Honeywell

Gas Sensor

Manning EC-P2
Instruction and Installation Manual

07/09

Notices and Trademarks

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About This Document

World Wide Web

The following Honeywell web sites may be of interest.

Honeywell Organization	WWW Address (URL)
Corporate	www.honeywell.com
Honeywell Analytics	www.honeywellanalytics.com
Manning Gas Detection	www.manningsystems.com

Telephone

Contact us by telephone at the numbers listed below.

Organization		Phone Number
United States	Honeywell Analytics Inc.	1-800-538-0363 1-913-712-5576 1-913-712-5580 Fax
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Middle East	Honeywell Analytics Inc.	+971 4 3458 338

Sales Information

Contact us at detectgas@honeywell.com

Symbol Definitions

The following table lists those symbols used in this document to denote certain conditions.

Symbol	Definition
	**ATTENTION:** Identifies information that requires special consideration.
	**TIP:** Identifies advise or hints for the user, often in terms of performing a task.
	**REFERENCE-EXTERNAL:** Identifies an additional source of information outside of this bookset.
	**REFERENCE-INTERNAL:** Identifies an additional source of information within this bookset.

Contents Serial number:

Introduction

This manual has been prepared to help in the use of the Manning EC-P2 Portable Gas Detector.

ATTENTION: This manual must be carefully followed by all individuals who have or will have the responsibility for using or servicing the sensor. Warranties made by Honeywell Analytics with respect to this equipment will be voided if the equipment is not used and serviced in accordance with the instructions in this manual. If in doubt about a procedure, please contact Honeywell Analytics before proceeding.

1 System Description

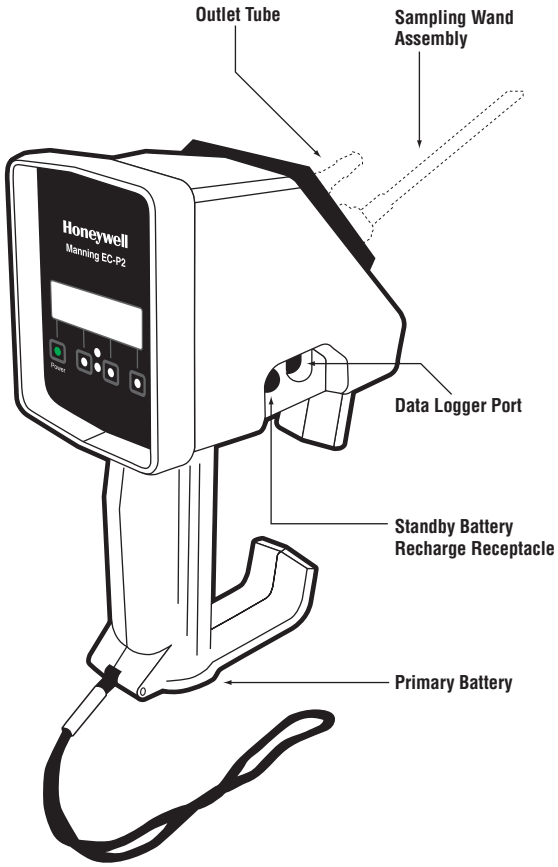
The Manning EC-P2 is a portable, battery operated instrument for the measurement of gas concentrations in ambient air.

The Manning EC-P2 can be converted from one target gas to another by simply plugging in a different SMART-CELL for the desired target gas (takes about 30 seconds). This allows one instrument to detect a number of different gases. All calibration and alarm setpoint data is stored on the individual SMART-CELL so reconfiguration is not necessary when changing target gases. Extra SMART-CELLs should be kept on the optional sensor keeper when not in use to keep them “warmed up” and ready for immediate use.

The Manning EC-P2 utilizes two different batteries to insure that you’ll never be without power when you need it. The primary power source is a “C” size alkaline battery housed in the handle. It will run the unit approximately 48 hours. When this battery is removed or dead, the unit will switch to its standby power source, an internal rechargeable NiCad battery, which will run the unit approximately six hours. When not in use, the unit should be plugged into the charger to keep this standby battery charged. If desired, the unit can be run continuously when plugged into the charger.

The Manning EC-P2 also has advanced capabilities such as data logging to an Excel spreadsheet, 0 to 1.0 Volt DC analog output capability, and a sampling mode for taking a single reading in a controlled, repeatable manner.

Figure 1: Basic Parts of the Manning EC-P2 Sensor



System Specifications

Primary Power: Alkaline C cell battery, 48 hours operation. **Note:** An audible alarm single beep every 60 seconds indicates that either the Alkaline C cell battery is low or the internal rechargeable NiCad battery is low.

Standby Power: Internal rechargeable NiCad battery, 6 hours operation. **Note:** An audible alarm single beep every 60 seconds indicates that either the Alkaline C cell battery is low or the internal rechargeable NiCad battery is low.

Charger: 120 VAC plug-in charger for internal standby battery

Display: Backlit LCD

Pump: Miniature internal diaphragm type, flowrate 0.5 SCFH

Alarms: Two concentration alarms, zero drift caution, Low flow and Low battery alarms. Alarms displayed on LCD and indicated by audible beeper.

Standard Accessories: Storage case, 10" extension wand, battery charger, filter material, datalogging software, RS-232 output cable (DB9 connector)

Optional Accessories: Analog output cable. Sensor Keeper for storage of additional SMART-CELLs

Sensor Type: Target gas selective electrochemical SMART-CELL

Accuracy: Sensor dependant but generally ± 5% of reading

Repeatability: ± 1% full scale

Operating Ambient Temperature Range: 0° to +120° F

Storage Temperature: Recommend storing on the charger in an air conditioned office

Weight: 3 lbs. (shipping weight), 1.8 lbs. (detector only)

Dimensions: Approx 3.5" x 5" x 8.5"

Outputs: RS-232 output of stored gas values. Analog output 0 to 1.0 VDC (requires optional analog output cable)

Memory: 12,000 data points, storage interval between points programmable at 1, 5, 10, or 15 minutes. Typical capacity: 8 days at 1 minute storage interval

2 Operation

A Operating the Sensor

The Manning EC-P2 is shipped ready for use. To power up the instrument, push the PWR button. The power up sequence displays first the self check, the sensor full scale value, the downscale caution level, warning concentration setpoint, alarm concentration setpoint, output ranges, software version, then the normal operating screen.

The unit will then display the instantaneous gas concentration and is ready for use.

The normal operating screen displays the information as shown in Figure 2.

The Manning EC-P2 is designed to avoid accidental shut-off of the power. **To turn the unit off, the PWR button must be held down for approximately three seconds.** Release the button after the "Power Down" message appears.

B Changing the Target Gas using SMART-CELL Technology

The Manning EC-P2 can easily be changed to sense another target gas by installing the SMART-CELL for the desired target gas. Each SMART-CELL contains all the calibration and alarm setpoint information on its internal memory chip, so recalibration or reprogramming is not necessary when changing the Manning EC-P2 from one gas to another. This procedure can be performed with the unit powered on or off (see Figure 3).

1) Unscrew the two stainless steel thumbscrews and remove the black inlet / outlet manifold lid from the back of the unit.

2) To remove the existing SMART-CELL, grip the sides of the cell and pull it straight out.

3) Install the desired SMART-CELL by gently inserting it into the socket. Notice that the SMART-CELL is keyed so it cannot be inserted incorrectly.

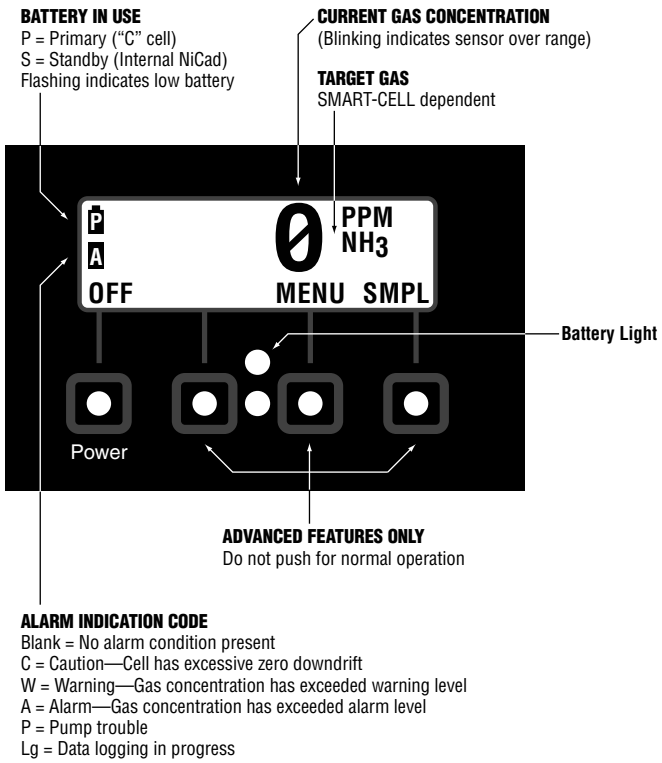
4) Replace the manifold and hand tighten the thumbscrews.

5) Verify proper flow through the sampling wand using the flowmeter provided.

Extra SMART-CELLS should be kept on the optional sensor keeper when not in use to keep them "warmed up" and ready for immediate use. The sensor keeper is powered by an Alkaline "C" size battery which should be replaced every 6 months.

For a variety of target gases, see page 15 for a list of available SMART-CELLs. Contact Honeywell Analytics if the desired target gas is not listed, as new cells may be available.

Figure 2: Normal Operating Screen



C Response Test

Prior to use, the unit should first be tested for proper response. With the detector operating, the unit should be exposed to a sample of the target gas. The display should show an increasing concentration. If not, do not use it for field measurements.

D Sample Inlet Port

The Manning EC-P2 is provided with a quick disconnect flexible extension wand. It will work with or without the wand. When using the extension wand, the internal walls must be kept dry. Water on the walls of the tubing can potentially absorb the target gas. To dry, allow the unit to pump dry, ambient air for 15 minutes.

E Response/Recovery Time

Under normal conditions, the instrument will reach 90% of final value within two minutes. This is dependent on concentration and temperature.

Recovery time for the sensor depends on duration and concentration of exposure. Short exposures of concentrations at the lower end of the target gas range result in rapid recovery. Long exposures to levels above the middle of the target gas range or short exposures to levels exceeding the target gas range can extend recovery times to hours. Repeated exposures above the target gas range will reduce cell life and should be avoided.

F Interference Gases

The Manning EC-P2 is generally quite specific to the target gas, but depending on the target gas, other gases may cause a reading. See Appendix B for a listing of potential interference gases for the various SMART-CELLs.

G Alarm Functions

The Manning EC-P2 provides both visible and audible gas concentration alarms and system alarms. An alarm condition will be displayed on the normal operating screen as described on page 8.

In addition to the alarm indication code in the left side of the screen, an alarm message will flash intermittently on the screen, the audible beeper will sound and the ACK button will appear. Pushing the ACK button will silence the beeper and stop the display flashing. The Alarm Indication Code will remain on the left side of the screen until the alarm condition clears.

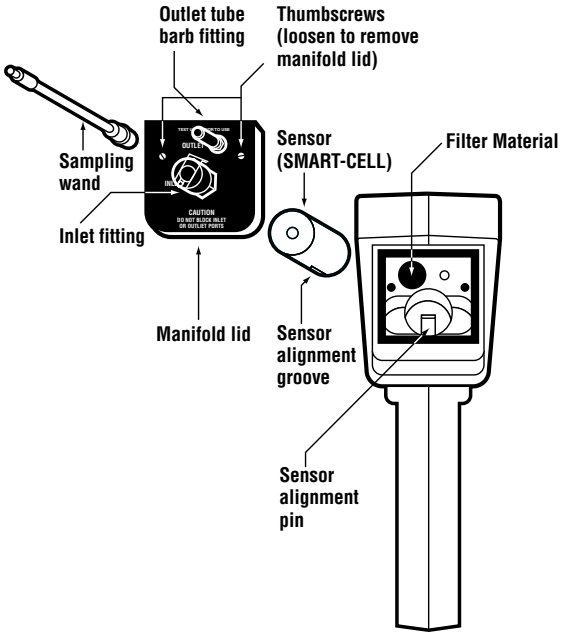
Alarm setpoints are stored on the individual SMART-CELL and can be changed by the user as described in Section 4.

NOTE: An audible alarm single beep every 60 seconds indicates that either the Alkaline C cell battery is low or the internal rechargeable NiCad battery is low.

H Display Resolution

The Manning EC-P2 displays gas concentration with a resolution that depends upon the range of the unit. Full scale ranges of 0-4.00 or below will provide resolution of 0.01. Ranges from 0-5.0 up to 0-49.9 will provide resolution of 0.1. Full scale ranges above 50 will have a resolution of 1.

Figure 3: Manifold Assembly



3 Maintenance

A Periodic Maintenance

It is essential that the test and calibration schedule be adhered to. Honeywell Analytics recommends the following maintenance schedule:

- Response test prior to each use. Expose sensor to a sample of the target gas to verify proper sensor response and alarm functions.
- Calibration should be performed with certified calibration gas every six months, and all tests must be logged.
- Check filter material every six months. Replace if dirty or moist.
- If the optional sensor keeper is used for extra SMART-CELLs, change the sensor keeper battery once every 6 months. Use only alkaline “C” size batteries.

B Sensor Life

The electrochemical SMART CELL is extremely reliable, but the following can cause the cell chemicals to become depleted:

- A period of time
- Exposure to high temperatures
- Exposure to high concentrations of the target gas
- Exposure to high moisture

When the cell becomes depleted, the unit will give no indication of failure other than that the sensor will not respond. For this reason it is absolutely essential that these units be exercised with a gas sample on a regular basis.

Typical sensor life under normal use is two years or more. When the SMART-CELL will no longer calibrate properly, simply purchase a new SMART-CELL and replace.

C Calibration

Calibration is recommended every six months in normal use. Each SMART-CELL stores its calibration and alarm setpoint information on its own memory chip. When the SMART-CELL is plugged into the Manning EC-P2, this information is used by the sensor. The SMART-CELL can be field calibrated by the user or returned to Honeywell Analytics for factory calibration.

The calibration procedure requires the use of a bypass tee to allow the gas to be drawn into the flow cell without creating variable pressure or dilution problems. Calibration gas cannot be fed into the flow cell under pressure.

When applying calibration gas use the bypass tee as shown in Figure 4 on page 11. The flowrate of calibration gas should be high enough that at least 0.5 SCFH is flowing out of the calibration tee. This can be measured with the supplied flowmeter and insures that air is not being drawn into the unit and diluting the calibration gas.

The unit may be zeroed without spanning it; however, never span the unit without first zeroing it.

The following procedure will calibrate the SMART-CELL.

To Enter ZERO / SPAN Mode

1) Push power button to turn unit on. Wait for power up sequence to finish (30 seconds).

2) Push and hold the unnamed button (second from left) first, then Push and hold the Menu button. Hold both buttons until the screen goes blank (2 seconds). Release both buttons and the unit is now in Programming Mode.

3) Push the SENS button and the unit is now in the zero/span mode.

3 Maintenance continued

Zero Calibration

4) Be sure the unit is in clean air or apply zero air for two minutes.

5) Push ZERO button.

6) Push SAVE button to save the new zero calibration.

Span Calibration

7) Push SPAN button.

8) Apply span gas for two minutes.

9) Push INC button (increase) or DEC button (decrease) until the display matches the span gas concentration.

10) Push SAVE button to store new span calibration.

To Exit ZERO / SPAN Mode

11) Push DONE button twice slowly to get back into normal operation mode.

D Troubleshooting

The detector does not start: Check to see that a fresh battery is installed. Both the primary and standby batteries must be discharged for this problem to occur. Plug the charger into the Manning EC-P2 to charge the standby battery. Wait 10 minutes and retry.

The detector does not respond to the target gas: Verify the proper flow rate using the supplied flowmeter. Perform calibration. If sensor won't calibrate, the SMART-CELL may be depleted. Contact Honeywell Analytics for a replacement SMART-CELL.

Pump alarm: This will occur if the pump motor stops or if an internal pressure sensor detects blockage of the inlet. Check that the internal filter is not clogged or wet and that the inlet tube is clear.

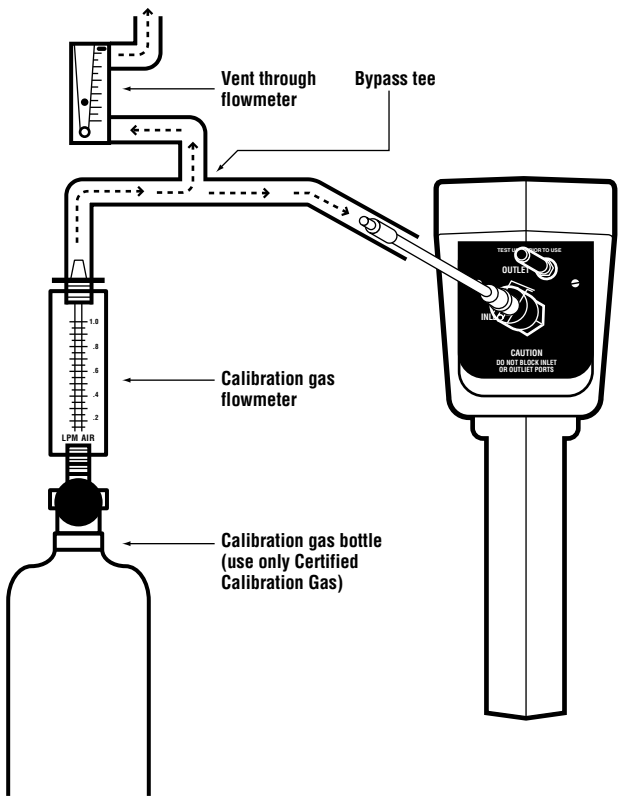
External flowmeter indicates no flow: Verify that pump is running. Check that the manifold screws are tight and the extension wand connection is tight.

Unit does not respond when keys are pressed: Press and hold all four buttons for five seconds. This will reset the Manning EC-P2. Turn the unit back on by pressing the PWR button.

High reading won't clear: When the sensor is exposed to very high gas concentrations, it takes a relatively long time for the sensor to clear. Leave the unit running in a clean environment for a few hours to clear the sensor. If it doesn't clear after six hours, the sensor may have been damaged. Contact Honeywell Analytics for a replacement SMART-CELL.

Unit is in alarm with gas reading of 0 ppm: Check the alarm setpoints and alarm functions as described on page 11. Verify that alarm is not programmed as a downscale alarm, and that the setpoint is above zero.

Figure 4: Calibration of the Manning EC-P2 Sensor using a Bypass Tee



4 Programming and Advanced Features

A Alarm Setpoints, Functions

The Manning EC-P2 has three adjustable alarm setpoints. These setpoints are stored on each SMART-CELL. The Caution setpoint is to warn of excessive negative zero drift. The WARNING and ALARM setpoints are to warn of potentially dangerous target gas concentrations. The following procedure will change the WARNING setpoint.

To Enter CAUT / WARN / ALRM Mode

1) Push power button to turn unit on. Wait for power up sequence to finish (30 seconds).

2) Push and hold the unnamed button first, then Push and hold the Menu button. Hold both buttons until the screen goes blank (two seconds). Release both buttons and the unit is now in Programming Mode.

3) Push the ALRM button and the unit is now in the CAUT / WARN / ALRM mode.

Warning Setpoint

4) Push WARN button.

5) Push S.P. button (setpoint).

6) Push INC button (increase) or DEC button (decrease) until the display matches the desired warning setpoint. Notice the minus sign above the arrow if the setpoint is below zero.

7) Push SAVE button to store new warning setpoint.

8) Push DONE button to return to Alarms mode.

To Exit CAUT / WARN / ALRM Mode

9) Push DONE button twice slowly to get back into normal operation mode.

The Caution and Alarm setpoints are programmed in the same manner, except for step four above in which you would push either the CAUT or ALRM button. The function of each alarm can be selected to alarm on increasing gas concentration (UP arrow), alarm on decreasing gas concentration (DOWN arrow), or be disabled (off). The following procedure will set the Warning function to alarm on decreasing concentration (Useful for Oxygen Depletion warning).

To Enter CAUT / WARN / ALRM Mode

1) Push power button to turn unit on. Wait for power up sequence to finish (30 seconds).

2) Push and hold the unnamed button first, then Push and hold the Menu button. Hold both buttons until the screen goes blank (two seconds). Release both buttons and the unit is now in Programming Mode.

3) Push the ALRMS button and the unit is now in the CAUT / WARN / ALRM mode.

Warning Function

4) Push WARN button.

5) Push FUNC (function) button.

6) Push SELECT button while viewing the arrow in the lower left hand corner of the screen to toggle through the following three possibilities:

- UP arrow – Warn on increasing concentration (gas goes higher than setpoint).
- DOWN arrow – Warn on decreasing concentration (gas goes lower than setpoint).
- Blank – warning function turned OFF.

7) Push SAVE button when the DOWN arrow is displayed to store new warning function.

8) Push DONE button to return to Alarms mode.

To Exit CAUT / WARN / ALRM Mode

9) Push DONE button two times slowly to get back into normal operation mode.

The Caution and Alarm functions are programmed in the same manner, except for step four above in which you would push either the CAUT or ALRM button.

B Display Variables

The Manning EC-P2 has two adjustable display variables. These variables control signal conditioning of the LCD display. Variables are stored on each SMART-CELL. The AVG (Average) variable determines the number of one second samples to average to calculate the displayed value. The lower the averaging value, the faster the display will change and the more "wiggle" will be displayed. The BLANK (zero blanking) variable controls the lowest reading that will be displayed. This is to eliminate the misleading display of signals within the zero noise of the sensor. The following procedure will change the AVG variable.

To Enter AVG / BLANK Mode

1) Push power button to turn unit on. Wait for power up sequence to finish (30 seconds).

2) Push and hold the unnamed button first, then Push and hold the Menu button. Hold both buttons until the screen goes blank (two seconds). Release both buttons and the unit is now in Programming Mode.

3) Push the MORE button.

4) Push the DISP (display) button and the unit is now in the AVG / BLANK mode.

AVG Variable

5) Push AVG button.

6) Push INC button (increase) or DEC button (decrease) until the display matches the desired value.

7) Push SAVE button to store new AVG variable.

To Exit AVG / BLANK Mode

8) Push DONE button twice slowly to get back into normal operation mode.

The Blanking variable is programmed in the same manner, except for step 5 above in which you would push the BLANK button.

C Sample Mode

The Sample Mode feature allows the user to take a measurement using a predefined repeatable method to eliminate user "interpretation" of a gas concentration that is changing. This is similar to a digital scale, for example, so the exact same reading will be taken regardless of who is taking it.

The measuring sequence used in Sample Mode is as follows:

- Draw a **Sample** for a user programmed sampling time to allow unit to stabilize to the existing gas concentration.
- **Measure** the gas concentration and average it for a user programmed measuring time.
- **Clear** the gas concentration to below a user programmed recovery value before allowing another cycle to start. (Unit should be moved to fresh air during the clear time.)

Taking a sample:

To take a sample, locate the detector at the desired sample location, and push the SMPL (sample) button on the normal operation screen. The unit will count down the Sample time, followed by the Measure time, at the end of which the average value will be displayed.

Note the displayed sample value. Pushing the CLEAR button will return the unit to the normal operation screen once the gas concentration is below the predefined recovery value. The unit is now ready to take another sample if desired.

Programming sample mode variables:

The sample mode variables are **Sample, Measure** and **Clear** as described above. The following procedure will change the Sample variable.

To Enter SAMP / MEAS / CLEAR Mode

1) Push power button to turn unit on. Wait for power up sequence to finish (30 seconds).

2) Push and hold the unnamed button (second from left) first, then Push and hold the Menu button. Hold both buttons until the screen goes blank (two seconds). Release both buttons and the unit is now in Programming Mode.

3) Push the MORE button.

4) Push the SMPL (sample) button and the unit is now in the SAMP / MEAS / CLEAR mode.

SAMP Variable

5) Push SAMP (sample) button.

6) Push INC button (increase) or DEC button (decrease) until the display matches the desired value. The display is in minutes and seconds.

7) Push SAVE button to store new SAMP variable.

To Exit SAMP / MEAS / CLEAR Mode

8) Push DONE button twice slowly to get back into normal operation mode.

The Measure and Clear variables are programmed in the same manner, except for step five above in which you would push the MEAS or CLEAR button.

D Data Logging

The Manning EC-P2 can log periodic gas concentration readings to be downloaded to a file which can be read by Microsoft Excel or other popular spreadsheet applications. The EC-P2 will store instantaneous gas values every one, five, 10, or 15 minutes. Multiple sessions can be logged and then downloaded as separate files.

EC-P2 software installation:

The Manning EC-P2 is supplied with a CD containing the "Manning EC-P2" program. It will run on Windows 95, Windows 98, or Windows 2000. To install the program, place the disk in your CD drive. The CD should automatically begin the installation process. Follow the prompts as they appear on your screen. Accepting the default directory locations is recommended for most installations. If the CD does not automatically start, click on "My Computer" and then your CD drive. Double-click on the file named "Setup.exe."

Prior to your first datalogging session it is recommended that you connect the Manning EC-P2 to your computer with the data logging program running. The computer can then set the time in the EC-P2 to match its own clock.

Data Logging with the Manning EC-P2:

To Start the Data Logging Session

1) Push power button to turn unit on. Wait for power up sequence to finish (30 seconds).

2) Push the MENU button.

3) Push the LOG button and the unit is now in the CLEAR / INT / START mode.

4) If the CLEAR button is available, that means there is data currently stored in the unit. If desired, you can erase the data already in the unit by pushing the CLEAR button. (If you don't push CLEAR, each data logging session can be downloaded as a separate file).

5) Push INT button (interval) to cycle through the choices for how often to log a data point. Stop when the desired interval is displayed. Notice how much time can be covered with the remaining free memory.

6) Push and hold the START button until the screen goes blank (two seconds) to begin a new data logging session. The unit will now display the gas concentration. The Lg symbol in the left side of the display indicates that the unit is logging data. If you watch this symbol carefully, you will see it change to an "s" each time a data point is stored.

To Stop the Data Logging Session

7) Push the MENU button.

8) Push the LOG button.

9) Push and hold the STOP button until the screen changes to CLEAR / INT / START / MODE (two seconds).

10) Push the DONE button to get back into normal operation mode.

Working with the "EC-P2" program:

The "EC-P2" program downloads the logging files from the Manning EC-P2. It does not display the data. The files it downloads can be opened by or imported into Excel, Lotus 123 or other programs for graphing and analysis.

Turn on the Manning EC-P2 and connect it to your PC using the RS-232 cable supplied. From Windows START menu, select "PROGRAMS," then "Manning EC-P2," and then "EC-P2". As soon as you start the "EC-P2" program, your computer will try to establish a connection to the Manning EC-P2. If the Manning EC-P2 is currently logging data, the "EC-P2" program will automatically stop the logging function.

The program contains two tabs, one marked "Download" and one marked "Configure". Review the settings on the "Configure" tab, making changes as necessary.

From the "Download" tab, review the Link Status block in the lower right hand corner. It should indicate "Link OK". Link Trouble can be caused by selection of the wrong Com port in the Configure Tab, improperly connecting the RS-232 cable, or not turning on the Manning EC-P2.

When you are ready to transfer data from the Manning EC-P2 to your PC, click on "get data" and the files will be downloaded to your computer. Note the file names in the destination window so you can locate the files.

These files can now be opened with Excel (use .csv filename), Lotus 123, or other user supplied programs.

E Analog Output

The Manning EC-P2 has a 0 to 1.0 volt DC analog output capability when used with the optional analog output cable. With the analog output cable plugged into the communication port of the EC-P2, the user can measure the voltage between the two wires and correlate it to gas concentration. The voltage output will be linear between zero and the full scale range of the SMART-CELL as programmed below. Each SMART-CELL has a wide range of choices of full scale values.

The full scale range as programmed below only affects the analog output and the data logging full-scale output. The display will always cover the entire operating range of the SMART-CELL. Changing the range can affect the display resolution for some SMART-CELLs.

Changing the full scale range on EC-P2:

To Enter RANGE Mode

1) Push power button to turn unit on. Wait for power up sequence to finish (30 seconds).

2) Push and hold the unnamed button (second from left) first, then Push and hold the MENU button. Hold both buttons until the screen goes blank (two seconds). Release both buttons and the unit is now in Programming Mode.

3) Push the MORE button.

4) Push the DISP (display) button.

5) Push the MORE button and the unit is now in the RANGE mode.

Adjusting the RANGE

6) Push RANGE button.

7) Push INC button (increase) or DEC button (decrease) until the display matches the desired full scale range.

8) Push SAVE button to store new full scale range.

To Exit RANGE Mode

9) Push DONE button twice slowly to get back into normal operation mode.

5 Appendices

APPENDIX A: SMART-CELLs Available

GAS	RANGE	PART NUMBER
Alcohol	0-500 ppm	EC-P2-SMART-CELL-OH-0/500ppm
Ammonia	0-500 ppm	EC-P2-SMART-CELL-NH_3-0/500ppm
Ammonia	0-2000 ppm	EC-P2-SMART-CELL-NH_3-0/2000ppm
Bromine	0-5 ppm	EC-P2-SMART-CELL-Br_2-0/5ppm
Carbon Monoxide	0-1000 ppm	EC-P2-SMART-CELL-CO-0/1000ppm
Chlorine	0-5 ppm	EC-P2-SMART-CELL-Cl_2-0/5ppm
Chlorine	0-200 ppm	EC-P2-SMART-CELL-Cl_2-0/200ppm
Chlorine Dioxide	0-5 ppm	EC-P2-SMART-CELL-ClO_2-0/5ppm
Flourine	0-5 ppm	EC-P2-SMART-CELL-Fl_2-0/5ppm
Formaldehyde	0-200 ppm	EC-P2-SMART-CELL-HCHO-0/200ppm
Hydrogen	0-2000 ppm	EC-P2-SMART-CELL-H_2-0/2000ppm
Hydrogen Chloride	0-200ppm	EC-P2-SMART-CELL-HCl-0/200ppm
Hydrogen Peroxide	0-200 ppm	EC-P2-SMART-CELL-H_2O_2-0/200ppm
Hydrogen Sulfide	0-200 ppm	EC-P2-SMART-CELL-H_2S-0/200ppm
Nitric Oxide	0-500 ppm	EC-P2-SMART-CELL-NO-0/500ppm
Nitrogen Dioxide	0-200 ppm	EC-P2-SMART-CELL-NO_2-0/200ppm
Oxygen	0-25%	EC-P2-SMART-CELL-O_2-0/25%
Ozone	0-5 ppm	EC-P2-SMART-CELL-O_3-0/5ppm
Ozone	0-100 ppm	EC-P2-SMART-CELL-O_3-0/100ppm
Sulfur Dioxide	0-500 ppm	EC-P2-SMART-CELL-SO_2-0/500ppm

APPENDIX B: SMART-CELL Cross-Sensitivity Table (Interference Gases)

INTERFERENCE GASES

SENSOR AND TARGET GAS

	Br_2	Cl_2	ClO_2	O_3	NH_3	CO	H_2	O_2	NO	H_2S	NO_2	SO_2	HCHO	OH	Fl_2	HCl	H_2O_2
Bromine	-----	1.0	1.0	0.7	-0.1	None	None	None	None	None	0.5	-0.1	None	None	1.0	None	None
Chlorine	1.0	-----	1.0	0.7	-0.1	None	None	None	None	None	0.5	-0.1	None	None	1.0	None	None
Chlorine dioxide	1.0	1.0	-----	0.7	-0.1	None	None	None	None	None	0.5	-0.1	None	None	1.0	None	None
Ozone	1.5	1.5	1.5	-----	-0.1	None	None	None	None	None	0.65	-0.1	None	None	1.5	None	None
Ammonia	None	None	None	None	-----	None	None	None	None	None	None	None	None	None	None	None	None
Carbon monoxide	None	None	None	None	0.05	-----	0.1	None	None	0.002	0.001	None	0.5	0.5	None	0.005	0.005
Hydrogen	None	None	None	None	0.02	0.1	-----	None	0.001	0.001	0.001	0.005	0.05	0.05	None	0.01	0.01
Oxygen	None	None	None	None	None	None	None	-----	None	None	None	None	None	None	None	None	None
Nitrogen oxide	None	None	None	None	None	0.1	None	None	-----	0.4	0.001	0.04	0.8	0.8	None	1.5	1.5
Hydrogen sulfide	-0.1	-0.1	-0.1	-0.07	0.3	None	None	None	None	-----	-2.5	None	2	2	-0.1	3	4
Nitrogen dioxide	0.2	0.2	0.2	0.15	None	None	None	None	None	0.1	-----	-0.08	0.1	0.1	0.2	0.2	0.2
Sulfur dioxide	-0.01	-0.01	-0.01	-0.01	None	None	None	None	None	0.1	-1	-----	0.4	0.4	-0.01	0.5	1
Formaldehyde	None	None	None	None	0.03	0.1	0.1	None	0.05	0.01	None	0.02	-----	1.2	None	None	0.1
Alcohol	None	None	None	None	0.03	0.1	0.1	None	0.05	0.01	None	0.02	None	-----	None	None	0.1
Flourine	1.0	1.0	1.0	0.7	-0.1	None	None	None	None	None	0.5	-0.1	None	None	-----	None	None
Hydrochloric acidNone	None	None	None	None	None	None	None	None	None	-0.3	None	0.2	0.2	None	-----	0.1	
Hydrogen peroxide	None	None	None	None	0.03	0.1	0.1	None	0.05	0.01	None	0.02	None	None	None	None	-----
Hydrogen cyanide	-0.08	-0.08	-0.08	-0.05	None	0.1	None	None	None	None	-0.07	0.15	0.1	0.1	-0.08	0.01	0.1
Hydroflouric acid	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
Hydride	None	None	None	None	0.5	None	None	None	1	0.5	-2	2	2	2	None	1.5	2
Silica hydride	None	None	None	None	0.5	None	None	None	1	0.5	-2	2	2	2	None	1.5	2
Carbon dioxide	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
Methane	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
Carbosulfonic acid	-0.04	-0.04	-0.04	-0.03	None	None	None	None	None	0.3	-0.8	None	1	1	-0.04	1	1.3
Ethylene	None	None	None	None	None	0.1	0.1	None	None	None	None	None	1	1	None	None	None
Ethyl alcohol	None	None	None	None	0.01	None	None	None	0.001	0.005	0.001	0.05	2	2	None	0.01	0.02

Notes: 1) None means there is no interference.

2) A number indicates that when exposed to the interference gas, the sensor will react the specified amount for a given concentration. For example, on the first line of the table above, if the NO_2 sensor is exposed to 1 ppm Bromine (Br_2), the sensor will read 0.5 ppm. This interference is in addition to the target gas present.

For example, if an NH_3 sensor is exposed to 1 ppm NH_3 and 1 ppm Br_2 at the same time, the reading will be 0.9 ppm (1ppm NH_3 + -0.1 ppm Br_2 = 0.9 ppm reading).

6 Limited Warranty

1. Limited Warranty

Honeywell Analytics, Inc. warrants to the original purchaser and/or ultimate customer ("Purchaser") of Manning products ("Product") that if any part thereof proves to be defective in material or workmanship within eighteen (18) months of the date of shipment by Honeywell Analytics or twelve (12) months from the date of first use by the purchaser, whichever comes first, such defective part will be repaired or replaced, free of charge, at Honeywell Analytics' discretion if shipped prepaid to Honeywell Analytics at 405 Barclay Blvd., Lincolnshire, IL 60069, in a package equal to or in the original container. The Product will be returned freight prepaid and repaired or replaced if it is determined by Honeywell Analytics that the part failed due to defective materials or workmanship. The repair or replacement of any such defective part shall be Honeywell Analytics' sole and exclusive responsibility and liability under this limited warranty.

2. Exclusions

A. If gas sensors are part of the Product, the gas sensor is covered by a twelve (12) month limited warranty of the manufacturer.

B. If gas sensors are covered by this limited warranty, the gas sensor is subject to inspection by Honeywell Analytics for extended exposure to excessive gas concentrations if a claim by the Purchaser is made under this limited warranty. Should such inspection indicate that the gas sensor has been expended rather than failed prematurely, this limited warranty shall not apply to the Product.

C. This limited warranty does not cover consumable items, such as batteries, or items subject to wear or periodic replacement, including lamps, fuses, valves, vanes, sensor elements, cartridges, or filter elements.

3. Warranty Limitation and Exclusion

Honeywell Analytics will have no further obligation under this limited warranty. All warranty obligations of Honeywell Analytics are extinguishable if the Product has been subject to abuse, misuse, negligence, or accident or if the Purchaser fails to perform any of the duties set forth in this limited warranty or if the Product has not been operated in accordance with instructions, or if the Product serial number has been removed or altered.

4. Disclaimer of Unstated Warranties

THE WARRANTY PRINTED ABOVE IS THE ONLY WARRANTY APPLICABLE TO THIS PURCHASE. ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

5. Limitation of Liability

IT IS UNDERSTOOD AND AGREED THAT HONEYWELL ANALYTIC'S LIABILITY, WHETHER IN CONTRACT, IN TORT, UNDER ANY WARRANTY, IN NEGLIGENCE OR OTHERWISE SHALL NOT EXCEED THE AMOUNT OF THE PURCHASE PRICE PAID BY THE PURCHASER FOR THE PRODUCT AND UNDER NO CIRCUMSTANCES SHALL HONEYWELL ANALYTICS BE LIABLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES. THE PRICE STATED FOR THE PRODUCT IS A CONSIDERATION LIMITING HONEYWELL ANALYTICS' LIABILITY. NO ACTION, REGARDLESS OF FORM, ARISING OUT OF THE TRANSACTIONS UNDER THIS WARRANTY MAY BE BROUGHT BY THE PURCHASER MORE THAN ONE YEAR AFTER THE CAUSE OF ACTIONS HAS OCCURRED.