

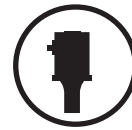
DUKANE

Intelligent Assembly Solutions

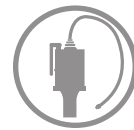
iQ Series

ULTRASONIC GENERATOR/POWER SUPPLY

Auto



AUTOMATED



HAND PROBE



PRESS

User's Manual



Dukane Part No. 403-573-02

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ISO 9001:2008

Products are manufactured in ISO registered facilities.



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This user's manual documents product features, hardware, and controls software available at the time this user's manual was published.

Printed in the United States of America.

Part Number: 403-573-02

This ultrasonic equipment is manufactured under one or more of the following U.S. Patents:

3,780,926 3,825,481 4,131,505 4,277,710 5,798,599 5,880,580 6,984,921,
7,225,965 7,475,801, and 7,819,158, B2

Revision History

Revision Number	Revision Summary	Date
- 00	Original release.	10/09/2007
- 01	20kHz and 30kHz models added. System I/O Connector signals modified. Amplitude control added.	08/27/2009
- 02	I/O Connector Pin 9 signal scale revised. Miscellaneous spelling errors corrected. Fig 5-1 and 5-2 dimensions edited. Fault conditions modified: Negative Peak Overload eliminated; Positive Peak Overload changed to Peak Overload; Frequency Lock Lost changed to Frequency Overload. Copyright page modified: Specifications subject to change statement added, and Patent 7,819,158 B2 added. Updated Dukane ISO certification statement to 2008. How to Lift Safely information added to Section 2, Health and Safety. International Protection Rating added to Section 5, Specifications.	12/15/2010

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Section 1- Introduction	1
General User Information	3
Generator Overview	4
Key Generator Features	4
Thermal Considerations	5
Section 2- Health and Safety	7
General Considerations	9
Plastics Health Notice	9
Electrical Safety	10
How to Lift Safely	11
Section 3- Installation	13
Unpacking	15
Placing	15
Power Grounding	16
Chassis Grounding Stud	16
Connecting Cables	17-19
MPC Module Installation Guide	20-25
Section 4 - System Operation	27
Standard <i>iQ</i> Auto System Test	29
<i>iQ</i> Auto System with MPC Test	30
Section 5 - Specifications	33
Section 6 - Automation Interface	41
Input/Output Connection Examples	43-44
E-Stop Circuitry Connection Examples	46
Section 7 - Contacting Dukane	47

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SECTION 1

Introduction

General User Information	3
Read The Manual First	3
Notes, Cautions and Warnings	3
Drawings and Tables	3
Generator Overview	4
Key Generator Features	4
Thermal Considerations	5

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General User Information

Read This Manual First

Before operating your ultrasonic generator, read this User's Manual to become familiar with the equipment. This will ensure correct and safe operation. The manual is organized to allow you to learn how to safely operate this generator. The examples given are chosen for their simplicity to illustrate basic operation concepts.

Notes, Cautions and Warnings

Throughout this manual we use NOTES to provide information that is important for the successful application and understanding of the product. A NOTE block is shown to the right.

In addition, we use special notices to make you aware of safety considerations. These are the CAUTION and WARNING blocks as shown here. They represent increasing levels of important information. These statements help you to identify and avoid hazards and recognize the consequences. One of three different symbols also accompany the CAUTION and WARNING blocks to indicate whether the notice pertains to a condition or practice, an electrical safety issue or an operator protection issue.

Drawings and Tables

The figures and tables are identified by the section number followed by a sequence number. The sequence number begins with 1 in each section. The figures and tables are numbered separately. The figures use Arabic sequence numbers (e.g. -1, -2, -3) while the tables use roman sequence numerals (e.g. -I, -II, -III). As an example, Figure 3-2 would be the second illustration in section three while Table 3-II would be the second table in section three.

NOTE

Note statements provide additional information or highlight procedures.

CAUTION



Caution statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING



Warning statements point out conditions or practices that could result in personal injury or loss of life.



Condition
or Practice



Electrical
Hazard



Hearing
Protection

Generator Overview

This generator is designed for ultrasonic applications controlled by a Programmable Logic Controller (PLC). Using the available system control inputs and outputs, the generator can easily be integrated into a wide variety of automated systems.

The generator design accepts several control input signals, provides system output signals, has a power status LED indicator, and an amplitude adjustment control.

An optional Multi-Probe Control (MPC) interface module allows the generator to power multiple probes selected by an automated control system.

This product's rugged internal ultrasonic generator circuitry ensures a continuous resonant frequency lock at the start of each weld. Ultrasonic settings for the drive signal, phase delay angle, starting frequency and soft-start ramp parameters can be customized at the factory. (Contact your local Dukane sales representative for more information.) Users can modify generator performance to meet a wide variety of ultrasonic processing requirements if needed.

The generator's compact size allows multiple units to be placed into an industrial equipment cabinet, and the generator will operate at the same international line voltage input specifications as the other generators of this product family. It also includes an RFI line filter that passes strict CE test specifications for global applications.

Key Generator Features

- **Compact Enclosure Size** requires a small footprint for either vertical or horizontal mounting into your equipment cabinet.
- **Pulse Width Modulation** incorporates patented circuitry giving the power supply the ability to efficiently change the output amplitude. This makes it possible to start large horns with reduced power. It also provides more power efficient switch-mode generator operation and increased reliability.
- **Linear Ramp Soft Start** circuitry allows the acoustic stack to ramp up to operating amplitude smoothly, minimizing the startup surges and abnormal stress to the stack and generator.
- **Automatic Tuning** tracks the resonant frequency of the acoustic stack (horn, booster, transducer) and adjusts the generator output frequency to match it. This is done for every weld cycle and eliminates the need to manually tune the generator.

- **Line Voltage Regulation** automatically maintains constant amplitude regardless of line voltage deviation. The available output power is maintained with any voltage input within the specified range. This provides consistent system performance regardless of line voltage fluctuations. It also eliminates the need for bulky, external constant-voltage transformers.
- **Load Regulation** provides constant amplitude automatically regardless of power draw. The ultrasonic output amplitude level is held to within $\pm 1\%$ to provide weld process consistency and reduced weld cycle times.
- **Industrial Line-Power Source** means that standard systems will operate worldwide at all industrial high line voltage levels, whether it is 200VAC @60Hz in Japan, 240VAC @50Hz in Europe or 208VAC @60Hz in the United States. There are no internal transformer taps to change for worldwide operation.

NOTE

120VAC is also available for these countries: United States of America, Canada, Mexico and Japan.

- **Amplitude Adjustment Control** allows the peak-to-peak excursion of the horn at its workface to be adjusted between 20% and 100% of the horn's nominal amplitude.
- **Multiple Electronic Overload** protection circuits prevent instantaneous component failure in the event of extreme output overload conditions and rated overload power limit is based on the actual true RMS power output level.
- **CE Certification** means that the system meets the required European standards to be sold and used in Europe.
- **ISO 9001 Certification** means that this system has been manufactured to high quality standards and assures you of manufacturing excellence.

Thermal Considerations

The thermal design of this generator is for applications that require 600 watts or less of power at less than a 50% duty cycle. For applications that require higher duty cycles, an optional cooling package is available, Part Number 438-962. The cooling package includes a heat sink that mounts to the rear of the generator (Refer to Figure 5-2).

Figure 1-1 shows the thermal capability of the generator with and without the cooling package. For further information about the cooling package, contact your local Dukane sales representative.

NOTE
Add transducer cooling as necessary to keep front mass temperature to 100°F or less.

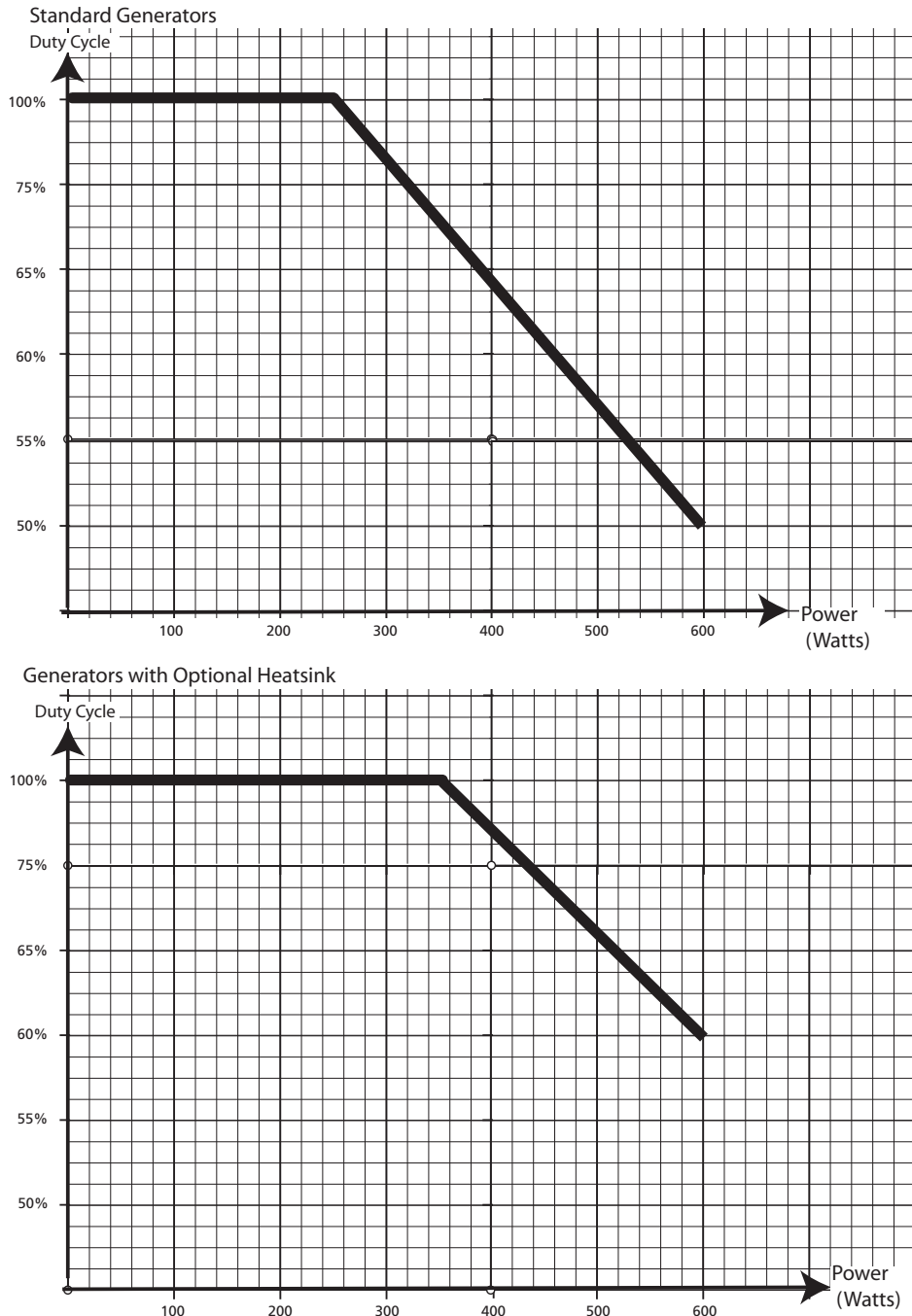


Figure 1-1 Thermal and Power Considerations for iQ Auto Generators

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SECTION 2

Health and Safety

General Considerations	9
Plastics Health Notice.	9
Electrical Safety	10
Power Grounding Connection	10
How to Lift Safely	11

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General Considerations

Please observe these health and safety recommendations for safe, efficient, and injury-free operation of your equipment. In this manual, the term *system* refers to a complete group of components associated with the welding of plastic or metal parts, also known as an ultrasonic assembly system. A typical system consists of a generator and/or ultrasonic process controller, start and stop switches, power controls, connecting cables, and the probe assembly which includes the transducer, booster, horn and replaceable horn tip.

Proper Installation - Operate system components only after they are properly installed and checked.

No Unauthorized Modifications - Do not modify your system in any way unless authorized to do so by the manufacturer. Unauthorized modifications may cause injury to the operator and/or equipment damage. In addition, unauthorized modifications will void the equipment warranty.

Keep the Cover On - Do not remove any equipment cover unless specifically directed to do so by the manufacturer. The generator produces hazardous electrical voltages which could cause injury.

Grounded Electrical Power - Operate this equipment only with a properly grounded electrical connection.

(See Page 16 for grounding information.)

Comply with Regulations - You may be required to add accessories to bring the system into compliance with applicable OSHA regulations for machine guarding and noise exposure.

Plastics Health Notice

Before using any ultrasonic welding system, be sure you are familiar with OSHA regulations from the U.S. Department of Labor about the particular type of plastic(s) you are using.

When plastic materials are being processed, they may emit fumes and/or gases that could be hazardous. Make sure you have adequate ventilation whenever these plastics are processed.



CAUTION

Never operate the generator with the cover off. This is an unsafe practice and may cause injury.



CAUTION

Parts being joined ultrasonically sometimes vibrate at audible frequencies. Wear ear protection to reduce annoying or uncomfortable sounds. In addition, sound absorbing materials, enclosures or sound deflectors may be installed to reduce the noise level.

Electrical Safety

Power Grounding Connection

Figure 2-1 illustrates how the AC line is connected.

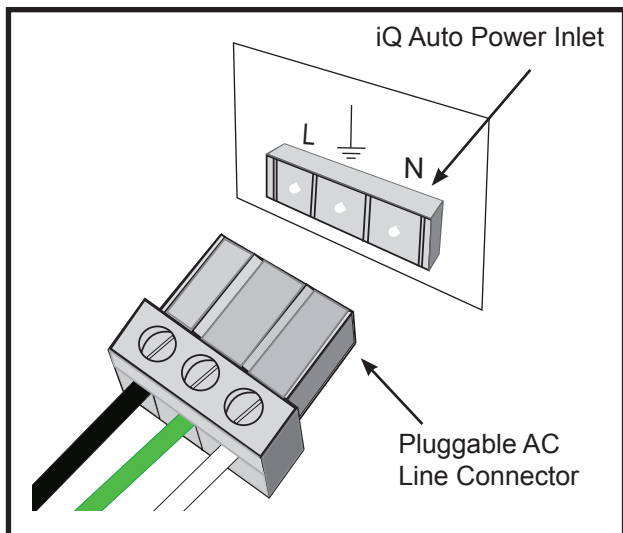


Figure 2-1 AC Line Connection

Terminal	Wire Color	
	North America	Europe
L (Live)	Black	Lt. Brown
⏏ (Ground)	Green	Green w/yellow stripe
N (Neutral)	White	Lt. Blue

Table 2-1 Conventional Wire Color Code

CAUTION

If there is any question about grounding of your equipment and/or its electrical power source, contact a qualified electrician.

CAUTION

For safe system operation: To avoid the risk of fire, electrical shock, serious injury or death, the power line safety ground must be securely connected to the center terminal on the (pluggable) AC line connector.

How to Lift Safely

- Before lifting, take a moment to think about what you're about to do.
- Examine the object for sharp corners, slippery spots or other potential hazards. Know your limit and don't try to exceed it.
- Ask for help if needed, or if possible, divide the load to make it lighter.

- Know where you are going to set the item down, and make sure it and your path are free of obstructions. Then follow these steps:

Step 1. Stand close to the load with your feet spread apart about shoulder width, with one foot slightly in front of the other for balance.

Step 2. Squat down bending at the knees (not your waist). Tuck your chin while keeping your back as vertical as possible.

Step 3. Get a firm grasp of the object before beginning the lift. Begin slowly lifting with your LEGS by straightening them. Never twist your body during this step.

Step 4. Once the lift is complete, keep the object as close to the body as possible. As the load's center of gravity moves away from the body, there is a dramatic increase in stress to the lumbar region of the back.

Step 5. If you must turn while carrying the load, turn using your feet-not your torso. To place the object below the level of your waist, follow the same procedures in reverse order. Remember, keep your back as vertical as possible and bend at the knees.



CAUTION

Take care in lifting the equipment. We recommend using a mechanical lift device to assist.

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SECTION 3

Installation

Unpacking	15
Placing	15
Power Grounding	16
Chassis Grounding Stud.	16
Connecting Cables	17
Standard Model Configuration.	17
System I/O Connector Pinout	18
Optional MPC Interface Model.	20
MPC I/O Connector Pinout	21
MPC Probe Control	22
MPC Installation Guide.	23
Connecting Cables	24
MPC Module Status LEDs.	25

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Unpacking

Carefully open your shipping container, and make sure it contains the items shown on the shipping documents. Inspect all items, and report any missing items or damage immediately.

Placing

Make certain generator placement and cable routing do not interfere with normal operation. Maintain easy access to your equipment.

The operator should have unobstructed access to cables and wiring.

Two sets of removable mounting brackets are attached to the generator. (Refer to Figure 5-1, Generator Outline Drawing.) Use them to securely mount the unit vertically or horizontally in your equipment cabinet.

If the generator is installed inside an enclosure with a door, be sure there is adequate clearance for the system cables with the door closed.

Power Grounding

For safety, the *iQ* Auto chassis must be properly grounded. The power line ground connection is located on the center screw terminal on the AC Power Inlet pluggable screw terminal connector.

This system ground connection must be attached to an earth ground potential at the electrical box that supplies power to the enclosure or cabinet in which the *iQ* Auto system is installed.

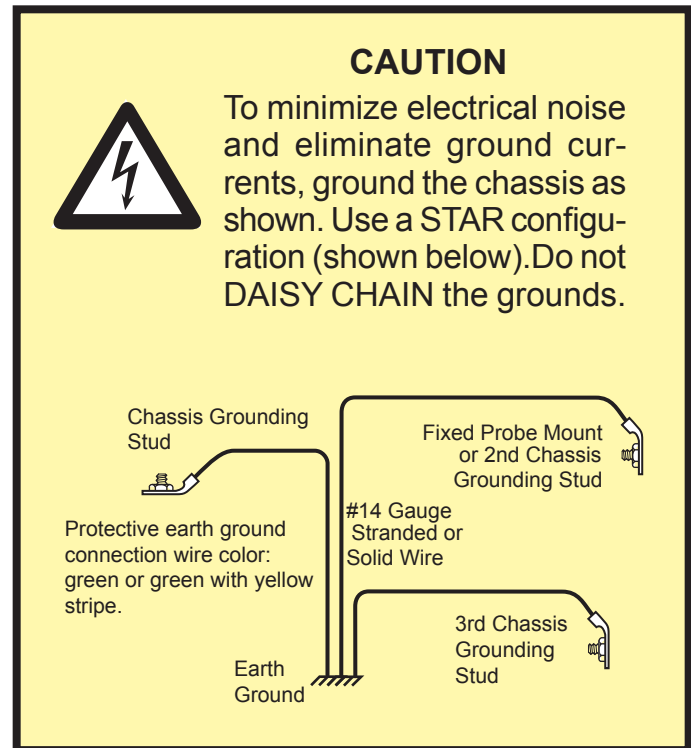
The ground connection should comply with all of the requirements specified by the National Electrical code and any other local codes or ordinances that are applicable.

Chassis Grounding Stud

Proper grounding for the generator chassis is essential for the effective suppression of electrical noise or RFI (Radio Frequency Interference). Every ultrasonic generator contains a RFI filter that blocks noise on the AC power line from entering the system control circuitry. This filter also prevents ultrasonic frequency noise from being fed back into the AC power line. For the RFI filter to operate effectively, it is necessary to correctly ground the system. The power line ground previously mentioned is mandatory.

Additionally, the included grounding wire must be connected from the grounding stud connection (see Figure 3-1) to the nearest grounded metal pipe or equivalent earth ground.

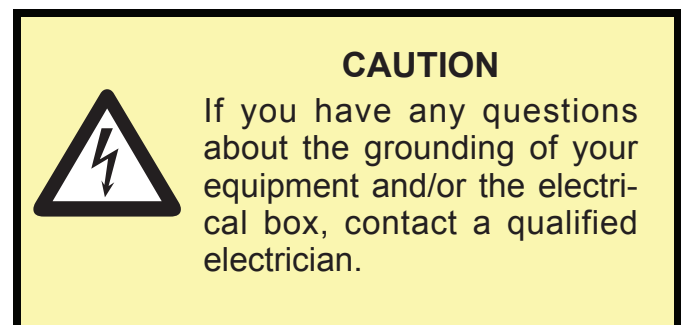
This will improve the chassis ground connection and may be needed in noisy industrial environments.



NOTE

Chassis Grounding Stud

The chassis grounding stud is used to attach a protective earth ground to the generator. This helps suppress electrical interference or radio frequency interference (RFI) that is common in an industrial environment. Stud location is shown in Figure 3-1 on the following page.



Connecting Cables

Standard Model Configuration

Complete three basic connections for the standard configuration as shown below:

- AC Line Input
- System Control Inputs/Status Outputs
- Ultrasound Output
- Grounding

Details about the various system connectors and their pin assignments are covered in the next section.

- Step 1. Wire the AC line connector, and attach it to the generator's power inlet connector, matching the power source line, ground, and neutral with the generator's line, ground, and neutral connector pins - **A** in Figure 3-1. (See Figure 2-1 also.)
- Step 2. Wire the user-supplied automation system control inputs/status outputs to the CONTROL CONNECTOR, and attach it to the system I/O port - **B** in Figure 3-1.
- Step 3. Attach a high-voltage coaxial ultrasound cable (from the ultrasonic probe) to J1, the ultrasound output connector - **C** in Figure 3-1.
- Step 4. Connect the included ground wire from the grounding stud, **D** in Figure 3-1, to earth ground.

NOTE

Connecting Cables

Two-piece pluggable terminal block connectors are used for the System I/O connections and the AC Power Inlet connections.

This type of connector allows the wiring to be attached to the screw terminal connector, which plugs into the mating connector on the *iQ* Auto system front panel.

In the event a field replacement unit is required, the screw terminal connectors with the wires can be easily detached and then plugged into the replacement unit.

NOTE

AC Power Inlet

Line voltage required for the generator is 200-240 VAC at 50/60 Hertz and 6.3 Amps, or 100-120VAC at 50/60 Hz and 15 Amps. The unit does not include a power switch, and is powered ON whenever the AC line power is live.

The unit can be switched ON/OFF with a user-supplied AC circuit breaker wired to the AC power inlet connection.

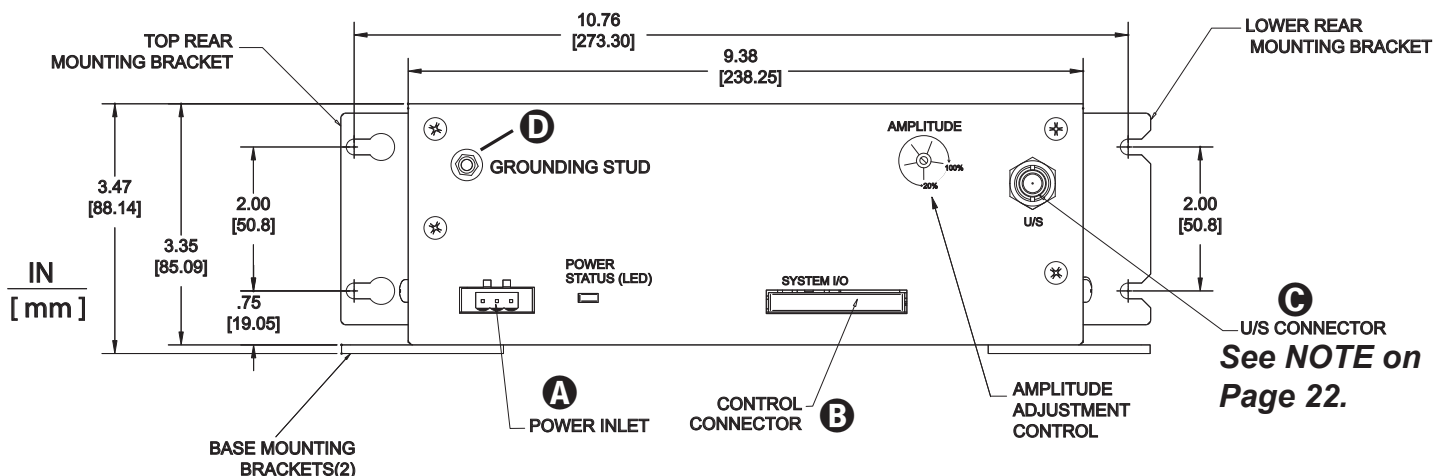


Figure 3-1 Generator Front View - Standard Model

System I/O Connector Pinout

The SYSTEM I/O connector is a two-piece pluggable terminal block connector.

Table 3-I lists the signal names and descriptions, with more detailed descriptions listed on the next page.

Pin	Signal Name
1	Enable Out (+22V Current Limited)
2	Enable In (Jumper to Pin1, without an E-Stop switch)
3	Overload Out (system overload status output)
4	U/S Status Out
5	Any Fault Out
6	Power OK Out
7	Output Common (chassis ground - non-isolated)
8	Spare Status Out (programmable status output)
9	Analog Power Out + (1mV = 1 Watt)
10	Analog Power Out - (analog monitor signal common, non-isolated)
11	Fault Reset Input
12	U/S Active Input
13	Input Common (electrically isolated from chassis ground)

Table 3-I System I/O Connector Signals

Pin 1 (Enable Out)

This is a current limited voltage source output intended to connect to an E-Stop circuit. If an E-Stop circuit is not used, Pin 1 must be jumpered to Pin 2 for ultrasound operation to be enabled.

Pin 2 (Enable In)

The output from the E-Stop circuit is connected to this pin when an E-Stop circuit is used. Otherwise, this pin must be jumpered to Pin 1 for ultrasound operation to be enabled. See Figure 6-4 for E-Stop circuit wiring examples.

Pin 3 (Overload Out)

Pin 3 is a non-isolated digital NPN status output that activates when an output overload condition is tripped. This output will be an open circuit if an output overload condition is not tripped. This output will remain latched ON until the U/S Activate input is switched OFF and then ON again.

Pin 4 (Ultrasound Active Status Output)

Pin 4 is a non-isolated digital NPN status output that activates when the system is delivering ultrasonic power to the load attached to the ultrasound output connector. This output will be an open circuit when the ultrasound output is off.

Pin 5 (Any Fault Out)

Pin 5 is a non-isolated digital NPN status output that activates whenever any fault condition is detected that inhibits ultrasound output and normal system operation. This output will be an open circuit when no system fault conditions are active.

Pin 6 (Power OK Out)

Pin 6 is a non-isolated digital NPN status output that activates when no fault conditions are detected by any of the power fault detection circuits included in the system. This output will be an open circuit when any power related fault condition is detected.

Pin 7 (Output Common)

Pin 7 is connected to chassis ground. The non-isolated NPN status output signals can drive isolated PNP inputs on the automation control system. Refer to Section 6 for wiring examples to connect output signals.

Pin 8 (Spare Status Out)

Pin 8 is not functional with the standard factory configuration.

Pin 9 (Analog Power Out +)

Pin 9 is a analog output signal proportional to the true RMS ultrasound power output level. This signal is scaled so $1\text{mV} = 1\text{ Watt}$.

Pin 10 (Analog Power Out -)

Pin 10 is a signal ground (non-isolated chassis ground) for the Analog Power output signal on Pin 9.

Pin 11 (Fault Reset Input)

Pin 11 is an isolated input control signal that will reset any output faults when it is activated. It can be used by the automation control system to simplify PLC programming.

Pin 12 (U/S Activate Input)

Pin 12 is used to activate the generator ultrasound output. Activating this isolated control input will switch the ultrasound output ON, and deactivating this signal will switch ultrasound OFF.

Pin 13 (Input Common)

[Electrically connected to Pin 5 on MPC I/O connector if MPC Interface option is installed.]

Pin 13 is electrically isolated from chassis ground. Using sourcing (PNP) output drivers, this common line would be connected to the automation system power supply common. Using sinking (NPN) output drivers, this common line would be connected to the automation system positive supply output. Refer to Section 6 for wiring examples to connect these input signals.

Optional Multi-Probe Control (MPC) Interface Model

The *iQ* Auto MPC model includes an optional MPC Interface circuit board that powers and controls an external MPC multi-probe control module. This external module, (that can be ordered with a minimum of two probe controls up to a maximum of 16 probe controls), must be purchased in addition to generator Model 40AT060-2N-MO (*iQ* Auto with MPC option) for a fully functional MPC system.

The connections needed for the MPC Interface board are described below. Connections required for the external MPC module are also described below.

Optional MPC Interface Connections

Complete the same basic connections used for the standard *iQ* Auto configuration as previously described.

- AC Line Input
- System Control Inputs/Status Outputs
- Ultrasound Output
- Grounding (optional)

In addition to completing Steps 1-4 of the basic connections as previously described, complete Steps 5 and 6 to wire the MPC Control Inputs/Status Outputs as described below.

Details about the various system connectors and their pin assignments are covered in the next section.

Step 5. MPC I/O - Wire the MPC control/input signals and status output signals terminal block to the user-supplied automation control system - **E** in Figure 3-2.

Step 6. MPC INTERFACE - Attach one end of the MPC Interface cable (Dukane # 200-1408-XX) to the MPC Interface connector on the *iQ* Auto panel - **F** in Figure 3-2. Connect the other end of the cable to the MPC INTERFACE connector on the right rear of the MPC module.

NOTE

The MPC Interface cable is a separate line item on the *iQ* Auto system order. The -XX at the end of the cable number specifies cable length. This will vary depending on your MPC installation.

NOTE

Amplitude adjustment will affect **ALL** MPC points.

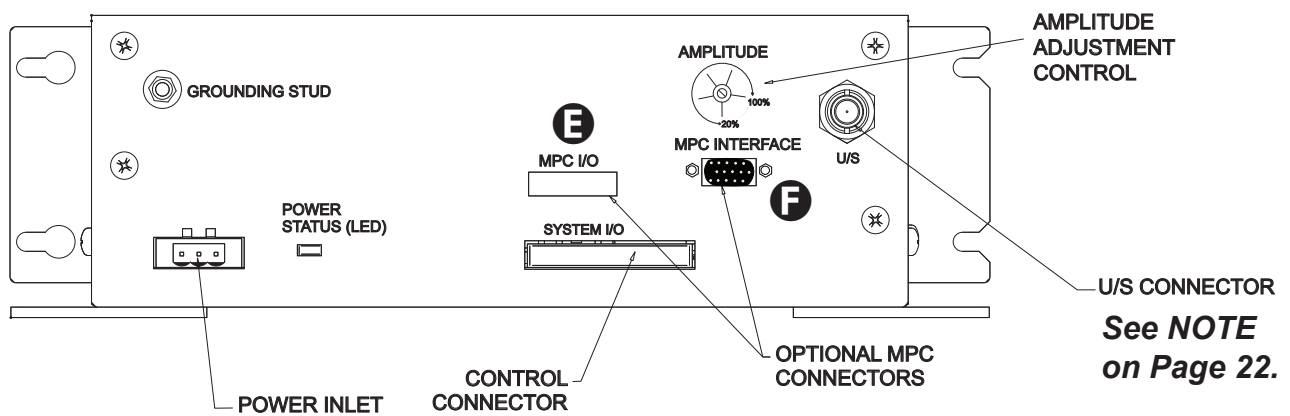


Figure 3-2 Generator Front View - Optional MPC Model

MPC I/O Connector Pinout

The MPC I/O connector is a two-piece pluggable terminal block connector.

Table 3-II lists the signal names and descriptions, with more detailed descriptions listed below.

Pin	Signal Name
1	Setup Bit 0 Input
2	Setup Bit 1 Input
3	Setup Bit 2 Input
4	Setup Bit 3 Input
5	Input Common
6	MPC Ready Out
7	Output Common

Table 3-II MPC I/O Connector Signals

Pin 1 (Setup Bit 0 Input)

Setup Bit 0 is the least significant bit used to select different probe channels when a Multi-Probe Control (MPC) Interface is used. This MPC control bit is used on all MPC systems.

Pin 2 (Setup Bit 1 Input)

Setup Bit 1 is the second least significant bit used to select different probe channels when a MPC Interface is used. This MPC control bit is used on MPC systems with three or more channels.

Pin 3 (Setup Bit 2 Input)

Setup Bit 2 is the third least significant bit used to select different probe channels when a MPC Interface is used. This MPC control bit is used on MPC systems with five or more channels.

Pin 4 (Setup Bit 3 Input)

Setup Bit 3 is the second most significant bit used to select different probe channels when a MPC Interface is used. This MPC control bit is used on MPC systems with nine or more channels.

Pin 5 (Input Common) [Electrically connected to Pin 13 on System I/O connector.]

Pin 5 is electrically isolated from chassis ground. Using sourcing (PNP) output drivers, this common line would be connected to the automation system ground potential. Using sinking (NPN) output drivers, this common line would be connected to the automation system positive supply voltage output. Refer to Section 6 for wiring examples to connect input signals.

Pin 6 (MPC Ready Out)

Pin 6 is a non-isolated digital NPN status output that activates when the MPC control is ready to accept changes on the probe selection control bits and ready to start the next MPC welding cycle. This output will be an open circuit when the MPC system is not ready to accept changes to control input signals, and it is able to switch a sourcing PNP input ON or OFF.

Any changes will be ignored until this status output signal activates to the ready state. This status output signal will also be open (MPC NOT READY) if a fault condition is detected inside the MPC system. If this status output will not activate, check for a RED fault status indication (SYSTEM STATUS LED) on the front panel of the MPC module.

Pin 7 (Output Common)

Pin 7 is connected to chassis ground. The non-isolated NPN status output signal can drive an isolated PNP input on the automation control system.

Refer to Section 6 for wiring examples to connect output signals.

NOTE

The Input Common Pins: Pin 13 of the System I/O connector and Pin 5 on the MPC I/O connector are both electrically isolated from chassis ground, but they are connected together. Both of these signals must be connected to the same voltage potential, either automation system ground or the automation system positive supply voltage.

MPC Probe Control

When the optional MPC Interface and MPC I/O connectors are used, the generator has the capability of controlling as many as sixteen compatible probes. One probe can be turned on at a time while the sequence of probe activation is determined by the user's automation.

The table below shows how the setup bit inputs correspond to the probes.

MPC				Probe Selected
3	2	1	0	
Off	Off	Off	Off	1
Off	Off	Off	On	2
Off	Off	On	Off	3
Off	Off	On	On	4
Off	On	Off	Off	5
Off	On	Off	On	6
Off	On	On	Off	7
Off	On	On	On	8
On	Off	Off	Off	9
On	Off	Off	On	10
On	Off	On	Off	11
On	Off	On	On	12
On	On	Off	Off	13
On	On	Off	On	14
On	On	On	Off	15
On	On	On	On	16

Table 3-III MPC Setup Bit Inputs

NOTE

Ultrasound Output Connector

The ultrasound output connector used with all standard generators is a high voltage (5000V) coaxial style SHV-BNC connector. This connector provides superior shielding of electrical noise, compared to other types of connectors. The ultrasound output connector mates with fully shielded coaxial ultrasound cables that are secured with a simple and reliable quarter-turn bayonet style attachment mechanism.

The ultrasonic output from this connector (that drives the attached ultrasonic load) is a very high AC voltage (1200VAC). At high power levels this can exceed 2 amps of current and must be securely terminated via the ultrasound cable for safe operation. Use original equipment ultrasound cables for safe and reliable system operation. Improperly assembled ultrasound cables can result in high voltage arcing and will destroy the ultrasound connectors.

MPC Module Installation Guide

MPC modules are designed for assembly systems where one ultrasonic generator is sequenced to as many as 16 ultrasonic probes.

The MPC module is typically supplied as a stand-alone bench-top unit, or as a component that can be mounted in a through-panel configuration.

No special installation is needed for a stand-alone MPC module that can be put on a bench top or a shelf.

Use the following installation recommendations for a panel mounted MPC module.

Cut Outs

For panel mounted modules:

Use Figure 3-3 below to determine the size of the cut needed for your equipment panel.

Make the appropriate cut, and install the MPC module securing the mounting flange to the equipment panel before continuing with the cable connections.

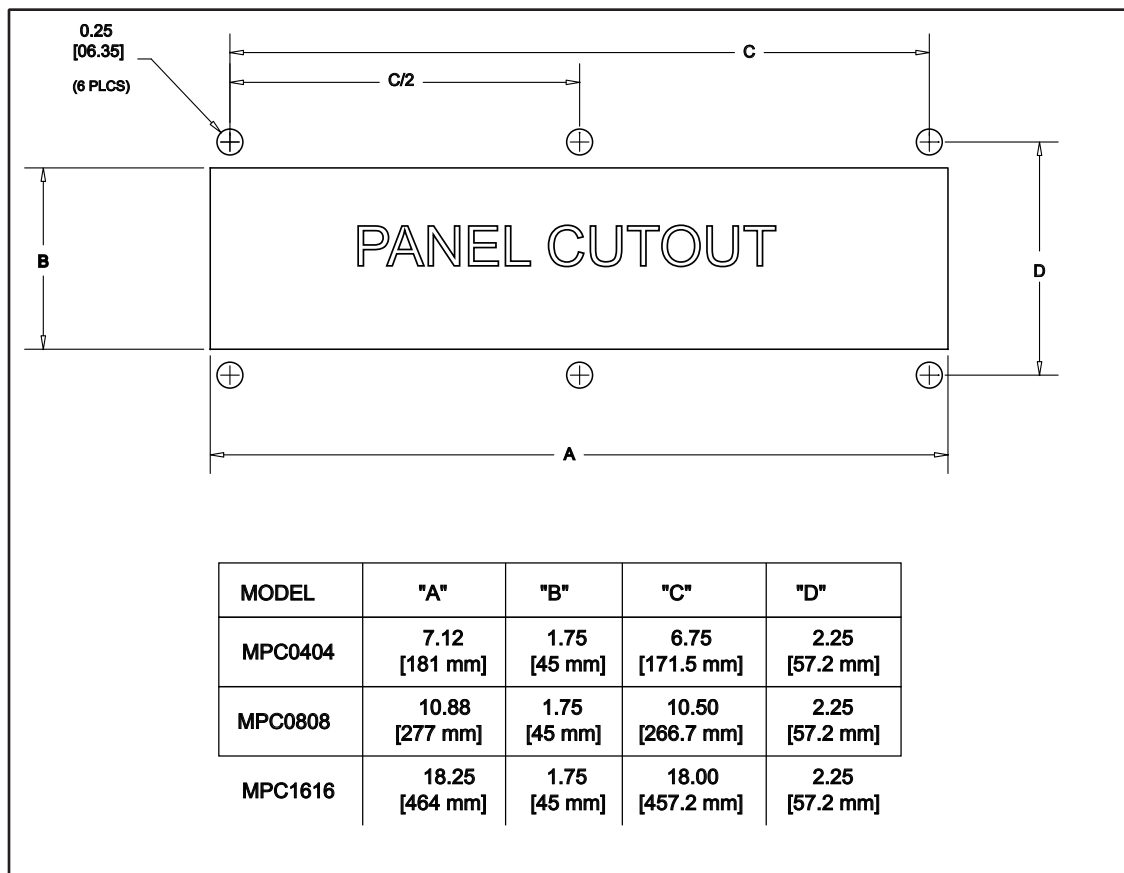


Figure 3-3 MPC Module Cutout Guide

Connecting Cables

For stand-alone modules and securely installed panel mounted modules:

Rear Connections

Refer to Figure 3-4 below. Complete these connections.

1. Earth ground - Connect one end of a user-supplied 14-Gauge ground wire to the ground connection at the rear of the MPC - **A** in Figure 3-4. Connect the other end of the wire to an earth ground potential at the electrical box that supplies power to the equipment (or to the equipment enclosure into which your system is installed).
2. U/S (ultrasonic) cable (Dukane P/N 200-479-XX - Order the correct cable length for your installation.) - Connect one end of the cable to the left rear U/S connector of the MPC module- **B** in Figure 3-4. The other end of the cable connects to J1 of the ultrasonic generator.
3. MPC Interface cable (Dukane P/N 200-1408-XX - Order the correct cable length for your installation.) - Connect one end of the cable to the right rear MPC Interface connector- **C** in Figure 3-4. The other end of the cable connects to the MPC INTERFACE connector on the ultrasonic generator.

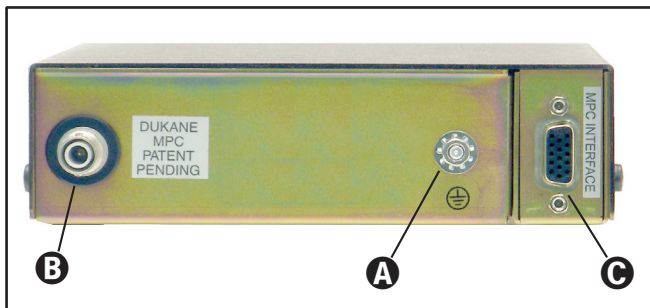


Figure 3-4 MPC Module Rear Connectors

Front Connections

Refer to Figure 3-5 below. Complete these connections.

1. Probe Cable(s) - Beginning with PROBE 1, connect one end of the cable (See Table 3-IV below.) to the U/S connector on the MPC's front panel - **D** in Figure 3-5. Connect the other end of the cable to the corresponding probe for your specific welding application.
2. Repeat Step 1 for each of the remaining probes (in sequence: 2, 3, 4, etc.) in your system.

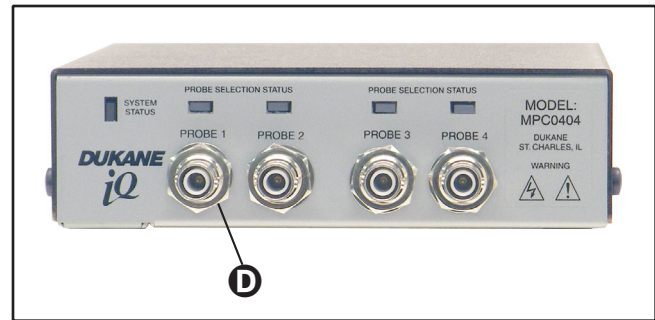


Figure 3-5 MPC Module Front Connectors

System Frequency	Probe P/N	Cable P/N : MPC to Probe
20kHz	41Q20RE or 41Q20RS	200-479-XXM
30kHz	41A60E or 41A60S	200-479-XXM
40kHz	41A40	200-615-XXM

Table 3-IV Probe Cables

XX = length in meters

MPC Module Status LEDs

System Status

The front panel SYSTEM STATUS LED lights up GREEN when the system is powered and ready - **E** in Figure 3-6.

If this LED is lit with a YELLOW/ORANGE color, a recoverable fault condition has tripped. This indicates that the system is operational, but a fault condition has occurred preventing normal operation. Examples of this type of fault would be a generator overload that will automatically reset when the next weld cycle begins, or the automation control system is selecting a channel that doesn't exist - trying to select channel 10 for an 8 channel system, for instance.

If this LED lights up RED, a hardware fault has been sensed, and the unit should be returned to Dukane for servicing.

Probe Selection Status

The PROBE SELECTION STATUS LED - **F** in Figure 3-6 - lights up GREEN indicating it is the selected probe.

A probe's LED turns to RED (from GREEN) when ultrasonic power is activated.

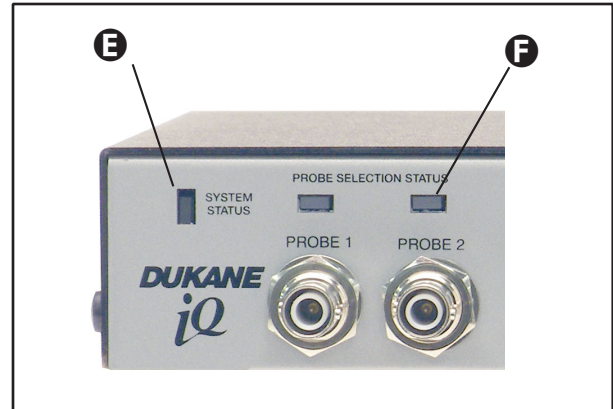


Figure 3-6 MPC Module Status LED's

NOTE

Refer to Section 4, System Operation, for more information.

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SECTION 4

System Operation

Standard <i>iQ</i> Auto System Operational Test	29
<i>iQ</i> Auto System with MPC Operational Test	30

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Standard *iQ* Auto System Operational Test

Step 1. Verify that the standard system installation is complete and all cables are connected.

Refer to installation instructions included in Section 3, if needed.

Refer to Section 6 - Automation Interface -for information on wiring system controls, if needed.

Step 2. After completing Step 1, activate line power to the standard *iQ* Auto system.

Normal Condition:

GREEN - The POWER STATUS LED on the *iQ* Auto panel should light up GREEN.

The system is now ready to operate.

Troubleshooting Abnormal *iQ* Auto System Conditions

RED - If the POWER STATUS LED lights up RED, check line voltage level.

GRAY - If the POWER STATUS LED is a gray color (not lit), check line input.

Optional System Status Output to Monitor:

Optionally the Power OK status output can be monitored on I/O connector Pin 6.

This NPN status output signal will activate when power is OK.

Step 3. After completing Step 2, test ultrasound output by activating I/O connector Pin 12.

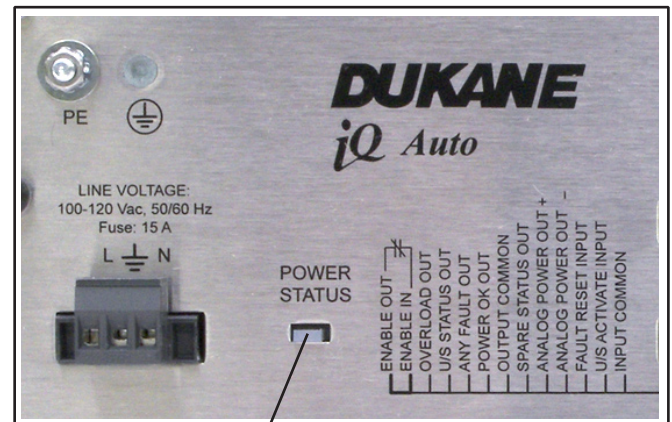
Normal Condition:

The system is operating properly when power is delivered to the attached stack.

Ultrasound Activation Connections:

Usually an automated control system is wired to this control input.

Optionally - A manual switch could be wired to this control input.



POWER STATUS LED

Figure 4-1 Generator POWER STATUS LED Detail

Options for U/S Activation Connections:

Optionally, monitor the U/S Active status output on I/O connector Pin 4.

This NPN status output signal will activate when U/S is ON.

Step 4. Other Options the Operator can Check:

- **Fault Status** output signals

Fault Status output signals are available for:

Overload (Pin 3), or

Any Fault (Pin 5).

These NPN status outputs will activate when there is a fault:

An **Overload Fault** latches until the next time U/S is activated, or Fault Reset Input is activated..

Any Fault status activates when any fault is detected by the system. It latches until the start of the next cycle, or Fault Reset Input is activated.

Continued

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Five fault conditions are monitored by the *iQ* Auto system for Any Fault:

- **Average Overload**

(Automatically resets on next cycle, or until an activation of Fault Reset Input)

- **Peak Overload**

(Resets same as Average Overload)

- **Overtemperature**

(Automatically resets on cool-down)

- **Power Not OK**

(AC line voltage under 180VAC)

- **Frequency Overload**

(Automatically resets on next cycle, or until an activation of Fault Reset Input)

iQ Auto System with MPC Operational Test

Step 1. Verify that the system installation (with the MPC option) is completed and all cables are connected.

Refer to the *iQ* Auto installation instructions in Section 3, if needed.

Refer to Section 6 - Automation Interface - for information on wiring system controls, if needed.

Step 2. After completing Step 1, activate line power to the standard *iQ* Auto system.

Normal Condition:

The POWER STATUS LED on the *iQ* Auto front panel should light up GREEN.

The MPC module SYSTEM STATUS LED should light up GREEN.

The system is ready to operate when both status LEDs light up GREEN.

Troubleshooting Abnormal *iQ* Auto System Conditions

RED - If the POWER STATUS LED lights up RED, check line voltage level.

GRAY - If the POWER STATUS LED is a gray color (not lit), check line input.

Troubleshooting Abnormal MPC Module Conditions

MPC Module SYSTEM STATUS LED is ORANGE/YELLOW (resettable fault):

- Check for an *iQ* Auto overload on the previous welding cycle.

- Check for an invalid channel selection input control code - selection code is greater than the number of installed channels.

MPC SYSTEM STATUS LED is RED (non-recoverable fault).

Check for POWER OK fault on the *iQ* Auto System.

- Resolve any *iQ* Auto power problem first.

- There could be a circuit failure in the MPC module. *If a circuit failure is discovered, return the MPC Module to Dukane for service.*

Step 3. After completing Step 2, test ultrasound output by activating I/O Connector Pin 12.

Normal Condition:

The system is operating properly when power is delivered to the attached stack.

Ultrasound Activation Connections:

Usually an automated control system is wired to this control input.

Optionally - A manual switch could be wired to this control input.

Continued

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Options for U/S Activation Connections:

- Optionally monitor the U/S Active status output on I/O connector Pin 4.

This NPN status output signal will activate when U/S is ON.

- Optionally monitor the MPC Ready status output on MPC I/O connector Pin 6.

This NPN status output signal will activate when the MPC is ready.

Step 4. Other options the operator can check:

- **Fault Status** output signals

Fault Status output signals are available for Overload (Pin 3) or Any Fault (Pin 5).

These NPN status outputs will activate when a fault occurs:

An **Overload Fault** latches until the next time U/S is activated, or the Fault Reset Input is activated.

Any Fault status activates when any fault is detected by the system. The output will latch until U/S is activated or the Fault Reset Input is activated.

Five fault conditions are monitored by the *iQ* Auto system for Any Fault:

- **Average Overload**

(Automatically resets on next cycle, or until an activation of Fault Reset Input)

- **Peak Overload**

(Resets same as Average Overload)

- **Overtemperature**

(Automatically resets on cool-down)

- **Power Not OK**

(AC line voltage under 180VAC)

- **Frequency Overload**

(Automatically resets on next cycle, or until an activation of Fault Reset Input)

Step 5. Check MPC Channels

Check that all MPC channels can be selected and activated. The automation control system activates input selection bits.

Select a channel: PROBE SELECTION STATUS indicator illuminates GREEN when it is the selected channel.

Activate ultrasound: Activate the *iQ* Auto ultrasound output on I/O connector Pin 12. The PROBE SELECTION STATUS indicator on the selected channel should switch to RED (from GREEN).

The probe on the selected channel should deliver ultrasonic power.

Repeat this test for all MPC channels.

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SECTION 5

Specifications

Generator Outline Drawings	35-36
Weight	37
Operating Environment.	37
AC Power Requirements	38
Regulatory Agency Compliance	39

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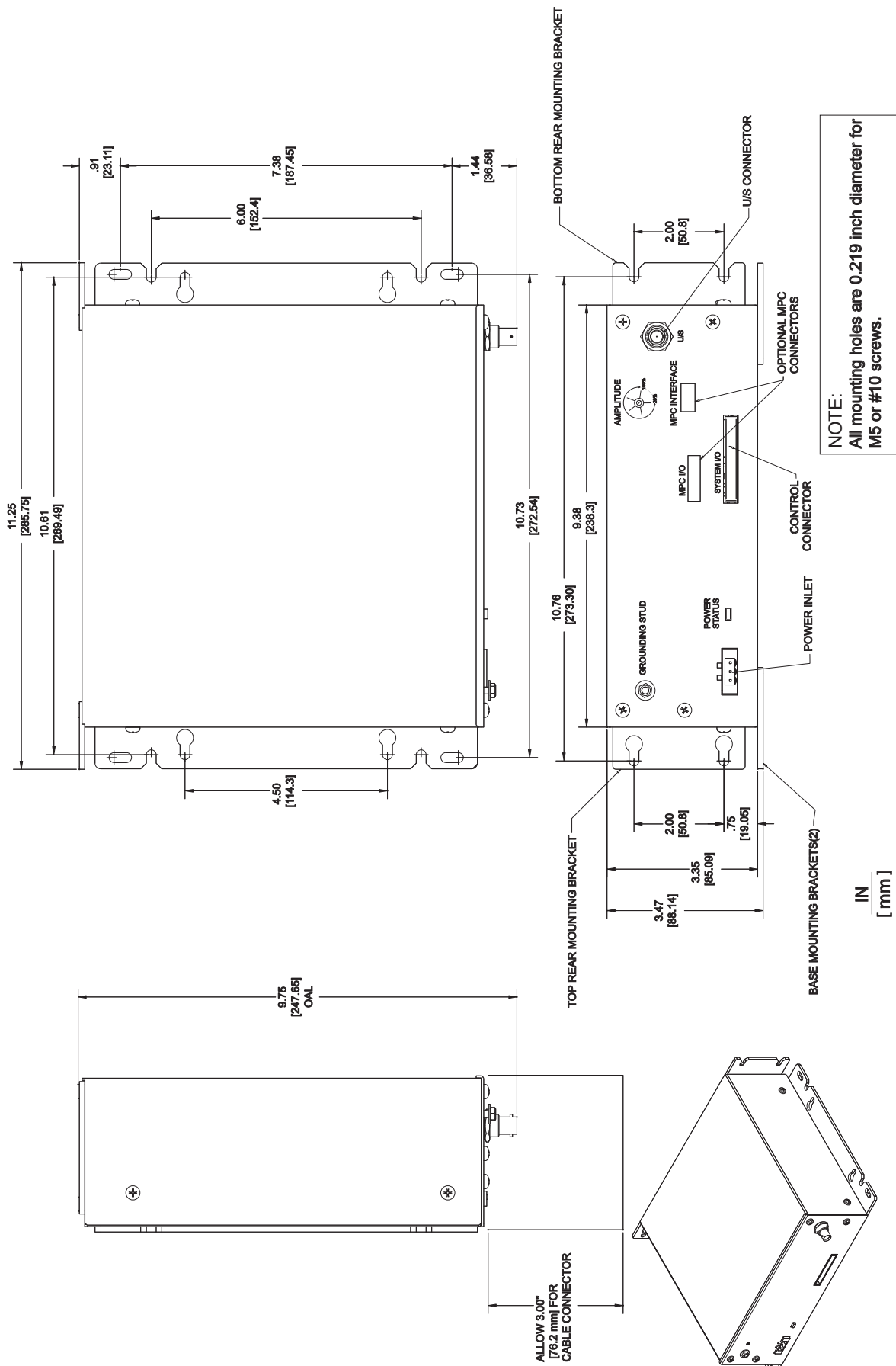


Figure 5-1 Generator Outline Drawing

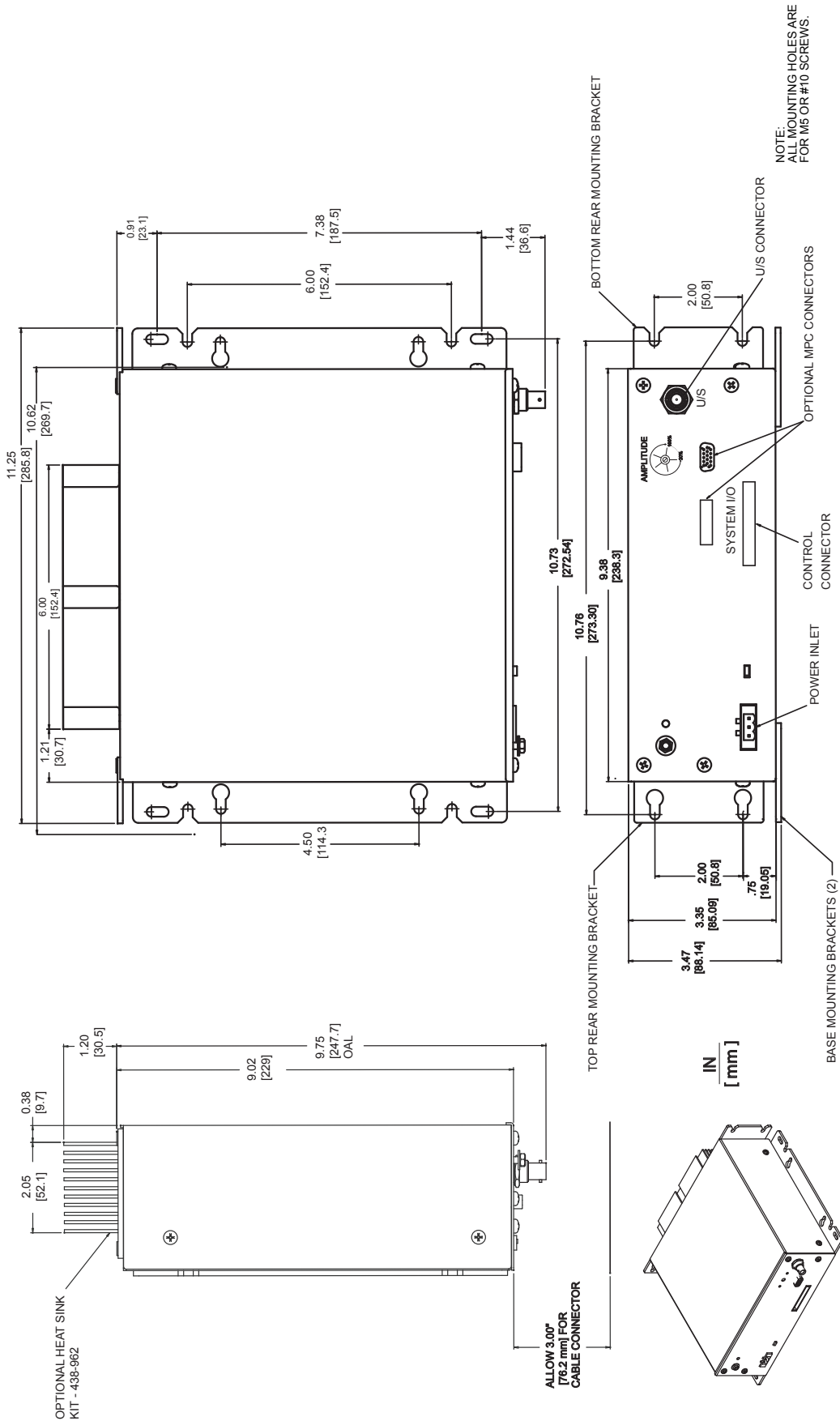


Figure 5-2 Generator with Optional Heat Sink Outline Drawing

Weight

Standard Model: 7 pounds (3.18 kg)

Model with MPC Option : 8 pounds (3.63 kg)

Shipping: Add 5 pounds (2.3 kg) to unit weight for packing materials.

Operating Environment

Operate the generator within these guidelines:

Temperature: 40°F to 100°F (+5°C to +38°C)

Air Particulates: Keep the equipment dry.
Minimize exposure to moisture, dust, dirt, smoke and mold.

Humidity: 5% to 95% non–condensing @ +5°C to +30°C

Nonoperating storage guidelines:

Temperature: -4°F to 158°F (-20°C to +70°C)

Air Particulates: Keep the equipment dry.
Minimize exposure to moisture, dust, dirt, smoke and mold.

Humidity: 5% to 95% non–condensing @ 0°C to +30°C

AC Power Requirements

Operating Frequency	Generator Model Number	Overload Power Ratings (Watts)	Input AC Power Requirements Nominal AC Volt @ Maximum RMS Current	North America/ Japan AC Outlet Rating
20kHz	20AT060-1X-XX	600	100-120V 50/60 Hz @ 15 Amps	15 Amps
20kHz	20AT060-2X-XX	600	200-240V 50/60 Hz @ 6.3 Amps	
30kHz	30AT060-1X-XX	600	100-120V 50/60 Hz @ 15 Amps	
30kHz	30AT060-2X-XX	600	200-240V 50/60 Hz @ 6.3 Amps	
40kHz	40AT060-1X-XX	600	100-120V 50/60 Hz @ 15 Amps	
40kHz	40AT060-2X-XX	600	200-240V 50/60 Hz @ 6.3 Amps	

Table 5-I AC Power Requirements

NOTE

Standard iQ Auto model = XXAT060-XN
iQ Auto with MPC model = XXAT060-XN-M0

Regulatory Agency Compliance

FCC

The generator complies with the following Federal Communications Commission regulations.

- The limits for FCC measurement procedure MP-5, “Methods of Measurement of Radio Noise Emissions from ISM Equipment”, pursuant to FCC Title 47 Part 18 for Ultrasonic Equipment.

CE Marking

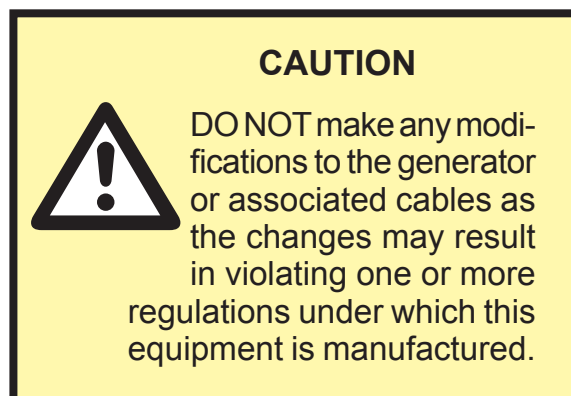
This mark on your equipment certifies that it meets the requirements of the EU (European Union) concerning interference causing equipment regulations. CE stands for Conformité Européenne (European Conformity). The generator complies with the following CE requirements.

- The EMC Directive 2004/108/EC for Heavy Industrial —
 - EN 61000-6-4: 2001
 - EN 55011: 2003
 - EN 61000-6-2: 2001
 - EN61000-4-2
 - EN61000-4-3
 - EN61000-4-4
 - EN61000-4-5
 - EN61000-4-6
 - EN61000-4-8
 - EN61000-4-11
- The Low Voltage Directive 2006/95/EC.
- The Machinery Directive 2006/42/EC.
 - EN 60204: 2006
 - Safety of Machinery - Electrical Equipment of Machines Part 1: General Requirements.

IP (International Protection) Rating

The *iQ* generator has an IP rating from the IEC (International Electrotechnical Commission).

The rating is IP2X, in compliance with finger-safe industry standards.



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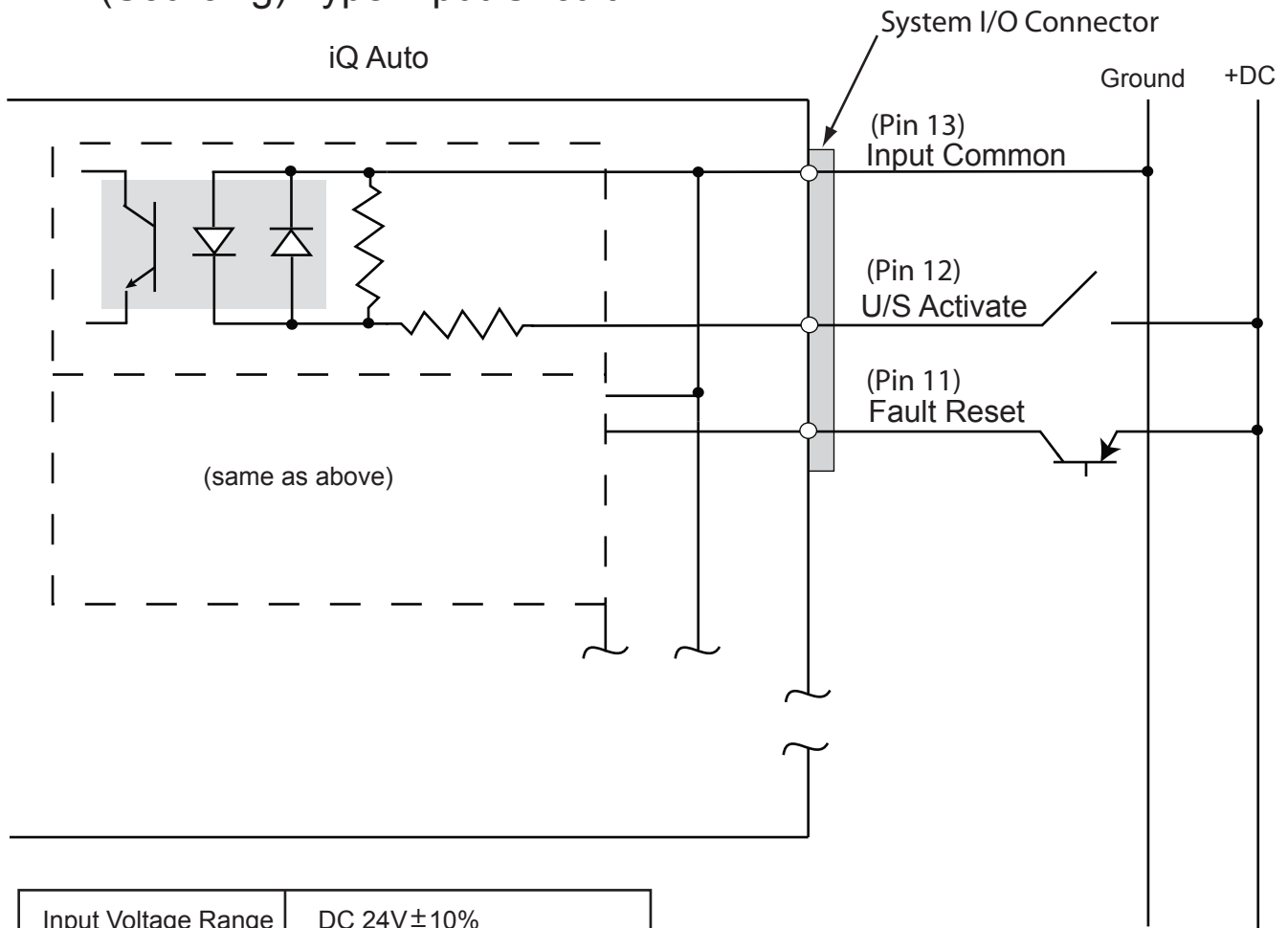
SECTION 6

Automation Interface

Input/Output Connection Examples	43
PNP (Sourcing) Type Input Circuit	43
NPN (Sinking) Type Input Circuit	44
NPN Type Output Circuit	45
E-Stop Circuitry	46

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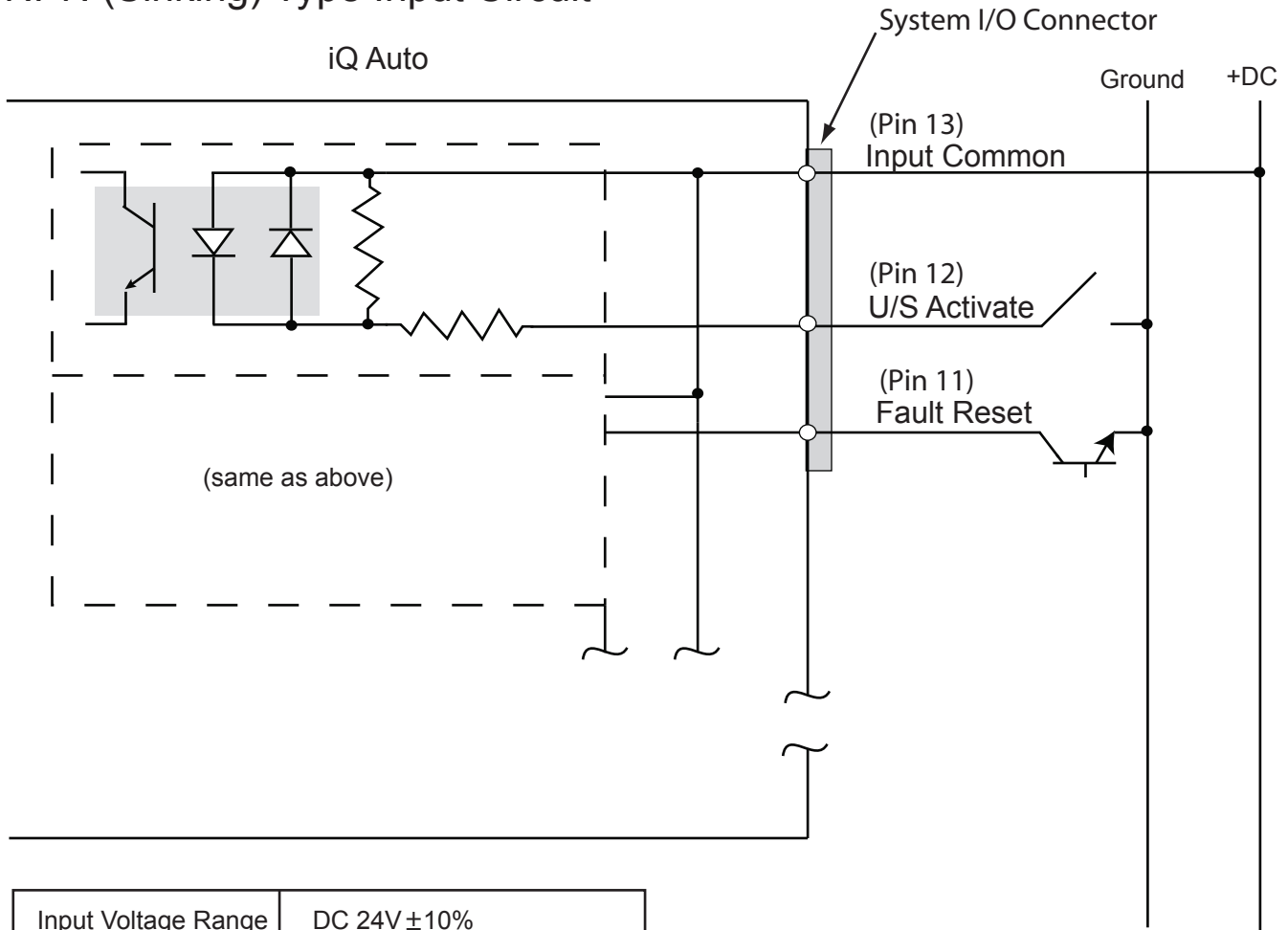
PNP (Sourcing) Type Input Circuit



Input Voltage Range	DC 24V ± 10%
Input Current	10mA(typ) @ DC 24V input

Figure 6-1 PNP Type Input Circuit

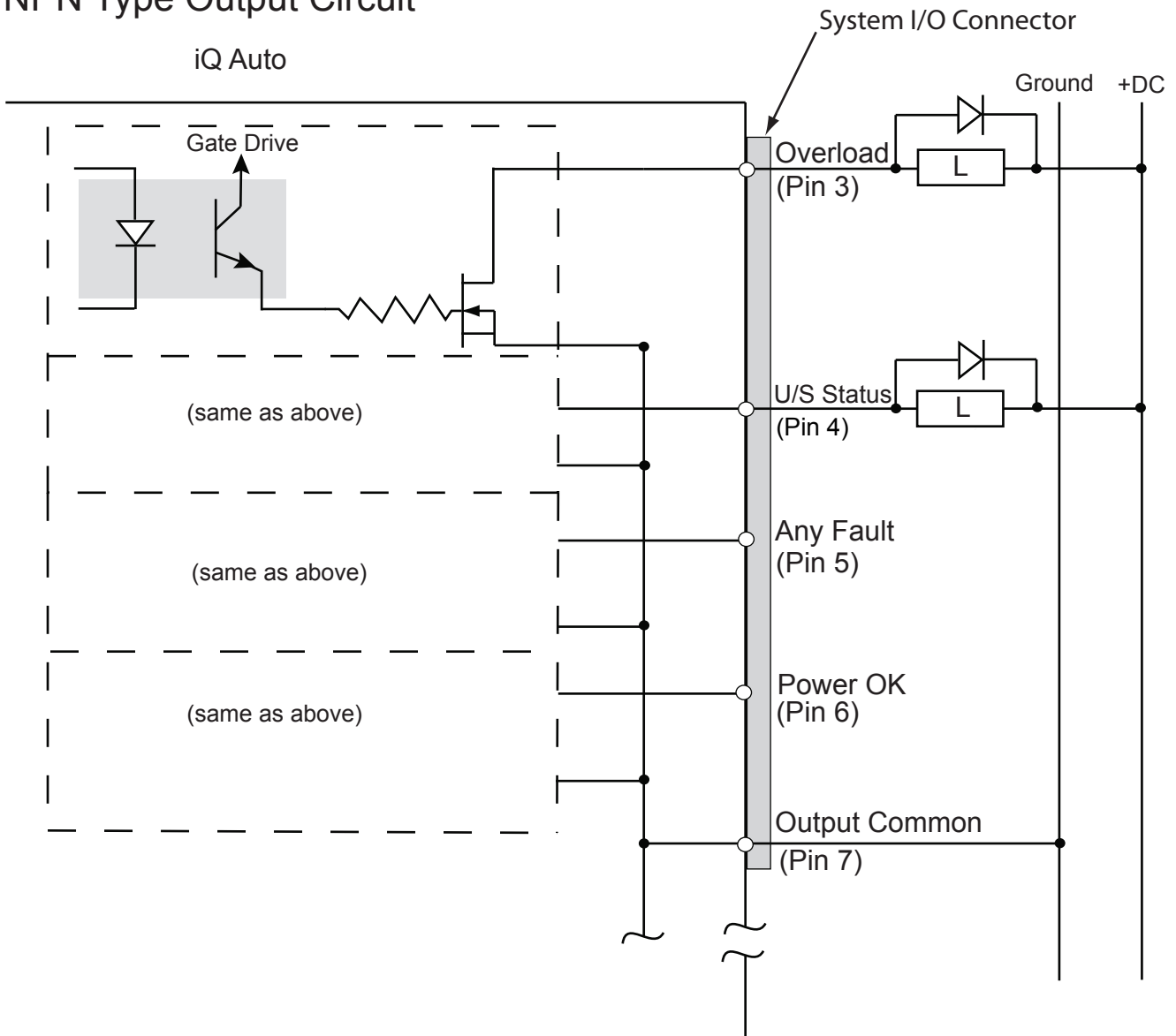
NPN (Sinking) Type Input Circuit



Input Voltage Range	DC 24V \pm 10%
Input Current	10mA(typ) @ DC 24V input

Figure 6-2 NPN Type Input Circuit

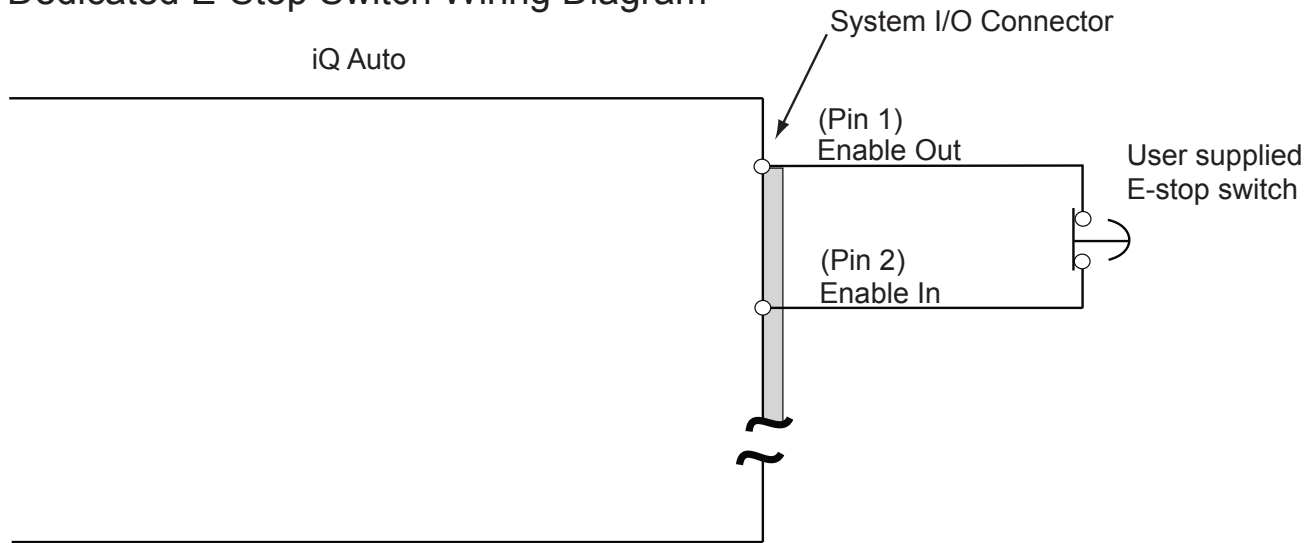
NPN Type Output Circuit



Rated Output Voltage	DC 24V ± 10%
Maximum Output Current	500mA/1 Output
Output Driver	N Channel Power MOSFET

Figure 6-3 NPN Type Output Circuit

Dedicated E-Stop Switch Wiring Diagram



Automation System Safety Circuit Wiring Diagram

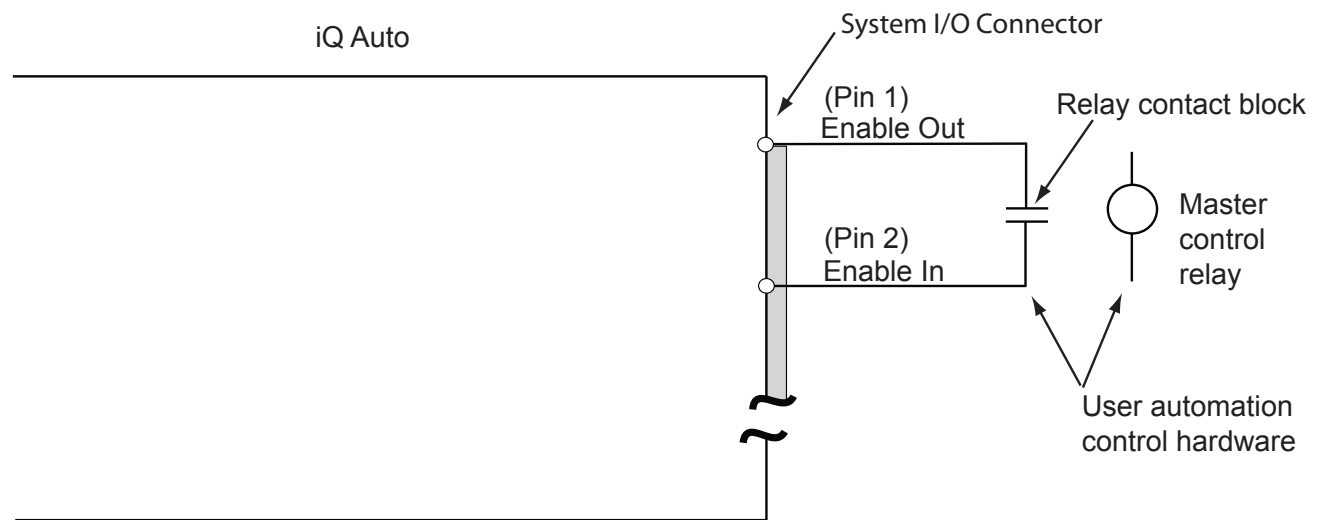


Figure 6-4 E-Stop Circuitry

SECTION 7

Contacting Dukane

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Contacting Dukane

Identify Equipment

When contacting Dukane about a service-related problem, be prepared to give the following information:

- Model number, line voltage and serial number.
- Fault status.
- Problem description and steps taken to resolve it.

Many problems can be solved over the telephone, so it is best to call from a telephone located near the equipment.

Intelligent Assembly Solutions

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E-mail: ussales@dukane.com

Fax:

Main (630) 797-4949

Service & Parts (630) 584-0796

Website

The website has information about our products, processes, solutions, and technical data. Downloads are available for many kinds of literature.

Here is the address for the main website:

www.dukane.com/us/

You can locate your local representative at:

www.dukane.com/us/sales/intsales.htm

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Dukane ISO

ISO CERTIFICATION

Dukane chose to become ISO 9001:2008 certified in order to demonstrate to our customers our continuing commitment to being a quality vendor. By passing its audit, Dukane can assure you that we have in place a well-defined and systematic approach to quality design, manufacturing, delivery and service. This certificate reinforces Dukane's status as a quality vendor of technology and products.

To achieve ISO 9001:2008 certification, you must prove to one of the quality system registrar groups that you meet three requirements:

1. Leadership
2. Involvement
3. Quality in Line Organizations and Quality System Infrastructure.

The ISO 9001:2008 standard establishes a minimum requirement for these requirements and starts transitioning the company from a traditional inspection-oriented quality system to one based on partnership for continuous improvement. This concept is key in that Dukane no longer focuses on inspection, but on individual processes.

Dukane's quality management system is based on the following three objectives:

1. Customer oriented quality. The aim is to improve customer satisfaction.
2. Quality is determined by people. The aim is to improve the internal organization and cooperation between staff members.
3. Quality is a continuous improvement. The aim is to continuously improve the internal organization and the competitive position.



Please refer to our website at:
www.dukane.com/us/sales/intsales.htm
to locate your local representative.

iQ Series, Ultrasonic Generator/Power Supply
Auto User's Manual
Part No. 403-573-02



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