

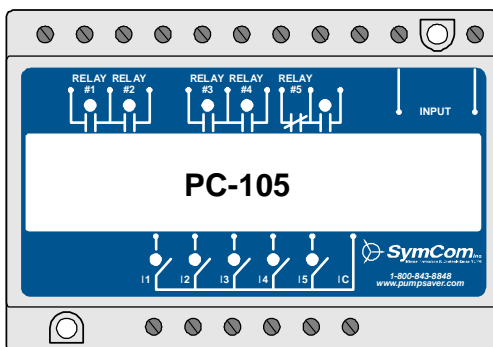
**BE SURE POWER IS DISCONNECTED PRIOR TO INSTALLATION!  
FOLLOW NATIONAL, STATE AND LOCAL CODES.  
READ THESE INSTRUCTIONS ENTIRELY BEFORE INSTALLATION.**

### **! WARNING !**

**UNEXPECTED OUTPUT ACTION CAN OCCUR .  
Use hard-wired safety interlocks where personnel and/or equipment hazards exist.  
Failure to follow this instruction can result in death, injury or equipment damage.**

## INTRODUCTION

The PumpControl™ Model PC-105 is a five-channel pump controller that can handle multiple pump applications or operate as a 5-channel switch. The PC-105 can indicate low, high and out-of-sequence alarms and use alternating pump control, non-alternating pump control, or alternating control with one non-alternating pump. The non-alternating pump can be used as either a jockey or emergency pump and can optionally be cycled once every 50 cycles of the lead pump to keep it working freely. Using the built-in DIP switches, individual pumps can be disabled when taken out of service for repair or maintenance.



The PC-105 has the following features and capabilities:

- 4 High, low and out-of-sequence alarms
- 4 Variable time delay/lag pump delay
- 4 Separate pump stop
- 4 Pump alternation with or without a non-alternating pump
- 4 Jockey or emergency pump
- 4 Duplex, triplex or quadplex pump modes
- 4 Pump-up or pump-down functions
- 4 External silence, reset and alternation configuration
- 4 Five-channel relay



# QUICK START

The PC-105 can operate as a pump controller for eight different pumping configurations. Duplex, triplex, quadplex and duplex SPS (separate pump stop) pumping modes are possible for either pump-up or pump-down applications. Refer to page 18 for the full description of five-channel relay operation.

Refer to **PUMPING MODES** (page 4) for details of PC-105 features and mode descriptions.

1. If you know the system's pump configuration, follow Table 1 to the page showing the typical wiring diagram and setup for each mode.
2. If further description is needed in choosing which mode to use, see Table 2 and Table 3 to view the capabilities of each pumping mode and look at the typical wiring diagrams of the eight different pumping modes starting on page 8.
3. Once the desired configuration is determined, punch out and slide the correct card into the slot on the front of the PC-105 to display the input and output connections.

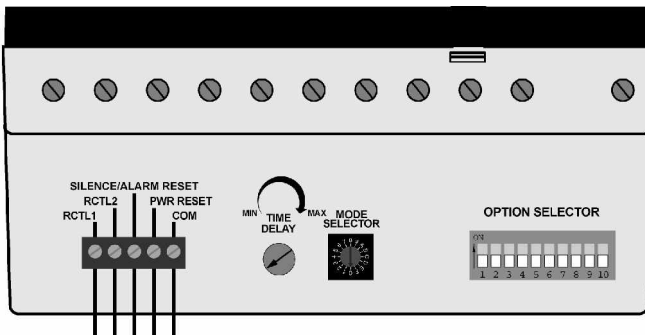
Mode Selector Switch	Mode Description	Page
0	5-Channel Relay – Mode 0	19
1	Duplex Pump-Down – Mode 1	8
2	Triplex Pump-Down – Mode 2	9
3	Quadplex Pump-Down – Mode 3	10
4	Duplex SPS Pump-Down – Mode 4	11
5	Duplex Pump-Up – Mode 5	12
6	Triplex Pump-Up – Mode 6	13
7	Quadplex Pump-Up – Mode 7	14
8	Duplex SPS Pump-Up – Mode 8	15

**Table 1: Mode Selector Switch Details**

## Model Description

The PC-105 has three adjustable controls to set the mode of operation:

1. Mode Selector
2. Option Selector
3. Time Delay



**To ensure proper initialization and operation, set the mode and option selectors before applying power to the unit.**

## Time Delay

The time delay can be set from 2–255 seconds and is the delay before the lag pump will turn on in each of the pumping modes. When the lead float closes (direct logic), the time delay starts and when it expires, the lag pump is ready to turn on or will turn on if the lag input is closed (direct logic). All subsequent pumps will turn on as called for after a two-second time delay each.

## Mode Selector

The mode selector switch sets the operation mode. A description of each mode is shown in Table 1. The capabilities of each pumping mode and the non-alternating pump designations are shown in Table 2 below.

	<b>Duplex</b>	<b>Triplex</b>	<b>Quadplex</b>	<b>Duplex SPS</b>
<b># Pumps</b>	2	3	4	2
<b>High alarm</b>	Yes	*Yes	No	**Yes
<b>Low alarm</b>	Yes	*Yes	No	**Yes
<b>Out-of-sequence alarm</b>	Yes	Yes	Yes	Yes
<b># Stop floats</b>	1	1	1	2
<b>Pump direction</b>	Up/Down	Up/Down	Up/Down	Up/Down
<b>Non-alternating start float</b>	Lag 1	Lag 2	Lag 3	N/A
<b>Non-alternation pump</b>	Pump 2	Pump 3	Pump 4	N/A
<b>Alternator</b>	Yes	Yes	Yes	Yes

**Table 2: Mode Capabilities**

\* On a Triplex system, either a High or Low Alarm is available—not both. See Triplex: **High/Low Alarm** (pg. 5) for details.

\*\* Duplex SPS applications typically use High Alarms on Pump-Down systems and Low Alarms on Pump-Up.

## Option Selector

Table 2 describes the Option Selector for all pumping modes.

(A “a” Indicates the function is available for the pump mode)

<b>Option Selector Switch</b>	<b>Function Description</b>	<b>Duplex</b>	<b>Triplex</b>	<b>Quadplex</b>	<b>Duplex SPS (Separate Pump Stop)</b>
1	High alarm	a	*a		a
2	Low alarm	a	*a		a
3	Pump 1	a	a	a	a
4	Pump 2	a	a	a	a
5	Pump 3		a	a	
6	Pump 4			a	
7	Audible alarm relay logic	a	a	a	a
8	<b>ALS-0</b> – Alternator select 0 (see Table 4)	a	a	a	a
9	<b>ALS-1</b> – Alternator select 1 (see Table 4)	a	a	a	a
10	<b>ALS-2</b> – Alternator select 2 (see Table 4)	a	a	a	a

**Table 3: Option Selector Switch Details**

\* On a Triplex system, either a high or low alarm can be utilized—not both. See Triplex: **High/Low Alarm** (page 4) for details.

## PUMPING MODES

**Duplex** – two pumps with one stop float, a high alarm and a low alarm.

**Triplex: High/Low Alarm** – three pumps with one stop float and a high or low alarm.

**Triplex Pump-Down:** a high alarm is typically used—Option Selector: 1=ON, 2=OFF.

If a low alarm is preferred, the alarm float must be moved to the location in the tank below the Stop Float—Option Selector: 1=OFF and 2=ON.

**Triplex Pump-Up:** a low alarm is typically used—Option Selector: 1=OFF, 2=ON.

If a high alarm is preferred, the alarm float must be moved to the location in the tank above the Stop Float—Option Selector: 1=ON and 2=OFF.

**Quadplex** – four pumps with one stop float and no alarms floats.

**Separate Pump Stop (SPS)** – two pumps, two stop floats, and a high or low alarm.

In **Duplex SPS** mode, both the lead and lag pumps have their own stop floats.

**Duplex SPS Pump-Down:** a high alarm is typically used—Option Selector: 1=ON, 2=OFF.

If a low alarm is preferred, the alarm float must be moved to the location in the tank below the Lead Stop Float—Option Selector: 1=OFF, 2=ON.

**Duplex SPS Pump-Up:** a low alarm is typically used—Option Selector: 1=OFF, 2=ON.

If a high alarm is preferred, the alarm float must be moved to the location in the tank above the Lead Stop Float—Option Selector: 1=ON, 2=OFF.

## PC-105 FUNCTIONS

### **High Alarm**

The High Alarm relay is activated when the High Alarm Float closes, indicating the pumps are unable to keep the water level down on a pump-down application. If the High Alarm Float closes at any time, all pumps will turn on, bypassing the 10-second out-of-sequence trip delay, and the adjustable Time Delay.

If a high alarm is used on a pump-up application, the alarm will be activated when the High Alarm Float closes indicating the water level has been pumped too high, possibly due to a defective Stop Float, and will turn off all pumps.

During a high or low alarm, the Alarm LED and Audible Alarm LED will be on. If the high or low alarm condition ends, the Audible Alarm will turn off and the Alarm LED will flash indicating the alarm had occurred, but is not present now. If the high or low alarm occurs again, the Audible Alarm LED will turn on again, but the Alarm LED will remain flashing. The unit must be silenced or reset to clear the flashing alarm LEDs.

### **Low Alarm**

The Low Alarm relay is activated when the Low Alarm Float opens indicating the pumps are unable to keep the water level up on a pump-up application. If the pump-up Low Alarm Float opens at any time, except if a High Alarm is activated, all pumps will turn on.

If a low alarm is used on a pump-down application, the alarm will be activated when the Low Alarm Float opens indicating the water level has been pumped too low. This may be a result of a defective stop float. The low alarm will not turn off the pumps though, but will activate the low alarm relay—another form of pump-dry protection such as the SymCom Model 777 may be necessary.

## **Out-of-Sequence Alarm**

When a float in the series does not open or close in sequence, the Audible Alarm relay will be activated and input LED(s) will flash until the unit is reset or power is cycled. An out-of-sequence condition has to exist for 10 seconds before the PC-105 will alarm. When the stop float fails open in pump-down mode or closed in pump-up mode, an out-of-sequence alarm will not occur and pumps will not turn on with floats. In this case, all pumps will turn on when the High/Low Alarm input is activated. Thus, in Quadplex mode, pumps will never turn on if the Stop Float malfunctions.

## **Audible Alarm**

The Audible Alarm relay is activated when a high, low or out-of-sequence alarm occurs. The Audible Alarm will turn off when there is no longer high or low alarms or if the unit is silenced.

## **Audible Alarm Logic / Fail-Safe**

The Audible Alarm relay can be configured to operate in either fail-safe mode (switch 7=ON), or non fail-safe mode (switch 7=OFF). In fail-safe mode, the N.C. (normally closed) contacts will be open during normal operation and closed during an alarm. In non-fail-safe mode, the N.C. contacts will be closed during normal operation and open during an alarm.

## **Clearing Alarms**

The external Silence / Alarm Reset button will clear the Audible Alarm. The Reset button or cycling power will clear out-of-sequence alarms.

## **Alternation**

The PC-105 is equipped with a built-in alternator that determines which pump will start each pumping cycle. This alternator is configured using switches ALS-0, ALS-1 and ALS-2 (switches 8, 9 and 10 of the Option Selector).

<b>Function</b>	<b>ALS-0 (8)</b>	<b>ALS-1 (9)</b>	<b>ALS-2 (10)</b>
Alternation On	ON	ON	ON
Alternation On	OFF	ON	ON
Alternation On, Non-Alternating Pump Enabled (1)	*ON	OFF	OFF
Alternation On, Non-Alternating Pump Enabled (1)	**OFF	OFF	OFF
Alternation Off, Force Pump 1 as Lead	OFF	ON	OFF
Alternation Off, Force Pump 2 as Lead	OFF	OFF	ON
Alternation Off, Force Pump 3 as Lead (2)	ON	ON	OFF
Alternation Off, Force Pump 4 as Lead (3)	ON	OFF	ON

**Table 4: Alternator Options**

Note (1) In Duplex Mode, this setting is the same as Alternation On.

Note (2) In Duplex Mode, Pump 1 is the Lead Pump and Pump 2 will be cycled every 50 cycles of the Lead.

Note (3) In Duplex Mode, Pump 2 is the Lead Pump and Pump 1 will be cycled every 50 cycles of the Lead.

\* If ALS-0 is ON in this mode, the Non-Alternating Pump will cycle when the non-alternating float changes state, or after 50 cycles of the Lead float.

\*\* If ALS-0 is OFF the Non-Alternating Pump will cycle only when the non-alternating float changes state.

## Alternation On

When the alternator is on, each pump will be alternated as the Lead Pump (see Table 5).

	<b>Cycle 1</b>	<b>Cycle 2</b>	<b>Cycle 3</b>	<b>Cycle 4</b>	<b>Cycle 5</b>
<b>Pump 1</b>	Lead	Lag 3	Lag 2	Lag 1	Lead
<b>Pump 2</b>	Lag 1	Lead	Lag 3	Lag 2	Lag 1
<b>Pump 3</b>	Lag 2	Lag 1	Lead	Lag 3	Lag 2
<b>Pump 4</b>	Lag 3	Lag 2	Lag 1	Lead	Lag 3

**Table 5. Pump Sequence**

## Alternation On, Non-Alternating Pump Enabled

The Triplex and Quadplex pump modes are equipped with an optional Non-Alternating Pump. This pump will **not** be included in the normal pump alternation sequence when ALS-1 and ALS-2 (switches 9 and 10) are both OFF. If ALS-0 (switch 8) is ON, the non-alternating pump will cycle when the Non-Alternating Float changes state or after every 50 cycles of the Lead Float. If ALS-0 is OFF, the non-alternating pump will only cycle if the non-alternating float changes state.

The last pump in the float sequence (highest #) is the non-alternating pump and can be used as either a jockey or emergency pump. (See Table 2, page 3 for non-alternating pump and float details for each pumping mode.)

A **Jockey Pump** is typically a smaller pump that will always be used first in the pump sequence. In order to implement a jockey pump, the non-alternating pump float must be moved in the tank to just above the Stop Float on a pump-down system, and to just below the Stop Float on a pump-up system. See

Figure 9 (page 16)—an example wiring diagram using a jockey pump in a duplex pump-down system.

An **Emergency Pump** is usually a larger pump that is always used last. In order to implement an emergency pump, the non-alternating pump is already the last pump in the sequence so there is no need to move the float. See Figure 10 (page 17)—an example wiring diagram using an emergency pump on a duplex pump-down system.

## Alternation Off

When the alternator is off, a Lead Pump can be forced by setting ALS-0, ALS-1 and ALS- 2 (see Table 4). The remaining pumps will start in a sequential order as each float opens/closes.

## Disabling Pumps

Using the built-in DIP switches, individual pumps can be disabled, when taken out of service for repair or maintenance.

## External Inputs

A five-pin connector is provided for optional external inputs.

### - External Silence / Alarm Reset

This input allows for an external N.O. (normally open) pushbutton that will silence audible alarms and clear flashing alarm lights.

### - External Power Reset

This input allows for an external N.O. pushbutton to reset the PC-105, causing the same effect as a power cycle.

### - External Alternation Configuration

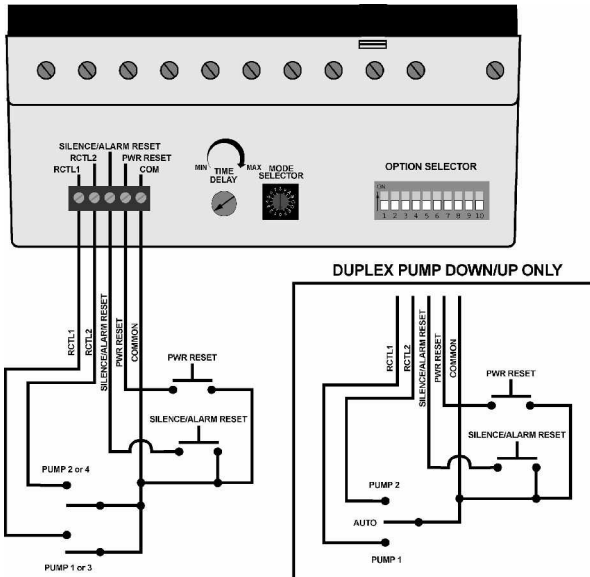
For duplex mode, a SPDT (single-pole, double-throw) switch can be connected to close RTCL1 or RTCL2 (remote controls) to force Pump 1 or 2 as the Lead Pump. Option Selector switches 8, 9 & 10 must be OFF. If the switch is in the middle position, pumps will be in alternation mode.

For triplex and quadplex modes, two SPST (single-pole, single-throw) switches can be connected to force Pump 1, 2, 3 or 4 to be the Lead Pump. Option Selector switches 9 & 10 must be OFF.

To force Pump 1 or 2 as Lead, Option Selector switch 8 must be OFF.

To force Pump 3 or 4 as Lead, Option Selector switch 8 must be ON.

For alternation mode, close both RTCL1 and RTCL2.



# WIRING DIAGRAMS

The following figures, 1-10, show typical wiring diagrams for all available PC-105 pumping modes .

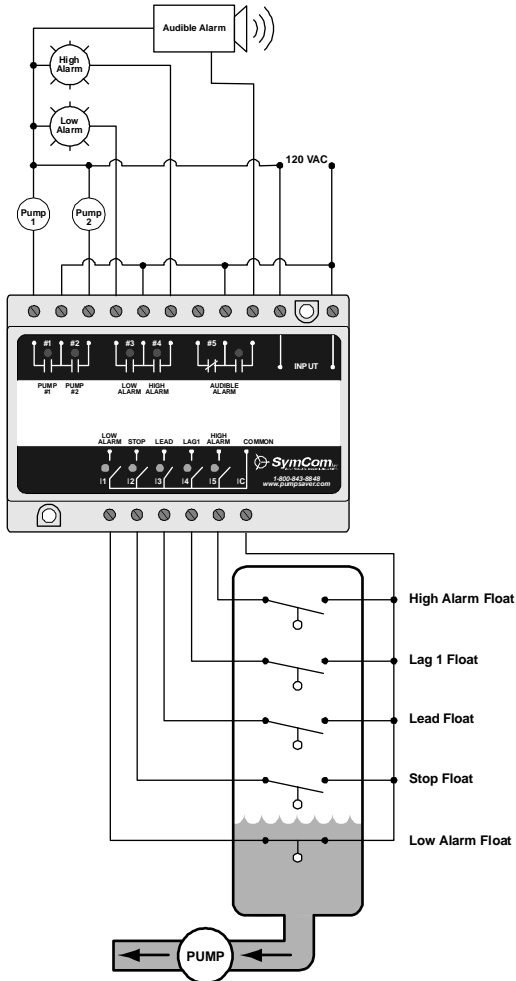


Figure 1: Typical Wiring for Duplex Pump-Down – Mode 1

		Switch State
<b>Mode Selector Switch</b>		1
<b>Time Delay Adjustment</b>		MIN
<b>Option Selector Switch</b>		
1	High Alarm	ON
2	Low Alarm	ON
3	Pump 1	ON
4	Pump 2	ON
5	Pump 3	NA
6	Pump 4	NA
7	Fail-Safe	OFF
8	ALS-0	ON
9	ALS-1	ON
10	ALS-2	ON

Table 6: Typical Duplex Pump-Down System



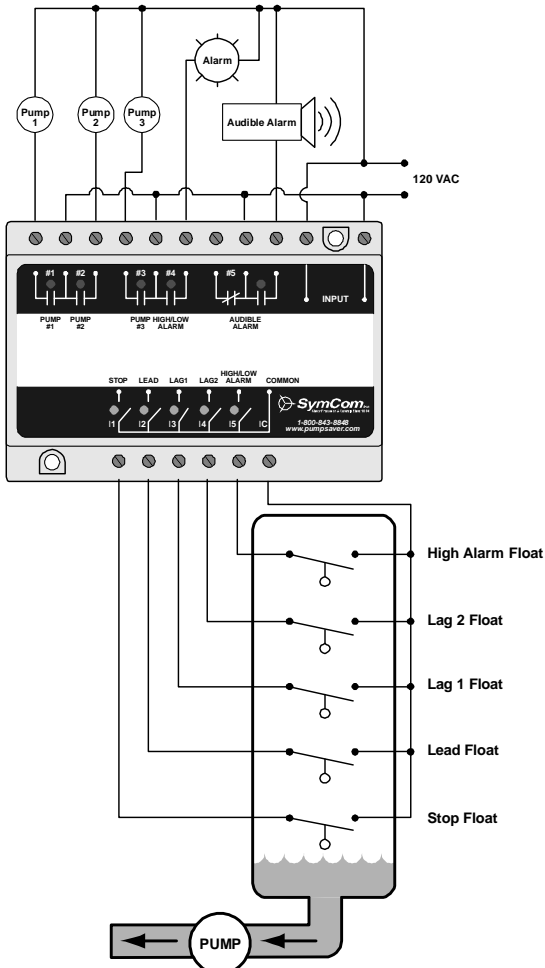


Figure 2: Typical Wiring for Triplex Pump-Down – Mode 2

		Switch State
<b>Mode Selector Switch</b>		2
<b>Time Delay Adjustment</b>		MIN
<b>Option Selector Switch</b>		
1	High Alarm	ON
2	Low Alarm	OFF
3	Pump 1	ON
4	Pump 2	ON
5	Pump 3	ON
6	Pump 4	NA
7	Fail-Safe	OFF
8	ALS-0	ON
9	ALS-1	ON
10	ALS-2	ON

Table 7: Typical Triplex Pump-Down System

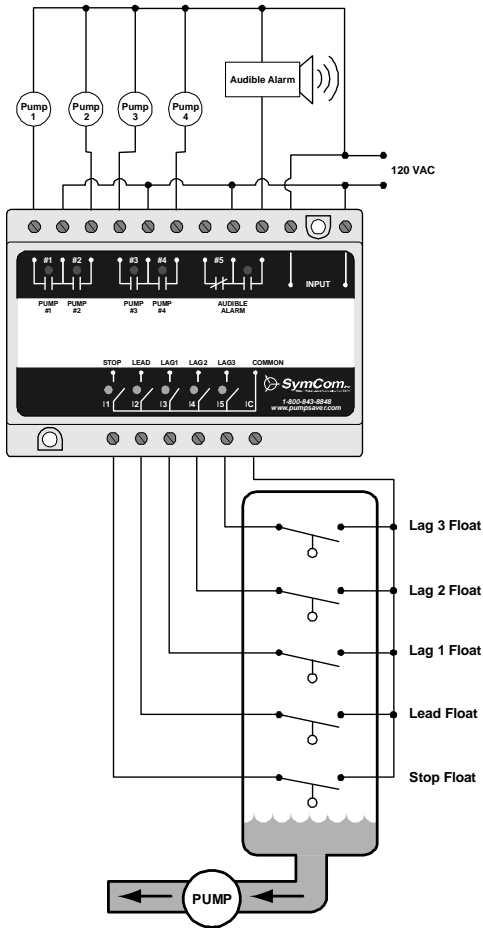


Figure 3: Typical Wiring for Quadplex Pump-Down – Mode 3

		Switch State
Mode Selector Switch		3
Time Delay Adjustment		MIN
Option Selector Switch		
1	High Alarm	NA
2	Low Alarm	NA
3	Pump 1	ON
4	Pump 2	ON
5	Pump 3	ON
6	Pump 4	ON
7	Fail-Safe	OFF
8	ALS-0	ON
9	ALS-1	ON
10	ALS-2	ON

Table 8: Typical Quadplex Pump-Down System

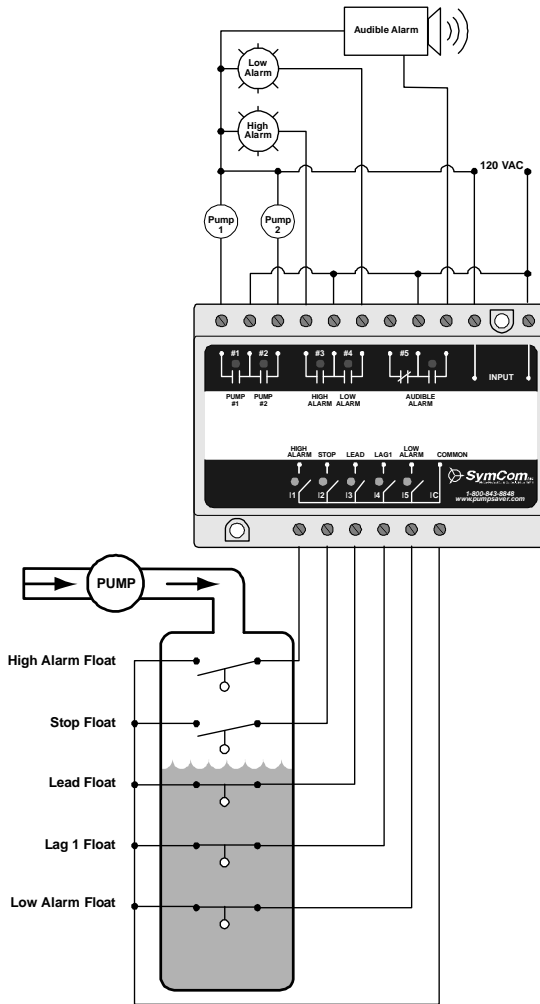


Figure 4: Typical Wiring for Duplex SPS Pump-Down – Mode 4

		Switch State
<b>Mode Selector Switch</b>		4
<b>Time Delay Adjustment</b>		MIN
<b>Option Selector Switch</b>		
1	High Alarm	ON
2	Low Alarm	OFF
3	Pump 1	ON
4	Pump 2	ON
5	Pump 3	NA
6	Pump 4	NA
7	Fail-Safe	OFF
8	ALS-0	ON
9	ALS-1	ON
10	ALS-2	ON

Table 9: Typical Duplex SPS Pump-Down System

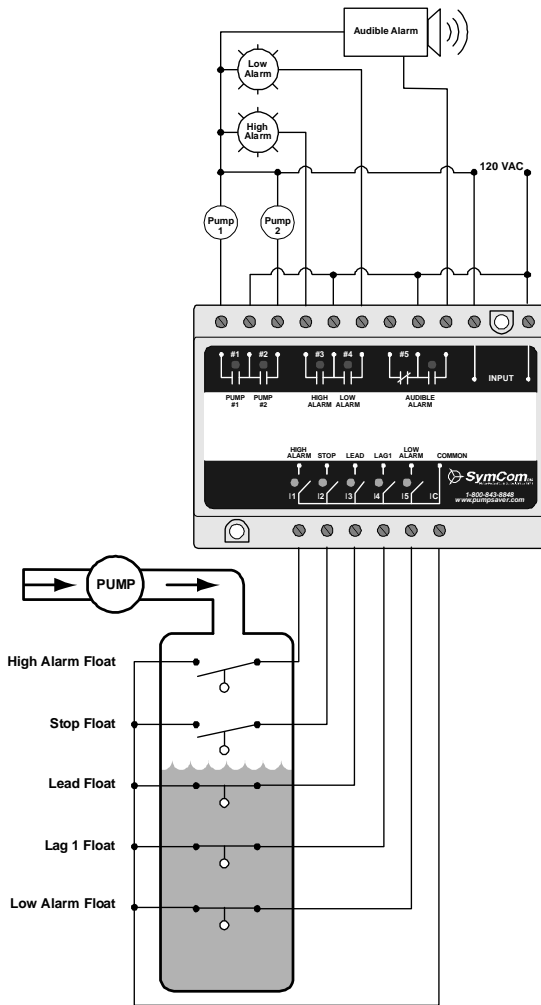


Figure 5: Typical Wiring for Duplex Pump-Up – Mode 5

		Switch State
<b>Mode Selector Switch</b>		5
<b>Time Delay Adjustment</b>		MIN
<b>Option Selector Switch</b>		
1	High Alarm	ON
2	Low Alarm	ON
3	Pump 1	ON
4	Pump 2	ON
5	Pump 3	NA
6	Pump 4	NA
7	Fail-Safe	OFF
8	ALS-0	ON
9	ALS-1	ON
10	ALS-2	ON

Table 10: Typical Duplex Pump-Up System

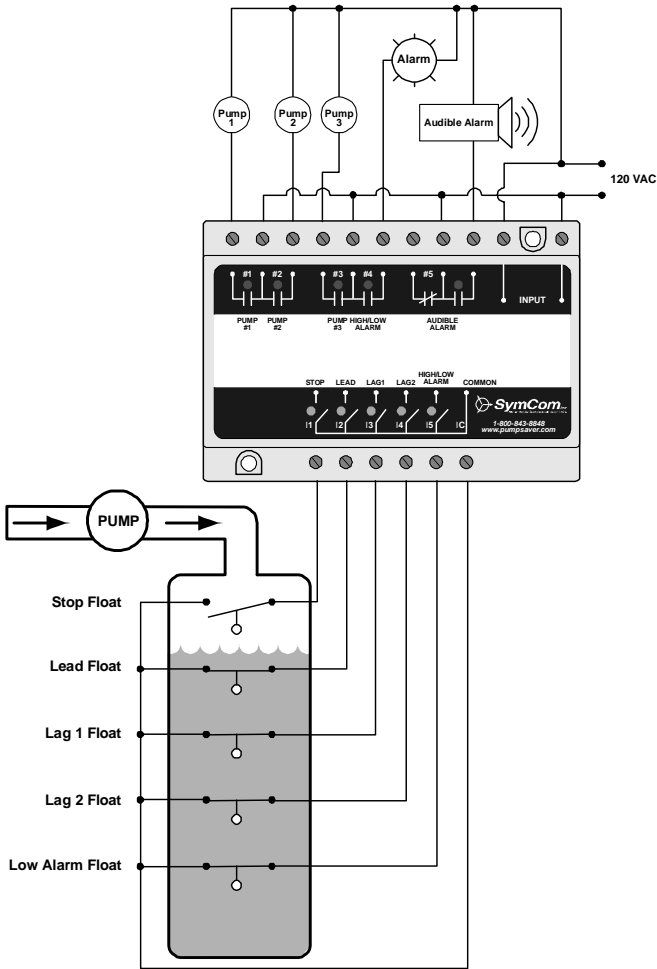


Figure 6: Typical Wiring for Triplex Pump-Up - Mode 6

		Switch State
<b>Mode Selector Switch</b>		6
<b>Time Delay Adjustment</b>		MIN
<b>Option Selector Switch</b>		
1	High Alarm	OFF
2	Low Alarm	ON
3	Pump 1	ON
4	Pump 2	ON
5	Pump 3	ON
6	Pump 4	NA
7	Fail-Safe	OFF
8	ALS-0	ON
9	ALS-1	ON
10	ALS-2	ON

Table 11: Typical Triplex Pump-Up System

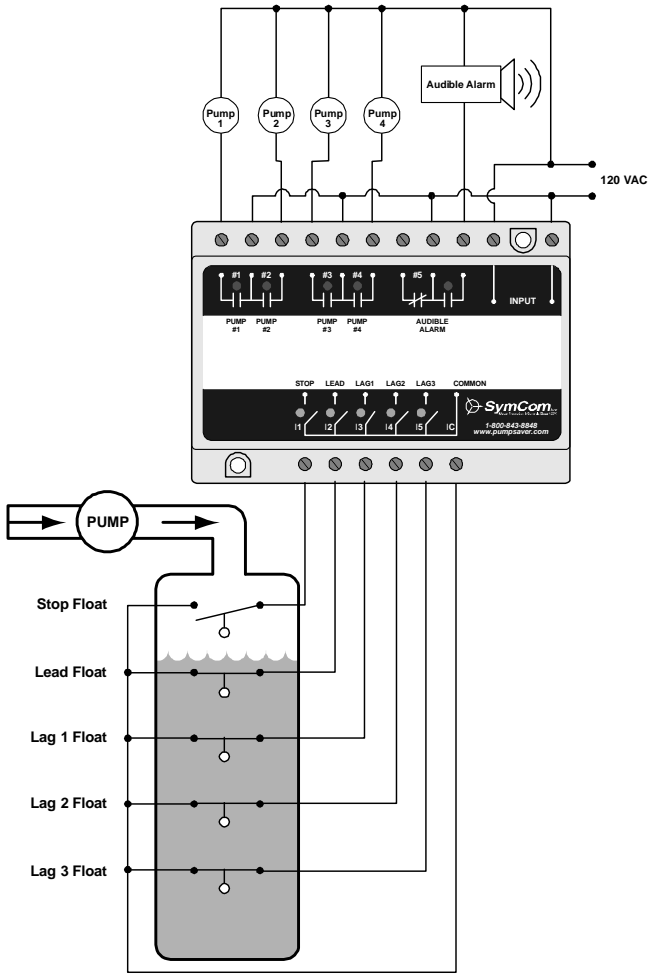


Figure 7: Typical Wiring for Quadplex Pump-Up – Mode 7

<b>Mode Selector Switch</b>		7
<b>Time Delay Adjustment</b>		MIN
<b>Option Selector Switch</b>		
1	High Alarm	NA
2	Low Alarm	NA
3	Pump 1	ON
4	Pump 2	ON
5	Pump 3	ON
6	Pump 4	ON
7	Fail-Safe	OFF
8	ALS-0	ON
9	ALS-1	ON
10	ALS-2	ON

Table 12: Typical Quadplex Pump-Up System

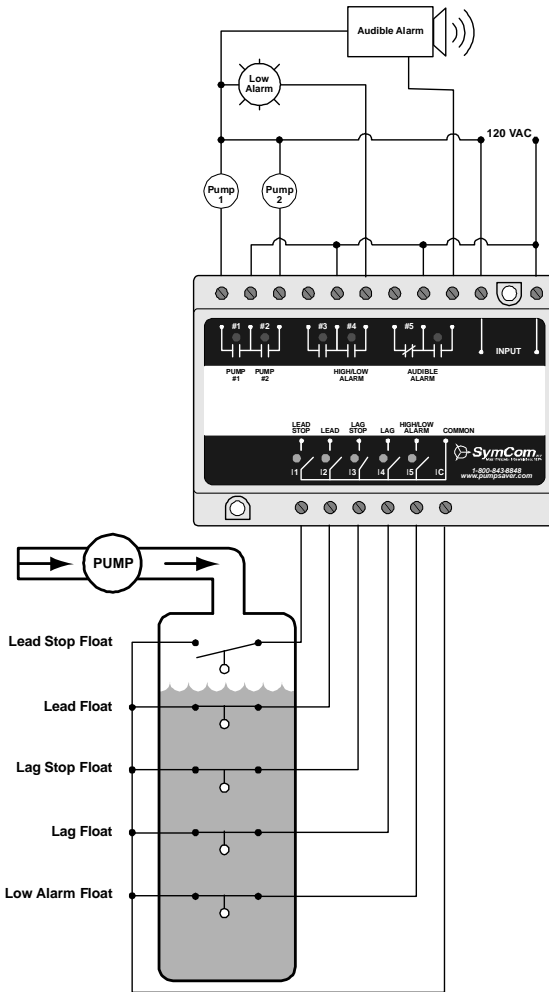


Figure 8: Typical Wiring for Duplex SPS Pump-Up – Mode 8

		Switch State
<b>Mode Selector Switch</b>		8
<b>Time Delay Adjustment</b>		MIN
<b>Option Selector Switch</b>		
1	High Alarm	OFF
2	Low Alarm	ON
3	Pump 1	ON
4	Pump 2	ON
5	Pump 3	NA
6	Pump 4	NA
7	Fail-Safe	OFF
8	ALS-0	ON
9	ALS-1	ON
10	ALS-2	ON

Table 13: Typical Duplex SPS Pump-Up System

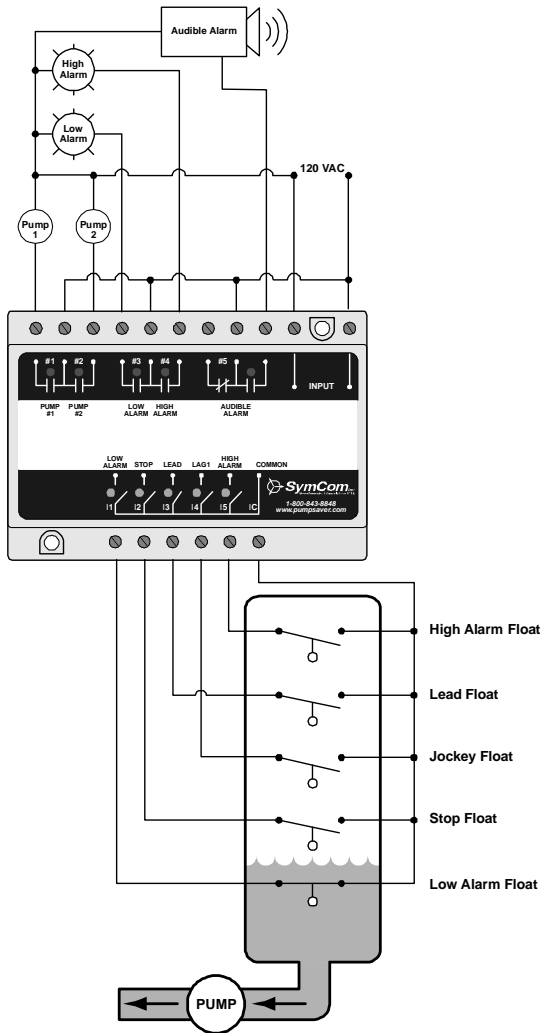


Figure 9: Typical Wiring for Duplex Pump-Down with Jockey Pump – Mode 1

		Switch State
Mode Selector Switch		1
Time Delay Adjustment		MIN
Option Selector Switch		
1	High Alarm	ON
2	Low Alarm	ON
3	Pump 1	ON
4	Pump 2	ON
5	Pump 3	NA
6	Pump 4	NA
7	Fail-Safe	OFF
8	ALS-0	OFF
9	ALS-1	ON
10	ALS-2	OFF

Table 14: Typical Duplex Pump-Down System with Jockey Pump



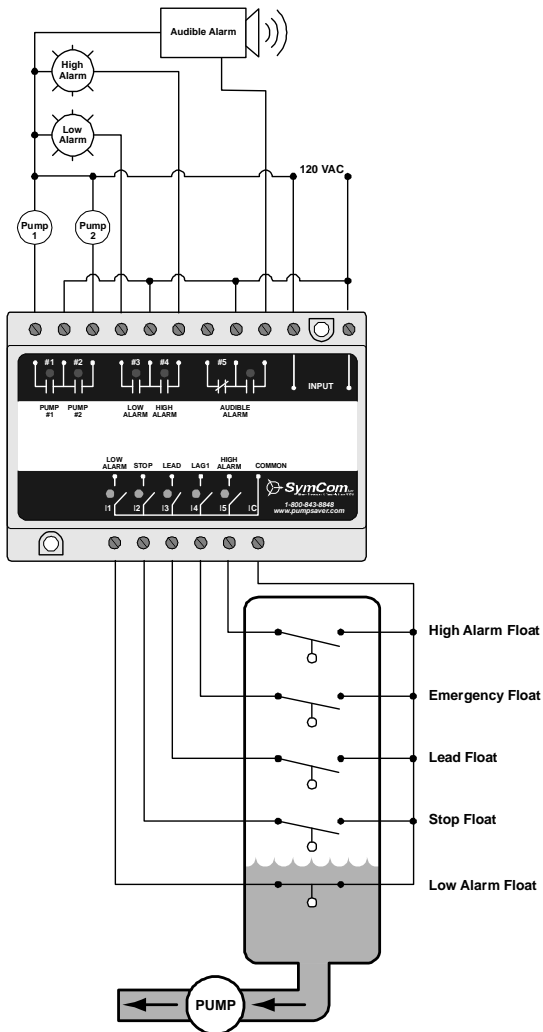


Figure 10: Typical Wiring for Duplex Pump-Down with Emergency Pump – Mode 1

		Switch State
<b>Mode Selector Switch</b>		1
<b>Time Delay Adjustment</b>		MIN
<b>Option Selector Switch</b>		
1	High Alarm	ON
2	Low Alarm	ON
3	Pump 1	ON
4	Pump 2	ON
5	Pump 3	NA
6	Pump 4	NA
7	Fail-Safe	OFF
8	ALS-0	OFF
9	ALS-1	OFF
10	ALS-2	ON

Table 15: Typical Duplex Pump-Down System with Jockey Pump

# FIVE-CHANNEL RELAY MODE

Some unique features of the five-channel relay mode are described below.

To use the PC-105 in this mode, the Mode Selector dial must be set to 0.

Option Selector Switch	Function Description	ON Function	OFF Function
1	Enables Channel 2 Latch	Channel 1 and 2 function normally	Channel 1 Latches Channel 2
2	Enables Channel 4 Latch	Channel 3 and 4 function normally	Channel 3 Latches Channel 4
3	Relay 1 Logic	Positive	Negative
4	Relay 2 Logic	Positive	Negative
5	Relay 3 Logic	Positive	Negative
6	Relay 4 Logic	Positive	Negative
7	Relay 5 Logic	Positive	Negative
8	Selects Make/Break	Delay-On-Break	Delay-On-Make
9	Enables Delay-On-Make/Break Timer	Make/Break Timer Disabled	Make/Break Timer Enabled
10	Not Used	-----	-----

Table 16: Five-Channel Relay Options

## Positive/Negative Logic

Using **positive logic** will give the same output as input—if the input is closed, the corresponding output relay is closed.

If using **negative logic**, the output will be the opposite of the input—if the input is closed, the output relay is open.

## Latched Output

Relays 2 and 4 can be configured as latched relays. Input 2 will cause relay 2 to close, but this relay will not open until input 1 opens. Relay 4 will close when input 4 closes, but will not open until input 3 opens.

## Time Delay Output

Relay 5 can be configured as a Delay-On-Make or a Delay-On-Break time delay output. All timing starts when the input switch opens or closes. The time base for this output is adjustable using the Time Delay knob and ranges from 2-255 seconds.

### **Delay-On-Make**

If Input 5 closes, the Time Delay will start and LED 5 will flash. Once the time delay has expired, output relay 5 will close and the LED will be on. If Input 5 opens at any point during the timing cycle, the time delay stops and output relay 5 remains open.

### **Delay-On-Break**

If input 5 opens, the time delay will start and LED 5 will flash. Once the time delay has expired, output relay 5 will open and the LED will be off. If input 5 closes at any point during the timing cycle, the time delay stops and output relay 5 remains closed.

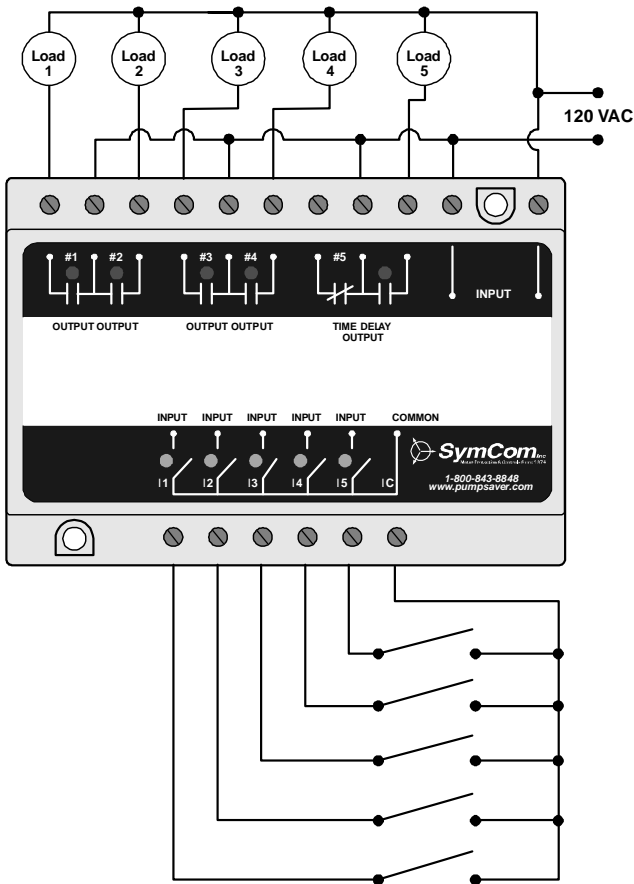


Figure 11: Typical Wiring for 5-channel Relay – Mode 0

SymCom warrants its microcontroller-based products against defects in material or workmanship for a period of five (5) years from the date of manufacture. All other products manufactured by SymCom shall be warranted against defects in material and workmanship for a period of two (2) years from the date of manufacture. For complete information on warranty, liability, terms, returns, and cancellations, please refer to the SymCom Terms and Conditions of Sale document.

## Model PC-105 Specifications

<b>Control Voltage</b>	108–132VAC
<b>Frequency</b>	50/60 Hz
<b>Power</b>	4 Watts (max.)
<b>Adjustments</b>	
Time delay/lag pump delay	2–255 sec.
Mode Selector	0–8 (9–F: force mode 0)
Option Selector	1–10, ON/OFF
Silence button	dry input only
Reset button	dry input only
External alternation configuration	ALS-1
External alternation configuration	ALS-2
<b>Pumping modes available</b>	
Duplex pump-down	2 pumps with high and low alarms
Triplex pump-down	3 pumps with high alarm (typical)
Quadplex pump-down	4 pumps
Duplex pump-down SPS (separate pump stop)	2 pumps with high alarm (typical) 2 stop floats
Duplex pump-up	2 pumps with high and low alarms
Triplex pump-up	3 pumps with low alarm (typical)
Quadplex pump-up	4 pumps
Duplex pump-up SPS (separate pump stop)	2 pumps with low alarm (typical) 2 stop floats
<b>5-Channel relay mode</b>	
5-channel	1 relay latched / time delay output
<b>Operating temperature</b>	-20 to 55°C
<b>Terminals</b>	
Wire AWG	12–20 AWG
Torque	6 in.-lbs.
<b>Relay contacts</b>	
	B 300 or 480VA @ 240VAC, Pilot Duty
	240 VAC, 7A (max.), general purpose
<b>Pump inrush delay</b>	2 sec.
<b>Standards passed</b>	
Electrostatic discharge (ESD)	IEC 61000-4-2, Level 3, 6 kv contact, 8 kv air
Radio frequency immunity (RFI)	IEC 61000-4-2, Level 3, 10V/m
Fast transients	IEC 61000-4-4, Level 3, 4 kv input power 2 kv inputs/outputs

