INSTRUCTION MANUAL

autopilot™

Environmental Controllers

APCEPH1 pH CONTROLLER

SPECIFICATIONS	APCEPH1
Input voltage	120 Volts AC
Maximum amperage	14.5 amps @ 120 VAC
pH Accuracy	+/- 0.2 pH
pH Control range	Adjustable 4.5 – 8.5 pH
Weight	< 1 lbs
Dimensions	3" x 6" x 3.5"

BASIC DESCRIPTION

The APCEPH1 has been designed to accurately and reliably measure and control the pH of any aqueous (water-based) solution, including hydroponic nutrient mixtures as well as fish aquariums. It does this by measuring the pH level of the water to be controlled and then it will automatically add pH adjustment (EITHER acid or alkali) to change the liquid's pH to the user's desired level. ***NOTE: Most water solutions will slowly change pH over time in a single direction (either raising OR lowering of the pH).***

The user can select their desired pH setting from 4.5 to 8.5 pH. Many other adjustable settings allow the APCEPH1 to be customized by the user for their specific needs. For best results, read and follow these instructions.

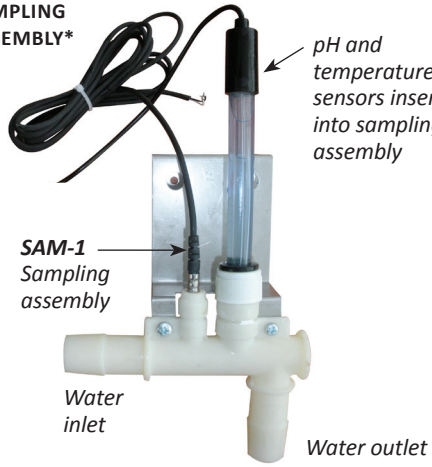
PRINCIPAL OF OPERATION

The APCEPH1 consists of several components. Understanding how these components work together is critical to getting the most from the APCEPH1.

1. **Sensors:** Two sensors are provided with the system, a temperature sensor and a pH sensor. The sensors are connected to an in-line sensor interface cable. The sensors are then inserted into the "sampling assembly".
2. **APCEPH1SK - Sampling assembly** *(optional / sold separately)*: For best results, the sensors should have a constant flow of water to ensure they are accurately measuring the pH and temperature. The sampling assembly holds the two sensors and provides water flow across the sensors to accurately measure the water temperature and pH level.

1. SENSORS

2. SAMPLING ASSEMBLY*



*Sold separately

3. **Circulating pump:** A circulating pump will constantly supply water to the sensor sampling assembly. The pump includes an inlet filter to ensure the sensors do not become fouled. The circulating pump will also provide good aeration of the water while operating.
4. **Dosing pump:** A chemically resistant low-voltage peristaltic pump is used to accurately transfer the pH adjustment liquid (acid or alkali) into the water. The pump comes with a low-volt power supply.
5. **Controller:** The APCEPH1 controller is the "brain" of the system. The sensors and peristaltic pump connect to the controller.

3. SUBMERSIBLE CIRCULATING PUMP*

**Sold separately*

4. PERISTALTIC DOSING PUMP

pH adjustment liquid inlet

pH adjustment liquid outlet

5. CONTROLLER

LCD display

4 simple to operate push buttons

Dosing pump connection

HOW IT WORKS

Although the APCEPH1 may seem complicated, the basic operation of the unit is actually quite simple. The example below describes the operation of the APCEPH1 being used to lower the pH of a water tank / reservoir or aquarium.

Let's assume that the user has selected pH down control with the following settings:

pH = 6.0

dosing time = 10 seconds

mixing time = 2 minutes

pH deadband = 0.2

pH Up or Down = Down

The pH sensor probe constantly measures the pH of the water to be controlled. In this example, when the pH levels rises beyond 6.0 ph, the unit will activate the dosing pump for 10 seconds.

After the dosing pump stops, the mixing timer will start to count down for 2 minutes. The mixing timer is important to allow sufficient time for the pH adjustment acid to completely mix into the water. During the mixing time, the unit is waiting for the water to react to the addition of the pH adjustment liquid.

By adding only a small amount of pH adjustment each dosing "cycle", the pH level can be lowered slowly to the desired level. If too much pH adjustment is added to the water or if the mixing timer is set too low, the pH level could "over-shoot" the desired pH level.

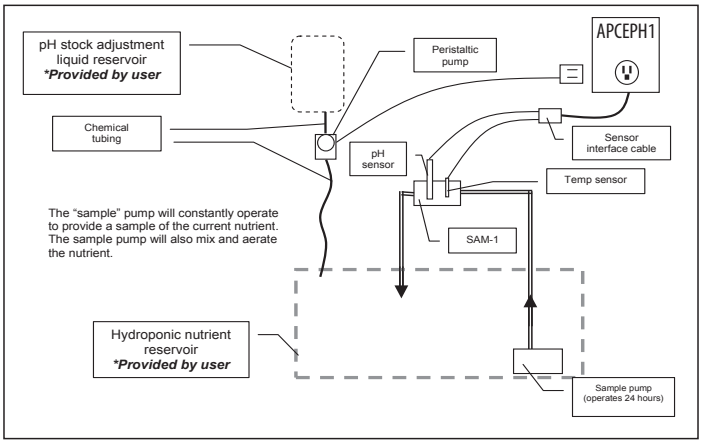
Once the mixing timer counts down to zero, the unit will again measure the pH level and determine if another dose is required (this is where the deadband setting works).

In this example, the pH deadband is set at 0.2 pH. So if the pH sensor detects that the level has dropped from 6.0 to 5.8 or below, no other doses are required and the controller will not activate another dosing cycle. If the unit measures the pH to still be above 5.8 pH, additional pH dosing cycle(s) will continue to occur until the pH level goes down below the pH setting MINUS the deadband setting. (The deadband setting works just the opposite when raising the pH level… pH setting PLUS the deadband).

By adding pH adjustment slowly in small amounts, the pH level will gradually go down to the desired level without "over-shooting" the pH setpoint.

Ideally, the user should start with a low setting for the dose time and a high setting for the mixing time to allow plenty of time for the pH adjustment to stabilize.

If the user has a large quantity of water to be controlled, the dosing and mixing timer settings may need to be increased. Smaller quantities of water can use lower dosing and mixing times.



INSTALLATION

SENSOR ASSEMBLY

1. If you are using the APCEPH1SK sampling assembly, refer to the instructions to install the sensors.
2. If you are not using the APCEPH1SK sampling assembly, connect the probe cables and then secure the probes in the water to be measured.

Using the sampling assembly

Not using the sampling assembly

CIRCULATING PUMP

1. A circulating pump provides a constant flow of water to the sensors. The circulating pump should be connected to a constant power source.
   NOTE: For aquarium use, a filter pump head can be used to provide constant water flow to the sensor assembly.
2. Connect a piece of tubing from your circulating pump to one of the inlets on the sensor assembly (water can flow in either direction through the sampling assembly). The sensor assembly has been designed to mount on the side of the water tank / reservoir or a wall. The return side of the sensor assembly must be positioned so that the water will go back into the water tank / reservoir. A second piece of tubing can be used.
   Note: The inlet filter on the submersible pump should be cleaned frequently to ensure the sensor probes do not become dirty.

DOSING PUMP

1. The dosing pump outlet tubing must be positioned to allow the pH adjustment liquid to enter the water tank/reservoir. The pump is self-priming and will transfer the pH adjustment liquid from the pH adjustment bottle into the water tank/ reservoir. Select a suitable location to secure the dosing pump.
   Note: Ensure you are using the correct pH adjustment (acid or alkali) based on your needs.
2. Once the dosing pump is secured, and the small tubing is securely connected to the pump's inlet and outlet, cut the tubing to the correct length. The inlet side of the tubing must reach into the bottom of the pH adjustment bottle, the outlet side is placed into the water tank / reservoir.
3. The peristaltic dosing pump inlet must be connected to the user's pH liquid adjustment bottle. The simplest way to do this is to drill or punch a small hole in the screw cap of your pH adjustment bottle. Then insert the small diameter chemically resistant tubing though the cap to the bottom of the pH adjustment bottle.

4. To "prime" the pump, plug the pump's power supply cable into a source of power and to the dosing pump. The pump will operate and slowly the pH adjustment liquid will be drawn up to the pump and out of the outlet tubing. Disconnect the dosing pump.

INSTALLATION, *cont.*

CONTROLLER

1. Connect the sensor interface cable to the controller.
2. Connect the pH sensor probe cable to the sensor interface cable.
3. Plug the controller into a source of power away from water.
   NOTE: Do not connect the dosing pump yet.

CHANGING SETTINGS - MENUS

The settings are listed below. When the user touches the MENU button, the LCD will show the user the menu items. If the user does not touch any button for 15 seconds, the LCD will revert back to the standard display.

SETTING	DESCRIPTION	FACTORY SETTING	SETTING RANGE
PH setpoint		6.0	4.5 – 8.5
Dosing time		10	3 – 60 seconds
Mixing time		4	1 – 20 minutes
pH deadband		0.2	0.1 – 0.5
Select pH UP or DOWN	User must select whether they are going to be increasing or decreasing pH.	Down	Up or Down
Maximum # of doses	User can set maximum number of dosing cycles before an error will be activated.	40	25–120 *
Low pH limit	User can select the lowest allowable pH level. If the unit measures the pH level to be under this setting, the unit will shut down and trigger an error.	4.5	3.5 – 7.0 pH
High pH limit	User can select the highest allowable pH level. If the unit measures the pH level to be over this setting, the unit will shut down and trigger an error.	7.5	6.7 – 9.0 pH
Minimum pH recorded	Records lowest measured pH. Press Enter to reset the recorded Min value.	Current value	n/a
Maximum pH recorded	Records lowest measured pH. Press Enter to reset the recorded Max value.	Current value	n/a
Dose count	Counts the number of dosing cycles.	0	n/a
Calibrate 7.0	See *Calibrating the pH Sensor* for details.	7.0	Fixed at 7.0
Calibrate 4.0	See *Calibrating the pH Sensor* for details.	4.0	Fixed at 4.0
F or C display	User can select either C or F for temperature display.	F	C or F

***NOTE: If the pH level does not get to the pH set-point before the maximum dose count is reached, an error will be activated.**

The 4 push buttons on the unit are **UP** / **DOWN** / **Menu** / **Enter**.

- When the user presses the **Menu** button, the first menu item will be displayed.
- Using the **UP** or **DOWN** buttons will scroll through the other menu items that can be customized by the user.
- When the user wants to change a setting, press the **Enter** button and the current setting will be blinking on and off to indicate the setting can be changed.
- Use the **UP** or **DOWN** buttons to change the setting.
- Press the **Enter** button a second time to accept the new setting and store it in memory.

LCD DISPLAY OPERATION

When the unit first powers up, there is a 1 minute “warm-up” period for the sensors to stabilize. During the first one minute of operation, the LCD will display the current measured readings.

T	E	M	P		7	8.	5	F				P	H	6.	0
W	A	R	M		U	P		P	H		T	E	M	P	

After one minute (during normal operation), LCD display will display the following screen:

T	E	M	P		7	8.	5	F				P	H	6.	0
P	H		O	O			P	R	O	B	E	S		O	K

During pH DOWN dosing, the screen will change to display the following (the time setting will be shown on the right side of the LCD display and the timer will count down the remaining time):

T	E	M	P		7	8.	5	F				P	H	6.	0
P	H		D	O	W	N		T	I	M	E			3	0

During pH UP dosing, the screen will change to display the following (the time setting will be shown on the right side of the LCD display and the timer will count down the remaining time):

T	E	M	P		7	8.	5	F				P	H	6.	0
P	H		U	P				T	I	M	E			3	0

During mixing, the screen will change to display the following (the time setting will be shown on the right side of the LCD display and the timer will count down the remaining time):

T	E	M	P		7	8.	5	F				P	H	6.	0
M	I	X	I	N	G		T	I	M	E		1	0	0	0

MANUAL DOSE – TEST

The user can manually test the dosing system by pressing Enter TWO TIMES. After pressing Enter the first time, the display will read: **Press Enter to test dosing.**

Pressing Enter will force the dosing pump to activate. The dosing timer and the mixing timer will cycle one time. When the test is complete, the unit resumes normal operation.

ERROR RESETTING

If an error needs to be reset, holding the Enter button for 3 seconds will reset any fault.

ERROR CODES AND TROUBLE-SHOOTING

There are several error conditions that the unit will monitor. If an error is detected, the unit will alert the user to a problem. If there is an error detected, the backlit LCD display will be flashing on and off and the output to the dosing pump will be disabled.

PH SENSOR READING "FROZEN" FOR MORE THAN 48 HOURS

If the sensor reading does not change by at least 0.01 pH in a 60-hour period, there could be something wrong with the sensor, or the sensor input. The user should check the calibration and function of the pH sensor.

T	E	M	P		7	8.	5	F				P	H	6.	0
		P	H		S	E	N	S	O	R		L	O	C	K

TEMP SENSOR READING "FROZEN" FOR MORE THAN 48 HOURS

If the sensor reading does not vary by at least .5 degree F in a 48 hour period, there could be something wrong with the temp sensor, or the sensor input.

E	R	R	O	R								P	H	6.	T
T	E	M	P		S	E	N	S	O	R		L	O	C	K

IF PH READING IS BELOW THE MINIMUM SETTING

If the unit reads a pH level below the minimum pH setting selected by the user, there could be something wrong with the sensor, the unit itself, the strength of the pH adjustment or even an empty reservoir. The user should check the calibration and function of the pH sensor.

T	E	M	P		7	8.	5	F			E	R	R	O	R
		P	H		L	O	W		L	I	M	I	T		

IF PH READING IS ABOVE THE MAXIMUM SETTING

If the unit reads a pH level above the maximum pH setting selected by the user, there could be something wrong with the sensor, the unit itself, the strength of the pH adjustment or even an empty reservoir. The user should check the calibration and function of the pH sensor.

T	E	M	P		7	8.	5	F			E	R	R	O	R
		P	H		H	I	G	H		L	I	M	I	T	

OPPOSITE REACTION TO DOSING DOWN

If pH dosing down, but the measured pH goes up, verify the correct pH adjustment liquid is being used. The user can also check the calibration and function of the pH sensor.

T	E	M	P		7	8.	5	F			E	R	R	O	R
		P	H		D	O	S	E		U	P	?			

OPPOSITE REACTION TO DOSING UP

If pH dosing up, but the measured pH goes down, verify the correct pH adjustment liquid is being used. The user can also check the calibration and function of the pH sensor.

T	E	M	P		7	8.	5	F			E	R	R	O	R
		P	H		D	O	S	E		D	O	W	N	?	

EXCEEDED MAX DOSES

After several dosing cycles, the unit should detect the pH level is now at the user's pH setting. If it takes too many doses to get the pH level to the desired setting, there is likely a problem. It could be a problem with the pH sensor or possibly the dosing pump is not operating correctly. This error may be caused by the pH adjustment bottle being empty. The dosing time or the maximum number of doses setting may need to be increased.

T	E	M	P		7	8.	5	F			E	R	R	O	R
	M	A	X		D	O	S	E		L	I	M	I	T	

SENSOR OR CONNECTION PROBLEMS

If there is a problem with the sensor interface, sensor connection or the sensors themselves, one of 2 errors will be displayed.

If the sensor interface is disconnected after the unit has been operating for some time, the LCD will read:

E	R	R	O	R							E	R	R	O	R
S	E	N	S	O	R		C	O	M		F	A	I	L	

If the pH sensor is disconnected, or the pH sensor is faulty, the LCD will read:

E	R	R	O	R							E	R	R	O	R
	P	H		S	E	N	S	O	R		F	A	I	L	

CURRENT OVERLOAD

If the unit detects excessive current (greater than 4.5 amps) the current overload error will be displayed.

Action: The output will be disabled until the unit is disconnected from the electric supply to reset the error. When the error occurs the unit will read:

E	R	R	O	R							E	R	R	O	R
				O	V	E	R	L	O	A	D				

FACTORY SETTINGS RESET

The unit comes pre-programmed with standard settings that can be modified easily by the user.

DESCRIPTION	FACTORY SETTING
pH setpoint	**6.0 pH**
Dosing time	**10 seconds**
Mixing time	**4 minutes**
pH deadband	**0.2 pH**
Select pH UP or DOWN	**Down**
Maximum # of Doses	**40**
Low pH limit	**4.5 pH**
High pH limit	**7.5 pH**
Minimum pH recorded	**Current value**
Maximum pH recorded	**Current value**
Dose count	**0**
Temp Mode (C or F)	**F**
Calibrate 7.0	**7.0 pH**
Calibrate 4.0	**4.0 pH**

NOTE: The factory settings can be recalled and the unit returned to factory settings at any time by pressing and holding the Menu and UP buttons for 3 seconds, then press Enter.

CALIBRATING THE pH SENSOR

The **APCEPH1** uses a high quality pH sensor, but all pH sensors can go out of calibration due to debris accumulating on the sensor surface or other factors. The APCEPH1 has a simple process to recalibrate the pH sensor.

The temperature sensor NEVER requires calibration.

NOTE: It is critical to FIRST calibrate the pH sensor to 7.0 pH. After Cal 7.0 is complete, you can calibrate to 4.0 pH.

1. Shut off water circulating pump. Remove the pH sensor from the pH sampling assembly.
2. Rinse the tip of the pH sensor with clean water to remove any accumulated dirt or debris.
3. Shake or wipe excess water from the sensor.
4. Place both the temp and pH sensor tip into a satchel or cup of fresh 7.0 calibration solution. Agitate the solution to ensure the sensor reads the calibration solution correctly.
5. To start the 7.0 calibration, press and hold the ENTER and UP push buttons for 3 seconds.

6. When the Calibrate 7.0 screen is displayed, press the Enter button to start the calibration process. After calibration, the unit will display the message 7.0 Calibration Complete.
7. If the user wants to calibrate to 4.0, repeat the process above using the 4.0 calibration solution and start the Calibrate 4.0 function using the ENTER and DOWN pushbuttons for 3 seconds.
8. When the Calibrate 4.0 screen is displayed, press the Enter button to start the calibration process. After calibration, the unit will display the message 4.0 Calibration Complete.

NOTE: If the unit displays a Calibration error, check to make sure the calibration solution you are using is correct. Re-start the calibration process from the beginning with 7.0 pH.

TROUBLESHOOTING

The LCD lighted display is blinking on and off.

All errors detected by the unit will cause the unit to go into “safe-mode” and disable the pH function. Refer to the Error codes and Troubleshooting section of the instructions.

NOTE: All errors are reset by pressing and holding the Enter button for 3 seconds. When the error has been reset, the display will stop flashing and the unit will return to normal operation.

The pH seems to be unstable and needs constant adjustment.

All water solutions will experience pH changes, but if excessive aeration or certain biologically active nutrients are used, the pH changes could be more dramatic. Using the APCEPH1SK sampling assembly and the submersible mixing pump that comes with the APCEPH1SK will provide adequate mixing of the water without over-aeration.

LIMITED WARRANTY

**6 months for pH probe*

Hydrofarm, Inc. doing business as Hydrofarm, Inc. (collectively **HYDROFARM**) warrants that for a period of three years from the date of purchase, this product will be free from defects in material and workmanship. **HYDROFARM**, at its option, will repair or replace this product or any component of the product found to be defective during the warranty period. Replacement will be made with a new or remanufactured product or component. If the product is no longer available, replacement may be made with a similar product of equal or greater value. This is your exclusive warranty. DO NOT attempt to repair or adjust any electrical or mechanical malfunctions on this product. Doing so will void this warranty and may cause serious injury/death/damage.

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This warranty does not cover normal wear of parts or damage resulting from the following: negligent use or misuse of the product, use on improper voltage or current, use contrary to the operating instructions, use contrary to any and all applicable local, state, provincial or federal laws, disassembly, repair or alteration by anyone other than **HYDROFARM** or an **HYDROFARM** authorized service center. Future, the warranty does not cover: Acts of God, such as fire, flood, hurricanes, tornadoes, nor Acts of War or Acts of Terrorism.

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