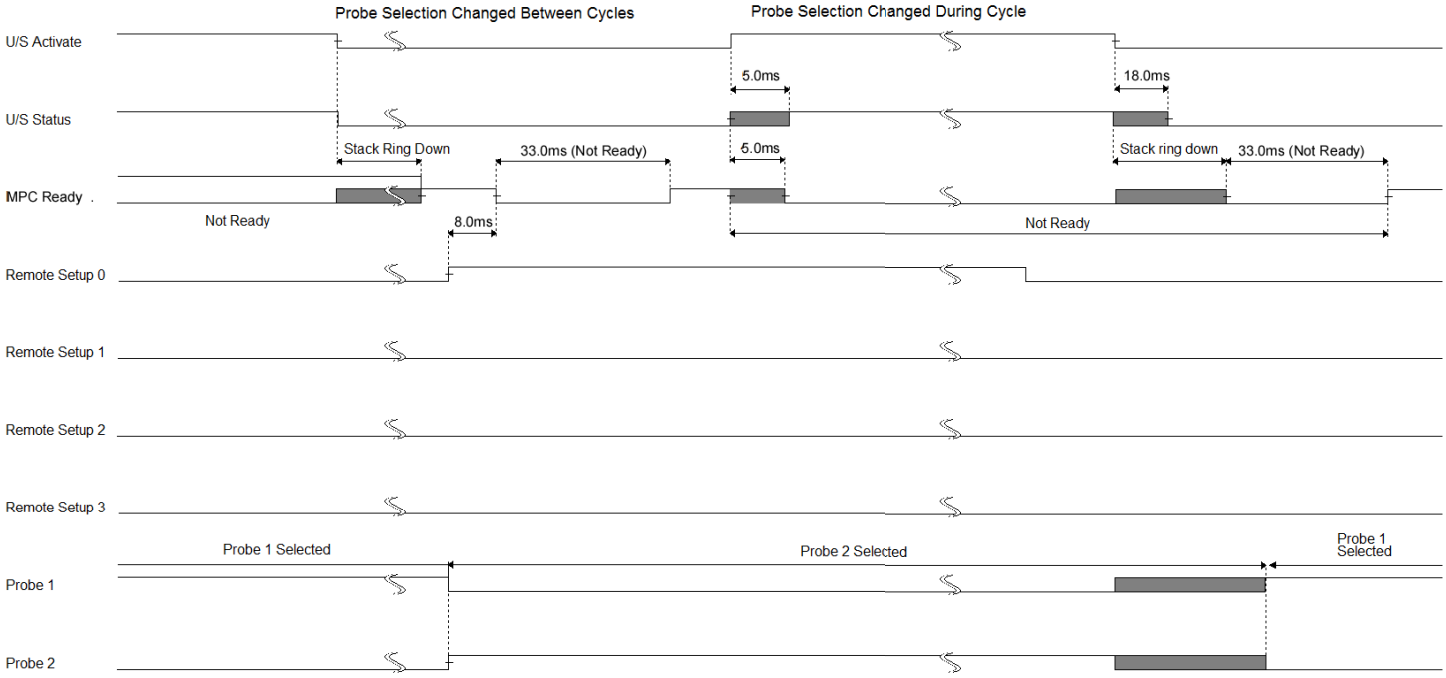


Figure 3 LS / LS-E with MPCQ Weld Cycle (Weld-by-Automation)

Timing Diagram Notes: All Signals are active high and the grey 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.

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