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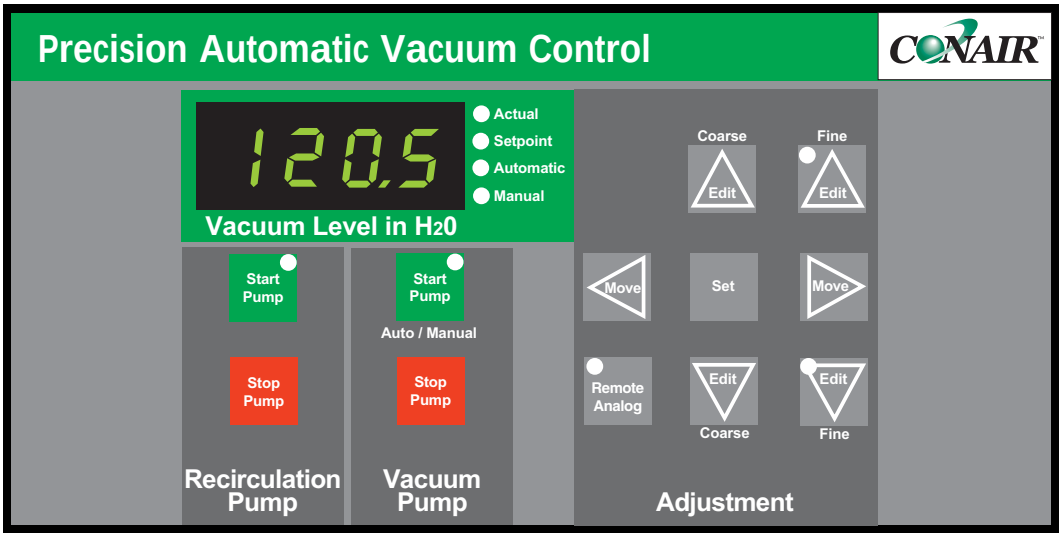
USER GUIDE

UGE069-0212

Precision Automatic Vacuum Control (PAVC)



Please record your equipment's model and serial number(s) and the date you received it in the spaces provided.

It's a good idea to record the model and serial number(s) of your equipment and the date you received it in the User Guide. Our service department uses this information, along with the manual number, to provide help for the specific equipment you installed.

Please keep this User Guide and all manuals, engineering prints and parts lists together for documentation of your equipment.

Date:

Manual Number: UGE069-0112

Serial Number(s):

Model Number(s):

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Table of Contents

1-1 Introduction

2-1 Description

3-1 Installation

4-1 Operation

5-1 Maintenance

A Appendix

Introduction

Purpose of the User Guide

This User Guide describes the Conair Precision Automatic Vacuum Control (PAVC) and explains step-by-step how to install and operate this equipment.

Before installing this product, please take a few moments to read the User Guide and review the diagrams and safety information in the instruction packet. You also should review manuals covering associated equipment in your system. This review won't take long, and it could save you valuable installation and operating time later.

How the Guide is Organized

Symbols have been used to help organize the User Guide and call your attention to important information regarding safe installation and operation.

 Symbols within triangles warn of conditions that could be hazardous to users or could damage equipment. Read and take precautions before proceeding.

1 Numbers indicate tasks or steps to be performed by the user.

◆ A diamond indicates the equipment's response to an action performed by the user.

❒ An open box marks items in a checklist.

• A circle marks items in a list.

 Indicates a tip. A tip is used to provide you with a suggestion that will help you with the maintenance and the operation of this equipment.

 Indicates a note. A note is used to provide additional information about the steps you are following throughout the manual.

Your Responsibility as a User

You must be familiar with all safety procedures concerning installation, operation, and maintenance of this equipment. Responsible safety procedures include:

- Thorough review of this User Guide, paying particular attention to hazard warnings, appendices, and related diagrams.
- Thorough review of the equipment itself, with careful attention to voltage sources, intended use and warning labels.
- Thorough review of instruction manuals for associated equipment.
- Step-by-step adherence to instructions outlined in this User Guide.

ATTENTION:
Read This So No One Gets Hurt

We design equipment with the user's safety in mind. You can avoid the potential hazards identified on this machine by following the procedures outlined below and elsewhere in the User Guide.

⚠ WARNING: Improper installation, operation, or servicing may result in equipment damage or personal injury.

This equipment should be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.

⚠ WARNING: Voltage hazard

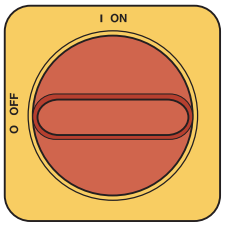
This equipment is powered by three-phase alternating current, as specified on the machine serial tag and data plate.

A properly sized conductive ground wire from the incoming power supply must be connected to the chassis ground terminal inside the electrical enclosure. Improper grounding can result in severe personal injury and erratic machine operation.

Always disconnect and lock out the incoming main power source before opening the electrical enclosure or performing non-standard operating procedures, such as routine maintenance. Only qualified personnel should perform troubleshooting procedures that require access to the electrical enclosure while power is on.

How to Use the Lockout Device

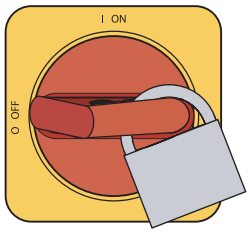
CAUTION: Before performing maintenance or repairs on this product, you should disconnect and lockout electrical power sources to prevent injury from unexpected energization or start-up. A lockable device has been provided to isolate this product from potentially hazardous electricity.



Lockout is the preferred method of isolating machines or equipment from energy sources. Your Conair product is equipped with the lockout device pictured below. To use the lockout device:

1 **Stop or turn off the equipment.**

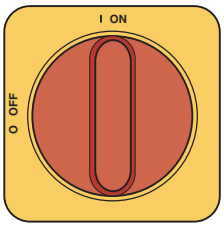
2 **Isolate the equipment from the electric power.** Turn the rotary disconnect switch to the OFF, or "O" position.



3 **Secure the device with an assigned lock or tag.** Insert a lock or tag in the holes to prevent movement.

4 **The equipment is now locked out.**

WARNING: Before removing lockout devices and returning switches to the ON position, make sure that all personnel are clear of the machine, tools have been removed, and all safety guards reinstalled.



To restore power, turn the rotary disconnect back to the ON position:

1 **Remove the lock or tag.**

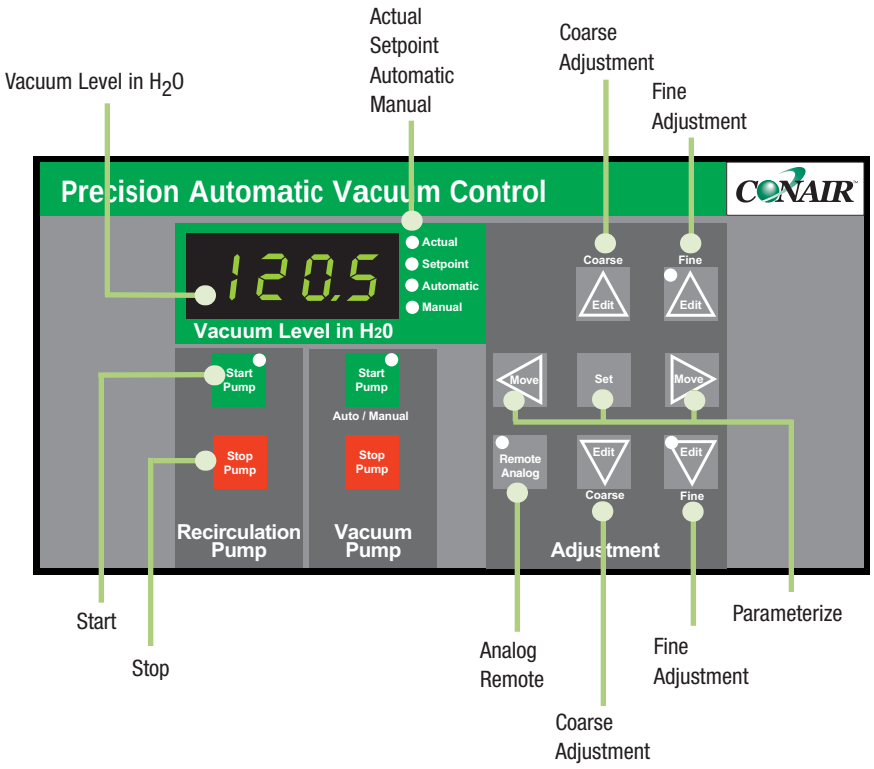
2 **Turn the rotary disconnect switch to the ON or "I" position.**

Description

Introduction

The PAVC is used with high technology vacuum water tanks to maintain a constant and precise vacuum pressure. Connections are provided for automatic feedback control of the setpoint by use of X/Y laser scanners that monitor the profile. The PAVC provides recirculation and vacuum pump Start and Stop, with input conditioning. Setpoint adjustment is via the control panel or an external remote analog source. The local setpoint can also be adjusted externally by Raise and Lower contacts via RS485 communications.

The "Vacuum Level" actual and setpoint values are displayed on a four-digit display. A wide pressure range is possible as the PAVC controls a Vent Valve and the vacuum pump RPM.



Power Up Reset

When power is first applied to the PAVC, all outputs are off. The display initially shows the EPROM version number - a reference of the current program. Eventually, the actual value will be shown with the “Actual” and “Manual” LEDs lit. The "Remote Analog" function will be at the previous state.

Face Panel

The face is a flat membrane type consisting of a four-digit display, LED indicators, and operator keypad switches. The display is primarily used to show actual vacuum pressure. Setpoint will be shown when making local adjustments. Displays are large, 0.56" {14 mm} high, green Light Emitting Diodes (LEDs) for clear and distant visibility.

Keys

A press of any key causes a momentary beep to be heard from the built-in buzzer. Some keys have no functions in certain modes, yet a beep will still indicate a response to the key press. A tactile click will be felt as the key flexes. Short notes indicate normal key presses. Long notes indicate errors.

Functions

The available keys are Start / Stop for pump control, Remote On/Off, and Edit.

The (recirculation) Start Pump key is used to turn on the recirculation pump. This is only possible provided that the recirculation condition input is closed (at zero volts). The indicator in the Start Pump key shows when the pump is active. If the recirculation condition input is open, then the function is declined. Recirculation uses the vacuum pump input to confirm that the recirculation pump energized. This input is tested 0.5 seconds after. In the absence of confirmation, the recirculation output switches off.

The Start Pump Auto/Manual key is used to turn on the vacuum pump. This is only possible provided the vacuum condition input is closed (at zero volts). The indicator in the Start Pump shows when the pump is active. If the vacuum condition input is open, then the function is declined. External wiring logic is arranged so that the recirculation pump has to be on before the vacuum pump can be on. In addition, it is not possible to start the vacuum pump during the 0.5 second recirculation pump verification period. The setpoint is reset to zero when starting the vacuum pump.

The Pump Start key is also used to toggle between “Automatic” and “Manual” modes - available after the vacuum pump has been started. Select “Automatic” when the vacuum is at the required setting.

(Continued)

Functions (continued)

The Stop Pump key switches off the associated pump. "Stop" is forced at power up or when the associated input conditioning signal is open. Stopping the recirculation pump will also stop the vacuum pump.

The Remote Analog key has an alternating action (toggle), i.e. each press will select the opposite state. The remote analog input is active when the indicator inside the key is lit. In this mode, the vacuum pressure is compared to the analog input voltage. The input voltage should range between 0 and 10 volts DC. A 10 volt DC reference is available at the rear of the control. It can be used with a 10 to 50 k potentiometer.

When switching to "Remote", there is a 5 second delay during which time the Remote LED flashes. This indicates that the system is in transition between local and external modes. In the transition period, the local setpoint continues to be used. This delay is used to give an external PLC analog control system enough time to match the analog input to that of the local setpoint. High and low logic outputs provide information to the external PLC analog system so that it can prepare its reference. An additional output called "Remote" is on when in the Remote Analog mode.

When switching from "Remote Automatic" mode to "Local Automatic" mode, the local setpoint is forced to the "Actual Measured" value. This provides a bump-less transition.

SECTION 3

Installation

Vacuum

Vacuum Port

This is a non-electrical connection for sensing the vacuum pressure of the tank. A length of 0.24 in. {6 mm} O.D. tubing should be used (do not use 0.25 in. tube as this will cause leaks).

Electrical

Power

Two versions of the PAVC are available (120 volts AC and 24 volts DC). Please check which version you have and connect the correct supply voltage.

AC Supply - 120 Volts, 12 VA, AC Supply Version

120 volts AC supply. Two terminals are provided labeled "Live" and "Neutral". A fuse is provided @ 250 milli-amps, connected in series between the transformer and the “Live” terminal.

DC Supply - 24 Volts, 12 Watts, DC Supply Version

24 volts DC supply (18 to 34 volt range). Two terminals are provided labeled “24 VDC” and “0 Volts”. A fuse is provided. This is rated @ 1 amp slow-blow.

Ground

Two terminals marked "Ground" are connected internally to the metal case and should be taken to the machine frame ground. A screw post is also available. Regulations suggest that it is not suitable to rely on the fixings alone to provide the suitable grounding so it is recommended to also ground the PAVC enclosure via this screw connection. A ground symbol is shown at the screw connection.

Control

Logic Inputs - 5 Pin

The following inputs all have similar characteristics. An internal load is connected to an internal 12 volts DC supply and draws about 10 milli-amps from the supply and through the external source. Inputs should be via normally open contacts referenced to the zero volts of the control. All inputs are active low.

Up (Scroll Up)

Each operation of this terminal to zero volts causes a Scroll Up request. The LED inside the Fine Edit Up key will light when this terminal is at zero volts. The Scroll function will be ignored during setpoint adjustment and when in Manual mode. It has a similar action to the Fine Edit Up key although an increase will also be made for each 0.5 second that the input is kept active.

Down (Scroll Down)

This input complements the Up (Scroll Up) input but will scroll down.

Recirc. (Recirculation Pump Enable)

With this terminal connected to zero volts, it is possible to start the recirculation pump. If this terminal is opened, the recirculation pump and vacuum pump will be stopped.

Vacuum (Vacuum Pump Enable)

This has the same action as the recirculation pump enable except that it affects the vacuum pump. It is also used to acknowledge a recirculation Start. If this terminal is opened, the recirculation and vacuum pumps will be stopped.

Logic Outputs - 8 Pin

All logic outputs are active low. Loading should be restricted to keep currents below 20 mA per channel except for recirculation and vacuum which can pull up to 0.5 amps each. Maximum switching voltage is 30 volts. An external 24 volts DC supply (preferred) should be fitted to the electrical enclosure to power any relays operated. Zero volts of the DC supply should be connected to the PAVC zero volts.

Recirc. (Recirculation Pump)

This output is used to drive an external 24 volt DC motor starter, which in turn is used to power the recirculation pump.

Vacuum (Vacuum Pump)

This output has the same characteristics as the Recirc. output. It should be connected to the "Run/Enable" of the drive. In addition, zero volts of the drive should be joined to zero volts of the PAVC. Some pump controls use a positive logic “Run” signal. In this instance, operate a 24 volt relay which in turn is used to operate the pump run terminal.

Remote

This output is active when in Remote Analog mode.

High

This output is available when in local Automatic mode and for the 5 second duration when switching to Remote Analog Automatic mode. It is active when the analog input is higher than the local setpoint.

Low

This output complements the High output. Both outputs are used together to guide an analog PLC control system to adjust its analog voltage to match the local setting.

Logic Outputs - 8 Pin (continued)

Limit

When Automatic mode is first entered, the setpoint is noted and an approximate 6.25% upper limit is calculated. Variations will then be made normally by the automatic loop comparing setpoint with actual. The pump control allows a certain amount of automatic adjustment but will limit at the upper 6.25% level if it is reached. This avoids runaway which can happen if the tank lid is opened or if the product falls under size. This output switches on to indicate that the upper limit has been reached.

Valve - 6 pin

The Motor "+" and Motor "-" terminals connect across the valve motor. The position of the valve is an analog value developed across a potentiometer. The PAVC supplies 0 and 12 volts to the potentiometer.

Analog - 7 Pin

10 Volts

This output is available as a reference, which can be used by an external 10 K to 50 K potentiometer for the remote analog input control.

VDC In (Remote Analog Input)

This input is used as the setpoint when the Remote Analog mode is selected. The range is 0 to 10 volts.

Vacuum Pump Speed Control

Reference

This input is not used. The pump output is referenced to an internal 10 volt source. This is an optional input that the output analog amplifier may use as an external reference.

Pump

This is an analog output from the vacuum pump. It is connected to the pump "Speed reference" input. Also, zero volts of both devices should be common (joined together).

An. Out (Trending)

This analog output is derived from the vacuum sensor amplifier. This vacuum sensor amplifier is internally calibrated for offset and gain so that the control can measure the actual vacuum pressure. The internal voltage is about +5 volts for 100 in. (2540 mm) H_2O (standard PAVC). This voltage is then passed on to the Trending Amplifier which has an additional offset and gain adjustments. These adjustments are available at the rear of the control so that the analog value can be calibrated to suit the scale required. The offset gives approximately ±2.5 volts of variation, and the gain can be adjusted between x 2 to x 7.

RS485 Input/Output Communications

The RS485 uses a 4-pin connector. Terminal A is the non-inverting input/output, and terminal B is the inverting input/output.

The PAVC uses the following technique for serial communications.

RS485 Multi Drop Ansi-	X3.28-2.5-A4
Baud Rate-	9,600
Format-	1 start, 7 data, 1 even parity, 1 stop
Address-	00 to 99 (default is 25) (00 is normally reserved and therefore should be avoided). (See section on Address Changing).

Officially, the standard allows for 32 drivers and 32 receivers using a maximum cable length of 4,000 feet (1,219 meters). Ideally, a shorter cable length will be used because of the typical noisy environment. The communications device uses a reduced slew rate driver to minimize EMI (required for CE), and reduce reflections caused by improperly terminated cables. This does not affect data transmission rates, as it is good up to 250 kbps, as opposed to the possible 2.5 Mbps of the standard RS485. The driver is short circuit protected.

To minimize reflections, the line should be terminated at both ends in its characteristic impedance, and stub lengths should be kept as short as possible. The total expected load for RS485 is 60 R, usually made up of a 120 R resistor at each end of the line. A 120 R resistor is internally provided with one end connected to the B terminal and the other end at the "A" load terminal. Link "A" and "A" Load terminals if the termination load is required.

Communications Parameters

Code	Description	Direction	Type
II #	Instrument Identifier	RO	Hex returns >2500, * default
KY	Key Code	WO	Hex (see Key Codes Section).
PV	Measured Value	RO	
SP	Setpoint	RO	
SL	Setpoint Local	RW	
SW#	Status Word	RW	Hex (bit list below)

- The first character after II and SW is ">" (ASCII-Hex 3E) indicating bit data follows. The next four hex characters are ASCII 0 to 9 (30H to 39H), or A to F (41H to 46H). These should be translated back into hex at the host processor.

RS485 Input-Output (continued)

I/O Bits

Bit	Name	Digit/bit	0	1	Type
15	Auto/Manual	1/3	Auto	Manual	RO
14	Local/Remote	1/2	Local	Remote Analog	RO
13	Not Used	1/1			
12	Not Used	1/0			
11	Not Used	2/3			
10	Not Used	2/2			
9	Not Used	2/1			
8	Not Used	2/0			
7	Recirculation	3/3	Off	On	RO
6	Vacuum	3/2	Off	On	RO
5	Setpoint (SL) Modify Locally	3/1	No	Modify Occurred	RC
4	Limit	3/0	In Range	Limit	RO
3	Checksum	4/3	Ok	Error	RO
2	Keys*	4/2	Enabled	Disabled	RW
1	Key Buffer	4/1	Empty	Active	RO
0	Not Used	4/0			

Key (Direction)	
RO	Read Only
RW	Read and Write
RC	Read, then Automatically Clear
WO	Write Only

* Keys - Stop buttons will still work if disable is selected.

Calibration

The PAVC controls a vacuum pump and a valve. Two modes are available known as "Manual" and "Automatic". In Manual mode, the valve and vacuum pump are positioned by the setpoint adjustment. No error correction is made to the outputs to make actual equal setpoints. Automatic mode includes error correction.

To create a bump-less transition, the actual value is used as the setpoint when Automatic mode is entered. Any pressure correction is made solely on the vacuum pump - valve position is locked. This ensures no conflict which would happen if both were able to change simultaneously.

The valve is adjusted in Manual mode only, using positional feedback compared to the setpoint. When the setpoint is almost at zero, the valve will be fully open and the pump will be running at a minimum speed (not zero). The voltage presented to the vacuum pump will be almost zero volts.

With the setpoint at maximum, the valve will be almost fully closed and the pump will be running at 90% of maximum speed. The voltage presented to the vacuum pump drive will be about 9 volts. This allows a little headroom for the automatic control program to bring about corrections.

The following procedures are used to find the minimum and maximum values, which should be entered into the vacuum pump drive. These values do not have to be too precise as the PID routines in the PAVC provide automatic compensation.

PAVC - Set Up Procedure (Using a Calibrated Digital Meter)

1. **Set the vacuum pump drive parameters according to the factory defined parameter table** contained on the pump schematic provided with the PAVC.
2. **Set minimum initially to 3 Hz. Set maximum initially to 60 Hz.**
3. **Connect a calibrated digital gauge to the vacuum tube** using a T-piece.
4. **Hold down the Move Left Key on the PAVC for 5 seconds while the tank lid is open.** This will make the control measure the initial offset - thus setting zero scale.
5. **Start the recirculation pump.** Allow the water to fill.
6. **Start the vacuum pump.** If the vacuum pump drive has a Local mode, this will aid setting.
7. **Wind the setpoint up to maximum on the PAVC** by using the Coarse Edit Up key. This will close the valve and place 9 volts at the analog input to the vacuum pump drive.

(Continued)

PAVC - Set Up Procedure (Using a Calibrated Digital Meter) (continued)

8 **If the vacuum pump is in Local mode - adjust the vacuum pump Hz / RPM** until the desired maximum reading is shown on the calibrated gauge (i.e. if the system is to run at a maximum of 100.0 in. {2540 mm} H_20, adjust the pump Hz / RPM until the gauge reads 100.0 in. {2540 mm} H_20. It should not matter if the exact maximum reading cannot be achieved. Setting slightly over should suffice and is preferred.

9 **If a Local mode is not available, keep adjusting the maximum until the required actual value is observed.**

10 **Adjust the vacuum transducer amplifier gain (preset inside the PAVC)** until the display reads the same as the calibrated gauge. This preset is on the display board next to the vacuum transducer.

11 **When the desired maximum reading has had chance to settle, hold down the Move Left Key on the PAVC for 5 seconds.** This will place the value shown on the Actual display into the setpoint so they both become the same. The analog output will automatically adjust for this span. This value will also be used as a maximum that an operator cannot exceed.

12 **Observe the vacuum pump frequency in Hz.** It will be necessary to re-adjust the maximum Hz / RPM to 10% above this value for headroom for the control routine.

13 **Adjust the PAVC setpoint to zero.** This will fully open the valve and place zero volts at the analog input of the vacuum pump drive. With the vacuum pump still in Local mode, adjust the RPM until the gauge just begins to show a vacuum. Observe the vacuum pump frequency and enter a value slightly less than this into the minimum preset.

14 **If a Local mode is not available on the drive, keep adjusting the minimum preset** until the actual display just begins to show a reading and then use a value slightly less.

15 **Place the vacuum pump in Remote mode (if a potentiometer is present).** Spot check at various settings making sure to occasionally select Manual mode so that the valve may reposition.

16 **Remove the calibrated gauge and T-piece and reconnect as normal.**

PAVC - Set Up Procedure (Without Calibrated Digital Meter)

The amplifier in the PAVC is calibrated prior to shipping so should not require any further adjustments. A calibrated gauge should not be necessary. Use the following procedure instead. Zero scale has also been set.

1 **Set the vacuum pump drive according to the factory defined parameter table** contained on the pump schematic provided with the PAVC. Set the value at minimum initially to 3 Hz. Set the value at maximum, initially to 60 Hz.

(Continued)

PAVC - Set Up Procedure (Without Calibrated Digital Meter) (continued)

2 **Start the recirculation pump.** Allow water to fill the tank.

3 **Start the vacuum pump.** If the vacuum pump drive has a Local mode, this will aid setting.

4 **Wind the setpoint up to maximum on the PAVC.** This will close the valve and place 9 volts at the analog input to the vacuum pump drive.

5 **If the vacuum pump is in Local mode, adjust the vacuum pump Hz/RPM** until the desired maximum reading is shown on the PAVC display (i.e. if the system is to run at a maximum of 100.0 in. {2540 mm} H_20, adjust the pump Hz/RPM until the gauge reads 100.0 in. {2,540 mm} H_20). It should not matter if the exact maximum reading cannot be achieved. Setting slightly over should suffice and is preferred.

6 **If a Local mode is not available, keep adjusting the maximum** until the required actual value is observed.

7 **When the desired maximum reading has had chance to settle, hold down the Move Left Key on the PAVC for 5 seconds.** This will place the value shown on the Actual display into the setpoint so they both become the same. The analog output will automatically adjust for this span. This value will also be used as a maximum so that an operator cannot attempt to set a higher value.

8 **Observe the vacuum pump frequency in Hz.** It will be necessary to re-adjust the maximum Hz/RPM to 10% above this value to allow for 10% headroom.

9 **Adjust the PAVC setpoint to zero.** This will fully open the valve and place zero volts at the analog input of the vacuum pump drive. With the vacuum pump still in Local mode, adjust the RPM until the gauge just begins to show a vacuum. Observe the vacuum pump frequency and enter a value slightly less than this into the minimum preset.

10 **If a Local mode is not available, keep adjusting the minimum preset** until the actual display just begins to show a reading and then use a value slightly less.

11 **Place the vacuum pump in Remote mode.** Spot check at various settings making sure to occasionally select Manual mode in order for the valve to reposition.

Some drives do not have local speed control. In addition, to set the maximum and minimum parameters it may be necessary to stop the pump for a new value to be entered. This could prove a bothersome process. To assist in finding suitable maximum and minimum values, it might be best to initially configure the Analog mode and use a potentiometer. Then remove the potentiometer after all the values have been noted.

SECTION
4

Operation

Manual Mode - Initial Mode

Starting the vacuum pump initially places the PAVC in “Manual” mode and sets the setpoint to zero. The operator should then use the Up and Down Edit keys to adjust the vacuum. The vacuum pump RPM and the valve position change in response to the adjustments. The operator should be visually monitoring the extruded product at this time. The display shows the actual vacuum pressure. External scroll inputs are disabled. Edit values are not accurate in “Manual” mode because the valve and pump are able to change at the same time.

✎ **NOTE:** The Fine Edit Up and Down keys will change the setpoint by 0.1 in. {2.54 mm} while the Coarse Edit Up and Down Keys will change the setpoint by 2.0 in. {50.8 mm}.

Each press of the Fine Edit Up key will cause an approximate increase of 0.1 in. {2.54 mm} of water.

Each press of the Fine Edit Down key will cause an approximate decrease of 0.1 in. {2.54 mm} of water.

The Coarse Edit Up key has a similar function to the Fine Edit Up except that the preset changes by approximately 2.0 in. {50.8 mm} of water for each key press. Faster changes will occur after the key has been held down for more than two seconds.

The Coarse Edit Down key has a similar function to the Fine Edit Down except that the preset changes by approximately 2.0 in. {50.8 mm} of water for each key press. Faster changes will occur after the key has been held down for more than two seconds.

The Move Left key has no functions during Manual mode.

The Move Right key has no functions during Manual mode.

The Set key has no functions during Manual mode. Pressing the Set key in the Manual mode will signal an error message (displays - Err).

Automatic Mode

The vacuum pressure is initially set using “Manual” mode. Once the product dimensions are correct (or close), the Start Pump Auto/Manual key should be pressed to toggle to the “Automatic” mode. A bump-less transition is made as the setpoint is forced to the “Actual” value. The vent valve locks in the current position (it does not move in “Automatic” mode). The system will now use automatic correction of the vacuum pump RPM in order to keep the actual pressure steady. External Raise and Lower scroll inputs become active so that external systems (X/Y Scanners) may make fine adjustments to the setpoint.

Each press of the Fine Edit Up key causes an increase of 0.1 in. {2.54 mm} of water. The setpoint will appear in the display and the Setpoint LED to the right of the display will light. Any further presses of the key pad will cause the whole display to count up (0.1 in. {2.54 mm} of water for each press). The display will return to show an actual "sensed" value after a short delay with the “Actual” LED lit. A scroll up terminal is available at the rear of the control. This has a similar action to the key pad except that the display continues to show the “Actual” value. Activity at the scroll up terminal will light the LED inside the Fine Edit Up key. This terminal is ignored when the "Manual" or "Setpoint" LEDs are on.

The Fine Edit Down key complements the Fine Edit Up key and will cause a decrease of 0.1 in. {2.54 mm} of water.

The Coarse Edit Up key has a similar function to the Fine Edit Up key except that the preset changes 2.0 in. {50.8 mm} of water for each key press. Faster changes will occur after the key has been pressed for more than two seconds.

The Coarse Edit Down key complements the Coarse Edit Up key and will cause a decrease of 2.0 in {50.8 mm} of water.

The Move Left key has no function during normal running of the Automatic mode.

The Move Right key has no function during normal running of the Automatic mode.

The Set key has an alternating action while in Automatic mode. The initial press of the Set key displays the setpoint in an editable mode (one of the digits will be flashing). The operator can then use the edit keys to enter a value (see Programming the Setpoint). A further press of the Set key is used to accept the new value.

Programming the Setpoint

Setpoint

1 **The setpoint is displayed with one of the digits flashing.** The range is between 0 and maximum. Maximum is about 100 in. {2540 mm} H_2O for a standard PAVC, or 200 in. {5080 mm} H_2O for a high-vacuum PAVC. The full range may not be achievable depending on valve position. The LEDs to the right of the display will change and the "Setpoint" LED will light.

2 **Use the following edit keys to change the setpoint.**

The Fine Edit Up key or the Coarse Edit Up key increases the flashing digit value by 1. Numbers step from 0 through 9 and then back to 0 with each key press.

The Fine Edit Down key or the Coarse Edit Down key decreases the flashing digit value by 1. Numbers step from 9 through 0 and then back to 9 with each key press.

The Move Left key selects the digit to the left of the flashing digit. This becomes the next editable digit and the previous digit stops flashing. Wrap around is used so that if the left-most digit was editable then the right-most digit will be the next editable digit.

The Move Right key complements the Move left Arrow key but selects the next digit to the right.

3 **The Set key is used to accept the new setpoint once the value is at the desired setting.** After a short delay, the display reverts to showing the actual value sensed with the "Actual" LED lit.

Communications Procedures
Communicating Parameters

Inquiries

All inquiries are initially made by the host computer using -

EOT, GID, UID, UID, P1, P2, ENQ.

EOT = ASCII - Hex 04, used to clear the line. All devices on the RS485 look at the next four characters to see if they are being addressed.

GID = Group Identifier (First part of Address - expects 0 to 9, ASCII - Hex 30 to 39). This is sent twice.

UID = Unit Identifier (Second part of Address). Also sent twice.

P1= First character of parameter.

P2 = Second character of parameter.

ENQ = ASCII - Hex 05.

After a communications link has been established (as notified by a valid response to the previous communication) it is possible to use a shorter inquiry method using ACK and NAK (explained later). The following abbreviation is also valid -

P1, P2, ENQ

If the address and parameter are recognized the PAVC will respond with -

STX, P1, P2, D1, D2, D3, D4, D5, ETX, BCC (Data length can vary D2 to D5 optional).

STX = ASCII - Hex 02

P1 and P2 = Parameter mnemonic

D1 to D5 = Data (Parameter Value) - ASCII

ETX = ASCII - Hex 03

BCC = Checksum of characters P1 to ETX inclusive. This is found by using the Exclusive Or (XOR) logic function -

BCC = P1 (XOR) P2 (XOR) D1 (XOR) D2 (XOR) D3 (XOR) D4 (XOR) D5 (XOR) ETX.

(Continued)

Inquiries (continued)

The host computer checks the BCC character with the BCC that it calculates. If they match, data is accepted.

If the address was recognized but the parameter was not then the PAVC respond with :

STX, P1, P2, EOT

If the PAVC responded using the first method, the host can now use the following -

NAK = ASCII - Hex 15. This requests that the same parameter be repeated. This may be required because the value was not understood the first time or it can provide a simple means to repeatedly monitor a value.

ACK = ASCII - Hex 06. This requests that the next parameter be sent.

PV, SP, SL, and SW parameters are returned using these inquiries.

Sending Data from the Host Computer to the PAVC

All parameter updates are initially made by the host computer using -

EOT, GID, UID, UID, STX, P1, P2, D1, D2, D3, D4, D5, ETX, BCC.

After a communications link has been established (as notified by a valid response to the previous communication) it is possible to use the shorter update -

STX, P1, P2, D1, D2, D3, D4, D5, ETX, BCC.

If the message was understood and in range the PAVC will respond with -

ACK

If the parameter is out of range the response will be -

NAK

No reply will be given if the address is not recognized or if a parity, framing, or over-run error occurs.

The host computer may now use ACK or NAK inquiries -

If the parameter that changed is an SL or SW, it can be echoed back using NAK.

KY Key Codes

It is possible to operate five of the PAVC keys through communications. The edit keys are not available. The possible keys and their codes are -

0 = Recirculation Pump Stop
1 = Recirculation Pump Start
2 = Vacuum Pump Stop
3 = Vacuum Pump Start
4 = Remote Analog

Codes not listed above will stop the recirculation and vacuum pumps.

This parameter is “write” only and uses the sequence -

STX, K, Y, >, D1, D2, D3, D4, ETX, BCC.

D2 to D4 are optional. If inserted, the key routines operate one at a time until all key operations have been performed. The keyboard buffer can only accept new data when the buffer is not full. A flag in the Status Word register determines if the buffer is available (see SW codes). If key codes are transmitted while the buffer is full, a NAK will be returned.

Multidrop Address - Set Up

The default address is 25, but can be any value from 00 to 99. The address can be set to a different value by using a special key sequence as follows -

1. **While the PAVC is not in an edit mode (no digits are flashing), press the right shift button and keep it pressed.** After five seconds the display will change to show Ad.## (where ## equals the current address).

2. **Using the edit keys, change the two digit address to a new value.**

3. **Press the Set key to accept the new address.** Address 00 is reserved so should be avoided.

SECTION
5

Maintenance

Valve Maintenance

The valve assembly used with the PAVC has moving parts in it, which may need occasional cleaning. Air flows through this adjustable vent so dust will collect inside the valve and around the movable disc.

Software routines in the PAVC detect when there is a severe valve problem needing immediate attention. The routines monitor the change in position when a change is expected and indicate an error when this change is not sufficient in the time allowed (56 milliseconds).

Two types of problems could cause valve errors:

- ❒ The moving parts could stall due to dirt. Typical causes – stuck valve, bad valve motor, bad gearbox, bad couplings, wiring, or transistor failure.
- ❒ The signal could be lost due to an open wiring circuit. Typical causes - break in wiring or connections or bad valve potentiometer.

✎ **NOTE:** Error Messages:
UALU= Valve
oPEn= Open Circuit

Any error will immediately disable the valve and the PAVC will display the error detected. For a stall condition, the PAVC will display “UALU” (meaning valve). A wire break at the feedback potentiometer would typically make the feedback voltage drop to zero volts or rise to 12 volts. On this occasion, the PAVC will display “oPEn” (meaning open circuit).

The message will remain in the display until the Set key is used to clear it. The valve remains disabled after a valve error until power is cycled, after which the system will try to move the valve again. All PAVC functions will continue to work as normal except for the valve. This allows the machine to function with limited use until the valve problem is fixed.

When a large vacuum is required but the valve is stuck in the fully open position, it may be necessary to block the vent hose. Likewise, if a small vacuum is being sought and the valve is stuck in the fully closed position, it might be beneficial to remove the pipe from the valve.

Valve Disc Positioning/Testing

The large hole in the disc should be visible when the setpoint is at zero and virtually fully blocked when the setpoint is at maximum (small hole showing). If this is not the case, the position can easily be tuned by hand. This can be achieved using either zero or maximum setpoint while in the Manual mode with the PAVC powered on.

✎ **NOTE:** Only loosen the potentiometer screw. **DO NOT** remove the screw.

To do this, adjust the setpoint as required and then loosen the potentiometer retaining screw (do not remove).

Turn the potentiometer slowly by hand clockwise or counter clockwise as required. The PAVC will energize the motor to follow your movement.

(Continued)

Valve Disc Positioning/Testing (continued)

Once the position is correct lock the potentiometer screw.

The position of the valve is given by the potentiometer, which is powered from a 12 volt DC source. The PAVC recognizes voltages between 0 and 10 volts DC and works in the 2 to 8 volt area. From 10 to 12 volts, the PAVC will think the potentiometer is not moving so will give an error. For this reason, do not turn the potentiometer too erratically so that it enters this unusable area. If the valve is accidentally moved to this position it will be necessary to use an external 12 volt DC source (9 volt PP3 battery is sufficient) to bring the rotor back into the correct range.

Cleaning

Cleaning the PAVC

Use mild non-abrasive detergent on the face panel.

Cleaning the Valve

In order to properly clean the valve it will be necessary to dismantle it.

✎ **NOTE:** During the cleaning procedure, it should not be necessary to remove the motor assembly.

1. **Remove the black cover that protects the valve assembly** (see photo on previous page for location).

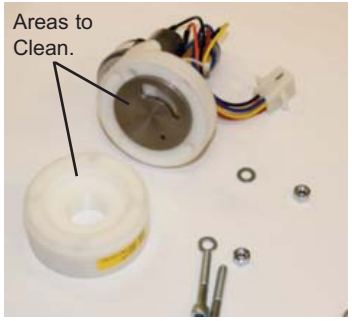
2. **Disconnect the control wiring from the valve** by separating the 6-pin connector.

3. **Remove 2 x M6 nylon insert nuts plus washers which secure the valve assembly bracket** to the PAVC. This allows the valve assembly to be removed for cleaning.

4. **Remove 4 x M6 hex screws that secure the nylon halves of the valve.** Note that the two rear screws also secure the bracket to the valve.

5. **The nylon halves of the valve can now be separated.**

6. **It may be necessary to power the valve motor to move the valve for complete cleaning.** The motor may be rotated with a 12 volt DC supply applied to the motor terminals; a 9-volt PP3 battery can also be used.



7. **Using a mild detergent, clean the inside of the nylon halves and the surface of the metal disk.**

8. **Ensure all parts are clean and dry** then reassembly in the reverse order.

9. **Check the potentiometer retaining screw is tight** before fitting back into the machine. Do this after the 4 x M6 hex screws are fitted.

Vacuum Leaks

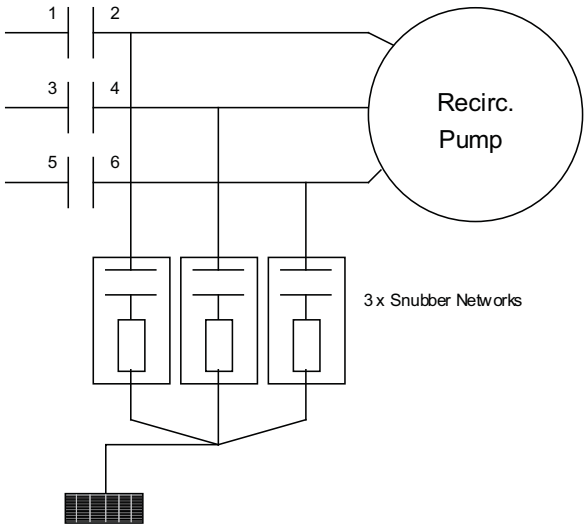
The pneumatic connection on the PAVC is for {6 mm} 0.24 in. OD tube, not 0.25 in. {6.3 mm}. By forcing 0.25 in. tube in to this connection it is highly likely that a leak will occur. The end that fits into the connector should be cut squarely.

The PAVC is tested and calibrated using a vacuum hand pump. Operation of the hand pump is used to bring the vacuum pressure up to around 100 in. {2540 mm} H_2O to assist in calibration of the PAVC. It is then pumped up to around 350 in. {8890 mm} H_2O and left for a 10 minute leak test. The small chamber of the hand pump cannot maintain a vacuum pressure if a leak is present.

Snubber Networks

These should be fitted to the recirculation pump motor starter (contactor). The inductive load creates electrical flashes across the contacts when switching on or off. The EMC and EMF generated should be eliminated or reduced by fitting these or equivalent devices. Snubbers are preferred over MOVs as they "round off" the high frequency factor and reduce harmonics. The MOV chops off (zeners) a high frequency spike at the rated voltage threshold and absorbs the excess energy. However, the high frequency content is still present and the noise harmonics generated extend further into the MHz spectrum by the zenering action.

One leg of each snubber should be connected to each motor phase, i.e. motor starter terminals 2, 4 and 6. The other ends of each snubber should be joined together and taken to ground or to an isolated terminal to form a virtual ground. Ensure the maximum voltage rating of the snubber exceeds the voltage that is supplied.



We're Here to Help

Conair has made the largest investment in customer support in the plastics industry. Our service experts are available to help with any problem you might have installing and operating your equipment. Your Conair sales representative also can help analyze the nature of your problem, assuring that it did not result from misapplication or improper use.

Additional manuals and prints for your Conair equipment may be ordered through the Customer Service or Parts Department for a nominal fee.

How to Contact Customer Service

To contact Customer Service personnel, call:

✎ **NOTE:** Normal operating hours are 8:00 am - 5:00 pm EST. After hours emergency service is available at the same phone number.

From outside the United States, call: 814-437-6861
You can commission Conair service personnel to provide on-site service by contacting the Customer Service Department. Standard rates include an on-site hourly rate, with a one-day minimum plus expenses.

Before You Call...

If you do have a problem, please complete the following checklist before calling Conair:

- ❒ Make sure you have all model, serial and parts list numbers for your particular equipment. Service personnel will need this information to assist you.
- ❒ Make sure power is supplied to the equipment.
- ❒ Make sure that all connectors and wires within and between control systems and related components have been installed correctly.
- ❒ Check the troubleshooting guide of this manual for a solution.
- ❒ Thoroughly examine the instruction manual(s) for associated equipment, especially controls. Each manual may have its own troubleshooting guide to help you.
- ❒ Check that the equipment has been operated as described in this manual.
- ❒ Check accompanying schematic drawings for information on special considerations.

Equipment Guarantee

Conair guarantees the machinery and equipment on this order, for a period as defined in the quotation from date of shipment, against defects in material and workmanship under the normal use and service for which it was recommended (except for parts that are typically replaced after normal usage, such as filters, liner plates, etc.). Conair's guarantee is limited to replacing, at our option, the part or parts determined by us to be defective after examination. The customer assumes the cost of transportation of the part or parts to and from the factory.

Performance Warranty

Conair warrants that this equipment will perform at or above the ratings stated in specific quotations covering the equipment or as detailed in engineering specifications, provided the equipment is applied, installed, operated and maintained in the recommended manner as outlined in our quotation or specifications. Should performance not meet warranted levels, Conair at its discretion will exercise one of the following options:

- Inspect the equipment and perform alterations or adjustments to satisfy performance claims. (Charges for such inspections and corrections will be waived unless failure to meet warranty is due to misapplication, improper installation, poor maintenance practices or improper operation.)
- Replace the original equipment with other Conair equipment that will meet original performance claims at no extra cost to the customer.
- Refund the invoiced cost to the customer. Credit is subject to prior notice by the customer at which time a Return Goods Authorization Number (RGA) will be issued by Conair's Service Department. Returned equipment must be well crated and in proper operating condition, including all parts. Returns must be prepaid.

Purchaser must notify Conair in writing of any claim and provide a customer receipt and other evidence that a claim is being made.

Warranty Limitations

Except for the Equipment Guarantee and Performance Warranty stated above, Conair disclaims all other warranties with respect to the equipment, express or implied, arising by operation of law, course of dealing, usage of trade or otherwise, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.