

FilterMinder

Users's Manual

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FilterMinder Capabilities

A Pool's filter system is often the most overlooked part of a pool, yet a poorly maintained filter can cause water purity problems, increased energy usage and premature pump failure.

The FilterMinder is designed to monitor filters for proper operation and then clean these filters as needed to assure proper filter system performance. The FilterMinder does this by measuring either the time since the filters were last washed or differential pressure across the filters and then automatically sequencing valves and relays as necessary to perform a complete backwash of single or multiple filter systems. Initiation and execution of this backwash sequence can be totally automatic, requiring no operator intervention.

If fully automatic operation is not desirable, the FilterMinder can be configured to only monitor the filter system and display its status. The bar graph indicator on the FilterMinder can then be used as a visual indication of when a backwash is required and pool maintenance personnel can initiate the backwash sequence from the keypad (semi-automatic operation). Once initiated, the backwash will advance automatically to assure that all valves and relays are sequenced correctly and proper timing is executed to assure a complete backwash of all filters. This frees maintenance personnel to perform other pool maintenance tasks while the filter system is backwashing.

Backwash Sequence

Once a backwash operation is initiated, FilterMinder first turns off the heater and any other device such as a chemical feeder that is attached to the Heat relay. The controller waits for the heater to cool off and all chemicals to flush into the pool and then shuts off the Pump relay. The Valve 1 output is now energized. The controller then waits for all diaphragm valves fed from the Valve 1 actuator to fill. The Pump is then turned on and backwash of the first filter begins. When this filter is clean, the Pump relay and the Valve 1 output are turned off and the controller waits for all diaphragm valves to return to their normal position in preparation for backwashing of the next filter. If desired, the controller can be programmed to pause at this point to allow waste water to disburse before moving on to the next filter (this is called the Interfilter delay). If this option is chosen, the pump will turn back on during this delay to resume filtering while waiting for effluent to drain. When it is time to advance to the backwash of Filter 2, the Pump relay is again turned off, the Valve 2 output is energized and the backwash sequence continues as it did for Filter 1. Filter systems containing up to 3 filters can be backwashed in this manner. After the last filter in the system is backwashed, the Pump and Heat relays are energized to resume normal pool operation until the next backwash is required. If there are less than 3 filters in the system, the Valve 3 output is energized for each filter backwash period and can be used to run a pressure boost pump or electrically actuated priority valve

In addition to the above standard sequence, FilterMinder can be configured to leave the pump and heater on through the backwash operation. Many operators feel that this modified sequence reduces wear on the pump associated with starting and stopping.

Front Panel Features

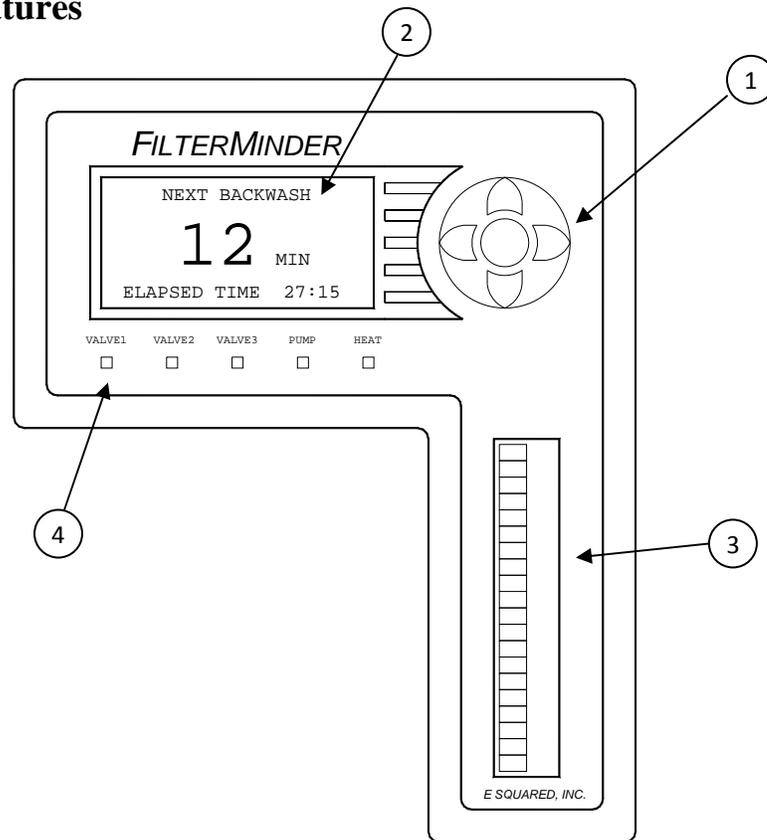


Figure 1

- ① The key pad contains five keys for navigating the menu system and modifying system parameters. Press the center “Select” key to enter the menu system. The “Up” and “Down” keys can now be used to scroll through the menu to the desired function. Then the Select key can be pressed again to select this function. Once selected, the parameters of interest can be modified using the Up and Down keys. On numeric parameters, these keys can be held down to increase or decrease automatically. Once the desired value is reached, the Select key can be used to save the new value and return to the menu. Similarly, the “Left” and “Right” keys can be used to navigate the menu system. The Right key will take you forward one level in the menu system and the Left key will take you back.
- ② The 128 x 64 pixel LCD display provides easy to read information about the current system status and provides a helpful interface for changing system parameters. Important values are displayed in large characters for easy viewing from a distance. Where appropriate, brief instructions are presented to the user. The display is transfective for easy viewing in bright sunlight and contains a backlight for viewing in dim ambient lighting.
- ③ The bright 20 element LED bar graph provides a graphical representation of filter system capacity. A new, clean filter will show as empty (no bars lit). As the filter accumulates particulates, the bar graph display increases until the filter reaches capacity (all bars lit). The first 16 bars are green to show normal operation. The last four bars are red to indicate that the filter needs to be backwashed, or will soon be backwashed if automatic backwash is selected.
- ④ These Five Status LEDs provide information on the state of the Pump, Heater, Valve actuators and any other device connected to the Valve3 output.

Access Control

The FilterMinder enclosure contains relays that can switch high currents at up to 250 volts. The latches on this enclosure are designed to accept a padlock to prevent unauthorized access.

WARNING

It is expected that some form of lock be used for safety as well as security and that access to the wiring inside the enclosure be limited to qualified service personnel.

Since the FilterMinder display and keypad are accessible from the outside of the case, some further means of preventing inadvertent or unauthorized operations of the controller is required. Three different levels of security have been provided. These security levels are set via two switches inside the case. These switches are located on the back side of the enclosure door just above the wiring connector.

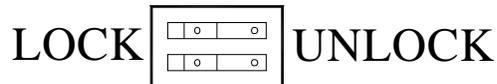


Figure 2

The first level of access allows all operations to be performed from the keypad. All parameters can be viewed and changed and backwash cycles can be initiated as desired. This level of access is selected by placing both switches in the UNLOCK position.

The second level of access allows backwash operations to be performed from the keypad and allows all parameters to be viewed, but does not allow the operator to change any of these parameters. Attempts to save altered parameters will result in the message “MEMORY IS LOCKED”. This level of access is selected by placing the top switch in the UNLOCK position and the bottom switch in the LOCK position.

The third level of access does not allow any operations from the keypad. The parameters can be viewed, but attempts to save will result in the message “MEMORY IS LOCKED” and attempts to execute a backwash or manipulate the pump or heater will result in the message “FRONT PANEL OPERATIONS ARE CURRENTLY LOCKED OUT”. This level of access is selected by placing both switches in the LOCK position.

If a Remote Access package has been installed, all functions can be accessed remotely regardless of security switch settings. Remote access relies on Password protection to prevent unauthorized access from the web interface. See the Remote Access Package documentation for details of this capability.

Operation

Press the center of the keypad to enter the operations menu.

BACKWASH NOW

This selection allows you to start a backwash from the keypad. The lower line on the display tells you that the FilterMinder is currently `FILTERING` pool water. Press the Select key once to start the backwash cycle. The system will now advance through the backwash cycle automatically, displaying the current stage of the backwash at the top of the display and counting down the seconds until the next stage at the bottom of the display. If you wish to abort this stage and move on to the next, press the Select key to advance. If you wish to terminate the backwash cycle and return to `FILTERING`, press the Down key to point to `CANCEL` and then the Select key to execute this request.

VIEW COUNT

FilterMinder keeps a log of the number of backwash cycles that have been completed. This count is useful to verify that a unit that is configured to backwash based on pressure settings is not backwashing too frequently. Excessive backwash operations could indicate a problem with the filter system or could be an indication that the trip pressure is set too low or that the surge delay needs to be increased. The log can be cleared to zero from this screen if desired.

VIEW ALARMS

The controller has a safeguard built in to prevent excessive discharge of pool water.

When backwash is initiated by differential pressure, if the setpoint is set too close to the normal operating pressure, the FilterMinder will perform one backwash cycle after another. This situation has the potential to empty large quantities of pool water out of the waste line while never addressing the actual problem. In situations like this where less than five minutes elapse between subsequent backwash operations, after three backwash cycles the Pump and Heat outputs are turned off and a message is displayed indicating why the pool was shut down.

If this happens, navigate the menu system to the `VIEW ALARMS` screen. The current alarm status will be displayed. Select `YES` to clear the alarm flags. The Pool will then re-start automatically.

CONTRAST ADJUST

The LCD display used in the FilterMinder is designed to provide excellent readability in both dim and bright ambient light situations and over all specified operating temperatures. The user has the ability to maximize this readability by adjusting the bias voltage of the LCD for maximum contrast in their particular installation. Use the Up and Down keys to adjust the display for the best viewing, then press the center Select key to save this new bias voltage in nonvolatile memory.

PUMP/HEAT CONTROL

The Pump and Heat output relays can be turned on and off as desired from this screen. Interlocks are provided to prevent thermal stress on the Heater. The Heater cannot be turned on unless the Pump is running. The Pump cannot be turned off if the Heater is running. After the Heater is turned off, a sufficient “Cool Down” interval must elapse before the Pump can be turned off. Messages indicating these interlocks are displayed if a disallowed operation is attempted.

SET AUTO MODE

Four different choices are available for backwash cycle initiation:

MANUAL ONLY With this selection, backwash operations will only commence if initiated from the BACKWASH NOW screen.

TIME INTERVAL With this selection, filters will be backwashed periodically based on a user selected period of time. Selection of this mode will automatically advance you to the INTERVAL SETPOINT screen so that the currently configured backwash interval can be viewed and adjusted. The interval selected is the number of seconds from the start of one backwash cycle to the start of the next backwash cycle. When in this mode of operation, the bar graph indicates the amount of time remaining until the start of the next backwash. Each illuminated bar indicates that 5% of the time remaining until the next backwash has elapsed. When all bars are lit, a new backwash operation will be initiated automatically.

PRESSURE CHANGE As the filter bed becomes clogged with debris from the pool, the pressure differential between the inlet and outlet of the filter increases. This decreases the flow through the filter and puts additional strain on the pump motor. By setting a trip pressure slightly above the normal operating pressure differential of a clean filter system, the filters will be cleaned automatically as needed to maintain this normal filter differential. Selection of this mode will automatically advance you to the PRESSURE SETPOINT screen so that the currently configured trip pressure can be viewed and adjusted. Be careful to select a trip pressure sufficiently above the normal operating filter differential to balance water usage with the desire for a clean filter system. When in this mode of operation, the bar graph indicates the current pressure difference between the inlet and outlet pipes of the filter system as a percentage of the difference in pressure between a clean new filter and the configured trip pressure. A quick glance at the bar graph will let you know how dirty the filter system currently is.

EXTERNAL SWITCH If you desire to connect the FilterMinder to a set of relay contacts controlled by a facility monitor or SCADA system, this other system can be used to trigger a backwash using this mode of operation. Disconnect the differential sensor wires at the three terminals marked Com, Sensor and +5 VDC and connect the switch or dry relay contacts between the Sensor and +5 VDC terminals. The SURGE DELAY is still in effect

for the EXTERNAL SWITCH input, as is a 10 second de-bounce timer. Set SURGE DELAY to zero seconds if this input is coming from anything other than a differential pressure switch and assure that the switch remains closed for a minimum of 10 seconds to initiate a backwash. When EXTERNAL SWITCH is selected for the auto mode, the bar graph display will illuminate briefly when the external switch is closed but otherwise will be inactive (no bars lit).

In any mode of operation, backwash can still be manually triggered from the Remote Access package, if installed. Also, backwash operations can always be initiated from the keypad unless front panel operation is locked out by the LOCK/UNLOCK switches inside the enclosure.

SYSTEM SETUP

All time intervals and many other operating modes and parameters can be configured using this sub-menu. These parameters have been grouped here because once the system is configured, it is not generally necessary to access these parameters in the course of normal pool operations.

INTERVAL SETPOINT This parameter is also available from the SET AUTO MODE menu if TIME INTERVAL is selected. The value selected is the number of minutes from the start of one backwash cycle to the start of the next. Valid values range from 5 to 9999 minutes (6.9 days). The interval should not be too short or it will trip the WE ARE BACKWASHING TOO OFTEN alarm message. To select an appropriate value, perform a backwash cycle. Then, using some means of measuring filter system inlet pressure, measure the amount of normal pool operation time required to increase this pressure by about 10 PSI. This should provide a reasonable starting place to set the interval setpoint.

PRESSURE SETPOINT This parameter is also available from the SET AUTO MODE menu if INLET PRESSURE is selected. The value selected is the filter system inlet pressure that must be met or exceeded for a SURGE DELAY period of time to cause a backwash cycle to be initiated. Valid values range from 0 to 50 PSI. The trip point should not be too close to normal operating pressure or it will trip the WE ARE BACKWASHING TOO OFTEN alarm message. A value between 5 and 10 PSI above the pressure observed on a clean filter is usually acceptable.

SET ZERO PRESSURE Small differences in location between the inlet and outlet pressure sensing ports on the system piping can result in a small head pressure being indicated by the filter differential displayed on the FilterMinder. A system variable called "offset" can be adjusted from this screen to set the filter differential reading to zero. To make this adjustment, turn the pump off to stop water flow through the filter system. Then use the Up and Down keys to find what value of offset results in a pressure reading that bounces equally between 1 and 0. Then find what value of offset results in a pressure reading that bounces equally between 0 and -1. Set the offset to half way between these two values. This value will be saved permanently when you exit this screen. Values

between 200 and 700 are allowed, which should provide an adjustment of +/- 5 PSI. If more range than this is needed to achieve a display of 0 PSI, there may be a problem with the pressure sensor.

BASELINE PRESSURE The bar graph is used to indicate the current health of the filter system. To provide an accurate indication, FilterMinder must be told what minimum inlet pressure to use as a reference or baseline. Valid values range from 0 to 50 PSI. This parameter should be set at the lowest pressure achieved with clean, new media in the filter system. As the media ages and gets contaminated or ground down from usage, the pressure observed just after a backwash operation will be found to increase, indicating that the media is starting to wear out. Observing the bar graph immediately after a backwash cycle will provide a visual indication of the health of the media. If five or more of the bars are still lit even when the filters have just been cleaned, the media should be evaluated to determine if replacement is in order.

BACKWASH DURATION This is the amount of time in seconds that each filter will be flushed once the valves have moved fully into the backwash position. Valid values range from 0 to 1800 seconds (30 minutes). To select an appropriate value, start a backwash operation and if possible, view the water being discharged out of the waste line. When the waste water starts to flow clear, sufficient time has been allowed for the backwash. If waste water cannot be observed, 180 seconds is a reasonable starting value for this parameter. Try experimenting with shorter values until the filter inlet pressure no longer returns to the base pressure after a backwash operation.

INTERFILTER DELAY If the waste water system is not able to handle large flows continuously, the FilterMinder can be configured to delay between backwashing of subsequent filters in a multiple filter system by return to normal filtering of pool water between backwashing of individual filters. The duration of this inter filter dwell time can be set via the Interfilter Delay. Valid values range from 0 to 9999 seconds (6.9 days). Since the heater is not operational during this inter filter dwell time, the delay should be kept to a minimum and for most systems can be left at 0.

VALVE SHIFT DELAY When a backwash operation is initiated, the Valve actuator associated with the filter being backwashed is energized. Water or air starts to flow into the diaphragm actuated valves that must be shifted to accomplish the backwash. Some time is required for the control sections of these valves to fill up before the flow through the filter is reversed for backwash. We call this the Valve Shift Delay. This delay varies depending on the size of the valves used and the supply pressure and type of the control media. Values range from 0 to 180 seconds. A typical value would be 60 seconds for a single 8 inch valve. This value can usually be determined by listening to the sound of the valves. They tend to be rather noisy while shifting positions.

COOL DOWN DELAY Pool heaters rely on the flow of pool water past the heat exchanger to keep temperatures from becoming too great. Thermal safeties are employed to

automatically turn off the heater when the internal temperatures become too high, but use of these safeties results in unnecessary thermal stress on the heat exchanger. The best approach is to turn off the heater in advance of shutting off the water flow and then allowing sufficient time for the heater to cool off before shutting off the water.

FilterMinder takes this latter approach. Values range from 0 to 600 seconds (10 minutes). This same delay can be used to disable chemical feed systems to allow all dispensed chemicals to be flushed into the pool before backwash operations divert flows to the waste line.

SURGE DELAY In many installations, events other than backwash operations can cause momentary fluctuations in the pressure at the inlet to the filter system. It is undesirable to have these fluctuations inadvertently initiate a backwash operation. If a pressure sensor is used, the FilterMinder averages readings from this sensor over a 10 second interval to prevent wild fluctuation of the displayed value. In addition to this averaging, the system can be configured to verify that the inlet pressure remains above the selected backwash trip pressure for an extended period of time before the decision to backwash is made. This period of time is called the **SURGE DELAY** and has values ranging from 0 to 180 seconds.

NUMBER OF FILTERS The FilterMinder can be configured to manage systems containing from 1 to 3 filters.

VALVE SHIFT MODE Most diaphragm actuated valves can be shifted while the circulation pumps are running but many operators prefer to shut the pump off while shifting valves to reduce stresses on the system (and noise). Other operators don't like to cycle the pumps any more than necessary and wish to leave them on while shifting valves. The **VALVE SHIFT MODE** allows the user to configure FilterMinder to do either. If the **TURN PUMP OFF** mode is selected, the pump relay is de-energized each time a valve is moved and remains off for the duration of the **VALVE SHIFT DELAY** before coming back on. If the **LEAVE PUMP ON** mode is selected, the pump relay remains energized all of the time. Regardless of which **VALVE SHIFT MODE** is selected, the heater relay is always de-energized and the system waits for a **COOL DOWN** period before moving any valves at the start of a backwash cycle and the heater relay remains off until all valves have returned to their normal Filter position.

SYSTEM STATUS

This screen allows the user to manipulate the state of the output relays and to see the states of the LOCK/UNLOCK switches. If your system is equipped with a rotary stager valve, the Valve 1 output is used to energize/de-energize the stager valve motor. When energized, you should be able to see the states of the CAM and HOME microswitches change as the motor rotates. Valve 1, Valve 2 and Valve 3 can be opened and closed from this screen. The pump and heater relays can be manipulated from the PUMP/HEAT CONTROL screen and are not included here.

FIELD WIRING DETAILS

All field wiring connections to the FilterMinder are made to screw terminals inside the enclosure. Wires should be routed through the two cable glands on the bottom of the enclosure and the clamping nuts should be tightened to 16 in-lbs. to effect a water tight seal around the wires. If possible, run all low voltage wiring through one gland (24VAC power, pressure sensor and remote interface cable, if used) and all high voltage wiring through the other (pump, heat and aux).

POWER

The FilterMinder is supplied with a cube style plug-in transformer that is rated at 120VAC 60 Hz input at 0.50A maximum. The output of this transformer is rated at 24VAC with 50VA maximum. If desired, an alternate supply may be substituted, but the supply must be U.L. Class 2 rated. The output terminals of this transformer should be connected to the two euro style clamping terminal contacts pointed to by arrow 1 in Figure 3 and identified as terminals 7 and 8 on the terminal block. Polarity is not important. If wire other than that supplied with the FilterMinder is used, strip the wire 5/16". Loosen the terminal screw until some resistance is felt indicating that the clamping mechanism is completely open. Install the stripped wire end into the terminal until it stops. The terminal should then be tightened to a torque of 56 in-oz. to secure the wire.

PRESSURE SENSOR

The FilterMinder comes with a differential pressure sensor installed on the bottom of the case. The filter inlet should be plumbed to the port on the left and the filter outlet should be plumbed to the port on the right. This sensor has been pre-wired to the terminals identified by arrow 2 in Figure 3 and marked as Com, Sensor and +5 VDC on the Wiring Label inside the case. If using an external trigger to initiate backwash operations, this sensor should be disconnected and the dry contacts of the external trigger wired between the Sensor and +5 VDC terminals. Tighten these terminals to 56 in-oz. Either an external switch or the pressure sensor can be used, but both cannot be connected at the same time. Attempts to do so will permanently damage the pressure sensor.

PUMP AND HEATER

The relay identified by arrow 3 in Figure 3 is for controlling the pool Heater. The relay identified by arrow 4 is for controlling the main circulation Pump. These relays are energized when the controller wishes to have the attached device running. Select the NO or NC relay contacts as appropriate for your particular installation requirements. For example, when the FilterMinder wishes to have the pool's main circulation pump running, it will energize the Pump relay and an electrical connection will be made between the two bottom screw terminals of this relay socket (see section on RELAY CONTACTS).

VALVE 1, VALVE 2, VALVE 3

The terminals identified by arrow 5 in Figure 3 are for controlling backwash valve actuators. These terminals are in pairs with the left terminal of the pair providing 24 VAC power (always) and the right terminal of the pair connecting this circuit to AC Common when active. A 24 VAC solenoid coil or relay coil can be connected between these two terminals and the solenoid or relay will be activated when the associated red LED under the display is illuminated. A maximum load of 300 MA (7 VA) can be powered from each of these terminal pairs.

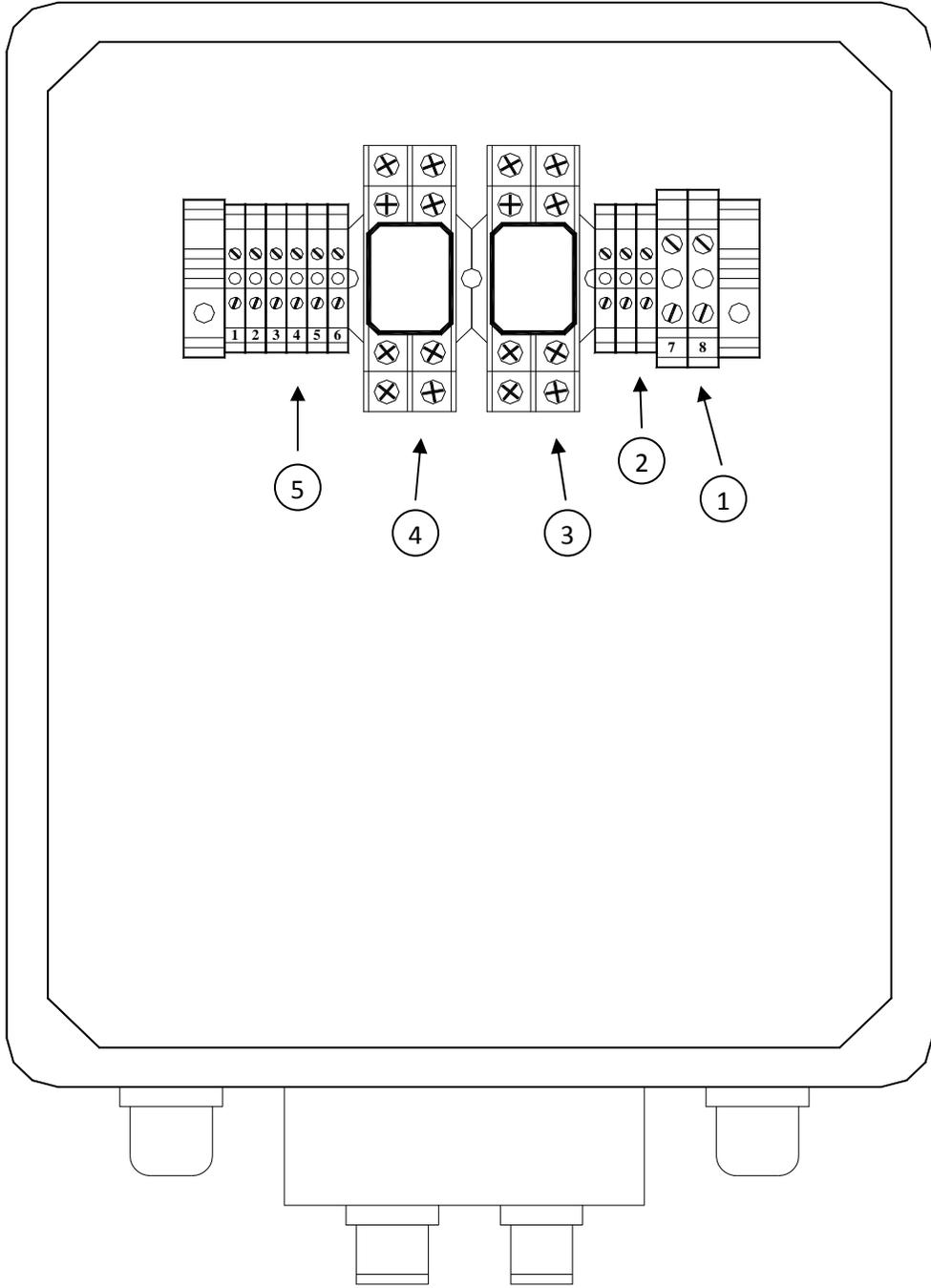


Figure 3

RELAY CONTACTS

Each relay contains two Form C contacts (both NO and NC poles available) rated at 10A 240VAC pure resistive load each contact.

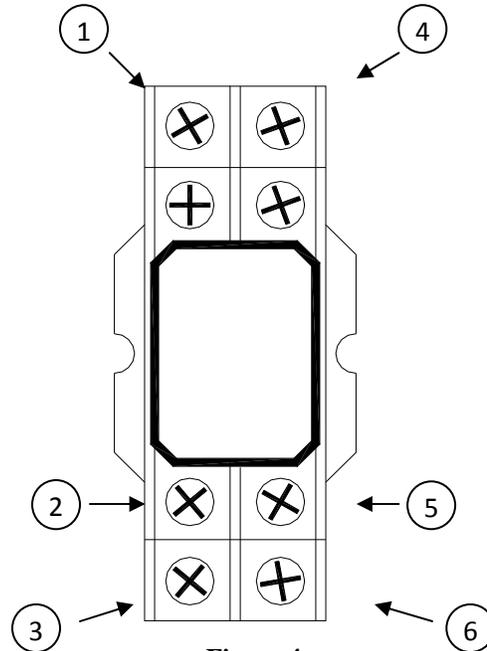


Figure 4

For section A of this relay, the terminal identified as item 1 in figure 4 is the Common contact, the terminal identified as item 2 is the Normally Closed (NC) contact and the terminal identified as item 3 is the Normally Open (NO) contact.

For section B of this relay, the terminal identified as item 4 is the Common contact, the terminal identified as item 5 is the Normally Closed (NC) contact and the terminal identified as item 6 is the Normally Open (NO) contact.

The relays come pre-wired with the two Common terminals (marked 1 and 4 above) connected to each other with a jumper. In this configuration, the relay can be used as a single Normally Closed switch by connecting the load in series with terminals marked 2 and 5 above, or as a single Normally Open switch by connecting the load in series with the terminals marked 3 and 6 above.

As an alternative, this jumper may be removed and a jumper placed from the Common contact of the relay to the terminal marked Hot (terminal 8) on the terminal strip. The relay now will source 24 VAC out of the NC contact when de-energized and out of the NO contact when energized.

These terminals are clamping style connectors. Strip the wire 5/16". Loosen the terminal screw sufficiently to open the clamping mechanism and provide clearance for the wire. Insert the wire until it stops against the back of the terminal. Clamp the wire by tightening the terminal screw to 10 in. lbs.

System Hardware Specifications

Electrical Specifications

Input Power:	Outlet Mounted Transformer Input: 120 VAC 60 Hz 0.50 Watts Max. Output: 24VAC 50VA UL Class 2 rated
Valve Outputs:	24 VAC, 300 MA each output. Power is Sourced continuously from terminals 1, 3 and 5 And returns are sunked to Com when energized
Relay Contacts:	10A 250/120 VAC or 30 VDC resistive, 7A 250/120 VAC or 30 VDC general purpose, 1/6 HP at 120 VAC or 1/3 HP at 240 VAC Normally Open and Normally Closed contacts are both available.
Pressure Sensors:	0 – 50 PSI Differential 100 PSI maximum pressure.

Environmental Specifications

Temperature:	0 to 50 Degrees C (32 to 122 Degrees F) Operating.
Humidity:	0% to 90% Relative Humidity (non-condensing)
Enclosure Sealing:	NEMA 4 (Hose Down) with access door closed.