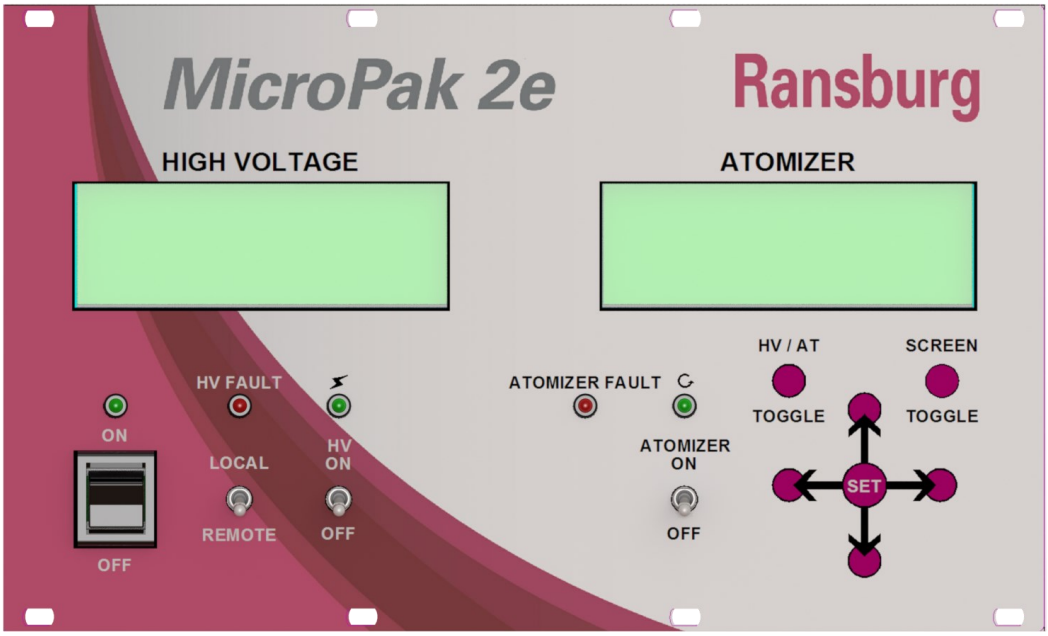
SERVICE MANUAL
LN-9624-00
June — 2014

Ransburg

MicroPak 2e
HV & Atomizer Controller



MODEL: A13338

IMPORTANT: Before using this equipment, carefully read SAFETY PRECAUTIONS, starting on page 1, and all instructions in this manual. Keep this Service Manual for future reference.

Service Manual Price: $50.00 (U.S.)

NOTE: This is the first release of this manual.

CONTENTS MicroPak 2e HV Controller

CONTENTS — MicroPak 2e Atomizer Controller

SAFETY

SAFETY PRECAUTIONS

Before operating, maintaining or servicing any Ransburg electrostatic coating system, read and understand all of the technical and safety literature for your Ransburg products. This manual contains information that is important for you to know and understand. This information relates to USER SAFETY and PREVENTING EQUIPMENT PROBLEMS. To help you recognize this information, we use the following symbols. Please pay particular attention to these sections.

A WARNING! states information to alert you to a situation that might cause serious injury if instructions are not followed.

A CAUTION! states information that tells how to prevent damage to equipment or how to avoid a situation that might cause minor injury.

A NOTE is information relevant to the procedure in progress.

While this manual lists standard specifications and service procedures, some minor deviations may be found between this literature and your equipment. Differences in local codes and plant requirements, material delivery requirements, etc., make such variations inevitable. Compare this manual with your system installation drawings and appropriate Ransburg equipment manuals to reconcile such differences.

Careful study and continued use of this manual will provide a better understanding of the equipment and process, resulting in more efficient operation, longer trouble-free service and faster, easier troubleshooting. If you do not have the manuals and safety literature for your Ransburg system, contact your local Ransburg representative or Ransburg.

! WARNING

➤ The user **MUST** read and be familiar with the Safety Section in this manual and the Ransburg safety literature therein identified.

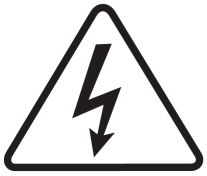
➤ This manual **MUST** be read and thoroughly understood by **ALL** personnel who operate, clean or maintain this equipment! Special care should be taken to ensure that the **WARNINGS** and safety requirements for operating and servicing the equipment are followed. The user should be aware of and adhere to ALL local building and fire codes and ordinances as well as **NFPA-33 SAFETY STANDARD, LATEST EDITION**, prior to installing, operating, and/or servicing this equipment.

! WARNING

➤ The hazards shown on the following pages may occur during the normal use of this equipment. Please read the hazard chart beginning on page 2.

AREA Tells where hazards may occur.	HAZARD Tells what the hazard is.	SAFEGUARDS Tells how to avoid the hazard.
Spray Area 	**Fire Hazard** Improper or inadequate operation and maintenance procedures will cause a fire hazard. Protection against inadvertent arcing that is capable of causing fire or explosion is lost if any safety interlocks are disabled during operation. Frequent Power Supply or Controller shutdown indicates a problem in the system requiring correction.	Fire extinguishing equipment must be present in the spray area and tested periodically. Spray areas must be kept clean to prevent the accumulation of combustible residues. Smoking must never be allowed in the spray area. The high voltage supplied to the atomizer must be turned off prior to cleaning, flushing or maintenance. When using solvents for cleaning: • Those used for equipment flushing should have flash points equal to or higher than those of the coating material. • Those used for general cleaning must have flash points above 100°F (37.8°C). Spray booth ventilation must be kept at the rates required by NFPA-33, OSHA, country, and local codes. In addition, ventilation must be maintained during cleaning operations using flammable or combustible solvents. Electrostatic arcing must be prevented. Safe sparking distance must be maintained between the parts being coated and the applicator. A distance of 1 inch for every 10KV of output voltage is required at all times. Test only in areas free of combustible material. Testing may require high voltage to be on, but only as instructed. Non-factory replacement parts or unauthorized equipment modifications may cause fire or injury. If used, the key switch bypass is intended for use only during setup operations. Production should never be done with safety interlocks disabled. Never use equipment intended for use in waterborne installations to spray solvent based materials. The paint process and equipment should be set up and operated in accordance with NFPA-33, NEC, OSHA, local, country, and European Health and Safety Norms.

AREA Tells where hazards may occur.	HAZARD Tells what the hazard is.	SAFEGUARDS Tells how to avoid the hazard.
Spray Area 	**Explosion Hazard** Improper or inadequate operation and maintenance procedures will cause a fire hazard. Protection against inadvertent arcing that is capable of causing fire or explosion is lost if any safety interlocks are disabled during operation. Frequent Power Supply or Controller shutdown indicates a problem in the system requiring correction.	Electrostatic arcing must be prevented. Safe sparking distance must be maintained between the parts being coated and the applicator. A distance of 1 inch for every 10KV of output voltage is required at all times. Unless specifically approved for use in hazardous locations, all electrical equipment must be located **outside** Class I or II, Division 1 or 2 hazardous areas, in accordance with NFPA-33. Test only in areas free of flammable or combustible materials. The current overload sensitivity (if equipped) MUST be set as described in the corresponding section of the equipment manual. Protection against inadvertent arcing that is capable of causing fire or explosion is lost if the current overload sensitivity is not properly set. Frequent power supply shutdown indicates a problem in the system which requires correction. Always turn the control panel power off prior to flushing, cleaning, or working on spray system equipment. Before turning high voltage on, make sure no objects are within the safe sparking distance. Ensure that the control panel is interlocked with the ventilation system and conveyor in accordance with NFPA-33, EN 50176. Have fire extinguishing equipment readily available
General Use and Maintenance 	Improper operation or maintenance may create a hazard. Personnel must be properly trained in the use of this equipment.	Personnel must be given training in accordance with the requirements of NFPA-33, EN 60079-0. Instructions and safety precautions must be read and understood prior to using this equipment. Comply with appropriate local, state, and national codes governing ventilation, fire protection, operation maintenance, and housekeeping. Reference OSHA, NFPA-33, EN Norms and your insurance company requirements.

AREA Tells where hazards may occur.	**HAZARD** Tells what the hazard is.	**SAFEGUARDS** Tells how to avoid the hazard.
Spray Area / High Voltage Equipment 	**Electrical Discharge** There is a high voltage device that can induce an electrical charge on ungrounded objects which is capable of igniting coating materials. Inadequate grounding will cause a spark hazard. A spark can ignite many coating materials and cause a fire or explosion.	Parts being sprayed and operators in the spray area must be properly grounded. Parts being sprayed must be supported on conveyors or hangers that are properly grounded. The resistance between the part and earth ground must not exceed 1 meg ohm. (Refer to NFPA-33.) Operators must be grounded. Rubber soled insulating shoes should not be worn. Grounding straps on wrists or legs may be used to assure adequate ground contact. Operators must not be wearing or carrying any ungrounded metal objects. When using an electrostatic handgun, operators must assure contact with the handle of the applicator via conductive gloves or gloves with the palm section cut out. NOTE: REFER TO NFPA-33 OR SPECIFIC COUNTRY SAFETY CODES REGARDING PROPER OPERATOR GROUNDING. All electrically conductive objects in the spray area, with the exception of those objects required by the process to be at high voltage, must be grounded. Grounded conductive flooring must be provided in the spray area. Always turn off the power supply prior to flushing, cleaning, or working on spray system equipment. Unless specifically approved for use in hazardous locations, all electrical equipment must be located **outside** Class I or II, Division 1 or 2 hazardous areas, in accordance with NFPA-33.

AREA Tells where hazards may occur.	HAZARD Tells what the hazard is.	SAFEGUARDS Tells how to avoid the hazard.
Electrical Equipment 	**Electrical Discharge** High voltage equipment is utilized in the process. Arcing in the vicinity of flammable or combustible materials may occur. Personnel are exposed to high voltage during operation and maintenance. Protection against inadvertent arcing that may cause a fire or explosion is lost if safety circuits are disabled during operation. Frequent power supply shutdown indicates a problem in the system which requires correction. An electrical arc can ignite coating materials and cause a fire or explosion.	Unless specifically approved for use in hazardous locations, the power supply, control cabinet, and all other electrical equipment must be located outside Class I or II, Division 1 and 2 hazardous areas in accordance with NFPA-33 and EN 50176. Turn the power supply OFF before working on the equipment. Test only in areas free of flammable or combustible material. Testing may require high voltage to be on, but only as instructed. Production should never be done with the safety circuits disabled. Before turning the high voltage on, make sure no objects are within the sparking distance.
Toxic Substances 	**Chemical Hazard** Certain materials may be harmful if inhaled, or if there is contact with the skin.	Follow the requirements of the Material Safety Data Sheet supplied by coating material manufacturer. Adequate exhaust must be provided to keep the air free of accumulations of toxic materials. Use a mask or respirator whenever there is a chance of inhaling sprayed materials. The mask must be compatible with the material being sprayed and its concentration. Equipment must be as prescribed by an industrial hygienist or safety expert, and be NIOSH approved.

AREA Tells where hazards may occur.	HAZARD Tells what the hazard is.	SAFEGUARDS Tells how to avoid the hazard.
Spray Area 	**Explosion Hazard—Incompatible Materials** Halogenated hydrocarbon solvents for example: methylene chloride and 1,1,1,-Trichloroethane are not chemically compatible with the aluminum that might be used in many system components. The chemical reaction caused by these solvents reacting with aluminum can become violent and lead to an equipment explosion.	Aluminum is widely used in other spray application equipment - such as material pumps, regulators, triggering valves, etc. Halogenated hydrocarbon solvents must never be used with aluminum equipment during spraying, flushing, or cleaning. Read the label or data sheet for the material you intend to spray. If in doubt as to whether or not a coating or cleaning material is compatible, contact your coating supplier. Any other type of solvent may be used with aluminum equipment.

N O T E S

INTRODUCTION—HV CONTROLLER

GENERAL DESCRIPTION

The ***Ransburg MicroPak 2e*** (A13338-00), in conjunction with an appropriate cascade is used to provide high voltage for electrostatic application equipment. The controller is packaged in a single package measuring 5.1" tall X 8.5" wide X 6.5" deep. The controller can operate in "Local" and "Remote" conditions with either "Voltage Mode" or "Current Mode" of high voltage control.

The Ransburg MicroPak 2e Controller uses a combination of proven high voltage generation technology including microprocessor-based control with diagnostic and communication functions. It uses a variable voltage output to drive a cascade that amplifies the voltage to a high value. It also uses both current and voltage feedback information to maintain the desired set point. The processor circuitry provides the maximum in applicator transfer efficiency, while maintaining the maximum safety

DISPLAYS

The front panel displays the high voltage and current output from the cascade as true readings. They are derived from feedback signals in the low voltage cable between the controller and the cascade.

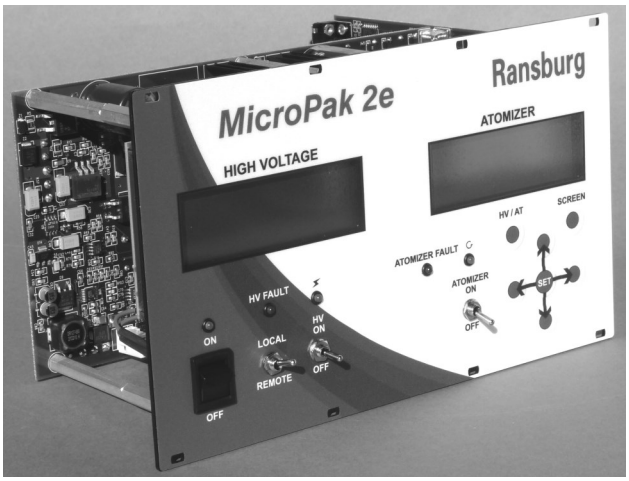


Figure 1: MicroPak 2e Controller

SAFETY FEATURES

When used with the appropriate applicators and cascades, the Ransburg MicroPak 2e Controller provides the ultimate in operational safety. The protections include Overvoltage, Overcurrent, Di/Dt and Dv/Dt. The microprocessor circuits allow the use of output load curve control, which limits the high voltage output to safe levels when the controls are set responsibly and safe distances are observed and followed.

SPECIFICATIONS

(At Sea-Level Conditions)

Environmental / Physical

Operating Temperature: 0°C to +55°C

Storage and Shipping Temperature: -40°C to +85°C

Humidity: 95% Non-Condensing

Physical Size: 5.1" tall X 8.5" wide X 6.5" deep

Electrical Requirements

Power Required:
(per controller)

J11 - Controller : 24V DC @ 0.5 Amps

J4 - Cascade: 24V DC @ 6.0 Amps (fully loaded output), RansPak 1000 (RP1000 or LEPS5002) Cascade

24V DC @ 2.0 Amps (fully loaded output), HP404, RP404, HP505 and CONSOLIDATED Cascades

Note: 24V DC power supply must be regulated and have over current and over voltage protection.

Electrical

Controls:

High Voltage Power : 24 Volts, 10Amp, Form C relay contact

Discrete In: (Dry Contact)
Remote Stop
Misc IO Interlock/Trigger
Door Interlock
Booth Air Interlock
(Analog)
KV Setpoint (0-10VDC)

Discrete Out: (3, Dry Contact)
Interlock Out
External Power Enable
System Alarm

Controller Operating Range

High Voltage: 0-100kV, settable in 1kV increments

Current:

HP404/RP404	0-125 microamps
CONSOLIDATED	0-150 microamps
HP505	0-240 microamps
RP1000	0-1000 microamps
LEPS5002	0-1000 microamps

Communication Requirements

Control and Reporting: EtherNet/IP

Note: A unique MAC address is hard coded into each MicroPak 2e & Atomizer Controller. User controls must be configured to recognize each unique address.

Internal Controller

Scan Time: 1 msec
(all data is taken from a rolling average of 16 scans)

HP404 / RP404 Cascades

Output:	100 kV @ 0 µA 125 µA @ 0 kV
Cascade Size:	HP404 1.50” X 1.56” x 7.0” RP404 4” X 4” X 12”

RP1000 / LEPS5002 Cascades

Output:	100 kV @ 0 µA 1000 µA @ 0 kV
Cascade Size:	RP1000 4” X 4” X 12” LEPS5002 17”x13”x13”

HP505 Cascade

Output:	100 kV @ 0 µA 240 µA @ 0 kV
Cascade Size:	1.50” X 1.56” x 7.0”

CONSOLIDATED Cascade

Output:	100 kV @ 0 µA 150 µA @ 0 kV
Cascade Sizes:	
A12760-02 (IN LINE)	3” X 3” x 16.97”
A12761-02 (RGT ANGLE)	3” X 7.64” x 11.8”

PASSWORD PROTECTION

MicroPak 2e Controller parameters are password protected with three levels, *Config, System and User* to help prevent unqualified operators from changing the values. The password menu is composed of two screens. The first screen prompts the user to confirm they wish to enter the required password, while the second screen accepts the entry of the password digits. The three levels represent a hierarchy with *Config* at the top, *System* in the middle and *User* at the bottom. This means that while a higher level password is active, the user will not be required to enter a lower level password if they change a parameter which requires it.

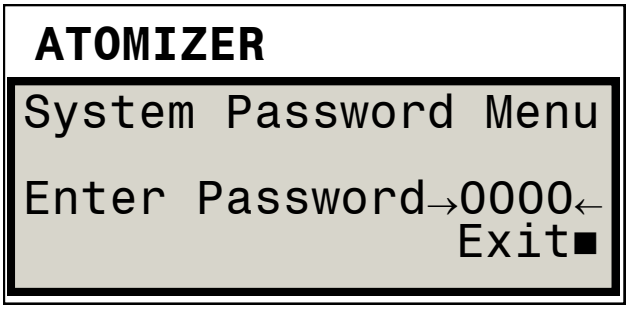


Figure 2: 1st Password Screen

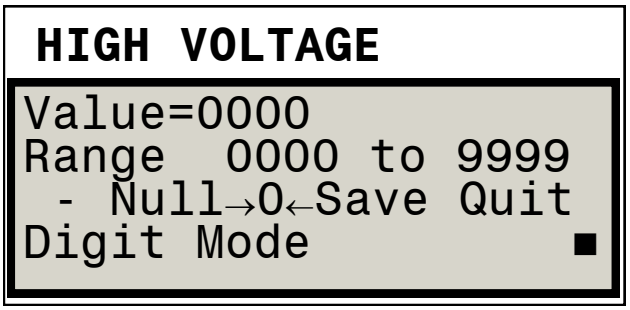


Figure 3: 2nd Password Screen

OPERATOR INTERFACE

The MicroPak 2e Controller shown in figure 4, has a physically simple operator interface consisting of five (5) LED's (Light Emitting Diodes), four (4) switches, seven (7) buttons, and two four line twenty character (4 X 20) alpha/numeric displays.

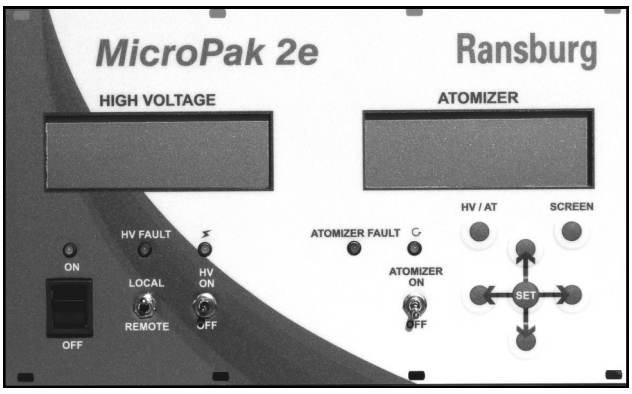


Figure 4: Operator Interface

SWITCHES

Power Switch

The rocker switch on the left and the LED directly above it are for power On/Off selection and display. The green LED is on when the power is On to the controller.

Local / Remote Switch

This is a two position toggle switch used to determine if the Local (Front Panel) controls have priority or if the Remote controls (EtherNet/IP Connection or Discrete inputs) have priority. If the switch is up (Local Mode) the Front Panel controls may change parameters, enable or disable the high voltage, and clear faults. The Remote EtherNet/IP connection may look at parameters and values, but may not change them or enable/disable the high voltage output. If the switch is down (Remote Mode) the opposite is true except that the Front Panel switch may be changed to local Mode at any time to disable the Remote Controls and to enable the Local Controls.

HV On / Off Switch

This is a return-to-center momentary toggle switch. It is active only when the Local/Remote mode switch is set to Local. It is used to enable and disable the High Voltage output and to clear system faults. When the System Checks and Current Status are OK, flipping the switch to the up position (HV On) will enable High Voltage Output (see "Figure 4 - Operator Interface" in this section). Flipping it to the down position (HV Off) will disable the High Voltage Output. If there is a system fault,

flipping this switch to the OFF position (also known as the Reset position) will reset (clear) any faults currently detected by the system.

Atomizer On / Off Switch

This is a two position toggle switch. It is used to enable and disable (i.e. start and stop) a configured atomizer when in LOCAL mode. When the controller is in REMOTE mode it is ignored.

LED'S

Power LED

If the Green Power LED is on, then the system power to the controller is On.

HV Fault LED

The red HV Fault LED is lit when the system detects a fault condition (see "Figure 4 - Operator Interface" in the SWITCHES section). When operating in "Local Mode", it is cleared by flipping the HV On/Off switch to the OFF (Reset) position. If the system is still in a fault condition, it will immediately be lit as the system detects the fault.

High Voltage LED

The green High Voltage LED displays the current state of the High Voltage Output. This LED is illuminated whenever High Voltage is being supplied.

Atomizer Fault LED

The red Atomizer Fault LED is lit when the Atomizer subsystem detects a fault condition. This condition will be displayed on the Atomizer status screen.

Atomizer LED

The green Atomizer LED is lit when the Atomizer controller commands the turbine to spin.

BUTTONS

The seven buttons used to control the viewing and entry of information on the two 4 X 20 character displays are:

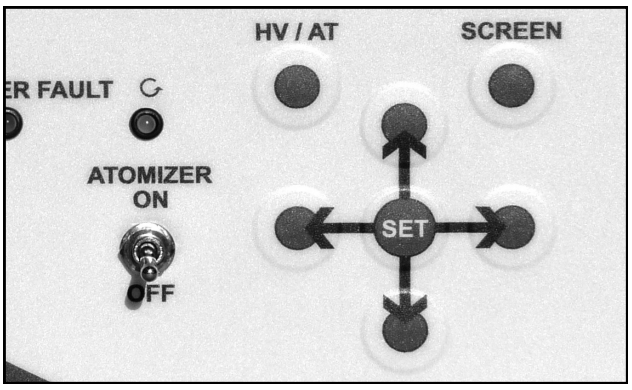


Figure 5: Buttons

HV/AT Button

The High Voltage/Atomizer Button (just below the right display) is used to toggle the active display between the “Atomizer” and “High Voltage” displays. Note that the active display always has a ■ (block character) in the lower right corner. So when the High Voltage is the active display, it will look like "Figure 3 - 2nd Password Screen" in the PASSWORD PROTECTION section.

Screen Button

The Screen Button (just below the right display) is used to change (toggle) to the next Menu screen. The menu screens wrap around so that after the last screen it will return to the first screen.

Up and Down Buttons

The buttons above and below the Set Button in the middle (the Up and Down Buttons) are used to move the selection indicator vertically to a value to be selected by the Set Button. When in a value entry menu, the Up and Down buttons are used to increase or decrease the value being entered.

Set Button

This labeled button (in the middle) is used to select the value to change and to enter the change after it has been made.

Left and Right Buttons

The buttons to the right and left of the Set Button (the Left and Right Buttons) are used to move the selection horizontally.

INSTALLATION

GENERAL INFORMATION

WARNING

➤ The MicroPak 2e Controller **MUST** be located outside of the hazardous area.

➤ The User **MUST** read and be familiar with the “Safety” section of this manual.

➤ This manual **MUST** be read and thoroughly understood by **ALL** personnel who operate, clean, or maintain this equipment! Special care should be taken to ensure that the warnings and requirements of operating and servicing safely are followed. The user should be aware of and adhere to ALL local building and fire codes and ordinances as well as NFPA-33, OSHA, and all related country safety codes prior to installing, operating, and/or servicing this equipment.

➤ Only approved applicators should be used with the MicroPak 2e High Voltage Controller.

NOTE

➤ As each installation is unique, this information is intended to provide general installation information for the MicroPak 2e Controller. Consult your authorized Ransburg distributor or Ransburg Technical Service for specific directions pertaining to the installation of your equipment.

LOCATION OF PRODUCT

Install the controller assembly in a control cabinet that is protected from the possibility of any contact with water, vapor or high humidity. Ambient temperature should not exceed 131°F (55°C). The area should be clean, dry and well ventilated.

CAUTION

➤ **DO NOT** locate the Controller near or adjacent to heat producing equipment such as ovens, high wattage lamps, etc.

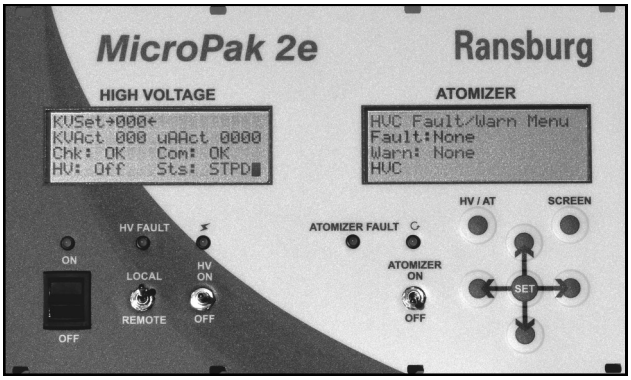


Figure 6: Installation

MOUNTING

Using eight (8) #4-40 or M3 screws (not included), secure the front panel of the MicroPak 2e & Atomizer Controller, using the supplied mounting holes, to enclosure. See Figure 43 in the appendix for a mounting diagram.

INPUT POWER CONNECTIONS

Input power must be supplied from one or two regulated DC power supplies. Two connectors, J4 and J11 are provided so that controller operating power may be separated from cascade operating power. Cascade operating power is delivered through J4 and controller operating power is delivered through J11. This configuration gives the user the ability to provide an ESTOP by inserting a suitable switch or contactor in the J4 power leads. When separate control of the cascade power is not required, power to J4 and J11 can be run from one DC power supply.

CAUTION

➤ Power supplies connected to J4 and J11 must be protected against excessive current and provide Over Voltage protection.

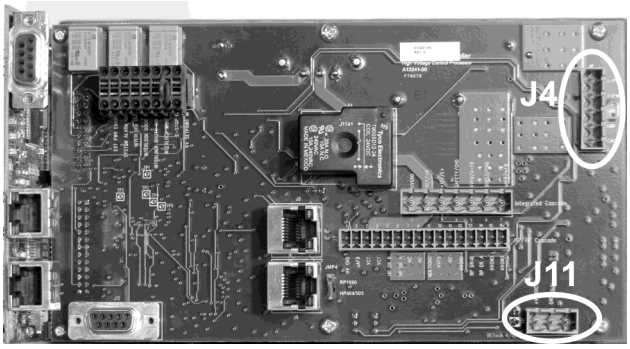


Figure 7: Input Power Connections

TABLE 1

Signal Name	J4 Connection	Power Supply
+VPWR	Pin 1	+ 24 VDC
+VPWR	Pin 2	+ 24 VDC
GND	Pin 3	DC return
GND	Pin 4	DC return
CHGND	Pin 5	Earth Ground

Tables 1 & 2 show the connections for Cascade and Controller power.

TABLE 2

Signal Name	J11 Connection	Power Supply
+VPWR	Pin 1	+ 24 VDC
GND	Pin 2	DC return
N.C.	Pin 3	N.C.

NOTE

➤ The Ransburg MicroPak 2e Controller has a built in resettable fuse in the controller power lead, so if the controller logic draws a current in excess of 1.5 amps it will open. Reset is achieved by turning controller power OFF for 5 minutes then back ON.

ETHERNET CONNECTORS

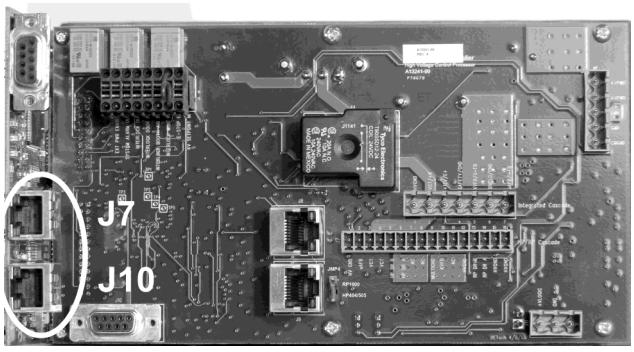


Figure 8: Ethernet Connector

Use the appropriate 10/100BASE-T Ethernet wiring (Straight EIA/TIA 568A) for your installation with an RJ-45 plug to connect to the MicroPak 2e Controller. Connection can be made using either J7 or J10 as shown in Figure 8 above.

NOTE

➤ The Ethernet connectors J7 and J10 use an integrated Ethernet Switch to connect to the controller. This allows the MicroPak 2e Controller to be networked with the LAN of a Robot or PLC and still provide a connection for a local networked display.

OUTPUT TO CASCADE

Make connections from either J6 or J7 of the controller, depending on the cascade in use. Refer to Table 3 for J6 connections and Table 4 for J7 connections.

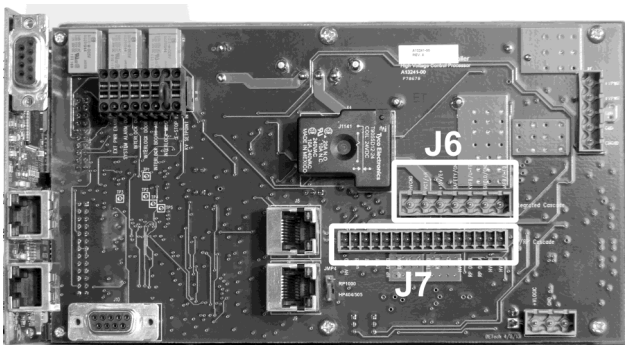


Figure 9: Outputs to Cascade

TABLE 3

J6	Cascades A12760-02 / A12761-02
HVGND	Pin 1 0 VDC for R+ and E+ Power
VCT/R+	Pin 2 Analog DC Cascade Drive Signal
+15V/E+	Pin 3 Nominal 15 VDC for Cascade Electronics
SAFETY /GND	Pin 4 0 VDC for Analog Cascade Voltage Feedback
KVFB/ V-FB	Pin 5 Analog Cascade Voltage Feedback Signal
SHIELD/ GND	Pin 6 0 VDC for Analog Cascade Current Feedback
μAFB/ I-FB	Pin 7 Analog Cascade Current Feedback Signal

TABLE 4

J7	Cascades HP404, RP404, HP505, RP1000, LEPS5002
HVGND	Pin 1 0 VDC for VCT Power
μAFB	Pin 2 Analog Cascade Current Feedback Signal
VCT	Pin 3 Analog DC Cascade Drive Signal
VCT	Pin 4 Analog DC Cascade Drive Signal
HP_DR B	Pin 5 Digital Cascade Drive Signal (HP404, HP505)
HP_DR A	Pin 6 Digital Cascade Drive Signal (HP404, HP505)
N.C.	Pin 7 (Termination point; No Connection)
N.C>	Pin 8 (Termination point; No Connection)
MULTI-GND	Pin 9 0 VDC for Analog Cascade Voltage Feedback
KVFB	Pin 10 Analog Cascade Voltage Feedback Signal
N/C	Pin 11 (Termination point; No Connection)
HVGND	Pin 12 0 VDC for VCT Power
RP DR B	Pin 13 Digital Cascade Drive Signal (RP1000, LEPS5002)
RP DR A	Pin 14 Digital Cascade Drive Signal (RP1000, LEPS5002)
HVGND	Pin 15 0 VDC for VCT Power
HVGND	Pin 16 0 VDC for VCT Power

ELECTRICAL NOISE

MicroPak 2e Grounding

1. The Power Supply must be referenced to true earth ground at only one point, through the controller's chassis ground connection. (Refer to Figures 10, 11, and 12 for Grounding Connections.)

2. Shields from the low voltage cable must be connected to the chassis ground where the controller's ground connection is made, then by a 3/4" braid to the building steel or ground grid if available.

MicroPak 2e Grounding (cont.)

3. The low voltage cable has a large amount of high frequency noise on the shields and grounds from being in proximity to the high voltage generator. Taking these grounds directly to earth ground or a ground grid through good high frequency conductors (braid) keeps this high frequency noise from interfering with the low voltage control circuitry.

4. The feedback signals for kV and μA are developed with respect to the cascade ground signal (MULTIGND). If the cascade ground were routed only to earth ground via the above mentioned shields, the feedback conditioning circuitry would have to depend on the panel ground or power supply common to get a ground reference for the feedback signals. This means the low level return current for these signals would have to flow to earth ground and back to the controller via factory ground or power supply common. This adds large amounts of noise to these low voltage signals. To combat these effects, the controller PCB provides a connection for MULTIGND which is separately routed to the CHGND pin of J4. This is the single ground point for MULTIGND, HVGND and logic GND to minimize noise on the cascade feedback signals.

5. A great deal of testing under high voltage corona conditions has confirmed that this cascade ground should be connected directly at a single point to the signal ground plane of the MicroPak 2e power supply controller. This single point method maintains a “clean” feedback signal while limiting the amount of high frequency noise that is dumped onto the signal ground and therefore other grounds in the overall system, such as a PLC or robot.

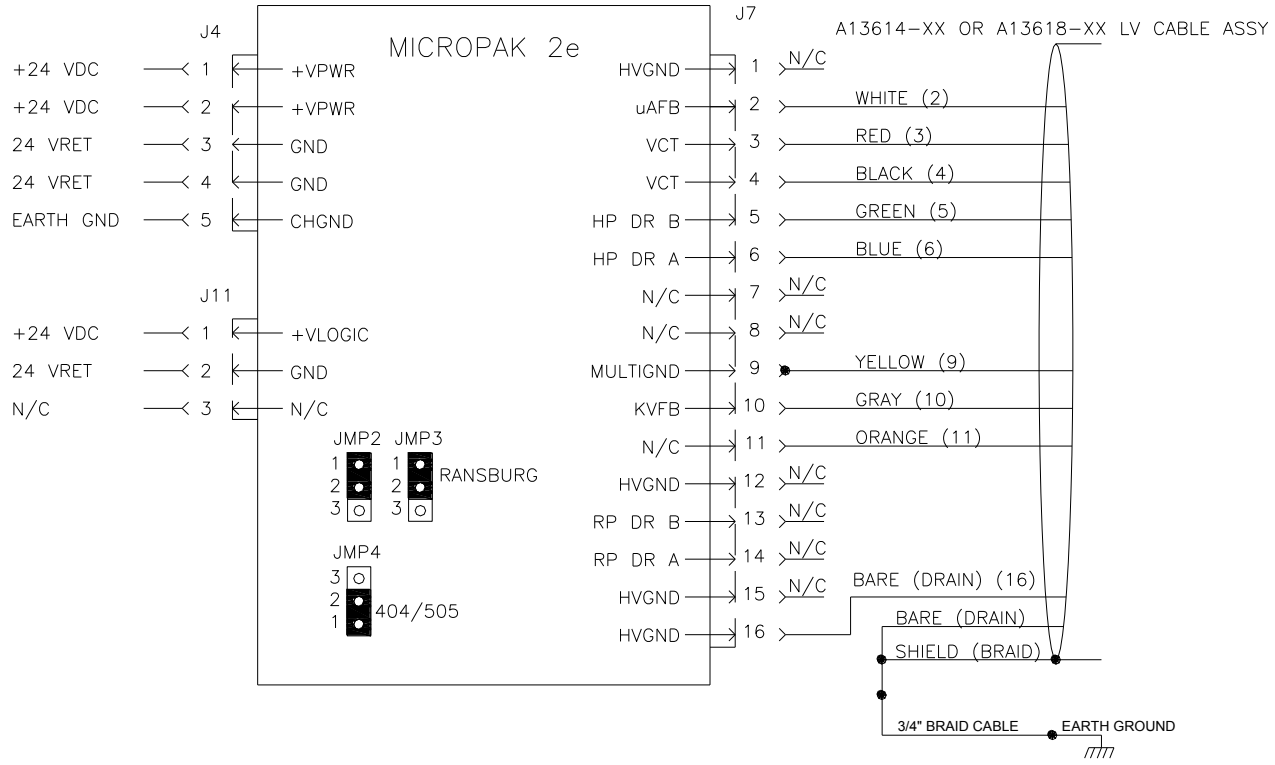


Figure 10: MicroPak 2e Controller W/HP404, RP-404 & HP505 Cascade

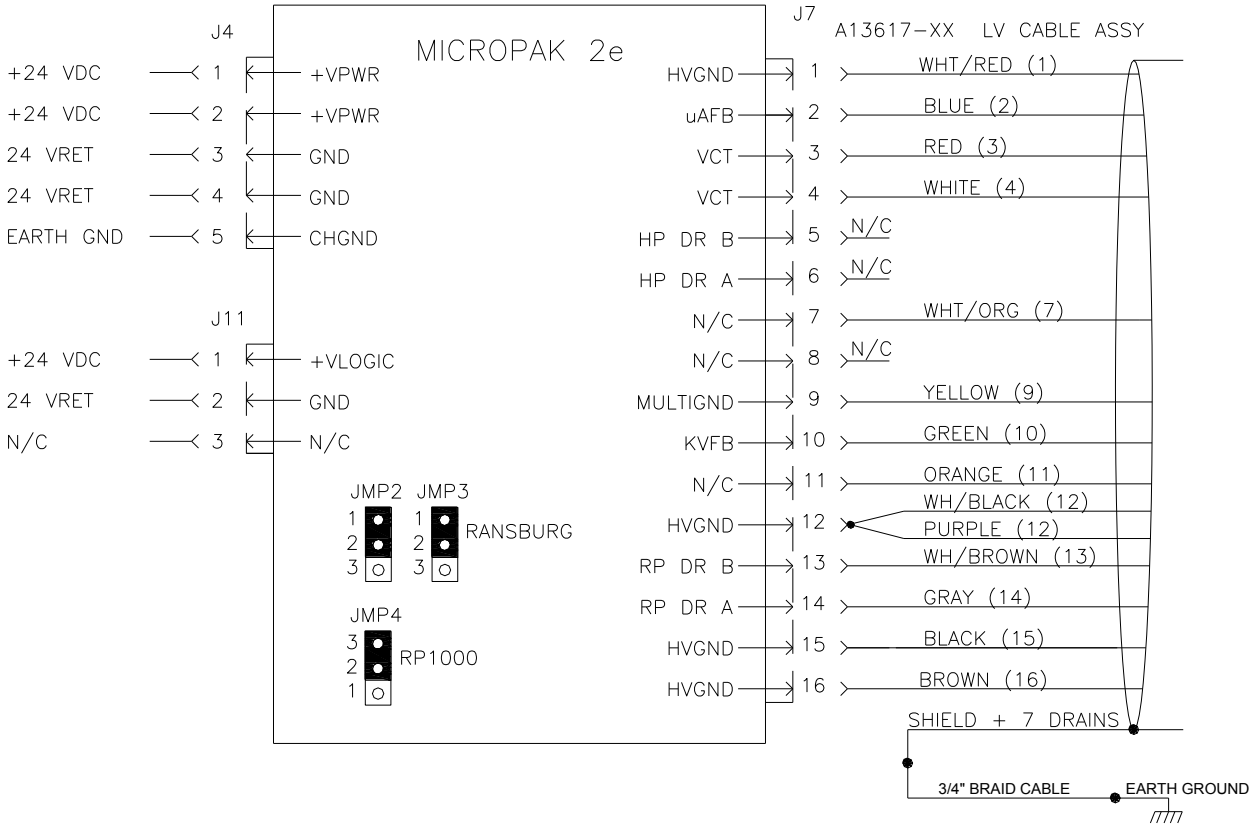


Figure 11: MicroPak 2e Controller W/LEPS5002 or 74793 Cascade (RansPak 1000)

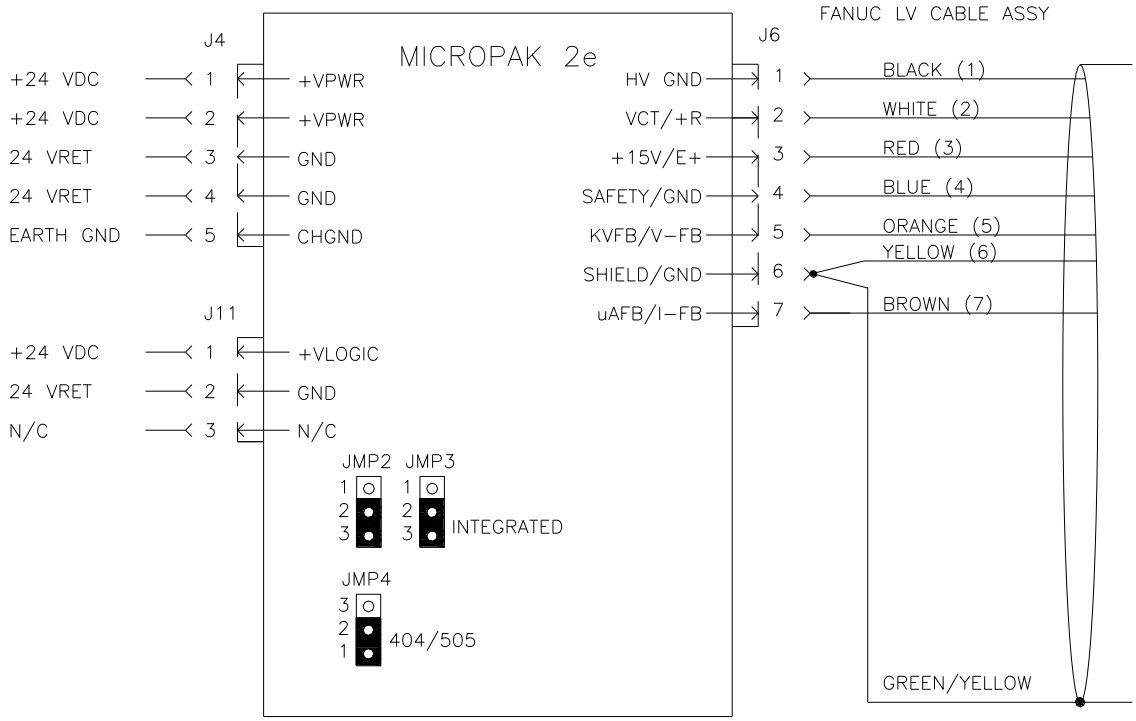


Figure 12: MicroPak 2e Controller W/CONSOLIDATED Cascade

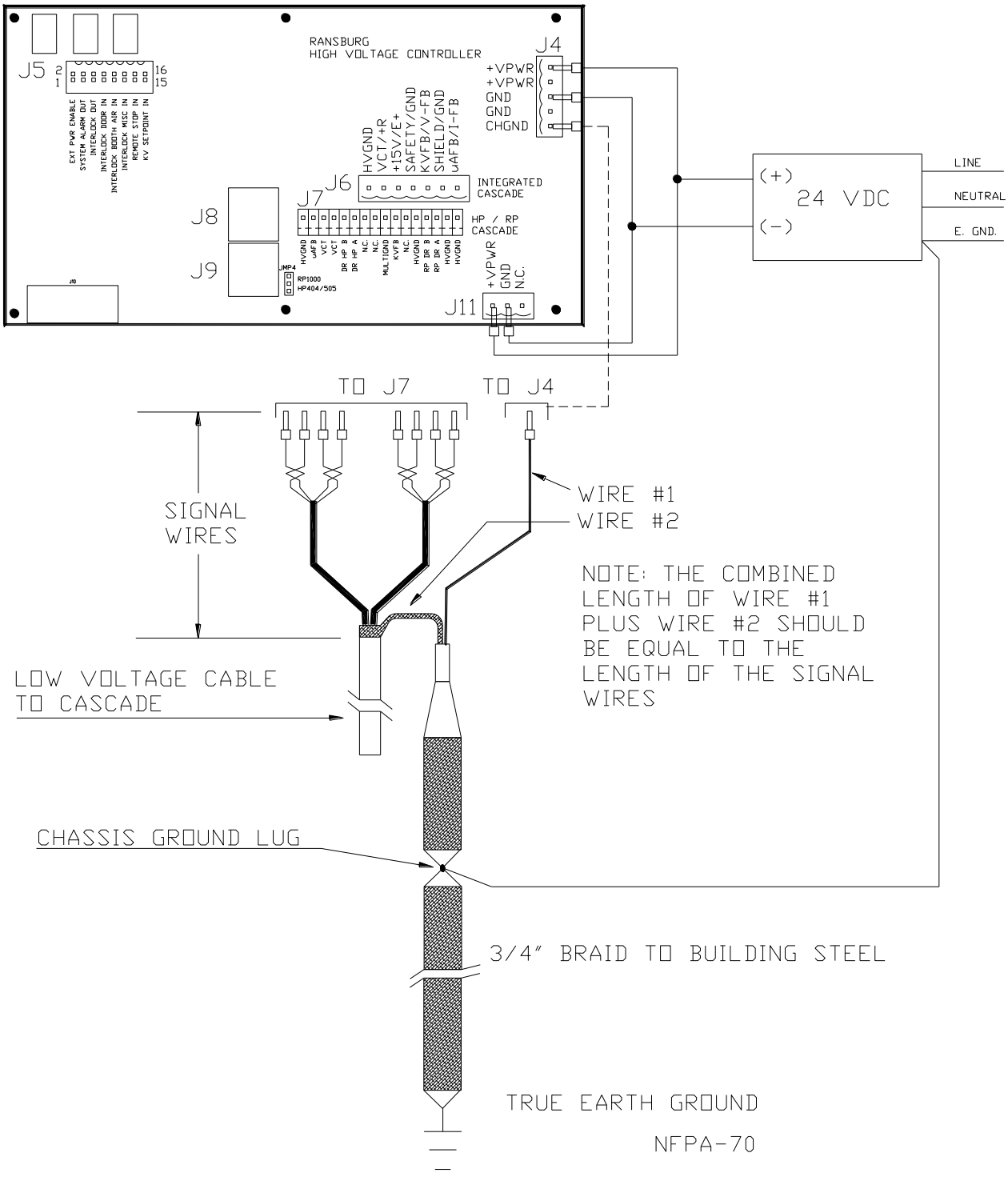


Figure 13: Proper Power Supply and Grounding Connections

INTERLOCK CONNECTIONS

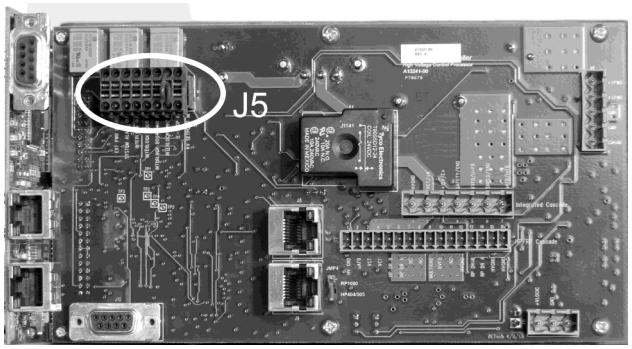


Figure 14: Interlock Connector

J5 is supplied to give the end-user access to interlock connections for integrating the controller into the user's system. Three output signals are provided thru dry contacts (rated 30 VDC @ 2 amps maximum). These three signals indicate: 1) the state of controller operating power, 2) when a controller fault exists, and 3) the state of the controller interlock inputs. Four input signals are provided which should only be connected to dry contact outputs from the user's system. The four interlock signals are designated as: 1) a door interlock, 2) a booth air interlock, 3) a miscellaneous interlock, which can be configured to serve as a HV Trigger input, and 4) a remote stop input which removes power from the cascade drive circuits when sensed by the Display and Communications Processor. A fifth input which accepts a 0-10 VDC analog control signal is provided to allow control of the high voltage setpoint.

NOTE

➤ The fourth interlock input *Remote Stop* cannot be disabled through software. If the user does not wish to use the Remote Stop input, a jumper must be placed between J5-13 and J5-14 to close the *Remote Stop* circuit.

Table 5 shows the pin assignments for the interlock signals.

TABLE 5

Outputs	**J5**
External Power Enable	Pins 1, 2
System Alarm Out	Pins 3, 4
Interlock Out	Pins 5, 6
Interlock Inputs	
Door Interlock (+)	Pins 7 *
Door Interlock (-)	Pins 8
Booth Air Interlock (+)	Pins 9 *
Booth Air Interlock (-)	Pins 10
Misc.Interlock/Trigger(+)	Pins 11 *
Misc. Interlock/Trigger(-)	Pins 12
Remote Stop (+)	Pins 13 *
Remote Stop (-)	Pins 14
Analog Input	
KV Setpoint (+)	Pins 15
KV Setpoint (Gnd)	Pins 16

* Refer to the following note.

NOTE

➤ The positive interlock input pins are directly connected to the internal +24VDC of the MP2e controller. It is recommended that these pins not be run outside of the MP2e enclosure without the addition of series limiting resistors (3.3K, 1/4w). This will prevent overloading the MP2e internal current limit if a positive input is accidentally shorted to ground. Alternatively, the user can provide a separate +24VDC supply external to the MP2e to power the (-) interlock inputs.

N O T E S

OPERATION — HV Controller

START-UP

Before its' first use, the following features of the MicroPak 2e controller must be configured by the user.

- If the EtherNet/IP interface will be used, it must be enabled.
- A valid IP address for EtherNet/IP use.

NOTE

➤ The MicroPak 2e controller will come preconfigured from the factory for the following: 1) The type of cascade to be driven, 2) whether an Atomizer Controller is included or not and 3) the Atomizer type supported when an Atomizer Controller is included..

In addition if an Atomizer Controller is present, the user must configure the following features of the Atomizer Controller.

- The type of each signal being supplied to the seven analog inputs of the Atomizer controller. i.e. Voltage (0-10 V) or Current (4-20mA).

NOTE

➤ For correct operation of the analog inputs, jumpers JMP15 through JMP9 on the Atomizer Controller must also be set to the matching V or I mode. See the section on Atomizer operation for further details.

START-UP MENU

The two menus that display on the unit at power up are shown in Figures 15 and 16. The HIGH VOLTAGE screen displays the Serial Number, Copyright Date and Software Version of the unit.

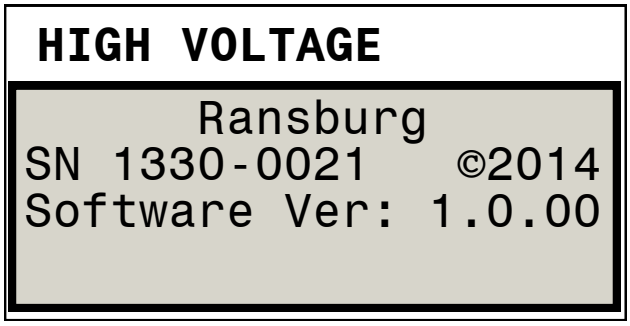


Figure 15: Start-Up Menu Screen (Left)

The ATOMIZER screen allows the user to select from one of three options: RUN mode, Configuration mode, or Diagnostics mode. In addition, the bottom line displays the status of the system connections.

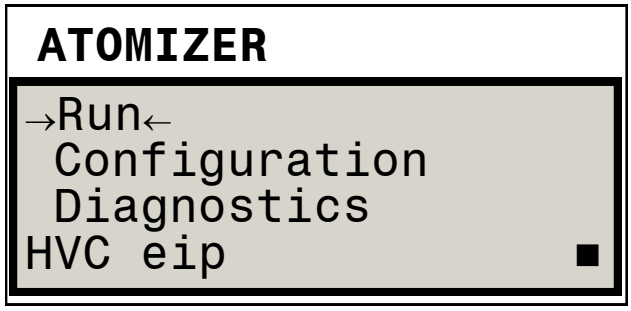


Figure 16: Start-Up Menu Screen (Right)

The status is displayed via upper or lower case letters which indicate the associated board is communicating (upper case) or not communicating (lower case). The letters "HVC" represents the High Voltage Control board and the letters "EIP" represent the EtherNet/IP host connection. If the configuration includes an Atomizer Controller the letters "AT" will be shown.

NOTE

➤ When the REMOTE/LOCAL switch is set to REMOTE at power-up, the controller automatically switches to RUN mode after approximately 5 seconds. When the REMOTE/LOCAL switch is set to LOCAL at power-up, the controller remains in the start-up screens until the user selects a mode.

MENUS AND OPERATION

On all of the menus, if a parameter can be changed it will be proceeded by a blinking "→" and followed by a blinking "←" to show that it is a changeable value. If there is more than one changeable value on a screen, pressing the Up or Down and Left or Right Buttons will move the selection "→ ←"s to the next value. If there are no changeable values on a screen then the "Active Screen Indicator" in the lower right corner will blink. When the selection "→ ←"s surround the value you wish to change, press the Set Button. If the value to be changed requires a password, either the User, System or Config Password Menu will be displayed allowing you to enter the required password. After entering the Password, you are returned to the originally selected value. If the password was entered correctly, the value may now be changed. If the entry was incorrect, the password screen will again be displayed. Once a password has been successfully entered, it will remain active for a period of time that depends on the password type. It then times out and must be re-entered to make further changes. During the active time, the block character indicating the active screen will alternate with the letters U, S or C corresponding to entry of the User, System or Config password. The activated time period for these password types decreases as the privilege level increases (U = 4, S = 3 and C = 2 minutes).

When a numeric value is being changed, a value change menu, similar to the one shown in Figure 17, will be displayed. In this menu the Left and Right Buttons allow the user to select from the two methods available to change a value.

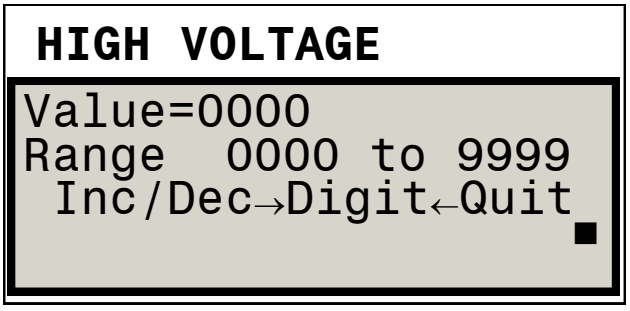


Figure 17: Value Change Screen

If the Inc/Dec method is selected, the user is shown the screen seen in Figure 18. In this mode, the Up and Down buttons (above and below the SET Button) can be used to incrementally change the value. The value will increase with the up button and decrease with the down button until it reaches the maximum or minimum allowed value.

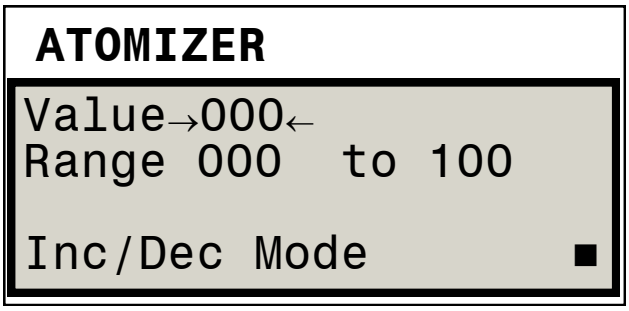


Figure 18: Inc/Dec Change Mode Screen

If the Digit method is selected, the user is shown the screen seen in Figure 19. This shows the current value to be modified, the low and high limits for the selected parameter and the digit mode options to change the current value. The "-" option allows the user to negate the current value displayed. The "Null" option causes the current value to be cleared allowing the user to begin entry of a new value. The 'number' option ("→0←") enables the Up and Down Buttons to select the next digit to be added to the value when the user presses the Set Button. The "Save" option saves any changes made in this screen and exits. And the "Quit" option cancels any changed made in the screen and exits.

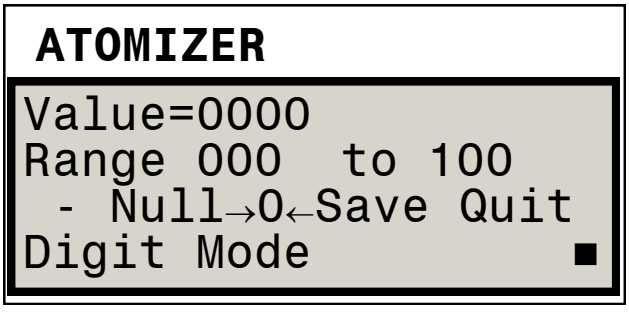


Figure 19: Digit Mode Change Screen

RUN MENUS

High Voltage Run Menu

This menu displays the KVSet value in Voltage Mode. Also displayed by this menu are the control mode and cascade type, the current actual KV value, the current µA value, the current hardware check value, the High Voltage status, and the current controller status. KVSet is the only changeable value on this menu. In Current Control Mode the menu displays µASet as the changeable value instead of KVSet.

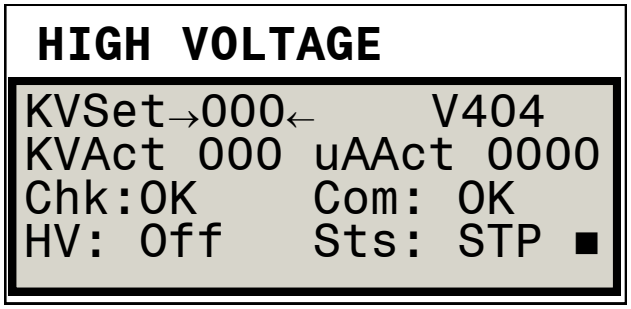


Figure 20: Run Menu Screen

High Voltage Mode Menu

This menu displays whether or not the DiDt or DvDt feature is enabled and the sensitivity of this feature. If the current/voltage changes greater than this value, within 100 milliseconds, a fault occurs. The next element displayed on this screen is a user settable limit on cascade output current when in voltage control mode. This limit has a range of 0 to the maximum current for the currently configured cascade. The last two items displayed are KV Low Limit and KV High Limit which are used in Current Mode to set a lower and upper bound, which if exceeded will cause a fault to occur. All five of these values can be selected and changed. Note: KV Low Limit and KV High Limit are only displayed when in Current Mode.

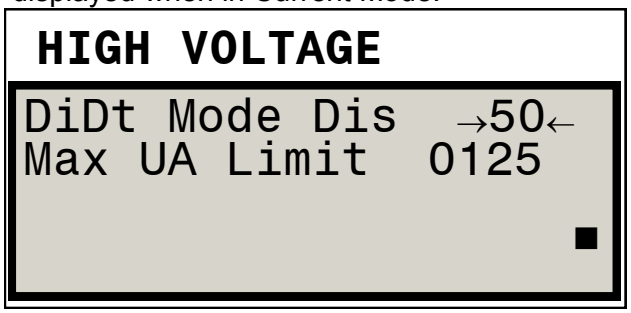


Figure 21: Voltage Mode Screen

High Voltage Fault Menu

This menu displays the latest fault and any current warning. It also provides an option to SAVE the current parameter values as default values. Selecting this option will cause the current values to be stored so that they will be available after a power cycle. If this option is not used, all parameter changes are discarded at the next power cycle when default parameters are restored.

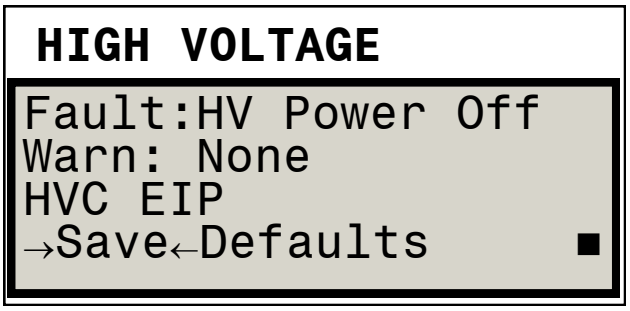


Figure 22: Fault Menu Screen

User Password Menu

When the password has been entered, the user will be returned to the value being changed.

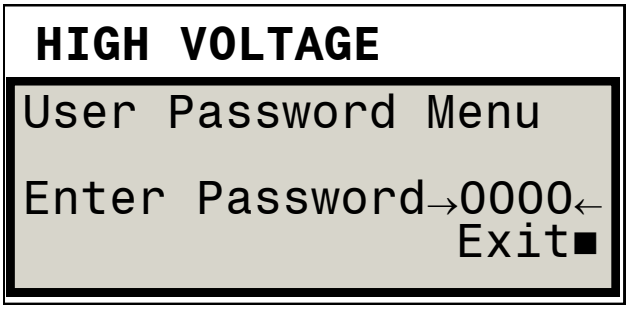


Figure 23: Password Menu Screen

Atomizer Run and Fault Menu

When an atomizer is configured, this menu displays the configured atomizer type on line 1, followed by the Turbine Speed Set Point value and the current actual Turbine Speed value. In addition, the current Fault status of the Atomizer Controller and the current Bearing Air pressure are displayed. If no atomizer is configured, this screen shows the high voltage controller's fault and connection status information similar to figure 22.

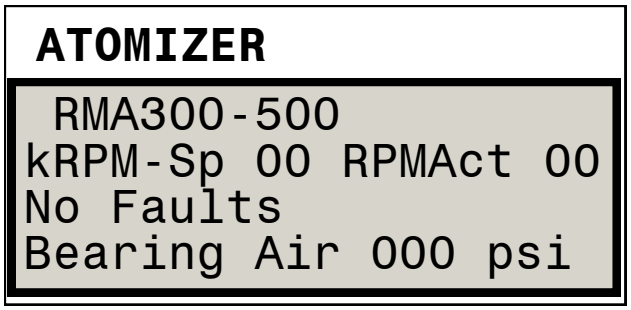


Figure 24: Run Menu Screen (Right)

Atomizer Shape Air Menu

This menu allows the user to manually adjust both the shaping air outputs and the paint flow rate outputs. The values used are expressed as percentages since the controller can be configured to provide either 0-10 V or 4-20 mA analog outputs.

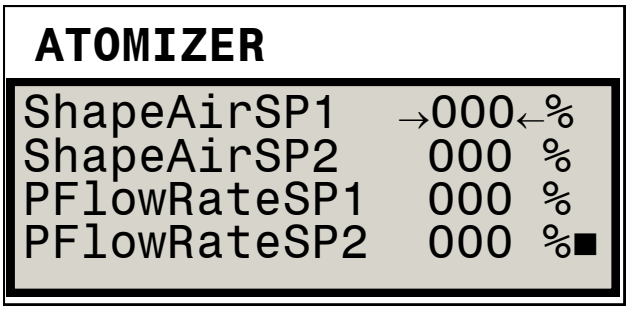


Figure 25: Shape Menu Screen

Atomizer Fluid Maintenance Menu

This menu enables the user to safely perform paint flow calibration or flushing operations by disabling the Fluid Interlocks. Disabling the fluid interlocks cause both the high voltage and atomizer to be disabled (forced off). While at the same time allowing the paint and solvent triggers to occur without checking the rotational speed of the atomizer.

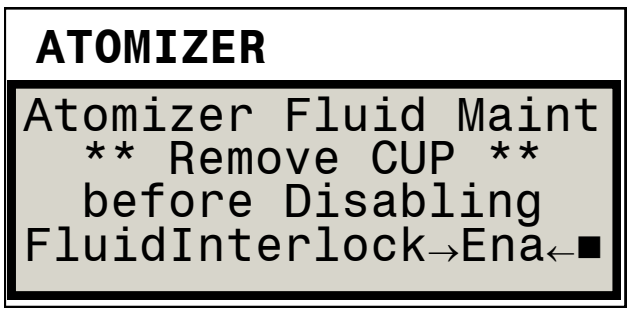


Figure 26: Atomizer Maint Menu Screen

Automatic Gun Fault Menu

This menu displays the latest faults for both the atomizer and high voltage controllers. In addition, it displays any current high voltage warning and the current connection status.

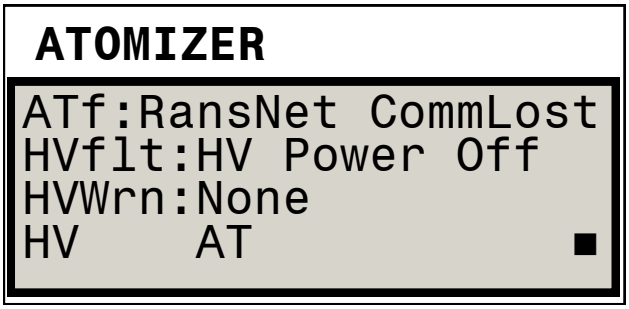


Figure 27: Gun Fault Menu Screen

CONFIGURATION MENUS

High Voltage Controller Configuration Menus

The following seven menus are displayed on the HIGH VOLTAGE screen (left panel).

Cascade Menu

This menu allows the factory to configure the type of cascade connected to the controller.

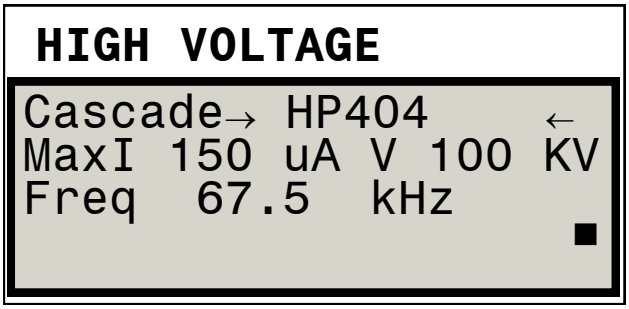


Figure 28: Cascade Menu Screen

Interlock Menu

The three Interlock inputs which can be enabled or disabled are configured in this screen. As seen in Figure 29, the first interlock is labeled *MiscIO*. This input can serve as

either an Interlock input (as shown in Figure 29) or as a Trigger input. It can be configured to the trigger function by selecting *Interlock* and pressing the Set button. It can similarly be returned to the interlock function by selecting *Trigger* and pressing the Set button. The other two inputs are dedicated to use as interlocks and are labeled *Door* and *Booth Air*. This screen has a total of four changeable items.

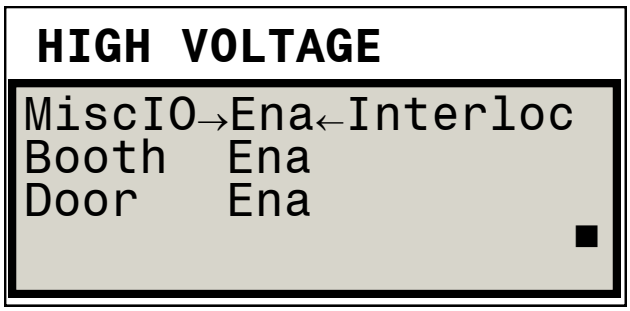


Figure 29: Interlock Menu Screen

➤ **NOTE**

The system default to have all interlocks ENABLED. So if the interlocks are not wired closed, the controller will remain in a faulted condition.

➤ The fourth interlock input *Remote Stop* cannot be disabled. If the user does not wish to use the Remote Stop input, a jumper must be placed between J5-13 and J5-14 to close the *Remote Stop* circuit.

MicroPak V-I Limiting Menu

This menu displays four settings that the factory configures to match the product(s) purchased with the controller. These settings cannot be changed by the user.

The control mode indicates if the controller is set to control Voltage or Current. The Charge Type corresponds to how the high voltage charge is transferred to the material being applied. This is normally set as direct for all cascades except the RP1000 when used with an indirect charge ring, The V-I limiting function is always enabled. It controls a software function which limits the voltage and current load curves to levels very similar to those used in the original MicroPak controller.

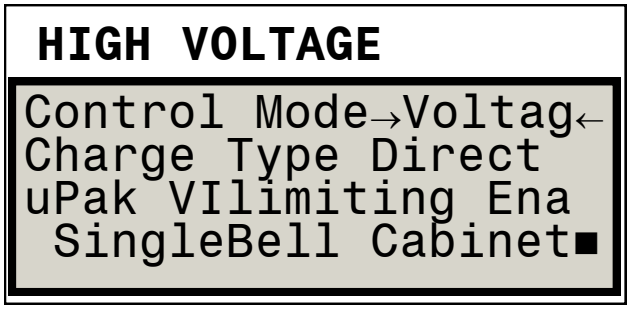


Figure 30: MicroPak V-I Limiting Screen

IP Address Menu

This menu provides the user with four options. It allows setting the EtherNet/IP Address for the controller, provides control over whether EtherNet/IP communications are enabled or not, provides control over whether DHCP is used to acquire an IP address and allows the user to save any Configuration changes that have been made. Note that the Save or Quit options will place the unit into run mode. This is the only way to exit the Configuration Menus other than cycling controller power.

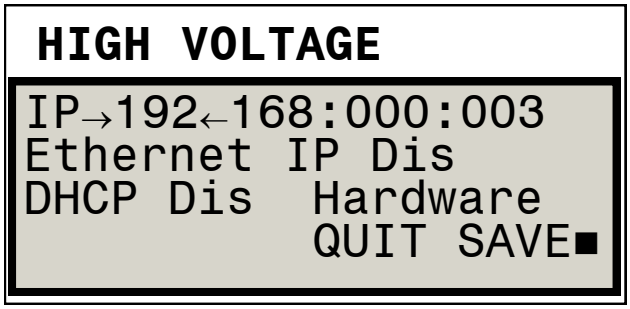


Figure 31: IP Address Menu Screen

When DHCP is disabled and a new IP Address has been entered and saved, power must be cycled on the unit before the new IP Address will be used.

When DHCP is enabled, the IP address, network mask and Gateway IP address will be

requested from a local DHCP server. The user is responsible for providing a server to respond to these requests. If no DHCP server is available the MicroPak 2e will wait indefinitely for a response. In addition, when DHCP is enabled, an EtherNet/IP controller can configure the MicroPak 2e to save the current configuration and use it at the next power cycle instead of requesting an address via DHCP. Similarly, the remote EtherNet/IP controller can also reconfigure the MicroPak 2e to request its IP configuration from a DHCP server at the next power cycle.

Feedback Fault Menu

This menu gives the user control over the use of the Feedback Fault. It allows this fault to be disabled and provides the means to modify the delay before a fault is generated after detection.

It also allows the user to modify the Communications Timeout value. The Communications Time Out value has a range of 500—5000 milliseconds with a default value of 1000. This parameter is used by the Display & Communications Control processor to determine how long to wait before signaling a fault when Ethernet/IP messages are not being received.

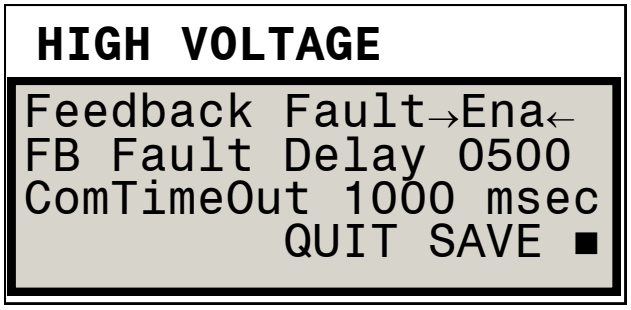


Figure 32: Feedback Menu Screen

NOTE

➤ The Feedback Fault settings should only be changed when adjacent indirect charge applicators cause Feedback Faults. In all other cases the defaults shown above should be used.

Date Menu

This menu allows the user to set the date and time for the controller's real-time clock (RTC). The RTC information is then used by the controller to apply a timestamp to log file entries. This is done to aid in later analysis. As figure 33 shows, there are six settable values on the date and time screen. Month, Day, Year, Hours, Minutes and Seconds,

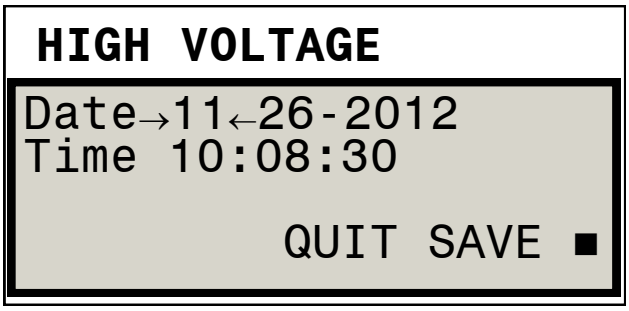


Figure 33: Date Screen

Change Passwords Menu

This menu requires the user to enter the current password before they are allowed to set a new password. When the new password is entered, it will immediately be used for all values being changed.

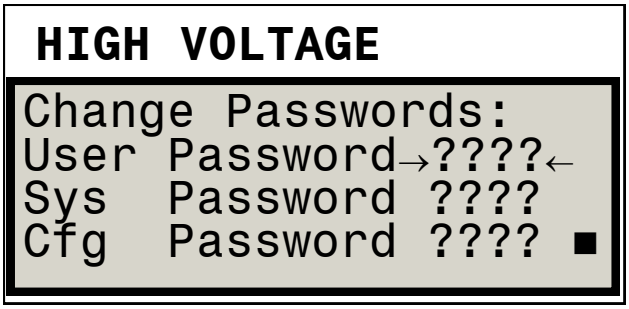


Figure 34: Change Passwords Screen

Broadcast Control Menu

This menu allows the user to control the filtering of excessive broadcast packets. The principal use of this feature is as an aid in confirming the presence of excessive broadcast traffic. Setting Suppression to Ena will enable the removal of broadcast packets if the count of packets per measurement interval exceeds the percentage specified by Storm Level. In normal use this feature should be disabled. In addition, the MAC address

assigned to the front board of the controller pair is displayed at the top of the screen.

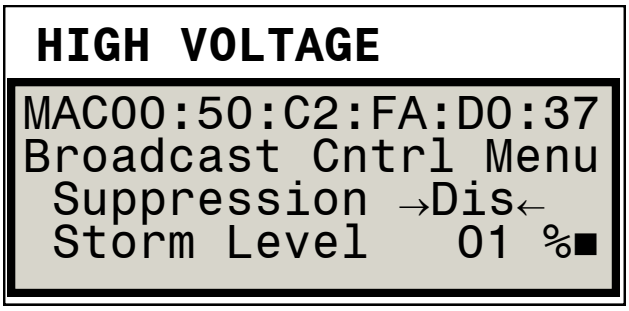


Figure 35: Broadcast Control Screen

ATOMIZER CONFIGURATION MENUS

The following three menus are displayed on the ATOMIZER screen (right panel). They are included in the base MicroPak 2e Controller but are only used when an Atomizer Controller board is configured.

Atomizer Use Menu

This menu shows the maximum number of Atomizers which can be configured, the number of Atomizers which have been configured, (as previously mentioned, only one Atomizer Controller is currently supported) and which atomizer type was configured by the factory.

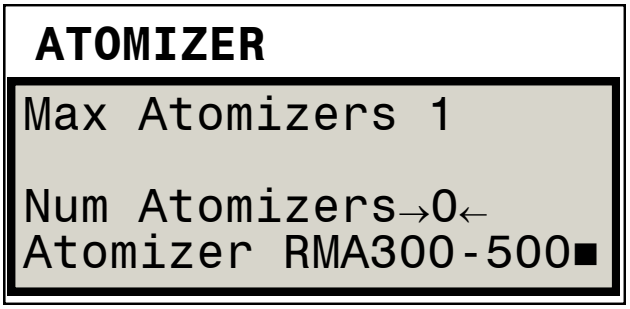


Figure 36: Atomizer Use Screen

Min Bearing Air Menu

The Bearing Air menu is provided so that a user can specify a lower than normal level of bearing air to the turbine in a production emergency.

CAUTION

➤ Extreme caution should be used with this setting as turbine failure can result from specifying a lower value than the factory default setting. This requires the System Password to change.

NOTE

➤ The factory default minimum value is restored at each controller power cycle to guard against forgetting the change was made .

Analog Inputs Mode Menu

This screen allows the user to select the mode of each analog input on the Atomizer Controller . Two options are available, “V” or “I”. “V” represents a 0-10 volt input and “I” represents a 4-20 milliamp input.

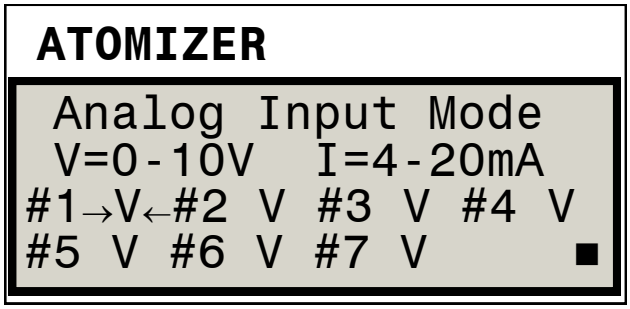


Figure 37: Analog Input Mode Screen

NOTE

➤ Jumpers JMP15 through JMP9 must be set to match the selections on this screen. See the Atomizer Controller operation section for further information.

DIAGNOSTICS MENU

Selecting **Diagnostics** from the Startup Menu

shown in Figure 16 causes the following two menu screens to be displayed. Note that once this menu is entered, a power OFF cycle must be done to exit the menu.

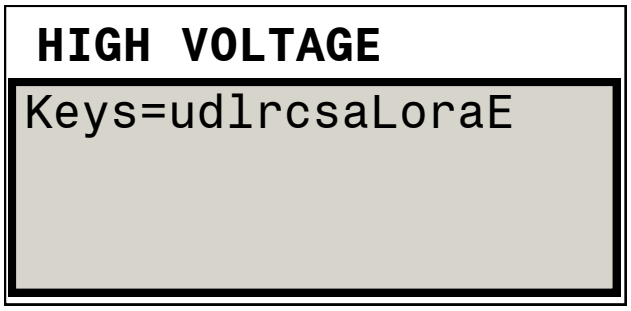


Figure 38: Diagnostic Key Screen

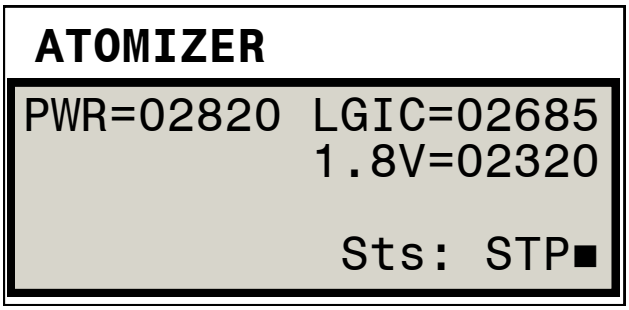


Figure 39: Diagnostic Voltage Screen

The first screen, Figure 38, only uses the first line of the display. This line begins with "Keys=" and is followed by single characters showing the current state of the front panel push buttons and switches. This allows a user to verify that all the front panel inputs, shown in Figure 40, work as expected.

Typically a lower case letter indicates the corresponding key is inactive while an upper case letter indicates activity. Working from left to right across the list of letters we have:

"u U" -the Up arrow button.

"d D" -the Down arrow button.

"l L" -the Left arrow button.

"r R" -the Right arrow button.

"c C" -the SET button. located in the Center of the arrows.

"s S" -the Screen button.

"a H" -the HV/AT button.

"L R" -the Local/Remote switch.

"o O" -the HV On switch.

"r R" -the momentary HV off switch which is used to Reset faults.

"a A" -the Atomizer on/off switch.

"E e" -the External stop input. Note the **"E"** indicates the external contact is closed which is the state required for normal operation.

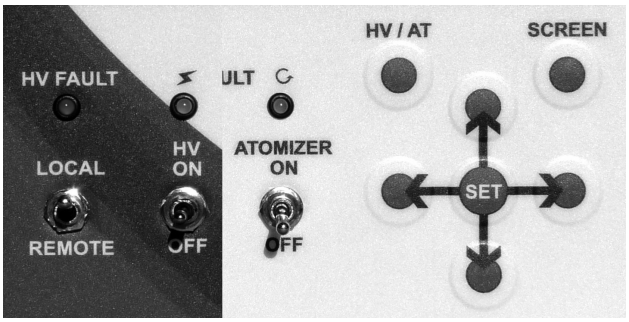


Figure 40: Front Panel Switches

The second screen, Figure 39 shows A2D readings for three of the system voltages along with the current system status. The items displayed are as follows:

PWR—this reading shows the main cascade power (+24V DC) connected to J4. It's nominal value is 2820.

LGIC—this reading shows the Logic power (+24V DC) connected to J11. It's nominal value is 2685.

1.8V—this readings shows the internal 1.8V DC power supply. It's nominal value is 2320.

Sts —this shows the current system state which can be either Stopped or Faulted.

OPERATING PARAMETERS AND SETTINGS

kVSet
This is the voltage setpoint, used in Voltage Mode. The system attempts to keep the voltage at this value when operating at low current levels, but as the current level is increased the voltage will be reduced to stay within the I-V curve of the selected cascade. When operating in Current Mode, kVSet is not displayed since the upper and lower voltage limits are determined by kV Low Limit and kV High Limit.

µASet
This is the current setpoint, used in Current Mode. The system attempts to keep the current at this value.

di/dt Enable/Disable
This allows the user to enable or disable the controller's detection of rapid current changes. This is only active and displayed in Voltage Mode.

di/dt Sensitivity
When a rapid current change occurs where current rises faster than this value in 100 milliseconds, a di/dt fault is generated. This is only active and displayed in Voltage Mode.

dv/dt Enable/Disable
This allows the user to enable or disable the controller's detection of rapid voltage changes. This is only active and displayed in Current Mode.

dv/dt Sensitivity
When a rapid voltage change occurs where voltage falls faster than this value in 100 milliseconds, a dv/dt fault is generated. This is only active and displayed in Current Mode.

Max µA Limit
This parameter determines the level where a Current Limit Fault occurs. When the current is greater than 90% of this value, it issues a Current Limit Warning. When the current rises above this value, it issues a Current Limit Fault.

kV Low Limit
This parameter determines the level where a kV Low Limit Fault occurs. When the Voltage falls below this value, it issues a kV Lo Fault. It only applies in Current Mode.

kV High Limit
This parameter determines the level where a kV High Limit Warning occurs. When the voltage exceeds 90% of this value, it issues a kV High Limit Warning and prevents the voltage from exceeding the limit value. It only applies in Current Mode.

Turbine Speed Setpoint
This parameter sets the turbine speed which will be commanded by the controller when in LOCAL mode. When in Remote mode it displays the speed setpoint commanded by the remote controller.

NOTE

➤ The following Atomizer settings and features are only available when .the Atomizer Controller is configured for use with a ControlPak.

ShapeAirSP1
This parameter determines the level in percent (i.e. 0-100%) that will be applied to the Shaping Air 1 output.

ShapeAirSP2
This parameter determines the level in percent (i.e. 0-100%) that will be applied to the Shaping Air 2 output.

PFlowRateSP1
This parameter determines the level in percent (i.e. 0-100%) that will be applied to the Paint

Flow Rate 1 output.

PFlowRateSP2

This parameter determines the level in percent (i.e. 0-100%) that will be applied to the Paint Flow Rate 2 output.

FluidInterLock

This parameter allows the user to disable the fluid interlocks between the high voltage controller and the atomizer controller. It is intended to allow maintenance activities such as paint flow calibrations. In addition, it can be used in an emergency to allow flushing of an atomizer when it cannot be run up to speed.

A description of the fluid interlocks follows:

There are two fluid interlocks implemented in the Atomizer which this parameter enables or disables. The first interlock normally prevents the Atomizers Paint Trigger and Wash outputs from being activated when the atomizer is below a minimum safe speed for fluid application. The purpose of this interlock is to prevent fluid from being applied when it could easily flood the turbine. The second interlock prevents the solvent control output (i.e. Bell Cup, Disk or Gun Wash) from activating when the high voltage controller is active. This is done to minimize the risk of a fire caused by a high voltage discharge while solvent fluid is present.

Table six lists the operating parameters and the passwords required to change each parameter.

TABLE 6

Parameter	Password Level
KvSet	-none-
uASet	-none-
Di/Dt Enable	User
Di/Dt Sensitivity	User
Dv/Dt Enable	User
Dv/Dt Sensitivity	User
Max µA Limit	System
KV Low Limit	-none-
KV High Limit	System
Turbine Speed Setpoint	-none-
Shaping Air 1	User
Shaping Air 2	User
Paint Flow Rate 1	User
Paint Flow Rate 2	User
FluidInterLock	System

CONFIGURATION PARAMETERS AND SETTINGS

Cascade Type

The MicroPak 2e Controller currently supports the following types of cascades.

- HP404
- RP404
- HP505
- RP1000
- LEPS5002
- CONSOLIDATED

NOTE

➤ The cascade type is configured by the factory based on the equipment ordered by the customer. In addition to configuring the controller for one of the cascade types shown above, the factory will also configure JMP2, JMP3 and JMP4 to match that cascade type.

Atomizer

This Atomizer controller currently supports the following types of atomizers. .

- RMA300-500
- AeroBell
- AeroBell 33
- RMA100-200
- TurboDisk
- Auto Gun

WARNING

➤ **ONLY USE** the type of atomizer which the controller was configured for by the factory. Using a different type atomizer may allow for operation outside the recommended parameters and values for the applicator and can result in **damage** or **unsafe operation**.

Date

This parameter consists of the Month, Day and Year which is maintained by the embedded realtime clock hardware. The controller uses it to apply a time stamp to log file entries.

Time

This parameter consists of the Hour, Minute and Second which is maintained by the embedded real-time clock hardware. The controller uses it to apply a time stamp to log file entries.

IP Address

This is the IP (Internet Protocol) address assigned to the controller. It is set by default to 192.168.0.3 but can be changed to allow the use of multiple MicroPak 2e Controllers and to accommodate the local network settings.

EtherNet/IP

This parameter controls whether the MicroPak 2e Controller will allow a host system to connect and remotely configure and command the controller via an EtherNet/IP connection.

Num Atomizers

This parameter sets the number of Atomizer units to be configured on the MicroPak 2e Controller. This serves as an enable/disable for the atomizer controller since the system is currently limited to a single atomizer controller.

MiscIO

This parameter controls whether the MicroPak 2e Controller will use the state of the MiscIO hardware input in its control calculations.

Interlock/Trigger

This parameter controls whether the MiscIO hardware input will be used as an interlock signal or as a trigger to enable HV.

NOTE

➤ MiscIO must be enabled to cause the controller to act on this setting.

Booth Air
This parameter controls whether the MicroPak 2e Controller will use the state of the Booth Air hardware input in its control calculations.

Door
This parameter controls whether the MicroPak 2e Controller will use the state of the Door hardware input in its control calculations.

Minimum Bearing Air
This parameter sets the air pressure which must be present at the Bearing Air Feedback input before the turbine is allowed to operate.

NOTE

➤ This input requires that bearing air be monitored with a transducer which scales 0-100 psi to 0-10V or 0-100 psi to 4-20mA.

Password
This parameter is the value entered for the user password.

System Password
This parameter is the value entered for the system password.

Mode
The operating mode can be set to either Voltage or Current mode. The mode selection determines which independent setpoint (i.e. kVSet or µASet) is the basis for control.

Charge Type
The charge type can be set to either DIRECT or INDIRECT type. This setting must match the type of charging provided by the applicator being used as it controls the calculations of the KV actual value.

Note the INDIRECT type can only be selected when an RP1000 cascade is configured. All other cascades will force Charge Type to be configured as DIRECT.

The following table (7) shows the passwords required to change the Configuration parameters.

TABLE 7

Parameter	Password Level
Booth Air	System
Broadcast Suppress	System
Cascade Type	Config
Charge Type	Config
ComTimeOut	System
Config Password	Config
Date	User
DHCP	System
Door	System
EtherNet/IP Enable	User
FB Fault Delay	System
Feedback Fault	System
Interlock/Trigger	System
IP Address	System
MiscIO	System
Mode	Config
Storm Level	System
System Password	System
Time	User
uPak VI Limiting	Config
User Password	User
Analog Inputs	System
Atomizer Type	Config
Min Bearing Air	System
Num Atomizers	System

CONTROL CONDITIONS

Power Up
On power up, the system does several checks to determine hardware status. It checks various signals to determine that there are no faults, including feedback from the Variable Voltage Output and High Voltage Inputs to determine system status. If it determines that it is OK to start, the Check display on the run menu changes from VOL or INT to OK and System Status changes to OK.

HV On
When the HV On signal is received and Check is OK, the system status changes to "Starting" and the Variable Voltage Output is increased until the Independent Value rises to within a tolerance window (currently +/-3) of the setpoint value. Then the System Status changes to "Running".

Setpoint Changed
If the setpoint changes outside the control window, the status changes to "Rising" or "Falling" until the Independent Value again reaches the control window at which point it returns to "Running".

HV Off
When HV Off is activated the system immediately sets the Variable Voltage Output to zero volts, disables the HV Relay and goes to Stop Mode.

The System Check goes to OK. However, before allowing the output to be enabled again, it checks the High Voltage and Variable Voltage Output feedback signals to verify that they have both decreased since the high voltage was disabled.

SYSTEM STATUS (STS)

STRT / RISE / FALL
System is changing from one voltage/current value to another. Di/dt and dv/dt checks are disabled. The abbreviations stand for Starting. Rising and Falling.

RUN
System is attempting to keep a steady value on Setpoint (the Independent Value). All enabled checks are active.

STPD
System output is off and awaiting a command. The abbreviation stands for Stopped.

WARN
System has detected a current or voltage condition within 10% of the limit settings. The abbreviation stands for Warning.

FALT
System has detected a fault condition, stopped and will not allow starting until the fault is reset. If the fault condition has not been cleared, it may immediately fault without starting. The abbreviation stands for Fault.

SYSTEM CHECK (CHK)

O K
System has passed the checks and is ready to start.

POWER
System is detecting a lack of cascade power.

VOLTG
System has detected excessive voltage on the High Voltage or Variable Voltage Output Feedback signals and will not allow a start.

INTLK
System is detecting an interlock failure.

SYSTEM FAULT BEHAVIOR

The following tables specify how High Voltage or Atomizer Faults effect the operation of each other.

The 1st table shows the four High Voltage Controller faults that will stop the Atomizer along with 8 which will leave the Atomizer in its current state. These faults are all reported over EtherNet/IP.

The second table shows that ALL Atomizer Faults will stop the High Voltage Controller.

The third table shows four other miscellaneous faults. The HVC WDog Reset fault will cause the Atomizer to stop since it will loose it's communications link.

High Voltage Faults	HV Action	Atom Action
Interlock	Fault	Disable
Comm Time Out	Fault	Disable
Communications	Fault	Disable
Hardware	Fault	Disable
KV Low	Fault	No effect
DIDT or DVDT	Fault	No effect
HV Feedback	Fault	No effect
Min Output	Fault	No effect
Max KV	Fault	No effect
Over Voltage	Fault	No effect
Over Current	Fault	No effect
Voltage Cable Fault	Fault	No effect
Current Cable Fault	Fault	No effect

Atomizer Faults	HV Action	Atom Action
Bell Overspeed	Disable	Fault
Bell Underspeed	Disable	Fault
Loss Of Feedback	Disable	Fault
Low Bearing Air	Disable	Fault
Comm. Lost	Disable	Fault

Other HV Faults	HV Action	Atom Action
Remote Stop	Fault	Disable
HVC Power OFF	Fault	Disable
System Mode	Fault	No effect
HVC WDog Reset	Fault	*RansNet Lost Fault
DSP WDog Reset	Fault	No effect

N O T E S

ETHERNET/IP INTERFACE

The EtherNet/IP Interface for the MicroPak 2e Controller is defined as a set of four 16 bit words of input plus a set of four 16 bit words of output. The Assembly instances are defined as objects 100 (0x64) and 116 (0x74), where object 100 is the input assembly and object 116 is the output assembly.

The Input bit definitions are shown in Table 8 and the Output bit definitions are shown in Table 9 on the following pages.

NOTE

➤ *When defining the IO Instances to the host system, specify the input object of the controller as the output object of the host and the output object of the controller as the input object of the host.*

Description of Interface Elements

Input Word 0

Bit 0 - Enable Control
When this bit is set (high) the system will attempt to keep the actual at the appropriate setpoint.

Bit 1 - Reset Faults
When this bit is changed from low to high (cleared to set) the system will clear any fault bits if any are set and will set the communication fault if no fault bits are set.

Bit 2 - Current Mode
When this bit is set, the system will operate in the Current Control Mode and when cleared will operate in the Voltage Control Mode.

Bits (3-15) - Unused
These bits are currently undefined and unused.

Input Word 1

Bits (0-7) - kV Setpoint
This byte (8 bit) value determines the active Voltage setpoint in kV.

Bits (8-15) - µA Setpoint
This byte (8 bit) value determines the active Current setpoint in µA.

NOTE

➤ When an RP1000 or LEPS5002 cascade is selected, this value is multiplied by 5 to set the actual µA setpoint.

Input Word 2

Bits (0-7) - Parameter Value
These bits are currently undefined and unused.

Bit (8-14) - Parameter Select Code
This 7 bit value determines the parameter to change.

Bit 15 - Parameter Write Strobe
When this bit changes from cleared to set, the parameter value is written into the selected parameter and displayed in the Output Word 2.

Input Word 3

Bits (0-7) - Unused
These bits are currently undefined and unused.

Bits (8-14) - Parameter Select code
The 7 bit value determines the parameter to change.

Bit 15 - Parameter Read Strobe
When this bit changes from cleared, to set the Current Parameter Value is read from the selected parameter and displayed in the Output Word 3.

MicroPak 2e
ETHERNET/IP INPUT BIT DEFINITIONS
Input Object (0X64)
TABLE 8

Bit	Word 0	Word 1	Word 2	Word 3
0	HV Enable Control	kV Setpoint	Parameter Value	
1	Reset Faults	kV Setpoint	Parameter Value	
2	Current Mode	kV Setpoint	Parameter Value	
3		kV Setpoint	Parameter Value	
4		kV Setpoint	Parameter Value	
5		kV Setpoint	Parameter Value	
6		kV Setpoint	Parameter Value	
7		kV Setpoint	Parameter Value	
8		µA Setpoint	Parameter Select Code	Parameter Select Code
9		µA Setpoint	Parameter Select Code	Parameter Select Code
10		µA Setpoint	Parameter Select Code	Parameter Select Code
11		µA Setpoint	Parameter Select Code	Parameter Select Code
12		µA Setpoint	Parameter Select Code	Parameter Select Code
13		µA Setpoint	Parameter Select Code	Parameter Select Code
14		µA Setpoint	Parameter Select Code	Parameter Select Code
15		µA Setpoint	Parameter Write Strobe	Parameter Read Strobe

MicroPak 2e
ETHERNET/IP OUTPUT BIT DEFINITIONS
Output Object (0X74)
TABLE 9

Bit	Word 0	Word 1	Word 2	Word 3
0	In Control	Over Current Warning	Parameter Data Value	Actual kV Value
1	Ramping	Over Voltage Warning	Parameter Data Value	Actual kV Value
2	OK to Start	Under Voltage Warning	Parameter Data Value	Actual kV Value
3	Remote Mode	Max Output Warning	Parameter Data Value	Actual kV Value
4	HV On Echo	Communications Time Out Fault	Parameter Data Value	Actual kV Value
5	Warning	Interlock Fault	Parameter Data Value	Actual kV Value
6	Fault	Communications Fault	Parameter Data Value	Actual kV Value
7		Hardware Fault	Parameter Data Value	Actual kV Value
8		Low Voltage Fault	Parameter Select Code	Actual µA Value
9		dv/dt Fault	Parameter Select Code	Actual µA Value
10		di/dt Fault	Parameter Select Code	Actual µA Value
11		Minimum Output Fault	Parameter Select Code	Actual µA Value
12		Feedback Fault	Parameter Select Code	Actual µA Value
13		Over Voltage Fault	Parameter Select Code	Actual µA Value
14		Over Current Fault	Parameter Select Code	Actual µA Value
15	Heartbeat	Cable Fault	Parameter Acknowledge	Actual µA Value

Output Word 0

Bit 0 - In Control

This bit is set when control is enabled and the controlled value has reached within three of the setpoint. This does not mean that the value is still within three of the setpoint, but that it had been at one time.

Bit 1 - Ramping

This bit is set when the setpoint has been changed and the controlled value has not yet come within three of the setpoint value.

During the time this bit is set, the di/dt and dv/dt checks are not active.

Bit 2 - OK to Start

This bit is set when the system determines that the voltage values are in a range where it is allowed to start control.

Bit 3 - Remote Mode

This bit is set when the front panel switch is set to remote. When set, an external unit can control the system.

Bit 4 - HV On Echo

This bit is set whenever HV is ON

Bit 5 - Warning

This bit is set whenever any warning is in effect.

Bit 6 - Fault

This bit is set whenever any fault is in effect (see "Fault Descriptions" in "Troubleshooting Guide" in the "Maintenance" section).

Bits (7-14) - Unused

These bits are currently undefined and unused.

Bit 15 - Heartbeat

This bit changes state every 1/4 second producing two pulses per second.

Output Word 1

Bit 0 - Over Current Warning

The current value is within 10% of the upper limit.

Bit 1 - Over Voltage Warning

The voltage value is within 10% of the upper limit in current mode.

Bit 2 - Under Voltage Warning

The voltage value is within 10% of the lower limit in current mode.

Bit 3 - Max Output Warning

The control voltage has reached its maximum value.

Bit 4 - Communication Time Out Fault

The system has detected a communication loss which was greater than the value specified by ComTimeOut.

Bit 5 - Interlock Fault

The system has detected one of the active interlock input in an open state.

Bit 6 - Communication Fault

The system has detected a communication failure after an EtherNet/IP connection was initiated.

Bit 7 - Hardware Fault

The system has detected a fatal System Failure.

Bit 8 - Low Voltage Fault

The system has fallen below the kV Limit Lo while in Current Mode.

Bit 9 - dv/dt Fault

The system has detected a dv/dt event.

Bit 10 - di/dt Fault

The system has detected a di/dt event.

Bit 11 - Minimum Output Fault

The system has lowered the Variable Voltage Output to zero and still is above the setpoint.

Bit 12 - Feedback Fault

The system has measured an high level of voltage or current feedback .which does not correspond to the level of the control outputs being applied.

Bit 13 - Over Voltage Fault

The system has exceeded the kV Limit Hi or the Max System Limit.

Bit 14 - Over Current Fault

The current value has exceeded the Current (I) Limit Hi or the Max System-Limit.

Bit 15 - Cable Fault

This bit is set whenever the voltage or current feedback from the cascade has been lost or fallen below the acceptable value.

Output Word 2

Bits (0-7) - Parameter Data Value

This byte (8 bit) tells the system the active parameter value.

Bits (8-14) - Parameter Select Code

This 7 bit value tells the system which parameter is being displayed.

Bit 15 - Parameter Acknowledge

When this bit changes from cleared to set a new Parameter Value is being displayed. It is cleared when the Parameter Read Strobe and Parameter Write Strobe are both cleared.

Output Word 3

Bits (0-7) - Actual kV Value

The byte (8 bit) value displays the latest voltage reading in kV.

Bits (8-15) - Actual µA Value

This byte (8 bit) value displays the latest current reading in µA.

NOTE

➤ When an RP1000 or LEPS5002 cascade is selected, the µA value returned is the actual value divided by 5.

Parameter Select Codes

Parameter Select = 1: DvDt

READ—returns value of DvDT threshold
WRITE —sets value of DvDT threshold

Parameter Select = 2: DiDt

READ—returns value of DiDT threshold
WRITE —sets value of DiDT threshold

Parameter Select = 3: kVHi

READ—returns value of max KV allowed
WRITE —sets value of max KV allowed

Parameter Select = 4: iHi

READ—returns value of max I allowed
WRITE —sets value of max I allowed

NOTE

➤ When an RP1000 or LEPS5002 cascade is selected, the µA value passed is scaled by 5 from the actual value.

Parameter Select = 5: kVLo

READ—returns value of kVLo
WRITE —sets value of kVLo

Parameter Select = 6: DxDtEna

READ—returns value of DxDtEna
WRITE —sets value of DxDtEna

NOTE

➤ DxDtEna will enable the DxDt check available in the control mode currently active. I.e. DiDT when in Voltage Mode and DvDT when in Current Mode.

Parameter Select = 7: Password 1
READ—returns User password (X…)
WRITE —(Unsupported)

Parameter Select = 8: Password 2
READ—returns User password (.X..)
WRITE —(Unsupported)

Parameter Select = 9: Password 3
READ—returns User password (..X.)
WRITE —(Unsupported)

Parameter Select = 10: Password 4
READ—returns User password (...X)
WRITE —(Unsupported)

TABLE 10

Parameter	Min Value	Max Value
DvDT	0	60
DiDt	0	60
kVHi	20	100
iHi	10	Per Cascade
kVLo	0	80
DxDtEna	0 = Disable	1 = Enable
Password 1	0	9
Password 2	0	9
Password 3	0	9
Password 4	0	9

NOTE

➤ The per Cascade iHi values can be found in the Electrical Specifications located in the Introduction section.

NOTES

N O T E S

INTRODUCTION—ATOMIZER CONTROLLER

ATOMIZER CONTROLLER GENERAL DESCRIPTION

The Atomizer Controller for use with the MicroPak 2e Controller is designed to continuously monitor and maintain the programmable speed of a rotary atomizer as well as provide a universal I/O interface for many atomizer functions. This module utilizes closed-loop control via a fiber optic cable to maintain the rotator speed. A number of configuration options are available to the end user. These include built in support for many Ransburg rotary atomizers as well as an assortment of inputs and outputs available to the user.

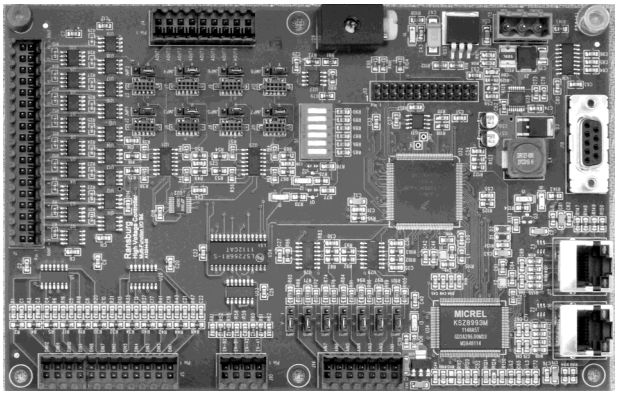


Figure 41: MicroPak 2e Multi I/O Board

SPECIFICATIONS
(At Sea-Level Conditions)

Environmental / Physical

Operating Temperature: 0°C to +55°C

Storage and Shipping Temperature: -40°C to +85°C

Humidity: 95% Non-Condensing

Physical Size: 2" tall X 7.5" X 4.75"

Mounting: Figure 44 in Appendix

Electrical Requirements

Power Required:
J15 - Controller : 24V DC @ 0.25 Amps

Note: 24V DC power supply must be regulated and have over current and over voltage protection.

Electrical

Communication Requirements

Control and Reporting:
Ethernet to the MicroPak 2e:
port J8 or J9

Note: A unique MAC address is hard coded into each Atomizer Controller.

Electrical

Controls in Local Mode

NOTE

➤ Signals shown in bold below are minimum required functions for Atomizer control to operate.

Analog In: (0-10V or 4-20mA)
BEARING AIR FEEDBACK

Analog Out: (0-10V or 4-20mA)
BELL DRIVE
Bell Speed Read Out

Discrete In: (Dry Contact)
(None active)

Discrete Out: (Dry Contact)
BRAKE
Overspeed Warn/Fault
Underspeed Warn/Fault
Loss of Bell Feedback Warn/Fault
Low Bearing Air Warn/Fault
Speed Out of Tolerance Warn

Electrical

Controls in Remote EtherNet/IP Mode

Analog In: (0-10V or 4-20mA)
- **BEARING AIR FEEDBACK**

Analog Out: (0-10V or 4-20mA)
- **BELL DRIVE**
- Bell Speed Read Out

Discrete In: (Dry Contact)
- (None active)

Discrete Out: (Hi-Side Switch)
- **BRAKE**
- Paint Trigger #1
- Paint Trigger #2
- Dump #1
- Dump #2
- Fluid Override #1
- Fluid Override #2
- Cup Wash
- Overspeed Warn/Fault
- Underspeed Warn/Fault
- Loss of Bell Feedback Warn/Fault
- Low Bearing Air Warn/Fault
- Speed Out of Tolerance Warn

Electrical

Controls in Remote Discrete Mode

Analog In: (0-10V or 4-20mA)
- **BEARING AIR FEEDBACK**
- Bell Speed Setpoint
- Flowrate Setpoint #1
- Flowrate Setpoint #2
- Shaping Air Setpoint #1
- Shaping Air Setpoint #2

Analog Out: (0-10V or 4-20mA)
- **BELL DRIVE**
- Bell Speed Read Out
- Flowrate #1
- Flowrate #2
- Shaping Air #1
- Shaping Air #2

Discrete In: (Dry Contact)
- **BELL SPIN ENABLE**
- Paint Trigger #1
- Paint Trigger #2
- Dump #1
- Dump #2
- Fluid Override #1
- Fluid Override #2
- Cup Wash

Discrete Out: (Dry Contact)
- **BRAKE**
- Paint Trigger #1
- Paint Trigger #2
- Dump #1
- Dump #2
- Fluid Override #1
- Fluid Override #2
- Cup Wash
- Overspeed Warn/Fault
- Underspeed Warn/Fault
- Loss of Bell Feedback Warn/Fault
- Low Bearing Air Warn/Fault
- Speed Out of Tolerance Warn

SPEED CONTROL

The Atomizer Controller is used in a closed-loop rotational speed control system for rotary atomizers as shown in Figure 42. It accepts a requested speed command and, after comparing this with the actual speed feedback from the atomizer, provides an output to maintain the requested speed.

When a speed request is received, the controller activates the Turbine Drive signal which controls the output of an E to P transducer providing an air pilot signal to a 1:1 volume booster. The volume booster supplies high volume drive air to the rotary atomizer.

The atomizer speed is monitored by a fiber optic cable to a fiber optic transceiver mounted on the Atomizer Controller board. The transceiver provides a speed feedback signal to the Atomizer Controller which is timed to determine the rotational speed. The speed, in increments of 1000's rpm, is displayed on the MicroPak 2e Controller front panel.

An optional braking system provides for rapid slowdown. When changing speeds from high to low (change greater than 3,000 rpm), the controller provides an electrical brake signal to drive a pneumatic solenoid which delivers high pressure air to the brake input of the atomizer. Ransburg part numbers, for each of the components described, are listed in the MicroPak 2e High Voltage Controller Parts List located in this manual.

NOTE

➤ A speed command of 1 krpm is recognized by the controller as an emergency stop condition and will cause the brake to stay engaged until the speed reaches 2 krpm from which the turbine will coast to a stop.

➤ A speed command of 0 krpm does not actuate the brake but allows the turbine to coast to a stop condition.

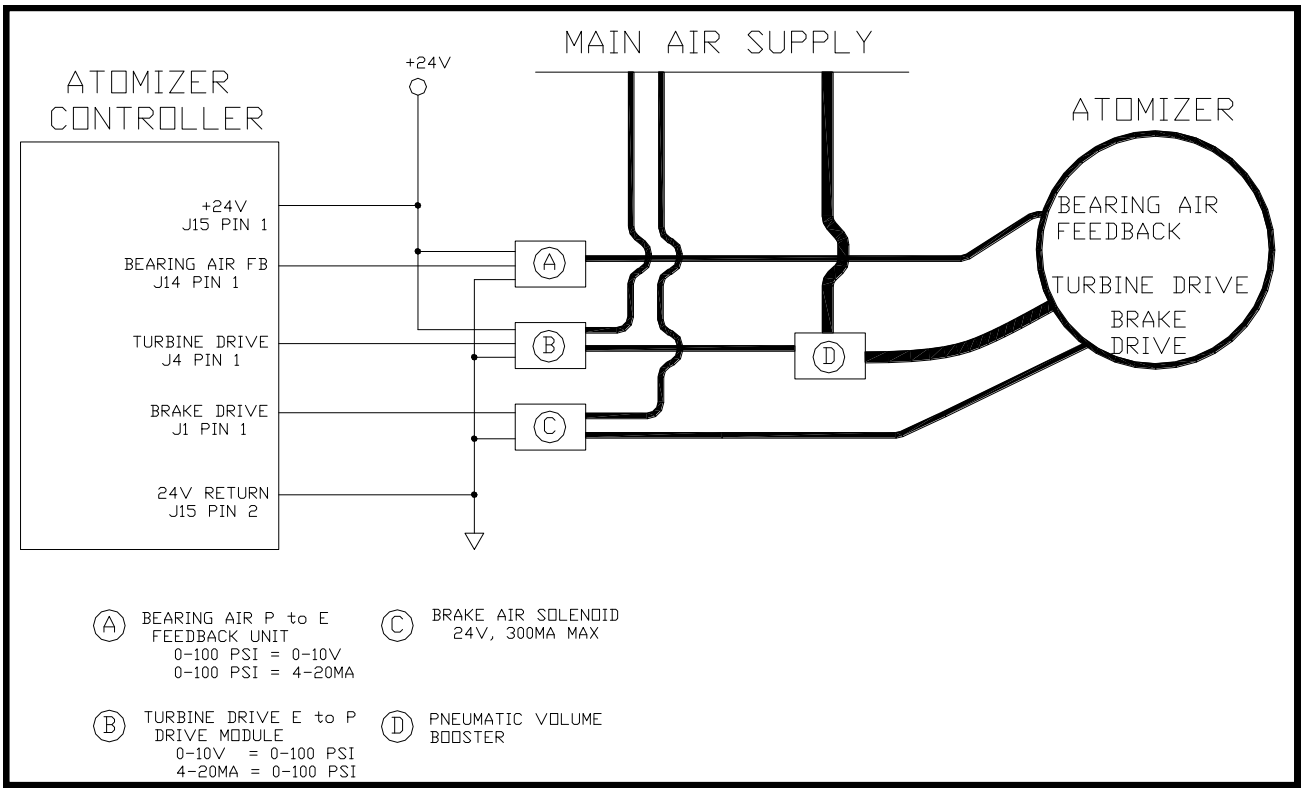


Figure 42: MicroPak 2e Controller/Atomizer Minimal System

NOTES

The speed feedback signal is designed to drop out at about 2 krpm and the controller will set a Loss of Feedback Fault. A new speed command will reset the fault at the Atomizer Controller, but the MicroPak 2e Controller will only reset its fault indication when commanded by the EtherNet/IP interface or the front panel HV On/Off switch.

An electrical input is provided and required for atomizer bearing air sensing and interlock. Minimum bearing air pressure threshold is set at 80 psi. This can be changed as described in the section titled MicroPak 2e Controller Configuration.

The maximum allowed speeds for various rotator types is shown in the "Specifications" in the "Introduction" section. There are no minimum speed limits set by the Atomizer Controller itself, however, the low speed operation is limited by the drop out of speed feedback signal at about 2 krpm.

OPERATION—ATOMIZER CONTROLLER

OPERATION

The Atomizer Controller currently supports three different operating modes with varying levels of capabilities.

Remote EtherNet/IP Control

This mode gives the remote system full access to the atomizer parameters and allows control of starting and stopping as well as collection of fault information.

Remote Discrete Control

This mode is only available when EtherNet/IP is disabled. While it provides no access to the atomizer parameters, it does allow the remote system to control starting, stopping and various other functions provided through the Atomizer Controller inputs and outputs. See tables 14, 15, 16, &17 for a complete list of I/O functions.

Local Front Panel Control

This mode is available whenever the MicroPak 2e Controller is in Local mode. In the current software release, operation is limited to starting and stopping the atomizer by means of the Atomizer On/Off switch located on the front panel.

NOTE

➤

In local mode the Turbine Speed Set point can be set from the front panel and that value will be used for local operation. Upon exiting Local mode, control of the Turbine Speed Setpoint reverts to either the EtherNet/IP interface or the Discrete inputs.

AUTOMATIC SHUTDOWN

The Atomizer Controller continuously monitors turbine operation and detects common fault conditions and will automatically stop the atomizer when one is detected.

1. **Overspeed**: If the speed feedback exceeds the speed setpoint.
   Liquid Bell - 10,000 rpm above setpoint
   Disk - any speed over 30 krpm
   Time delay is 0.5 seconds

2. **Underspeed**: If the speed feedback is less than the speed setpoint:.
   Liquid Bell - 10,000 rpm under setpoint
   Disk - No underspeed checks made
   Time delay is 0.5 seconds.

3. **Loss of Feedback**: Senses when feedback should be present but is not.
   Pulses received from the fiber optics must be no greater than 800 msec apart during normal operation.
   Start-up delay:
   Liquid Bell - 1 second for the first pulse
   Disk - 7 seconds
   Once the first pulse has been received, the 800 msec interval applies.

4. **Invalid Speed Command**: Will not process speed requests higher than rated maximum. Internally set speed command to zero.

5. **Low Bearing Air Pressure**: If the bearing air pressure feedback drops below the minimum bearing air threshold. There is a 4 second time delay for all settings.

6. **Interlock Open**: If an active interlock is opened while the atomizer is running, all outputs will be disabled and a brake assisted ESTOP will be done before faulting.

Out of Tolerance (WARNING)

Speed is not within +/- 5% of setpoint, no internal action taken, 1 second delay. Signal may be used externally as desired.

INTERFACING CONSIDERATIONS

When using an Atomizer there are some operational restrictions that must be observed to avoid damaging the turbine. Five of these conditions were listed in the Automatic Shutdown section and are automatically enforced by the Atomizer Controller. There is also a sixth condition which the controller is programed to prevent. That is, the flow of paint to the bell when the Atomizer is not spinning. This operational interlock is accomplished by deactivating the signals *Paint Trigger #1* and *Paint Trigger #2* whenever the Atomizer is not running, i.e. either *IDLE* or *FAULTED*.

! CAUTION

➤ If the user chooses not to use the discrete outputs *Paint Trigger #1* and *Paint Trigger #2* provided by the Atomizer Controller*, then* they are responsible for implementing a comparable interlock between Atomizer operation and paint flow. Failure to do so may result in a turbine failure.

ETHERNET/IP INTERFACE

The EtherNet/IP Interface for the Atomizer Controller is defined as two assembly instances that contain the MicroPak 2e interface in the first four words of the input and output sets. Six additional words for the Atomizer Controller have been added at the end of the MicroPak 2e EtherNet/IP interface.

This means that the Atomizer Controller interface is a set of ten 16 bit words of input plus a set of ten 16 bit words of output. The Assembly instances are defined as objects 101 (0x65) and 117 (0x75), where object 101 is the input assembly and object 117 is the output assembly.

Since the first four words of the Atomizer Controller interface are identical to those defined for the MicroPak 2, the following interface description only includes the six words which are specific to the Atomizer Controller. The Input bit definitions are shown in Table 11 and the Output bit definitions are shown in Table 12 on the following pages.

ATOMIZER CONTROLLER
ETHERNET/IP INPUT BIT DEFINITIONS
Input Object (0X65)
TABLE 11

Bit	Word 4	Word 5	Word 6	Word 7	Word 8	Word 9
0	Atomizer Enable	RPM Setpoint	ShapeAir 1 Setpoint	ShapeAir 2 Setpoint	Param Read Code	Parameter Value
1	Reset Faults	RPM Setpoint	ShapeAir 1 Setpoint	ShapeAir 2 Setpoint	Param Read Code	Parameter Value
2		RPM Setpoint	ShapeAir 1 Setpoint	ShapeAir 2 Setpoint	Param Read Code	Parameter Value
3		RPM Setpoint	ShapeAir 1 Setpoint	ShapeAir 2 Setpoint	Param Read Code	Parameter Value
4	Paint Trigger #1	RPM Setpoint	ShapeAir 1 Setpoint	ShapeAir 2 Setpoint	Param Read Code	Parameter Value
5	Dump #1	RPM Setpoint	ShapeAir 1 Setpoint	ShapeAir 2 Setpoint	Param Read Code	Parameter Value
6	Fluid Override #1	RPM Setpoint	ShapeAir 1 Setpoint	ShapeAir 2 Setpoint	Param Read Code	Parameter Value
7		RPM Setpoint	ShapeAir 1 Setpoint	ShapeAir 2 Setpoint	Param Read Strobe	Parameter Value
8	Paint Trigger #2		FlowRate 1 Setpoint	FlowRate 2 Setpoint	Parameter Write Code	Parameter Value
9	Dump #2		FlowRate 1 Setpoint	FlowRate 2 Setpoint	Parameter Write Code	Parameter Value
10	Fluid Override #2		FlowRate 1 Setpoint	FlowRate 2 Setpoint	Parameter Write Code	Parameter Value
11			FlowRate 1 Setpoint	FlowRate 2 Setpoint	Parameter Write Code	Parameter Value
12	Bell Cup Wash		FlowRate 1 Setpoint	FlowRate 2 Setpoint	Parameter Write Code	Parameter Value
13			FlowRate 1 Setpoint	FlowRate 2 Setpoint	Parameter Write Code	Parameter Value
14			FlowRate 1 Setpoint	FlowRate 2 Setpoint	Parameter Write Code	Parameter Value
15			FlowRate 1 Setpoint	FlowRate 2 Setpoint	Parameter Write Strobe	Parameter Value

Input Word 4

Bit 0 - Atomizer Enable
When this bit is set (high) the system will attempt to keep the actual at the appropriate setpoint.

Bit 1 - Reset Atomizer Faults
When this bit is changed from low to high (cleared to set) the system will clear any fault bits if any are set and will set the communication fault if no fault bits are set.

Bits (2-3) - Unused
These bits are currently unused.

Bit 4 - Paint Trigger #1
When this bit is set, the system will activate the Paint Trigger #1 output and when cleared will de-activate the Paint Trigger #1 output. This output is only active when the bell is running.

Bit 5 - Dump #1
When this bit is set, the system will activate the Dump #1 output and when cleared will de-activate the Dump #1 output.

Bit 6 - Fluid Override #1
When this bit is set, the system will activate the Fluid Override #1 output and when cleared will de-activate the Fluid Override #1 output.

Bit 7 - Unused
This bit is currently unused.

Bit 8 - Paint Trigger #2
When this bit is set, the system will activate the Paint Trigger #2 output and when cleared will de-activate the Paint Trigger #2 output. This output is only active when the bell is running.

Bit 9 - Dump #2
When this bit is set, the system will activate the Dump #2 output and when cleared will de-activate the Dump #2 output.

Bit 10 - Fluid Override #2
When this bit is set, the system will activate the Fluid Override #2 output and when cleared will de-activate the Fluid Override #2 output.

Bit 11 - Unused
This bit is currently unused.

Bit 12 - Bell Cup Wash
When this bit is set, the system will activate the Bell Cup Wash output and when cleared will de-activate the Bell Cup Wash output.

Input Word 5

Bits (0-7) - kV Setpoint
This byte (8 bit) value determines the active Voltage setpoint in kV.

Bits (8-15) - Unused
These bits are currently unused.

Input Word 6

Bits (0-7) - Shape Air 1 Setpoint
This byte (8 bit) value determines the Shaping Air 1 setpoint in % of full scale.

Bits (8-15) - Flow Rate 1 Setpoint
This byte (8 bit) value determines the Flow Rate 1 setpoint in % of full scale.

Input Word 7

Bits (0-7) - Shape Air 2 Setpoint
This byte (8 bit) value determines the Shaping Air 2 setpoint in % of full scale.

Bits (8-15) - Flow Rate 2 Setpoint
This byte (8 bit) value determines the Flow Rate 2 setpoint in % of full scale.

Input Word 8

Bits (0-6) - Parameter Read Code

This 6 bit value determines the parameter to read.

Bit 7 - Parameter Read Strobe

When this bit changes from cleared to set, the parameter value is read from the selected parameter and displayed in Output Word 7.

Bits (8-14) - Parameter Write Code

This 6 bit value determines the parameter to set.

Bit 15 - Parameter Write Strobe

When this bit changes from cleared to set, the parameter value is written into the selected parameter and displayed in Output Word 7.

Input Word 9

Bits (0-15) - Parameter Value

This 16 bit value is written to the parameter being changed.

NOTES

ATOMIZER CONTROLLER
ETHERNET/IP OUTPUT BIT DEFINITIONS
Output Object (0X75)
TABLE 12

Bit	Word 4	Word 5	Word 6	Word 7	Word 8	Word 9
0	Bell Running	Bell Overspeed Warning	Parameter Read Code	Parameter Read Value	Actual RPM Value	Actual Flow 1 (Future)
1		Bell Underspeed Warning	Parameter Read Code	Parameter Read Value	Actual RPM Value	Actual Flow 1 (Future)
2	OK to Start	Loss of Feed-back Warning	Parameter Read Code	Parameter Read Value	Actual RPM Value	Actual Flow 1 (Future)
3	Remote Mode	Speed Out of Tol-erance Warning	Parameter Read Code	Parameter Read Value	Actual RPM Value	Actual Flow 1 (Future)
4			Parameter Read Code	Parameter Read Value	Actual RPM Value	Actual Flow 1 (Future)
5	Atomizer Warning		Parameter Read Code	Parameter Read Value	Actual RPM Value	Actual Flow 1 (Future)
6	Atomizer Fault	Atomizer Comm Fault	Parameter Read Code	Parameter Read Value	Actual RPM Value	Actual Flow 1 (Future)
7			Parameter Acknowledge	Parameter Read Value	Actual RPM Value	Actual Flow 1 (Future)
8		Bell Overspeed Fault	Turbine Drive Value	Parameter Read Value	Actual Bearing Air Value	Actual Flow 2 (Future)
9		Bell Underspeed Fault	Turbine Drive Value	Parameter Read Value	Actual Bearing Air Value	Actual Flow 2 (Future)
10		Loss of Feed-back Fault	Turbine Drive Value	Parameter Read Value	Actual Bearing Air Value	Actual Flow 2 (Future)
11			Turbine Drive Value	Parameter Read Value	Actual Bearing Air Value	Actual Flow 2 (Future)
12		Low Bearing Air Fault	Turbine Drive Value	Parameter Read Value	Actual Bearing Air Value	Actual Flow 2 (Future)
13			Turbine Drive Value	Parameter Read Value	Actual Bearing Air Value	Actual Flow 2 (Future)
14			Turbine Drive Value	Parameter Read Value	Actual Bearing Air Value	Actual Flow 2 (Future)
15			Turbine Drive Value	Parameter Read Value	Actual Bearing Air Value	Actual Flow 2 (Future)

Output Word 4

Bit 0 - Bell Running
This bit is set when the atomizer control is enabled. It means that the atomizer controller is actively attempting to control the bell speed.

Bit 1 - Unused

Bit 2 - OK to Start
This bit is set when the system determines that the voltage values are in a range where it is allowed to start control.

Bit 3 - Remote Mode
This bit is set when the front panel switch is set to remote. When set, an external unit can control the system.

Bit 4 - Unused

Bit 5 - Warning
This bit is set whenever an Atomizer warning is in effect.

Bit 6 - Fault
This bit is set whenever an Atomizer fault is in effect (see "Fault Descriptions" in "Troubleshooting Guide" in the "Maintenance" section).

Bits (7-15) - Unused
These bits are currently undefined and unused.

Output Word 5

Bit 0 - Bell Overspeed Warning
This bit is set when the Atomizer detects an overspeed condition as described in the “Automatic Shutdown” section.

Bit 1 - Bell Underspeed Warning
This bit is set when the Atomizer detects an underspeed condition as described in the “Automatic Shutdown” section.

Bit 2 - Loss of Feedback Warning
This bit is set when the Atomizer detects a loss of feedback condition as described in the “Automatic Shutdown” section.

Bit 3 - Speed Out of Tolerance Warning
This bit is set when the Atomizer detects a speed out of tolerance condition as described in the “Automatic Shutdown” section.

Bits (4-5) - Unused
These bits are currently undefined and unused.

Bit 6 - Atomizer Communication Fault
The system has detected a communication failure after an EtherNet/IP connection was initiated.

Bit 7 - Unused

Bit 8 - Bell Overspeed Fault
This bit is set when the Atomizer faults due to an overspeed condition as described in the “Automatic Shutdown” section.

Bit 9 - Bell Underspeed Fault
This bit is set when the Atomizer faults due to an underspeed condition as described in the “Automatic Shutdown” section.

Bit 10 - Loss of Feedback Fault
This bit is set when the Atomizer faults due to a loss of feedback condition as described in the “Automatic Shutdown” section.

Bit 11 - Unused

Bit 12 - Low Bearing Air Fault
This bit is set when the Atomizer faults due to a low bearing air pressure condition as described in the “Automatic Shutdown” section.

Bits (13-15) - Unused

Output Word 6

Bits (0-6) - Parameter Read Code

This 7 bit value tells the system which parameter is being displayed.

Bit 7 - Parameter Acknowledge

When this bit changes from cleared to set a new Parameter Value is being displayed. It is cleared when the Parameter Read Strobe and Parameter Write Strobe are both cleared.

Bits (8-15) - Turbine Drive Value

This byte (8 bit) value displays the air pressure applied to the Atomizer turbine. If this value is monitored for each speed and paint combination, it can be used as an indicator of correct operation or a potential problem.

Output Word 7

Bits (0-15) - Parameter Read Value

This 16 bit value tells the system which parameter is being displayed.

Output Word 8

Bits (0-7) - Actual RPM Value

The byte (8 bit) value displays the latest turbine speed in 1000 RPM.

Bits (8-15) - Actual Bearing Air Value

This byte (8 bit) value displays the latest bearing air pressure reading.

Output Word 9

Bits (0-7) - Actual Flow #1 Value

In the future this byte (8 bit) value will be used to display the latest measurement of flow rate #1.

Bits (8-15) - Actual Flow #2 Value

In the future this byte (8 bit) value will be used to display the latest measurement of flow rate #2.

Parameter Select Codes

Parameter Select = 1: Atom Enabled

READ—returns value 0=Disabled
1= Enabled

WRITE —is not supported

Parameter Select = 2: Atom Type

READ—returns value 0=RMA300-500
1= AeroBelll
2= AeroBell33
3= RMA100-200
4= TurboDisk
5= Auto Gun

WRITE —is not supported.

Parameter Select = 3: Input Mode

READ—returns bit values of 0-127

WRITE —sets bit values of 0-127

See Table 13 for bit details

See table for corresponding jumpers

Parameter Select = 4: Min Bearing Air

READ—returns value 0—100

WRITE —sets value 0—100

TABLE 13

Bit	Analog Input
0	1) Bearing Air Feedback
1	2) Bell Speed Setpoint
2	3) Paint Flow Rate 1 Setpoint
3	4) Paint Flow Rate 2 Setpoint
4	5) Shaping Air 1 Setpoint
5	6) Shaping Air 2 Setpoint
7	7) (unassigned)

A “0” bit = Voltage Mode (0-10V)

A “1” bit = Current Mode (4-20mA)

Hardware Signals

TABLE 14

J14	Analog Inputs	V-I Select Jumper
J14-1	1—Bearing Air Feedback	JMP15
J14-3	2—Bell Speed Setpoint	JMP14
J14-5	3—Paint Flow Rate 1 Setpoint	JMP13
J14-7	4—Paint Flow Rate 2 Setpoint	JMP12
J14-9	5—Shaping Air 1 Setpoint	JMP11
J14-11	6—Shaping Air 2 Setpoint	JMP10
J14-13	7—(unassigned)	JMP9
even pins	Ground	

Analog Input Jumper setting:

Pins 1-2 = Voltage Mode (0-10V)
Pins 2-3 = Current Mode (4-20mA)

TABLE 15

J5	Digital Inputs
J5-1	1—Bell Spin Enable
J5-3	2—Paint Trigger 1
J5-5	3—Paint Trigger 2
J5-7	4—Dump 1
J5-9	5—Dump 2
J5-11	6—Fluid Override 1
J5-13	7—Fluid Override 2
J5-15	8—Bell Cup Wash
J5-17	9—(unassigned)
J5-19	10—(unassigned)
J5-21	11—(unassigned)
J5-23	12—(unassigned)
J5-2, 4, 6, 8, 10, 12 , 14, 16, 18, 20, 22, 24	Ground

TABLE 16

J4	Analog Outputs	V-I Select
J4-1	1—Bell Drive	JMP1
J4-3	2—Bell Speed Read Out	JMP2
J4-5	3—Paint Flow Rate 1	JMP3
J4-7	4—Paint Flow Rate 2	JMP4
J4-9	5—Shaping Air 1	JMP5
J4-11	6—Shaping Air 2	JMP5
J4-13	7—(future)	JMP7
J4-15	8—(future)	JMP8
	Ground	
J4-17, J4-18	(N.C.)	

Analog Output Jumper setting:

Pins 1-2 = Voltage Mode (0-10V)
Pins 2-3 = Current Mode (4-20mA)

NOTE

➤ Current mode output requires the installation of an optional 4-20 mA converter: Ransburg part number A13248-00.

➤ Location of the jumpers and I/O connectors referred to in tables 14, 15, 16 & 17 can be found in Figure 45 in the Appendix.

TABLE 17	
J1	**Digital Outputs**
J1-1	1—Brake
J1-3	2—Paint Trigger 1
J1-5	3—Paint Trigger 2
J1-7	4—Dump 1
J1-9	5—Dump 2
J1-11	6—Fluid Override 1
J1-13	7—Fluid Override 2
J1-15	8—Bell Cup Wash
J1-17	9—Overspeed Warning/Fault
J1-19	10—Underspeed Warning/Fault
J1-21	11—Loss of Bell Feed Back Warning/ Fault
J1-23	12—Low Bearing Air Warning/Fault
J1-25	13—Speed Out of Tolerance Warning
J1-27	14—(unassigned)
J1-29	15—(unassigned)
J1-31	16—(unassigned)
J1-33	17—(future)
J1-35	18—(unassigned)
J1-2, 4, 6, 8, 10, 12 , 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36	Ground

NOTES

INTEGRATION NOTES

GUIDELINES

Networking:

It is important to use a suitably configured network for EtherNet/IP communications. Following is a list of Ransburg's recommendations:

- Use a private switched LAN for an EtherNet/IP control network.
- For large installations the use of a switch which supports IGMP Snooping is recommended. These switches can direct multicast traffic to only the multicast group members instead of broadcasting it to all connected ports.

NOTE

➤ The MicroPak 2e does not support multicast communications.

➤ Many PLCs and robots make use of multicast communications to minimize packet transmissions. Low cost Ethernet switches treat these as broadcasts and send these messages to all connected devices. This can present a substantial processing load for devices which are not group members.

- Do not allow Internet access from the EtherNet/IP control network.
- Monitor the EtherNet/IP control network to confirm it remains isolated.
- If remote monitoring from the plant LAN is necessary, use a managed gateway to limit access to the private LAN.

For further guidance refer to ODVA document: *Network Infrastructure for EtherNet/IP™*, Publication Number: PUB00035R0.

EtherNet/IP TCP Configuration:

The present implementation of TCP Configuration through EtherNet/IP, requires that the MicroPak 2e does not have another active EtherNet/IP connection when the TCP Configuration message exchange occurs. This means that if a PC is being used to set the TCP configuration, there must not be a PLC or robot link to the MicroPak 2e (i.e. the Fault Menu Screen must show "eip" in lower case). It is planned to address this issue in a future software update.

Atomizer Operation:

When deciding how to control an atomizer, there are several important issues to consider.

1. The atomizer must not be run without an adequate supply of bearing air.
2. The flow of paint must be interlocked with the atomizer's rotation. That is, paint must not flow if the atomizer is not rotating. Failure to stop the flow of paint will result in "flooding" which can destroy an atomizer.
3. The flow of solvent must be interlocked with the atomizer's rotation and also with the high voltage control.

Compliance with item 1 is built into the Atomizer Controller and requires user action to defeat. The user is responsible for the effects of defeating this operational interlock.

Compliance with item 2 is easily achieved by using the Paint Trigger outputs of the Atomizer Controller. The controller has been programmed to interlock these outputs with the atomizer's rotation, thereby freeing the user from adding additional control logic to meet this requirement. This behavior is included in all input modes.

Compliance with item 3 is also easily achieved by using the Wash output (Bell Cup/Disk/Gun) of the Atomizer Controller. The controller has been programmed to interlock this output with the high voltage controller, so that if high voltage controller is enabled, the Bell Cup Wash output will not activate. This will prevent solvent from being dispensed when high voltage is present.

CAUTION

➤ Failure to interlock the flow of paint with atomizer rotation may cause damage to the atomizer.

Atomizer Interlock Behavior:

To help implement a safer paint booth, the High Voltage controller has been programmed to provide the state of the interlocks to the Atomizer controller with each update packet. This enables the Atomizer Controller to perform a forced stop, using the air brake, if an interlock opens while the atomizer is in motion. In addition, the atomizer controller will also immediately disable the paint and solvent outputs.

Atomizer - MP2e Power Cycling

When the MP2e power is cycled quickly using the front panel switch (i.e. OFF for less than 3 seconds), an Atomizer fault may occur. This is because the Atomizer Controller executes a reboot operation every time a failure of the RansNet communications link is detected. This behavior ensures the Atomizer Controller always has current configuration data from the MP2e.

Controller Fault Detection:

When programming the controlling PLC to detect faults the user should always:

- Use bit 6 of output word zero to detect a Voltage Controller fault.
- Use bit 6 of output word four to detect an Atomizer Controller fault.

The bits contained in output words one and five are provided to aid fault isolation. These bits should not be relied on for fault detection, since it is not guaranteed that a fault will always set an isolating bit.

Controller DIP Switch Settings:

Both the High Voltage Control Processor and the Display and Communications Processor boards have a 2 position dip switch labeled S1. Switch 1 is not currently used and switch 2 which is for factory use only, should remain in the CLOSED position for normal operation.

Likewise, the MicroPak 2e Multi I/O Board (Atomizer Controller) contains a 6 position dip switch labeled S1. The first four switch positions are used to determine the I/O function of the Multi I/O Board. For the Atomizer board, switches 1, 3 & 4 must be CLOSED and switch 2 must be OPEN. Switch 5 is not currently used and switch 6, which is for factory use only, should remain in the CLOSED position for normal operation.

MAINTENANCE

TROUBLESHOOTING GUIDE

⚠ WARNING

➤ Before troubleshooting gun and control unit problems, flush the gun with solvent and purge with air. Some of the tests will require high voltage to be applied to the gun, so the gun must be empty of paint and solvent.

Fault	Description	Solution
Cable Fault (CF)	The Cable Fault indicates the control unit does not detect a high voltage section on the end of the cable. The fault typically occurs at a high voltage trig-ger.	1. Check for loose wiring between the pc board connector and the high voltage section by pulling on each wire. Repair if necessary. Insure both connectors are secure and re-test for CF fault. 2. Replace high voltage section or send unit in for repair. 3. Send unit in for repair.

FAULT/WARN TROUBLESHOOTING GUIDES

General Problem	Fault Report	Explanation
Atom Faults	No Fault	No Fault was detected.
	Bell Overspeed	The bell speed feedback indicated the bell exceeded the setpoint. *
	Bell Underspeed	The bell speed feedback indicated the bell was below the setpoint. *
	Loss of Feedback	The fiber optic speed feedback signal was not detected. *
	Low Bearing Air	The bearing air monitor indicated the pressure was too low. *
	RansNet CommLost	The Ethernet communications between the HVC and speed controller were interrupted.
	Faulted by HVC	The speed controller has been stopped due to an HVC fault.
	Interlock	The Atomizer controller has detected an open interlock. *
Atom Warns	Speed Out of Tol	Speed is not within +/- 5% of setpoint. *

* For further information, see “Automatic Shutdown” in the section of this manual on Operation of the Atomizer.

General Problem	Fault Report	Explanation
HVC Faults	No Fault	No Fault was detected.
	Over Current	The current value has exceeded the I Limit Hi or the Max System Limit.
	MAX KV	The system has raised the Variable Voltage Output to the system maximum, but could not reach the setpoint.
	Min Output	The system has lowered the Variable Voltage Output to zero and still is above the setpoint.
	kV Limit	The system has exceeded the kV Limit Hi or the Max System Limit.
	DVDT	The system has detected a dv/dt event.
	DIDT	The system has detected a di/dt event.
	Cascade Feedback	The current or voltage feedback from the cascade is out of range.
	Voltage Cable	The system has detected a loss of the High Voltage Feedback signal from a Consolidated cascade..
	Current Cable	The system has detected a loss of the Current Feedback signal from a Consolidated cascade...
	KV Low	The system has fallen below kV Lo Limit while operating in Current Mode.
	Communications	The system has detected an EtherNet/IP communication failure. Possible causes are: - Receipt of a reset command when no fault was active. - Receipt of an invalid high voltage controller parameter value. - Receipt of an invalid atomizer parameter value, Atomizer Fault LED will also be lit
	FLT'd by Atom	An atomizer fault has caused the high voltage controller to stop.
	Comm Timeout	Either the MP2e or the "originating" EtherNet/IP controller failed to receive a message for three update intervals, so the connection was dropped.
	System Mode	The control software detected an invalid state.
	Interlock	One of the enabled interlock input circuits was broken, i.e. the circuit was opened..
	Remote Stop	The Remote Stop input circuit was opened.
	HVC WDog Reset	The high voltage control processor board reset by the WatchDog Timer.
	DSP WDog Reset	The display processor board reset by the WatchDog Timer.
	HV Power Off	External power was removed from the cascade power input—J4.
HVC Warns	Over Current	The current level is within 10% of *Max uA Limit*.
	Over Voltage	The voltage level is within 10% of *KV High Limit* (current mode only).
	Under Voltage	The voltage level is within 10% of *KV Low Limit* (current mode only).
	Max Output	Vct is maximum and the kV setpoint has not been reached.
	KV High Limit	The voltage level (kV) is within 10% of *kV Maximum,* i.e. 110 kV.

MicroPak 2e High Voltage Controller - Parts List	
Part #	**Description**
A13338-XX XX XX	MicroPak 2e HV & Atomizer Controller For replacement use, the user should order the same model number (-XXXXXX) that was listed on the original invoice.
A13245-00	MicroPak 2e Multi-Function Board
A13248-00	MicroPak 2e Analog Output, 4-20mA add-on board
A11111-00	Volume Booster, 1:1
78643-00	E/P Transducer, High Speed, High Flow, DIN Rail Mount, 0-10V : 0-100PSI
A11485-01	Pneumatic Solenoid, minimum 4mm bore, 0-120 PSI
A13596	Pressure Transducer, 0-100 PSI : 0-10V

NOTES

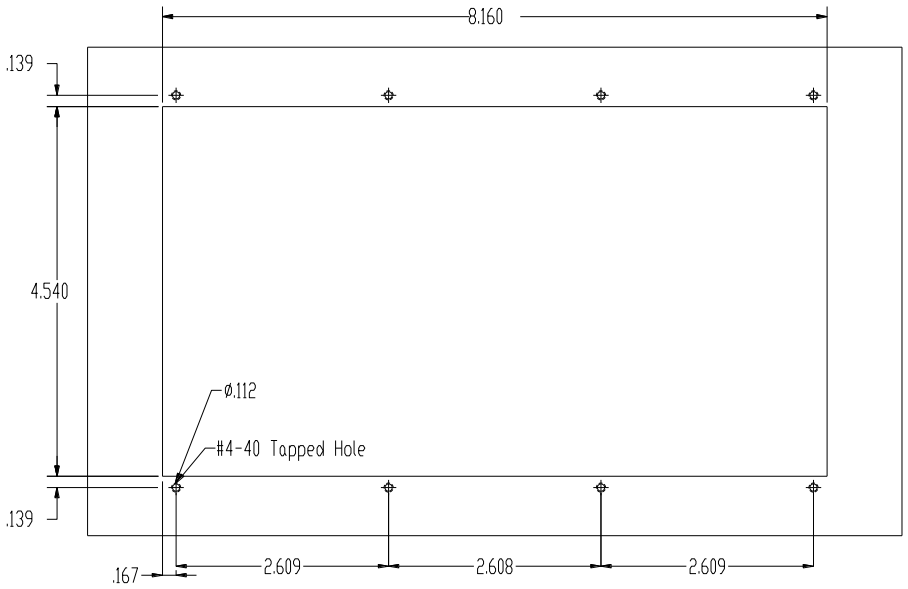


Figure 43: MicroPak 2e Controller Panel Mount Layout

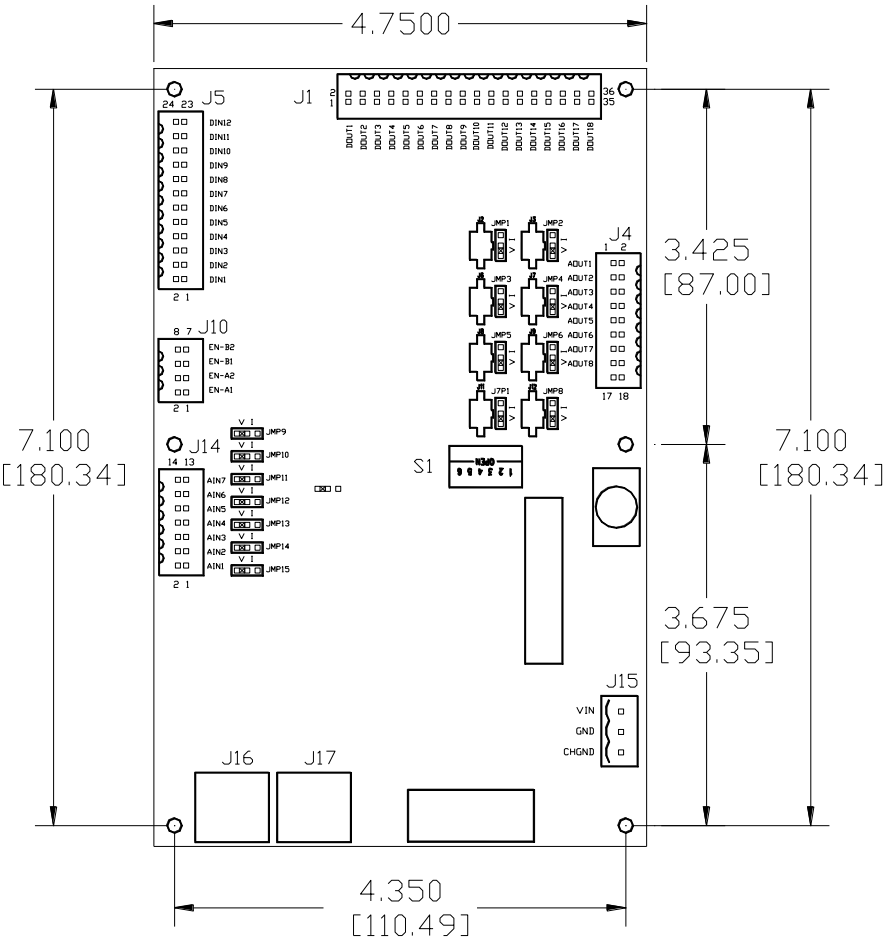


Figure 44: Atomizer Dimensions

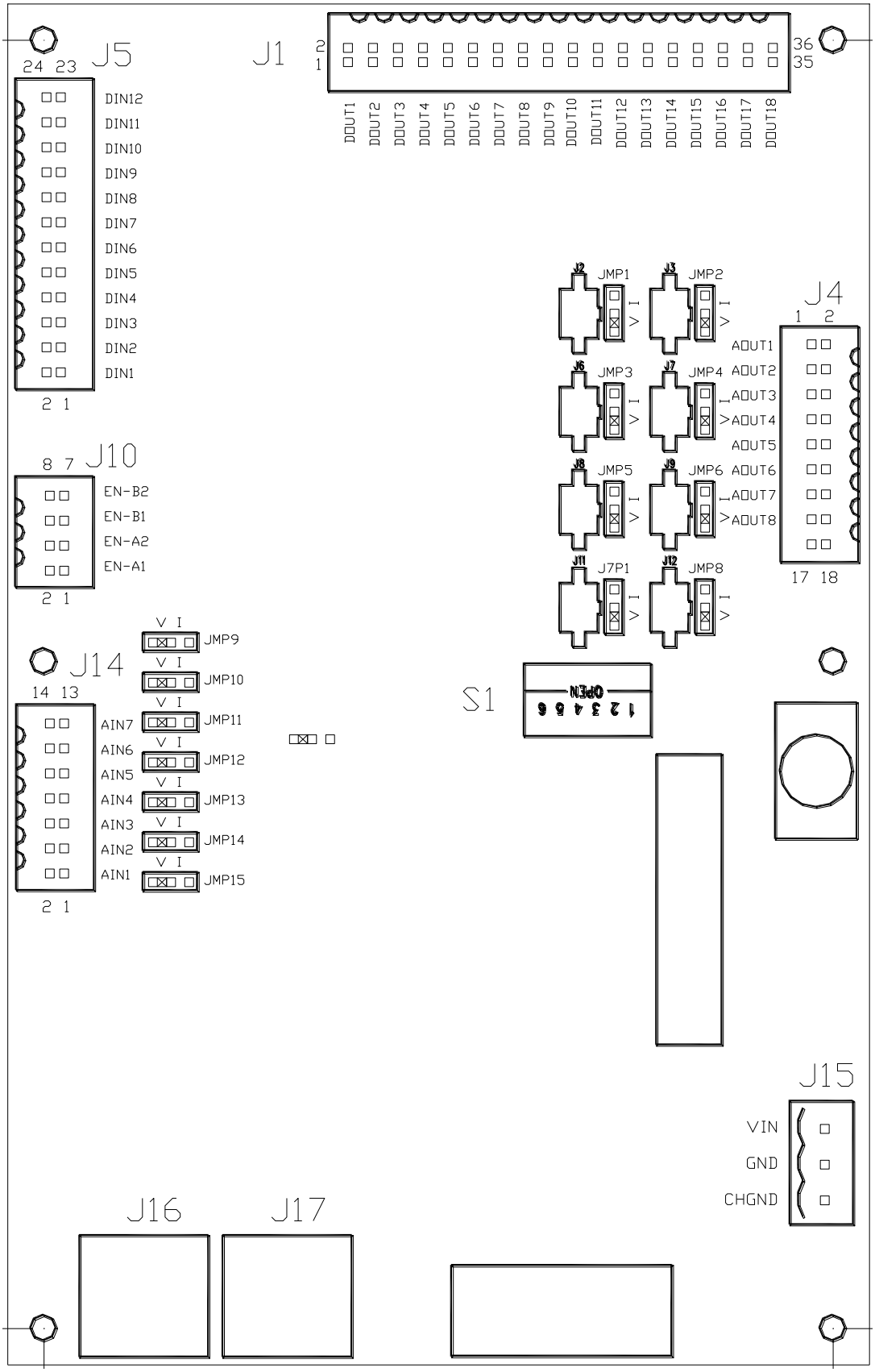


Figure 45: MicroPak 2e Controller/Atomizer Layout

WARRANTY POLICIES

LIMITED WARRANTY

Ransburg will replace or repair without charge any part and/or equipment that falls within the specified time (see below) because of faulty workmanship or material, provided that the equipment has been used and maintained in accordance with Ransburg's written safety and operating instructions, and has been used under normal operating conditions. Normal wear items are excluded.

THE USE OF OTHER THAN RANSBURG APPROVED PARTS, VOID ALL WARRANTIES.

SPARE PARTS: One hundred and eighty (180) days from date of purchase, except for rebuilt parts (any part number ending in "R") for which the warranty period is ninety (90) days.

EQUIPMENT: When purchased as a complete unit, (i.e., guns, power supplies, control units, etc.), is one (1) year from date of purchase.

WRAPPING THE APPLICATOR, ASSOCIATED VALVES AND TUBING, AND SUPPORTING HARDWARE IN PLASTIC, SHRINK -WRAP, OR ANY OTHER NON-APPROVED COVERING, WILL VOID THIS WARRANTY.

RANSBURG'S ONLY OBLIGATION UNDER THIS WARRANTY IS TO REPLACE PARTS THAT HAVE FAILED BECAUSE OF FAULTY WORKMANSHIP OR MATERIALS. THERE ARE NO IMPLIED WARRANTIES NOR WARRANTIES OF EITHER MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. RANSBURG ASSUMES NO LIABILITY FOR INJURY, DAMAGE TO PROPERTY OR FOR CONSEQUENTIAL DAMAGES FOR LOSS OF GOODWILL OR PRODUCTION OR INCOME, WHICH RESULT FROM USE OR MISUSE OF THE EQUIPMENT BY PURCHASER OR OTHERS.

EXCLUSIONS:

If, in Ransburg's opinion the warranty item in question, or other items damaged by this part was improperly installed, operated or maintained, Ransburg will assume no responsibility for repair or replacement of the item or items. The purchaser, therefore will assume all responsibility for any cost of repair or replacement and service related costs if applicable.

Ransburg

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Toledo, Ohio 43612-1493

Telephone (toll free): 800-233-3366

Fax: 419-470-2233

Technical Support Representative will direct you to the appropriate telephone number for ordering Spare Parts.

Form No. LN-9624-00
Litho in U.S.A.
03/14