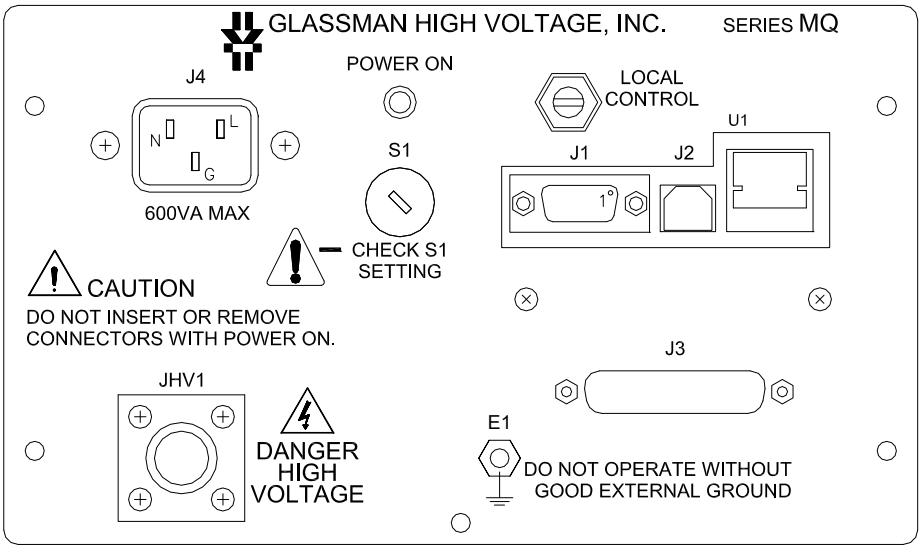
INSTRUCTION MANUAL

MQ SERIES



XP Power
124 West Main Street, PO Box 317, High Bridge, NJ 08829

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MQ SERIES

LIMITED WARRANTY

XP Power LLC ("XP Power") provides a limited warranty in lieu of all other warranties. Buyer's exclusive remedies in the event of a defect are limited to repair, replacement, or at XP Power's discretion, refund of the purchase price. The terms of the limited warranty and the Buyer's remedies are described below.

XP Power warrants its standard power supplies to be free from defect in material and workmanship, and XP Power agrees to repair or replace any power supply which fails to perform in accordance with XP Power's written specification within three years after date of shipment from XP Power.

This limited warranty shall not apply to any power supply which has been:

(1) Repaired, worked on, or altered by persons unauthorized by XP Power, which in XP Power's sole judgement, adversely affects the performance, stability, or reliability of the power supply.
(2) Subject to misuse, negligence, or accident; or
(3) Connected, installed, adjusted, or used otherwise than in accordance with instructions furnished by XP Power.

XP Power reserves the right to make any changes in design or construction of its power supply at any time, without incurring any obligation to make any change whatsoever in units previously delivered.

LIMITATION ON REMEDIES. Buyer's exclusive remedy in the event of a defect in a power supply is limited to the repair or replacement of any defective power supply or to refund of the purchase price at XP Power's sole discretion. Buyer must return the power supply to the XP Power factory, transportation prepaid by the Buyer, within the warranty period for the warranty claim to be effective. **XP Power is not liable to Buyer or to any third party for consequential or incidental damages** under any circumstances, whether due to defect in the power supply, due to delay or failure of delivery, due to a failure of the power supply to perform as specified, or for any other reason or cause. Buyer and XP Power agree that Buyer's sole remedy and XP Power's sole liability to Buyer is limited to repair, replacement, or refund of the purchase price of the power supply as described herein, whether Buyer's claim arises out of contract or tort.

DISCLAIMER OF IMPLIED WARRANTIES. This limited warranty excludes all other warranties and is offered and accepted in lieu of any and all other warranties, whether express or implied, including without limitation the implied warranties of merchantability and fitness for a particular purpose.

The entire contract concerning warranty rights and obligations and concerning Buyer's remedies is embodied in this writing. This writing constitutes the final expression of the parties' agreement, and it is a complete and exclusive statement of the terms of that agreement. No statements or understanding, purporting to modify or vary the terms hereof, shall be binding and cannot be relied upon by Buyer.

SECTION II - GENERAL INFORMATION

UNPACKING AND INSPECTION

First inspect package exterior for evidence of rough handling in transit. If none, proceed to unpack ... carefully. After removing the supply from its shipping container, inspect it thoroughly for damage.

IMPORTANT! In cases of damage due to rough handling in transit, notify the carrier immediately if damage is evident from appearance of package. Do not destroy or remove any of the packing material used in a damaged shipment. Carrier companies will usually not accept claims for damaged material unless they can inspect the damaged item and its associated packing material. Claims must be made promptly - certainly within five days of receipt of shipment.

CORRESPONDENCE

Each XP Power HV power supply has an identification label on the chassis that bears its model and serial number. When requesting engineering or applications information, reference should be made to this model and serial number. If specific components or circuit sections are involved in the inquiry, also indicate the component symbol number(s) shown on the applicable schematic diagram.

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ACCESSORIES (provided)

QTY	ITEM
1	HV Output cable
1	AC input line cord for models without AC selector switch
2	AC input line cords for units with switchable input
1	USB A/B interconnect cable, 10'.
1	RS232 interconnect cable, null modem, 10'.
1	Subminiature "D" mating connector kit, 25 pin female.

SAFETY

This symbol, wherever it appears on the supply, alerts you to the presence of uninsulated dangerous voltages - voltages that may be sufficient to constitute a risk of electrical shock.

This symbol, wherever it appears on the supply, alerts you to important operating and maintenance instructions in the accompanying literature. Read the manual.

TERMS IN THIS MANUAL

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

WARNING! statements identify conditions or practices that could result in injury or loss of life.

WARNING!

If this equipment is used in a manner not specified herein, the protection provided by the equipment may be impaired.

To avoid the risk of shock or fire do not attempt to service the supply beyond that described in these instructions.

To avoid the risk of shock and personal injury, do not remove the product covers while the unit is operating or connected to the AC mains. Wait at least 3 minutes after disconnecting the AC mains power before removing any covers or panels. Wait at least 1 minute before disconnecting the HV cable.

Upon loss of protective ground connection(s), all accessible conductive parts can render an electric shock.

Use the NRTL listed power cord provided by the manufacturer or use only a NRTL listed power cord with a separable mains plug, rated greater than the input current rating of the unit. For CE and UKCA compliant supplies used in Europe or the UK, the protective conductor/ground wire on the cord must be green/yellow. Use only a cord in good condition.

To avoid explosion, do not operate this product in an explosive atmosphere.

If liquid is spilled on the supply, shut it off immediately and disconnect it from the AC mains.

Always maintain adequate supply ventilation. All ventilation openings must remain free from obstruction.

Equipment Maintenance

There is no regular maintenance required to be performed on this equipment.

User Serviceable Components

There are no user-serviceable components. Return supply to factory for replacement of components by qualified technicians.

CONNECTIONS AND CONTROLS

FRONT PANEL ELEMENTS

S1 AC INPUT VOLTAGE SELECTOR SWITCH
(Units with selectable input voltage only.)

CAUTION

Setting the voltage selector incorrectly can cause permanent damage to the power supply. Make absolutely sure that the switch setting is correct before applying AC power. In addition, use the appropriate IEC line cord (Both NEMA line cords are supplied for models with AC selector switch.)

S1 is a tool only selectable switch which selects either 115V nominal or 230VAC nominal input voltage ranges. Before connecting the AC power line cord make sure the selector switch is set to the correct position. To set the switch if necessary, select the desired voltage range by rotating to the appropriate position. The position is marked on the switch.

MQ
AC INPUT SELECTOR SWITCH

NOTE: The power supply is shipped from the factory with selector switch set to the "230" position for 230VAC operation. Set to "115" for operation at 115VAC.

For 200V OPTION models, the "230" position is used for 200VAC operation and "115" position is used for 100 VAC operation.

J4 AC POWER INPUT

MQ units operate off single phase 115 or 230 VAC as selected by S1 (see above). For models without selector switch, consult model label for correct input voltage.

WARNING! The ground (center) terminal of this input should be connected to the AC outlet ground or other good earth ground.

J4 is an IEC C14 receptacle. Mating line cords are provided for both 115VAC and 230VAC operation. The 115VAC line cord has a plug for a NEMA 5-15 grounded outlet and the 230VAC line cord has a plug for a NEMA 6-15 grounded outlet. In other regions, the appropriate plug or IEC cord set should be substituted.

If the plug is removed from the cord provided, the wires should be connected as follows:

Green/Yellow - Ground

Brown - Line

Blue - Line or Neutral

Check to see that your input line voltage matches the rating of the supply before applying power.

For CE compliant and UKCA supplies used in Europe or the UK:
Please refer to the Declaration of Conformity located elsewhere in this manual for installation environment conditions required to conform to 2014/35/EU (Low Voltage Directive) and The Electrical Equipment (Safety) Regulations 2016, SI 2016 No. 1101.

POWER ON INDICATOR

WARNING! When this lamp is illuminated, power supply is turned on. Do not apply or remove any connections to this unit until AC power is removed and the DC output has discharged.

JHV1 HIGH VOLTAGE OUTPUT

WARNING! Do not insert or remove the output cable from this connector until AC power is off and the DC output has discharged.

This is the high voltage output of the supply (see INTERFACE DIAGRAM Figures 11 and 12). Engage the connector as follows:

UNITS > 5 kV: Insert the high voltage cable provided into the receptacle. Screw the threaded barrel onto the receptacle.

UNITS <= 5 kV: Align plug, push in, and rotate 1/2 turn to engage.

E1 GROUND STUD

WARNING! Do not operate unit without good external earth ground connected to this point.

This is the main grounding terminal for the supply and **must** be connected to a good external earth GROUND. This terminal should also be used for the HV load return. *(See INTERFACE DIAGRAM Figures 11 and 12).*

J3 ANALOG CONTROL CONNECTOR

WARNING! Do not make or remove connections to this connector or any other connector until power is off and the output has discharged.

This connector provides inputs and outputs for the analog remote control functions. For a description of each of these signals and their application see INTERFACE DIAGRAM Figures 1 - 12 and the remote control interface section.

Note: When there are no digital computer connections, signals must be provided to the V-PROGRAM, I-PROGRAM, & HV ENABLE inputs of J3 in order for high voltage to be generated.

LOCAL PROGRAM CONTROL

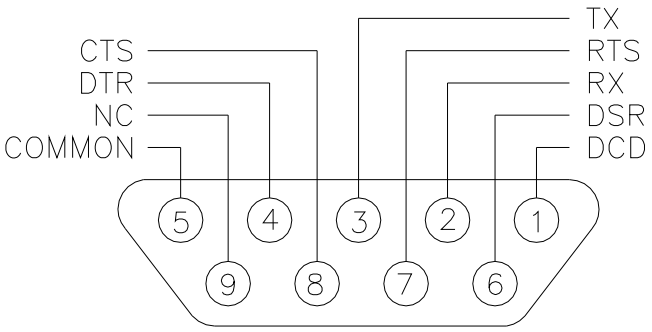
This 10-turn control provides a 0 to +10 V signal that can be used for local voltage or current programming. Clockwise rotation increases output. A locking nut is provided to secure the setting.

J1 RS232 DB9 CONNECTOR

(See INTERFACE DIAGRAM FIG 10, Table 1, and figure below)

WARNING! Do not make or remove connections to this connector or any other connector until power is off and the output has discharged.

J1 is a 9 pin female connector used to connect to a serial computer interface. A null modem RS232 cable (approx. 3m/10ft) DB9 (male) to DB9 (female) is supplied for interconnection.



DB9 RS232 CONNECTOR

SIGNAL NAME	DB-9 PINOUT	DB-25 EQUIV	COMMENTS (PINS REFER TO DB-9)
Data Carrier Detect (DCD)	1	8	shorted to pins 4 and 6
Receive Data (RxD)	2	3	power supply transmit line
Transmit Data (TxD)	3	2	power supply receive line
Data Terminal Ready (DTR)	4	20	shorted to pins 1 and 6
Signal Ground (GND)	5	7	signal ground
Data Set Ready (DSR)	6	6	shorted to pins 1 and 4
Request To Send (RTS)	7	4	shorted to pin 8
Clear To Send (CTS)	8	5	shorted to pin 7
Ring Indicator (RI)	9	22	not used

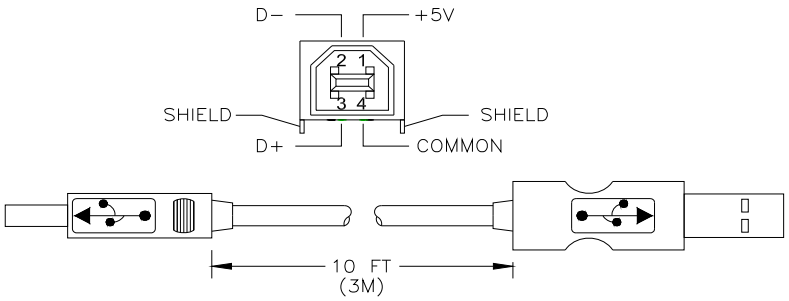
Table 1 DB-9 Pinouts

J2 USB CONNECTOR

(See INTERFACE DIAGRAM FIG 10, Table 2, and figure below)

WARNING! Do not make or remove connections to this connector or any other connector until power is off and the output has discharged.

This serial link implements USB2.1 communication protocol. A 3m (10ft) cable is supplied with the unit for this purpose.



USB CABLE

SIGNAL NAME	B PINOUT
VBUS	1
D-	2
D+	3
Ground	4

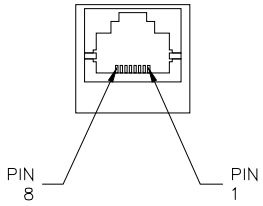
Table 2 USB B Pinouts

U1 ETHERNET CONNECTOR OPTION

(See INTERFACE DIAGRAM FIG 10 and figure below)

WARNING! Do not make or remove connections to this connector or any other connector until power is off and the output has discharged.

U1 is a RJ-45 connector used to connect to an Ethernet network. A standard RJ-45 plug and cat-5e cable may be used for interconnection.



ETHERNET CONNECTOR

INSTALLATION AND OPERATION

This module is a component type of power supply, and as such, is designed for permanent mounting within larger industrial equipment that will provide adequate fire and shock protection. This supply is not intended to be used for “Bench Top” operation.

Refer to the OUTLINE AND INTERFACE drawing located in Section III for mechanical mounting specifications and dimensions.

CAUTION
Care should be taken when mounting this supply not to block or otherwise impede airflow at inlet and exhaust areas.

WARNING!

NEVER ATTEMPT TO OPERATE THIS UNIT WITHOUT A GOOD EARTH GROUND CONNECTED TO THE GROUND STUD, "E1", ON THE FRONT PANEL. THE GROUND WIRE OF THE AC LINE CORD MUST ALSO BE GROUNDED.

PER EN61010-1 THE DISCONNECTING DEVICE MUST BE READILY IDENTIFIABLE AND EASILY REACHED BY THE USER. THE DETACHABLE POWER CORD IS THE POWER SUPPLY DISCONNECTING DEVICE. TO DISCONNECT THE POWER SUPPLY FROM THE MAINS, THE POWER SUPPLY CORD MUST BE UNPLUGGED.

READ AND FULLY UNDERSTAND THE OPERATING INSTRUCTIONS BEFORE APPLYING POWER TO THIS UNIT.

THIS EQUIPMENT EMPLOYS VOLTAGES THAT ARE DANGEROUS. EXTREME CAUTION MUST BE EXERCISED WHEN WORKING WITH THIS EQUIPMENT.

DO NOT HANDLE THE LOAD OR EXPOSED HIGH VOLTAGE TERMINATIONS OR ATTEMPT TO MAKE OR REMOVE ANY CONNECTIONS TO THE SUPPLY UNTIL THE LOAD AND/OR SUPPLY HAS BEEN DISCHARGED (GROUNDED). AN UNLOADED SUPPLY MAY TAKE UP TO 1 MINUTE TO FULLY DISCHARGE.

ALWAYS MAKE CERTAIN THAT THE RETURN SIDE OF THE LOAD IS CONNECTED TO GROUND.

INITIAL TURN ON

WARNING! **This procedure should only be attempted by qualified personnel who are knowledgeable in methods of safely testing and operating high voltage power supplies and related high voltage equipment. The following steps to connect and operate this equipment should be carried out only after the unit has been placed or mounted in position.**

1. **CAUTION: Check the input voltage switch (S1) setting on the front panel of the power supply and make certain that this is the rating of the available power source. For units without a selector switch, make certain the AC power source matches the rating shown on the model label.**

2. **FOR LOCAL CONTROL:** Using the supplied "D" connector kit, make connections as shown in figure 12 of the INTERFACE DIAGRAM.

   FOR REMOTE ANALOG CONROL: Using the supplied "D" connector kit, connect external pots or control signals to REMOTE V-PROGRAM and REMOTE I-PROGRAM terminals. Connect HV ENABLE to REFERENCE. See INTERFACE DIAGRAM figures 3, 4, 11, & 12.

   FOR REMOTE DIGITAL CONTROL: Connect a digital interface (RS-232, USB or optional Ethernet) to a control computer. Using the supplied "D" connector kit, make connections as shown in figures 1 & 7 of the INTERFACE DIAGRAM.

   Note: Always connect J3-1 (GROUND) to J3-2 (COMMON) unless COMMON needs to "float" for isolation or metering purposes.

3. Connect the high voltage output cable to your HV apparatus and ground the return lead of the load as shown in Figures 11 & 12 of INTERFACE DIAGRAM. Connect the high voltage cable to the receptacle on the front panel.
   WARNING! **Make sure to isolate your HV apparatus/load from any possible contact with other objects and personnel.**

   Monitor the V-MONITOR terminal with a DVM (0 – 10 VDC = 0 – rated kV output), or monitor the voltage on a remote computer.

   FOR LOCAL CONTROL:

4. **CAUTION:** Rotate the LOCAL CONTROL fully counter-clockwise. This is optional, but desirable so as to prevent damage to external equipment caused by inadvertent overvoltage setting. Not required if correct setting has already been established.

5. Connect the AC input cable provided to J4 and to the power source. **WARNING! Supply is energized and capable of generating HV immediately upon the application of AC power!**

6. Rotate LOCAL CONTROL until voltage meter indicates desired output voltage.

FOR REMOTE ANALOG CONTROL:

7. **CAUTION:** Set external V-PROGRAM pot to zero volts. This is optional, but desirable so as to prevent damage to external equipment caused by inadvertent overvoltage setting. Not required if correct setting has already been established.

8. Set I-PROGRAM (LOCAL CONTROL or external pot) to a level that is greater than the amount that the connected load will require (any setting above zero if no load is connected). Note: A setting above zero is required for HV generation even if no load is connected.

9. Connect the AC input cable provided to J4 and to the power source. **WARNING! Supply is energized and capable of generating HV immediately upon the application of AC power!**

10. Rotate external V-PROGRAM pot until voltage meter indicates desired output voltage.

FOR REMOTE DIGITAL CONTROL:

11. Launch the downloaded software on the connected computer (see QR code label on the chassis).

12. Connect the AC input cable provided to J4 and to the power source. **WARNING! Supply is energized and capable of generating HV immediately upon the application of AC power!**

13. Using the software, set voltage and current programs to desired levels. Select HV ON, then Send Program.

    Refer to page 16 for complete REMOTE DIGITAL CONTOL operating instructions.

14. To shut down supply, disconnect AC power.

WARNING!
DO NOT HANDLE THE LOAD OR EXPOSED HIGH VOLTAGE TERMINATIONS OR ATTEMPT TO MAKE OR REMOVE ANY CONNECTIONS TO THE SUPPLY UNTIL THE LOAD AND/OR SUPPLY HAS BEEN DISCHARGED (GROUNDED). AN UNLOADED SUPPLY MAY TAKE UP TO 1 MINUTE TO FULLY DISCHARGE.

ANALOG REMOTE CONTROL INTERFACE

***NOTE**: It is recommended that shielded cable(s) be used for these connections and that the shield be terminated to ground.*

***For CE and UKCA compliant supplies used in Europe or the UK:** Please refer to the EMC addendum located elsewhere in this manual for shielding, terminating filtering conditions required to conform to 2014/30/EU and the Electromagnetic Compatibility Regulations 2016, No. 1091.*

WARNING! Do not use J3 connections for main earth ground or load return! E1 ground stud on the rear panel is provided for this purpose.

J3-1, J3-25 GROUND

These terminals should not be used as the main connection to earth ground or for load return. Use the main ground terminal, "E1", for that purpose.

J3-1 should be connected to the COMMON terminal J3-2 unless a floating common is desired *(**See J3-2 and INTERFACE DIAGRAM FIG 7**)*.

J3-25 terminal is provided for an instrumentation ground connection.

J3-2 POWER COMMON

This COMMON should be jumpered to J3-1 GROUND unless it is desired to allow COMMON to "float" for isolation or load current measurement purposes. Note that the load current will flow through J3-1 and J3-2. For that reason, don't use these terminals for any other purpose if J3-1 is tied to J3-2. Note that the output voltage will regulate with respect to COMMON, not GROUND.

When COMMON is floating, it is clamped internally by a bi-directional diode circuit. The inserted drop of a current measurement shunt between COMMON and GROUND should not exceed 5V; otherwise, erroneous readings may be obtained *(**See INTERFACE DIAGRAM FIG 7**)*.

J3-11 DIGITAL COMMON

Digital Signals, such as HV ENABLE, INTERLOCK and status indicator signal returns, should be connected to J3-11 DIGITAL COMMON and all analog monitor/programming returns should be connected to SIGNAL COMMON (J3-8)

J3-8 **SIGNAL COMMON**

This terminal is provided for all programming and measuring instrument returns. This separate COMMON return is provided so that the digital and HV return currents cannot create a voltage drop that could cause an error in the program monitor/signals. It is connected internally to the same COMMON as J3-2 and J3-11.

NOTE:
INTERFACE DIAGRAM FIG 11 is just one example of the many possible interface configurations.

INTERFACE DIAGRAM FIG 12 shows the minimum number of connections to completely enable the supply. In this configuration, output voltage is controlled by the front panel control. No external signals are required.

J3-10 **I-MONITOR**

A 0-10 V signal, positive with respect to SIGNAL COMMON, and in direct proportion to the output current, is available at this terminal. An internal 10 k ohm, 1%, limiting resistance protects the circuitry. Therefore, it is recommended that a digital voltmeter be used to monitor this output. It is also acceptable to use a 1 mA DC full scale instrument (i.e. analog meter) for monitor purposes ***(See INTERFACE DIAGRAM FIG 6)***.

J3-7 **ANALOG I-PROGRAM**

Note: When any digital interface is operational, this input is disconnected and current programming is set by the computer

A positive 0-10 V signal (with respect to SIGNAL COMMON at J3-8) will program the output current proportionally from zero to rated output. This input can be programmed in several ways ***(See INTERFACE DIAGRAM FIG 4)***:

* A user supplied 0 - +10 V signal.

* A user supplied potentiometer (5-50 k ohms, 10 k nominal) can be connected between the +10 V REFERENCE and SIGNAL COMMON, with the wiper connected to the ANALOG I-PROGRAM terminal.

* The ANALOG I-PROGRAM input may be jumpered to the +10 V REFERENCE voltage terminal for a fixed current limit at the maximum rated current.

* The ANALOG I-PROGRAM input may be jumpered to the wiper of the LOCAL CONTROL, J3-13, for local control operation.

J3-17, J3-18 CURRENT LIMIT (CL) CURRENT TRIP (CT) SELECT
(See INTERFACE DIAGRAM Figure 8)

CURRENT LIMIT (J3-17 & J3-18 unconnected): When load current exceeds the current program or control setting the unit regulates the current at the setting. (Constant Current).

CURRENT TRIP (J3-17 jumpered to J3-18): When load current exceeds the current program or control setting the HV output will trip and latch off. Reset is by toggling the AC power, or by toggling the HV enable signal.

J3-3 INTERLOCK

INTERLOCK (J3-3) must be jumped to DIGITAL COMMON (J3-11) to enable the supply. If desired, this jumper may be removed and replaced by an external switch which must be closed for the supply to operate. If the external switch is opened, HV generation will be inhibited.
WARNING! When the switch is again closed, HV will be generated immediately ***(See INTERFACE DIAGRAM FIG 1)***.

J3-9 V-MONITOR

A 0-10V positive signal with respect to SIGNAL COMMON, in direct proportion to the output voltage, is available at this terminal. An internal 10 k ohm, 1%, limiting resistance protects the circuitry. Therefore, it is recommended that a digital voltmeter be used to monitor this output. It is also acceptable to use a 1 mA DC full scale instrument (i.e. analog meter) for monitor purposes
(See INTERFACE DIAGRAM FIG 5).

J3-6 ANALOG V-PROGRAM

Note: When any digital interface is operational, this input is disconnected and voltage programming is set by the computer.

A positive 0-10 V signal (with respect to SIGNAL COMMON at J3-8) will program the output voltage proportionally from zero to rated output. This input can be programmed in several ways *(**See INTERFACE DIAGRAM FIG 3**)*:

* A user supplied 0 - +10 V signal.

* A user supplied potentiometer (5-50 k ohms, 10 k nominal) can be connected between the +10 V REFERENCE and SIGNAL COMMON, with the wiper connected to the ANALOG V-PROGRAM terminal.

* The ANALOG V-PROGRAM input may be jumpered to the +10 V REFERENCE voltage terminals for a fixed output at the maximum voltage.

* The ANALOG V-PROGRAM input may be jumpered to the wiper of the LOCAL CONTROL, J3-13, for local control operation.

J3-12 +10 V REFERENCE

The output of this terminal is an ultra-stable, positive, +10 V reference voltage (with respect to SIGNAL COMMON) that is supplied for user programming applications. Maximum current drain from this point should be limited to 4 mA.

J3-20 HV ENABLE

An external positive 2.5-15 V source (with respect to COMMON at J3-11) will enable the supply. A 0-1.5 V signal at this input will disable the supply. This input must be jumpered to REFERENCE (J3-12) if no external HV ENABLE signal is used *(**See INTERFACE DIAGRAM FIG 2**)*.

J3-21 HV STATUS

When the supply is enabled to produce HV, the HV status signal goes from a low to a high state and stays high until the HV is disabled.

High is a 1k resistor pull up to +5V.
Low is 0V (common) and can sink up to 5mA.

J3-22 **FAULT STATUS**

During normal operation, this signal is low and goes high when a fault occurs. It stays high until the fault is cleared. If the supply is enabled and generating HV when the fault occurs, the HV will be disabled and consequently the HV status signal will go low as well as the fault signal going high.

A fault can be either under voltage, over temperature or a faulty fan.

High is a 1k resistor pull up to +5V.
Low is 0V (common) and can sink up to 5mA.

J3-23 **MODE STATUS**

During operation in voltage mode, this signal will be low. During operation in current mode, this signal will be high.

High is a 1k resistor pull up to +5V.
Low is 0V (common) and can sink up to 5mA.

J3-24 **ARC STATUS**

If the supply includes ARC Quench, when an ARC discharge occurs this signal will transition from Low to High for a 20ms duration (20ms high pulse for each ARC). An ARC is defined as an instantaneous HV output discharge that exceeds 15-30% of the supply voltage rating.

High is a 1k resistor pull up to +5V.
Low is 0V (common) and can sink up to 5mA.

.

DIGITAL INTERFACE

MQ Computer Interface

This section describes the specific implementation of the XP Power High Voltage RS232/USB/Ethernet Serial Data Interface for the MQ series power supplies. The Ethernet interface (U1) is optional and is not included with standard power supplies.

The purpose of this interface is to provide monitoring and control capability of all analog and digital functions available for these power supplies, while providing 1000V RMS voltage isolation between the power supply and the controlling computer. The interface is microcontroller based and built into the control board of the power supply.

The interface uses ASCII encoded character strings for data transmission. Transmission error checking is implemented using modulo 256 checksums. The transmission format uses no parity and one stop bit with a baud rate of 9600.

The power supply interface acts strictly as a slave device. It will not transmit any messages over the data link unless it receives a request from the master computer.

Serial Interface Connections

(SEE FIGURE 10 ON INTERFACE DRAWING)

RS232:
Using the provided Null Modem cable, attach the control computer's serial port to J1 on the rear panel of the power supply.

USB:
J2 on the rear panel is USB "B" connector. The USB connection is detected automatically and it will take precedence over RS232. A standard USB cable is provided.

ETHERNET (optional):
Using a CAT5e Ethernet cable, attach U1 on the rear panel of the power supply to the local network. Alternately, the power supply can be connected directly to a computer's Ethernet port using a crossover Ethernet cable. The Ethernet connection is detected automatically and it will take precedence over both RS232 and USB.

Serial Interface Software

Installation:

The following Serial Interface Software is available for download using the QR code on the unit chassis:

Serial Power Supply Control Program (XP.exe): This program can run on Windows XP and later. XP.exe should be copied from the downloaded software package to a writeable location on the hard drive in order to store the power supply parameters. Power supply parameters will be stored in XP.ini. This file will be created after the program is launched from a writeable location for the first time. Both files must remain in the same folder/sub-directory to recall power supply parameters when launched. This file is located in the root (\) of the downloaded software package.

USB drivers: USB communications between a MS Windows computer and the serial interface is implemented using USB drivers installed on the computer. These drivers allow USB communications via a "virtual com port". USB drivers MUST be installed in order to use the USB communications interface feature. Installation instructions for the USB drivers are provided in a PDF file supplied by the driver vendor. These files are located in the \Drivers\USB\ folder in the downloaded software package. Run Setup.exe to install.

Labview drivers: Labview drivers are provided. In addition, a generic sample power supply control template is provided with application notes. Customizing is done by the user as required to match the power supply features available. These files are located in the \Drivers\Labview\ folder in the downloaded software package. You must have the Labview software to use these drivers.

Ethernet Installation and set up: (units with Ethernet Option only):

IP Address:

With the power supply connected to the network and powered on, run the Digi Device Discovery program from the downloaded software package. The program must be permitted to access the network by any firewall program in use. The program will locate the power supply by its unique MAC Address. Choose ‘Configure Device Settings’ from the task list on the left. Select ‘Manually configure network settings.’ Set an IP Address, Subnet Mast, and Gateway as required for the local network and save.

Choose ‘Open Web Interface’ from the task list or open a web browser to the IP address of the device (http://xxx.xxx.xxx.xxx). Enter the default login when prompted.

User: root

Password: *The unique default password is printed on a label near the ethernet port. If there is no password label, the default password is:* dbps

NOTE: If the default password is misplaced, contact XP Power. It can be retrieved using your power supply serial number.

CAUTION: If the user changes the default password, XP cannot reset to the default password remotely and the supply will need to be returned to the factory for reset. For this reason, changing the default password is not recommended. Additional user profiles with unique passwords can be created if desired. Refer to the DIGI documentation provided in the downloaded software package for more information.

Under Configuration, select 'Serial Ports.' Select 'Port 1' and choose 'Real Port Profile,' then 'Apply.' Next, select 'GPIO' also under Configuration. Change Pin 2 mode to 'Out,' Initial Output State to 'asserted,' then 'Apply.' Logout of the web interface.

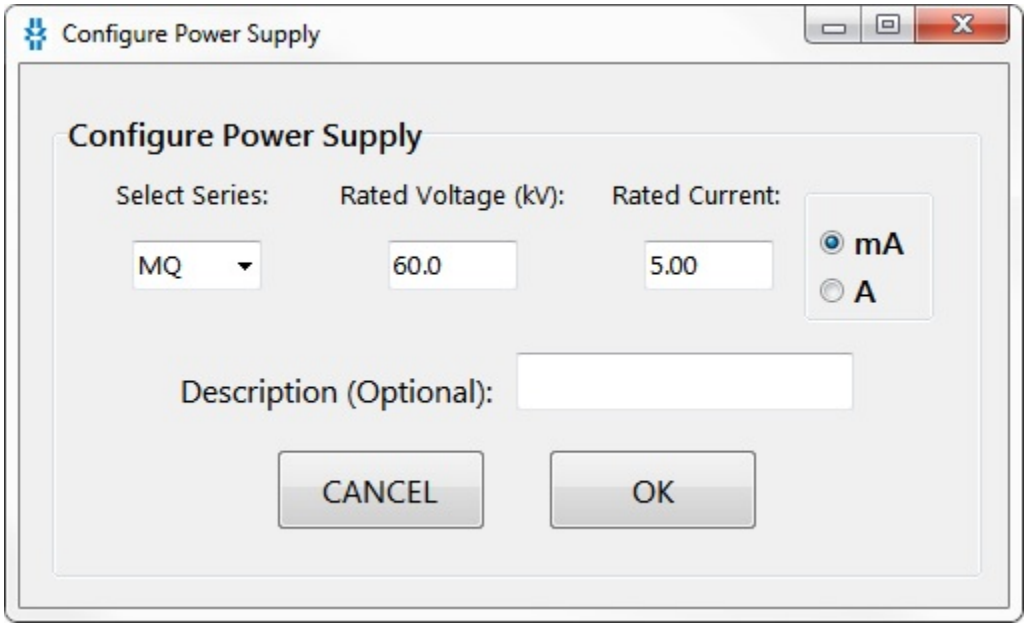
Note: In order to switch back to either RS232 or USB control, the above process must be repeated and GPIO pin 2 output must be de-asserted.

RealPort Drivers:

The communication using the Ethernet interface of the power supply and the XP Power control software requires the installation of RealPort Drivers. These drivers allow communication with the power supply via a 'virtual com port.' Installation instructions are provided in the downloaded software package in PDF form. Drivers are provided for Windows XP and later. These files are located in the \Drivers\Ethernet folder in the downloaded software package.

Serial Power Supply Control Program Operation:

The program consists of a **main window**, Configuration, and About menus:

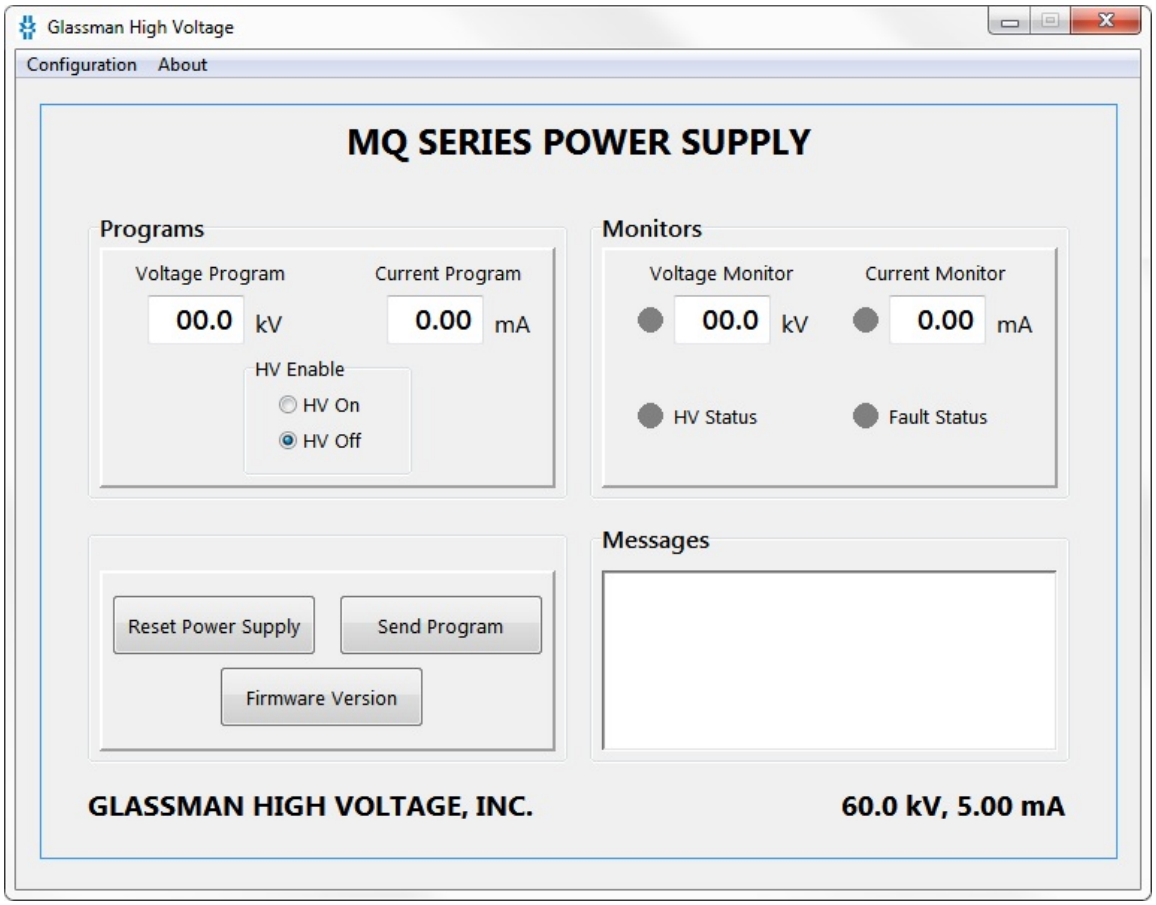


Configuration - Power Supply: On the initial run (or any run without XP.ini present in the directory with XP.exe), the Power Supply Configuration window will launch immediately. Choose the appropriate Series from the pull down menu or manually enter the Series letters if it is not in the list. Enter the Voltage in kilovolts and the Current in either milliamps or Amps exactly as they appear on the power supply label without any polarity indication. Enter a description of the power supply if desired. The description will appear on the main window, underneath the Series name. Clicking 'OK' will set the scale factors and resolution for both Voltage and Current. Be sure to check these numbers on the Confirmation pop-up. The Power Supply Configuration window can be accessed any time through the Configuration menu.

Configuration - Com Port: Allows for selection of the Serial Port Com 1 up to Com 10 and opens/closes the port. In order to use the USB interface, the assigned virtual com port, as installed by the USB driver software, must be selected.

NOTE: If run from a read-only location, Power Supply and Com Port configuration changes cannot be saved.

About - Software Version: Displays a window with the Software Revision.



The **Program Main Screen** displays four data entry and display text boxes, three control buttons, one HV enable/disable selector, and up to four status indicators. See series specific manual for available status indicators.

Voltage Program allows entry of values up to the rating of the power supply. For example, for a 3 kV power supply, the maximum is 3.00. If a greater value is entered, the program will not execute the command and will issue a warning asking that the user enter values within the allowable voltage range.

Current Program allows entry of values up to the rating of the power supply. For example, for a 400 mA power supply, the maximum is 400. If a greater value is entered, the program will not execute the command and will issue a warning asking that the user enter values within the allowable current range.

Voltage Readback displays voltage values sent from the power supply to the computer. The program refreshes this information approximately every 250 milliseconds when the power supply is connected to computer through the interface and operating normally.

Current Readback displays current values sent from the power supply to the computer. The program refreshes this information approximately every 250 milliseconds when the power supply is connected to the computer through the interface and operating normally.

Send Program Button is used to send new voltage & current program values or Enable/Disable commands to the power supply.

Power Supply Reset Button is used to reset the power supply, so that the output voltage is disabled, and voltage and current programs are set to zero.

Firmware Version Button is used to display the current firmware version of the interface.

Voltage Control Status Indicator is used to indicate that the power supply is operating in voltage regulation mode.

Current Control Status Indicator is used to indicate that the power supply is operating in current regulation mode (or current trip where applicable).

PS Fault Status Indicator is used to indicate that the power supply HV enable is inhibited due to a Fault condition. Refer to the instruction manual text for a description of conditions which cause a Fault.

HV On Status Indicator is used to indicate that the power supply HV is on.

Message Report window displays:

1. Commands that the program sends to the power supply.
2. Responses sent from the power supply to the program.
3. Program status and execution errors.

Please refer to the XP Power Serial Interface Specification for firmware commands, responses and error reports.

REMOTE MONITORING

The power supply can be monitored remotely by a computer while still in LOCAL control mode. The power supply can be queried by the computer to retrieve both analog and digital status monitors at any time. In order to remotely control the programs or HV enable, the corresponding front panel remote/local button must be switched to remote.

Serial Interface Command Protocol

CHARACTER SENT	ASCII CODE (Hexadecimal)	COMMENTS
SOH	1	Start of header (Ctrl-A)
<CR>	0D	Carriage return (Enter)
0	30	
1	31	
2	32	
3	33	
4	34	
5	35	
6	36	
7	37	
8	38	
9	39	
A	41	CAPITAL letters only!
B	42	
C	43	
D	44	
E	45	
F	46	
Q	51	
R	52	
S	53	
V	56	

Table 3. Relevant ASCII Codes

NOTE: The power supply has a communication timeout of 1.5 seconds built in for safety. When writing custom software, the program must send a data packet to the power supply in intervals of less than 1.5 seconds or the high voltage will turn off and the remote digital programs will be reset to zero. The recommended method is to send a "Query" command once per second to keep the remote monitors and status signals updated. The timeout can be disabled for debugging purposes via the Configure Command.

SIGNAL SUMMARY

The data interface receives and transmits digital data packets between the Customer computer and the XP Power HV power supply that represent the analog and digital signals defined below:

Analog Control Signals sent from Customer Computer to XP Power HV Power Supply:

1. Voltage Control (0 – FFF hex represents 0 – Vmax output)
2. Current Control (0 – FFF hex represents 0 – Imax output)

Internal to the power supply interface, the D/A converters have an analog output range of 0 to + 5 volts DC, where FFF hex represents full scale.

Digital Control Signals sent from Customer Computer to XP Power HV Power Supply:

1. HV On (0 = off, 1 = on)
2. HV Off (0 = on, 1 = off)
3. Power Supply Reset (1 – reset)

Programming a digital control bit to a "1" will generate an internal 250 millisecond pulse that will assert the desired function.

Analog Monitor Signals sent from XP Power HV Power Supply to Customer Computer:

1. Voltage Monitor (0 – 3FF hex represents 0 – Vmax output)
2. Current Monitor (0 – 3FF hex represents 0 – Imax output)

Internal to the power supply interface, the A/D converters have an analog input range of 0 to +5 volts DC, where 3FF hex represents full scale.

Digital Monitor Signals sent from XP Power HV Power Supply to Customer Computer:

1. Power Supply Fault (1 = fault) when available.
2. HV On Status (1 = on, 0= off) when available.
3. Control Mode Status (V mode = 1, I mode = 0) when available.

COMMAND STRUCTURE

The general operation of the data link is described in this section.

The Customer computer can send three possible commands to the XP Power HV power supply:

SET POWER SUPPLY (S) command

QUERY POWER SUPPLY (Q) command

SOFTWARE VERSION LEVEL REQUEST (V) command

A Set command contains a total of 18 bytes and instructs the power supply to change any or all of its control signals. The power supply will execute the Set command and respond with a simple 2 byte **ACKNOWLEDGE (A)** packet, or, if errors are detected, the power supply will not execute the Set command but will return a 5 byte **ERROR (E)** packet.

A Query command contains a total of 5 bytes, and is used to request that the power supply return an information packet containing the analog and digital information that it monitors. The power supply responds by sending back a 16 byte **RESPONSE (R)** packet.

In response to a 5 byte Version Request command, the power supply will return a 6 byte **SOFTWARE VERSION LEVEL RESPONSE (B)** packet to the computer.

For all these commands, if communication errors or illegal conditions are detected by the power supply, the command will not be executed and the appropriate 5 byte **ERROR (E)** packet will be sent back to the computer.

SET COMMAND ("S") AND ACKNOWLEDGE ("A") RESPONSE

Prior to sending a Set Command that performs any function other than a Power Supply Reset, the computer should ensure that no fault conditions are existing within the power supply. This is done by first sending a Query Command and examining the returned Response Packet.

Note that it is legal to send a Set Command that does not assert any of the three digital controls. For example, if the HV was on and it was desired to change one or more of the two analog controls, a command packet could be sent containing the new values for the analog controls but with the three digital control bits set to 0. In this case, the analog values will be changed and the HV will remain on.

If any of the analog monitor fault bits are active, the Set Command packet must include a Power Supply reset assertion.

The protocol for the Set Command is as follows:

The power supply receives the "S" command and performs a checksum comparison and other error checking. If a communication or other error is detected, the power supply will not execute the command but will send an error message back to the computer. If the checksum compares properly and no other errors exist, the power supply will execute the Set Command and return a simple 2 byte Acknowledge message. The computer should then Query the power supply to be sure that the power supply parameters are set as desired.

The data will be ASCII encoded, where scaling is done in the Customer computer. The resolution for the four analog controls is 12 bits, so full scale will be represented by FFF hex. The first byte "SOH", can be entered at the keyboard by the "CONTROL-A" key combination ("CTRL-A").

All alphabetical entries should use CAPITAL letters only. Use of lower case letters will result in errors.

The byte definitions of the command message are shown in Table 6. Note that high order bytes are sent first.

BYTE	DESCRIPTION
1	Start of message character ("SOH" character: hex 01)
2	Command Identifier Character (S character, hex 53)
3 - 5	Voltage command (0 – Vmax corresponds to 0 – FFF hex)
6 - 8	Current command (0 – Imax corresponds to 0 – FFF hex)
9 -14	Not implemented
15	Digital control data (HV On, HV Off, Power Supply Reset)
16 -17	Modulo 256 Checksum of all previous bytes except start character
18	End of message character (carriage return, hex 0D)

Table 4. SET Command Byte Contents

An example will illustrate how the ASCII data protocol is used. Assume that the Customer computer sends a command to the power supply that sets the analog power supply parameters to 55% Vmax, 25% Imax, and asserts the digital HV Off control.

The following 18 byte packet will be sent:

The first byte will contain the ASCII character SOH, which will be sent as 01 hex = 0000 0001 binary (enter CTRL-A at the computer keyboard).

Byte 2 is the Set Power Supply command identifier character S. In ASCII, this is 53 hex = 0101 0011 binary (enter capital S at the computer keyboard).

Bytes 3 through 5 represent the voltage, 55% of full scale. Full scale with 12 bit resolution is FFF hex. 55% is therefore represented as 8CC hex (within an error of 1 lsb). Bytes 3-5 will be sent containing the ASCII representation of 8CC hex (enter 8CC at the computer keyboard):

Byte 3:	38 hex = 0011 1000 binary
Byte 4:	43 hex = 0100 0011 binary
Byte 5:	43 hex = 0100 0011 binary

Bytes 6 through 8 represent the current, 25% of full scale. Full scale with 12 bit resolution if FFF hex. 25% is therefore represented as 3FF hex (within an error of 1 lsb). Bytes 6 – 8 will be sent containing the ASCII representation of 3FF hex (enter 3FF at the computer keyboard):

Byte 6:	33 hex = 0011 0011 binary
Byte 7:	46 hex = 0100 0110 binary
Byte 8:	46 hex = 0100 0110 binary

Bytes 9 through 14 are not implemented, and all are set to 30 hex = 0 decimal. Byte 15 represents the digital control data. The digital control byte is assigned as follows (only the least significant four bits are encoded into the ASCII byte):

Bit 0	HV Off (Off = 1)
Bit 1	HV On (On = 1)
Bit 2	Perform Reset (reset = 1). Sets V = 0, I = 0 & HV Enable = off,
Bit 3	Unused

The digital control nibble will therefore contain 0001 binary = 01 hex. The ASCII representation is (enter the number 1 at the computer keyboard):

Byte 15:	31 hex = 0011 0001 binary

The checksum is calculated on all bytes before it except the SOH character. Bytes 16 and 17 will therefore contain the remainder of a modulo 256 addition of bytes 2 through 15. In hex, these bytes are:

53 + 38 + 43 + 43+ 33 + 46 + 46 + 30 + 30 + 30 + 30 + 30 + 30 + 31 hex = 321 hex

Since modulo 256 decimal is modulo 100 hex, we can divide 321 hex by 100 hex. The remainder is 21 hex. Therefore 21 hex will be sent in bytes 16 and 17 in ASCII representation as 32 hex and 31 hex. Note that the actual implementation of the checksum by the data interface is very simple and requires no actual division. The data bytes are simply added up on an eight bit counter whose carry overflow is ignored. The result stored in the counter will be the checksum remainder (If entering the checksum directly from the computer keyboard, enter the numbers 2 and 1):

Byte 16:	32 hex = 0011 0010 binary
Byte 17:	31 hex = 0011 0001 binary

The last byte is the carriage return (press the “Enter” key on the computer keyboard), represented in ASCII as:

Byte 18:	0D hex = 0000 1101 binary

To summarize, the entire 18 ASCII character packet will be sent as follows, where the start character, SOH = Ctrl-A = 01 hex is the first byte sent and the carriage return = 0D hex is the last byte sent:

Byte Number:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Entered at the keyboard:

Ctrl-A	S	8	C	C	3	F	F	0	0	0	0	0	0	1	2	1	Enter

Sent in ASCII coded hexadecimal:

01	53	38	43	43	33	46	46	30	30	30	30	30	30	31	32	31	0D

(Note that the spaces between bytes are shown for clarity only and are not actually sent.)

The actual data is sent in serial binary format. Each 8-bit byte is framed with 1 start and 1 stop bit. No parity bits are being sent or received. Therefore this data packet is 180 bits long.

The data interface will receive this command and place it in a temporary memory area. Before executing the command, several checks are made. If an illegal condition is detected, the command will not be executed and an error message will be sent back to the computer. The conditions that are checked are described in the Error Responses section of this document.

If no errors are detected, the data interface will execute the command, and then send a 2 byte Acknowledge Packet back to the computer.

The format of the Acknowledge Packet is:

A <CR> where <CR> indicates the carriage return.

In ASCII coded hexadecimal:

41 0D

QUERY COMMAND ("Q")

The 5 byte command to request power supply status information is the Query ("Q") command.

The protocol for the Query command will be as follows:

The power supply will receive a Q command requesting information. If the command is properly received with no errors detected, the power supply will return the Response packet back to the computer. If errors are detected in the command, the power supply will return an appropriate error message.

The format of the command is:

SOH	Q	Check1	Check2	<CR>

Entered at the keyboard:

Ctrl-A	Q	5	1	Enter

Sent in ASCII coded hexadecimal:

01	51	35	31	0D

where the checksum, which does not include the SOH character, will always be hex 51, transmitted in two ASCII bytes representing 5 and 1.

RESPONSE PACKET ("R")

The 16 byte Response Packet will be returned to the computer in response to a valid Query command. It will contain status information in the following order:

BYTE #	DESCRIPTION
1	Response identifier character "R"
2-4	Voltage monitor (0 – Vmax) corresponds to (0 – 3FF) hex.
5-7	Current monitor (0 – Imax) corresponds to (0 – 3FF) Hex.
8-10	Reserved, Set to 0 decimal = 30 hex.
11-13	Digital monitors (12 bits encoded in three ASCII bytes)
14-15	Modulo 256 checksum of bytes 2 –13
16	End of message character (carriage return, hex 0D)

Table 5. Response Packet Byte Contents

Note that the analog monitors have 10 bit resolution, therefore, full scale is represented in hexadecimal as 3FF. The checksum is calculated on bytes 2 through 13.

The 12 digital monitor status bits are sent as three ASCII characters. The bit assignments are as follows:

Byte 11:
- Bit 0 Control Mode: Voltage Mode = 0, Current Mode = 1
- Bit 1 Power Supply Fault (1 = Fault)
- Bit 2 HV On Indicator (1 = on)
- Bit 3 Unused=

Byte 12:
- Bit 0 Unused=
- Bit 1 Unused=
- Bit 2 Unused =
- Bit 3 Unused =

Byte 13:
- Bit 0 Unused =
- Bit 1 Unused =
- Bit 2 Unused =
- Bit 3 Unused =

For example, a monitored voltage of Vmax will correspond to 3FF hex, sent with ACII encoding as follows:

Byte 2: 33 hex (00110011 binary)
Byte 3: 46 hex (01000110 binary)
Byte 4: 46 hex (01000110 binary)

If HV was On, and the Current Mode was set, the digital status bytes will be:

Byte 11: 35 hex (00110101 binary)
Byte 12: 30 hex (00110000 binary)
Byte 13: 30 hex (00110000 binary)

SOFTWARE VERSION REQUEST ("V") COMMAND AND RESPONSE ("B")

The 5 byte command to request the software revision level of the power supply's data interface is the "V" command.
The protocol for the V command will be as follows:

The power supply will receive a V command requesting information. If the command is properly received with no errors detected, the power supply will return the 6 byte Version Response (B) packet back to the computer. If errors are detected in the V command, the power supply will return an appropriate error message.

The format of the V command is:

SOH	V	Check1	Check2	<CR>

Entered at the keyboard:

Ctrl-A	V	5	6	Enter

Sent in ASCII coded hexadecimal:

01	56	35	36	0D

where the checksum, which does not include the SOH character, will always be hex 56, transmitted in two ASCII bytes representing 5 and 6.

The format of the 6 byte Response Packet (B) will be:

B	2 byte revision level	2 byte checksum	<CR>

For example, if a V command was properly received by a data interface with software revision level 25, the following packet will be returned to the computer:

B	25	2 byte Checksum	<CR>

Sent in ASCII coded hexadecimal:

42	32	35	36	37	0D

since the checksum of 32 hex + 35 hex is 67 hex which is transmitted in ASCII as two bytes containing 36 and 37 hex.

POWER SUPPLY CONFIGURE COMMAND ("C")

WARNING! The timeout should be disabled for software debugging purposes only. Use extreme caution when disabling the timeout. For the safety of the user, it is recommended to always re-enable the timeout once software debugging is complete.

The 6 byte command to enable/disable the communication timeout is the "C" command. The 1.5 second communication timeout is enabled at the factory by default. If the user disables the timeout feature, the power supply will continue to produce high voltage during a loss of communication. This setting is stored in the power supply and will be recalled at turn on. A proper command, with no errors will result in an Acknowledge Response ("A").

The timeout enable/disable is toggled via Byte 3. The bit assignments are as follows:
Byte 3:

Bit 0 0 = Timeout Enabled, 1 = Timeout disabled
Bit 1 unused
Bit 2 unused
Bit 3 unused

The format of the "C" command to disable the timeout is:

SOH	C	1	Check 1	Check 2	<CR>

Entered at the keyboard:

Ctrl-A	C	1	7	4	Enter

Sent in ASCII coded hexadecimal:

01	43	31	37	34	0D

where the checksum, which does not include the SOH character, will always be 74 to disable the time out.

The command to re-enable the timeout is:

Crtl-A	C	0	7	3	Enter

Sent in ASCII coded hexadecimal:

01	43	30	37	33	0D

where the checksum, which does not include the SOH character, will always be 73 to re-enable the timeout.

ERROR RESPONSES (E) AND ILLEGAL CONDITIONS

Error responses are messages sent back to the computer in response to a communication error detected on receipt of an S, Q, or V command or an illegal setting in an S command. The 5 byte error response packet takes the following form:

E 1 byte error code 2 byte checksum >CR>

The checksum is only calculated on the 1 byte error code. For example, for error 5, the error byte will be transmitted as 35 hex. The checksum of 35 hex is 35 hex which is transmitted in ASCII as two bytes containing 33 and 35 to represent the 3 digit and 5 digit, respectively.

Error Codes Are:

1. Undefined Command Code – the command character received was not an S, Q, or V. The power supply will send back this error message if the second character of the received command packet is not an S, Q, or V.

The error packet that will be returned to the computer will be:

Characters sent:	E	1	3	1	<CR>
In ASCII coded hexadecimal:	45	31	33	31	0D

2. Checksum Error – the transmitted checksum received in the command packet did not match the checksum calculated on the received bytes. The error packet that will be returned to the computer will be:

Characters sent:	E	2	3	2	<CR>
In ASCII coded hexadecimal:	45	32	33	32	0D

3. Extra Byte(s) Received – a byte other than the carriage return character was received in the last expected byte position of the command. The error packet that will be returned to the computer will be:

Characters sent:	E	3	3	3	<CR>
In ASCII coded hexadecimal:	45	33	33	33	0D

4. Illegal Digital Control Byte In Set Command – only one of the following three conditions can be set in the digital control byte of the Set command at any one time:

   HV On
   HV Off
   Power supply Reset

If the computer requests that the power supply set more than one of the above three conditions simultaneously, error 4 will be generated. The error packet that will be returned to the computer will be:

Characters sent:	E	4	3	4	<CR>
In ASCII coded hexadecimal:	45	34	33	34	0D

5. Illegal Set Command Received While a Fault is Active – if a fault is active at the time a Set command is received. The command must assert the Power Supply Reset line. If the computer attempts to turn HV On or HV Off, or to change only the analog control signals while a fault is active, the command will be rejected and error 5 will be generated. The error packet that will be returned to the computer will be:

Characters sent:	E	5	3	5	<CR>
In ASCII coded hexadecimal:	45	35	33	35	0D

6. Processing Error: Data received was valid, however an error was detected when executing the Command. The error packet that will be returned to the computer will be:

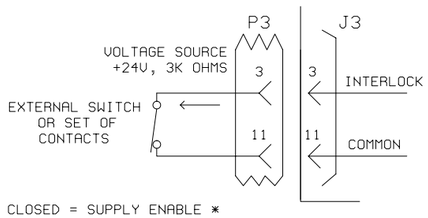
Characters sent:	E	6	3	6	<CR>
In ASCII coded hexadecimal:	45	36	33	36	0D

The fault signals that are checked are:

Power Supply Fault (when available)

REV	BY	DESCRIPTION	DATE	APPROVED
A	TJP	ECN 9803: WIRING CORRECTIONS	030712	KJD
B	JAG	ECN 11372: REMOVED (OPTIONAL)	072318	

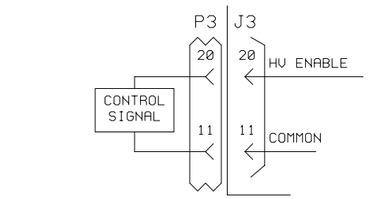
REMOTE INTERLOCK — FIGURE 1

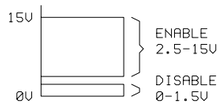


CLOSED = SUPPLY ENABLE *
OPEN = SUPPLY DISABLE

* (REFER TO INSTRUCTION MANUAL)

ANALOG HV ENABLE — FIGURE 2

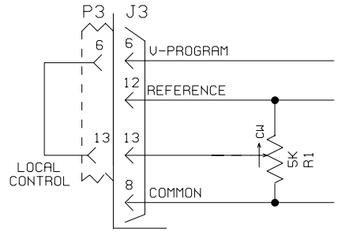




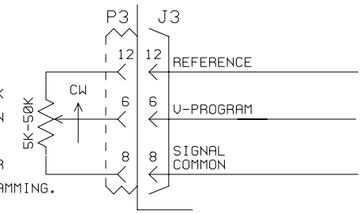
INPUT CHARACTERISTICS:
>20K OHMS @ 0-5VDC
1mA @ 15VDC

ANALOG VOLTAGE PROGRAMMING — FIGURE 3

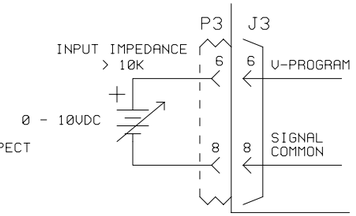
LOCAL ADJUSTABLE
VOLTAGE PROGRAMMING.



REMOTE VOLTAGE
PROGRAMMED BY
ATTACHING A 5K TO 50K
POTENTIOMETER BETWEEN
REFERENCE AND SIGNAL
COMMON WITH THE WIPER
ARM TO VOLTAGE PROGRAMMING.

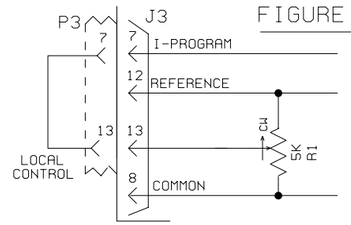


THE SUPPLY MAY BE
PROGRAMMED WITH
A REMOTE 0-10VDC
VOLTAGE WHICH IS
POSITIVE WITH RESPECT
TO SIGNAL COMMON.

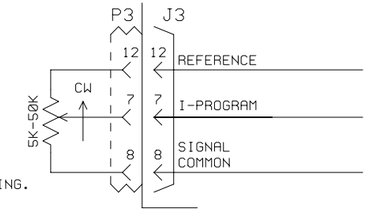


ANALOG CURRENT PROGRAMMING — FIGURE 4

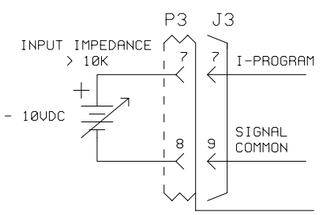
LOCAL ADJUSTABLE
CURRENT PROGRAMMING.



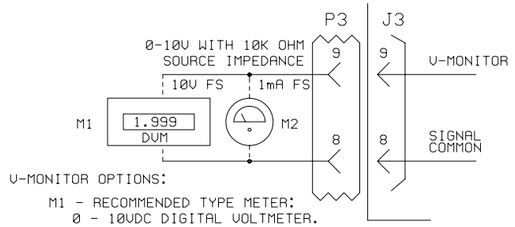
REMOTE CURRENT
PROGRAMMED BY
ATTACHING A 5K TO 50K
POTENTIOMETER BETWEEN
REFERENCE AND SIGNAL
COMMON WITH THE WIPER
ARM TO CURRENT PROGRAMMING.



THE SUPPLY MAY BE
PROGRAMMED WITH
A REMOTE 0-10VDC
VOLTAGE WHICH IS
POSITIVE WITH RESPECT
TO SIGNAL COMMON.



ANALOG VOLTAGE MONITOR — FIGURE 5

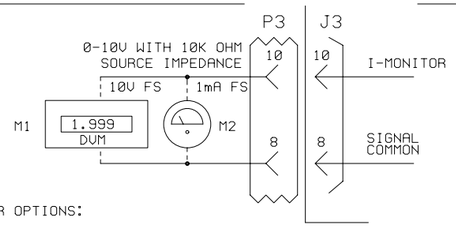


V-MONITOR OPTIONS:

M1 - RECOMMENDED TYPE METER:
0 - 10VDC DIGITAL VOLTMETER.
0 - 10V IS DIRECTLY PROPORTIONAL TO 0 - MAX KV RATING.

M2 - ALTERNATE TYPE METER:
0 - 1mA FULL SCALE CURRENT METER.
0 - 1mA IS DIRECTLY PROPORTIONAL TO 0 - MAX KV RATING.

ANALOG CURRENT MONITOR — FIGURE 6

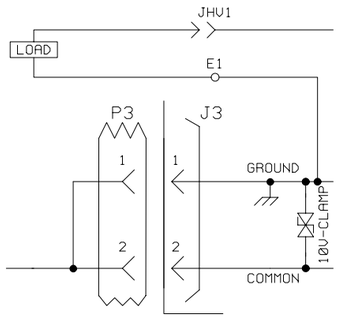


I-MONITOR OPTIONS:

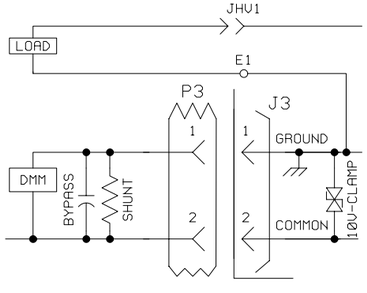
M1 - RECOMMENDED TYPE METER:
0 - 10VDC DIGITAL VOLTMETER.
0 - 10V IS DIRECTLY PROPORTIONAL TO 0 - MAX mA RATING.

M2 - ALTERNATE TYPE METER:
0 - 1mA FULL SCALE CURRENT METER.
0 - 1mA IS DIRECTLY PROPORTIONAL TO 0 - MAX mA RATING.

COMMON AND GROUND — FIGURE 7

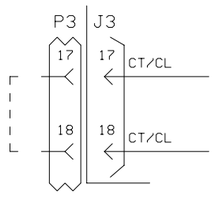


SYSTEM COMMON AND GROUND ARE NORMALLY TERMINATED TOGETHER. IN THIS CONFIGURATION, SIGNAL RETURNS AND LOAD RETURN CAN BE CONNECTED EITHER TO GROUND OR COMMON.



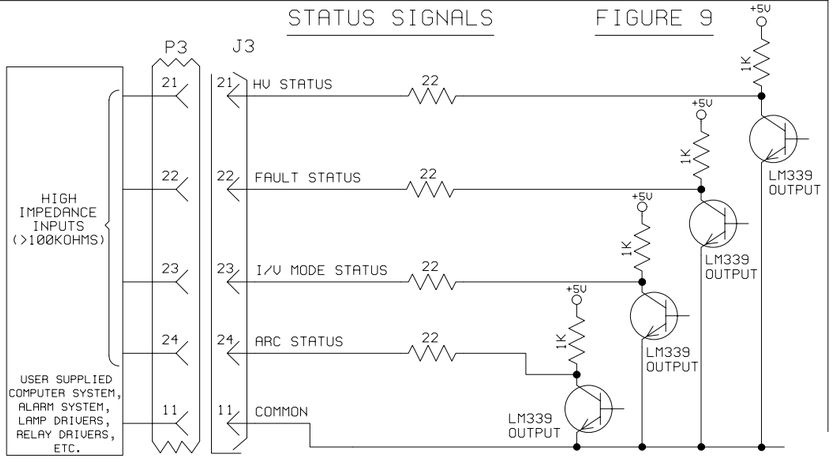
TO "FLOAT" COMMON FOR ISOLATION OR MEASUREMENT PURPOSES, REMOVE COMMON AND GROUND CONNECTION ON TB1. FOR THIS CONFIGURATION INSTRUMENT RETURNS MUST BE TIED TO COMMON, AND LOAD RETURN MUST BE CONNECTED TO GROUND. INSTRUMENT RETURNS MUST BE FLOATING WITH RESPECT TO GROUND. SINCE COMMON IS INTERNALLY CLAMPED TO GROUND WITH A BIDIRECTIONAL ZENER, THE DROP ACROSS THE SHUNT SHOULD BE < 5.0V.

CURRENT TRIP — FIGURE 8



JUMPER INSTALLED = CURRENT TRIP OPERATION
JUMPER REMOVED = CURRENT LIMIT OPERATION

STATUS SIGNALS — FIGURE 9



DIGITAL INTERFACE — FIGURE 10

REDUCED ONLY

W3 IS A NULL MODEM CABLE.
IF MULTIPLE CONNECTIONS ARE MADE THE PRIORITY IS:
USB TAKES PRIORITY OVER RS232.
ETHERNET (OPTIONAL) TAKES PRIORITY OVER BOTH
RS232 AND USB.

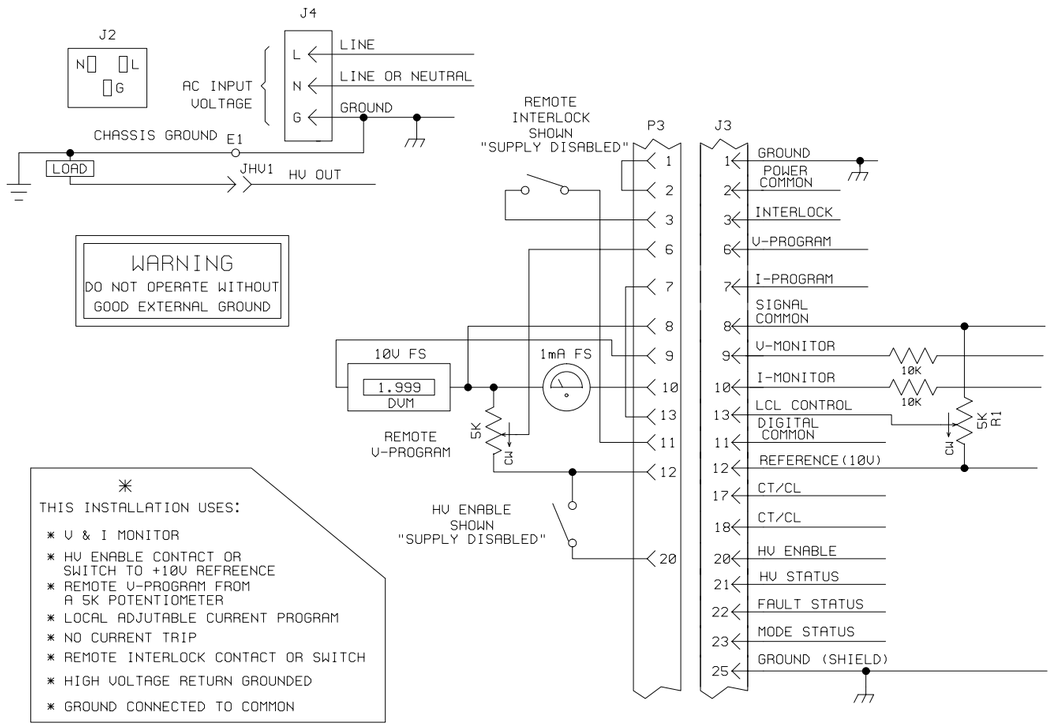
* CAT 5 ETHERNET CABLE IF CONNECTED TO A NETWORK, CROSSOVER CABLE IF CONNECTED DIRECTLY TO A COMPUTER.

FILE NO. EXTENSION	GLASSMAN HIGH VOLTAGE
\2003\13002B.SCH	124 WEST MAIN STREET, P.O. BOX 317, HIGH BRIDGE, NJ 08829-0317 (908) 638-3800 FAX (908) 638-3700
APPROVALS / DATE	TITLE: INTERFACE DIAGRAM MQ SERIES
DRAWN TJP 012610	
CHECKED SD 012610	D — DWG. NO. 200313-002 — REV. B
RELEASED	SCALE NONE — SHEET 1 OF 2

REV	BY	DESCRIPTION	DATE	APPROVED

A TYPICAL INSTALLATION WITH ANALOG INTERFACE *

FIGURE 11



WARNING
DO NOT OPERATE WITHOUT GOOD EXTERNAL GROUND

*

THIS INSTALLATION USES:

* V & I MONITOR
* HV ENABLE CONTACT OR SWITCH TO +10V REFREENCE
* REMOTE V-PROGRAM FROM A 5K POTENTIOMETER
* LOCAL ADJUTABLE CURRENT PROGRAM
* NO CURRENT TRIP
* REMOTE INTERLOCK CONTACT OR SWITCH
* HIGH VOLTAGE RETURN GROUNDED
* GROUND CONNECTED TO COMMON

MINIMUM NUMBER OF CONNECTIONS IN ORDER TO COMPLETELY ENABLE THE SUPPLY. *

FIGURE 12

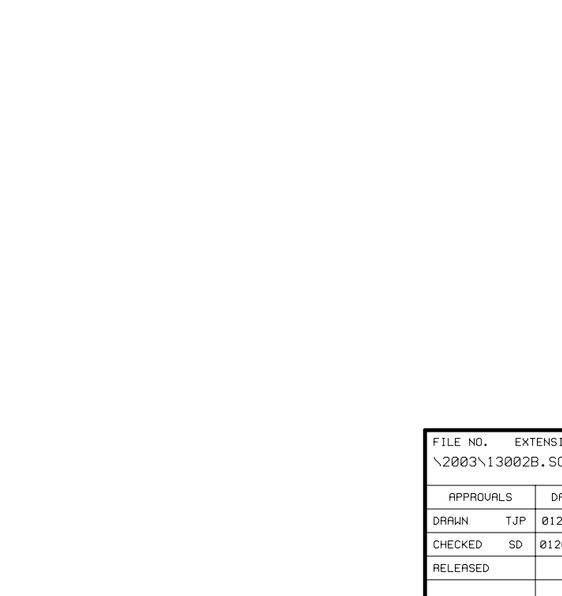
WARNING
DO NOT OPERATE WITHOUT GOOD EXTERNAL GROUND

MINIMUM CONNECTIONS:

* FIXED CURRENT PROGRAM AT MAXIMUM
* HV ENABLED BY +10V REFERENCE
* NO CURRENT TRIP
* LOCAL ADJUSTABLE VOLTAGE PROGRAM
* INTERLOCK ENABLED BY JUMPER TO COMMON
* HV RETURN GROUNDED

NOTE:

1. TERMINATE COMMON TO GROUND (J3-1 TO J3-2) UNLESS COMMON NEEDS TO "FLOAT" FOR ISOLATION OR METERING PURPOSES.
2. IN DIGITAL PROGRAM MODE GROUND-COMMON & INTERLOCK STILL FUNCTION AS DESCRIBED.

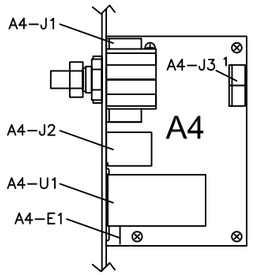


REDUCED ONLY

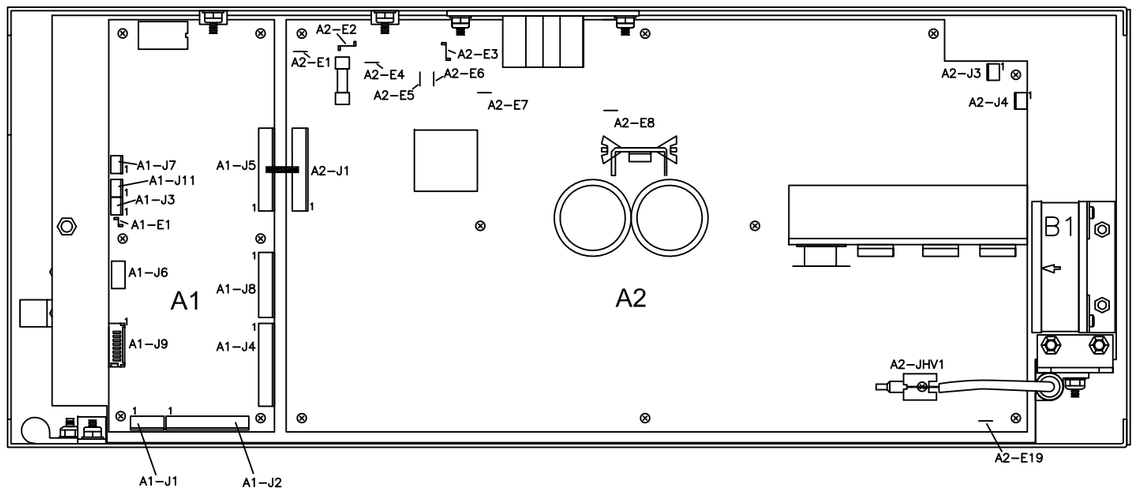
FILE NO. EXTENSION \2003\13002B.SCH	XP GLASSMAN HIGH VOLTAGE 124 WEST MAIN STREET, P.O. BOX 317, HIGH BRIDGE, NJ 08829-0317 (908) 638-3800 FAX (908) 638-3700
APPROVALS / DATE	TITLE: INTERFACE DIAGRAM MQ SERIES
DRAWN TJP 012610	
CHECKED SD 012610	D — DWG. NO. 200313-002 — REV. B
RELEASED	
	SCALE NONE — SHEET 2 OF 2

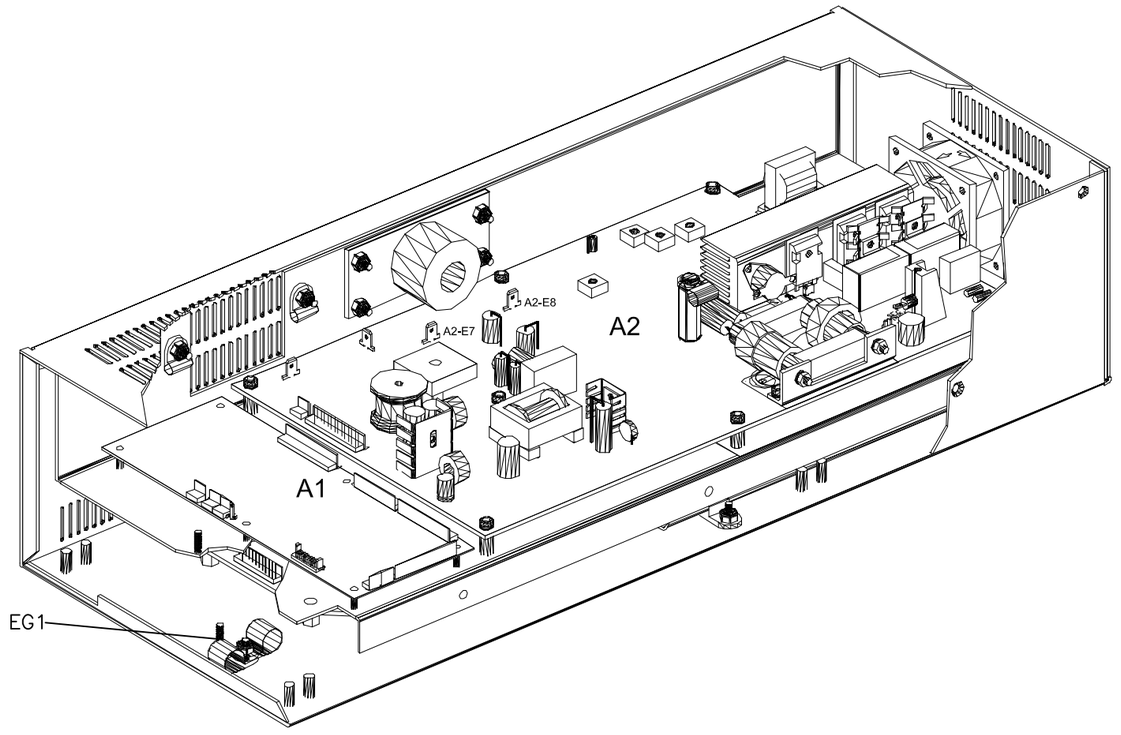
REV	BY	DESCRIPTION	DATE	APPROVED
A	EJM	ECN 9862: MISC. CORRECTIONS	051812	JMC
B	JAG	ECN 10520: ROTATED CABLE CLAMP	040715	JMC
C	JAG	ECN 10569: UPDATED WIRE VIEWS	060915	J.M.
D	JAG	ECN 11200: RELABELED BOTTOM VIEW.	092117	

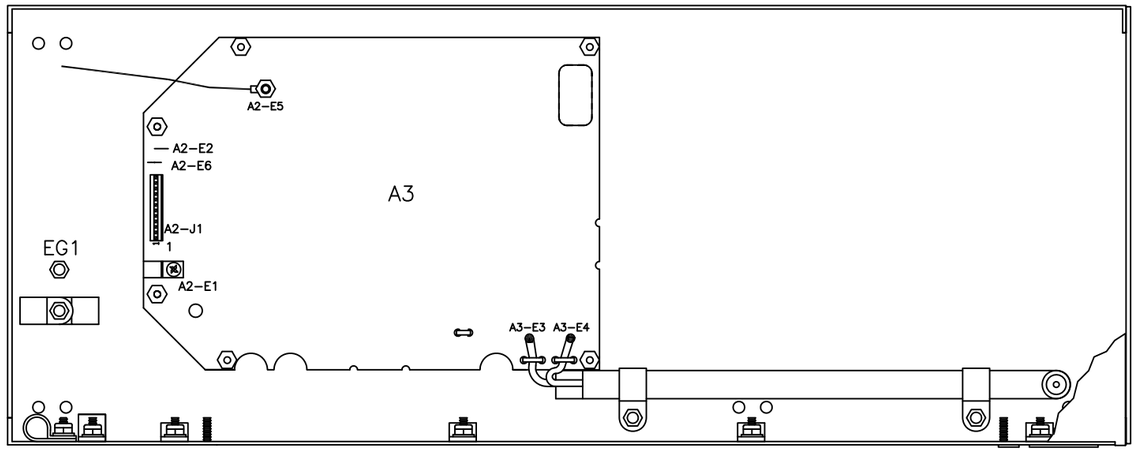
P/O AFP
(REFERENCE)



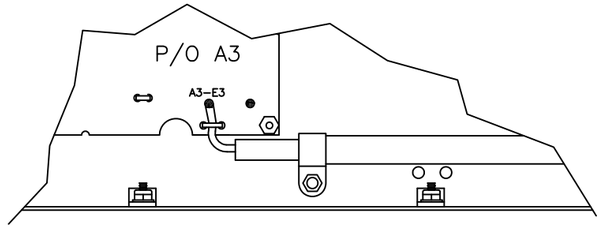
TOP VIEW







BOTTOM, VIEWED FROM TOP
1–3KV



BOTTOM, VIEWED FROM TOP
5KV

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE :
DEC. XXX ± XX ±
DEG. ±

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

FILE NO. EXTENSION
\2016\12007D.DWG

APPROVALS	DATE
DRAWN EJM	022112
CHECKED JMC	022112
RELEASED	

GLASSMAN HIGH VOLTAGE, INC.
P.O. BOX 317, HIGH BRIDGE, N.J. 08829
(908) 638–3800 FAX (908) 638–3700

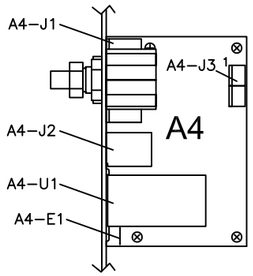
TITLE
PARTS PLACEMENT DRAWING
MQ SERIES 1–5KV

D DWG.NO. 201612–007 REV. D

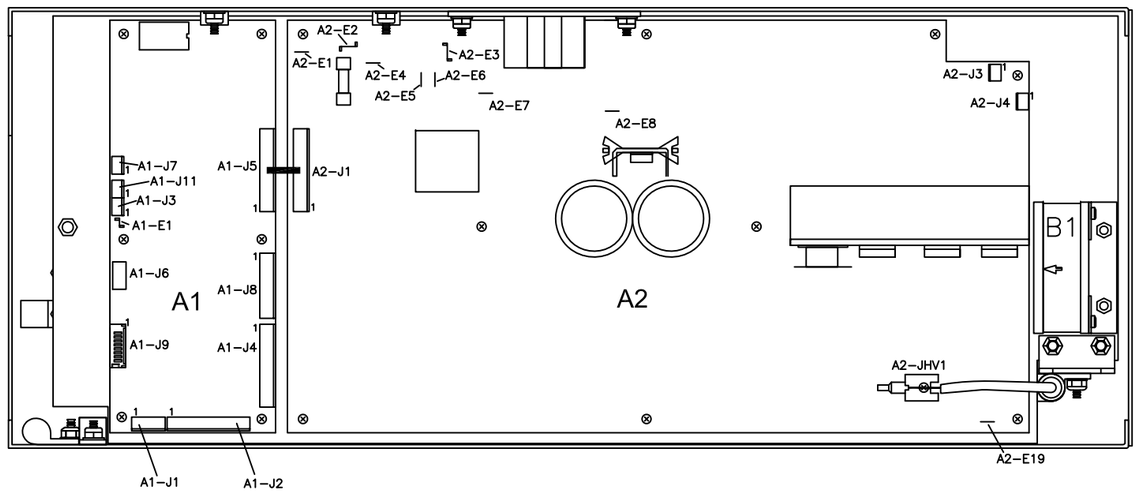
SCALE: NONE SHEET 1 OF 1

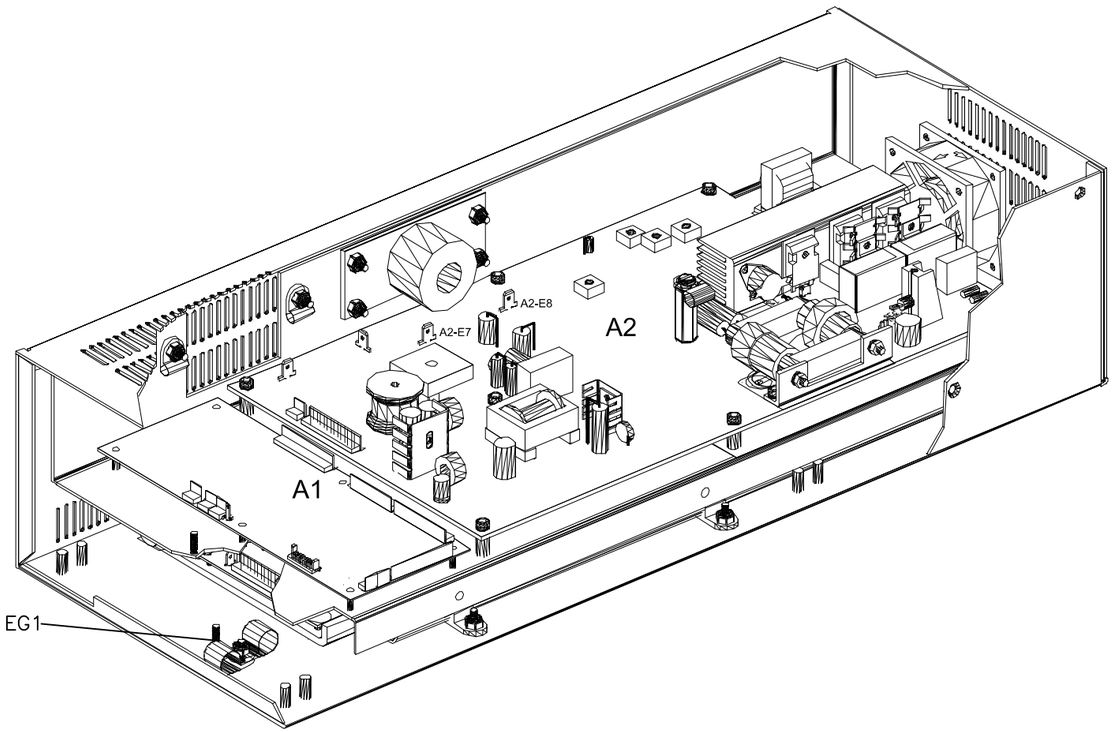
REV	BY	DESCRIPTION	DATE	APPROVED
A	JAG	ECN 10520: ROTATED CABLE CLAMP	040715	JMC
B	JAG	ECN 11200: RELABELED BOTTOM VIEW.	092117	

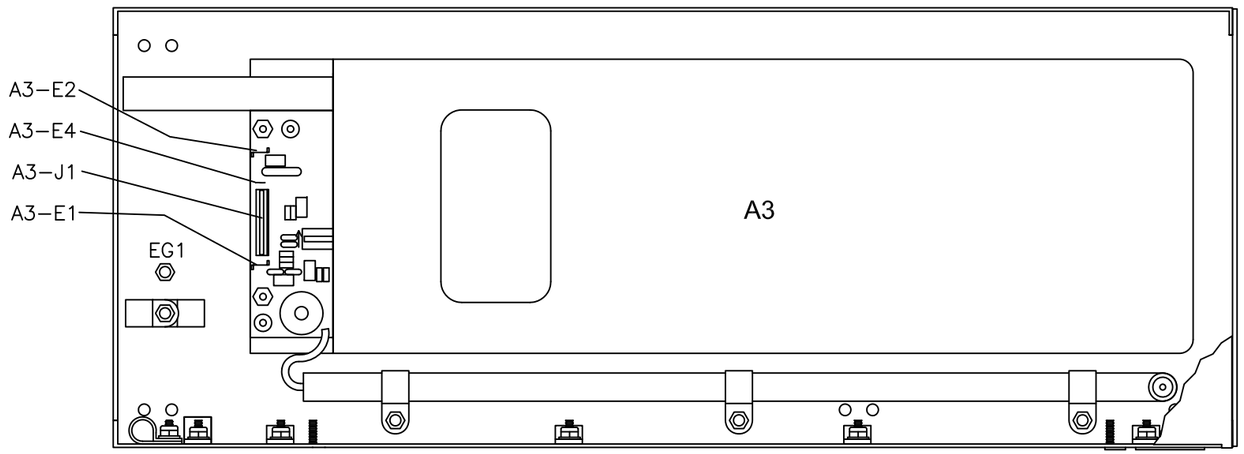
P/O AFP
(REFERENCE)



TOP VIEW



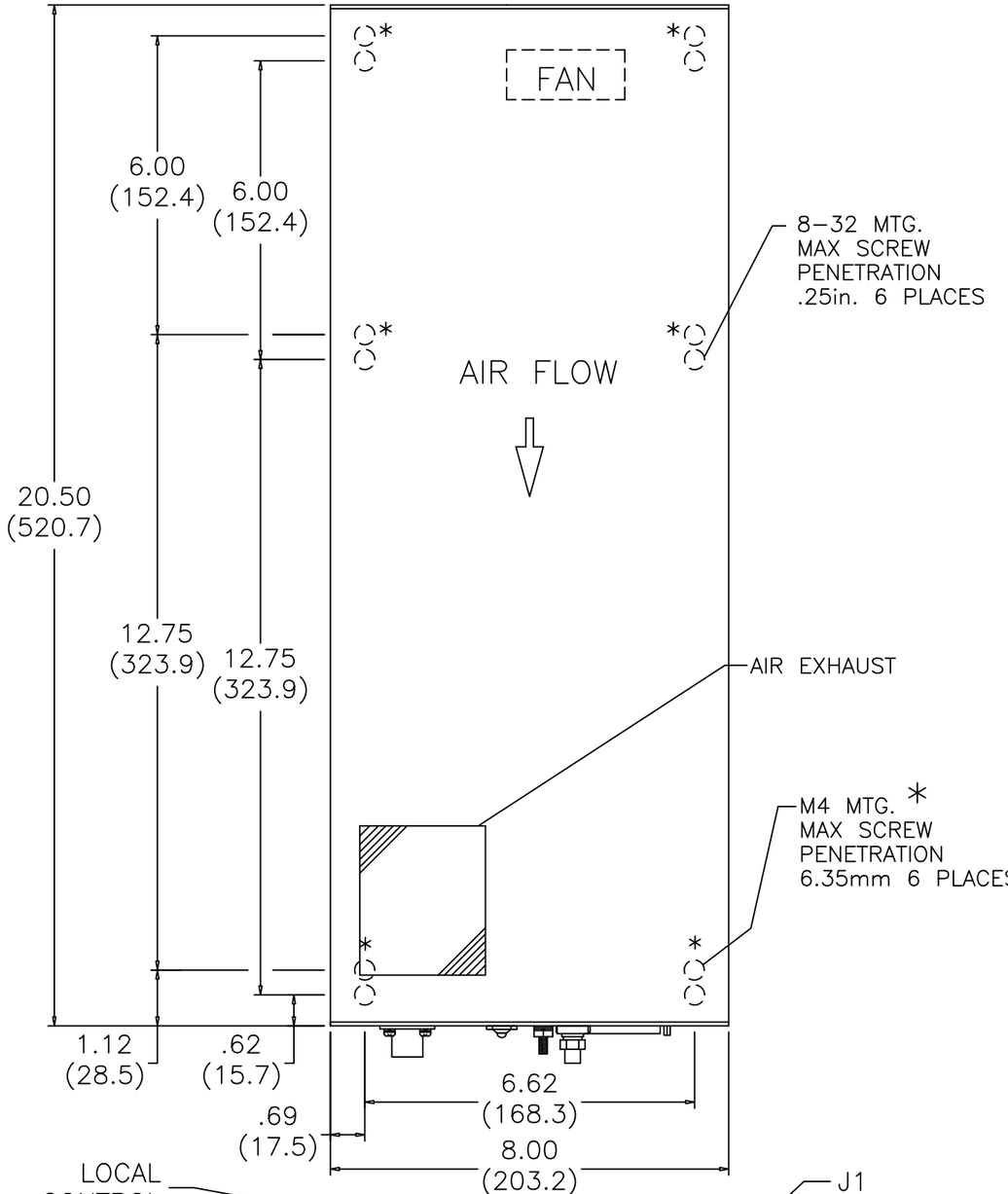


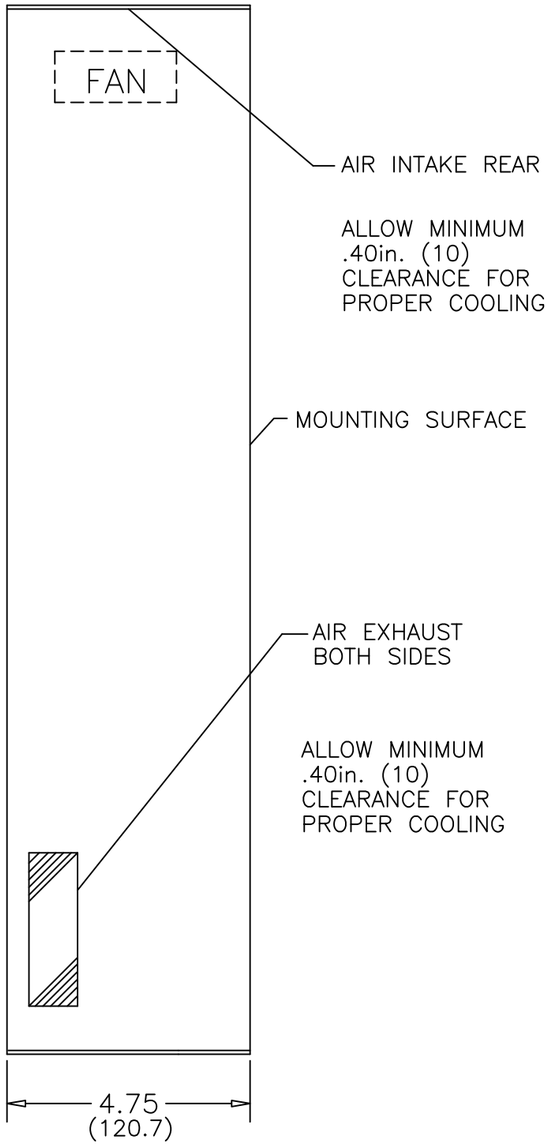


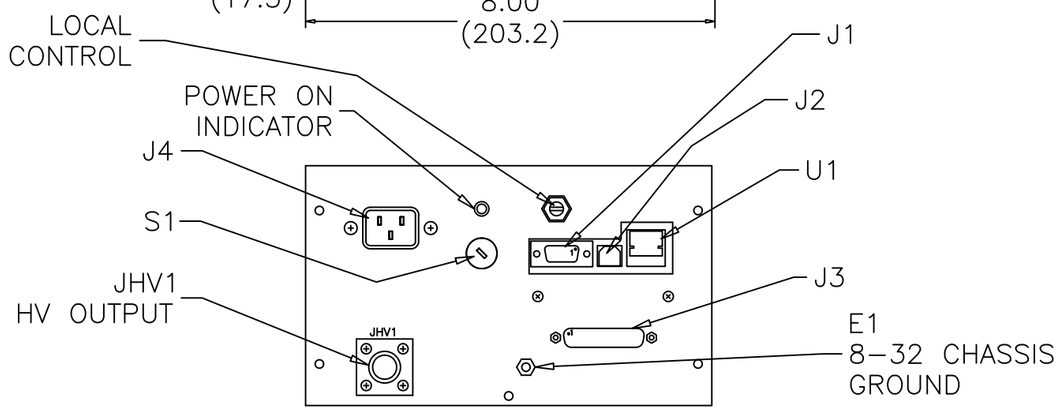
BOTTOM, VIEWED FROM TOP

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE : DEC. XXX ± XX ± DEG. ±	FILE NO. EXTENSION \2016\12006B.DWG	GLASSMAN HIGH VOLTAGE, INC. P.O. BOX 317, HIGH BRIDGE, N.J. 08829 (908) 638-3800 FAX (908) 638-3700
	APPROVALS / DATE	TITLE: PARTS PLACEMENT DRAWING MQ SERIES >/=6KV
	DRAWN EJM 022112	
	CHECKED JMC 022112	D DWG.NO. 201612-006 REV. B
THIRD ANGLE PROJECTION	RELEASED	
DO NOT SCALE DRAWING		SCALE: NONE SHEET 1 OF 1

REV	BY	DESCRIPTION	DATE	APPROVED
NR1	EJM	J2 & U1 LEGEND CORRECTIONS	020509	J.M.
NR2	EJM	J2 LEGEND CORRECTIONS	021009	KJD
A	EJM	ECN 9596: PROTOTYPE CHANGES	091010	JMC
B	EJM	ECN 10140: 6.62 DIM WAS 7.37	090413	JMC
C	TJP	ECN 11372: J3–24 WAS OPTIONAL	072418	







J1 LEGEND	
1	DCD
2	RX
3	TX
4	DTR
5	COMMON
6	DSR
7	RTS
8	CTS

J2 LEGEND	
1	+5V
2	D–
3	D+
4	COMMON

U1 OPTION LEGEND	
1	TXD+
2	TXD–
3	RXD+
4	E POWER+
5	E POWER+
6	RXD –
7	E POWER–
8	E POWER–

J3 LEGEND

1	GROUND	13	LOCAL CONTROL
2	COMMON	14	RESERVED
3	INTERLOCK	15	RESERVED
4	RESERVED	16	RESERVED
5	RESERVED	17	CT/CL
6	VOLTAGE PROGRAM	18	CT/CL
7	CURRENT PROGRAM	19	RESERVED
8	COMMON	20	HV ENABLE
9	VOLTAGE MONITOR	21	HV STATUS
10	CURRENT MONITOR	22	FAULT STATUS
11	COMMON	23	MODE STATUS
12	REFERENCE	24	ARC STATUS
		25	GROUND

J4: INPUT RECEPTACLE C14 PER: IEC 60320.

JHV1: HV OUTPUT
1–5KV KINGS SHV 1704–1 OR EQUIVALENT
6–60KV AMPHENOL 83–1R–RFX OR EQUIVALENT

S1: 115/230VAC SELECTOR

in
(mm)

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE :
DEC. XXX ± XX ±
DEG. ±

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

FILE NO. EXTENSION
\2016\14001C.DWG

APPROVALS	DATE
DRAWN EJM	011909
CHECKED SD	012009
RELEASED	

GLASSMAN HIGH VOLTAGE
124 West Main Street, PO Box 317, High Bridge, NJ 08829-0317
(908) 638-3800 Fax (908) 638-3700

TITLE
OUTLINE AND INSTALLATION
MQ SERIES

B | DWG.NO. 201614–001 | REV. C

SCALE NONE | SHEET 1 OF 1