The Fredericks Company

MC300 Vacuum Sensor Controller
Instruction Manual

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1.1 Disclaimer

All information in this manual is subject to change without notice. The Fredericks Company assumes no responsibility for inaccuracies in product specifications or any liability arising from product use. Please contact Televac at sales@televac.com or call 215-947-2500 with comments or questions.

1.2 Description

The MC300 is a rack-mountable vacuum controller, which operates up to three vacuum sensors, including cold cathode, mini Bayard-Alpert, thermocouple convection, and thermocouple sensors. The capability of controlling a wide range of sensors allows the MC300 to provide a maximum vacuum measurement range of 1×10^{-11} Torr to 1,000 Torr.

The MC300 includes up to three, red LED, seven segment displays. There are also four dome switches for use in setting up the unit.

The Televac brand of Fredericks Company was created in 1935 and is an industry leader in vacuum measurement technology. Our team of engineers and application specialists deliver broad practical knowledge and experience across a wide range of markets and application areas. In keeping with the company's history of outstanding customer support, Televac provides the insight and guidance needed to take design concepts to reality in a cost-effective manner. For more information, visit our website at www.frederickscompany.com.

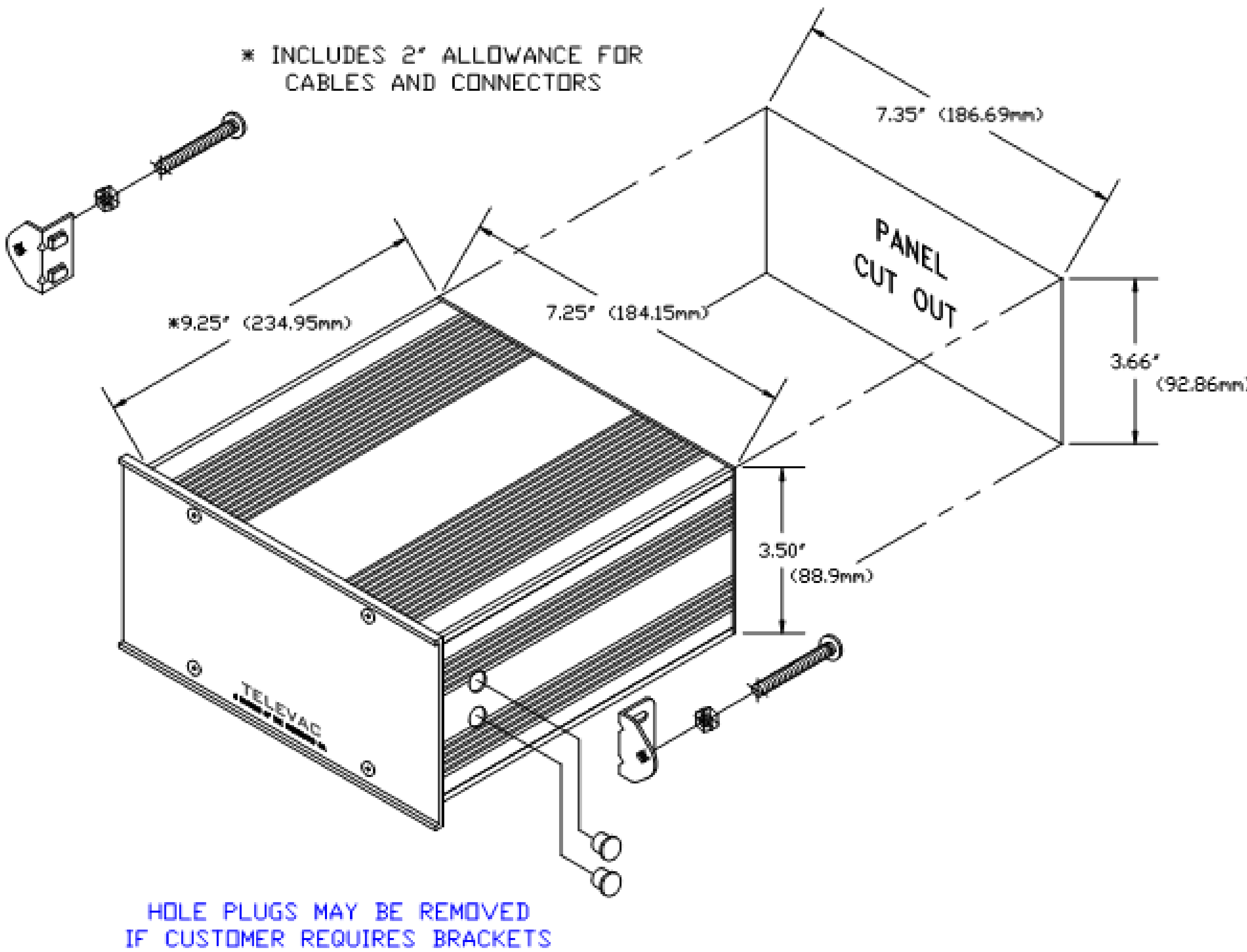
1.3 Operating Specifications

Table 1: Operating Specifications

Operating Range	1×10^{-11} to 1000 Torr
Communications	N/A
Analog Output Resolution	12 bits
Display Output Resolution	Up to 3 significant digits
Programmable Set Points	4
Set Point Type	Relay
Supply Voltage	115/230 VAC (0.3/.15A), 50-60 Hz
Maximum Power	35 W
Calibration Medium	Dry air or nitrogen
Overpressure	Sensor-dependent
Operating Temperature	0° to 50°
Storage Temperature	−40° to 85°
Display Readable Distance	10 m (33 ft)
Maximum Sensors Controlled	Up to 3

1.4 Dimensions

Figure 1: MC300 Dimensional Drawing



1.5 Safety Information

START BY READING THESE IMPORTANT SAFETY INSTRUCTIONS AND NOTES

In these instructions the word “product” refers to the MC300 and all of its approved parts and accessories. NOTE: These instructions do not and cannot provide for every contingency that may arise in connection with the installation, operation, or maintenance of this product. Should you require further assistance, please contact Televac at the email address found in the footer of this manual.

This product has been designed and tested to offer reasonably safe service provided in it is installed, operated and serviced in strict accordance with these safety instructions.

These safety precautions must be observed during all phases of operation, installation, and service of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Televac disclaims all liability for the customer’s failure to comply with these requirements.

- READ instructions – Read all safety and operating instructions before operating the product.

- RETAIN instructions – Retain the safety and operating instructions for future reference.
- HEED warnings – Adhere to all warnings on the product and in the operating instructions.
- FOLLOW instructions – Follow all operating and maintenance instructions.
- ACCESSORIES – Do not use accessories not recommended in this manual as they may require a technician to restore the product to its normal operation.

Do not substitute parts or modify instrument. Because of the danger onj introducing additional hazards, do not install substitute parts or perform any unauthorized modifications to the product. Return the product to Televac for service and repair to ensure that safety features are maintained. Do not use this product if it has unauthorized modifications.

- The unit should only be serviced by trained technicians. Contact Televac with requests for training.
- Always power down and disconnect power from the unit before attempting to perform service.
- This unit can be used with 110 V AC or 220 V AC power. There is a switch on the back of the unit to change between the two settings. Failure to use a correct power source may cause damage to the unit. See Section 5 for more information.
- Hazardous high voltages (2 kV to 4 kV) are present when any cold cathode modules are installed. This includes the 7B/E/F/FC/FCS modules.
- Strong magnetic fields are present near cold cathode sensors.
- Take proper precautions to avoid hazardous overpressure conditions.
- Televac and Fredericks Company are not liable for any direct or indirect damages that result from the use of the MC300 or its peripherals.

2 Setup

2.1 Quick Start Guide

Follow the steps outlined in this section to quickly verify your MC300 for use.

2.1.1 Check What You've Received

Compare what you've received to your purchase order. Check for any damage to the unit that may have occurred during shipping. In the unlikely event that your MC300 or related item is damaged, please contact Fredericks Company immediately.

2.1.2 Safey Instructions

Review all safety instructions outlined in Section 1.5, Safety Information.

2.1.3 Connect power

Connect the power cord provided with the MC300 to a suitable power supply.

2.1.4 Turn on MC300

Flip the power switch on the power supply on the back of the MC300 (next to where the power cord is connected).

2.1.5 Check Display

The unit will first display the Software version number and instrument type in a four-digit code. The first two digits refer to the software version and the second two digits refer to the Instrument Sensor type summarized in Table 9.

2.1.6 Gas Correction

The MC300 sensors are calibrated under dry nitrogen gas. Each MC300 is shipped in the default nitrogen configuration. The MC300 includes built in correction factors for the 2A Thermocouple Sensor and 4A Thermocouple Convection Sensors for use in argon gas. To toggle between the default nitrogen setting and correction factors for argon, complete the following steps.

1. Press **SETUP** once. The Nitrogen (N2) or Argon (Ar) indicator will flash on the display.
2. Press **UP** or **DOWN** to select between the gas corrections.
3. Press **TEST/OP** to save the selection. If **TEST/OP** is not pressed within 60 seconds, the instrument will return to normal operation and the change in gas parameter will not be saved.

The gas light will appear lit on the front panel if Argon mode is active on the MC300.

2.1.7 Measurement Units

The MC300 can be toggled between displaying pressure measurements in Pa, mbar, or mTorr and Torr. The default configuration is mTorr and Torr. To toggle between the default units setting and other available units, complete the following steps.

1. Press **SETUP** twice. The Pa, mbar, and Torr light on the front panel will flash.
2. Press **UP** and **DOWN** to select the desired units.
3. Press **TEST/OP** to save the selected unit. If **TEST/OP** is not pressed within 60 seconds, the instrument will return to normal operation and the change in units will not be saved.

2.1.8 Set points

To configure the set points, complete the following steps. For more information, see Section 2.4.1, Assigning Set Points and Values.

1. Press **SETUP** three times. **SP 1** will appear on one display with **CH 1**, **CH 2** or **CH 3** (MC300 with ion sensors only) on a second display.
2. Use the **UP** and **DOWN** arrows to select a channel to assign the set point to.
3. Press **SETUP** again and the display will read **ON**.
4. Use the **UP** and **DOWN** arrows to set the **ON** value.
5. Press **SETUP** again and the display will read **OFF**.
6. Use the **UP** and **DOWN** arrows to set the **OFF** value.
7. Press **SETUP** again to move to the next set point.
8. Repeat the previous steps to set up all four of the set points.

The MC300 will return to its normal operating mode after the fourth relay has been set up or 60 seconds have elapsed since the last button press. Changes are stored after the complete set up of an individual relay channel. These set up parameters are stored in non-volatile memory and are not lost during power outages.

Note that for MC300s with a Mini Bayard-Alpert configuration, there are four extra steps in the setup menu. See Section 4.2, Mini Bayard-Alpert Configurations, for more information.

2.1.9 Lock Switch

Move the lock switch into the upper position to lock out all changes from the front panel, including set point assignments and values as well as the Mini BA sensitivity adjustment.

2.1.10 Power down MC300 and connect peripherals

Once you've confirmed that the MC300 is functional, power it down. Connect all sensors using sensor cables, and connect any analog output, or set point cables as necessary. Be sure to follow all safety precautions associated with these items and your system.

2.1.11 Restart MC300

Restart your MC300. It should be ready for use. Contact the Fredericks Company with any comments or questions.

2.2 Installation

The MC300 can be installed as a benchtop unit, rack mounted, or panel mounted. Please see Section 1.4, Dimensions, for the relevant mounting dimensions.

2.3 Electrical Information

2.3.1 Power Requirements

Table 2: MC300 Power Requirements

Supply Voltage	110 VAC ±10% or 220 VAC ±10%
Supply Current	.3A at 115 VAC, .15A at 230 VAC
Maximum Power	35 W
Power Connection	Power cord (IEC 60320 C-13)

2.3.2 Supply Voltage

The MC300 can be configured to operate with either a 110 VAC ±10% or 220 VAC ±10% supply. The configuration can only be set at the factory. The default setting is 110 VAC compatibility and 220 VAC operation must be specified upon order. Changing the configuration requires the user to return the unit to Fredericks Company.

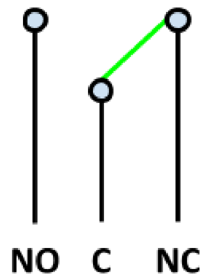
2.3.3 Electrostatic Discharge Sensitivity

The MC300 contains ESD-sensitive components but is designed to withstand ±2 kV discharges using the human body model.

2.4 Set Points

There are four set point relays available for use to control ON/OFF or open/close (binary state) devices. The relays are assignable to any one of the vacuum signal input channels through front panel software control. When the pressure is lower than the ON value of the set point, the NO and C terminals are connected (normally open and common). When the pressure is higher than the OFF value of the set point, the NC and C terminals are connected (normally closed and common). When the unit is powered down, the NC and C terminals remain connected. The relays are single pole double throw (SPDT) and rated for 6 A at 24 V DC or 10 A at 120 V AC.

Figure 2: Relay Wiring Diagram in the OFF State



2.4.1 Assigning Set Points and Values

The instrument has four relays that are assignable to any of the vacuum measurement channels. The default setting is thermocouple (or convection) Channel 1 is Channel 1 (CH 1), thermocouple (or convection) Channel 2 is Channel 2 (CH 2) and the ion sensor is Channel 3 (CH 3), if applicable. Set point SP 1 is relay 1, set point SP 2 is relay 2, and etc. The default assignments for each set point to each channel are SP 1 to Channel 1 and SP 2 to Channel 2 for all versions. For configurations with an ion sensor, SP 3 and SP 4 will be assigned to Channel 3. For configurations without an ion sensor, SP 3 and SP 4 are assigned to Channel 2 by default.

To change the assignment of the set points or change their values, follow the steps below.

1. Press **SETUP** three times. **SP 1** will appear on one display with **CH 1**, **CH 2** or **CH 3** (MC300 with ion sensors only) on a second display.
2. Use the **UP** and **DOWN** arrows to select a channel to assign the set point to.
3. Press **SETUP** again and the display will read **ON**.
4. Use the **UP** and **DOWN** arrows to set the **ON** value.
5. Press **SETUP** again and the display will read **OFF**.
6. Use the **UP** and **DOWN** arrows to set the **OFF** value.
7. Press **SETUP** again to move to the next set point.
8. Repeat the previous steps to set up all four of the set points.

2.4.2 Normally Closed

In this state there is an electrical continuity path between terminals C and NC. This continuity path is broken when the software set point values dictates an ON state for the specific measurement channel. Continuity is returned when the OFF state is dictated by software control. In the power off mode of the MC300 (due to failure of the main power source or turning off the instrument), the relay will revert to this state.

2.4.3 Normally Open

In this state there is no electrical continuity path between terminals C and NO. This Path is established ONLY when the Instrument control software satisfies conditions for the ON state. It will break continuity under the instrument control parameters for the OFF condition or the power off mode of the MC300 (due to failure of the main power source or turning off the instrument).

2.5 Analog Outputs

Each sensor on the MC300 ships with two different analog output formats for ease of use by the customer. Consult the appropriate section below to learn more about each sensor output. The MC300 will return to its normal operating mode after the fourth relay has been set up or 60 seconds have elapsed since the last button press. Changes are stored after the complete set up of an individual relay channel. These set up parameters are stored in non-volatile memory and are not lost during power outages.

2.5.1 2A Thermocouple Sensor

The 2A Thermocouple sensor has two analog output formats. The Traditional Output option mimics the output of the raw signal from the 2A sensor. The voltage can be converted to a pressure by using a linear interpolation table.

The Linear Output option provides a linear signal from .001 Torr to 1 Torr. The voltage can be converted to a pressure via an equation.

$$Pressure\ (Torr) = V\ (Volts) \times .1 \quad (1)$$

Figure 3: 2A Analog Output

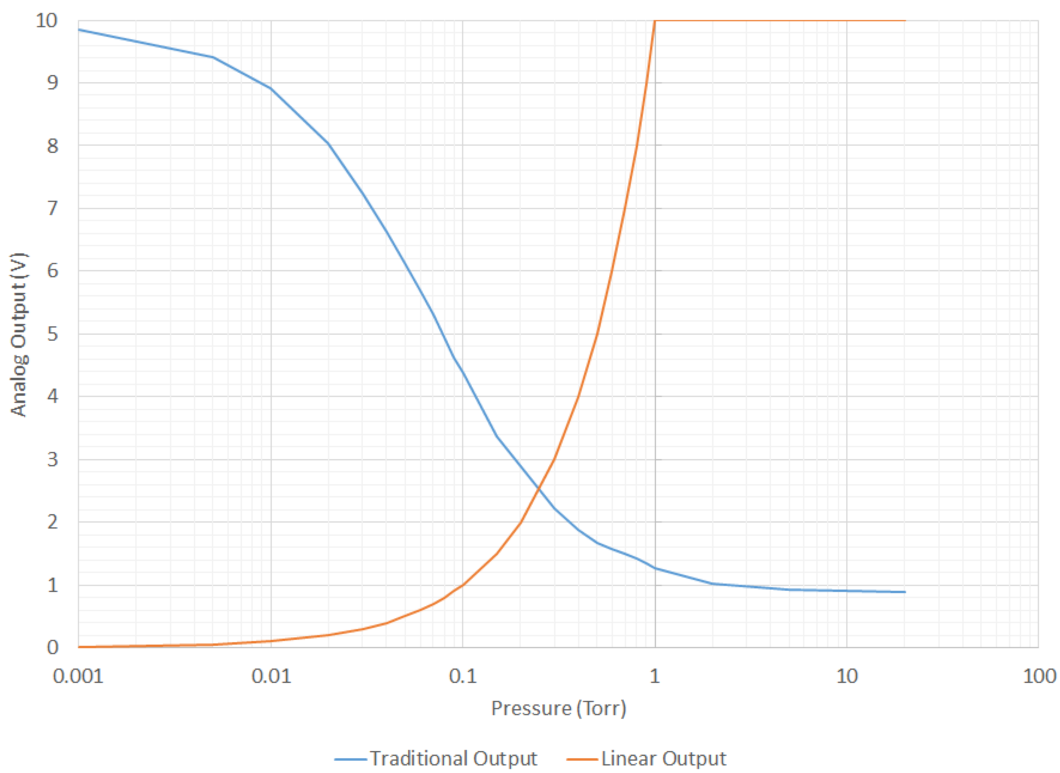


Table 3: 2A Analog Output

Pressure (Torr)	Traditional Output (V)	Linear Output (V)
-0.005	10.59	-0.05
-0.001	10.16	-0.01
0	10	0
0.001	9.84	0.01
0.005	9.41	0.05
0.01	8.92	0.1
0.02	8.03	0.2
0.03	7.23	0.3
0.04	6.63	0.4
0.05	6.13	0.5
0.06	5.69	0.6
0.07	5.31	0.7
0.08	4.95	0.8
0.09	4.63	0.9
0.1	4.37	1
0.15	3.37	1.5
0.2	2.89	2
0.3	2.23	3
0.4	1.88	4
0.5	1.67	5
0.6	1.58	6
0.7	1.5	7
0.8	1.42	8
0.9	1.34	9
1	1.26	10
2	1.02	10.2
5	0.92	10.2
10	0.9	10.2
20	0.88	10.2
CABLE	0	10.2

2.5.2 4A Thermocouple Convection Sensor

The 4A Thermocouple Convection sensor has two standard analog output formats and possesses a third optional analog output format. The Traditional Output option mimics the output of the raw signal from the 4A sensor. The voltage can be converted to a pressure by using a linear interpolation table. To receive an MC300 with a 4A sensor analog output set to Traditional, the user must specify this change during ordering.

The Linear Output option provides a linear signal from .001 Torr to 1 Torr. The voltage can be converted to a pressure via an equation. The Linear Output is included in standard units.

$$Pressure\ (Torr) = V\ (Volts) \times .1 \tag{2}$$

The Linear by Decade Output option provides a signal that is linear within each decade (power of ten) and uses the first digit to convey the decade of pressure. The signal can be converted to a pressure by using a function to parse the voltage measurement. The Linear by Decade Output is included in standard units.

$$\begin{gathered} For\ V = INT.DDD \\ Pressure\ (Torr) = 0.DDD \times 10^{(INT-6)} \end{gathered} \tag{3}$$

Figure 4: 4A Analog Output

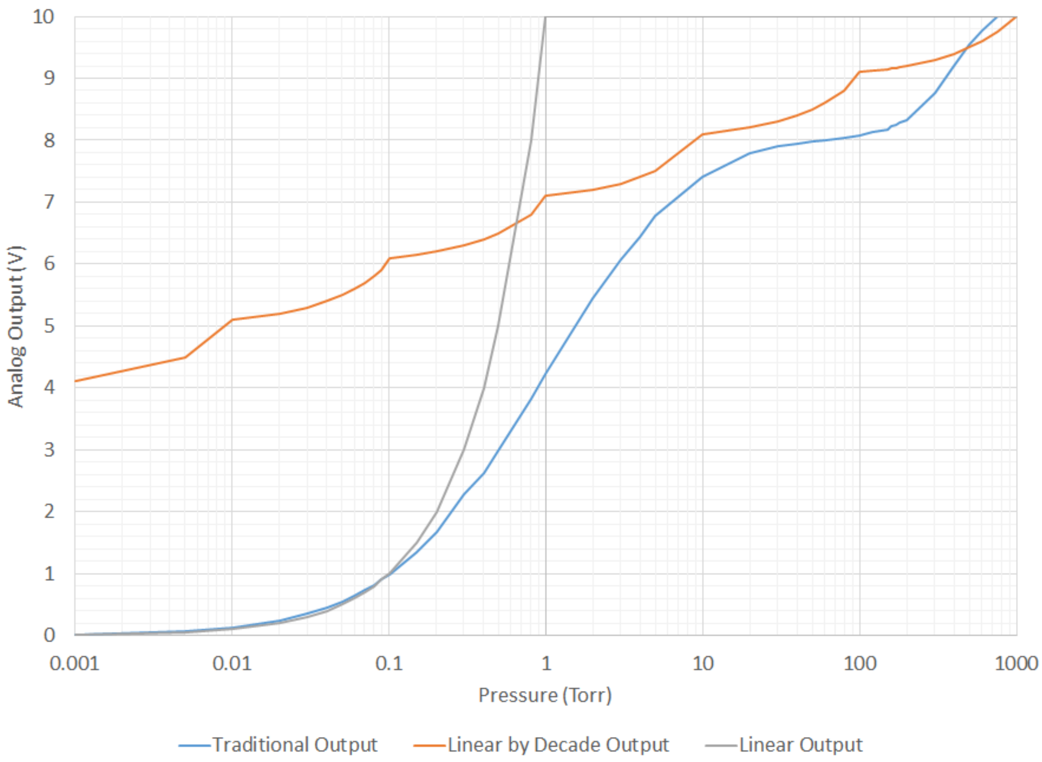


Table 4: 4A Analog Output

Pressure (Torr)	Traditional Output (V)	Linear by Decade Output (V)	Linear Output (V)
0	0	4.0	0
0.001	0.013	4.1	0.01
0.005	0.065	4.5	0.05
0.01	0.124	5.1	0.1
0.02	0.238	5.2	0.2
0.03	0.344	5.3	0.3
0.04	0.45	5.4	0.4
0.05	0.546	5.5	0.5
0.06	0.638	5.6	0.6
0.07	0.73	5.7	0.7
0.08	0.816	5.8	0.8
0.09	0.898	5.9	0.9
0.1	0.98	6.1	1
0.15	1.35	6.15	1.5
0.2	1.67	6.2	2
0.3	2.285	6.3	3
0.4	2.63	6.4	4
0.5	2.992	6.5	5
0.8	3.824	6.8	8
1	4.226	7.1	10
2	5.44	7.2	13.5
3	6.08	7.3	13.5
4	6.44	7.4	13.5
5	6.772	7.5	13.5
10	7.412	8.1	13.5
20	7.782	8.2	13.5
30	7.91	8.3	13.5
40	7.936	8.4	13.5
50	7.976	8.5	13.5
60	8.006	8.6	13.5
80	8.042	8.8	13.5
100	8.072	9.1	13.5
150	8.18	9.15	13.5
200	8.328	9.2	13.5
300	8.756	9.3	13.5
400	9.208	9.4	13.5
500	9.544	9.5	13.5
600	9.772	9.6	13.5
760	10	9.76	13.5
900	10.142	9.9	13.5
1000	10.232	10	13.5
CABLE	10.5	10.11	13.5

2.5.3 7B Penning Magnetron Cold Cathode

The 7B Penning Magnetron Cold Cathode sensor has two analog output settings. The Linear Output option provides a linear signal from 1×10^{-7} Torr to 1×10^{-3} Torr. The voltage can be converted to a pressure via an equation.

$$Pressure\ (Torr) = V\ (Volts) \times 10^{-4} \tag{4}$$

The Linear by Decade Output option provides a signal that is linear within each decade (power of ten) and uses the first digit to convey the decade of pressure. The signal can be converted to a pressure by using a function to parse the voltage measurement.

$$\begin{gathered} For\, V = 2 \times (INT.DDD) \\ Pressure\ (Torr) = 0.DDD \times 10^{(INT-7)} \end{gathered} \tag{5}$$

Figure 5: 7B Analog Output

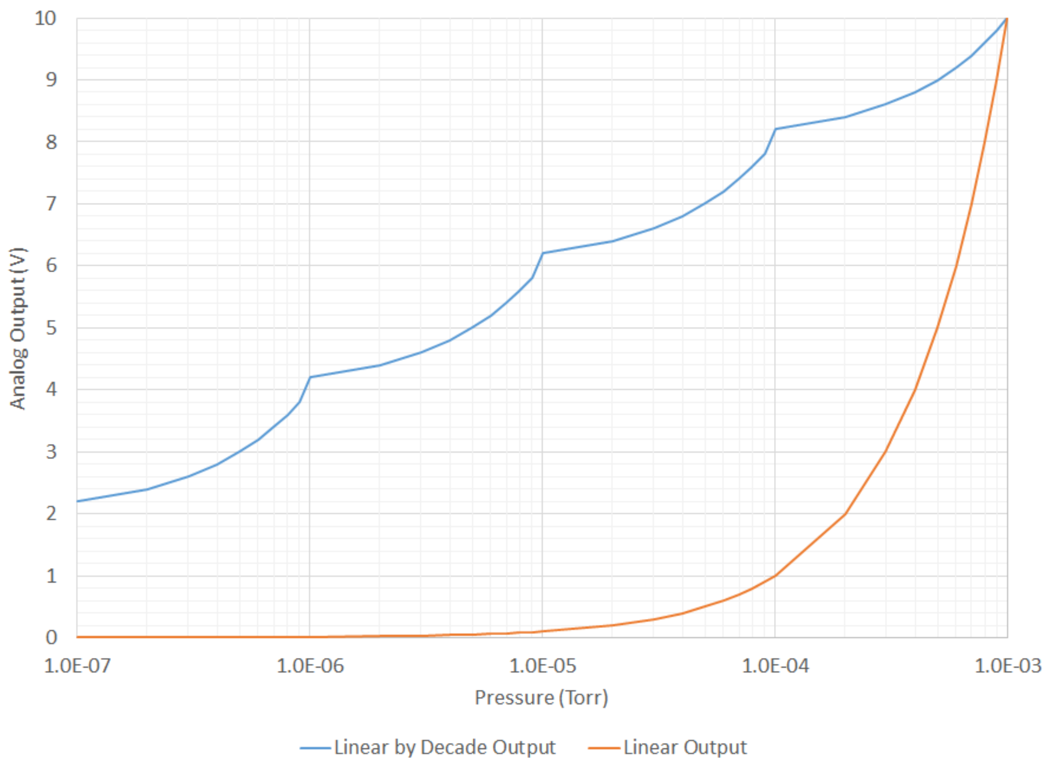


Table 5: 7B Analog Output

Pressure (Torr)	Linear by Decade Output (V)	Linear Output (V)
1.10E-03	10.11	10.11
1.00E-03	10	10
9.00E-04	9.8	9
8.00E-04	9.6	8
7.00E-04	9.4	7
6.00E-04	9.2	6
5.00E-04	9	5
4.00E-04	8.8	4
3.00E-04	8.6	3
2.00E-04	8.4	2
1.00E-04	8.2	1
9.00E-05	7.8	0.9
8.00E-05	7.6	0.8
7.00E-05	7.4	0.7
6.00E-05	7.2	0.6
5.00E-05	7	0.5
4.00E-05	6.8	0.4
3.00E-05	6.6	0.3
2.00E-05	6.4	0.2
1.00E-05	6.2	0.1
9.00E-06	5.8	0.09
8.00E-06	5.6	0.08
7.00E-06	5.4	0.07
6.00E-06	5.2	0.06
5.00E-06	5	0.05
4.00E-06	4.8	0.04
3.00E-06	4.6	0.03
2.00E-06	4.4	0.02
1.00E-06	4.2	0.01
9.00E-07	3.8	0
8.00E-07	3.6	0
7.00E-07	3.4	0
6.00E-07	3.2	0
5.00E-07	3	0
4.00E-07	2.8	0
3.00E-07	2.6	0
2.00E-07	2.4	0
1.00E-07	2.2	0

2.5.4 7E/7F/7FC Double Inverted Magnetron Cold Cathode

The 7E/7F/7FC Double Inverted Magnetron cold cathode sensor has two analog output settings. The Logarithmic Output option provides a logarithmic signal from 1×10^{-11} Torr to 1×10^{-2} Torr. The voltage can be converted to a pressure via an equation.

$$Pressure\ (Torr) = 10^{V-11} \tag{6}$$

The Linear by Decade Output option provides a signal that is linear within each decade (power of ten) and uses the first digit to convey the decade of pressure. The signal can be converted to a pressure by using a function to parse the voltage measurement.

$$\begin{gathered} For\ V = INT.DDD \\ Pressure\ (Torr) = 0.DDD \times 10^{(INT-10)} \end{gathered} \tag{7}$$

Note that the range of the 7E sensor is limited by the outgassing of the rubber o-ring and does not possess the same range as the 7F and 7FC sensors. For more information, please see Section 3.1.4, 7E Double Inverted Magnetron Cold Cathode, for more information.

Figure 6: 7E/7F/7FC Analog Output

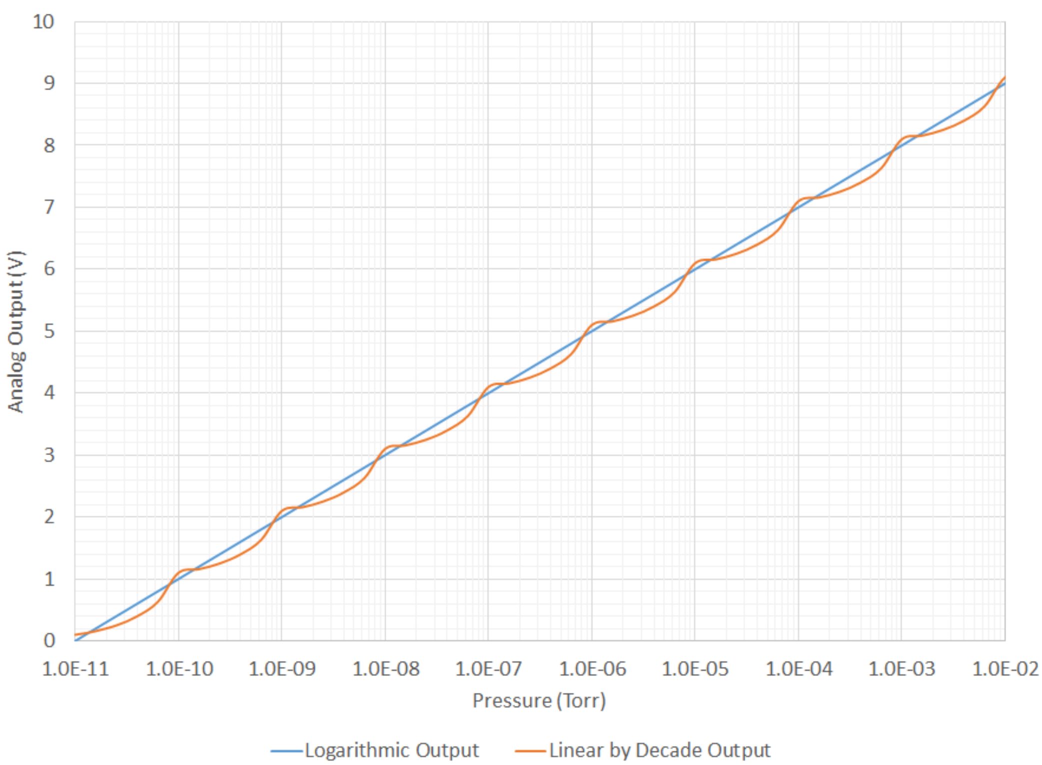


Table 6: 7E/7F/7FC Analog Output

Pressure (Torr)	Logarithmic Output (V)	Linear by Decade Output (V)
1.00E-11	0	0.1
2.51E-11	0.4	0.251
6.31E-11	0.8	0.631
1.00E-10	1.0	1.1
2.51E-10	1.4	1.251
6.31E-10	1.8	1.631
1.00E-09	2.0	2.1
2.51E-09	2.4	2.251
3.98E-09	2.6	2.398
6.31E-09	2.8	2.631
1.00E-08	3.0	3.1
2.51E-08	3.4	3.251
3.98E-08	3.6	3.398
6.31E-08	3.8	3.631
1.00E-07	4.0	4.1
2.51E-07	4.4	4.251
3.98E-07	4.6	4.398
6.31E-07	4.8	4.631
1.00E-06	5.0	5.1
2.51E-06	5.4	5.251
3.98E-06	5.6	5.398
6.31E-06	5.8	5.631
1.00E-05	6.0	6.1
2.51E-05	6.4	6.251
3.98E-05	6.6	6.398
6.31E-05	6.8	6.631
1.00E-04	7.0	7.1
2.51E-04	7.4	7.251
3.98E-04	7.6	7.398
6.31E-04	7.8	7.631
1.00E-03	8.0	8.1
2.51E-03	8.4	8.251
3.98E-03	8.6	8.398
6.31E-03	8.8	8.631
1.00E-02	9.0	9.1
OL’D	>9.2	>9.160

2.5.5 Mini Bayard-Alpert Sensor

The Mini Bayard-Alpert sensor has two analog output settings. The Logarithmic Output option provides a logarithmic signal from 1×10^{-10} Torr to 1×10^{-2} Torr. The voltage can be converted to a pressure via an equation.

$$Pressure\ (Torr) = 10^{V-11} \tag{8}$$

The second analog output format is the Millivolt Logarithmic Output. The voltage can be converted to a pressure via an equation.

$$Pressure\ (Torr) = 10^{mV-11} \tag{9}$$

Figure 7: Mini Bayard-Alpert Analog Output

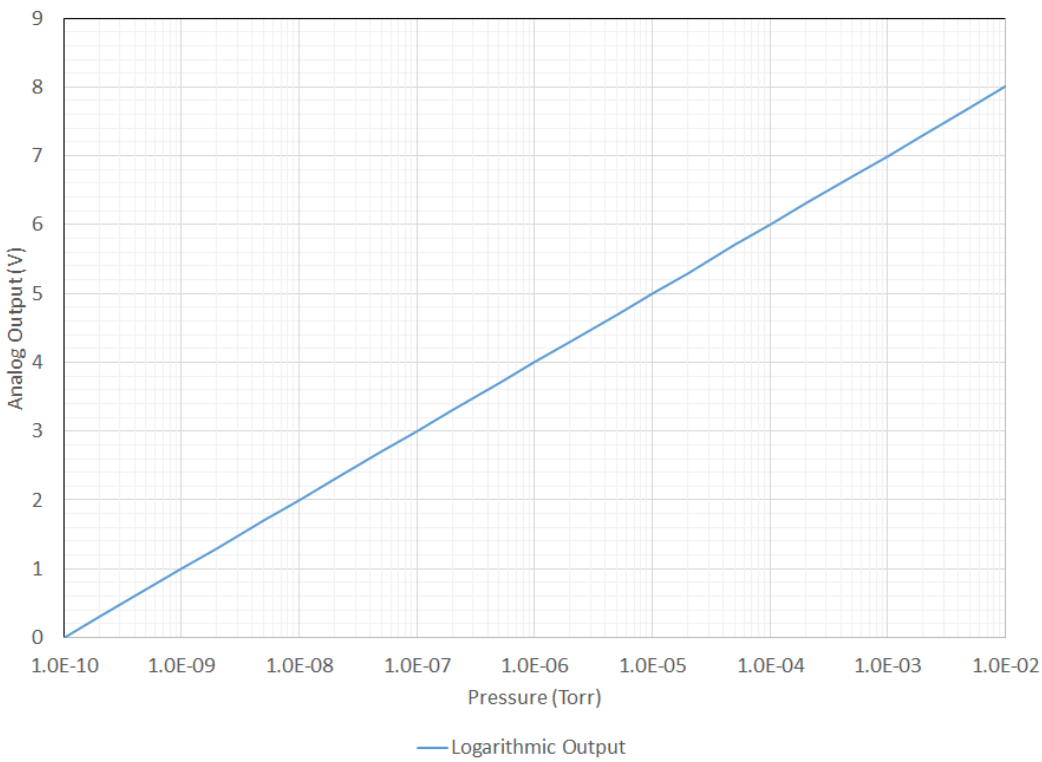


Table 7: Mini Bayard-Alpart Analog Output

Pressure (Torr)	Logarithmic Output (V)
“CABLE”	0
1.00E-10	0
2.00E-10	0.3
1.00E-09	1
2.00E-09	1.3
5.00E-09	1.7
1.00E-08	2
2.00E-08	1.3
5.00E-08	1.7
1.00E-07	3
2.00E-07	3.3
5.00E-07	3.7
1.00E-06	4
2.00E-06	4.3
5.00E-06	4.7
1.00E-05	5
2.00E-05	5.3
5.00E-05	5.7
1.00E-04	6
2.00E-04	6.3
5.00E-04	6.7
1.00E-03	7
2.00E-03	7.3
5.00E-03	7.7
1.00E-02	8
1.40E-02	8.15
"OVER CURRENT"	8.15

2.6 Calibration

The MC300 is factory calibrated to ensure that each sensor meets its specified accuracy. As such, calibration of new units is unnecessary. However, with extended use, sensors characteristics may change and the user may wish to calibrate sensors to return the unit to maximum accuracy. Users may also wish to calibrate replacement sensors. Please see the below sections for more information on calibrating each specific sensor.

The correct calibration of each sensor includes pumping down to one order of magnitude of pressure below the desired calibration point, using a controlled, dry nitrogen leak to increase the pressure of the system to the desired level, and then adjusting the reading of the MC300 via a potentiometer until the MC300 reads the same pressure as a NIST calibrated reference gauge.

2.6.1 READ THIS BEFORE CALIBRATING

Please note that for customers who opt for NIST certified calibration, adjusting the calibration of any sensor will void the NIST calibration.

2.6.2 2A Thermocouple Sensor

The MC300 includes a "zero" adjustment point via a potentiometer for each 2A sensor. For maximum accuracy, the 2A "zero" adjustment should be made at 10^{-3} Torr as read by a NIST calibrated reference gauge.

2.6.3 4A Thermocouple Convection Sensor

The MC300 includes a "zero" adjustment point and "atmosphere" adjustment via two potentiometers for each 4A sensor. For maximum accuracy, the 4A "zero" adjustment should be made at 10^{-3} Torr as read by a NIST calibrated reference gauge. The 4A "atmosphere" adjustment should be made at 760 Torr as read by a NIST calibrated reference gauge. Note that the "zero" adjustment should be made before the "atmosphere" adjustment.

2.6.4 7B Penning Magnetron Cold Cathode

The MC300 includes a "10^{-3}" adjustment point via a potentiometer for the 7B sensor. For maximum accuracy, the 7B "10^{-3}" adjustment should be made at 10^{-3} Torr as read by a NIST calibrated reference gauge.

2.6.5 7E/7F/7FC Double Inverted Magnetron Cold Cathode

The MC300 includes a "10^{-3}" adjustment point and "10^{-5}" adjustment via two potentiometers for each 7E/7F/7FC sensor. For maximum accuracy, the "10^{-5}" adjustment should be made at 10^{-5} Torr as read by a NIST calibrated reference gauge. The "10^{-3}" adjustment should be made at 10^{-3} Torr as read by a NIST calibrated reference gauge. Note that the "10^{-5}" adjustment should be made before the "10^{-3}" adjustment.

2.6.6 Mini Bayard-Alpert Sensor

To calibrate the Mini BA sensor, instead of making an adjustment via a potentiometer, adjust the sensitivity of the MC300 controller. To do this, press the **TEST/OP** button until the MC300 reads **SEN**. Then use the **UP** and **DOWN** arrows to adjust the sensitivity to the correct value between 1 and 99. The default value for the sensitivity is 10. To confirm the correct sensitivity is set, compare the reading of the MC300 to a NIST calibrated reference gauge at 1×10^{-5} Torr.

3 Configurations

The MC300 can be configured to run two low vacuum sensors and an optional high vacuum sensor. The low vacuum sensors available are the 2A Thermocouple sensor and the 4A Thermocouple Convection sensor. The two low vacuum sensors must be the same type. The optional high vacuum sensors are the 7B Penning Magnetron cold cathode, 7E/F/FC Double Inverted Magnetron cold cathode, and the Mini Bayard-Alpart sensor.

Note that the 7FCS Quick Start Double Inverted Magnetron cold cathode can be operated by both the 2-4502-303 and 2-4502-304 configurations of the MC300 with the Quick Start feature disconnected.

Table 8: MC300 Configuration Part Numbers

Model	Part Number
MC300 2A, 7B	2-4502-301
MC300 4A, 7B	2-4502-302
MC300 2A, 7E/F/FC	2-4502-303
MC300 4A, 7E/F/FC	2-4502-304
MC300 2A, Mini BA	2-4502-305
MC300 4A, Mini BA	2-4502-306
MC300 2A only	2-4503-401
MC300 4A only	2-4503-402

If you are uncertain of your configuration, you can check the code that is displayed upon start up against Table 9. Note that **Y.Y** refers to the revision number of the software.

Table 9: MC300 Startup Software Code

Code	Instrument Type
Y.Y 2H	2A and Mini BA Sensor
Y.Y 4H	4A and Mini BA Sensor
Y.Y 2b	2A and 7B Sensor
Y.Y 2F	2A and 7E/7F/7FC Sensor
Y.Y 4b	4A and 7B Sensor
Y.Y 4F	4A and 7E/7F/7FC Sensor

3.1 Sensor Descriptions

3.1.1 2A Thermocouple Sensor

The 2A thermocouple sensor has a measurement range from 1×10^{-3} up to 20 Torr. It indirectly measures absolute pressure by detecting the amount of energy that is thermally dissipated from a heated filament.

3.1.2 4A Thermocouple Convection Sensor

The 4A convection sensor has a measurement range from 1×10^{-3} to 1000 Torr. The sensor features a rapid response time when compared to typical thermal sensors. It indirectly measures absolute pressure by detecting the amount of energy that is thermally dissipated from a heated filament. It provides an extended range in comparison to other thermocouple or pirani sensors by utilizing the physical principle of convection.

3.1.3 7B Penning Magnetron Cold Cathode

The 7B Penning Magnetron cold cathode sensor has a measurement range from 1×10^{-7} up to 1×10^{-3} Torr. It indirectly measures absolute pressure by ionizing gas in the presence of a magnetic field. Unlike hot filament sensors, the 7B is resistant to in-rushes of gas. The design of this sensor allows for easy disassembly enabling quick cleaning and extended use.

3.1.4 7E Double Inverted Magnetron Cold Cathode

The 7E Double Inverted Magnetron cold cathode sensor has a measurement range from 1×10^{-8} up to 1×10^{-2} Torr. It indirectly measures absolute pressure by ionizing gas in the presence of a magnetic field. Unlike hot filament sensors, the 7E is resistant to inrushes of gas. The design of this sensor allows for easy disassembly enabling quick cleaning and extended use.

The 7E is electrically identical to the 7F and 7FC sensors but the inclusion of a rubber o-ring that allows for faster cleaning prevents the 7E from reaching UHV pressures.

3.1.5 7F Double Inverted Magnetron Cold Cathode

The 7F Double Inverted Magnetron cold cathode sensor has a measurement range from 1×10^{-11} up to 1×10^{-2} Torr. It indirectly measures absolute pressure by ionizing gas in the presence of a magnetic field. Unlike hot filament sensors, the 7F is resistant to inrushes of gas. The design of this sensor allows for an extended range of measurement and high bakeout temperatures up to 400° C with the magnets removed.

The 7F is electrically identical to the 7E and 7FC sensors but the 7F is not able to be disassembled for cleaning. It is the sensor of choice for UHV systems that require a high temperature bakeout.

3.1.6 7FC Cleanable Double Inverted Magnetron Cold Cathode

The 7FC Cleanable Double Inverted Magnetron cold cathode sensor has a measurement range from 1×10^{-11} up to 1×10^{-2} Torr. It indirectly measures absolute pressure by ionizing gas in the presence of a magnetic field. Unlike hot filament sensors, the 7FC is resistant to inrushes of gas. The design of this sensor allows for easy disassembly enabling quick cleaning and extended use.

The 7FC is electrically identical to the 7E and 7F sensors but the inclusion of a copper gasket allows the sensor to be disassembled and cleaned while still making it compatible with UHV pressures and a moderate bakeout.

3.1.7 Mini Bayard-Alpert Sensor

The Mini Bayard-Alpert sensor has a measurement range from 1×10^{-10} up to 1×10^{-2} Torr. It indirectly measures absolute pressure by ionizing gas. While accurate, the mini BA sensor is very susceptible to the presence of oxygen and sudden inrushes of gas, which can cause a filament to fail. To extend the life of the sensor, two filaments are included in each sensor.

3.2 Sensor and Cable Part Numbers

Table 10: MC300 Cable Part Numbers

Length	2A Cable	4A Cable	7B Cable	7E/F/FC Cable	Mini BA Cable
10 ft	2-9800-077	2-9820-010	2-9800-09	2-9841-010	2-9854-10
20 ft	2-9800-078	2-9820-020	2-9800-41	2-9841-020	2-9854-20
35 ft	2-9800-079	2-9820-035	2-9800-42	2-9841-035	2-9854-35
50 ft	2-9800-080	2-9820-050	2-9800-43	2-9841-050	2-9854-50

Table 11: Selected Sensor Part Numbers

Sensor and Flange Type	Part Number
2A 1/8" NPT Brass	2-2100-10
2A 1/8" NPT Stainless Steel	2-2126-001
2A NW16 Stainless Steel	2-2126-030
4A 1/8" NPT Brass	2-2119-001
4A 1/8" NPT Stainless Steel	2-2120-001
4A NW16 Stainless Steel	2-2120-030
7B 3/4" NPT Brass	2-2100-263
7B NW25 Stainless Steel	2-2100-272
7E NW25	2-2141-031
7F 2 3/4" Conflat	2-2145-052
7FC 2 3/4" Conflat	2-2146-053
Mini BA NW25	3451-8305-35
Mini BA 2 3/4" Conflat	3451-8305-25

4 High Vacuum Versions and Operation

High vacuum versions of the MC300 include automatic operation of the high vacuum sensors based on the low vacuum sensor in Channel 1. Channel 2 is also a low vacuum sensor. The high vacuum sensor is labeled "ION GAUGE" on the MC300 display and is referred to as Channel 3.

4.1 Cold Cathodes Configurations

For MC300 configurations that contain a cold cathode (either 7B or 7E/7F/7FC), the cold cathode sensor will occupy Channel 3. When the low vacuum sensor pressure in Channel 1 is below 10 mTorr, the high voltage to the cold cathode will be enabled and the sensor will produce a reading. If the pressure is above the acceptable range for the cold cathode, it will display **OLd** to indicate this. When the pressure in Channel 1 is above 10 mTorr, the cold cathode sensor will dispaly **OFF** and there will be no high voltage to the sensor.

4.2 Mini Bayard-Alpert Configurations

For MC300s with Mini Bayard-Alpert configurations, there are four extra steps in the setup menu. More informations is contained below.

Note for the BA that whenever the filament is turned off via the user or via over current protection, the MC300 power must be cycled to turn on the mini BA sensor again.

4.2.1 ON/OFF

The first **SETUP** position on Mini Bayard-Alpert configurations allows the mini BA sensor to be toggled between **ON** and **OFF** using the **UP** and **DOWN** arrows. If the sensor is set to **OFF**, the sensor will not turn on under any circumstances. If the sensor is set to **ON**, the sensor will turn on if the low vacuum sensor in Channel 1 is below 10 mTorr. If the low vacuum sensor in Channel 1 is above 10 mTorr, the display for the mini BA sensor will read **RDY** to indicate that the sensor is ready for automatic operation but the pressure is not low enough to allow for its operation.

4.2.2 Sensitivity

The second **SETUP** position on Mini Bayard-Alpert configurations allows the user to set the sensitivity for the mini BA sensor. The value can be set between 1 and 99 using the **UP** and **DOWN** arrows. Changing the sensitivity will affect the reading of the mini BA sensor. Mini BA sensors from Fredericks Company have a sensitivity of 10/Torr.

4.2.3 Filament Select

The third **SETUP** position on Mini Bayard-Alpert configurations allows the user to select between the two filaments of the mini BA sensor. The user can only select between the two filaments when the mini BA sensor is not currently powered. Note that it can be set in **RDY** mode. Use the **UP** and **DOWN** arrows to toggle between the two filaments, indicated by **FIL 1** and **FIL 2**.

4.2.4 Filament Degas

The fourth **SETUP** position on Mini Bayard-Alpert configurations allows the user to degas the mini BA sensor. Degassing is a heating of the sensor via electron bombardment (EB) to decrease the outgassing of the sensor when it is pumped down. This feature is toggled on by selecting a time of one to five minutes using the **UP** and **DOWN** arrows after pressing **SETUP** four times. To cancel the degas at any time, press **TEST/OP**.