Instruction Manual for
Automatic Valve controller
AVC-585

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1.0 Introduction

1.1 Description

The AVC -585 (P/N 502457), controller is designed to automate the valving sequence of any vacuum system which uses electrically operated valves. In the Automatic mode, the valves are operated in response to pressure within the vacuum system. The vacuum system is completely protected against improper sequencing of the valves. Provisions are made for handling diffusion pumped, turbo pumped, or cryo pumped systems. A Manual operating mode is provided to facilitate setup or service work on the vacuum system.

The status of each valve is indicated by indicators on the screen. (LED is on green when valve is open and red when the valve is closed). A blinking yellow light identifies trouble in the fore-line areas and warns of an unsafe operating condition.

1.2 Features

An on screen AUTO/MANUAL mode selector in Auto mode the unit helps to prevent operator error. The automatic control helps to ensures safe operation regardless of which selection is pressed. Electro-mechanical relays or contacts for output. Easy on screen setpoints simplify calibration of trip points for fore-line and chamber pressure circuits.

Signals are available for controlling external loads after the high-vacuum valve opens, and for turning off the diffusion pump in the event of abnormally high fore-pressure.

The controller can be interlocked with external controls, such as a bell jar hoist switch, to prevent initiation of the START phase until conditions are safe. Pressure sensors are rugged, interchangeable, contamination resistant thermistor tubes, with pressure read out on a front panel display. Pressure output signals suitable for recording and/or external control use is continuously available for each pressure sensor.

A built in Automatic Vent Stop, adjustable up to 999 seconds, closes the vent valve after preset venting time.

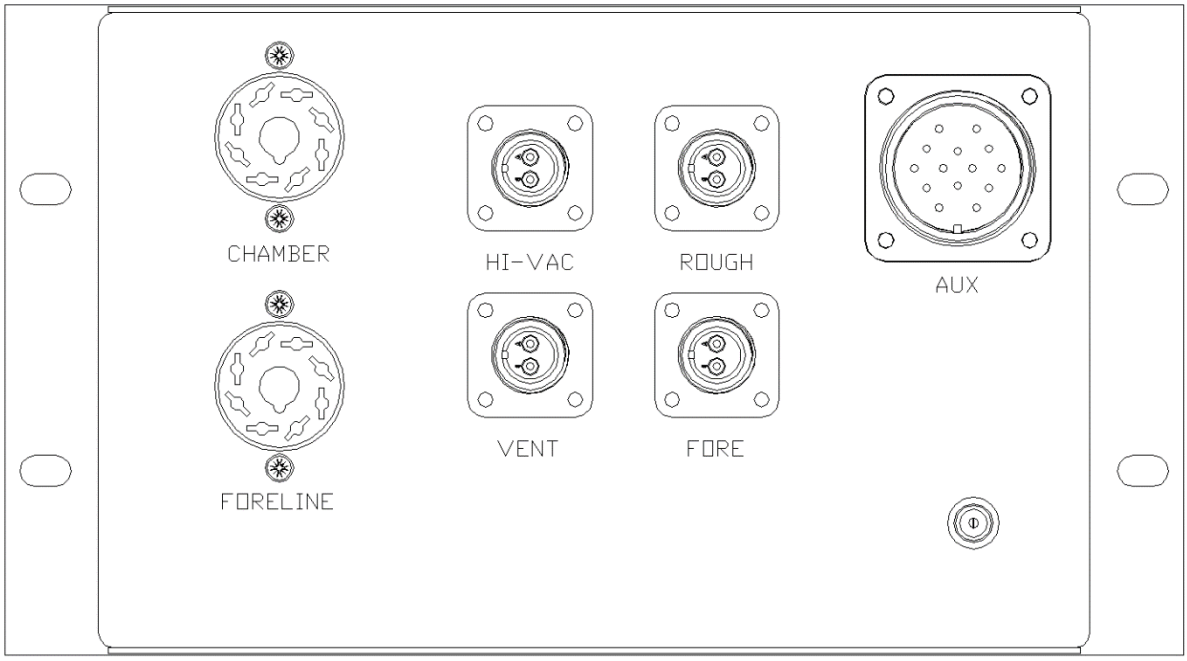
Low profile cabinet is suitable for bench top use or half rack mounting in a 19 - inch enclosure.

1.3 **Specifications**

Height:	5.25”
Width:	9.5”
Depth:	9.75” (allow additional 3” for connections)
Input Power:	80-264 VAC 50/60 HZ into a convent in line 24VDC adaptor
Fuse:	3 amp 154 series
Outputs to energize valve:	5 amp max up to 240 VAC or 5 amp 30 VDC 20 mA at 24V minimum load
Time delay adjustment range:	Valves 0-999 seconds Vent Stop 0-999 seconds Ext Control 0-999 seconds
Range of pressure sensitive circuits:	0-760 torr
External control relay:	5 amp, up to 240 VAC 5 amp 30 VDC 20 mA at 24V minimum load
Pressure sensor tubes:	GT-034 (part # 277289)


Auto Cryo
17.1 Torr
CHAMBER PRESSURE
Vent
Rough
Main Menu
Hi-Vac
Fore
CYCLE STOPPED
VENT OFF
12.2 Torr
FORELINE PRESSURE
REGEN OFF

Front


CHAMBER
HI-VAC
ROUGH
AUX
FORELINE
VENT
FORE

Rear

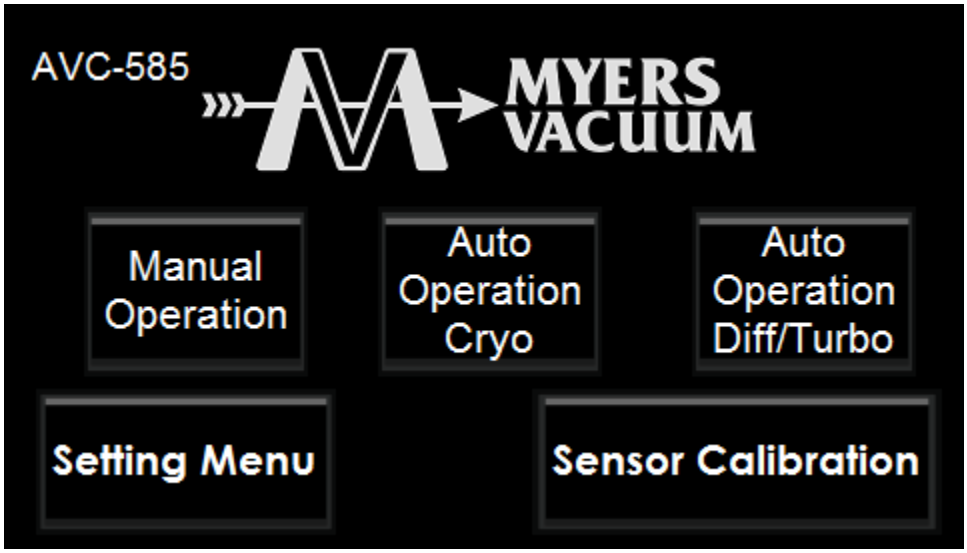
2.0 Controls and Indicators

2.1 The power switch controls power to the AVC-585 unit.

2.2 The touch screen panel is used for display of pressure, valve indications, control/change of settings.

2.2.1 From the main screen there are five possible selections.

1. Manual Operation
2. Auto Operation Cryo
3. Auto Operation Diff/Turbo
4. Setting Menu
5. Sensor Calibration

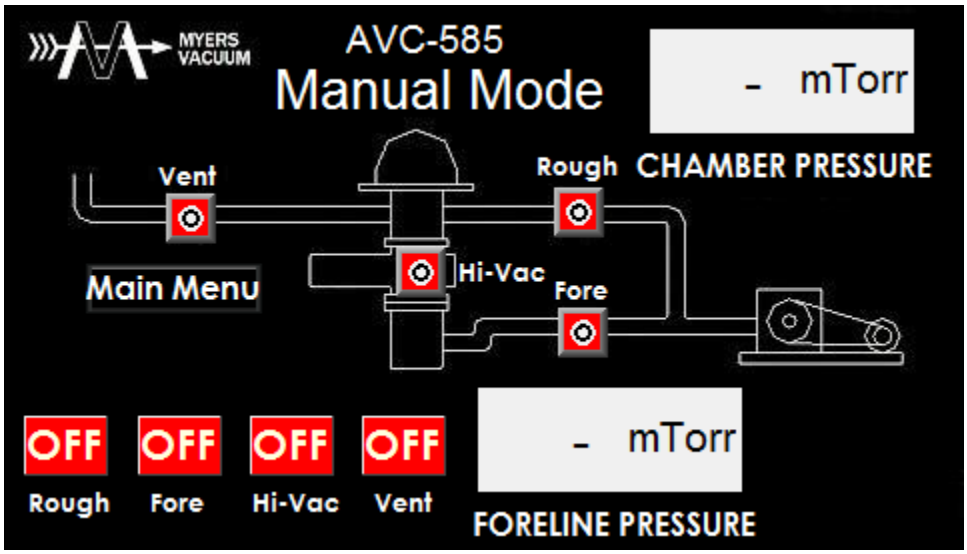


Main Screen

2.2.1.1 Manual Mode

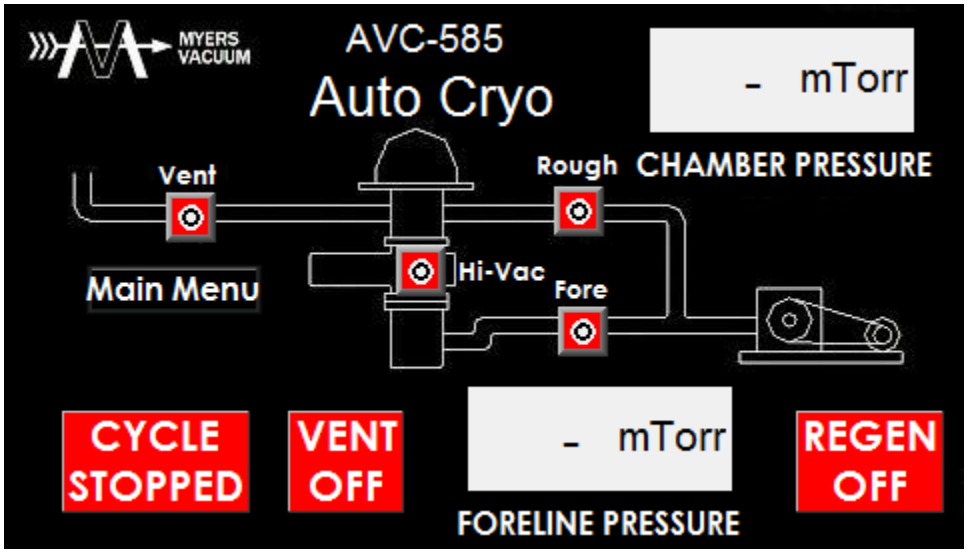
Access for manual control of the vacuum valves/sequence.

CAUTION: THE MANUAL OPERATION BY-PASSES ALL AUTOMATIC CONTROLS.



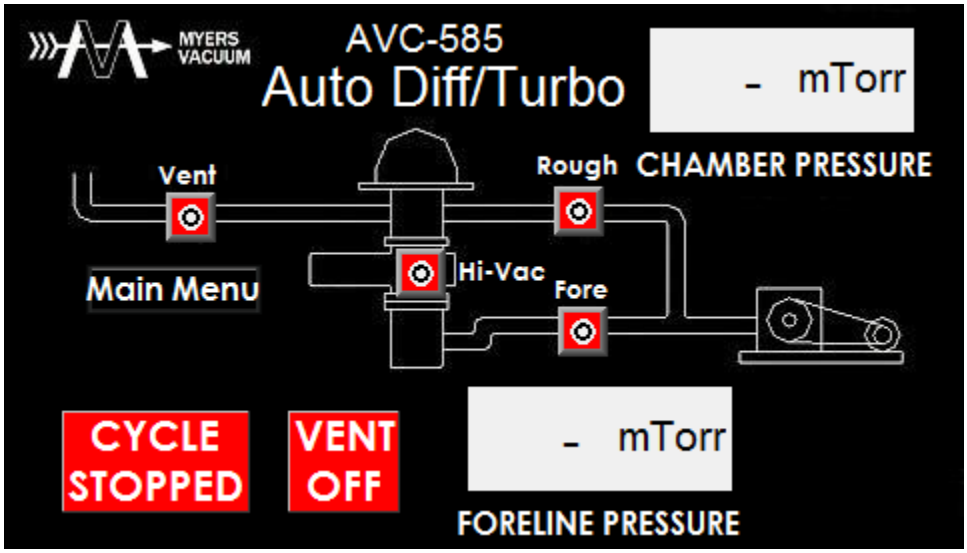
2.2.1.2 Auto Operation Cryo

Access for automatic cycling of a cryo pumped system.



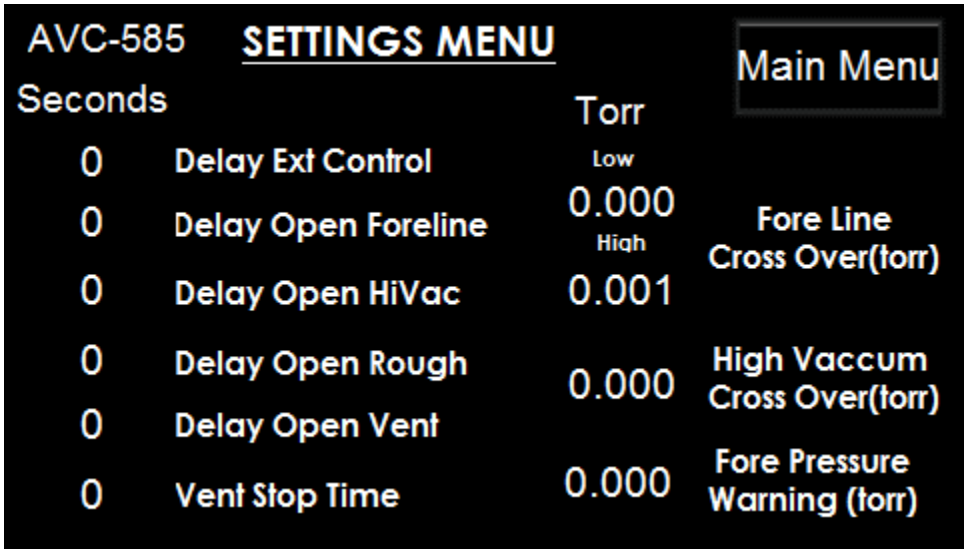
2.2.1.3 Auto Operation Diff/Turbo

Access for automatic cycling of a diffusion or turbo pumped system.



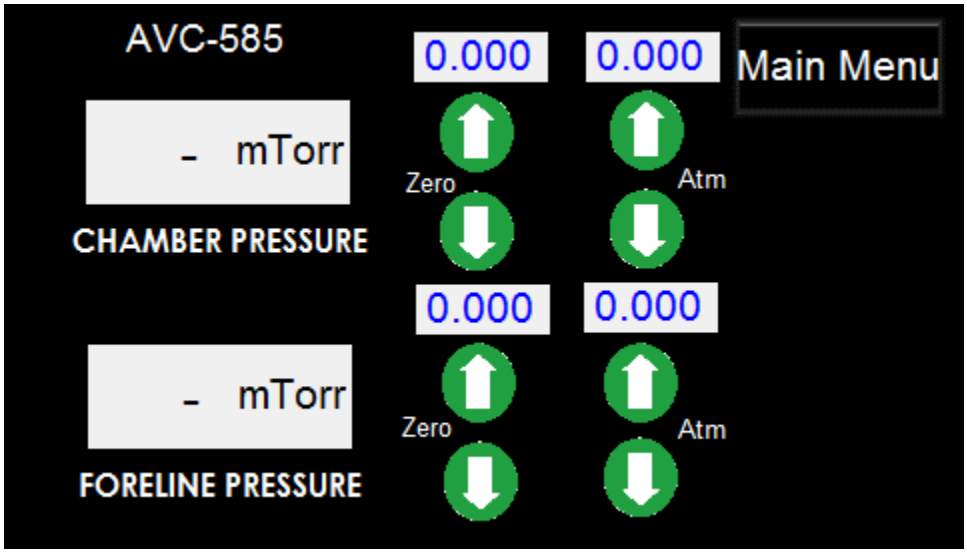
2.2.1.4 Setting Menu

Access for change/adjustments of timers and crossover pressures.



2.2.1.5 Sensor Calibration

Access for pressure reading adjustments.



2.3 Once an operation mode is selected the Chamber Pressure and Fore-line Pressure display in their respective locations.

3.0 Installation

3.1 Shipping List

The following items are included with the AVC-585:

1. The AVC-585 control unit.
2. AC line cord (for 115 V)
3. Two GT-034 Thermistor Sensor Tubes part number 277289
4. Connectors for valve connections
5. Connector for axillary connections.

3.2 Electrical Connections

All connection to the AVC-585 are plug terminals on the rear panel. Use shielded wire if operating the unit near a RF generator or in a noisy electrical environment.

NOTE: The labels on the back panel were designed for a typical diffusion-pumped system, and may be confusing when the controller is used with a cryo-pumped system. If the system is cryo pumped, the Fore-pressure is the regeneration line pressure. The FORE Valve is the Regen. Valve.

3.3 Input Power

Input power is located on the lower right of the rear panel.

3.4 Installing and Connecting Sensor Tubes

Mount the two thermistor tubes in suitable locations so that Station 1 senses chamber pressure and Station 2 senses fore-line pressure.

In a cryo pumped system, install the Sta. 2 tube in the regeneration line between the regeneration valve and the cryo pump.

Note: Connect Station 1 (chamber) and Station 2 (fore-line). If there is an incorrect connection at that sensor the screen will indicate "**CHECK CONNECTION SENSOR**" if there is an incorrect connection at the back of the gauge the screen will indicate "**CHECK CONNECTION GAUGE**". These are located above each pressure indication.

Although thermistor tubes are relatively immune to contamination, for accurate pressure response and freedom from zero drift they should be kept clean. Install the tubes so as to minimize the entrance of oil vapor or process contaminants. If possible, the Sta. 1 tube should also be located away from electrical discharges which may take place within the high-vacuum chamber.

The sensor tubes may be installed in any of the following ways:

a. Thread the tubulation into a mating 1/8 -inch pipe threaded opening in the vacuum system. Seal the threads with Teflon tape, Celvaseal® leak sealant, or other sealing material which has a low vapor pressure.

b. Use a type AC compression connector with 0 -Ring seal. Type AC connectors are designed for welding or soldering into the vacuum system. The sensor tube is then inserted into the connector and the knurled ring is hand tightened to compress the 0 -Ring against the tubulation sealing surface.

3.5 Valve Connections

Connect the roughing valve, hi-vacuum valve, and vent valve to their respective terminals on the back panel of the controller. Customer switched power to pin "A" and output to pin "B". In a diffusion-pumped system, connect the fore-line valve to the FORE connector. In a cryo-pumped system, connect the regeneration vacuum valve to this connector.

3.6 Control of External Loads

The auxiliary jack pins "H" and "L" are for controlling an external load such as a high vacuum gauge or process heater. The external control is activated at a user set time after the hi-vacuum valve is opens and remains active until the hi-vacuum valve closes.

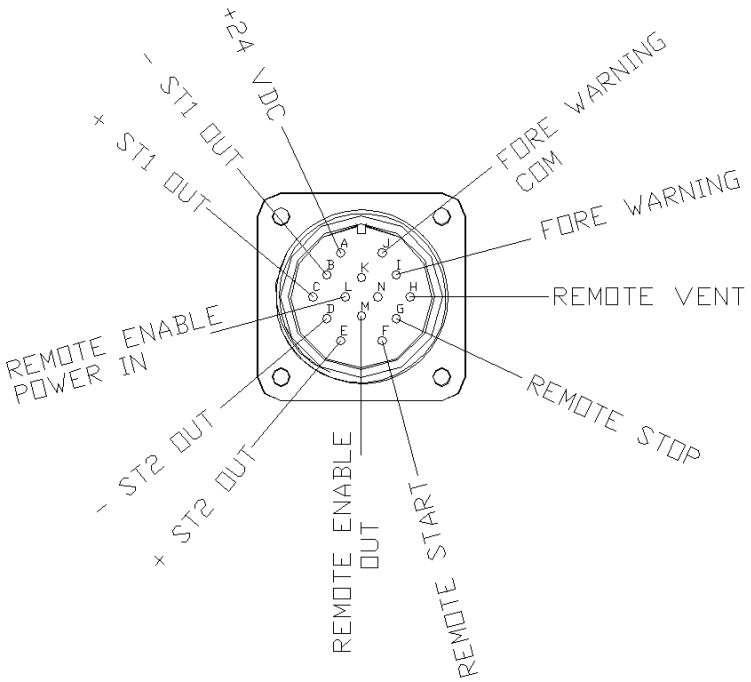


Figure 1

3.7 **Remote Triggering of Cycles**

The automatic mode start, stop, and vent cycles can be triggered from a customer supplied remote monetary switch. At the auxiliary connector pin "A" to "F" for start, pin "A" to "G" for stop and pin "A" to "H" for vent.

3.7 **Fore-pressure Warning Signal**

If the fore-pressure rises above a user setpoint a relay is active on pins "I" and "J" of the auxiliary connector. This signal can be used to sound an alarm, or, with an additional relay, to turn off the diffusion pump.

3.8 **External Interlock**

If the unit is in one of the **automatic modes** of operation and external interlocks can be added to tie in other functions which must be satisfied before the vacuum cycle can start. Examples of such functions are belljar down or coolant water on. Each interlock should consist of a switch wired to the auxiliary connect pin "A" and "G" (STOP input). As many additional interlocks as desired may be connected in parallel in this manner. The interlock switch should close in the unsafe condition. This produces a STOP signal which will close all valves. The interlock switches will control the valves in the **Automatic mode only**. Use shielded wire for all interlock wiring.

4.0 Checkout and Operation

Note: When the AVC-585 is first powered on, the sensor have a period of time needed until they reach operating conditions, the word WAIT will display and this may trigger the fore-pressure alarm.

4.1 Manual Operation

The ROUGH, FORE, HIVAC, and VENT switches provide manual operation of the indicated valves when the controller is in Manual mode.

4.1.1 With the power switch on and the unit in manual operation and displaying pressures.

CAUTION: Only qualified personnel should operate the system in Manual mode with the high vacuum pump running. Opening the wrong valve could damage the diffusion pump fluid, damage the cryo pump and contaminate the system, requiring a major clean-up and significant downtime.

4.1.2 Operate by pressing the screen in each valves location to be sure the respective valve operates correctly and that each indicator changes from red to green. Then return switches to the OFF position.

4.1.3 Start the mechanical pump. Then press the FORE to open the fore valve. Observe the fore-pressure pumps down on the meter by observing the fore-line pressure indication.

4.1.4 Press the ROUGH. Then observe the chamber pressure pumps down on the chamber pressure indication.

4.2 Automatic Mode Diffusion/Turbo Pump

4.2.1 With the power switch on and place the unit in Auto Diff/Turbo mode and after a user set time the fore-line valve will be energized and the FORE indicator light will change to green indicating that the valve is open.

4.2.2 Press the VENT switch. The VENT on indicator light should change to green after a user set duration of time a countdown timer will appear above the vent indicator location, the vent indicator light will change to green, and the fore-line valve should remain open. After the user set time, the vent countdown timer expires and the vent valve will close and the indicators will change to red.

4.2.3 To check for system protection against a gross leak in the high-vacuum valve, raise the fore-pressure by introducing a leak in the fore-line or shutting off the mechanical pump.

NOTE: If the fore-pressure exceeds the fore-pressure trip setting (user set) fore valve indicator will blink green to yellow but, remains open, indicating abnormally high fore-pressure.

4.2.4 With the abnormally high fore-pressure existing, press the START. The system will wait until the fore-pressure is below the trip setpoint.

4.2.5 Correct the fore-pressure condition. When the fore-pressure has recovered to less than the user setpoint, the fore-line valve will close. After a user set time, the roughing valve will open allowing the mechanical pump to begin pumping the system.

NOTE: If the fore-pressure rises above the setpoint during rough pumping, the roughing valve will close and after user set time the fore-line valve should open allowing the mechanical pump to restore the fore-pressure to a safe level. The FORE indicator will blink until the fore-pressure drops below the setpoint. The fore-line valve will then close and, after user set duration of time, the roughing valve will open, resuming the roughing portion of the cycle.

4.2.6 Continue rough pumping the system. When the pressure in the vacuum chamber reaches the user trip point, the roughing valve will close and after a user set time duration the fore-line valve will open. After that, the high vacuum valve will open based on the user delay time duration. After an additional user delay time duration the external load relay will be activated.

4.2.7 Press the Cycle on the left side of the panel to stop the pump cycle. The high vacuum valve will close, then press the VENT switch. The VENT on indicator light should change to green after a user set duration of time a countdown timer will appear above the vent indicator location, the vent indicator light will change to green, and the fore-line valve should remain open. After the user set time, the vent countdown timer expires and the vent valve will close and the indicators will change to red. The System will return to STOP condition.

NOTE: The system can be placed in a Stop condition at any time during the cycle. All valves except the fore-line valve will close. The system will remain in this safe stand-by condition until receiving further commands from the operator.

4.3 **Automatic Mode Cryo Pumped**

4.3.1 With the power switch on place the unit in Auto Cryo mode.

4.3.2 Be sure the mechanical pump and the cryo pump are operating. Press the START. After user set duration of time the roughing valve will open. Observe the chamber pressure pump down on the pressure meter.

4.3.3 When the chamber pressure is at the user setpoint, the roughing valve will close. After a user set delay, the high vacuum valve will open. An additional user set time later, the external load relay will be activated. The vacuum system is now ready for use.

4.3.4 Press the Cycle on the left side of the panel to stop the pump cycle. The high vacuum valve will close, then press the VENT switch. The VENT on indicator light should change to green after a user set duration of time a countdown timer will appear above the vent indicator location, the vent indicator light will change to green. After the user set time, the vent countdown timer expires and the vent valve will close and the indicators will change to red. The System will return to Stop condition

4.3.5 Cryo Pump Regeneration Procedure

4.3.6 After prolonged use, the cryo pump will become saturated with captured gases. To regenerate the pump, use the following procedure.

WARNING: The mechanical pump must be turned on and be at a low pressure before opening the regeneration valve. Failure to meet this requirement will expose the cryo pump to too high a pressure and could cause it to become contaminated with oil vapor from the mechanical pump.

4.3.7 With the AVC -585 in the Automatic Cryo mode, press the Regen. This latches the controller in the regeneration cycle.

4.3.8 Turn off the cryo -pump compressor, and allow the pump to warm up.

4.3.9 When pressure in the pump exceeds the fore-pressure trip setting, the regeneration valve will open allowing the mechanical pump to remove the gases until the pressure decreases below the trip point. The regeneration valve will then close. This cycle will continue until you end the regeneration sequence by pressing the Regen.

4.3.10 When regeneration is complete, press the REGEN. This returns the controller to the normal cryo pump operating cycle. Turn on the cryo pump compressor and allow the pump to cool before starting another process cycle.

5.0 Pressure Measuring System

5.1 Pressure Meter

The pressure indication are on the following screens. Manual Operation, Auto Operation Cryo, Auto Operation Diff/Turbo and Sensor Calibration.

5.2 Calibration for Various Gases

The two sensor stations are calibrated for dry air. To determine the pressure of gases other than air, refer to Figure 2.

5.3 Remote Pressure Read-Out

For recording pressure or indicating pressure at a location remote from the AVC - 585 unit, the pressure can be read as a function of the voltage at the output pins of the auxiliary connector: station one at + pin "C", – pin "B" and station two at + pin "E", - pin "D".

NOTE: Any recorder or remote display device connected to the bridge output circuit must be a high-impedance type to avoid loading and affecting calibration.

If the cable or tube is disconnected the voltage output is 9 VDC, for typical pressure reading the DC output voltage is logarithmic. To calculate the pressure based on this voltage is as follows:

$$10^{\wedge Vdc} / 10{,}000 = \text{Pressure torr}$$

Example: 3 Vdc output

$10^{\wedge 3} / 10{,}000 = \text{Pressure torr}$
$1{,}000 / 10{,}000 = 0.1 \text{ torr}$

Example: 6.88 Vdc output

$10^{\wedge 6.88} / 10{,}000 = \text{Pressure torr}$
$7{,}585{,}775 / 10{,}000 = 758 \text{ torr}$

5.4 Leak Detection

The AVC-585 is useful for locating leaks of moderate size. The response of the pressure meter is related to the thermal conductivity of the gas in the sensing tube as well as to its pressure. When the pressure has stabilized, probe the suspected area with a gas whose thermal conductivity is substantially different from that of air. Probe gas entering the leak will cause a meter response which is either upscale or downscale, depending upon the probe gas used. Argon can be used with complete safety. It provides a down -scale meter response.

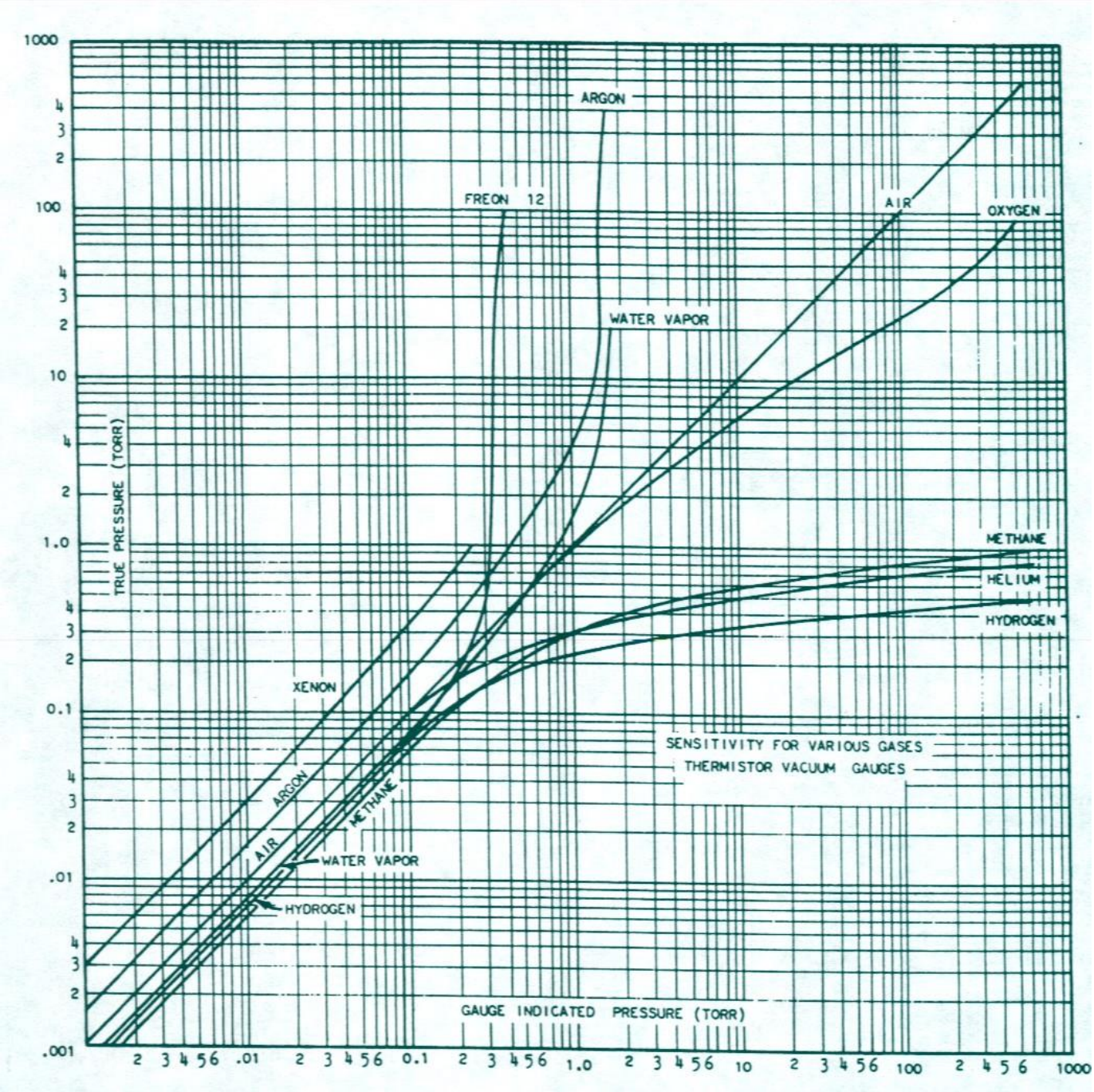

TRUE PRESSURE (TORR)
GAUGE INDICATED PRESSURE (TORR)
SENSITIVITY FOR VARIOUS GASES
THERMISTOR VACUUM GAUGES
ARGON
FREON 12
AIR
OXYGEN
WATER VAPOR
METHANE
HELIUM
HYDROGEN
XENON
1000
100
10
1.0
0.1
.01
.001
.01
0.1
1.0
10
100
1000

Figure 2

6.0 Normal Circuit Adjustments

6.1 Timers and Trip Adjustments

All timers, pressure cross overs setpoints and the fore-line warning setpoint are located in the setting menu (reference 2.2.1.4), access to this is from the main screen. All timer inputs are in seconds and all pressures adjustments are in torr. Typical pressure trip points should be 0.05 to 0.06 torr chamber, 0.22 to 0.32 torr fore-line and typical valve delays are 5-15 seconds, and 900 seconds for the vent stop timer.

The pressure for the fore-line pressure control should consider the tolerable fore-pressure of the diffusion pump and the magnitude of the gas pressure surge which occurs when the high vacuum valve is opened. Set the circuit to trip off before the tolerable fore-pressure is exceeded.

On large systems it may be desirable to adjust the high vacuum valve to open slowly, so as to minimize the gas load in the fore-line. Time delays on all valves must take this factor into account.

The type of gas being pumped is also a factor. The trip off pressure, as indicated by the gauge, should be decreased approximately 50% when pumping argon rather than nitrogen or air.

6.2 Pressure Calibration

The pressure measuring circuits are carefully calibrated at the factory before shipment. Any new GT -034 Sensor Tube can be plugged into the circuit and used without need for further adjustment.

Drift in the calibration at atmosphere or zero setting of the pressure measuring circuits is usually due to contamination of the sensor tube by oil vapor or process contaminants. Cleaning, as specified in Section 7.1 will frequently restore the original accuracy.

The sensor calibration screen can be accessed from the main menu, on this screen both the chamber and fore-line pressure are indicated along with arrows for adjusting pressure for atmosphere and zero, only use these adjustment when the pressure in the system is at a known value. Should these procedures fail, install a new GT -034 tube.

7.0 Maintanance

7.1 Cleaning Sensor Tubes

1. Disconnect and remove the sensor from the vacuum system. Wash the interior with a hot water and detergent solution (Joy and Alconox are good). Agitate gently.

2. Rinse thoroughly with hot water. Fill and empty the tube carefully to avoid breaking the fine wire elements.

3. Rinse with clean acetone or isopropyl alcohol.

4. Dry the tube byheating at 50° - 6O° C for several hours. Do not use compressed air.

7.2 Cleaning the touch screen

Resistive touchscreen surface material is PET (polyethylene terephthalate, also called polyester). Capacitive touchscreen surface material is tempered glass. Both surfaces can be cleaned with the following method.

Using a cleaning solution of 75% alcohol or 1:100 diluted bleach, spray the solution on a dry cloth. Gently wipe the HMI's screen.

Note: Avoid spraying the solution directly onto the HMI.

8.0 Service and Troubleshooting

8.1 Circuit Description

8.1.1 Power Supply

The power supply is a conventional 24 VDC supply. The DC output is regulated to 10.00 volts by voltage regulators for powering the pressure measuring circuit.

8.1.2 Pressure Measuring Circuit

A thermistor type sensor tube senses pressure as a function of the heat conducted away by the surrounding gas. The resulting temperature change in the thermistor element alters its electrical resistance. The 10 volt power applied to each sensor causes precisely the current flow required to heat the thermistor so that its resistance becomes known. Any increase in pressure tends to cool the thermistor, and change its resistance thus changing an output voltage. These voltages go into an input and with calculations is converted to a pressure reading.

8.2 SERVICE

WARNING: LINE VOLTAGE CAN BE PRESENT ON THE PRINTED WIRING BOARD. SERVICE SHOULD BE PERFORMED ONLY BY A QUALIFIED TECHNICIAN.

Components are conservatively rated, and under normal operating conditions little or no service should be required. Should trouble develop, it can usually be corrected by replacement of one or more of the components

Repair and recalibration service is available at the factory. For information, contact your local Myers Vacuum sales office or call the Myers Vacuum Order Service Dept. at 1-888-780-8331.

9.0 Drawing & Schematics List

502457	AVC-585 Assembly Drawing (various dash numbers)
277289	GT-034 Thermistor Sensor
502456	Assembly Cable AVC/GT (various dash numbers)
502453-2430	Power Supply
502459	Schematic Electrical (proprietary)