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DIGITEL MPCe & LPCe

(Multiple Pump Controller & Large Pump Controller)

Users Manual

PN 900015, Rev B

Specification information is located on our website at:

www.gammavacuum.com

ISO 9001:2000 Certified

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General Information

The DIGITEL™ Multiple Pump Controller (MPCe) and Large Pump Controller (LPCe) are ion pump power supply controllers.

The DIGITEL MPCe is designed to operate up to two ion pumps independently or up to four simultaneously along with and a titanium sublimation pump (TSP) or non-evaporable getter (NEG) pump.

The DIGITEL LPCe can operate a single ion pump independently or up to four ion pumps simultaneously

Both units can accommodate pump sizes from 10 l/s and up to 1200 l/s.

They are microprocessor-based controllers containing a metering circuit, 8 process set points, and support standard serial communications. The front panel display provides direct readout of the ion pump voltage, current, or pressure.

Features

High Voltage Modules

The DIGITEL MPCe is available with up to two high-voltage (HV) modules and the DIGITEL LPCe is available with one medium high voltage module:

- The medium HV module has a starting capacity of 200W, 100 mA. It is intended to operate pumps from 10 l/s to 200 l/s and can be used on larger pumps if they are already under high vacuum.
- The large HV module has a starting capacity of 1000W, 500 mA. It is intended for pumps from 160 l/s to 1200 l/s.

HV modules are transformer design with low noise, high reliability, and pump overload protection. The output voltage can be configured to ± 7000 or ± 5600 VDC for operating different pumps. For economical operation of more than one pump, optional high-voltage output connectors can be added. Output connectors are configurable between SHV 10kV and Fisher Style connectors.

Serial Port

The DIGITEL MPCe and LPCe can be interfaced and remotely controlled by a computer. All commands entered from the touch screen can be performed from the serial port.

Analog Outputs

Two analog outputs are provided independently for each HV module to connect the controller to data-acquisition devices (for a total of 4 analog outputs). One outputs provide a 0 to 10 volt signal with a scale factor of 1 volt per 1000V output voltage (V_{MON}). The other output is programmable based on current or pressure.

SAFE-CONN

When operated with SAFE-CONN safety interlocked pumps and cables, the DIGITEL MPCe and LPCe will not allow high voltage operation when the high voltage cable is disconnected at either the pump or controller end. When high voltage is operating the units automatically shut off high voltage and provide protection from possible human shock hazard.

Set Point

Eight programmable set points, four relay controlled and four TTL controller, can be configured to either supply. Hysteresis and control values can be programmed through the computer interface or keypad.

AUTOSTART/AUTORUN

AUTOSTART/AUTORUN determines optimum starting and operating conditions based the pump size entered and then starts and monitors the pump down without assistance. In start mode, because an ion pump can draw high currents, the controller goes through a protected-start process, monitoring current, voltage, power, and time. If the pump starts properly, the controller automatically goes into run protection mode. If the pump does not start properly — the controller puts the pump into a cool-down mode. If the pump does not start properly after three tries, a message is displayed and the controller shuts down high voltage. The event log can be sued to determine the sequence of messages that lead to the shut down.

The DIGITEL MPCe and LPCe continuously protect the ion pump during start-up and normal operation. If there is a vacuum failure, the controller shuts down high voltage, thereby preventing serious damage. It can also detect power failures and be configured to automatically restart high voltage after a power loss, if desired.

Remote TSP/NEG Control Option

The remote TSP/NEG option allows you to operate a TSP (titanium sublimation pump) or NEG (non-evaporable getter) from the DIGITEL MPCe. All commands to operate the Remote TSP/NEG Control can be entered using the DIGITEL MPCe display or through serial commands. It can operate in current or power control mode and can be cycled based on time and pressure.

The option consists of:

- Remote TSP/NEG Control unit
- MPCe J505 Output
- Control cable from the DIGITEL MPCe to the Remote TSP/NEG Control
- High-current cable from the Remote TSP/NEG Control to the TSP/NEG
- AC input power cable

NOTE: Details of the TSP/NEG option are available in the TSP & Remote TSP/NEG Controller Manual (part number 900016).

High-Voltage/TSP Filament Interlock Option

The remote interlock allows enabling/disabling of either the high voltage outputs or TSP filament firing. The interlock is installed at **J506** (on the back panel of the MPCe/LPCe) if the option is installed. A loopback plug is shipped with the option along with a connector kit for custom configuration by the user.

Specifications

Parameter	Specification
Operating temperature	0 to 40°C
Operating humidity	0 to 80% RH (non-condensing)
Storage temperature	-20 to 70°C
Dimensions	WxHxD: 483 mm (19") x 133mm (5.25") x 476 mm (18.75")
Input power Requirements	115 VAC, 210-230 VAC configurable 100 mA (5 watts min, 325 watts max) 500 mA (6 watts min, 1056 watts max)
Serial interface: Baud Rate number of start bits number of stop bits parity number of data bits	9600 1 1 none 8
Set points (8):	
Type	Set points 1 - 4 are relay; Set points 5 - 8 are TTL
Electrical characteristics	Relay: 500 mA, 28V each, maximum TTL: 15 mA each, maximum
Response time	Parameters are measured at least every 320 milliseconds. Assuming a set point decision is handled right after measurement is made, response time is 320 milliseconds. Assuming a set point decision is made on the next time through the standard loop response time is 640 milliseconds. Relays take a few milliseconds to operate, so this increases response time slightly.
Line frequency	48 to 62 Hz. No adjustment necessary
High voltage output: Short circuit	+7000 VDC output standard; \pm 5600 and -7000 VDC selectable Medium HV module: 200W, 100 mA Large HV module: 1000W, 500 mA (MPCe only)
Polarity	Positive or negative (factory configurable)
Analog outputs:	0 to 10V
Voltage Current Operating Load	1V = 1000V programmable 1V = 20mA or 20 μ A on 100mA HV modules Lowest resistance = 2k Ω .
Pump size	Programmable from front panel or serial commands

Approvals

The DIGITEL MPCe and LPCe are shown to meet the intent of Directive 89/336/EEC for Electromagnetic Compatibility and Low-Voltage Directive 73/23/EEC for product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 50081-1 Emissions

- EN 55011 Class A radiated and Conducted Emissions

EN 50082-1 Immunity

- IEC 801-2 Electrostatic Discharge Immunity
- IEC 801-3 RF Electromagnetic Field Immunity
- IEC 801-4 Electrical Fast Transient/Burst Immunity

Low Voltage Directive 73/23/EEC

- EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use



Installation

Receiving and Unpacking

Check the equipment received against the packing list enclosed to insure that all items shipped have been received. If there are any shortages, notify the carrier and Gamma Vacuum. Save all packaging material for inspection.

Inspect for any obvious damage. If the equipment is damaged any way, a claim should be filed with the carrier (one copy to Gamma Vacuum). If equipment is to be returned for inspection or repair, authorization must be obtained from Gamma Vacuum Prior to reshipping.

Safety Notices



WARNING: GAMMA VACUUM CONTROLLERS DESIGNED FOR ION-PUMP OPERATION ARE CAPABLE OF DELIVERING 7000 VDC UNDER OPEN CIRCUIT OR LOW PRESSURE OPERATING CONDITIONS. GAMMA VACUUM PRODUCTS ARE DESIGNED AND MANUFACTURED TO PROVIDE PROTECTION AGAINST ELECTRICAL AND MECHANICAL HAZARDS FOR THE OPERATOR AND THE AREA SURROUNDING THE PRODUCT. OBSERVE ALL INFORMATION IN THIS SECTION.

Installation procedures are for use by qualified and authorized personnel who have experience working with voltages greater than 50 volts. To avoid personal injury, do not perform any installation or service unless qualified to do so.

There are no serviceable parts inside the controller power-supply, and voltages over 5000V are present. Do not open the supply case under any circumstances. In the event of the power-supply requiring attention return it to Gamma Vacuum.

Do not disconnect the high-voltage cable with power on. After turning power off, allow at least one minute before disconnecting electrical equipment.

Do not operate the control without a proper electrical ground or near water. The controller may be damaged and its safety reduced, if it is operated outside of its specifications.

Product Safety Labeling


WARNING:

SHOCK HAZARD. CAN CAUSE INJURY OR DEATH. REMOVE POWER BEFORE SERVICING.

ALERTE:

RISQUE DE CHOC. PEUT CAUSER DES BLESSURES OU LA MORT. RETIRER LA SOURCE D'ALIMENTATION AVANT LE SERVICE.

警告：

点検・修理の際は必ず全ての電源をお切りください。使用者が感電したり、死亡、または重傷を負う危険があります。

安全警告：

触电危険。触电可能导致受伤或死亡。请于维修前去掉电源。

ADVERTENCIA:

PELIGRO POR DESCARGA. PUEDE CAUSAR LESIÓN O INCLUSO LA MUERTE. RETIRE Y DESCONECTE LA FUENTE DE ALIMENTACION ELECTRICA, ANTES DE PROCEDER AL SERVICIO DE REPARACIÓN, MANTENIMIENTO O REVISION INTERNA.

ACHTUNG:

GEFAHR ELEKTRISCHER SCHLÄGE. VERLETZUNGS- ODER LEBENSGEFAHR. TRENNEN SIE ALLE ELEKTRISCHEN ANSCHLÜSSE VON DER SPANNUNGSVERSORGUNG BEVOR SIE ARBEITEN AN DEM GERÄT AUSFÜHREN


WARNING:

HEAVY OBJECT. TO AVOID MUSCLE STRAIN OR BACK INJURY, USE LIFTING AIDS AND PROPER LIFTING TECHNIQUES WHEN REMOVING OR REPLACING.

ALERTE:

OBJET LOURD. POUR EVITER UNE TENSION MUSCULAIRE OU UN MAL DE DOS, UTILISER DES AIDES ET DES TECHNIQUES DE LEVAGE APPROPRIÉES POUR L'ENLEVEMENT OU LE DEPLACEMENT.

警告：

大変重い装置です。筋挫傷、背部損傷等を防ぐ為、移動や移設の際は適切な技術や補助機器等を使用してください。

安全警告：

重物。为避免肌肉拉伤或背部受伤，当移动或归位时请使用起重设备以及适当的起重技术。

ADVERTENCIA:

OBJETO PESADO. PARA EVITAR UN SOBRE-ESFUERZO MUSCULAR O DAÑO FÍSICO, UTILIZE LA AYUDA DE ELEVADORES Y TÉCNICAS APROPIADAS PARA EL MANEJO DE OBJETOS PESADOS, CUANDO LO TRANSPORTE, DESPLAZE O CONSIDERE REEMPLAZARLO.

ACHTUNG:

SCHWERES OBJEKT. ZUR VERMEIDUNG VON MUSKELZERRUNGEN ODER RÜCKENSCHÄDEN BEIM TRANSPORT GEEIGNETE HUBVORRICHTUNGEN UND HEBETECHNIKEN VERWENDEN.


WARNING:

READ AND UNDERSTAND OPERATOR'S MANUAL BEFORE USING THIS MACHINE. FAILURE TO FOLLOW OPERATING INSTRUCTIONS COULD RESULT IN INJURY OR DAMAGE TO EQUIPMENT.

ALERTE:

LIRE ET COMPRENDRE LE MANUEL D'OPERATION AVANT D'UTILISER CETTE MACHINE. NE PAS SUIVRE LES INSTRUCTIONS D'OPERATION PEUT CAUSER DES BLESSURES OU DES DEGATS A L'EQUIPEMENT.

警告：

この装置を使用される前に必ず取扱説明書を熟読し理解した上でご使用ください。取扱説明書の通り操作をしなかった場合、装置が損傷、破損することがあります。

安全警告：

在使用这台机器前，请务必阅读并理解“操作员手册（指南）”。如果不能遵循操作步骤说明，将可能导致设备的损坏。

ADVERTENCIA:

LEA, ESTUDIE, Y ENTIENDA BIEN EL MANUAL DE OPERACION, ANTES DE USAR ESTA MAQUINARIA. UNA FALLA POR NO SEGUIR LAS INSTRUCCIONES OPERATIVAS, PUDIERA RESULTAR EN DAÑO O PERJUICO DEL EQUIPO.

ACHTUNG:

LESEN UND VERSTEHEN SIE DIE BEDIENUNGSANLEITUNG BEVOR SIE DAS GERÄT IN BETRIEB NEHMEN. FEHLBEDIENUNGEN KÖNNEN ZU VERLETZUNGEN FÜHREN ODER DIE AUSRÜSTUNG BESCHÄDIGEN.

Installation Procedure

The DIGITEL MPCe can be mounted in a standard 19 in. (48.3 cm) rack or used as a free-standing unit. The DIGITEL LPCe is a ½ rack controller and can be joined with a second LPCe or provided with a 19" rack mount kit (part number 320261). Make sure to provide clearance for air flow through the top cover vent holes and for the fan on the rear panel. Installation should be in such a manner as to make the rear power cord accessible.

NOTE: A 64mm (1/8") clearance should be maintained behind controllers for cable bend radius and proper airflow.

NOTE: A 3mm (1/8") gap should be maintained between vertically mounted controllers. This gap is designed in the controller chassis and they can be mounted directly above/below each other.

Required Items

You need the following items to install the controller:

1. 3-wire, detachable universal input power cable (included with controller)
2. high voltage (HV) cable for each pump (ordered separately)
3. safety ground cable for each pump (included with high voltage cable)

Procedure

Perform the following procedure to install the controller (see Back Panel Description for real panel image):

1. Place the controller in its location and secure as necessary.
2. Connect the safety ground cable between the pump and safety ground stud at the DIGITEL rear panel.
3. Connect the high voltage cable to the ion pump and to the appropriate high voltage connector on the DIGITEL rear panel (J501-J504).
4. If you have the optional SAFE-CONN feature, an additional connector is part of the HV connector. Connect it to the appropriate SAFE CONN connector (J401-J404).
5. Verify correct input voltage requirements. Connect the AC input power cable to input power receptacle on the DIGITEL rear panel.

Front Panel Operation

Description



DIGITEL MPCe Front Panel



DIGITEL LPCe Front Panel

Power On/Off Switch

The main switch controls the input power to the controller. Off and on positions are indicated on the switch. Turning off the controller will immediately disable all power from the outputs on the back panel.

High Voltage Indicator Lights

The two high voltage indicator lights indicate power to supply one and/or supply two. Both are installed regardless of how many high voltage sections are present.

LCD Touch Screen

This interface consists of a 1/4 VGA LCD touch screen. This screen is used for all front panel operations excluding the main power on/off switch.

Initial Power Up

After following the installation instructions, the controller can be turned on. Prior to allowing high voltage operation the size of the ion pump must be programmed.

Quick Start (High Voltage Operation)

Ensure that the pump has been installed according to the Ion Pump User Manual (Part Number 900013). Prior to attempting to starting any ion pump, confirm the following:

- The controller and respective ion pumps are be grounded using the redundant grounding wire supplied with the high voltage cable.
- The high voltage cable are be attached to the controller and the ion pump.
- The controller high voltage output has the correct output polarity for the ion pump (positive for diode and negative for triode)

NOTE: More power and current are required to start larger ion pumps or pumps started at higher pressures. Use the full extent of available rough pumping before starting a pump to extend pump lifetime, improve system ultimate pressure, and give the most accurate current readings.

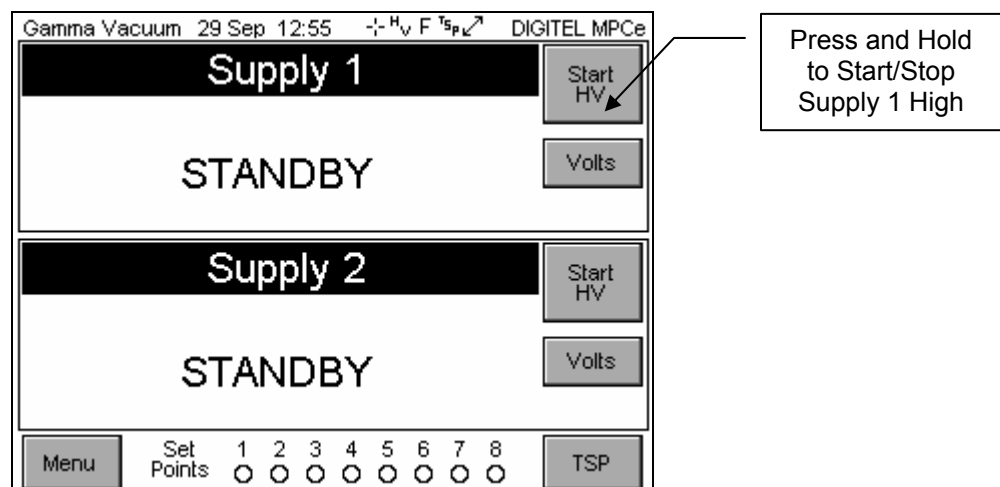
Evacuate the Vacuum System

Before you turn on an ion pump, it and the system it is attached to, must be evacuated to a minimum vacuum of 1×10^{-4} Torr. Details are best obtained from the rough pump manual, but in general, use the following recommendations:

1. Rough pump down to 1×10^{-4} Torr or less (the lower the better).
2. Ensure that contaminants do not exist in the system.
3. If an ion pump is used or has been at atmospheric pressure, it may be necessary to bake the pump into the roughing pump to achieve the best pressure. See the Ion Pump Manual for details.

Starting the Ion Pump

To start the ion pump, press and hold the Start HV button on the main display.

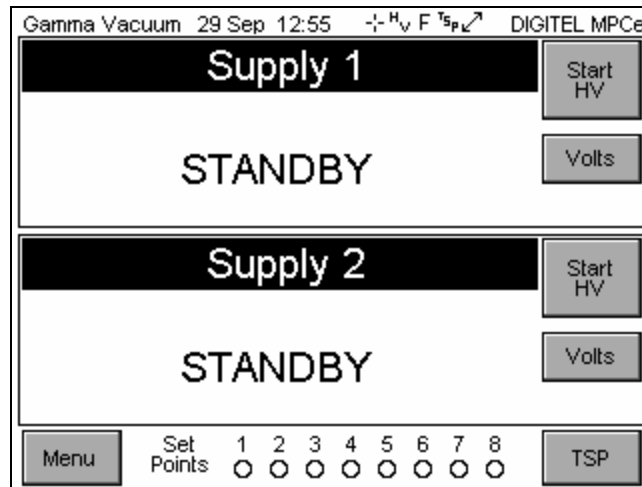


Stopping the Ion Pump

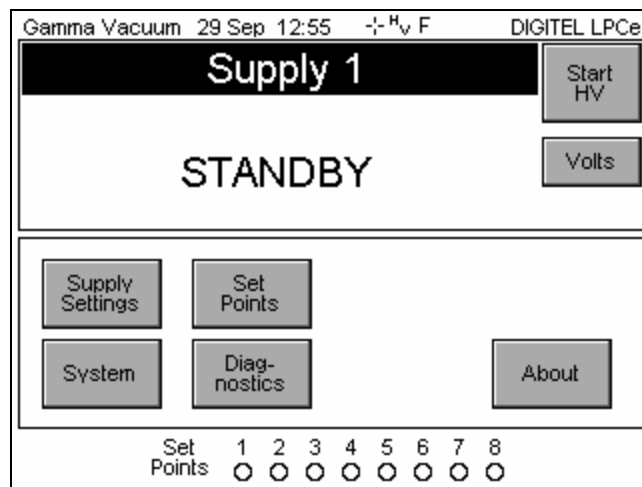
To stop high voltage, press and hold the Start HV button on the main.

Main Display

DIGITEL MPCe Main Display



DIGITEL LPCe Main Display



The main display of the MPCe and LPCe are shown upon start-up of the controller. This display is comprised of four areas:

1. Identification/Calibration Information
2. Supply one status and operational parameters.
3. Supply two status and operational parameters.
4. Menu/Set point/TSP (MPCe only)

NOTE: Details of the TSP/NEG option are available in the Remote TSP Controller Manual (part number 900016).

NOTE: The LPCe Menu is always visible. As menu functions are identical for each controller, the remaining sections will refer to visual images of the MPCe display.

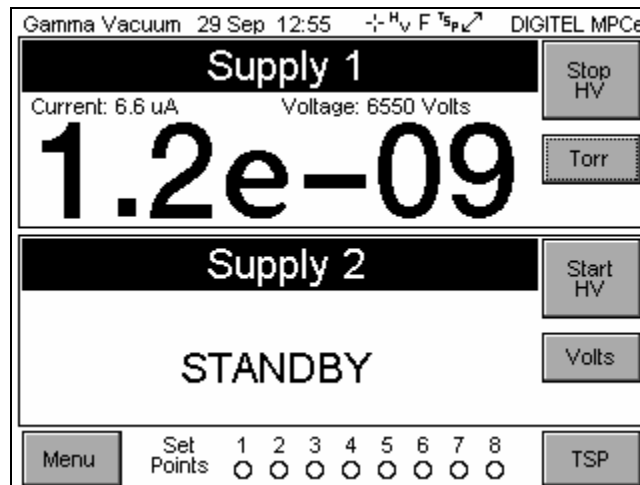
Identification/Calibration Information

The controller indicates identification and calibration information across the top of the screen. “Gamma Vacuum” along with the date, time, and model are permanently displayed information. In addition, the controller can display up to 3 symbols representing areas of the controller that remain to be calibrated. Those are:

1. The touch screen calibration indicator is symbolized by cross hairs
2. The high voltage calibration indicator is symbolized by the letters “HV”
3. The TSP calibration indicator is symbolized by the letters “TSP” on controllers with this option installed. When the MPCe is linked to the remote controller, a line with arrows on each end is present. If the TSP is not present or if the type of controller has not been selected in the TSP Config Menu, the line with arrows will have a slash through it.
4. A HV Interlock icon is displayed if the HV1 or HV2 interlocks are not preset.
5. A TSP Interlock icon is displayed if the TSP interlock is not present.
6. The capital letter F, L, or R signify the communication modes of:
 - a. F = Full, both front panel and serial commands are accepted (default).
 - b. L = Local, only front panel commands are accepted.
 - c. R = Remote, only serial commands are accepted.
7. A pad-lock symbol is shown when the touch screen is locked.

Supply Sections

Current, pressure, and voltage are displayed simultaneously. The desired reading can be rotated into the main position by pressing the value button below the Start/Stop HV button.



If a supply is not installed, the reading for that supply will indicated “NOT INSTALLED”. A second section can be added in the factory or by a trained technician.

Menu Button

The menu button opens the main menu of the MPCe. This button does not exist on the LPCe. The LPCe Menu is always visible.

Set Point Display

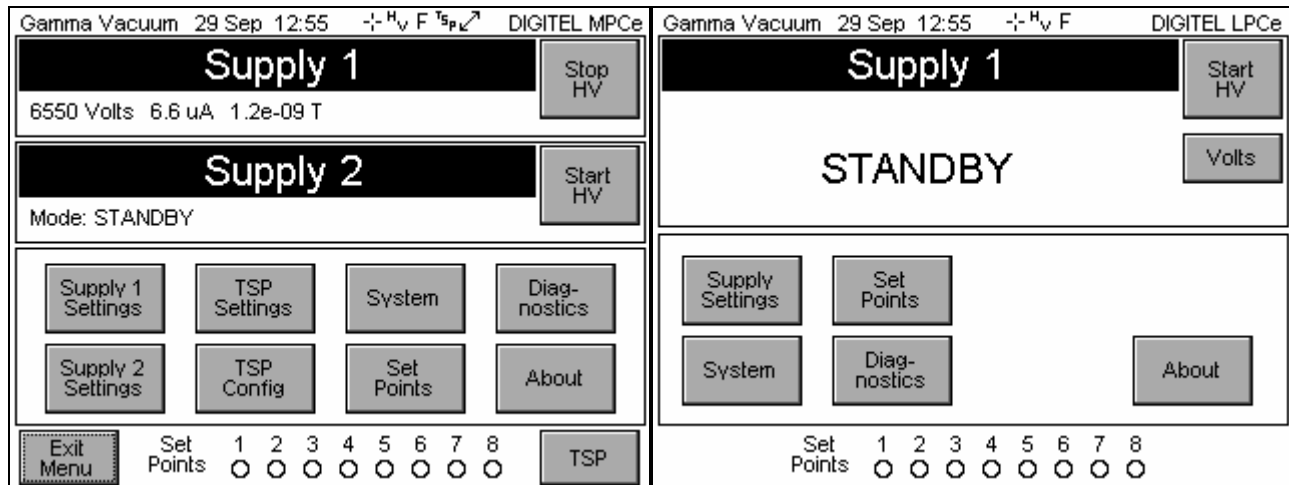
The area to the right of the menu button is dedicated to the status of the set points. There are two status symbols that indicate the current state of the set point. An open circle (○) indicates an open set point (inactive). A filled circle (●) indicates a closed set point (active).

TSP Button

The TSP button opens the TSP operation screen on the MPCe.

NOTE: Details of the TSP/NEG option are available in the Remote TSP Controller Manual (part number 900016)

Main Menu



The Main Menu of the separated in to 8 areas:

- Supply1 settings are specific to supply one, such as pump size.
- Supply2 settings are specific to supply two (MPCe only).
- System contain settings common across both high voltage settings, such as pressure units or date.
- Set Points controls the set point configuration.
- TSP Config allows for TSP hardware set-up (MPCe only, if installed).
- TSP Settings controls TSP operating variables (MPCe only, if installed).
- Diagnostics allows calibration and error handling interaction.
- About provides contact and revision information.

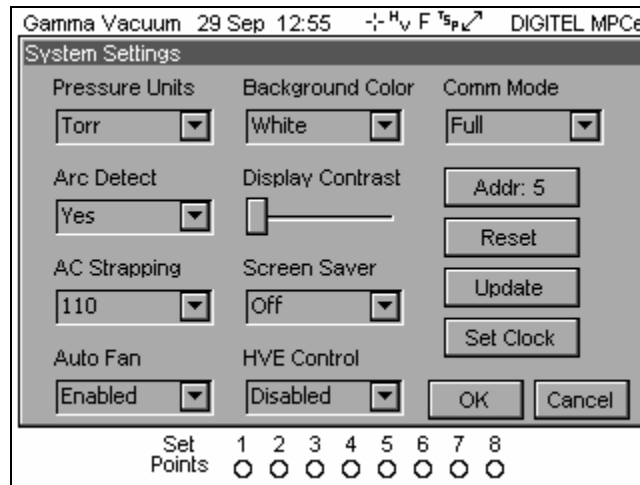
NOTE: Details of the TSP/NEG option are available in the Remote TSP Controller Manual.

NOTE: Disabled options are not selectable and their text is shown in white. For example, if Supply 2 is not installed, Supply 2 Settings are disabled.

The MPCe and LPCe have 10 high voltage modes visible from the main menu. Those modes are defined as:

- STANDBY – The supply is prepared to have high voltage turned on.
- SAFECONN – SAFECONN connections are not connected.
- WAITING – High voltage has been enabled and the controller is waiting for supply 1 or 2 to enter AUTORUN.
- HV INTERLOCK – The high voltage interlock circuit is installed and not satisfied.
- AUTOSTART – The supply is starting an ion pump and monitoring start-up conditions.
- AUTORUN – The supply is running an ion pump and continuously monitoring.
- COOL DOWN – Maximum power for the pump has been reached and the controller has stopped trying to start the pump. The controller will attempt to start the pump again.
- SHUT DOWN – The supply has encountered a shut down condition. See event log for details.
- CALIBRATION – The supply is currently being calibrated.
- ARC EVENT – Arc detection is enabled and the controller has encountered an arc

System Menu



System settings are entire controller parameters that are not specific to supply one, supply two, or the remote TSP/NEG controller. Values are selectable via pull-down menus or edit buttons. When parameters are entered press the OK button.

Pressure Units

This value determines if the displays pressure in Torr, mBar, or Pascal. The default value is Torr.

Comm Mode

The communications mode determines local, full, or remote control of the controller. In local mode, the controller only accepts front panel commands and serial communication is ignored. In full mode, the controller accepts both front panel and serial commands. In remote mode, the controller accepts only serial commands and the front panel becomes locked. To unlock the front panel, press and hold the 'Supply 1' area of the screen for several seconds.

AutoFan

This option enables the MPCe to control the cooling fan based on high voltage operation. It can be disabled if the fan is causing excessive noise or vibration.

Arc Detect

The controller is designed to protect both the controller and ion pump in harsh starting and vacuum events. Older ion pumps can send false positive readings to the controller and inadvertently trigger the arc detection software. In these cases, it desirable to bypass this detection.

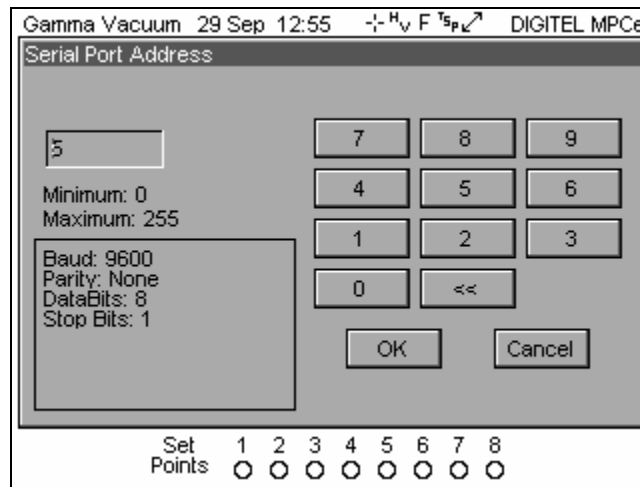
If Arc Detect is enabled, then the HV will turn off and attempt to restart for approximately 20 cycles. Arc Detect will attempt restarting several times. If unsuccessful the controller will not attempt further restarts. If Arc Detect is disabled, the HV will continue to be active for approximately 60 seconds at which time the HV will turn off due to excessive power delivery to the given size ion pump.

HVE Control

This setting enables and disables the high voltage enable (HVE) options. See the High Voltage/TSP Interlock section for additional details on this option.

Addr

The controller supports RS 232/422/485 serial standards. These protocols require the controller to have a unique address. For controllers set in the same 485 string, this address must be unique for each controller in the string. The default value set is five (5). The address can be between 0 and 255. The << button is equal to a backspace.



Reset

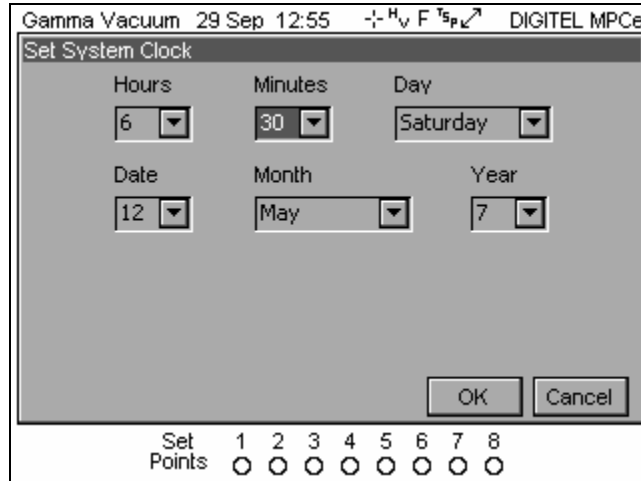
Selecting this option resets all MPCe/LPCe system parameters to their default values. A confirmation is required.

Update

This option initiates an on screen message to confirm that a new firmware version is to be loaded. For further information, contact Gamma Vacuum and reference Service Bulletin 00.004.343.

Set Clock

Settable parameters include hours, minutes, day, date, month, and year. Hours are in 24 hour format. AM and PM are not selectable. When parameters are entered, press the OK button.



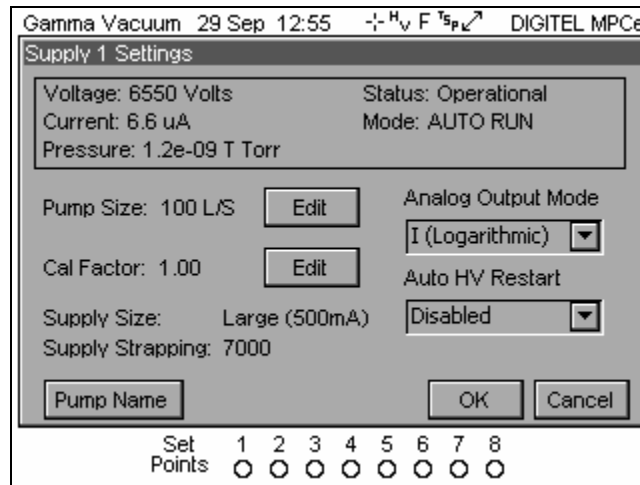
Background Color and Display Contrast

These parameters change the appearance of the LCD touch screen. Depending on lighting and individual preference, one value may appear better to a particular individual. The background can be changed between white, black, and gray. The contrast is scalable through seven settings. Contact Gamma Vacuum if the contrast needs altering beyond the 7 scalable software units.

Screen Saver

The compact florescent bulb in LCD touch screen is automatically dimmed to 50% brightness after 30 minutes of inactivity to conserve bulb lifetime. The time interval of this screen saver can be set to 30 minutes, 4 hours or 8 hours. It can also be disabled.

Supply Menu



Gamma Vacuum 29 Sep 12:55 H_v F T_p L DIGITEL MPCe

Supply 1 Settings

Voltage: 6550 Volts Status: Operational
Current: 6.6 uA Mode: AUTO RUN
Pressure: 1.2e-09 T Torr

Pump Size: 100 L/S Edit Analog Output Mode
I (Logarithmic) ▼

Cal Factor: 1.00 Edit Auto HV Restart
Disabled ▼

Supply Size: Large (500mA)
Supply Strapping: 7000

Pump Name OK Cancel

Set Points 1 2 3 4 5 6 7 8
○ ○ ○ ○ ○ ○ ○ ○

Supply settings are MPCe/LPCe parameters that are specific to the supply one or supply two high voltage sections. Each supply has its own menu. The supplies current voltage, current, pressure, and status are displayed. Values are selectable via pull-down menus or edit buttons. When parameters are entered correctly, press the OK button.

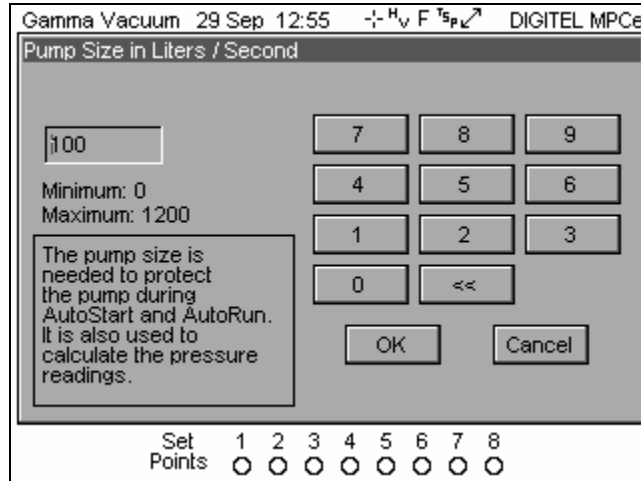
Pump Name

The user may change the default pump names (set to Supply 1 and Supply 2 by default) to a more useful description by pressing the Pump Name button. The control characters of the keyboard are as follows:

<< Move the cursor to the left
>> Move the cursor to the right
BKS Backspace
SP Space character
SFT Shift key; Press to alternate between upper and lower case letters

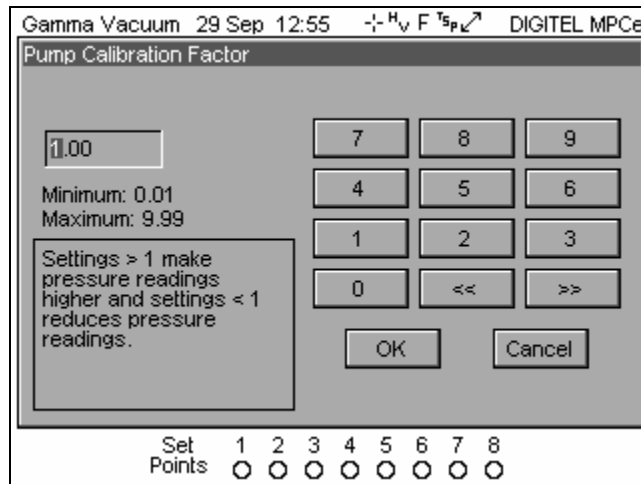
Pump Size

This parameter is required prior to operation of a high voltage section. It is set by using the edit button. This value is used to properly calculate pressure using a pressure to current calculation. The <- button is equal to a backspace.



Calibration Factor

The calibration factor is a variable used in the current to pressure calculation. The default value is one (1). Changing this value will have a linear relationship with respect to pressure. This setting can be changed, for example, if calibrating the MPC pressure to a known gauge pressure.



Auto HV Restart After Power Loss

This option enables the controller to automatically restart high voltage after there has been a power loss to the controller.

Analog Output Mode

Analog current/pressure outputs 1 and 2 are controlled for maximum flexibility. These outputs provide signals that are proportional to pump voltage, current or pressure. The controller allows selection of eight output modes.

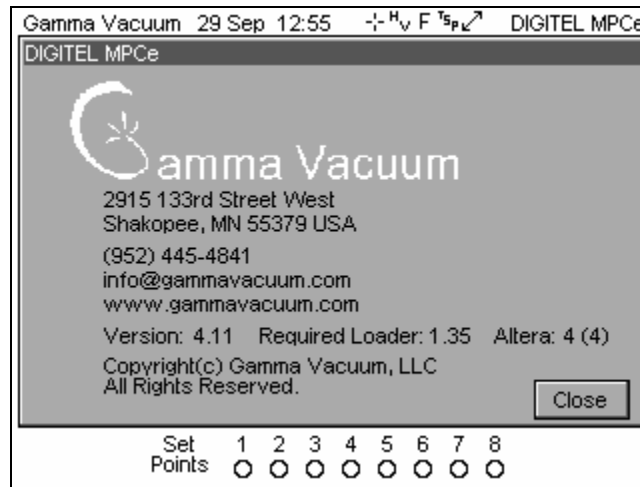
Analog Current Output Modes

Mode	Range	Scale Factor	
I Log	0 – 1 Amp	Logarithmic	Volts out = log(current) + 8.0V
P Log	1E-4 – 1E-10	Logarithmic	Volts out = log(pressure) + 10.0V
1V per 1uA	0 – 10uA	1uA per Volt	
1V per 10uA	0 – 100uA	10uA per Volt	
1V per 100uA	0 – 1mA	100uA per Volt	
1V per 1mA	0 – 10mA	1mA per Volt	
1V per 10mA	0 – 100mA	10mA per Volt	
1V per 50mA	0 – 500mA	50mA per Volt	

Note: All modes are 0 – 10Vdc out.

Note: Pressure units are the same as selected for the display.

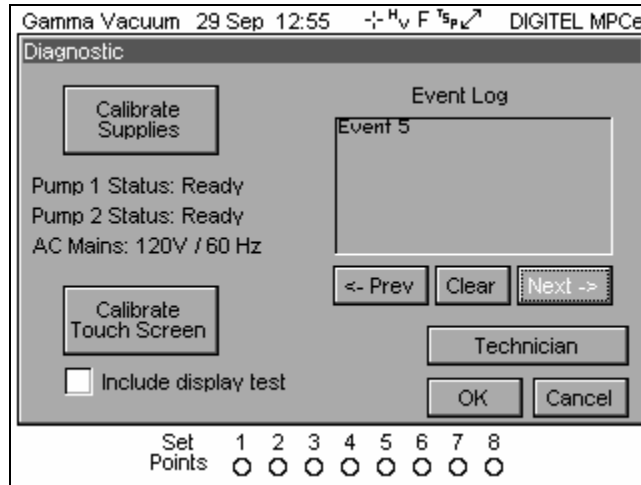
About Menu



The about menu shows Gamma Vacuum contact information and installed software revision. Revision information may be required for service or support from Gamma Vacuum.

The Required Loader indicates the version of the bootloader that the software expects to be present. Contact Gamma if a different version is loaded than is shown on this screen. The first number of the Altera version is the version of Altera PLDs loaded on the processor board, and the second number (in parentheses) is the version expected. Again, contact Gamma if a different version is loaded than is shown on this screen.

Diagnostic Menu

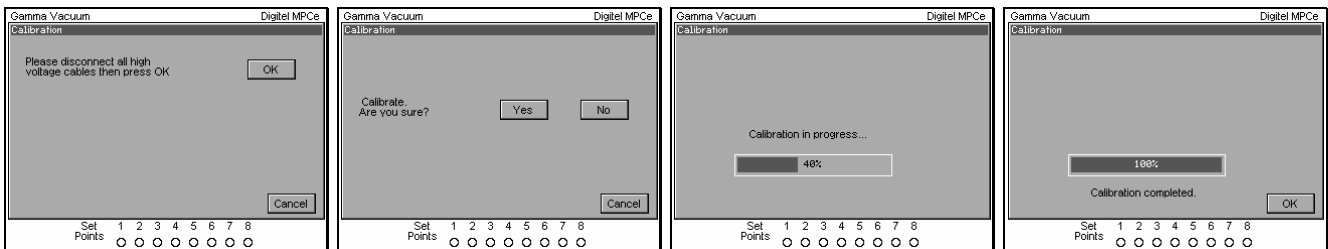


The diagnostic menu provides screens for calibrating and determining historical events recorded in the event log. Memory information is also provided for service/support diagnostic information.

Calibrate Supplies

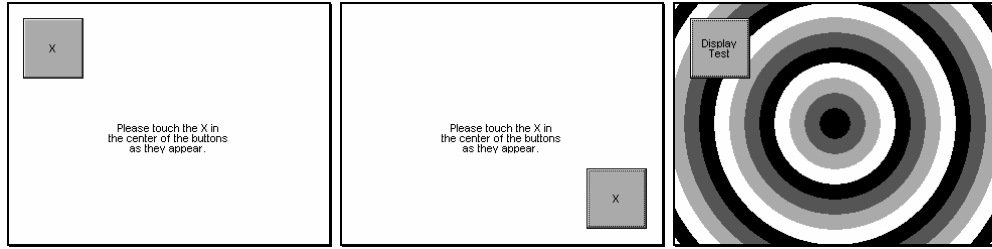
The controller can be calibrated to remove any electrical noise in the system. This provides a more accurate current measurement given all site specific parameters that may be different than those observed during production. When initiated, the controller goes through the calibration steps on screen for reference. Click OK when calibration process is completed.

NOTE: Prior to initiating this procedure, ensure that ion pump can be turned off and cables disconnected at the back panel of the controller.



Calibrate Touchscreen

To accurately represent button presses with corresponding information on the screen, the touchscreen may require calibration. When started, the controller goes through the calibration steps on the screen for reference. It is important that when pressing the target X calibration buttons that the user press the X firmly and hold for at least 1/2 second. An additional display test can be added to verify contrast settings show distinction between all gray scales.



Event Log

The Event Log stores information whenever a significant “event” occurs. The log contains up to 50 events. When the buffer is full, the earliest event is erased to store a new event. The <- and -> buttons navigate from one event to another. An event contains the following information:

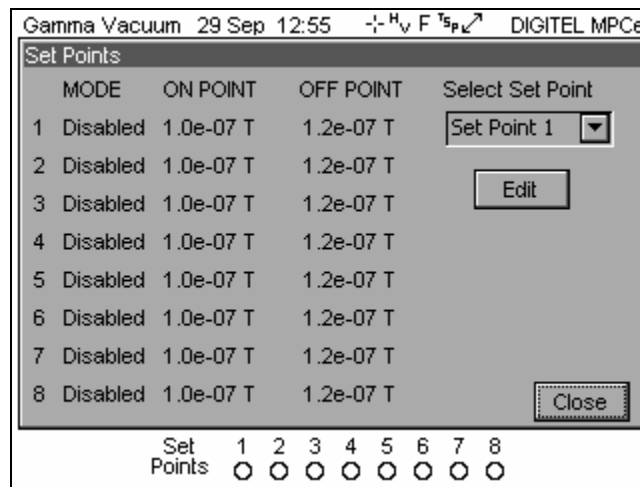
1. The high voltage supply the event occurred on.
2. The type of event that occurred.
3. The date and time when the event occurred.
4. Supply voltage and current at the time of the event.
5. Supply size and specified pump size.
6. The number of over-current cycles and number of cool down cycles.

Event Types

Event types consist of a message that describes the reason the event was recorded in the event log. Event type messages are defined as follows:

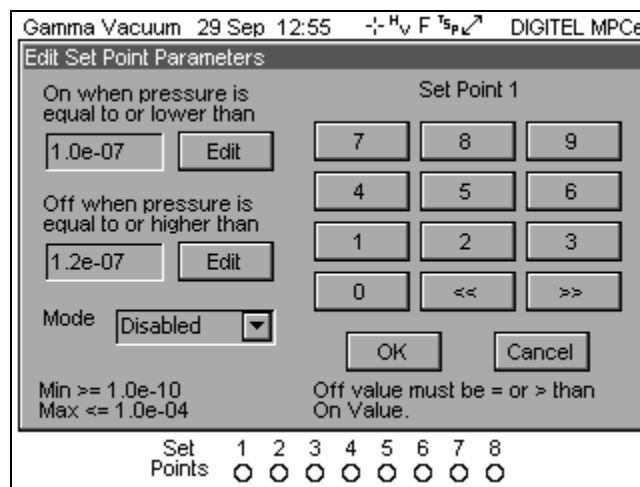
Message
The controller shut down as a result of 3 consecutive cool down cycles.
Cool down was entered because pump power exceeded a safe value.
Cool down was entered because the current from the supply exceeded a safe value.
Cool down was entered because the supply output was a short circuit.
HV was shut down because HV dropped below 1200V.
The number of arcs set in Arc Detection was exceeded.

Set Points Menu



The set point menu displays a list of all 8 available set points. From this menu, the mode, on point and off point can be seen as well as a pull down menu for selecting the set point to be edited. Pressing edit will open the respective edit set point parameters screen. When set points have been configured, press close to return to the main menu.

Edit Set Point Parameters



The Mode determines if the set point is active and which supply it is dependant on. By default, all set points are disabled.

The set point parameters are defined as:

- On Point – This is the pressure that the set point relay will activate. The set point will activate when the pressure is equal to or **lower than** this pressure.
- Off Point – This is the pressure that the set point relay will deactivate. The set point will deactivate when the pressure is equal to or **higher than** this pressure.
- The off point must be equal to or greater pressure than the on point.

- When the off point value is set to 0.1e-10 the off point value will be ignored and the relay will remain active.
- The pressure values are stored in the units that are set up in the system menu.

To edit the on or off point, press the edit button. The respective value will change from black to white and a cursor will appear to the left of the value. The <- and -> buttons control the position of the cursor. To change the value, press the corresponding number for the value to the right of the cursor. When finished editing the value, press OK.

Press OK again to return to the set point menu.

Back Panel Operation

Description



DIGITEL MPCe Rear Panel

Input Power, J507

The J507 location is dedicated to input power. It is a standard IEC interface. Prior to attaching input power, verify the proper voltage of the controller is 110 or 220-230 volts. This information is available on the serial number block of the controller and is configured in the part number. Gamma Vacuum places a label in proximity to the J507 input stating the wired input voltage upon shipment.

Contact Gamma Vacuum if a change in input power is required.

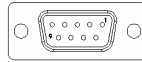
10kV SHV/SAFECONN, J401-J504 Pairings

A 10kV SHV and corresponding SMB connector is required for each high voltage connection on the rear panel of the controller. 10kV connections are used to relay high voltage to the ion pump. The SMB connections are used to relay the SAFECONN signal from the MPCe/LPCe to the ion pump high voltage feedthrough.

10kV SHV connector operates similarly to BNC style connectors. Insert the mating connector the desired J50X connection and rotate clockwise until the connection is snug.

SMB connectors are push on connectors. Press firmly until the connector snaps into place.

Serial Interface, J112



J112 is a 9-pin, female DE-9 connector that routes serial interface signals. Specific protocols are configured at the factory. The default setting is RS 232. Alternate configurations are RS 485 (full or half duplex) and RS 422. Specific OEM configurations may also be available upon request.

RS-232 Operation	
DCD	1
RXD	2
TXD	3
GND	5
DSR	6
RTS	7
CTS	8

RS-485 Operation	
+TX	2
-TX	8
GND	5

RS-422 Operation	
+RX	3
-RX	7
GND	5

TIA/EIA RS-232/422/485 are electrical standards specifying hardware requirements for a serial communications interfaces. The standard specifies a bi-directional (half duplex), multi-point interface, allowing multiple devices to be connected to the same serial port on a computer. The standard does not set up or address any software protocols. A carefully planned protocol for use between the remote devices and the controlling computer allows devices manufactured by different companies to function on the same port, even if they do not use the same protocol. This section lays out a standard protocol for use on any future Gamma Vacuum instruments that use the standard, and makes recommendations regarding hardware design in areas where software performance may be affected.

Standard

The interface consists of a differential (balanced) twisted wire pair that is connected to all devices on that serial port. This makes the interface fairly immune to electrical and RF (radio frequency) noise generated in the vicinity. All controllers on the same port must be configured for the same baud rate.

Devices cannot send data until they have been addressed by the controlling computer. A typical command exchange for a device would be:

1. The computer sends a command.
2. Devices read the address.
3. When a device recognizes its address, it decodes the message and returns an acknowledgement to the computer, along with any data that was requested.

The serial communications port settings such as number of data/start/stop bits, parity, etc. are defined subsequently. Every communications exchange between the controlling computer and a Gamma Vacuum controller using the standard interface consists of a command packet (sent by the controlling computer), and a response packet (returned by the remote controller). All characters in these packets are ASCII. All fields are separated by a space (not required between the checksum and terminator). Hexadecimal numbers can be represented in either upper or lower case.

Cabling

The MPCe and LPCe function as DTE (Data Terminal Equipment) devices. When the controller is connected to another DTE device (such as a personal computer), a null modem serial cable is required to connect the devices. The null modem cable swaps the signal and control lines so that receive and transmit are properly connected. The controller is equipped with a nine-pin female (DCE) D-sub connector protruding from the chassis rear.

RS-485 allows communications over greater distances. RS-485 cables can be as long 1220 meters (4000 ft.) while RS-232 lines are typically limited to between 15 and 30 meters (50 - 100 ft.). RS-422 is possible for Apple's Macintosh computers which utilizes this protocol. Protocol configuration is accomplished by DIP switch settings completed by Gamma Vacuum.

Maximum operating baud rate is determined by cable length and the environment near the cable. External noise sources and line loss degrade the signal. Twisted-pair cable should be used with signal wires twisted with ground wires. Shielded cables also decrease the maximum transmission length but may be required for (electrically) noisy environments. The baud rate should be adjusted on the controller to ensure viable communication.

Command Packet Structure

The command packet is made up of at least five fields and contains information needed for a remote controller to perform a command. The minimum command packet (single command with no data) is 11 bytes long and consists of the following fields:

<START CHAR>	<space>	<ADDRESS>	<space>	<COMMAND>	<space>	<CHECKSUM>	<TERMINATOR>
1 byte	1 byte	2 byte	1 byte	2 byte	1 byte	2 byte	1 byte

Field	Size	Comment
1. START character	1 character (byte)	ASCII character is '~' (TILDA)
<p>Start is the first byte in the command packet and tells remote controllers to start decoding a message. It should be implemented as a #define, so that it can be changed if necessary. As a #define, the character is rarely changed because it is hard coded into the MPC.</p> <p><SPACE></p>		
2. ADDRESS	2 hex characters	Range 00 through FF
<p>This field should be filled in with the hexadecimal representation of the integer address of the controller. The range provides 255 unique addresses. Only 32 devices may reside on the same serial port due to hardware loading limitations.</p> <p><SPACE></p>		
3. COMMAND CODE	2 hex characters	Range 00 through FF
<p>This field is one of 255 possible hexadecimal numbers, which is typically an index into a table of functions on the remote controller. Commands should be implemented as #defines with integers between 0 and 255. The integer value must be converted into ASCII hex before placement into the command packet character array. The command code must be two hex digits, even if the first is a zero.</p> <p><SPACE></p>		
4. DATA field(s), optional	as needed	ASCII printable characters only
<p>Data field(s) are for any commands that have a data value. For instance, a command to set a beam voltage in some unit would probably consist of a command to set the beam voltage, along with a value of beam voltage. If the command had more than one data value associated with it, such as setting an X and a Y value in a unit, the command field could be followed by two data fields (X and Y) separated by a space between them. All data must be sent in ASCII printable format (no binary or "control" characters). There is no limit on the number or size of data fields. It is up to the remote unit designer to keep practicality in mind when determining these fields. A data field is not required for all commands.</p> <p><SPACE></p>		
5. CHECKSUM	2 hex characters	Computed checksum of packet
<p>The calculated checksum must have its value in ASCII hexadecimal notation. It is calculated by adding the decimal value of all characters in the packet (excluding start, checksum, and terminator), and then dividing the result by 256. The integer remainder converted to two ASCII hex digits is the checksum. When a remote device receives a packet, the passed checksum is compared with a computed checksum and if they do not match, the device discards the packet.</p>		
6. Terminator character	2 hex characters	ASCII carriage return
<p>This field is an ASCII carriage return placed at the end of a command packet. This character is not the newline character "\n", but can be used in string assign statements as "\r". There is not a space between the checksum and terminator field.</p>		

Decoding the Command Packet

A MPCe/LPCe operates in one of three modes. Receipt of data is interrupt driven or otherwise multiplexed so that other tasks are performed by the unit's microprocessor. When the controller receives a command packet, it continues monitoring for new commands while the current one is carried out.

1. MONITOR. The controller monitors serial data traffic. When a "start" character is detected, the controller changes to the RECEIVE MODE.
2. RECEIVE. After receiving start, the controller tests subsequent characters for a valid command packet. This mode must have a count down timer associated with it, which is a predetermined time for a valid command packet to be received. Furthermore if another start character is received while in this mode, (i.e. the first start character was actually part of a command packet for a different device) the controller responds by going back to the beginning of the RECEIVE mode, with a fresh timer setting. If a command packet is not received within the

allowed time frame or if the checksum does not match, the timer is disabled, the packet is discarded, and the mode is reset back to MONITOR. Once a command packet is received, the mode changes to RESPOND. The only way the controller can get to a RESPOND is by receiving

- 2.1. a valid start character followed by a space,
 - 2.2. a 2-byte hex value matching the controller's address followed by a space,
 - 2.3. at least one 2-character hex value command followed by a space,
 - 2.4. a 2-byte hex checksum matching the command packet's actual checksum,
 - 2.5. and a carriage return terminator.
3. RESPOND. The controlling computer is in count-down timer mode waiting for a response from the MPC. All controllers must respond within 500 milliseconds once a valid command has been received. A valid response could be an error code indicating that the controller is BUSY with a previous command or an acknowledging response packet. After returning a response packet, the unit returns to MONITOR and executes the command. If the controlling computer needs to verify that the last command was successful, it sends a command to the unit requesting status feedback.

Response Packet

The response packet is made up of at least five fields, and contains information to let the controlling computer know that the command requested was either recognized and accepted (STATUS = "OK"), or an error condition occurred (STATUS = "ER"). The minimum packet also contains a RESPONSE CODE that is used either to pass an error code (if STATUS = "ER"), or is available for each unit to use as needed for a STATUS return of "OK". The minimum response packet (simple acknowledgment with no data) would consist of the following fields, and would be 12 bytes long.

<ADDRESS>	<space>	<STATUS>	<space>	<RESPONSE CODE>	<space>	<CHECKSUM>	<TERMINATOR>
2 byte	1 byte	2 byte	1 byte	2 byte	1 byte	2 byte	1 byte

NOTE: When a device responds to the controlling computer, that response has been requested and is expected by the computer. For this reason, a specific "start" character is not required in the response packet. The address of the responding unit is included in the packet so the controlling computer can verify it to make the data exchange easier to view on an ASCII terminal.

Field	Size	Comment
1. ADDRESS of unit	2 hex characters	Range 00 through FF
<p>This field is filled in with the hexadecimal representation of the integer address of the unit. The range provides 255 unique addresses. The controlling computer will use this field to determine that the correct remote unit is responding.</p> <p><SPACE></p>		
2. STATUS MNEMONIC	2 ASCII characters	Either OK or ER
<p>This field is made up of two ASCII characters and is either OK or ER. OK indicates success in recognizing the command. ER indicates an error condition which can mean that the command is invalid, or that the remote unit received the command but is still busy with a previous command. Specific information about ER is reported in the RESPONSE CODE field.</p> <p><SPACE></p>		
3. RESPONSE CODE	2 hex characters	Range 00 through FF
<p>For an error condition with an incoming command, this field returns an error number to the controlling computer. For non-error conditions, this field returns a status byte/word to the controlling computer, which is defined in the MPC, and can vary with the needs of individual commands within a unit, as well as varying from unit to unit. Data must be in ASCII printable format.</p> <p><SPACE></p>		
4. DATA field(s), optional	as needed	ASCII printable characters only
<p>Data field(s) are used to respond to commands requesting data. For example, a command requesting the current voltage setting in a unit would have the reading placed in a data field. Data must be in ASCII printable format. There is no limit on the number or size of data fields. Data is not required for all responses.</p> <p><SPACE></p>		
5. CHECKSUM	2 hex characters	Computed checksum of packet
<p>Checksum contains a simple computed checksum of the command packet. The value must be in ASCII hexadecimal notation. The checksum is calculated by adding the decimal value of all characters in this packet (including the space before the checksum field) and then dividing the result by 256 (base 10). The integer remainder converted to two ASCII hex digits is the packet checksum. When the controlling computer receives a response packet, the passed checksum is converted from the hex value to a binary integer and compared with a computed checksum. If they are not the same, considers it an error, and repeats the last command. When qualified technicians are testing the remote unit using a dumb terminal this returned checksum value can be ignored.</p>		
6. Terminator character	2 hex characters	ASCII carriage return
<p>This field is an ASCII carriage return placed at the end of a packet. This character is not the newline character “\n” which is actually an ASCII linefeed, but can be assigned using the “\r” designation in a string. There is not a space between the checksum and terminator field.</p>		

RS 232/422/485 General Commands

Hex Command	Description	Data Field	Response	Data/Response Interpretation
01	MODEL NUMBER, A description of the controller	-	DIGITEL MPC	-
02	VERSION, Firmware revision level	-	FIRMWARE X.X.nn	X.X is the numerical revision level for major changes and n is an alpha character for minor changes
07	MASTER RESET, Executes a complete software reset	-	-	No response due to initialization of controller
0E	SET PRESS UNITS, Specifies the default pressure units	U or UUU	-	U, UUU is pressure units U = T (Torr), M (Mbar), P (Pascal) UUU = Torr, MBR, PA
0F	GET DATE/TIME Reads the date and time	-	w mm/dd/yy hh:mm	w is day of the week (0=Sun) dd is date mm is month yy is year hh is hour mm is min
10	SET DATE/TIME Sets the date and time	w mm/dd/yy hh:mm	-	w is day of the week (0=Sun) dd is date mm is month yy is year hh is hour mm is min
24	GET LINE FREQUENCY Reads the line frequency	-	50HZ or 60HZ	-
32	CONTROL FAN Turns the cooling fan on or off	"ON or OFF"	-	-
3C	GET SETPOINT Reads configuration of specified set point	n	n, s, X.XE-XX, Y.YE-YY, ST	n = set point number (1-8) s= configured supply (1 or 2) X.XE-XX = On Point Y.YE-YY = Off Point ST = 1 (active), 0 (inactive)
3D	SET SETPOINT Configures a specified set point	n, s, X.XE-XX, Y.YE-YY	-	n = set point number (1-8) s= configured supply (1 or 2) X.XE-XX = On Point Y.YE-YY = Off Point
44	LOCK KEYPAD Established Remote Mode	-	-	-
45	UNLOCK KEYPAD Established Local Mode	-	-	-
50	GET ANALOG MODE Reads the current/pressure analog output mode for each supply	s	0-7	s= configured supply (1 or 2) 0 = Logarithmic pressure 1 = Logarithmic current 2 = Volts per 1.0uA 3 = Volts per 10.0uA 4 = Volts per 100.0uA 5 = Volts per 1.0mA 6 = Volts per 10.0mA 7 = Volts per 50.0mA
51	SET ANALOG MODE Sets the current/pressure analog output mode for each supply	s, n	-	s= configured supply (1 or 2) n = 0-7 0 = Logarithmic pressure 1 = Logarithmic current 2 = Volts per 1.0uA 3 = Volts per 10.0uA 4 = Volts per 100.0uA 5 = Volts per 1.0mA 6 = Volts per 10.0mA 7 = Volts per 50.0mA
60	IS FAN ON Indicates if the internal fan is currently operational	-	YES or NO	-

Hex Command	Description	Data Field	Response	Data/Response Interpretation
61	IS HIGH VOLTAGE ON Indicates if the high voltage for supply 1 or 2 is enabled	"1" or "2"	YES or NO	1 or 2 indicates the supply
62	SET SERIAL ADDRESS Sets the controllers serial address	-	nnn	nnn = new serial address (000-255)
63	IHIGH OFFSET Sets the offset value for high current metering	s, nnn	-	s= configured supply (1 or 2) nnn = -999 to 999 mA
68	HVE RESTART Specifies the mode of the interlock input pins to either restart or remain off after an open circuit is detected.	c	-	c = "y" for yes or "n" for no Yes indicates that shorted pins will restart the supply after an open circuit is detected. No indicates that the shorted pins will not restart the supply after an open circuit is detected.
69	GET HVE RESTART Displays the mode of the interlock input pins to either restart or remain off after an open circuit is detected.	-	YES or NO	Yes indicates that shorted pins will restart the supply after an open circuit is detected. No indicates that the shorted pins will not restart the supply after an open circuit is detected.
CB	READ EVENT LOG Reads event data from the event log	0-50	String	0 = latest event 1-50 = specific event String = pump#, message type, time/date, voltage, current, pump size, supply size, # of arcs, # cool down cycles, 0 0 0 0 (reserved)
CC	READ LAST EVENT Reads event data from the last entry in the event log	-	String	String = pump#, error code, time/date, voltage, current, pump size, supply size, # of arcs, # of cool down cycles, 0 0 0 0
CD	CLEAR EVENT LOG Removes all entries from the event log	-	-	-
D3	SET COMM MODE Sets the communication mode to local, full, or remote	N	-	N is the mode 0 = Local 1 = Remote 2 = Full
D4	GET COMM MODE Returns the current communication mode.	-	"N"	N is the mode 0 = Local 1 = Remote 2 = Full

RS232/422/485 DIGITEL MPCe/LPCe Supply Specific Commands

Hex Command	Description	Data Field	Response	Data/Response Interpretation
0A	READ CURRENT, Reads pump current from supply one or two	"1" or "2"	X.XE-X AMPS	1 or 2 indicates the supply. 0.1E-9 = HV OFF STATUS
0B	READ PRESSURE, Reads pump pressure from supply one or two	"1" or "2"	X.XE-XX UUU	1 or 2 indicates the supply UUU is pressure units (Torr, MBR, or PA) 0.1E-10 = HV OFF STATUS
0C	READ VOLTAGE, Reads pump voltage from supply one or two	"1" or "2"	XXXX	1 or 2 indicates the supply In volts

Hex Command	Description	Data Field	Response	Data/Response Interpretation
0D	GET SUPPLY STATUS	"1" or "2"	WAITING TO START STANDBY SAFE-CONN RUNNING COOL DOWN XX PUMP ERROR XX SAFE-CONN XX RUNNING XX INTERLOCK XX SHUT DOWN XX CALIBRATION XX	1 or 2 indicates the supply XX is the pump error code
11	GET PUMP SIZE, Reads pump size in liters per second	"1" or "2"	ssss L/S	ssss is pump size
12	SET PUMP SIZE, Sets pump size in liters per second	"1, ssss" or "2, ssss"	-	1, 2 indicates the supply ssss is pump size
1C	GET SUPPLY SIZE, Reads high voltage transducer size	"1" or "2"	"LARGE" or "MEDIUM"	Large = 500 mA max current Medium = 100 mA max current
1D	GET CAL FACTOR, Reads the calibration factor that modifies pressure	"1" or "2"	n.nn	n.nn range is 0.00 – 9.99
1E	SET CAL FACTOR, Sets the calibration factor that modifies pressure	"1, n.nn" or "2, n.nn"	-	n.nn range is 0.00 – 9.99
20	GET HV STRAPPING, Reads the supplies strapped high voltage output	"1" or "2"	5600 or 7000	1, 2 indicates the supply
25	SET DISPLAY, Changes the displays main parameter	"1, P" or "2, P"	-	1, 2 indicates the supply P = V (volts), C (current), or P, (pressure)
33	SET AUTO-RESTART, Sets supplies to automatically restart on power up. This applies to both HV sections.	"YES" or "NO"	-	-
34	GET AUTO RESTART, Reads auto restart status of supplies. This applies to both HV sections.	-	YES or NO	-
35	GET AUTO-RESTART2, Reads auto restart status of supply two	-	YES or NO	-
36	SET AUTO RESTART2, Sets indicated supply two to automatically restart on power up	"YES" or "NO"	-	-
37	START PUMP, Enables high voltage of specified supply	"1" or "2"	-	1, 2 indicates the supply
38	STOP PUMP, Disables high voltage of specified supply	"1" or "2"	-	1, 2 indicates the supply

RS232/422/485 Remote TSP/NEG Related Commands

Remote TSP/NEG Related serial commands can be located in the TSP & Remote TSP/NEG Controller Manual (part number 900016).

CRC Checksum Error

The following is an example of the CRC checksum calculation.

1. The response from the controller to command 01 is:

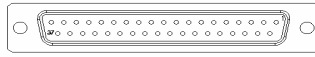
00 OK 00 DIGITEL MPC DC

2. The table below gives the values of the response.
3. Add all values below to get 4DCh¹.
4. Divide by 100h (256d). $4DCh \div 100h = 4h$ with a remainder of DCh.
5. The remainder, DCh, is the CRC.

Response	Value (hex)
0	30
0	30
space	20
O	4F
K	4B
space	20
0	30
0	30
space	20
D	44
I	49
G	47
I	49
T	54
E	45
L	4C
space	20
M	4D
P	50
C	43
space	20

¹ *h* indicates a hexadecimal (base 16) value while *d* indicates a decimal (base 10) value.

Set Point/Analog Output, J104



J104 is a 37-pin, female Sub-D connector that provides connectivity for the MPCe's or LPCe's 8 set point signals and 4 voltage/current analog output signals.

Pin	Set Point Signals	
1	Set Point 1 (Relay)	Common
2	500 mA, 28V, max.	NC
3		NO
4	Set Point 2 (Relay)	Common
5	500 mA, 28V, max.	NC
6		NO
7	Set Point 3 (Relay)	Common
8	500 mA, 28V, max.	NC
9		NO
10	Set Point 4 (Relay)	Common
11	500 mA, 28V, max.	NC
12		NO
13, 14, 16, 18	GND1	
15	Set Point 5 (TTL), 15 mA max.	
17	Set Point 6 (TTL), 15 mA max.	
19	Set Point 7 (TTL), 15 mA max.	
37	Set Point 8 (TTL), 15 mA max.	

Pin	Analog Output Signals
20	HV1 On Indicator (5V)
21	HV2 On Indicator (5V)
22 ... 28	Unused
29	GND2
30	Analog HV Supply 1
31	GND2
32	Analog Current/Pressure Supply 1
33	GND2
34	Analog Current/Pressure Supply 2
35	GND2
36	Analog HV Supply 2

Analog Current/Pressure Measuring (pins 32,34)

The analog voltage output representing current can vary depending on the mode selected in the software. A list of these modes is given in the Supply Menu.

Jumpers on the internal CPU board assembly allow selecting positive or negative outputs. Contact Gamma Vacuum technical support for additional information.

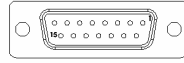
Analog High Voltage Measuring (pins 30, 36)

HV supply outputs 1 and 2 provide 0 to 10 volt signals with a scale factor of 1V/1000V output voltage.

High Voltage Status Indication (pins 20, 21)

Pins 20 and 21 indicate the status of the each high voltage supply. A zero volt signal represents an off condition. The signal changes to +5 volts when high voltage is enabled from the front panel or serial command.

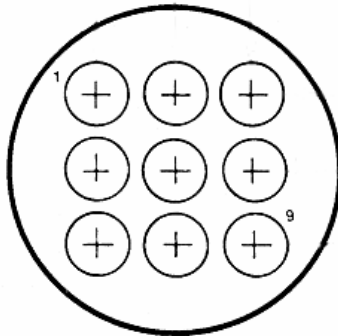
Remote TSP/NEG Control, J505 (Optional, MPCe only)



The Remote TSP/NEG Controller requires a 15-pin Sub-D connector to facilitate communications between the MPCe and Remote TSP/NEG Controller. This connection is made using a 15-pin Sub-D cable available from Gamma Vacuum.

NOTE: Details of the TSP/NEG option are available in the Remote TSP Controller Manual.

High Voltage/TSP Interlock, J506 (Optional)



The remote interlock allows disabling of the high voltage outputs or TSP filament firing (if TSP option is installed). The interlock is installed at **J506** (on the back panel of the MPCe) if the option is installed.

The interlock is configured to enable both high voltage outputs when the loopback plug (PN 380082 or 380079) is attached. The user may install external interlock switches using the extra connector kit provided with the interlock option.

To enable high voltage, short pins 1 to 3 and 7 to 9 for high voltage output one and high voltage output two (if available) respectively.

To enable the TSP (if installed), short pins 2 to 4 and 6 to 8 for TSP 1 and TSP 2 (if available) respectively.

Warranty & Service

Service

Service Requests

Upon notification, Gamma Vacuum will identify the level of service required. To assist in this process, please provide the following information in as much detail as possible:

- Part Number
- Serial Number
- Detailed Description of the Vacuum System Hardware
- Detailed Description of the Vacuum System Process (gas species introduced, ultimate pressure, operational pressure)
- Reason for Service Request
- Required Documentation

To expedite this process, please forward this information to service@gammavacuum.com.

Direct Support

Prior to recommending replacement parts or service at our facility, Gamma Vacuum can assist with general vacuum issues via e-mail or by telephone at no charge. It is our goal to have vacuum systems functional with minimal time and financial investment. To do this, our service technicians require as much information as possible about the vacuum system in need of support. To assist in this process, please provide the following information in as much detail as possible:

- Part Number
- Serial Number
- Detailed Description of the Vacuum System Hardware
- Detailed Description of the Vacuum System Process (gas species introduced, ultimate pressure, operational pressure)
- Reason for Support Inquiry

To expedite this process, please forward this information to service@gammavacuum.com or contact our facility directly at the numbers below.

Warranty

General Terms

Gamma Vacuum warrants to the Buyer that the equipment sold is new equipment, unless previously stated, and is, at the time of shipment to Buyer from Gamma Vacuum, free from defects in material and workmanship. As Buyers sole exclusive remedy under this warranty, Gamma Vacuum agrees to either repair or replace, at Gamma Vacuums option and free of parts charge to Buyer, and part or parts which, under proper and normal conditions of

use, prove to be defective within twelve (12) months from the date of receipt by buyer. As expendable items may have a life time of less than one year, their warranty is subject to reasonable service and will be replaced as determined by Gamma Vacuum. All warranty claims must be brought to the attention of Gamma Vacuum within 30 days of failure to perform.

This warranty does not cover loss, damage, or defects resulting from transportation to the buyer's facility, improper or inadequate maintenance by buyer, buyer supplied software or interfacing, unauthorized modifications of misuse, operation outside of environmental specifications for the equipment or improper site preparation and maintenance.

In-Warranty repaired or replacement parts are warranted only for the remaining unexpired portion of the original warranty period applicable to the parts which have been repaired or replaced. After expiration of the applicable warranty period, the Buyer shall be charged at Gamma Vacuum's then current prices for parts, labor, and transportation.

Reasonable care must be used to avoid hazards. Gamma Vacuum expressly disclaims responsibility for any loss or damage caused by the use of its products other than in accordance with proper operating and safety procedures.

EXCEPT AS STATED HEREIN, GAMMA VACUUM MAKES NO WARRANTY, EXPRESSED OR IMPLIED (EITHER IN FACT OR BY OPERATION OF LAW), STATUTORY OR OTHERWISE: AND, EXCEPT AS STATED HEREIN, GAMMA VACUUM SHALL HAVE NO LIABILITY FOR SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND OR FROM ANY CAUSE ARISING OUT OF THE SALE, INSTALLATION, OR USE OF ANY OF ITS PRODUCTS.

Statements made by any person, including representatives of Gamma Vacuum, which are inconsistent or in conflict with the terms of this warranty shall not be binding upon Gamma Vacuum unless reduced to writing and approved by an officer of Gamma Vacuum.

Gamma Vacuum may at any time discharge its warranty as to any of its products by refunding the purchase price and taking back the products.

Warranty Claims

Upon notification, Gamma Vacuum will investigate Warranty Claims. To initiate a Warranty Claim, please contact Gamma Vacuum directly or a representative of Gamma Vacuum. To assist in this evaluation, please provide the following information in as much detail as possible:

- Part Number
- Serial Number
- Detailed Description of the Vacuum System Hardware
- Detailed Description of the Vacuum System Process (gas species introduced, ultimate pressure, operational pressure)
- Detailed Reason for the Warranty Claim

To expedite this process, please forward this information to service@gammavacuum.com.

Returning Material

Return Procedure

In the event a product requires service, exchange, or return, a Return Material Authorization (RMA) number must be obtained from Gamma Vacuum prior to shipment. RMA numbers can be obtained by calling the Gamma Vacuum toll-free number. The RMA process will be expedited if any of the following information can be provided:

- Original Purchase Order Number
- Gamma Vacuum Sales Order Number
- Product Order Number and/or Product Description
- Product Serial Number

All products received for repair or replacement shall be prepaid. Items not labeled with an RMA number will be accepted; however substantial delay in process may result. A standard restocking fee may apply.

Note: Prior to issuance of an RMA, the required documents must be submitted to Gamma Vacuum.

Required Documentation

During a lifetime of system operation, it is possible that certain contaminants, some of which could be hazardous, may be introduced into the vacuum system, thus contaminating the components. Please complete the form on the next page to identify any known hazardous substances that have been introduced into the vacuum system. This will enable us to evaluate your equipment and determine if we have the facilities to make the repair without risk to employee health and safety. Return, repairs, or credit will not be authorized until this form has been signed and returned.

Note: Prior to returning any materials, Gamma Vacuum must issue an RMA. The RMA number should be clearly labeled on all shipping information and packages.

Return Material Authorization Form

Thank you for taking the time to complete this form. Please complete this form in word and return to Gamma Vacuum in word, Adobe Acrobat format (.pdf), or via fax. The "tab" key moves between fields. Digital signatures are acceptable.

Assigned RMA:

Your Reference:

Company Information

Company Name:

Date:

Address:

Contact Information

Name:

Phone:

Primary E-mail:

Fax:

Web Site Address:

Return Information

Type of Product:

- ION PUMP
 ION PUMP CONTROLLER
 OTHER

Part Number:

Description:

Serial Number:

Contaminant Status*:

- HAS NOT BEEN EXPOSED
 HAS BEEN EXPOSED

Original Purchase Order:

Claim Status:

- WARRANTY CLAIM
 SERVICE REQUEST
 SHIPPING ERROR
 EVALUATION
 OTHER

Your Reference:

Reason for Return:

Additional Information:

Signature of Certifying Official

Name and Title of Certifying Official

* Contaminants to vacuum systems are defined as: any substance that, because of its properties, is not compatible with ultra-high vacuum (UHV) operation. Some of these are: silicon (in the form of silicones), sulfur, cadmium, fluorine and chlorine. Contaminants have been determined by vapor pressure curves and/or properties that are detrimental to the operation of UHV products.

** "Hazardous substance" means a chemical or substance, or mixture of chemicals or substances, which:

- is regulated by the Federal Occupational Safety and Health Administration under Code of Federal Regulations, title 29, part 1910, subpart Z;
- is either toxic or highly toxic, an irritant, corrosive, a strong oxidizer, a strong sensitizer, combustible, either flammable or extremely flammable, dangerously reactive, pyrophoric, a carcinogen, a teratogen, a mutagen, a reproductive toxic agent, or that otherwise, according to generally accepted documented medical or scientific evidence, may cause substantial acute or chronic personal injury or illness during or as a direct result of any customary or reasonably foreseeable accidental or intentional exposure to the chemical or substance. (Common examples: arsenic, cadmium, gallium, cesium, mercury, radiation, etc.)

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