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VACUUM EQUALIZER

OPERATOR'S MANUAL



AIR TECHNIQUES equipped for life™

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TABLE OF CONTENTS

Safety Instructions 2
Introduction 3
Warranty 3
On-Line Warranty Registration 3
Key Part Identification 4
Site Requirements 5
Physical Characteristics 6
Installation Information 7
Changing Settings 14
Trouble Shooting 18
Parts List / Replacement Parts 19
Optional Accessories 19

SAFETY INSTRUCTIONS

Use of the **Vacuum Equalizer** not in conformance with the instructions specified in this manual may result in permanent failure of the unit.

WARNING: To prevent fire or electrical shock, do not expose this appliance to rain or moisture.

All user serviceable items are described in the maintenance sections.

Manufacturing date code on serial number label is in the format MONTH YYYY.

Markings.
The following terms or symbols are used on the equipment or in this manual to denote information of special importance:



This symbol alerts the user that important Operating and Maintenance instructions have been included with the unit. Read carefully to avoid any problems.



Earth ground.

c UL us
LISTED
LABORATORY
EQUIPMENT
60CB

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INTRODUCTION

Congratulations on the purchase of your new **Vacuum Equalizer**. The **Vacuum Equalizer** is an electronically controlled device that regulates the vacuum level in your dental facility. While conserving electricity and prolonging the life of your pumps the **Vacuum Equalizer** is capable of controlling 2 to 4 vacuum pumps that can be turned "OFF" and "ON" using low voltage remote switch. The **Vacuum Equalizer** is easily installed and requires no scheduled maintenance.

WARRANTY

The **Vacuum Equalizer** is warranted to be free from defects in material and workmanship from the date of installation for a period of twelve (12) months.

Any item returned to our factory in New York through an Air Techniques' Dealer, will be repaired or replaced at our option at no charge provided that our inspection shall indicate it to have been defective. Dealer labor, shipping and handling charges are not covered by this warranty.

This warranty does not apply to damage due to shipping, misuse, careless handling or repairs by other than authorized service personnel. Warranty void if installed or serviced by other than Authorized Air Techniques' Dealer service personnel. Air Techniques, Inc. is not liable for indirect or consequential damages or loss of any nature in connection with this equipment.

This warranty is in lieu of all other warranties expressed or implied. No representative or person is authorized to assume for us any liability in connection with the sale of our equipment.

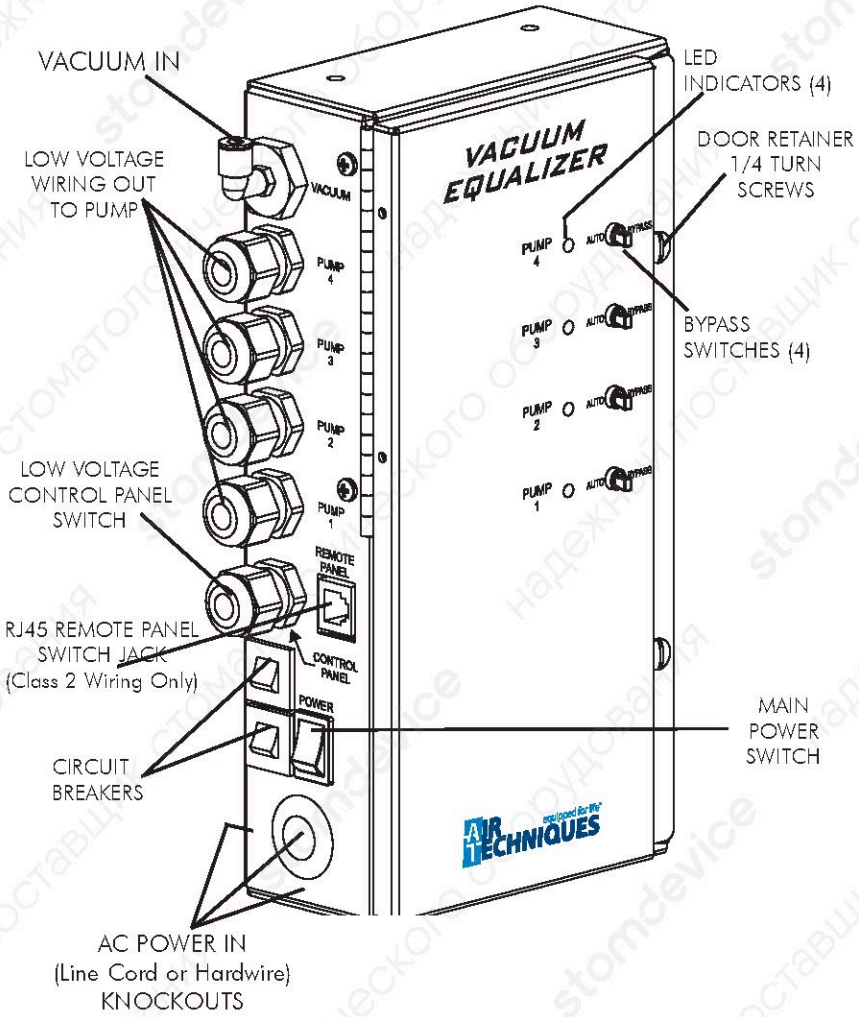
ON-LINE WARRANTY REGISTRATION

Quickly and easily register the **Vacuum Equalizer** on-line. Just have your product model and serial numbers available. Then go to the Air Techniques web site, **www.airtechniques.com**, click the **warranty registration** link and complete the registration form. This on-line registration ensures a record for the warranty period and helps us keep you informed of product updates and other valuable information.

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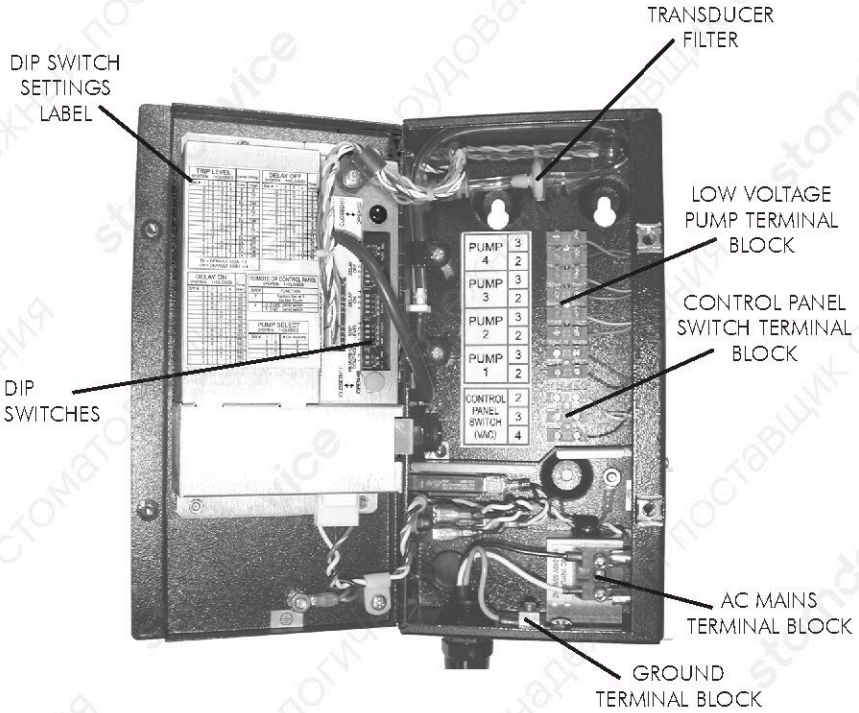
KEY PARTS IDENTIFICATION



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KEY PARTS IDENTIFICATION



SITE REQUIREMENTS

Electrical Input

Wire size AWG	#12 to #14 300V minimum permissible
Voltage	100-240 VAC
Frequency	50/60 Hz
Current	1.0 A

Environment Conditions:

Operating Conditions	Indoor use at altitudes up to 2000m Temperature 5° to 40° C (41° to 104° F). Maximum relative humidity 80% for temperatures up to 31° C, decreasing linearly to 50% relative humidity at 40° C. Supply voltage fluctuation of +/- 10% of nominal voltage.
IEC 61010 Classification	Class II Installation Category 2 Pollution Degree

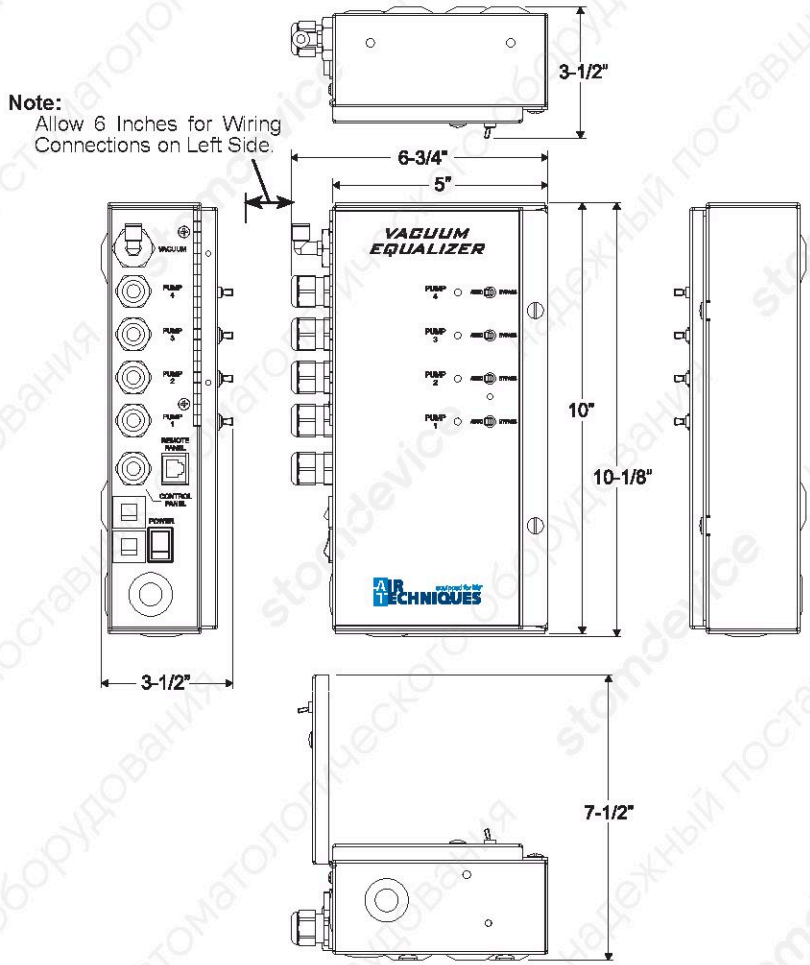
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PHYSICAL CHARACTERISTICS

The **Vacuum Equalizer** can automatically turn up to 4 pumps "ON" and "OFF" depending on the vacuum demand. If a single pump turns "ON" and "OFF" three times within an hour, that pump will be locked into the "ON" position for another hour before returning to normal operation. The **Vacuum Equalizer** is also equipped with 4 bypass switches to manually turn the corresponding pump "ON".

When the **Vacuum Equalizer** is turned "ON" the primary pump is chosen. Each time the unit is turned "OFF" then back "ON" the primary pump changes to the next pump in sequence. This allows each pump to have more equal run times.



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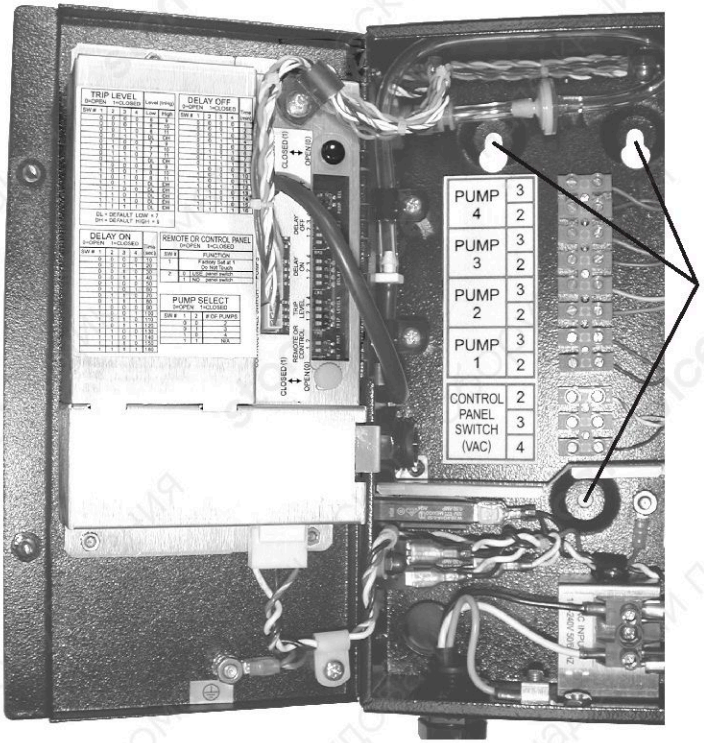
Installation

The **Vacuum Equalizer** is designed for easy flexible installation. It can be mounted to a wall (preferred) or simply laid flat on a sturdy level surface. The unit also provides adaptable wiring options. It can be hard wired directly to AC mains or connected using an optional line cord kit (P/N 56106). Either way the connection is made, the wiring can be routed to the side, bottom, or back of the unit via one of three panel knockouts provided.

Wall Mounting

Refer to the figure below and mount he **Vacuum Equalizer** to the wall by performing the following steps.

1. Find a suitable location for the unit.
2. Use Wall Mount Template P/N 56108 to locate position for the 3 mounting holes.
3. Drill three 1/4" holes at designated position for #10 Anchors.
4. Screw unit to wall using supplied Anchors and Screws.



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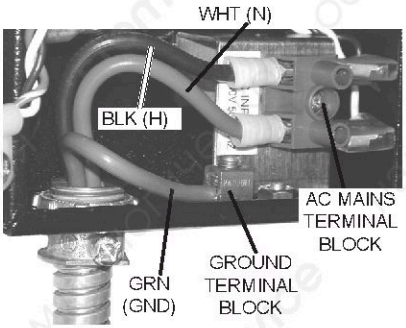
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INSTALLATION INFORMATION

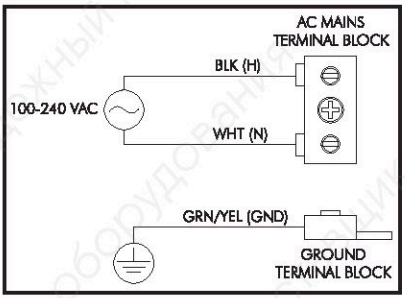
Hard Wiring Unit To Mains

To hardwire the unit to mains, feed wires through one of the 3 knock-out openings and connect the 3 wires to the Mains Terminal Block and Ground Terminal Block as shown below.

Connections To Mains

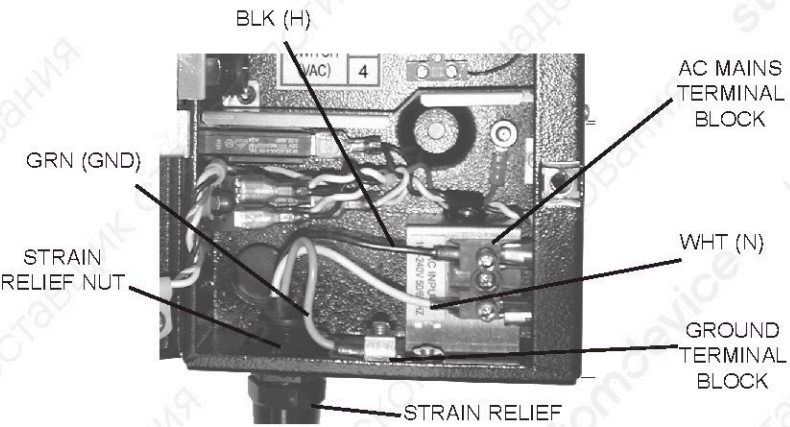


Block Wiring Diagram



Installing Optional Line Cord

To install optional Line Cord, route the Line Cord with Strain Relief through one of the 3 knockout holes and connect the 3 wires to the Mains Terminal Block and Ground Terminal Block as shown below.



Pump Setup

Open front cover by turning the two Door Retaining Screws 1/4 turn counter clockwise. Each pump in the system should have its two wires fed through a strain relief on the side of the unit starting with pump 1. Once the wires are through the strain relief they should be tightened down in the Terminal Block for the corresponding pump. Refer to Pump Select in the Changing Settings section if you have more than (2) pumps in your system.

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Instructions for using the Vacuum Equalizer with VacStar & STS units:

1. The vacuum relief valve on all units controlled by the Vacuum Equalizer **must** be set to the same vacuum level. Set vacuum relief valve on each unit using the same vacuum gauge.
2. The vacuum relief valve on the pumps **must** be set higher than the high vacuum setting of the Vacuum Equalizer. (i.e. if the high setting on the Vacuum Equalizer is set to 9 in-Hg the vacuum relief valve on the pumps should be set to 10 In-Hg).
3. The low vacuum setting on the Vacuum Equalizer can be set to 6, 7 or 8 in-Hg, depending on what the end user requires.
4. The delay on and delay off time settings of the Vacuum Equalizer can be set to their lowest values for the greatest electric and water savings. Note that if a pump turns "ON" and "OFF" three times within an hour it will stay powered on for an additional hour before returning to normal operation. If this happens repeatedly it may be beneficial to increase the delay off time to prevent this from happening.

Instructions for using the Vacuum Equalizer with VacStar NEO units:

1. Up to four VacStar 20 NEO or four VacStar 40 NEO or two VacStar 50 NEO or two VacStar 80 NEO unit can be controlled by the Vacuum Equalizer.
2. All the units must be the same. Do not mix VacStar NEO models.
3. The vacuum settings on all the VacStar NEO pumps must be set to the same value.
4. The vacuum setting on the VacStar NEO pumps must be set to 1 in-Hg higher than the high vacuum setting of the Vacuum Equalizer. (i.e. if the high setting on the Vacuum Equalizer is set to 9 in-Hg the vacuum setting on the VacStar NEO should be set to 10 In-Hg).
5. The low vacuum setting on the Vacuum Equalizer can be set to 6, 7 or 8 in-Hg, depending on what the end user requires.
6. The delay on and delay off time settings of the Vacuum Equalizer can be set to their lowest values for the greatest electric and water savings. Note that if a pump turns "ON" and "OFF" three times within an hour it will stay powered on for an additional hour before returning to normal operation. If this happens repeatedly it may be beneficial to increase the delay off time to prevent this from happening.

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INSTALLATION INFORMATION

Air Techniques Approved Pumps

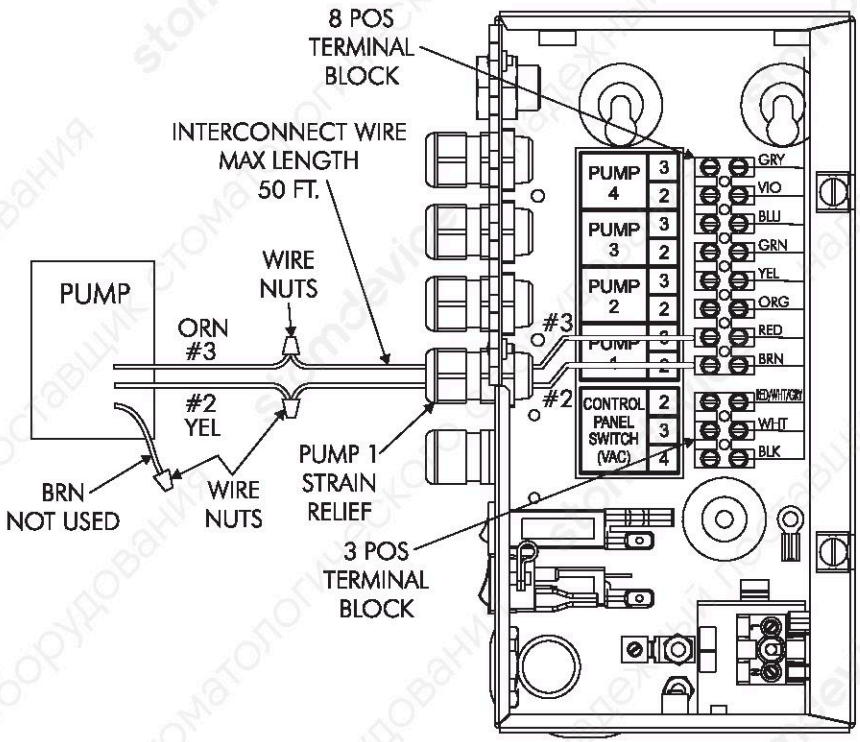
VS20	VS50, VS50H
VS40	VS80, VS80H
VS20NEO	VS50NEO
VS40NEO	VS80NEO
STS3, STS5 & STS15	
Maximum Switching Voltage:	30 VAC
Maximum Switching Current:	3.5A

Note: Only install one wire per terminal block port. Pumps may not be wired in parallel. One pump per switch only.

Vacuum Equalizer To Pump

Interconnect wire guage: #14 to #22 AWG
Interconnect wire length: 50 feet maximum
Wire Jacket O.D. 0.187" - 0.300"

Pump Setup Wiring Diagram



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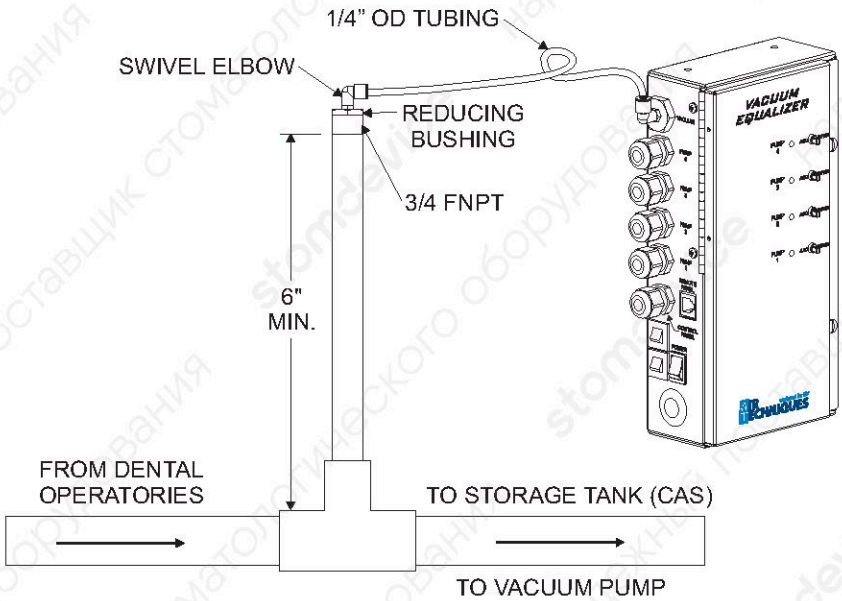
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Plumbing Installation

The **Vacuum Equalizer** needs to read the vacuum level in the piping between the dental operatories and the vacuum pump (wet system) or storage tank (dry system). A tee needs to be placed in the piping within 10 feet of the vacuum pump or storage tank. The tee should be positioned with the open leg pointed up with a minimum of a six inch rise terminating in a ¾ inch FNPT. The supplied ¾ MNPT x ¼ FNPT reducing bushing should then be installed into the top of the tee assembly. The supplied ¼ MNPT x ¼ push to connect swivel elbow should then be installed into the reducing bushing. The supplied ¼ inch OD tubing should then be attached between the ¼ inch swivel elbow on the tee assembly and the ¼ inch swivel elbow designated VACUUM on the Vacuum Equalizer. A loop in this tubing will help ensure that liquids do not reach the Vacuum Equalizer.

We Supply:

¾ MNPT x ¼ FNPT Reducing Bushing P/N 56209
¼ MNPT x ¼ Push to Connect Swivel Elbow P/N 56121
¼ OD Translucent Blue Vacuum Tubing (10 feet) P/N 51453



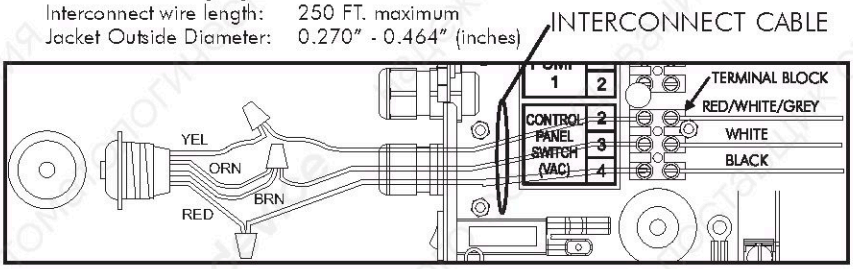
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Supplied Control Panel Switches

The **Vacuum Equalizer** is supplied with two Control Panel Switches; a Bi-Color Push Button Switch, P/N 53202-1 and a 6 VDC Rocker Switch, P/N 56233. Either switch provides external remote control of the power function (ON/STANDBY) for the unit. Use the corresponding drawing shown below when connecting a Control Panel Switch.

Bi-Color Push Button Switch to Vacuum Equalizer
Interconnect wire gauge: #14 to #22 AWG
Interconnect wire length: 250 FT. maximum
Jacket Outside Diameter: 0.270" - 0.464" (inches)

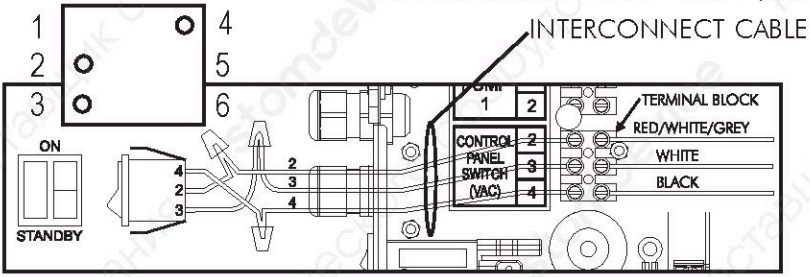


Note: The orange (ORG) and Brown (BRN) wires are tied together at the switch panel.

Bi-Color Push Button Control Panel Switch, P/N 53202-1

6 VDC Switch to Vacuum Equalizer
Interconnect wire gauge: #14 to #22 AWG
Interconnect wire length: 250 FT. maximum
Jacket Outside Diameter: 0.270" - 0.464" (inches)

REAR VIEW 6 VDC CONTROL PANEL SWITCH (SUPPLIED)



6 VDC Control Panel Rocker Switch, P/N 56233

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Optional Remote Panel Switch

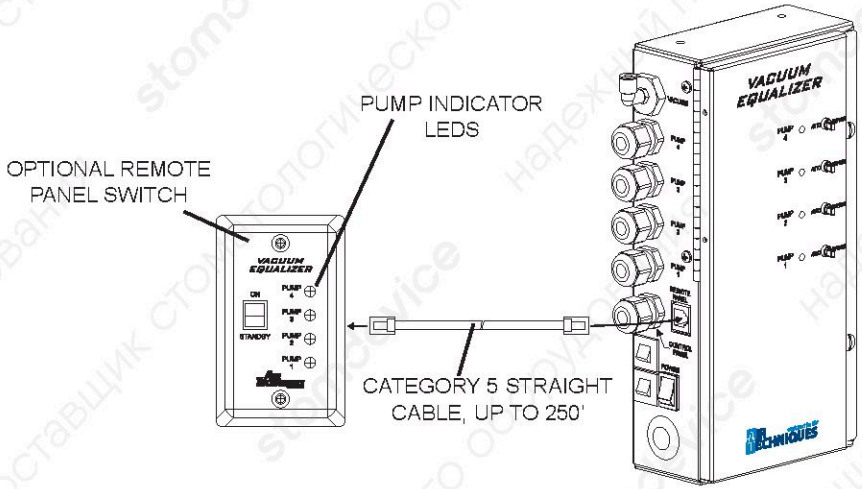
There is also an optional Remote Panel Switch, P/N 56240, available as an accessory.

Locate a convenient location for the Remote Panel and install in wall.

Connect the Remote Panel using Category 5 Straight Cable (up to 250 feet) as shown below.

Important: Make sure to disconnect the CAT5 cable before opening the front cover. Otherwise damage may occur to either the CAT5 cable or the RJ-45 Jack.

Note: RJ-45 Jack is a low voltage communications port only. It is not a Phone or Ethernet Jack.

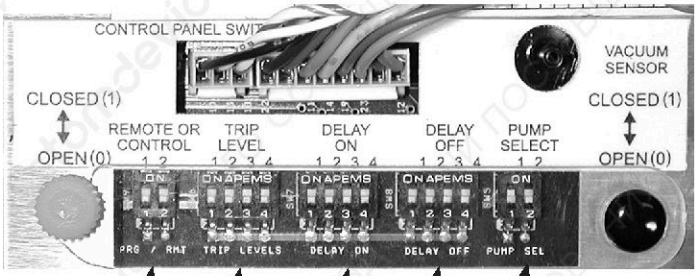


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CHANGING SETTINGS

System functions are set via internal DIP switches shown below. Loosen the two door retainer thumb screws and open the to access the DIP switches.



DIP Switches 1 2 3 4 5

DIP Switch	Function Control
1	Sets the use of a Control Panel Switch or Remote Panel Switch
2	Sets the high and low vacuum trip levels
3	Sets the delay on timer
4	Sets the delay off timer
5	Sets the number of pumps in the system

Important: Make sure the Main Power Switch is "OFF" before changing any of the field adjustable settings. When setting dip switches use an appropriate tool to gently slide switch up or down.

Changes only take affect after the Main Power Switch is turned "OFF".

1. Using a Control Panel Switch - DIP Switch 1

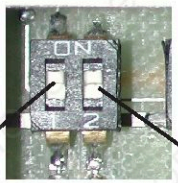
Note: If using Control Panel Switch or Remote Panel Switch the Power Switch on the **VACUUM Equalizer** must be in the "ON" position.

In order to use a Control Panel Switch or Remote Panel Switch DIP switch 1 must be set to "0". It is factory set to "1" for "No Panel Switch". There is a supplied Control Panel Switch P/N 56233. Install as per Figure 1.

REMOTE OR CONTROL PANEL

Closed (1)

Open (0)



FACTORY SET AT "1" DO NOT TOUCH

SET TO "0" TO USE EITHER PANEL SWITCH

REMOTE OR CONTROL PANEL 0=OPEN 1=CLOSED		
SW #	FUNCTION	
1	Factory Set at 1 Do Not Touch	
2	0	USE panel switch
	1	NO panel switch

PANEL SWITCH

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DIP Switch Setting Label

TRIP LEVEL
0=OPEN 1=CLOSED

SW # 1	2	3	4	Level (InHg) Low	High
0	0	0	0	6	9
0	0	0	1	6	10
0	0	1	0	6	11
0	0	1	1	DL	DH
0	1	0	0	7	9
0	1	0	1	7	10
0	1	1	0	7	11
0	1	1	1	DL	DH
1	0	0	0	8	9
1	0	0	1	8	10
1	0	1	0	8	11
1	0	1	1	DL	DH
1	1	0	0	DL	DH
1	1	0	1	DL	DH
1	1	1	0	DL	DH
1	1	1	1	DL	DH

DL = DEFAULT LOW = 7
DH = DEFAULT HIGH = 9

DELAY OFF
0=OPEN 1=CLOSED

SW # 1	2	3	4	Time (min)
0	0	0	0	1
0	0	0	1	2
0	0	1	0	3
0	0	1	1	4
0	1	0	0	5
0	1	0	1	6
0	1	1	0	7
0	1	1	1	8
1	0	0	0	9
1	0	0	1	10
1	0	1	0	11
1	0	1	1	12
1	1	0	0	13
1	1	0	1	14
1	1	1	0	15
1	1	1	1	16

DELAY ON
0=OPEN 1=CLOSED

SW # 1	2	3	4	Time (sec)
0	0	0	0	10
0	0	0	1	20
0	0	1	0	30
0	0	1	1	40
0	1	0	0	50
0	1	0	1	60
0	1	1	0	70
0	1	1	1	80
1	0	0	0	90
1	0	0	1	100
1	0	1	0	110
1	0	1	1	120
1	1	0	0	130
1	1	0	1	140
1	1	1	0	150
1	1	1	1	160

REMOTE OR CONTROL PANEL
0=OPEN 1=CLOSED

SW #		FUNCTION
1		Factory Set at 1 Do Not Touch
2	0	USE panel switch
	1	NO panel switch

PUMP SELECT
0=OPEN 1=CLOSED

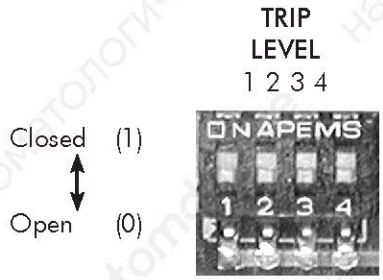
SW # 1	2	# OF PUMPS
0	0	2
0	1	3
1	0	4
1	1	N/A

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2. The high and low vacuum trip levels

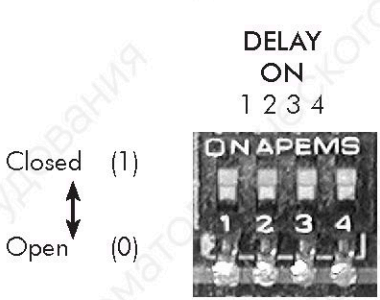
The **Vacuum Equalizer** has a factory preset vacuum range of 7 to 9 inHg. If the vacuum level falls below the vacuum range an additional pump will be turned "ON" if all pumps are not in use. If the vacuum level is higher than the vacuum range a pump will be turned "OFF" unless it is the primary pump. Both the upper and lower ranges are field adjustable in 1 inHg intervals. The lower limit is 6 to 8 inHg and upper limit is 9 to 11 inHg.



TRIP LEVEL 0=OPEN 1=CLOSED				Level (inHg)	
SW # 1	2	3	4	Low	High
0	0	0	0	6	9
0	0	0	1	6	10
0	0	1	0	6	11
0	0	1	1	DL	DH
0	1	0	0	7	9
0	1	0	1	7	10
0	1	1	0	7	11
0	1	1	1	DL	DH
1	0	0	0	8	9
1	0	0	1	8	10
1	0	1	0	8	11
1	0	1	1	DL	DH
1	1	0	0	DL	DH
1	1	0	1	DL	DH
1	1	1	0	DL	DH
1	1	1	1	DL	DH
DL = DEFAULT LOW = 7 DH = DEFAULT HIGH = 9					

3. The delay on timer

The delay "ON" setting indicates the number of seconds, after a low vacuum level is detected, until the next pump sequence is turned "ON". The **Vacuum Equalizer** has a factory set delay "ON" time of 20 seconds with a field adjustable range of 10 to 160 seconds in 10 second intervals.

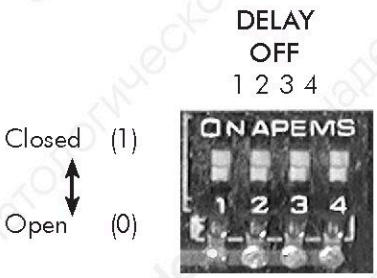


DELAY ON 0=OPEN 1=CLOSED				Time
SW # 1	2	3	4	(sec)
0	0	0	0	10
0	0	0	1	20
0	0	1	0	30
0	0	1	1	40
0	1	0	0	50
0	1	0	1	60
0	1	1	0	70
0	1	1	1	80
1	0	0	0	90
1	0	0	1	100
1	0	1	0	110
1	0	1	1	120
1	1	0	0	130
1	1	0	1	140
1	1	1	0	150
1	1	1	1	160

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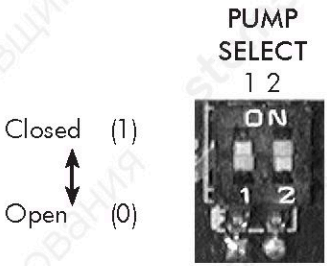
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4. **The delay off timer**
The delay "OFF" setting indicates the number of minutes after a high vacuum level is detected before a pump is turned "OFF". The Vacuum Equalizer has a factory set delay "OFF" time of 10 minutes with a field adjustable range of 1 to 16 minutes in 1 minute intervals.



DELAY OFF 0=OPEN 1=CLOSED				Time
SW # 1	2	3	4	(min)
0	0	0	0	1
0	0	0	1	2
0	0	1	0	3
0	0	1	1	4
0	1	0	0	5
0	1	0	1	6
0	1	1	0	7
0	1	1	1	8
1	0	0	0	9
1	0	0	1	10
1	0	1	0	11
1	0	1	1	12
1	1	0	0	13
1	1	0	1	14
1	1	1	0	15
1	1	1	1	16

5. **The number of pumps in the system**
The number of pumps that you use can be set to 2, 3 or 4 pumps. The Pump Select is factory set for 2 pumps.



PUMP SELECT 0=OPEN 1=CLOSED		
SW # 1	2	# OF PUMPS
0	0	2
0	1	3
1	0	4
1	1	N/A

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TROUBLESHOOTING

SYMPTOM	POSSIBLE FIXES
LED indicator turns on, but the corresponding pump doesn't turn on	Check that the power switch on the pump is "ON". Check that the Yellow and Orange wires from the pump are making contact with the terminal block.
Pumps are running, and the Vacuum Level is too high	Check that the Bypass switches are set to "AUTO". Check the "DELAY OFF" switch settings to make sure the "DELAY OFF" time is not to long. Check the "TRIP LEVELS" switch settings to make sure the "TRIP LEVELS" "HIGH" value is not too high. Check the Vacuum In line and filter to make sure that they are not clogged.
Panel Switch Doesn't turn the unit "ON"	Check the wiring connections of the panel switch. Check the "REMOTE OR CONTROL PANEL" switch setting and make sure that it is set to "0" for using the panel switch. Make sure that the Main Power switch is set to "ON".
Main power Switch doesn't turn the unit "ON"	Check that the Circuit Breakers have not tripped. Check AC main power wiring connections are made correctly Check the "REMOTE OR CONTROL PANEL" switch setting and make sure that it is set to "1" to not use a panel switch.
Pump is running, but the LED indicator is "OFF"	Check that the bypass switch for that pump is set to "AUTO"

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PARTS LIST/REPLACEMENT PARTS

Part No.	Description	Qty
56259	Instructions; Vacuum Equalizer	1
30936	Anchor, #10-12 X 1" Screw, Plastic	3
30295	Screw, #10 X 3/4,Type A, Slot Pan Hd	3
85779	Strain Relief, .27- .47 OD Cord, Blk	1
85789	Nut, Strain Relief,1/2NPT, Blk	1
51453	Tubing, Urethane, 1/4OD, Translucent Blue	Per Foot
56233	Switch, 6 VDC Rocker, Control Panel	1
53202-1	Switch, Bi-Color, Control Panel	1
56209	Pconn, Bushing, 3/4MNPT X 1/4FNPT	1
43303	Nut, Wire:Blue, 22 TO 14 Gauge, 300V	3
56108	Mounting Template	1
56268	Transducer Filter	1
56113	Swivel Elbow 1/4" PUSH x 1/8" MNPT	1
31191	Cable Clamps, 1/4"	2
30953	Cable Clamp, 3/16"	2
30954	Cable Clamp, 5/16"	3
24128	Reducing Barb, 2/32" x 1/8"	
A2334	AC Mains Terminal Block	1
56319	Main Harness Assembly	1
117061	1/2 AMP Circuit Breaker	2
116512	Main Power Switch	1
56318	Bulk Head Fitting Assembly	1
56231	PCB Replacement Kit	1
56298	Acrylic Window	1

OPTIONAL ACCESSORIES

Part No.	Description
56240	Remote Panel Switch
56106	Line Cord Kit

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