INSTRUCTION MANUAL

OQ SERIES

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

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OQ OPEN STACK 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.

EMC Directive Addendum

For Model: LH and OQ, Open Stack

Your high voltage power supply has been designed and tested to ensure compliance with the European Community's EMC directives and the UK EMC regulations, when used as described in the instruction manual. However, in regards to the remote interface cables, the following precautions must be followed in order to ensure continued compliance with EMC radiated emissions & immunity requirements, as specified in the harmonized standard EN 61000-6-4 (CISPR 11 Class A) & EN 61000-6-2 (IEC 61000-4-3, 4-4, & 4-6) and the UK ELECTROMAGNETIC COMPATIBILITY REGULATIONS 2016, SI 2016 NO. 1091.
(Refer to installation drawings on Page 2 & 3.)

1. The remote Analog, TB Analog, Interlock, RS232 & USB interface cables must be of a shielded type with the shields and connector housings terminated at both ends to an adequate ground/common source. At the remote control assembly end, TB1 pin 1 provides a ground connection for the Analog (enable & program) interface cable shield. Pins 1 & 25 of J3 or its 25 pin "D" connector housing, provides a ground connection for the Analog interface cable shield. The shell of the 9 pin "D" connector housing J1, provides a ground connection for the RS232 interface cable shield, and the shell of the "USB" connector housing J2, provides a Common/Return connection for the "USB" connector interface cable shield.

2. At the driver chassis end, TB2 pin 1 provides a ground connection for the Interlock interface cable shield.

3. If the power supply is provided with the Ethernet Option installed, the Ethernet interface cable should be an enhanced category 5E or better, shielded UTP/LAN cable. This is connected to U1, the RJ45 connector of the power supply.

4. A ferrite suppressor must be placed at the driver chassis end of the Interlock interface cable & (W5) the Driver to Remote Control interface cable, and at the remote control assembly end of each interface cable. Over the jacket & shield for Analog, RS232, USB, Ethernet, and (W5) the Driver to Remote interface cable..

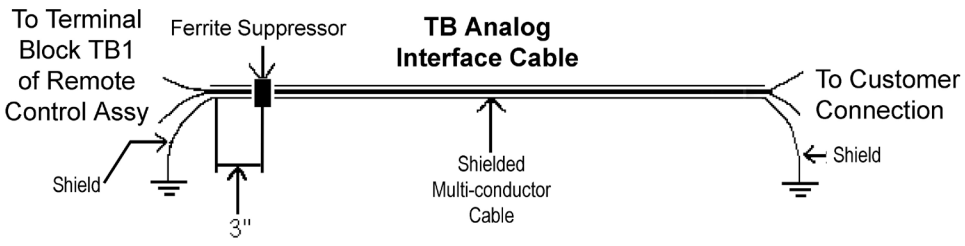
   These suppressors must be located within 3" of the terminations at the driver chassis or remote control assembly end of the cables (see drawings on sheets 2 & 3). The ferrite suppressors should each have the following properties:

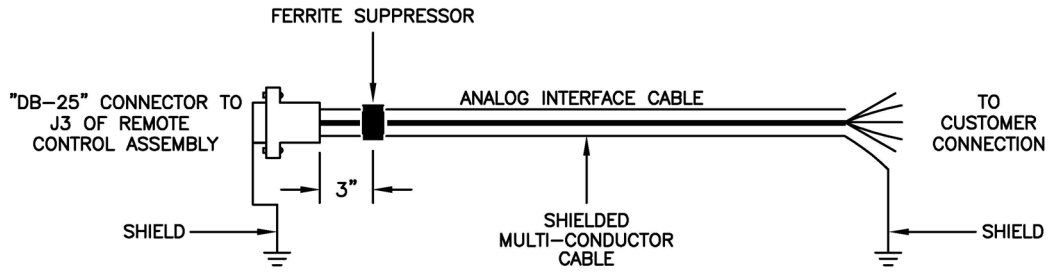
   A) Analog, TB Analog, RS232, USB, Ethernet, and (W5) on the remote control assembly - impedance should be greater than 200 ohms at 100 MHz.
   B) Interlock and (W5) on the driver chassis – impedance should be greater than 200 ohms at 100 MHz.

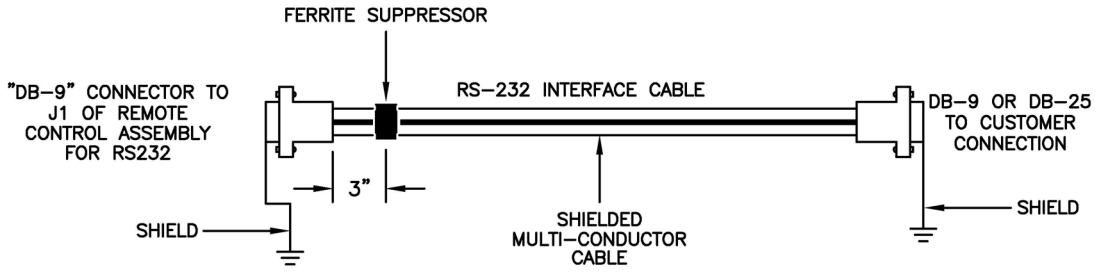
5. Any combination of Analogs, Interlock, RS232, USB, Ethernet, or (W5) connections made to the power supply will meet the EMC radiated emissions & immunity requirements specified above, when the recommended ferrites are used & installed as described.

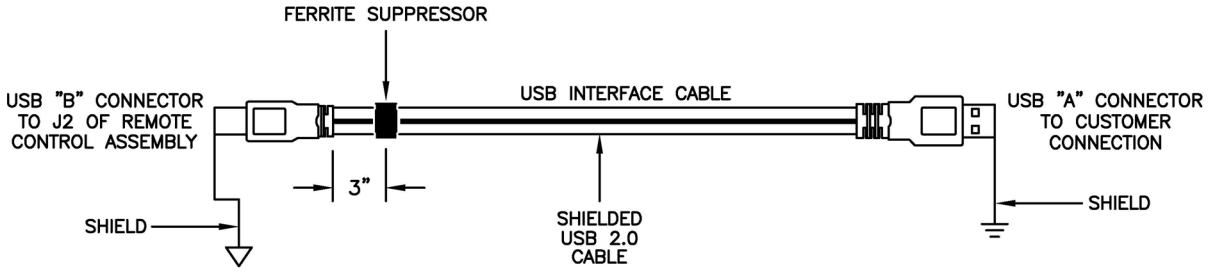
For your convenience, included with your power supply is a kit (SPK-CE-015) that contains the required ferrite suppressors.

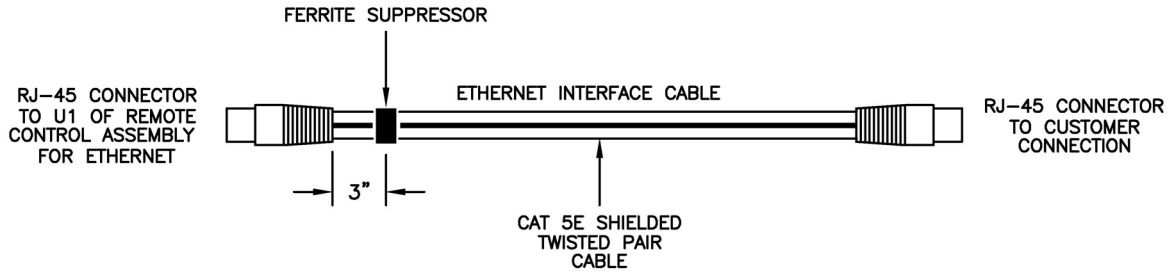
If your power supply is a modified standard, and contains any additional interface connectors, each additional interface cable must follow the same precautions as stated above.
Contact your XP Glassman High Voltage representative for further information.

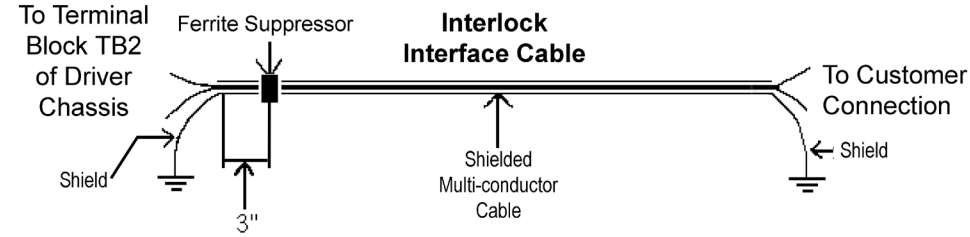

To Terminal Block TB1 of Remote Control Assy
Ferrite Suppressor
TB Analog Interface Cable
To Customer Connection
Shield
Shielded Multi-conductor Cable
Shield
3"

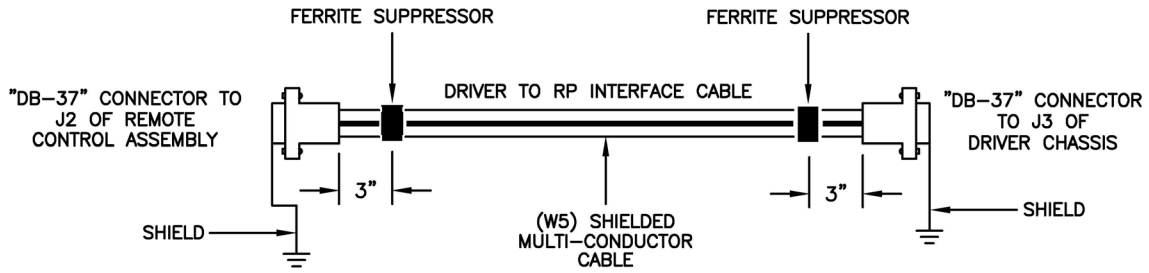

FERRITE SUPPRESSOR
"DB–25" CONNECTOR TO J3 OF REMOTE CONTROL ASSEMBLY
ANALOG INTERFACE CABLE
TO CUSTOMER CONNECTION
3"
SHIELD
SHIELDED MULTI–CONDUCTOR CABLE
SHIELD


FERRITE SUPPRESSOR
"DB–9" CONNECTOR TO J1 OF REMOTE CONTROL ASSEMBLY FOR RS232
RS–232 INTERFACE CABLE
DB–9 OR DB–25 TO CUSTOMER CONNECTION
3"
SHIELD
SHIELDED MULTI–CONDUCTOR CABLE
SHIELD


FERRITE SUPPRESSOR
USB "B" CONNECTOR TO J2 OF REMOTE CONTROL ASSEMBLY
USB INTERFACE CABLE
USB "A" CONNECTOR TO CUSTOMER CONNECTION
3"
SHIELD
SHIELDED USB 2.0 CABLE
SHIELD


FERRITE SUPPRESSOR
RJ–45 CONNECTOR TO U1 OF REMOTE CONTROL ASSEMBLY FOR ETHERNET
ETHERNET INTERFACE CABLE
RJ–45 CONNECTOR TO CUSTOMER CONNECTION
3"
CAT 5E SHIELDED TWISTED PAIR CABLE


To Terminal Block TB2 of Driver Chassis
Ferrite Suppressor
Interlock Interface Cable
To Customer Connection
Shield
Shielded Multi-conductor Cable
Shield
3"



Because of the requirements of the very high voltage that these supplies provide, the design precludes the incorporation of an enclosure around the HV stack. This could result in electrostatic radiation from the HV components at approximately 40 kHz. In order to ensure continued compliance with EMC radiated emissions requirements, the stack/driver assembly must be externally shielded by placing it within a shielded enclosure, area or building. However, since the HV output is exposed, enough distance must be maintained between the stack and the shielding to eliminate the possibility of corona or arc over.

Shielding may consist of a conductive or semi conductive material placed around the unit and connected to ground or may consist of similar material placed on the surrounding walls in which the unit is housed. The distance between the HV output and the surrounding shielding is recommended to be not less than the following:

200kV - 24” (610mm)
250kV - 31’ (787mm)
300kV - 38” (965mm)
350kV - 45” (1143mm)
400kV - 52” (1321mm)
450kV - 60” (1524mm)
500kV - 68” (1727mm)

If a cable is connected to the HVDC output terminal of the stack, that cable need not be contained in a shielded area since the signal at the cable is predominantly DC with a very small AC “ripple” voltage which will not produce significant radiated EMI.

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.

CAUTION. The power supply Driver is equipped with four handles, two front & two rear. The cabinet which contains the Driver is equipped with two handles, one on each side. Due to the weight of the unit, always lift or carry using a minimum of two handles. Because of potential overbalancing, the cabinet containing the driver should not be lifted or carried with the HV Open Stack Assembly mounted to it.

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
4	Driver to HV Stack HV AC Power Cables, (W1 & W2). Two short & two long per Driver/HV Stack Group.
2	Driver to HV Stack Interconnect Cable, (W3). One short & one long per Driver/HV Stack Group.
2	Driver to HV Stack Ground Cable, (W4). One short & one long per Driver/HV Stack Group.
1	Driver to Remote Control Interconnect Cable, (W5).
1	Driver to Remote Control Ground Cable, (W6).
1	Driver to Driver Fiber-Optic Cables, (W7). *(One pair per Slave Supply. Only on Master/Slave Systems)*
1	Driver to Driver Interconnect Cable, (W8). *(One per Slave Supply. Only on Master/Slave Systems).*
1	HV Stack to HV Stack Ground Cable, (W9) *(One per Slave Supply. Only on Master/Slave Systems).*
1	Subminiature "D" 15 pin male terminator connector. *(One per Master/Slave Systems only)*
2/4	Fiber-Optic Connector Caps. *(Two on each Master Driver, Four on each Slave Driver)*
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 4 minutes after disconnecting the AC mains power before removing any covers or panels.

Do not handle exposed high voltage terminations or attempt to make or remove any connections to the supply until load and/or supply has been fully discharged (grounded). An unloaded supply may take up to 5 minutes to discharge.

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

Use only a NRTL listed power cord with a separable mains plug of the proper voltage, rated greater that 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 fire hazard, use only fuses of the correct type, voltage rating, and current rating as specified.

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. Contact the factory if the HV STACK/DRIVER ASSEMBLY performance becomes compromised due to exposure from airborne containments.

User Serviceable Components

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

(For instructions on changing the polarity in reversible polarity models see POLARITY REVERSAL Section elsewhere in this manual).

CONNECTIONS AND CONTROLS

DRIVER REAR PANEL ELEMENTS

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

TB1 AC POWER INPUT

OQ units operate off 208 VAC +/-10%, 3 phase, (Delta or Wye connectable), 48-63Hz. (Unless ordered with 200V, 380V, 415V, or 480V options. See option spec control provided).

WARNING! The TB1-5 ground terminal should always be connected to the AC mains ground.

TB1 is an NRTL approved terminal block rated for 600V, 50 A & 105 Deg. C. The power cord provided by the user should be an NRTL approved, 4 or 5/C, 8AWG, 300VAC, 40 A, 90 Deg. C. **minimum rating**.
For 380VAC thru 480VAC options the power cord provided by the user should be an NRTL approved, 4 or 5/C, 10AWG, 500VAC, 25 A, 90 Deg. C. **minimum rating**.
The line cord wires should be connected as follows (See OUTLINE & INSTALLATION drawings):

TB1-1 Line 1 (Brown)
TB1-2 Line 2 (Black)
TB1-3 Line 3 (Grey)
TB1-4 Neutral (Blue)
TB1-5 Ground (Green/Yellow)

Colors indicated are for CE and UKCA compliant supplies.

Note: Master/Slave systems have one additional set of AC input terminals per Slave Driver chassis. A separate NRTL approved line cord must be provided for each module.

It is recommended that an NRTL approved Separable Plug be installed on each power cord to connect & disconnect from the Mains.

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

MAINS SERVICE MUST BE PROTECTED WITH FUSES OR CIRCUIT BREAKERS WITH A MAXIMUM RATING OF 125 A FOR 208 VAC MODELS AND 100 A FOR 380 THRU 480 VAC MODELS AND A MINIMUM INTERUPTING CAPACITY OF 5000 A.

For CE and UKCA compliant supplies used in Europe or the UK:
Multi-phase equipment is required to have a Safety Disconnect switch or circuit-breaker from the supply source. This should installed in the MAINS SERVICE connected to the unit and meet the following requirements:

- The switch or circuit breaker must meet the relevant requirements of IEC60947-1 & IEC60947-3.
- The switch or circuit breaker should be rated for the load requirements of the supply or supplies connected to it.
- The Disconnect must be in close proximity to the supply and within easy reach of the operator.
- It must be marked as the disconnecting device for the supply or supplies.

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, AC power is on. Do not apply or remove any connections to this unit until AC power is removed and the DC output has discharged.

The AC POWER ON indicator lamp will illuminate when power is present, the POWER BREAKER is in the ON / 1 position and the Remote Control Assembly Power Switch is on.

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 **must** also be used as the ground connection point from the High Voltage Stack Assembly (via W4) & the Remote Control Assembly (via W6). See SCHEMATICS, OUTLINE & INSTALLATION and SYSTEM INSTALLATION drawings.

J1 SIGNAL INTERFACE CONNECTOR

This connector and associated cable (W3) carry the current and voltage feedback, polarity, and interlock signals from the HV Stack Assembly to the Driver Assembly. See SCHEMATICS & OUTLINE & INSTALLATION drawings.

TB2 CUSTOMER INTERFACE TERMINAL STRIP

WARNING! Do not use TB2 connections for main earth ground, High Voltage Stack Assembly or Remote Control Assembly ground connections! E1 ground stud on the rear panel is provided for this purpose.

TB2-1 GROUND **TB2-2** INTERLOCK **TB2-3** INTERLOCK

(Explained in greater detail in REMOTE CONTROL AND MONITOR SIGNALS section).

JHV1 & JHV2 HVAC CONNECTORS

CAUTION
All HVAC interconnect cable plugs must be fully seated properly in JHV1 & JHV2 before applying power to the system. Faulty installation may damage the supply.

These connectors and wires (W1 & W2) deliver the high voltage AC power generated in the Driver Assembly to the High Voltage Stack Assembly. See SCHEMATICS & and SYSTEM INSTALLATION drawings.

J2 MASTER/SLAVE CONNECTOR (OPTION)

This connector provides the interface signals needed for parallel operation to J3 of the first Slave Driver chassis (only used on Master/Slave supplies). See the SCHEMATICS, OUTLINE & INSTALLATION and SYSTEM INSTALLATION drawings.

J3 CONNECTOR (OPTIONAL)

JF1, JF2 MASTER/SLAVE GATE TRIGGER CONNCTIONS (OPTION)

CAUTION
All fiber optic interconnect cables must be properly installed before applying power to the system. Faulty installation may damage the supply.

These connectors provide the fiber optic "Gate Drive" signals needed for parallel operation to JF3 & JF4 of the nearest downstream Slave Driver chassis (only used on

Master/Slave supplies). See the SCHEMATICS, OUTLINE & INSTALLATION and SYSTEM INSTALLATION drawings.

SLAVE DRIVER MODULES (MASTER/SLAVE SYSTEMS ONLY):

POWER ON INDICATOR

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

The AC POWER ON indicator lamp will illuminate when power is present, the MASTER & SLAVE POWER BREAKER is in the ON / 1 position and the Remote Control Assembly Power Switch is on.

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 Slave Driver Module and MUST be connected to E1 of the associated Slave High Voltage Stack Assembly (via W4). It is connected to earth ground via the W9 connection between Master & Slave High Voltage Stack Assemblies.
See the SCHEMATICS, MASTER/SLAVE SYSTEM INSTALLATION drawing and the MASTER/SLAVE WIRING DIAGRAM.

J1 SIGNAL INTERFACE CONNECTOR

This connector and cable (W3) carry the current and voltage feedback, polarity, and interlock signals from the Slave HV Stack Assembly to the Slave Driver Assembly.
See the SCHEMATICS, MASTER/SLAVE SYSTEM INSTALLATION drawing and the MASTER/SLAVE WIRING DIAGRAM.

TB2 CUSTOMER INTERFACE TERMINAL STRIP

***NOTE**: Operational connections to TB2 are only required on Stand-Alone & on Master units in a Master/Slave system.*

WARNING! Do not use TB2 connections for main earth ground, High Voltage Stack Assembly or Remote Control Assembly ground connections! E1 ground stud on the rear panel is provided for this purpose.

TB2-1 GROUND TB2-2 COMMON

(Explained in greater detail in REMOTE CONTROL AND MONITOR SIGNALS section)

JHV1 & JHV2 HVAC CONNECTORS

CAUTION
All HVAC interconnect cable plugs must be fully seated properly in JHV1 & JHV2 before applying power to the system. Faulty installation may damage the supply.

These connectors and wires (W1 & W2) deliver the high voltage AC power generated in the Master or Slave driver assembly to the corresponding Master or Slave High Voltage Stack Assembly. See the MASTER & SLAVE O & I, INSTALLATION and SYSTEM WIRING drawings.

J2 MASTER/SLAVE CONNECTOR (OPTION)

This connector provides the interface signals needed for parallel operation to J3 of the nearest downstream Slave Driver chassis. In the case of the last Slave Driver chassis, a terminator plug is installed on J2.

For a description of each of these signals and their application see the SCHEMATICS, MASTER & SLAVE O & I, INSTALLATION and SYSTEM WIRING drawings.

J3 MASTER/SLAVE CONNECTOR (OPTION)

This connector provides the interface signals needed for parallel operation from J2 of the Master Driver chassis or J2 of the nearest upstream Slave Driver chassis. For a description of each of these signals and their application see the SCHEMATICS, MASTER & SLAVE O & I, INSTALLATION and SYSTEM WIRING drawings.

JF1, JF2 **MASTER/SLAVE GATE TRIGGER CONNCTIONS**

CAUTION
All fiber optic interconnect cables must be properly installed before applying power to the system. Faulty installation may damage the supply.

These connectors provide the fiber optic "Gate Drive" signals needed for parallel operation to JF3 & JF4 of the nearest downstream Slave Driver chassis. In the case of the last Slave Driver chassis, protective caps are installed on JF1 & JF2. See the SCHEMATICS, MASTER & SLAVE O & I, INSTALLATION and SYSTEM WIRING drawings.

JF3, JF4 **MASTER/SLAVE GATE TRIGGER CONNCTIONS**

CAUTION
All fiber optic interconnect cables must be properly installed before applying power to the system. Faulty installation may damage the supply.

These connectors receive the fiber optic "Gate Drive" signals needed for parallel operation from JF1 & JF2 of the Master Driver chassis or the nearest upstream Slave Driver chassis. See the SCHEMATICS, MASTER & SLAVE O & I, INSTALLATION and SYSTEM WIRING drawings.

FRONT PANEL ELEMENTS

(Refer to the Outline & Installation, System Wiring & System Installation Drawings).

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

POWER BREAKER

Applies AC input power to the unit when in the on ON/1 position (as long as power is present at TB1). The Remote Control Assembly Power Switch functions as the power supply On/Off switch.

POWER ON INDICATOR

WARNING! When this lamp is illuminated, AC power is on.

The AC POWER ON indicator lamp will illuminate when power is present, the POWER BREAKER is in the ON / 1 position and the Remote Control Assembly Power Switch is on.

J3 REMOTE INTERFACE CONNECTOR

This connector and associated cable (W5), carry the low voltage control signals between the "Stand Alone" or Master Driver Assembly and the Remote Control Assembly.

SLAVE DRIVER MODULES (MASTER/SLAVE SUPPLIES ONLY):

POWER BREAKER

Applies AC input power to the Slave unit when in the on ON/1 position (as long as power is present at TB1). The Remote Control Assembly Power Switch functions as the power supply system On/Off switch.

POWER ON INDICATOR

WARNING! When this lamp is illuminated, AC power is on.

The AC POWER ON indicator lamp will illuminate when power is present, the POWER BREAKER on the Slave Driver is in the ON / 1 position and the Remote Control Assembly Power Switch is on.

CURRENT TEST POINT

A 0 to 10 V service test point for measuring the relative output current of a slave module.

VOLTAGE TEST POINT

A 0 to 10 V service test point for measuring the relative output voltage of a slave module.

WARNING! When system is powered down under light or no load conditions, the output may retain a charge even after power is removed. This charge may not show on the VOLTAGE TEST POINT. Discharge the output to ground or use an external meter to determine if output has discharged. Or, wait at least 5 minutes before making or removing any connections to the supply.

COMMON TEST POINT

The common return point for the instrument(s) measuring the VOLTAGE and/or CURRENT test points.

FAULT INDICATORS

BIAS INDICATOR

Normally not illuminated when the AC power is applied. Will light if any of the following conditions are present:

- An internal bias voltage is missing.
- Insufficient AC line voltage is present.
- An over-temperature condition has occurred.

FAN INDICATOR

Illuminates when one or more cooling fans are slow or inoperative.

TRACKING INDICATOR

This indicator will illuminate if the slave module is not tracking the master. The tracking circuit will latch and shutdown the supply if the condition persists for more than approximately 5 seconds. TRACKING shutdown can be reset by toggling the HV ENABLE or by AC power-down, either by the slave module POWER BREAKER, by disconnecting the supply from the AC mains or by toggling the POWER SWITCH on the Remote Control Assembly. It is normal for this indicator to momentarily illuminate during load or programming transients.

SYSTEM INDICATOR

Illuminates if the master and slave high voltage polarities do not match. (This applies only to reversible power supplies.)

REMOTE CONTROL ASSEMBLY REAR PANEL ELEMENTS

(Refer to the Outline & Installation, System Wiring & System Installation Drawings).

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

POWER ON INDICATOR

WARNING! When this lamp is illuminated, AC power is on.

The AC POWER ON indicator lamp will illuminate when power is present, the POWER BREAKER on the "Stand Alone" or Master Driver Assembly is in the ON/1 position and the Remote Control Assembly Power Switch is on.

E1 GROUND STUD

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

WARNING! Do not use this as the power supplies main ground terminal or the load return point.

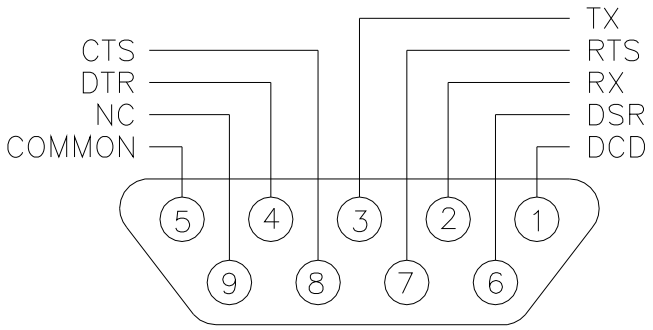
This is the main grounding terminal for the Remote Control Assembly and MUST be connected to a good earth ground. Connecting it back to E1 of the Stand Alone/Master Driver (via W6) is recommended.

J2 DRIVER INTERFACE CONNECTOR

This connector and associated cable (W5), carry the low voltage control signals between the "Stand Alone" or Master Driver Assembly and the Remote Control Assembly.

J1 RS232 INTERFACE CONNECTOR

This connector is a 9 pin DB9 female connector used to connect a serial computer interface. A null modem RS232 cable (approx. 3m/10ft) DB9 (male) to DB9 (female) is supplied for interconnection. See REMOTE CONTROL INTERFACE DIAGRAM figure 7, Table 1 & figure below.



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

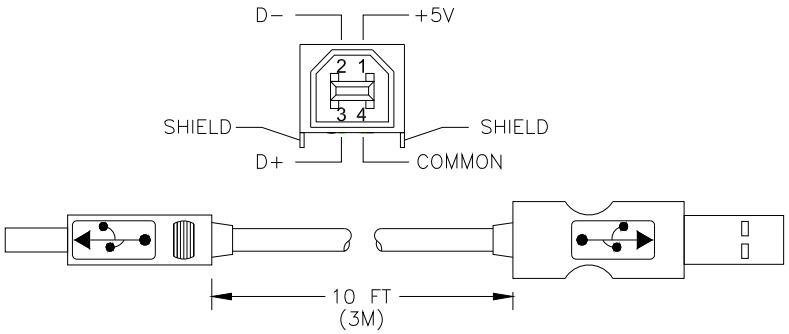
Table 1 DB-9 Pinouts

J3 ANALOG INTERFACE CONNECTOR

This connector provides inputs & outputs for the analog remote control & monitor functions. See REMOTE CONTROL INTERFACE DIAGRAM figures 1 thru 6 & 8 thru 10. *(Explained in greater detail in REMOTE CONTROL AND MONITOR SIGNALS section).*

J4 USB INTERFACE CONNECTOR

This serial link implements USB 2.1 communication protocol. A 3m (10ft) cable is supplied with the unit for this purpose. See REMOTE CONTROL INTERFACE DIAGRAM figure 7, Table 2 & figure below.

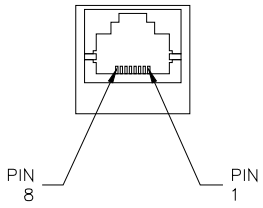


SIGNAL NAME	B PINOUT
VBUS	1
D-	2
D+	3
Ground	4

Table 2 USB B Pinouts

U1 ETHERNET INTERFACE CONNECTOR (OPTIONIONAL)

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. See REMOTE CONTROL INTERFACE DIAGRAM figure 7 & figure below.



ETHERNET CONNECTOR

S4 CT/CL SWITCH

Selects current trip or current limit operating modes. Normally, when the output current of the supply reaches the MILLIAMPERE CONTROL set point, a crossover occurs and the supply becomes a current, rather than voltage regulating supply. When S4 is set to the CT (current trip) position, an over current condition will disable the high voltage. The MILLIAMPERE CONTROL indicator will remain lit, and the unit will remain in a current trip condition until either the HIGH VOLTAGE OFF/RESET button is pressed, or the supply is reset by toggling the AC POWER switch off and on.
Note: UNITS SHIP WITH THE S4 SWITCH SET TO CL MODE.

TB1 CUSTOMER INTERFACE TERMINAL STRIP

Provides customer interface connections as follows:

TB1-1 GROUND	**TB1-7** DIG MA PROGRAM
TB1-2 COMMON	**TB1-8** MA PROGRAM
TB1-3 RESERVED	**TB1-9** LOCAL MA CONTROL
TB1-4 DIG KV PROGRAM	**TB1-10** DIG HV ENABLE
TB1-5 KV PROGRAM	**TB1-11** HV ENABLE
TB1-6 LOCAL KV CONTROL	**TB1-12** +10 V REFERENCE

(Explained in greater detail in REMOTE CONTROL AND MONITOR SIGNALS section).

REMOTE CONTROL ASSEMBLY FRONT PANEL ELEMENTS

(Refer to the Outline & Installation Drawing)

POWER SWITCH

Turns the supply on and off (1 = ON, 0 = OFF), only when the Master/Stand Alone POWER BREAKER on the Driver is in the ON / 1 position.

POWER INDICATOR

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

The AC POWER ON indicator lamp will illuminate when power is present, the POWER BREAKER on the Driver is in the ON / 1 position and the Remote Control Assembly Power Switch is on.

HIGH VOLTAGE ON PUSH BUTTON

WARNING! Enables the high voltage output when actuated. This push-button will NOT activate when one or more of the following conditions are present:

- The FAULT indicator is illuminated.
- There is an open interlock (INTERLOCK indicator is illuminated).
- Unit is in CURRENT TRIP mode

HIGH VOLTAGE OFF PUSH BUTTON

Turns off the high voltage output and resets the following latching faults:

- CURRENT TRIP (if enabled by rear panel switch. See S4 description for an explanation of CURRENT TRIP).
- ARC TRIP (if ARC TRIP option is factory installed).

HIGH VOLTAGE ON INDICATOR

Illuminates when the high voltage is enabled (if the INTERLOCK signal is closed).

WARNING! If this indicator is on and the HV ENABLE signal is present, the supply will generate high voltage.

If the INTERLOCK signal is opened, even temporarily, the high voltage will be disabled and the HIGH VOLTAGE ON indicator will extinguish. Once the interlock is closed, the HIGH VOLTAGE ON pushbutton must again be depressed to restart the supply.

INTERLOCK INDICATOR

Illuminates when an open is/was present in the customer interlock circuit. The high voltage output is disabled and cannot be enabled until the open interlock is corrected (closed) and the system is reset.

FAULT INDICATOR

Illuminates when one or more of the following fault conditions are present:

- One or more cooling fans are slow or inoperative.
- Insufficient AC line voltage is present.
- The power supply temperature is too high.
- An internal bias voltage is low or missing (circuit failure).
- There is a fault in the slave module or open master/slave interconnect cable. (Master/Slave systems only).

KILOVOLTS CONTROL

10-turn control provide a 0-10V signal for KILOVOLT programming. Clockwise rotation increases the output voltage regulation point. A 10- turn dial with brake is provided to secure the settings, if desired.

- 0.00 = 0.00kV
- 10.00 = Maximum rated output voltage.

KILOVOLT CONTROL INDICATOR

This indicator is located above the kV control. If the KILOVOLTS CONTROL indicator is illuminated, the supply is operating in voltage regulation mode with an output voltage determined by the KILOVOLTS CONTROL or remote V-PROGRAM signal.

KILIVOLT DIGITAL PANEL METER

Displays output voltage in kilovolts (unless otherwise specified).
Note: Meter is operational only when power is applied to the unit.

WARNING! When system is powered down under light or no load conditions, the output may retain a charge even after power is removed. This charge may not show on the kilovolt meter. Discharge the output to ground or use an external meter to determine if output has discharged. Or, wait at least 5 minutes before making or removing any connections to the supply.

MILLIAMPERE CONTROL

10-turn control provide a 0-10V signal for MILLIAMPERE programming. Clockwise rotation increases output current regulation or current trip point. A 10- turn dial with brake is provided to secure the settings, if desired.

- 0.00 = 0.00mA
- 10.00 = Maximum rated output current.

MILLIAMPERE CONTROL INDICATOR

This indicator is located above the mA control. If the MILLIAMPERE CONTROL indicator is illuminated, the supply is operating in current regulation mode with an output current determined by the MILLIAMPERE CONTROL or remote I-PROGRAM signal, or a current trip has occurred. (See S4 description for an explanation of CURRENT TRIP).

MILLIAMPERE DIGITAL PANEL METER

Displays output current in milliamperes (unless otherwise specified).
Note: Meter is operational only when power is applied to the unit.

POLARITY (POS & NEG) INDICATORS

Indicates the output polarity of the supply with respect to ground of the high voltage output.

HV STACK ASSEMBLY ELEMENTS

WARNING!
DO NOT HANDLE THE LOAD OR EXPOSED HIGH VOLTAGE TERMINATIONS OR ATTEMPT TO MAKE OR REMOVE ANY CONNECTIONS TO THE SUPPLY UNTIL AC POWER IS OFF AND THE LOAD AND/OR SUPPLY HAS BEEN DISCHARGED (GROUNDED). AN UNLOADED SUPPLY MAY TAKE UP TO 5 MINUTES TO FULLY DISCHARGE.

E1 GROUND STUD

WARNING! Do not attempt to operate unit without good earth ground connected to this point on the High Voltage Stack!

This is the main grounding terminal for the High Voltage Stack Assembly and MUST be connected (via W4) back to E1 of the Driver Module. E1 must also be used as the main connection point for the users load return.
(Applicable to "Stand Alone" & Master supplies). See SCHEMATICS, OUTLINE & INSTALLATION and SYSTEM INSTALLATION/WIRING drawings.

E2 HIGH VOLTAGE DC OUTPUT

Located on top of the HV Stack Assembly, this is the high voltage output terminal for the users load connection. See the SCHEMATICS, INSTALLATION and SYSTEM WIRING drawings.

JHV1 & JHV2 HVAC CONNECTORS

CAUTION
All HVAC interconnect cable plugs must be fully seated properly in JHV1 & JHV2 before applying power to the system. Faulty installation may damage the supply.

These connectors and wires (W1 & W2) deliver the high voltage AC power generated in the Driver Assembly to the HV Stack Assembly. See SCHEMATICS & and SYSTEM INSTALLATION drawings.

J1 SIGNAL INTERFACE CONNECTOR

This connector and associated cable (W3) carry the current and voltage feedback, polarity, and interlock signals from the HV Stack Assembly to the Driver Assembly. See SCHEMATICS & OUTLINE & INSTALLATION drawings.

J2 CONNECTOR (OPTIONAL)

This is an unused "Reserved" connector location.

W1, W2 & W3 OPEN STACK INTERCONNECT CABLES

An additional set of interface cables is provided for the open stack. Use of this longer set of cables facilitates operating the power supply with the HV Open Stack Assembly located safely away from the Driver chassis (e.g. for test purposes).

SLAVE HV STACK ASSEMBLY (MASTER/SLAVE SUPPLIES ONLY):

WARNING!
DO NOT HANDLE THE LOAD OR EXPOSED HIGH VOLTAGE TERMINATIONS OR ATTEMPT TO MAKE OR REMOVE ANY CONNECTIONS TO THE SUPPLY UNTIL AC POWER IS OFF AND THE LOAD AND/OR SUPPLY HAS BEEN DISCHARGED (GROUNDED). AN UNLOADED SUPPLY MAY TAKE UP TO 5 MINUTES TO FULLY DISCHARGE.

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 Slave HV Stack Assembly and MUST be connected to E1 of the associated Slave Driver (via W4). It must also be connected (via W9) to E1 of the Master HV Stack Assembly & or the closest "Upstream" Slave HV Stack Assembly. See the SCHEMATICS, MASTER/SLAVE SYSTEM INSTALLATION drawing and the MASTER/SLAVE WIRING DIAGRAM.

E2 HIGH VOLTAGE DC OUTPUT

Located on top of the Slave HV Stack Assembly, this is the high voltage output terminal for the users load connection. See the SCHEMATICS, MASTER/SLAVE SYSTEM INSTALLATION drawing and the MASTER/SLAVE WIRING DIAGRAM.

JHV1 & JHV2 HVAC CONNECTORS

CAUTION
All HVAC interconnect cable plugs must be fully seated properly in JHV1 & JHV2 before applying power to the system. Faulty installation may damage the supply.

These connectors and wires (W1 & W2) deliver the high voltage AC power generated in the Slave Driver Assembly to the associated Slave HV Stack Assembly. See the SCHEMATICS, MASTER/SLAVE SYSTEM INSTALLATION drawing and the MASTER/SLAVE WIRING DIAGRAM.

J1 SIGNAL INTERFACE CONNECTOR

This connector and associated cable (W3) carry the current and voltage feedback, polarity, and interlock signals from the Slave HV Stack Assembly to the associated Slave Driver Assembly. See the SCHEMATICS, MASTER/SLAVE SYSTEM INSTALLATION drawing and the MASTER/SLAVE WIRING DIAGRAM.

J2 CONNECTOR (OPTIONAL)

This is an unused “Reserved” connector location.

W1, W2 & W3 OPEN STACK INTERCONNECT CABLES

An additional set of interface cables is provided for the open stack. Use of this longer set of cables facilitates operating the power supply with the HV Open Stack Assembly located safely away from the Driver chassis (e.g. for test purposes).

INSTALLATION AND OPERATION

This unit is a component type of power supply, and as such, is designed for permanent mounting within equipment that will provide adequate fire and shock protection. This supply might in some cases be used for "TEST" operations with the HV Open Stack Assembly(s) located safely away from the Driver chassis.

WARNING!
If configured as a "TEST" operation supply, all user controls & monitoring should continue to be accessed via the Remote Control Assembly which MUST be located a safe distance from the HV Open Stack Assembly(s)**. Using the extra set of longer interconnect cables, the HV Open Stack Assembly**(s) **must also be positioned a safe distance from the Driver Assembly**(s)**. Safety precautions should be taken during the installation to prevent the connections on the Driver rear panel**(s) **from becoming "Operator Accessible" when power is applied. ALL HV Open Stack connections & ANY part of the HV Open Stack Assembly**(s) **or the users load must be located a safe distance from the "Operator"!**

Refer to the OUTLINE AND INSTALLATION, OUTLINE & SYSTEM WIRING DIAGRAM and SYSTEM INSTALLATION drawings located in Section III for assembly instructions as well as mechanical mounting specifications and dimensions.

CAUTION
This power supply Driver is equipped with four handles, two front & two rear. The cabinet which contains the Driver is equipped with two handles, one on each side. Due to the weight of the unit, always lift or carry using a minimum of two handles. Because of potential overbalancing, the cabinet containing the driver should not be lifted or carried with the HV Open Stack Assembly still mounted to it.

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

The High Voltage Stack/Driver Assembly should not be installed in a location where it would be prone to exposure by conductive dust or airborne containments.

WARNING!

NEVER ATTEMPT TO OPERATE THIS UNIT WITHOUT A GOOD EARTH GROUND CONNECTED TO THE DRIVER CHASSIS GROUND STUD E1 (E1 OF THE MASTER DRIVER CHASSIS ON MASTER/SLAVE SUPPLIES).

THE GROUND WIRE OF THE AC LINE CORD OR CORDS SHALL BE GROUNDED FROM THE MAINS AC GROUND TO TB1-5 GROUND (AND ON ALL TB1-5 GROUNDS FOR MASTER/SLAVE SUPPLIES).

PER EN61010-1 THE DISCONNECTING DEVICE MUST BE READILY IDENTIFIABLE AND EASILY REACHED BY THE USER. THE EXTERNAL SAFETY DISCONECT (CIRCUIT BREAKER OR SWITCH) INSTALLED BY THE USER, IS THE POWER SUPPLY DISCONNECTING DEVICE. TO DISCONNECT THE POWER SUPPLY FROM THE MAINS, THE CIRCUIT BREAKER OR SWITCH MUST BE TURNED OFF.

MAKE SURE THAT ALL INTERCONNECT CABLES AND GROUNDS ARE PROPERLY INSTALLED BETWEEN THE HV OPEN STACK ASSEMBLY AND DRIVER CHASSIS & BETWEEN THE DRIVER CHASSIS AND REMOTE CONTROL ASSEMBLY. IF A MASTER/SLAVE SYSTEM, ALSO MAKE SURE ALL THE INTERCONNECTS AND GROUNDS ARE PROPERLY INSTALLED BETWEEN THE MASTER AND SLAVE SUPPLIES.

THE REMOTE CONTROL ASSEMBLY AND ALL REMOTE USER CONTROLS AND MONITORING MUST BE LOCATED A SAFE OPERATING DISTANCE FROM THE DRIVER/HV STACK ASSEMBLY(S). ALL PARTS OF THE DRIVER/HV STACK ASSEMBLY(S) AND THE USER LOAD CANNOT BE "OPERATOR ACCESSIBLE" WHEN IN OPERATION.

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 5 MINUTES TO FULLY DISCHARGE.

THE LOAD RETURN SHALL BE CONNECTED TO E1 OF THE HV STACK ASSEMBLY. FOR MASTER/SLAVE SUPPLIES, THE LOAD RETURN SHALL BE CONNECTED TO E1 (GROUND STUD) ON THE MASTER HV STACK ASSEMBLY.

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.

It is suggested that the operator become familiar with the operation of the unit under local control via the Remote Panel Assembly and then add the other remote functions as desired. Thus, the initial turn on sequence described below assumes that there are no signals applied to the customer interface connectors J3 & TB1 of the Remote Assembly and that the , I-PROGRAM, V-PROGRAM, and HV ENABLE jumpers on TB1 are installed for local operation (as shipped from the factory). The INTERLOCK jumper must be installed from TB2-2 to TB2-3 of the Driver/Master Driver chassis.

WARNING!
PLEASE VERIFY THE FOLLOWING:

1. That the AC power is disconnected from the unit, either by the disconnecting of an appropriate three phase plug/jack combination or, if the supply is wired directly to the mains, by setting the power breaker or safety switch to OFF.

2. That there are no signals applied to J3.

3. That a good earth ground is connected to the ground stud, E1, as described in the WARNING! statement above.

4. That all inter-chassis wires and cables have been installed in accordance with the schematic/interface drawings supplied.

5. That the Remote Control Assembly switches and controls are set as follows:

POWER ON Breaker(s)	Off / 0 (DRIVER ASSEMBLY)
POWER ON Switch	Off / 0 (REMOTE CONTROL ASSEMBLY)
KILOVOLT CONTROL	Counterclockwise
MILLIAMPERE/AMPERE CONTROL	As required for load, 1.00 = 10 % of rating 5.00 = 50 % of rating, etc.

6. That the rear Remote Control Assembly switches/jumpers are set as follows:

V-PROGRAM JUMPER	LOCAL (TB1-5 TO TB1-6)
I-PROGRAM JUMPER	LOCAL (TB1-8 TO TB1-9)
HV ENABLE JUMPER	LOCAL (TB1-11 TO TB1-12)
CURRENT SWITCH	LIMIT (up)

7. That the Driver/Master Driver rear panel jumper is set as follows:

INTERLOCK JUMPER	LOCAL (TB2-2 TO TB2-3)

ATTACH LOAD AS FOLLOWS (optional):

1. Connect the load return to the ground stud E1 on the HV Stack Assembly. (E1 of the Master HV Stack Assembly on Master/Slave supplies).
2. Connect the HV end of the load to the "push to insert" connector E2, located on the top toroid of the HV Open Stack Assembly(s).

WARNING!

NEVER ATTEMPT TO OPERATE THIS UNIT WITHOUT A GOOD EARTH GROUND CONNECTED TO THE DRIVER GROUND STUD E1, (E1 OF THE MASTER DRIVER CHASSIS ON MASTER/SLAVE SUPPLIES).

POWER UP SEQUENCE:

1. **CAUTION: Check the input voltage rating on the rear or side panel nameplate of the power supply and make certain that this is the rating of the available power source.**
2. Make appropriate line cord connections to the power source.
3. Set the Circuit Breaker on the Driver Assembly(s) to the ON/ 1 position.
4. Set the POWER switch on the Remote Control Assembly to the ON / 1 position. The following indicators should be illuminated:
    - POWER
    - KILOVOLT CONTROL
    - POS or NEG POLARITY

5. Activate the high voltage output by depressing HIGH VOLTAGE ON button. The HIGH VOLTAGE ON lamp will illuminate.

6. Rotate KILOVOLT CONTROL clockwise until the KILOVOLT digital panel meter indicates the desired voltage. If the MILLIAMPERE/AMPERE CONTROL indicator illuminates before the desired voltage is achieved, the supply has gone into constant current mode (current limit) and the setting of the MILLIAMPERE/AMPERE CONTROL will have to be increased to supply the required current to the load, at the desired kV level.

7. The high voltage can be turned off by depressing the HIGH VOLTAGE OFF push-button. The supply will go into the standby mode (HIGH VOLTAGE ON lamp off). The high voltage can also be turned off by shutting down the supply with the POWER switch. When the supply is again powered up, the unit will go into the standby mode.

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 5 MINUTES TO FULLY DISCHARGE.

REVERSE POLARITY SUPPLIES

Two separate HV Stack Assemblies - one for each polarity - are shipped with the power supply. A label affixed to each high voltage indicates its polarity. Connect the HV Stack Assembly(s) of the desired polarity as shown in the SYSTEM INSTALLATION drawing and OUTLINE & SYSTEM WIRING diagram.

REMOTE CONTROL AND MONITOR SIGNALS

***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 make or remove connections to any REMOTE CONTROL/MONITOR connector until AC power is off and the output has discharged.

DRIVER CHASSIS TB2 CONNECTIONS:
(Refer to Remote Control Interface and Master/Slave O&I drawings)

***NOTE**: Operational connections to TB2 are only required on Stand-Alone & on Master units in a Master/Slave system.*

WARNING! Do not use TB2 connections for main earth ground, High Voltage Stack Assembly or Remote Control Assembly ground connections! E1 ground stud on the rear panel is provided for this purpose.

TB2-1 GROUND

This is a ground connection which can be used to ground the shield of a shielded interlock cable if used. This terminal should not be used as the main connection to earth ground. Use the main ground terminal, "E1", for that purpose.

TB2-2 INTERLOCK RETURN

This terminal must be connected to INTERLOCK terminal TB2-3 on Stand Alone & Master units for the high voltage to be enabled.

TB2-3 INTERLOCK

This INTERLOCK terminal is provided only on the Stand Alone unit and Master unit in a Master/Slave system and must be connected to INTERLOCK RETURN for the high voltage to be enabled. The supply is shipped with this terminal tied to the adjacent TB2-2 terminal by means of a terminal jumper. This jumper may be removed and a pair of wires may be installed in its place, which then may be connected to a switching device, such as a door interlock switch.

CAUTION: This terminal must not be connected to GROUND or COMMON.

When the unit is in the standby mode, an open circuit at the INTERLOCK terminal will cause the INTERLOCK lamp to light. The interlock circuit will not allow the high voltage to be activated by the front panel HIGH VOLTAGE ON button on the Remote Control Assembly. When the INTERLOCK terminal is again connected to COMMON, the system will revert back to the normal standby condition. If the high voltage is already enabled, an open circuit at the INTERLOCK terminal will disable the high voltage. Even if the open interlock is reconnected, the high voltage will remain off until a HIGH VOLTAGE ON command is received by the front panel HIGH VOLTAGE ON button on the Remote Control Assembly.

REMOTE CONTROL ASSEMBLY TB1 CONNECTIONS: (Refer to Remote Control Interface and O & I drawings)

WARNING! Do not use the TB1 ground connection as the power supplies main ground terminal, the load return point or as the ground connection between the Remote Control Assembly & the Driver.

TB1-1 GROUND

This is an instrumentation GROUND connection. This terminal should not be used for the main GROUND connection between the Remote Control Assembly and the Driver. Use E1 on the rear panel for that purpose.

TB1-2 COMMON

This is a signal COMMON and can be used for any signal or monitor returns.

TB1-3 RESERVED

This terminal is reserved for special options or expansion of features.

LOCAL/REMOTE PROGRAM SELECTION

TB1-4 DIG KV PROGRAM
TB1-5 KV PROGRAM
TB1-6 LCL KV CONTROL
TB1-7 DIG MA PROGRAM
TB1-8 MA PROGRAM
TB1-9 LCL MA CONTROL

Two terminal block jumpers are provided for selection of remote or local programming as follows:

TB1-4 to TB1-5	Output voltage is programmed by remote digital interface.
TB1-5 to TB1-6	Output voltage is programmed by front panel control.
TB1-7 to TB1-8	Output current is programmed by remote digital interface.
TB1-8 to TB1-9	Output current is programmed by front panel control.

To program output with an external analog signal, remove jumper(s) and apply signal directly to TB1-5 or J3-8 (voltage) or TB1-8 or J3-9 (current).

TB1-10 DIG HV ENABLE
TB1-11 HV ENABLE

The TB1-11 terminal is normally connected to TB1-12, + 10V to enable the supply locally. If remote HV ENABLE is desired, remove this jumper and apply a HV enable at TB1-11 or J3-1 enable supply. If remote DIGITAL HV ENABLE is desired, move jumper to TB1-10 and TB1-11.

TB1-12 +10 V REFERENCE

This output is an ultra-stable, positive 10 V reference that is normally connected to TB1-11 to enable the supply locally. Maximum current drain should be limited to 4 mA.

REMOTE CONTROL ASSEMBLY J3 CONNECTIONS: (Refer to Remote Control Interface and O & I drawings)

WARNING! Do not use J3 ground connections as the power supplies main ground terminal, the load return point or as the ground connection between the Remote Control Assembly & the Driver.

J3-10 SIGNAL COMMON
J3-14 SIGNAL COMMON

These pins are the analog programming and monitoring returns.

J3-5 COMMON
J3-15 COMMON

These signal commons are provided as a return for TTL HV ENABLE and if desired, a connection point to reference any of the following signals:

- PROGRAM RETURN
- MONITOR RETURN
- I/V MODE STATUS
- HV STATUS
- FAULT STATUS

J3-7 GROUND
J3-25 GROUND

These connections are for instrumentation grounding. These connections can be used to ground the shield of the CUSTOMER INTERFACE cable. These connections should NOT be used as the main connection to earth ground. Use the ground terminal, E1 of the Driver Chassis for that purpose.

J3-11 +10 V REFERENCE

This output is an ultra-stable, positive 10 V reference that is supplied for user programming applications. Maximum current drain should be limited to 4 mA.

J3-1 HV ENABLE

For this input to function, any jumper connection to TB1-11 must be removed. The HIGH VOLTAGE ON switch will not generate HV unless there is a "HIGH" (+2.5 V to +5 V) signal present at this connection.
(Since the input is clamped to a zener diode through a 10 k ohm impedance, any voltage from 5 to 15 V is acceptable for enabling this input.) A "LOW" (V = 0 to 2.0 V) or disconnect will turn the high voltage off. (This will also reset CURRENT TRIP if enabled.)

Unlike the front panel push-buttons, the signal applied to the HV ENABLE input must be a constant, not momentary signal. An example of how the HV ENABLE signal operates the high voltage follows:

1. AC power is applied to the supply with HV ENABLE "LOW". Supply is now in standby mode.

2. The HIGH VOLTAGE ON switch is actuated. The supply is no longer in standby, but the HV generation is inhibited by the HV ENABLE signal.

3. A "HIGH" signal is sent to the HV ENABLE input, turning on the high voltage.

4. Sometime later, with the supply set for current trip (Remote Control rear panel CURRENT switch S4 in TRIP position), an overcurrent occurs and the HV latches off. The supply is now in current trip mode as indicated by the illumination of the MILLIAMPERE/AMPERE CONTROL lamp.

5. The "HIGH" signal at the HV ENABLE input is brought "LOW", resetting the current trip circuit as indicated by the MILLIAMPERE/AMPERE CONTROL lamp extinguishing and the KILOVOLT CONTROL lamp illuminating. The HV remains off due to the HV ENABLE "LOW".

6. A high signal is again applied to the HV ENABLE input and the high voltage output returns.

J3-8 V PROGRAM

For this input to function, any jumper connection to TB1-5 must be removed. The front panel KILOVOLT CONTROL and digital KV control are then disabled. A 0 to +10 V signal with respect to COMMON at this input will program the output voltage proportionally from zero to full output. There are several ways to program this input:

- A user supplied 0 to +10 V signal (such as a D to A converter).
- A user supplied potentiometer (5 to 50 k ohms, 10 k nominal) can be connected between the +10 V REFERENCE and COMMON with the wiper connected to V PROGRAM.
- The V PROGRAM input may be jumpered to the +10 V REFERENCE (for a fixed output at the maximum voltage.) A resistor divider could also be used to program any fixed voltage.

J3-9 I PROGRAM

For this input to function, any jumper connection to TB1-8 must be removed. The front panel MILLIAMPERE CONTROL and digital MA control are then disabled. A 0 to +10 V signal with respect to COMMON at this input will program the output voltage proportionally from zero to full output. There are several ways to program this input.

- A user supplied 0 to + 10 V signal (such as a D to A converter).
- A user supplied potentiometer (5 TO 50 k ohms, 10 k nominal) can be connected between the +10 V REFERENCE and COMMON with the wiper connected to I PROGRAM.
- The I PROGRAM input may be jumpered to the +10 V REFERENCE for a fixed output at the maximum voltage. A resistor divider could also be used to program any fixed voltage.

J3-12 V MONITOR

This output is a 0 to 10 V signal, positive with respect to COMMON, and in direct proportion to the output voltage. A 10 k ohm limiting impedance protects the internal circuitry. Thus, the instrument monitoring this output should have an input impedance greater than 10 M ohms, otherwise, the accuracy of the measurement will be degraded. It is also acceptable to use a 1 mA full scale analog meter for monitoring purposes.

J3-13 I MONITOR

This output is a 0 to 10 V signal, positive with respect to COMMON, and in direct proportion to the output current. A 10 k ohm limiting impedance protects the internal circuitry. Thus, the instrument monitoring this output should have an input impedance greater than 10 M ohms, otherwise, the accuracy of the measurement will be degraded. It is also acceptable to use a 1 mA full scale analog meter for monitoring purposes.

STATUS MONITOR SIGNALS

J3-2 HV STATUS
J3-3 FAULT STATUS
J3-4 I/V MODE STATUS

CAUTION: Status monitor signals should only be measured using high input impedance circuits, >100k ohms. Connecting low impedance inputs may cause device failure or false indications on the front panel LEDs and remote digital signals.

Three status monitor signals are provided as defined in the table below:

TERMINAL	STATUS SIGNAL	LOGIC LOW	LOGIC HIGH
J3-2	HV STATUS	Approx. 0 VDC: Supply is not generating high voltage	Approx. 11 VDC: Supply is generating high voltage
J3-3	FAULT STATUS	Approx. 0 VDC: No FAULT is present	Approx. 11 VDC: A FAULT has occurred. (See FAULT indicator for list of conditions which cause a fault.)
J3-4	I/V MODE STATUS	Approx. 0 VDC: Supply is operating in CURRENT LIMIT or CURRENT TRIP mode (as determined by the rear panel CURRENT TRIP/LIMIT switch)	Approx. 11 VDC: Supply is operating in voltage regulation mode.

As an illustration of how FAULT STATUS and HV STATUS signals differ, consider the following scenario:

1. Initially, there is no AC power applied and all status signals are "LOW".
2. AC power is applied with a "HIGH" on the HV ENABLE (with HV ENABLE jumper set for remote operation). There is no change to the status signals (assuming there are no faults).
3. The HIGH VOLTAGE ON push-button is pressed, causing the generation of HV and the HV STATUS signal to go "HIGH".
4. Sometime later, a fan fails inside the unit causing a fault and shutting off the high voltage. The FAULT STATUS signal goes "HIGH" to indicate the presence of a fault and the HV STATUS signal goes "LOW" indicating the absence of HV at the output.
5. An attempt is made to restart the HV by depressing the HV on switch and toggling the HV ENABLE signal, but the fault prevents the HV from being enabled and there is no effect on the HV STATUS signal.
6. The supply is powered down and the defective fan is replaced.
7. AC power is applied with a "LOW" HV ENABLE signal. The FAULT STATUS signal is "LOW" because there is no longer a fan fault.
8. The HIGH VOLTAGE ON button is pressed causing the HIGH VOLTAGE ON lamp to illuminate. However, the HV STATUS signal does not go "HIGH" and no HV is generated because the HV ENABLE is still low.
9. Upon bringing the HV ENABLE signal "HIGH", HV is generated and the HV status signal goes "HIGH".

REMOTE DIGITAL INTERFACE

OQ Open Stack Computer Interface

This section describes the specific implementation of the XP Power High Voltage RS2323/USB/Ethernet Serial Data Interface for the OQ 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 remote monitoring and control capability of all analog and digital functions available for these power supplies, while providing 1000 V 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.

Note that the Interlock on TB2 of the Driver Chassis must be satisfied, the HV ON function must be operated by pressing the front panel HV ON button, and the Remote Panel TB1 jumpers must be set for digital control, before being able to control the unit with the digital interface.

SERIAL INTERFACE CONNECTIONS

(SEE FIGURE 7 ON INTERFACE DRAWING)

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

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:
J4 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:

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.

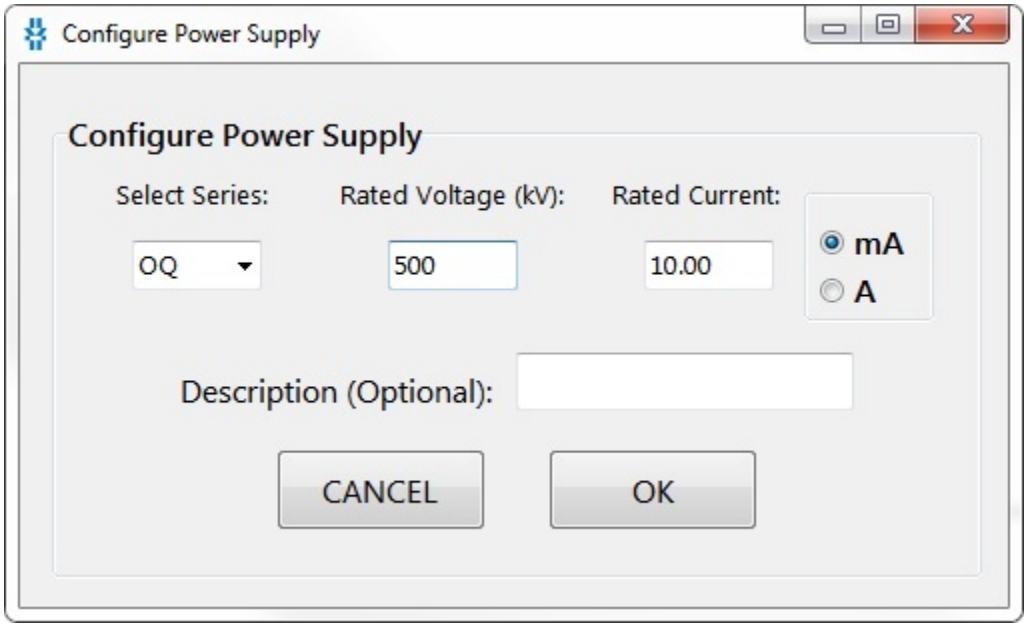
Note: In order to switch back to either RS232 or USB control, the above process must be repeated and GPIO pin 2 output must be de-asserted.

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 consist of a **main window**, **Configuration** and **About** menus.

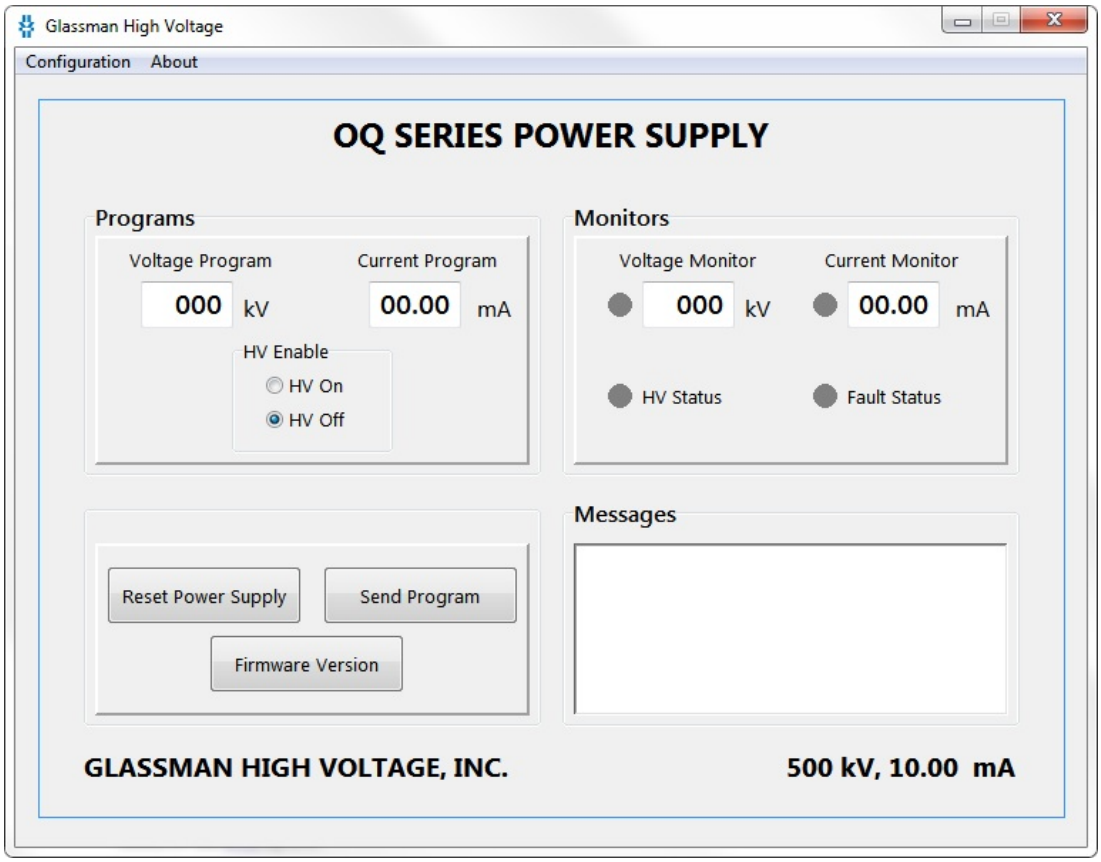


Configuration - Power Supply: On the initial run (or any run without XP.ini present in the directory with XP.exe), the Power Supply Configuration window will launch immediately. Choose the appropriate Series from the pull down menu or manually enter the Series letters if it is not in the list. Enter 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 within the downloaded software package, 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 5. 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 6. 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 7. 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

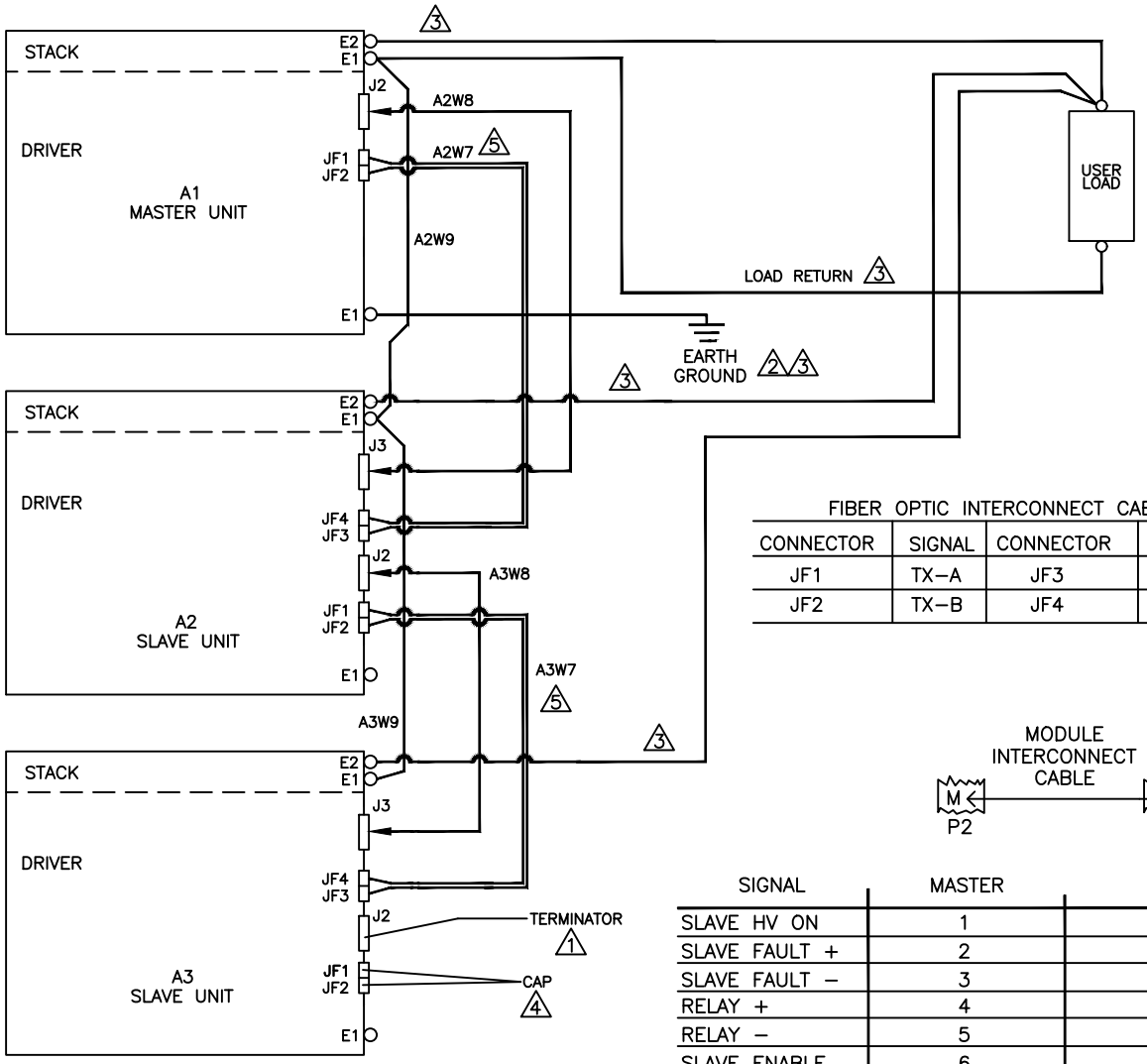
6. Processing Error: Data received was valid, however an error was detected when executing the Command. The error packet that will be returned to the computer will be:

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



FIBER OPTIC INTERCONNECT CABLE

CONNECTOR	SIGNAL	CONNECTOR	SIGNAL
JF1	TX–A	JF3	RX–A
JF2	TX–B	JF4	RX–B

SIGNAL	MASTER	SLAVE 1
SLAVE HV ON	1	1
SLAVE FAULT +	2	2
SLAVE FAULT –	3	3
RELAY +	4	4
RELAY –	5	5
SLAVE ENABLE	6	6
COMMON	7	7
POLARITY	8	8
RESERVED	9	9
V PROGRAM	11	11
IFB	12	12
I PROGRAM	13	13
SIGNAL COMMON	14	14
SHIELD GROUND	NC	15

NOTES:

1. TERMINATOR IS A MALE PLUG WITH PINS 2 AND 3 WIRED TOGETHER TO BE CONNECTED TO J2 OF THE LAST SLAVE UNIT (OR MASTER UNIT IF NO SLAVES ARE USED).
2. WARNING!! NEVER OPERATE THIS SYSTEM WITHOUT A GOOD EARTH GROUND CONNECTED AS SHOWN.
3. PROVIDED BY USER.
4. CAP JF1 AND JF2 (TX) ON LAST SLAVE (OR MASTER UNIT IF NO SLAVES ARE USED).
5. CAUTION FIBER OPTIC CABLES W7 MUST BE PROPERLY CONNECTED BEFORE APPLYING POWER TO THE SYSTEM.

FILE NO. EXTENSION	
\1000\78010-.DWG	
APPROVALS	DATE
DRAWN MM	080320
CHECKED KJD	082720
RELEASED	

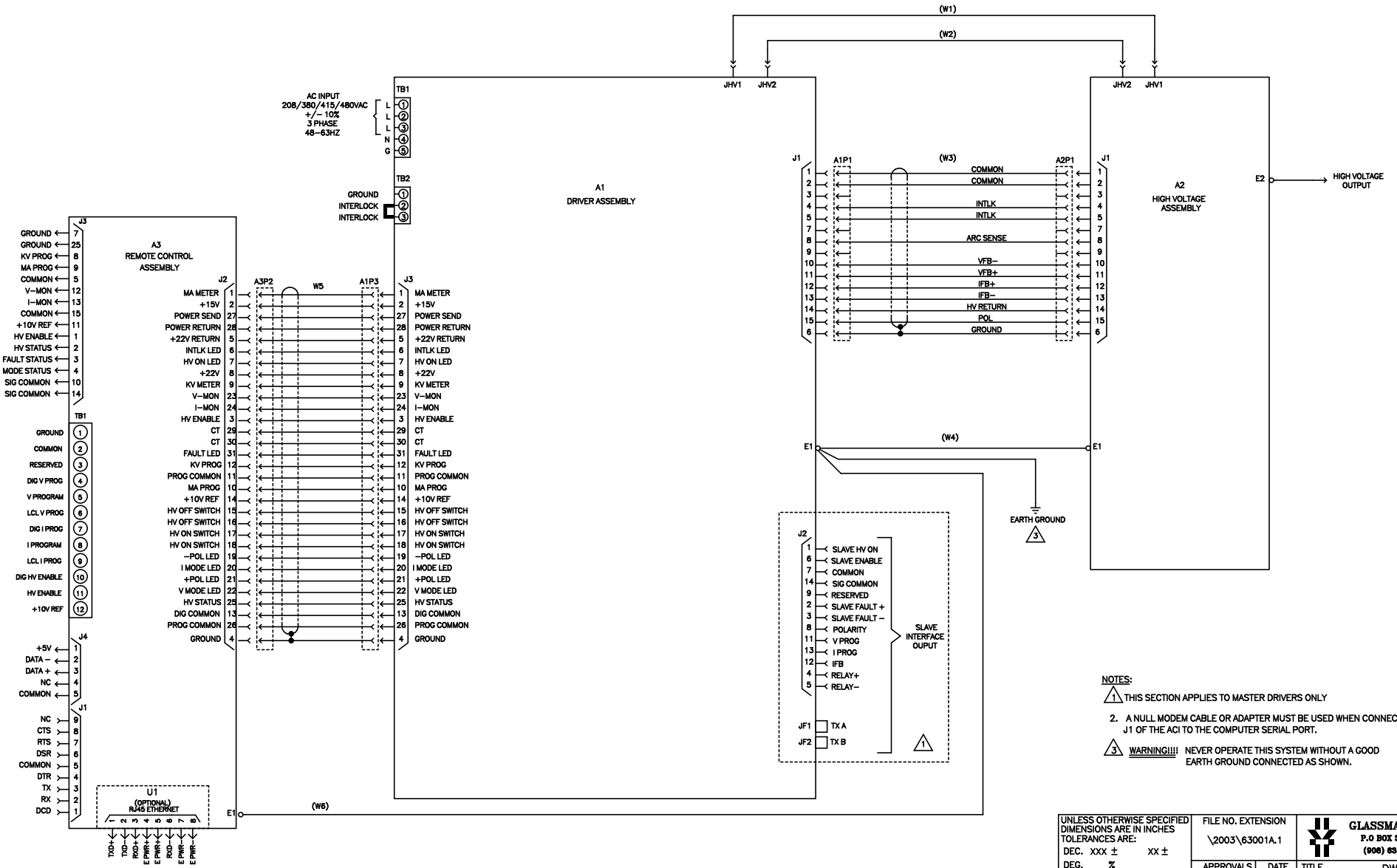
XP GLASSMAN HIGH VOLTAGE
124 West Main Street, PO Box 317, High Bridge, NJ 08829-317
(908) 638-3800 Fax (908) 638-3700

TITLE
SYSTEM SCHEMATIC
OQ OPEN STACK MASTER/SLAVE

A	DWG.NO. 100078-010	REV. NR

SCALE NONE | SHEET 1 OF 1

REV	BY	DESCRIPTION	DATE	APPROVED
NR–1	JAG	ADDED PINS 4 AND 5 TO A1J2	013017	KJD
A	JAG	ECN 11325: UPDATED LABELS	042718	



NOTES:

1. THIS SECTION APPLIES TO MASTER DRIVERS ONLY
2. A NULL MODEM CABLE OR ADAPTER MUST BE USED WHEN CONNECTING J1 OF THE ACI TO THE COMPUTER SERIAL PORT.
3. WARNING!!! NEVER OPERATE THIS SYSTEM WITHOUT A GOOD EARTH GROUND CONNECTED AS SHOWN.

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

USED WITH:

DO NOT SCALE DRAWING

FILE NO. EXTENSION
\2003\63001A.1

APPROVALS	DATE
DRAWN JAG	011116
CHECKED KJD	011116
RELEASED	
USED WITH:	

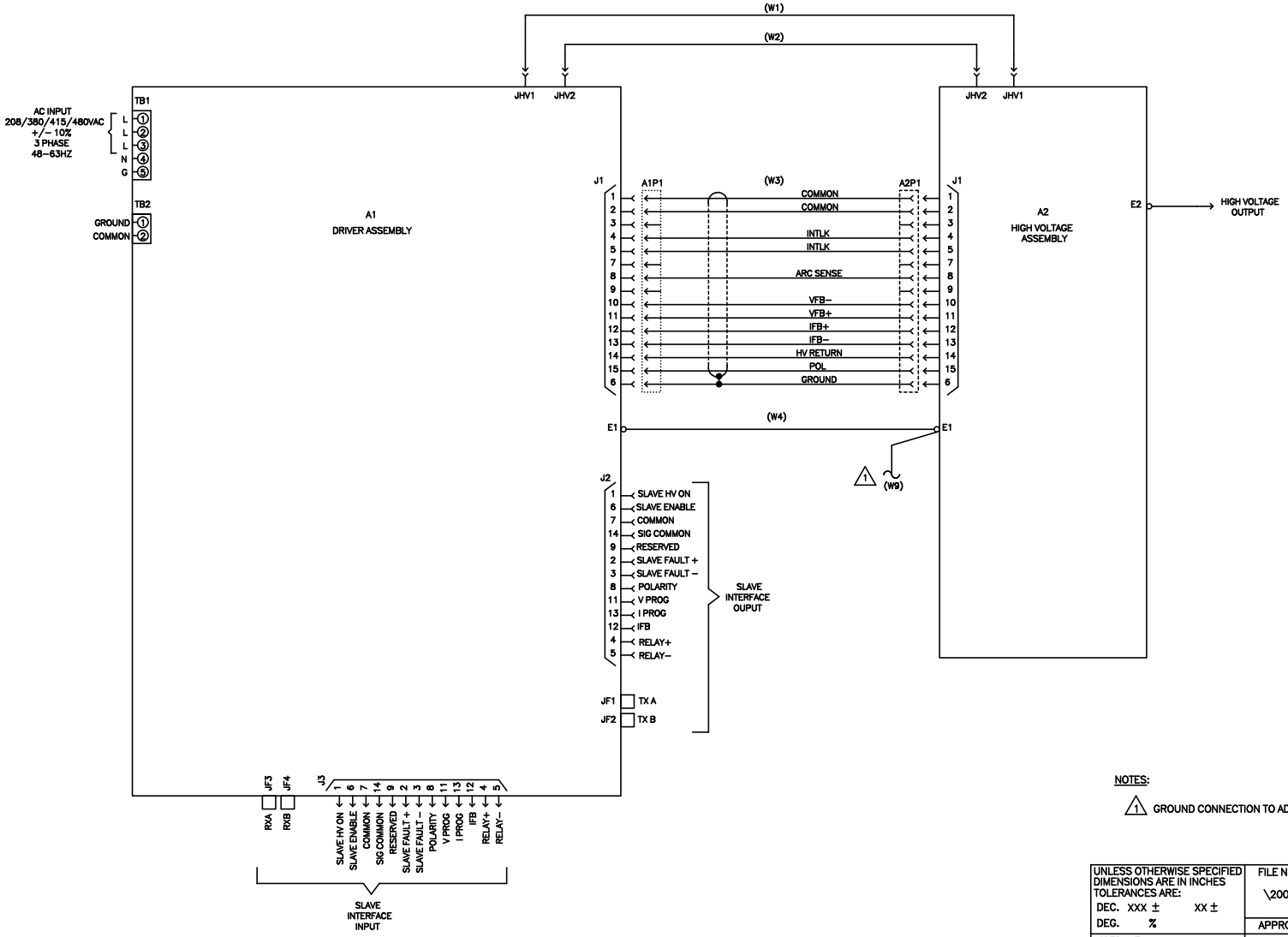
GLASSMAN HIGH VOLTAGE INC.
P.O BOX 317, HIGH BRIDGE, N.J. 08829
(908) 638–3600 FAX (908) 638–3700

TITLE: DWG, SCHEMATIC, SYSTEM, PS/OQ

SIZE	DWG NO	REV.
D	200363–001	A

SCALE NONE SHEET 1 OF 1

REV	BY	DESCRIPTION	DATE	APPROVED
NR–1	JAG	ADDED PINS 4 AND 5 TO A1J2 AND A1J3	013017	KJD
A	JAG	ECN 11325: UPDATED LABELS	042718	



NOTES:

1. GROUND CONNECTION TO ADJACENT MASTER OR SLAVE HIGH VOLTAGE ASSEMBLY.

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

USED WITH:

DO NOT SCALE DRAWING

FILE NO. EXTENSION
\2003\63002A.1

APPROVALS	DATE
DRAWN JAG	011116
CHECKED KJD	011116
RELEASED	
USED WITH:	

GLASSMAN HIGH VOLTAGE INC.
P.O BOX 317, HIGH BRIDGE, N.J. 08829
(908) 638–3600 FAX (908) 638–3700

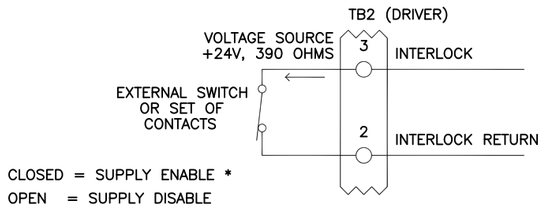
TITLE: DWG, SCHEMATIC, SYSTEM, PS/OQ

SIZE	DWG NO	REV.
D	200363–002	A

SCALE NONE SHEET 1 OF 1

REV	BY	DESCRIPTION	DATE	APPROVED
A	JAG	ECN 11325: UPDATED LABELS	042718	

REMOTE INTERLOCK — FIGURE 1

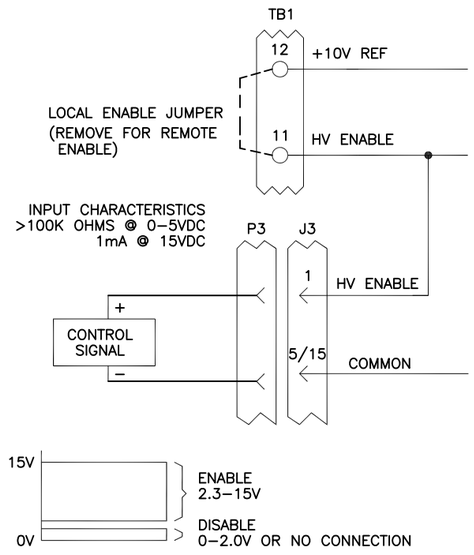


CLOSED = SUPPLY ENABLE *
OPEN = SUPPLY DISABLE

* (REFER TO INSTRUCTION MANUAL TEXT)

REMOTE HV ENABLE — FIGURE 2

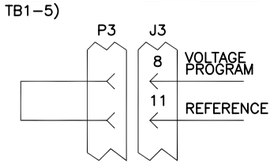
(LOCAL ENABLE JUMPER REMOVED)



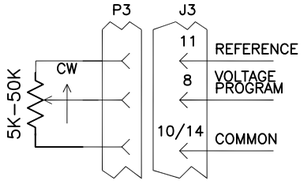
REMOTE VOLTAGE PROGRAM — FIGURE 3

(REMOVE V–PROGRAM JUMPER ON TB1–5)

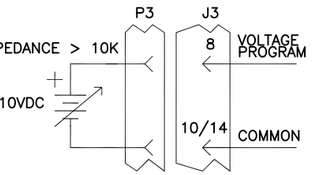
VOLTAGE PROGRAM TO MAXIMUM BY CONNECTING TO REFERENCE TERMINAL AND RETURN TO COMMON



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



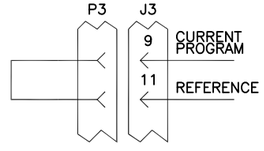
THE SUPPLY MAY BE PROGRAMMED WITH A REMOTE 0–10VDC VOLTAGE WHICH IS POSITIVE WITH RESPECT TO PROGRAM RETURN.



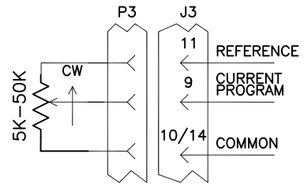
REMOTE CURRENT PROGRAM — FIGURE 4

(REMOVE I–PROGRAM JUMPER ON TB1–8)

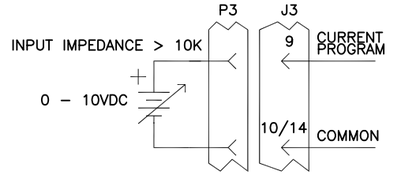
CURRENT PROGRAM TO MAXIMUM BY CONNECTING TO REFERENCE TERMINAL AND RETURN TO COMMON



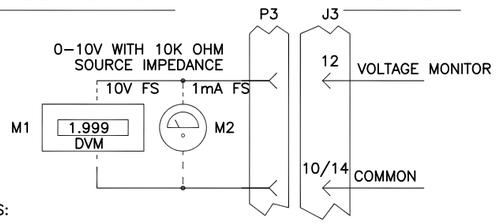
REMOTE CURRENT PROGRAMMED BY ATTACHING A 5K TO 50K POTENTIOMETER BETWEEN REFERENCE AND RETURN WITH THE WIPER ARM TO CURRENT PROGRAMMING.



THE SUPPLY MAY BE PROGRAMMED WITH A REMOTE 0–10VDC VOLTAGE WHICH IS POSITIVE WITH RESPECT TO PROGRAM RETURN.



VOLTAGE MONITOR — FIGURE 5

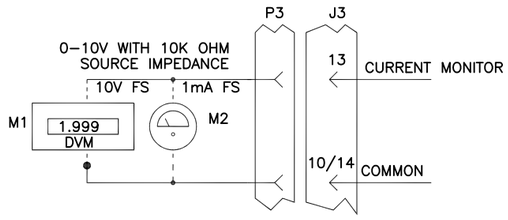


KV MONITOR OPTIONS:

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

CURRENT MONITOR — FIGURE 6



MA MONITOR OPTIONS:

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

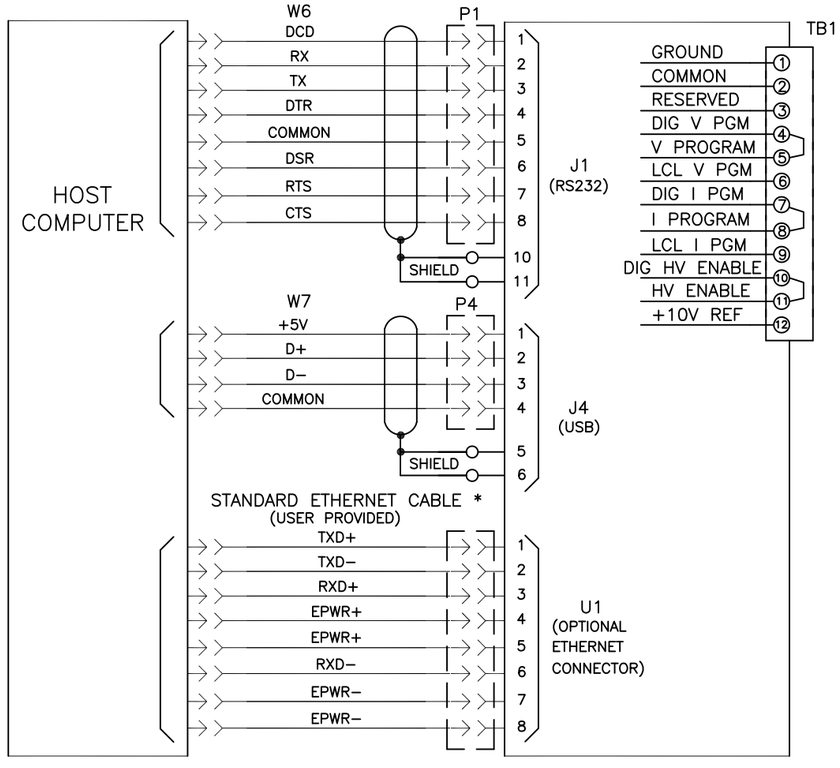
M2 – ALTERNATE TYPE METER:
0 – 1mA FULL SCALE CURRENT METER
0 – 1mA IS DIRECTLY PROPORTIONAL TO 0 – MAX mA RATING

NOTES:

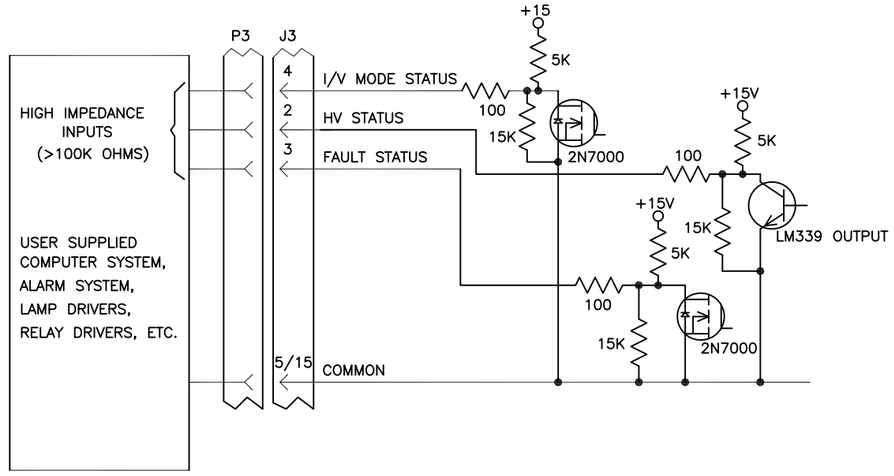
1. THESE DIAGRAMS ARE PROVIDED AS A SUPPLEMENT TO THE INSTRUCTION MANUAL TEXT, NOT AS A SUBSTITUTE. READ INSTRUCTION MANUAL TEXT CAREFULLY BEFORE MAKING CONNECTIONS.

DIGITAL REMOTE INTERFACE — FIGURE 7

TB1 ENABLE AND PROGRAM JUMPERS MUST BE IN REMOTE DIG POSITION.



STATUS SIGNALS — FIGURE 8

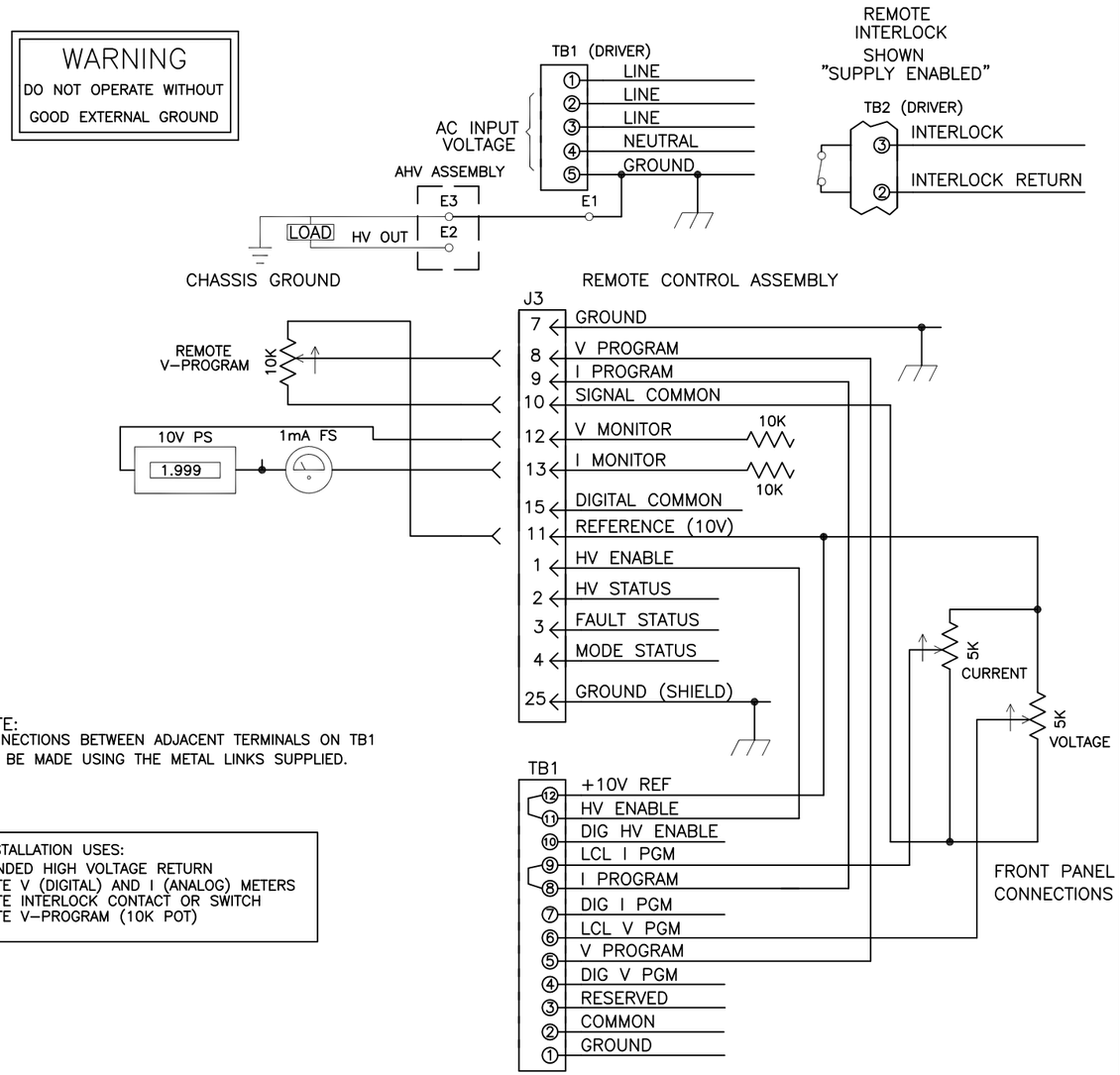


UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: DEC. XXX± XX± DEG. %	FILE NO. EXTENSION \2003\64001A.DWG	GLASSMAN HIGH VOLTAGE, INC. P.O. BOX 317, HIGH BRIDGE, N.J. 08829 (908) 638–3800 FAX (908) 638–3700
	APPROVALS / DATE	TITLE: REMOTE CONTROL INTERFACE OQ SERIES
MATERIAL	DRAWN JAG 011116	
FINISH	CHECKED KJD 011116	
DO NOT SCALE DRAWING	RELEASED	D DWG. NO. 200364–001 REV. A
		SCALE NONE SHEET 1 OF 2

REV	BY	DESCRIPTION	DATE	APPROVED

A TYPICAL OQ INSTALLATION

FIGURE 9

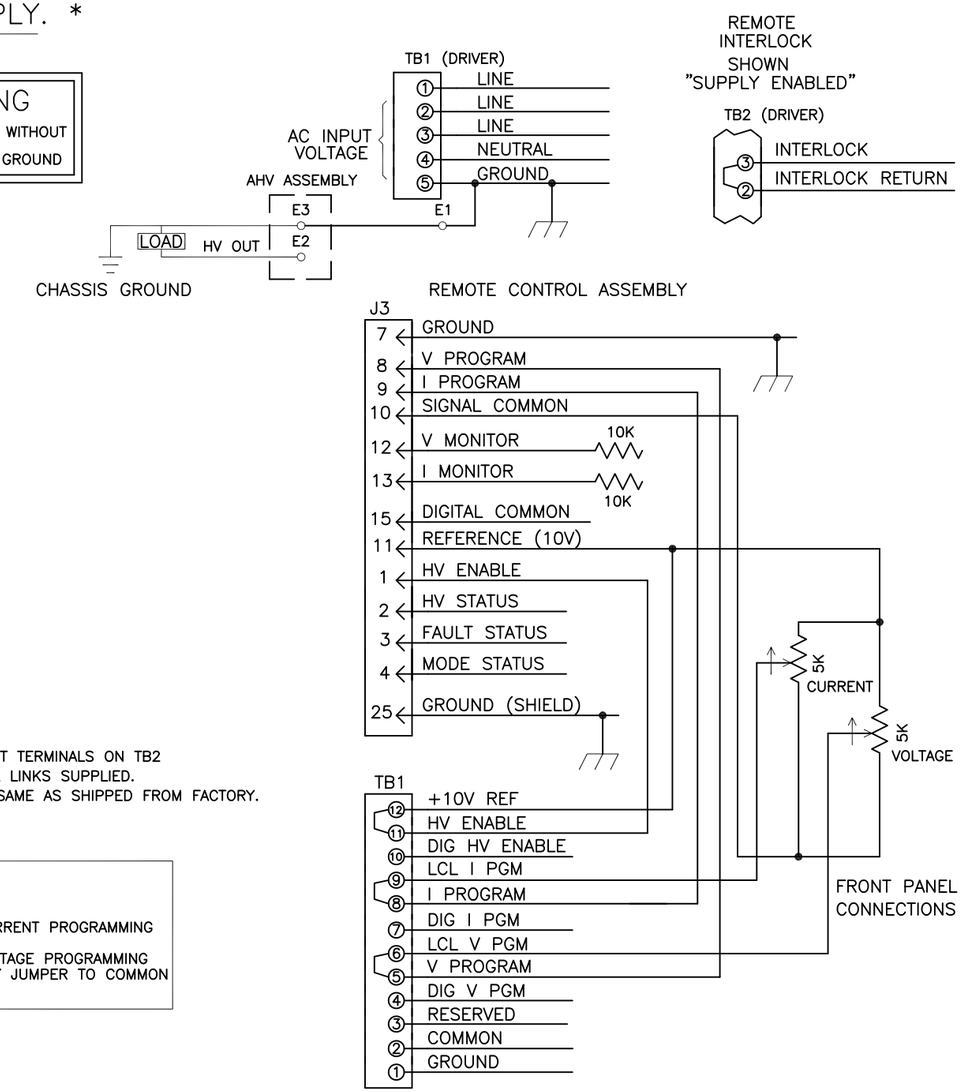


NOTE:
CONNECTIONS BETWEEN ADJACENT TERMINALS ON TB1 CAN BE MADE USING THE METAL LINKS SUPPLIED.

THIS INSTALLATION USES:
* GROUNDED HIGH VOLTAGE RETURN
* REMOTE V (DIGITAL) AND I (ANALOG) METERS
* REMOTE INTERLOCK CONTACT OR SWITCH
* REMOTE V–PROGRAM (10K POT)

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

FIGURE 10

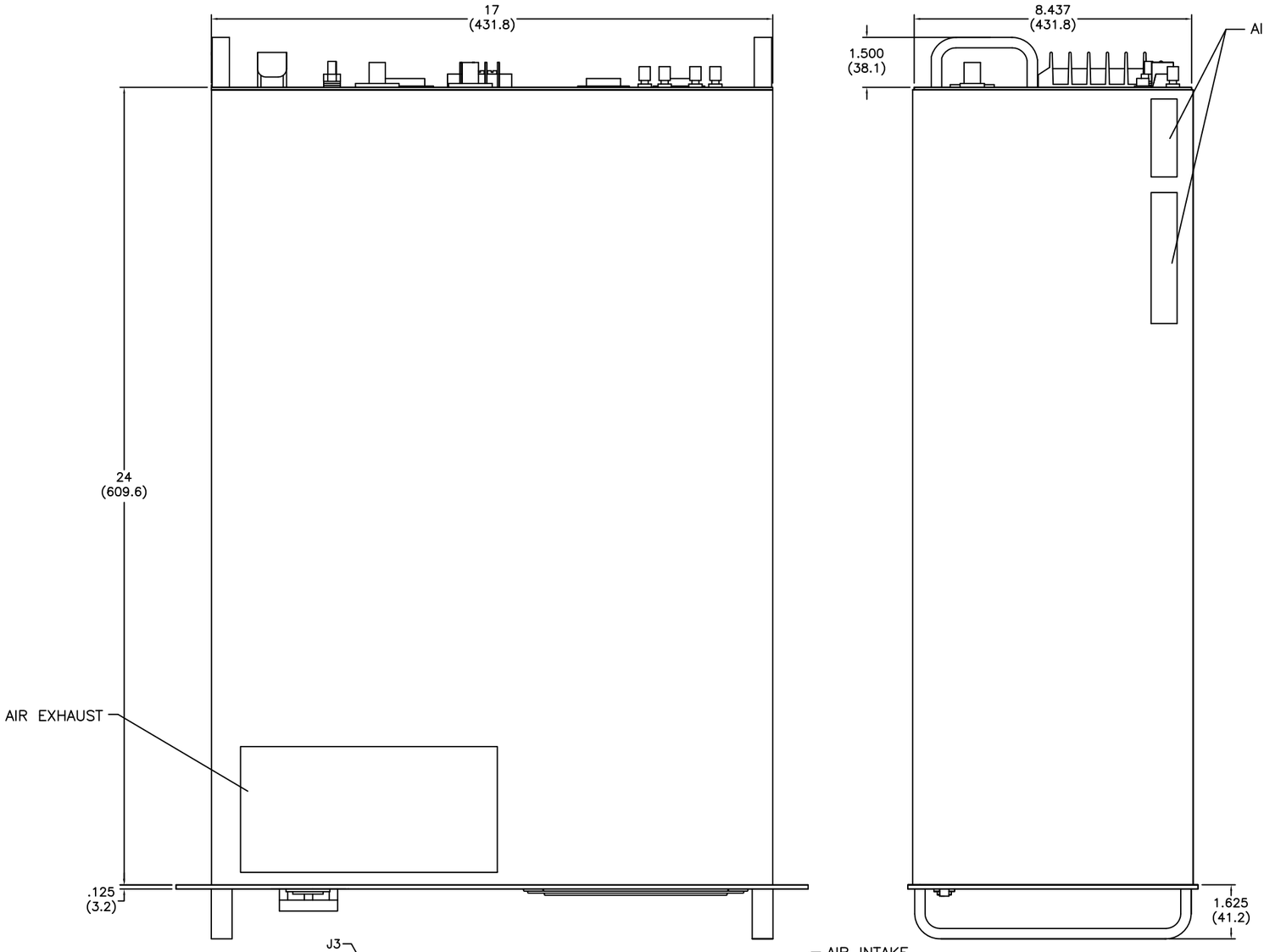


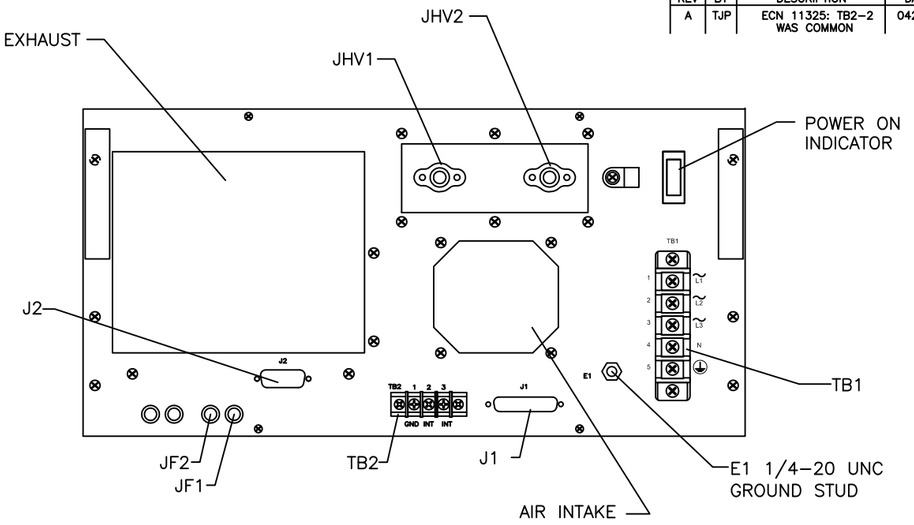
NOTE:
CONNECTIONS BETWEEN ADJACENT TERMINALS ON TB2 CAN BE MADE USING THE METAL LINKS SUPPLIED.
CONNECTIONS SHOWN ARE THE SAME AS SHIPPED FROM FACTORY.

*
MINIMUM CONNECTIONS:
* LOCAL ADJUSTABLE CURRENT PROGRAMMING
* LOCAL HV ENABLE
* LOCAL ADJUSTABLE VOLTAGE PROGRAMMING
* INTERLOCK ENABLED BY JUMPER TO COMMON

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: DEC. XXX± XX± DEG. °	FILE NO. EXTENSION \2003\64001A.DWG	GLASSMAN HIGH VOLTAGE, INC. P.O. BOX 317, HIGH BRIDGE, N.J. 08829 (908) 638–3800 FAX (908) 638–3700
MATERIAL	APPROVALS / DATE	TITLE: REMOTE CONTROL INTERFACE OQ SERIES
FINISH	DRAWN JAG 011116	
DO NOT SCALE DRAWING	CHECKED KJD 011116	D DWG. NO. 200364–001 REV. A
	RELEASED	SCALE NONE SHEET 2 OF 2

REV	BY	DESCRIPTION	DATE	APPROVED
A	TJP	ECN 11325: TB2-2 WAS COMMON	042718	





TB2 LEGEND
1 GROUND
2 INTERLOCK
3 INTERLOCK

TB1 LEGEND			
1 LINE	4 NEUTRAL (NC)	AC INPUT	208/380/415/480VAC
2 LINE	5 GROUND		+/- 10%
3 LINE			48-63 HZ
			3 PHASE

J1 LEGEND	
1 COMMON	9 RESERVED
2 COMMON	10 V FEEDBACK -
3 RESERVED	11 V FEEDBACK +
4 INTERLOCK	12 I FEEDBACK +
5 INTERLOCK	13 I FEEDBACK -
6 SHIELD	14 HV RETURN
7 RESERVED	15 POLARITY
8 ARC	16-25 RESERVED

J3 LEGEND		
1 I METER	13 COMMON	25 HV STATUS
2 +15V	14 +10V REFERENCE	26 SIGNAL COMMON
3 HV ENABLE	15 HV OFF SWITCH	27 POWER SEND
4 GROUND	16 HV OFF SWITCH	28 POWER RETURN
5 +24V RETURN	17 HV ON SWITCH	29 CURRENT TRIP
6 INTERLOCK LED	18 HV ON SWITCH	30 CURRENT TRIP
7 HV ON LED	19 - POLARITY LED	31 FAULT LED
8 +24V	20 I MODE LED	32 RESERVED
9 V METER	21 + POLARITY LED	33 RESERVED
10 I PROGRAM	22 V MODE LED	
11 SIGNAL COMMON	23 V MONITOR	
12 V PROGRAM	24 I MONITOR	

J2 LEGEND	
1 SLAVE HV ON	8 POLARITY
2 SLAVE FAULT +	9 RESERVED
3 SLAVE FAULT -	10 RESERVED
4 RELAY +	11 V PROGRAM
5 RELAY -	12 I FEEDBACK
6 SLAVE ENABLE	13 I PROGRAM
7 COMMON	14 SIGNAL COMMON
	15 RESERVED

JF1 TX-A OUTPUT
JF2 TX-B OUTPUT

IN
(MM)

NET WEIGHT:
60 POUNDS; 27kg

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

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

FILE NO. EXTENSION
\2017\05001A.DWG

APPROVALS		DATE
DRAWN	EJM	110315
CHECKED	KJD	110315
RELEASED		

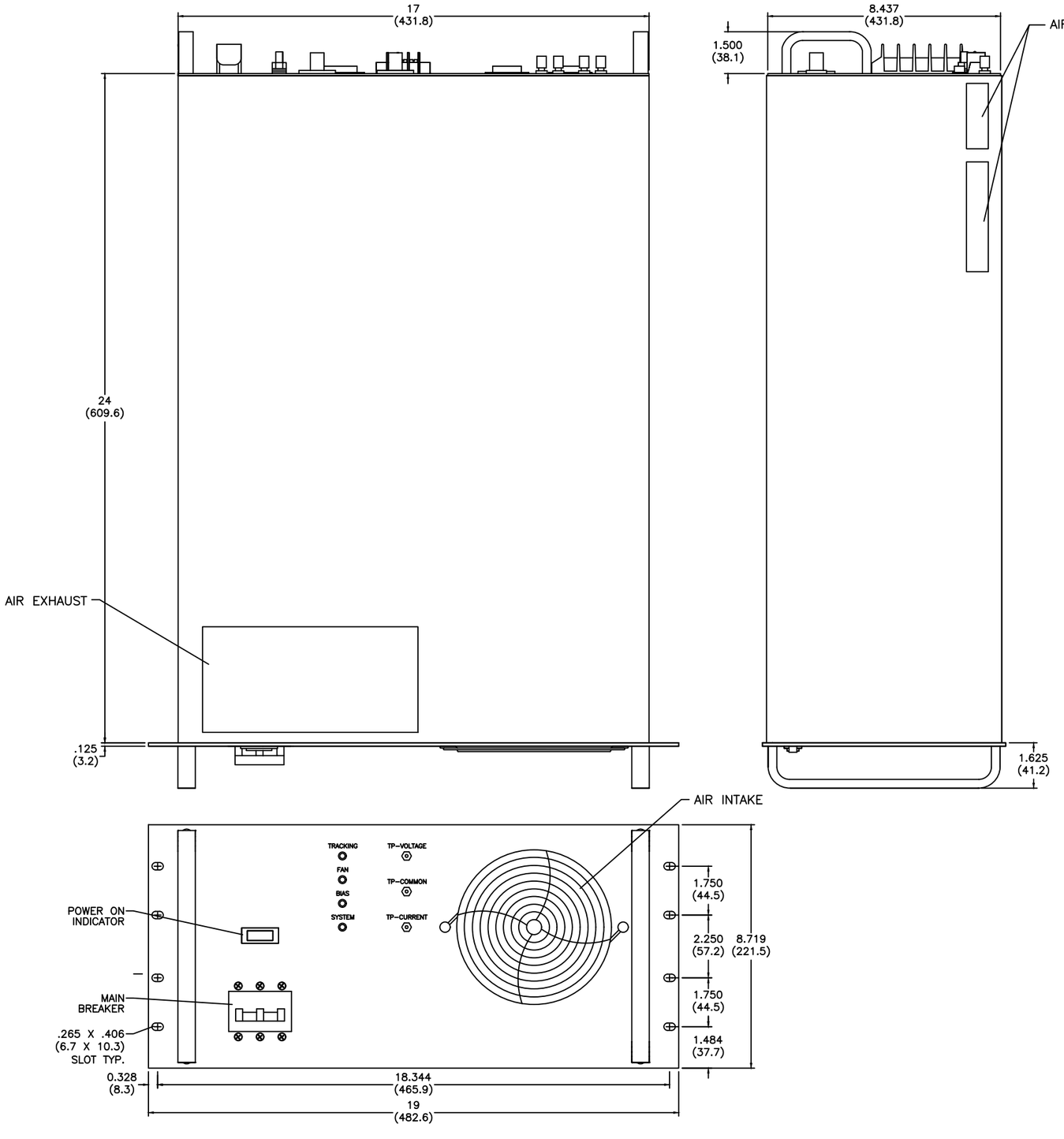
GLASSMAN HIGH VOLTAGE, INC.
P.O. BOX 317, HIGH BRIDGE, NJ 08829
(908) 638-3800 FAX (908) 638-3700

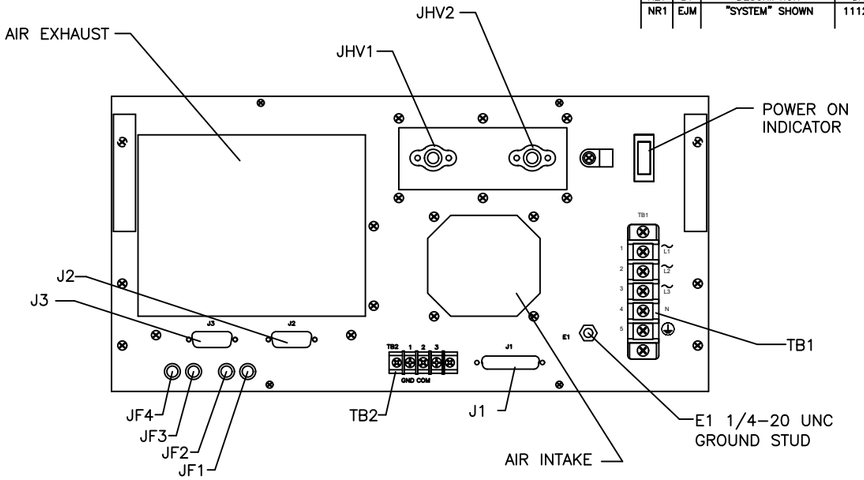
TITLE
OUTLINE & INTERFACE
AM8-0Q OPEN STACK, MASTER

D DWG.NO. 201705-001 REV. A

SCALE NONE SHEET 1 OF 1

REV	BY	DESCRIPTION	DATE	APPROVED
NR1	EJM	"SYSTEM" SHOWN	111215	





TB2 LEGEND

1	GROUND
2	COMMON
3	RESERVED

TB1 LEGEND

1	LINE	4	NEUTRAL (NC)
2	LINE	5	GROUND
3	LINE		

AC INPUT
208/380/415/480VAC
+/– 10%
48–63 HZ
3 PHASE

J1 LEGEND

1	COMMON	9	RESERVED
2	COMMON	10	V FEEDBACK –
3	RESERVED	11	V FEEDBACK +
4	INTERLOCK	12	I FEEDBACK +
5	INTERLOCK	13	I FEEDBACK –
6	GROUND	14	HV RETURN
7	RESERVED	15	POLARITY
8	ARC	16–25	RESERVED

J3 LEGEND

1	SLAVE HV ON	8	POLARITY
2	SLAVE FAULT +	9	RESERVED
3	SLAVE FAULT –	10	RESERVED
4	RELAY +	11	V PROGRAM
5	RELAY –	12	I FEEDBACK
6	SLAVE ENABLE	13	I PROGRAM
7	COMMON	14	SIG. COMMON
		15	GROUND

J2 LEGEND

1	SLAVE HV ON	8	POLARITY
2	SLAVE FAULT +	9	RESERVED
3	SLAVE FAULT –	10	RESERVED
4	RELAY +	11	V PROGRAM
5	RELAY –	12	I FEEDBACK
6	SLAVE ENABLE	13	I PROGRAM
7	COMMON	14	SIGNAL COMMON
		15	RESERVED

JHV1 – HIGH VOLTAGE OUTPUT CONNECTOR
JHV2 – HIGH VOLTAGE OUTPUT CONNECTOR
J1 – HIGH VOLTAGE INTERFACE
J2 – SLAVE INTERFACE OUTPUT
J3 – SLAVE INTERFACE INPUT
JF1 – TX–A OUTPUT
JF2 – TX–B OUTPUT
JF3 – RX–A INPUT
JF4 – RX–B INPUT
E1 – GROUND STUD

IN
(MM)

NET WEIGHT:
60 POUNDS; 27kg

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

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

FILE NO. EXTENSION
\2017\05002–1.DWG

APPROVALS		DATE
DRAWN	EJM	110315
CHECKED	KJD	110315
RELEASED		

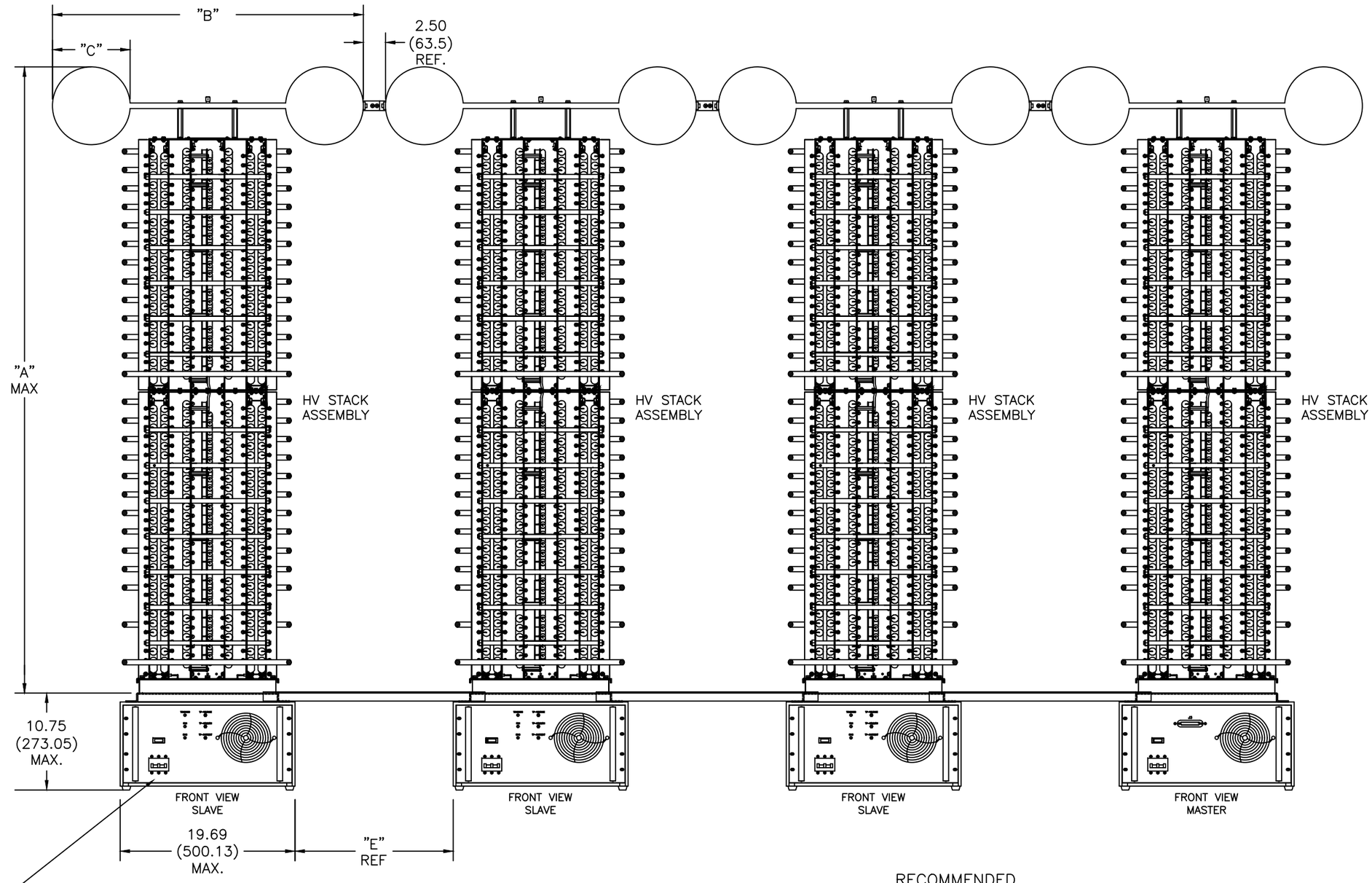
GLASSMAN HIGH VOLTAGE, INC.
P.O. BOX 317, HIGH BRIDGE, NJ 08829
(908) 638–3800 FAX (908) 638–3700

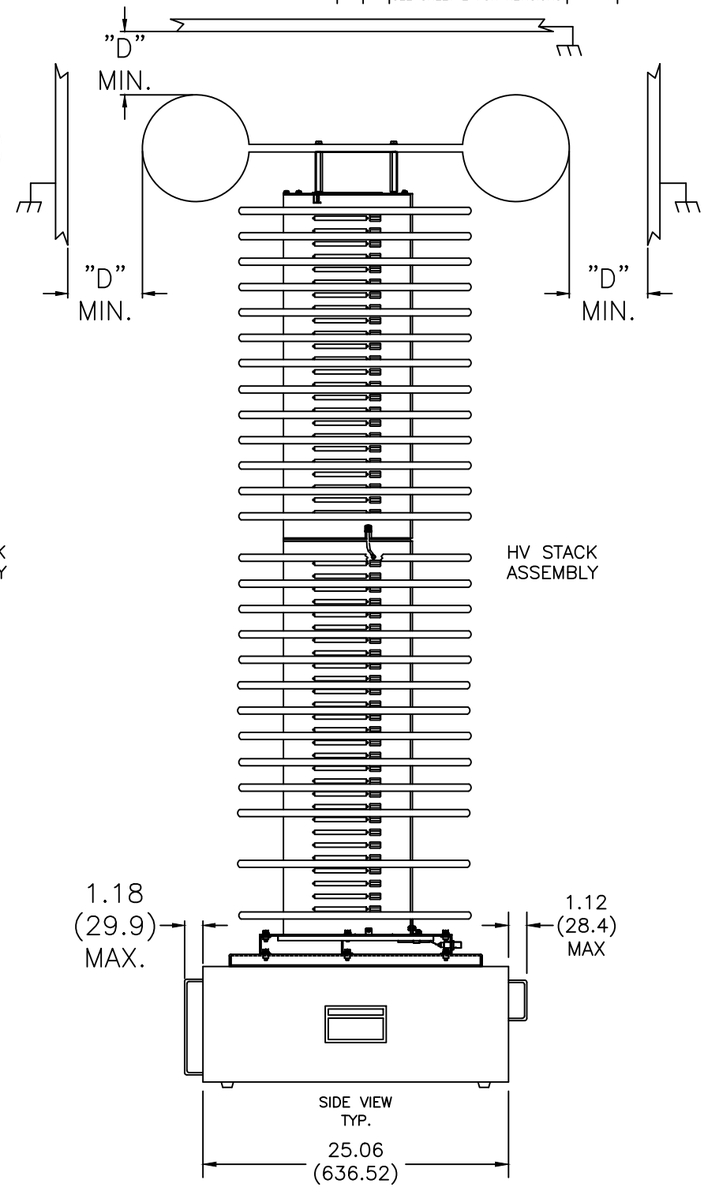
TITLE
OUTLINE & INTERFACE
AM8–0Q, OPEN STACK, SLAVE

D DWG.NO. 201705–002 REV. NR1

SCALE NONE SHEET 1 OF 1

REV	BY	DESCRIPTION	DATE	APPROVED
		SEE SHEET 2 FOR REVISIONS.		





STACK DIMENSIONS (NOMINAL)

RECOMMENDED MINIMUM CLEARANCE

SIZE KV	"A"	"B"	"C"	"D"	"E"
200KV	30.00 (762)	24.00 (610)	5.00 (127)	24 (610)	6.81 (172.97)
250KV	37.30 (947.42)	28.00 (711)	7.00 (178)	31 (787)	10.81 (274.57)
300KV	41.50 (1054.10)	28.00 (711)	7.00 (178)	38 (965)	10.81 (274.57)
350KV	53.75 (1365.25)	34.00 (864)	8.50 (216)	45 (1143)	16.81 (426.97)
400KV	57.97 (1472.44)	34.00 (864)	8.50 (216)	52 (1321)	16.81 (426.97)
450KV	62.94 (1598.67)	38.00 (965)	10.00 (254)	60 (1524)	20.81 (528.57)
500KV	71.31 (1811.27)	38.00 (965)	10.00 (254)	70 (1778)	20.81 (528.57)

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

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

FILE NO. EXTENSION
\2017\12001A.DWG

APPROVALS		DATE
DRAWN	EJM	011216
CHECKED	KJD	011216
RELEASED		

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

TITLE OUTLINE & SYSTEM WIRING DIAGRAM
OPEN STACK, MASTER/SLAVE
OQ SERIES (200–500KV)

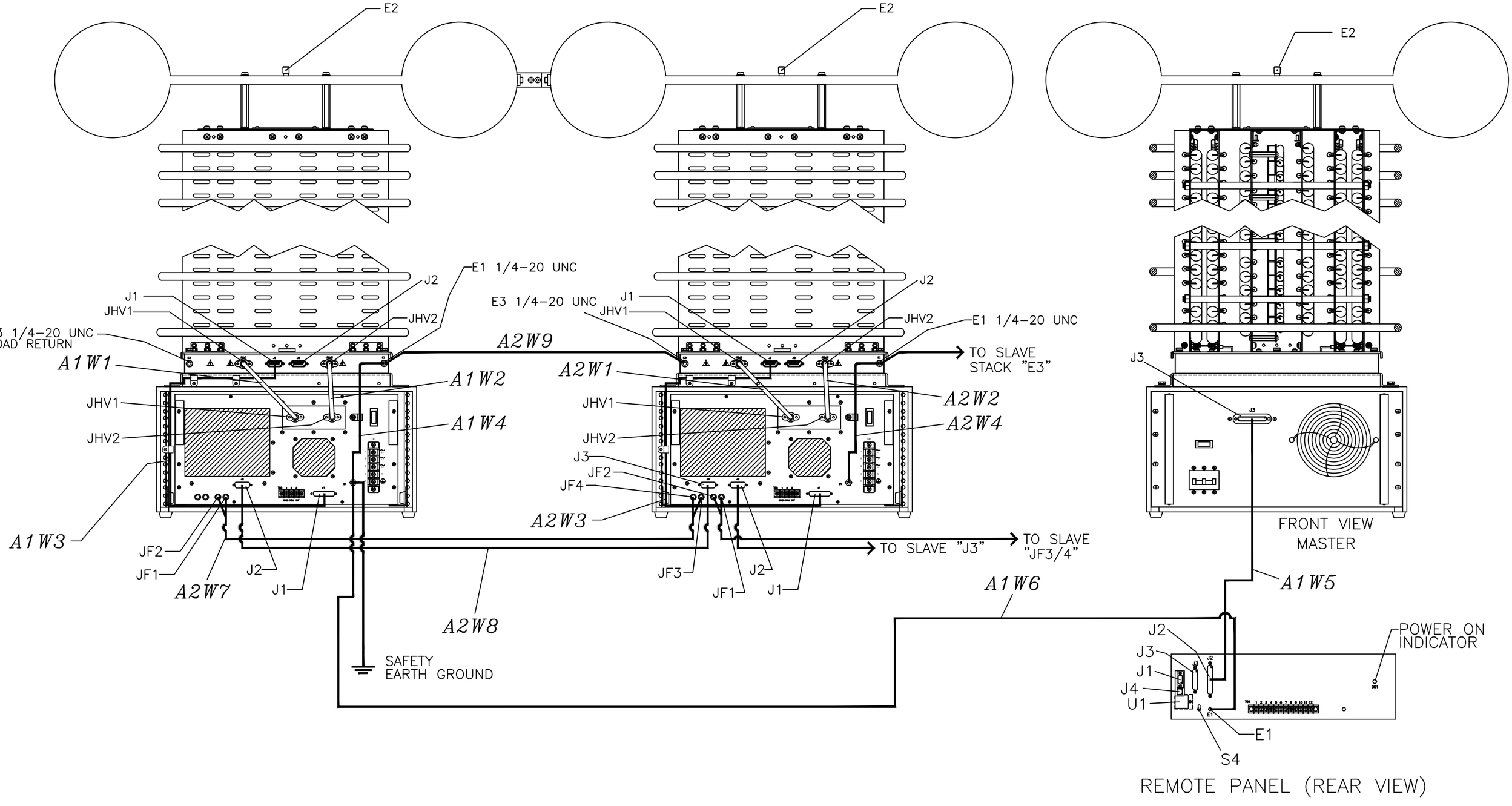
D | DWG.NO. 201712–001 | REV. A

SCALE: NONE | SHEET 1 OF 2

REV	BY	DESCRIPTION	DATE	APPROVED
A	MM	ECN 11553: ADDED A1W3 AND A2W3 ROUTING DETAILS.	051319	

MASTER DRIVER
ASSEMBLY–A1

SLAVE DRIVER
ASSEMBLY–A2



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

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

FILE NO. EXTENSION
\2017\12001A.DWG

APPROVALS	DATE
DRAWN EJM	011216
CHECKED KJD	011216
RELEASED	

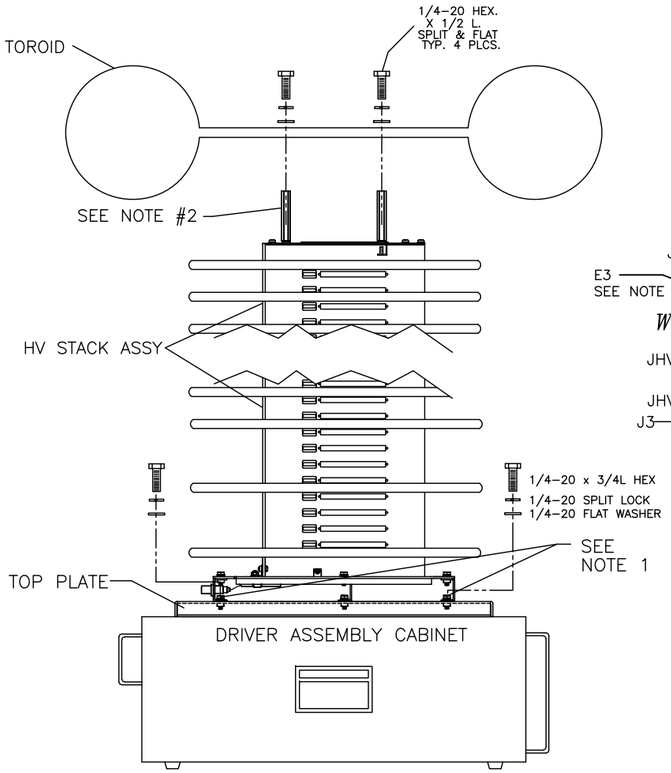
XP GLASSMAN HIGH VOLTAGE
124 West Main Street, PO Box 317, High Bridge, NJ 08829-317
(908) 638-3800 Fax (908) 638-3700

TITLE OUTLINE & SYSTEM WIRING DIAGRAM
OPEN STACK, MASTER/SLAVE
OQ SERIES (200–500KV)

D | DWG.NO. 201712–001 | REV. A

SCALE: NONE | SHEET 2 OF 2

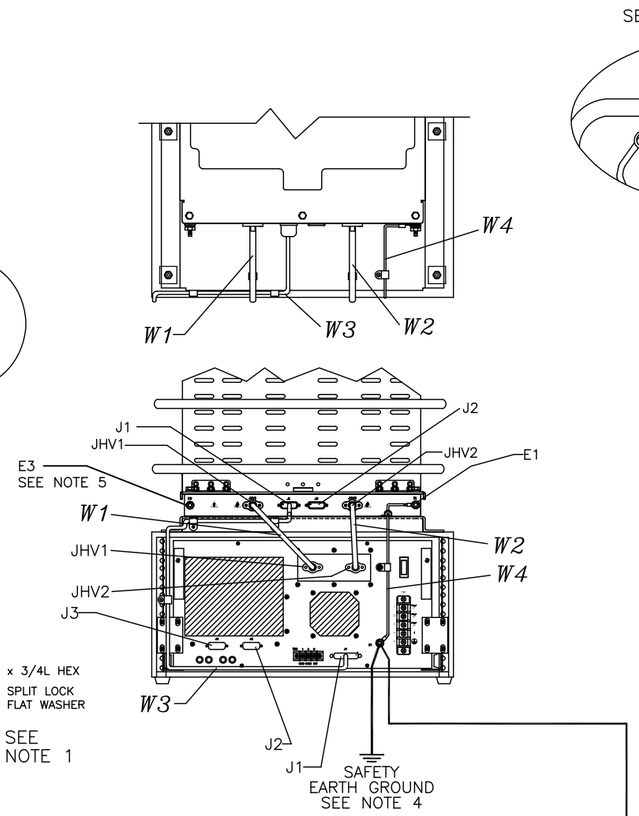
REV	BY	DESCRIPTION	DATE	APPROVED
NR–1	EJM	ITEMS 1 THRU 4 SHOWN	063016	JMC
A	TJP	ECN 11325: REVISED NOTE 5	042718	KJD
B	MM	ECN 11553: REVISED W4 AND A2W4 ROUTING.	051019	

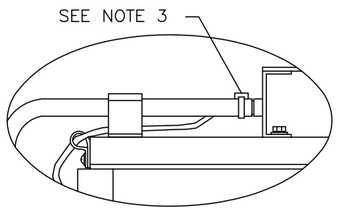


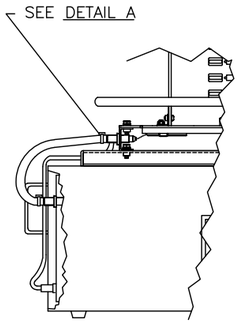
STACK & DRIVER MECHANICAL ASSEMBLY (200-500KV):

NOTES:

1. MOUNT HV STACK ASSEMBLY TO TOP PLATE OF DRIVER ASSEMBLY CABINET WITH 1/4-20 HARDWARE PROVIDED (6 PLACES).
2. MOUNT TOROID TO HV STACK ASSEMBLY WITH 1/4-20 HARDWARE PROVIDED (4 PLACES).
4. **CAUTION:** DO NOT SCRATCH OR DAMAGE TOROID.







STACK & DRIVER WIRING INSTRUCTIONS (200-500KV):

NOTES:

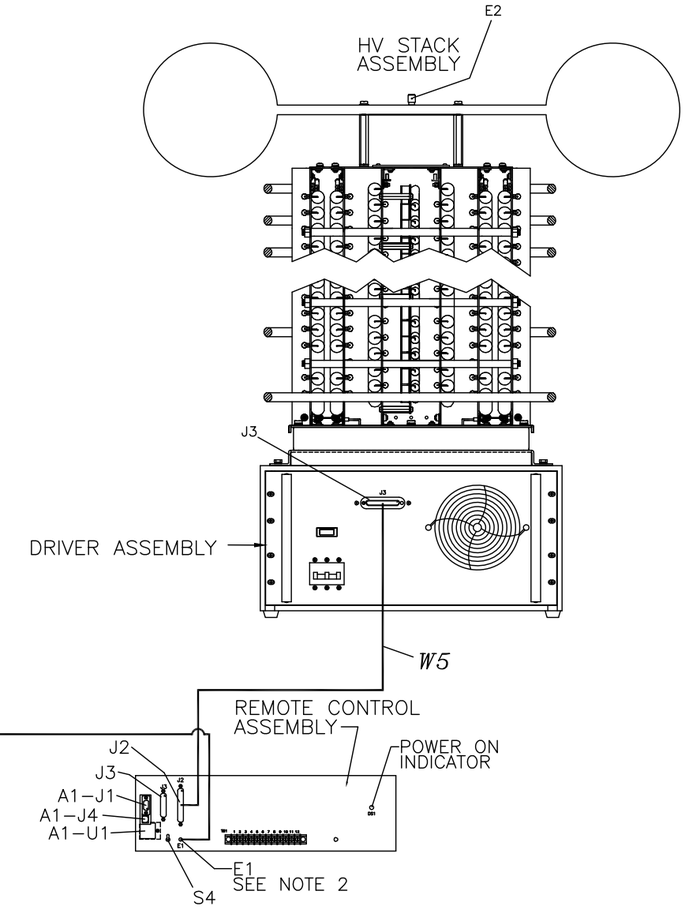
1. CONNECT INTERFACE CABLE ***(W3)*** AS SHOWN. SECURE WITH 5/16" CABLE CLAMPS PROVIDED.
2. CONNECT GROUND CABLE ***(W4)*** AS SHOWN. SECURE WITH 5/8" CABLE CLAMPS PROVIDED.
3. CONNECT HIGH VOLTAGE CABLES ***(W1 & W2)*** AS SHOWN. SECURE CABLES AT EACH END WITH RECLOSABLE TIE WRAPS PROVIDED. SEE DETAIL A. **CAUTION:** HIGH VOLTAGE CABLE PLUGS MUST BE FULLY SEATED IN JHV1 & JHV2.

   CAUTION: HIGH VOLTAGE CABLES MUST BE KEPT AWAY FROM INTERFACE CABLE ***(W3)***.
4. **WARNING!** PROVIDE ADEQUATE EARTH GROUND TO DRIVER ASSEMBLY GROUND STUD (E1).
5. **WARNING!** PROVIDE ADEQUATE LOAD RETURN TO HV OPEN STACK GROUND STUD (E3).

REMOTE & DRIVER WIRING INSTRUCTIONS:

NOTES:

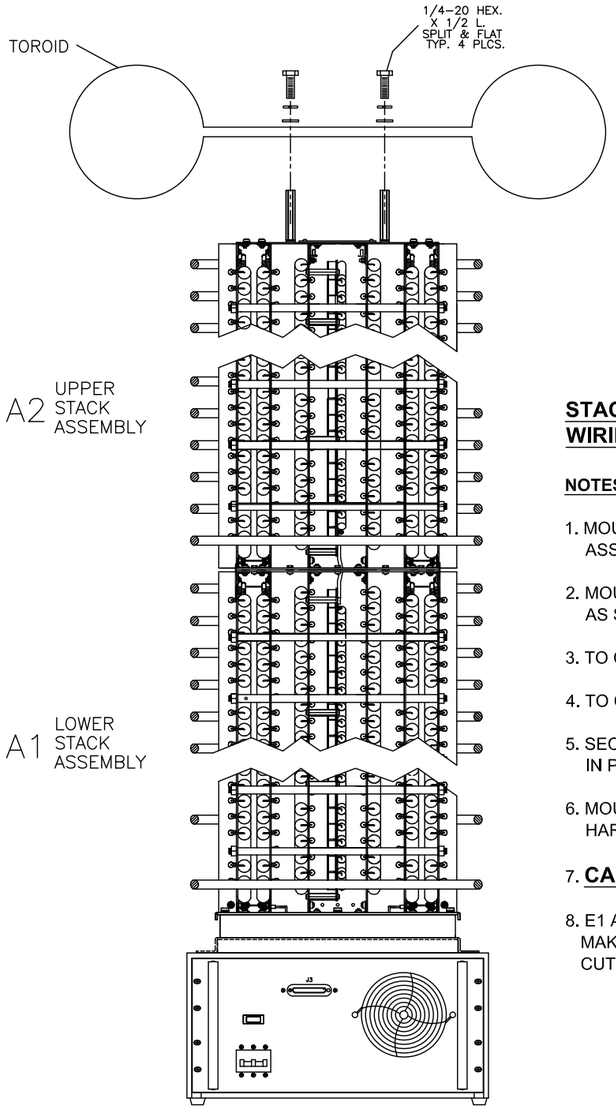
1. CONNECT CABLE ***(W5)*** AS SHOWN.
2. CONNECT GROUND CABLE ***(W6)*** FROM DRIVER GROUND STUD (E1) TO REMOTE CONTROL UNIT GROUND STUD (E1).



FRONT VIEW OF HV STACK ASSEMBLY AND REAR VIEW OF REMOTE CONTROL ASSEMBLY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE : DEC. XXX ± .XXX XX ± .XX DEG. ±	FILE NO. EXTENSION \2017\13001B.DWG	GLASSMAN HIGH VOLTAGE 124 West Main Street, PO Box 317, High Bridge, NJ 08829-317 (908) 638-3800 Fax (908) 638-3700
THIRD ANGLE PROJECTION	APPROVALS / DATE: DRAWN EJM 012216; CHECKED KJD 012216; RELEASED	TITLE: SYSTEM INSTALLATION OPEN STACK OQ SERIES
DO NOT SCALE DRAWING		B DWG.NO. 201713–001 REV. B
		SCALE NONE SHEET 1 OF 3

REV	BY	DESCRIPTION	DATE	APPROVED



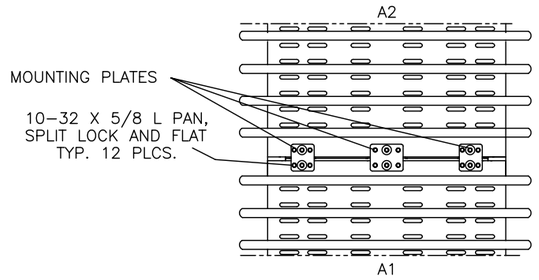
FRONT VIEW
TOROIDS & CORONA RINGS CUT AWAY FOR CLARITY

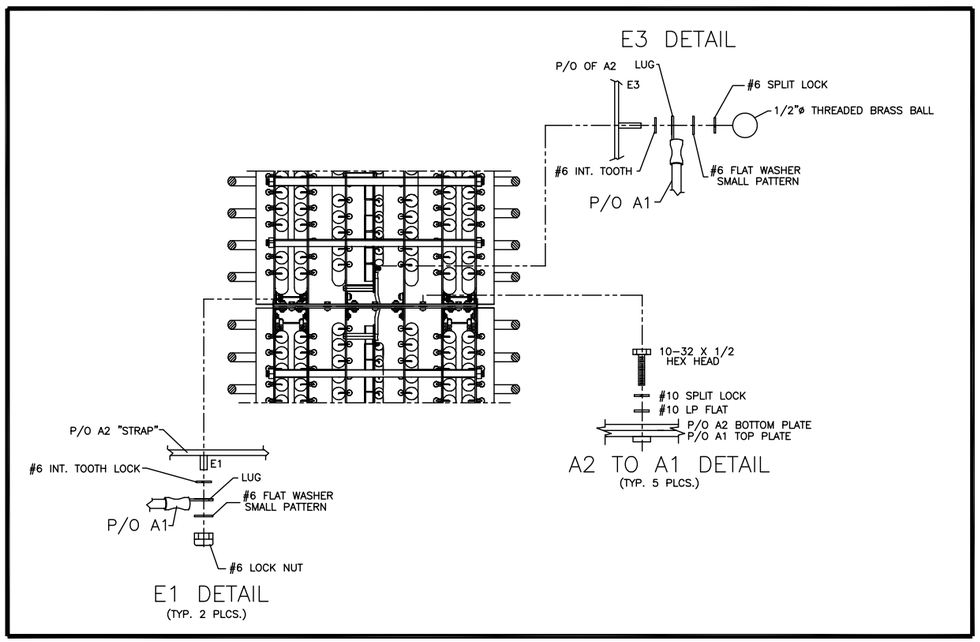
STACK TO STACK WIRING & MECHANICAL INSTRUCTIONS (350-500KV):

NOTES:

1. MOUNT LOWER SECTION (A1) OF HV STACK TO TOP PLATE OF DRIVER ASSEMBLY CABINET AND WIRE AS PER SHT 1.
2. MOUNT UPPER SECTION (A2) TO LOWER SECTION (A1) WITH HARDWARE AS SHOWN IN A2 TO A1 DETAIL.
3. TO CONNECT A3-E2, MOUNT WITH HARDWARE AS SHOWN IN E3 DETAIL.
4. TO CONNECT E1-A2, MOUNT WITH HARDWARE AS SHOWN IN E1 DETAIL.
5. SECURE A1 TO A2 WITH MOUNTING PLATES AND HARDWARE AS SHOWN IN PLATE DETAIL.
6. MOUNT TOROID TO UPPER SECTION (A2) OF HV STACK WITH 1/4-20 HARDWARE PROVIDED AS SHOWN (4 PLACES).
7. **CAUTION:** DO NOT SCRATCH OR DAMAGE TOROID.
8. E1 AND E3 CONNECTION WIRES MUST NOT TOUCH ANY METAL EDGES. MAKE SURE THEY ARE DRESSED STRAIGHT THRU THE PROPER CUTOUTS AND ARE SECURE.

PLATE DETAIL





IN
(MM)

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

THIRD ANGLE PROJECTION

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FILE NO. EXTENSION
\2017\13001B.DWG

APPROVALS		DATE
DRAWN	EJM	012216
CHECKED	KJD	012216
RELEASED		

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

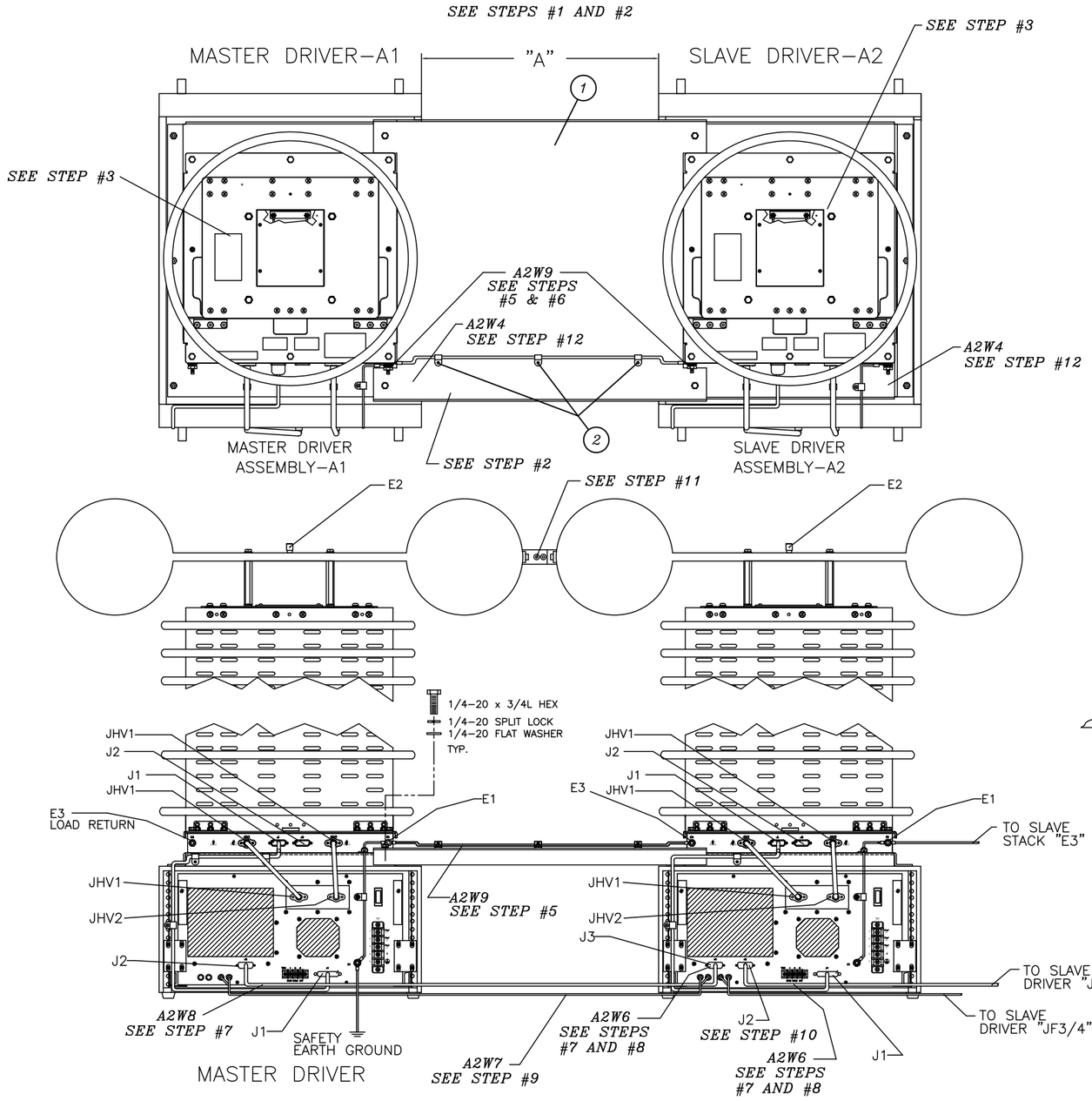
TITLE: SYSTEM INSTALLATION OPEN STACK OQ SERIES

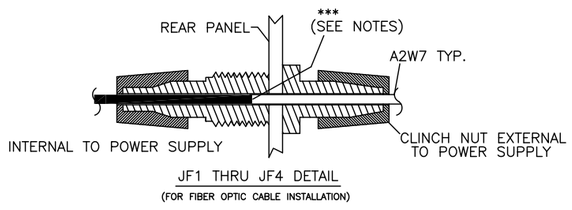
SIZE	DWG.NO.	REV.
B	201713-001	B

SCALE NONE | SHEET 2 OF 3

REV	BY	DESCRIPTION	DATE	APPROVED

TOP TOROIDS NOT SHOWN FOR CLARITY





JF1 THRU JF4 DETAIL
(FOR FIBER OPTIC CABLE INSTALLATION)

JF1 & JF2 OF THE LAST SLAVE TO BE CAPPED WITH COVERS PROVIDED

FIBER OPTIC CABLE A2W7 MUST BE PROPERLY CONNECTED BEFORE APPLYING POWER TO THE SYSTEM.

REMOVE PROTECTIVE END CAPS FROM A2W7 BEFORE INSTALLING.

*** - **CAUTION** WHEN INSERTING THE FIBER OPTIC CABLES IN JF1 THRU JF4, THE CABLES SHOULD BE **"BOTTOMED OUT" & SEATED BEFORE TIGHTENING THE "CLINCH NUTS".**

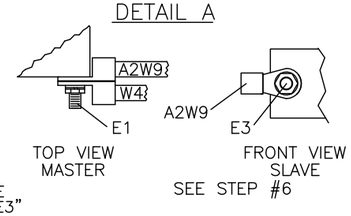
MASTER/SLAVE INSTALLATION PROCEDURE:

1 - POSITION MASTER AND SLAVE CABINETS AS INDICATED IN "A" DIMENSION (SEE CHART).
2 - INSTALL BRIDGE PLATE ((1)) BETWEEN MASTER AND SLAVE CABINETS AS SHOWN WITH 1/4-20 HARDWARE PROVIDED.
3 - ASSEMBLE MASTER STACK AND DRIVER AS SHOWN. SEE SHEETS 1 AND 2.
4 - ASSEMBLE SLAVE STACK AND DRIVER AS SHOWN. SEE SHEETS 1 AND 2.
5 - CONNECT GROUND WIRE A2W9 FROM E1 OF MASTER STACK TO E3 OF SLAVE STACK AS SHOWN. SEE DETAIL "A". SECURE WITH 5/8" CABLE CLAMP ((2)) PROVIDED.
6 - FOR MULTIPLE SLAVE CONFIGURATIONS: AN ADDITIONAL W9 IS PROVIDED WITH EACH SLAVE STACK TO CONNECT E3 TO E1 OF THE PREVIOUS SLAVE STACK. SEE DETAIL "A". SECURE WITH 5/8" CABLE CLAMP ((2)) PROVIDED.
7 - CONNECT CABLE A2W8 FROM J2 OF MASTER DRIVER TO J3 OF SLAVE STACK DRIVER AS SHOWN.
8 - FOR MULTIPLE SLAVES: AN ADDITIONAL W8 IS PROVIDED WITH EACH SLAVE DRIVER TO CONNECT J3 TO J2 OF THE PREVIOUS SLAVE DRIVER.
9 - CONNECT FIBER OPTIC CABLE A2W7 FROM JF1/2 OF MASTER DRIVER TO JF3/4 OF SLAVE DRIVER AS SHOWN. FOR MULTIPLE SLAVES, AN ADDITIONAL W7 IS PROVIDED WITH EACH SLAVE DRIVER TO CONNECT JF3/4 TO JF1/2 OF PREVIOUS SLAVE DRIVER. SEE JF1 THRU JF4 FIBER OPTIC DETAIL FOR CABLE INSTALLATION.
10 - IF NOT INSTALLED ALREADY, INSTALL TERMINATOR PLUG ON J2 OF THE LAST SLAVE DRIVER.
11 - INSTALL ANGLES ((3),(4)) TO UPPER TOROIDS WITH 1/4-20 HARDWARE PROVIDED. SEE ANGLE DETAIL.
12 - CONNECT W4 FROM E1 OF STACK TO E1 OF DRIVER CHASSIS FOR BOTH MASTER AND SLAVE DRIVERS.

NOTES:

1 - **CAUTION:** ENSURE THAT BOTH HV STACKS ARE THE SAME POLARITY.
2 - **WARNING!** PROVIDE ADEQUATE EARTH GROUND TO MASTER DRIVER ASSEMBLY E1.
3 - **WARNING!** PROVIDE ADEQUATE GROUND TO HIGH VOLTAGE OPEN STACK GROUND STUD (MASTER E1).
4 - **WARNING!** PROVIDE ADEQUATE LOAD RETURN TO HIGH VOLTAGE OPEN STACK GROUND STUD (MASTER E1).
5 - **CAUTION:** HIGH VOLTAGE CABLES **MUST BE** KEPT AWAY FROM ALL OTHER CABLES.

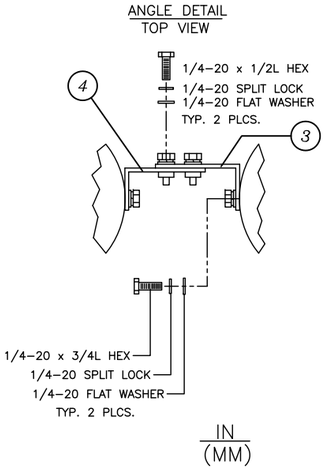
DETAIL A



STACK SPACING DIMENSIONS (NOMINAL)

SIZE KV	"A"
200KV	6.81 (172.97)
250KV	10.81 (274.57)
300KV	10.81 (274.57)
350KV	16.81 (426.97)
400KV	16.81 (426.97)
450KV	20.81 (528.57)
500KV	20.81 (528.57)

ANGLE DETAIL
TOP VIEW



IN
(MM)

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TOLERANCES ARE :
DEC. XXX ± .XXX XX ± .XX
DEG. ±

THIRD ANGLE PROJECTION

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FILE NO. EXTENSION
\2017\13001B.DWG

APPROVALS		DATE
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XP GLASSMAN HIGH VOLTAGE
124 West Main Street, PO Box 317, High Bridge, NJ 08829-317
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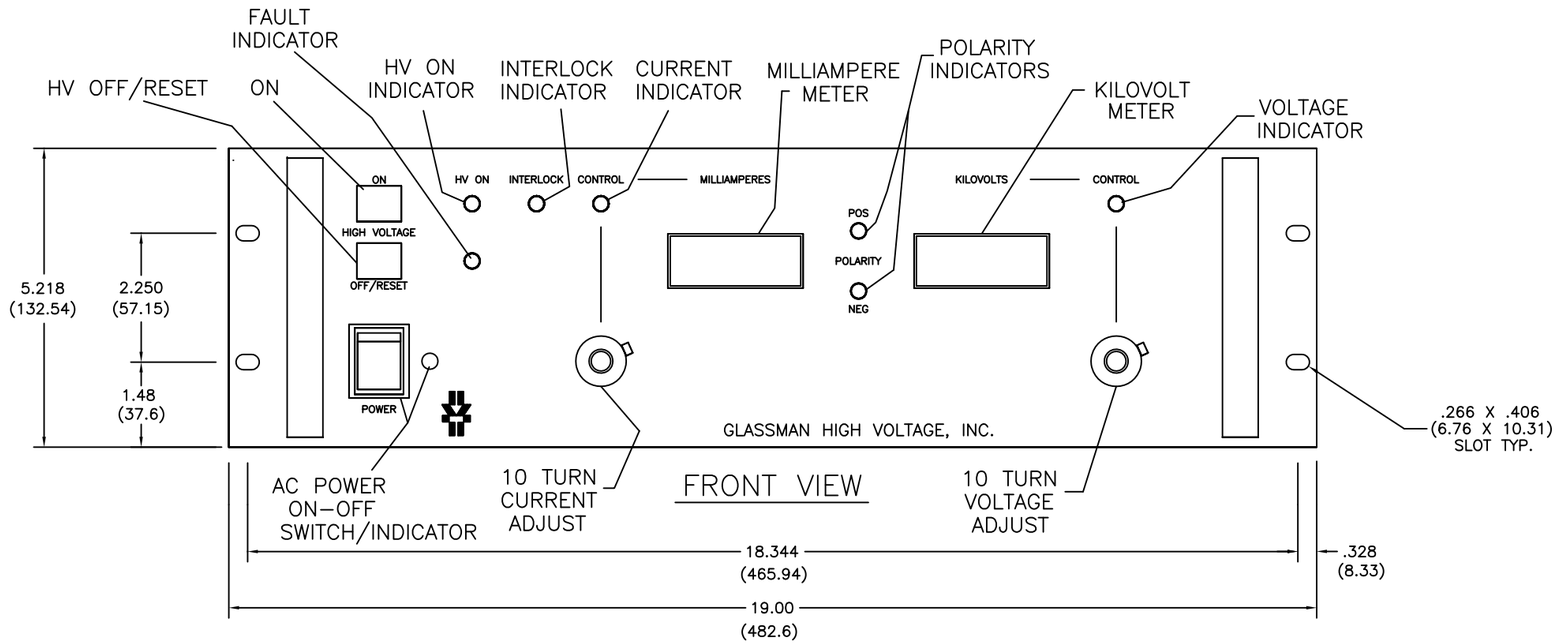
TITLE
SYSTEM INSTALLATION
OPEN STACK
OQ SERIES

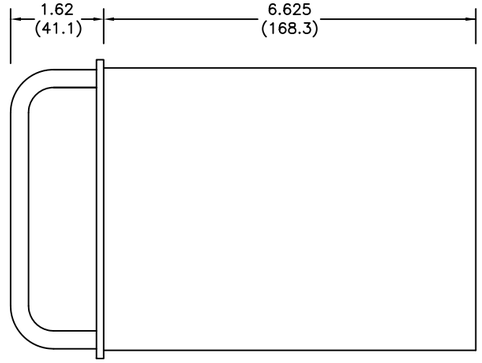
SIZE	DWG.NO.	REV.
B	201713–001	B

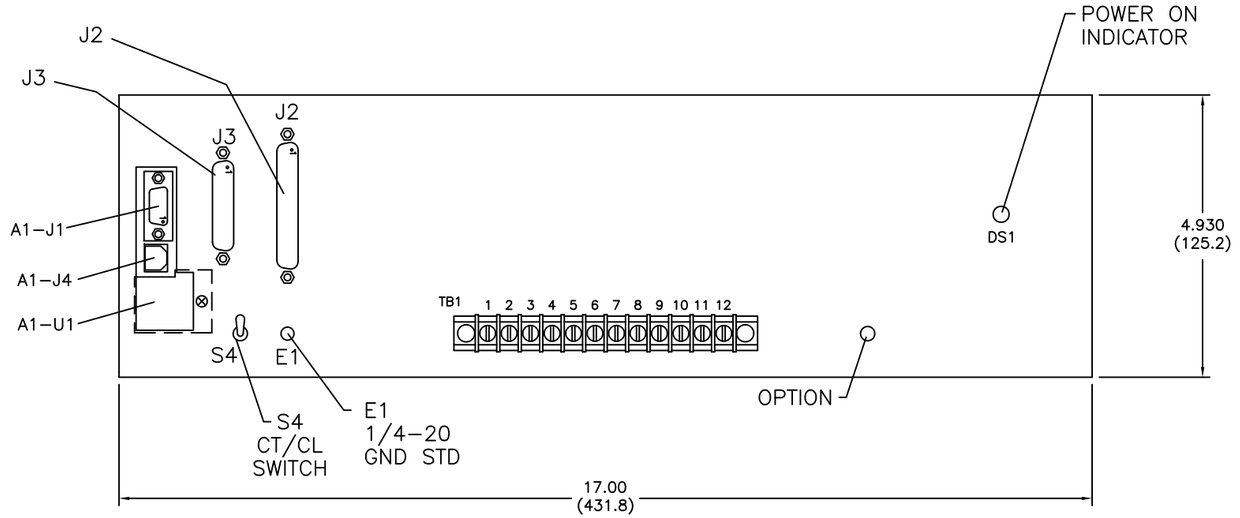
SCALE NONE SHEET 3 OF 3

REV	BY	DESCRIPTION	DATE	APPROVED
A	EJM	ECN 10320: J2, J3, AND TB1 PIN OUTS UPDATED	071414	



FRONT VIEW





J4 LEGEND

1	+5V
2	D–
3	D+
4	COMMON

TB1 LEGEND

1	GROUND
2	COMMON
3	RESERVED
4	DIG V PROGRAM
5	V PROGRAM
6	LOCAL V PROGRAM
7	DIG I PROGRAM
8	I PROGRAM
9	LOCAL I PROGRAM
10	DIG HV ENABLE
11	HV ENABLE
12	+10V REF

U1 OPTION LEGEND

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

S4: CL/CT SELECT

J1 LEGEND

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

J2 LEGEND

1	I METER	17	HV ON SW
2	+15V	18	HV ON SW
3	HV ENABLE	19	–POL LED
4	GROUND	20	I MODE LED
5	+22V RETURN	21	+ POL LED
6	INTLK LED	22	V MODE LED
7	HV ON LED	23	V MON
8	+22V	24	I MON
9	V METER	25	HV STATUS
10	I PROGRAM	26	SIG COMMON
11	SIG COMMON	27	POWER SEND
12	V PROGRAM	28	POWER RTN
13	COMMON	29	CT
14	+10V REF	30	CT
15	HV OFF SW	31	FAULT LED
16	HV OFF SW	32	THRU 37 RESERVED

J3 LEGEND

1	HV ENABLE	16	THRU 24 RESERVED
2	HV STATUS	25	GROUND
3	FAULT STATUS		
4	MODE STATUS		
5	COMMON		
6	RESERVED		
7	GROUND		
8	V PROGRAM		
9	I PROGRAM		
10	SIG COMMON		
11	REFERENCE		
12	V MON		
13	I MON		
14	SIG COMMON		
15	COMMON		

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DEG. ±

THIRD ANGLE PROJECTION

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FILE NO. EXTENSION
\2016\70001A.DWG

APPROVALS		DATE
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CHECKED	JMC	061313
RELEASED		

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

TITLE OUTLINE & INSTALLATION
REMOTE CONTROL ASSY
RP–LH

B | DWG.NO. 201670–001 | REV. A

SCALE NONE | SHEET 1 OF 1